CIS

English

CoaXPress I/F
2M CMOS B/W Camera
VCC-2CXP2M

Product Specifications
& Operational Manual

CIS Corporation

Table of Contents

PAGE

1. Handling Precautions

1.1. Camera Handling Precautions

- Do not use or store the camera in the extremely dusty or humid places.
- Do not apply excessive force or static electricity that could damage the camera.
- Do not shoot direct images that are extremely bright (e.g., strong light source, sun, etc.). When strong light such as spot light was shed, blooming or smear may occur. Put the lens cap on when camera is not in use.
- Follow the instructions in Chapter 3.3, "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 before connecting the camera to monitors or computers. Any AC leaks or coupling noises 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 assembly.
- Our warranty does not apply to damages or defects caused by irregular and/or abnormal use of the product.
- Ambient temperature of the camera's upper part should not exceed 65°C. In case of when it exceeds 65°C, heat dissipation measures shall be carefully and fully considered. If heat dissipation measures taken were insufficient, long term quality assurance would be difficult.

1.2. Restrictions on Applications

- 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.
- The camera must not be used under conditions or environments other than specified in this manual.

1.3. Disclaimers (exception clause)

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, flood, 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.

2. Product Outline

VCC-2CXP2M is a CoaXPress interfaced small B/W camera utilizing a 2/3 type, 2M pixels CMOS image sensor.

2.1. Features

- ☐ 29mm x 29mm x 29mm cubic in size
- ☐ Global shutter CMOS (Monochrome)
- ☐ CoaXPress Ver.1.0, CXP-1, CXP-2, and CXP-3
- ☐ The maximum cable length: Approx. 100m at CXP-1, and approx. 40m at CXP-3.
- ☐ Partial Scan (ROI)
- ☐ Sub-sampling
- ☐ Exposure Time, Gain settings
- ☐ External trigger mode (Fixed trigger shutter mode / Pulse width trigger shutter mode)
- ☐ GenICam complied

2.2. Bundled Items

☐ Standard Bundled Items

- Camera module, VCC-2CXP2M
- Lens cap

☐ Packaging

- Individual carton
- Master carton (10pcs/carton)

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

3. Specifications

3.1. General Specifications

Electrical Specifications			
☐ Pick up device	Device Type	2/3 type, Global shutter type CMOS sensor	
	Effective pixel number	1984(H)×1264(V)	
	Unit cell size	4.8μm(H)×4.8μm(V)	
☐ Interface	Camera standard	CoaXPress Ver1.0, CXP3 / CXP2 / CXP1	
	Video output	Mono8 / Mono10	
	Video output frequency	Pixel Clock: 74.25MHz	
☐ Frame rate	CXP1 8bit / 10bit	41.7fps / 36.4fps	
	CXP2 8bit / 10bit	84.5fps / 72.6fps	
	CXP3 8bit / 10bit	84.5fps / 84.5fps	
☐ Sync system	Internal Sync		
☐ Video output pixel size	The maximum 1984(H)×1264(V)		
☐ Video signals (Gain x 1.0)	White clip level	FFh	At Mono8
	Set up level	1.0±1.0	At Mono8, and at factory setting
	Dark shading	1.3	At Mono8, and at factory setting
☐ Sensitivity	F8	CXP1, at Shutter1/50	
☐ Minimum illumination	1.0 lx	CXP1, at F1.4, Gain×8, Shutter1/50	
☐ Gain variable range	×1.0 – 32.0 (0.0 – 30.0dB equivalent)		
☐ Shutter speed	110 – 27,256μs		
☐ Gamma correction	None (γ=1)		
☐ Trigger mode	Free run mode (Camera internal trigger) Trigger mode (Host, external terminal) ・Fixed trigger shutter ・Pulse width trigger shutter		
☐ Partial scan	5 Preset patterns (1600×1200, 1280×1024, 1024×1024, 800×600, 640×480)		
☐ Power requirements	Dedicated to PoCXP, 24V		
☐ Power consumption	3.1W CXP3 at free run		

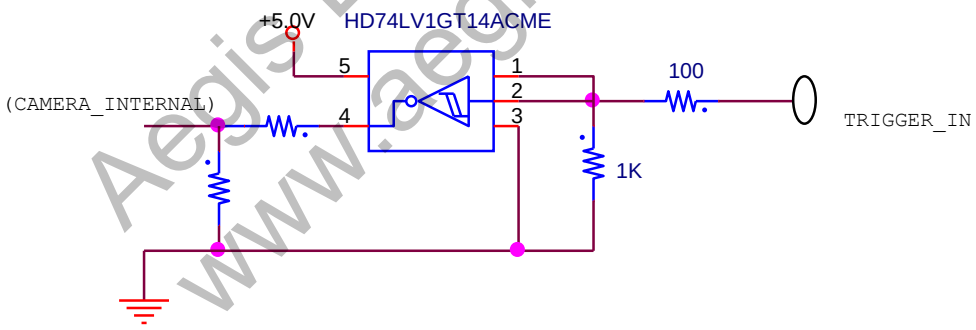
Mechanical Specifications		
☐ Dimensions	H:29mm W:29mm D:29mm (without protruding portion)	
☐ Weight	Approx. 50g	
☐ Lens mount	C-mount	

Environmental Specifications			
☐ Safety/Quality Standard	UL: Conform to UL for all the materials. CE: EMC (2014/30/EU) Conform to EN61000-6-4:2007+A1:2011 for Emission Conform to EN61000-6-2:2005 for Immunity RoHS: Conform to RoHS Quality Standard: Conform to EN50581 (RoHS2)		
☐ Durability	Vibration	Acceleration	98m/s^2 (10G)
		Frequency	20~200 Hz
		Direction	X, Y, and Z 3 directions
		Testing time	120 min for each direction
	Shock	No malfunction shall occur with the maximum 980m/s^2(100)G for ±X, ±Y, and ±Z 6 directions without packaging.	
☐ Specifications guaranteed environment	Temperature: 0 ~ +40°C Humidity: 20 ~ 60% RH with no condensation	Ambient temperature of the camera's upper part should not exceed 65°C. In case of when it exceeds 65°C, heat dissipation measures shall be carefully and fully considered. If heat dissipation measures taken were insufficient, long term quality assurance would be difficult.	
☐ Operation guaranteed environment	Temperature:-5 ~ +45°C Humidity: 20 ~ 60% RH with no condensation		
☐ Storage environment	Temperature: -25 ~ 60°C Humidity: 20 ~ 80%RH with no condensation		

3.2. Input and Output

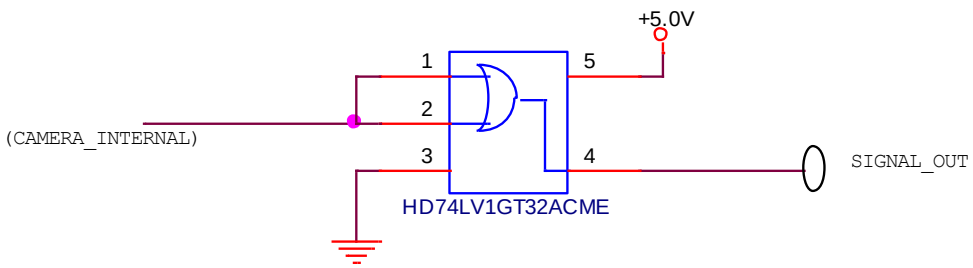
3.2.1. Trigger Input (6pins circular connector, No. 5 pin)

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



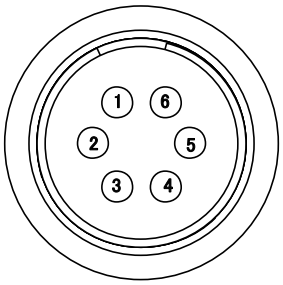
3.2.2. Monitor Signal Output (6pins circular connector, No. 3 pin)

- ☐ 5.0V, CMOS Logic level output
- ☐ Output voltage Low: 0.55Vdc (Max.), High: 3.8Vdc (Min.)



3.3. External Connector Pin Assignment

3.3.1. 6pins Circular Connector

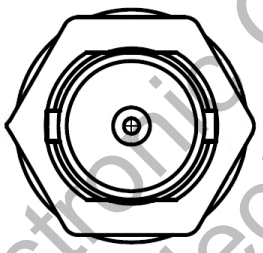


SNH-8-6(RPCB)
SamWoo Electronics

Pin No.	Signals	Explanation
1	NC	
2	NC	
3	SIGNAL_OUT	Refer to the general signal output.
4	NC	
5	TRIGGER_IN	External trigger input Equivalent to "Line 0" of "TriggerSource" described in Section 4.8.
6	GND	Ground. Conducted to the camera chassis.

†NC means No Connection. Do not connect to any terminal.

3.3.2. 75Ω BNC Connector



(Japan Aviation Electronics Industry, Limited)

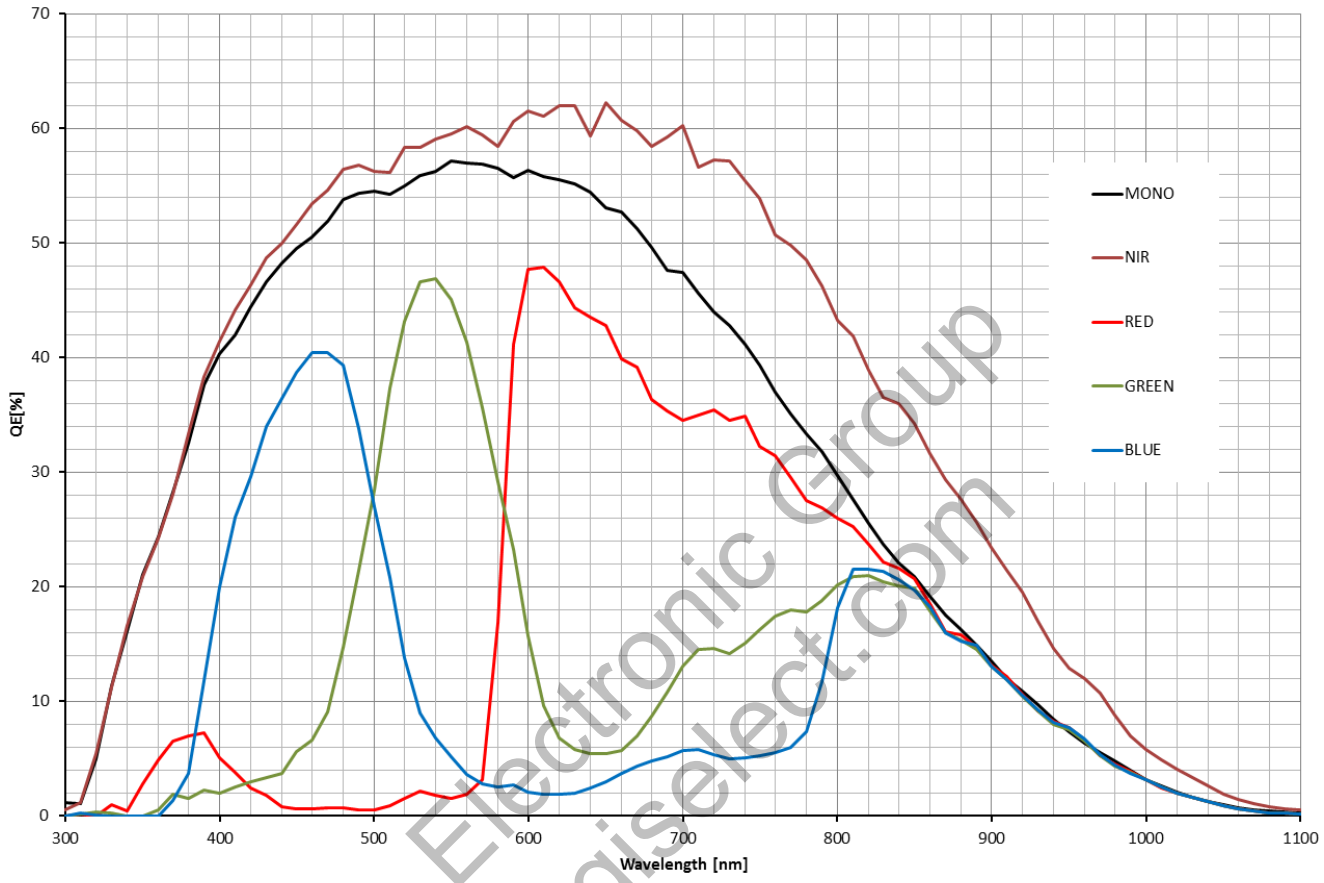
3.3.3. LED Indicator

☐ Lighting patterns of LED when it is set to active are as follows. It shows the camera status by the way of its lighting.

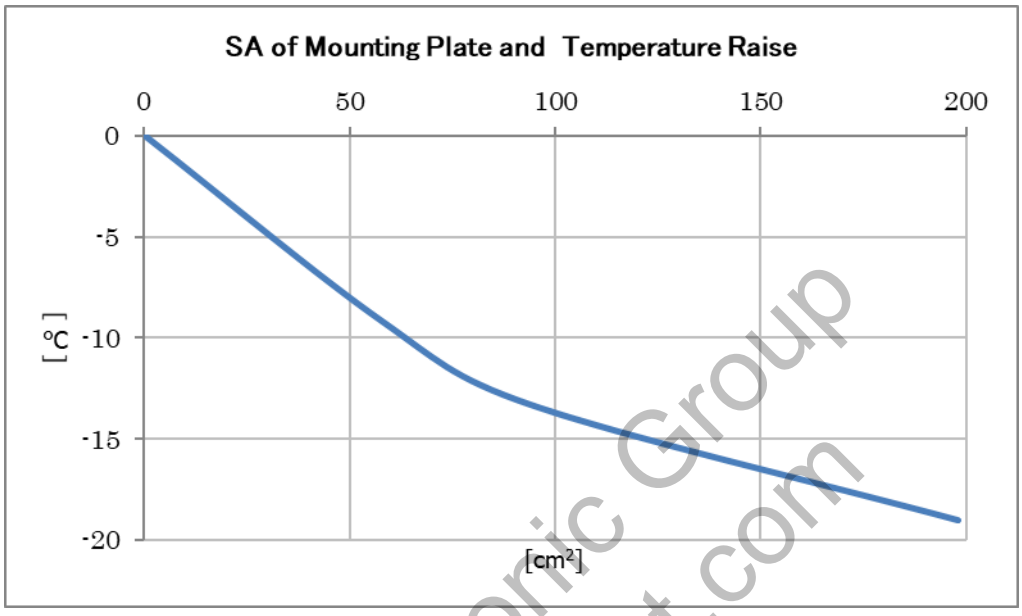
Lighting Status	Camera Status
OFF	No PoCXP Supplied
Green Slow Blinking	Confirmed connection of the device and the host.
Green Lighting	Transmitting video data.
Orange Slow Blinking	Waiting for a trigger input.
Red Fast Blinking	System error occurred.

3.4. Spectral Response

※The lens characteristic and the illuminant characteristics are excluded.
※Please refer to the data for Mono below.



4. Camera Mount and Heat Dissipation
   - ☐ When the top side of the camera housing temperature exceeds 65°C, you must provide sufficient heat dissipation or the life time could lead to impair.
   - ☐ As a reference, we estimated the relevance between the superficial area of mounting plate and the temperature of camera housing.



This graph is just a reference. Please confirm the usage environment and camera.

- ☐ The condition of measurement.

Items	Condition	Mounting Image
Camera Orientation	Downward-pointing	
Mounting Instruction	Fixed with M3 thread x3 at the bottom (Refer to 7. Dimensions) Without using thermal dissipation sheet	
Lens	None	
Camera Settings	LinkConfig CXP3_X1 Other settings are the same as factory settings Video output mode	
Temp. Measurement Place	Center of the top side (The red part on the right image)	
Mounting Plate Material	Black anodized alminum board	
Mounting Plate Size	3 kind of plates ◆ t5×40×60 (SA: approx.60cm²) ◆ t10×50×70 (SA: approx. 95cm²) ◆ t10×70×115 (SA: approx. 200cm²)	
Airflow	Natural Convection	

5. Camera Operational Function

5.1. Control System

☐ Complies with CoaXPress standard.

5.2. Device Information

☐ This is to indicate the camera status.

DeviceControl	
DeviceModelName	Read Only
DeviceVersion	Read Only
DeviceFirmwareVersion	Read Only
DeviceSerialNumber	Read Only

DeviceModelName	Model name of the camera.
DeviceVersion	Device Version
DeviceFirmwareVersion	Firmware Version
DeviceSerialNumber	Serial number of the camera

☐ A letter string consisting of the maximum 16 characters, including the terminal NUL letter (¥0), can be set to the camera. To save it into the volatile memory of the camera, execute "UserSetSave". Execute "UserSetDefault" to restore it to the factory setting.

DeviceControl	
DeviceUserID	Manual

5.3. LED Operational Mode

☐ This is to change LED operation of the camera rear. For the lighting patterns, please refer to the Section 3.3.3. LED Indicator.

DeviceControl	
DeviceIndicatorMode	Active Error Status Inactive

Active	Indicate the communication status of CoaXPress
ErrorStatus	OFF at normal operation. Lights only when video transmitting error occurs.
Inactive	OFF

5.4. Partial Scan (ROI)

- ☐ This is to increase its frame rate by cutting out and reducing the read out area.
- ☐ One area out of 5 preset patterns can be selected.
- ☐ This function cannot be used with sub-sampling function.
- ☐ ROI is to be cut from the center of the sensor.
- ☐ When ROI is changed, "Width", "Height", "OffsetX", and "OffsetY" shall be updated.
- ☐ Execute "ROIQuickChangeOff" to get back to the Full size of 1984×1264.
- ☐ The frame rates at ROI mode depend on "PixelFormat" and "LinkConfig".

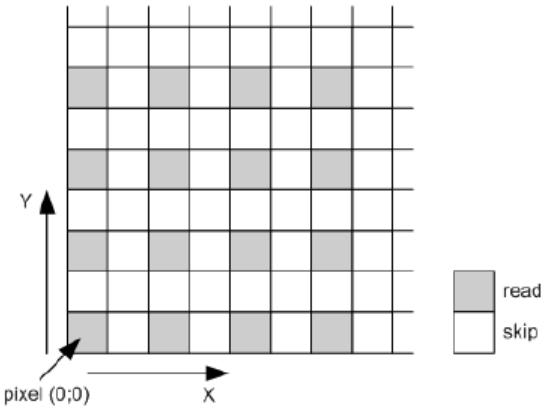
Frame rates for each ROI settings [fps]

ROI Setting (Video Image size)	Known as	Pixel Format	Link Configuration		
			CXP1_X1	CXP2_X1	CXP3_X1
ROIQuickChangeOff (1984×1264)		Mono8	41.7	84.5	84.5
		Mono10	36.4	72.6	84.5
ROIQuickChangePattern1 (1600×1200)	UXGA	Mono8	45.8	102.2	102.2
		Mono10	40.7	92.5	102.2
ROIQuickChangePattern2 (1280×1024)	SXGA	Mono8	64.9	138.4	138.4
		Mono10	61.0	135.2	138.4
ROIQuickChangePattern3 (1024×1024)	1M	Mono8	73.2	158.4	158.4
		Mono10	64.6	158.4	158.4
ROIQuickChangePattern4 (800×600)	SVGA	Mono8	137.3	297.9	297.9
		Mono10	122.1	297.9	297.9
ROIQuickChangePattern5 (640×480)	VGA	Mono8	199.8	399.5	399.5
		Mono10	183.1	399.5	399.5

5.5. Sub-Sampling

- ☐ This is 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.
- ☐ This function cannot be used with ROI function.

ImageFormatControl	
Subsampling	Subsampling_Off Subsampling_On



Frame rates for Sub-sampling [fps]

Subsampling mode (Pixel number)	PixelFormat	LinkConfig		
		CXP1_X1	CXP2_X1	CXP3_X1
Subsampling_On	Mono8	64.6	138.6	138.6

(992×632)	Mono10	54.9	135.4	138.6

5.6. Pixel Format

☐ This is to set the output format of the video data.

☐

ImageFormatControl	
PixelFormat	Mono8 Mono10

Mono8	Mono 8bit
Mono10	Mono 10bit

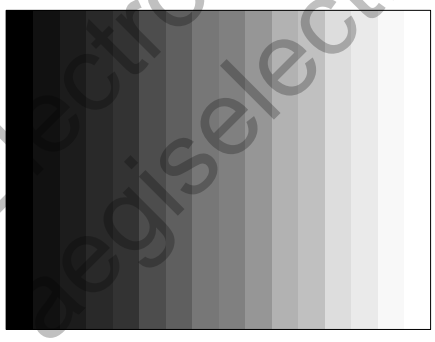
5.7. Test Pattern

☐ Test pattern can be output from the camera. It is useful to check if your system is operating properly.

☐ The status of this function cannot be saved so that it is OFF all the time when the camera is booted.

ImageFormatControl	
TestImageMode	OFF ON

Image of the Test Pattern



5.8. Trigger Mode

AcquisitionControl	
TriggerSelectorAndActivation	AcquisitionMode FrameStartRisingEdge FrameStartFallingEdge FrameStartLevelHigh FrameStartLevelLow
TriggerSource	LinkTrigger0 Line0

☐ Trigger Selector "TriggerSelectorAndActivation"
This is to select how to start capturing video or how long to capture video.

AquisitionMode	Use the setting values of "AcquisitionMode". (Continuous fixed = Internal sync (free run))
FrameStartRisingEdge	Fixed trigger shutter mode: rising edge
FrameStartFallingEdge	Fixed trigger shutter mode: falling edge
FrameStartLevelHigh	Pulse width trigger shutter mode: High active
FrameStartLevelLow	Pulse width trigger shutter mode: Low active

For the details on exposure time settings, please refer to the Section 4.9. Exposure Time

☐ Trigger Source

This is to select from where to get the external trigger input.

LinkTrigger0	Input the trigger packet from the CoaXPress Host Device. Please refer to the specification manuals of the Host Device such as frame grabber board to know how to generate triggers.
Line0	Input the trigger signals from the 6pins circular connector, No. 5 pin.

5.8.1. Internal Sync Mode (Free Run Mode)

☐ This is a mode to use triggers continuously made in the camera. No external trigger shall be used.

☐ Set TriggerSelectorAndActivation to AcquisitionMode.

Frame rate when ROI is invalid [fps]

PixelFormat	CXP1_X1	CXP2_X1	CXP3_X1
Mono8	41.7	84.5	84.5
Mono10	36.4	72.6	84.5

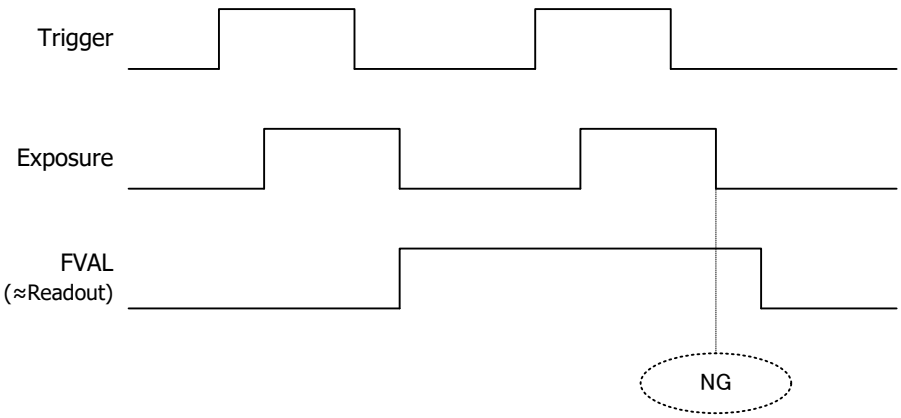
5.8.2. External Trigger Sync Mode

☐ This is a mode to input external trigger signals to capture images by any preferred timings.

☐ Set TriggerSelectorAndActivation" to other than "AcquisitionMode".

5.8.2.1. Restrictions on Trigger Pulse Input Timing

☐ The next trigger pulse can be input while reading out signals. However, please do not input a trigger pulse which ends its exposure while reading out the prior signals. In other words, a trigger pulse, while reading out signals for the prior frame and starts reading out signals for the next frame, cannot be input.



☐ When a trigger is input with the restricted timing explained the above, or with the timing to end exposure right after FVAL becomes "Low", video output from the camera might be stopped or the image turns to be all black.
In such case, remove the cause of this problem and execute "SensorReset" to re-start camera operation.
In case of when camera does not start operating, please reboot the camera.

DeviceControl	
SensorReset	Execute

5.8.2.2. Trigger Input Timing and Delay Time to Start Exposure

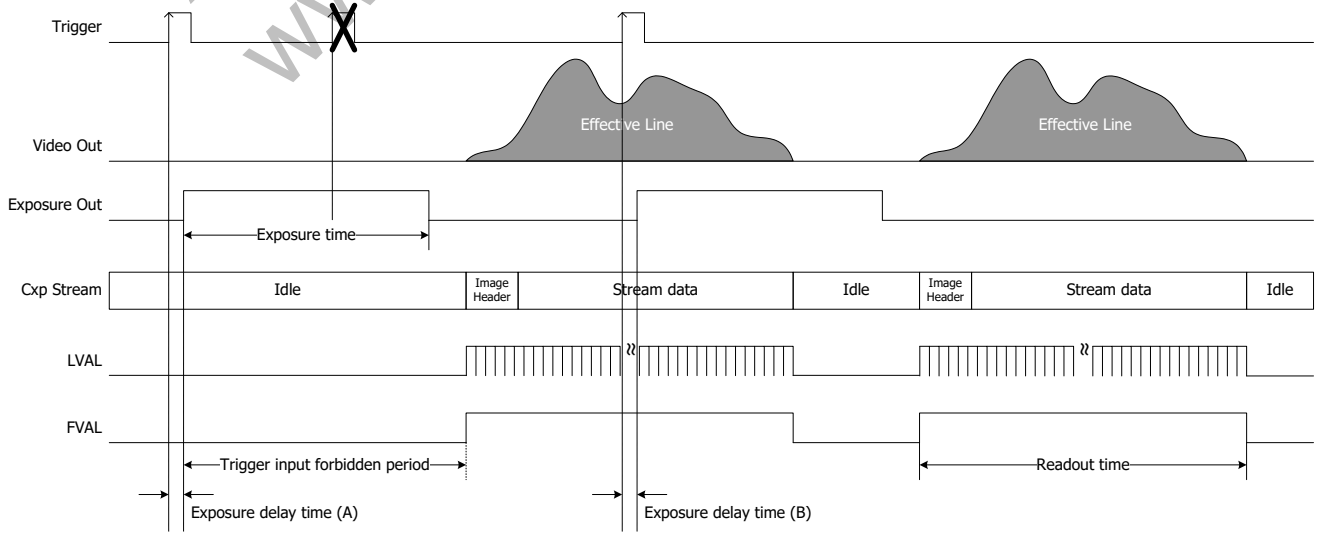
☐ Due to image sensor's own characteristics, the timing, for standard operation and overlapped operation, from when a trigger is input to the image sensor to when the actual exposure starts, would be different. With standard operation, the exposure for the next frame starts after completion of reading out the prior frame. With overlapped operation, the next exposure starts while reading out the prior frame.

Trigger Input Timing and Delay Time to Start Exposure [µs]

	Link Config		
	CXP1_X1	CXP2_X1	CXP3_X1
Exposure Delay [µs] to start exposure for Standard operation ※Timing chart: Exposure delay time (A)	8.0	4.1	4.1
Exposure Delay [µs] to start exposure for overlapped operation ※Timing chart: Exposure delay time (B)	8.0 – 25.2	4.1 – 12.7	4.1 – 12.4

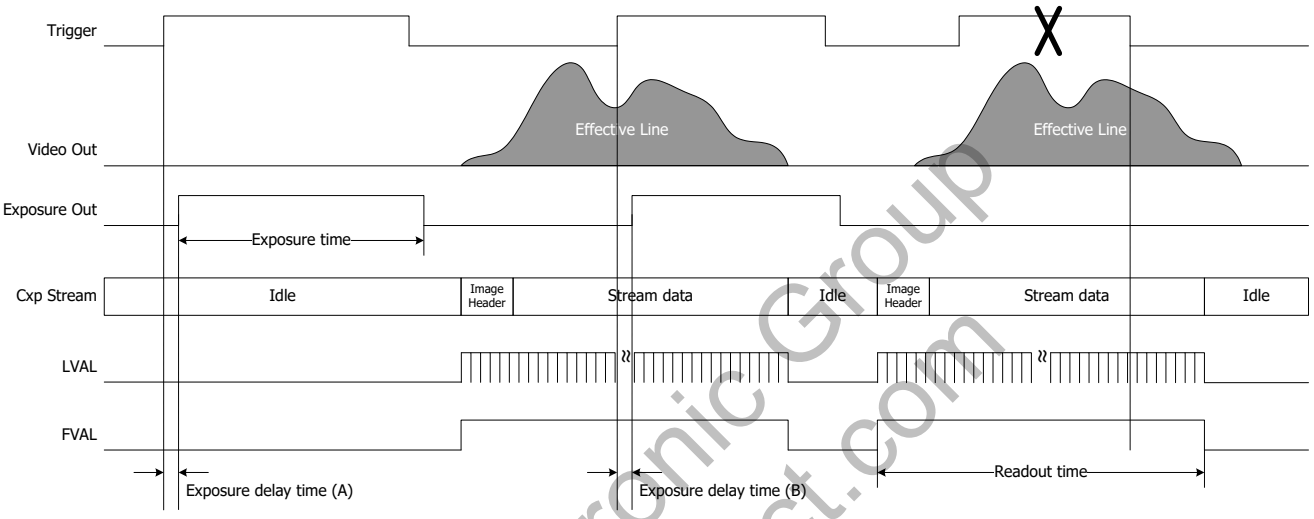
5.8.2.3. Fixed Trigger Shutter Mode

☐ This is the mode to start exposure by the input trigger signals. Exposure time is the set time with "Exposure Time".
☐ Set "TriggerSelectorAndActivation" to "FrameStartRisingEdge" or "FrameStartFallingEdge".
☐ Trigger cycle needs to be longer than FVAL period (Frame data reading out period).
☐ Trigger cycle needs to be longer than the exposure time.
☐ Trigger operation is CLK Sync HV Sync Reset.
☐ The minimum trigger pulse width to be input shall be 110µs.



5.8.2.4. Pulse Width Trigger Shutter Mode

- ☐ This is the mode to start exposure by the input trigger signals. The exposure time is its trigger pulse width.
- ☐ Set "TriggerSelectorAndActivation" to "FrameStartLevelHigh" or "FrameStartLevelLow".
- ☐ Trigger cycle needs to be longer than FVAL period (Frame data reading out period).
- ☐ Trigger operation is CLK Sync H-V Sync Reset.
- ☐ The minimum trigger pulse width to be input shall be 110µs.
- ☐ Functionally, there is no upper or lower limitation. However, at long exposure, some noises, lines, pixel-wise FPN, and shading might be noticeable.



5.9. Exposure Time

Acquisition Control	
ExposureTime	Manual
PresetShutter1_Xs	Execute

- ☐ Exposure time can be set per 1µs.
- ☐ Exposure time can be also set by the preset command function "Shutter1_Xs".
- ☐ The minimum exposure time is 110µs.
- ☐ The maximum exposure time depends on ROI settings, "PixelFormat", and "LinkConfig".
- ☐ The smaller values than the chart in the next page shall be set.

The maximum long exposure time [μs]

ROI Setting mode (Image size)	Known as	Pixel Format	Link Configuration		
			CXP1_X1	CXP2_X1	CXP3_X1
ROIQuickChangeOff (1984×1264)		Mono8	23,779	11,605	11,605
		Mono10	27,256	13,539	10,622
ROIQuickChangePattern1 (1600×1200)	UXGA	Mono8	21,617	9,557	9,557
		Mono10	24,348	10,581	9,557
ROIQuickChangePattern2 (1280×1024)	SXGA	Mono8	15,189	6,997	6,997
		Mono10	16,156	7,168	6,997
ROIQuickChangePattern3 (1024×1024)	1M	Mono8	13,425	6,087	6,087
		Mono10	15,246	6,087	6,087
ROIQuickChangePattern4 (800×600)	SVGA	Mono8	7,054	3,128	3,128
		Mono10	7,964	3,128	3,128
ROIQuickChangePattern5 (640×480)	VGA	Mono8	4,778	2,275	2,275
		Mono10	5,233	2,275	2,275
Subsampling (992×632)		Mono8	15,246	6,986	6,986
		Mono10	17,976	7,157	6,986

Exposure Time Preset Setting Values

PresetShutter1_Xs	Exposure Time [s]	Exposure Time [μs]
Shutter_1_50s	1/50	20,000
Shutter_1_60s	1/60	16,666
Shutter_1_100s	1/100	10,000
Shutter_1_150s	1/150	6,666
Shutter_1_300s	1/300	3,333
Shutter_1_600s	1/600	1,666
Shutter_1_1200s	1/1200	833
Shutter_1_2500s	1/2500	400
Shutter_1_5000s	1/5000	200

5.10. Gain

- ☐ This is to increase the video out level with "Gain" and its level can be increased from x1.0 to x 32.0 per x0.25.
- ☐ The setting can be also done by the preset command function, "PresetGainX".
- ☐ Functionally, the settings are available up to 32.0 times. However, the image quality will be reduced when gain setting is high. We recommend you to evaluate it first.

AnalogControl	
Gain	Manual
PresetGainX	Execute

Gain Preset Setting Values

PresetGainX	Magnification	Decibel equivalent
Gain_x1	×1.0	0.0dB
Gain_x1_5	×1.5	3.5dB
Gain_x2	×2.0	6.0dB
Gain_x3	×3.0	9.5dB
Gain_x4	×4.0	12.0dB
Gain_x6	×6.0	15.6dB
Gain_x8	×8.0	18.0dB

5.11. Black Level Adjustment

- ☐ Black level is adjustable with relative values.
- ☐ When it is increased or decreased by 1, its luminance level changes by approx. 0.25 at 8 bit output, and it changes by approx. 1.0 at 10 bit output.
- ☐ When the lower values than the initial value are set, saturation level would not achieve to the maximum value for output range.

AnalogControl	
BlackOffset	0 – 255

5.12. Shading

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

AnalogControl	
DetectShading	Execute
ShadingCorrection	True False

- ☐ Detect Shading

  Shoot a uniform object such as a pattern box, to full screen, then execute DetectShading, to calculate and save the correction data automatically in the camera.

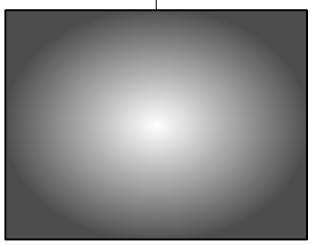
  When detecting shading, set the image size to 1984×1264

  When detecting shading at fixed trigger mode or at pulse width trigger mode, a trigger signal shall be input within 200ms after execution

□ Shading Correction

Turn ShadingCorrection ON to start shading correction according to the shading correction data prepared by shading detection.

◆ Before Shading Correction



◆ After Shading Correction

5.13. Defective Pixels Correction

□ CIS compensates the noticeable CMOS pixel defects found at the shipping inspection prior to our shipment, but these can be disabled.

AnalogControl	
DefectivePixelCorrection	True False

5.14. General Signals Output

□ This is to switch the output signals from No. 3pin of 6pins circular connector.

DigitalIOControl	
LineSource	OFF ExposureActive FrameActive LineActive TriggerPacketActive

OFF	Invalid Signal output
ExposureActive	Exposure out
FrameActive	Frame Valid
LineActive	Line Valid
TriggerPacketActive	High by receiving rising trigger packet. Low by receiving falling trigger packet.

5.15. Link Speed and Link Count

TranceferControl	
LinkConfig	CXP1_X1 CXP2_X1 CXP3_X1

CXP1_X1	Link speed =1.250Gbps, Link Count =1
CXP2_X1	Link speed =2.500Gbps, Link Count =1
CXP3_X1	Link speed =3.125Gbps, Link Count =1

5.16. Setting Save and Initialization

- □ Execute "UserSave" to save the setting values. The setting values are to be saved in the non-volatile memory in the camera and those saved settings will be reflected when the camera is rebooted next time.
  The changes to "LinkConfig" can also be saved but these changes are reflected only when the camera is rebooted.
- □ Execute "UserSetDefault" to restore to the factory settings. This is valid only when "LinkConfig" is at "CXP1_X1".

UserSets	
UserSetSave	Execute
UserSetDefault	Execute

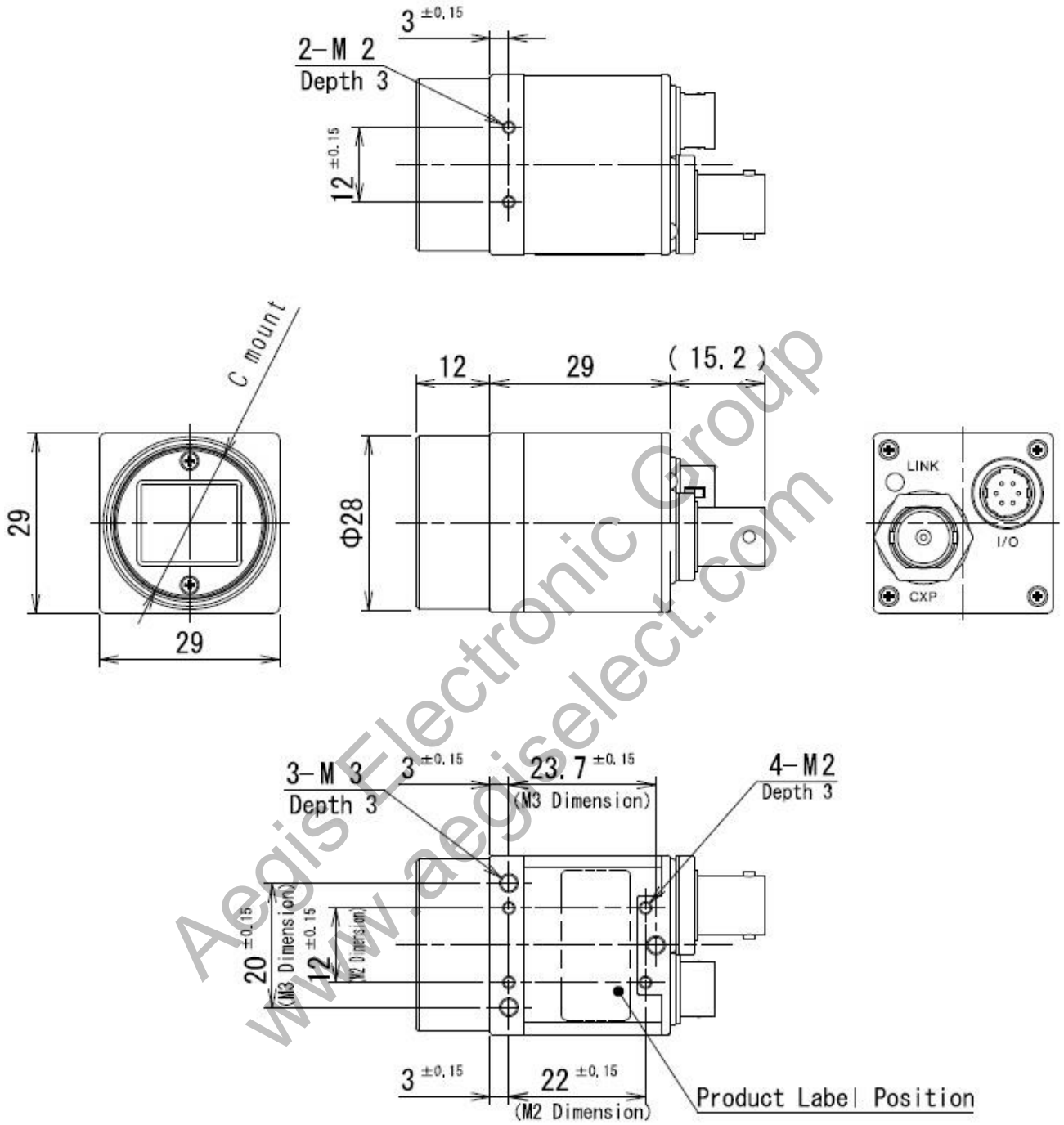
6. Factory Settings

Function	Data	Explanation
DeviceUserID	""	Null Character strings
DeviceIndicatorMode	Active	
Width	1984	
Height	1264	
OffsetX	0	
OffsetY	0	
SubsamplingMode	Subsampling_Off	
PixelFormat	Mono8	
TriggerSelectorAndActivation	AcquisitionMode	=Free run
TriggerSource	LinkTrigger0	
ExposureTime	3333	
Gain	1.00	
BlackOffset	53	
ShadingCorrection	False	
DefectivePixelCorrection	True	
LinkConfig	CXP1_X1	

※ Execute UserSetDefault to restore to the factory settings.

7. Dimensions

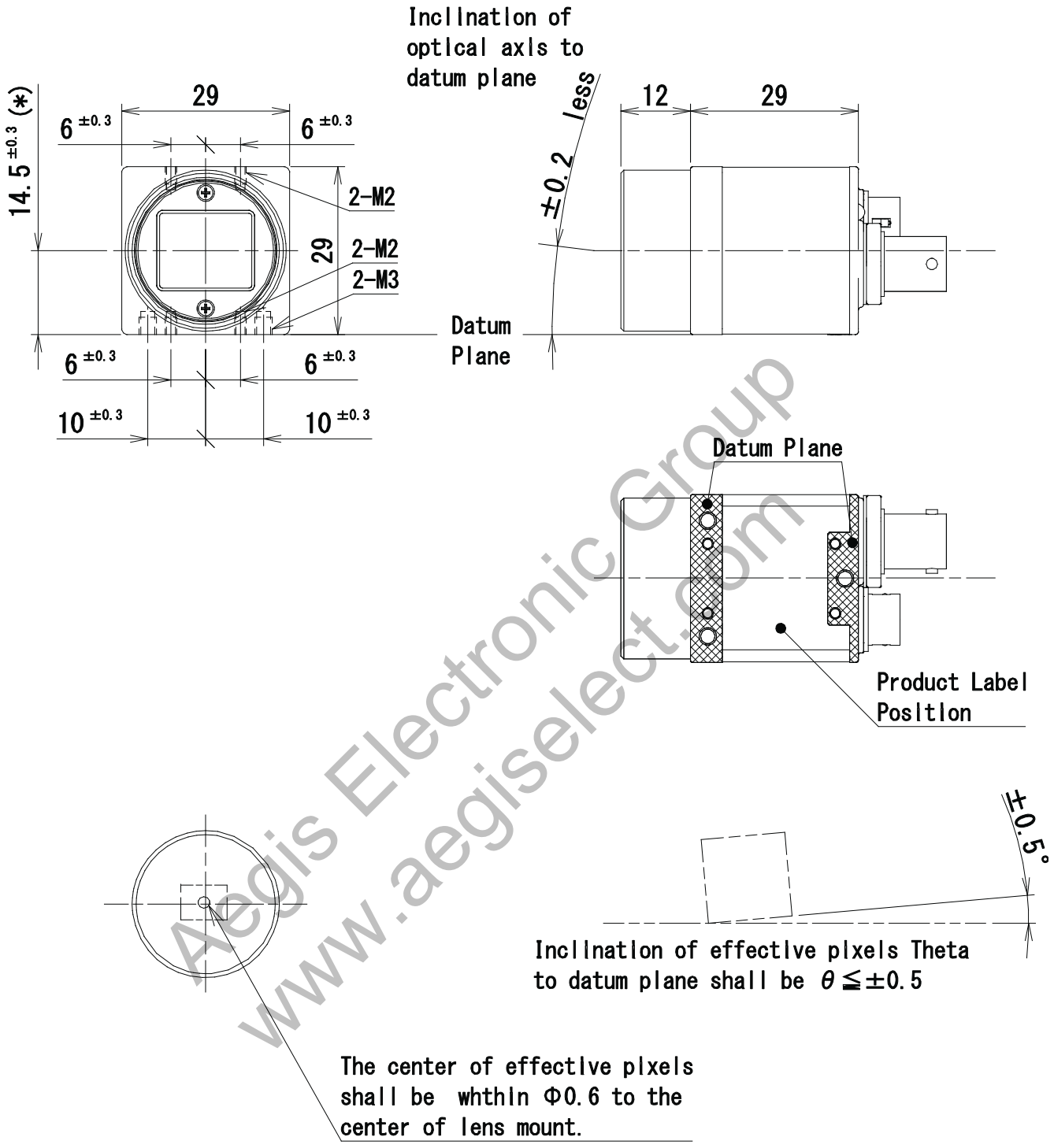
7.1. Camera Dimensions



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

Note 1) 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.

7.2. Optical Axis Accuracy



(*)Dimension from datum plane to the center of lens mount.

937-0014-00
(Unit:mm)

8. Case for Indemnity (Limited Warranty)

8.1. Product 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, flood, 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.

8.2. 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.

8.3. 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.