See the possibilities

Tentative Version

User Manual

Sweep+ Series - CoaXPress Interface

SW-4000Q-CXP2A
SW-8000Q-CXP2A

4CMOS Prism Line Scan Camera
Document Version: Tentative
Date: 2026-08-25

Thank you for purchasing this product.

⚠Be sure to read this documentation before use.

This documentation includes important safety precautions and instructions on how to operate the unit. Be sure to read this documentation to ensure proper operation.

The contents of this documentation are subject to change without notice for the purpose of improvement.

Table of Contents

About Technical Note

Some additional technical information is provided on the JAI website as Technical Notes. In this manual, if a technical note is available for a particular topic, the above icon is shown. Please refer to the following URL for Technical notes.

https://www.jai.com/support-software/technical-notes

Notice/Warranty

Notice

The material contained in this manual consists of information that is proprietary to JAI Ltd., Japan, and may only be used by the purchasers of the product. JAI Ltd., Japan makes no warranty for the use of its product and assumes no responsibility for any errors which may appear or for damages resulting from the use of the information contained herein. JAI Ltd., Japan reserves the right to make changes without notice.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

Warranty

For information about the warranty, please contact your factory representative.

Certifications

CE Compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that the following model(s) comply with the following provisions applying to their standards.

Model Name	Standards
SW-4000Q-CXP2A	EN55032:2015/A11:2020, EN55035:2017 (CISPR35:2016)
SW-8000Q-CXP2A	

FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning

Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

KC

제조년월은 제품상자의 라벨을 참조하십시오.

China RoHS

The following statement is related to the regulation on “Measures for the Administration of the Control of Pollution by Electronic Information Products “, known as “China RoHS“. The table shows contained Hazardous Substances in this camera.

mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电器电子产品有害物质限制使用管理办法』， 本产品《有毒有害物质或元素名称及含量表》如下.

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
SW-4000Q-CXP2A	×	○	○	○	○	○
SW-8000Q-CXP2A						

○:表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572-2011规定的限量要求以下。

×:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572-2011规定的限量要求。

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外 泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染 或对其人身、财产造成严重损害的期限。

数字「15」为期限15年。

Usage Precautions

This chapter refers to the precautions for use.

Notes on Cable Configurations

The presence of lighting equipment and television receivers nearby may result in video noise. In such cases, change the cable configurations or placement.

Notes on Attaching the Lens

How to Clean a Sensor

Avoiding Dust Particles

When attaching the lens to the camera, stray dust and other particles may adhere to the sensor surface and rear surface of the lens. Be careful of the following when attaching the lens.

- Work in a clean environment.
- Do not remove the caps from the camera and lens until immediately before you attach the lens.
- To prevent dust from adhering to surfaces, point the camera and lens downward and do not allow the lens surface to come into contact with your hands or other objects.
- Always use a blower brush to remove any dust that adheres.
- Never use your hands or cloth, blow with your mouth, or use other methods to remove dust.

Phenomena Specific to CMOS Image Sensors

The following phenomena are known to occur on cameras equipped with CMOS image sensors. These do not indicate malfunctions.

- **Aliasing**: When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- **Blooming**: When strong light enters the camera, some pixels on the CMOS image sensor may receive much more light than they are designed to hold, causing the accumulated signal charge to overflow into surrounding pixels. This “blooming” phenomenon can be seen in the image but does not affect the operation of the camera.
- **Fixed pattern noise**: When shooting dark objects in high-temperature conditions, fixed pattern noise may occur throughout the entire video monitor screen.
- **Defective pixels**: Defective pixels (white and black pixels) of the CMOS image sensor are minimized at the factory according to shipping standards. However, as this phenomenon can be affected by the ambient temperature, camera settings (e.g., high sensitivity and long exposure), and other factors, be sure to operate within the camera’s specified operating environment.

Notes on Exportation

When exporting this product, please follow the export regulations of your country or region.

Features

This camera is a high-speed 4-CMOS line scan camera equipped with four line sensors for the R, G, B, and near-infrared (NIR) channels. It captures near-infrared images in addition to visible-light images with excellent color reproduction.

The camera employs a CoaXPress interface, enabling highly accurate and reliable line scan imaging through high-speed, low-latency image data transfer. Its CXP-12 configuration provides efficient, high-bandwidth image transmission over coaxial cables and supports seamless integration with standard CoaXPress frame grabbers and existing image-processing systems.

Refer to the table below for the number of effective pixels, pixel size, and maximum line rate.

	4000Q Models	8000Q Models
Active Pixels	4096 x 4 (R, G, B, NIR)	8192 x 4 (R, G, B, NIR)
Pixel Size	TypeA: 7.5 µm x 7.5 µm	3.75 µm x 5.78 µm
	TypeB: 7.5 µm x 10.5 µm	
Max Line Rate (RGBa8)	146kHz	73kHz

Features Overview

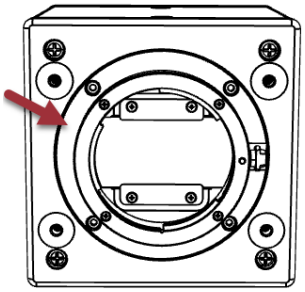
- Prism technology for superior color quality and better color differentiation
- SW-4000Q models: Pixel size can be switched (7.5 µm x 7.5 µm, 7.5 µm x 10.5 µm)
- It can output both video in visible region and video in the near-infrared region.
    - Supports Pixel Format RGBa8, which outputs video in the visible region and video in the near-infrared region as a single stream.
    - Video in the visible region (RGB8, RGB10) and video in the near-infrared region (Mono8, Mono10) can be output.
- Supports the binning function.
- Supports Flat Shading and Color Shading.
- HSI, sRGB, Adobe RGB and XYZ color space conversion.
- Supports direct connection to rotary encoders plus large variety of trigger options.
- Excellent shock and vibration resistance.
- Lens mount: F or M52

Parts Identification

> **Note:** See the "Dimensions" section for exterior views of this camera.

Lens Mount (F-Mount or M52-Mount)

Mount an F-mount or M52-mount lens here.

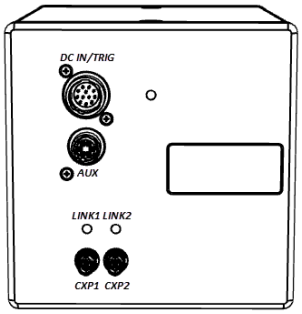


- Back flange distance (both F- and M52-mount): 46.5 mm
- Thread pitch (M52): 0.75mm

> **Note:** Before mounting a lens, be sure to refer to Lens and confirm the precautions for attaching a lens and the supported lens types.

Connectors

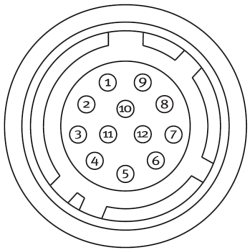
This section displays the pin assignments for each connector.



DC IN/TRIG Connector (12-Pin Round)

Related Setting Items: DigitalIOControl

Connect the cable for a power supply or for DC IN / trigger IN here.



Camera side: 12-pin circular connector equivalent to Hirose HR10A-10R-12PB(71) (gold-plated pins)
Cable side: Hirose HR10A-10P-12S(73) (Plug) or equivalent

Pin #	I/O	Signal	Description
1		GND	
2	Power In	DC In (+12V)	DC +10.8V to +26.4V
3		GND	
4		TTL In 4	Line 14
5	In	OPT IN1 -	Line 5
6	In	OPT IN1 +	
7	Out	TTL OUT 4	Line 12
8		NC	
9	Out	TTL OUT 1	Line 1
10	In	TTL IN 1	Line 4
11	Power In	DC In (+12V)	DC +10.8V to +26.4V
12		GND	

Note: Refer to "Recommended External Input Circuit Diagram" for recommended circuit diagram.

TTL Signal specification

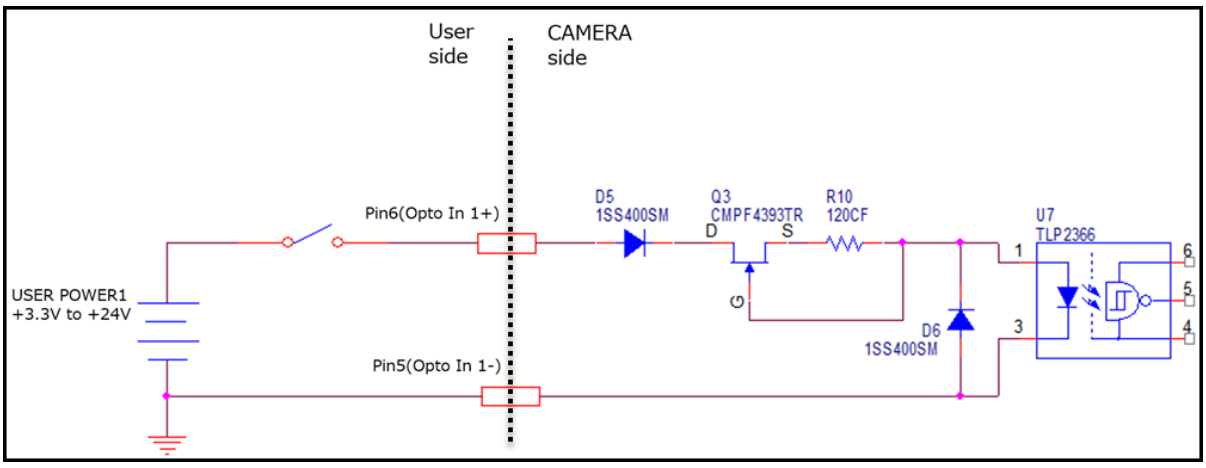
TTL out signal specification (Typ.)	Output voltage: Low 0.0V, High 5.0V
TTL in signal specification (Typ.)	Input voltage: Low 0.0 ~ 0.7V, High 2.0 ~ 5.5V

Recommended External Input Circuit Diagram

Related Setting Items: DigitalIOControl

Technical Notes OPTO-In Circuit Characteristics

Recommended External Input Circuit Diagram

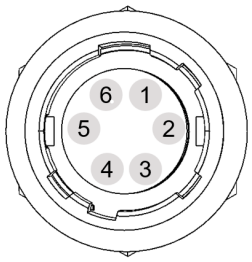


Caution: Check the recommended external input circuit diagram (reference example) and connect correctly.

Note: Parts may be replaced with equivalent products.

AUX Connector (6-pin)

Connect the cable for DC IN / trigger IN here.

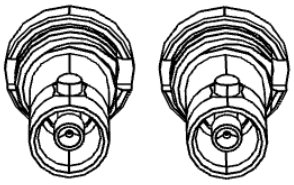


Camera side: 6-pin circular connector equivalent to Hirose HR10A-7R-6SB
Cable side: Hirose HR10A-7P-6P(77) or equivalent

Pin No.	I/O	Signal	Description
1	In	TTL In 3	Line 13
2	Out	TTL Out 2	Line 8
3	In	TTL In 2	Line 10
4		NC	
5	Out	TTL Out 3	Line 9
6	GND	GND	

CXP (CoaXPress) Connector

Coaxial cable for digital video output.



- **Connector**: Micro-BNC x 2
- **CxpLinkConfiguration**: CXP12_X2, CXP6_X2, CXP3_X2, CXP12_X1, CXP6_X1, CXP3_X1 (Default)

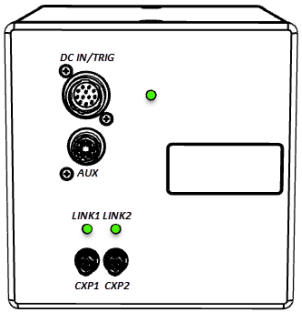
> **Note:** You can check the current CXP version in **CxpVersion Used** [TransportLayerControl]. If CxpVersionUsed is CXP 1.1, you cannot use the CXP12 link configurations. Even if you are using a CoaXPress frame grabber board that supports CXP 2.0, if CxpVersionUsed is CXP 1.1, you may need to make settings on the frame grabber board side. For details on the settings, refer to the instruction manual for the frame grabber board being used.

Power over CoaXPress (PoCXP)

This camera supports Power over CoaXPress (PoCXP). Both the **CXP1** and **CXP2** connectors can be used to supply power to the camera.

- When supplying power through both the CXP1 and CXP2 connectors, ensure that both connectors are powered from **the same frame grabber board**. For example, when the camera is connected to multiple PCs using the CXP Link Sharing function, supply power through only one of the CXP connectors if PoCXP is used.
- On the SW-4000Q-CXP2A, the maximum line rate is limited when the camera is powered only through the CXP1 connector. For details, refer to "PowerSourceStatus Function".

LEDs



The table below shows the LED indications and corresponding camera status.

POWER TRIG

Light		Status
	Lit amber	Camera initializing.
	Lit green	Camera in operation.
	Blinking green	During operation in trigger mode, trigger signals are being input. **Note:** The blinking interval is not related to the actual input interval of the external trigger.

LINK

Light		Status
	Off	The network link is not established (or is in progress).
	Lit amber	System is powering up.
	Red pulse - slow	No connection (not applicable when using PoCXP).
	Alternating between green and amber - rapid	**When using PoCXP**: Detecting link. **Note:** Blinks for 1 second even when detected immediately.
	Blinking amber - rapid	**When not using PoCXP**: Detecting link. **Note:** Blinks for 1 second even when detected immediately.
	Lit green	Connection between device and host is established, but there is no data being transmitted.
	Blinking amber - slow	The connection between the camera and frame grabber is established. Waiting for an event (trigger, exposure pulse, etc.)
	Blinking green - rapid	The connection between the camera and frame grabber is established. Data is being transmitted.
	Alternating between green and amber - slow	Sending connection test packet.

Mounting Holes

Use these holes when mounting the camera directly to a wall or other structural system.

Location	Description
Bottom, Top, Side	M4, Depth 6mm
Front	M4, Depth 5mm

Note: Refer to "Dimensions" for the location of the mounting holes.

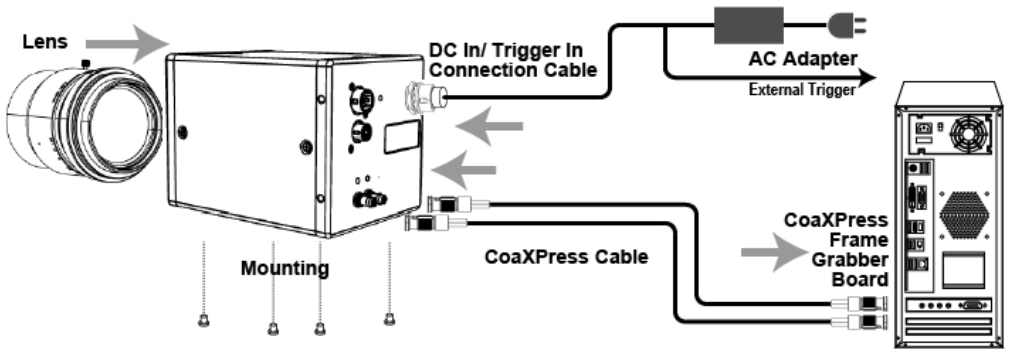
Preparation

Read this section to learn how the camera connects to devices and accessories. The preparation process is described below.

> **Note:** eBUS Player for JAI does not support this camera.

1	**Step 1: Connect Devices** • Connect the lens, cable, AC adapter, computer, and other devices.
2	**Step 2: Verify Camera Operation** • Verify whether the camera is turned on and ready for use.
3	**Step 3: Verify the Connection between the Camera and PC** • Verify whether the camera is properly recognized via Control Tool.
4	**Step 4: Configure Trigger, Exposure, and Line Rate Settings** • Configure the camera's basic settings.
5	**Step 5: Adjust the Image Quality** • Perform DSNU, PRNU and other basic settings for image quality.
6	**Step 6: Save the Settings** • Save the current setting configurations in user memory.

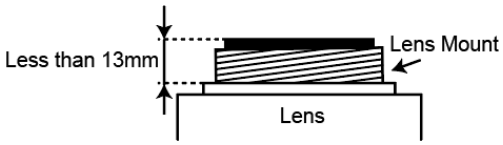
Step 1: Connect Devices



Lens
Mounting
⑤ DC IN / Trigger IN Connection Cable
AC Adapter
CoaXPress Cable
CXP Frame Grabber Board

Lens

F-mount or M-52 mount lenses with lens mount protrusions of 13 mm or less can be attached.



- Back flange distance (both F- and M52-mount): 46.5 mm
- Thread pitch (M52): 0.75mm

> **Note:** Use only lenses designed for prism cameras. Lenses designed for single-sensor cameras may not allow the camera to achieve its full performance.

> **Cautions:**
> - The maximum performance of the camera may not be realized depending on the lens.
> - Attaching a lens with a mount protrusion of 13 mm or longer may damage the lens or camera.

> **Note**: The following formula can be used to estimate the focal length: **Focal length = WD / (1 + W/w)**
> - WD: Working distance (distance between lens and object)
> - W: Width of object
> - w: Width of sensor

Mounting

When mounting the camera directly to other device, use screws that match the mounting holes on the camera. (Mounting Holes)

> **Caution:** For heavy lenses, be sure to support the lens itself. Do not use configurations in which its weight is supported by the camera.

⑤ DC IN / Trigger IN Connection Cable

Performs external I/O such as power supply and trigger input.

CoaXPress Cable

Connect the CXP cables to the CXP connectors on the camera and frame grabber board. Refer to the specifications of the cable for details on its bend radius.

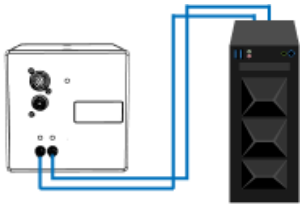
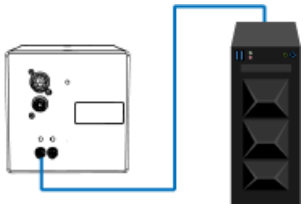
CxpLinkConfiguration

Examples of CxpLinkConfiguration are shown below.

Cautions:

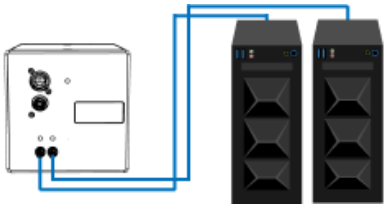
- The CxpLinkConfigurationPreferred [TransportLayerControl] setting must match the number of CoaXPress cables that connect the camera to the PC. For example, if it is CXP12_X2, connect two cables to one PC. If the number of connection cables does not match the setting, reset the setting according to the number of connection cables.
- Do not plug cables into connectors that are not used.

When Not Using CXP Link Sharing ([CXPLinkSharingEnable] = [Off])

CXP12_X2, CXP6_X2, CXP3_X2	CXP12_X1, CXP6_X1, CXP3_X1
	

When Using CXP Link Sharing ([CXPLinkSharingEnable] = [On])

Note: In this configuration, simultaneous PoCXP power supply through both connectors (CXP1 and CXP2) is not supported. For details, refer to "CXP (CoaXPress) Connector".

CXP12_X1, CXP6_X1, CXP3_X1	
	CXP-1 connector = PC1 (Master) CXP-2 connector = PC2 (Slave)

CXP Frame Grabber Board

Refer to the operating instructions of the frame grabber board, and configure settings on the computer as necessary.

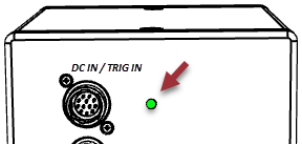
AC Adapter

Connect the AC adapter and the round connector of the connection cable to the DC IN / Trigger IN connector on the camera.

Step 2: Verify Camera Operation

When power is supplied to the camera while the necessary equipment is connected, the POWER/TRIG LED at the rear of the camera lights amber, and initialization of the camera starts. When initialization is complete, the POWER/TRIG LED lights green.

Verify whether power is being supplied to the camera by checking the rear LED. When properly turned on, the power LED is lit green.



> **Note:** For details on how to read the LEDs, see the LEDs section.

PowerSourceStatus Function

> **Related Setting Items:** DeviceControl

> **Note:** This function is supported only on the SW-4000Q-CXP2A model.

Use this function to determine which power source was used to start the camera.

- **DC**: The camera was started using power supplied through the 12-pin DC power connector.
- **PoCXPx1**: The camera was started using power supplied through one PoCXP lane.

  > **Caution:** For the SW-4000Q-CXP2A model, when powered only through a single PoCXP lane (PoCXPx1), the maximum line rate is limited to 73 kHz.

- **PoCXPx2**: The camera was started using power supplied through two PoCXP lanes.

> **Note:** For the SW-8000Q-CXP2A model, there is no line rate limitation when powered through a single PoCXP lane.

Step 3: Verify the Connection between the Camera and PC

To verify the connection, use the control tool that corresponds to your CoaXPress frame grabber board. This tool allows you to configure the camera and view the captured images. For specific instructions on using the control tool, please refer to its operation manual.

> **Note:** eBUS Player for JAI does not support this camera.

Step 4: Configure Trigger, Exposure, and Line Rate Settings

> **Related Setting Items:** AcquisitionControl

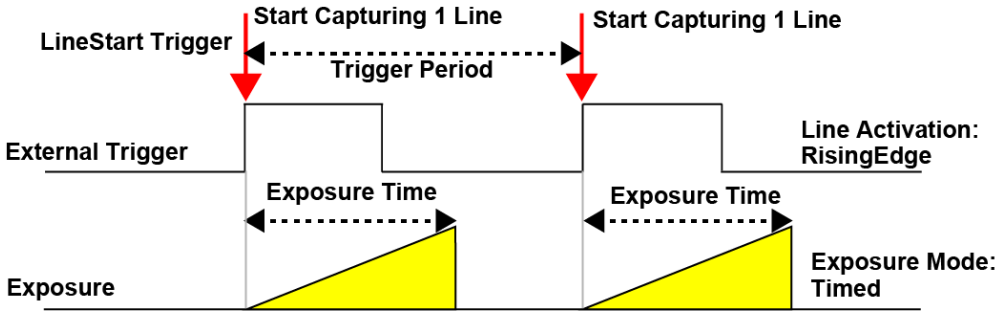
This section describes five scenarios for controlling the trigger, exposure, and line rate.

> **Notes:**
> - This section is intended to explain the basic relationship between the trigger, exposure, and line rate.

Trigger	Exposure	Example
ON	Timed	Control via External Triggers with the Specified Exposure Time
	Off	Control via External Triggers without Specifying the Exposure Time
	TriggerWidth	Control via External Triggers with Exposure Time Set to TriggerWidth
Off	Timed	Control without External Triggers with the Specified Exposure Time
	Off	Control without External Triggers without Specifying the Exposure Time

Control via External Triggers with the Specified Exposure Time

In the example below, **TriggerSelector** is set to **LineStart**.



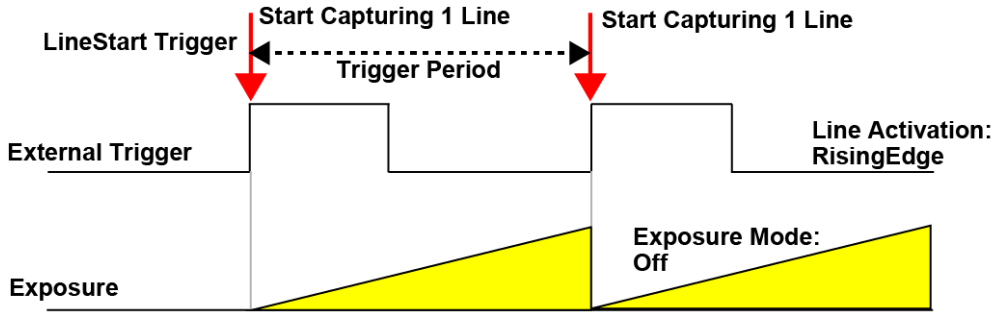
Notes:

- When using external triggers, the line rate is determined by the trigger period.
- The ExposureTime value cannot be longer than the trigger period.

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Selector	Line Start
Trigger Source	Any
Trigger Activation	RisingEdge (rising edge of input signal) or FallingEdge (falling edge of input signal)
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.

Control via External Triggers without Specifying the Exposure Time

In the example below, **TriggerSelector** is set to **LineStart**.



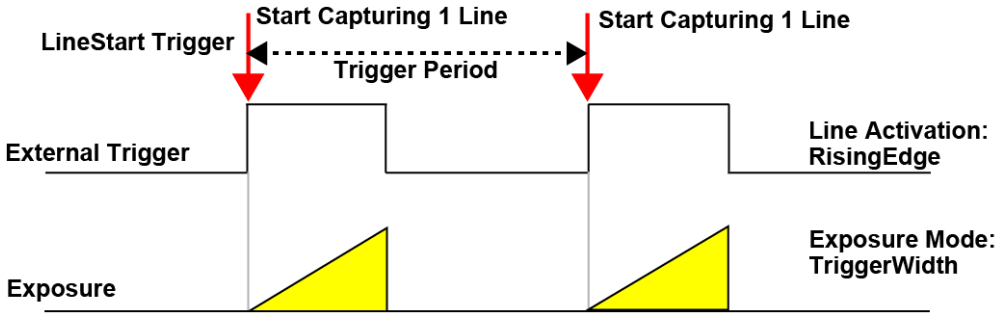
Notes:

- When using external triggers, the line rate is determined by the trigger period.
- The exposure is performed with an exposure time calculated from 1 / (line rate).

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Selector	Line Start
Trigger Source	Any
Trigger Activation	RisingEdge (rising edge of input signal) or FallingEdge (falling edge of input signal)
Exposure Mode	Off

Control via External Triggers with Exposure Time Set to TriggerWidth

In the example below, **TriggerSelector** is set to **LineStart**.



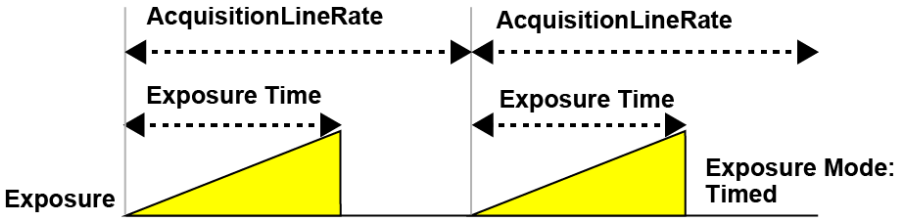
Notes:

- When using external triggers, the line rate is determined by the trigger period.

Item	Setting Value / Selectable Range
Trigger Mode	On
Trigger Selector	Line Start
Trigger Source	Any
Trigger Activation	LevelHigh (high-level duration) or LevelLow (low-level duration)
Exposure Mode	TriggerWidth (control via trigger width)

Control without External Triggers with the Specified Exposure Time

Configure the settings as follows.



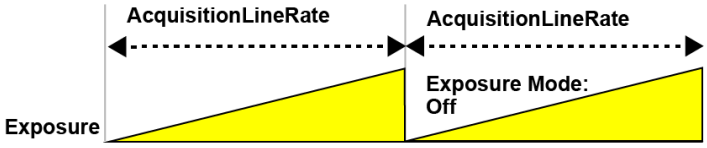
Notes:

- The line rate can be set up to 1 line cycle to match the speed of the object or to lengthen the accumulation time to increase sensitivity.
- The ExposureTime value cannot be longer than the line period.

Item	Setting Value / Selectable Range
Trigger Mode	Off
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.
Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.

Control without External Triggers without Specifying the Exposure Time

Configure the settings as follows.



Notes:

- The line rate can be set up to 1 line cycle to match the speed of the object or to lengthen the accumulation time to increase sensitivity.
- The exposure will be performed with an exposure time equal to 1 / line rate.

Item	Setting Value / Selectable Range
Trigger Mode	Off
Exposure Mode	Off
Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.

Step 5: Adjust the Image Quality

To get the best performance from the camera, set the following functions in the following order.

1. DSNU Correction (Pixel Black Correct)
2. PRNU Correction (Pixel Gain Correct)
3. Adjust the Black Level
4. Adjust the White Balance

DSNU Correction (Pixel Black Correct)

> **Related Setting Items:** Correction

DSNU (dark signal non-uniformity) is a variation between pixels in the dark areas generated by the sensor. If the line rate is slowed or a long exposure time is set, the dark current in the sensor may change and the state of the DSNU may change.

1. Place the sensor protection cap on the camera.
2. Start image acquisitions with AcquisitionStart [AcquisitionControl].
3. Specify the user area (User1 ~ User3) to save the black level correction value with **PixelBlackCorrectionMode** (Correction).

   > **Note:** Default saves the correction data set at the factory. You cannot overwrite this data.

4. Execute **CalibratePixelBlackCorrection**. Black level correction data is automatically generated and saved in the user area specified in PixelBlackCorrectionMode.

   > **Caution:** This camera may take several minutes or more to complete DSNU correction, especially when the line rate setting is low.

5. You can check the execution result of black level correction by **PixelBlackCalibrationResult**.

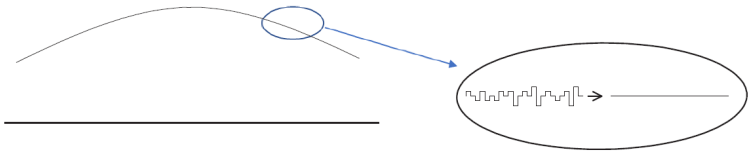
Result	Description
Idle	No correction has been perfomed.
Succeeded	The correction has been successfully completed. The correction data has been saved to the user area specified in PixelBlackCorrection.

Result	Description
Error1 - Image was too bright	Correction failed. The image was too bright.
Error2 - Image was too dark	Correction failed. The image was too dark.
Error3 - Could not calibrated	Could not perform the correction because the camera is in one of the following status: • The image is not being output. • TestPattern[ImageFormatControl] is set to anything other than **Off**. • **PixelBlackCorrectionMode** is set to **Off** or **Default**.

PRNU Correction (Pixel Gain Correct)

> **Related Setting Items:** Correction

PRNU (photo response non-uniformity) is a variation between pixels generated by the sensor under bright conditions. If the line rate is slowed or a long exposure time is set, the dark current in the sensor may change and the state of the PRNU may change.



How to Execute

> **Notes:**
> - The video level should be between 70% and 90% of the saturation level.
> - The lens should be defocused.
> - The subject should be a white, flat surface (such as a sheet of white paper).

1. Specify the user area (User1 ~ User3) to save the gain correction value with **PixelGainCorrectionMode** (Correction).

   > **Note: Default** saves the correction data set at the factory. You cannot overwrite this data.

2. Execute **CalibratePixelGainCorrection** and correct the image. Gain correction data is automatically generated and saved in the area specified in **PixelGainCorrectionMode**. Then, the calibration result "Succeeded" is displayed in **PixelGainCalibrationResult**.

> **Caution:** This camera may take several minutes or more to complete PRNU correction, especially when the line rate is low.

3. You can check the execution result of gain correction by **PixelBlackCalibrationResult**.

Result	Description
Idle	No Correction has been performed.
Succeeded	The correction data has been applied and saved in the user area specified in PixelGainCorrectionMode.
Error1 - Image was too bright	Correction failed. The image was too bright.
Error2 - Image was too dark	Correction failed. The image was too dark.
Error3 - Could not calibrated	Could not perform the correction because the camera is in one of the following status: • The image is not being output. • TestPattern[ImageFormatControl] is set to anything other than **Off**. • **PixelGainCorrectionMode** is set to **Off** or **Default**.

Adjust the Black Level

> **Related Setting Items:** AnalogControl

Black level correction is a function for adjusting the setup level. When this function is used, the following is performed for the gain mode setting.

1. Select the black level you want to configure in **BlackLevelSelector**. (All, Red, Blue, NIR)
2. Specify the adjustment value in **BlackLevel**. (All: -133 ~ 255; Red/Blue/NIR: -64 ~ 64)

Adjust the White Balance

> **Related Setting Items:** AnalogControl

Adjust the white balance using the automatic adjustment function.

Automatic White Balance Adjustment

1. Place a white sheet of paper or similar object under the same lighting conditions as the intended subject, and zoom in to capture the white. White objects near the subject, such as a white cloth or wall, can also be used. Be sure to prevent the high-intensity spot lights from entering the screen.

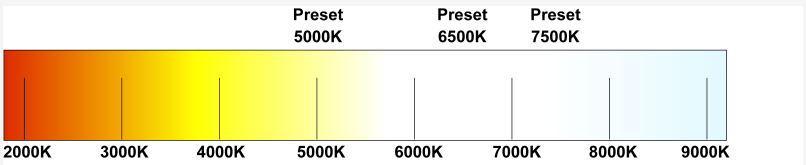
2. If necessary, use **BalanceWhiteAutoWidth** and **BalanceWhiteAutoOffsetX** to configure the white balance adjustment area.
3. Select **Once** or **ExposureOnce** from **BalanceWhiteAuto**.
    - **Once**: The white balance is automatically adjusted by calculating Red / Blue of the Gain control (AnalogControl). When **IndividualGainMode** = **Off**, the white balance is adjusted based on **DigitalAll** of the Gain setting, and when **IndividualGainMode** = **On**, it is adjusted based on **DigitalGreen** of the **Gain** setting.
    - **ExposureOnce**: The white balance is automatically adjusted by calculating Red / Blue of the ExposureTime setting based on the Green ExposureTime setting (AcquisitionControl).

    > **Notes:**
    > - To use the **ExposureOnce** option, **ExposureTimeMode** (AcquisitionControlmust be set to **Individual**.
    > - When **RBExposureInterlocked** (AcquisitionControlis **On**, the white balance will not be adjusted automatically, however BalanceWhiteAutoResult displays "Succeeded".

4. The white balance is automatically adjusted. After the adjustment, "**Succeeded**" is displayed in **BalanceWhiteAutoResult**. Once the adjustment is completed, BalanceWhiteAuto returns to Off.
5. The table below shows a list of the adjustment result:

Result	Description
Idle	No adjustment has been performed.
Succeeded	Adjustment was completed successfully. After the adjustment, BalanceWhiteAuto returns to Off.
Error1 - G image was too bright	Adjustment failed. The Green level was too high compared to the Red or Blue level.
Error2 - G image was too dark	Adjustment failed. The Green level was too low compared to the Red or Blue level.
Error3 - Timeout	Adjustment failed. Adjustment was repeated for 10 seconds without success.

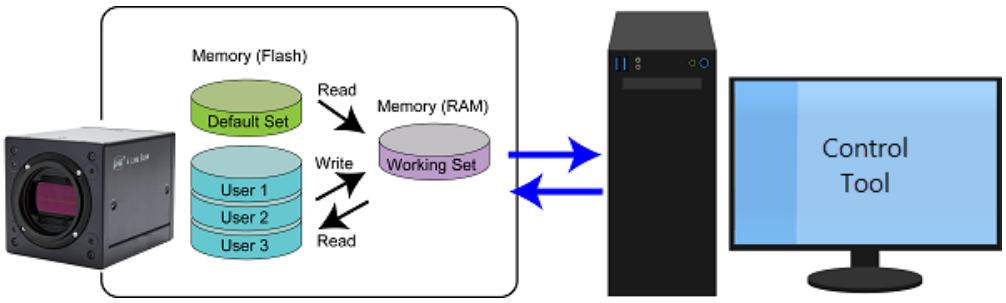
> **Note**: On this camera, the white balance can also be set to "Color Temperature" (**Preset5000K**, **Preset6500K**, **Preset7500K**). When using the Color Temperature option, **IndividualGainMode** [AnalogControl] must be set to **Off**.



Step 6: Save the Settings

Related Setting Items: UserSetControl

The configured setting values will be deleted when the camera is turned off. By saving current setting values to user memory, you can load and recall them whenever necessary. You can save up to three sets of user settings in the camera. (User Set1 to 3)



Note: The camera has non-volatile flash memory for users to store data; however, images should be saved to a PC or other storage location using eBUS Player for JAI (Image and Video Saving Options).

To Save User Settings

1. Stop image acquisition.
2. Expand **UserSetControl** and select the save destination (UserSet1 to UserSet3) in UserSetSelector.

   Note: The factory default setting values are stored in Default and cannot be overwritten.

   Caution: Settings can only be saved when image acquisition on the camera is stopped.
3. Select **UserSetSave** and click the **UserSetSave** button.
4. The current setting values are saved as user settings.

To Load User Settings

1. Stop image acquisition. User settings can only be loaded when image capture on the camera is stopped.
2. Select the settings to load (UserSet1 to UserSet3) in UserSetSelector.
3. Select **UserSetLoad** and click the **UserSetLoad** button.
4. The selected user settings are loaded.

> **Note:** When selecting **Default** for UserSetSelector, the factory settings are loaded.

Main Functions

This chapter describes the camera's main functions.

ROI (Regional Scanning Function)

Related Setting Items: ImageFormatControl

The ROI (region of interest) function allows you to output images by specifying the area to scan.

ROI Settings

Specify the area to scan by specifying the Width and Horizontal Offset values (ImageFormatControl).

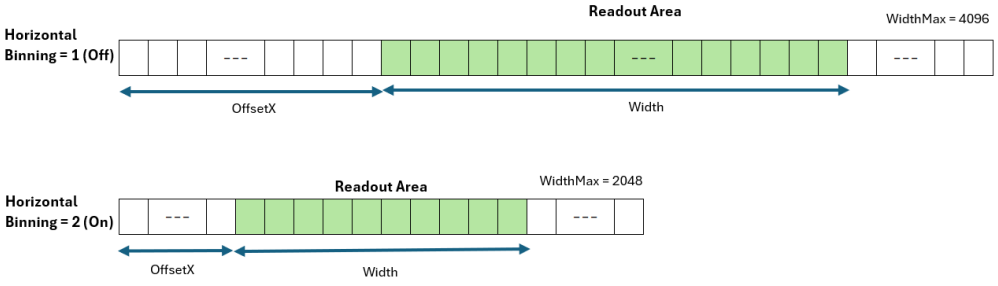
The setting ranges for the ROI function's readable area based on the Binning setting are as follows.

Model	BinningHoizontal	Width (Pixel)	Offset X (Pixel)
4000Q Model	1 (Off)	128 ~ 4096, Step 16	0 ~ 3968, Step 16
	2 (On)	64 ~ 2048, Step 8	0 ~ 1984, Step 8
8000Q Model	1 (Off)	128 ~ 8192, Step 16	0 ~ 8067, Step 16
	2 (On)	64 ~ 4096, Step 8	0 ~ 4032, Step 8

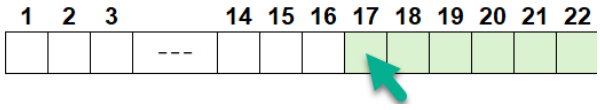
Notes:

- On this camera, Height is fixed to 1.

Example (4000Q Model)



For example, when **OffsetX** is set to 16 , the first readout pixel is the 17th pixel on Line 5.



Binning Function

Related Setting Items: ImageFormatControl

The Binning function allows you to combine the signal values of clusters of adjacent pixels to create improved virtual pixels. Using this function results in images with higher sensitivity (Sum Mode).

Binning Off	Binning On (Sum Mode)
	

This camera supports BinningHorizontal and SensorBinningVertical.

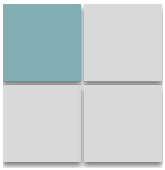
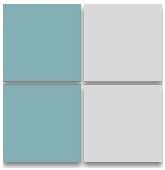
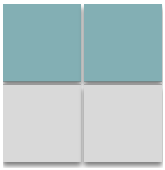
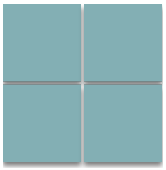
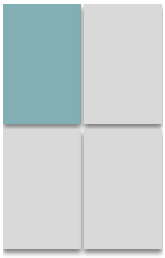
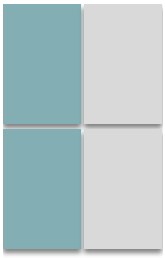
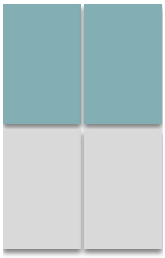
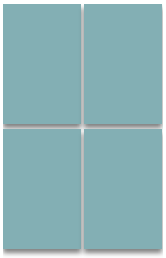
Binning Type	Process Method	Supported Mode
BinningHorizontal	Digital (FPGA)	Sum, Average
SensorBinningVertical (4000Q Model only)	Analog (Sensor)	Sum

Note: Refer to JAI's blog "Using pixel binning to increase image quality under low light conditions" on how to use the Binning function.

Binning Types

4000Q Models

The 4000Q models support the following binning types by combining Type A / Type B Sensor Type and horizontal / vertical binning (BinningHorizontal / Binning Vertical).

Sensor Type	Binning Off	1 x 2	2 x 1	2 x 2
	WidthMax: 4096 pixels		**WidthMax: 2048 pixels**	
Type A				
	7.5 µm x 7.5 µm	7.5 µm x 15.0 µm	15.0 µm x 7.5 µm	15.0 µm x 15.0 µm
Type B				
	7.5 µm x 10.5 µm	7.5 µm x 21.0 µm	15.0 µm x 10.5 µm	15.0 µm x 21.0 µm

Note: TypeA / Type B Sensor Type can be condigured in **SensorType** (AnalogControl).

8000Q Models

The 8000Q models support the following binning types.

BinningHorizontal Off	BinningHorizontal On
WidthMax: 8192 pixels	**WidthMax 4096 pixels**
	
3.75 µm x 5.78 µm	7.50 µm x 5.78 µm

Pixel Format

Related Setting Items: ImageFormatControl

Technical Notes Pixel Format Alignments for GigE Vision

The camera uses four integrated CMOS image sensors to simultaneously capture visible and near-infrared (NIR) images.

- RGBA8 (visible + NIR)
- RGBA10 (visible + NIR)

The following pixel formats are also supported.

- RGB8, RGB10 (visible)
- Mono8, Mono10 (NIR)

Notes:

- If your image display application does not display NIR data, you can set **OutputLineSelector** (ImageFormatControl) to output NIR at the conventional R, G, or B position. For example, when set to Rch=NIR / Gch=Green / Bch=Blue / Nch=Red, NIR is output at the conventional R position.
- This camera does not support the dual stream output to transmit the visible and NIR data separately.

Horizontal Image Mirroring

Related Setting Items: ImageFormatControl

The HorizontalImageMirroring function allows you to flip an image horizontally.

HorizontalImageMirroring = Off	HorizontalImageMirroring = On
	

Note: The **Width** and **OffsetX** settings are not affected by this function because the image is flipped after the image acquisition.

Test Pattern Function

Selects the test pattern to output.

Note: When **Width** or **OffsetX** is changed, the image data is displayed from the specified position.

- **White** (RGB and NIR): Outputs a uniform image with a pixel value of 222 LSB (8-bit).

- **Pattern1** (RGB and NIR): Outputs a gray ramp image with pixel values ranging from 8 LSB (8-bit) at the left edge to 222 LSB (8-bit) at the right edge.

- **Pattern2** (RGB and NIR): Outputs a stripe pattern that alternates between 8 LSB (8-bit) and 222 LSB (8-bit).

- **ColorBar** (RGB): Outputs an image with black regions on both sides and a color bar in the center.

- **ColorBar** (NIR): Outputs a repeating pattern of black, gray, and white.

Change the Line Rate

Related Setting Items: AcquisitionControl

When **TriggerMode** is set to **Off**, you can set the line rate using **AcquisitionLineRate**. This function can be used to match the scanning speed of the camera to the feeding speed of the object or to lengthen the accumulation time to increase sensitivity.

The minimum value that can be set is 66 Hz (step: 0.1Hz).

Supported Operation Mode

ExposureMode	TriggerMode	Example
Timed	Off	Control without External Triggers with the Specified Exposure Time
Off	Off	Control without External Triggers without Specifying the Exposure Time

Notes:

- You can also save the setting, and have it applied whenever the power is subsequently turned on, but this requires additional operations. (Step 6: Save the Settings)
- The black level will change depending on the line rate, so be sure to readjust the black level after changing the line rate or trigger period.

Maximum Line Rate (Approximate)

Related Setting Items: AcquisitionControl

The below table shows the maximum line rate in different ROI (Regional Scanning Function) and Pixel Format settings.

Notes:

- The maximum line rates shown below are when DeviceThroughputLimitMode = Off and Packet Size = 5532.
- When BinningHorizontal (ImageFormatControl) = 2 (ON), the Width value after Binning applies.

SW-4000Q-CXP2A

Caution: When powered only through a single PoCXP lane (PoCXPx1), the maximum line rate is limited to 73 kHz. The power source can be verified by the "PowerSourceStatus Function".

Link Config.	Width	RGBa8	RGBa10	RGB8	RGB10	Mono8	Mono10
CXP12_x2	4096 (Full)	146kHz	117kHz	146kHz	117kHz	146kHz	117kHz
	3072 (3/4)	183kHz	155kHz	183kHz	155kHz	183kHz	155kHz
	2048 (1/2)	183kHz	183kHz	183kHz	183kHz	183kHz	183kHz
	1024 (1/4)	183kHz	183kHz	183kHz	183kHz	183kHz	183kHz
CXP6_x2	4096 (Full)	73kHz	58kHz	73kHz	58kHz	73kHz	58kHz
	3072 (3/4)	97kHz	78kHz	97kHz	78kHz	97kHz	78kHz
	2048 (1/2)	144kHz	116kHz	144kHz	116kHz	144kHz	116kHz
	1024 (1/4)	183kHz	183kHz	183kHz	183kHz	183kHz	183kHz
CXP3_x2	4096 (Full)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	3072 (3/4)	48kHz	39kHz	48kHz	39kHz	48kHz	39kHz
	2048 (1/2)	72kHz	58kHz	72kHz	58kHz	72kHz	58kHz
	1024 (1/4)	143kHz	115kHz	143kHz	115kHz	143kHz	115kHz
CXP12_x1	4096 (Full)	73kHz	58kHz	73kHz	58kHz	73kHz	58kHz
	3072 (3/4)	97kHz	78kHz	97kHz	78kHz	97kHz	78kHz
	2048 (1/2)	145kHz	116kHz	145kHz	116kHz	145kHz	116kHz
	1024 (1/4)	183kHz	183kHz	183kHz	183kHz	183kHz	183kHz
CXP6_x1	4096 (Full)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	3072 (3/4)	48kHz	39kHz	48kHz	39kHz	48kHz	39kHz
	2048 (1/2)	72kHz	58kHz	72kHz	58kHz	72kHz	58kHz
	1024 (1/4)	143kHz	115kHz	143kHz	115kHz	143kHz	115kHz
CXP3_x1	4096 (Full)	18kHz	14kHz	18kHz	14kHz	18kHz	14kHz
	3072 (3/4)	24kHz	19kHz	24kHz	19kHz	24kHz	19kHz
	2048 (1/2)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	1024 (1/4)	71kHz	57kHz	71kHz	57kHz	71kHz	57kHz

SW-8000Q-CXP2A

> **Note:** This model has no line rate limitations due to the power source.

Link Config.	Width	RGBa8	RGBa10	RGB8	RGB10	Mono8	Mono10
CXP12_x2	8192 (Full)	73kHz	58kHz	73kHz	58kHz	73kHz	58kHz
	6144 (3/4)	97kHz	78kHz	97kHz	78kHz	97kHz	78kHz
	4096 (1/2)	100kHz	100kHz	100kHz	100kHz	100kHz	100kHz
	2048 (1/4)	100kHz	100kHz	100kHz	100kHz	100kHz	100kHz
CXP6_x2	8192 (Full)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	6144 (3/4)	49kHz	39kHz	49kHz	39kHz	49kHz	39kHz
	4096 (1/2)	73kHz	58kHz	73kHz	58kHz	73kHz	58kHz
	2048 (1/4)	100kHz	100kHz	100kHz	100kHz	100kHz	100kHz
CXP3_x2	8192 (Full)	18kHz	14kHz	18kHz	14kHz	18kHz	14kHz
	6144 (3/4)	24kHz	19kHz	24kHz	19kHz	24kHz	19kHz
	4096 (1/2)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	2048 (1/4)	72kHz	58kHz	72kHz	58kHz	72kHz	58kHz
CXP12_x1	8192 (Full)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	6144 (3/4)	49kHz	39kHz	49kHz	39kHz	49kHz	39kHz
	4096 (1/2)	73kHz	58kHz	73kHz	58kHz	73kHz	58kHz
	2048 (1/4)	100kHz	100kHz	100kHz	100kHz	100kHz	100kHz
CXP6_x1	8192 (Full)	18kHz	14kHz	18kHz	14kHz	18kHz	14kHz
	6144 (3/4)	24kHz	19kHz	24kHz	19kHz	24kHz	19kHz
	4096 (1/2)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz
	2048 (1/4)	72kHz	58kHz	72kHz	58kHz	72kHz	58kHz
CXP3_x1	8192 (Full)	9kHz	7kHz	9kHz	7kHz	9kHz	7kHz
	6144 (3/4)	12kHz	9kHz	12kHz	9kHz	12kHz	9kHz
	4096 (1/2)	18kHz	14kHz	18kHz	14kHz	18kHz	14kHz
	2048 (1/4)	36kHz	29kHz	36kHz	29kHz	36kHz	29kHz

Trigger Control

Related Setting Items: AcquisitionControl

The camera allows the following controls to be performed via external trigger signals.

TriggerSelector	Description
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.
LineStart	Acquire one line in response to the external trigger input. Select this option when Exposure control is performed by an external trigger.

Notes:

- When TriggerMode is On, the camera first receives the AcquisitionStart command (AcquisitionControl), the Acquisition trigger signal, and then outputs images.
- The settings for exposure control and triggers are related to each other. Refer to "Step 4: Configure Trigger, Exposure, and Line Rate Settings" when configure the settings.

Exposure Mode

Related Setting Items: AcquisitionControl

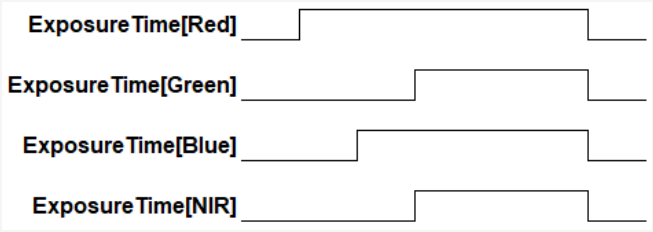
This camera supports the following exposure modes:

Exposure Mode	Description	Setting Example
Off	Exposure control is not performed (free-running operation).	Control via External Triggers without Specifying the Exposure Time
		Control without External Triggers without Specifying the Exposure Time
Timed	Mode in which control is performed using ExposureTime. Acquire images using an exposure time configured beforehand on an external trigger.	Control via External Triggers with the Specified Exposure Time
		Control without External Triggers with the Specified Exposure Time
TriggerWidth	Mode in which control of the exposure time is performed using the pulse width of the trigger input signal. The exposure time will be the same as the pulse width of the trigger input signal.	Control via External Triggers with Exposure Time Set to TriggerWidth

Note: When **ExposureMode** is set to **Timed** or **TriggerWidth**, the actual exposure time will consist of the image sensor's offset duration subtracted from the ExposureTime setting configured on the camera or the Width of the trigger signal to the camera. For more information, see "Actual Exposure Time".

ExposureTimeMode

When **ExposureMode** is set to **Timed**, you can select the following Exposure Time Mode.

Exposure Mode	Description
Common (Default)	Set the common exposure time for Red, Green, Blue, and NIR (the R/G/B/NIR channels will have the same exposure time).
Individual	Set the exposure times for Red, Green, Blue, and NIR individually. To set the exposure time individually for Red, set **ExposureTimeSelector** to **Red**, and configure the exposure time for Red in ExposureTime. Similarly, configure the exposure times individually for Green, Blue, and NIR. **Note**: The actual exposure time starts with the channel with the longest exposure time and ends with the channel with the shortest exposure time, so that the exposures end at the same time (see image below). 

Notes:

- When ExposureMode is set other than Timed, ExposureTimeMode is fixed to Common.
- The **RBExposureInterlocked** function is available when the Individual setting is selected. This function changes the exposure time while maintaining the Red / Blue exposure time ratio (G:R and G:B ratio before the change) with respect to Green.

  For example, if R: 20µs / G: 10µs / B: 15µs and G is changed to 30µs, R will automatically change to 60µs (= 20 * 30 / 10) and B will automatically change to 45µs (= 15 * 30 / 10).

Actual Exposure Time

The actual exposure time will consist of the image sensor's offset duration (0.85µs) subtracted from the ExposureTime setting configured on the camera or the Width of the trigger signal to the camera.

- Exposure Offset Time: -0.85µs

The minimum ExposureTime setting is 3 µs (step 0.01), and the maximum Exposure setting depends on other settings (see Exposure Mode on "Specifications").

ExposureMode = Timed

When ExposureTime is set to 3 µs, the actual exposure time will be 2.15µs (= 3µs - 0.85µs).

ExposureMode = TriggerWidth

The actual exposure time will consist of the image sensor's offset duration added to the Width of the trigger signal to the camera. If the needed ExposureTime is 2.15µs, the width of the Trigger Signal to the camera will be 3 µs (= 2.15µs + 0.85µs).

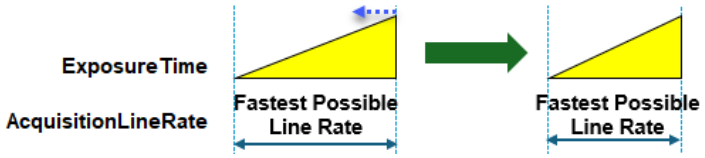
ExposureModeOption

Specifies whether to prioritize exposure time (PrioritizeExposureTime) or line rate (PrioritizeLineRate) when controlling line rate and exposure.

PrioritizeExposureTime (Default) :

This option does not allow you to set a line rate shorter than the configured ExposureTime.

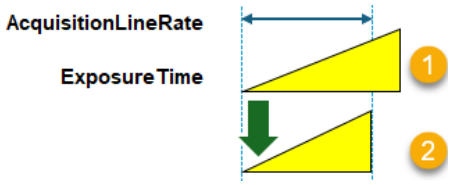
- The maximum AcquisitionLineRate value is limited by the line rate value calculated from the current ExposureTime setting.
- If you want a faster AcquisitionLineRate value, you must first decrease the ExposureTime value.



PrioritizeLineRate:

This option gives the line rate priority over the configured ExposureTime.

- When AcquisitionLineRate becomes faster, if the current ExposureTime value (1) is greater than the ExposureTime value calculated from the faster AcquisitionLineRate setting (2), the ExposureTime value will be overwritten with the value (2).



- If you want to increase the ExposureTime value further, you must first set AcquisitionLineRate to a slower value.

Gain Control

> **Related Setting Items:** AnalogControl

The Gain setting can be configured using the following settings.

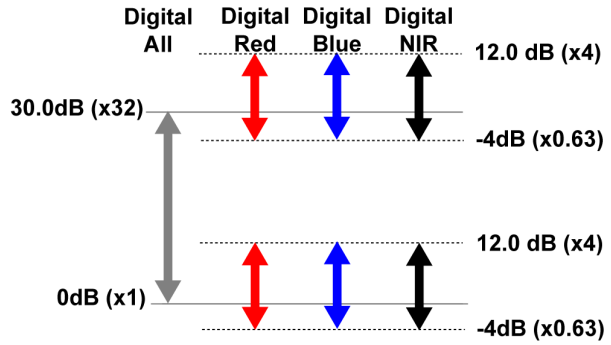
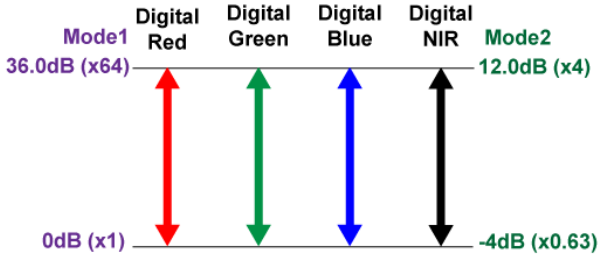
- **Digital Gain**: Configure Gain in Master Mode or Individual Gain Mode. For more information, see "Individual Gain Mode".
- **Analog Gain** (4000Q models Only): This setting is applied to the analog video signal output from the sensor. The gain steps can be configured to one of three levels (0 dB, 6 dB, 12 dB).

> **Note:** 4000Q models Only: The following two gain values are added together for the total gain value: Total Gain = AnalogGain (dB) + DigitalGain (dB)

Individual Gain Mode

Configure DigitalGain using this mode. This camera supports two Individual Gain Modes: Mode 1 (0 to 36dB) and Mode 2 (-4 to 12dB).

> **Note:** The Gain setting is configured in multipliers. For more information, see "Comparison of the Decibel Display and Multiplier Display."

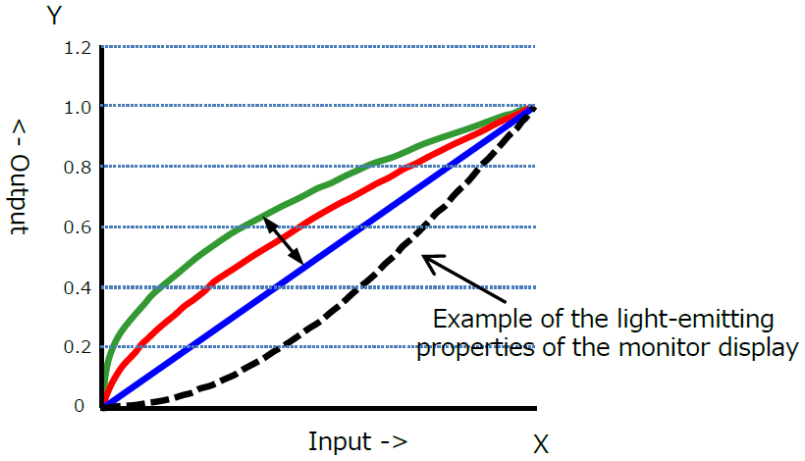
Individual Gain Mode = Off	Individual Gain Mode = Mode 1 / Mode 2
	
Adjust the **DigitalAll** (master gain) setting first, and then adjust the **DigitalRed**, **DigitalBlue**, and **DigitalNIR** setting values to perform fine adjustment.	Adjust the **DigitalGreen**, **DigitalRed**, **DigitalBlue**, and **DigitalNIR** setting values to adjust the gain. This mode allows a wider range of adjustment by the user when compared to Master Mode.

Gamma Function

Related Setting Items: AnalogControl,

The Gamma function corrects the output signals from the camera beforehand (reverse correction), taking into consideration the light-emitting properties of the monitor display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing.

The Gamma function can be used to correct the camera signals with an opposite-direction curve and produce a display that is close to linear.



To Use the Gamma Function

1. Select the correction value from **Gamma**. The selectable values are as follows:
    - **4000Q model**: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0
    - **8000Q model**: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.1, 2.4, 2.7, 3.1, 3.5, 4.0
2. Select **Gamma** from **LUTMode**.

Note: You can use the LUT function to configure a curve with more detailed points. For details, see LUT (Lookup Table).

LUT (Lookup Table)

Related Setting Items: LUTControl

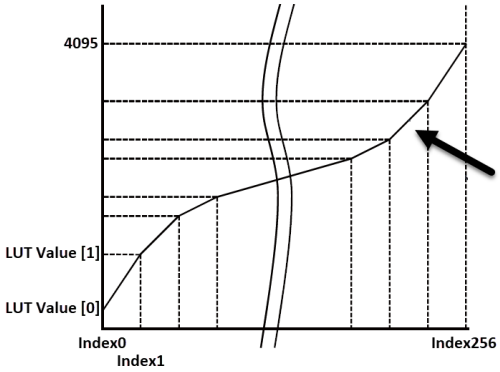
The LUT function is used to generate a non-linear mapping between signal values captured on the sensor and those that are output from the camera. On this camera, you can specify the output curve using 257 setting points (indexes).

How to Configure

1. Select **LUT** from LUTControl [AnalogControl].
2. Select the LUT channel you want to control from **LUTSelector** [LUTControl]. (Red, Green, or Blue)
3. Select the LUT Index from **LUTIndex** (0 ~ 256). Indexes represent the possible pixel values captured on the sensor, from the lowest value (Index 0) to the highest (Index 256). For example, Index 0 represents a full black pixel and Index 256 represents a full white pixel.
4. Set the LUT output value for the selected index in **LUTValue** (0 ~ 4095).

LUT Values

LUT values range from 0 at the lowest to 4095 at the highest. Linear interpolation is used to calculate LUT values between the index points.

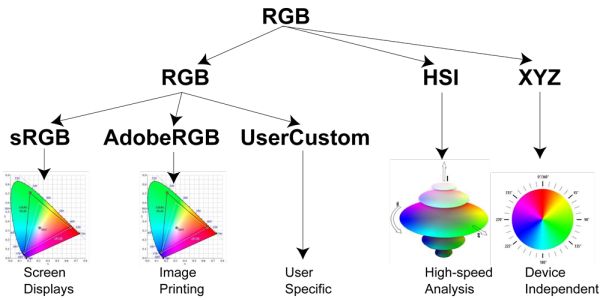


Interpolation using the average values of data to the left and right is used to determine values between points.

Color Space Conversion (Color Transformation Control)

Related Setting Items: ColorTransformationControl

This camera allows you to convert the standard color space (RGB) that is used to produce colors into other color spaces.



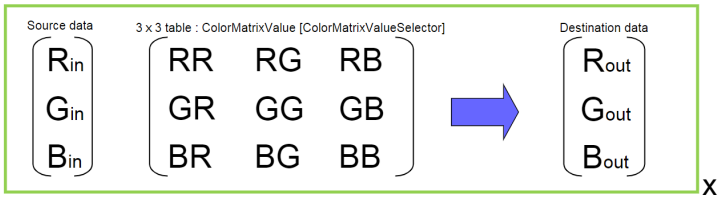
Note: This function is available only when **PixelFormat** is set to **RGB8** or **RGB10**.

How to Configure

1. Set **PixelFormat** [ImageFormatControl] to **RGB8** or **RGB10**.
2. Select the color space (**RGB**, **HSI**, or **XYZ**) you want to use from **ColorTransformationMode** (ColorTransformationControl).
3. When **RGB** is selected, select the details (sRGB, AdobeRGB, UserCustom) from **ColorTransformationRGBMode**.

   Note: If you select other than RGB, ColorTransformationRGBMode is fixed to Off.

4. When UserCustom is selected,
   a. Select the item you want to configure in **ColorMatrixValueSelector**.
   b. Configure the value (-2 to +2) in **ColorMatrixValue**.



X

Caution: If you set the color space to XYZ or HSI, Control Tool will not display the images captured by the camera properly. To display them properly, XYZ- or HSI-compatible image processing must be performed on the computer side.

About Color Space HSI

- Hue Value: 0° to 360° can be specified as follows.

Output	Description
8bit	Can be specified in 2° increments - 0°(00000000) ~ 360°(10110100)
10bit	Can be specified in 0.5°increments- 0°(0000000000) ~ 360°(1011010000)
12bit	Can be specified in 0.125°increments- 0°(000000000000) ~ 360°(101101000000)

- Saturation value, Intensity value: 0 ~ 100% can be specified as follows.

Output	Description
8bit	0% (00000000) ~ 100% (11111111)
10bit	0% (00000000) ~ 100% (1111111111)
12bit	0% (00000000) ~ 100% (111111111111)

GPIO (Digital Input/Output Settings)

Related Setting Items: DigitalIOControl

The camera is equipped with GPIO (general-purpose input/output) functions for generating and using combinations of triggers and other necessary signals within the camera and of signals output from the camera to the system such as those used for lighting equipment control.

These signals can be used as triggers and other necessary signals within the camera or as signals output from the camera to the system, such as those used for lighting equipment control.

Note: See "DC IN/TRIG Connector (12-Pin Round)" for recommended external circuit examples.

You can check the status of each digital I/O as shown in the table below with LineStatusAll.

Line Selector	LineMode	LineFormat	LineInverter	Line Status All	Line Source
20: Line1: TTL Out1 (Default)	Output	TTL	True	bit0	User-specified
23: Line4: TTL In1	Input	TTL	False	bit3	
24: Line5: Opt In1	Input	OptoCoupled	False	bit4	
26: Line7: CXP In	Input	Cxp Packet	False	bit6	
27: Line8: TTL Out2	Output	TTL	True	bit7	User-specified
28: Line9: TTL Out3	Output	TTL	True	bit8	User-specified
29: Line10: TTL In2	Input	TTL	False	bit9	
31: Line12: TTL Out4	Output	TTL	True	bit11	User-specified
32: Line13: TTL In3	Input	TTL	False	bit12	
33: Line14: TTL In4	Input	TTL	False	bit13	

Notes:

- Line Status: "Low" signal level is indicated by **False**, and "High" signal level is indicated by **True**.
- Line Status All: The current status of the Line signal is indicated by the above bit field.
- Line Source: Selectable items are listed in "LineSource Items".

LineSource Items

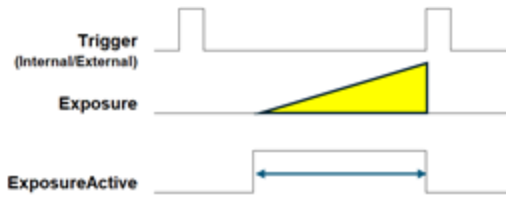
This section describes each item that can be selected in **LineSource**.

LineSource	Description
AcquisitionActive	From AcquisitionStart to AcquisitionStop.
ExposureActive	Camera is doing the exposure. See "ExposureActive Signal" for reference.
LVAL	Image data (line) from the sensor is being read.
PulseGenerator0 ~ 3	PulseGenerator output. For more information, see the following technical note: https://www.jai.com/uploads/documents/Technical-notes/English/TNE-0005-2015XII11-000-TechNote-PulseGenerator-tips.pdf
UserOutput0 ~ 3	Allows you to toggle UserOutput's On / Off on the software. Select the User Output 0 ~ 3 you want to use from **UserOutputSelector**, and then set the UserOutputValue (**High** or **Low**).
Line4 TTL In1	TTL In1
Line5 Opt In1	Opt In1
Line7 Cxp In	CXP In
Line10 TTL In2	TTL In2
Line13 TTL In3	TTL In3
Line14 TTL In4	TTL In4
Logic Block0 ~ 3	Logic Block output. See "Logic Block Control" for reference.
EncoderTrigger	Encoder output. See "Connecting Rotary Encoders" for reference.
Encoder Direction	Direction of encoder rotation. See "Rotation Direction" for reference.

ExposureActive Signal

Perform external output for the timing at which video is accumulated to the sensor. The signal is output to the DC IN / TRIG IN connector (12-pin round) or AUX connector (6-pin).

> **Note:** ExposureActive includes the exposure offset time. For more information see "Actual Exposure Time".



Counter and Timer Control

Related Setting Items: CounterAndTimerControl

Note: This camera supports the Counter function only.

The Counter function counts up change points in the camera's internal signals using the camera's internal counter, and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.

When a problem occurs in a system that includes this camera, comparing the values from multiple counters allows you to verify the extent of normal operability and can be useful when investigating the cause of the problem.

The following counters are available on this camera, and the functions that can be counted are fixed for each counter.

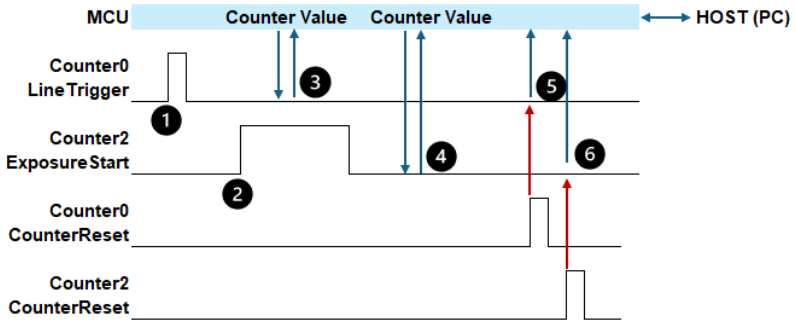
Counter Selector	Counter Event Source (Fixed)	Counter Event Activation
Counter0	Counts the number of **Line Trigger** instances.	Rising Edge (Fixed)
Counter1	Counts the number of **Line Start** instances.	Rising Edge (Fixed)
Counter2	Counts the number of **Exposure Start** instances.	Rising Edge (Fixed)

How to Configure

1. Select the counter you want to use from **CounterSelector**.
2. Enable the counter by selecting the event source in **ConterEventSource** (Default = Off).
3. **CounterEventActivation** displays the timing for counting for the selected counter.
4. You can reset and refresh the selected counter's counter value by executing **CounterReset** and **CounterRefresh**, respectively. The selected counter's value and status are displayed in **CounterValue** and **CounterStatus**, respectively.

   Note: After a power cycle, **CounterValue** is reset to 0.

Counter Occurrence Diagram (Example)



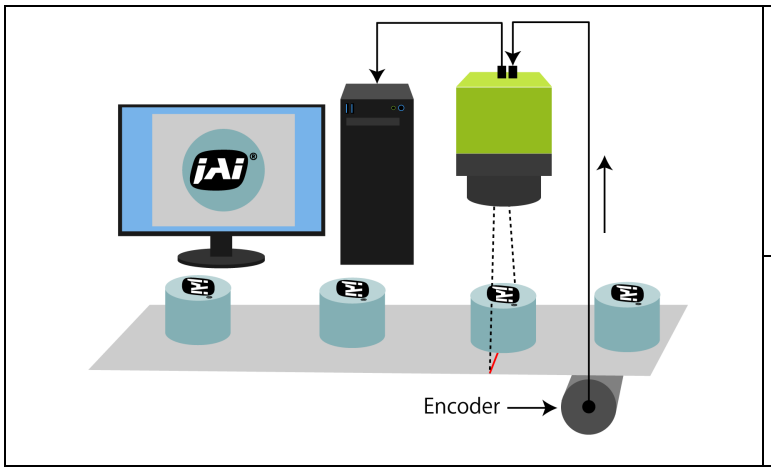
1. A LineTrigger Event occurs. Counter0 counts up.
2. An Exposure Start Event occurs. Counter 2 counts up.
3. The camera's internal MCU requests and reads the Counter0's counter value.
4. The camera's internal MCU requests and reads the Counter2's counter value.
5. Reset the Counter0's counter value to 0 by a CounterReset command or a CounterResetSource signal.
6. Reset the Counter2's counter value to 0 by a CounterReset command or a CounterResetSource signal.

Connecting Rotary Encoders

Related Setting Items: EncoderControl

Encoders are useful in line scan applications where line triggers need to be tied to motion, such as applications using conveyors with varying belt speeds.

If the object is moving at a constant speed, a fixed line rate can be set. In most cases, however, the speed of the belt speed is not always constant and must be triggered by an encoder to ensure that the speed of the object and the image acquisition are always synchronized. If the line rate and the belt speed do not match, the image of the object will appear stretched or shrunk (see images below).



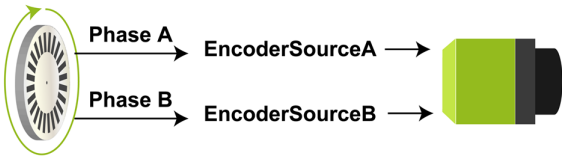
Line Rate Does NOT Match the Belt Speed

Line Rate Matches the Belt Speed

Note: JAI tests the encoder-related functions with a 2-Phase (Phase A and Phase B) incremental encoder.

How to Configure

1. Connect the two signals (Phase A and Phase B) from the rotary encoder to the camera's inputs (**EncoderSourceA** and **EncoderSourceB**).



2. Select the encoder trigger method in **EncoderTriggerOption** and configure the setting.

   - **EncoderDivider** (Default): Specify the number of triggers to generate as a ratio (65536 / EncodeDivider value). For more information, see "EncoderDivider Trigger Option".

     > **Note:** With this setting, input pulses are generated on the rising edge of the Phase A signal.

   - **EncoderDetection**: Specify the number of edges to pass between each encoder trigger signal. The number of edges to pass is specified by **EncoderEdgeDectionPassCount**. For more information, see "EdgeDetection Trigger Option".

     > **Note:** With this setting, input pulses are generated on the rising edge and falling edge of both the Phase A and B signals.

3. Specify the condition under which the camera outputs images in **EncoderOutputMode**.

   - **PositionUp**: The camera outputs images at all new positions in the positive direction (when **ObjectDirection** is set to **Forward Direction**).
   - **PositionDown**: The camera outputs images at all new positions in the negative direction (when **ObjectDirection** is set to **Reverse Direction**).
   - **Motion** (Default): The camera outputs images at all motion increments in both directions.

   > **Note:** For more information, see "Resume Scanning (Backward Counter)".

4. Specify the direction of moving objects in **ObjectDirection** (**Forward Direction** or **Reverse Direction**).
5. Select the input to use for obtaining the movement direction information for the object in **ObjectDirectionSource**.

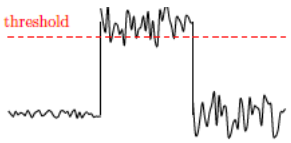
   > **Note**: If you want to reverse the object direction, change the ObjectDirection setting. Alternatively, you can reverse the object direction by changing the High/Low setting of the selected ObjectDirectionSource.

> For example, when ObjectDirectionSource is set to UserOutputValue0 [DigitalIOControl], the object direction can be reversed by changing the False (Low)/True (High) setting of UserOutputValue0.

6. When **EncoderOutputMode** is set to **PositionUp** or **PositionDown**, **EncoderOutputMaskedCount** displays the number of pulses generated during the reverse rotation.
   - EncoderOutputMaskedCount counts up while reversing.
   - EncoderOutputMaskedCount counts down when the reverse rotation is complete and the encoder rotates in the direction set by PositionUp or PositionDown. When the counter reaches 0, the camera resumes image output.

> **Note:** For more information, see "Resume Scanning (Backward Counter)" and "Rotation Direction".

7. If necessary, configure the following settings.
   - **EncoderFilter**: Enable the low-pass filter for the signal to prevent unintended operations due to signal noise from the rotary encoder. Specify the number of cycles from a range of 0 to 150 ns.



   - **EncoderStrobe**: Specify the strobe length of the generated signal (10 ~ 2550 ns).
   - **EncoderAveragingInterval**: When **EncoderOutputMode** is set to **EncoderDivider** and EncoderDvidier is not set to an integer multiple of 65536, use this setting if the reliability of the interval of the signal output from the rotary encoder is low (some signal interval is extremely long or short; the encoder's jitter is large). When this function is enabled, internal processing is performed by averaging the interval of several previous signals.
   - **EncoderMaxIntervalForNonDecimationMode**: When **EncoderOutputMode** is set to **EncoderDivider** and EncoderDvidier is not set to an integer multiple of 65536, set the maximum interval period of the output signal.

     When set to 0 (Default), the trigger output period is calculated using only the encoder input period. When set to anything other than 0, the trigger output period is calculated using the encoder input period and this setting.

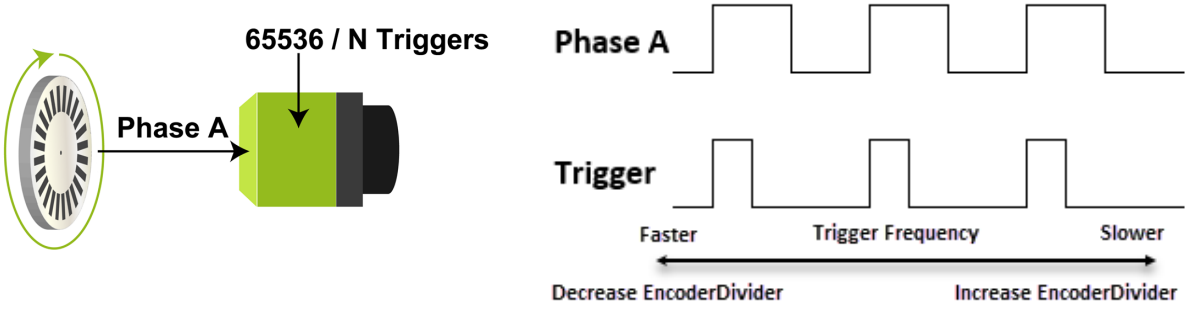
> **Note**: If the time interval of the output of the rotary encoder fluctuates greatly, the output of the camera's internal trigger generated may also fluctuate greatly.

For example, if the belt is stopped for a long time and no signal is received from the encoder, **EncoderDivider** tries to generate a trigger signal calculated from the time the belt was stopped. This will result in no trigger signal being output even after the belt starts moving again.

In this case, by setting the upper limit of the Phase A interval measurement time in **EncoderAveragingInterval**, even if the encoder stops for a long time, the trigger signal can be generated with the setting configured in **EncoderMaxIntervalForNonDecimationMode**.

EncoderDivider Trigger Option

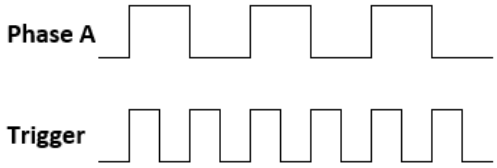
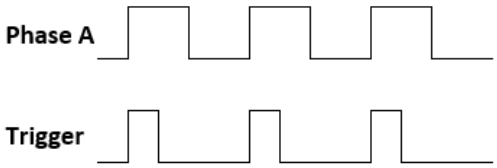
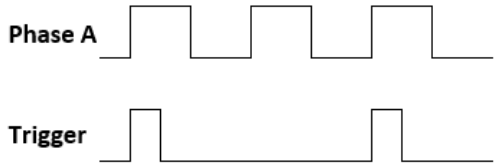
The **EncoderDivider** trigger option allows you to specify the number of triggers to generate as a ratio (65536 / N).



Notes:

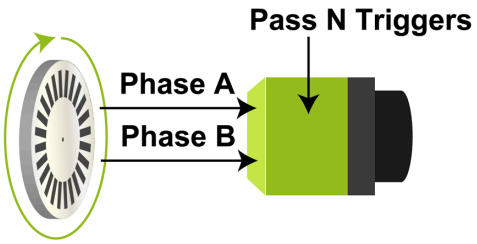
- With this setting, input pulses are generated on the rising edge of PhaseA.
- **When N is an integer multiple of 65536**: The camera's internal trigger is generated by the decimation of the output trigger of a rotary encoder.
- **When N is not an integer multiple of 65536**: Using the time interval of the output trigger of the rotary encoder, the camera's internal trigger is generated so that the set division ratio is obtained. For example, if the encoder frequency is 10khz, but you need a line rate of 12khz to get a proper image, then the EncoderDivider option can be used to set this 1:1.2 ratio, which will be maintained even if the encoder frequency changes.
- If the time interval of the output of the rotary encoder fluctuates greatly, the output of the camera's internal trigger generated may also fluctuate greatly. In this case, by setting **EncoderAveragingInterval**, it is possible to perform internal processing with the value obtained by averaging the time intervals of the specified number of signals.

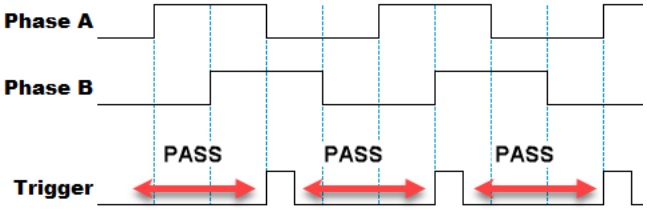
EncoderDivider Examples

EncoderDivider Setting	Encoder Input : Encoder Trigger Ratio	Number of Triggers (Output Pulse No.)	Timing Chart
32768	1 : 2	2 (= 65536/32768) The camera generates "two" triggers per a PhaseA input pulse signal.	
65536 (Default)	1 : 1	1 (= 65536/65536) The camera generates "one" trigger per a PhaseA input pulse signal.	
131072	2 : 1	0.5 (= 65536/131072) The camera generates "one" trigger per" two" PhaseA input pulse signals.	

EdgeDetection Trigger Option

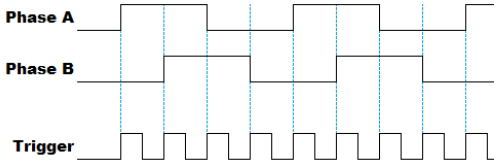
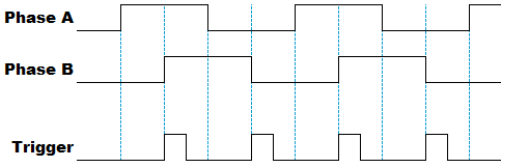
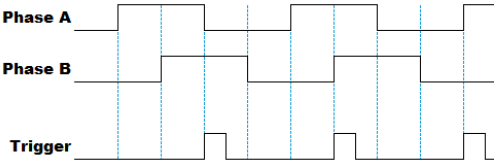
The **EdgeDetection** trigger option allows you to specify the number of edges to pass between encoder trigger signals. The number of edges to pass is specified by **EncoderEdgeDectionPassCount**. This option is useful, for example, if you need to trigger every second or third pulse.





> **Note:** With this setting, input pulses are generated on the rising and falling edge of both PhaseA and B. When Phase A - Phase B are exactly 90 degrees apart, the encoder input cycle is 1/4 of Phase A's rising cycle.

EdgeDetection Examples

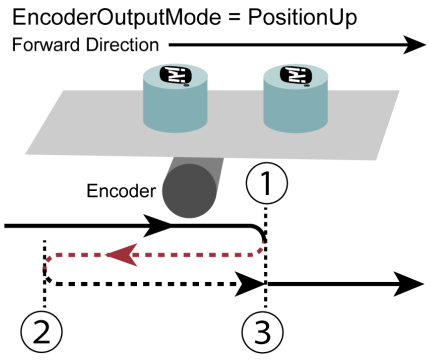
Edge Detection Pass Count Setting	Description	Timing Chart
0 (Default)	The camera generates "one" trigger per an input pulse signal.	
1	The camera generates "one" trigger per "two" input pulse signals.	
2	The camera generates "one" trigger per "three" input pulse signals.	

Resume Scanning (Backward Counter)

This camera can be configured to stop outputting images when the direction of movement of an object moving on a conveyor belt, etc. is reversed, and to resume outputting images when the object returns to the position where the reversal began. In order for the camera to work in this way, configure the following:

- Configure the camera so that the direction of rotation of the encoder can be determined (see "Rotation Direction")
- Set **EncoderOutputMode** to **PositionUp** or **PositionDown**.

Example



1. Reversal has started. The camera stops outputting images and **EncoderOutputMaskedCount** starts counting up.

2. Reversal has ended and the object has started to move forward. **EncoderOutputMaskedCount** starts counting down. However, image output is still paused.

3. The object has returned to the position where the reversal was started. **EncoderOutputMaskedCount** returns to 0 and the camera resumes image output.

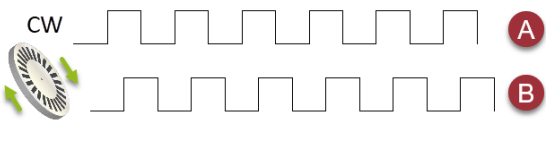
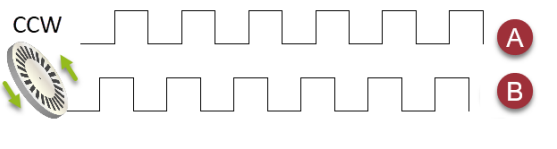
Notes:

- When **AcquisitionStart** [AcquisitionControl] is executed, **EncoderOutputMaskedCount** is reset to 0.
- If you want to output images while the object is moving in a reverse direction, change the **ObjectDirection** (Forward Direction / Reverse Direction)] setting to reverse the detected direction of the object.

Rotation Direction

Incremental encoders typically have two channels (A and B), and the channels operate in a square logical pattern. In one cycle, an encoder outputs a number of pulses on each channel which is called the resolution.

Because the A and B channels are phase shifted, it is possible to determine which direction the rotation is based on which channel is leading (see below).

The A channel is leading.		The B channel is leading.	

Logic Block Control

> **Related Topic:** Logic Block Control

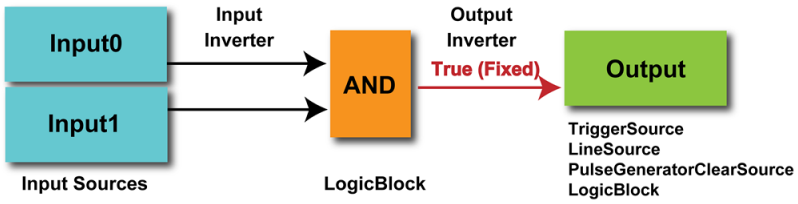
This camera supports the Logic Block Control function. A Logic Block is a combinational logic element that conditions various input signal sources by determining true/false and generates output signals accordingly.

This camera supports up to 4 Logic Blocks, and each block has two input sources.

> **Caution**: On this camera, the LogicBlock function is fixed to AND, and the LogicBlock output signal is always inverted; so it acts as an NAND. For example, in the following table, the Logic Block output signal is generated when NAND is 1. If both Input signals are 1, no Logic Block output signal is generated (NAND = 0).

Input0	Input1	AND	NAND
0	**0**	**0**	**1**
0	**1**	**0**	**1**
1	**0**	**0**	**1**
1	1	1	**0**

How to Configure



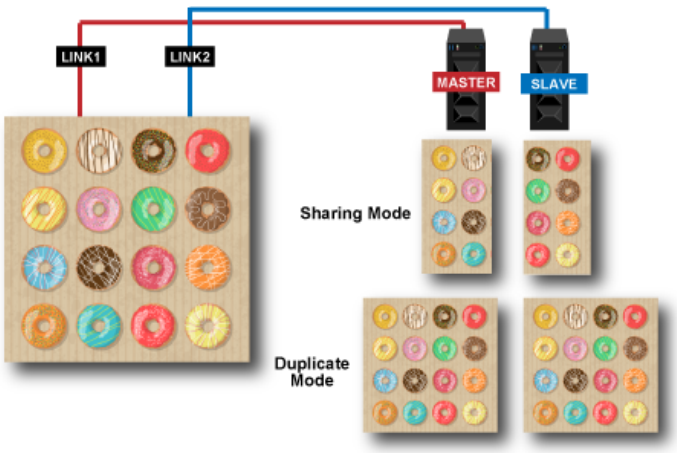
1. Set **LogicBlockSelector** to **LogicBlock0**.
2. Configure LogicBlockInput0. Set **LogicBlockInputSelector** to **0**, and select the Input Souce from **LogicBlockInputSource**. If the input source is inverted, set **LogicBlockInputInverter** to **1 (True)**.
3. Configure LogicBlockInput1. Set **LogicBlockInputSelector** to **1**, and select the Input Source from **LogicBlockInputSource**. If the input source is inverted, set **LogicBlockInputInverter** to **1 (True)**.
4. Finally, configure LogicBlock0 as the output signal.

   On this camera, the Logic Block can be used as the following signal source: TriggerSource [AcquisitionControl], LineSource[DigitalIOControl], PulseGeneratorClearSource[PulseGenerator], LogicBlock[Logic Block Control]

CXP Link Sharing

> **Related Setting Items:** TransportLayerControl

This function allows the camera to be connected to multiple PCs for shared data processing. The camera supports two modes: Sharing Mode, in which acquired images are split and transmitted, and Duplicate Mode, in which the same acquired images are duplicated and transmitted.



> **Notes:**
> - This function (Sharing mode, Duplicate mode) can only be used with **CXP 2.0**. The CoaXPress frame grabber board used must support CXP 2.0 and CXP Link Sharing function.
> - You can check the current CXP version in **CxpVersion Used** [TransportLayerControl]. If CxpVersionUsed is CXP 1.1, you cannot use this function.
> - This function can be used only when **CxpLinkConfigurationPreferred** (TransportLayerControl) is set to **CXP3_X1**, **CXP6=X1**, or **CXP12_X1**. The CXP Link Configuration when CXPLinkSharing is enabled, see "CxpLinkConfiguration".

How to Configure

The following describes how to set up the CXPLinkSharing function.

> **Notes:**
> - In this topic, the link connected to the CXP-1 connector of this camera is referred to as LINK1, and the link connected to the CXP-2 connector is referred to as LINK2.
> - The camera must be controlled via the Master sub-device connection (control via the Slave sub-device connection is not supported).

1. Set **CXPLinkSharingEnable** to **On**, and then restart the camera and the tool. The CXPLinkSharing settings can only be configured after a restart.

   > **Note:** CXPLinkSharing can be configured only when **CXPVersionUsed = CXP2.0** and **CxpLinkConfigurationPreferred = CXP3_X1, CXP6_X1** or **CXP12_X1**.

2. Select **Master sub-Device** from **CxpLinkSharingSubDeviceSelector**. The status (CxpLinkSharingStatus) and the device type (CxpLinkSharingSubDeviceType) of the Master sub-device are displayed.

   Make sure that the PC that is connected to **LINK1** (= CXP-1 connector) is displayed as **Master** in **CxpLinkSharingSubDeviceType** before you start to configure the Sharing Mode or Duplicate Mode settings.

   - Status (CxpLinkSharingStatus)

CxpLinkSharingStatus	Description
NotReady	Not ready for stream output
Ready	Ready for stream output
NotUsed	The selected Sub-Device is not used

   - Sub-Device Type (CxpLinkSharingSubDeviceType)

CxpLinkSharing SubDeviceType	Connected Link	Description
Master (Fixed)	LINK1	The selected sub-device is a master device.
Slave (Fixed)	LINK2	The selected sub-device is a slave device.

3. Check the status and the sub-device type of the slave sub-device (Slave sub-Device #1).

4. To set to **Sharing Mode** (acquired images are splited and transmitted), set each item as follows.

   > **Note:** For details on Sharing Mode setting items, see "Sharing Mode".

Setting Item	Setting Range	Description
CxpLinkSharingVerticalStripeCount	0, 2	Specify the number of vertical splits.
CxpLinkSharingVerticalOverlap	0, 64, 128	Specify the amount of overlap in pixels (option).
CxpLinkSharingDuplicateStripe	0	Setting item for Duplicate Mode. **Caution:** If this item is set to other than 0, CxpLinkSharingVerticalStripeCount is fixed to 0 and Sharing Mode cannot be configured.

5. To set to **Duplicate Mode** (acquired images are duplicated and transmitted), set each item as follows.

> **Note:** For details on Sharing Mode setting items, see "Duplicate Mode".

Setting Item	Setting Range	Description
CxpLinkSharingVerticalStripeCount	0 (Default)	This item is not used in Duplicate Mode.
CxpLinkSharingVerticalOverlap	0 (Default)	This item is not used in Duplicate Mode.
CxpLinkSharingDuplicateStripe	0 ~ 2	Set the number of destinations.

Sharing Mode

This section describes the details of the Sharing Mode setting items.

> **Note:** This camera supports the vertical splitting only.

CxpLinkSharingVerticalStripeCount

Specify the number of vertical splits.

CxpLinkSharingVerticalStripeCount	Connected Link (Fixed)	Description
0, 1	Link1 (see note below)	No splitting (default, No LinkSharing)
2	Link1, Link2	Vertical split in 2

> **Note:** When this item is set to 0 or 1, the image is not split (no LinkSharing).

> **Caution:** When **CxpLinkSharingDuplicateStripe** is set to other than 0, this item is fixed to 0 and Sharing Mode cannot be configured.

CxpLinkSharingVerticalOverlap

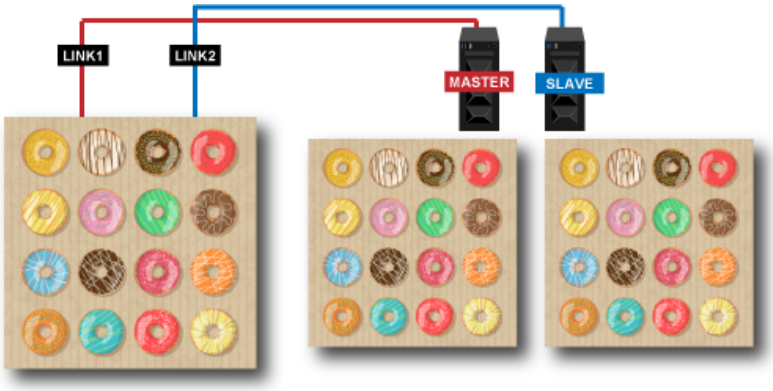
When CxpLinkSharingVerticalStripeCount is set to 2, the split image can be overlapped. The amount of overlap is specified in pixels (0, 64 or 128). When this item is set to 0 (default), there is no overlap.

CxpLinkSharingVerticalStripeCount = 2


> **Note:** The minimum **Width** value [ImageFormatControl] depends on the LinkSharing settings. For example, when CxpLinkSharingVerticalStripeCount is set to 2 and CxpLinkSharingVerticalOverlap is set to 128, the minimum Width value is 384.

Duplicate Mode

This section describes the details of the Duplicate Mode setting items.



CxpLinkSharingDuplicateStripe

Set the number of destinations (0 ~ 2).

CxpLinkSharingDuplicateStripe	Description
0, 1	No Duplicates (No LinkSharing)
2	Duplicate and transmit the same image from LINK1 and LINK2.

> **Note:** If this setting is changed from 0 or 1 to a value of 2, the mode is forcibly switched from Sharing mode to Duplicate mode (CxpLinSharingVerticalStripeCount is forcibly set to 0).

Pulse Generator

Related Setting Items: PulseGenerator

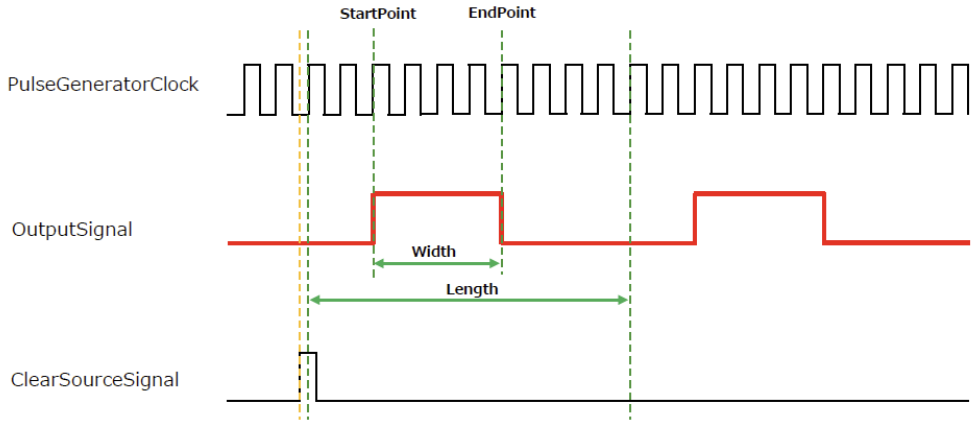
Technical Notes Tips for using the Pulse Generator

By using this function, any signal can be generated inside the camera.

The following is an example of signal generation.

Settings

PulseGeneratorStartPoint = 2
PulseGeneratorEndPoint = 6
PulseGeneratorLength = 10
PulseGeneratorPulseWidth = 4
PulseGeneratorClearSyncMode = AsyncMode



The table below shows the PulseGeneratorClearSource signals that can be set.

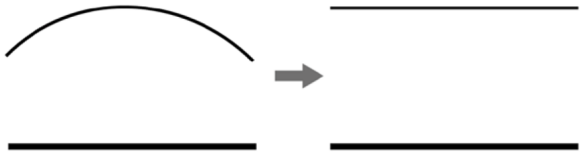
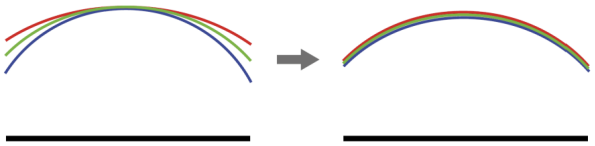
- ExposureActive, LVAL, PulseGenerator0-3*, UserOutput0-3, Line4 TTL In1, Line5 Opt In1, Line10 TTL In2, Line13 TTL In3, Logic Block0-2, EncoderTrigger

> **Note:** *PulseGenerator0-3: You cannot select the same Pulse Generator that is currently selected. For example, if Pulse Generator 0 is selected, you cannot select Pulse Generator 0 as the Clear source.

Shading Correction

Related Setting Items: Shading

The Shading Correction function corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment. This camera supports the following shading correction modes.

FlatShading	ColorShading
	
The highest brightness level is used as a reference, and other areas are corrected to match that brightness level.	R-, B,- and NIR-channel properties are adjusted by using the G-channel shading properties as a reference.

Shading Correction Blocks

The camera makes adjustments in blocks (4 pixels/block for the 4000Q models; 8 pixels/block for the 8000Q models). The block Index number (ShadingDataIndex) can be used to view and change the settings per block (ShadingData). For more information, see "How to Configure the Shading Correction Function".

How to Configure the Shading Correction Function

This section explains how to configure the Shading Correction function.

1. Select the Shading Correction Mode from **ShadingCorrectionMode**. (Flat Shading (Default) or Color Shading)
2. Select the user area (User1 ~ 3) where you save the shading correction data from **ShadingMode**.
3. Display a white chart under a uniform light and execute **CalibrateShadingCorrection**.
4. Once the shading correction is successfully completed, the shading correction values are automatically saved to the area specified in ShadingMode. Also, the calibration result "**Succeeded**" is displayed in **ShadingDetectResult**.
5. Optionally, you can view or change the setting of each correction block.
    1. Select a color channel (Red, Green, Blue or NIR) from **ShadingDataSelector** and an Index number (block number) from **ShadingDataIndex**.
    2. The setting selected by ShadingDataSelector and ShadingDataIndex is displayed in **ShadingData**. To change the setting, overwrite the value (0x4000 = 1x).

3. Execute **ShadingDataSave**. The currently set ShadingData will be overwritten and save to the area specified in **ShadingMode**.

> **Note:** The setting is immediately reflected in the image, but is not saved until **ShadingDataSave** is executed. If **ShadingMode** is changed without executing **ShadingDataSave**, the setting will be discarded.

Cautions:

- The maximum amount of corrected gain is limited to 8 times the amount of gain before correction for all pixels. (The amount of gain will not be increased beyond 8 times the amount of gain before correction.)
- If the highest brightness level in the image is less than 175 LSB (at 10-bit video output), it cannot be corrected correctly.

ShadingDetectResult

A list of correction results is shown below.

Result	Description
Idle	Correction is not being performed.
Succeeded	Correction was completed successfully. The correction data was applied to the image area and saved in the user area specified by **ShadingMode**.
Error1 - Image was too bright	Correction failed. The image was too bright.
Error2 - Image was too dark	Correction failed. The image was too dark.
Error3 - Could not calibrated	Could not perform the adjustment due to one of the following reasons: • The image is not being output. • **TestPattern**[ImageFormatControl] is set to anything other than Off. • **ShadingMode** is set to **Off**.

Pixel Sensitivity Correction

> **Related Topic:** Correction

Correct variations between the sensor's pixels.

Calibration must be performed within the camera and correction data must be created beforehand. DSNU (PixelBlackCorrect) / PRNU (PixelGainCorrect) can be reduced using that correction data.

We recommend performing calibration and creating correction data whenever the line rate setting or Analog base gain setting or vertical binning setting are changed significantly.

Refer to the following topics on how to perform the calibration.

- DSNU Correction (Pixel Black Correct)
- PRNU Correction (Pixel Gain Correct)

> **Notes:**
> - Correction data is saved for DSNU (PixelBlackCorrect) / PRNU (PixelGainCorrect) according to the conditions adjusted at the factory.
> - We recommend performing DSNU and PRNU calibration again whenever the ExposureTime setting and Analog Gain setting (4000Q only) are changed significantly.
> - A single correction data entry can be saved on the camera for each user. When calibration is performed, the correction data is saved to the non-volatile ROM at the same time.

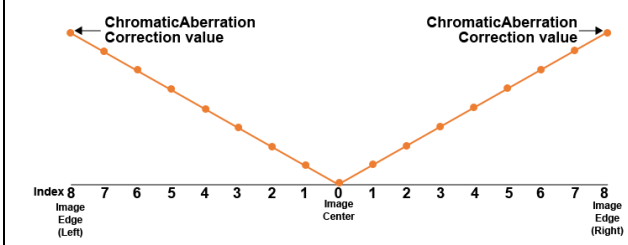
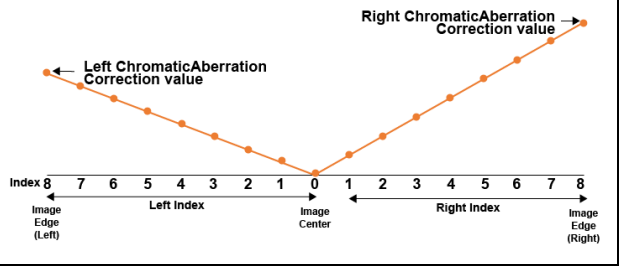
Chromatic Aberration Correction

> **Related Setting Items:** Correction

This function corrects the magnification differences between the color channels which is caused by the chromatic aberration of the lens. In simpler terms when the object appears with a slightly different width on the blue, green, red and NIR channels. You can save correction data for three types of lenses. Specify the number of pixels to delay or advance the R, B and NIR channeles using the G channel as a reference. With this camera, correction can be applied either symmetrically to the left and right sides or independently (asymmetrically) to each side. In addition, the correction method can be selected from three available options.

How to Configure

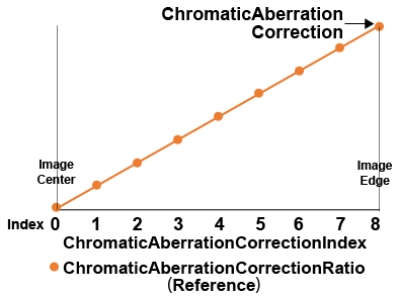
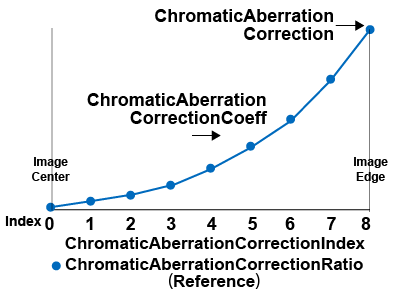
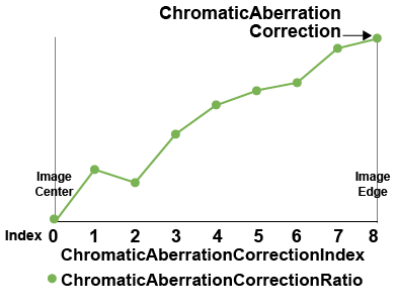
1. In **ChromaticAberrationCorrectionMode**, select **Lens1**, **Lens2**, or **Lens3**.
2. In **ChromaticAberrationCorrectionSymmetricMode**, select whether chromatic aberration correction is applied symmetrically to the left and right sides or independently to each side. Select **Symmetric** to apply symmetric correction, or **Asymmetric** to apply independent correction for the left and right sides.

Symmetric (Simple Interpolation)	Asymmetric (Simple Interpolation)
	

3. When **ChromaticAberrationCorrectionSymmetricMode** is set to **Asymmetric**, select the side for which the correction values are configured (**Left** or **Right**) in **ChromaticAberrationCorrectionSideSelector**.

> **Note:** When **Symmetric** is selected, this setting is fixed to **Both**.

4. Select how the correction is performed in **ChromaticAberrationCorrectionMethod**. Whichever option is selected, the correction is performed with the image center as the origin and the ChromaticAberrationCorrection value at both ends of the image.

Simple Interpolation	Linear Spline Interpolation	Custom (Example)
		
Perform a two-point linear interpolation.	Perform piecewise linear interpolation using a quadratic curve formula.	Modify each correction point (= Index) as desired.

> **Note:** When **Asymmetric** is selected, different correction methods cannot be applied to the left and right sides. The same correction method is used for both sides.

5. In **ChromaticAberrationCorrectionSelecter**, select **R Channel** to first configure the correction for the Red channel. The parameters that must be set depend on the selected correction method.

   - **ChromaticAberrationCorrection (Simple Interpolation, Linear Spline Interpolation, Custom)**: Set the correction amount at the image edges. The setting range is −8.0 to +8.0 for SW-4000Q, and −16.0 to +16.0 for SW-8000Q.
   - **ChromaticAberrationCorrectionCoeff (Linear Spline Interpolation only)**: Set the correction coefficient. Setting range: 1.0 ~ 10.0, step 0.1
   - **ChromaticAberrationCorrectionRatio (Simple Interpolation, Linear Spline Interpolation)**: Refer to the correction ratio for each point (Chromatic Aberration Correction Index). Setting range: -1.000 ~ + 1.000; step 0.001
   - **ChromaticAberrationCorrectionRatio (Custom)**: Configure the correction ratio for each point (Chromatic Aberration Correction Index). Setting range: -1.000 ~ + 1.000; step 0.001. Configure the ChromaticAberrationCorrection setting first, and then configure this setting item.

   Notes:
   - When **Symmetric** is selected, **ChromaticAberrationCorrectionIndex** is defined such that the image center corresponds to 0, and both image edges correspond to 8. When **Asymmetric** is selected, the **ChromaticAberrationCorrectionIndex** range is 0 to 8 for the left side and 1 to 8 for the right side (see the images in Step 2).
   - If **ChromaticAberrationCorrectionMethod** is set to any option other than **Custom** and the **ChromaticAberrationCorrectionRatio** value is changed manually, the correction method is forcibly switched to **Custom**.
   - When the selected correction method is **Linear Spline Interpolation** or **Custom**, the correction value of each index will be calculated using the following formula.
     - **[Linear Spline Interpolation]**: Correction value [ChromaticAberrationCorrectionIndex] = pow (ChromaticAberrationCorrectionIndex/10, ChromaticAberrationCorrectionCoeff) x ChromaticAberrationCorrection
     - **[Custom]:** Correction value[ChromaticAberrationCorrectionIndex] = ChromaticAberrationCorrection x ChromaticAberrationCorrectionRatio [ChromaticAberrationCorrectionIndex]

6. Select **B Channel** from **ChromaticAberrationCorrectionSelecter**, and configure the correction settings as R Channel.

   When **ChromaticAberrationCorrectionSymmetricMode** is set to **Asymmetric**, select the other side (**Left** or **Right**) for which the correction values are to be configured, and repeat Steps 5 through 6 to set the correction values.

7. Select **NIR Channel** from **ChromaticAberrationCorrectionSelecter**, and configure the correction settings as R Channel.

   When **ChromaticAberrationCorrectionSymmetricMode** is set to **Asymmetric**, select the other side (**Left** or **Right**) for which the correction values are to be configured, and repeat Steps 5 through 6 to set the correction values.

8. Execute **ChromaticAberrationCorrectionSave** to save the settings. The saved settings are for the area (Lens1 ~ 3) selected in **ChromaticAberrationCorrectionMode**.

9. Optionally, adjust the red/blue pixel position using **SubPixelImageShiftR** / **SubPixelImageShiftB**. The setting range is -1.0 ~ +1.0 pixel (0.01pixel/step).

   - A positive value shifts the pixel to the right of the scan direction. A negative value shifts the pixel to the left of the scan direction.
   - An error will occur if a value greater than +1.0 is set.
   - The set value may not be displayed correctly in 0.01 pixel units on the host side.

Noise Reduction Filter Functions

> **Related Setting Items:** Correction

The camera has noise reduction functions. The noise reduction methods vary depending on the channel.

Three filters are available:

- **MEDIAN Filter**: Apply 1x3 MEDIAN filter

  Select the target to apply the filter from Red, Green, Blue, and Green, and set the **Median Filter Mode**. When set to **On**, this function is enabled. (Default = Off)

- **FIR Filter**: Apply the FIR (Finite Impulse Response) filter

  Select the target to apply the filter from Red, Green, Blue, and set the **FIR Filter Mode**. When set to **On**, this function is enabled (Default = Off). In FIR Filter, the coefficients of the three signals (left, center, right) can be set in the range of -2 to 2. The correction value through the FIR Filter is:

  - Left pixel read value x Left pixel coefficient +
  - Center pixel read value x Center pixel coefficient +
  - Right pixel read value x Right pixel coefficient.

- **Noise Reduction**: Apply the noise filter using JAI's own algorithm.

  Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong.

Any of the above filters can improve SNR, but it affects the sense of resolution and sensitivity. An imaging test should be performed before deciding to use this feature.

Setting List (Feature Properties)

This camera complies with GenICam. Each setting item name conforms to GenICam SFNC (Standard Features Naming Convention). (There are some JAI-specific setting items).

Each setting item is an integer type (IInteger), a real type (IFloat), an element enumeration type (IEnumeration), a character string (IString), a logical type (IBoolean), and a category type (ICategory) or a command type (ICommand) for executing the function.

Beginner: For beginner users.

Expert: For users with deep knowledge of camera functions.

Guru: For advanced users who make settings, including advanced features that can cause the camera to malfunction if not set correctly.

> **Note:** Depending on the setting item, you may need to change visibility. Please switch visibility (Beginner / Expert / Guru) as necessary.

Selector

A Selector is used to index which instance of the feature is accessed in situations where multiple instances of a feature exist.

Instance Example:

Each Line-related item (LineSource, LineInverter, etc.) has LineSelector-LineX instances, which can be set or referenced as an index.

Selectors are a feature of element enumeration type (IEnumeration) or an integer type (IInteger). However, unlike normal configuration items, it is only used to select the instance in the following configuration item.

It does not change the behavior of the camera by changing the value of the selector. Also, the selector may have only one selectable value. In this case, use the selector function only for information purposes. In this document, it is described as SelectedFeature[Selector] according to the description method of GenICam.

In the case of Line Selector with a specific I/O line selected, the description could be as follows.

LineSource[LineSelector-LineX] = High

LineInverter[LineSelector-LineX] = False

LineMode[LineSelector-LineX] = Input

LineFormat[LineSelector-LineX] = TTL

Generally, selectors only apply to a single category of features. (Example: TriggerSelector only applies to trigger related functions.)

DeviceControl

Display/configure information related to the device.

Device Control Item	Setting Range	Default	Description
DeviceVendorName (IString)	"JAI Corporation"		Display the manufacturer name.
DeviceModelName (IString)	"SW-4000Q-CXP2A" "SW-8000Q-CXP2A"		Display the model name.
DeviceManufacturerInfo (IString)	"See the possibilities"		Display the manufacturer information.
DeviceVersion (IString)	-	-	Display the hardware version.
DeviceFirmwareVersion (IString)	-	-	Display the firmware version.
DeviceFpgaVersion (IString)			Display the FPGA version.
DeviceSerialNumber (IString)	-	-	Display the device ID.
DeviceUserID (IString)	Any	-	Set the user ID (16bytes) for the camera.
DeviceSFNCVersionMajor (IInteger)	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor (IInteger)	-	3	Display the SFNC Minor version.
DeviceSFNCVersion SubMinor (IInteger)	-	0	Display the SFNC Sub Minor version
DeviceManifestEntry Selector (IInteger)	-	1	Display information on valid XML file.
DeviceManifestXML MajorVersion (IInteger)	0 ~ 32bit max	0	Indicates the major version number of the XML file of the selected manifest entry.
DeviceManifestXML MinorVersion (IInteger)	0 ~ 32bit max	2	Indicates the minor version number of the XML file of the selected manifest entry.
DeviceManifestXML SubMinorVersion (IInteger)	0 ~ 32bit max	1	Indicates the subminor version number of the XML file of the selected manifest entry.
DeviceManifestSchema MajorVersion (IInteger)	0 ~ 32bit max	1	Indicates the major version number of the schema file of the selected manifest entry.
DeviceManifestSchema MinorVersion (IInteger)	0 ~ 32bit max	1	Indicates the minor version number of the schema file of the selected manifest entry.
DeviceManifest PrimaryURL (IString)			Display the Primary URL.

<table>
<tr><th>Device Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>DeviceTLType (IEnum)</td><td>-</td><td>3: CoaXPress (Fixed)</td><td>Display type of transport layer.</td></tr>
<tr><td>DeviceTLVersionMajor (IInteger)</td><td>-</td><td>2</td><td>Display the Major version of transport layer.</td></tr>
<tr><td>DeviceTLVersionMinor (IInteger)</td><td>-</td><td>0</td><td>Display the Minor version of transport layer.</td></tr>
<tr><td>DeviceTLVersion SubMinor (IInteger)</td><td>-</td><td>1</td><td>Display the Sub Minor version of transport layer.</td></tr>
<tr><td>DeviceMaxThroughput (bps) (IInteger)</td><td>390625000 ~ 1562500000</td><td>390625000</td><td>Maximum bandwidth of the data that can be streamed out of the device. The maximum value depends on the CxpLinkConfiguration setting.<table><tr><td>CXP12-2</td><td>3125000000</td></tr><tr><td>CXP6-2</td><td>1562500000</td></tr><tr><td>CXP3-2</td><td>781250000</td></tr><tr><td>CXP12-1</td><td>1562500000</td></tr><tr><td>CXP6-1</td><td>781250000</td></tr><tr><td>CXP3-1</td><td>390625000</td></tr></table></td></tr>
<tr><td>DeviceLinkThroughput LimitMode (IEnum)</td><td>0: Off
1: On</td><td>0: Off</td><td>Off: No CXP bandwidth limit; Device Link Throughput Limit is disabled.
On: CXP bandwidth is limited; LineRate cannot exceed the Device Link Throughput Limit value.</td></tr>
<tr><td>DeviceLinkThroughput Limit (IInteger)</td><td>DeviceMaxThrougout/2 ~ DeviceMaxThrougout</td><td>DeviceMaxThrougout</td><td>Enabled when DeviceLinkThroughputLimitMode = On. Limits the maximum bandwidth of the data that will be streamed out by the device.</td></tr>
<tr><td>DeviceStreamChannelCount (IInteger)</td><td></td><td>1</td><td>Display the number of supported stream channels.</td></tr>
<tr><td>DeviceReset (ICommand)</td><td>-</td><td>-</td><td>Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)</td></tr>
<tr><td>DeviceTempeatureSelector (IEnum)</td><td>-</td><td>0: Mainboard</td><td>Select the area of the camera's interior for which to display the temperature sensor's reading. (fixed Mainboard)</td></tr>
<tr><td>DeviceTemperature (IFloat)</td><td>-55 ~ 125</td><td>-</td><td>Display the internal temperature (°C) of the camera.</td></tr>
<tr><td>Timestamp (ns) (IInteger)</td><td>0~ 9223372036854775807 (maximum value of unsigned 64-bit)</td><td>0</td><td>Display the timestamp value. Resets to 0 when the signed maximum 64-bit value is exceeded.</td></tr>
</table>

Device Control Item	Setting Range	Default	Description
TimestampReset (ICommand)	-	-	Forcibly sets the timestamp's count value to 0.
TimestampLatch (ICommand)	-	-	Sets the timestamp's count value to TimestampLatchValue.
TimestampLatchValue (ns) (IInteger)	0 ~ 9223372036854775807	-	Max: unsigned 64-bit
UserDefinedValueSelector (IEnum)	0: Value1 (Default) 1: Value2 2: Value3 3: Value4 4: Value5		32bit data x 5 can be set and saved.
UserDefinedValue (IInteger)	-2147483648 to +2147483648	0	Read and set the value for the 32-bit data (Value 1 to Value5) selected in UserDefinedValueSelector.
PowerSourceStatus (IEnum) **Related Topic:** PowerSourceStatus Function **Note:** 4000Q Only	0: DC (Default) 1: PoCXPx1 2: PoCXPx2		Display the power source currently used. **Caution:** When **PoCXPx1** is displayed, the line rate will be limited. For more information, see "PowerSourceStatus Function".

ImageFormatControl

Configure image format settings.

Image Format Control Item	Setting Range	Default	Description
WidthMax (IInteger)	4000Q: 4096 (2048) 8000Q: 8192 (4096) ( ): BinningHorizontal = 2		Display the maximum image width.
Width (IInteger) **Related Topic:** ROI (Regional Scanning Function)	128 (64) ~ (WidthMax - OffsetX) Step: 16 (8) Default: WidthMax ( ): BinningHorizontal = 2		Set the image width.
Height (IInteger)	-	1 (Fixed)	Display the image height.
OffsetX (IInteger)	0 (Default) ~ (WidthMax - OffsetX) Step: 16 (8) ( ): BinningHorizontal = 2		Set the horizontal offset.
BinningHorizontalMode (IEnum)	0: Sum (Default) 1: Average		Set the processing method for horizontal binning.
BinningHorizontal (IInteger) **Related Topic:** Binning Function	1: Binning Off (Default) 2: Binning On		Set the number of pixels in the horizontal direction for which to perform binning.
SensorBinningVertical (IInteger) **Note:** SW-4000Q Only	1: Binning Off (Default) 2: Binning On		Set the number of pixels in the vertical direction for which to perform binning. BinningMode is fixed to Sum.
PixelFormat (IEnum) **Related Topic:** Pixel Format	0x02180014: RGB8 (Visible) 0x02300018: RGB10 (Visible) 0x01080001: Mono8 (NIR) 0x01100003: Mono10 (NIR) 0x02200016: RGBA8 (Visible + NIR) 0x0240005F: RGBA10 (Visible + NIR)		Set the pixel format.

Image Format Control Item	Setting Range	Default	Description
TestPattern (IEnum) **Related Topic:** Test Pattern Function	0: Off (Default) 1: White 2: GreyPattern1 (Ramp) 3: GreyPattern2 (Stripe) 4: ColorBar		Select the test image.
Horizontal Image Mirroring (IEnum) **Related Topic:** Horizontal Image Mirroring	0: Off 1: On	Off	Invert the image left and right.
OutputLineSelector **Related Topic:** Pixel Format	0: Rch (Default) 1: Gch 2: Bch 3: NIRch		Assigns a color channel to the selected output line independently of the PixelFormat definition. This feature is intended for applications that do not display NIR data.
OutputLine	0: Red (Line0 Default) 1: Green (Line1 Default) 2: Blue (Line2 Default) 3: NIR (Line3 Default)		Selects the color channel to output on the selected output line. For example, if Rch = NIR, Gch = Green, Bch = Blue, and Nch = Red, the NIR data is output in the conventional Red channel position.

AcquisitionControl

Configure image capture settings.

Acquisition Control Item	Setting Range	Default	Description
AcquisitionMode (IEnum)	2: Continuous		Display the image capture mode.
AcquisitionStart (ICommand)	-	-	Start image capture.
AcquisitionStop (ICommand)	-	-	Stop image capture.
AcquisitionLineRate (Hz) (IFloat) **Related Topic:** Change the Line Rate	66 ~	66	Set the AcquisitionLineRate in Hz (step: 0.1). The maximum value varies depending on the PixelFormat and ROI settings.
Trigger Selector (IEnum) **Related Topic:** Trigger Control	0: Acquisition Start (Default) 1: Acquisition End 2: Line Start		Select the trigger operation.
TriggerMode (IEnum)	0: Off 1: On	Off	Select the trigger mode
TriggerSource (IEnum)	7 ~ 10: PulseGenerator0 ~ 3 11 ~ 14: UserOutput0 ~ 3 23: Line4 TTL In 1 (Default) 24: Line5 Opt In1 26: Line7 CXP In 29: Line10 TTL In2 32: Line13 TTL In3 33: Line14 TTL In4 36 ~ 37: Logical Block0 ~ 1 38: EncoderTrigger 39 ~ 40: Logical Block2 ~ 3		Select the trigger signal source.
TriggerActivation (IEnum)	1: Rising Edge (Default) 2: Falling Edge 3: Level High 4: Level Low		Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied). When TriggerSelector = LineStart, • ExposureMode = Off or Timed: RisingEdge, FallingEdge • ExposureMode = TriggerWidth: LevelHigh, LevelLow

Acquisition Control Item	Setting Range	Default	Description
ExposureMode (IEnum) **Related Topic:** Exposure Mode	0: Off 1: Timed (Default) 2: TriggerWidth		Select the exposure mode.
ExposureTimeMode (IEnum)	0: Common (Default) 1: Individual		Select the exposure time mode. Select "Common" to set the common value for all three sensors, and "Individual" to set the individual value for each channel. **Note:** This setting is available only when **ExposureMode** is set to **Timed**.
ExposureTimeSelector (IEnum)	0: Common (Default) 1: Red 2: Green 3: Blue 4: NIR		Select the sensor to set ExposureTime. To set the common setting values for all four sensors, select Common. **Note:** This setting is available only when **ExposureMode** is set to **Timed**.
ExposureTime (μs) (IFloat) **Related Topic:** Actual Exposure Time	4000Q: 3 ~ 15149 8000Q: 3 ~ 15148.8 (step: 0.01)		Set the exposure time (in μs) for the setting selected from ExposureTimeSelector . **Note:** Exposure Offset Time: -0.85μs
ExposureModeOption (IEnum) **Related Topic:** ExposureModeOption	0: PrioritizeExposureTime 1: PrioritizeLineRate		Specifies whether to prioritize exposure time (PrioritizeExposureTime) or line rate (PrioritizeLineRate) when controlling line rate and exposure.
RBExposureInterlocked (IEnum)	0: Off 1: On	Off	When set to On, changes the exposure time while maintaining the Red / Blue exposure time ratio (G:R and G:B ratio before the change) with respect to Green.

AnalogControl

Configure analog control settings.

Analog Control Item	Setting Range	Default	Description
IndividualGainMode (IEnum) **Related Topic:** Gain Control	0: Off 1: Mode1 2: Mode2	0: Off	Select how to configure DigitalGain. When **Off** (=Master Mode), the overall gain is set by DigitalAll (master gain), and then the gain is fine-tuned by changing the DigitalRed, DigitalBlue, and DigitalNIR settings. When Mode 1/ Mode 2,(= Individual Gain Mode), DigitalR/G/B/NIR can be configured individually for the entire gain adjustment range of the sensor.
GainSelector (IEnum)	0: DigitalAll* 1: DigitalRed 2: DigitalGreen** 3: Digital Blue 4: Digital NIR *IndividualGainMode=OFF Only **IndividualGainMode=ON Only		Select the gain to configure.
Gain (IFloat)	**Individual Gain Mode = Off** • DigitalAll: x1.0 ~ x32.0 • DigitalRed/Blue/NIR: x0.63 ~ x4.0 **Individual Gain Mode = Mode1** • DigitalRed/Green/Blue/NIR: x1.0 ~ x64.0 **Individual Gain Mode = Mode2** • DigitalRed/Green/Blue/NIR: x0.63 ~ x4.0		Set the gain value for the gain setting selected in GainSelector.
AnalogGainSelector (IEnum) **Note:** 4000Q model Only	1: Analog Red (Default) 2: Analog Green 3: Analog Blue 4: Analog NIR		Select the analog gain to configure.
AnalogGain (IEnum) **Note:** 4000Q model Only	0: 0dB (Default) 1: 6dB 2: 12dB		Set the gain value for the analog gain setting selected in **Analog Gain Selector**.

Analog Control Item	Setting Range	Default	Description
BlackLevelSelector (IEnum) **Related Topic:** Adjust the Black Level	1: Red 2: Green 3: Blue 4: NIR		Select the black level to configure.
BlackLevel (IFloat)	-133 to +255		Set the black level value.
BalanceWhiteAuto (IEnum) **Related Topic:** Step 5: Adjust the Image Quality	0: Off (Default) 1: Once 2: ExposureOnce 3: Preset 5000K 4: Preset 6500K 5: Preset 7500K		Enable/disable auto white balance. **Once** automatically changes to **Off** when the signal level converges once.
Balance White Auto Width (IInteger)	128 (64) ~ (WidthMax - OffsetX), Step: 16 (8) Default: WidthMax ( ): BinningHorizontal = 2		Set the area for adjusting white balance.
BalanceWhiteAutoOffsetX (IInteger)	0 (Default) ~ (WidthMax - OffsetX), Step: 16 (8) ( ): BinningHorizontal = 2		Set the area for adjusting white balance.
BalanceWhiteAutoResult (IEnum)	0: Idle 1: Succeeded 2: Error1- G image was too bright 3: Error2 - G image was too dark 4: Error3 - Timeout error occurred		Display the result for adjusting white balance.
Gamma (IFloat) **Related Topic:** Gamma Function	**4000Q**: 0.45 (Default), 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00 **8000Q**: 0.45 (Default), 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00, 1.1, 1.2, 1.4, 1.6, 1.8, 2.1, 2.4, 2.7, 3.1, 3.5, 4.0		Set the gamma value.
LUTMode (IEnum)	0: Off (Default) 1: Gamma 2: LUT		Select the LUT mode.
SensorType (IEnum) **Note:** 4000Q Only	0: Type A (Default) 1: Type B		Select the size of pixel. TypeA : 7.5um x 7.5um TypeB : 7.5um x 10.5um

LUTControl

Configure LUT settings.

> **Related Topic:** LUT (Lookup Table)

Image Format Control Item	Setting Range	Default	Description
LUTSelector (IEnum)	0: Red (Default) 1: Green 2: Blue 3: NIR		Select the LUT channel to control.
LUTIndex (IInteger)	0 ~ 256	0	Set the LUT index table number.
LUTValue (IInteger)	0 ~ 4095	Gamma≒ 1.0	Set the LUT value.

ColorTransformationControl

Configure color transformation settings.

> **Related Topic:** Color Space Conversion (Color Transformation Control)

Color Transformation Control Item	Setting Range	Default	Description
ColorTransformationMode (IEnum)	0: RGB (Default) 1: HSI 2: XYZ		Set the output image format.
ColorTransformationRGBMode (IEnum)	0: OFF (Default) 1: sRGB 2: AdobeRGB 3: UserCustom		Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector (IEnum)	0: R-R (Default) 1: R-G 2: R-B 3: G-R 4: G-G 5: G-B 6: B-R 7: B-G 8: B-B		Select the ColorMatrix setting component.
ColorMatrixValue (IFloat)	-2.0 to +2.0	-	Set the Color Matrix value. (step = 0.1) **Default**: R-R, G-G, B-B: 1.0 Other than above: 0.0

DigitalIOControl

Configure settings for digital input/output.

> **Related Topic:** GPIO (Digital Input/Output Settings)

<table>
<tr><th>Digital IO Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>LineSelector (IEnum)</td><td colspan="3">Select the input/output to configure.
<table>
<tr><th>Line Selector</th><th>LineMode</th><th>LineInverter</th><th>LineFormat</th></tr>
<tr><td>20: Line1: TTL Out1 (Default)</td><td>Output</td><td>True</td><td>TTL</td></tr>
<tr><td>23: Line4: TTL In1</td><td>Input</td><td>False</td><td>TTL</td></tr>
<tr><td>24: Line5: Opt In1</td><td>Input</td><td>False</td><td>OptoCoupled</td></tr>
<tr><td>26: Line7: CXP In</td><td>Input</td><td>False</td><td>CXP Packet</td></tr>
<tr><td>27: Line8: TTL Out2</td><td>Output</td><td>True</td><td>TTL</td></tr>
<tr><td>28: Line9: TTL Out3</td><td>Output</td><td>True</td><td>TTL</td></tr>
<tr><td>29: Line10: TTL In2</td><td>Input</td><td>False</td><td>TTL</td></tr>
<tr><td>31: Line12: TTL Out4</td><td>Output</td><td>True</td><td>TTL</td></tr>
<tr><td>32: Line13: TTL In3</td><td>Input</td><td>False</td><td>TTL</td></tr>
<tr><td>33: Line14: TTL In4</td><td>Input</td><td>False</td><td>TTL</td></tr>
</table></td></tr>
<tr><td>LineMode (IEnum)</td><td>0: Input
1: Output</td><td>-</td><td>Display the input/output status (whether it is input or output). Please see the LineSelector's descriptions for the values displayed on this item.</td></tr>
<tr><td>LineInverter (IBoolean)</td><td colspan="2">False (Default)
True</td><td>Enable/disable polarity inversion for the selected input signal or output signal.</td></tr>
<tr><td>LineStatus (IBoolean)</td><td colspan="2">False (Low) (Default)
True (High)</td><td>Display the status of the input signal or output signal (True: High, False: Low).</td></tr>
<tr><td>LineStatusAll (IInteger)</td><td colspan="2">bit0: Line1
bit1 ~ 2: Unused
bit3: Line4
bit4: Line5
bit5: Unused
bit6: Line7
bit7: Line8
bit8: Line9
bit9: Line10
bit10: Unused
bit11: Line12
bit12: Line13
bit13: Line14
bit14 ~ 15: Unused</td><td>Display the input/output signal status. The state is shown with 16 bits.
Note: Unused is fixed to 0.</td></tr>
</table>

Digital IO Control Item	Setting Range	Default	Description
LineSource (IEnum) **Related Topic:** LineSource Items	1: Acquisition Active 4: ExposureActive 6: LVAL 7 ~ 10: PulseGenerator0 ~ 3 11 ~ 14: UserOutput0 ~ 3 23: Line4: TTL In1 (Default) 24: Line5: Opt In1 26: Line7 CXP In 29: Line10: TTL In2 32: Line13: TTL In3 33: Line14: TTL In4 36 ~ 37: LogicBlock0 ~ 1 38: EncoderTriger 39: EncoderDirection 41 ~ 42: Logic Block2 ~ 3		Select the line source signal for the item selected in **Line Selector**.
LineFormat (IEnum)	2: TTL 5: Opto Coupled 8: CXP Packet		Display the signal format.
OptInFilterSelector (ns) (IInteger)	0 ~ 1000000, step 100	0	Remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector (IEnum)	0: User Output 0 (Default) 1: User Output 1 2: User Output 2 3: User Output 3		Set the UserOutput signal.
UserOutputValue (IBoolean)	False (Default) True		Set the value for the UserOutput selected in **UserOutputSelector**.
ExposureActiveSource (IEnum) **Related Topic:** ExposureActive Signal	0: Common (Default) 1: Red 2: Green 3: Blue 4: NIR		Select the channel for the ExposureActive signal when LineSource is set to ExposureActive. When set to Common, the channel with the longest exposure time is output as the ExposureActive signal.

CounterAndTimerControl

Configure counter settings.

> **Note:** This camera only supports counter functions

> **Related Topic:** Counter and Timer Control

Counter and Timer Control Item	Setting Range	Default	Description
CounterSelector (IEnum)	0 ~ 3: Counter0 (Default) ~ 3		Select the counter.
CounterEventSource (IEnum)	0: Off (Default) 1: LineTrigger (Counter0) 2: Line Start (Counter1) 3: Exposure Start (Counter2)		Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value
CounterEventActivation (IEnum)	1: Rising Edge		Display the count timing. This camera shows RisingEdge only.
CounterResetSource (IEnum)	0: Software (Default) 23: Line4 TTL In1 24: Line5 Opt In1 26: Line7 CXP In 29: Line10 TTL In2 32: Line13 TTL In3 33 Line14 TTL In4		Specifies the source that resets the counter. This source triggers and resets the counter. When set to **Software**, the counter value is reset by the **CounterReset** command. Otherwise, the counter value is reset by the Line input of the GPIO.
CounterResetActivation (IEnum)	1: Rising Edge (Default) 2: Falling Edge 3: Level High 4: Level Low		Selects the timing of the counter reset when CounterResetSource is set to other than Software.
CounterReset (ICommand)	-	-	Reset the counter.
CounterValue (IInteger)	0 ~ 32bit max	0	Display the count value.
CounterStatus (IEnum)	0: CounterIdle (Default) 1: CounterTriggerWait 2: CounterActive 3: CounterCompleted 4: CounterOvewflow		Display the counter status.

EncoderControl

> **Related Topic:** Connecting Rotary Encoders

Configure settings for encoder control.

Encoder Control Item	Setting Range	Default	Description
EncoderSourceA EncoderSourceB (IEnum)	0: Off (Default) 23: Line4 TTL In1 24: Line5 Opt In1 29: Line10 TTL In2 32: Line13 TTL In3 33: Line14 TTL In4		Select where to input the signal from the rotary encoder.
EncoderTriggerOption (IEnum)	0: EncoderDivider (Default) 1: EdgeDetection		Select the encoder triggering method. **EncoderDivider** specifies the number of triggers to generate as a ratio (65536 / EncoderDivider value). **EncoderDetection** specifies the number of edges to pass between encoder trigger signals.
EncoderDivider (IInteger) **Related Topic:** EncoderDivider Trigger Option	1~ 32bit max	65536	When **EncodeDivider** is selected for **EncoderTriggerOption**, set the number of triggers to be generatedas a ratio 65536 / (set value).
EncoderEdgeDectionPassCount (IInteger) **Related Topic:** EdgeDetection Trigger Option	0 ~ 65535	0	When **EdgeDetection** is selected for **EncoderTriggerOption**, set how many edges to pass between encoder trigger signals.

Encoder Control Item	Setting Range	Default	Description
EncoderOutputMode (IEnum) **Related Topic:** Resume Scanning (Backward Counter)	1: PositionUp 2: PositionDown 5: Motion (Default)		Specify the condition under which a valid encoder output signal is generated. **PositionUp**: Outputs images at all new positions in the positive direction (when ObjectDirection] is set to Forward Direction). When the direction of encoder rotation is reversed, the camera stops outputting images until **EncoderOutputMaskedCount** returns 0, while output pulses continue to be generated. **PositionDown**: Outputs images at all new positions in the negative direction (when ObjectDirection] is set to Forward Direction). When the direction of encoder rotation is reversed, the camera stops outputting images until **EncoderOutputMaskedCount** returns 0, while output pulses continue to be generated. **Motion**: Outputs images at all motion increments in both directions.
EncoderOutputMaskedCount (IInteger)	0 ~ 32bit max	0	Display the number of pulses during the reverse rotation after the AcquisitionStart command when **EncoderOutputMode** is set to **PositionUp** or **PositionDown**. The counter counts up during the reverse rotation. The counter counts down when rotation returns to the direction set by **EncodeOutputMode**.
EncoderFilter (ns) (IInteger)	0 ~ 150, step: 10	0	Apply a low-pass filter to prevent noise on the signal from the rotary encoder and stabilize the signal for the specified number of cycles.
EncoderStrobe (ns) (IInteger)	10 ~ 2550, step: 10	10	Set the strobe length of the Trigger signal generated from the rotary encoder by the number of cycles.
EncoderAveraging Interval (IEnum)	0: none (Default) 1: 2 pulses 2: 4 pulses 3: 8 pulses 4: 16 pulses 5: 32 pulses		When **EncoderOutputMode** is set to **EncoderDivider** and EncoderDivider is not set to an integer multiple of 65536, use this setting if the reliability of the interval of the signal output from the rotary encoder is low (some signal interval is extremely long or short; the encoder's jitter is large). When this function is enabled, internal processing is performed by averaging the interval of several previous signals.

Encoder Control Item	Setting Range	Default	Description
EncoderMaxIntervalFor NonDecimationMode (s) (IInteger)	0 ~ 60	0	When **EncoderOutputMode** is set to **EncoderDivider** and EncoderDivider is not set to an integer multiple of 65536, set the maximum interval period of the output signal. This setting item is disabled when EncoderDivider is set to an integer multiple of 65536. 0: The trigger output period is calculated using the encoder input period only. 1 ~ 60: The trigger output period is calculated using the encoder input period and this setting.
ObjectDirection (IEnum)	0: Forward Direction (Default) 1: Reverse Direction		Set the direction of moving objects.
ObjectDirectionSource (IEnum)	11-14: UserOutput0-3 (Default = UserOutput0) 23: Line4 TTL In1 24: Line5 Opt In1 26: Line7 CXP In 29: Line10 TTL In2 32: Line13 TTL In3 33: Line14 TTL In4 39: EncoderDirection		Select the input to use for obtaining the movement direction information for the object.

Logic Block Control

Related Topic: Logic Block Control

Configure Logic Block settings.

Logic Block Control Item	Setting Range	Default	Description
Logic Block Selector (IEnum)	0: Logic Block 0 (Default) 1: Logic Block 1 2: Logic Block 2 3: Logic Block 3		Specifies the Logic Block to configure.
Logic Block Function (IEnum)	AND (Fixed)		Selects the combinational logic Function of the Logic Block to configure.
Logic Block Input Selector (IInteger)	0 ~ 1	0	Selects the Logic Block's input to configure.
Logic Block Input Source (IEnum)	4: ExposureActive 6: LVAL 7 ~ 9: PulseGenerator0 ~ 3 11 ~ 14: UserOutput0 ~ 3 23: Line4 TTL In1 (Default) 24: Line5 Opt In1 26: Line7 CXP In 29: Line10 TTL In2 32: Line13 TTL In3 33: Line14 TTL In4 36 ~ 37: Logic Block0 ~ 1 38: Encoder Trigger 41 ~ 42: Logic Block2 ~ 3		Selects the source signal for the input into the Logic Block.
Logic Block Input Inverter (IBoolean)	False True	False	Selects if the selected Logic Block Input source signal is inverted.
Logic Block Output Inverter (IBoolean)	True (Fixed)		Selects if the selected Logic Block Output signal is inverted.

UserSetControl

Configure user settings.

Related Topic: Step 6: Save the Settings

User Set Control Item	Setting Range	Default	Description
UserSetSelector (IEnum)	0: Default (Default) 1: User1 2: User2 3: User3		Select the user settings. **Note:** Default - Invalid when executing UserSetSave
UserSetLoad (ICommand)	-	-	Read the user settings specified in UserSetSelector. When selecting Default for UserSetSelector, the factory settings are loaded.
UserSetSave (ICommand)	-	-	Overwrite the current setting values with the user settings specified in UserSetSelector. Invalid when UserSetSelector is set to Default.

TransportLayerControl

Display information on transport layer control.

Transport Layer Control Item	Setting Range	Default	Description
PayloadSize (bytes) (IInteger)	48 ~ 67109240	4000Q: 12288 8000Q: 24576	Display the payload size. (unit: bytes)
DeviceTapGeometry (IEnum)	0: Geometry_1X_1Y (Fixed)		The method of transferring images from the device at one time (TAP configuration).
CoaXPress (ICategory)			
CxpLinkConfigurationPreferred (IEnum)	0x00010038: CXP3_X1 (3.125 Gbps) (Default) 0x00010048: CXP6_X1 (6.25Gbps) 0x00040058: CXP12_X1 (12.5Gpbs) 0x00020038: CXP3_X2 (6.25 Gbps) 0x00020048: CXP6_X2 (12.5 Gpbs) 0x00020058: CXP12_X2 (25.0 Gbps)		Displays the preferred link structure. This setting can be configured using **JAICxpLinkConfigurationPreferred**.
CxpLinkConfiguration (IEnum)			Set the current CoaXPress Link Configuration.
JAICxpLinkConfigurationPreferred (IEnum)	**Note:** CXP12 can only be used when VersionUsed = 2.0 or later		Custom command to change and save the CxpLinkConfigurationPreferred configuration value. This setting configures the CXP link configuration at startup.

Transport Layer Control Item	Setting Range	Default	Description
CxpLinkSharingEnable (IBoolean) **Related Topic:** CXP Link Sharing	False True	False	Enable/disable CxpLinkSharing. **Note:** CXPLinkSharing can be configured only when **CXPVersionUsed = CXP2.0** and **CxpLinkConfigurationPreferred = CXP3_X1, CXP6_X1** or **CXP12_X1**.
CxpLinkSharingSubDeviceSelector (IEnum)	0: Master sub-Device (Default) 1: Slave sub-Device #1		Select a SubDevice.
CxpLinkSharingStatus (IEnum)	0: Ready 1: NotReady 2: Not Used (Default)		Display the LinkSharingStatus for the selected SubDevice.
CxpLinkSharingSubDeviceType (IEnum)	0: Master (Default) 1: Slave		Displays theDevice type for the selected SubDevice. Link1: Master Link2: Slave
CxpLinkSharingVerticalStripeCount (IInteger)	0 ~ 2	0	Set the number of vertical strips for Sharing Mode.
CxpLinkSharingVerticalOverlap (IInteger)	0, 64, 128	0	Set the vertical overlap amount of the spripped image in pixels for Sharing Mode.
CxpLinkSharingDuplicateStripe (IInteger)	0 ~ 2	0	Set the number of duplication for Duplicate Mode.
CxpConnectionSelector (IInteger)	-	-	Select the CoaXPress physical connection you want to control.
CxpConnectionTestMode (IEnum)	0: Off 1: On	0: Off	0: Normal Mode 1: Sends a test packet to each connection that is connected.
CxpConnectionTestErrorCount (IInteger)	-	-	Reports the current connection error count for the test packet.
CxpConnectionTestPacketCount (IInteger)	-	-	Reports the current count of test packets.
CxpVersionUsed (IEnum)	2: CXP1.1 (Default) 3: CXP2.0		Display the current CXP version.

PulseGenerator

Configure pulse generator settings.

Pulse Generator Item	Setting Range	Default	Description
ClockPreScaler (IInteger)	1 ~ 4096	1	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz) (IFloat)	-	100	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base. PulseGeneratorClock = 100 / ClockPreScaler
PulseGeneratorSelector (IEnum)	0: PulseGenerator0 (Default) 1: PulseGenerator1 2: PulseGenerator2 3: PulseGenerator3		Select the pulse generator.
PulseGeneratorLength Value (IInteger)	1 ~ 1048575	30000	Set the maximum count-up value as a clock count.
PulseGeneratorLength (ms) (IFloat)	-	0.3	Set the maximum count-up value in milliseconds. PulseGeneratorLength = 1/PulseGeneratorClock * PulseGeneratorLengthValue
PulseGeneratorFrequency (Hz) (IFloat)	0 ~ 1048574	3333.3333	Set the maximum count-up value as a frequency. PulseGeneratorFrequency = 1sec / PulseGeneratorLength
PulseGeneratorStartPoint Value (IInteger)	0 ~ 1048575	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPoint (ms) (IFloat)	-	0	Set the start point of the High interval in milliseconds. When the counter reaches this value, the output will be 1. PulseGeneratorStartPoint = 1/PulseGeneratorClock * PulseGeneratorStartPointValue
PulseGeneratorEndPoint Value (IInteger)	1 ~ 1048575	15000	Set the start point of the Low interval as a clock count. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPoint (ms) (IFloat)	-	0.15	Set the start point of the Low interval in milliseconds. When the counter reaches this value, the output will be 0. PulseGeneratorEndPoint = 1/PulseGeneratorClock * PulseGeneratorEndPointValue

Pulse Generator Item	Setting Range	Default	Description
PulseGeneratorPulseWidth (ms) (IFloat)	-	0.15	Display the High interval width of the pulse in milliseconds. The duration between the Start Point and End Point is calculated. PulseGeneratorPulseWidth = 1/PulseGeneratorClock * (PulseGeneratorEndPointValue - PulseGeneratorStartPointValue)
PulseGeneratorRepeat Count (IInteger)	0 ~ 255	0	Set the repeat count for the counter. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorClear Activation (IEnum)	0: Off (Default) 1: Rising Edge 2: Falling Edge 3: Level High 4: Level Low		Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClear Source (IEnum)	1: ExposureActive 6: LVAL 7 ~ 10: PulseGenerator0 ~ 3* 11 ~ 14: UserOutput0 ~ 3 23: Line4: TTL In1 (Default) 24: Line5: Opt In1 26: Line7 CXP In 29: Line10: TTL In2 32: Line13 TTL In3 33: Line14 TTL In4 36 ~ 37: Logic Block0 ~ 1 38: EncoderTriger 39 ~ 40: Logic Block2 ~ 3		Select the count clear input signal source. **Note:** *Disabled if the PulseGenerator is selected in PulseGeneratorSelector.
PulseGeneratorClear SyncMode (IEnum)	0: Async Mode 1: Sync Mode		Select the sync mode for the count clear input signal.

Shading

Configure shading correction settings.

> **Related Topic:** Shading Correction

Shading Control Item	Setting Range	Default	Description
ShadingCorrectionMode (IEnum)	0: Flat Shading (Default) 1: Color Shading		Select the shading correction method.
ShadingMode (IEnum)	0: Off (Default) 1: User1 2: User2 3: User3		Set the area to which to save shading correction data. When this is set to Off, CalibrateShadingCorrection will not be executed.
CalibrateShadingCorrection (ICommand)	-	-	Execute shading correction. **Note:** "Error3 - Could not calibrated" is displayed when this command cannot be executed. For more information, see "How to Configure the Shading Correction Function".
ShadingCalibrationResult (IEnum)	0: Idle (Default) 1: Succeed 2: Error1 - Image was too bright 3: Error2 - Image was too dark 4: Error3 - Could not calibrated		Display the shading correction results.
ShadingDataSelector (IEnum)	0: Red (Default) 1: Green 2: Blue 3: NIR		Read the shading correction data and select the sensor to be changed.
ShadingDataIndex (IInteger)	1 ~ 1024	1	Set the index table number for shading correction.
ShadingData (IInteger)	0 ~ 0x1FFF	0x4000	Display the result of shading correction.
ShadingDataSave (ICommand)	-	-	Save the result of shading correction.

Correction

Correct variations due to sensors and lenses.

Correction Control Item	Setting Range	Default	Description
PixelBlackCorrectionMode (IEnum) **Related Topic:** DSNU Correction (Pixel Black Correct)	0: Off 1: Default (Default) 2: User1 3: User2 4: User3		(DSNU) Select under which setting to store / load the correction values. **Note:** Default contains the correction data that was set at the factory.
CalibratePixelBlackCorrection (ICommand)	-	-	(DSNU) Generate black level correction data automatically from the captured image. Please follow the instructions on "DSNU Correction (Pixel Black Correct)". **Caution:** When PixelBlackCorrectionMode is set to Off or Default, or test pattern is being output instead of an image, this command cannot be executed. In this case, "**Error3 - Could not calibrated**" is displayed on **PixelBlackCalibrationResult**.
PixelBlackCalibrationResult (IEnum)	0: Idle (Default) 1: Succeeded 2: Error1 - Image was too bright 3: Error2 - Image was too dark 4: Error3 - Could not calibrated 7: Processing		(DSNU) Display the results of Calibrate Pixel Black Correction execution.
PixelGainCorrectionMode (IEnum) **Related Topic:** PRNU Correction (Pixel Gain Correct)	0: Off 1: Default (Default) 2: User1 3: User2 4: User3		**Note:** Default contains the correction data that was set at the factory.

Correction Control Item	Setting Range	Default	Description
CalibratePixelGainCorrection (ICommand)	-	-	(PRNU) Generate gain correction data automatically from the captured image. **Caution:** When PixelGainCorrectionMode is set to Off or **Default**, or a test pattern is being output instead of an image, this command cannot be executed. In this case, "**Error3 - Could not calibrated**" is displayed on **PixelGainCalibrationResult**.
PixelGainCalibrationResult (IEnum)	0: Idle (Default) 1: Succeeded 2: Error1 - Image was too bright 3: Error2 - Image was too dark 4: Error3 - Could not calibrated 7: Processing		(PRNU) Display the results of Calibrate Pixel Gain Correction execution. For more information on the results, see "PRNU Correction (Pixel Gain Correct)".
ChromaticAberration CorrectionMode (IEnum) **Related Topic:** Chromatic Aberration Correction	0: Off (Default) 1: Lens1 2: Lens2 3: Lens3		Selects the area to load or save the Chromatic Aberration Correction values.
ChromaticAberration CorrectionMethod (IEnum)	0: Simple Interpolation (Default) 1: Linear Spline Interpolation 2: Custom		Selects the Chromatic Aberration Correction method. **Simple Interpolation**: Perform a two-point linear interpolation. **Linear Spline Interpolation**: Performs piecewise linear interpolation using a quadratic curve formula. **Custom**: Modify each correction point as desired.
ChromaticAberration CorrectionSelector (IEnum)	0: R channel (Default) 2: B channel		Selects the color of the Chromatic Aberration Correction values.
ChromaticAberration CorrectionIndex (IInteger)	0 ~ 8	1	Selects the Index to refer the Chromatic Aberration Correction Ratio values.
ChromaticAberration CorrectionRatio (IInteger)	-1.000 ~ 1.000; step 0.001	0.125	Sets the Chromatic Aberration Correction Ratio values.
ChromaticAberration Correction (IFloat)	**4000Q** -8.0 ~ 8.0; step 0.1 **8000Q** -16.0 ~ 16.0; step 0.1	0	Sets the value of the Chromatic Aberration Correction.
ChromaticAberration CorrectionCoeff (IFloat)	1 ~ 10; step 0.1	2	Sets the coefficient value of the Chromatic Aberration Correction for Linear Spline Interpolation.

Correction Control Item	Setting Range	Default	Description
ChromaticAberration CorrectionSave (ICommand)	-	-	Save the related value of the Chromatic Aberration Correction features.
SubPixelImageShiftR (IFloat)	-1 to +1; step 0.01	0	Adjust the red pixel position. A positive value shifts the pixel to the right of the scan direction. A negative value shifts the pixel to the left of the scan direction.
SubPixelImageShiftB (IFloat)	-1 to +1; step 0.01	0	Adjust the blue pixel position. A positive value shifts the pixel to the right of the scan direction. A negative value shifts the pixel to the left of the scan direction.
FIRFilterSelector (IEnum) **Related Topic:** Noise Reduction Filter Functions	0:Red (Default) 1:Green 2:Blue		Select the target to apply FIR Filter from Red, Green, Blue.
FIRFilterMode (IEnum)	0: Off 1: On	0: Off	Enable / Disable FIR Filter.
FIRFilterLeftRatio (IFloat)	-2 ~ 2	0	Set the coefficient of the left pixel when FIR Filter is applied.
FIRFilterCenterRatio (IFloat)	-2 ~ 2	1	Set the coefficient of the center pixel when FIR Filter is applied.
FIRFilterRightRatio (IFloat)	-2 ~ 2	0	Set the coefficient of the right pixel when FIR Filter is applied.
MEDIANFilterSelector (IEnum)	0: Red (Default) 1: Green 2: Blue 3: NIR		Select the target to apply Median Filter from Red, Green, Blue.
MEDIANFilterMode (IEnum)	0: Off 1: On	0: Off	Enable / Disable MEDIAN Filter.
NoiseReduction (IEnum)	0: Off (Default) 1: Level1 2: Level2 3: Level3 4: Level4		Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong

Miscellaneous

Troubleshooting

Check the following before requesting help. If the problem persists, contact your local JAI distributor.

Power Supply and Connections

Issue: The POWER/TRIG LED remains lit amber and does not turn green, even after power is supplied to the camera.

Cause and Solution: Camera initialization may not be complete due to lack of power. Check the 12-pin power cable connection.

Image Display

Issue: Gradation in dark areas is not noticeable.

Cause and Solution: Use the gamma function to correct the display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing. Using the gamma function performs correction to produce a display that is close to linear. For details, see Gamma Function.

Settings and Operations

Issue: Settings cannot be saved to user memory.

Cause and Solution: You cannot save to user memory while images are being acquired by the camera. Stop image acquisition before performing the save operation.

Issue: I want to restore the factory default settings.

Cause and Solution: Load Default under User Set Selector in the Feature Properties tab to restore the factory default settings.

Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Image Sensor</td><td>4K / 8K line scan CMOS image sensor × 4
<table>
<tr><th></th><th>SW-4000Q-CXP2A</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td>Effective Pixels</td><td>4096 × 4 (R, G, B, NIR)</td><td>8192 × 4 (R, G, B, NIR)</td></tr>
<tr><td rowspan="2">Pixel Size</td><td>TypeA: 7.5 µm x 7.5 µm</td><td rowspan="2">3.75 µm x 5.78 µm</td></tr>
<tr><td>TypeB: 7.5 µm x 10.5 µm</td></tr>
</table></td></tr>
<tr><td>Synchronization</td><td>Internal</td></tr>
<tr><td>Communication Interface</td><td>CoaXpress v2.0 / v1.1</td></tr>
<tr><td>Line Rate
(Full ROI)</td><td>
<table>
<tr><th>PixelFormat</th><th>CxpLinkConfig.</th><th>SW-4000Q-CXP2A</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td rowspan="4">RGBa8</td><td>CXP12_X2</td><td>66Hz ~ 146kHz</td><td>66Hz ~ 73kHz</td></tr>
<tr><td>CXP12_X1, CXP6_X2</td><td>66Hz ~ 73kHz</td><td>66Hz ~ 36kHz</td></tr>
<tr><td>CXP6_X1, CXP3_X2</td><td>66Hz ~ 36kHz</td><td>66Hz ~ 18kHz</td></tr>
<tr><td>CXP3_X1</td><td>66Hz ~ 18kHz</td><td>66Hz ~ 9kHz</td></tr>
<tr><td rowspan="4">RGBa10</td><td>CXP12_X2</td><td>66Hz ~ 117kHz</td><td>66Hz ~ 59kHz</td></tr>
<tr><td>CXP12_X1, CXP6_X2</td><td>66Hz ~ 58kHz</td><td>66Hz ~ 29kHz</td></tr>
<tr><td>CXP6_X1, CXP3_X2</td><td>66Hz ~ 29kHz</td><td>66Hz ~ 14kHz</td></tr>
<tr><td>CXP3_X1</td><td>66Hz ~ 14kHz</td><td>66Hz ~ 7kHz</td></tr>
</table>
Note: See "Maximum Line Rate (Approximate)" for the maximum line rates in different ROI settings. When taking a trigger signal from the outside, there is no limitation on the minimum value </td></tr>
<tr><td>Dark SN (DR)
DarkLevel @ 10bit</td><td>
<table>
<tr><th>IndividualGainMode</th><th>Channel</th><th>SW-4000Q-CXP2A*</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td rowspan="4">Off
(DSNU: On,
Gain All/R/B: 0dB)</td><td>Rch</td><td>57dB (Typ)</td><td>58dB (Typ)</td></tr>
<tr><td>Gch</td><td>55dB (Typ)</td><td>56dB (Typ)</td></tr>
<tr><td>Bch</td><td>58dB (Typ)</td><td>58dB (Typ)</td></tr>
<tr><td>NIRch</td><td>58dB (Typ)</td><td>58dB (Typ)</td></tr>
<tr><td rowspan="4">Off
(DSNU: On,
Gain G/R/B: 0dB)</td><td>Rch</td><td>> 60dB (Typ)</td><td>> 60dB (Typ)</td></tr>
<tr><td>Gch</td><td>> 60dB (Typ)</td><td>> 60dB (Typ)</td></tr>
<tr><td>Bch</td><td>> 60dB (Typ)</td><td>> 60dB (Typ)</td></tr>
<tr><td>NIRch</td><td>> 60dB (Typ)</td><td>> 60dB (Typ)</td></tr>
<tr><td colspan="4">*Both Sensor TypeA and TypeB</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Bright SNR
890LSB @ 10bit</td><td>
<table>
<tr><th rowspan="2">IndividualGainMode</th><th rowspan="2">Channel</th><th colspan="2">SW-4000Q-CXP2A</th><th rowspan="2">SW-8000Q-CXP2A</th></tr>
<tr><th>TypeA</th><th>TypeB</th></tr>
<tr><td rowspan="4">Off
(DSNU: On,
Gain All/R/B: 0dB)</td><td>Rch</td><td>37dB (Typ)</td><td>39dB (Typ)</td><td>37dB (Typ)</td></tr>
<tr><td>Gch</td><td>36dB (Typ)</td><td>38dB (Typ)</td><td>36dB (Typ)</td></tr>
<tr><td>Bch</td><td>37dB (Typ)</td><td>39dB (Typ)</td><td>37dB (Typ)</td></tr>
<tr><td>NIRch</td><td>37dB (Typ)</td><td>39dB (Typ)</td><td>37dB (Typ)</td></tr>
<tr><td rowspan="4">Off
(DSNU: On,
Gain G/R/B: 0dB)</td><td>Rch</td><td>39dB (Typ)</td><td>41dB (Typ)</td><td>39dB (Typ)</td></tr>
<tr><td>Gch</td><td>39dB (Typ)</td><td>41dB (Typ)</td><td>39dB (Typ)</td></tr>
<tr><td>Bch</td><td>39dB (Typ)</td><td>41dB (Typ)</td><td>39dB (Typ)</td></tr>
<tr><td>NIRch</td><td>39dB (Typ)</td><td>41dB (Typ)</td><td>39dB (Typ)</td></tr>
</table>
</td></tr>
<tr><td>Digital Image Output Format</td><td>
<table>
<tr><th></th><th>SW-4000Q-CXP2A</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td>Width (pixels)</td><td>128 (64) ~ 4096 (2048), 16 (8) pixels/step</td><td>128 (64) ~ 8192 (4096), 16 (8) pixels/step</td></tr>
<tr><td>OffsetX</td><td>0 ~ 3968 (1984), 16 (8) pixels/step</td><td>0 ~ 8067 (4032), 16 (8) pixels/step</td></tr>
<tr><td>PixelFormat</td><td colspan="2">Visible + NIR: RGBa8, RGBa10
Visible: RGB8, RGB10, Mono8 (NIR), Mono10 (NIR)</td></tr>
<tr><td colspan="3">( ) = Binning On</td></tr>
</table>
</td></tr>
<tr><td>Acquisition Mode</td><td>Continuous</td></tr>
<tr><td>Exposure Mode</td><td>
<table>
<tr><th>Exposure Mode</th><th>ExposureTime (step: 0.01µs)</th></tr>
<tr><td>Off</td><td>Line Period - 3.29µs + 0.85µs</td></tr>
<tr><td>Timed (LineStart Trigger Off)</td><td rowspan="2">3.0µs ~ 15.149ms (4000Q), 15.1488 (8000Q) (Setting Value)</td></tr>
<tr><td>Timed (LineStart Trigger On)</td></tr>
<tr><td>TriggerWidth (LineStart only)</td><td>TriggerWidth + 0.85µs (1.8µs ~ 1s)</td></tr>
</table>
</td></tr>
<tr><td>Trigger Selector</td><td>Acquisition: AcquisitionStart / AcquisitionEnd
Exposure: LineStart</td></tr>
<tr><td>Trigger Input Signals</td><td>Line4 (TTL In1), Line5 (Opt In), Line7 (CXP In), Line10 (TTL In2), Line13 (TTL In3), Line14 (TTL In4), PulseGenerator0-3, UserOutput0-3, LogicBlock0-3, EncoderTrigger
Positive / negative logic switchable. Minimum trigger width: TBDns and more</td></tr>
<tr><td>Digital I/O</td><td>Input: Opto Coupled x1 (12-pin), TTL x2 (12-pin), TTL x2 (6-pin), CXP In
Output: TTL x2 (12-pin), TTL x2 (6-pin)</td></tr>
<tr><td>Gain Adjustment</td><td>
<table>
<tr><th>Mode</th><th>Gain Range</th></tr>
<tr><td>Analog Gain (4000Q Only)</td><td>0dB / 6dB / 12dB</td></tr>
<tr><td>Individual Gain Mode 1</td><td>DigitalG/R/B/NIR: 0 ~ 36.0dB</td></tr>
<tr><td>Individual Gain Mode 2</td><td>DigitalG/R/B/NIR: -4 ~ +12dB</td></tr>
<tr><td rowspan="2">Master Mode
(IndividualGainMode = Off)</td><td>DigitalAll: 0 ~ 30.0dB</td></tr>
<tr><td>Digital R/B/NIR: -4 ~ +12.0dB</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Black Level Adjustment</td><td>All: -133 ~ +255 (LSB@12bit)
Red/Blue/NIR: -64 ~ +64 (LSB@12bit)
Default setting: Output black level at 0 (33LSB during 10-bit)</td></tr>
<tr><td>White Balance</td><td>BalanceWhiteAuto: Off, Once, Exposure Once, Preset5000K, Preset6500K, Preset7500K
Adjustment Range: 3000K ~ 9000K</td></tr>
<tr><td>Test Pattern</td><td>Off, White, GreyPattern1(Ramp), GreyPattern2(Stripe), ColorBar</td></tr>
<tr><td>Image Processing</td><td>Pixel Sensitivity Correction: Pixel Correction (DSNU、PRNU)
Shading Correction ColorShading, FlatShading
LUT: Off : y =1.0, ON: 257 points can be set.
Gamma (4000Q): 0.45 ~ 1.0 (9 steps available)
Gamma (8000Q): 0.45 ~ 4.0 (20 steps available)
Noise Reduction Filter (MEDIAN, FIR, NoiseReduction)</td></tr>
<tr><td>Power Supply (12-pin)</td><td>
<table>
<tr><th></th><th>SW-4000Q-CXP2A</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td>Input Voltage</td><td colspan="2">DC10.8 ~ 26.4V</td></tr>
<tr><td>Power Consumption *</td><td>TBDW (Typ), TBDW (Max)</td><td>TBDW (Typ), TBDW (Max)</td></tr>
<tr><td colspan="3">*Default / 25°C Environment @ DC+12V</td></tr>
</table>
</td></tr>
<tr><td>Power Supply (PoCXP)</td><td>
<table>
<tr><th></th><th>SW-4000Q-CXP2A</th><th>SW-8000Q-CXP2A</th></tr>
<tr><td>Input Voltage</td><td colspan="2">DC18.5 ~ 26V</td></tr>
<tr><td>Power Consumption *</td><td>TBDW (Typ), TBDW (Max)</td><td>TBDW (Typ), TBDW (Max)</td></tr>
<tr><td colspan="3">*Default / 25°C Environment @ DC+12V</td></tr>
</table>
</td></tr>
<tr><td>Lens Mount</td><td>M52-mount, F-mount. Lens mount protrusions of 13 mm or less can be attached.</td></tr>
<tr><td>Back Flange Distance</td><td>46.5 mm, tolerance: 0 mm to ~ -0.05 mm (F- and M52-mount)</td></tr>
<tr><td>Verified Performance Temperature/Humidity</td><td>-5°C ~ +45°C (20 to 80%, non-condensing)
Note: It may change depending on the installation environment. Please refer to the Caution in this section.</td></tr>
<tr><td>Storage Temperature/Humidity</td><td>-25°C ~ +60°C (20 to 80%, non-condensing)</td></tr>
<tr><td>Vibration Resistance</td><td>3G (20 Hz~ 200 Hz X-Y-Z direction)</td></tr>
<tr><td>Shock Resistance</td><td>50G</td></tr>
<tr><td>Regulations</td><td>EMI:EN55032:2015/A11:2020, EMS:EN55035:2017(CISPR35:2016), FCC Part15 Subpart A, KC, RoHS</td></tr>
<tr><td>Dimensions</td><td>90mm x 90mm x 120mm (WHD; excluding mount and protrusions)</td></tr>
<tr><td>Weight</td><td>880g</td></tr>
</table>

Notes:

- Design and specifications are subject to change without notice.
- Approximately 30 minutes of warm-up are required to achieve these specifications.

Caution: About the verified performance temperature

Make sure the following temperature conditions are met when operating the unit.

- The camera's internal temperature should not exceed 59 °C during operation.

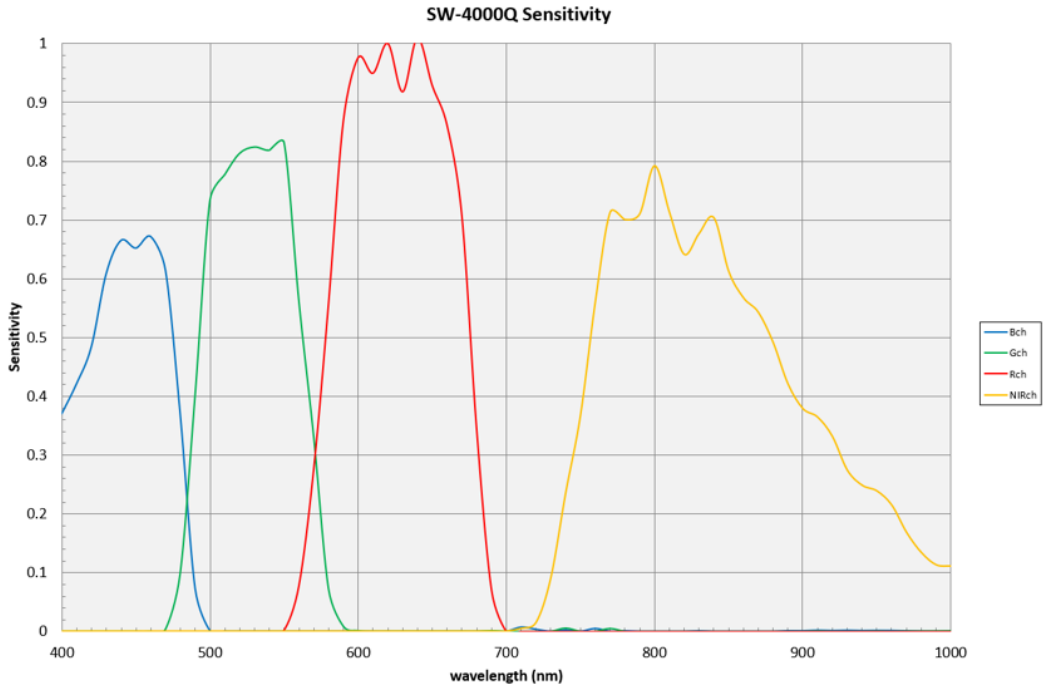
If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

Package Contents

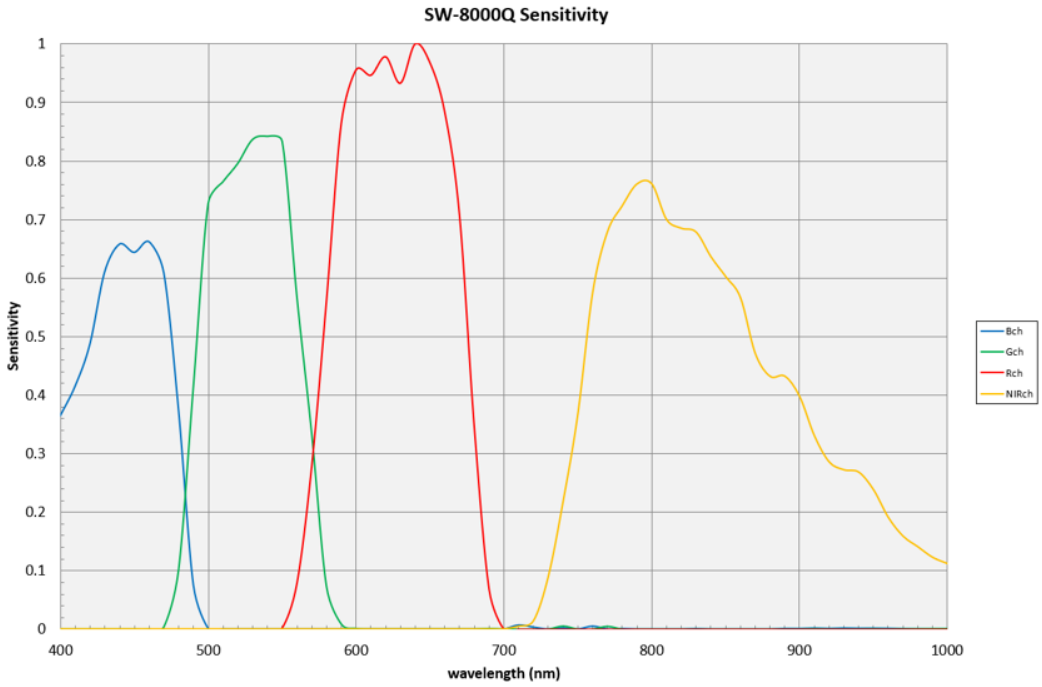
- Camera body (1)
- Sensor protection cap (1)
- Dear Customer (sheet) (1)

Spectral Response

SW-4000Q-CXP2A



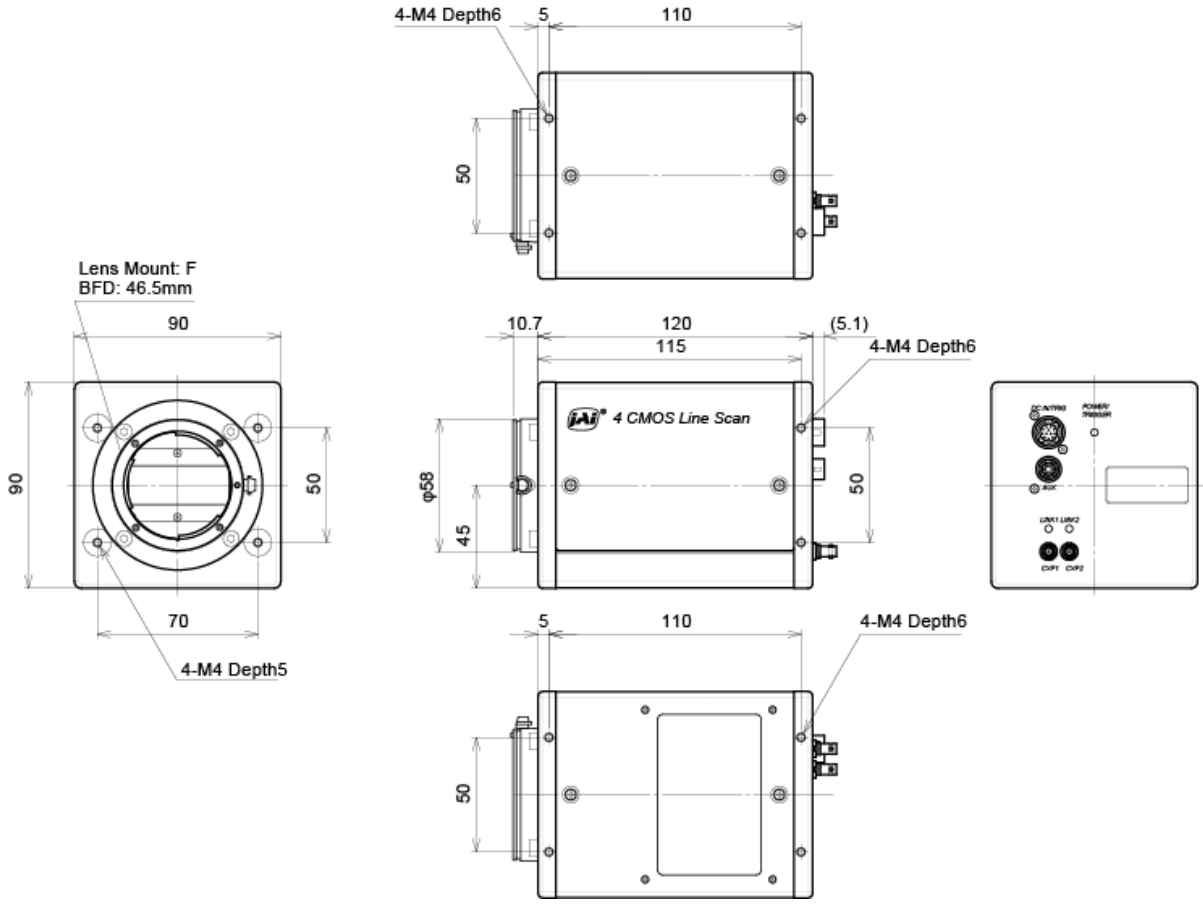
SW-8000Q-CXP2A



Dimensions

This section shows the dimensional drawings of each camera model.

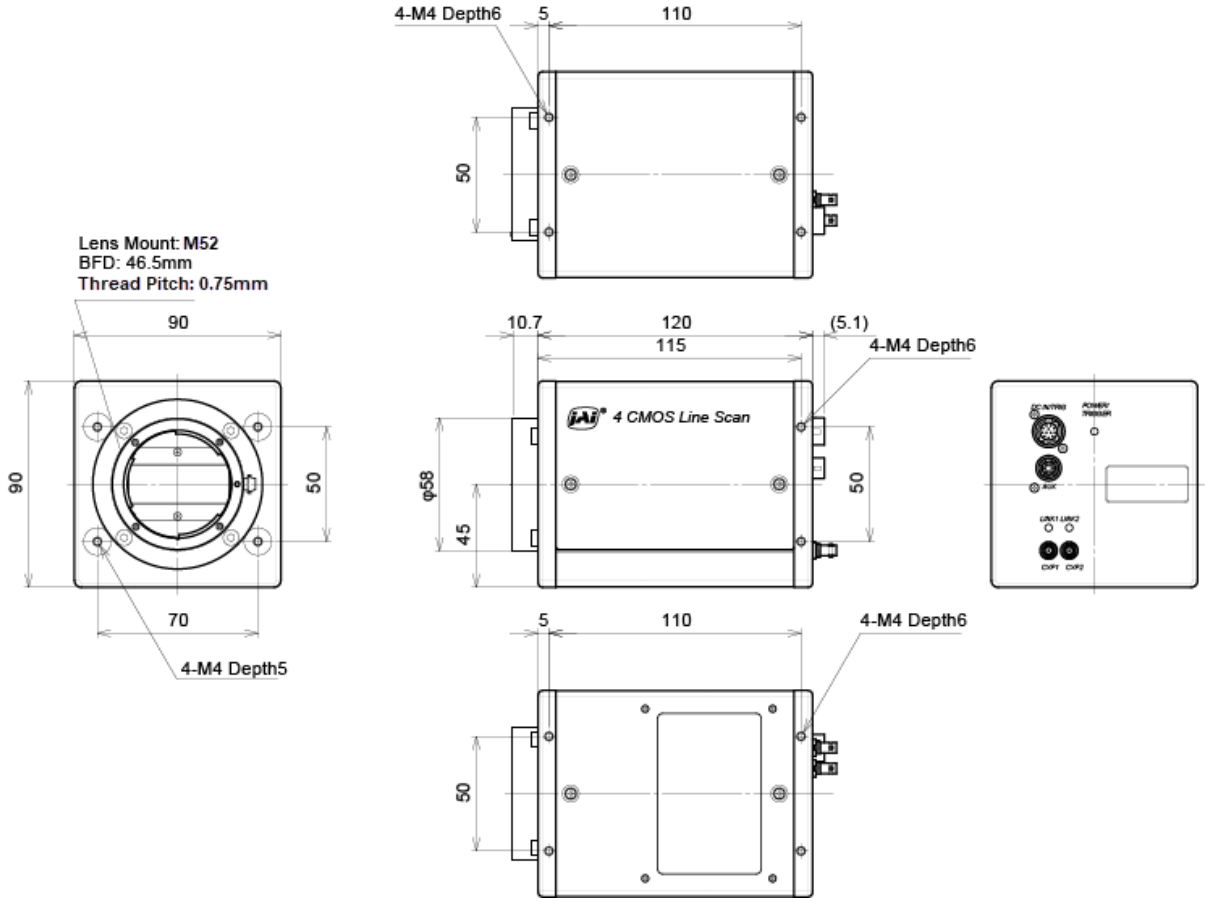
SW-4000Q-CXP2A-F / SW-8000Q-CXP2A-F



Notes:

- Dimensional Tolerance: ± 0.3 mm
- Unit: mm

SW-4000Q-CXP2A-M52 / SW-8000Q-CXP2A-M52



Notes:

- Dimensional Tolerance: ± 0.3 mm
- Unit: mm

Comparison of the Decibel Display and Multiplier Display

Decibels [dB]	Multipliers [X]	Remarks
-6	0.501	
-5	0.562	
-4	0.631	
-3	0.708	
-2	0.794	
-1	0.891	
0	1	
1	1.122	
2	1.259	
3	1.413	
4	1.585	
5	1.778	
6	1.995	
7	2.239	
8	2.512	
9	2.818	
10	3.162	
11	3.548	
12	3.981	
13	4.467	
14	5.012	
15	5.623	
16	6.31	
17	7.079	
18	7.943	
19	8.913	
20	10	
21	11.22	
22	12.589	
23	14.125	
24	15.849	
25	17.783	
26	19.953	
27	22.387	
28	25.119	
29	28.184	
30	31.623	
31	35.481	
32	39.811	
33	44.668	

Decibels [dB]	Multipliers [X]	Remarks
34	50.119	
35	56.234	
36	63.096	

User's Record

Model name:

Revision: ……

Serial No: ……

Firmware version: ……

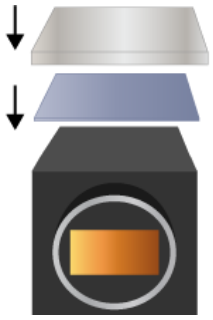
For camera revision history, please contact your local JAI distributor.

Appendix

This section provides information about the thermal management of this camera.

Recommended Passive Cooling Method

If the camera's internal temperature exceeds the allowed maximum temperature (59 °C), JAI recommends attaching a thermal pad to the camera and place a metal plate over it.



Notes:

- A thermal pad and metal plate can be attached to the top, bottom, or a side of the camera, depending on how the camera is installed.
- You can monitor the camera's internal temperature by DeviceTemperature (DeviceControl).

Revision History

Revision	Date	Changes
Tentative	2026/08/25	For Marketing Launch

Trademarks

Systems and product names described in this document are trademarks or registered trademarks of their respective owners. The ™ and ® symbols are not used in this document.