CIS

CoaXPress I/F

127M pixels CMOS RAW Camera

VCC-127CXP6RHS

Product Specifications & Operational Manual

CIS Corporation

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.

Our warranty does not apply to damages or defects caused by neglecting the instructions and precautions explained in this manual.

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 Overview

VCC-127CXP6RHS is a CoaXPress interfaced camera (Type 3.6), 127M pixels CMOS global shutter image sensor. Complies with CoaXPress Version 1.1.1. Must have function ready for Machine Vision applications such as trigger shutter, ROI, Gain, black level adjustment, FFC (flat field correction), defective pixel correction, and PoCXP. Suitable for various FA/Machine vision applications.

2.1. Features

- ☐ Global shutter type CMOS sensor
- ☐ Complies with 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
- ☐ Exposure time and Gain settings
- ☐ FFC(Flat Field Correction)
- ☐ External trigger sync. mode (Fixed trigger shutter mode / pulse width trigger shutter mode)
- ☐ Compliant with the CoaXPress standard (GenICam supported)
- ☐ M72 lens mount

3. Specifications

3.1. General Specifications

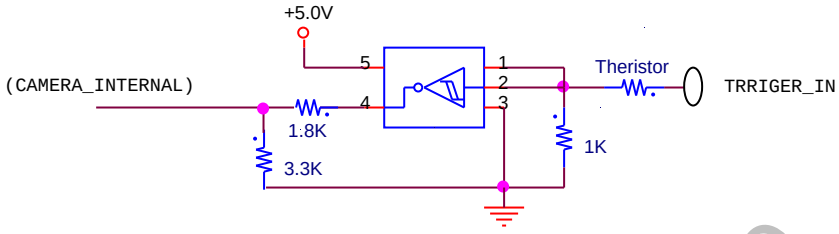
Electrical Specifications			
Image sensor	Device type	Type 3.6 global shutter type CMOS sensor	
	Effective pixel number	13408(H) × 9528(V)	
	Unit cell size	3.45µm(H) × 3.45µm(V)	
Video output mode		Ver. 1.1.1complied, CXP12 / CXP6	
Video output	Pixel clock frequency	1250MHz	
Video output format		Bayer 8 / Bayer 10 / Bayer 12 / Bayer14	
Frame rate	CXP12_X2	17.5fps@8bit / 13.1fps@10bit / 11.1fps@12bit / 9.1fps@14bit	
	CXP12_X1 / CXP6_X2	8.7fps@8bit / 6.5fps@10bit / 5.6fps@12bit / 4.6fps@14bit	
	CXP6_X1	4.4fps@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		7.24[µs]~15[s] ※Use trigger mode when long time exposure is required.	
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		Manual ROI	
Power requirements		12pins circular connector: +24V±10%, or PoCXP: +18.5V~26V (Use a power cable length of 10m or less for circular connectors.)	
Power consumption		21.0W max (CXP12_X2), [at free run]	
Mechanical Specifications			
Dimensions		H:100mm W:100mm D:57.5mm excluding protrusion.	
Weight		730 g	
Lens mount		M72 mount	
Environmental Specifications			
Safety/Quality standard		CE: EMC: 2014/30/EU Emission: EN61000-6-4:2019 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.	

※Operational temperature: Temperature range within which all the various functions of the camera operate normally

3.2. Input and Output

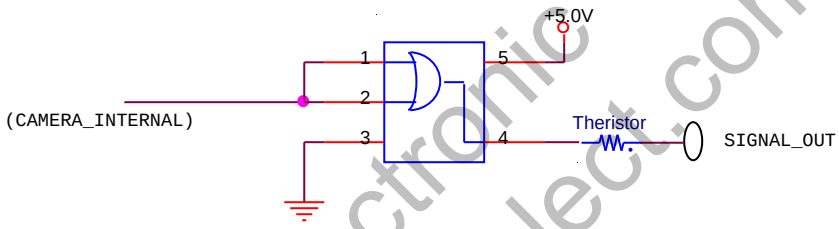
3.2.1 12pins Connector External Input (Trigger No.11 pin)

- ☐ 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.



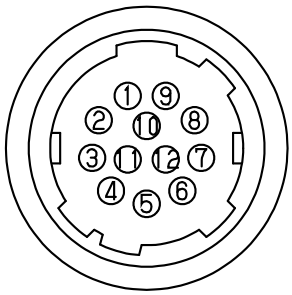
3.2.2 12pins Connector External Output (No.7, 9, and 10 pin)

- ☐ 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.

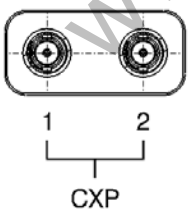
※When external power input is used, CoaXPress power supply(PxCXP) should be used. It may cause malfunction.

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

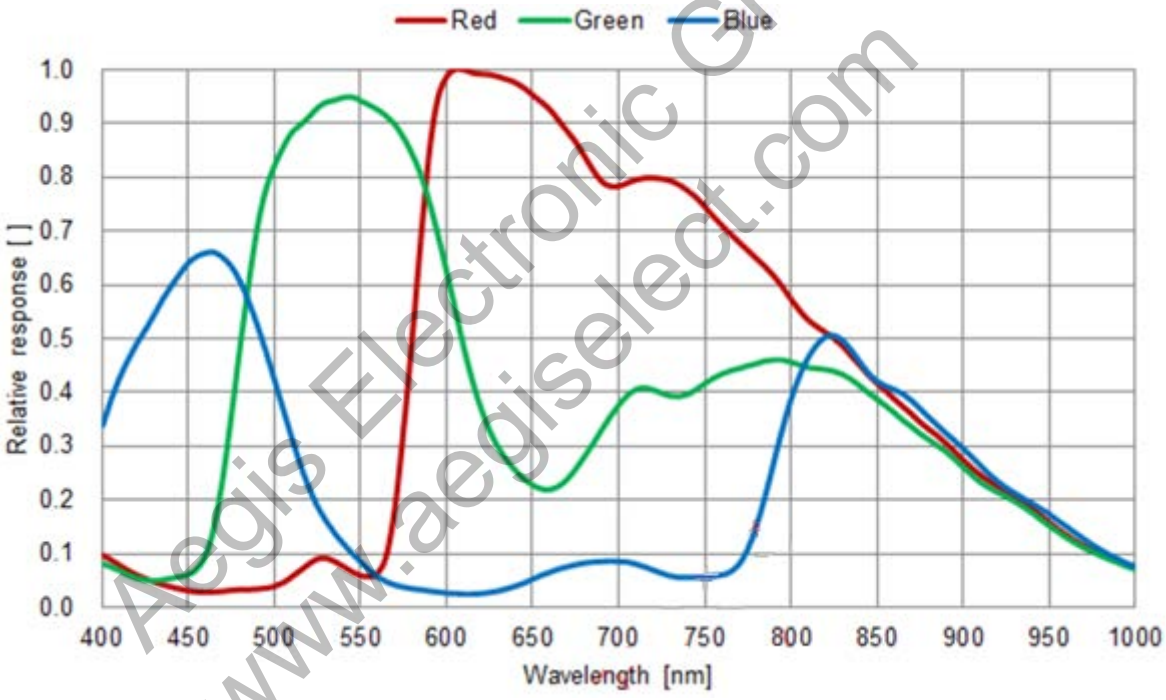
☐ When DeviceIndicatorMode is Active, lighting patterns of LED shows the camera status by the way of its lighting.

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

☐ Tap Geometry

TransportLayerControl		
DeviceTapGeometry	[1] : Geometry_1X_2YE	ReadOnly

[Note]
Depending on the FrameGrabberBoard to use, user may need to set DeviceTapGeometry to Geometry_1X_2YE to successfully acquire images.

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 the frame rate by cropping and reducing the read out area.

☐ User can change X direction freely, but Y direction is fixed at the center.

☐ User cannot set OffsetY.

☐ 1/2 of the Height is the center of the image.

ImageFormatControl	
RegionSelector	Region0
RegionMode	On/Off
Width	1920～13408
Height	1080~9528
OffsetX	0~(13408-Width)
OffsetY	[ReadOnly]

☐ ROI

- RegionSeletor: Fixed to Region0.
- RegionMode : Turn Off to change "Width", "Height", and "OffsetX".
  Turn On to enable the value of “Width”, “Height”, “OffsetX”, and “OffsetY” are On.
  Make sure to start acquiring images when On.
- Width : User can specify the size of ROI in the X direction in 32-pixel increment.
- Height : User can specify the size of ROI in the Y direction in 8-pixel increment.
- OffsetX : User can specify the position of Offset in the X direction in 32-pixel increment.
- OffsetY : Read Only. The Offset position changes as the Height value changes.

[Note]

- User cannot change ROI when ShadingCorrection is True.
- User cannot use ROI and 2x2 binning together.
- When the image is not full scale (13408x9528), the DetectShading function of the shading correction is disabled.
- User cannot use FlatFieldCorrectionDataTransfer together.

Calculation formula at ROI

- The frame rate does not change from 13408 horizontal pixels even if the user changes the horizontal size.
- For the vertical size, the frame rate depends on the position and size of ROI.

PixelFormat	Time per frame		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Mono8	(L+384)*11.1µs	(L+384)*2*11.1µs	(L+384)*4*11.1µs
Mono10	(L+384)*14.8µs	(L+384)*2*14.8µs	(L+384)*4*14.8µs
Mono12	(L+364)*17.5µs	(L+364)*2*17.5µs	(L+364)*4*17.5µs
Mono14	(L+300)*21.5µs	(L+300)*2*21.5µs	(L+300)*4*21.5µs

The frame rate at ROI is 1/(time per frame) fps.

L= Height/2.

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

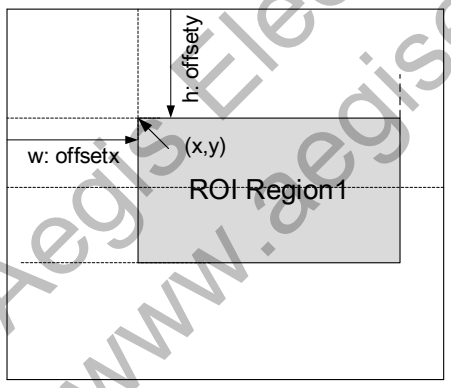
ImageFormatControl	
ReverseX	True/False
ReverseY	True/False

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

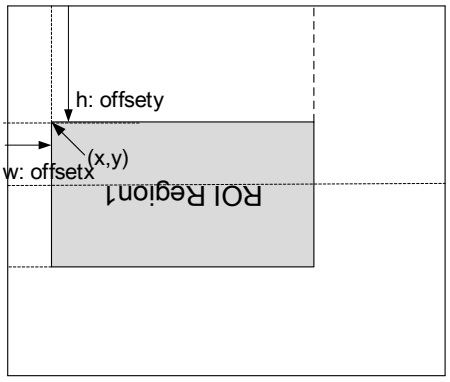
[Note]

Flipping the image vertically or horizontally at ROI will also flip OffsetX and OffsetY values.

[When both ReverseX and ReverseY are False]



[When both ReverseX and ReverseY are 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 Software
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.

・IllegalTriggerFlag :

This will be “1”, when illegal trigger is detected at external sync. Mode. In terms of illegal trigger, please refer 4.9.2 External Sync. Mode (Edge Trigger Sync. Mode) and 4.9.3 External Sync. Mode (Pulse Width Trigger Sync. Mode).

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

・AcquisitionFrameRate :

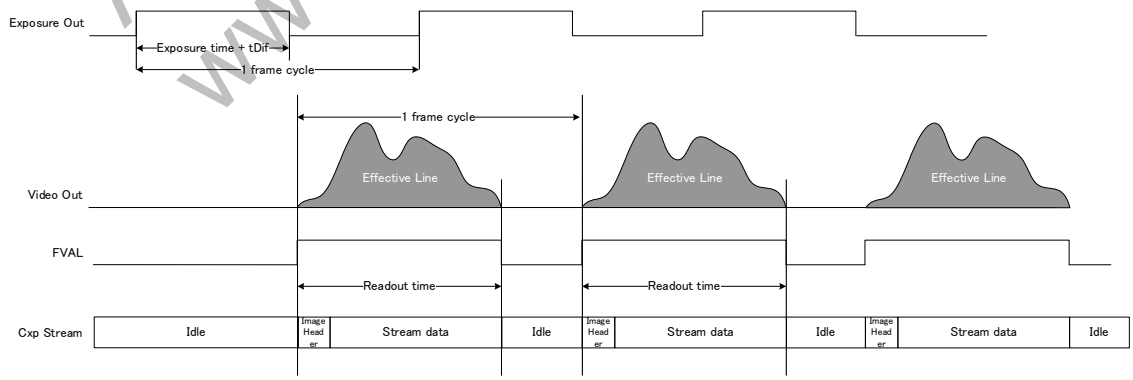
Display the frame rate in decimal format during operation, and update the value every 3 seconds.

The slowest frame rate is 1.0fps. Frame rates below 1.0fps are displayed as 0.0fps.

4.9.1 Internal Sync. Mode (Free Run Mode)

☐ This is the mode to output images continuously.

☐ Set TriggerSelector to AcquisitionStart.



※User can check the actual exposure time from ExposureOut signal. Please refer to Section 4.10 Exposure Time for the formula to calculate the actual exposure time.

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".

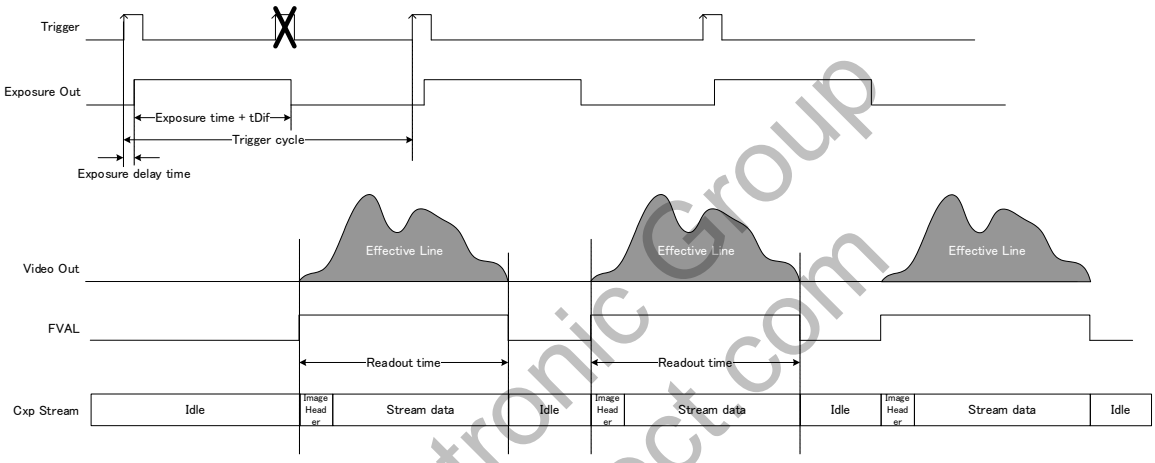
☐ Trigger period must be longer than the period in internal sync. mode (free-run).

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

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

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

☐ The first frame after changing the settings for CXP link speed and link count, pixel format, ROI and trigger mode is an invalid frame. Input a dummy trigger once, and use the second and subsequent trigger signals as the regular imaging signal.



In NormalMode

※Exposure delay time depends on the PixelFormat and ConnectionConfig settings. 4~6 are jitter.

PixelFormat	Exposure delay time		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Bayer8	11.1µs*(4to6)	11.1µs*(4to6)*2	11.1µs*(4to6)*4
Bayer 10	14.8µs*(4to6)	14.8µs*(4to6)*2	14.8µs*(4to6)*4
Bayer 12	17.5µs*(4to6)	17.5µs*(4to6)*2	17.5µs*(4to6)*4
Bayer 14	21.5µs*(4to6)	21.5µs*(4to6)*2	21.5µs*(4to6)*4

In ShortExposureMode, the exposure delay time jitter from 0ms to 4ms depending on the PixelFormat, ConnectionConfig or ExposureTime.

※User can check the actual exposure time from ExposureOut signal. Please refer to Section 4.10 Exposure Time for the formula to calculate the actual exposure time.

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".

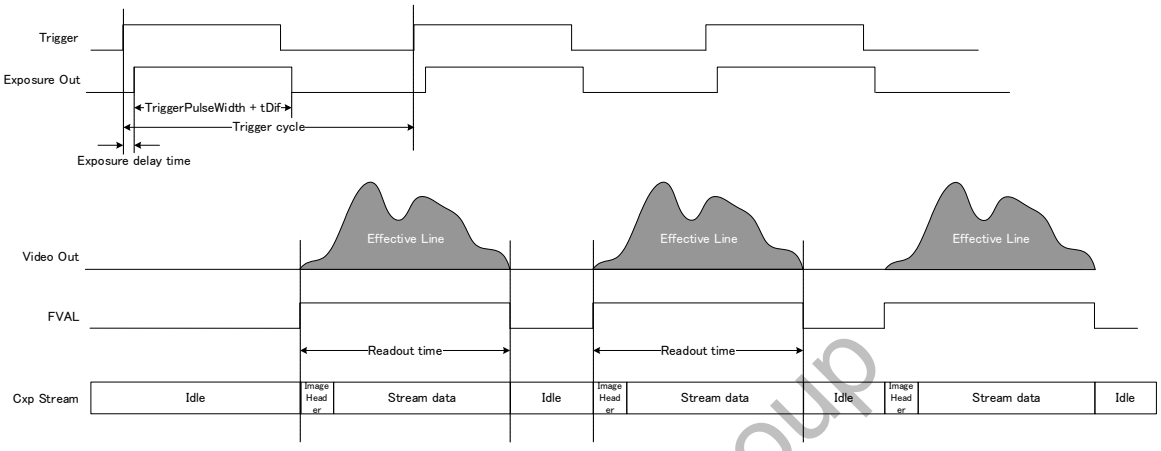
☐ Set "TriggerActivation" to "LevelHigh" or "LevelLow".

☐ Trigger period must be longer than the period in internal sync. mode (free-run).

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

☐ Trigger pulse width to be input needs to be 86.2µs or longer.

☐ The first frame after changing the settings for CXP link speed and link count, pixel format, ROI and trigger mode is an invalid frame. Input a dummy trigger once, and use the second and subsequent trigger signals as the regular imaging signal.



※Exposure delay time depends on the PixelFormat and ConnectionConfig settings. 4~6 are jitter.

PixelFormat	Exposure delay time		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Bayer 8	11.1μs*(4to6)	11.1μs*(4to6)*2	11.1μs*(4to6)*4
Bayer 10	14.8μs*(4to6)	14.8μs*(4to6)*2	14.8μs*(4to6)*4
Bayer 12	17.5μs*(4to6)	17.5μs*(4to6)*2	17.5μs*(4to6)*4
Bayer 14	21.5μs*(4to6)	21.5μs*(4to6)*2	21.5μs*(4to6)*4

※User can check the actual exposure time from ExposureOut signal. Please refer to Section 4.10 Exposure Time for the formula to calculate the actual exposure time.

[Note]

ShortExposureMode and external sync. mode (pulse width trigger shutter mode) are mutually exclusive.

4.10. Exposure Time

There are two exposure modes, NormalMode and ShortExposureMode.

Please use ShortExposureMode to operate with short exposure times.

[Note]

ShortExposureMode and external sync. mode (pulse width trigger shutter mode) are mutually exclusive.

Set trigger mode to internal sync. mode (free-run mode) or external trigger sync. mode (fixed trigger shutter mode) to use ShortExposureMode.

Acquisition Control		
ExposureTime (μs)	At NormalMode	87~15000000
	At ShortExposureMode	7.24~3158
SensorExposureMode	NormalMode ShortExposureMode	

ExposureTime : This is to display the exposure time. The range of exposure time that can be set varies depending on the SensorExposureMode.

※The actual exposure time in Normal Mode is the value set here plus tDif.

※The exposure time in ShortExposureMode is the same as the set value and the actual exposure time.

In Normal Mode, the following tDif exposure time is automatically added to the value set in ExposureTime.

PixelFormat	tDif		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Bayer 8	11.1μs*(47to49)+6.95μs	11.1μs*(47to49)*2+6.95μs	11.1μs*(47to49)*4+6.95μs
Bayer 10	14.8μs*(47to49)+6.95μs	14.8μs*(47to49)*2+6.95μs	14.8μs*(47to49)*4+6.95μs
Bayer 12	17.5μs*(43to45)+6.95μs	17.5μs*(43to45)*2+6.95μs	17.5μs*(43to45)*4+6.95μs
Bayer 14	21.5μs*(31to33)+6.95μs	21.5μs*(31to33)*2+6.95μs	21.5μs*(31to33)*4+6.95μs

In ShortExposureMode, user can set the exposure time within the following range.

PixelFormat	tDif		
	CXP12_X2	CXP6_X2 CXP12_X1	CXP6_X1
Bayer 8	7.24μs to 550μs	7.24μs to 1094μs	7.24μs to 2182μs
Bayer 10	7.24μs to 732μs	7.24μs to 1458μs	7.24μs to 2910μs
Bayer 12	7.24μs to 794μs	7.24μs to 1582μs	7.24μs to 3158μs
Bayer 14	7.24μs to 718μs	7.24μs to 1429μs	7.24μs to 2851μs

The maximum value of ExposureTime that can be set varies depending on the settings of trigger mode, ROI, PixelFormat, and ConnectionConfig.

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 : User can set the preferred gain value in the range of x1.0~x64.0 per 0.01 step.
- BaseGainSelector : This is to specify the position of the image sensor when setting BaseGain.
- BaseGain : The values adjusted at factory are stored here to suppress sensitivity variations and uneven saturation in each area of the image sensor selected by BaseGainSelector. Make sure that all items are set to 1024 (x1) when calculating FPN and PRNU correction coefficients.
- BaseOffset : The values adjusted at factory are stored here to suppress sensitivity variations and uneven saturation of each image sensor.
  Specify the input value in 14bit range (-16384~16383).

[Note]

- User can set the preferred gain value in the range of x1.0~x64.0 per 0.01 step. However, with high gain settings (x64.0 or more), degradation of image quality and increase of noise is unavoidable. Please evaluate it first.
- In BaseGain, 1024 is x1, but due to image sensor specifications, the output image does not reach saturation level at 1024.
- When gain is x16 or more, the gain may not be linear.

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	0x0~0x7fff
ShadingDataLoad	Execute
ShadingDataSave	Execute

・ShadingCorrection : Shading correction

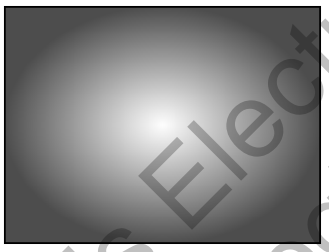
When ShadingCorrection is turned True, shading correction shall be executed according to the shading correction data generated by shading detection.

[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 :

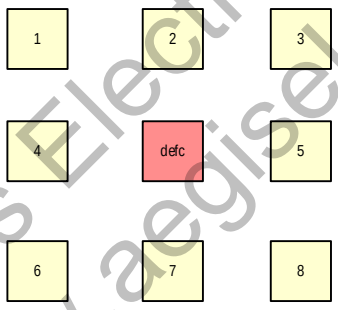
Select the pixel defects correction mode. Refer to Section 4.17.1 Concealment and 4.17.2 Replacement.

・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

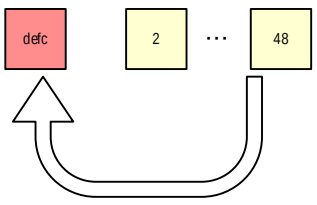
Pixel defects shall be interpolated by 8 pixels around it as the chart below. If the pixel defect is included in these 8 pixels, the target pixel defect("defc" in chart below) shall be interpolated by 8 pixels excluding this pixel defect.



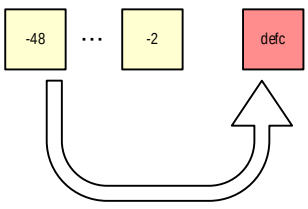
4.17.2 Replacement

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.

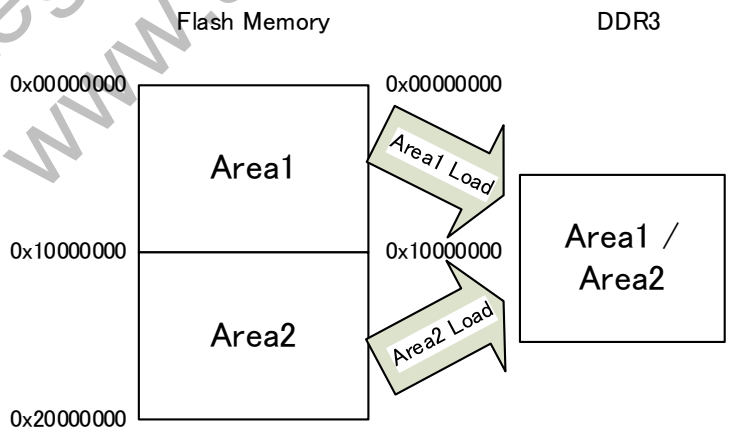
・FlatFieldCorrectionDataStatus :

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



FlatFieldCorrectionData(FFCData) saved in FlashMemory is once loaded into DDR3 SDRAM and used as correction coefficients. FlashMemory is 4G bit.

FlatFieldCorrectionDataLoad command is the transfer command from FlashMemory to DDR3 SDRAM.

Once transferred, the value of the data in DDR3 SDRAM will not change until the camera is turned off or loaded again. Also, when changing correction coefficient of FlashMemory by FlatFieldCorrectionDataWrite or FlatFieldCorrectionDataSectorErase, user needs to reload it to reflect it as a correction coefficient.

☐ At startup

This is to load FFCData selected by FlatFieldCorrectionDataSelector.
・If None, camera will not load FFCData.
・This is to load data in Area1 when selecting Area1 and saving FFC data in Area1 by FlatFieldCorrectionDataStatus. (It takes approximately 4 seconds to startup.)
・This is to load data in Area2 when selecting Area2 and saving FFC data in Area2 by FlatFieldCorrectionDataStatus. (It takes approximately 4 seconds to startup.)
・Camera does not load the areas without FFC data saved by FlatFieldCorrectionDataStatus at startup.

☐ FlatFieldCorrectionDataLoad

This is to load FFCData selected by FlatFieldCorrectionDataSelector.
・If None, camera will not load FFCData.
・This is to load data in Area1 when selecting Area1 (It takes approximately 4 seconds to startup.)
・This is to load data in Area2 when selecting Area2. (It takes approximately 4 seconds to startup.)
・This command does not affect information in FlatFieldCorrectionDataStatus.

☐ FlatFieldCorrectionDataSave

This is to write new FFCData by deleting data in the area selected by FlatFieldCorrectionDataSelector. When doing this, the area selected by FlatFieldCorrectionDataSelector and the area selected by FlashMemoryUpdate.exe must be the same.

☐ FlatFieldCorrectionDataTransfer

This is to display DDR3 SDRAM data in the area loaded by FlatFieldCorrectionDataSelector as image data.

4.19. Device Temperature Control Function

☐ Device temperature control function

・Temperature of the device can be controlled.

DeviceControl	
DeviceTemperature	[ReadOnly]

・DeviceTemperature :

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

※Enable Polling function of the grabber board to update the DeviceTemperature value in 3 seconds.

※Use the camera in an environment where the camera displays a temperature below 55°C in Device Temperature. If the temperature exceeds 55°C, take sufficient measures to dissipate heat. Otherwise, CIS cannot guarantee the reliability and operating performance of the product.

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. Save and Initialize Settings

☐ Execute "UserSetSave" to save settings into camera non-volatile memory. Camera loads the saved settings upon next rebooting.

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

・UserSetSelector : This is to select the camera setting values.
User can execute UserSetLoad only with Default. UserSetSave is invalid with Default.
※This value corresponds to the UserSetLoad and UserSetSave operations.

・UserSetLoad : This is to load the camera setting value selected by UserSetSelector from non-volatile memory.
When UserSetSelector is Default, the camera displays the factory setting.
※ConnectionConfig, PixelFormat, ReverseX, and ReverseY are not affected by UserSetLoad.

・UserSetSave : This is to save the camera setting values.
User can execute UserSetLoad only with Default. UserSetSave is not subject to save.

・UserSetDefault : This is to select the camera settings at startup. Load the selected settings and the camera will start its operation.
※This value does not correspond to UserSetSelector operation. The camera does not save the values with UserSetSave. It saves the values at the time when user changed the selection. Also, the value is not updated by UserSetLoad.

※ShadingData are LUTValue are not subject to UserSetSave. User can save these values in non-volatile memory via individual Save commands.

☐ The camera changes the set values to the loaded values after executing UserSetLoad. However, the command display may not be updated depending on the display software used.

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	
ImageFormatControl		
RegionSelector	EffectiveRegion	
RegionMode	On	
Width	13408	
Height	9528	
OffsetX	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	
SensorExposureMode	NormalMode	
AnalogControl		
Gain	1.0	
Gamma	1.0	
ShadingCorrection	False	
ShadingCorrectionDataSelector	Table1	
BlackLevel	0	
BalanceRatioSelector	Red	
BalanceWhiteAuto	Off	
BalanceRatio	1.00	
LUTControl		
LUTEnable	False	

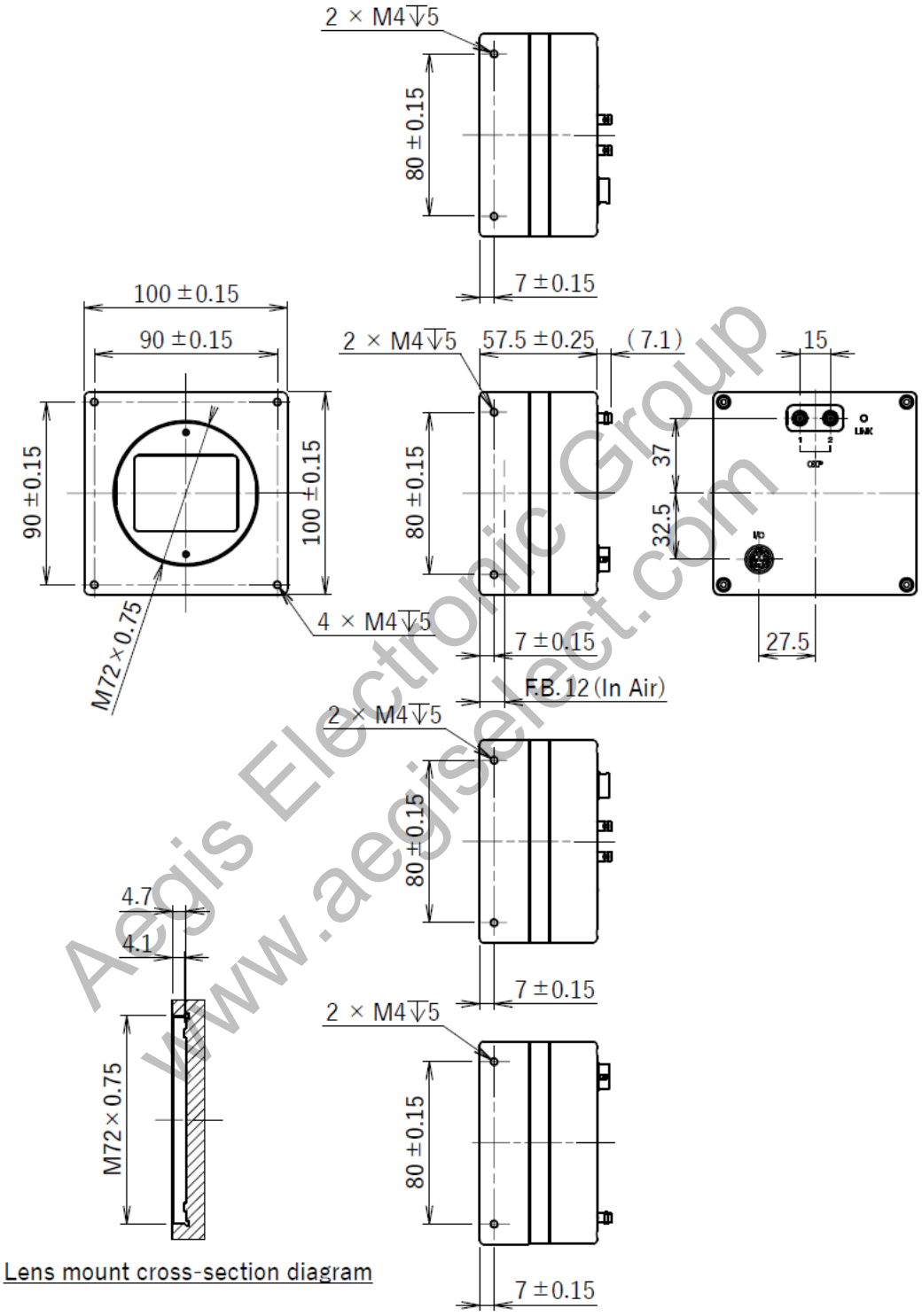
Function	Initial Data	Explanation
FlatFieldCorrectionControl		
FFCCoefficientWidth	NormalMode	
FPNCorrectionEnable	False	
FPNShiftPosition	-	Factory adjustment value
GlobalFPN	-	Factory adjustment value
PRNUCorrectionEnable	False	
PRNUShiftPosition	-	Factory adjustment value
FlatFieldCorrectionDataControl		
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

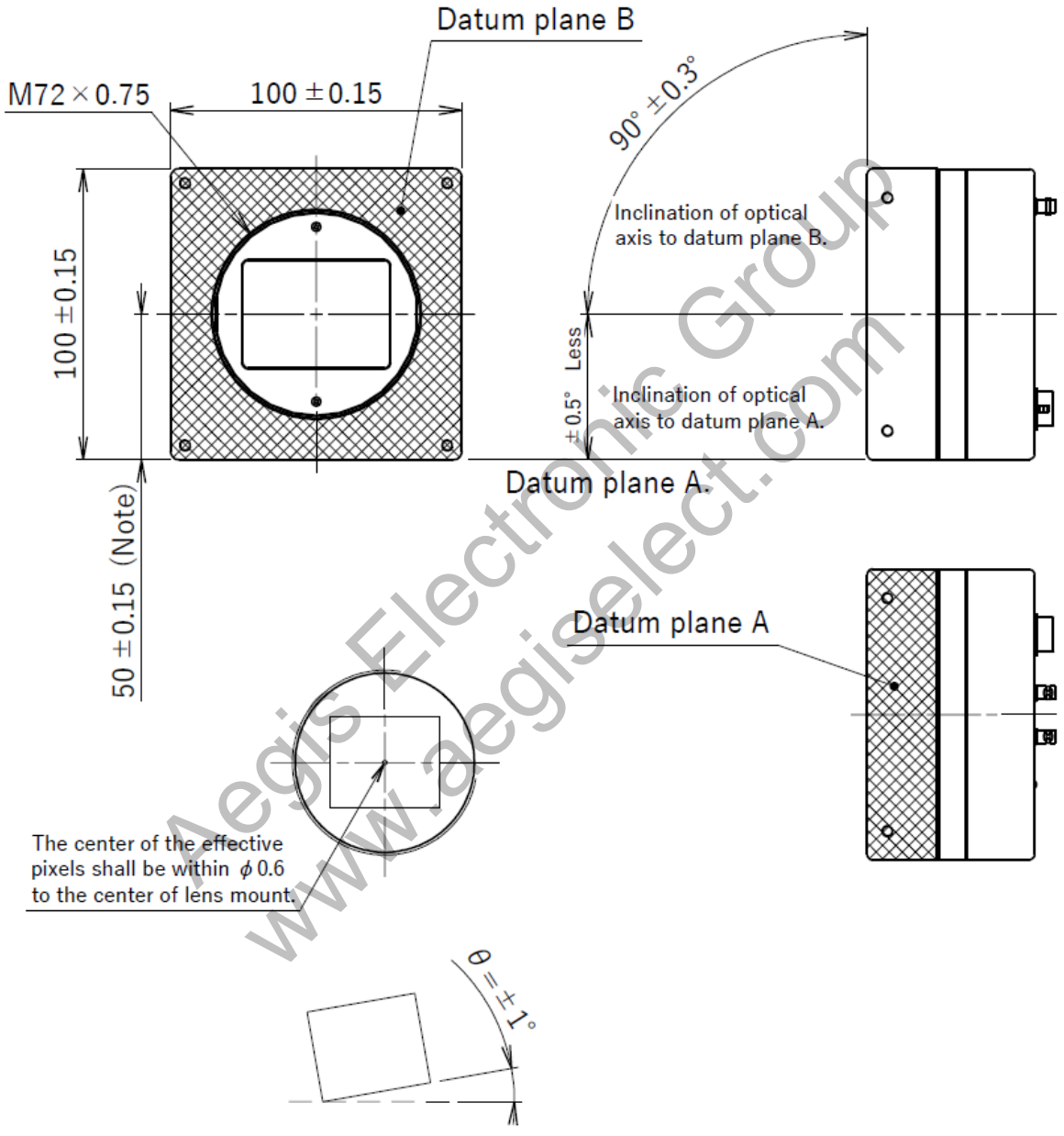
Note2) Lens mount screw complies with M72×0.75-6H.
Please refer to ISO 68-1,965-1 (or JIS B0205-1,B0209-1).
Note1) Please make sure the protrusion portion does not inter with the lens selected.
Pefer to the Lens mount cross-section diagram for the detailes.

(Unit : mm)
935-xxxx-00

☐ Note for camera installation and heat dissipation.

DeviceTemperature feature of the camera must be less than 55 degree. Ensure sufficient heat dissipation by mounting it on a metal surface of at least 200 mm × 200 mm × 10 mm. If adequate heat dissipation is not provided, reliability and operational performance cannot be guaranteed.

6.2. Optical Axis Accuracy



Inclination of effective pixels θ to datum plane A is $\theta \leqq \pm 1^{\circ}$.

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

Drawing Number : TBD
(Unit : mm)

7. Warranty Policy, etc.

7.1. Product Warranty

The warranty period for this product is 3 years from the date of shipment.
If a failure occurs during this period due to our design or manufacturing, we will repair the product free of charge in accordance with the product service described in Section 7.3. Product Services.
Repair after the warranty period will be charged if repair is possible.

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 applies defective pixel correction prior to shipment of the product. However, the number of defective pixels are subject to increase due primarily to the effect of cosmic rays. Due to this nature, CIS should not hold responsible for the natural increase of defective pixels.

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 your local distributor.