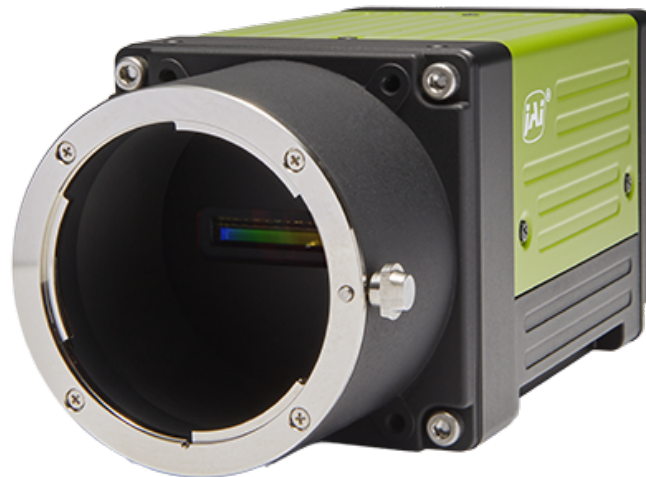




See the possibilities

User Manual



SW-4000TL-10GE

SW-4000TL-SFP

High Speed CMOS Trilinear Camera

Document Version: 2.1

Date: 2023-12-21

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.

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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 SW-4000TL-10GE and SW-4000TL-SFP comply with the following provisions applying to their standards.

SW-4000TL-10GE	EN55032:2015/A11:2020 Class B EN55035:2017/A11:2020
SW-4000TL-SFP	EN55032:2015 Class B EN55035:2017/A11:2020

FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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

	상 호:	JAI Ltd. Japan
	기자재명칭:	Industrial Camera
	모 델 명:	SW-4000TL-10GE-F
	제조사 및 제조국가:	JAI Ltd., Japan / JAPAN
R-R-JAI-SW-4000TL-10GE		


	상 호:	JAI Ltd. Japan
	기자재명칭:	Industrial Camera
	모 델 명:	SW-4000TL-10GE-M42A
	제조사 및 제조국가:	JAI Ltd., Japan / JAPAN
R-R-JAI-SW-4000TL-10GE		

	상 호:	JAI Ltd. Japan
	기자재명칭:	Industrial Camera
	모 델 명:	SW-4000TL-SFP-M42A
	제조사 및 제조국가:	JAI Ltd., Japan / JAPAN
R-R-JAI-SW-4000TL-SFP		

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-4000TL-10GE SW-4000TL-SFP	x	○	○	○	○	○

○: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。
x: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

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

Technical Notes How to Clean a Sensor

Avoiding Dust Particles

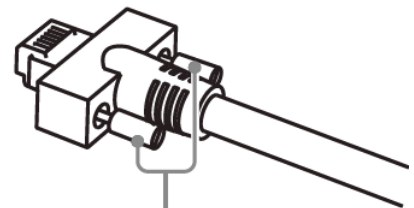
When attaching the lens to the camera, stray dust and other particles may adhere to the sensor surface and rear surface of the lens. Be careful of the following when attaching the lens.

- 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.

Notes on LAN Cable Connection

Secure the locking screws on the connector manually, and do not use a driver. Do not secure the screws too tightly. Doing so may wear down the screw threads on the camera. (Tightening torque: 0.147 Nm or less)

Caution: Secure manually. Do not secure too tightly.



Notes on SFP+ Module Installation

Check the operation manual of the SFP+ module to be used, and attach it or remove it from the camera. The SFP module can be attached to and removed from the camera only when the camera is turned off.

Many SFP modules and fiber optic cables are Class 1 laser products. Do not look into connectors and cables when installing or removing. There is a risk of injury to eyes.

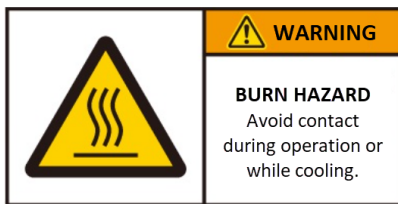
Notes on Temperature Conditions

The guaranteed operating temperature and humidity of this camera are -5°C to +45°C, 20% to 80% (non-condensing). Please make sure the following temperature condition is met when operating the unit.

SW-4000TL-10GE	The camera's internal temperature sensor detects temperatures of 100 °C or less during operation.
SW-4000TL-SFP	The camera's internal temperature sensor detects temperatures of 80 °C or less during operation.

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

In addition, when using the SW-4000TL-SFP model, operating temperature range of SFP+ modules varies depending on the product. Please use it after confirming the specifications in the data sheet of the product to be used.



Depending on the operating environment, the surface of the camera may become very hot during operation. Do not touch the camera during operation and while it is being cooled. Also, make sure that the cable surface and other easily deformable items do not contact the surface of the camera.

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 3×4096 pixel trilinear (RGB) CMOS line scan camera. The Camera is capable of high-speed scanning at up to 66kHz (Line Rate). 8-bit and 10-bit video output is possible via 10GigE.

■ Features Overview

- **SW-4000TL-10GE: 10 GigE Interface**

- The camera supports the following Ethernet standards (1000Base-T, 2.5GBase-T, 5GBase-T, 10GBase-T)

- **SW-4000TL-SFP: Supports 10GBASE-R**

- Attach an SFP+ module to the camera to enable 10 Gigabit Ethernet connection via fiber optic cable.

- **Trilinear line-scan camera**

- Tilted view correction
- Spatial compensation
- Automatic detection of scan direction (when using rotary encoders)
- Support for connection of rotary encoders

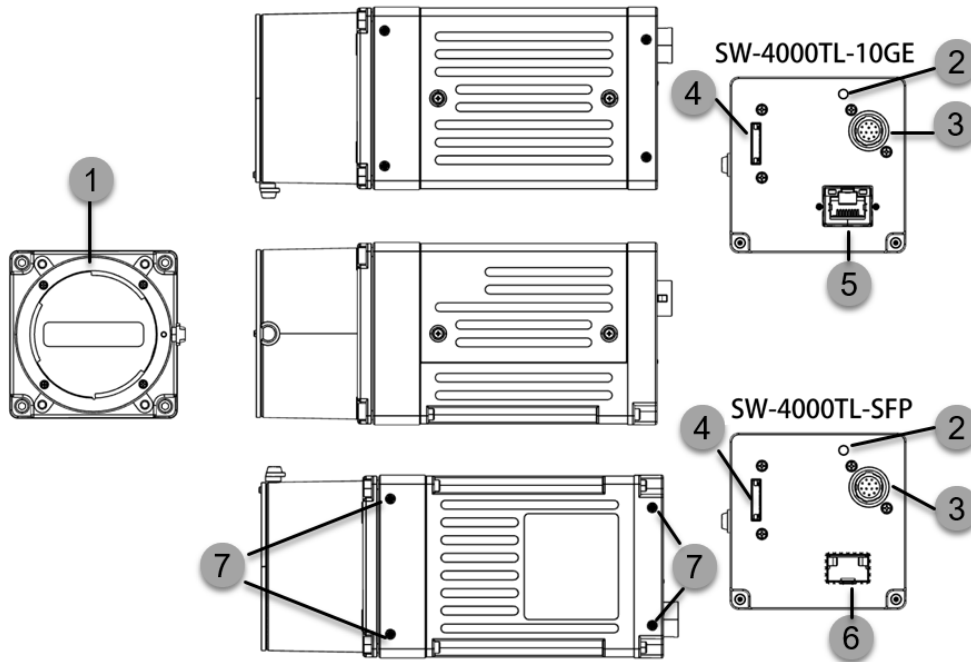
- **Variety of pre-process functions**

- LUT (Lookup Table): Programmable control over gamma and contrast is possible.
- Gamma correction: can be set to 1.0, 0.9, 0.8, 0.75, 0.65, 0.6, 0.55, 0.5, or 0.45 (off).
- Shading correction (flat field): Non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment can be corrected.
- Variable line rate: By varying the line rate, the scanning speed of the camera can be matched to the feeding speed of the object, and the accumulation time can be lengthened to increase sensitivity.

- **Miscellaneous**

- Timestamp function
- Color space conversion function (HSI, XYZ, sRGB, Adobe RGB) support

Parts Identification



Note: An exterior view of the F-mount model is shown above. See the "[Dimensions](#)" section for exterior views of M52-mount models.

① [Lens Mount \(M42-Mount or F-Mount\)](#)

② [POWER/TRIG LED](#)

③ [DC IN/TRIG Connector \(12-Pin Round\)](#)

④ [AUX Connector \(10-pin\)](#)

⑤ [RJ-45 Connector \(SW-4000TL-10GE\)](#)

⑥ [SFP+ Connector \(SW-4000TL-SFP\)](#)

⑦ [Mounting Holes \(M4, 6mm Depth\)](#)




① Lens Mount (M42-Mount or F-Mount)

Mount an M42-mount lens or F-mount lens here.

Note: Before mounting a lens, be sure to refer to [① Lens](#) and confirm the precautions for attaching a lens and the supported lens types.

② POWER/TRIG LED

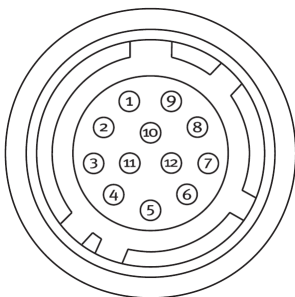
Indicates the power or trigger input status.

LED		Status
	Lit amber	Camera initializing. SW-4000TL-SFP: SFP+ module not inserted. Not compatible SFP+ module inserted. The Ethernet Link has not been established.
	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.

③ 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: HR10A-10R-12PB (71) (Hirose Electric or equivalent)		
	Cable Side: HR-10A-10P-12S (Plug) (Hirose Electric or equivalent)		
Pin No.	Input/Output	Signal	Description
1		GND	
2	Power In	DC In	DC +10V ~ + 25V
3		GND	
4		Reserved	
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	DC +10V ~ + 25V
12		GND	

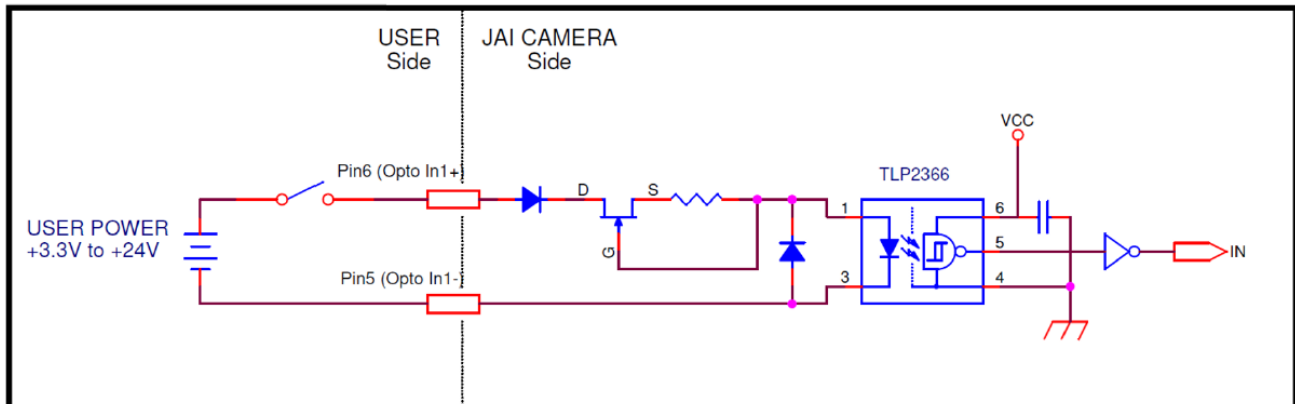
Note: The maximum current rating for the power and ground pins is 1.6A per pin pair. If you are using a power supply whose voltage would create a current flow above this limit in order to meet the camera’s maximum power consumption (19.3 W), then power must be connected via both pin pairs.

TTL Signal specification

TTL out signal specification (Typ.)	Output voltage: Low 0.0V, High 5.0V Input/Output current: +/-32mA
TTL in signal specification (Typ.)	Input voltage: Low 0.0 ~ 0.8V, High 2.0 ~ 5.5V


Caution: About Opto In: Check the recommended external input circuit diagram (reference example) and connect correctly. If you connect Opto In 1 and Opto In 2 in reverse, camera may be damaged.

Recommended External Input Circuit Diagram (Reference Example)



④ AUX Connector (10-pin)

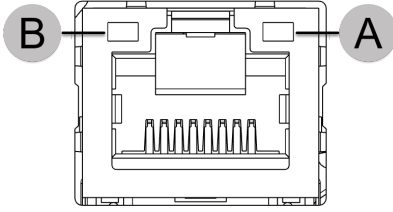







Connect the cable for DC IN / trigger IN here.

	Camera side: Equivalent to Hirose Electronic 3260-10S3(55)			
	Cable side: Equivalent to Hirose Electronic 3240-10P-C(50)			
	Pin No.	Attribute	Name	Description
	1	Out	TTL OUT2	Line 8
	2	Out	TTL OUT3	Line 9
	3	IN	TTL_IN2	Line 10
	4		N.C	
	5	GND	GND	
	6	IN	TTL_IN3	Line 13
	7		N.C	
	8		N.C	
	9	GND	GND	
	10	GND	GND	

⑤ RJ-45 Connector (SW-4000TL-10GE)

SW-4000TL-10GE supports the following Ethernet standards: 1000Base-T, 2.5GBase-T, 5GBase-T, 10GBase-T

Depending on the Ethernet standard to be used, the cable type and the maximum cable length are limited. For details, refer to "[Step 2: Connect Devices](#)".

 <p>A: LINK LED Indicates the link status of the network.</p> <p>B: ACT LED Indicates the network communication status</p>	A: LINK	 Light off	Network Link is not established.
		 Blinking green - slow	1000Base-T Link is established. (Interval 1sec)
		 Blinking green - fast	2.5GBase-T Link or 5GBase-T Link is established. (Interval 200 msec)
		 Lit green	10GBase-T Link is established.
	B: ACT	 Light off	No network communication
		 Blinking green	(Tx) Network communication in progress.
		 Blinking yellow	(Rx) Network communication in progress.

⑥ SFP+ Connector (SW-4000TL-SFP)

SW-4000TL-SFP supports 10GBASE-R Ethernet standards.

Requirements specification for SFP+ module:

- Support 10GBASE-R
- Support Power level 1

Depending on the Ethernet standard to be used, the cable type and the maximum cable length are limited.

For details, refer to "[Step 2: Connect Devices.](#)"

⑦ Mounting Holes (M4, 6mm Depth)

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

Preparation

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

1	<p><u>Step 1: Install the Software (First Time Only)</u></p> <ul style="list-style-type: none"> Install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.
2	<p><u>Step 2: Connect Devices</u></p> <ul style="list-style-type: none"> Connect the lens, cable, AC adapter, computer, and other devices.
3	<p><u>Step 3: Verify Camera Operation</u></p> <ul style="list-style-type: none"> Verify whether the camera is turned on and ready for use.
4	<p><u>Step 4: Verify the Connection between the Camera and PC</u></p> <ul style="list-style-type: none"> Verify whether the camera is properly recognized via Control Tool.
5	<p><u>Step 5: Configure Trigger, Exposure, and Line Rate Settings</u></p> <ul style="list-style-type: none"> Configure the Trigger and Exposure settings.
6	<p><u>Step 6: Adjust the Image Quality</u></p> <ul style="list-style-type: none"> Adjust the Gain, White Balance and Black Level settings, and adjust the image quality.
7	<p><u>Step 7: Save the Settings</u></p> <ul style="list-style-type: none"> Save the current setting configurations in user memory.

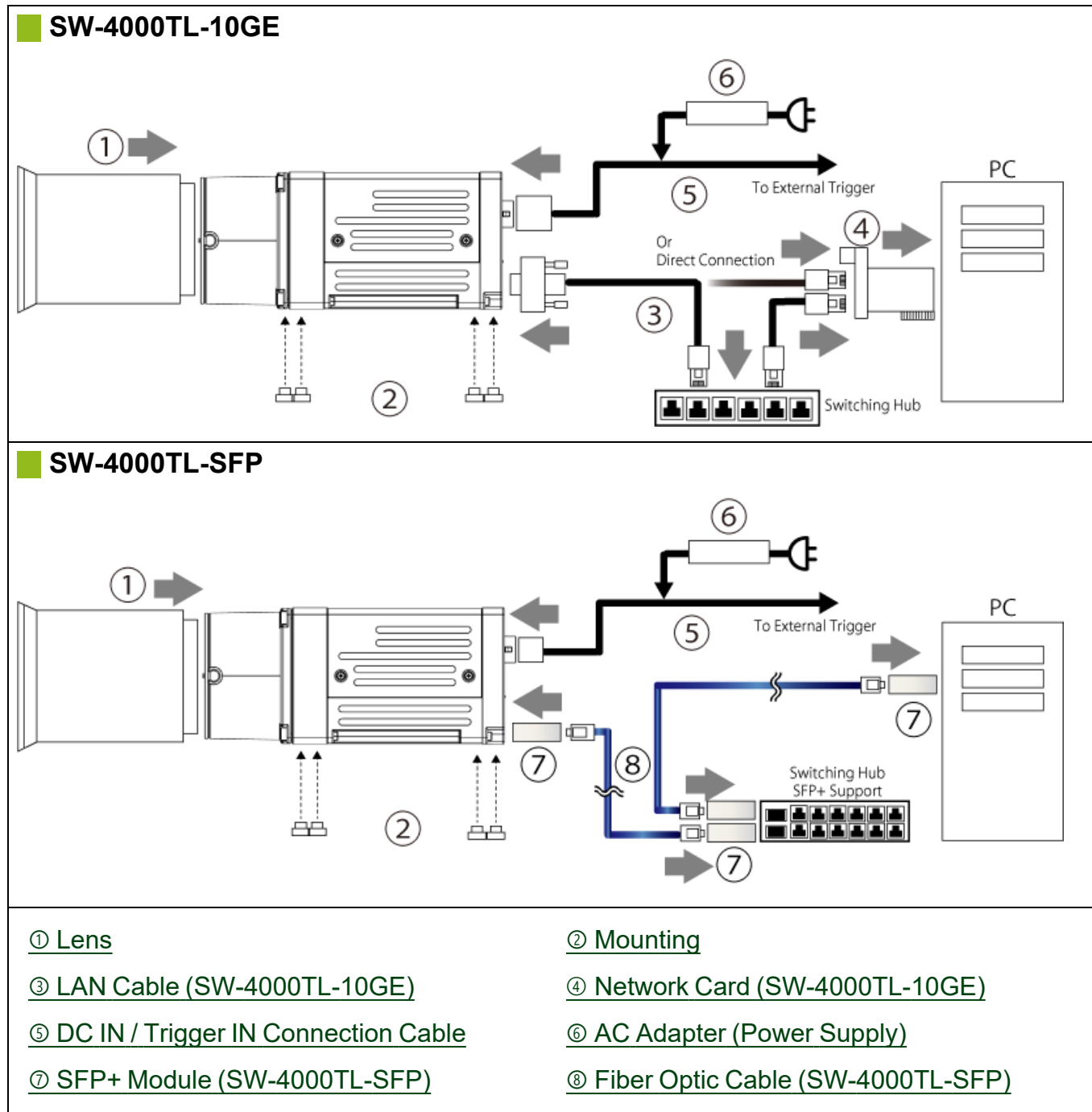
Step 1: Install the Software (First Time Only)

When using the camera for the first time, install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.

Note: When you install eBUS SDK for JAI, eBUS Player for JAI will also be installed.

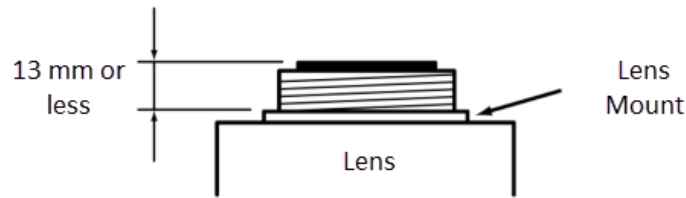
- Download the eBUS SDK for JAI from the JAI website (<https://www.jai.com/support-software/jai-software>).
- Install eBUS SDK for JAI on the computer.

Step 2: Connect Devices



① Lens

F-mount or M-42 mount lenses with lens mount protrusions of 13 mm or less can be attached.



Caution: The maximum performance of the camera may not be realized depending on the lens.

Notes:

The following formula can be used to estimate the focal length.

$$\text{Focal length} = \text{WD} / (1 + \text{W}/\text{w})$$

WD: Working distance (distance between lens and object)

W: Width of object

w: Width of sensor (30.72mm)

② Mounting

When mounting the camera directly to other device, use screws that match the mounting holes on the camera (M3: depth 5mm).

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

③ LAN Cable (SW-4000TL-10GE)

Connect a LAN cable to the RJ-45 connector.

- The camera supports the following Ethernet standards: 1000Base-T, 2.5GBase-T, 5GBase-T, 10GBase-T
- The longest cable length varies depending on the type of LAN cable and the Ethernet standard. Below, the table shows the relationship diagram between LAN cable type and Ethernet standard. Correctly select the LAN cable type according to the Ethernet standard to be used.

Longest Cable Length

	Cat5e	Cat6/Cat6e	Cat6A	Cat7
1000Base-T	100m	100m	100m	100m
2.5GBase-T	100m	100m	100m	100m
5GBase-T	-	100m	100m	100m
10GBase-T	-	55m	100m	100m

- Refer to the specifications of the cable for details on its bend radius.

Caution: See the [Notes on LAN Cable Connection](#) topic as well.

④ Network Card (SW-4000TL-10GE)

Install this in the computer that will be used to configure and operate the camera. Refer to the instruction manual of the network card, and configure settings on the computer as necessary.

⑤ DC IN / Trigger IN Connection Cable

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

⑥ AC Adapter (Power Supply)

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

⑦ SFP+ Module (SW-4000TL-SFP)

Check the operation manual of the SFP+ module to be used, and attach it or remove it from the camera. The SFP+ module can be attached to and removed from the camera only when the camera is turned off.

Cautions:

- Many SFP+ modules and fiber optic cables are Class 1 laser products. Do not look into connectors and cables when installing or removing. There is a risk of injury to eyes.
- Do not exceed the operational temperature of SW-4000TL-SFP and SFP+ module.

⑧ Fiber Optic Cable (SW-4000TL-SFP)

The longest cable length varies depending on the type of 10GBASE-R standard and SFP+ module. Below shows the relationship between fiber optic cable type and 10GBASE-R standard. Correctly select the fiber optic cable type according to the 10GBASE-R standard and SFP+ module to be used.

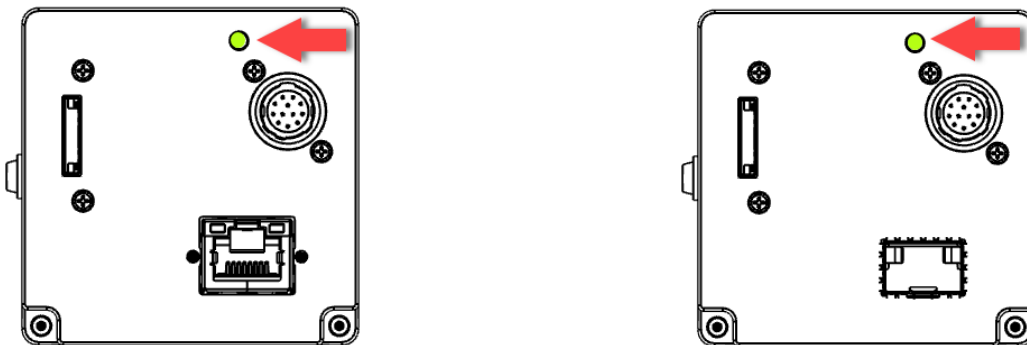
Maximum Fiber Optic Cable Length

- 10GBase-SR : 300m (Fiber optic cable type OM3), 400m (Fiber optic cable type OM4)
- 10GBase-LR : 10km (Fiber optic cable type OS2)
- 10GBase-ER : 40km (Fiber optic cable type OS2)

Step 3: 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.



For details on how to read the LEDs, see the [② POWER/TRIG LED](#) section.

Step 4: Verify the Connection between the Camera and PC

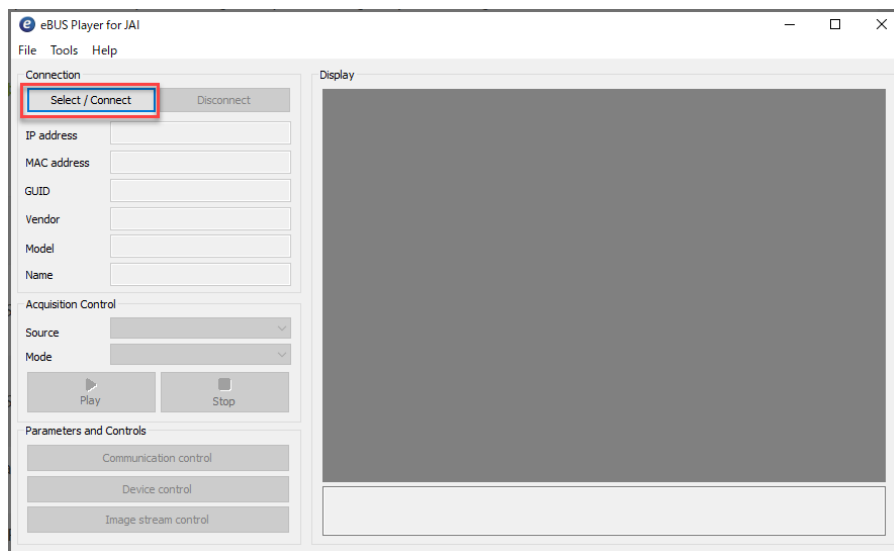
Verify whether the camera is properly recognized via Control Tool.

1. Launch eBUS Player for JAI

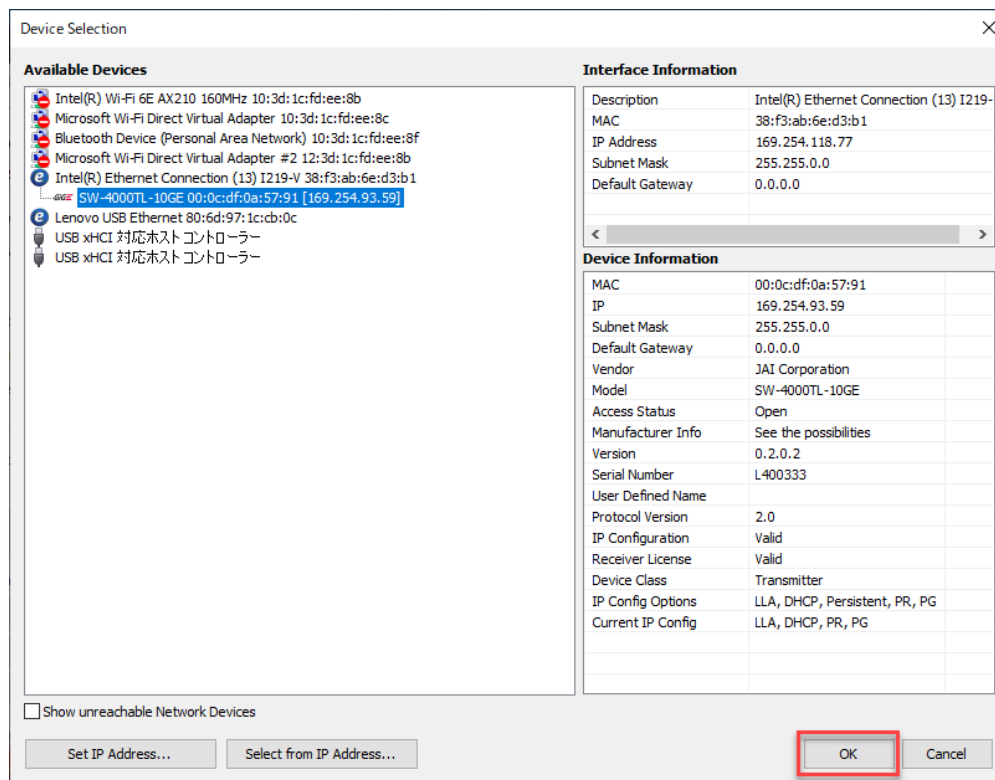


eBUS Player for JAI startup screen appears.

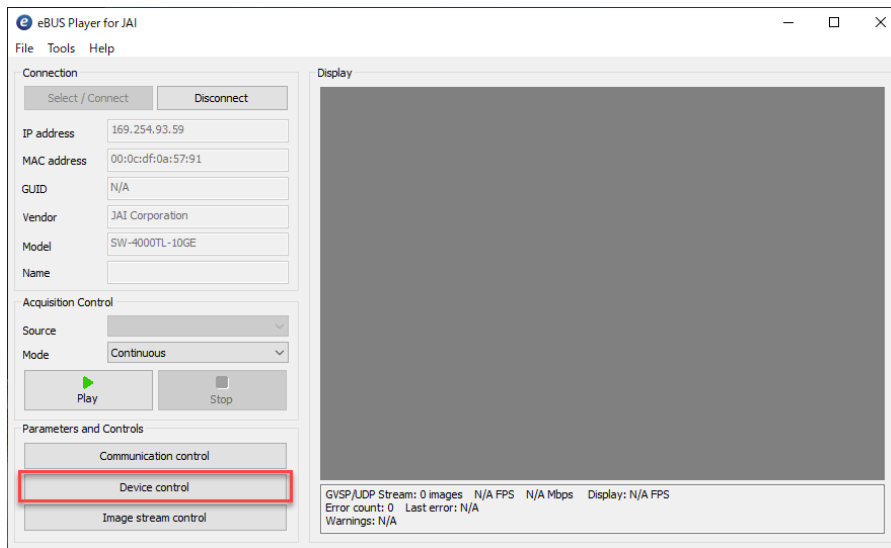
2. Select the camera you want to configure. Click the **Select / Connect** button.



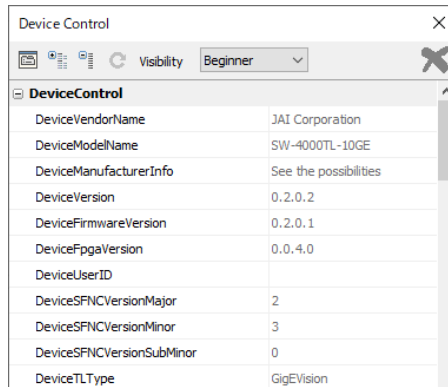
3. The connected camera is listed. Please select one camera and click **OK**.



4. Check that the settings of the selected camera are displayed.



5. Click the **Device control** button. The screen shown below will be displayed. In this window, you can adjust various settings of the camera.



The screenshot shows a window titled "Device Control" with a close button (X) in the top right corner. Below the title bar, there are icons for visibility and a dropdown menu set to "Beginner". The main content area is a table with the following data:

DeviceControl	
DeviceVendorName	JAI Corporation
DeviceModelName	SW-4000TL-10GE
DeviceManufacturerInfo	See the possibilities
DeviceVersion	0.2.0.2
DeviceFirmwareVersion	0.2.0.1
DeviceFpgaVersion	0.0.4.0
DeviceUserID	
DeviceSFNCVersionMajor	2
DeviceSFNCVersionMinor	3
DeviceSFNCVersionSubMinor	0
DeviceTLType	GigEVision

This completes the procedure for verifying whether the camera is properly recognized and whether control and settings configuration are possible.

Step 5: Configure Trigger, Exposure, and Line Rate Settings

Related Setting Items: [AcquisitionControl](#)

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

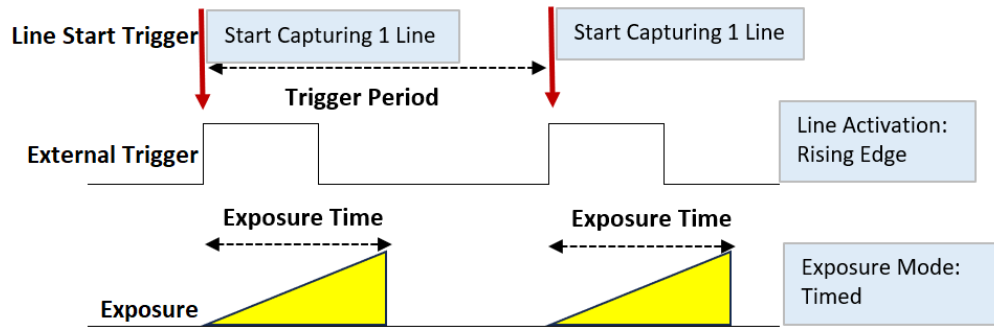
Trigger	Exposure	Setting Example
On	Timed	Control via External Triggers with the Specified Exposure Time
	TriggerWidth	Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal
	Off	Control via External Triggers without Specifying the ExposureTime
Off	Timed	Control without External Triggers with the Specified Exposure Time
	Off	Control without External Triggers without Specifying the Exposure Time

Caution: Because this camera automatically performs several correction functions at startup, the first three lines captured after powering on or resetting the camera will contain incorrect data. To ensure accuracy, you should not use the first three lines acquired after any power-up or reset.

Note: For more information on the Trigger, Exposure and Line Rate settings, see the following topics.

- [Variable Line Rate](#)
- [Exposure Mode, Exposure Time \(Electronic Shutter\)](#)
- [Image Output Timing](#)

Control via External Triggers with the Specified Exposure Time



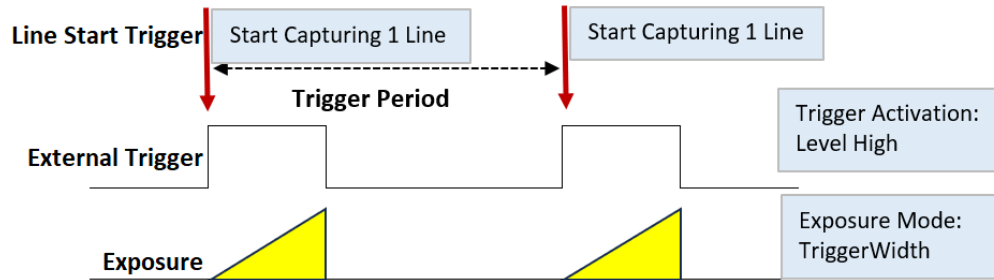
	Item	Setting												
<table border="1"> <tr> <td>TriggerSelector</td> <td>LineStart</td> </tr> <tr> <td>TriggerMode</td> <td>On</td> </tr> <tr> <td>TriggerSource</td> <td>Line4</td> </tr> <tr> <td>TriggerActivation</td> <td>RisingEdge</td> </tr> <tr> <td>ExposureMode</td> <td>Timed</td> </tr> <tr> <td>ExposureTime</td> <td>15149.1 us</td> </tr> </table>	TriggerSelector	LineStart	TriggerMode	On	TriggerSource	Line4	TriggerActivation	RisingEdge	ExposureMode	Timed	ExposureTime	15149.1 us	Trigger Mode	On
	TriggerSelector	LineStart												
	TriggerMode	On												
	TriggerSource	Line4												
	TriggerActivation	RisingEdge												
	ExposureMode	Timed												
	ExposureTime	15149.1 us												
Trigger Selector	Line Start													
Trigger Source	Any													
Trigger Activation	RisingEdge (rising edge of input signal) FallingEdge (falling edge of input signal)													
Exposure Mode	Timed (control via exposure time)													
Exposure Time	Varies depending on settings.													

1. Set **Exposure Mode** to **Timed**. (Timed = Default).
2. Specify the Exposure Time in **Exposure Time**.
3. Set **Trigger Mode** to **On**, and set **Trigger Selector** to **Line Start**.
4. Configure the **Trigger Source** and **Trigger Activation** settings.

Notes:

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

Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal

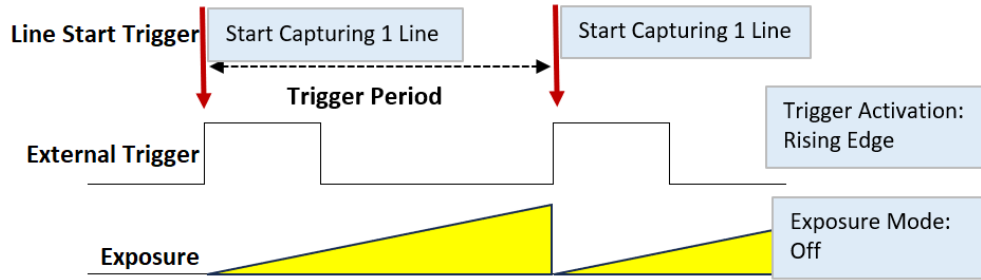


		Item	Setting											
<table border="1"> <tr> <td>TriggerSelector</td> <td>LineStart</td> </tr> <tr> <td>TriggerMode</td> <td>On</td> </tr> <tr> <td>TriggerSource</td> <td>Line4</td> </tr> <tr> <td>TriggerActivation</td> <td>LevelHigh</td> </tr> <tr> <td>ExposureMode</td> <td>TriggerWidth</td> </tr> <tr> <td>ExposureTime</td> <td>{Not available}</td> </tr> </table>	TriggerSelector	LineStart	TriggerMode	On	TriggerSource	Line4	TriggerActivation	LevelHigh	ExposureMode	TriggerWidth	ExposureTime	{Not available}	Trigger Mode	On
	TriggerSelector	LineStart												
	TriggerMode	On												
	TriggerSource	Line4												
	TriggerActivation	LevelHigh												
	ExposureMode	TriggerWidth												
ExposureTime	{Not available}													
Trigger Source	Any													
Trigger Activation	LevelHigh (high-level duration) LevelLow (low-level duration)													
Exposure Mode	TriggerWidth (control via trigger width)													

1. Set **Trigger Mode** to **On**.
2. Set **Exposure Mode** to **TriggerWidth**.
3. Configure the **Trigger Source** and **Trigger Activation** settings, if necessary.

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

Control via External Triggers without Specifying the ExposureTime



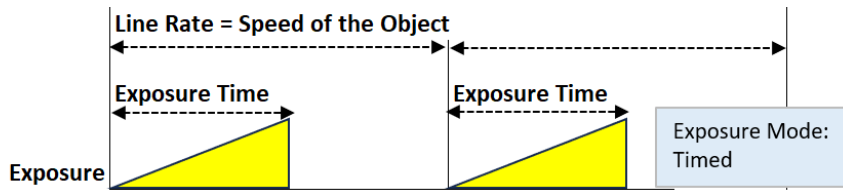
		Item	Setting
TriggerSelector	LineStart	Trigger Mode	On
TriggerMode	On	Trigger Source	Any
TriggerSource	Line4	Trigger Activation	RisingEdge (rising edge of input signal) FallingEdge (falling edge of input signal)
TriggerActivation	RisingEdge	Exposure Mode	Off
ExposureMode	Off		
ExposureTime	{Not available}		

1. Set **ExposureMode** to **Off**.
2. Set **TriggerMode** to **On**.
3. Configure the **Trigger Source** and **Trigger Activation** settings, if necessary.

Notes:

- When using external triggers, the line rate is determined by the trigger period.
- The exposure will be performed with an exposure time equal to 1 / line rate.

Control without External Triggers with the Specified Exposure Time



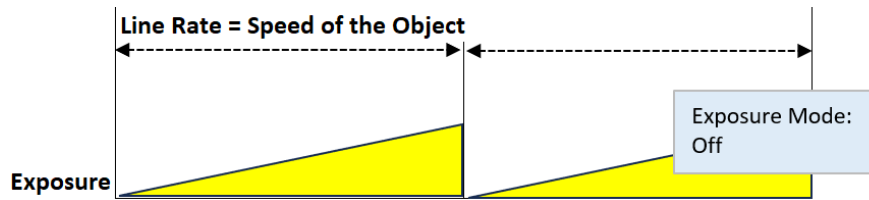
		Item	Setting
AcquisitionLineRate	66 Hz	Trigger Mode	Off
TriggerSelector	AcquisitionStart	Exposure Mode	Timed (control via exposure time)
TriggerMode	Off	Exposure Time	Varies depending on settings.
TriggerSource	Line4	Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.
TriggerActivation	RisingEdge		
ExposureMode	Timed		
ExposureTime	15149.1 us		

1. Set **Exposure Mode** to **Timed**. (Timed = Default).
2. Set **Trigger Mode** to **Off**. (Off = Default)
3. Specify a line period slower than the exposure time in **Acquisition Line Rate**.
4. Specify the exposure time in **Exposure Time**.

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.

Control without External Triggers without Specifying the Exposure Time



		Item	Setting
AcquisitionLineRate	66 Hz	Trigger Mode	Off
TriggerSelector	AcquisitionStart		
TriggerMode	Off		
TriggerSource	Line4	Exposure Mode	Off
TriggerActivation	RisingEdge	Acquisition Line Rate	Varies depending on the PixelFormat and Link speed.
ExposureMode	Off		
ExposureTime	{Not available}		

1. Set **TriggerMode** to **Off**.
2. Set **Exposure Mode** to **Off**. (Off =Default)
The exposure will be performed with an exposure time equal to 1 / line rate.
3. Specify a line period in **Acquisition Line Rate**.

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.

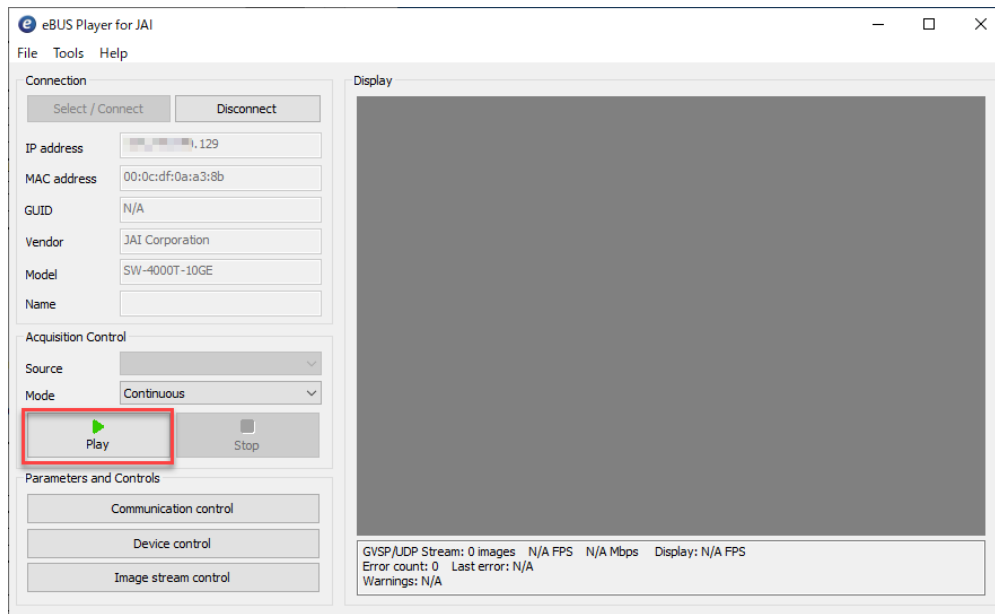
Step 6: Adjust the Image Quality

Related Setting Items: [AnalogControl](#)

Display the camera image and adjust the image quality.

Display the Image

Display the image captured by the camera. When you click the **Play** button, the camera image appears in the right area.



Note: It is recommended to set **GevGVCPPendingAck** in [TransportLayerControl](#) to True. When a time-consuming process such as white balance is performed, this camera returns an Ack response when the process is completed. In this case, some camera control software may cause a timeout error without waiting for an Ack response from the camera. When the **GevGVCPPendingAck** setting is enabled, if a time-consuming process is performed, the camera immediately returns a Pending Ack response and returns an Ack response when the processing is completed. The Timeout errors are prevented.

Configure Basic Settings

To maximize the performance of the camera, configure its basic function in the following order.

1. Perform DSNU and PRNU corrections.

For more information, see [Pixel Sensitivity Correction](#).

2. Adjust the Black Level.

For more information, see [Black Level Correction](#).

3. Adjust the White Balance using the automatic adjustment function.

- a. 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. The white balance is automatically adjusted.

- b. Select the **BalanceWhiteAuto** tab, and select **Once**.

The white balance is automatically adjusted.

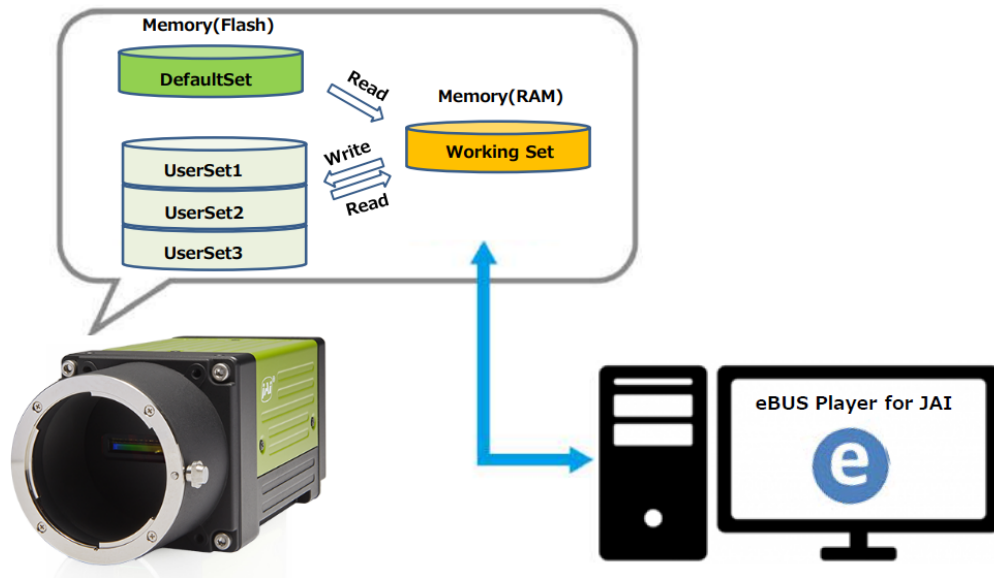
4. Perform spatial correction.

For details on this setting, see [“Spatial Compensation”](#).

Step 7: 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)

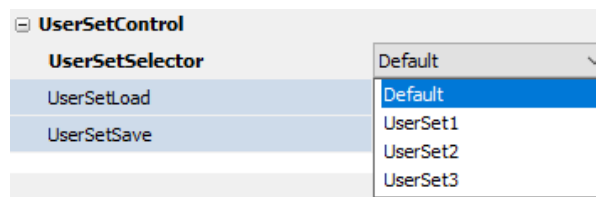


Notes:

- Changes to settings are not saved to the computer (eBUS SDK for JAI).
- 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

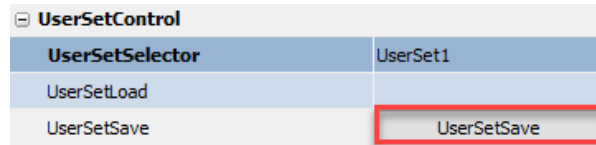
1. Stop image acquisition.
2. Expand **UserSetControl** and select the save destination (UserSet1 to UserSet3) in UserSetSelector.



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.

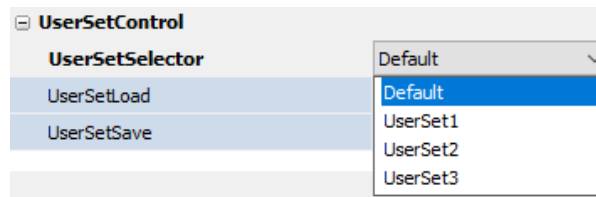
3. Select **UserSetSave** and click the **UserSetSave** button.



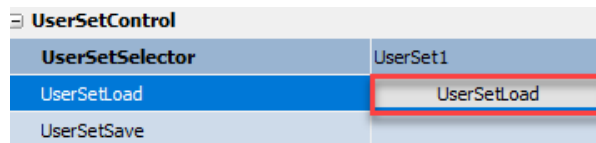
4. The current setting values are saved as user settings.

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.

Basic Function Matrix

Valid Input / Output Combinations

The following signals can be used as sources for each output destination (Trigger Selector, Line Selector, Pulse Generator Selector).

The combinations of source signals and output destinations are indicated in the following.

	Output destination														
	Trigger Selector					Line Selector						Pulse Generator Selector			
	Acquisition Start	Acquisition End	Frame Start	Line Start	Frame Transfer Start	Line1 TTL Out 1	Line8 TTL Out 2	Line9 TTL Out 3	Line12 TTL Out 4	Logic Block 0	Logic Block 1	Pulse Generator 0	Pulse Generator 1	Pulse Generator 2	Pulse Generator 3
Signals to use as output	Line4 TTL In 1	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	Line5 Opt In 1	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	Line10 TTL In 2	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	Line13 TTL In 3	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	UserOutput0	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	UserOutput1	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	UserOutput2	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	UserOutput3	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	Action0	>	>	>	>	>									
	Action1	>	>	>	>	>									
	Action2	>	>	>	>	>									
	Action3	>	>	>	>	>									
	PulseGenerator0	>	>	>	>	>	>	>	>	>	>				
	PulseGenerator1	>	>	>	>	>	>	>	>	>	>				
	PulseGenerator2	>	>	>	>	>	>	>	>	>	>				
	PulseGenerator3	>	>	>	>	>	>	>	>	>	>				
	Encoder Trigger	>	>	>	>	>	>	>	>	>	>	>	>	>	>
	Encoder Direction						>	>	>	>					
	Logic Block 0	>	>	>	>	>	>	>	>	>		>	>	>	>
	Logic Block 1	>	>	>	>	>	>	>	>	>	>		>	>	>
Acquisition Active						>	>	>	>	>					
Exposure Active						>	>	>	>	>		>	>	>	
LVAL						>	>	>	>	>		>	>	>	
		Trigger Selector				Line Selector						Pulse Generator Selector			
		Use													

GPIO (Digital Input/Output Settings)

Related Setting Items: [DigitalIOControl](#)

The camera can input/output the following signals to and from external input/output connectors.

External Output	Line1 TTL Out 1	DC IN / TRIG IN Connector (12-pin)
	Line8 TTL Out 2	AUX Connector (10-pin)
	Line9 TTL Out 3	
	Line12 TTL Out 4	DC IN / TRIG IN Connector (12-pin)
External Input	Line4 TTL In 1	DC IN / TRIG IN Connector (12-pin)
	Line5 Opt In 1	DC IN / TRIG IN Connector (12-pin)
	Line10 TTL In 2	
	Line13 TTL In 3	AUX Connector (10-pin)

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.

Signals are selected as follows.

- When using external signals or the signals of each GPIO module as trigger signals:
Select in **TriggerSource** [TriggerSelector] ([AcquisitionControl](#)).
- When selecting the signals to use for external outputs:
Select in **LineSource** [LineSelector] ([DigitalIOControl](#)).

Camera Output Formats

Related Setting Items: [ImageFormatControl](#)



Technical Notes

Pixel Format Alignments for GigE Vision

This camera supports the following output formats.

- RGB8
- RGB10V1Packed
- RGB10p32
- YUV422_8_UYVY
- YUV422_8

Exposure Mode

Related Setting Items: [AcquisitionControl](#)

The following operation modes are available on the camera.

Operation Mode	
Exposure Mode	Trigger Mode
OFF	OFF
	ON
Timed	OFF
	ON
TriggerWidth	ON

Exposure Time (Electronic Shutter)

Related Setting Items: [AcquisitionControl](#)

When you use this function, you can set the exposure to a preconfigured accumulation time, regardless of the line rate.

- Variable range: 3 μ s to 15.149 ms
- Variable unit: 0.01 μ s (1clk)
- Supported operation modes: When Trigger Mode ON, Exposure Mode Timed

Caution: In “Trigger Mode Off, Exposure Mode Timed” mode, the line rate configured will be the maximum value at which the shutter operates. However, in “Trigger Mode ON, Exposure Mode Timed” mode, the input trigger period will be the maximum value.

Note: You can also save the setting, and have it applied whenever the power is subsequently turned on, but this requires additional operations.

Image Output Timing

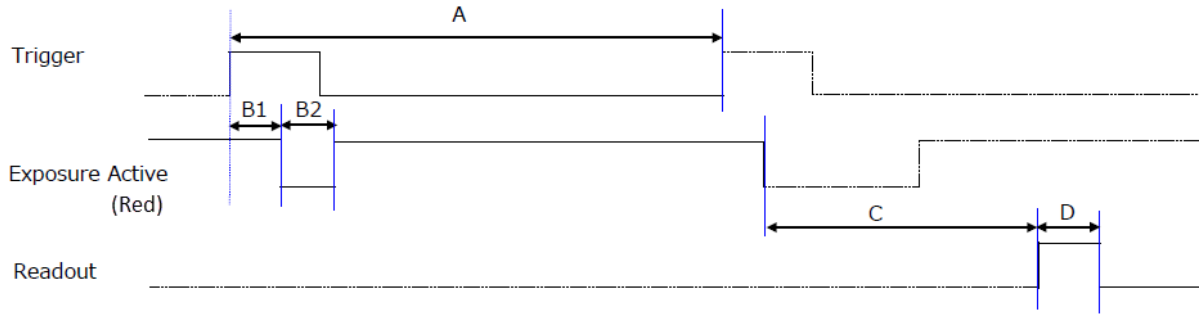
Related Setting Items: [AcquisitionControl](#)

Trigger Control

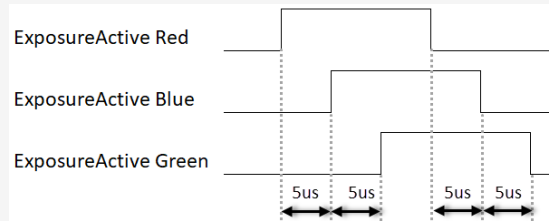
In this camera, the following control is performed by the external trigger signal.

Trigger Selector	Description
Acquisition Start	Imaging of one frame is started by input of external trigger signal.
Acquisition End	Start image acquisition in response to the external trigger signal input.
Frame Start	Stop image acquisition in response to the external trigger signal input.
Frame Transfer Start	Output acquired images at a specified timing in response to an external trigger signal input. There is a limit to the number of image frames that can be stored internally. The limits for each image format are as follows. Acquired images must be output to avoid exceeding these limits. Example : (PixelFormat RGB8, Width 4096, Height 4096) It is possible to hold 4 frames of images.
Line Start	Imaging of one line is started by input of external trigger signal.

ExposureMode: Off



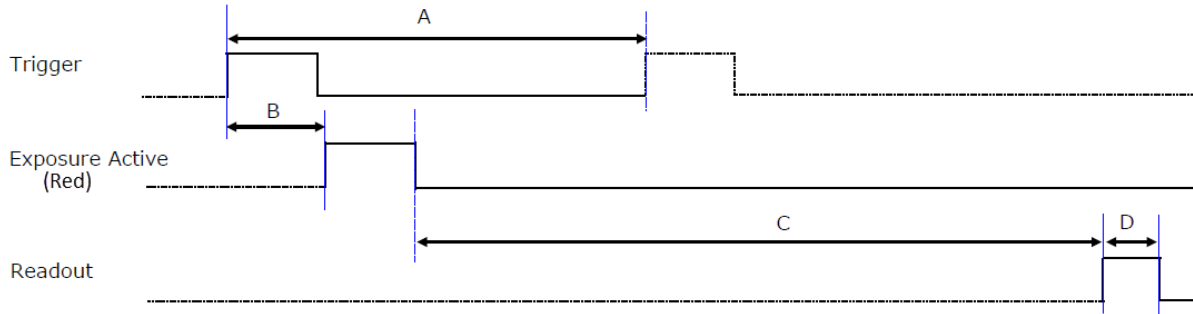
Note: Exposure Active in the figure above shows the waveform of the Red channel. The exposure timing delay for R, G, and B channels is 5.0us for each color (see below).



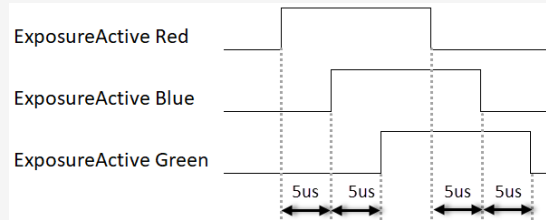
Pixel Format	Width	Trigger Period [A] (μs) (*)	Delay Time from Trigger to Exposure Active (Red) [B1] (μs)	Exposure Active Non Active (Red) [B2] (μs)	Period from Exposure Active Falling (Red) to LVAL rising[C] (μs)	LVAL Active[D] (μs)
RGB8	4096	15.02	0.3	3.8	42.9	6.56
	2048	15.02	0.3	3.8	38.2	3.28
	16	15.02	0.3	3.8	33.6	0.03
RGB10V1Packed	4096	15.02	0.3	3.8	42.9	6.56
	2048	15.02	0.3	3.8	38.2	3.28
	16	15.02	0.3	3.8	33.6	0.03
RGB10p32	4096	15.02	0.3	3.8	42.9	6.56
	2048	15.02	0.3	3.8	38.2	3.28
	16	15.02	0.3	3.8	33.6	0.03
YUV422_8	4096	15.02	0.3	3.8	42.9	6.56
	2048	15.02	0.3	3.8	38.2	3.28
	16	15.02	0.3	3.8	33.6	0.03
YUV422_8_UYVY	4096	15.02	0.3	3.8	42.9	6.56
	2048	15.02	0.3	3.8	38.2	3.28
	16	15.02	0.3	3.8	33.6	0.03

Note: *H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

ExposureMode: Timed



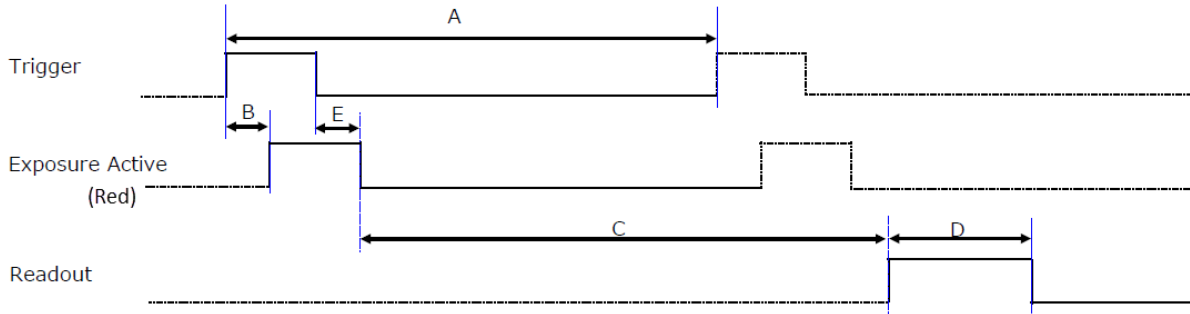
Note: Exposure Active in the figure above shows the waveform of the Red channel. The exposure timing delay for R, G, and B channels is 5.0us for each color (see below).



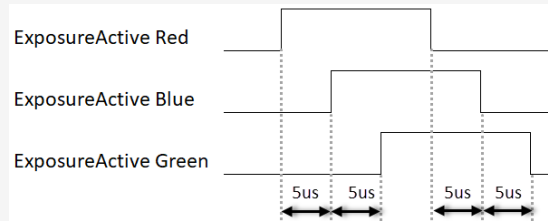
Pixel Format	Width	Trigger Period[A] (μs) (*)	Delay Time from Trigger Rising to Exposure Active Rising (Red) [B] (μs)	Period from Exposure Active Falling to LVAL rising[C](μs)	LVAL Active[D] (μs)
RGB8	4096	15.02	0.3	42.9	6.56
	2048	15.02	0.3	38.2	3.28
	16	15.02	0.3	33.6	0.03
RGB10V1Packed	4096	15.02	0.3	42.9	6.56
	2048	15.02	0.3	38.2	3.28
	16	15.02	0.3	33.6	0.03
RGB10p32	4096	15.02	0.3	42.9	6.56
	2048	15.02	0.3	38.2	3.28
	16	15.02	0.3	33.6	0.03
YUV422_8	4096	15.02	0.3	42.9	6.56
	2048	15.02	0.3	38.2	3.28
	16	15.02	0.3	33.6	0.03
YUV422_8_UYVY	4096	15.02	0.3	42.9	6.56
	2048	15.02	0.3	38.2	3.28
	16	15.02	0.3	33.6	0.03

Note: *H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

ExposureMode: TriggerWidth



Note: Exposure Active in the figure above shows the waveform of the Red channel. The exposure timing delay for R, G, and B channels is 5.0us for each color (see below).



Pixel Format	Width	Trigger Period [A] (μs) (*)	Delay Time from Trigger Rising to Exposure Active Rising (Red) [B](μs)	Period from Exposure Active Falling (Red) to LVAL rising[C](μs)	LVAL Active[D] (μs)	Delay Time from TriggerFalling to Exposure Active Falling (Red) [E] (μs)
RGB8	4096	15.02	0.3	42.9	6.56	0.3
	2048	15.02	0.3	38.2	3.28	0.3
	16	15.02	0.3	33.6	0.03	0.3
RGB10V1Packed	4096	15.02	0.3	42.9	6.56	0.3
	2048	15.02	0.3	38.2	3.28	0.3
	16	15.02	0.3	33.6	0.03	0.3
RGB10p32	4096	15.02	0.3	42.9	6.56	0.3
	2048	15.02	0.3	38.2	3.28	0.3
	16	15.02	0.3	33.6	0.03	0.3
YUV422_8	4096	15.02	0.3	42.9	6.56	0.3
	2048	15.02	0.3	38.2	3.28	0.3
	16	15.02	0.3	33.6	0.03	0.3
YUV422_8_UYVY	4096	15.02	0.3	42.9	6.56	0.3
	2048	15.02	0.3	38.2	3.28	0.3
	16	15.02	0.3	33.6	0.03	0.3

Note: *H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

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.

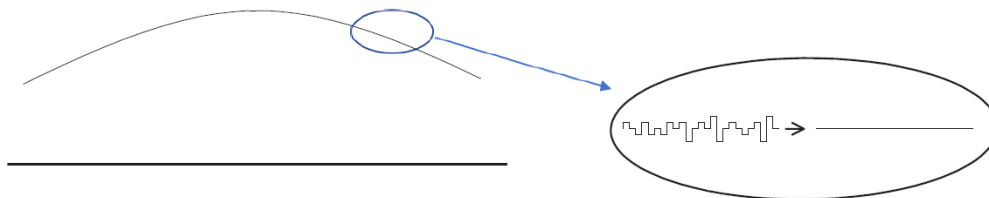
Notes:

- 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 line rate setting is 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.

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.



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

Note: You cannot perform calibration when **Off** or **Default** is selected.

- Gain correction data is automatically generated by **CalibratePixelGainCorrection** and saved in the user area specified in step 1.
- You can check the execution result of gain correction by **PixelGainCalibrationResult**.

Caution: This camera may take several minutes to complete PRNU correction.

Notes:

- The lens aperture should be set so that the video level is between saturation and 80% of the saturation level.
- The lens should be defocused.
- The subject should be a white, flat surface (such as a sheet of white paper).

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.



- Specify the user area (User1 ~ User3) to save the black level correction value with **PixelBlackCorrectionMode** ([Correction](#)).

Note: You cannot perform calibration when **Off** or **Default** is selected.

- Black level correction data is automatically generated by **CalibratePixelBlackCorrection** and saved in the user area specified in step 1.
- You can check the execution result of black level correction by **PixelBlackCalibrationResult**.

Gain Control

Related Setting Items: [AnalogControl](#)

The following gain functions are available on the camera: Analog Base Gain and Digital Gain.

Analog Base Gain

Analog base gain (ABG) is gain that is performed 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).

Digital Gain

Two digital gain control modes are available; a mode where you adjust the master gain and then perform fine adjustment for R and B (MasterMode), and a mode where R, G, and B gain are adjusted individually (IndividualMode).

MasterMode: Set **IndividualGainMode** to **Off**, and adjust the gain by configuring the following three items.

DigitalAll	× 1 ~ × 32 (0 dB ~ 30 dB)
DigitalRed	× 0.4 ~ × 4.0 (-7.96 dB ~ 12 dB)
DigitalBlue	

Individual Mode: Set **IndividualGainMode** to **On**, and adjust the gain by configuring the following three items.

DigitalGreen	× 1 ~ × 64 (0 dB ~ 36 dB)
DigitalRed	
DigitalBlue	

Notes:

- The following two gain values are added together for the total gain value.
Total Gain = AnalogBaseGain (dB) + DigitalGain (dB)
- In the IndividualGainMode, only AWB Once and AGC Once can be executed.

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).

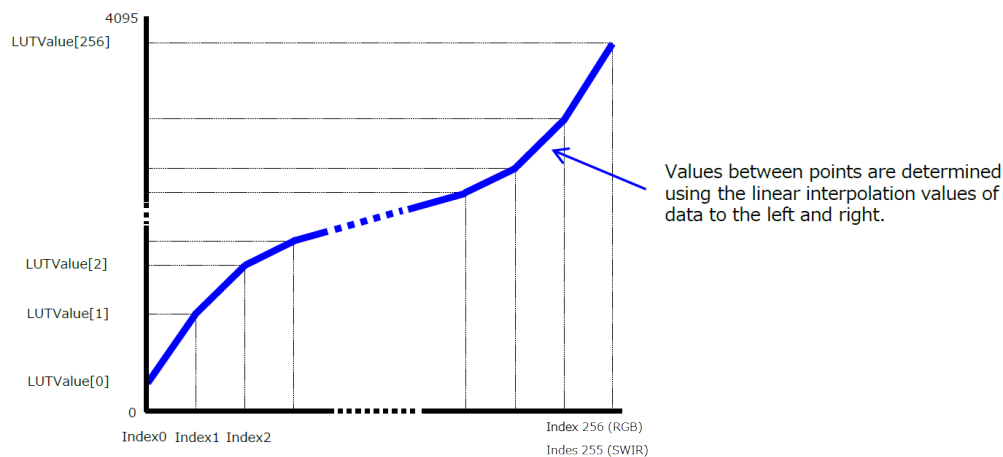
To Use the LUT Function

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
LUTSelector	Red, Green, Blue	Select the LUT channel to control.
LUTIndex	0 ~ 256	Select the LUT index to configure. 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.
LUTValue	0 ~ 4095	Set the LUT output value for the selected index.

LUT Value

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.

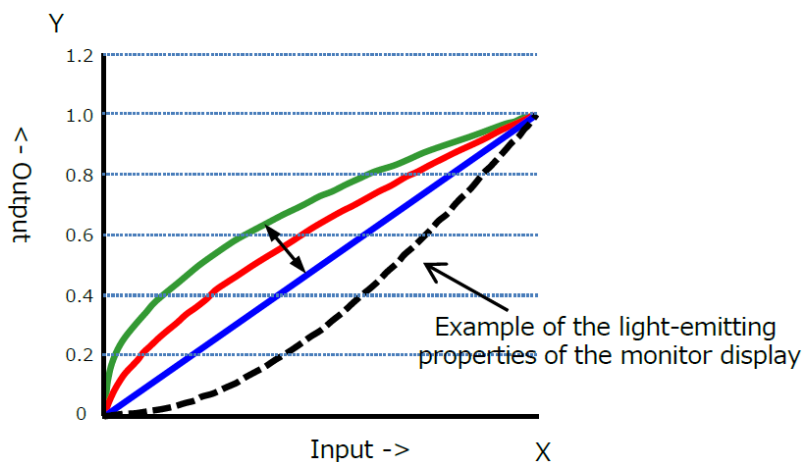


Gamma Function

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

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
Gamma	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0	Select the Gamma correction value.
LUTMode	Gamma	Use Gamma.

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

Shading Correction

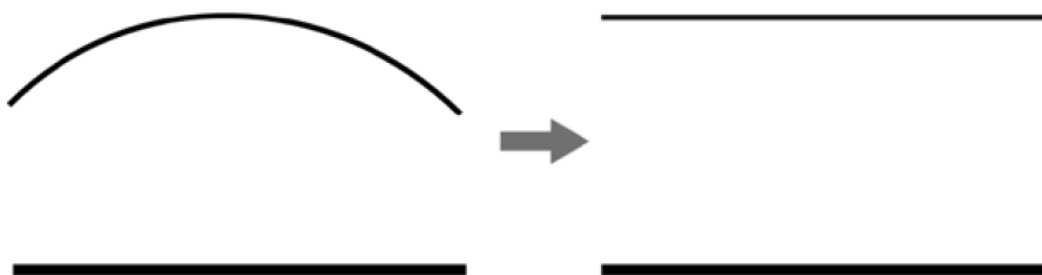
Related Setting Items: [Shading](#)

The ShadingCorrection function corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment.

The following shading correction modes are available on the camera.

FlatShading

Correct so that the part with the highest luminance level in the screen is taken as the reference and the other part is adjusted to this luminance level.

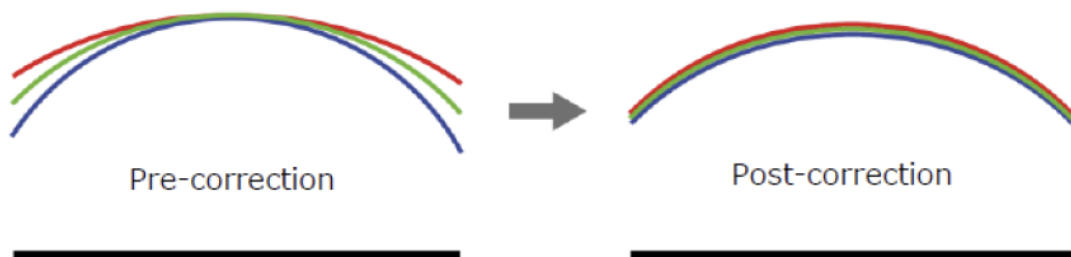


Notes:

- Complete correction may not be possible depending on the optical system and light source you are using.
- Data based on corrections performed under factory conditions is stored for this function.

ColorShading

R-channel and B-channel properties are adjusted by using the G-channel shading properties as a reference.



To Use the Shading Correction Function

The function is turned ON/OFF via serial communication. This function is not dependent on the operation mode but is effective when used during actual use.

Note: You can save the setting, and have it applied whenever the power is subsequently turned on. For details on saving the setting, see [Step 7: Save the Settings](#).

1. Select the shading correction mode (**FlatShading** or **ColorShading**) in **ShadingCorrectionMode**.
2. In **ShadingMode**, select the user area (User1 - 3) where you save the shading correction data.

Note: You cannot perform calibration when **Off** is selected.

3. Display a white chart under a uniform light and execute **CalibrateShadingCorrection**.

Cautions:

- For Flat Shading and Color Shading, the maximum correction gain amount is limited to 8 times the gain amount before correction in all pixels.
- If the highest luminance level in the image is 175 LSB (10 bit image output) or less, it can not be corrected correctly.

Black Level Correction

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.

- All: Min = -133, Max = 255 (LSB@12bit)
- Red: Min = -64, Max=64 (LSB@12bit)
- Blue: Min = -64, Max=64 (LSB@12bit)

Variable Line Rate

Related Setting Items: [AcquisitionControl](#)

You can set the line rate to up to 1 line cycle. 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.

Variable Range	<ul style="list-style-type: none"> • RGB8: 66 Hz* ~ 66 kHz <p>Note: *When taking a trigger signal from the outside, there is no limitation on the minimum value.</p>
Variable Unit	<ul style="list-style-type: none"> • 0.1Hz
Supported Operation Modes	<ul style="list-style-type: none"> • Exposure Mode = OFF / TriggerMode = Off • ExposureMode = Timed / TriggerMode = Off

Notes:

- You can also save the setting, and have it applied whenever the power is subsequently turned on, but this requires additional operations.
- Switching and settings storage for this function is performed via serial communication.
- 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.
- The maximum line rates for 1GigE, 2.5GigE, and 5GigE are shown below.
 - 1GigE: 9KHz
 - 2.5GigE: 24Khz
 - 5GigE: 49Khz

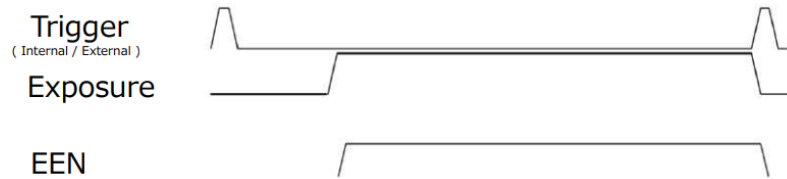
ExposureActive (EEN) Function

Related Setting Items: [AcquisitionControl](#)

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.

■ Example: Output to the DIGITAL I/O-1 video output connector (Camera Link)



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, including XYZ and HSI. Five color spaces are available: RGB(sRGB), RGB(AdobeRGB), RGB(UserCustom), XYZ, and HSI. Specify the desired color space by configuring ColorTransformationMode and ColorTransformationRGBMode as follows.

Note: This function is valid only when PixelFormat is RGB8, RGB10V1Packed, RGB10p32.

ColorTransformation	ColorTransformationMode	ColorTransformationRGBMode
RGB (sRGB)	RGB	sRGB
RGB (AdobeRGB)	RGB	AdobeRGB
RGB (UserCustom)	RGB	UserCustom
XYZ	XYZ	Off
HSI	HSI	Off
Default	RGB	Off

Caution: If you set the color space to XYZ or HSI, eBUS Player for JAI 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.

Note: About Color Space HSI

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

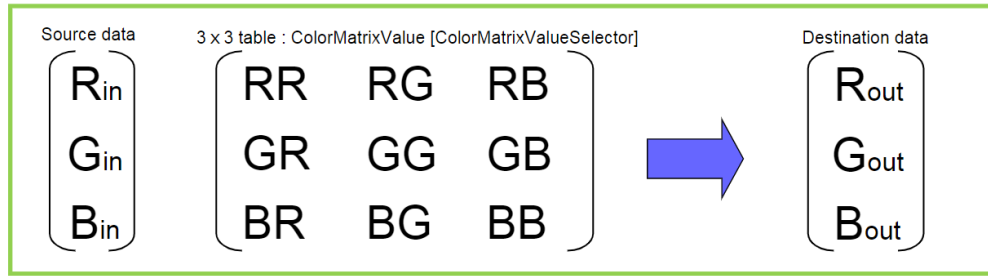
- 8bit output: Can be specified in 2° increments - 0°(00000000) ~ 360°(10110100)
- 10bit output: Can be specified in 0.5° increments- 0°(0000000000) ~ 360°(1011010000)

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

- 8bit output: 0% (00000000) ~ 100% (11111111)
- 10bit output: 0% (000000000) ~ 100% (1111111111)

Note on RGB (UserCustom)

This allows you to use user-configured 3x3 conversion tables to perform color space conversion.



Configuration 3x3 table

1. Specify one of the nine items that are the components to the 3×3 conversion table in **ColorMatrixValueSelector**.
2. Specify a value from -2 to +2 in **ColorMatrixValue**.

See [ColorTransformationControl](#) for detailed information on the setting items.

Test Pattern Function

Related Setting Items: [ImageFormatControl](#)

You can display the following test patterns (White, GreyPattern1(Ramp), GreyPattern2(Stripe), ColorBar). Video output is not possible while a test pattern is being executed. This function is not dependent on gain and offset values that have already been configured, and output is performed in the following states.

Note: This function cannot be saved as the initial state of the camera.

Counter and Timer Control Function

Related Setting Items: [CounterAndTimerControl](#)

Note: This camera supports only the counter function.

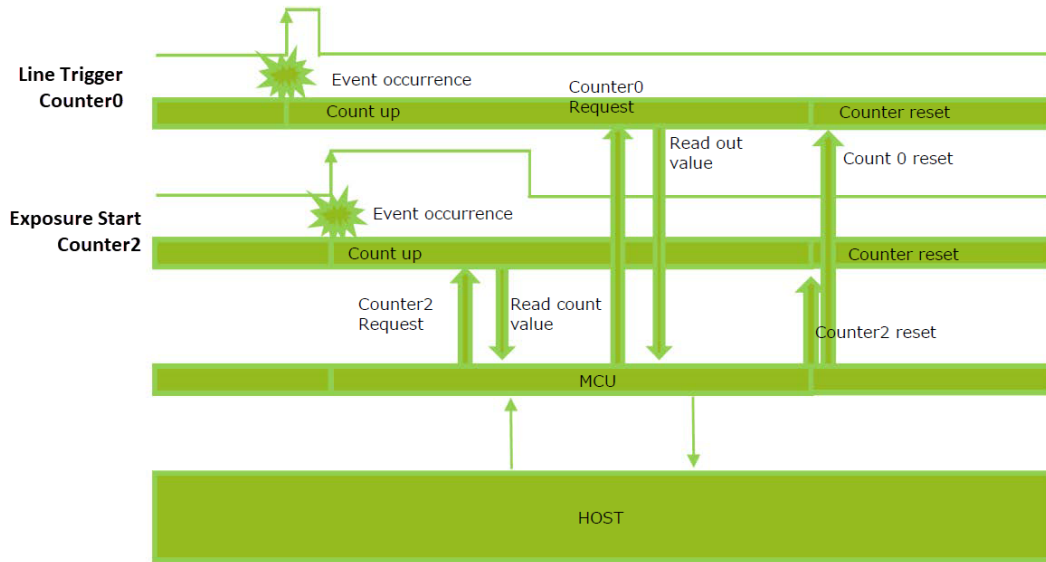
The Counter function counts up change points in the camera's internal signals using the camera's internal counter and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.

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

Counter	Description
Counter0	Count the number of Line Trigger instances.
Counter1	Count the number of Line Start instances.
Counter2	Count the number of Exposure Start instances.
Counter3	Count the number of Frame Trigger instances.
Counter4	Count the number of Frame Start instances.
Counter5	Count the number of Frame Transfer End instances.

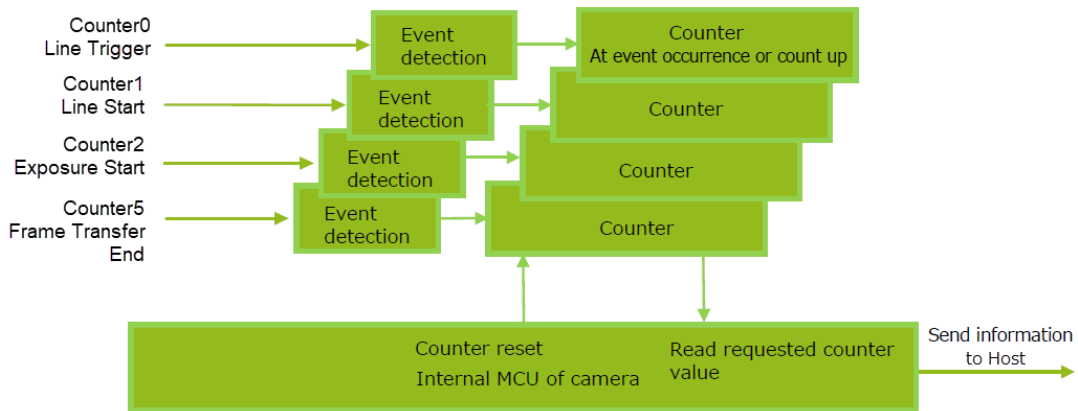
When a problem occurs in a system that includes this camera, comparing the values from multiple counters allows you to verify the extent of normal operability and can be useful when investigating the cause of the problem.

Counter Occurrence Diagram



Note: You can reset a specific counter's count value by executing CounterReset[Counter0, Counter1, Counter2, Counter3, Counter4, Counter5].

Internal Camera Blocks



To Use the Counter Function

Configure the settings as follows.

Eight counters are available. Specify a counter (Counter0 to Counter7), and configure the settings.

Item	Setting Value Selectable Range	Description
Counter 0 ~ 7	Counter 0 ~ 5	Select the counter.
CounterEventSource	Counter0: Off, Line Trigger Counter1: Off, Line Start Counter2: Off, Exposure Start Counter3: Off, Frame Trigger Counter4: Off, Frame Start Counter5: Off, Frame Transfer End	Select the Counter Event signal for which to read the count value. When set to Off, the counter operation will stop (but will not be reset).
CounterEventActivation	Counter0 ~ 4: Rising Edge Counter5: Falling Edge	Specify the timing at which to count. This setting is fixed.

Tilted View Correction and Chromatic Aberration Correction

Related Setting Items: [Correction](#)



Technical Notes

Lateral Chromatic Aberration Compensation Function

This camera features a tilted view correction function.

The G channel, B channel, and R channel are positioned in that order on the sensor used on this camera. The G channel and R channel are corrected using the B channel in the middle as a reference. The user can adjust the amount of correction to capture the best possible image based on the angle of the camera in relation to the subject, the distance between the camera and the subject, the lens used, and other factors.

The tilted view correction function also corrects for the chromatic aberration of magnification caused by the lens (i.e., when the size of the image differs at the focal point for each color (RGB)). You can save correction data for three types of lenses. This function assumes that the amount of deviation between the left and right is identical. If the amount of deviation between the left and right is not identical, correction will not be performed properly. Specify the number of pixels to delay or advance the R channel and B channel using the G channel as a reference. The correction range is -4.0 to $+4.0$ in steps of 0.1 .

Adjustment Procedure

1. Enable the chromatic aberration of magnification correction function. Set **Chromatic Aberration Correction Mode** to **Lens1**, **Lens2**, or **Lens3**.
2. Correct the R channel. Set **ChromaticAberrationCorrectionSelector** to **RChannel**. Specify the amount of correction in **ChromaticAberrationCorrectionLens1,2,3** (-4.0 to $+4.0$ in steps of 0.1).
3. Similarly, correct the B channel. Set **ChromaticAberrationCorrectionSelector** to **BChannel**. Specify the amount of correction in **ChromaticAberrationCorrection** (-4.0 to $+4.0$ in steps of 0.1).

Spatial Compensation

Related Setting Items: [SpatialControl](#)



Technical Notes

Spatial compensation adjustment for trilinear cameras

This function corrects the spatial pixel differences individually for the R, G, and B lines captured by the trilinear line sensor.

Two modes are available; Manual and Auto.

■ Configuring settings for SpatialCompensationMode: Manual

You can configure the number of pixels to correct individually for the R, G, and B lines. To do so, configure the SpatialCompensationR, SpatialCompensationG, and SpatialCompensationB values.

■ Configuring settings for SpatialCompensationMode: Auto

In this mode, the number of pixels to correct individually for the R, G, and B lines is calculated automatically using the trigger interval at which the camera operates, the amount of movement in pixels of the imaging subject within the sensor during a single trigger (SpatialCompensationDistance), and the movement direction (Object Direction) signal of the subject.

The object direction signal is used to obtain the direction of the imaging subject. The direction signal from the rotary encoder, the I/O signal input of the camera, or the high/low control signal from the software can be used as the object direction signal.

Connecting Rotary Encoders

Related Setting Items: [EncoderControl](#)

This camera can generate trigger signals or detect the scanning direction of the subject in response to signals output from the rotary encoder.

Adjustment Procedure

1. Input the two signals (phase A and phase B) from the rotary encoder. Select which I/O on the camera (Line5:OptIn1, Line4:TTLIn1, Line10:TTLIn2, Line13:TTLIn3) you want to input each of the two outputs from the rotary encoder phase A (**EncoderSourceA**), phase B (**EncoderSourceB**).
2. Specify the number of triggers (number of vertical lines) to generate during each rotation of the rotary encoder. When **EncoderDivider** is set to **N**, the rotary encoder generates $65536/N$ triggers.
 - 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.

Note: If the time interval of the output of the rotary encoder fluctuates greatly, the output of the camera 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.

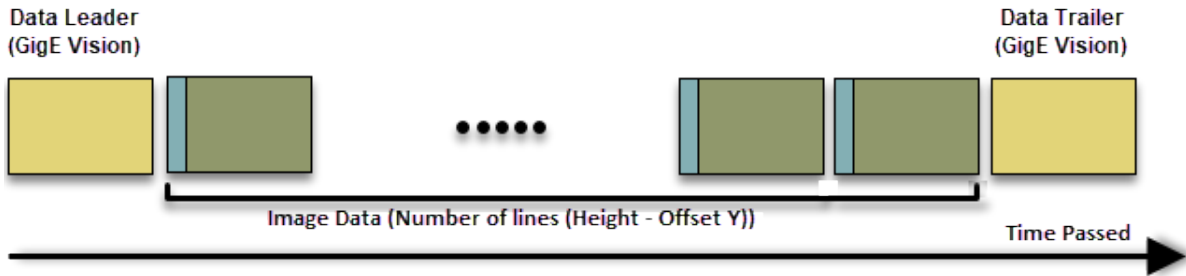
3. If necessary, enable the low-pass filter for the signal to prevent unintended operations due to signal noise from the rotary encoder. Specify the number of cycles from a range of 0 to 15 (0 to 150 ns) in **EncoderFilter**.
4. If necessary, specify the strobe length of the generated signal. When **EncoderStrobe** is set to **M**, the strobe length will be $M \times 10$ ns.

Frame Start Trigger

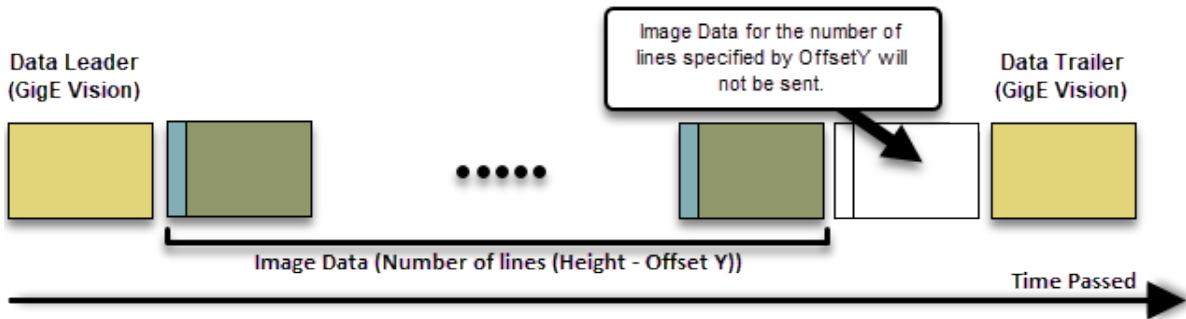
In this camera, Data Leader and Data Trailer are added to every frame. The number of lines per frame is set by Offset Y and Height of ImageFormatControl.

Offset Y's setting range is 0 to 4096. The Height setting range is 1 to 4096.

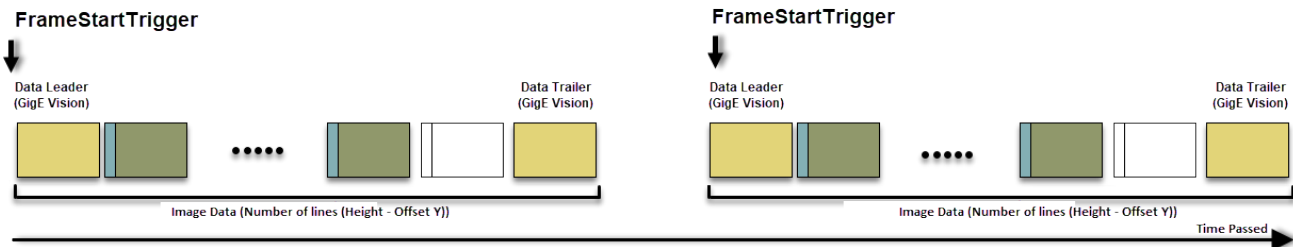
One Frame of Image Data (Offset Y = 0)



One Frame of Image Data (Offset Y > 0)



When using Frame Start Trigger, after receiving Frame Start Trigger, skip the image data of the number of lines of Offset Y and send the data of Data Leader, image data, and Data Trailer. (Upon completion of data transmission for one frame, no data will be sent until the next Frame Start Trigger is received.)



Caution: Chunk Data (first line of every frame only) is sent after Data Trailer.

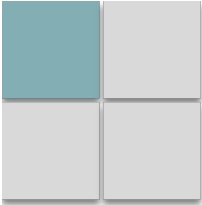
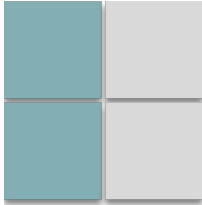
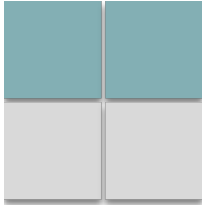
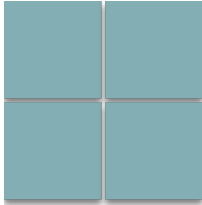
Binning

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 the function results in images with lower pixel resolution and higher sensitivity.

This camera performs vertical x2 analog (sensor) binning (fixed to Sum), and horizontal x2 digital binning (fixed to Sum).

The following table shows the Binning options in this camera.

Binning Off	1 x 2	2 x 1	2 x 2
			
7.5 μm x 7.5 μm 4096 pixels	7.5 μm x 15.0 μm 4096 pixels	15.0 μm x 7.5 μm 2048 pixels	15.0 μm x 15.0 μm 2048 pixels

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

ROI (Regional Scanning Function)

Related Setting Items: [ImageFormatControl](#)

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

ROI Settings

Specify the area to scan by specifying width and horizontal offset values under [ImageFormatControl](#). The setting ranges for the ROI function's readable area based on the Binning setting (Binning Horizontal) are as follows.

BinningHorizontal	Width (Pixel)	Offset X (Pixel)
1 (Off)	16 ~ 4096, Step 16	0 ~ 4080, Step 16
2 (On)	8 ~ 2048, Step 8	0 ~ 2040, Step 8

Delayed Readout

Delayed readout allows images captured by a **Frame Start** trigger command to be stored temporarily inside the camera (delayed readout buffer) and read out using a **FrameTransferStart** trigger after capture.

This function is useful when executing triggers simultaneously on multiple cameras.

Note: This function imposes a heavy processing load on the network bandwidth, as images from multiple cameras are read out simultaneously. About delayed readout buffer size, refer to "[Image Output Timing](#)".

Chunk Data Function

Related Setting Items: [ChunkDataControl](#)

The Chunk Data function adds camera configuration information to the image data that is output from the camera.

Embedding camera configuration information in the image data allows you to use the serial number of the camera as a search key and find specific image data from among large volumes of image data. In addition, when images are shot with a single camera in sequence under multiple setting conditions, you can search for images by their setting conditions.

How to Configure Chunk Data Function

1. Set **ChunkModeActive** to **True**.
2. Select the items of information you want to add to image data with **Chunk Selector**, and set **Chunk Enable** from **False** to **True**.

Notes:

- When **Chunk Mode Active** is set to **True**, **Chunk Image** is automatically set to **True**.
- For items that can be added to image data as Chunk Data, refer to "[ChunkDataControl](#)."

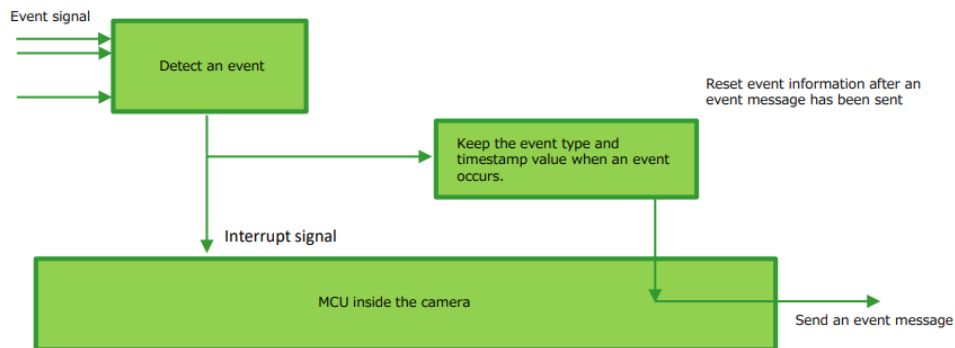
Caution: The Chuck Data function settings cannot be changed during image output. To change the settings, stop Acquisition.

Event Control Function

Related Setting Items: [EventControl](#)

The Event Control Function is a function that outputs a signal change point inside the camera as information indicative of an event occurrence (event message) by using GVCP (GigE Vision Control Protocol).

Flow from detecting an event to sending an event message



Events that can use the Event Control Function

Events that can use the Event Control Function are as follows. You can specify whether or not to send an event message when an event occurs at each event.

AcquisitionStart	AcquisitionEnd
FrameStart	FrameEnd
LineStart	LineEnd
ExposureRedStart	ExposureRedEnd
ExposureGreenStart	ExposureGreenEnd
ExposureBlueStart	ExposureBlueEnd
Line1 RisingEdge	Line1 FallingEdge
Line4 RisingEdge	Line4 FallingEdge
Line5 RisingEdge	Line5 FallingEdge
Line8 RisingEdge	Line8 FallingEdge
Line9 RisingEdge	Line9 FallingEdge
Line10 RisingEdge	Line10 FallingEdge
Line12 RisingEdge	Line12 FallingEdge
Line13 RisingEdge	Line13 FallingEdge
LVALStart	LVALEnd

Action Control Function

Related Setting Items: [ActionControl](#)



Technical Notes

How to use GigE Vision Action Commands

The Action Control Function is a function that executes the pre-configured action when the camera receives action commands. Action commands can send both unicast and broadcast messages and give instructions for actions to multiple cameras simultaneously by broadcasting them. A camera that has this function can even give instructions for actions to different types of multiple cameras. Although this function includes jitter and delays, it is useful for controlling multiple cameras simultaneously.

Actions are performed when the following three conditions are met.

1. ActionDeviceKey set to the camera and ActionDeviceKey in the action command match.
2. ActionGroupKey set to the camera and ActionGroupKey in the action command match.
3. ActionGroupMask set to the camera and GroupMask in the action command perform AND operation, and the result is not 0.

How to Configure

1. Specify ActionDeviceKey.
2. Then, specify two actions that can be configured on the camera.
 - a. Action1
 1. Select 1 in ActionSelector.
 2. Specify ActionGroupMask [ActionSelector].
 3. Specify ActionGroupKey [ActionSelector].
 - b. Action2
 1. Select 2 in ActionSelector.
 2. Specify ActionGroupMask [ActionSelector].
 3. Specify ActionGroupKey [ActionSelector].
3. Set triggers (AcquisitionStart, AcquisitionEnd, FrameStart, AcquisitionTransferStart) to Action1 and Action2.

Action Control Example

Assume that the following settings have been pre-configured on the camera.

- ActionDeviceKey : 0x00001001
- ActionGroupMask[1] : 0x00000011
- ActionGroupKey[1] : 0x00000001
- ActionGroupMask[2] : 0x00000111
- ActionGroupKey[2] : 0x00000002

When the camera receives action commands (ActionDeviceKey:0x00001001, ActionGroupMask:0x00000011, ActionGroupKey: 0x00000002), Action2 is executed.

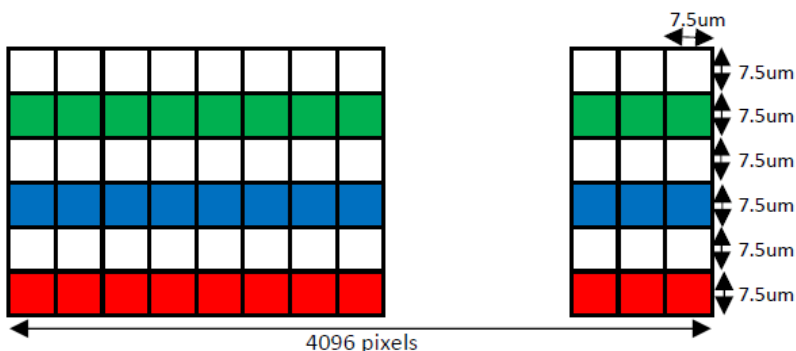
When the camera receives action commands (ActionDeviceKey:0x00001001, ActionGroupMask:0x00000011, ActionGroupKey: 0x00000001), ActionDevice and ActionGroupKey[1] match. However, the result of AND operation performed by ActionGroupMask is 0. Therefore, in this case, neither Action1 nor Action2 is executed.

Layout of pixels

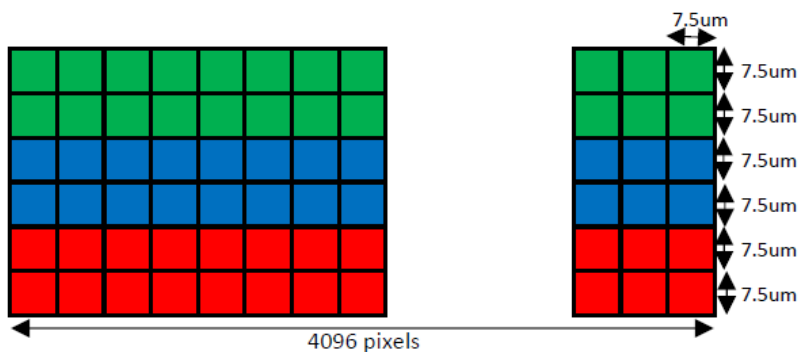
The arrangement of Green, Blue, Red pixels in the sensor is shown in the figure below.

Note: In the case of Binning Off, there is a gap between individual lines of Green, Blue, Red.

■ BinningVertical = Off (1)



■ BinningVertical = On (2)



PTP (Precision Time Protocol)

Related Setting Items: [TransportLayerControl](#)

The camera can work as the slave for Precision Time Protocol defined in IEEE 1588. When the IEEE 1588 master clock exists in the network where the camera is connected, this function synchronizes the camera to the time of the master clock.

- Transport to be used: Multicast UDP datagram (224.0.1.129); however, Delay Resp is a unicast UDP datagram.
- Destination port number:
 - 319 : Sync, Delay Req, Pdelay Req, Pdelay Resp
 - 320 : Announce, Follow Up, Delay Resp, Pdelay Resp, Management, Signaling
- Items for synchronization: Time synchronization is performed. Frequency tuning is not performed.
- PTP time data: 80 bit (elapsed time in 1 ns, with 00:00:00, January 1 1970 set as the origin)
- Timestamp (this camera): 64 bit* (PTP synchronization: LSB64bit* of PTP time data)
- Supported PTP messages: Announce message (receive only), Sync message (receive only), Follow Up message (receive only), Delay Req message (send only), Delay Resp message (receive only)

Cautions:

- The Timestamp Tick Frequency register value is fixed at 1,000,000,000 (1 GHz).
- When PTP synchronization is being performed, the Timestamp Reset function is disabled.
- Because GenICam treats the timestamp (64 bit) as a 64 bit signed integer, 63 bit is actually timestamp data without the sign bit.

How To Configure

1. Set **GevIEEE1588** ([TransportLayerControl](#)) to **True**.
2. After several statuses from Disable, when a Sync Message is received from the PTP server, **Slave** is Displayed in **GevIEEE1588 Status**.

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 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. (SW-4000TL-10GE only)
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 (Integer), a real type (Float), an element enumeration type (Enumeration), a character string (String), a logical type (Boolean), and a category type (Category) or a command type (Command) 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 (Enumeration) or an integer type (Integer). 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	-	"JAI Corporation"	Display the manufacturer name.
DeviceModelName	-	"SW-4000TL-10GE" SW-4000TL-SFP	Display the model name.
DeviceManufacturerInfo	-	"See the possibilities"	Display the manufacturer information.
DeviceVersion	-	-	Display the hardware version.
DeviceFirmwareVersion	-	-	Display the firmware version.
DeviceFpgaVersion	-	-	Display the FPGA version.
DeviceSerialNumber	-	-	Display the device ID.
DeviceUserID	Any	-	Set the user ID (16bytes) for the camera.
DeviceSFNCVersionMajor	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor	-	3	Display the SFNC Minor version.
DeviceSFNCVersionSubMinor	-	0	Display the SFNC Sub Minor version
DeviceManifestEntrySelector	-	1	Display information on valid XML file.
DeviceTLType	-	GigE Vision	Display type of transport layer.
DeviceTLVisionMajor	-	2	Display the Major version of transport layer.
DeviceTLVisionMinor	-	0	Display the Minor version of transport layer.
Device TL Version Sub Minor	-	1	Display the Sub Minor version of transport layer.
Device Link Selector	-	0	Select I/F for control. (0 fixed)
Device Link Speed (Bps)	-	-	Display Link speed.
Device Link Heartbeat Mode	Off On	On	Set the mode of Link heartbeat.
Device Link Heartbeat Timeout (us)	500000 ~ 120000000	3000000	Set the time of heartbeat timeout.
Device Stream Channel Count	-	-	Display the number of stream channels.
Device Event Channel Count	-	-	Display the number of event channels.

Device Control Item	Setting Range	Default	Description
DeviceReset	-	-	Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)
DeviceTemperatureSelector	-	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading. (fixed Mainboard)
DeviceTemperature	-	-	Display the internal temperature (°C) of the camera.
Timestamp (ns)	0~ 9223372036854775807 (maximum value of unsigned 64-bit)	0	Display the timestamp value. Resets to 0 when the signed maximum 64-bit value is exceeded.
Timestamp Reset	-	-	Forcibly sets the timestamp's count value to 0.
DeviceReset	-	-	Reset the device. (After the camera receives this command, it returns an ACK response and executes the reset.)
Timestamp Latch	-	-	Sets the timestamp's count value to TimestampLatchValue.
Timestamp Latch Value (ns)	0~ 9223372036854775807 (maximum value of unsigned 64-bit)	-	Max: unsigned 64-bit

ImageFormatControl

Configure image format settings.

Image Format Control Item	Setting Range	Default	Description
WidthMax	-	4096	Display the maximum image width.
HeightMax	-	4096	Display the maximum image height.
Width	-	4096	<p>Set the image height (number of lines).</p> <p>Image data with the specified number of lines will be streamed as 1 block.</p> <p>Max: 4096 (2048)* - OffsetX Min,Step: 16 (8)*</p> <p>Note: *When BinningHorizontal=2, the value in parenthesis is applicable.</p>
OffsetX	0 ~ [4096 (2048)* - Width]	0	<p>Set the horizontal offset.</p> <p>Max: WidthMax - Width Step: 16 (8)*</p> <p>Note: *When BinningHorizontal=2, the value in parenthesis is applicable.</p>
OffsetY	0 ~ 4096	0	Set the vertical offset.
BinningHorizontal	1: Binning Off 2: Binning On	1	Set the number of pixels in the horizontal direction for which to perform binning. BinningMode is fixed to Sum.
SensorBinningVertical	1: Binning Off 2: Binning On	1	Set the number of pixels in the vertical direction for which to perform binning. BinningMode is fixed to Sum.
PixelFormat	RGB8 RGB10V1Packed RGB10p32 YUV422_8 YUV422_8_UYVY	RGB8	Set the pixel format.

Image Format Control Item	Setting Range	Default	Description
TestPattern Related Topic: Test Pattern Function	Off White GreyPattern1 (Ramp) GreyPattern2 (Stripe) ColorBar	Off	Select the test image.
Horizontal Image Mirroring	Off On	Off	Invert the image left and right.

AcquisitionControl

Configure image capture settings.

Acquisition Control Item	Setting Range	Default	Description
AcquisitionMode	Single Frame Multi Frame Continuous	Continuous	Select the image capture mode.
Acquisition Start	-	-	Start image capture.
Acquisition Stop	-	-	Stop image capture.
Acquisition Frame Count	1~ 65535	1	In MultiFrame mode, set the number of frames to capture.
Acquisition Frame Rate(Hz)	-	66	Display the frame rate as a frequency (unit: Hz).
AcquisitionLineRate (Hz) Related Topic: Variable Line Rate	66 ~	66	Set the AcquisitionLineRate (Hz). The maximum value varies depending on the PixelFormat and ROI settings
Trigger Selector Related Topic: Image Output Timing	Acquisition Start Acquisition End Line Start Frame Start Frame Transfer Start	Acquisition Start	Select the trigger operation.
TriggerMode	Off On	Off	Select the trigger mode

Acquisition Control Item	Setting Range	Default	Description
TriggerSource	PulseGenerator0 ~ 3 UserOutput0 ~ 3 Action0 ~ 3 Line4 TTL In 1 Line5 Opt In1 Line10 TTL In2 Line13 TTL In3 Logical Block0 ~ 1 EncoderTrigger	Line4 TTL In1	Select the trigger signal source.
TriggerActivation	Rising Edge Falling Edge Level High Level Low	Rising Edge	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
ExposureMode	Off Timed TriggerWidth	Timed	Select the exposure mode.
ExposureTime (us)	3 ~ 15149 (step: 0.01)	15149	Set the exposure time.

AnalogControl

Configure analog control settings.

Analog Control Item	Setting Range	Default	Description
IndividualGainMode	Off On	Off	In IndividualGainMode, RGB can be configured individually for the entire gain adjustment range of the sensor.
GainSelector	-	Digital All	Select the gain to configure. Digital All (Only when IndividualGainMode=OFF) Digital Green (Only when IndividualGainMode=ON) Digital Red Digital Blue
Gain	-	x1.0	Set the gain value for the gain setting selected in GainSelector. When IndividualGainMode=OFF - Digital All: x1.0 ~ x32.0 - Digital Red/Blue: x0.4 ~ x4.0 When IndividualGainMode=ON - DigitalGreen/Red/Blue: x1.0 ~ x64.0
AnalogGain	0dB 6dB 12dB	0dB	Set the Analog Gain value.
BlackLevelSelector	All Red Blue	All	Select the black level to configure.
BlackLevel	-	0	Set the black level value. All: Min = -133, Max = 255 Red: Min = -64, Max=64 Digital: Min = -64, Max=64
BalanceWhiteAuto	Off Once Preset 5000K Preset 6500K Preset 7500K	Off	Enable/disable auto white balance. Once automatically changes to Off when the signal level converges once.

Analog Control Item	Setting Range	Default	Description
Balance White Auto Width	-	4096	Set the area for adjusting white balance. Min: 16(8)* Max:4096 (2048)* Step: 16(8)* Note: *When BinningHorizontal=2, the value in parenthesis is applicable.
BalanceWhiteAutoOffsetX	-	0	Set the area for adjusting white balance. Min: 0 Max: WidthMax - BalanceWhiteAuto Width Step: 16(8)* Note: *When BinningHorizontal=2, the value in parenthesis is applicable.
BalanceWhiteAutoResult	-	Idle	Display the result for adjusting white balance. Idle Succeeded Error1- G image was too bright Error2 - G image was too dark Error3 - Timeout error occurred
Gamma Related Topic: Gamma Function	0.45~ 1	0.45	Set the gamma value. Setting Range: 0.45, 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00
LUTMode	Off Gamma LUT	0:Off	Select the LUT mode.
GainAuto Note: SW-4000TL-10GE only	Off Once	Off	Enable/disable gain auto adjustment. Once automatically changes to Off when the signal level converges once.
AGCReference Note: SW-4000TL-10GE only	30 ~ 95	-	Set the target level for GainAuto.

Analog Control Item	Setting Range	Default	Description
AGCOncStatus Note: SW-4000TL-10GE only	-	-	Allows confirmation of the current status during gain auto adjustment. Idle : Auto Gain Control is not executed yet. Succeeded : Auto Gain Control was Succeeded. Error1 - Timeout : Timeout error has occurred. Please try again. Error3, 4, 5: Undefined Error

LUTControl

Configure LUT settings.

Related Topic: [LUT \(Lookup Table\)](#)

LUT Control Item	Setting Range	Default	Description
LUTSelector	Red Green Blue	Red	Select the LUT channel to control.
LUTIndex	0 ~ 256	0	Set the LUT index table number.
LUTValue	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	RGB HSI XYZ	RGB	Set the output image format.
ColorTransformationRGBMode	OFF sRGB AdobeRGB UserCustom	OFF	Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector	R-R R-G R-B G-R G-G G-B B-R B-G B-B	R-R	Select the ColorMatrix setting component.
ColorMatrixValue	-2.0 ~ 2.0	R-R: 1.0 R-G: 0.0 R-B: 0.0 G-R: 0.0 G-G: 1.0 G-B: 0.0 B-R: 0.0 B-G: 0.0 B-B: 1.0	Set the Color Matrix value. (step = 0.1)

DigitalIOControl

Configure settings for digital input/output.

Related Topic: [GPIO \(Digital Input/Output Settings\)](#)

Digital IO Control Item	Setting Range	Default	Description
LineSelector	Line1: TTL Out1 Line4: TTL In1 Line5: Opt In1 Line8: TTL Out2 Line9: TTL Out3 Line10: TTL In2 Line12: TTL Out4 Line13: TTL In3	-	Select the input/output to configure.
LineMode	Input Output	-	Display the input/output status (whether it is input or output).
LineInverter	False True	False	Enable/disable polarity inversion for the selected input signal or output signal.
LineStatus	False (Low) True (High)	False	Display the status of the input signal or output signal (True: High, False: Low).
LineStatusAll	bit0:Line1 bit1:Unused bit2:Unused bit3:Line4 bit4:Line5 bit5:Unused bit6:Unused bit7:Line8 bit8:Line9 bit9:Line10 bit10:Unused bit11:Line12 bit12:Line13 bit13 - 15:Unused	bit0:Line1 (TTL Out1)	Display the input/output signal status. The state is shown with 16 bits. Note: Unused is fixed to 0.

Digital IO Control Item	Setting Range	Default	Description
LineSource	Acquisition Active Frame Active ExposureActive LVAL PulseGenerator0 ~ 3 UserOutput0 ~ 3 Line4: TTL In1 Line5: Opt In1 Line10: TTL In2 Line13: TTL In3 LogicBlock0 ~ 1 EncoderTriger EncoderDirection	-	Select the line source signal for the item selected in Line Selector .
LineFormat	TTL Opto Coupled	-	Display the signal format.
OptInFilterSelector	0 ~ 1000000 (step 100ns)	Off	Remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector	User Output 0 User Output 1 User Output 2 User Output 3	User Output 0	Set the UserOutput signal.
UserOutputValue	False True	False	Set the value for the UserOutput selected in UserOutputSelector .
ExposureActiveSource	Red Green Blue	Red	Select the channel for exposure active.

CounterAndTimerControl

Configure counter settings.

Note: This camera only supports counter functions

Related Topic: [Counter and Timer Control Function](#)

Counter and Timer Control Item	Setting Range	Default	Description
CounterSelector	Counter0 ~ 5	Counter0	Select the counter.
CounterEventSource	-	Off	Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value Counter0: Off, Line Trigger Counter1: Off, Line Start Counter2: Off, Exposure Start Counter3: Off, Frame Trigger Counter4: Off, Frame Start Counter5: Off, Frame Transfer End
CounterEventActivation	Rising Edge Falling Edge	-	Set the count timing. The setting value is fixed with the following data Counter0 ~ 4: Rising Edge Counter5: Falling Edge
CounterReset Source Note: SW-4000TL-10GE only	0: Software 3: Line4 TTL In1 4: Line5 Opt In1 9: Line10 TTL In2 12: Line13 TTL In3	-	Specifies the source that resets the counter. This source triggers and resets the counter.
CounterResetActivation Note: SW-4000TL-10GE only	Rising Edge Falling Edge Level High Level Low	-	Selects the timing for counter reset.
CounterReset	-	-	Reset the counter.
CounterValue	0 ~ 32bit max	0	Display the count value.
CounterStatus		-	Display the counter status. CounterIdle CounterActive CounterOverflow

EncoderControl

Configure settings for encoder control.

Related Topic: [Connecting Rotary Encoders](#)

Encoder Control Item	Setting Range	Default	Description
EncoderSourceA	Off Line4 TTL In1 Line5 Opt In 1 Line10 TTL In2 Line13 TTL In3	Off	Select where to input the signal from the rotary encoder.
EncoderSourceB	Off Line4 TTL In1 Line5 Opt In 1 Line10 TTL In2 Line13 TTL In3	Off	Select where to input the signal from the rotary encoder.
EncoderDivider	1~ 4294967295	65536	Set the number of triggers to be generated during one pitch of the rotary encoder. The number of triggers is 65536 / (set value).
EncoderFilter (ns)	0 ~ 150 (10 step)	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)	10 ~ 2550 (10 step)	10	Set the strobe length of the Trigger signal generated from the rotary encoder by the number of cycles.
EncoderAveragingInterval	none 2 pulses 4 pulses 8 pulses 16 pulses 32 pulses	none	When the reliability of the interval of the signal output from the rotary encoder is low. (Some signal interval is extremely long or short). When this function is enabled, internal processing is performed by averaging the interval of several previous signals.
EncoderMaxIntervalForNonDecimationMode	0 ~ 60	0	Set the maximum interval period of the output signal only if the EncoderDivider is not set to an integer multiple of 65536.

Note: SW-4000TL-10GE only

Logic Block Control

Configure Logic Block settings.

Logic Block Control Item	Setting Range	Default	Description
Logic Block Selector	Logic Block 0 Logic Block 1	Logic Block 0	Specifies the Logic Block to configure.
Logic Block Function	AND (Fixed)	-	Selects the combinational logic Function of the Logic Block to configure.
Logic Block Input Selector	0 1	0	Selects the Logic Block's input to configure.
Logic Block Input Source	ExposureActive LVAL PulseGenerator0 ~ 3 UserOutput0 ~ 3 Line4: TTL In1 Line5: Opt In1 Line10: TTL In2 Line13: TTL In3 LogicBlock0 ~ 1 EncoderTriger	Line4: TTL In1	Selects the source signal for the input into the Logic Block.
Logic Block Input Inverter	False True	False	Selects if the selected Logic Block Input source signal is inverted.
Logic Block Output Inverter	True (Fixed)	-	Selects if the selected Logic Block Output signal is inverted.

ActionControl

Configure settings for action control.

Related Topic: [Action Control Function](#)

Action Control Item	Setting Range	Default	Description
ActionDeviceKey	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if this ActionDeviceKey matches the DeviceKey contained in the action command message.
ActionQueueSize	-	256	Indicates the size of the scheduled action commands.
ActionSelector	0, 1, 2, 3	0	Select the ActionSelector.
ActionGroupMask	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if the result of an AND operation of GroupMask contained in this ActionGroupMask and an action command message is not 0.
ActionGroupKey	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if this ActionGroupKey matches the GroupKey contained in the action command message.

EventControl

Configure event settings.

Related Topic: [Event Control Function](#)

Event Control Item	Setting Range	Default	Description
EventSelector	-	Acquisition Start	Select the event to send the event message. AcquisitionStart AcquisitionEnd FrameStart FrameEnd LineStart LineEnd ExposureRedStart ExposureRedEnd ExposureGreenStart ExposureGreenEnd ExposureBlueStart ExposureBlueEnd Line1 RisingEdge Line1 FallingEdge Line4 RisingEdge Line4 FallingEdge Line5 RisingEdge Line5 FallingEdge Line8 RisingEdge Line8 FallingEdge Line9 RisingEdge Line9 FallingEdge Line10 RisingEdge Line10 FallingEdge Line12 RisingEdge Line12 FallingEdge Line13 RisingEdge Line13 FallingEdge LVALStart LVALEnd
EventNotification	Off On Once	Off	Sets whether or not to send an event message when an event selected by EventSelector occurs.
EventAcquisitionStartData	-	-	When the Event occurs, the following data can be checked.
EventAcquisitionStart	-	0x9011	Display the EventID.
EventAcquisitionStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventAcquisitionStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventAcquisitionEndData	-	-	When the Event occurs, the following data can be checked.
EventAcquisitionEnd	-	0x9012	Display the EventID.
EventAcquisitionEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventAcquisitionEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.

Event Control Item	Setting Range	Default	Description
EventFrameStartData	-	-	When the Event occurs, the following data can be checked.
EventFrameStart	-	0x9300	Display the EventID.
EventFrameStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventFrameStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventFrameEndData	-	-	When the Event occurs, the following data can be checked.
EventFrameEnd	-	0x9301	Display the EventID.
EventFrameEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventFrameEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLineStartData	-	-	When the Event occurs, the following data can be checked.
EventLineStart	-	0x9032	Display the EventID.
EventLineStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLineStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLineEndData	-	-	When the Event occurs, the following data can be checked.
EventLineEnd	-	0x9033	Display the EventID.
EventLineEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLineEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureRedStartData	-	-	When the Event occurs, the following data can be checked.
EventExposureRedStart	-	0x9302	Display the EventID.
EventExposureRedStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureRedStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureRedEndData	-	-	When the Event occurs, the following data can be checked.
EventExposureRedEnd	-	0x9303	Display the EventID.

Event Control Item	Setting Range	Default	Description
EventExposureRedEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureRedEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureGreenStartData	-	-	When the Event occurs, the following data can be checked.
EventExposureGreenStart	-	0x9304	Display the EventID.
EventExposureGreenStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureGreenStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureGreenEndData	-	-	When the Event occurs, the following data can be checked.
EventExposureGreenEnd	-	0x9305	Display the EventID.
EventExposureGreenEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureGreenEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureBlueStartData	-	-	When the Event occurs, the following data can be checked.
EventExposureBlueStart	-	0x9306	Display the EventID.
EventExposureBlueStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureBlueStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventExposureBlueEndData	-	-	When the Event occurs, the following data can be checked.
EventExposureBlueEnd	-	0x9307	Display the EventID.
EventExposureBlueEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventExposureBlueEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine1RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine1RisingEdge	-	0x9310	Display the EventID.
EventLine1RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine1RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.

Event Control Item	Setting Range	Default	Description
EventLine1FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine1FallingEdge	-	0x9318	Display the EventID.
EventLine1FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine1FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine4RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine4RisingEdge	-	0x9313	Display the EventID.
EventLine4RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine4RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine4FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine4FallingEdge	-	0x931B	Display the EventID.
EventLine4FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine4FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine5RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine5RisingEdge	-	0x9314	Display the EventID.
EventLine5RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine5RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine5FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine5FallingEdge	-	0x931C	Display the EventID.
EventLine5FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine5FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine8RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine8RisingEdge	-	0x9507	Display the EventID.

Event Control Item	Setting Range	Default	Description
EventLine8RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine8RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine8FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine8FallingEdge	-	0x931F	Display the EventID.
EventLine8FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine8FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine9RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine9RisingEdge	-	0x9340	Display the EventID.
EventLine9RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine9RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine9FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine9FallingEdge	-	0x9360	Display the EventID.
EventLine9FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine9FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine10RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine10RisingEdge	-	0x9341	Display the EventID.
EventLine10RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine10RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine10FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine10FallingEdge	-	0x9361	Display the EventID.
EventLine10FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine10FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.

Event Control Item	Setting Range	Default	Description
EventLine12RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine12RisingEdge	-	0x9343	Display the EventID.
EventLine12RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine12RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine12FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine12FallingEdge	-	0x9363	Display the EventID.
EventLine12FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine12FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine13RisingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine13RisingEdge	-	0x9344	Display the EventID.
EventLine13RisingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine13RisingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLine13FallingEdgeData	-	-	When the Event occurs, the following data can be checked.
EventLine13FallingEdge	-	0x9364	Display the EventID.
EventLine13FallingEdgeTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLine13FallingEdgeFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLVALStartData	-	-	When the Event occurs, the following data can be checked.
EventLVALStart	-	0x9330	Display the EventID.
EventLVALStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLVALStartFrameID	0 ~	0	Displays the FrameID value when an event occurs.
EventLVALEndData	-	-	When the Event occurs, the following data can be checked.
EventLVALEnd	-	0x9331	Display the EventID.

Event Control Item	Setting Range	Default	Description
EventLVALEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs
EventLVALEndFrameID	0 ~	0	Displays the FrameID value when an event occurs.

UserSetControl

Configure user settings.

Related Topic: [Step 7: Save the Settings](#)

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

ChunkDataControl

Configure Chunk control settings.

Related Topic: [Chunk Data Function](#)

Chunk Data Control Item	Setting Range	Default	Description
ChunkModeActive	False True	False	Set whether to enable ChunkData.
Chunk Selector	OffsetX OffsetY Width Height BinningHorizontal SensorBinningVertical PixelFormat Timestamp LineStatusAllOnExposureStart LineStatusAllOnLVALStart LineStatusAllOnLVALEnd CounterValue ExposureTime Gain BlackLevel DeviceSerialNumber DeviceUserID DeviceTemperature	OffsetX	Select the Chunk data to add.
ChunkEnable	False True	False*	Select whether to output ChunkData. *True for ChunkImage.
ChunkImage			ChunkID: 0x00001000
ChunkOffsetX	-	-	Display the OffsetX value (ImageFormatControl) ChunkID: 0x00002000
ChunkOffsetY	-	-	Display the OffsetY value (ImageFormatControl) ChunkID: 0x00002001
ChunkWidth	-	-	Display the Width value (ImageFormatControl) ChunkID: 0x00002002

Chunk Data Control Item	Setting Range	Default	Description
ChunkHeight	-	-	Display the Height value (ImageFormatControl) ChunkID: 0x00002003
ChunkBinningHorizontal	-	-	Display the BinningHorizontal value (ImageFormatControl) ChunkID: 0x00002022
ChunkSensorBinningVertical	-	-	Display the SensorBinningVertical value (ImageFormatControl) ChunkID: 0x00002025
ChunkPixelFormat	-	-	Display the PixelFormat value (ImageFormatControl) ChunkID: 0x00002012
ChunkTimeStamp	-	-	Display the ChunkTimeStamp value. ChunkID: 0x00002014
ChunkLineStatusAllOn ExposureStart	-	-	Display the LineStatusAllOnExposureStart value. ChunkID: 0x00002015
ChunkLineStatusAllOn LVALStart	-	-	Display the LineStatusAllOnLVALStart value. ChunkID: 0x00002027
ChunkLineStatusAllOn LVALEnd	-	-	Display the LineStatusAllOnLVALEnd value. ChunkID: 0x00002028
ChunkCounterSelector	Counter0 ~ 5	Counter0	Select the counter to display the ChunkCounterValue.
ChunkCounterValue			Display the CounterValue specified by ChunkCounterSelector. Counter0: Line Trigger (ChunkID: 0x00002029) Counter1: Line Start (ChunkID: 0x0000202A) Counter2: Exposure Start (ChunkID: 0x0000200F) Counter3: Frame Trigger (ChunkID: 0x0000200E) Counter4: Frame Start (ChunkID: 0x0000202B) Counter5: Frame Transfer End (ChunkID: 0x00002011)

Chunk Data Control Item	Setting Range	Default	Description
ChunkExposureTime	-	-	Display the ExposureTime specified by ChunkExposureTimeSelector. ExposureTime (Red): (ChunkID: 0x0000201C) ExposureTime Green/Common: (ChunkID: 0x00002004) ExposureTime Blue: (ChunkID: 0x0000201D)
ChunkIndividualGainMode	-	-	Display the IndividualGainMode value. ChunkID: 0x0000201E
ChunkGainSelector	Digital All Digital Green Digital Red Digital Blue	-	Select the Gain to configure.
ChunkGain	-	-	Display the Gain (AnalogControl) value. Digital All / Digital Green (ChunkID: 0x00002005) Digital Red (ChunkID: 0x00002006) Digital Blue (ChunkID: 0x00002007)
ChunkBlackLevelSelector	DigitalAll DigitalRed DigitalBlue	-	Select the Black Level to configure.
ChunkBlackLevel	-	-	Display the BlackLevel specified by ChunkBlackLevelSelector. DigitalAll: ChunkID: 0x00002008 DigitalRed: ChunkID: 0x00002009 DigitalBlue: ChunkID: 0x0000200A
ChunkDeviceSerialNumber	-	-	Display the DeviceSerialNumber value. ChunkID: 0x00002017
ChunkDeviceUserID	-	-	Display the DeviceUserID value. ChunkID: 0x00002018
ChunkDeviceTemperature Selector	Mainboard (Fixed)	-	Select the device to display the ChunkDeviceTemperature.
ChunkDeviceTemperature	-	-	Display the DeviceTemperature value (°C). ChunkID: 0x00002019

TransportLayerControl

Display information on transport layer control.

Transport Layer Control Item	Setting Range	Default	Description								
PayloadSize	48 - 67109240	12288	Display the payload size. (Include ChunkData) (unit: bytes)								
GigEVision											
GevPhysicalLinkConfiguration	-	0:Single Link (Fixed)	Display the LinkConfiguration status.								
GevSupportedOptionSelector	-	-	<p>Select the supported options for GigE Vision.</p> <table border="1"> <tr> <td>Link Configuration</td> <td>0: SingleLink</td> </tr> <tr> <td>nif Configuration</td> <td>4:PAUSEFrameReception, 5:PAUSEFrameGeneration, 6:IPConfigurationLLA, 7:IPConfigurationDHCP, 8:IPConfigurationPersistentIP</td> </tr> <tr> <td>GVCP</td> <td>11:MessageChannelSourceSocket, 12:CommandsConcatenation, 13:WriteMem, 14:PacketResend, 15:Event, 17:PendingAck, 18:IEEE1588, 19:Action, 21:ScheduledAction, 23:ExtendedStatusCodes, 24:ExtendedStatusCodesVersion2_0, 28:ManifestTable, 29:CCPApplicationSocket, 30:LinkSpeed, 31:HeartbeatDisable, 32:SerialNumber, 33:UserDefinedName</td> </tr> <tr> <td>GVSP</td> <td>9:StreamChannelSourceSocket, 10:StandardIDMode</td> </tr> </table>	Link Configuration	0: SingleLink	nif Configuration	4:PAUSEFrameReception, 5:PAUSEFrameGeneration, 6:IPConfigurationLLA, 7:IPConfigurationDHCP, 8:IPConfigurationPersistentIP	GVCP	11:MessageChannelSourceSocket, 12:CommandsConcatenation, 13:WriteMem, 14:PacketResend, 15:Event, 17:PendingAck, 18:IEEE1588, 19:Action, 21:ScheduledAction, 23:ExtendedStatusCodes, 24:ExtendedStatusCodesVersion2_0, 28:ManifestTable, 29:CCPApplicationSocket, 30:LinkSpeed, 31:HeartbeatDisable, 32:SerialNumber, 33:UserDefinedName	GVSP	9:StreamChannelSourceSocket, 10:StandardIDMode
Link Configuration	0: SingleLink										
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GVSP	9:StreamChannelSourceSocket, 10:StandardIDMode										
GevSupportedOption	-	-	Displays whether the function selected by GevSupportOptionSelector is supported or not.								
GevInterfaceSelector		0: (Fixed)	Controls whether PAUSE Frames can be generated on the given logical link.								
GevMACAddress	-	-	Display the MAC address.								
GevPAUSEFrameReception	False True	False	Controls whether incoming PAUSE Frames are handled on the given logical link.								

Transport Layer Control Item	Setting Range	Default	Description
GevPAUSEFrameTransmission	False True	False	Controls whether PAUSE Frames can be generated on the given logical link.
GevCurrentIPConfigurationLLA	True	True (Fixed)	Display whether the current IP configuration is calibrated by LLA (link-local address).
GevCurrentIPConfigurationDHCP	False True	True	Select whether to set the IP configuration to DHCP.
GevCurrentIPConfigurationPersistentIP	False True	True	Select whether to set the IP configuration to Persistent IP.
GevCurrentIPAddress	-	-	Display the IP address.
GevCurrentSubnetMask	-	-	Display the subnet.
GevCurrentDefaultGateway	-	-	Display the default gateway.
GevIPConfigurationStatus	None PersistenIP DHCP LLA ForceIP	DHCP	Display the current IP configuration status.
GevPersistentIPAddress	-	-	Set the persistent IP address.
GevPersistentSubnetMask	-	-	Set the persistent subnet mask.
GevPersistentDefaultGateway	-	-	Set the persistent default gateway.
GevIEEE1588	False True	FALSE	TRUE : Enables PTP FALSE: Disables PTP
	Related Topic: PTP (Precision Time Protocol)		
GevIEEE1588ClockAccuracy	-	19:Unknown	Indicates clock accuracy. 0:Within25ns, 1:Within100ns, 2:Within250ns, 3:Within1us, 4:Within2p5u, 5:Within10us, 6:Within25us, 7:Within100us, 8:Within250us, 9:Within1ms, 10:Within2p5ms, 11:Within10ms, 12:Within25ms, 13:Within100ms, 14:Within250ms, 15:Within1s, 16:Within10s, 17:GreaterThan10s, 18:AlternatePTPProfile, 19:Unknown, 20:Reserved
GevIEEE1588Status	-	-	Display the IEEE 1588 Status. 1:initializing, 2:faulty, 3:disabled, 4:listening, 5:preMaster, 6:master, 7:passive, 8:uncalibrated, 9:slave
GevGVCPEExtendedStatusCodesSelector	Version1_1 Version2_0	Version1_1	Select the GevGVCPEExtendedStatusCodes.

Transport Layer Control Item	Setting Range	Default	Description
GevGVCPExtendedStatusCodes	False True	0: False	Enables the generation of extended status codes.
GevGVCPPendingAck	False True	False	Enables/disables the PENDING_ACK.
			Related Topic: Display the Image
GevGVSPExtendedIDMode	Off On	Off	Enables/disables Extended ID Mode.
GevCCP	0 ~ 2	Open Access	Control access rights. 0: OpenAccess - Access rights have not been obtained by the application. 1: ExclusiveAccess -Once the application has made this setting, no other applications can control or reference the camera. 2: ControlAccess -Access rights have been obtained by the application. Other applications cannot control the camera, but can refer to it.
GevPrimaryApplicationSocket	-	-	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	-	-	Returns the address of the primary application.
GevMCPHostPort	-	-	Controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GevMCDA	-	-	Controls the destination IP address for the message channel.
GevMCSP	-	-	This feature indicates the source port for the message channel.
GevStreamChannelSelector	0	0	Selects the stream channel to control.
GevSCPHostPort	-	-	Controls the port of the selected channel to which a GVSP transmitter must send data stream or the port from which a GVSP receiver may receive a data stream. Setting this value to 0 closes the stream channel.
GevSCPSFireTestPacket	False True	FALSE	Sends a test packet. When this feature is set, the device will fire one test packet.
GevSCPSDoNotFragment	False True	FALSE	The state of this feature is copied into the "do not fragment" bit of IP header of each stream packet. It can be used by the application to prevent IP fragmentation of packets on the stream channel.
GevSCSPPacketSize	576 ~ 16366	1476	Specify the SCPS packet size (bytes).

Transport Layer Control Item	Setting Range	Default	Description
GevSCPD	0 ~ 4294967295	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel. (step 8)
GevSCDA	-	-	Controls the destination IP address of the selected stream channel to which a GVSP transmitter must send data stream or the destination IP address from which a GVSP receiver may receive data stream.
GevSCSP	-	-	Indicates the source port of the stream channel.

PulseGenerator

Configure pulse generator settings.

Pulse Generator Item	Setting Range	Default	Description
ClockPreScaler	1 ~ 4096	1	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz)	-	100	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base. PulseGeneratorClock = 100 / ClockPreScaler
PulseGeneratorSelector	PulseGenerator0 PulseGenerator1 PulseGenerator2 PulseGenerator3	PulseGenerator0	Select the pulse generator.
PulseGeneratorLength Value	1 ~ 1048575	30000	Set the maximum count-up value as a clock count.
PulseGeneratorLength(ms)	-	0.3	Set the maximum count-up value in milliseconds. PulseGeneratorLength = 1/PulseGeneratorClock * PulseGeneratorLengthValue
PulseGeneratorFrequency (Hz)	0 ~ 1048574	3333.3333	Set the maximum count-up value as a frequency. PulseGeneratorFrequency = 1sec / PulseGeneratorLength
PulseGeneratorStartPoint Value	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.

Pulse Generator Item	Setting Range	Default	Description
PulseGeneratorStartPoint (ms)	-	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	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)	-	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
PulseGeneratorPulseWidth (ms)	-	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	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	Off Rising Edge Falling Edge Level High Level Low	Off	Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClear Source	ExposureActive LVAL PulseGenerator0 ~ 3* UserOutput0 ~ 3 Line4: TTL In1 Line5: Opt In1 Line10: TTL In2 Logic Block0 ~ 1 EncoderTriger	Line4: TTL In1	Select the count clear input signal source. Note: *Disabled if the PulseGenerator is selected in PulseGeneratorSelector.
PulseGeneratorClear SyncMode	Async Mode Sync Mode	Async 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	0: Flat Shading 1: Color Shading	0: Flat Shading	Select the shading correction method.
ShadingMode	0: Off 1: User1 2: User2 3: User3	0: Off	Set the area to which to save shading correction data. When this is set to Off, PerformShadingCalibration will not be executed.
CalibrateShadingCorrection	-	-	Execute shading correction. Note: This command cannot be executed under the following conditions: when outputting no image, when outputting TestPattern.Width and/or Height are less than 128, when Shading Mode is Off.
ShadingCalibrationResult	-	Idle	Display the shading correction results. Idle Succeed Error1 - Image was too bright Error2 - Image was too dark Error3 - Could not calibrated
ShadingDataSelector	Red Green Blue	Red	Read the shading correction data and select the sensor to be changed.
ShadingDataIndex	1 ~ 1024	1	Set the index table number for shading correction.
ShadingData	0 ~ 0x1FFF	0x4000	Display the result of shading correction.
ShadingDataSave	-	-	Save the result of shading correction.

Correction

Correct variations due to sensors and lenses. (PRNU/DSNU)

Correction Control Item	Setting Range	Default	Description
PixelBlackCorrectionMode Related Topic: DSNU Correction (Pixel Black Correct)	Off Default User1 User2 User3	1: Default	(DSNU) Select the user area to which to save the black level correction value.
CalibratePixelBlackCorrection	-	-	(DSNU) Generate black level correction data automatically from the captured image. Caution: When Pixel Black Correction Mode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.
PixelBlackCalibrationResult	Idle Succeeded Error1 - Image too bright Error2 - Image too dark Error3 - Could not calibrated	Idle	(DSNU) Display the results of Calibrate Pixel Black Correction execution.
PixelGainCorrectionMode Related Topic: PRNU Correction (Pixel Gain Correct)	Off Default User1 User2 User3	Default	Select the user area to which to save the gain correction value.
CalibratePixelGainCorrection	-	-	(PRNU) Generate gain correction data automatically from the captured image. Caution: When Pixel Black Correction Mode is set to Off or Default and a test pattern is being output instead of an image, this command cannot be executed.

Correction Control Item	Setting Range	Default	Description
PixelGainCalibrationResult	Idle Succeeded Error1 - Image too bright Error2 - Image too dark Error3 - Timeout error	Succeeded	(PRNU) Display the results of Calibrate Pixel Gain Correction execution.
ChromaticAberrationCorrectionMode Related Topic: Tilted View Correction and Chromatic Aberration Correction	Off Lens1 Lens2 Lens3	Off	Correct the color aberration that occurs at the left and right edges due to lens characteristics.
ChromaticAberrationCorrectionSelector	R Channel B Channel	R Channel	Specify the channel for which to perform Chromatic Aberration Correction Lens1,2,3.
ChromaticAberrationCorrection	- 4.0 ~ + 4.0, Step 0.1	0	Set the amount of correction for Chromatic Aberration Correction Lens1,2,3.
FIRFilterSelector Related Topic: Noise Reduction Filter Functions	Red Green Blue	Red	Select the target to apply FIR Filter from Red, Green, Blue.
FIRFilterMode	Off On	Off	Enable / Disable FIR Filter.
FIRFilterLeftRatio	-2 ~ 2	0	Set the coefficient of the left pixel when FIR Filter is applied.
FIRFilterCenterRatio	-2 ~ 2	1	Set the coefficient of the center pixel when FIR Filter is applied.
FIRFilterRightRatio	-2 ~ 2	0	Set the coefficient of the right pixel when FIR Filter is applied.
MEDIANFilterSelector	Red Green Blue	Red	Select the target to apply Median Filter from Red, Green, Blue
MEDIANFilterMode	Off On	Off	Enable / Disable MEDIAN Filter.

Correction Control Item	Setting Range	Default	Description
NoiseReduction	Off Level1 Level2 Level3 Level4	Off	Set the noise reduction intensity in 4 levels. Level1 = weak, Level4 = strong
Note: SW-4000TL-10GE only			

SpatialControl

Corrects the spatial pixel differences individually for the R, G, and B lines captured by the trilinear line sensor.

Related Topic: [Spatial Compensation](#)

Spatial Control Item	Setting Range	Default	Description
SpatialCompensationMode	0: Manual 1: Auto	0: Auto	Set the spatial compensation mode.
SpatialCompensationSelector	0: Red 1: Green 2: Blue	0: Red	Set the channel. Note: SpatialCompensationMode = Manual Only
SpatialCompensationValue	0 - 8, step 0.01	0	Set the compensation value for each channel. Note: SpatialCompensationMode = Manual Only
ObjectDirection	0: Forward Direction 1: Reverse Direction	Forward Direction	Set the direction og moving objects. Note: SpatialCompensationMode = Auto Only
ObjectDirectionSource	UserOutput0 ~ 3 Line4: TTL In1 Line5: Opt In1 Line10: TTL In2 Line13: TTL In3 EncoderDirection	Line4: TTL In1	Select the input to use for obtaining the movement direction information for the object. Note: SpatialCompensationMode = Auto Only
SpatialCompensationDistance	0.5 - 2, step 0.01	1	Set the amount of movement in pixels of the imaging subject within the sensor during a single trigger. Note: SpatialCompensationMode = Auto Only

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 Camera Link cable or 6-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

Item	Specifications	
Image Sensor	4K high speed trilinear CMOS image sensor	
	Effective Pixels	4096 pixel × 3 (R, G, B)
	Pixel Size	7.5 μm × 7.5 μm
Synchronization	Internal	
Communication Interface	SW-4000TL-10GE: 10GBase-T, 5GBase-T, 2.5GBase-T, 1000Base-T SW-4000TL-SFP: 10GBase-R	
Line Rate	RGB8: 66* ~ 66kHz (0.1Hz/step)	
	Note: *When taking a trigger signal from the outside, there is no limitation on the minimum value	
Video S/N ratio	>55 dB (Gain = 0dB) @10bit	
Object illuminance (min.)	220 lx @ 7800 K, Mode A (Gain 18 dB, Line period 525 μs, 50% video, Light source White LED7800K)	
Responsivity	127 DN/nJ/cm ² , Mode A (G channel, 10-bit @ 550 nm, 0 dB gain)	
Digital Image Output Format	ROI (Horizontal) / Binning	Width: 16(8) ~ 4096 (2048) pixels, 16 (8) pixels/step
		OffsetX: 0 ~ 4080 (2040) pixels, 16 (8) pixels/step
		When Binning is On (=2), the value in parenthesis is applicable.
	ROI (Vertical)	Height: 1 ~ 4096 lines, 1 line/step
		Offset: 0 ~ 4095 lines, 1 line/step
Pixel Format	RGB8, RGB10V1Packed, RGB10p32, YUV422_8_UYVY, YUV422_8	
Acquisition Mode	SingleFrame, MultiFrame, Continuous	
Exposure Mode	Off: Line Period - 3.29μs + 0.85μs Variable Unit: 1.0 μ s Timed: 3.0μs ~ 15.149ms Variable Unit: 1.0 μ s TriggerWidth: 1.8μs ~ 1s Variable Unit: 1.0 μ s (Trigger Width + 0.85μs)	
Trigger Selector	Acquisition: AcquisitionStart / AcquisitionEnd Exposure: FrameStart / LineStart Transfer: FrameTransferStart	

Item	Specifications		
Trigger Inputs	12pin (DC IN/TRIG): TTL, Opt Input 10pin (AUX): TTL Input Positive / negative logic switchable. Minimum trigger width: 50ns and more		
Trigger Input Signals	Line4 (TTL In1), Line5 (Opt IN1), Line10 (TTL In2), Line13 (TTL In3), PulseGenerator0-3, UserOutput0-3, Action0-3, LogicBlock0-1, EncoderTrigger		
Gain Adjustment	Analog AnalogBaseGain: 0dB, 6dB, 12dB Digital IndividualGainMode = Off - Digital All: x1.0 ~ x32.0 (0dB ~ 30dB) - DigitalRed/DigitalBlue:x0.4 ~ x4 (-7.96dB ~ 12dB) IndividualGainMode = ON - DigitalGreen/DigitalRed/DigitalBlue: x1.0 ~ x64.0 (0dB ~ 36dB)		
Black Level Adjustment	Manual All: -133 ~ +255 (LSB@12bit) Red/Blue: -64 ~ +64 (LSB@12bit) Default setting: Output black level at 0 (33LSB during 10-bit)		
White Balance	BalanceWhiteAuto: Off, Once, Preset5000K, Preset6500K, Preset7500K Adjustment Range: 3000K ~ 9000K		
Test Pattern	White, GreyPattern1(Ramp), GreyPattern2(Stripe), ColorBar		
Image Processing	Pixel Sensitivity Correction: Pixel Correction (DSNU, PRNU) Shading Correction (ColorShading, FlatShading) LUT: Off : y =1.0, ON: 257 points can be set. Gamma: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0 (9 steps available) Noise Reduction Filter (MEDIAN, FLIR, NoiseReduction*) <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Note: NoiseReduction: SW-4000TL-10GEonly </div>		
PRNU	Post-correction: Within ±1% (during 100% output)		
DSNU	Post-correction: Within ±5% (during 0% output)		
Power Supply (12-pin Connector)	12-pin	Input Range	DC + 10V ~ + 25V
		Consumption	SW-4000TL-10GE: 9.3 W(typ.)(at 12 V input, full pixel, Default setting, Environmental temperature 25°C) (Typical), 14.7 W (Maximum)
			SW-4000TL-SFP: 8.0 W(typ.)(at 12 V input, full pixel, Default setting, Environmental temperature 25°C) (Typical), 12.4 W (Maximum)

Item	Specifications	
Connectors / LEDs	RJ45 (SW-4000TL-10GE)	Ethernet standards and the cable type and the maximum cable length. 1000 Base-T : Cat5e, Cat6, Cat6e, Cat6A, Cat7 2.5G Base-T : Cat5e, Cat6, Cat6e, Cat6A, Cat7 5G Base-T : Cat6, Cat6e, Cat6A, Cat7 10G Base-T : Cat6*, Cat6e*, Cat6A, Cat7 *) The maximum cable length is limited to 55m.
	SFP+ (SW-4000TL-SFP)	10GBase-R, Power Level 1
	12-pin (DC IN / TRIG)	Model: HR10A-10R-12PB(71) (or equivalent) Function: Power supply input / External trigger / External I/O
	10-pin (AUX)	Model (Camera side): Equivalent to Hirose Electronic 3260-10S3 (55) Model (Cable side): Equivalent to Hirose Electronic 350-10P-C (50) Function: External trigger / External I/O
	LED	Function: Power on, trigger input indicator
Flange back	M42 mount: 16 mm (in air), tolerance: 0 mm to ~ 0.05 mm F mount: 46.5 mm, tolerance: 0 mm to ~ 0.05 mm	
Verified Performance Temperature/Humidity	-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.	
Storage Temperature/Humidity	-25°C ~ +60°C (20 to 80%, non-condensing)	
Vibration Resistance	10G (20 Hz~ 200 Hz X-Y-Z direction)	
Shock Resistance	80G	
Regulations	SW-4000TL-10GE: CE (EN55032:2015/A11:2020 Class B, EN55035:2017/A11:2020), RoHS/WEEE, Part15 subpartB Class B, KC	
	SW-4000TL-SFP: CE (EN55032:2015 Class B, EN55035:2017/A11:2020), RoHS/WEEE, FCC Part15 subpartB Class B), KC	
Dimensions	62mm x 62mm x 102.3mm (WHD; excluding mount and protrusions)	
Weight	M42 mount: 340g (typ.) F mount: 410g (typ.)	

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.

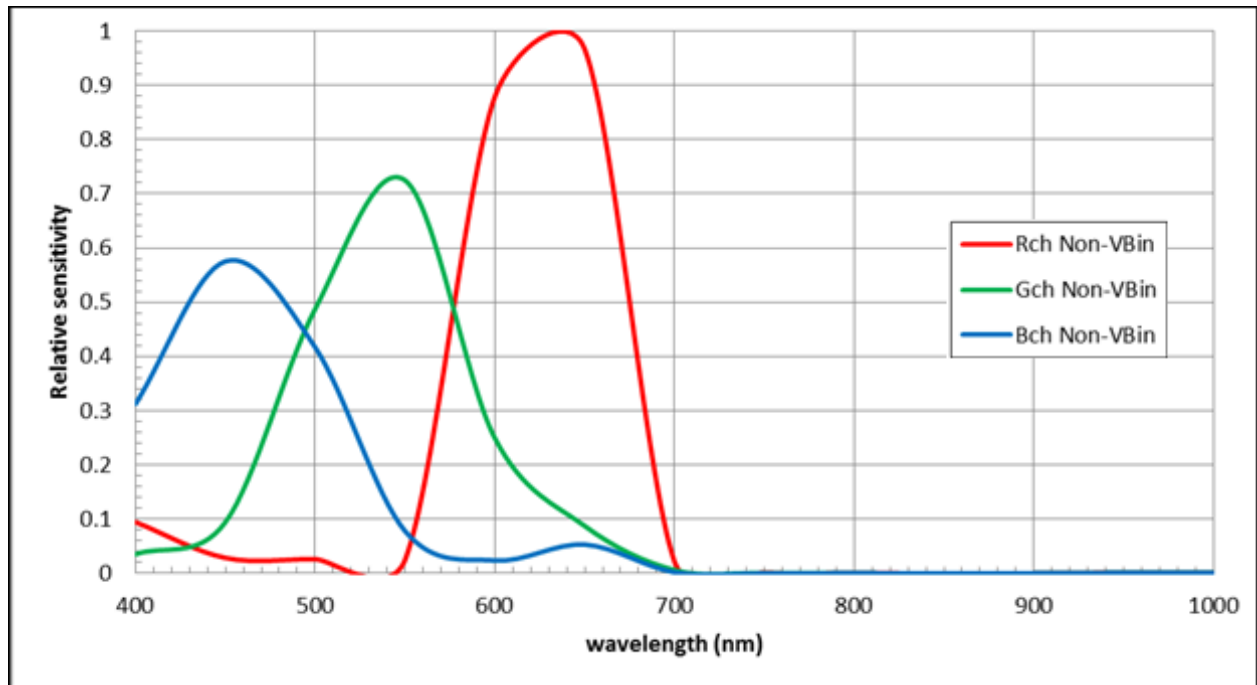
- SW-4000TL-10GE: The camera's internal temperature should not exceed 100°C during operation.
- SW-4000TL-SFP: The camera's internal temperature should not exceed 80°C during operation.

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)

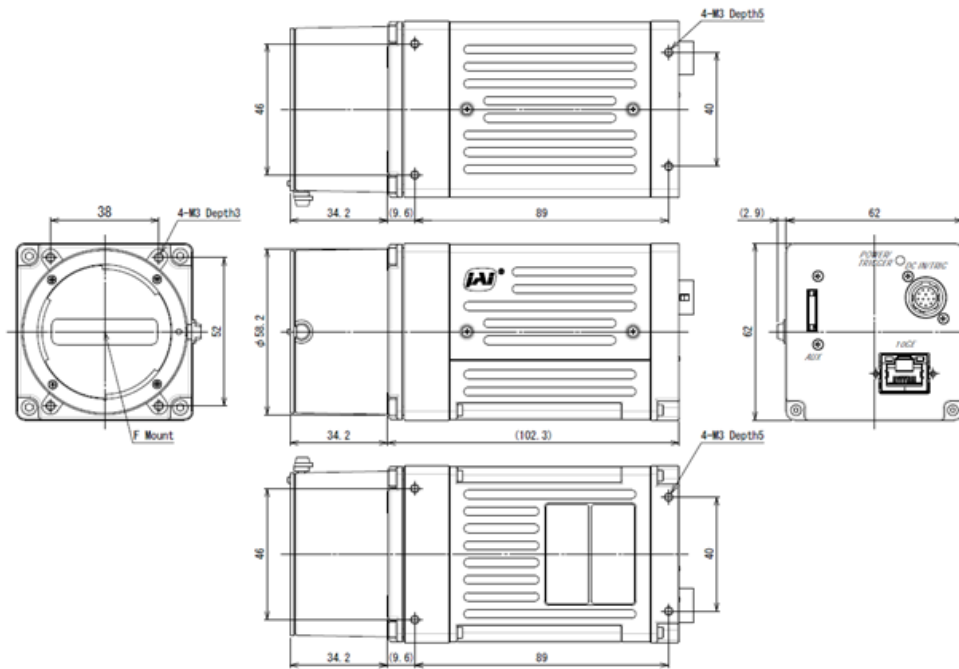
Spectral Response



Dimensions

This section shows the dimensional drawings of each camera model.

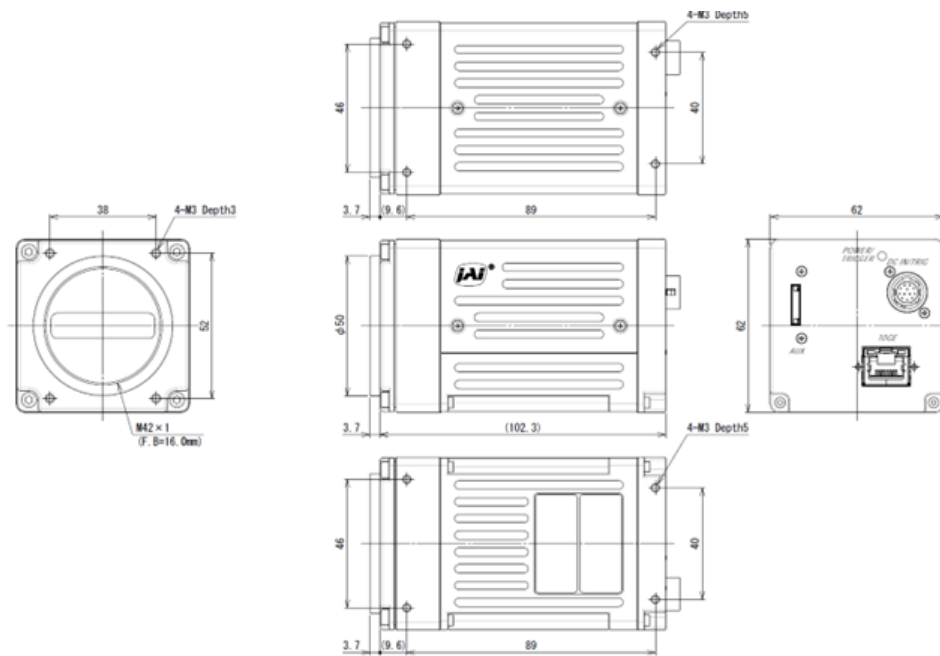
SW-4000TL-10GE-F



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- Unit: mm

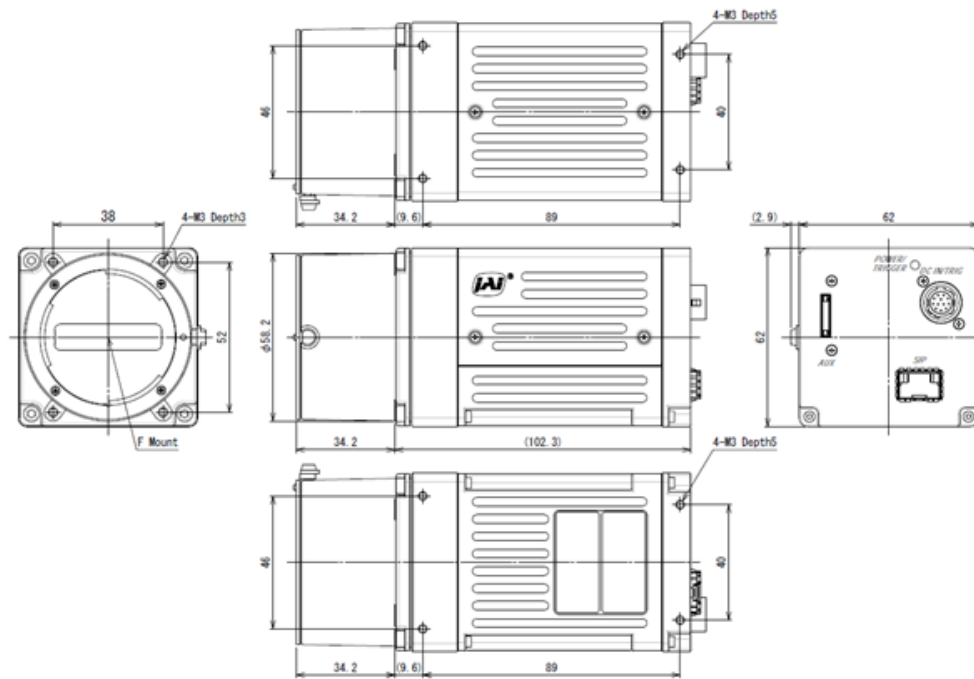
SW-4000TL-10GE-M42



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- Unit: mm

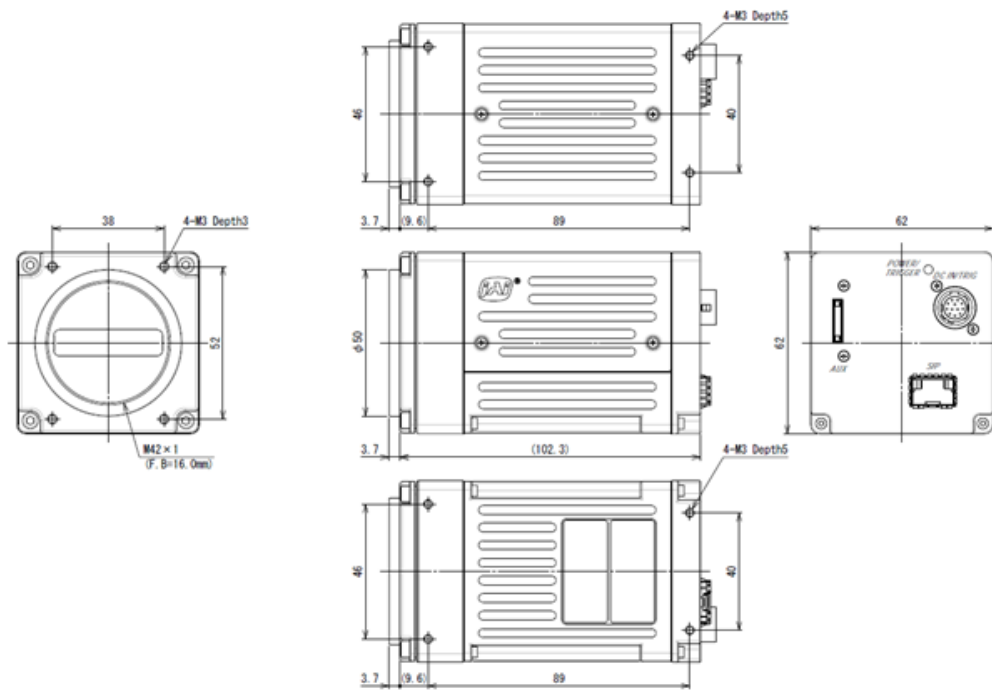
SW-4000TL-SFP-F



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- Unit: mm

SW-4000TL-SFP-M42



Notes:

- Dimensional Tolerance: $\pm 0.3\text{mm}$
- 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.

Revision History

Revision	Date	Device Version		Changes
		10GE	SFP	
2.1	2023/12/21	DV0207	DV0200	<p>Updated Certifications and Specifications (regulations/certifications).</p> <p>Revised the Step 5: Configure Trigger, Exposure, and Line Rate Settings section.</p>
2.0	2023/10/04	DV0207	DV0200	<p>Redesigned and combined the SW-4000TL-10GE and SW-4000TL-SFP user manuals, and corrected errors.</p> <p>Added the PTP (Precision Time Protocol) topic.</p> <p>Added the following functions (supported on SW-4000TL-10GE only):</p> <ul style="list-style-type: none"> "CounterResetSource" and "CounterResetActivation" (CounterAndTimerControl). (DV0207) "EncoderMaxIntervalForNonDecimationMode" (EncoderControl). (DV0202) "NoiseReduction" (Correction). (DV0107) GainAuto, AGCReference, AGCOnceStatus (AnalogControl). <p>Added a note regarding the exposure timing delay for RGB channels (e.g. ExposureMode: Off).</p> <p>Added the max line rate for 1GigE, 2.5GigE, and 5GigE. (Variable Line Rate)</p> <p>Updated "China RoHS".</p>

■ Previous Revisions

SW-4000TL-10GE

Revision	Date	Changes
1.4	Feb. 2022	Fixed the Spatial Compensation topic. Fixed the setting ranges for Objection Direction Source (SpatialControl) and Counter Value (Counter And Timer Control). Fixed China RoHS.
1.3	Nov. 2021	Modified the lens description (Preparation). Added the Non-Volatile Flash Memory topic.
1.2	Nov. 2020	China RoHS, etc
1.1	Oct. 2020	Added NoiseReduction digital filter function, etc.
1.0	April 2019	First version

SW-4000TL-SFP

Revision	Date	Changes
1.3	July 2022	Corrected China RoHS, added the Non-Volatile Flash Memory topic.
1.2	Nov. 2020	China RoHS, etc
1.1	Oct. 2020	Added NoiseReduction digital filter function, etc.
1.0	May 2019	First Release

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