CIS

CoaXPress I/F

127M pixels CMOS RAW Camera

VCC-127CXP6R

Product Specifications & Operational Manual

CIS Corporation

CIS Corporation

様式№.7026-07

目次

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. Handle the camera with care.
- ☐ Do not shoot direct images that are extremely bright (e.g., strong light source, sun, etc.). 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 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.
- ☐ The voltage ripple of camera power DC+24V±10% shall be within ±50mV. Improper power supply voltage may cause noises on the video signals.
- ☐ Our warranty does not apply to damages or defects caused by irregular and/or abnormal use of the product.

1.2. Restrictions on Applications

- ☐ The camera must not be used for any nuclear equipment or aerospace equipment 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-127CXP6R is a CoaXPress interfaced camera (Type 3.6), 127M pixels CMOS global shutter image sensor.

2.1. Features

- ☐ Global shutter type CMOS sensor
- ☐ CoaXPress CXP-6/CXP-12
- ☐ 2lane / 1lane
- ☐ PoCXP
- ☐ The maximum cable length: 40m at CXP-6, 24m at CXP-12 (Depending on cable specification)
- ☐ ROI / Multi ROI
- ☐ Exposure time and Gain settings
- ☐ FFC(Flat Field Correction)
- ☐ External trigger sync. mode (Fixed trigger shutter mode and pulse width trigger shutter mode)
- ☐ CoaxXPress GenICam complied
- ☐ M72 lens mount

2.2. Bundled Items

- ☐ Standard bundled items
  - Camera module, VCC-127CXP6R

3. Specifications

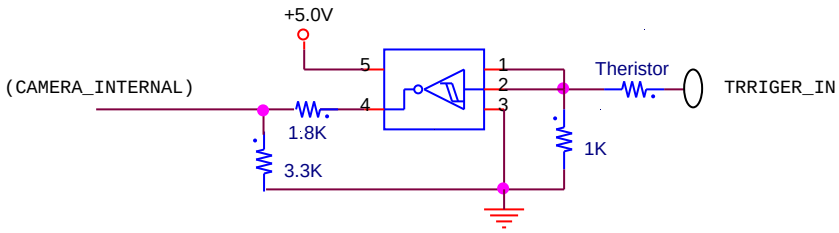
3.1. General Specifications

Electrical Specifications			
Image sensor	Device type	Type 3.6 global shutter type CMOS sensor	
	Effective pixel number	13408(H) × 9528(V)	
	Unit cell size	3.45µm(H) × 3.45µm(V)	
Video output mode		Ver. 1.1.1complied, CXP12 / CXP6	
Video output	Pixel clock frequency	1250MHz	
Video output format		Bayer 8 / Bayer 10 / Bayer 12 / Bayer14	
Frame rate	CXP12_X2	18.5fps@8bit / 13.1fps@10bit / 11.1fps@12bit / 9.1fps@14bit	
	CXP12_X1 / CXP6_X2	9.2fps@8bit / 6.5fps@10bit / 5.6fps@12bit / 4.6fps@14bit	
	CXP6_X1	4.6fps@8bit / 3.3fps@10bit / 2.8fps@12bit / 2.2fps@14bit	
Video output pixel size (Max. pixel size)		13408(H) x 9528(V)	
Video signals	White clip level	FFh	BAYER8, default settings (Defect Pixel Correction ON)
	Set up level	0~2h	BAYER8, default settings (Defect Pixel Correction ON)
	Dark shading	0~2h	BAYER8, default settings (Defect Pixel Correction ON)
Sensitivity		F8 (2000lx, Bayer14, at default settings)	
Minimum illumination		F3.5 2.70lx (Bayer14, Gain x64, ExposureTime 100000µs, level=50%)	
Gain variable range		x1～x64 (0dB～36dB)	
Shutter speed		22[µs]～15[s] ※When long exposure time, TriggerMode shall be used	
Gamma correction		γ=0.3 to 3.0, 0.01steps	
Trigger mode		Free run mode (Camera internal trigger) Trigger mode (Host, external terminal)	
Partial scan		Custom ROI, multi ROI	
Power requirements		12pins circular connector: +24V±10%, or PoCXP: +18.5V~26V （length of power cable for circular connector is less than 10m requried）	
Power consumption		21.0W max (CXP12_X2), [at free run]	
Mechanical Specifications			
Dimensions		H:100mm W:100mm D:100mm (Without protruding portion)	
Weight		940g	
Lens mount		M72 mount	
Environmental Specifications			
Safety/Quality standard		CE EMC: 2014/30/EU Emission: EN61000-6-4:2007+A1:2011 Immunity: EN61000-6-2:2019	
		RoHS: 2011/65/EU (EU)2015/863	
Durability	Vibration	Acceleration	: 98m/s^2 (10G)
		Frequency	: 20 ~ 200Hz
		Direction	: X, Y, and Z 3 directions
		Testing time	: 120min 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.	
Operation guaranteed environment		0°C ~ +40°C Humidity: 20~80% RH with no condensation.	
Storage environment		-25°C ~ +60°C Humidity: 20~80% RH with no condensation.	

3.2. Input and Output

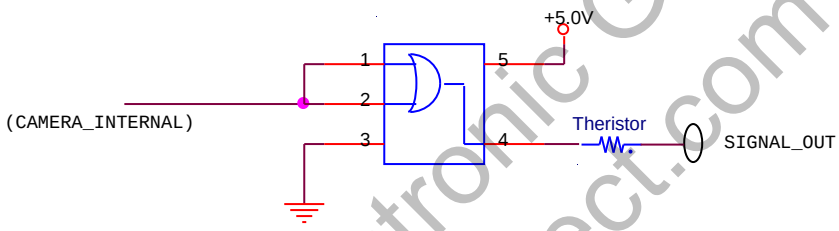
3.2.1 12pins Connector External Input (Trigger No.11 pin)

- ☐ 5.0V, 3.3V CMOS level / TTL level
- ☐ Input voltage Low: 0.5Vdc (Max.), High: 2.1Vdc (Min.)
- ☐ To use this terminal, please set TriggerSource of AcquisitionControl to Line 0.



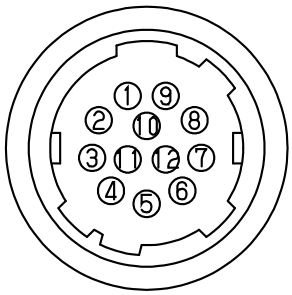
3.2.2 12pins Connector External Output (No.7, 9, and 10 pin)

- ☐ 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 12pins Circular Connector HR10-10R-12PA(73) (HIROSE) or Equivalent



Pin	Signal Name	Explanation
1	GND	GND
2	Power	External power input +24V±10%
3	USB D+	For FFC program
4	USB D-	For FFC program
5	GND	GND
6	USB VBUS	For FFC program
7	GPO1	Universal output(default: Low)
8	GND	GND
9	GPO2	Universal output(default : Low)
10	GPO3	Universal output(default : Low)
11	TRIGGER_IN	External trigger input
12	GND	GND

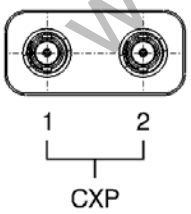
※See Application Note for FFC program on detail
※See 4.24 Digital IO Control for Universal output on detail
※Recommended voltage value and corrent value
1. Voltage: E[V]
2. CXP cable length: ℓ[m]
3. Resistance value of the CXP cable per 1 meter: r[Ω/m]
Calculation formula of External Power Input: E[V]=24[V]+r[Ω/m]×ℓ[m]×0.6[A]
When external power input is used, supply E[V] value more than the power consumption specification of this camera.
※When external power input is used, CoaXPress power supply(PxCXP) should be used. It may cause malfunction.

3.3.2 75ΩMicroBNC Connector

☐ CoaXPress Video output signals.

☐ Both No.1 pin connector and No.2 pin connector should be needed for PoCXP.

When PoCXP is used, 2connections supply power at the same time. If there is a difference in connection time, camera initializaion may fail.



(Amphenol Connectors)

3.3.3 LED Indicator

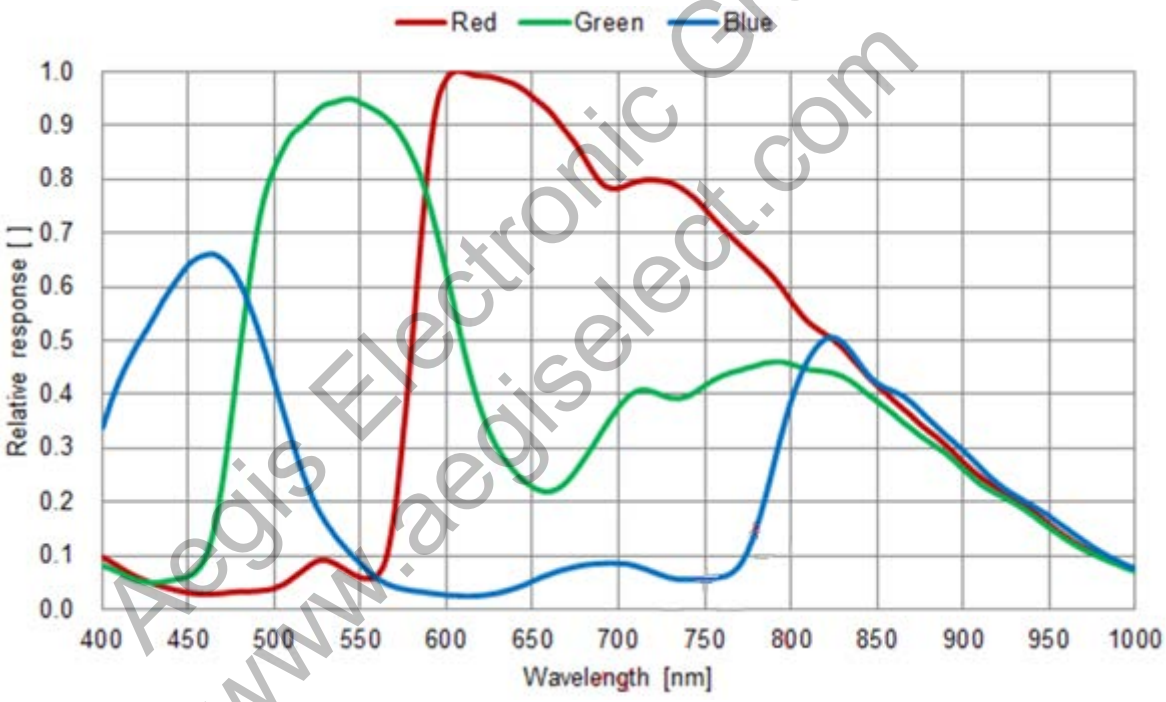
☐ When DeviceIndicatorMode is Active, lighting patterns of LED shows the camera status by the way of its lighting.

OFF	No Power supplied
Green/Orange Fast blinking [12.5Hz]	2 cable lines are not connected.
Green Lighting	Confirmed connection of the device and the host.
Green Fast blinking [12.5Hz]	Transmitting video data.
Orange Slow blinking [1Hz]	Waiting for the trigger input.
Red Fast blinking [12.5Hz]	Image transmission error occurred or inappropriate trigger input is detected. [Error]

※Error shall appear when an illegal trigger is detected while using external trigger sync. mode.

3.4. Spectral Sensitivity Characteristic

※ The lens characteristics, IR cut filter characteristics, and the illuminant characteristics are excluded.



4. Camera Operational Function

4.1. Control System

☐ Complies with CoaXPress standard.

Each setting features comply with GenICam SFNC(Standard Features Naming Convention).

The corresponding SFNC version is available from DeviceSFNCVersionMajor, DeviceSFNCVersionMinor and DeviceSFNCVersionSubMinor.

4.2. Device Information

☐ This is to indicate the camera status.

DeviceControl	
DeviceModelName	ReadOnly
DeviceVersion	ReadOnly
DeviceFirmwareVersion	ReadOnly
DeviceSerialNumber	ReadOnly

- DeviceModelName : Model name of the camera
- DeviceVersion : Circuit version
- DeviceFirmwareVersion : Firmware version
- DeviceSerialNumber : Serial number of the camera

☐ A letter string consisting of the maximum 16 characters including NUL letter (¥0) on DeviceUserID and maximum 256 characters including NUL letter (¥0) on DeviceUserString, can be set to the camera. To save it into the volatile memory of the camera, execute “UserSetSave”. After setting the camera to “Default” with “UseSetDefault”, the camera will not return to the factory settings after rebooting.

DeviceControl	
DeviceUserID	Manual
DeviceUserString	Manual

4.3. 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 ErrorStatus Inactive

- Active : Indicate the communication status of CoaXPress.
- ErrorStatus : OFF at normal operation. Lights only when video transmitting error occurs or when an inappropriate trigger is input.
- Inactive : ALL LED OFF

4.4. Region of Interest (ROI)

☐ This is to increase its frame rate by cutting out and reducing the read out area.

ImageFormatControl	
RegionSelector	EffectiveRegion, Region0~7
RegionMode	Off/On
Width	1920～13408
Height	1080~9528
OffsetX	0~(13408-Width)
OffsetY	0~(9528-Height)

☐ ROI

- "RegionSeletor: Select the ROI region.
  Can be modified ROI areas of Region0 to Region7
  When EffectiveRegion is selected, the ROI areas shall be active. If incorrect ROI settings are found, display Error.
  ※Before grab the images, make sure this shall be set EffectiveRegion.
- RegionMode :"Width", "Height", "OffsetX", and "OffsetY" can be changed at Off.
  :The value of "Width", "Height", "OffsetX", and "OffsetY" shall become valid at On.
  Please make sure to start acquiring images when RegionMode is On.
- "Width" :The size for X direction of ROI can be specified per 32 pixels.
  The procedure of Width value setting at multi ROI.
  First, select RegionMode ON at any RegionSelector then set the Width value, after that Width value should not be changed at other RegionSelector. If the Width is not same as other RegionSelector's one, it will be Error appeared.
- "Height" : The size for Y direction of ROI can be specified per 4 pixels.
- "OffsetX" :The position of Offset for X direction of ROI can be specified per 32 pixels.
- "OffsetY" :The position of Offset for X direction of ROI can be specified per 4 pixels.

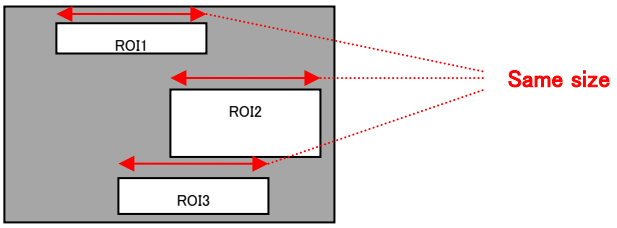
[Note]

・When ShadingCorrection is true, RegionSelector cannot be changed.

・When DetectShading at Shading Correction, make sure the image size shall be set to 19568 x 12588 to execute.

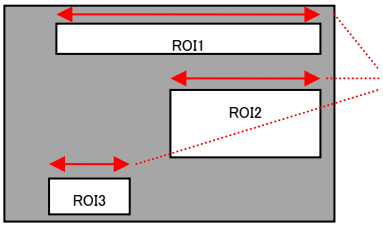
Multi ROI constraints

OK same horizontal width, not vertical position overlapped and not overlapped areas

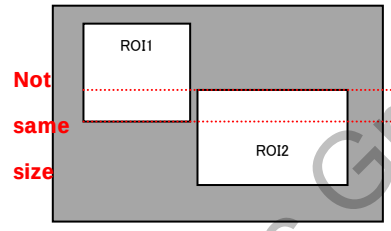


NG

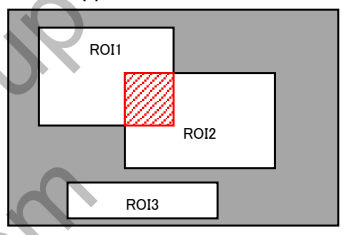
① Not same size for horizontal



② Vertical overlapped



③ Overlapped areas



Formula of ROI frame rate

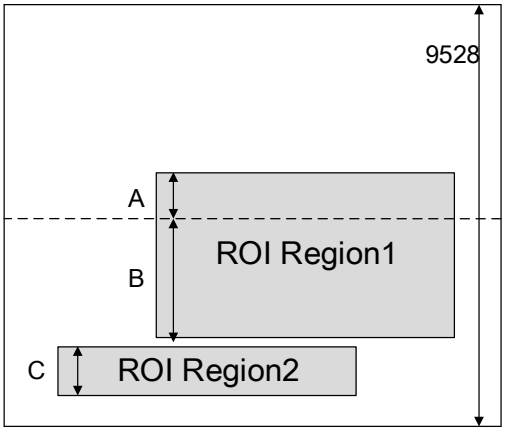
- When smaller size of Horizontal width is used, frame rate is the same as 13408 size.
- When smaller size of Vertical height is used, frame rate is faster.

PixelFormat	1 frame time		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Bayer8	(L+384)*10.5us	(L+384)*2*10.5us	(L+384)*4*10.5us
Bayer10	(L+384)*14.8us	(L+384)*2*14.8us	(L+384)*4*14.8us
Bayer12	(L+364)*17.5us	(L+364)*2*17.5us	(L+364)*4*17.5us
Bayer14	(L+300)*21.5us	(L+300)*2*21.5us	(L+300)*4*21.5us

Frame rate of ROI is 1 / (1 frame time) [fps].

L in the above table is larger part of the total size of the effective area when the size of full scale 13408x9528 is divided into upper and lower parts.

Exmaple below, A is the vertical size of upper part, B+C is the vertical size of lower part. L is B+C, as B+C>A.



4.5. Pixel Format

ImageFormatControl	
PixelFormat	Bayer8 Bayer10 Bayer12 Bayer14

・Bayer8 : Bayerchrome 8bit
・Bayer10 : Bayerchrome 10bit
・Bayer12 : Bayerchrome 12bit
・Bayer14 : Bayerchrome 14bit

4.6. Flip

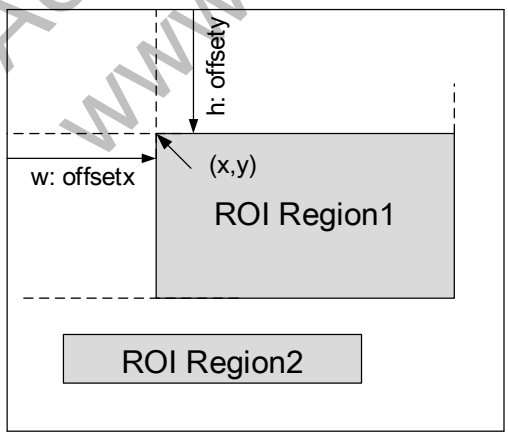
ImageFormatControl	
ReverseX	True/False
ReverseY	True/False

ReverseX :Horizontal Flip
ReverseY :Vertical Flip
※Cannot be changed when grabbing the images.

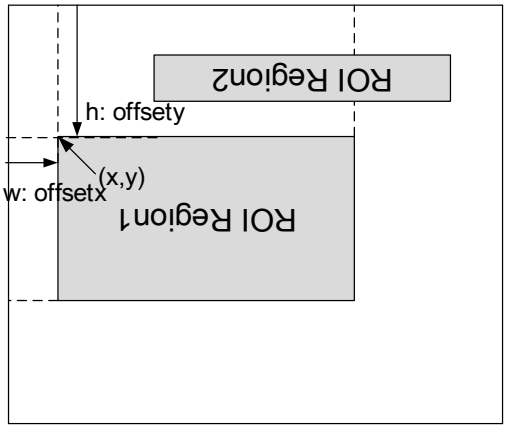
[Note]
・When ShadingCorrection with ReverseY is used, ShadingDetection is executed with Vertical Flip image then ShadingCorrection will be set to True.

・ReverseX parameter or ReverseY parameter is changed at ROI, the value of OffsetX or OffsetY shall be the flipped position.

ReverseX=False, ReverseY=False



ReverseX=True, ReverseY=True



4.7. Cursor Indication

☐ Cursor can be shown on the screen.

ImageFormatControl	
CursorPattern	On/Off
CursorOffsetX	X coordinate
CursorOffsetY	Y coordinate
CursorColor	White/Black

- CursorPattern : Specify if the cursor shall be indicated or not.
- CursorOffsetX : Specify the X coordinate of the vertical cursor.
- CursorOffsetY : Specify the Y coordinate of the horizontal cursor.
- CursorColor : Specify the color of the cursor (Black or White).

[Note]

- Cursor may not be shown when the screen size is scaled down.
- Cursor indication cannot be set when the test pattern indication is ON.
- Input the CursorOffsetX and CursorOffsetY position of the coordinate at full scale when ROI.

4.8. Test Pattern Indication

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

ImageFormatControl	
TestPattern	OFF ColorBar ColorBarMoving

[Note]

- Test pattern indication function cannot be set when cursor indication is ON.

4.9. Trigger Mode

Acquisition Control	
TriggerSelector	AcquisitionStart FrameStart
TriggerMode	Off/On
TriggerActivation	RisingEdge FallingEdge LevelHigh LevelLow
TriggerSource	LinkTrigger0 Line0
TriggerSoftware	Execute
IllegalTriggerFlag	0 or 1
AcquisitionFrameRate	[ReadOnly]

・TriggerSelector : Trigger selector

This is to select how to start capturing video out of the followings.

・AcquisitionStart : Free run mode [Internal sync. mode]

・FrameStart : External trigger sync. mode [External sync. mode]

・TriggerMode : Trigger mode

This is to select enable / disable of the trigger at external trigger sync. mode.

・Off : Disable trigger.

・On : Enable trigger.

・TriggerActivation : Trigger activation

This is to select the trigger polarity out of the followings.

TriggerActivation becomes operable when the TriggerSelector is at FrameStart.

・RisingEdge : Rising edge [External sync. mode]

・FallingEdge : Falling edge [External sync. mode]

・LevelHigh : High level signal indicates directly exposure time [External sync. mode]

・LevelLow : Low level signal indicates directly exposure time [External sync. mode]

・TriggerSource: Trigger source

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

・LinkTrigger0 : External trigger input 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 : External trigger input from the 12pins circular connector.

・Software : TriggerSoftware command is active.

※Not recommended, selected LevelLow or FallingEdge of TriggerActivation, when LinkTrigger0 selected. The images of the 1st frame may not be displayed, depends on the grabber board.

・TriggerSoftware: Software trigger

A trigger is generated in the camera and capture images for one frame when this command is executed.

This command is valid when TriggerSelector is at FrameStart.

※Please set TriggerActivation to RisingEdge.

・IllegalTriggerFlag :

This will be “1”, when illegal trigger is detected at external sync. Mode. In terms of illegal trigger, please refer 4.10.2 External Sync. Mode (Edge Trigger Sync. Mode) and 4.10.3 External Sync. Mode (Pulse Width Trigger Sync. Mode).

After ErrorFlagReset of DeviceControl is executed, this flag will be reset.

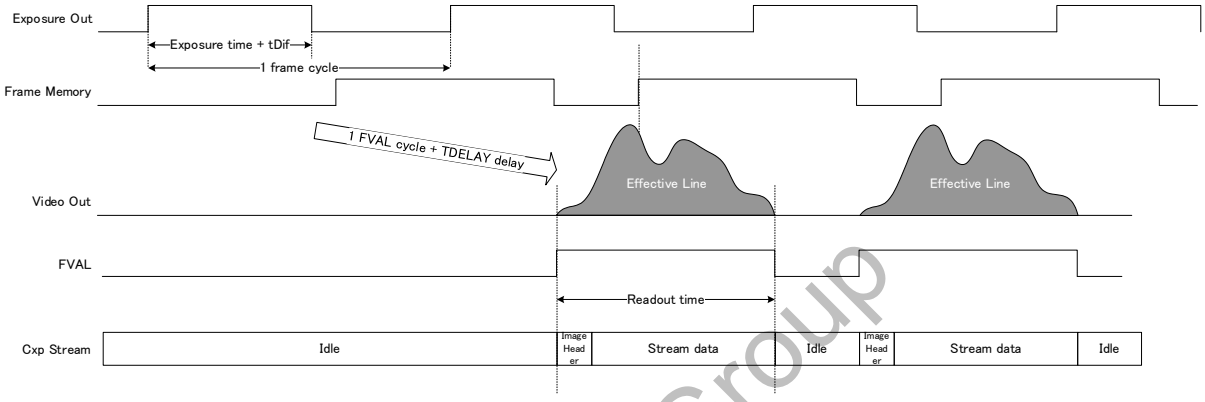
・AcquisitionFrameRate ：The actual frame rate is displayed. This will be updated every 3s.

※When the frame rate is less than 1fps at trigger mode, 0fps is displayed.

4.9.1 Internal Sync. Mode (Free Run Mode)

☐ This is the mode to output images continuously.

☐ Set TriggerSelector to AcquisitionStart.



※Actual exposure time(Exposure Out) is set Exposure Time parameter + tDif. tDif is depend on PixelFormat.

Bayer8: 10.5µs * (47 to 49) + 6.95µs

Bayer10: 14.8µs * (47 to 49) + 6.95µs

Bayer12: 17.5µs * (43 to 45) + 6.95µs

Bayer14: 21.5µs * (31 to 33) + 6.95µs

4.9.2 External Sync. Mode (Edge Trigger Sync. Mode)

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

☐ Set "TriggerSelector" to "FrameStart".

☐ This is a mode to exposure for the period set with “ExposureTime” when a trigger signal is input.

☐ Set "TriggerActivation" to "RisingEdge" or "FallingEdge".

☐ Trigger cycle needs to be longer than the frame rate of Free run mode.

☐ Trigger cycle needs to be longer than set exposure time.

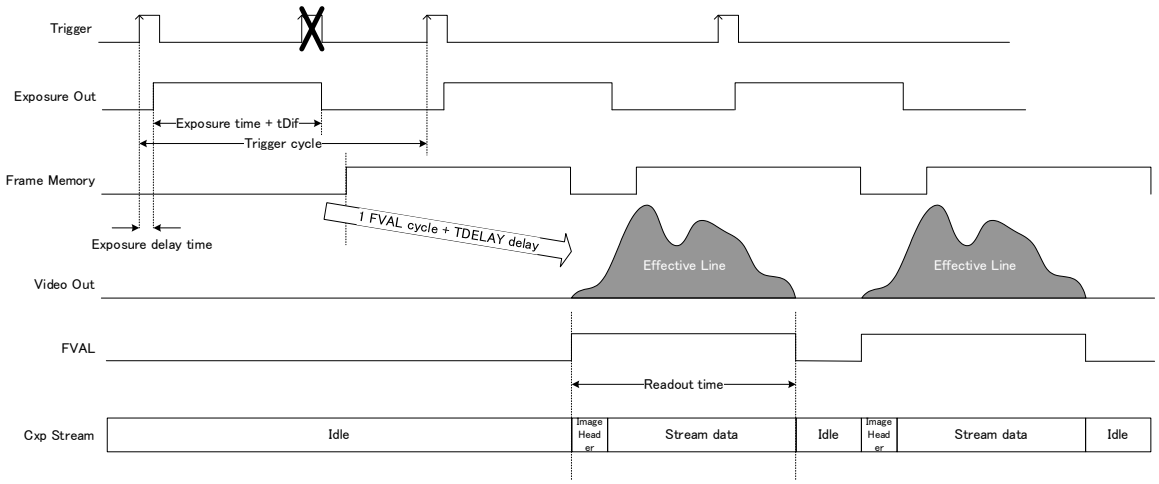
☐ Trigger operation is H sync. H-V sync. reset.

☐ Trigger pulse width to be input needs to be 1us or longer.

☐ The first frame after changing belows settings will be an invalid frame.

CXPlink speed or link num, pixel format, ROI or trigger mode.

Input the dummy trigger once then from 2nd trigger input will be valid to capture images.



※Actual exposure time(Exposure Out) is set Exposure Time parameter + tDif. tDif is depend on PixelFormat.

Bayer8: 10.5µs * (47 to 49) + 6.95µs

Bayer10: 14.8µs * (47 to 49) + 6.95µs

Bayer12: 17.5µs * (43 to 45) + 6.95µs

Bayer14: 21.5µs * (31 to 33) + 6.95µs

※Exposure delay time is depends on PixelFormat. 4 to 6 means jitter.

Bayer8: 10.5µs * (4 to 6)

Bayer10: 14.8µs * (4 to 6)

Bayer12: 17.5µs * (4 to 6)

Bayer14: 21.5µs * (4 to 6)

4.9.3 External Sync. Mode (Pulse Width Trigger Sync. Mode)

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

☐ Set "TriggerSelector" to "FrameStart".

☐ Set "TriggerActivation" to "LevelHigh" or "LevelLow".

☐ Trigger cycle needs to be longer than the frame rate of Free run mode.

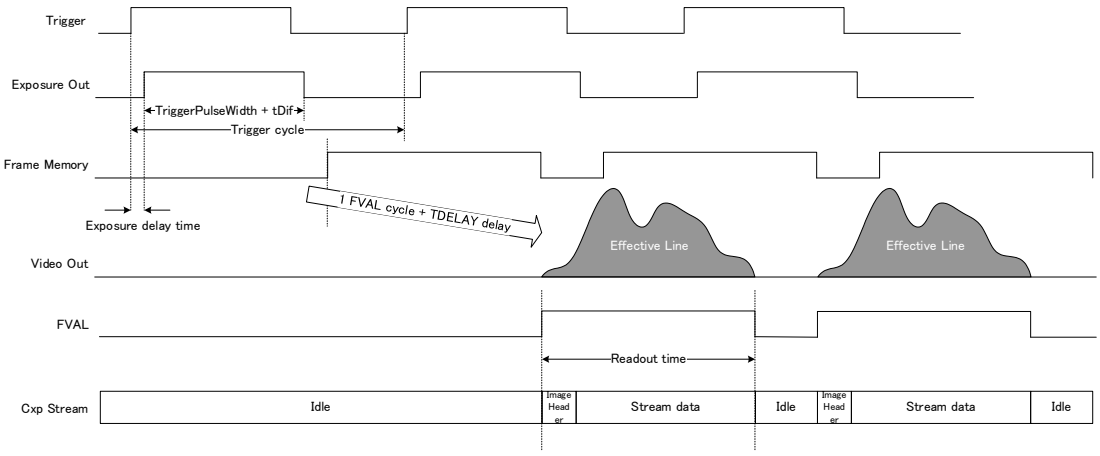
☐ Trigger operation is H sync. H-V sync. reset.

☐ Trigger pulse width to be input needs to be 22us or longer.

☐ The first frame after changing belows settings will be an invalid frame.

CXPlink speed or link num, pixel format, ROI or trigger mode.

Input the dummy trigger once then from 2nd trigger input will be valid to capture images.



※Actual exposure time(Exposure Out) is the time of external trigger pulse + tDif. tDif is depend on PixelFormat.

Bayer8: 10.5µs * (47 to 49) + 6.95µs

Bayer10: 14.8μs * (47 to 49) + 6.95μs
Bayer12: 17.5μs * (43 to 45) + 6.95μs
Bayer14: 21.5μs * (31 to 33) + 6.95μs

※Exposure delay time is depends on PixelFormat. 4 to 6 means jitter.

Bayer8: 10.5μs * (4 to 6)
Bayer10: 14.8μs * (4 to 6)
Bayer12: 17.5μs * (4 to 6)
Bayer14: 21.5μs * (4 to 6)

4.10. Exposure Time

Acquisition Control	
ExposureTime (μs)	22~ExposureTimeMax
ExposureTimeMax	[ReadOnly]

ExposureTime :set ExposureTime(Actual exposure time is this value + tDif)

Bayer8: tDif = 10.5μs * (47 to 49) + 6.95μs
Bayer10: tDif = 14.8μs * (47 to 49) + 6.95μs
Bayer12: tDif = 17.5μs * (43 to 45) + 6.95μs
Bayer14: tDif = 21.5μs * (31 to 33) + 6.95μs

ExposureTimeMax :

Available maximum exposure time on the current mode(depends on ROI and PixelFormat) is displayed.
This read value is depend on the Free Run mode.
Maximum value is 15000000μs (15s) at External Sync. Mode.

※If long exposure time is required, please use External Sync. Mode.

4.11. Gain

AnalogControl	
Gain	1.0～64.0
RegistersControl	
BaseGainSelector	UpperLeft,UpperRight,BottomLeft,BottomRight
BaseGain	1024~16383 : 0x400 (x1)
BaseOffset	-16384~16383 : 0x0

- Gain : From x1 to x64 preferred gain can be set
- BaseGainSelector: Specify the position of the sensor.
- BaseGain : The values adjusted at ex-factory to suppress the variability of sensitivity and the unevenness of saturation of each sensor area are stored. To calculate the FPN correction coefficient and PRNU correction coefficient, please set 1024 (x1).
- BaseOffset : The values adjusted at ex-factory to suppress the variability of sensitivity and the unevenness of saturation of each sensor are stored. Specify the input value with 14bit range (-16384~16383).

[Note]

- Functionally, gain up to +8 times can be set. However, the image quality will be deteriorated when gain setting is increased. We recommend you to evaluate it first.
- 1024 is x1 at BaseGain, however output image will not reach the saturation level with 1024 due to the image sensor specifications.

4.12. Black Level Adjustment

☐ This is a function to adjust the black level at the latter part of the camera image processing.

AnalogControl	
BlackLevel	0～16

BlackLevel	8bit	10bit	12bit	14bit
0	0	0	0	0
1	1	4	16	64
2	2	8	32	128
3	3	12	48	192
4	4	16	64	256
5	5	20	80	320
6	6	24	96	384
7	7	28	112	448
8	8	32	128	512
9	9	36	144	576
10	10	40	160	640
11	11	44	176	704
12	12	48	192	768
13	13	52	208	832
14	14	56	224	896
15	15	60	240	960
16	16	64	256	1024

※This adjustment function is only for + direction.

4.13. Flat Field Correction

☐ This is to correct the flat field according to the FPN correction coefficient and PRNU correction coefficient for entire pixels stored at the memory.

FlatFieldCorrectionControl	
FFCCoefficientWidth	NormalMode/PRNUExtensionMode
FPNCorrectionEnable	True/False
FPNShiftPosition	10~14
GlobalFPN	-4096~4095
PRNUCorrectionEnable	True/False
PRNUShiftPosition	8~14

- FFCCoefficientWidth : Set the bit width of FFC coefficient.
  FPN and PRNU of FFC coefficient shall be allocated to 8bit each at NormalMode.
  FPN of FFC coefficient shall be allocated to 7bit, and PRNU to 9bit at PRNUExtensionMode.
  ※This selection depends on whether the acquired format of correction coefficient is NormalMode or PRNUExtensionMode. Please select the mode appropriate to correction coefficient.
- FPNCorrection : FPN correction
  When changed to True, it will be corrected with FPN(Offset)+Global_FPN at light shielding.
- FPNShiftPosition : FPN correction coefficient decimal point position
  ※It will depend on the decimal point position of the acquired FPN correction coefficient. Please select the value appropriate to correction coefficient.
- GlobalFPN : When FPN correction is True, it will be corrected with FPN(Offset)+Global_FPN.
  Since the black level is decreased when FPN correction is True, please adjust to the appropriate black level With GlobalFPN.
- PRNUCorrection : Column PRNU correction
  When changed to True, PRNU(Gain) shall be corrected.
- PRNUShiftPosition : PRNU correction coefficient decimal point position
  ※It will depend on the decimal point position of the acquired PRNU correction coefficient. PRNU correction is used with FFC data of Area1, default value shall be used.

※When switch False⇔True of FPNCorrection and PRNUCorrection, the position of black level may change. When switching, please input the appropriate value to GlobalFPN and adjust so that the black level will not become 0 or less.

※On the detail of this Flat Field Correction category, please refer Application Note

4.14. Shading Correction

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

AnalogControl	
ShadingCorrection	True/False
DetectShading	Execute
ShadingCorrectionDataSelector	Table1 Table2 Table3 Table4
ShadingDataIndex	0~8131
ShadingDataValue	0x0~0xffff
ShadingDataLoad	Execute
ShadingDataSave	Execute

・ShadingCorrection : Shading correction

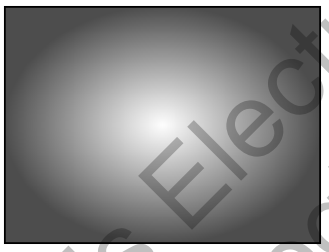
When ShadingCorrection is turned True, shading correction shall be executed according to the shading correction data generated by shading detection.

[Note]

・ShadingCorrection is not available with ROI.

・When ShadingCorrection is used with vertical flip ON, after shading detection of vertical flipped image to get proper shading table. (In case of horizontal flip ON, that is not the case)。

Before shading correction



After shading correction

Shading correction data needs to be acquired with DetectShading before executing shading correction.

・DetectShading :Shading detection

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

[Note]

☐ When shading detection, make sure the image size shall be set to 13408 x 9528 to execute. This function is not available with ROI.

☐ Shading detection only when the camera is in operation. When more than 1s long exposure time is used, shading detection may not be updated. This case change the exposure time setting less than 1s and detect shading again. (Appropriate shading correction data cannot be acquired if the camera is not outputting anything).

・ShadingCorrectionDataSelector :Select the shading correction data

Shading correction data can be selected out of 4tables. The data of selected Table1~4 here shall become the correction data to control the each function.

・ShadingDataIndex :Shading correction data index number

Each table of shading correction data contains 8132 indexes. Set the input value in the range of 0~8131.

・ShadingDataValue :Shading correction data value

ShadingDataValue selected of ShadingDataIndex is read/written.

※Shading correction data value shall not be saved with UserSetSave.

・ShadingDataLoad :Shading correction data readout

Only the Table selected with ShadingCorrectionDataSelector shall be readout from the non-volatile memory in the camera.

※When start up the camera, All tables' shading correction data shall be readout from the non-volatile memory in the camera as well.

・ShadingDataSave :Save the shading correction data

Only the Table selected with ShadingCorrectionDataSelector shall be saved in the non-volatile memory in the camera.

4.15. Gamma Correction

☐ This is to correct gamma. (This function cannot be executed with LUT function at the same time.)

AnalogControl	
Gamma	0.30～3.00 gamma coefficients

Gamma : Set the gamma correction value per 0.01 step.

While grabbing the images, Gamma shall not be changed the value.

[Note]

・This cannot be executed when LUTEnable is True.

・When PixelFormat is Bayer14, Gamma works only MSB12bit and LSB2bit will be 0. As an exception, when Gamma is 1.0 at Bayer14, all bits work gamma function. At Bayer8, Bayer10 and Bayer12 cases, Gamma works all bits.

4.16. LUT Function

☐ LUT function can be executed. (This function cannot be executed with Gamma correction at the same time.)

LUTControl	
LUTEnable	True/False
LUTIndex	0～4095
LUTValue	0～4095
LUTSave	Execute

・LUTEnable : Gamma correction can operate at False, and LUT function can operate at True.
The saved data shall be loaded when turned True. In case of no data is saved, the initial value shall be loaded.
While grabbing the images, LUTEnable shall not be change.

・LUTIndex : Specify the input value with 12bit range (0~4095).
When the input value is specified here, the output value for the input value shall be indicated in LUTValue.
※LUTIndex can be modified only when LUTEnable is True.

・LUTValue :Specify the output value with 12bit range (0~4095).
Output value “LUTValue” for input value specified with LUTIndex can be set.
※LUTValue shall not be saved with UserSetSave.
※LUTValue can be modified only when LUTEnable is True.

・LUTSave :Data set with LUTIndex and LUTValue shall be saved.
※LUTSave can be modified only when LUTEnable is True.

[Note]

・LUT function and Gamma function are sharing the resource therefore, these command LUTIndex, LUTValue and LUTSave can be changed when LUTEnable is True.

・When PixelFormat is Bayer14, LUT works only MSB12bit and LSB2bit will be 0. At Bayer8, Bayer10 and Bayer12 cases, LUT works all bits.

4.17. Pixel Defects Correction

☐ Pixel defects correction at ex-factory

CIS compensates the noticeable CMOS pixel defects found at the shipping inspection prior to our shipment. This function can be turned OFF.

PixelCorrectionControl	
DefectPixelCorrectionEnable	True/False
DefectPixelCorrectionMode	Concealment Replacement
HorizontalReplacementDistance	2~48

・DefectPixelCorrectionEnable :

When set to True, pixel defects correction shall become valid, and become invalid at False.

Pixel defects correction information shall define defect when PRNU coefficient of FFC coefficient is All1.

・DefectPixelCorrectionMode :

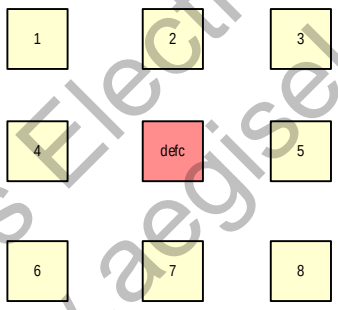
Select the pixel defects correction mode. Refer to Section 4.19.1 Concealment and 4.19.2 Replacement.

・HorizontalReplacementDistance :

When selecting Replacement, pixel defects shall be replaced to the pixel data of horizontal distance specified here. This value can be set per 2 step.

4.17.1 Concealment

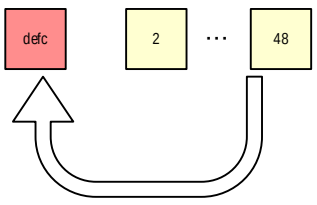
Pixel defects shall be interpolated by 8 pixels around it as the chart below. If the pixel defect is included in these 8 pixels, the target pixel defect("defc" in chart below) shall be interpolated by 8 pixels excluding this pixel defect.



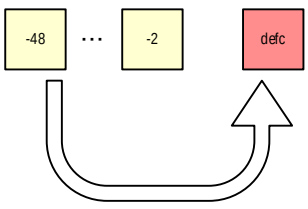
4.17.2 Replacement

Pixel defects shall be replaced by the pixel data at the horizontal distance specified with HorizontalReplacementDistance.

In case of the pixel defect position is smaller than 13408/2



In case of the pixel defect position is bigger than 13408/2



4.18. FlatFieldCorrectionData Control

☐ This is to access to FlashFieldCorrectionData.

☐ FFC coefficient is divided into Area 1 and Area 2.
0x0000_0000~0x0F3A_A9FF of FlatFieldCorrectionDataAddress is Area 1 (13408*9528*2Byte)
Area1 is not available for erase and overwrite, programmed by CIS factory settings.
0x1000_0000~0x1F3A_A9FF of FlatFieldCorrectionDataAddress is Area 2 (13408*9528*2Byte)
Deletion and overwriting can be done there.

FlatFieldCorrectionDataControl	
FlatFieldCorrectionDataAddress	0x1000_0000～0x1FFF_FFFC
FlatFieldCorrectionDataValue	0x0000_0000～0xFFFF_FFFF
FlatFieldCorrectionDataSector	16384～32767
FlatFieldCorrectionDataRead	Execute
FlatFieldCorrectionDataWrite	Execute
FlatFieldCorrectionDataSectorErase	Execute
FlatFieldCorrectionDataSelector	None/Area1/Area2
FlatFieldCorrectionDataLoad	Execute
FlatFieldCorrectionDataSaveEnable	True/False
FlatFieldCorrectionDataSave	Execute
FlatFieldCorrectionDataTransfer	Off/FPN/PRNU [Save cannot be executed.]
FlatFieldCorrectionDataStatus	None/Area1/Area2/Area1 and Area2 [ReadOnly]

・FlatFieldCorrectionDataAddress :Specify the address for FlatFieldCorrectionDataValue.

・FlatFieldCorrectionDataValue :Output 4Byte data or set 4Byte data to input.

・FlatFieldCorrectionDataSector :Set the sector number to delete.

・FlatFieldCorrectionDataRead :
Output data specified with FlatFieldCorrectionDataAddress to FlatFieldCorrectionDataValue.

・FlatFieldCorrectionDataWrite :
Set the 4Byte data to FlatFieldCorrectionDataValue to the address specified with FlatFieldCorrectionDataAddress

・FlatFieldCorrectionDataSectorErase :Delete data of the sector specified with FlatFieldCorrectionDataSector.
※Even if the FFC coefficient is deleted with this process, the value of FlatFieldCorrectionDataStatus is not changed. This function is provided to partially modify the FFC coefficient.

・FlatFieldCorrectionDataSelector : Select area as FlatFieldCorrectionData.
Also, select data to perform FlatFieldCorrectionDataLoad/Save operation.
When it is set to None, FFCdata shall not be output at start up, and the execution of FlatFieldCorrectionDataLoad/Save shall be invalid.

・FlatFieldCorrectionDataLoad :
Readout the FPN/PRNU correction coefficient of the area specified with FlatFieldCorrectionDataSelector.
Approx. 4 sec is needed for readout.
※While grabbing the images, FlatFieldCorrectionDataLoad shall not be executed.

・FlatFieldCoefficientDataSaveEnable :

The is the protection for FlatFieldCoefficientDataSave. Only this is True, FlatFieldCoefficientDataSave can be functioned. This command cannot be saved with UserSetSave.

※Do not use except updating all Area2 FFC data.

・FlatFieldCoefficientDataSave :

Shift to FPN/PRNU correction coefficient save mode of the area specified with FlatFieldCorrectionDataSelector, only available for FlatFieldCoefficientDataSaveEnable True.

After executing this command, the camera shall not receive other commands. When the camera is rebooted, the camera shall start up with FlatFieldCoefficientDataSaveMode next time. The correction coefficient can be deleted and saved with this mode. When completed writing coefficients with FlashMemoryUpdate.exe tool at correction coefficient save mode, camera shall be returned to normal mode when rebooted next time.

※Do not use except updating all Area2 FFC data.

・FlatFieldCorrectionDataTransfer :

Transmit FlatFieldCorrectionData as images.

When it is Off, FPN correction data shall be transmitted at normal images and FPN, and PRNU correction data shall be transmitted at PRNU. Please specify Bayer8 for PixelFormat(At Bayer10, Bayer12 and Bayer14 it can be worked, MSB8bit indicates FPN or PRNU correction data).

※The register of FlatFieldCorrectionDataTransfer cannot be saved with UserSetSave. It shall be OFF at start up and at UserSetLoad.

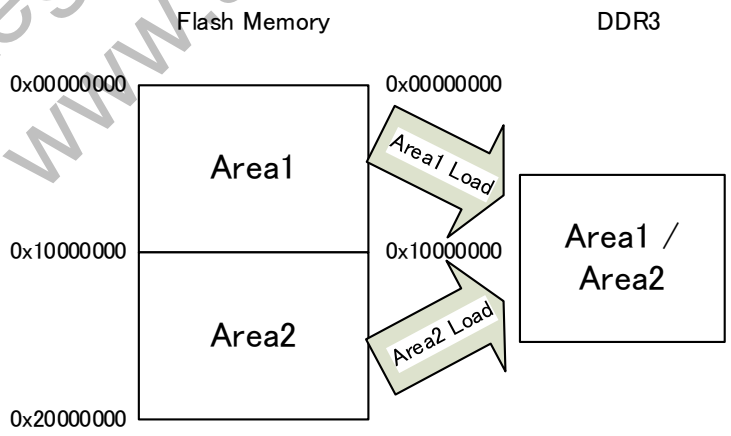
・FlatFieldCorrectionDataStatus :

Display the status of FlatFieldCorrectionData.

None :	not stored FFCdata in the Flashmemory
Area1 :	Stored FFCdata in the area1 of the Flashmemory
Area2 :	Stored FFCdata in the area2 of the Flashmemory
Area1 and Area2 :	Stored FFCdata in the both areas of the Flashmemory

4.18.1 FlatFieldCorrectionData

☐ The flow of FlatFieldCorrectionData below



Stored FlatFieldCorrectionData(FFCData) once load to the DDR3 SDRAM. Use for the correction from DDR3 SDRAM. FlashMemory is 4Gbit size.

When FlatFieldCorrectionDataLoad executes, FFCData transfers FlashMemory to DDR3 SDRAM.

When the FFCData are transferred, the FFCData at DDR3 SDRAM never changes, except to the reload by FlatFieldCorrectionDataLoad or reboot the camera. When the FFCData of FlashMemory are changed

by FlatFieldCorrectionDataWrite or deleted by FlatFieldCorrectionDataSectorErase, the FFCData shall be loaded again by FlatFieldCorrectionDataLoad.

☐ Power On

The camera loads the FFCData selected FlatFieldCorrectionDataSelector, when power on.

- None : no load FFCData to DDR3 SDRAM
- Area1: When FlatFieldCorrectionDataStatus includes Area1, load FFCData at Area1 to DDR3 SDRAM
- Area2: When FlatFieldCorrectionDataStatus includes Area2, load FFCData at Area2 to DDR3 SDRAM
- When FlatFieldCorrectionDataStatus is none, no load FFCData to DDR3 SDRAM

☐ FlatFieldCorrectionDataLoad

The camera loads the FFCData selected FlatFieldCorrectionDataSelector.

- None : no load FFCData to DDR3 SDRAM
- Area1: Load FFCData at Area1 to DDR3 SDRAM
- Area2: Load FFCData at Area2 to DDR3 SDRAM
- FlatFieldCorrectionDataStatus information is not affected to the loading.

☐ FlatFieldCorrectionDataSave

This function is used for deleting and programming FFCData of each area of the FlashMemory.
Before executing, make sure FlatFieldCorrectionDataSelector shall be set to the area to be deleting and programming. And the same area shall be chosen in the FlashMemoryUpdate.exe. Not available, None at FlatFieldCorrectionDataSelector are selected.

☐ FlatFieldCorrectionDataTransfer

Display loaded area's FFCData as camera image.

4.19. Device Temperature Control Function

☐ Device temperature control function

・Temperature of the device can be controlled.

DeviceControl	
DeviceTemperature	[ReadOnly]
DeviceTemperatureUpperLimit	29~39
DeviceTemperatureLowerLimit	25~35
DeviceFanEnable	True/False

・DeviceTemperature :
Display the sensor temperature by degrees Celsius. This will be updated every 3s.

・DeviceTemperatureUpperLimit :The upper limit for temperature controlled by FAN.

・DeviceTemperatureLowerLimit :The lower limit for temperature controlled by FAN.

※The setting range for lower limit value needs to be set lower than 4degree from the upper limit value.

※Temperature which exceed the set upper limit value and lower limit value may be indicated to DeviceTemperature depend on ambient temperature.

※To update the value of DeviceTemperature by every 3s, Polling function of the grabber board needs to be valid.

・DeviceFanEnable :FAN control enable function

[Note]

・DeviceTemperature must be less than 60degrees. Insufficient heat dissipation may cause damages or malfunction of the camera. Our warranty does not apply to damages or defects caused by neglecting our instructions and precautions explained in this manual.

☐ How to control

・The device temperature shall be controlled by controlling the rotation number of the FAN in the device, with the average of the upper and lower limits as the target value.

4.20. Link Speed and Link Count

TransferControl	
ConnectionConfig	CXP12_X2 CXP12_X1 CXP6_X2 CXP6_X1

・CXP12 : Link speed＝12.5Gbps, Link num＝1 or 2

・CXP6 : Link speed＝6.25Gbps, Link num＝1 or 2

※ ConnectionConfig shall not be changed, while grabbing the images.

4.21. How to Save and Initialize the Settings

☐ If you wish to save the setting values, execute “UserSetSave”. Doing so, the setting values shall be saved in the camera non-volatile memory and the saved settings data shall be reflected when the camera is turned on next time.

UserSets	
UserSetSelector	Default UserSet0 UserSet1
UserSetLoad	Execute
UserSetSave	Execute
UserSetDefault	Default UserSet0 UserSet1

・UserSetSelector : Select the camera setting values.
When selecting Default, only UserSetLoad is valid, and UserSetSave cannot be executed.
※This value is for UserSetLoad and UserSetSave, not for UserSetDefault.

・UserSetLoad : The camera setting values selected with UserSetSelector shall be loaded from camera non-volatile memory. When UserSetSelector is Default, factory settings shall be readout.
※ConnectionConfig, PixelFormat, ReverseX, and ReverseY are not affected by UserSetLoad.

・UserSetSave : Save the camera setting values.
When selecting Default, only UserSetLoad is valid, and UserSetSave cannot be executed.

・UserSetDefault : Select the camera default setting values.
The camera loads selecting settings, after reboot the camera
※UserSetDefault is not related on UserSetSelector. This value is not saved by UserSetSave. When this value is changed, saving this value to the camera non-volatile memory. This is not affected by UserSetLoad.

※ShadingData, LUTValue cannot be saved with UserSetSave, and save in the camera non-volatile memory with individual commands.

☐ After executed UserSetLoad, the camera shall change the setting value to the loaded value. However, there would be some cases that command indications are not updated depending on its indication software used. Please make sure to update the command.

4.22. Digital IO Control

☐ 7-pin, 9-pin or 10-pin output signals of 12-pins round connector can be selected by LineSelector and LineSource command.

Digital IO Control	
LineSelector	Line1/Line2/Line3
LineMode	Output
LineSource	Off ExposureActive FrameActive LineActive TriggerPacketActive

- LineSelector
  Line1 : select 7-pin output signal
  Line2 : select 9-pin output signal
  Line3 : select 10-pin output signal

- LineSource
  Settings for the pin that selected by LineSelector.
  OFF : fixed 0
  ExposureActive : actual exposure time (Hi active)
  FrameActive : Frame valid signal (Hi active)
  LineActive : Line valid signal (Hi active)
  TriggerPacketActive: Uplink trigger packet from frame grabber.

4.23. OpticalBlackControl

☐ OpticalBlackLevel can be controlled.

OpticalBlackControl	
OpticalBlackEnable	True/False
OpticalBlackFunction	AverageValue IndividualValue

- OpticalBlackEnable : Select OpticalBlackControl Auto or Manual.
  When “False” is selected, OpticalBlack level can be controlled by user manually via BaseOffset parameter. OpticalBlack level will be changed by temperature, Gain setting, ROI settings etc.
  When “True” is selected, OpticalBlack level can be adjusted automatically.
- OpticalBlackFunction : Select OpticalBlackClamp mode when OpticalBlackEnable is “True”.
  When “AverageValue” is selected, OpticalBlack will be adjusted for the average of 4 divided areas. This is recommended.
  When “IndividualValue” is selected, OpticalBlack will be adjusted for each 4 divided area(Top/bottom and left/right).

4.24. WhiteBalance

AnalogControl	
BalanceRatioSelector	Red Blue
BalanceWhiteAuto	Off Once
BalanceRatio	1.00~8.00

☐ BalanceRatioSelector : This is to select the color component you wish to change with BalanceRatio.

☐ BalanceWhiteAuto : This is to adjust white balance gain automatically

Off : Waiting

Once : Adjust white balance automatically with one push.

Select “Once” of BalanceWhiteAuto to adjust white balance automatically and return to off.

BalanceRatio shows new gain of color component selected with BalanceRatioSelector.

Shoot an object with achromatic color to full screen to execute BalanceWhiteAuto. Recommendation is approx. 50% of signal level to execute.

※Set RegionSelector to EffecitveRegion to execute “Once” of BalanceWhiteAuto.

※More than 2 partial areas disable BalanceWhiteAuto.

Enables the following commands only when BalanceWhiteAuto is OFF.

☐ BalanceRatio : This is to set gain in the range of x1 ~ x8.

If user set Red with BalanceRatioSelector, set BlanaceRatio to 1.0, then change BlanaceRatioSelector to Blue, and set BlanaceRatio to 1.0, white balance becomes invalid.

5. Factory Settings

Function	Initial Data	Explanation
DeviceControl		
DeviceUserID	“”	
DeviceUserString	“”	
DeviceIndicatorMode	Active	
DeviceTemperatureUpperLimit	39	
DeviceTemperatureLowerLimit	25	
ImageFormatControl		
RegionSelector	EffectiveRegion	
RegionMode	-	Region0 is ON, others are OFF
Width	13408	
Height	9528	
OffsetX	0	
OffsetY	0	
PixelFormat	Bayer8	
ReverseX	False	
ReverseY	False	
TestPattern	Off	
CursorPattern	Off	
CursorOffsetX	6704	
CursorOffsetY	4764	
CursorColor	White	
AcquisitionControl		
TriggerSelector	AcquisitionStart	
TriggerMode	Off	
TriggerSource	LinkTrigger0	
TriggerActivation	RisingEdge	
ExposureTime	100000	
AnalogControl		
Gain	1.0	
Gamma	1.0	
ShadingCorrection	False	
ShadingCorrectionDataSelector	Table1	
BlackLevel	0	
BalanceRatioSelector	Red	
BalanceWhiteAuto	Off	
BalanceRatio	1.00	
LUTControl		
LUTEnable	False	

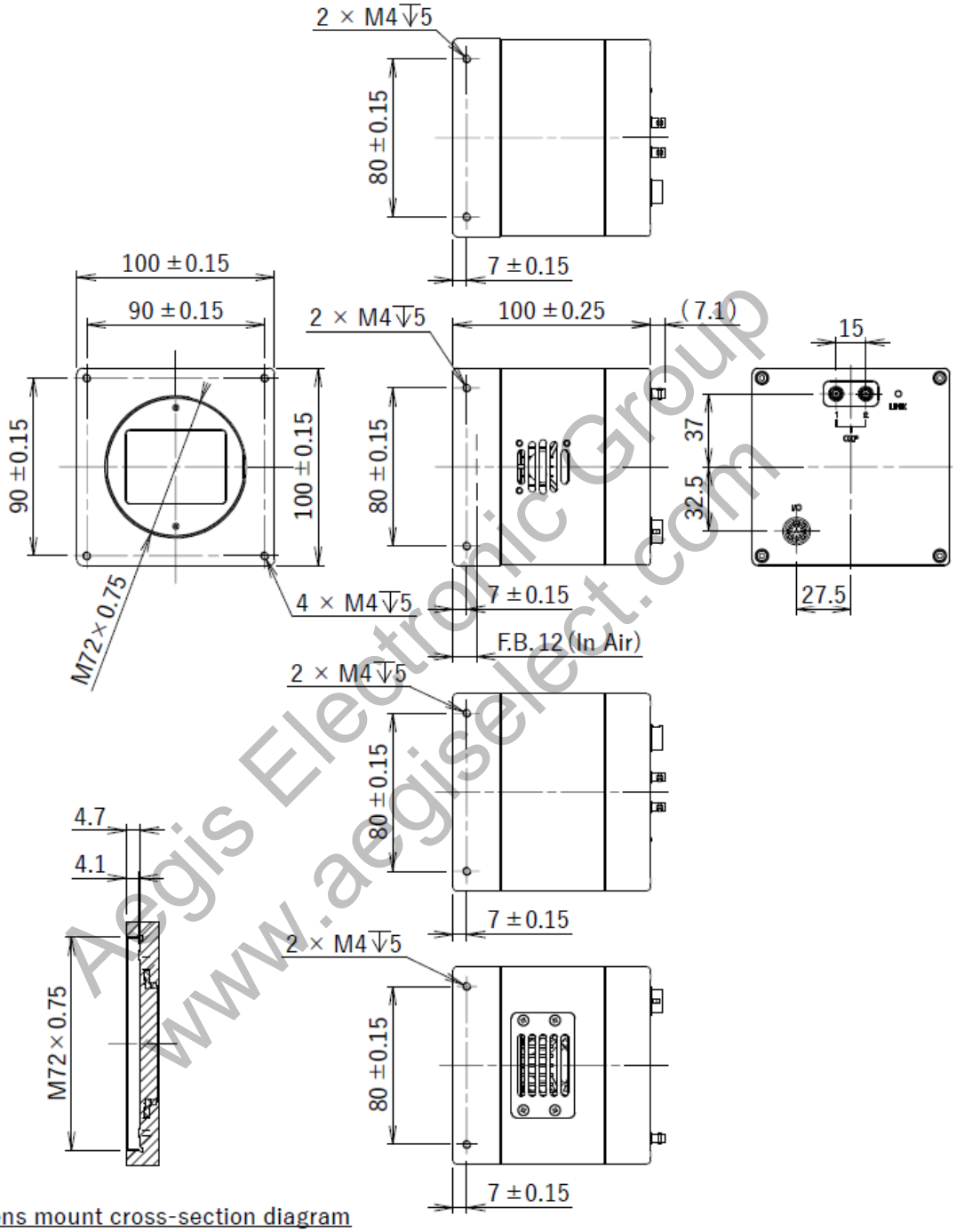
Function	Initial Data	Explanation
FlatFieldCorrectionControl		
FFCCoefficientWidth	NormalMode	
FPNCorrectionEnable	False	
FPNShiftPosition	-	Factory adjustment value
GlobalFPN	-	Factory adjustment value
PRNUCorrectionEnable	False	
PRNUShiftPosition	-	Factory adjustment value
FlatFieldCorrectionDataControl		
FlatFieldCorrectionDataSelector	None	
FlatFieldCoefficientDataSaveEnable	False	
FlatFieldCorrectionDataTransfer	Off	
Digital IO Control		
LineSelector	Line1	
LineSource	Off	
PixelCorrectionControl		
DefectPixelCorrectionEnable	False	
DefectPixelCorrectionMode	Concealment	
HorizontalReplacementDistance	2	
RegistersControl		
BaseGain	-	Factory adjustment value
BaseOffset	-	Factory adjustment value
OpticalBlackControl		
OpticalBlackEnable	True	
OpticalBlackFunction	AverageValue	
TransferControl		
ConnectionConfig	CXP6_X2	

※Factory settings are the same value as UserSetDefault command.

※ConnectionConfig, PixelFormat, ReverseX, and ReverseY are not affected by UserSetLoad.

6. Dimensions

6.1. Camera Dimensions

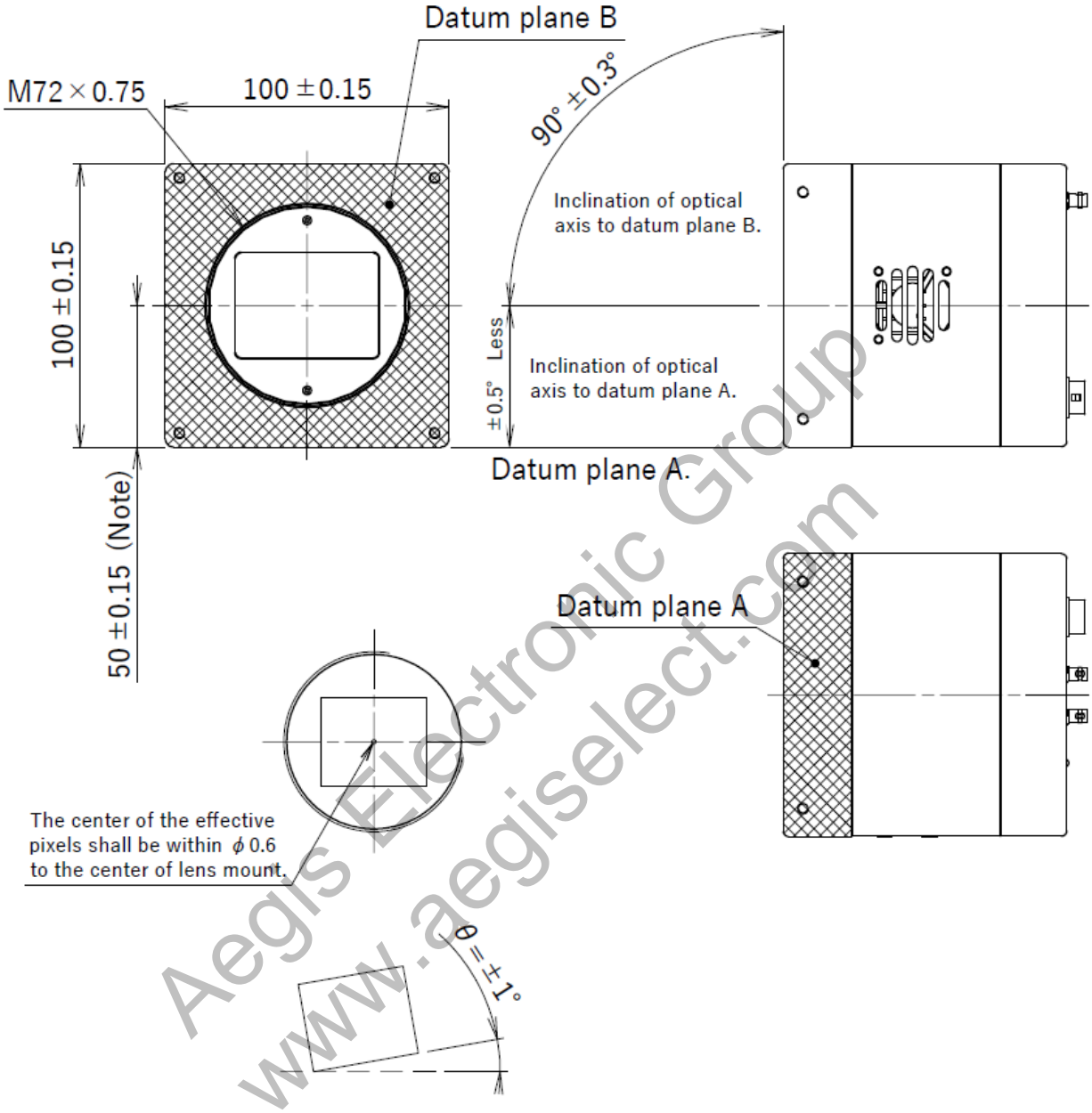


Lens mount cross-section diagram

Note2) Lens mount screw complies with M72×0.75-6H.
Please refer to ISO 68-1,965-1 (or JIS B0205-1,B0209-1).
Note1) Please make sure the protrusion portion does not inter with the lens selected.
Pefer to the Lens mount cross-section diagram for the detailes.

(Unit : mm)
935-0200-00

6.2. Optical Axis Accuracy



Inclination of effective pixels θ to datum plane A is $\theta \leqq \pm 1°$.

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

937-0043-00
(Unit : mm)

7. Case for Indemnity

7.1. 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.

7.2. 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.

7.3. 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.