See the possibilities

User Manual

SW-4000TL-10GE

High Speed CMOS Trilinear Camera
Document Version: 1.0
SW-4000TL-10GE_Ver.1.0 _Apr.2019

Thank you for purchasing this product.

⚠ Be sure to read this manual before use.

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

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

Contents

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 complies with the following provisions applying to its standards.
EN 61000-6-3 (Generic emission standard part 1)
EN 61000-6-2 (Generic immunity standard part 1)

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

제조년월은 제품상자의 라벨을 참조하십시요

Supplement

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『电子信息产品污染控制管理办法』，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 (PPB)	多溴二苯醚 (PBDE)
棱镜	×	○	○	○	○	○
光学滤镜	×	○	×	○	○	○
连接插头	×	○	○	○	○	○
电路板	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 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SJ/T11363-2006规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。
（企业可在此处、根据实际情况对上表中打 "×" 的技术原因进行进一步说明。）

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基人身、财产造成严重损害的期限。

数字「15」为期限15年。

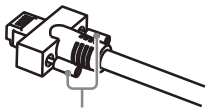
Usage Precautions

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 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)



Secure manually.
Do not secure too tightly.

Notes on temperature conditions

The guaranteed operating temperature and humidity of this camera are -5℃ to +45℃, 20% to 80% (non-condensing).
Please make sure the following temperature condition is met when operating the unit.
1) The camera's internal temperature sensor detects temperatures of 100 °C or less during operation.
If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

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.

Notes on attaching the lens

Avoiding dust particles
When attaching the lens to the camera, stray dust and other particles may adhere to the sensor surface and rear surface of the lens. Be careful of the following when attaching the lens.
- Work in a clean environment.
- Do not remove the caps from the camera and lens until immediately before you attach the lens.
- To prevent dust from adhering to surfaces, point the camera and lens downward and do not allow the lens surface to come into contact with your hands or other objects.
- Always use a blower brush to remove any dust that adheres.
  Never use your hands or cloth, blow with your mouth, or use other methods to remove dust.

Phenomena specific to CMOS image sensors

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

Notes on exportation

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

Features

The SW-4000TL-10GE 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

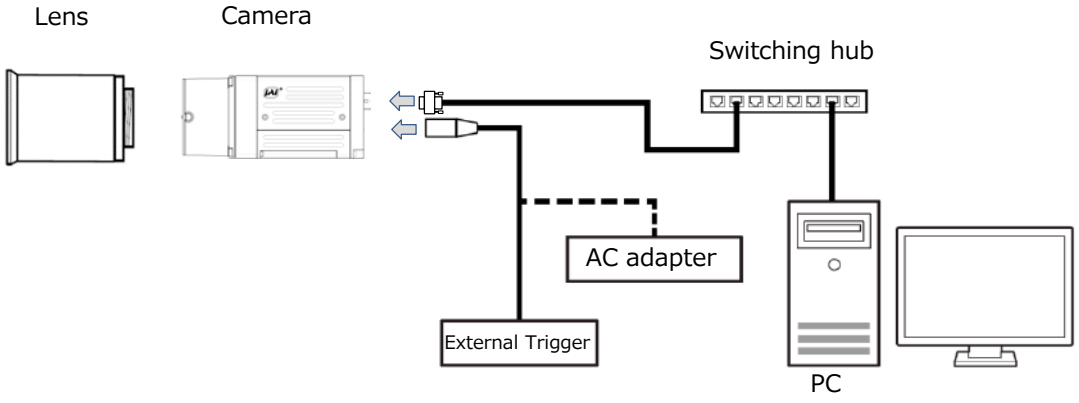
- **10 GigE Interface**
  - The camera supports the following Ethernet standards. (1000Base-T, 2.5GBase-T, 5GBase-T, 10GBase-T)

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

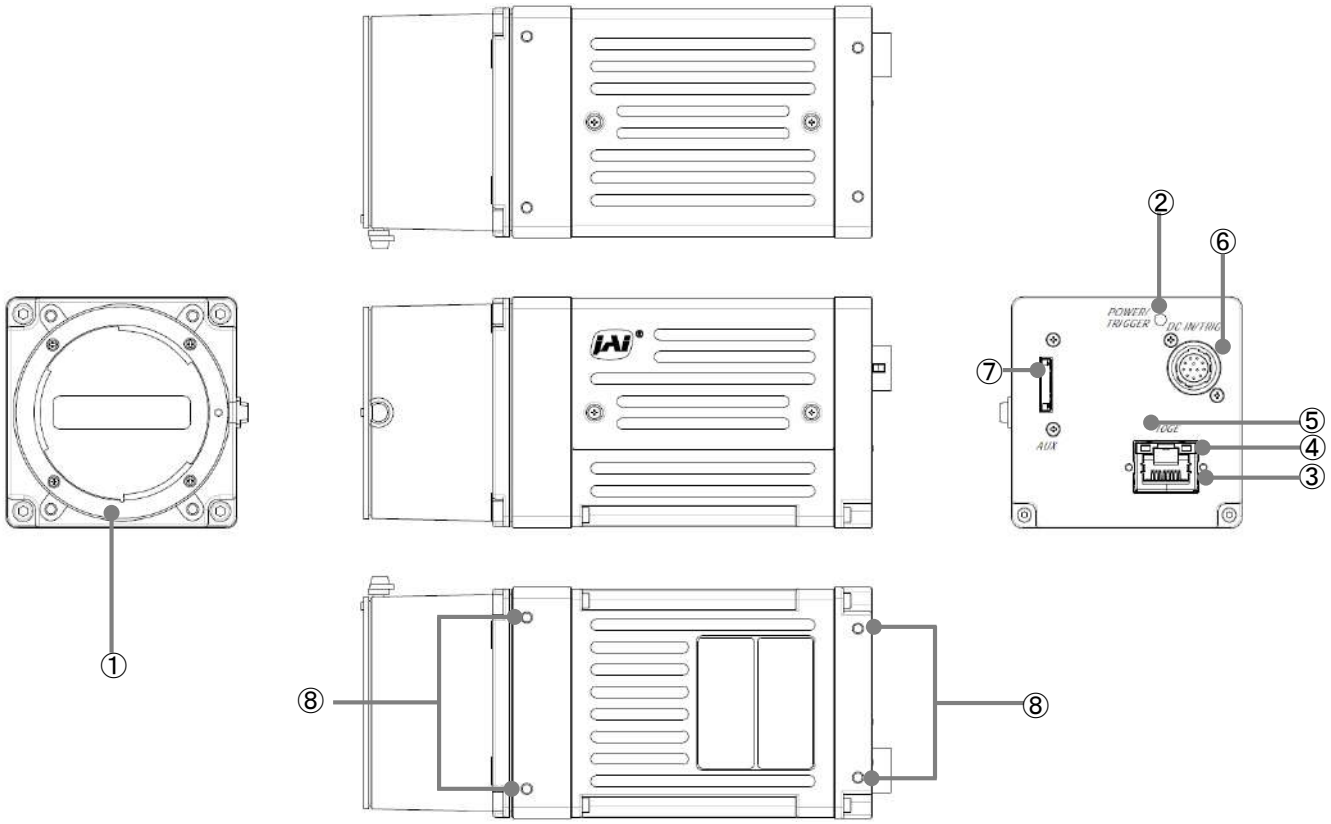
- **Variety of pre-process functions**
  - **LUT (Lookup Table)**
    Programmable control over gamma and contrast is possible.
  - **Gamma correction**
    Gamma can be set to 1.0, 0.9, 0.8, 0.75, 0.65, 0.6, 0.55, 0.5, or 0.45 (off).
  - **Shading correction (flat field)**
    Non-uniformity (i.e., 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

Connection example:



Parts Identification



① Lens mount （M42-mount /F-mount)
Mount a M42-mount lens, F-mount lens, etc. here.
❖ Before mounting a lens, be sure to refer to “Step 2:Connecting Devices” and confirm the precautions for attaching a lens and the supported lens types.

② POWER/TRIG LED

Indicates the power and trigger input status.

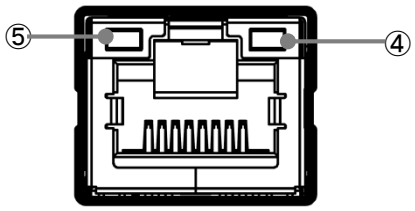
LED status and camera status

LED	Light	Status
POWER/TRIG LED	(Lit amber)	Camera initializing.
	(Lit green)	Camera in operation.
	(Blinking green)	During operation in trigger mode, trigger signals are being input * The blinking interval is not related to the actual input interval of the external trigger.

③ RJ-45 connector

The camera 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 Connecting Devices".



④ LINK LED

Indicates the link status of the network.

LED	Light	Status
LINK	(Lights off)	Network Link is not established.
	(Blinking green slowly)	1000Base-T Link is established. (Interval 1sec)
	(Blinking green quickly)	2.5GBase-T Link or 5GBase-T Link is established. (Interval 200 msec)
	(Lit green)	10GBase-T Link is established.

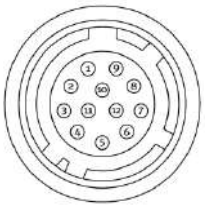
⑤ ACT LED

Indicates the network communication status.

LED	Light	Status
ACT	(Lights off)	No network communication
	(Blinking green)	(Tx) Network communication in progress.
	(Blinking yellow)	(Rx) Network communication in progress.

⑥ DC IN/TRIG connector（12-pin round）

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



HR10A-10R-12PB（71） (Hirose Electric or equivalent)

Pin No.	Input/Output	Signal	Description
1		GND	
2	Power In	DC In	DC 10 V ～ 25 V
3		GND	
4		RESERVED	
5	In	Opto In 1 -	Line 5
6	In	Opto In 1 +	
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 10 V ～ 25 V
12		GND	

Note

In order to operate at the maximum line rate, 10-25V DC power must be connected to both Pin1/Pin2 and Pin 11/Pin12. If you supply power to only one pin pair, the camera may operate at less than the maximum line rate or may not operate at all.
IMPORTANT! You must supply the same voltage to each pin pair. If you supply different voltages to each pin pair, the power unit of the camera will be damaged.

TTL signal specification

TTL out signal specification (Typ.)

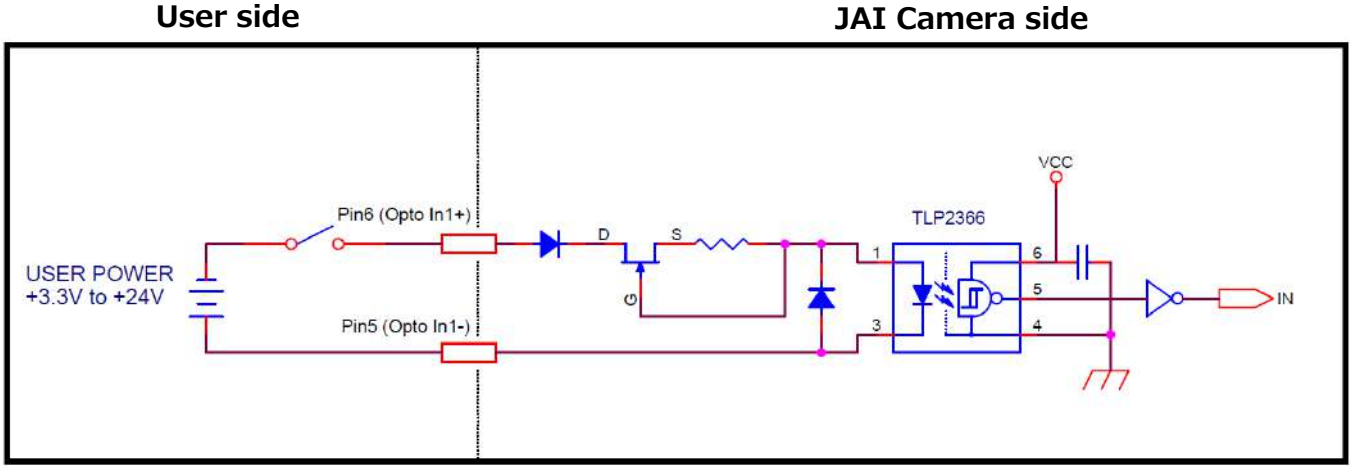
Output voltage : Low 0.0V
High 5.0V

Input/Output current : +/-32mA

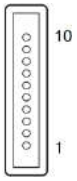
TTL in signal specification (Typ.)

Input voltage : Low 0.0～0.8V
High 2.0～5.5V

Recommended external input circuit diagram (reference example)



⑦ AUX connector（10-pin）



Camera side : 3260-10S3（55） （Hirose Electric or equivalent ）
Cable side : 3240-10P-C（50）（Hirose Electric or equivalent ）

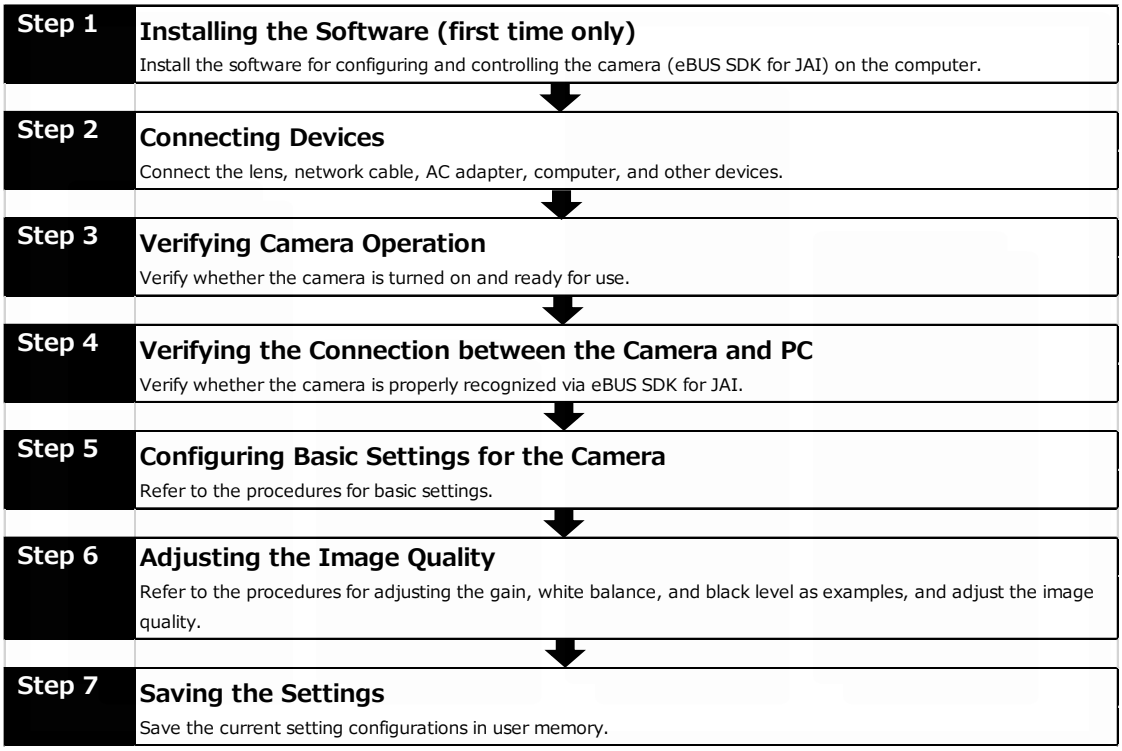
Pin No.	Input/Output	Signal	Description
1	Out	TTL_OUT2	Line 8
2	Out	TTL_OUT3	Line 9
3	In	TTL_IN2	Line 10
4		N.C.	
5	GND	GND	
6	In	TTL_IN3	Line 13
7		N.C.	
8		N.C.	
9	GND	GND	
10	GND	GND	

⑧ Camera locking screw holes （M3, 5mm depth）

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

Preparation

Preparation Process



Step 1: Installing 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.

❖ When you install eBUS SDK for JAI, eBUS SDK for JAI player will also be installed.

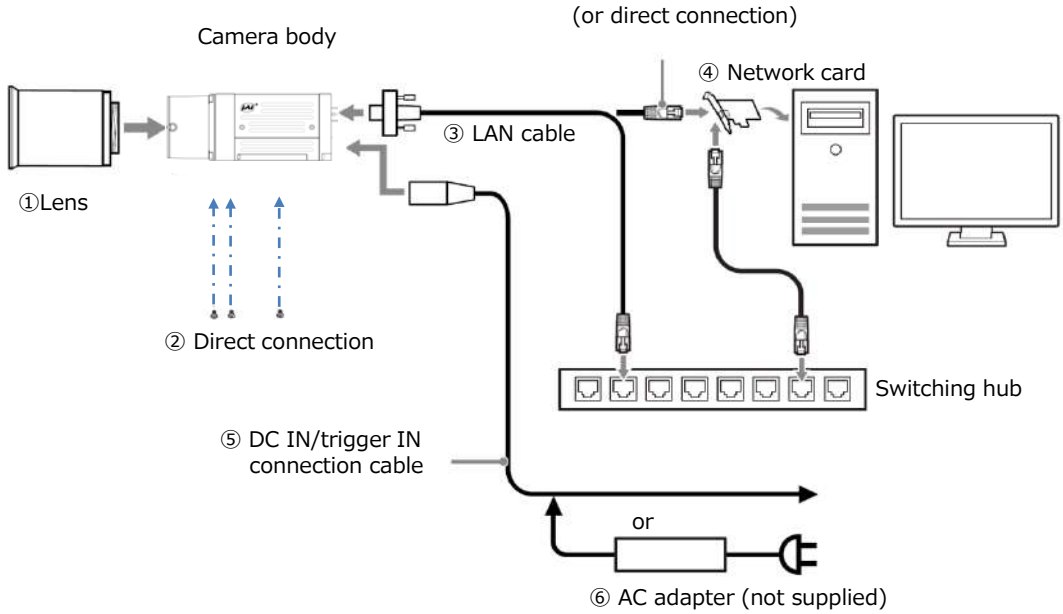
1 **Download the eBUS SDK for JAI from the JAI website.**
URL https://www.jai.com/jp/support-software/jai-software

2 **Install eBUS SDK for JAI on the computer.**

Caution

eBUS SDK for JAI was released in April 2018 and is the latest software for setting and controlling JAI cameras.
When JAI SDK and eBUS SDK for JAI are installed on the same machine, conflicts can occur. Therefore, JAI strongly recommends that JAI SDK is uninstalled before installing eBUS SDK for JAI.

Step 2: Connecting Devices



① Lens

・Attach an M42-mount lens or F-mount lens.

Caution

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

Note

The following formula can be used to estimate the focal length.
focal length = WD/(1 + W/w)
WD: Working distance (distance between lens and object)
W : Width of object
w : Width of sensor 30.72 mm on this camera.

② Direct connection

When mounting the camera directly to another device, for example, use screws that match the camera locking screw holes on the camera. (M3, 5 mm depth)

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

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.

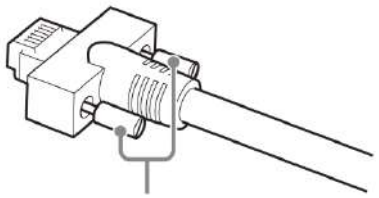
■ About the longest cable length

LAN cable type / Ethernet standard	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

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)



Secure manually.
Do not secure too tightly.

④ Network card

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**

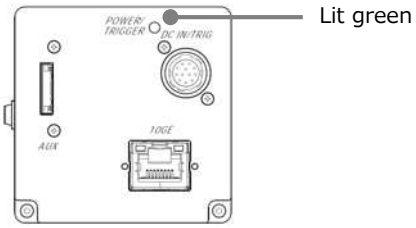
⑥ **AC adapter (power supply) (if necessary)**
Connect the AC adapter and the round connector of the connection cable to the DC IN / trigger IN connector on the camera.

Step 3: Verifying 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



* For details on how to read the LEDs, see “LED status and camera status” in the “Parts Identification” section.

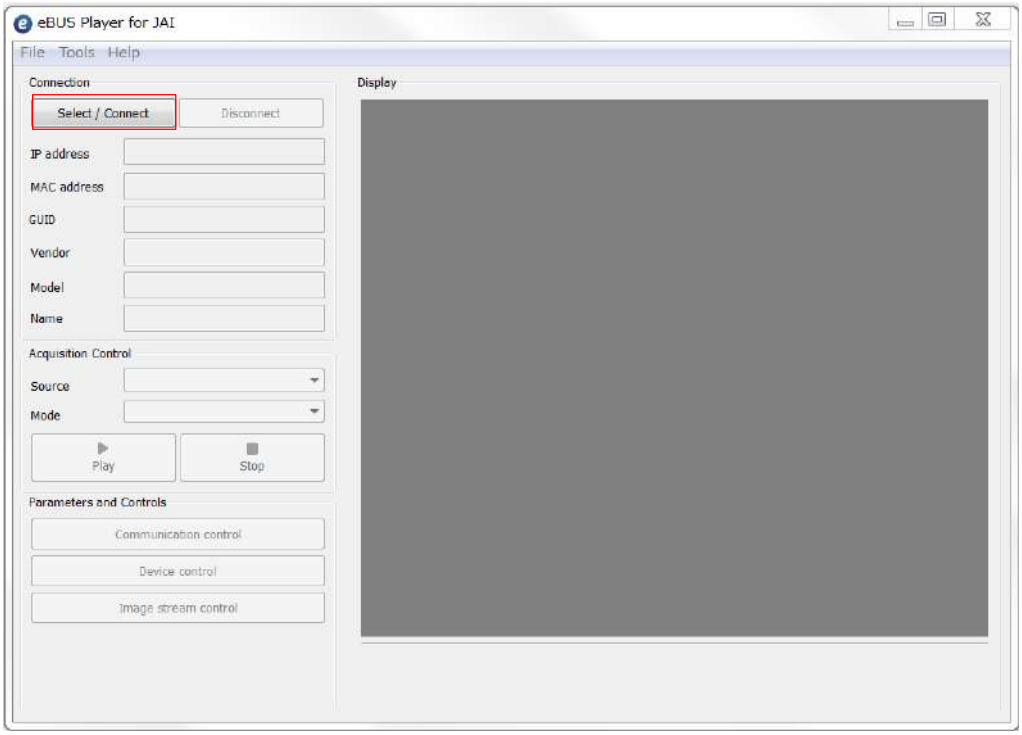
Step 4: Verifying the Connection between the Camera and PC

Verify whether the camera is properly recognized via Control Tool.

Connecting the Camera to Control Tool

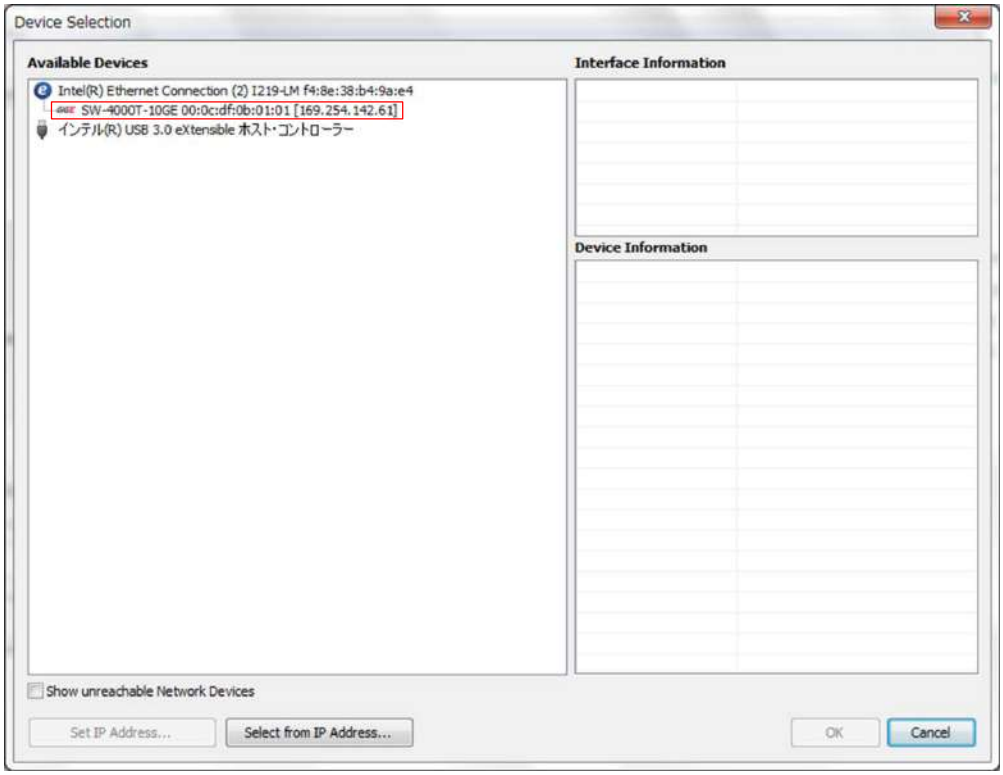
1 **Startup eBUS Player for JAI**

eBUS Player for JAI startup screen appears.



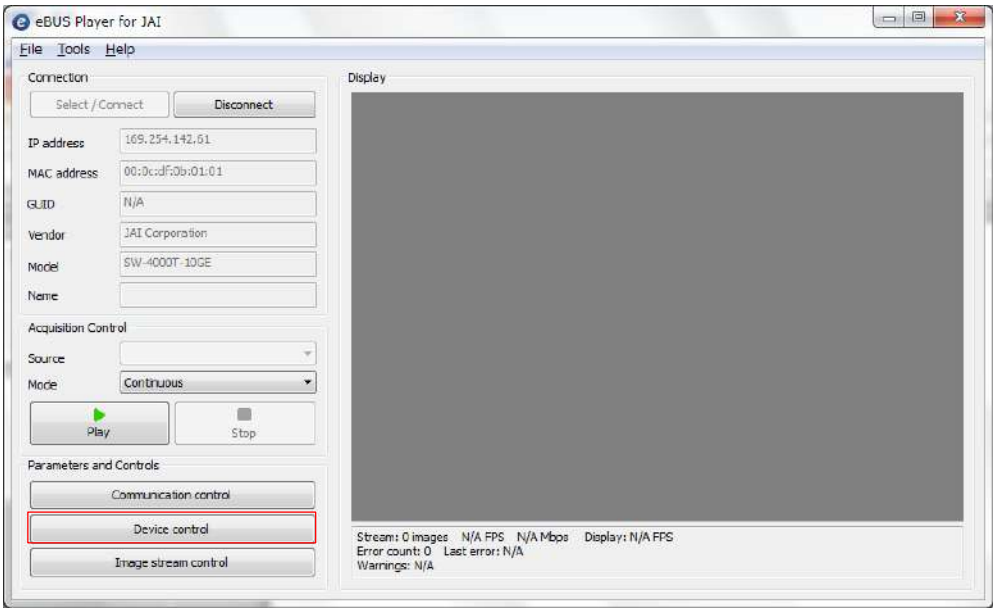
2 Select the camera you want to configure.

Push Select / Connect button

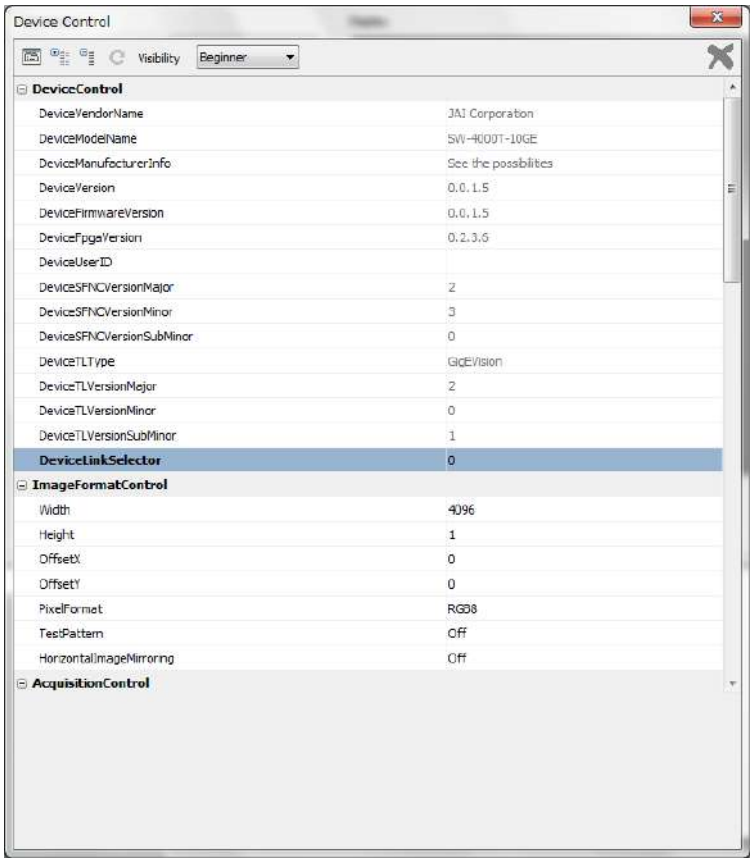


The connected camera is listed.
Please select one camera.

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



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



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

Step 5 Configuring Basic Settings for the Camera

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.

■Control via External Triggers

When Controlling the Exposure Time Using Specified Exposure Times

Configure the settings as follows.

Item	Setting value / selectable range
Trigger Mode	On
Trigger Selector	Line Start
Trigger Source	Any
Trigger Activation	Rising Edge (rising edge of input signal), Falling Edge (falling edge of input signal)
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.

1 **Set [Exposure Mode] to [Timed].**

2 **Specify the exposure time in [Exposure Time].**

3 **Set [Trigger Mode] to [On] and set [Trigger Selector] to [Line Start].**

4 **If necessary, change the [Trigger Source], and [Trigger Activation] settings.**

When Controlling the Exposure Time Using the Pulse Width of the Trigger Input Signal

Configure the settings as follows.

Item	Setting value / selectable range
Trigger Mode	On
Trigger Selector	Line Start
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 [Trigger Width] .**

3 **If necessary, change the [Trigger Source] and [Trigger Activation] settings.**

■Control Without External Triggers

When Controlling the Exposure Time Using Specified Exposure Times

Configure the settings as follows.

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

1 **Set [Exposure Mode] to [Timed].**

2 **Set [Trigger Mode] to [Off].**

3 **Specify a line period slower than the exposure time in [Acquisition Line Rate].**

4 **Specify the exposure time in [Exposure Time].**

When Not Controlling the Exposure Time

Configure the settings as follows.

Item	Setting value / selectable range
Exposure Mode	Off

The exposure will be performed with an exposure time equal to 1 / line rate.

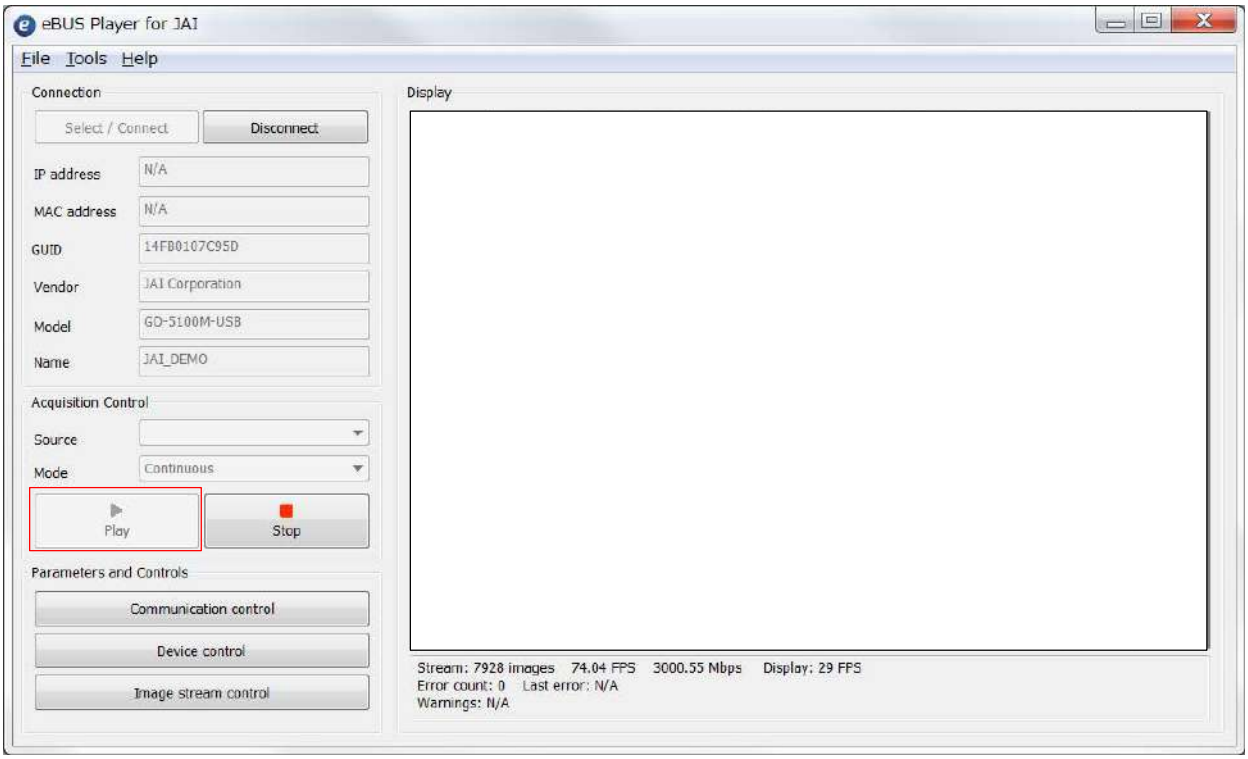
* The exposure time specified in [Exposure Time] will be disabled.

Step 6: Adjusting the Image Quality

Display the camera image and adjust the image quality.

Displaying the Image

Display the image captured by the camera.
When you push [Play] button, the camera image appears in right area.



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

1 **Configure the line rate.**

◇ For details on this setting, “Variable Line Rate”.

2 **Configure the exposure time.**

◇ For details on this setting, “Electronic Shutter” .

3 **Perform DSNU correction.**

◇ For details on this setting, “Pixel Sensitivity Correction”.

4 **Perform PRNU correction.**

◇ For details on this setting, “Pixel Sensitivity Correction” .

5 **Adjust the black level.**

◇ For details on this setting, “Black Level Correction”.

6 **Adjust the white balance.**

Adjust the white balance using the automatic adjustment function.

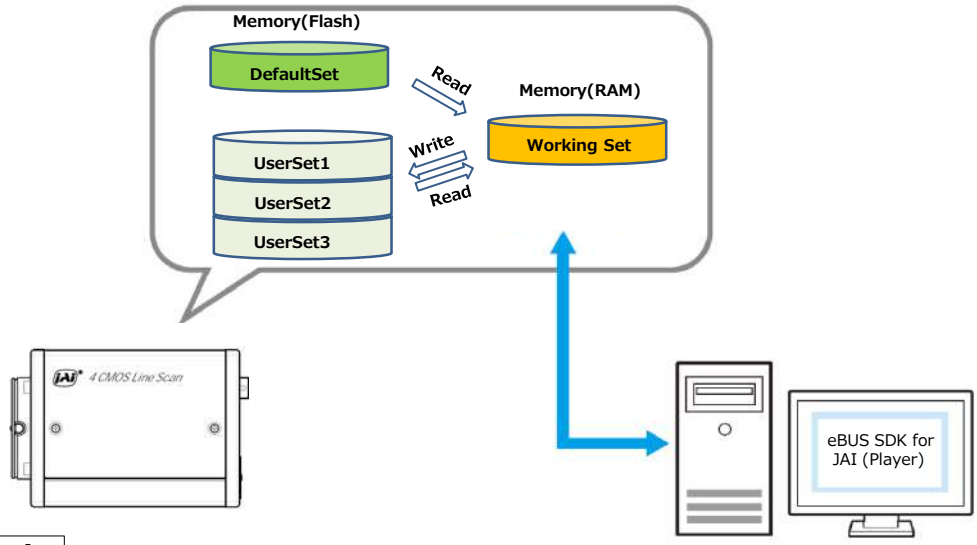
① Place a white sheet of paper or similar object under the same lighting conditions as the intended subject, and zoom in to capture the white.
White objects near the subject, such as a white cloth or wall, can also be used.
Be sure to prevent the high-intensity spot lights from entering the screen.
The white balance is automatically adjusted.
② Select the [Balance White Auto] tab, and select [Once].
The white balance is automatically adjusted.

7 **Perform spatial correction.**

◇ For details on this setting, “Spatial Compensation Function” .

Step 7: Saving the Settings

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



Note

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

■ **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 [UserSetSave].**

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 [UserSetLoad].**

The selected user settings are loaded.

Main Functions

Valid Input / Output Combinations

The following signals can be used as sources for each output destination (Trigger Selector, Line Selector, Pulse Generator Selector).
You can also connect two different sources to NAND paths in the GPIO and reuse the signal generated there as a source for a different selector.

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

Selector (Cross point switch output) / Source Signal (Cross point switch input)		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)

The unit 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	AUX connector (10 pin)
	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	AUX connector (10 pin)
	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 [Trigger Selector] > [Trigger Source].
- When selecting the signals to use for external outputs:
  Select in [Line Selector] > [Line Source].

Pixel Format

The SW-4000T-10GE supports five output formats.

RGB8
RGB10V1Packed
RGB10p32
YUV422_8_UYVY
YUV422_8

Exposure Mode

The following operation modes are available on the camera.

Operation mode	
Exposure Mode	**Trigger Mode**
OFF	OFF
	ON
Timed	OFF
	ON
Trigger Width	ON

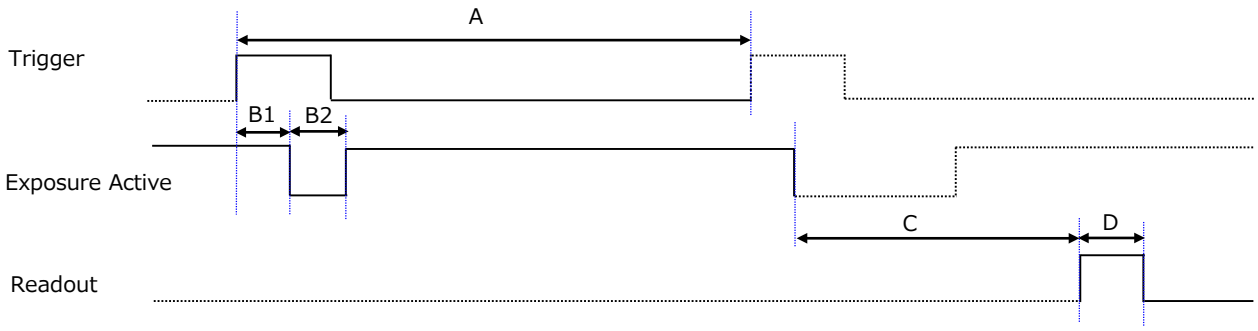
Image Output Timing

■ Trigger Control

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

Trigger Selector	Description
FrameStart	Imaging of one frame is started by input of external trigger signal.
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.
FrameTransferStart	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.

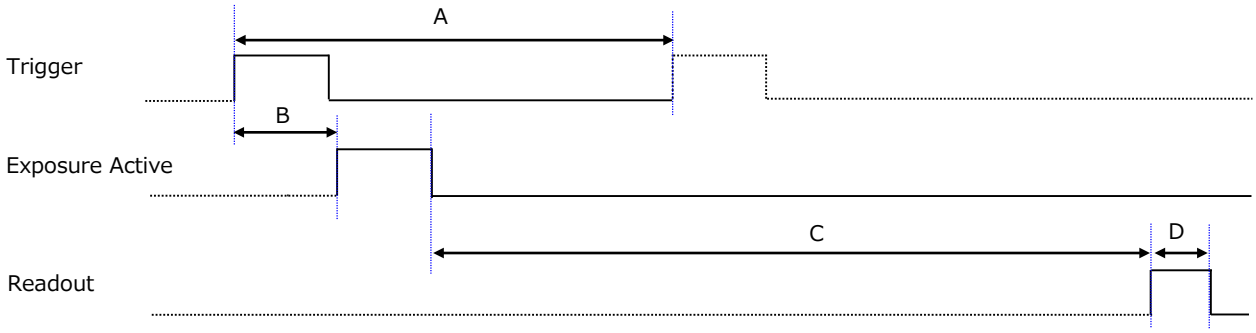
■ When [Exposure Mode] is [OFF]



Pixel Format	Width	Trigger Period[A] (µs) (*)	Delay Time from Trigger to Exposure Active[B1] (µs)	Expousre Acrive Non Active[B2] (µs)	Period from Exposure Active Falling 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
RGBa8	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

(*) H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

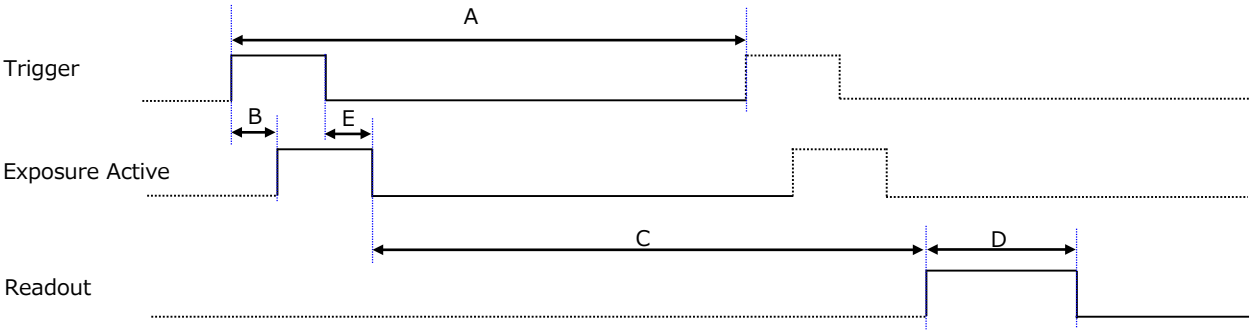
■ When [Exposure Mode] is [Timed]



Pixel Format	Width	Trigger Period[A] (µs) (*)	Delay Time from Trigger Rising to Exposure Active Rising[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
RGBa8	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

*) H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

■ When [Exposure Mode] is [Trigger Width]



Pixel Format	Width	Trigger Period[A] (µs) (*)	Delay Time from Trigger Rising to Exposure Active Rising[B] (µs)	Period from Exposure Active Falling to LVAL rising[C] (µs)	LVAL Active[D] (µs)	Delay Time from Trigger Falling to Exposure Active Falling[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
RGBa8	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

*) H Binning = Off, GevGVSPExtendedIDMode = Off, GevSCPDPacketSize = 8976

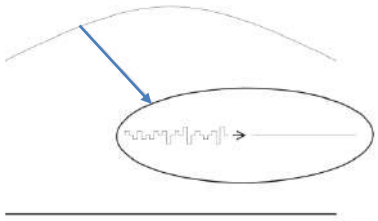
Pixel Sensitivity Correction

Correct variations between the sensor's pixels.
Calibration must be performed within the camera and correction data must be created beforehand. DSNU (Pixel Black Correct) / PRNU (Pixel Gain Correct) can be reduced using that correction data. We recommend performing calibration and creating correction data whenever the line rate setting is changed significantly.

- ⯎ Correction data is saved for DSNU (Pixel Black Correct) / PRNU (Pixel Gain Correct) according to the conditions adjusted at the factory. Perform calibration whenever changing setting, such as the Acquisition Line Rate setting, and use the correction data for DSNU (Pixel Black Correct) / PRNU (Pixel Gain Correct).
- ◇ Perform DSNU (Pixel Black Correct) calibration again whenever the exposure time or analog base gain value is adjusted.
- ◇ 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)

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.



DSNU Correction (Pixel Black Correct)

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.

Gain Control

The following gain functions are available on the camera.
- Analog base gain
- 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).

■ Two digital gain control modes

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

・Master Mode

Set [Individual Gain Mode] to [Off], and adjust the gain by configuring the following three items.

Digital All	x 1 ～ x 8	(0dB ～18dB)
Digital Red	x 0.4 ～ x 4	(-7.96dB ～ 12dB)
Digital Blue	x 0.4 ～ x 4	(-7.96dB ～ 12dB)

・Individual Mode

Set [Individual Gain Mode] to [On], and adjust the gain by configuring the following three items.

Digital Green	x 1 ～ x 16	(0dB ～ 24dB)
Digital Red	x 1 ～ x 16	(0dB ～ 24dB)
Digital Blue	x 1 ～ x 16	(0dB ～ 24dB)

The following two gain values are added together for the total gain value.
Total Gain = Analog Base Gain (dB) + Digital Gain (dB)

Lookup Table（LUT）

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.
You can specify the output curve using 257 setting points (indexes).

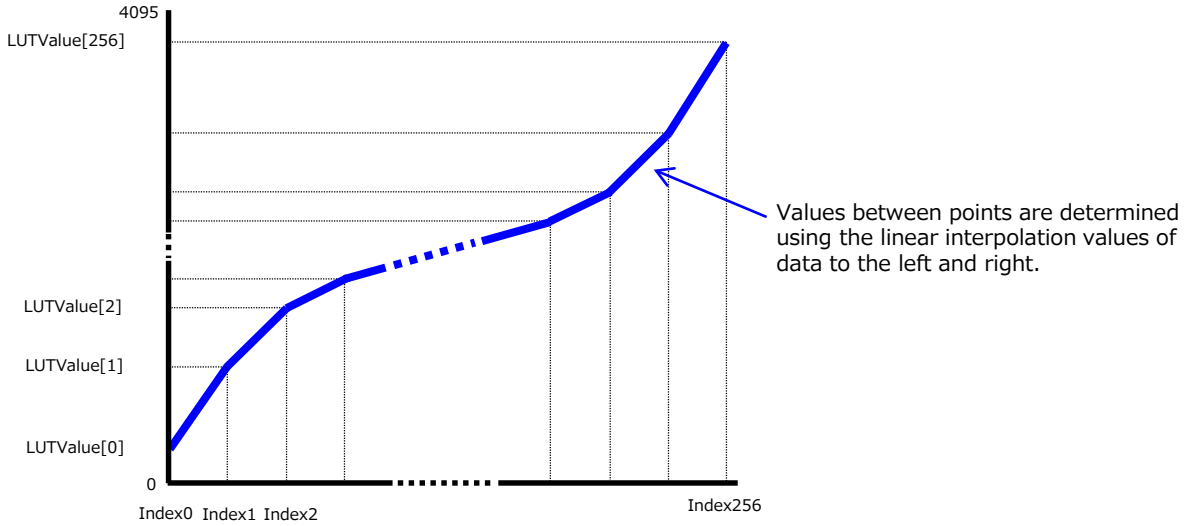
■ To use the LUT function

Configure the settings as follows.

Item	Setting value / selectable range	Description
LUTMode	LUT	Use LUT.
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.

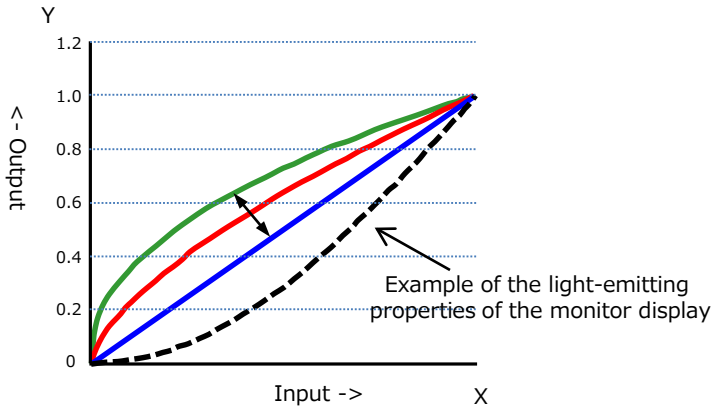
■ LUT Value

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

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 “Lookup Table (LUT)”.

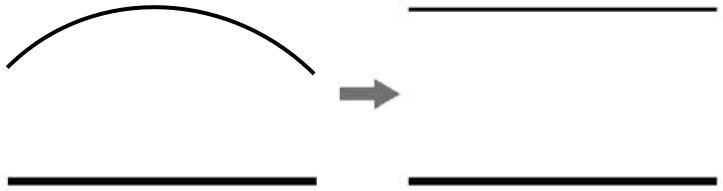
Shading Correction

The shading correction is a function that 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。

■ **Flat shading correction**

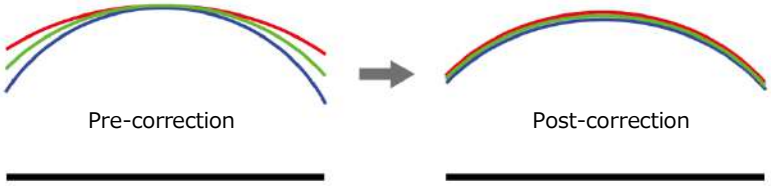
Correct so that the part with the highest luminance level in the screen is taken as the reference and the other part is adjusted to this luminance level.



◇ 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.

■ **Color shading correction**

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



■ **To perform the shading 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.

◇ You can also save the setting and have it applied whenever the power is subsequently turned on. For details on saving the setting, see “Step 7: Saving the Settings”

Caution

- 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

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.

Digital All	−133 ～+255	(LSB@12bit)
Digital Red	−64 ～ +64	(LSB@12bit)
Digital Blue	−64 ～ +64	(LSB@12bit)

Variable Line Rate

You can set the line rate to 1L or more. 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: RGB8 66Hz*～ 66kHz

*) When taking a trigger signal from the outside, there is no limitation on the minimum value.

- Variable unit: 0.1 Hz
- Supported operation modes: Exposure Mode OFF / Trigger OFF
  Exposure Mode Timed / Trigger OFF

◇ 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.

Electronic Shutter

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

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

Caution

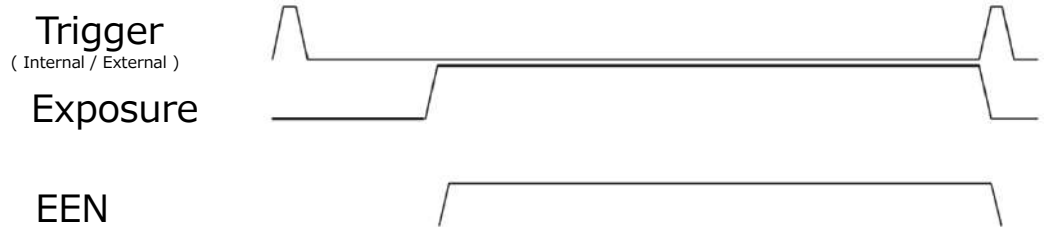
In “Trigger Mode OFF, Exposure Mode Timed” mode, the line rate configured will be the maximum value at which the shutter operates. However, in “Trigger Mode ON, Exposure Mode Timed” mode, the input trigger period will be the maximum value.

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

EEN (Exposure Enable) Function

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 DC IN/TRIG IN connector (12-pin round)



Test Pattern Function

You can display the following types of test patterns (Off, White, GrayPattern1, GrayPattern2, 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.

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

Color Space Conversion (Color Transformation Control)

The SW-4000TL-10GE model 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 Color Transformation Mode and Color Transformation RGB Mode as follows.

*) 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
H S I	H S I	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.

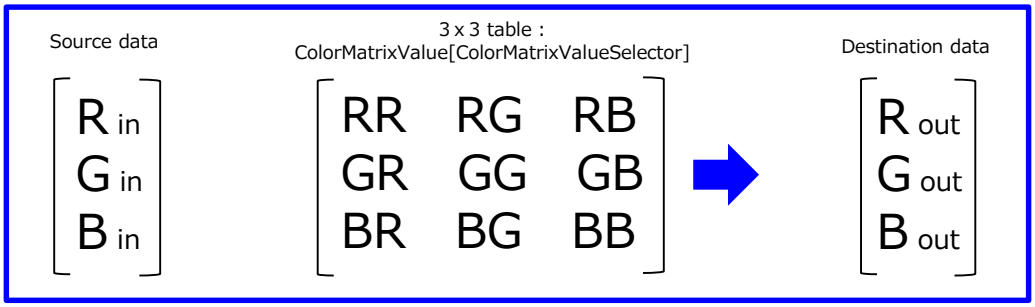
Note

Color space (H S I)
Value of Hue : For 0°-360°, specify as follows.
8bit output: 2°/step 0°(00000000) ～ 360°(10110100)
10bit output: 0.5°/step 0°(0000000000) ～ 360°(1011010000)

Value of Saturation, Intensity: For 0% - 100%, specify as follows.
8bit output: 0%(00000000) ～ 100%(11111111)
10bit output : 0%(00000000) ～ 100%(1111111111)

■ Note on RGB (UserCustom)

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



Configuration 3x3 table. Select the item you want to configure in [ColorMatrixValueSelector]. And configure the value in [ColorMatrixValue]. [ColorMatrixValue] can be set to a value from -2 to +2.

Item		Setting value	Description
ColorMatrixValueSelector		ColorMatrixR-R, ColorMatrixR-G, ColorMatrixR-B, ColorMatrixG-R, ColorMatrixG-G, ColorMatrixG-B, ColorMatrixB-R, ColorMatrixB-G, ColorMatrixB-B	Select the ColorMatrix setting component.
	ColorMatrixValue	−2 to 2	Set the Color Matrix value.

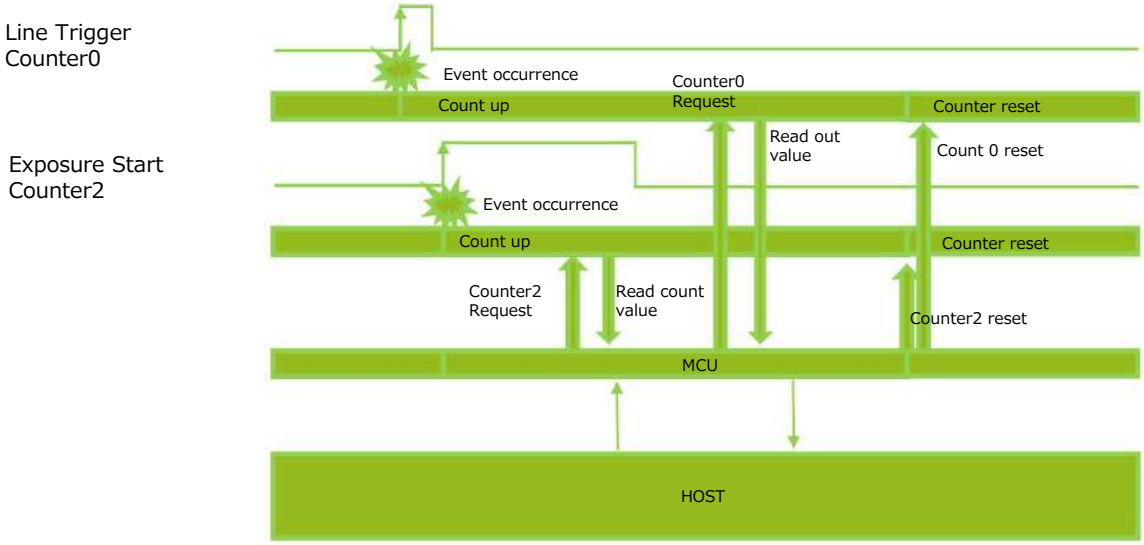
Counter And Timer Control Function

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.
Six counters are available on the camera; Counter0, Counter1, Counter2, Counter3, Counter4 and Counter5.
The functions that can be counted are fixed for each counter.

Counter0: Counts the number of Line Trigger instances.
Counter1: Counts the number of Line Start instances.
Counter2: Counts the number of Exposure Start instances.
Counter3: Counts the number of Frame Trigger instances.
Counter4: Counts the number of Frame Start instances.
Counter5: Counts 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.

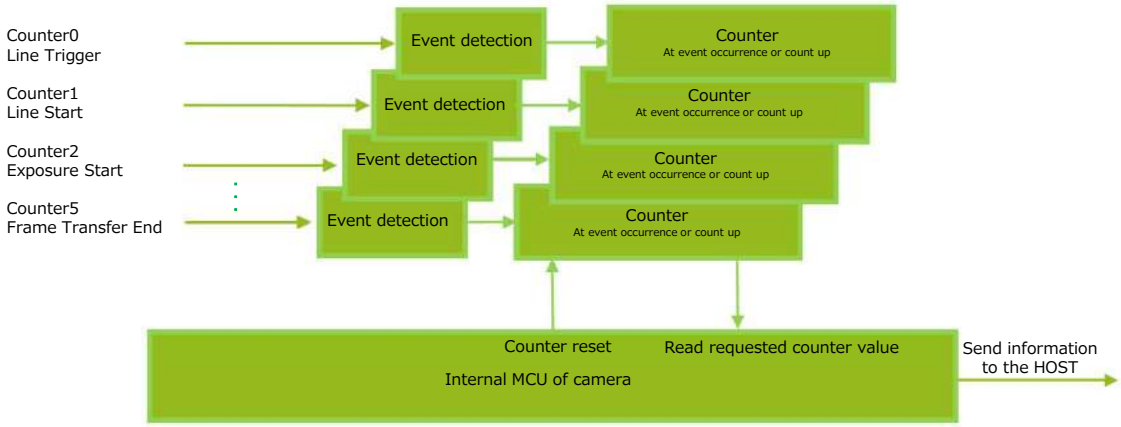
■ Counter occurrence diagram



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.
Six counters are available. Specify a counter (Counter0 to Counter5), and configure the settings.

Item	Setting value / selectable range	Description
Counter 0 ～ 5	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 Rising Edge Counter1 Rising Edge Counter2 Rising Edge Counter3 Rising Edge Counter4 Rising Edge Counter5 Falling Edge	Specify timing at which to count. (This setting is fixed.)

Tilted View Correction and Chromatic Aberration Correction

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 [On].
Alternatively, select preset Lens1, Lens2, or Lens3.

2 **Correct the R channel.**
Set [Chromatic Aberration Correction Selector] to [RChannel].
Specify the amount of correction in [Chromatic Aberration Correction Lens1,2,3] (–4.0 to +4.0 in steps of 0.1).

3 **Similarly, correct the B channel.**
Set [Chromatic Aberration Correction Selector] to [B Channel].
Specify the amount of correction in [Chromatic Aberration Correction Lens1,2,3] (–4.0 to +4.0 in steps of 0.1).

Spatial Compensation Function

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

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 (Encoder Source A), phase B (Encoder Source B)].

2 **Specify the number of triggers (number of vertical lines) to generate during each rotation of the rotary encoder.**

When [Encoder Divider] is set to [N], the rotary encoder generates 65536/N triggers.

When N is an integer multiple of 65536
Camera internal trigger is generated by decimation of output trigger of rotary encoder.

When N is not an integer multiple of 65536
Using the time interval of the output trigger of the rotary encoder, Camera 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).

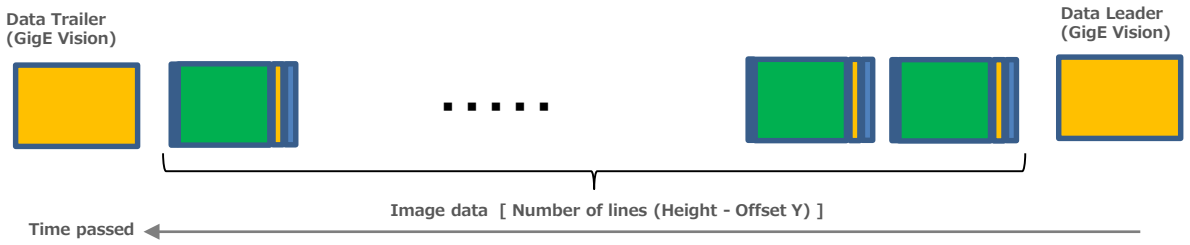
4 **If necessary, specify the strobe length of the generated signal.**

When [EncoderStrobe] is set to [M], the strobe length will be [M]×10 ns.

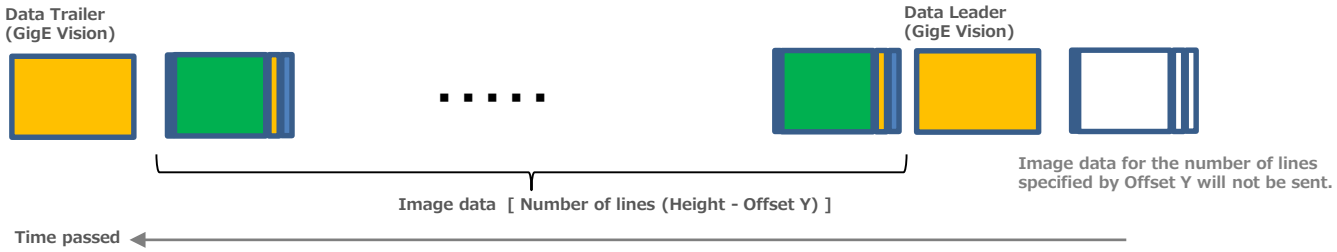
Frame Start Trigger

In this camera, Data Leader and Data Trailer are added every frame.
The number of lines of one frame is set by Offset Y, Height of [Image Format Control].
Offset Y's setting range is 0 to 4096.
Height setting range is 1 to 4096.

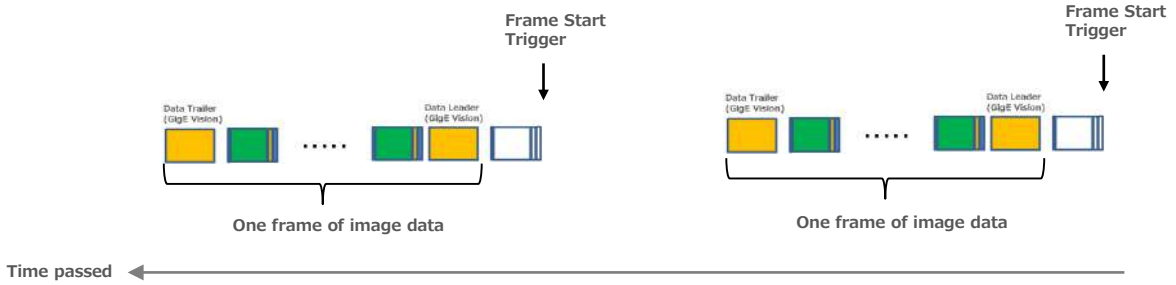
■**One frame of image data (Offset Y = 0)**



■ **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, Data Trailer. (Upon completion of data transmission for one frame, no data will be sent until the next Frame Start Trigger is received.)



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

Binning Function

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 binning via digital addition in the sensor.
This camera performs horizontal binning via digital addition processing.

ROI (Regional Scanning Function)

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 [Image Format Control].
The setting ranges for the ROI function's readable area based on the Binning setting (Binning Horizontal) are as follows.

Width (pixels)
BinningHorizontal Off: 16 to 4096 step 16
BinningHorizontal On: 8 to 2048 step 8

Offset X (pixels)
BinningHorizontal Off: 0 to 4080 step 16
BinningHorizontal On: 0 to 2040 step 8

Chunk Data Function

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.

■ **Configuring Chunk Data**

1 **Set [ChunkModeActive] to [True].**

2 **Select the items of information you want added to image data with [ChunkSelector], and set [ChunkEnable] from [False] to [True].**

Note

When [ChunkModeActive] is set to [True], [ChunkImage] is automatically set to [True].

Caution

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

*) For items that can be added to image data as Chunk Data, refer to [n) ChunkDataControl] in the setting item list.

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

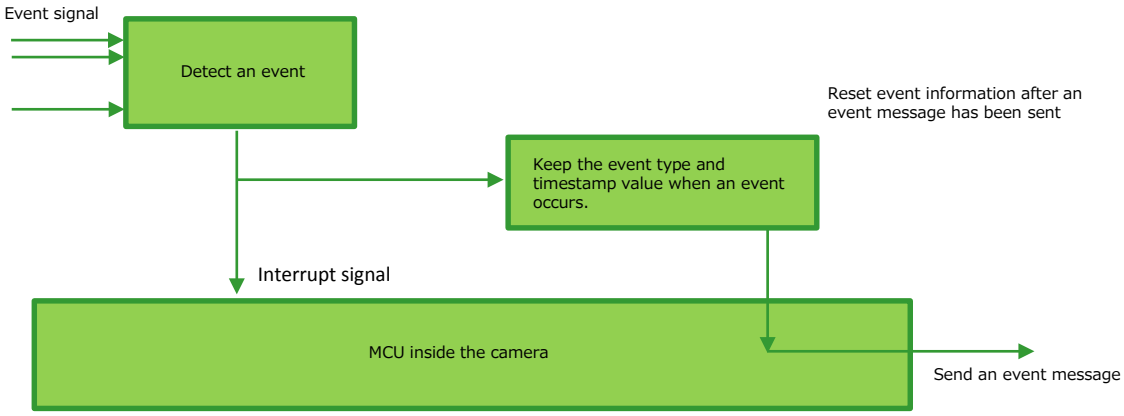
This function imposes a heavy processing load on the network bandwidth, as images from multiple cameras are read out simultaneously.

* About delayed readout buffer size, refer to “Trigger Control”.

Event Control Function

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.

Acquisition Start,	Acquisition End,
Frame Start,	Frame End,
Line Start,	Line End,
Exposure Red Start,	Exposure Red End,
Exposure Green Start,	Exposure Green End,
Exposure Blue Start,	Exposure Blue End,
Line1 Rising Edge,	Line1 Falling Edge,
Line4 Rising Edge,	Line4 Falling Edge,
Line5 Rising Edge,	Line5 Falling Edge,
Line8 Rising Edge,	Line8 Falling Edge,
Line9 Rising Edge,	Line9 Falling Edge,
Line10 Rising Edge,	Line10 Falling Edge,
Line12 Rising Edge,	Line12 Falling Edge,
Line13 Rising Edge,	Line13 Falling Edge,
LVAL Start,	LVAL End

Action Control Function

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.

■ About the settings of the camera

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

■ Setting 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

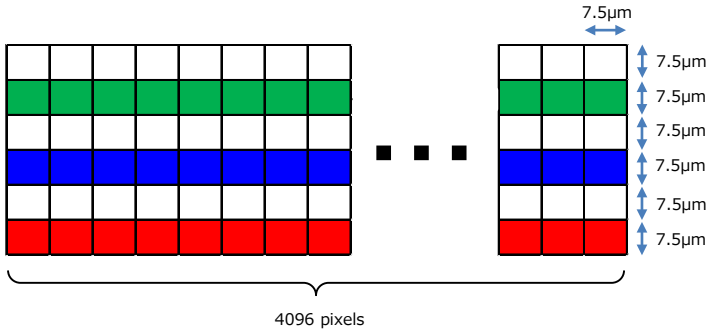
When the camera receives action commands (ActionDeviceKey:0x00001001, ActionGroupMask:0x00000011, ActionGroupKey: 0x00000002), Action2 is executed.

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.

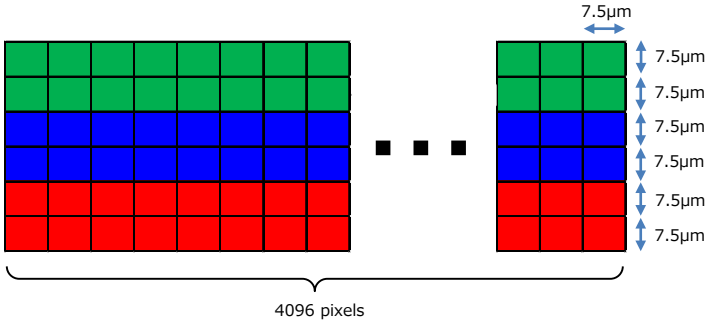
Layout of pixels

The arrangement of Green, Blue, Red pixels in the sensor is shown in the figure below. In the case of Binning Off, there is a gap between individual lines of Green, Blue, Red.

[Binning Vertical] : Off



[Binning Vertical] : On



Setting List

Feature Properties

Item	Setting range	Default value	Description
a) Device Control			Display/configure information related to the device.
Device Vendor Name	—	"JAI Corporation"	Display the manufacturer name.
Device Model Name	—	SW-4000TL-10GE	Display the model name.
Device Manufacturer Info	—	See the possibilities	Display the manufacturer information.
Device Version	—	—	Display the hardware version.
Device Firmware Version	—	—	Display the firmware version.
Device Fpga Version	—	—	Display the FPGA version.
Device Serial Number	—	—	Display the device ID.
Device User ID	Any	—	Set the user ID (16bytes) for the camera.
Device SFNC Version Major	2	2	Display the SFNC Major version.
Device SFNC Version Minor	3	3	Display the SFNC Minor version.
Device SFNC Version Sub Minor	0	0	Display the SFNC Sub Minor version.
Device Manifest Entry Selector	1	1	Display information on valid XML file.
Device TL Type	GigE Vsion	GigE Vsion	Display type of transport layer.
Device TL Vision Major	2	2	Display the Major version of transport layer.
Device TL Version Minor	0	0	Display the Minor version of transport layer.
Device TL Version Sub Minor	1	1	Display the Sub Minor version of transport layer.
Device Link Selector	0	0	Select I/F for control. (0 fixed)
Device Link Speed (Bps)	—	—	Display Link spped.
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.
DeviceReset	—	—	Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)
DeviceTemperatureSelector	Mainboard	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading. (fixed Mainboard)
DeviceTemperature(C)	—	—	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.
Timestamp Latch	—	—	Sets the timestamp's count value to TimestampLatchValue.
Timestamp Latch Value (ns)	0～9223372036854775807 (maximum value of unsigned 64-bit)	0	
Item	**Setting range**	**Default value**	**Description**
b) ImageFormatControl			Configure image format settings.
WidthMax	—	4096	Display the maximum image width.
HeightMax	—	4096	Display the maximum image height.
Width	BinningHorizontal 1: 16～4096 step 16 BinningHorizontal 2: 8～2048 step 8	4096	Set the image width.
Height	1 ～ 4096 step 1	1	Set the image height (number of lines). Image data with the specified number of lines will be streamed as 1 block.
OffsetX	BinningVertical 1: 0 ～ 4080 step 16 BinningVertical 2: 0 ～ 2040 step 8	0	Set the horizontal offset.
OffsetY	0 ～ 4096	0	Set the vertical offset.
BinningHorizontal	1,2	1	Set the number of pixels in the horizontal direction for which to perform binning. BinningMode is fixed to Sum.
SensorBinningVertical	1,2	1	Set the number of pixels in the vertical direction for which to perform binning. BinningMode is fixed to Sum.
PixelFormat	—	RGB8	Set the pixel format. [Setting Range] RGB8 (Default), RGB10V1Packed, RGB10p32, YUV422_8_UYVY, YUV422_8
TestPattern	—	Off	Select the test image. [Setting Range] Off, White, GrayPattern1(Ramp), GrayPattern2(Stripe), ColorBar
Horizontal Image Mirroring	Off, On	Off	Invert the image left and right.

Item	Setting range	Default value	Description
c) Acquisition Control			Configure image capture settings.
Acquisition Mode	Single Frame, Multi Frame, Continuous	Countinuous	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)
Acquisition Line Rate	66 ～	66	Set the AcquisitionLineRate (Hz). The maximum value varies depending on the PixelFormat and ROI settings.
Trigger Selector	—	Acquisition Start	Select the trigger operation. [Setting range] Acquisition Start, Acquisition End, Line Start, Frame Start, Frame Transfer Start
TriggerMode	Off, On	Off	Select the trigger mode.
TriggerSource	—	Line4 TTL In 1	Select the trigger signal source. [Setting range] PulseGenerator0, PulseGenerator1, PulseGenerator2, PulseGenerator3 UserOutput0, UserOutput1, UserOutput2, UserOutput3 Action 0, Action 1, Action 2, Action 3 Line4 TTL In 1, Line5 Opt In 1, Line10 TTL In 2, Line13 TTL In 3 Logic Block 0, Logic Block 1, Encoder Trigger
TriggerActivation	RisingEdge, FallingEdge, Level High, Level Low	Rising Edge	Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied). [Trigger Selector] = Line Start ExposureMode is Off or Timed : RisingEdge, Falling Edge ExposureMode is TriggerWidth : LevelHigh, LevelLow
ExposureMode	Off, Timed, Trigger Width	Timed	Select the exposure mode.
ExposureTime	3 ～ 15149		Set the exposure time.
Item	**Setting range**	**Default value**	**Description**
d) Analog Control			Set whether to enable auto exposure.
IndividualGainMode	Off, On	Off	In IndividualGainMode, R, G, B can be configured individually for the entire gain adjustment range of the sensor.
GainSelector	—	—	Select the gain to configure. [Setting range] IndividualGainMode : On DigitalGreen, DigitalRed, DigitalBlue IndidualGainMode : Off DigitalAll, DigitalRed, DigitalBlue
Gain	—	x1.0	Set the gain value for the gain setting selected in [GainSelector]. [Setting Range] IndividualGainMode : On DigitalGreen : x1.0 ～ x16.0 DigitalRed: x1.0 ～ x16.0 DigitalBlue: x1.0 ～ x16.0 IndidualGainMode : Off DigitalAll: x1.0 ～ x8.0 DigitalRed: x0.4 ～ x4.0 DigitalBlue: x0.4 ～ x4.0
AnalogBaseGain	x1(0dB), x2(6dB), x4(12dB)	x1(0dB)	Set the gain value for the analog gain setting selected in [Analog Gain Selector].
BlackLevelSelector	All, Red, Blue	All	Select the black level to configure.
BlackLevel	DigitalAll -133～255 DigitalRed -64～ 64 DigitalBlue -64～ 64	DigitalAll 0 DigitalRed 0 DigitalBlue 0	Set the black level value.
Balance White Auto	Off, Once, Preset5000K, Preset6500K, Preset7500K	Off	Enable/disable auto white balance.
Balance White Auto Width	16～4096 step 16	4096	Set the area for adjusting white balance.
Balance White Auto OffsetX	0 ～ 4080 step 16	0	Set the area for adjusting white balance.
Balance White Auto Result	—	Idle	Display the result for adjusting white balance. 0:Idle 1:Succeeded 2:Error1 - G image was too bright 3:Error2 - G image was too dark 4:Error3 - Timeout
Gamma	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0	0.45	Set the gamma value.
LUTMode	Off, Gamma, LUT	Off	Select the LUT mode.

Item	Setting range	Default value	Description
e) LUTControl			Configure LUT settings.
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.
Item	**Setting range**	**Default value**	**Description**
f) Color Transformation Control			
Color Transformation Mode	RGB, XYZ, HSI	RGB	Set the output image format.
Color Transofrmation RGB Mode	Off, sRGB, AdobeRGB, UserCustom	Off	Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector	—	RR	Select the ColorMatrix setting component. [Setting range] RR, RG, RB, GR, GG, GB, BR, BG, BB
ColorMatrixValue	-2.0 ～ 2.0	—	Set the Color Matrix value. [Default value] ColorMatrixValue [RR] = 1.0, ColorMatrixValue [RG] = 0, ColorMatrixValue [RB] = 0 ColorMatrixValue [GR] = 0, ColorMatrixValue [GG] = 1.0, ColorMatrixValue [GB] = 0 ColorMatrixValue [BR] = 0, ColorMatrixValue [BG] = 0, ColorMatrixValue [BB] = 1.0
Item	**Setting range**	**Default value**	**Description**
g) Digital I/O control			Configure settings for digital input/output.
Line Selector	Line1 (TTL Out 1), Line4 (TTL In 1), Line5 (Opt In 1), Line8 (TTL Out 2), Line9 (TTL Out 3), Line10 (TTL In 2), Line12 (TTL Out 4), Line13 (TTL In 3)	—	Select the input/output to configure.
Line Mode	Input, Output	—	Display the input/output status (whether it is input or output).
Line Inverter	True, False	False	Enable/disable polarity inversion for the selected input signal or output signal.
Line Status	True, False	—	Display the status of the input signal or output signal (True: High, False: Low).
LineStatusAll	—	—	Display the input/output signal status. The state is shown with 16 bits. Bit assignments are as follows. bit0:Line1 bit3:Line4 bit4:Line5 bit7:Line8 bit8:Line9 bit9:Line10 bit11:Line12 bit12:Line13 bit1, bit2, bit5, bit6, bit10, bit13-31 unused (fixed 0)
Line Source	—	—	Select the line source signal for the item selected in [Line Selector]. [Setting range] Acquisition Active, Frame Active, Exposure Active, LVAL, Pulse Generator 0, Pulse Generator 1, Pulse Generator 2, Pulse Generator 3, User Output 0, User Output 1, User Output 2, User Output 3, Line4 (TTL In 1), Line5 (Opt IN 1), Line10 (TTL In 2), Line13 (TTL In 3), Logic Block 0, Logic Block 1, Encoder Trigger, Encoder Direction
Line Format	TTL, OptoCoupled	—	Display the signal format.
OptInFilterSelector (ns)	0 ～ 1000000 step 100	Off	Remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector	UserOutput0, UserOutput1, UserOutput2, UserOutput3	UserOutput0	Set the UserOutput signal.
UserOutputValue	True, False	False	Set the value for the UserOutput selected in [UserOutputSelector].
ExposureActiveSource	Red, Green, Blue	Red	Select the channel for exposure active.

Item	Setting range	Default value	Description
h) Counter And Timer Control			Configure counter settings. (This camera only supports counter functions.)
Counter Selector	Counter0, Counter1 Counter2, Counter3 Counter4, Counter5	—	Select the counter.
Counter Event Source	—	Off	Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value. [Setting range] 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
Counter Event Activation	—	—	Set the count timing. The setting value is fixed with the following data. Counter0 Rising Edge Counter1 Rising Edge Counter2 Rising Edge Counter3 Rising Edge Counter4 Rising Edge Counter5 Falling Edge
Counter Reset	—	—	Reset the counter.
Counter Value	0～65535	0	Display the count value.
Counter Status	—	—	Display the counter status. Counter Idle: Idle Counter Active: Counting Counter Overflow: Count value exceeded the mazimum value.

Item	Setting range	Default value	Description
i) EncoderControl			Configure settings for encoder control.
EncoderSourceA	Off, Line4 (TTL In 1), Line5 (Opt In 1), Line10 (TTL In 2), Line13 (TTL In 3)	Off	Select where to input the signal from the rotary encoder.
EncoderSourceB	Off, Line4 (TTL In 1), Line5 (Opt In 1), Line10 (TTL In 2), Line13 (TTL In 3)	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).
Encoder Averaging Interval	none, 2pulse, 4pulse, 8pulse, 16pulse, 32pulse	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.
Encoder Filter (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)	1 ～ 2550	10	Set the strobe length of the Trigger signal generated from the rotary encoder by the number of cycles

Item	Setting range	Default value	Description
j) Logic Block Control			
Logic Block Selector	Logic Block 0, Logic Block 1	Logic Block 0	Specifies the Logic Block to configure.
Logic Block Function	AND	AND	Selects the combinational logic Function of the Logic Block to configure.
Logic Block Output Inverter	True	True	Selects if the selected Logic Block Output signal is inverted. (True fixed)
Logic Block Input Selector	0, 1	0	Selects the Logic Block's input to configure.
Logic Block Input Source	—	Line4 (TTL In 1)	Selects the source signal for the input into the Logic Block. [Setting range] Exposure Active, LVAL, Pulse Generator 0, Pulse Generator 1, Pulse Generator 2, Pulse Generator 3, User Output 0, User Output 1, User Output 2, User Output 3, Line4 (TTL In 1), Line5 (Opt IN 1), Line10 (TTL In 2), Line13 (TTL In 3), Logic Block 0, Logic Block 1, Encoder Trigger
Logic Block Input Inverter	True, False		Selects if the selected Logic Block Input source signal is inverted.

Item	Setting range	Default value	Description
k) Action Control			Configure settings for action control.
Action Device Key	0x00000000～ 0xFFFFFFFF	—	An action command is executed if this ActionDeviceKey matches the DeviceKey contained in the action command message.
Action Queue Size	—	256 (Fixed)	Indicates the size of the scheduled action commands.
Action Selector	0,1,2,3	0	Select the ActionSelector.
Action Group Mask	0x00000000～ 0xFFFFFFFF	—	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.
Action Group Key	0x00000000～ 0xFFFFFFFF	—	An action command is executed if this ActionGroupKey matches the GroupKey contained in the action command message.
Item	**Setting range**	**Default value**	**Description**
l) Event Control			
Event Selector	—	—	Select the event to send the event message. [setting range] AcquisitionStart, AcquisitionEnd, FrameStart, FrameEnd, LineStart, LineEnd, ExposureRedStart, ExposureRedEnd, ExposureGreenStart, ExposureGreenEnd, ExposureBlueStart, ExposureBlueEnd, Line1RisingEdge, Line1FallingEdge, Line4RisingEdge, Line4FallingEdge, Line5RisingEdge, Line5FallingEdge, Line8RisingEdge, Line8FallingEdge, Line9RisingEdge, Line9FallingEdge, Line10RisingEdge, Line10FallingEdge, Line12RisingEdge, Line12FallingEdge, Line13RisingEdge, Line13FallingEdge, LVALStart, LVALEnd
Event Notification	On, Off	Off	Sets whether or not to send an event message when an event selected by [EventSelector] occurs.
Event Acquisition Start Data	—	—	When the event [AcquisitionStart]occurs, the following three data can be checked.
Event Acquisition Start	—	—	Display the EventID(0x9011).
Event Acquisition Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Acquisition Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Acquisition End Data	—	—	When the event [AcquisitionEnd]occurs, the following three data can be checked.
Event Acquisition End	—	—	Display the EventID(0x9012).
Event Acquisition End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Acquisition End Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Frame Start Data	—	—	When the event [FrameStart]occurs, the following three data can be checked.
Event Frame Start	—	—	Display the EventID(0x9300).
Event Frame Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Frame Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Frame End Data	—	—	When the event [FrameEnd]occurs, the following three data can be checked.
Event Frame End	—	—	Display the EventID(0x9301).
Event Frame End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Frame End Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line Star tData	—	—	When the event [LineStart]occurs, the following three data can be checked.
Event Line Start	—	—	Display the EventID(0x9032).
Event Line Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line End Data	—	—	When the event [LineEnd]occurs, the following three data can be checked.
Event Line End	—	—	Display the EventID(0x9033).
Event Line End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line End Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Red Start Data	—	—	When the event [ExposureRedStart]occurs, the following three data can be checked.
Event Exposure Red Start	—	—	Display the EventID(0x9302).
Event Exposure Red Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Red Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Red End Data	—	—	When the event [ExposureRedEnd]occurs, the following three data can be checked.
Event Exposure Red End	—	—	Display the EventID(0x9303).
Event Exposure Red End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Red End Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Green Start Data	—	—	When the event [ExposureGreenStart]occurs, the following three data can be checked.
Event Exposure Green Start	—	—	Display the EventID(0x9304).
Event Exposure Green Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Green Start FrameID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Green End Data	—	—	When the event [ExposureGreenEnd]occurs, the following three data can be checked.
Event Exposure Green End	—	—	Display the EventID(0x9305).
Event Exposure Green End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Green End Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Blue Start Data	—	—	When the event [ExposureBlueStart]occurs, the following three data can be checked.
Event Exposure Blue Start	—	—	Display the EventID(0x9306).
Event Exposure Blue Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Blue Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Exposure Blue End Data	—	—	When the event [ExposureBlueEnd]occurs, the following three data can be checked.
Event Exposure Blue End	—	—	Display the EventID(0x9307).
Event Exposure Blue End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Exposure Blue End Frame ID	—	—	Displays the FrameID value when an event occurs.

Event Line1 Rising Edge Data	—	—	When the event [Line1RisingEdge]occurs, the following three data can be checked.
Event Line1 Rising Edge	—	—	Display the EventID(0x9310).
Event Line1 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line1 Rising Edge FrameID	—	—	Displays the FrameID value when an event occurs.
Event Line1 Falling Edge Data	—	—	When the event [Line1FallingEdge]occurs, the following three data can be checked.
Event Line1 Falling Edge	—	—	Display the EventID(0x9318).
Event Line1 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line1 Falling Edge FrameI D	—	—	Displays the FrameID value when an event occurs.
Event Line4 Rising Edge Data	—	—	When the event [Line4RisingEdge]occurs, the following three data can be checked.
Event Line4 Rising Edge	—	—	Display the EventID(0x9313).
Event Line4 Rising EdgeTimestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line4 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line4 Falling Edge Data	—	—	When the event [Line4FallingEdge]occurs, the following three data can be checked.
Event Line4 Falling Edge	—	—	Display the EventID(0x931B).
Event Line4 Falling EdgeTimestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line4 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line5 Rising Edge Data	—	—	When the event [Line5RisingEdge]occurs, the following three data can be checked.
Event Line5 Rising Edge	—	—	Display the EventID(0x9314).
Event Line5 Rising EdgeTimestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line5 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line5 Falling Edge Data	—	—	When the event [Line5FallingEdge]occurs, the following three data can be checked.
Event Line5 Falling Edge	—	—	Display the EventID(0x931C).
Event Line5 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line5 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line8 Rising Edge Data	—	—	When the event [Line8RisingEdge]occurs, the following three data can be checked.
Event Line8 Rising Edge	—	—	Display the EventID(0x9317).
Event Line8 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line8 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line8 Falling Edge Data	—	—	When the event [Line8FallingEdge]occurs, the following three data can be checked.
Event Line8 Falling Edge	—	—	Display the EventID(0x93F).
Event Line8 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line8 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line9 Rising Edge Data	—	—	When the event [Line9RisingEdge]occurs, the following three data can be checked.
Event Line9 Rising Edge	—	—	Display the EventID(0x9340).
Event Line9 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line9 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line9 Falling Edge Data	—	—	When the event [Line9FallingEdge]occurs, the following three data can be checked.
Event Line9 Falling Edge	—	—	Display the EventID(0x9360).
Event Line9 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line9 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line10 Rising Edge Data	—	—	When the event [Line10RisingEdge]occurs, the following three data can be checked.
Event Line10 Rising Edge	—	—	Display the EventID(0x9341).
Event Line10 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line10 Rising Edge FrameID	—	—	Displays the FrameID value when an event occurs.
Event Line10 Falling Edge Data	—	—	When the event [Line10FallingEdge]occurs, the following three data can be checked.
Event Line10 Falling Edge	—	—	Display the EventID(0x9361).
Event Line10 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line10 Falling Edge FrameID	—	—	Displays the FrameID value when an event occurs.
Event Line12 Rising Edge Data	—	—	When the event [Line12RisingEdge]occurs, the following three data can be checked.
Event Line12 Rising Edge	—	—	Display the EventID(0x9343).
Event Line12 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line12 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line12 Falling Edge Data	—	—	When the event [Line12FallingEdge]occurs, the following three data can be checked.
Event Line12 Falling Edge	—	—	Display the EventID(0x9363).
Event Line12 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line12 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line13 Rising Edge Data	—	—	When the event [Line13RisingEdge]occurs, the following three data can be checked.
Event Line13 Rising Edge	—	—	Display the EventID(0x9344).
Event Line13 Rising Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line13 Rising Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event Line13 Falling Edge Data	—	—	When the event [Line13FallingEdge]occurs, the following three data can be checked.
Event Line13 Falling Edge	—	—	Display the EventID(0x9364).
Event Line13 Falling Edge Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event Line13 Falling Edge Frame ID	—	—	Displays the FrameID value when an event occurs.
Event LVAL Start Data	—	—	When the event [LVALStart]occurs, the following three data can be checked.
Event LVAL Start	—	—	Display the EventID(0x9330).
Event LVAL Start Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event LVAL Start Frame ID	—	—	Displays the FrameID value when an event occurs.
Event LVAL End Data	—	—	When the event [LVALEnd]occurs, the following three data can be checked.
Event LVAL End	—	—	Display the EventID(0x9331).
Event LVAL End Timestamp	—	—	Displays the Timestamp value when an event occurs.
Event LVAL End Frame ID	—	—	Displays the FrameID value when an event occurs.

Item	Setting range	Default value	Description
m) User Set Control			Configure user settings.
User Set Selector	Default, User Set1, User Set2, User Set3	Default	Select the user settings.
User Set Load	0, 1, 2, 3	0	Load user settings. (If 0 is specified, the factory default setting is read.)
User Set Save	1,2,3	—	Save the current setting values as user settings.

Item	Setting range	Default value	Description
n) Chunk Data Control			Configure chunk control settings.
Chunk Mode Active	True, False	False	Set whether to enable ChunkData
Chunk Selector	—	OffsetX	Select the chunk settings. [Setting range] OffsetX, OffsetY, Width, Height, Binning Horizonal, Sensor Binning Vertical Pixel Format, Timestamp Line Status All On Exposure Start, Line Status All On LVAL Start, Line Status All On LVAL End Counter Value, Exposure Time, Gain, Black Level Device Serial Number, Device User ID, Device Temperature
ChunkEnable	True, False	False	Select whether to output ChunkData. Default: Only [ChunkImage] is [True].
ChunkImage	—	—	(ChunkID 1000h)
ChunkOffsetX	—	—	(ChunkID 2000h : DataType Integer)
ChunkOffsetY	—	—	(ChunkID 2001h : DataType Integer)
ChunkWidth	—	—	(ChunkID 2002h : DataType Integer)
ChunkHeight	—	—	(ChunkID 2003h : DataType Integer)
ChunkBinningHorizontal	—	—	(ChunkID 2022h : DataType Integer)
ChunkSensorBinningVertical	—	—	(ChunkID 2025h : DataType Integer)
ChunkPixelFormat	—	—	(ChunkID 2012h : DataType Enum.)
ChunkTimestamp	—	—	(ChunkID 2014h : DataType Integer)
ChunkLineStatusAllOnExposureStart	—	—	(ChunkID 2015h : DataType Integer)
ChunkLineStatusAllOnLVALStart	—	—	(ChunkID 2027h : DataType Integer)
ChunkLineStatusAllOnLVALEnd	—	—	(ChunkID 2028h : DataType Integer)
ChunkCounterSelector	Counter0-5	Counter0	Select counter to display the ChunkCounterValue.
ChunkCounterValue			Display the CounterValue. DataType Integer Counter0(Line Trigger) (ChunkID 2029h) Counter1(Line Starrt) (ChunkID 202Ah) Counter2(Exposure Start) (ChunkID 200Fh) Counter3(Frame Trigger) (ChunkID 200Eh) Counter4(Frame Start) (ChunkID 202Bh) Counter5(Frame Transfer End) (ChunkID 2011h)
ChunkExposureTime	—	—	Display the ExposureTime. DataType Float ExposureTime(Red) (ChunkID 201Ch) ExposureTime(Green/Common) (ChunkID 2004h) ExposureTime(Blue) (ChunkID 201Dh)
ChunkIndividualGainMode	—	—	(ChunkID 201Eh : DataType Float)
ChunkGainSelector	DigitalAll, DigitalRed, DigitalGreen, DigitalBlue	DigitalAll	Select Gain to diplay the ChunkGain.
ChunkGain			Diplay the Gain. DataType Float Gain(DigitalRed) (ChunkID 2006h) Gain(DigitalGreen/DigitalAll) (ChunkID 2005h) Gain(DigitalBllue) (ChunkID 2007h)
ChunkBlackLevelSelector	All, Red, Blue	—	Select the Black level to display.
ChunkBlackLevel	—	—	Display the Black level. DataType Float BlackLevel(DigitalRed) (ChunID 2009h) BlackLevel(DigitalGreen/DigitalAll) (ChunID 2008h) BlackLevel(DigitalBlue) (ChunID 200Ah)
ChunkDeviceSerialNumber	—	—	(ChunkID 2017h : DataType String)
ChunkDeviceUserID	—	—	(ChunkID 2018h : DataType String)
ChunkDeviceTemperatureSelector	—	MainBoard	Select the device to diplay the ChunkDeviceTemperature. (MainBoard fixed)
ChunkDeviceTemperature	—	—	(ChunkID 2019h :DataType Float)

Item	Setting range	Default value	Description
o) Transport Layer Control			Display information on transport layer control.
PlayloadSize (B)	—	12288	Display the payload size.
GevSupportedOptionSelector			Select the supported options for GigEVision. [Setting range] SingleLink, MultiLink, StaticLAG, DynamicLAG, PAUSEFrameReception, PAUSEFrameGeneration, IPConfigurationLLA, IPConfigurationDHCP, IPConfigurationPersistentIP, StreamChannelSourceSocket, StandardIDMode, MessageChannelSourceSocket, CommandsConcatenation, WriteMem, PacketResend, Event, EventData, PendingAck, IEEE1588, Action, UnconditionalAction, ScheduledAction, PrimaryApplicationSwitchover, ExtendedStatusCodes, ExtendedStatusCodesVersion2_0, DiscoveryAckDelay, DiscoveryAckDelayWritable, TestData, ManifestTable, CCPApplicationSocket, LinkSpeed, HeartbeatDisable, SerialNumber, UserDefinedName, StreamChannel BigAndLittleEndian, StreamChannel IP Reassembly, StreamChannel Multi Zone, StreamChannel PacketResendDestination, StreamChannel AllInTransmission, StreamChannel UnconditionalStreaming, StreamChannel ExtendedChunkData
GevSupportedOption	True, False	—	Display whether support for the function selected in GevSupportedOptionSelector is enabled or disabled.
GevInterfaceSelector	0	0	The value for this item is fixed at 0.
GevMACAddress	—	—	Display the MAC address.
GevPAUSEFrameReception	True, False	False	Controls whether incoming PAUSE Frames are handled on the given logical link.
GevPAUSEFrameTransmission	True, False	False	Controls whether PAUSE Frames can be generated on the given logical link.
GevCurrentIPConfigurationLLA	True	True	Display whether the current IP configuration is calibrated by LLA (link-local address). (fixed at [True])
GevCurrentIPConfigurationDHCP	True, False	True	Select whether to set the IP configuration to DHCP.
GevCurrentIPConfigurationPersistentIP	True, False	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	—	—	Display the current IP configuration status. [Setting range] None, PersistentIP, DHCP, LLA, ForceIP
GevPersistentIPAddress	—	—	Set the persistent IP address.
GevPersistentSubnetMask	—	—	Set the persistent subnet mask.
GevPersistentDefaultGateway	—	—	Set the persistent default gateway.
Gev IEEE 1588 Clock Accuracy	—	Unknown	Indicates the expected accuracy of the device clock when it is the grandmaster, or in the event it becomes the grandmaster. [Setting range] Within25ns, Within100ns, Within250ns, Within1us, Within2p5u, Within10us, Within25us, Within100us, Within250us, Within1ms, Within2p5ms, Within10ms, Within25ms, Within100ms, Within250ms, Within1s, Within10s, GreaterThan10s, AlternatePTPProfile, Unknown, Reserved
Gev IEEE 1588 Status	—	—	Display the status of IEEE 1588 clock. [Settiing range] Initializing, Faulty, Disabled, Listening, PreMaster, Master, Passive, Uncalibrated, Slave
GevGVCPExtendedStatusCodesSelector	Version 1 1, Version 2 0	Version 1 1	Selects the GigE Vision version to control extended status codes for.
GevGVCPExtendedStatusCodes	True, False	—	Enables the generation of extended status codes.
GevGVCPPendingAck	True, False	—	Enables the generation of PENDING_ACK.
GevGVSPExtendedIDMode	Off, On	Off	Enables the extended IDs mode.
GevCCP	—	OpenAccess	Controls the device access privilege of an application. [Setting range] OpenAccess, ExclusiveAccess, ControlAccess, ControlAccessSwitchoverActive
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:RGB	0:RGB	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 data stream. Setting this value to 0 closes the stream channel.
GevSCPSFireTestPacket	True, False	False	Sends a test packet. When this feature is set, the device will fire one test packet.
GevSCPSDoNotFragment	True, False	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.
GevSCPSPacketSize (B)	576～16366	1476	Set the packet size.
GevSCPD	0～4294967295	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel.
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.

Item	Setting range	Default value	Description
p) PulseGenerator			Configure pulse generator settings.
ClockPreScaler	1～4096	165	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz)	0.024414 ～ 100	100	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base.
PulseGeneratorSelector	PulseGenerator[0-3]	PulseGenerator0	Select the pulse generator.
PulseGeneratorLengthValue	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. This value is calculated using the [PulseGeneratorLength] value as a base. The setting range varies depending on the [ClockPreScaler] value.
PulseGeneratorFrequency (Hz)	PulseGeneratorClock (MHz) ÷ 1048575 x 1000000 ～ PulseGeneratorClock (MHz) x 1000000	3333.33 Hz	Set the maximum count-up value as a frequency. This value is calculated using the [PulseGeneratorLength] value as a base.
PulseGeneratorStartPointValue	0～1048575	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPoint (ms)	0～42949.6	0	Set the start point of the High interval in milliseconds. When the counter reaches this value, the output will be 1. The setting range varies depending on the [ClockPreScaler] value.
PulseGeneratorEndPointValue	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)	0～42949.6	0.15	Set the start point of the Low interval in milliseconds. When the counter reaches this value, the output will be 0. The setting range varies depending on the [ClockPreScaler] value.
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. The setting range varies depending on the [ClockPreScaler] value.
PulseGeneratorRepeatCount	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.
PulseGeneratorClearActivation	—	Off	Set the clear signal condition for the count clear input of the pulse generator. [Setting range] Off, LevelHigh, LevelLow, RisingEdge, FallingEdge
PulseGeneratorClearSource	—	Low	Select the count clear input signal source. [Setting range] Exposure Active, LVAL, Pulse Generator 0, Pulse Generator 1, Pulse Generator 2, Pulse Generator 3, User Output 0, User Output 1, User Output 2, User Output 3, Line4 (TTL In 1), Line5 (Opt IN 1), Line10 (TTL In 2), Line13 (TTL In 3), Logic Block 0, Logic Block 1, Encoder Trigger
PulseGeneratorClearSyncMode	AsyncMode, SyncMode	AsyncMode	Select the sync mode for the count clear input signal.

Item	Setting range	Default value	Description
q) Shading			Configure shading correction settings.
Shading Correction Mode	FlatShading, ColorShading	FlatShading	Select the shading correction method.
Shading Mode	Off, User1, User2, User3	Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
Calibrate Shading Correction	—	—	Execute shading correction. This command can not be excuted under the following conditions. ・When no image is output. ・Outputting TestPattern. ・When the ROI setting is under the following conditions. (Width or Height are less than 128) ・Shading Mode is Off.
Shading Calibration Result	—	Idle	Display the shading correction results. 0:Idle 1:Succeeded 2:Error1 - Image was too bright 3:Error2 - Image was too dark 4:Error3 - Could not calibrated
Shading Data Selector	Red, Green, Blue	Red	Read the shading correction data and select the sensor to be changed.
Shading Data Index	1 ～ 1024	1	Set the index table number for shading correction.
Shading Data	0 ～ 0x1FFFF	0x4000	Display the result of shading correction.
Shading Data Save	—	—	Save the result of shading correction.

Item	Setting range	Default value	Description
r) Correction			Correct variations due to sensors and lenses.
Pixel Black Correction Mode	Off, Default, User1, User2, User3	Default	Select the user area to which to save the black level correction value.
Calibrate Pixel Black Correction	—	—	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.
Pixel Black Calibration Result	—	—	Display the results of [Calibrate Pixel Black Correction] execution. The results will be one of the following. 0:Idle 1:Succeeded 2:Error1 - Image was too bright 3:Error2 - Image was too dark 4:Error3 - Could not calibrated
Pixel Gain Correction Mode	Off, Default, User1, User2, User3	Default	Select the user area to which to save the gain correction value.
Calibrate Pixel Gain Correction	—	—	Generate gain correction data automatically from the captured image Caution When [PixelBlackCorrectionMode] is set to [Off] or [Default] and a test pattern is being output instead of an image, this command cannot be executed.
Pixel Gain Calibration Result	—	—	Display the results of [Calibrate Pixel Gain Correction] execution. The results will be one of the following. 0:Idle 1:Succeeded 2:Error1 - Image was too bright 3:Error2 - Image was too dark 4:Error3 - Could not calibrated
Chromatic Aberration Correction Mode	Off, Lens1, Lens2, Lens3	Off	Correct the color aberration that occurs at the left and right edges due to lens characteristics.
Chromatic Aberration Correction Selector	R Channel, B Channel	R Channel	Specify the channel for which to perform [Chromatic Aberration Correction Lens1,2,3].
Chromatic Aberration Correction	—	0	Set the amount of correction for [Chromatic Aberration CorrectionLens1, 2, 3]. [Setting range] R, B Channel -4 ～ 4 (step 0.1)

Item	Setting range	Default value	Description
r) Spatial Control			Corrects the spatial pixel differences individually for the R, G, and B lines captured by the trilinear line sensor.
Spatial Control	—	Default	Select area to save. [Seeting range] Off, Default, User1, User2, User3
Spatial Compensation Mode	Manual, Auto	Manual	Set the spatial compensation mode.
Spatial Compensation Selector	Red, Green, Blue	—	Select the channel.
Spatial Compensation Value	0～8 step 0.1	0	Set the compensation value for each channel.
Object Direction	Forward Direction, Reverse Direction	Forward Direction	Set the direction moving objects.
Object Direction Source	—	Line4 (TTL In 1)	Select the input to use for obtainning the movement direction information for the object. *) This setting is valid in SpatialCompensationMode : Auto . [Setting range] Low, Hight, Line5(OptIn1), Line4(TTLIn1), Line10(TTLIn2), Line13(TTLIn3), EncoderDirection
Spatial Compensation Distance	0.5 ～ 2.0 Step 0.1	1.0	Set the amount of movement in pixels of the imaging subject within the sensor during a single trigger. *) This setting is valid in SpatialCompensationMode : Auto .

Miscellaneous

Troubleshooting

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

■ Power supply and connections

Problem	Cause and solution
The POWER/TRIG LED remains lit amber and does not turn green, even after power is supplied to the camera.	Camera initialization may not be complete due to lack of a network connection. Check the 12-pin power cable connection.

■ Image display

Problem	Cause and solution
Gradation in dark areas is not noticeable.	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

Problem	Cause and solution
Settings cannot be saved to user memory.	You cannot save to user memory while images are being acquired by the camera. Stop image acquisition before performing the save operation.
I want to restore the factory default settings.	Load [Default] under [User Set Selector] in the [Feature Properties] tab to restore the factory default settings.

Specifications

Item	SW-4000TL-10GE	
Image sensor	4K high speed trilinear CMOS image sensor	
	Effective pixels	3×4096 pixel (R, G, B)
	pixel size	7.5 μ m × 7.5 μ m
Synchronization	Internal	
Communication Interface	10GBase-T, 5GBase-T, 2.5GBase-T, 1000Base-T	
Line rate	RGB8	66Hz* ～66kHz (0.1Hz/step)
Video S/N ratio	55 dB or more (when Gain = 0 dB)	
Object illuminance (min.)	220 lx (Gain 18 dB, Line period 525 μs, 50% video, Light source White LED7800K)	
Responsivity	127 DN/nJ/cm2, Mode A (G channel, 10-bit @ 550 nm, 0 dB gain)	
Digital image output format	ROI(Horizontal)/Binning	Binning Hrizontal1(Off) Width : 16 ～ 4096 pixels (16 pixels/step) OffsetX : 0 ～ 4080 pixels (16 pixels/step) Binning Hrizontal2(On) Width : 8 ～ 2048 pixels (8 pixels/step) OffsetX : 0 ～ 2040 pixels (8 pixels/step)
	ROI(Vertical)	Hieght : 1 ～ 4096 lines (1 line/step) Offset : 0 ～ 4095 lines (1 line/step)
	Pixel Format	RGB8, RGB10V1Packed, RGB10p32, YUV422_8, YUV422_8_UYVY
Acquistion Mode	SingleFrame, MultiFrame, Continuous	
Exposure Mode	Off	Line Period - 3.29μs + 0.85μs (1.0 μ s/step)
	Timed	3.0μs ～ 15.149ms (1.0 μ s/step)
	Trigger Width	1.8μs ～ 1s (1.0 μ s/step) (Trigger Width + 0.85μs)
Trigger Selector	Acquisition	AcquisitionStart / AcquisitionEnd
	Exposure	FrameStart / LineStart
	Transfer	FrameTransferStart
Trigger inputs	12-pin: TTL input, OPT input 10-pin: TTL input Positive / negative logic switchable. Minimum trigger width: 50ns and more	
	Line4(TTL In1), Line5(Opt IN1), Line10(TTL In2), Line13(TTL In3), PulseGenerator0-3, UserOutput0-3, Action0-3, LogicBlock0-1, EncoderTrigger	
Gain adjustment	Analog Base Gain : 0dB、6dB、12dB Digtal : IndividualGainMode Off : Digital All x 1 ～ x 8 (0dB ～18dB) Digital Red x 0.4 ～ x 4 (-7.96dB ～ 12dB) Digital Blue x 0.4 ～ x 4 (-7.96dB ～ 12dB) IndividualGainMode On : Digital Green x 1 ～ x 16 (0dB ～ 24dB) Digital Red x 1 ～ x 16 (0dB ～ 24dB) Digital Blue x 1 ～ x 16 (0dB ～ 24dB)	
Black level adjustment	Manual DigitalAll −133 ～+ 255 (LSB@12bit) DigitalRed −64 ～ +64 (LSB@12bit) DigitalBlue −64 ～ +64 (LSB@12bit) Default setting: Output black level at 0 (33LSB during 10-bit)	

*) When taking a trigger signal from the outside, there is no limitation on the minimum value.

White balance	BalanceWhiteAuto	Off, Once, Preset5000K, Preset6500K, Preset7500K
	Adjustment range	3000K ～ 9000K
Test pattern	Available： Off、White、GrayPattern1(Ramp)、GrayPattern2(Stripe)、ColorBar	
Image porcessing	1 Pixel sensitivity correction: Pixel correction (DSNU, PRNU) 2 Shading correction: ColorShading, FlatShading 3 LUT: OFF: γ＝1.0, ON: 257 points can be set 4 Gamma: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0 (9 steps available)	
PRNU	Post-correction: Within ±1% (during 100% output)	
DSNU	Post-correction: Within ±5% (during 0% output)	
Power supply voltage	12pin (DC IN/TRIG)	Input range： DC ＋10V ～＋ 25V consumption： 9.3 W(typ.) (at 12 V input, full pixel, Default setting, Environmental temperature 25°C) (Typical) 14.7 W (Maximum)
Connectors / LEDs	RJ-45	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.
	12pin (DC IN/TRIG)	Model ： HR10A-10R-12PB(71) (or equivalent) Function： Power supply input / External trigger / External I/O
	10pin (AUX)	Model Camera side : Equivalaent to Hirose Electronic 3260-10S3 (55) Cable side ： Equivalaent to Hirose Electronic 350-10P-C (50) Function： External tigger / External I/O
	LED (Power/TRIG)	Function : Power on, trigger input indicator
Lens mount	M42 mount, F mount	
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	
Operating temperature / humidity	− 5℃～+ 45℃ / 20%～ 80% (non-condensing)	
Storage temperature / humidity	− 25℃～+ 60℃ / 20%～ 80% (non-condensing)	
Vibration resistance	10G（20 Hz ～ 200 Hz X-Y-Z direction）	
Impact resistance	80G	
Standard compliance	CE(EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE, KC	
Dimensions	62 × 62 × 102.3 mm (WHD; excluding mount and protrusions)	
Weight	M42 mount : 340 g (typ.) F mount : 410 g (typ.)	

Package contentsCamera

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

Design and specifications are subject to change without notice.

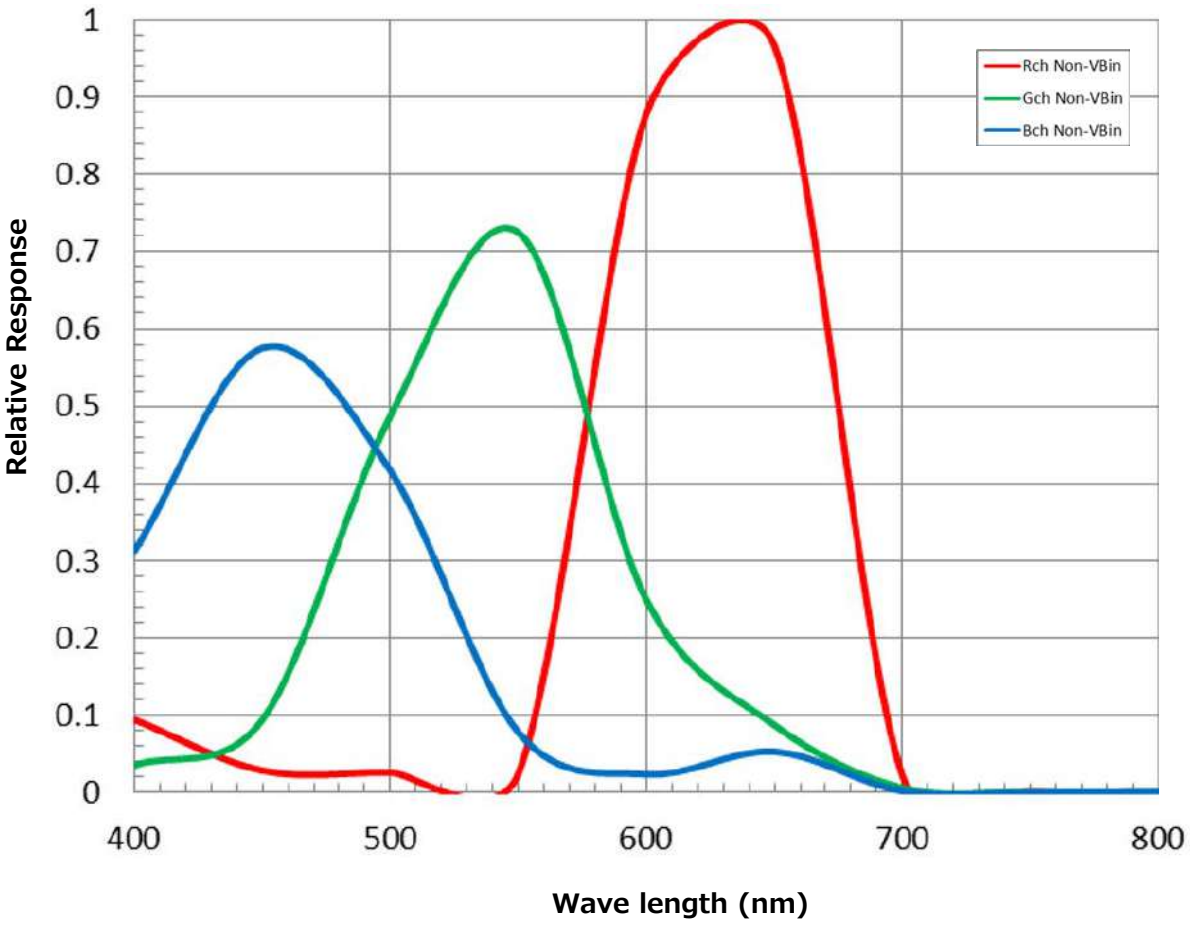
Approximately 30 minutes of warm-up are required to achieve these specifications.

Caution

About the verified performance temperature
Make sure the following temperature conditions are met when operating the unit.
1) The camera's internal temperature sensor detects temperatures of 100 °C or less during operation.

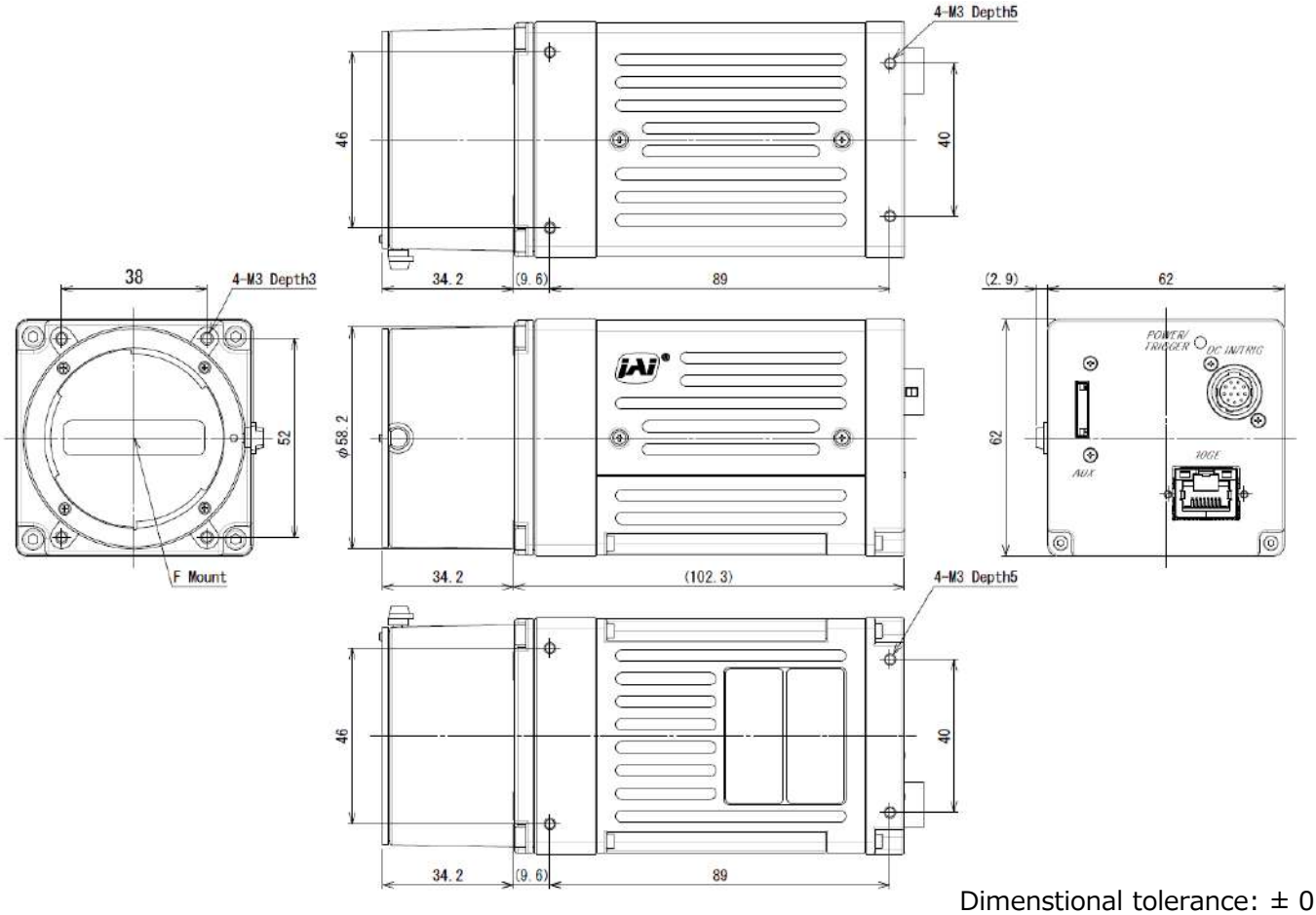
If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

Spectral Response



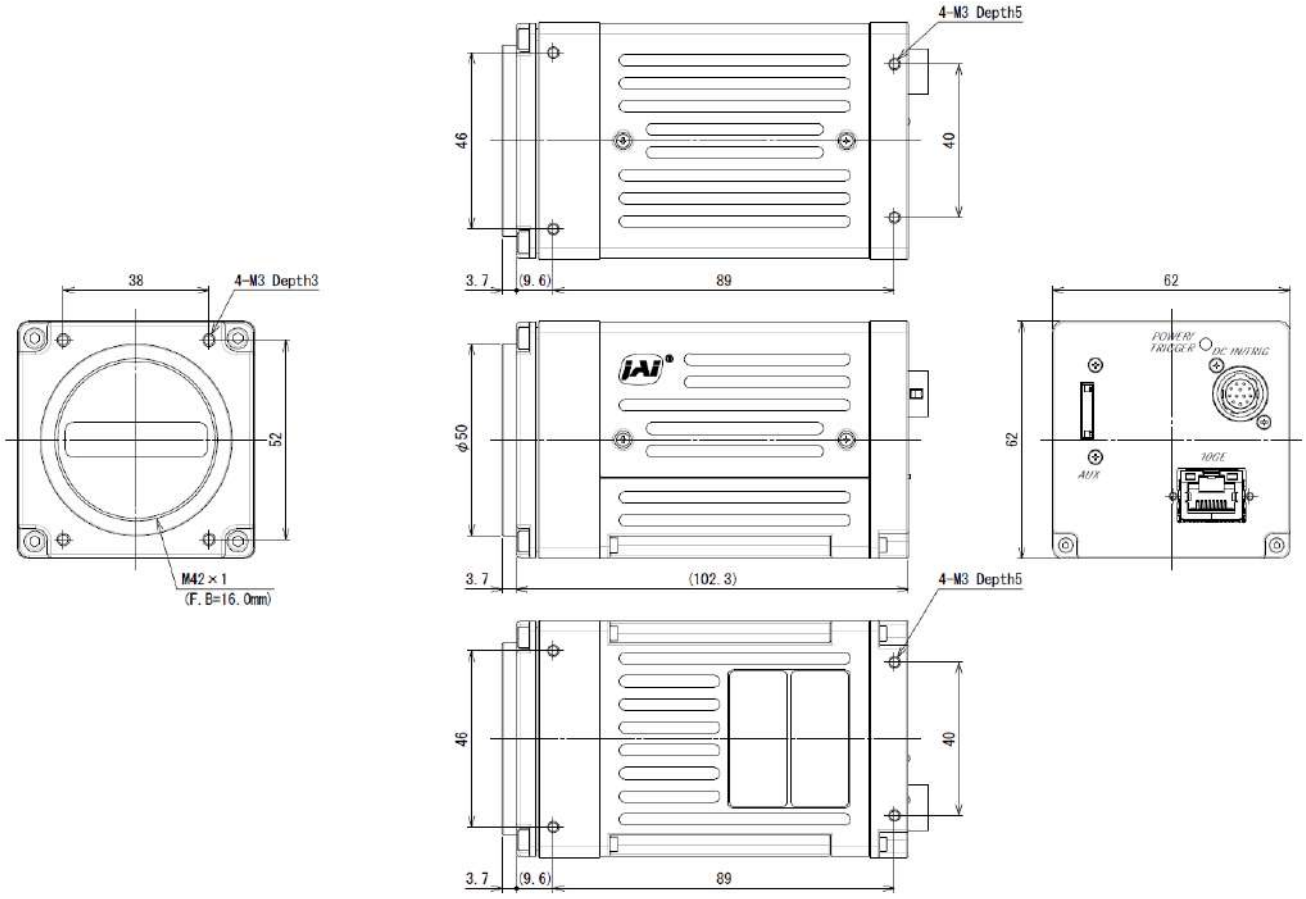
Dimensions

F mount (SW-4000TL-10GE-F)



Dimenstional tolerance: ± 0.3mm
Unit: mm

M42 mount (SW-4000TL-10GE-M42)



Dimenstional tolerance: ± 0.3mm
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	
34	50.119	
35	56.234	
36	63.096	

User's Record

Camera type: SW-4000TL-10GE

Revision: ……

Serial No: ……

Firmware version: ……

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

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Revision history

Revision	Date	Changes
1.0	Apr. 2019	First version.