See the possibilities

User Manual

AP-3200T-10GE

Digital 3CMOS Progressive Scan
RGB Color Camera

Document Version: 1.1
AP-3200T-10GE_Ver.1.1 _July 2022

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.

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 complies with the following provisions applying to its standards.
EN 55032:2015(CISPR32:2015)
EN 55035:2017(CISPR35:2016)

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.

Contents

■ Table of contents by function

■ About Technical Note

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

Please refer to the following URL for Technical notes.
https://www.jai.com/support-software/technical-notes

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

环保使用期限
电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、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 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 101°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.

Technical notes How to clean a sensor

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 AP-3200T-10GE is an industrial progressive scan camera that uses three 1/1.8-inch global shutter CMOS image sensors with 2064×1544 effective pixels.

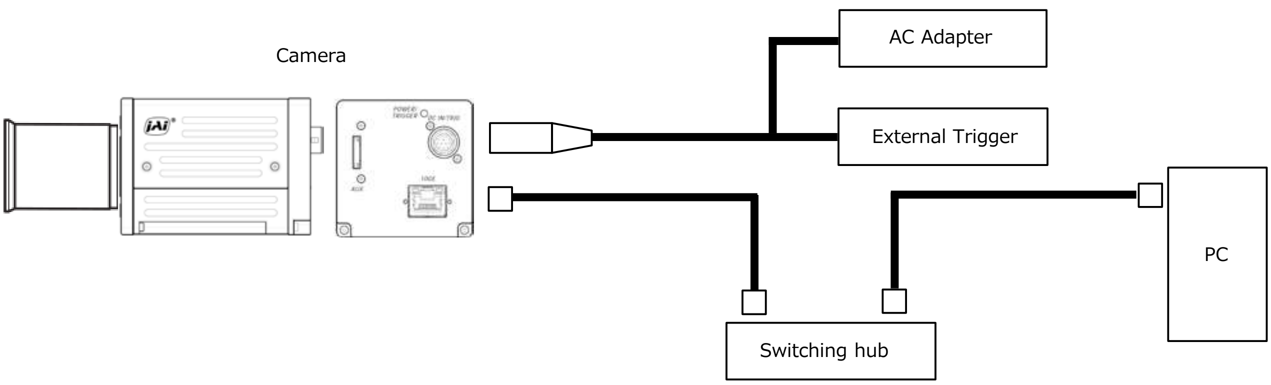
It allows maximum frame rates of 106.29 fps at full resolution.
Enhanced color reproduction is achieved via the newly-developed compact-designed 1/1.8-inch 3CMOS C-mount F4 prism optical system in addition to the internal color matrix circuit. Even higher definition imaging is made possible by the shading correction and gamma correction circuits.

The ROI and vertical binning functions allow for even faster readout speeds.
The gain and exposure time can be configured individually for each CMOS sensor. A color space conversion function is also supported.

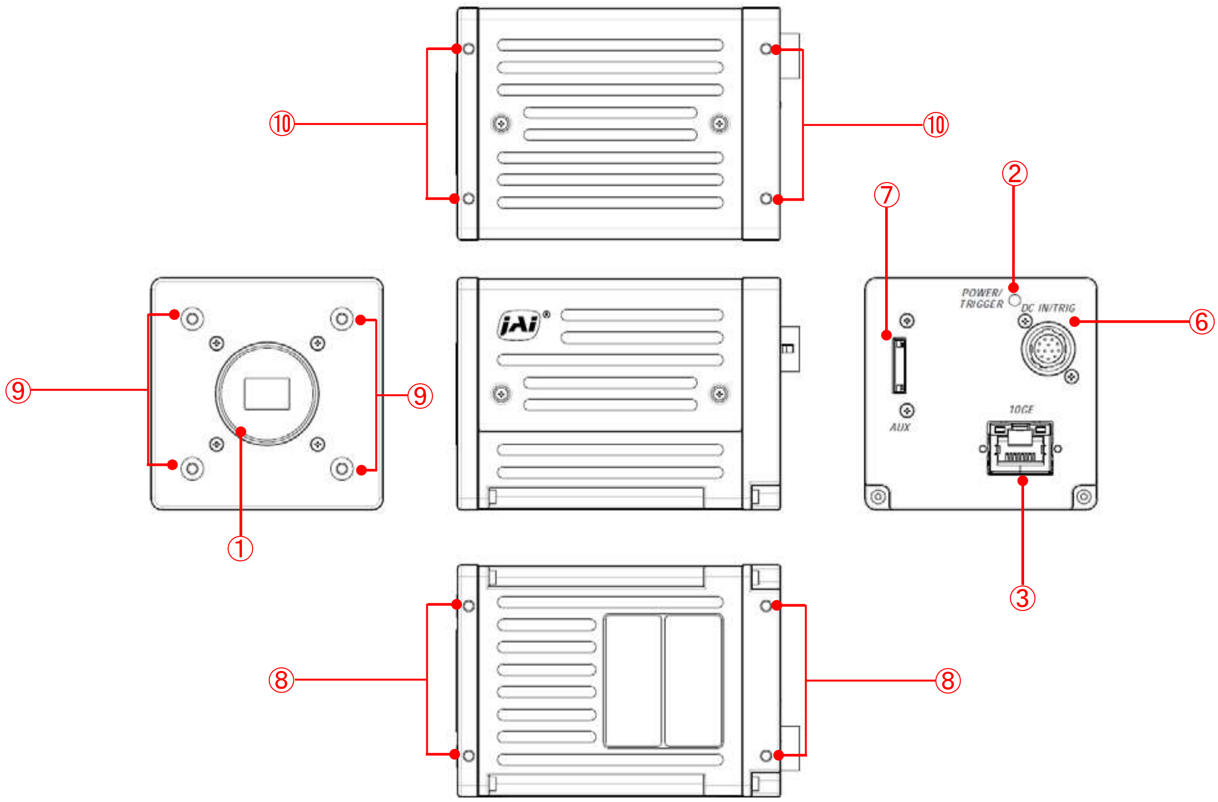
Feature overview

- 1/1.8-inch 3CMOS progressive RGB color camera
- Lens mount: C-mount (flange back: 17.526 mm)
- Effective pixels: 2064 (H) × 1544 (V); pixel size: 3.45 × 3.45 um
- Maximum frame rates of 106.29 fps at full resolution possible
- 24-bit or 30-bit RGB output
  (36-bit RGB output possible in video process bypass mode)
- Gamma correction circuit that uses lookup tables
- Color matrix that allows faithful color reproduction
- Color space conversion function (sRGB, Adobe RGB, HSI, XYZ) support
- The camera supports the following Ethernet standards.
  (1000Base-T, 2.5GBase-T, 5GBase-T, 10GBase-T)
- Internal test signal for settings configuration
- Compliance with GigE Vision and GenICam standards

Connection example



Parts Identification



① Lens mount（F-mount)

Mount a C-mount lens, microscope adapter, 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.

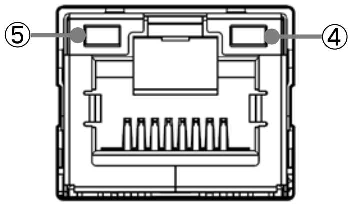
LED status and camera status

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.

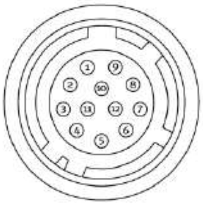
⑤ ACT LED

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.



Compatible connectors

Camera side : HR10A-10R-12PB（71） (Hirose Electric or equivalent)
Cable side : HR10A-10P-12S (plug) (Hirose Electric or equivalent)

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

Be sure to use a power supply that can support the maximum power consumption of this camera.
This camera cannot be powered by PoE (Power over Ethernet).

TTL signal specification

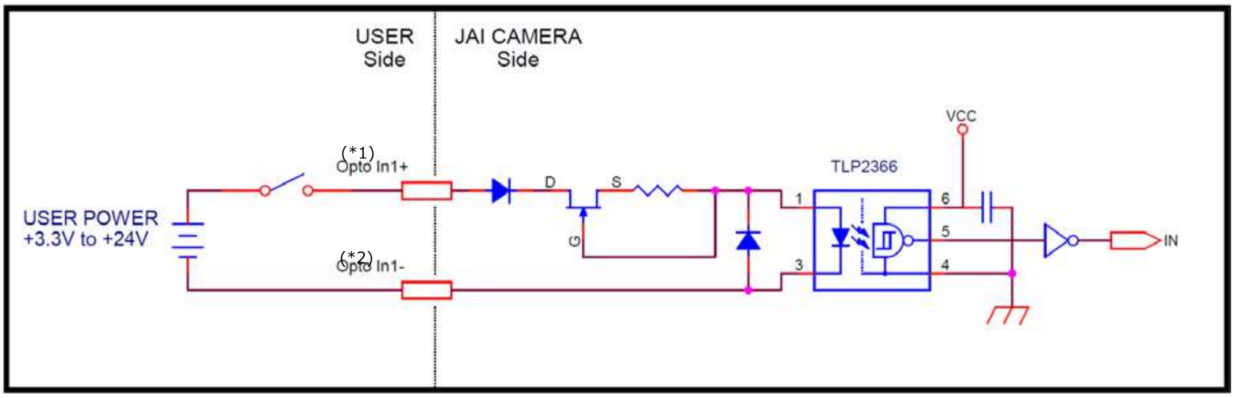
TTL out signal specification (Typ.)
Output voltage : Low 0.0V
High 5.0V
Input/Output current : +/-32mA

TTL in signal specification (Typ.)
Input voltage : Low 0.0～0.8V
High 2.0～5.5V

Caution

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

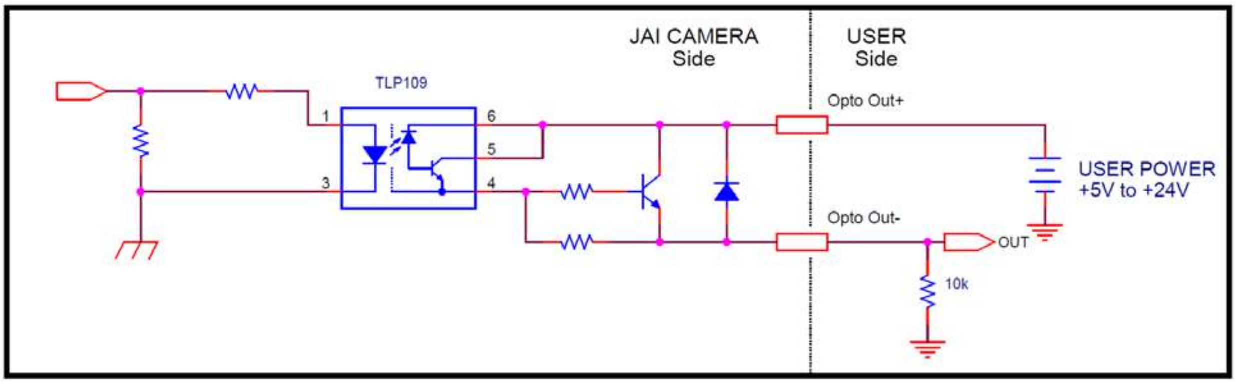
■ Recommended external input circuit diagram (reference example)



Opto In 1 :
(*1) Pin6 (Opto In 1+)
(*2) Pin5 (Opto In 1−)

Opto In 2 :
(*1) Pin4 (Opto In 2+)
(*2) Pin3 (Opto In 2−)

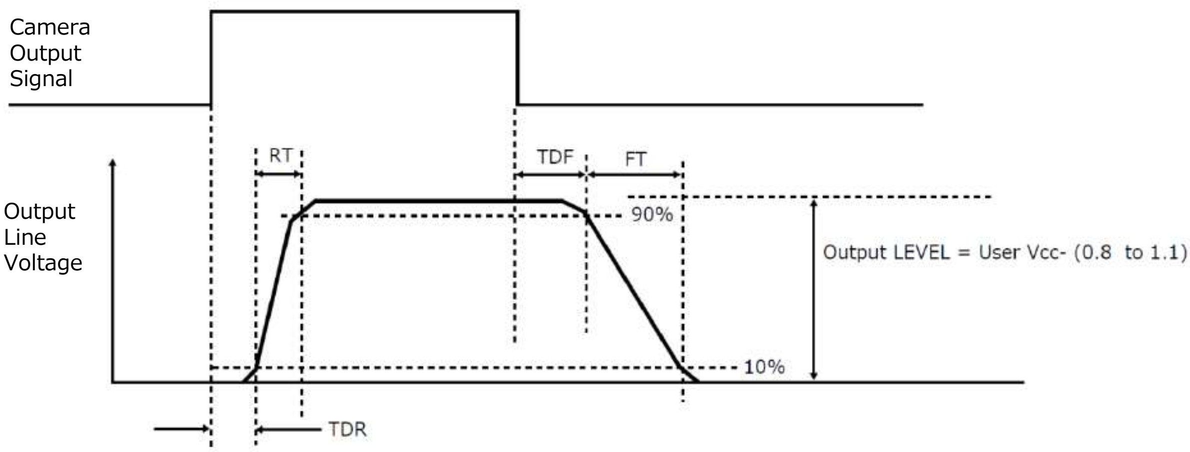
■ Recommended external output circuit diagram (reference example)



Technical notes OPTO-In circuit characteristics

■ Characteristics of the recommended circuits for Opto OUT

OUTPUT LINE RESPONSE TIME



For the operating conditions of applied voltage (User Power) +12V, load resistance 10kΩ, and cable length 1m, the timing is shown in the table below.

Item	Result (Typ)
TDR(Time Delay Rise) (μs)	0.48
RT(Risc Time) (μs)	3.08
TDF(Time Delay Fall) (μs)	3.16
FT(Fall Time) (μs)	52.4

*) Since it varies depending on the applied voltage, load resistance, cable length, etc., check the actual environment before use.

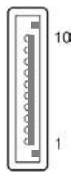
Caution

Please note that the recommended load resistance of Opto output is 10 kΩ (rated 1/10 W) or more. The 270 Ω resistor shown in the circuit diagram is the MINIMUM resistance that should be used. The response speed from On (High) to Off (Low) depends on the voltage applied to Opto output and the value of the load resistance. Higher load resistance results in slower response. If the response at 10 kΩ is slower than desired, you can try reducing the load resistance in order to increase the response speed but DO NOT go below the minimum 270 Ω value.

The load resistance loss can be calculated as follows.

load resistance loss ≒ (voltage applied to Opto output)^2 / (load resistance)

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	Line8
2		NC	
3	IN	TTL_IN2	Line10
4		NC	
5	GND	GND	
6		NC	
7	OUT	OptOut2(-)	Line3
8	OUT	OptOut2(+)	
9	GND	GND	
10	GND	GND	

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

Use these holes when attaching an MP-41 tripod adapter plate (optional) or mounting the camera directly to a wall or other structural system.

⑨ Camera locking screw holes （M3, 5 mm depth）

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

⑩ Camera locking screw holes （M3, 5 mm depth）

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

Digital I/O Control

Preparation

Preparation Process

Step 1	**Installing the Software (first time only)** Install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.
Step 2	**Connecting Devices** Connect the lens, network cable, AC adapter, computer, and other devices.
Step 3	**Verifying Camera Operation** Verify whether the camera is turned on and ready for use.
Step 4	**Verifying the Connection between the Camera and PC** Verify whether the camera is properly recognized via eBUS SDK for JAI.
Step 5	**Configuring Basic Settings for the Camera** Refer to the procedures for basic settings.
Step 6	**Adjusting the Image Quality** Refer to the procedures for adjusting the gain, white balance, and black level as examples, and adjust the image quality.
Step 7	**Saving the Settings** Save the current setting configurations in user memory.

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.

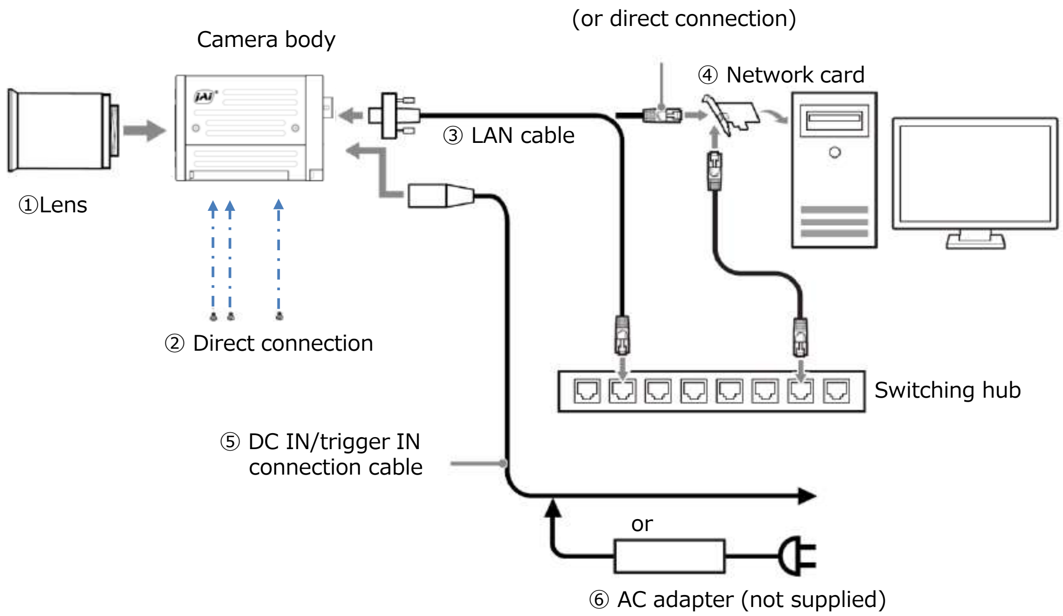
1 **Download the eBUS SDK for JAI from the JAI website.**
URL https://www.jai.com/jp/support-software/jai-software

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.

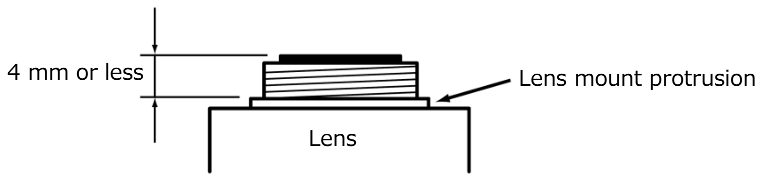
Step 2: Connecting Devices



① Lens

・C-mount lenses with lens mount protrusions of 4 mm or less can be attached.

Technical notes Lens Selection Guide



・The diagonal of the camera's CMOS image sensor is 8.89 mm, the size of standard 1/1.8-inch lenses. To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the 8.89 mm diagonal. Some lens manufacturers offer lenses with an 8.89 mm format. If not, a 1/1.8-inch lens is recommended.

Caution

・The maximum performance of the camera may not be realized depending on the lens.
・Attaching a lens with a mount protrusion of 4 mm or longer may damage the lens or camera.

Note

The following formula can be used to estimate the focal length.
Focal length = WD / (1 + W/w)
WD : Working distance (distance between lens and object)
W : Width of object
w : Width of sensor (7.12 mm on this camera)

② Direct connection（or MP-41 tripod adapter plate）

When mounting the camera directly to a wall or other device, use screws that match the camera locking screw holes on the camera (M3, depth: 5 mm).
Use the supplied screws to attach the tripod adapter plate.

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.

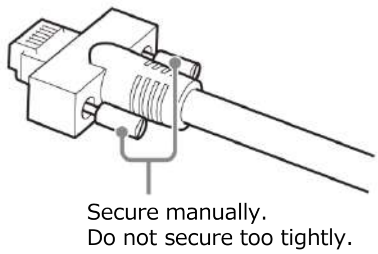
■ About the longest cable length

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)



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)

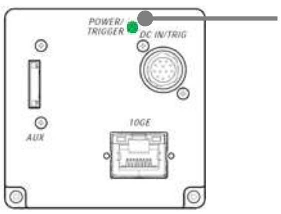
Connect the AC adapter and the round connector of the connection cable to the DC IN / TRIG IN connector on the camera.

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



Lit green

- 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

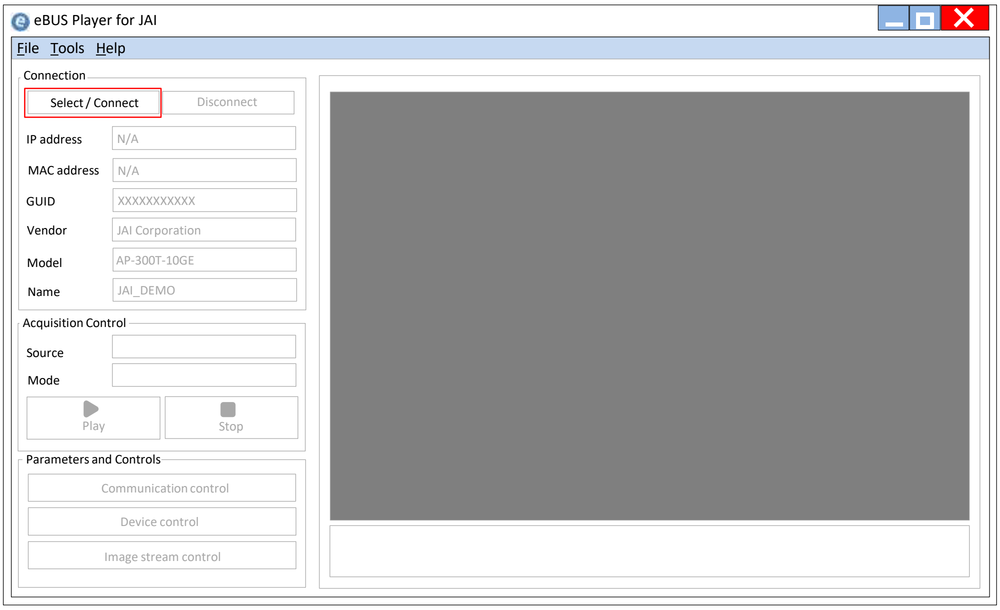
Verify whether the camera is properly recognized via Control Tool.

Connecting the Camera to Control Tool

1 **Startup eBUS Player for JAI**

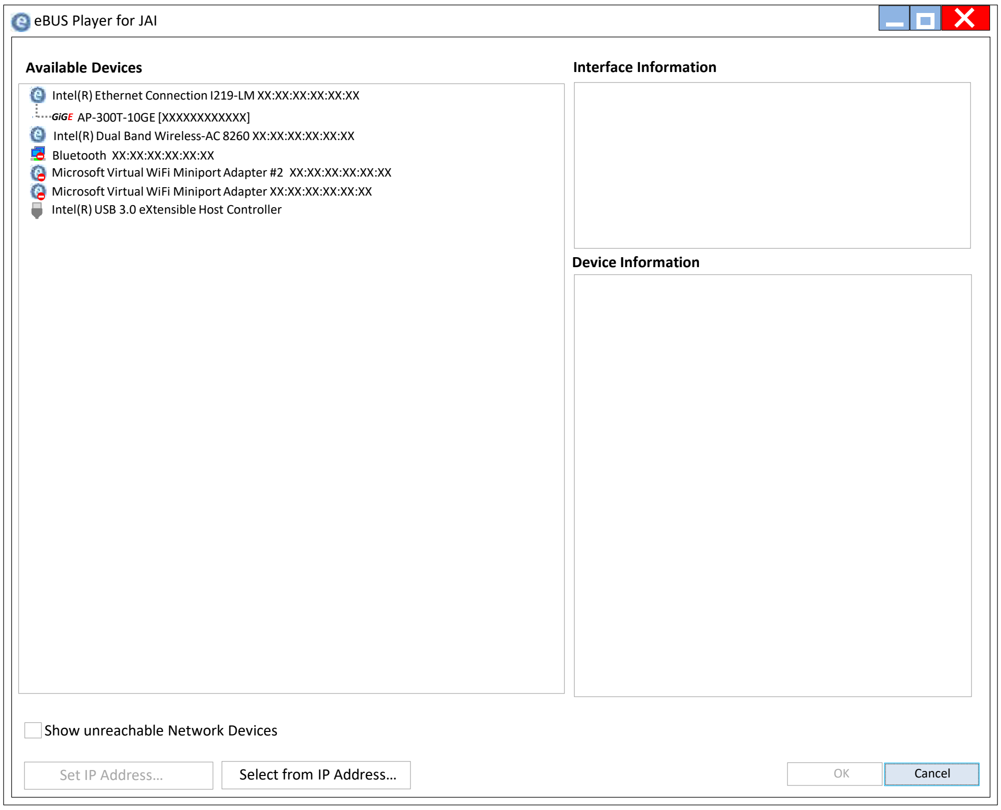
eBUS Player for JAI

eBUS Player for JAI startup screen appears.



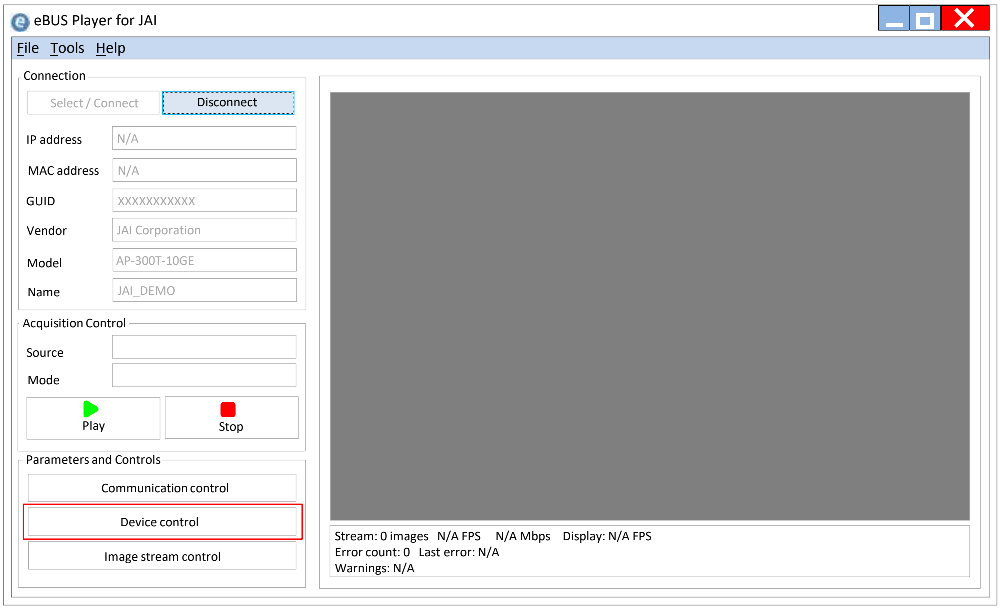
2 Select the camera you want to configure.

Push $\boxed{\text{Select / Connect}}$ button

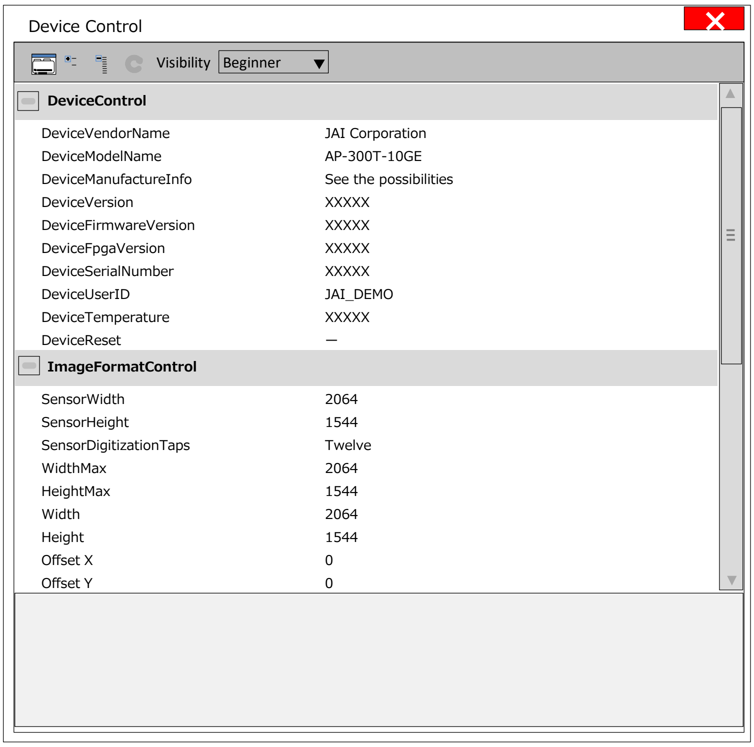


The connected camera is listed.
Please select one camera.

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

This section explains how to change settings by describing the procedure for changing the output format as an example.

Set the output format

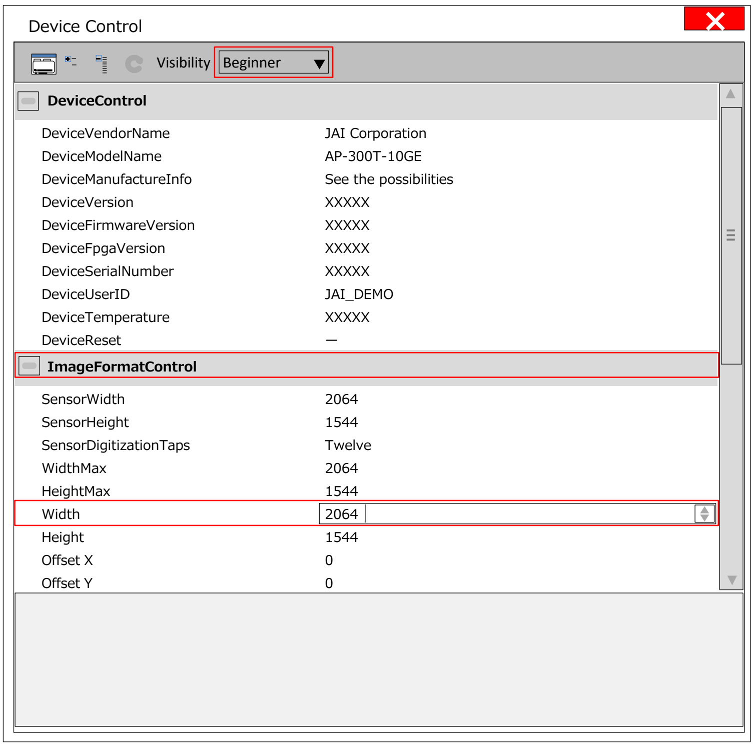
Set the size, position, and pixel format of the image to be captured.
The factory default settings are as follows. Change the settings as needed.

The factory default settings (Sensor 0/Stream 0)

Item		Default
ImageFormatControl	Width	2064
	Height	1544
	OffsetX	0
	OffsetY	0
	PixelFormat	RGB8

1 **The following example shows how to change the [ImageFormatControl] -> [Width] setting.**

If you select the [Width] item, you can change the value as shown below.



Note

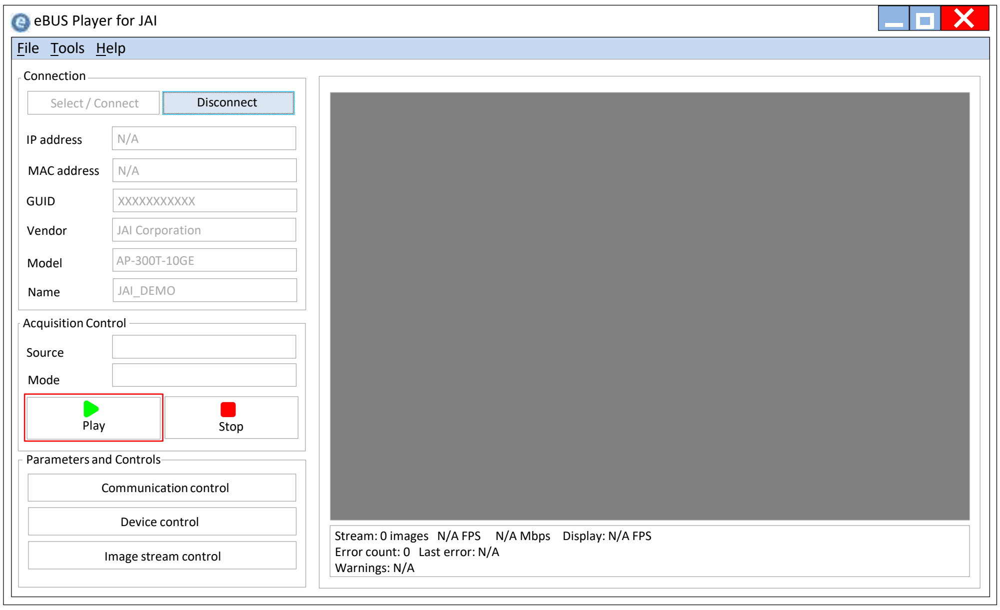
Depending on the setting items, you need to change the visibility.
If necessary, switch between Visibility (Beginner / Expert / Guru).

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.



Note

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

Adjusting the Gain

To adjust the image quality

The Visibility must be changed from [Beginner] to [Guru].
Adjust the sensitivity via the analog gain (i.e., master gain).
For details on gain control, see “Gain Control” in the “Main Functions” section.

■ Manual adjustment

1 **Expand [AnalogControl], and set [GainAuto] to [Off].**

([Off] is default setting.)

2 **Configure the gain.**

❶ Expand [AnalogControl], and select the gain you want to configure in [GainSelector].
[AnalogAll] (master gain), [AnalogRed] (R gain), [AnalogBlue] (B gain), [DigitalRed] (digital R gain), and [DigitalBlue] (digital B gain) can be configured.

❷ Configure the gain value in [Gain].

- [AnalogAll] (master gain) can be set to a value from x1 to x8 (0 dB to about +18 dB) the analog gain value. The resolution is set in x0.1 steps. Values are configured by multipliers.
- The [AnalogRed] (R gain) and [AnalogBlue] (B gain) can be set to a value from x0.47 to x4.0 (−6.5 dB to +12 dB) the [AnalogAll] (master gain) value.
- The [DigitalRed] (digital R gain) and [DigitalBlue] (digital B gain) can be set to a value from x0.9 to x1.1 (−0.915 dB to +0.828 dB) the [AnalogAll] (master gain) value.

Note

The following two methods are available for adjusting the gain manually.
- MasterMode (set IndividualGainMode to Off) (see the above)
- IndividualMode (set IndividualGainMode to On)

For details, see “Gain Control”.

Adjusting the White Balance

Adjust the white balance using the automatic adjustment function.

■ Automatic white balance adjustment

1 **Place a white sheet of paper or similar object under the same lighting conditions as the intended subject, and zoom in to capture the white.**

White objects near the subject, such as a white cloth or wall, can also be used.
Be sure to prevent the high-intensity spot lights from entering the screen.

2 **Select the [BalanceWhiteAuto] tab, and select [Continuous], [Once], [ExposureContinuous], or [ExposureOnce] for the adjustment method.**

The white balance is automatically adjusted.

Note

- The white balance is adjusted via gain adjustment for [Continuous] and [Once].
- The white balance is adjusted via exposure time adjustment for [ExposureContinuous] and [ExposureOnce].

Adjusting the Black Level

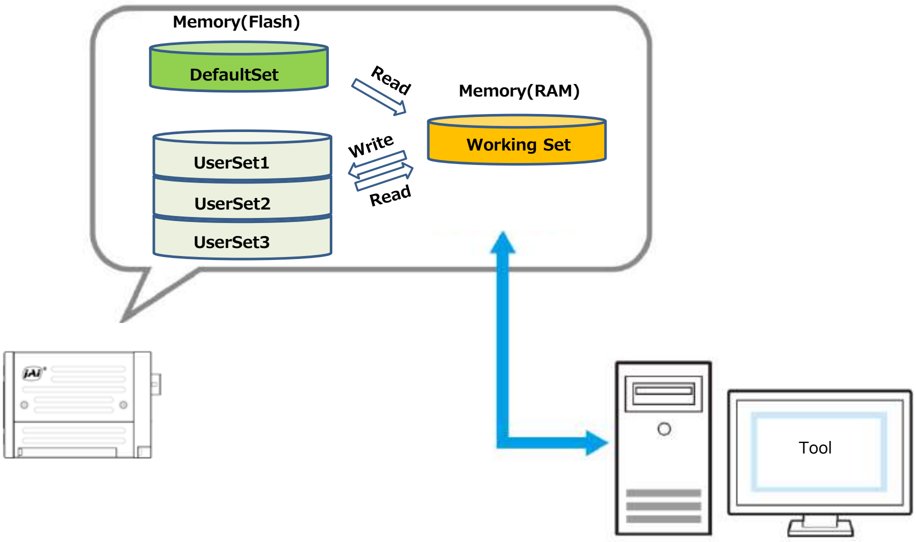
1 **Expand [AnalogControl], and select the black level you want to configure in [BlackLevelSelector].**

[DigitalAll] (master black), [DigitalRed] (digital R), and [DigitalBlue] (digital B) can be configured.

2 **Specify the adjustment value in [BlackLevel].**

Step 7: Saving the Settings

The setting values configured in the tool 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)



■ **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 [Execute 'UserSetSave' Command].**

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 [Execute 'UserSetLoad' Command].**

The selected user settings are loaded.

Main Functions

Acquisition Control

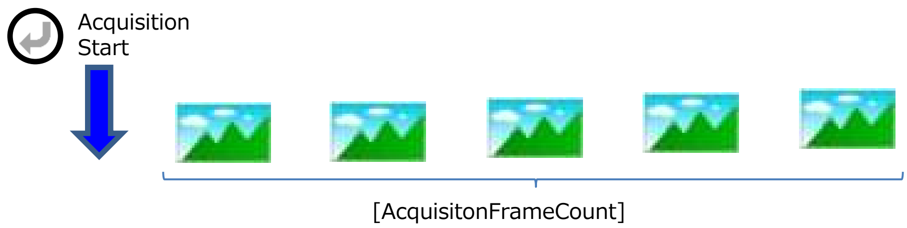
This camera has three Acquisition modes (SingleFrame, MultFrame, Continuous).
Use [AcquisitionControl] settings to perform operations and settings for image capture.

SingleFrame

When the [AcquisitionStart] command is executed, one frame of image is captured.

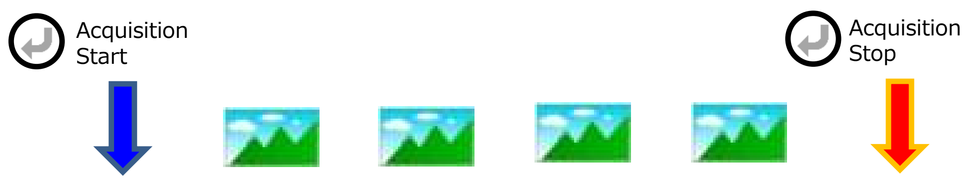
MultiFrame

When the [AcquisitionStart] command is executed, the number of frames set in [AcquisitonFrameCount] are acquired as images.



Continuous

When the [AcquisitionStart] command is executed, images will continue to be acquired until the [AcquisitionStop] command is executed.



Changing the Frame Rate

When [TriggerMode] is disabled, you can change the frame rate in [AcquisitionFrameRate].

Note

- The shortest frame period varies depending on the ROI, pixel format, and binning mode selected. The longest frame period is 0.125 Hz (8 sec.).
- When TriggerMode[FrameStart] is enabled, the [AcquisitionFrameRate] setting is disabled.

Exposure Mode

This camera has three Exposure modes (Off, Timed, TriggerWidth).
Use [AcquisitionControl] settings to perform operations and settings for exposure.

ExposureMode = Off

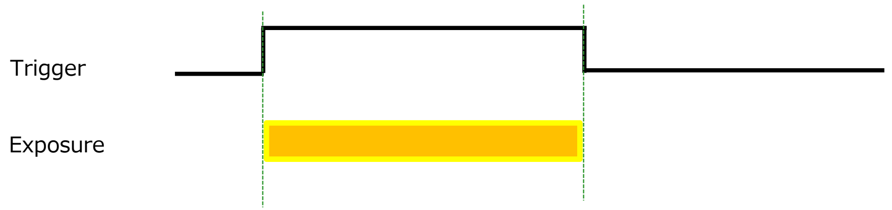
Exposure control is not performed (free-running operation).
The exposure time is the longest possible time within the operating conditions such as the frame rate.

ExposureMode = Timed

Mode in which control is performed using exposure time. Acquire images using an exposure time configured beforehand on an external trigger.
In this mode, the exposure time can be adjusted automatically by setting [ExposureAuto]. For details, refer to “ALC (Automatic Brightness Control) Function”.

ExposureMode = TriggerWidth

Mode in which control of the exposure time is performed using the pulse width of the trigger input signal. The exposure time will be the same as the pulse width of the trigger input signal.



* The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in “Trigger Control”.

* When [ExposureTimeMode] is set to [Individual], you can set the exposure times for Red, Green, and Blue individually. To set the exposure time individually for Red, set [ExposureTimeSelector] to [Red], and configure the exposure time for Red in [ExposureTime]. Similarly, configure the exposure times individually for Green and Blue.

Actual Exposure Times

The minimum exposure time that can be configured are as follows.

ExposureMode	Minimum exposure time
Timed	14.73us (8bit)
TriggerWidth	14.73us (8bit)

The actual exposure time will consist of the image sensor’s offset duration (13.73 μs) added to the setting configured on the camera.
When [ExposureMode] is set to [Timed] and the exposure time is set to 1 μs, the actual exposure time will be as follows.
1 μs + 13.73 μs (offset duration of image sensor) = 14.73 μs
When [ExposureMode] is set to [TriggerWidth], the exposure is slightly longer than the width of the trigger signal. To achieve an exposure time of 14.73 μs and the exposure time offset is 13.73 μs, use 14.73 μs - 13.73 μs = 1 μs as the high or low time for the trigger signal.

Trigger Control

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

TriggerSelector	Description
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.
FrameStart	Start exposure in response to the external trigger signal input. Select this to perform exposure control using external triggers.

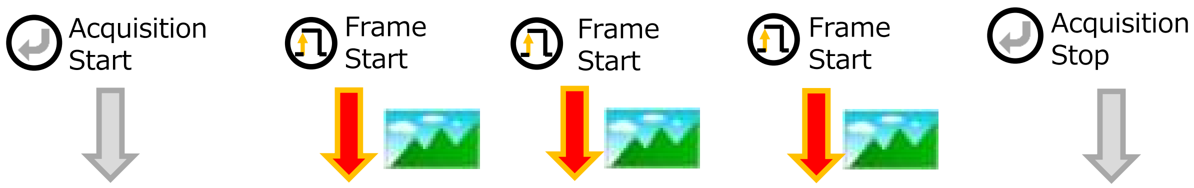
- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in "ExposureMode" .
- You can delay when exposure actually starts after a trigger is received by a specific amount of time by configuring [TriggerDelay].

Select the trigger type with TriggerSelector, and set the following items for each trigger.

[TriggerMode] Switch enable or disable.
[TriggerSource] Select the source signal.
PulseGenerator0, PulseGenerator1, PulseGenerator2, PulseGenerator3,
UserOutput0, UserOutput1, UserOutput2, UserOutput3,
Action0, Action1, Action2, Action3,
Software*,
Line4, Line5, Line6, Line10,
Nand0Out, Nand1Out
* Trigger can be executed by TriggerSoftware [TriggerSelector] command only when Software is set.
[TriggerActivation] Sets the polarity of the trigger signal.
[TriggerDelay] You can specify a delay after receiving the trigger signal until the trigger is enabled.

When using FrameStart trigger

If [AcquisitionStart] is executed and the [AcquisitionStop] command is not executed, if a FrameStart trigger is received, one frame is acquired.



The source signals that can be set for the trigger are as follows.

	Off	AcquisitionActive	FrameActive	ExposureActive	AcquisitionTriggerWait	FrameTriggerWait	FVAL	LVAL	Software	PulseGenerator0	PulseGenerator1	PulseGenerator2	PulseGenerator3	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Action0	Action1	Action2	Action3	Line4	Line5	Line6	Line10	Nand0Out	Nand1Out	Low	High
AcquisitionStart									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
AcquisitionEnd									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
FrameStart									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
AcqusitionTransferStart									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

GPIO (Digital Input/Output Setting)

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 round)
	Line2: Opto Out 1	DC IN / TRIG IN connector (12-pin round)
	Line3: Opto Out 2	AUX connector (10-pin)
	Line8: TTL Out 2	AUX connector (10-pin)
External Input	Line4: TTL In 1	DC IN / TRIG IN connector (12-pin round)
	Line5: Opto In 1	DC IN / TRIG IN connector (12-pin round)
	Line6: Opto In 2	DC IN / TRIG IN connector (12-pin round)
	Line10: TTL In 2	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.

Use the [Digital I/O Control] to set the digital input / output.
Select input or output in [LineSelector], you can check [LineMode], [LineFormat] and set [LineInverter].
You can also check the status of each digital I/O as shown in the table below with [LineStatusAll].

LineSelector	**LineMode**	**LineFormat**	**LineInverter**	**LineStatusAll**	
Line1	Output	TTL	True/False	bit0	DC IN / TRIG IN connector (12-pin round)
Line2	Output	OptoCoupled	True/False	bit1	DC IN / TRIG IN connector (12-pin round)
Line3	Output	OptoCoupled	True/False	bit2	AUX connector (10-pin)
Line4	Input	TTL	False (fixed)	bit3	DC IN / TRIG IN connector (12-pin round)
Line5	Input	OptoCoupled	False (fixed)	bit4	DC IN / TRIG IN connector (12-pin round)
Line6	Input	InternalSignal	False (fixed)	bit6	DC IN / TRIG IN connector (12-pin round)
Line8	Output	TTL	True/False	bit7	AUX connector (10-pin)
Line10	Input	TTL	False (fixed)	bit9	AUX connector (10-pin)
Nand0In1	Input	InternalSignal	True/False		
Nand0In2	Input	InternalSignal	True/False		
Nand1In1	Input	InternalSignal	True/False		
Nand1In2	Input	InternalSignal	True/False		
TimestampReset	Internal Connection	InternalSignal	False (fixed)		

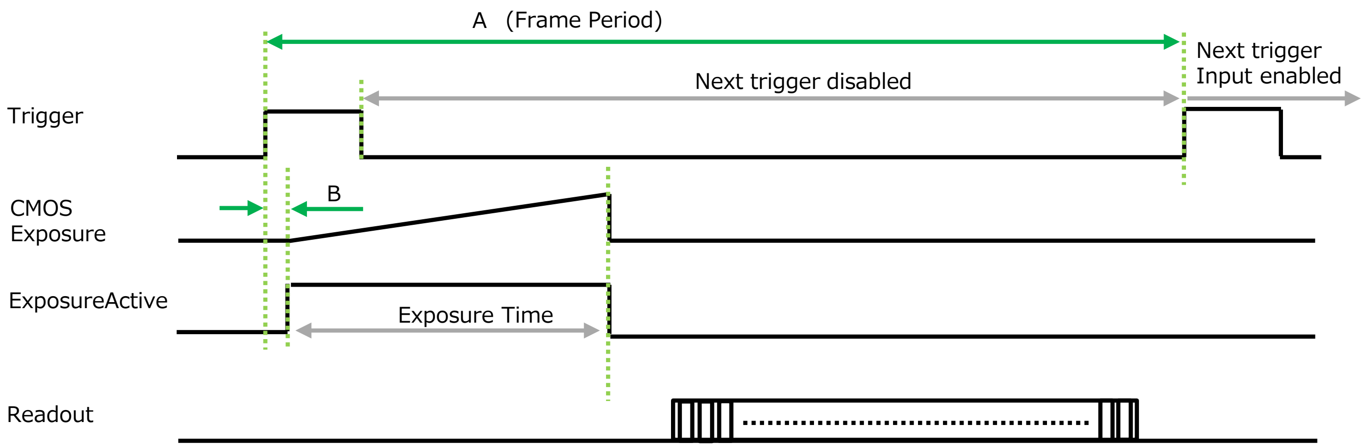
For digital output, set the output source signal using [LineSource].
Set the source signal in the same way for NAND Logic (Nand0In1, Nand0In2, Nand1In1, NandIn2) and TimestampReset.
The table below shows the source signals that can be set.

LineSelector	Off	AcquisitionActive	FrameActive	ExposureActive	AcquisitionTriggerWait	FrameTriggerWait	FVAL	LVAL	Software	PulseGenerator0	PulseGenerator1	PulseGenerator2	PulseGenerator3	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Action0	Action1	Action2	Action3	Line4	Line5	Line6	Line10	Nand0Out	Nand1Out	Low	High
Line1		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Line2		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Line3		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Line4																													
Line5																													
Line6																													
Line8		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Line10																													
Nand0In1		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓	✓
Nand0In2		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓	✓
Nand1In1		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		✓	✓
Nand1In2		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		✓	✓
TimestampReset	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓

Timing chart

■ **[ExposureMode] = [Timed]**

• **[FrameStartTrigger] = [On], [TriggerOverlap] = [Readout]**

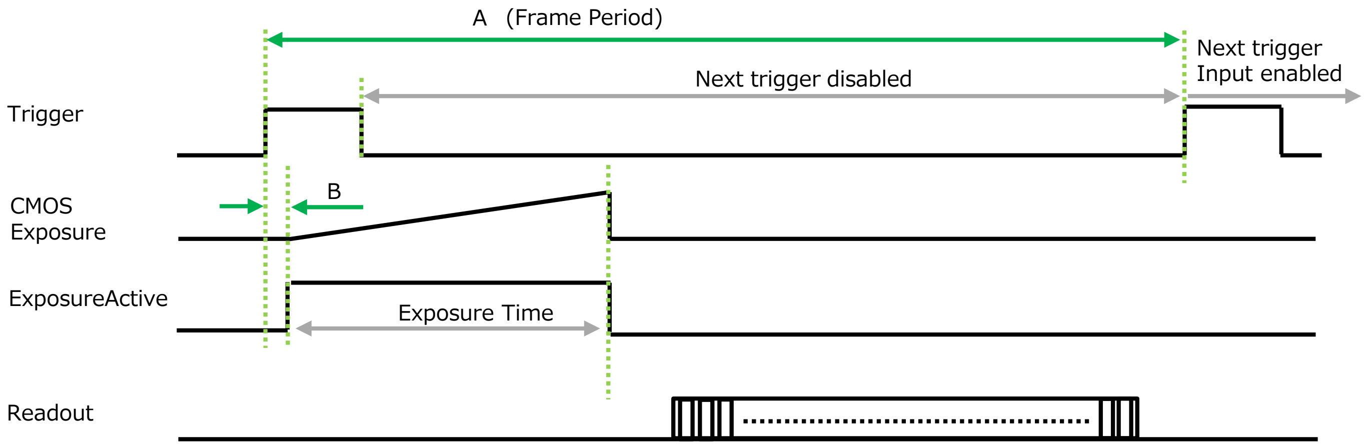


PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
RGB8	9046	18
RGB10V1Packed RGB10p32	12054	23.7
RGB12V1Packed	13548	26.5
Horizontal Binning On		
RGB8	8107	16.2
RGB10V1Packed RGB10p32	9472	19
RGB12V1Packed		
Vertical Binning On		
RGB8	4637	18
RGB10V1Packed RGB10p32	6179	23.7
RGB12V1Packed	6945	26.5

*) It is the value when operating with 10GBase-T.
These values may vary depending on the operating mode conditions.

■ [ExposureMode] = [Timed]

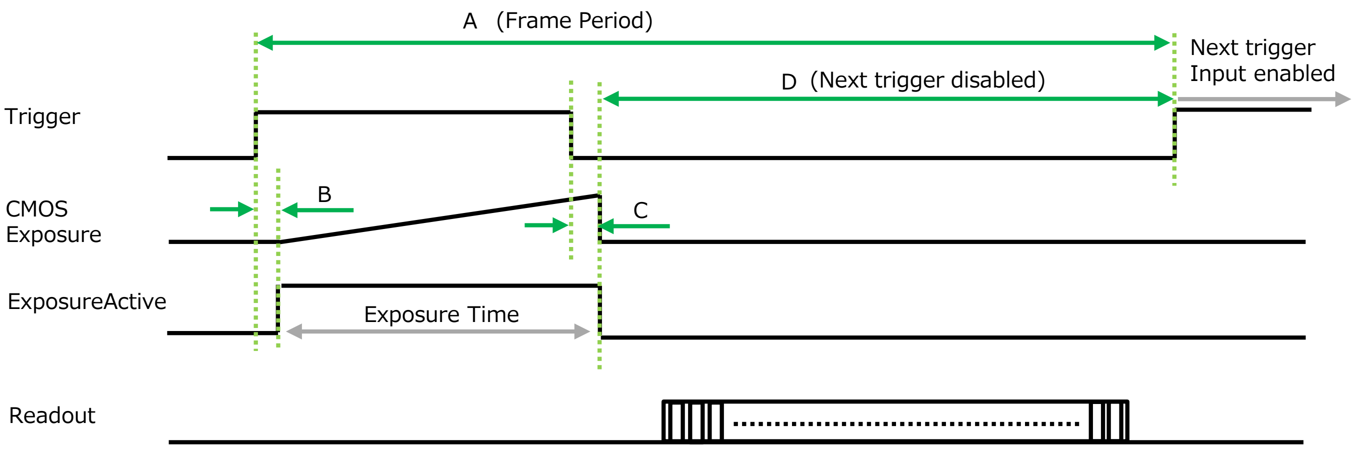
• **[FrameStartTrigger] = [On], [ExposureModeOption] = [RCT]**



PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
RGB8	100102	115.1
RGB10V1Packed RGB10p32	100129	153.1
RGB12V1Packed	100144	171.9
Horizontal Binning On		
RGB8	100087	103.2
RGB10V1Packed RGB10p32	100102	120.5
RGB12V1Packed		
Vertical Binning On		
RGB8	100097	115.1
RGB10V1Packed RGB10p32	100130	153.1
RGB12V1Packed	100144	171.9

*) It is the value when operating with 10GBase-T.
These values may vary depending on the operating mode conditions.

■ [ExposureMode] = [TriggerWidth]



PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger Start [D] (usec)
Binning Off				
RGB8	9027	18	18	68.7
RGB10V1Packed RGB10p32	12027	23.7	23.7	91.2
RGB12V1Packed	13515	26.4	26.4	103.4
Horizontal Binning On				
RGB8	8091	16.2	16.2	61.8
RGB10V1Packed RGB10p32	9453	18.8	18.8	72.1
RGB12V1Packed				
Vertical Binning On				
RGB8	4619	18	18	69.2
RGB10V1Packed RGB10p32	6152	23.7	23.7	91.2
RGB12V1Packed	6913	26.5	26.5	103.4

*) It is the value when operating with 10GBase-T.
These values may vary depending on the operating mode conditions.

Calculate the maximum frame rate (approximate)

H_Period

Use the foillowing formula to calculate H_Period.

H_Period = MAX(Sensor_H_Period, Interface_H_Period, FPGA_H_Period)

Among Sensor_H_Period, Interface_H_Period, and FPGA_H_Period, the one with the largest value is H_Period.

■ Sensor_H_Period

Sensor_H_Period is a fixed value for each PixelFormat regardless of the ROI size. Please refer to the table below.

PixelFormat	PixelSize	Sensor_H_Period(μs)
RGB8	24	5.118
RGB10V1Packed	32	5.98
RGB10p32	32	5.98
RGB12V1Packed	36	5.98

■ Interface_H_Period

Calculate the Interface_H_Period using the following formulas.

Interface_H_Period = (Width x PixelSize) / (AvailablePayloadBandwith x 1000)

Refer to the values in the table above for PixelSize.

[When the maximum packet length is 1476 bytes and the packet delay is 0 ns]

LinkSpeed	AvailablePayloadBandwidth
10Gbps	8.3577
5Gbps	4.389
2.5Gbps	2.1705
1Gbps	0.8952

[When the maximum packet length is 8976 bytes and the packet delay is 0 ns]

LinkSpeed	AvailablePayloadBandwidth
10Gbps	8.7258
5Gbps	4.5315
2.5Gbps	2.2284
1Gbps	0.9159

Caution

The value of AvailablePayloadBandwidth varies depending on conditions such as maximum packet length and packet delay.

■ FPGA_H_Period

Calculate the FPGA_H_Period using the following formulas.

FPGA_H_Period =((Width + 8) ÷ 4 + 32) ÷ 111

Maximum frame rate period formula

Calculate H_Period (number of clocks) from H_Period.

H_Period(number of clocks) = ROUNDUP(H_Period × 74.25, 0)

Maximum frame rate
= 74.25 × 1000000 ÷ (H_Period(number of clocks) × (Height + 40))

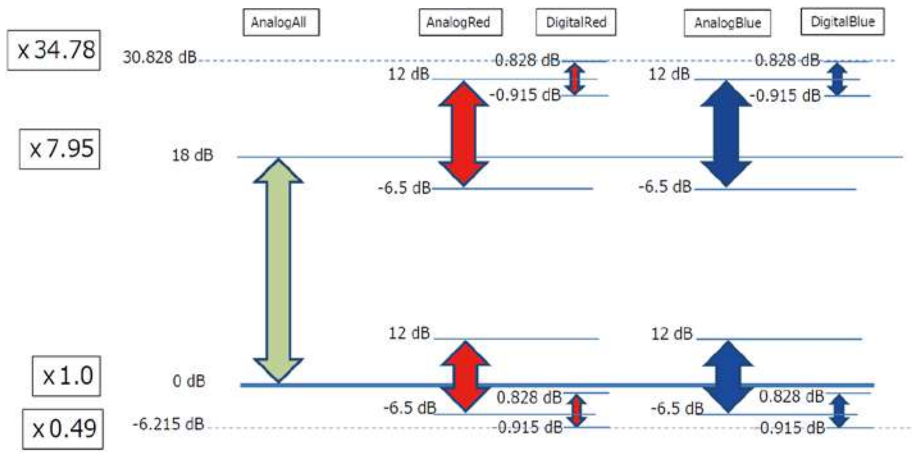
Gain Control

Gain control can be performed in the following two modes on this camera.

■ Adjusting the Master Gain and Performing Fine Adjustment with R and B (Master Mode)

When using this mode, set IndividualGainMode to Off.
Adjust the [AnalogAll] (master gain) setting first, and then adjust the [AnalogRed], [DigitalRed], [AnalogBlue], and [DigitalBlue] setting values to perform fine adjustment.

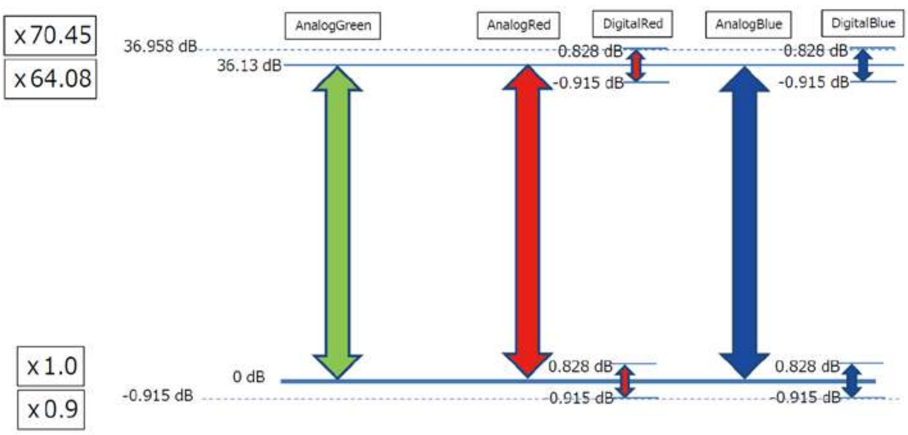
When IndividualGainMode is set to Off



■ Adjusting the Gain Individually for RGB (Individual Mode)

When using this mode, set IndividualGainMode to On.
Adjust the [AnalogGreen], [AnalogRed], [DigitalRed], [AnalogBlue], [DigitalBlue] setting values to adjust the gain.
This mode allows a wider range of adjustment by the user when compared to Master Mode.

When IndividualGainMode is set to On



Note

The baseline for 0 dB is different between MasterMode and IndividualMode.
0 dB in MasterMode is about 6 dB higher than 0 dB in IndividualMode.

■ Automatic Gain Level Control

Set [GainAuto] to [Continuous] to control the gain level automatically.

Note

When [IndividualGainMode] is set to [On], [GainAuto] will be fixed at [Off].

When [GainAuto] is set to [Continuous], you can configure the conditions for automatic adjustment in detail.

Item	Description
ALCReference	Specify the target level for automatic gain control. (This setting is also used for automatic exposure control.)
ALCAreaEnableAll	Select whether to specify all areas as auto gain metering areas or whether to specify the areas individually. [False]: Specify areas as auto gain metering areas (16 areas) individually. [True]: Specify all areas as auto gain metering areas.
ALCAreaSelector	Individually select any of 16 areas for automatic gain metering. (This setting is also used for automatic exposure control.)
ALCAreaEnable	Select [True] to enable the metering area selected in [ALCAreaSelector], or select [False] to disable it.
AGCMax.	Specify the maximum value for the automatic gain control range.
AGCMin.	Specify the minimum value for the automatic gain control range.
ALCControlSpeed	Specify the reaction speed for automatic gain control. (This setting is also used for automatic exposure control.)

When [GainAuto] is set to [Continuous], automatic adjustment will be performed continuously.

Auto gain metering areas (16 areas)

High Left	High Mid-left	High Mid-right	High Right
Mid-High Left	Mid-High Mid-left	Mid-High Mid-right	Mid-High Right
Mid-Low Left	Mid-Low Mid-left	Mid-Low Mid-right	Mid-Low Right
Low Left	Low Mid-left	Low Mid-right	Low Right

White Balance

To adjust the white balance automatically, set [BalanceWhiteAuto] to Once (automatic adjustment only once) or Continuous (automatic adjustment always).
The metering area can be limited for automatic adjustment. To limit the metering area, specify each of the 16 areas with [AWBAreaSelector] and set [AWBAreaEnable] to True or False.

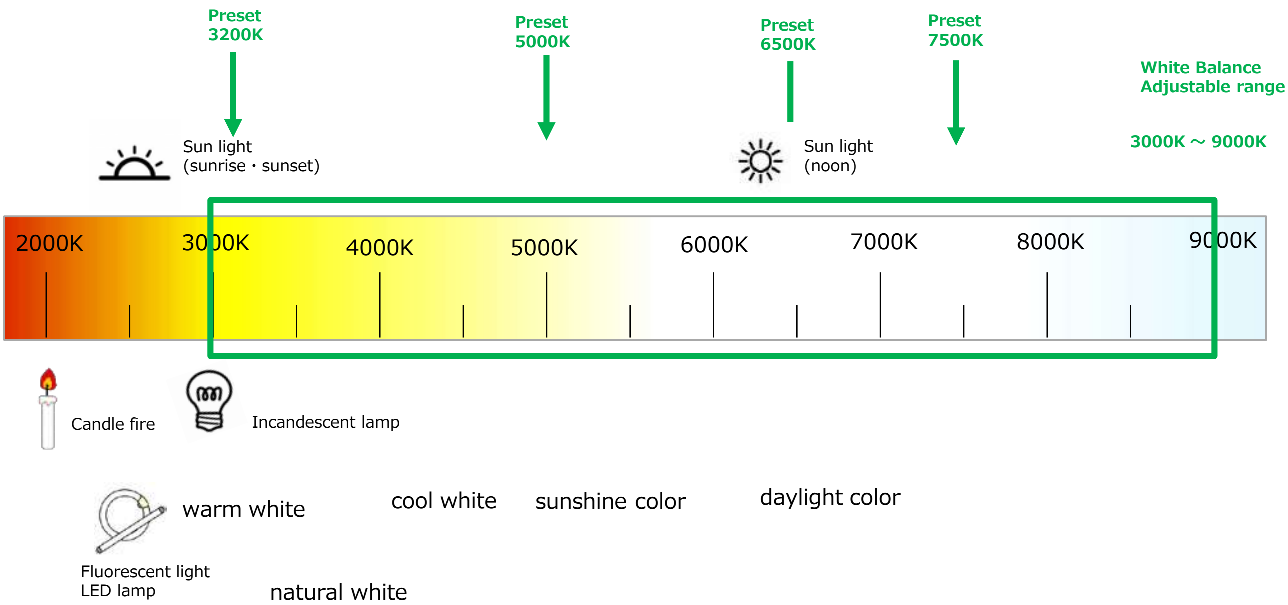
■ 16 areas

HighLeft	HighMidLeft	HighMidRight	HighRight
MidHighLeft	MidHighMidLeft	MidHighMidRight	MidHighRight
MidLowLeft	MidLowMidLeft	MidLowMidRight	MidLowRight
LowLeft	LowMidLeft	LowMidRight	LowRight

In addition, the white balance has been adjusted in advance for specific color temperature lighting.
It is possible to select from the following four presets.
(Color temperature for preset : 3200K, 5000K, 6500K, 7500K)

Color temperature

The adjustable range of white balance for this camera is 3000K to 9000K.
Please refer to the figure below for an overview of the relationship between various lighting types and color temperature.

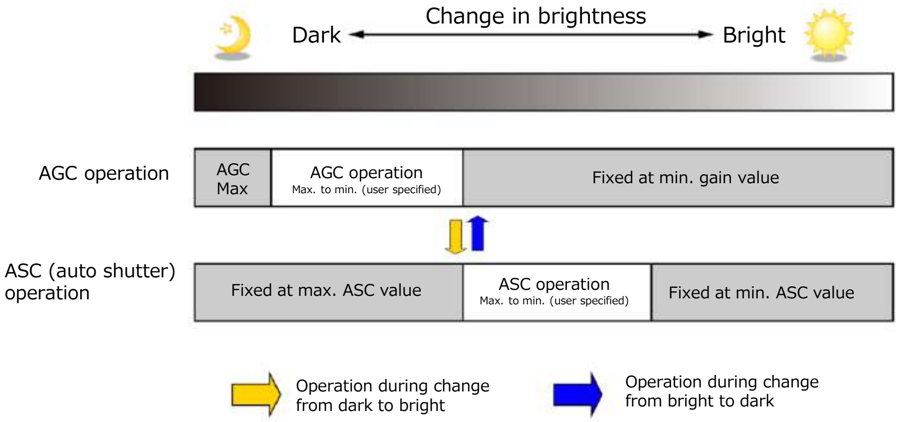


Analog Control

ALC (Automatic Level Control) Function

The ALC (automatic level control) function combines the automatic gain control (AGC/Auto Gain Control) and automatic exposure control (ASC/Auto Shutter Control) functions, and is capable of handling various changes in brightness.The function operates as follows in response to changes in brightness.

Change from bright to dark: ASC → AGC
Change from dark to bright: AGC → ASC



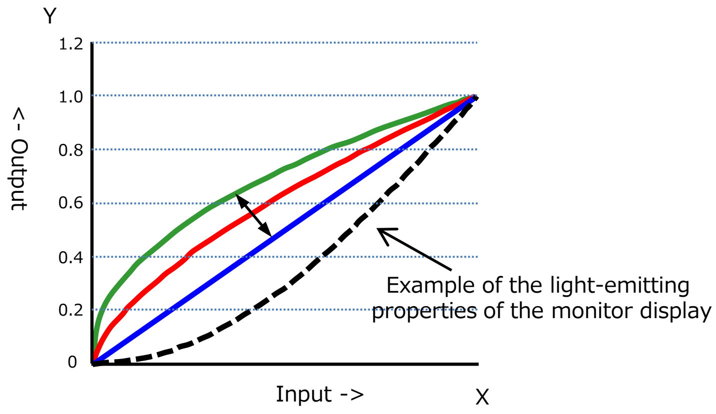
■ To use the ALC function

Set [GainAuto] or [ExposureAuto] or both to [Continuous] mode. Configure the minimum value, maximum value, etc. for AGC and ASC under [JAICustomControlALC]. The target video levels for AGC and ASC are configured in [ALCReference].
For example, when [ALCReference] is set to 95%, video levels will be maintained at 95% using AGC and ASC.

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)".

LUT (Lookup Table)

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).

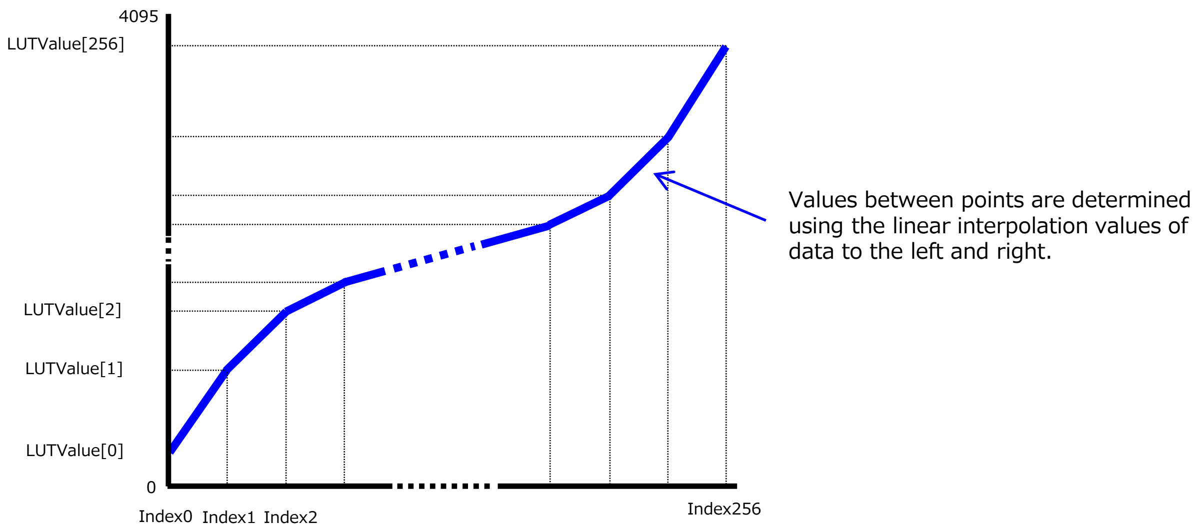
■ To use the LUT function

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.



BlemishCompensation

Multiple defective pixels that are not adjacent to each other can occur on conventional CMOS sensor cameras.
This camera features a function that interpolates defective pixels using the surrounding pixels. Up to 1736 pixels can be corrected for each of the three sensors. Pixel interpolation can be performed via automatic detection or point-by-point manual settings.

■ Automatic detection

Automatic detection can only detect lit defective pixels (i.e., white blemishes).

1 Shield the camera sensor.

If a lens is attached, use the lens cap as a shield, for example.

2 Configure the threshold level for defective pixel detection.

Up to 1736 pixels can be corrected. The threshold value is specified as a percentage. The default setting is "10" with 10% of the full scale (100%) specified as the threshold value.

3 Execute [BlemishDetect] to start automatic detection.

After detection, the interpolation data is saved to the camera's internal memory.

To check the number of interpolated pixels after automatic detection
You can check the number of pixels interpolated via automatic detection by loading the BlemishNum data.

■ Manual configuration

1 Select the index in [BlemishCompensationIndex].

You can select from 1 to 1736. However, configure the indexes in order starting with the smallest index. If you skip indexes while configuring settings, interpolation may not be performed.

2 Specify the pixel points for interpolation using the [BlemishCompensationPositionX] and [BlemishCompensationPositionY] settings.

You can configure values that are within the total effective pixel area. Specify pixels for which interpolation is not necessary as -1. If 0 is specified, the first line or first pixel will be interpolated.

3 Execute [BlemishStore].

Blemish compensation data will be stored.

4 Set [BlemishEnable] to [True], and execute interpolation.

If it is set to [False] , Blemish compensation is not effective.

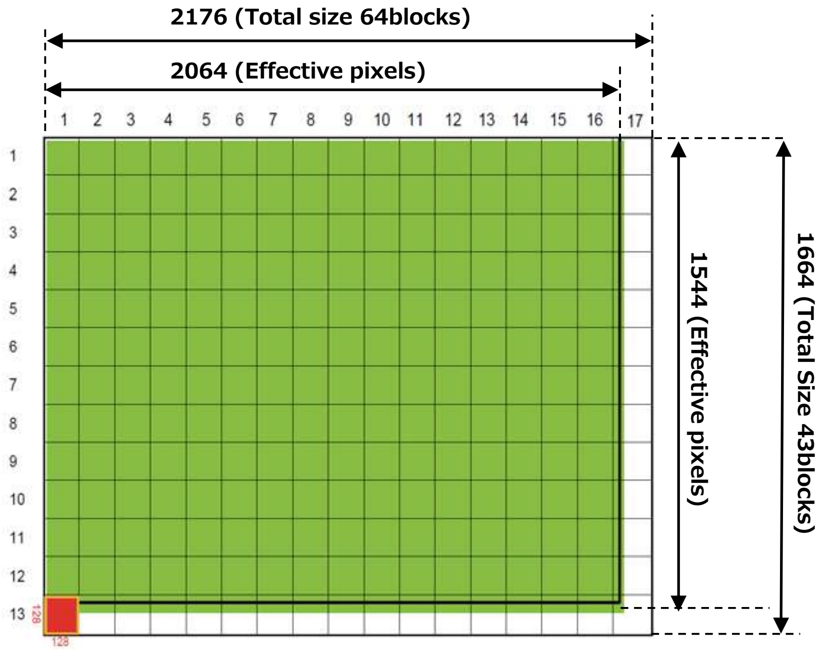
Shading Correction

The ShadingCorrection function corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment. Using this function allows correction even if top, bottom, left, and right shading is not symmetrical in relation to the center of the screen (H, V).

This function can be used even when the effective image area is limited (an area with both Width and Height set to more than 128 must be configured) by the ROI function. In such cases, the correction area is included in the image area configured by the ROI.

For a full image, the number of correction blocks is 17 (H) × 13 (V) blocks and calculation errors in the correction data are minimized due to the small interpolation areas. Each block is 128 × 128 pixels. The total size of the blocks is 2176 (H) × 1664 (V), but the actual number of effective pixels for the camera is 2064 (H) × 1544 (V). The ineffective peripheral areas will be deleted internally on the camera automatically.

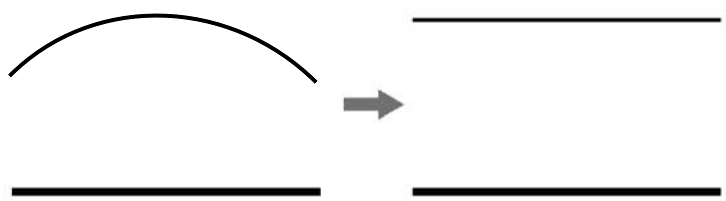
When using ROI, the number of blocks and the number of pixels that comprise each block differ from a full image.



The following shading correction modes are available on the camera.

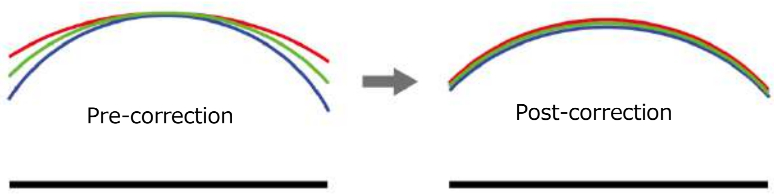
■ **FlatShading**

Correction is performed using the area of the screen with the highest brightness level as the reference, and adjusting the brightness levels of the other areas to match this level.



■ ColorShading

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



Caution

- For FlatShading and ColorShading, the maximum amount of correction gain for all pixels is limited to 8 times the amount of gain before correction. (The amount of gain cannot be increased to more than 8 times the amount of gain from before correction.)
- If the area in the screen with the highest brightness level is 175 LSB or less (during 10-bit video output), proper correction is not possible.

■ To use the shading correction function

Configure the settings as follows.

Item	Setting value	Description
ShadingCorrectionMode	FlatShading, ColorShading	Select the shading correction mode.
ShadingMode	User1, User2, User3, Off	Select the user area to which to save the shading correction value.

Display a white chart under a uniform light, and execute [PerformShadingCalibration].

Note

After shading correction is executed, the shading correction value is automatically saved to the user area selected in [ShadingMode].

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.

Horizontal Binning performs addition or averaging digitally.
Vertical Binning performs addition within the image sensor.

ROI Function (Single ROI)

The ROI (region of interest) function allows you to output images by specifying the areas to scan. Specify the area to scan by specifying width, height, and horizontal/vertical offset values under [ImageFormatControl].

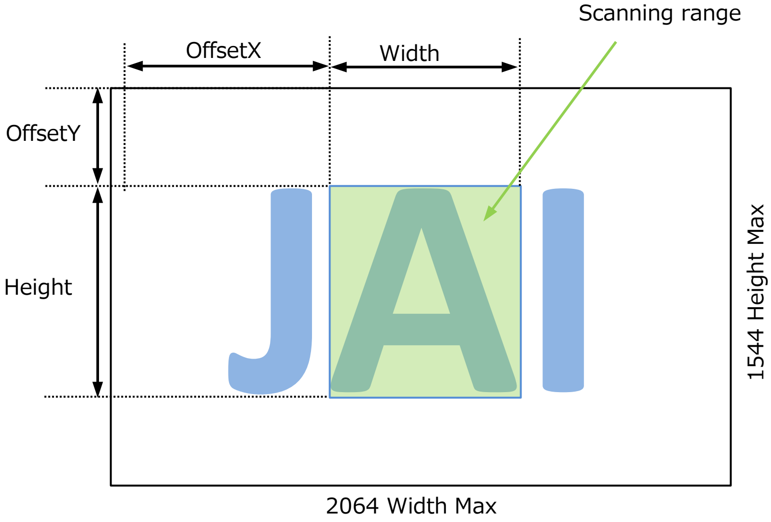
For details on how to configure the settings, see “Configuring the Output Format”. You can increase the frame rate by specifying a lower height, as the number of lines scanned decreases.The setting ranges for the ROI function's readable area based on the Binning setting (BinningHorizontal, BinningVertical) are as follows.

Width (pixels)	Height (lines)
BinningHorizontal Off: 16 to 2064 step 16	BinningVertical Off: 8 to 1544 step 4
BinningHorizontal On: 8 to 1032 step 8	BinningVertical On: 8 to 772 step 2

Offset X (pixels)	Offset Y (lines)
BinningHorizontal Off: 0 to 2048 step 16	BinningVertical Off: 0 to 1540 step 4
BinningHorizontal On: 0 to 1024 step 8	BinningVertical On: 0 to 770 step 2

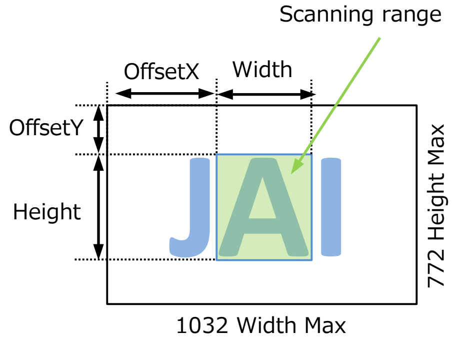
■ **Without Binning**

[BinningHorizontal] : 1
[BinningVertical] : 1



■ **With Binning**

[BinningHorizontal] : 2
[BinningVertical] : 2



ROI Function (Multi ROI)

In the Multi ROI mode, you can specify up to 64 scanning areas for a single-frame image. The areas cannot overlap.

The Multi ROI mode can be used only when both the Sequencer mode and the Shading mode are off.

Set [MultiROIControl]->[MultiRoiMode] On. Select from the eight indexes in [MultiRoiIndex] then set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
And set the maximum index number to be enabled to [MultiRoiVerticalEnableNumber] and [MultiRoiHorizontalEnableNumber].

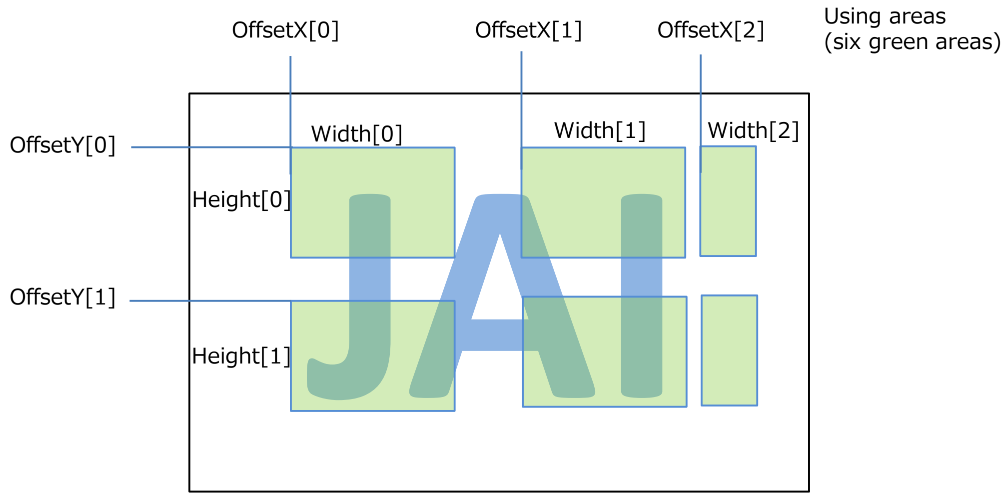
Caution

Make sure that the total value of MultiRoiWidth instances is at least 80. If the total value is less than 80, the image will not be output correctly.
For example, when MultiRoiHorizontalEnableNumber is set to 2 and MultiRoiWidth[0] is set to 16, MultiRoiWidth[1] must be set to 64 or larger.

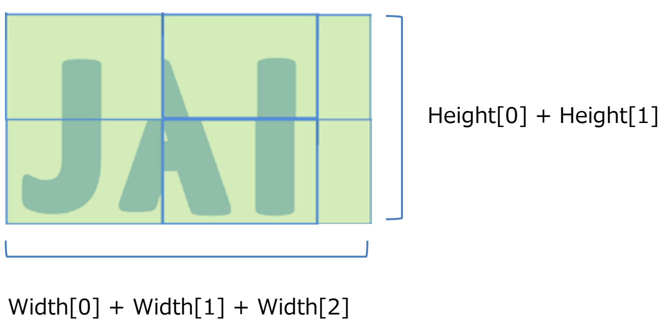
■ Example

To use six areas as shown below, refer to the following.

1. Set [MultiROIControl]->[MultiRoiMode] On.
2. Select “0” in [MultiRoiIndex].
   Set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
3. Select “1” in [MultiRoiIndex].
   Set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
4. Select “2” in [MultiRoiIndex].
   Set [MultiRoiWidth], [MultiRoiOffsetX].
5. Set 2 to [MultiRoiVerticalEnableNumber].
   Set 3 to [MultiRoiHorizontalEnableNumber].



Output image



Sequencer Function

The Sequencer function lets you define up to 128 index combinations of exposure time, gain, ROI, and other settings which can be stepped through each time a trigger is received.This is particularly useful for quickly capturing multiple exposures of objects under inspection to adjust for areas or components with significantly different levels of reflectance. You can specify the next index in the stepping sequence and the order in which indexes are executed. Multiple indexes can also be executed repeatedly.

Two operation modes (TriggerSequencer mode and CommandSequencer mode) are available for the Sequencer function.

Note

Sequencer function can not be used with Multi ROI Function.

Caution

If the values of [ImageFormatControl] Width and Height are smaller than [SequencerControl] SequencerWidth and SequencerHeight, the image may not be output correctly.
When using SequencerWidth / SequencerHeght, set the Width and Height to the default values Width = 2064 and Height = 1544 in advance.

Trigger Sequencer mode

With this mode, the Sequencer Trigger “pattern” is predetermined by the user. The user defines up to 128 different “indexes.” The items indicated in the above index can be configured for each index. The operation of this mode is controlled using the following five commands.

[SequencerSetActive]
This allows you to confirm the index number displayed on next trigger reception.

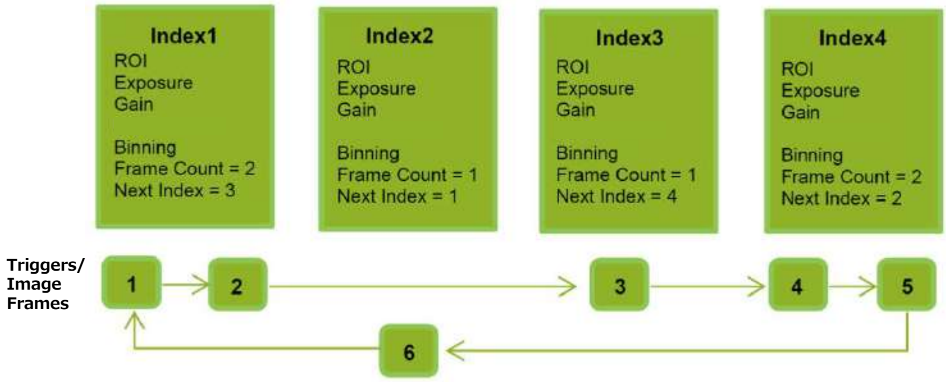
[SequencerSetStart]
This configures the index number to execute at the start of TriggerSequencer mode.

[SequencerReset]
During TriggerSequencer mode operation, this switches the index number to be executed to that specified in [SequencerSetStart].

[SequencerRepetition]
This parameter applies to TriggerSequencer patterns which include an index whose [SequencerROINextIndex] is set to 0 (OFF).When the index whose [SequencerROINextIndex] is set to 0 (OFF) is finished executing, the value of Sequencer Repetition (range = 1-255) is decremented internally. If the result of the decrement is not zero, the TriggerSequencer pattern starts over from the index specified in SequencerSetStart. If the result of the decrement is zero, the status changes to Acquisition Stop and external triggers are not accepted.

Sample TriggerSequencer mode operation

User-defined Indexes (up to 128)



1 **Specify "1" in [SequencerSetStart], and start TriggerSequencer mode with index 1.**

2 **Capture a 2-frame image with the first and second triggers.**

3 **For the next index, configure index 3 specified in [SequencerSetNext], and capture an image with the number of frames (number of triggers) specified in [SequencerFrameNumber].**

Proceed to sequence from index 4 to index 2 to index 1.

Note

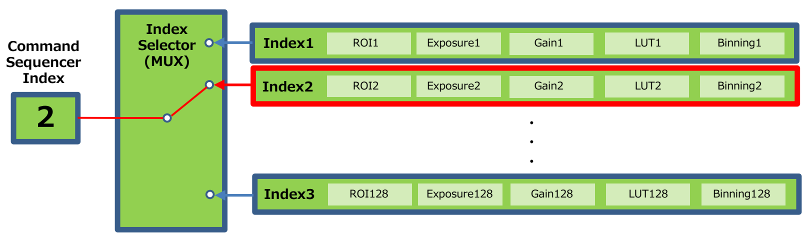
In addition to repeating multiple conditions as in the above example, you can specify "0" (which indicates the end of TriggerSequencer mode) in [SequencerSetNext] of index 2, and specify the number of repetitions in [SequencerRepetition].

Command Sequencer mode

As with TriggerSequencer mode, you can define up to 128 indexes beforehand in this mode. Set [SequencerCommandIndex] to point to one of your pre-configured indexes. This index will be executed on each trigger, until it is changed to point to a different index, typically by your vision application. In this way, Command Sequencer mode allows you to programmatically adjust your sequence in response to image analysis or input from other sensors.

Note

- The same index table will be executed for subsequent triggers unless the [CommandSequencerIndex] value is changed.
- [SequencerFrameNumber] and [SequencerSetNext] cannot be used in CommandSequencer mode.



Color Space Conversion (Color Transformation Control)

This camera allows you to convert the standard color space (RGB) that is used to produce colors into other color spaces, including XYZ and HSI.
Five color spaces are available: RGB(sRGB), RGB(AdobeRGB), RGB(UserCustom), XYZ, and HSI. Specify the desired color space by configuring 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.

Source data

3 x 3 table :
ColorMatrixValue[ColorMatrixValueSelector]

Destination data

$$\begin{bmatrix} R_{in} \\ G_{in} \\ B_{in} \end{bmatrix} \quad \begin{bmatrix} RR & RG & RB \\ GR & GG & GB \\ BR & BG & BB \end{bmatrix} \Rightarrow \begin{bmatrix} R_{out} \\ G_{out} \\ B_{out} \end{bmatrix}$$

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.

Color Transformation Control

Edge Enhancer, Color Enhancer

This camera is equipped with an edge enhancer function for enhancing the contrast of lines or edges within images and a color enhancer function for enhancing specified colors.

Edge enhancer function
The edge enhancer function is enabled when EnhancerEnable[Edge] is set to True.
Four enhancement levels are available: Low, Middle, High, and Strong.

Color enhancer function
The color enhancer function is enabled when EnhancerEnable[Color] is set to True.
Set a value from 0 to 1 (0.1 steps) for ColorEnhancerValue[ColorEnhancerSelector] to set the enhancement to one of ten levels.
(0: no enhancement; 1: approx. x2 the color level of the original data)
Six colors can be specified in ColorEnhancerSelector: Red, Cyan, Green, Magenta, Blue, and Yellow.

VideoProcessBypassMode

The video process bypass mode is a function that bypasses internal video processing on the camera. When bypass is enabled, the sensor output and camera output data can be set to the same bit width.
12-bit outputs (RGB12V1Packed) can only be performed in bypass mode.

VideoprocessbypassMode	On	Off
Camera operation	The following functions will be disabled, regardless of their configurations. Gain[DigitalRed], Gain[DigitalBlue], BlackLevel, LUT, Shading, Binning(H,V), Enhancement, ColorMatrix	All video processes are enabled.
Camera output	8bit(RGB8)/10bit(RGB10V1Packed, RGB10p32)/12bit(RGB12V1Packed)	8bit(RGB8)/10bit(RGB10V1Packed, RGB10p32)

■ Functions available in VideoProcessBypassMode

The following functions can be used in video process bypass mode.
Gain[AnalogAll], Gain[AnalogRed], Gain[AnalogGreen], Gain[AnalogBlue],
AutoGainControl, AutoShutterControl, AutoWhiteBalance,
SequencerMode,
BlemishCompensation

■ To enable VideoProcessBypassMode

Item	Setting value / selectable range	Description
VideoProcessBypassMode	On	Enable VideoProcessBypassMode.

* In VideoProcessBypassMode, saturated level of brightness decreases

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].**

Caution

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

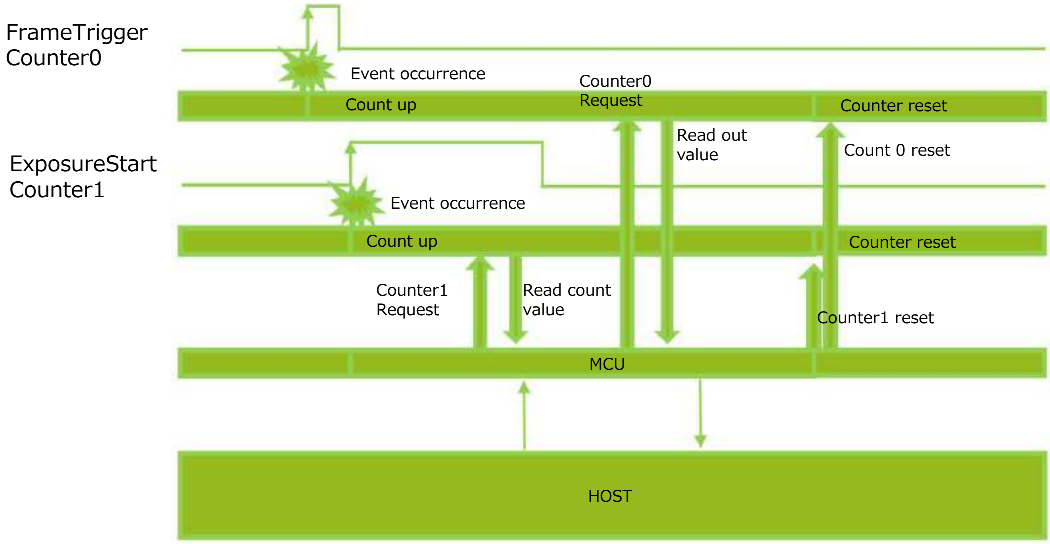
Counter And Timer Control Function

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

Counter0 : Counts the number of FrameTrigger.
Counter1 : Counts the number of ExposureStart.
Counter2 : Counts the number of SensorReadOut.
Counter3 : Counts the number of FrameTransferEnd.

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.

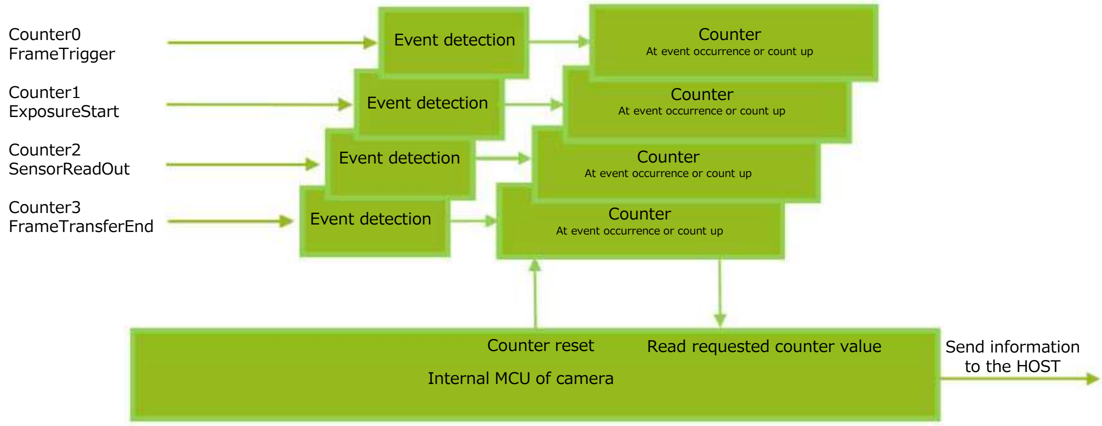
■ Counter occurrence diagram



Note

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

■ Internal camera blocks



■ To use the counter function

Configure the settings as follows.
Four counters are available. Specify a counter (Counter0 to Counter3), and configure the settings.

Item		Setting value / selectable range	Description
Counter 0 ～ 3		Counter 0 ～ 3	Select the counter.
	CounterEventSource	Counter0 Off, FrameTrigger Counter1 Off, ExposureStart Counter2 Off, SensorReadOut Counter3 Off, FrameTransferEnd	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	Rising Edge, Falling Edge	Specify timing at which to count. Counter0 Rising Edge Counter1 Rising Edge Counter2 Rising Edge Counter3 Falling Edge

Non-Volatile Flash Memory

The camera has non-volatile memory for users to store data.
Refer to the technical note "Storing Data in On-Camera Flash Memory" for more information.

Note

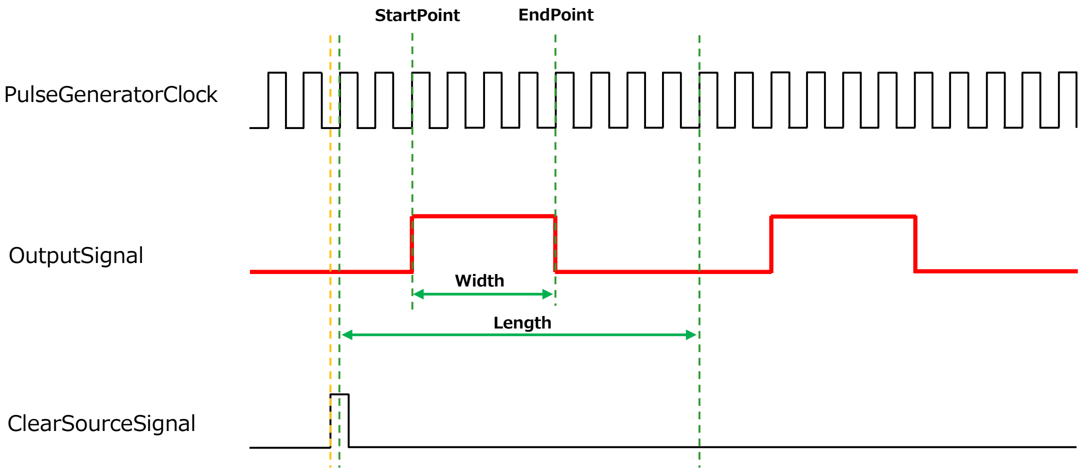
JAI strongly recommends saving images to the PC or other storage location because the non-volatile flash memory may not have enough memory size to store large data.

Pulse Generator

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

The following is an example of signal generation.

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



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

	Off	AcquisitionActive	FrameActive	ExposureActive	AcquisitionTriggerWait	FrameTriggerWait	FVAL	LVAL	Software	PulseGenerator0	PulseGenerator1	PulseGenerator2	PulseGenerator3	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Action0	Action1	Action2	Action3	Line4	Line5	Line6	Line10	Nand0Out	Nand1Out	Low	High
PulseGenerator0		✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓		
PulseGenerator1		✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓		
PulseGenerator2		✓	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓		
PulseGenerator3		✓	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓	✓					✓	✓	✓	✓	✓	✓		

Technical notes The Pulse Generator function – what it is and how to use it

Setting List

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

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

Each setting item is given permission to view and set. There are three types of authority: Beginner, Expert, and Guru.
Beginner : For beginner users.
Expert : For users with deep knowledge of camera functions.
Guru : For advanced users who make settings, including advanced features that can cause the camera to malfunction if not set correctly

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

[Instance example]
When the analog gain can be changed for each of the red, green, and blue channels in a color camera.
Analog gain is a function that has multiple instances, and red, green, and blue are the indexes.

Selectors are a feature of element enumeration type (IEnumeration) or an integer type (IInteger). However, unlike normal configuration items, it is only used to select the instance in the following configuration item.
It does not change the behavior of the camera by changing the value of the selector.
Also, the selector may have only one selectable value. In this case, use the selector function only for information purposes. In this document, it is described as SelectedFeature[Selector] according to the description method of GenICam.

In the case of analog gain given as an example of an instance, the description is as follows.

AnalogGain[Red] = 1.0
AnalogGain[Green] = 1.1
AnalogGain[Blue] = 1.2

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

Feature Properties

Item	Setting range	Default value	Description
DeviceControl			Display/configure information related to the device.
DeviceVendorName	—	"JAI Corporation"	Display the manufacturer name.
DeviceModelName	—	AP-3200T-10GE	Display the model name.
DeviceManufacturerInfo	—	See the possibilities	Display the manufacturer information.
DeviceVersion	—	—	Display the hardware version.
DeviceFirmwareVersion	—	—	Display the firmware version.
DeviceFpgaVersion			Display the FPGA version.
DeviceSerialNumber	—	—	Display the device ID.
DeviceUserID	Any	—	Set the user ID (16bytes) for the camera.
DeviceTLType	—	—	Transport Layer type of the device.
DeviceTLVersionMajor	—	—	Indicates the major version number of the GenICam XML file of the selected manifest entry.
DeviceTLVersionMinor	—	—	Indicates the minor version number of the GenICam XML file of the selected manifest entry.
DeviceTLVersionSubMinor	—	—	Indicates the subminor version number of the GenICam XML file of the selected manifest entry.
DeviceLinkSelector	—	—	Selects which Link of the device to control.
DeviceLinkSpeed	—	—	Indicates the speed of transmission negotiated on the specified Link.
DeviceLinkHeartbeatMode	0: On, 1: Off		Activate or deactivate the Link's heartbeat.
DeviceLinkHeartbeatTimeout	—	—	Controls the current heartbeat timeout of the specific Link.
DeviceStreamChannelCount	3	3	Indicates the number of streaming channels supported by the device.
DeviceEventChannelCount	1	1	Indicates the number of event channels supported by the device.
DeviceReset	—	—	Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)
DeviceTemperatureSelector	0: Mainboard	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading. (fixed Mainboard)
DeviceTemperature	—	—	Display the internal temperature (°C) of the camera.
Timestamp	0~9223372036854775807 (maximum value of unsigned 64-bit)	—	Display the timestamp value. Resets to 0 when the signed maximum 64-bit value is exceeded.
TimestampReset	—	—	Forcibly sets the timestamp's count value to 0.
TimestampLatch	—	—	Sets the timestamp's count value to TimestampLatchValue.
TimestampLatchValue (ns)	0~9223372036854775807 (maximum value of unsigned 64-bit)	0	
UserDefinedValueSelector			
UserDefinedValue			

Item	Setting range	Default value	Description
TransportLayerControl			Display information on transport layer control.
PayloadSize			Display the payload size.
GigEVision			
GevCurrentPhysicalLinkConfigration	SingleLink	SingleLink	Display the status for LinkConfiguration. (fixed at SingleLink)。
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, StreamChannel0BigAndLittleEndian, StreamChannel0MultiZone, StreamChannel0PacketResendDestination, StreamChannel0AllInTransmission, StreamChannel0UnconditionalStreaming, StreamChannel0ExtendedChunkData, StreamChannel1BigAndLittleEndian, StreamChannel1MultiZone, StreamChannel1PacketResendDestination, StreamChannel1AllInTransmission, StreamChannel1UnconditionalStreaming, StreamChannel1ExtendedChunkData, StreamChannel2BigAndLittleEndian, StreamChannel2MultiZone, StreamChannel2PacketResendDestination, StreamChannel2AllInTransmission, StreamChannel2UnconditionalStreaming, StreamChannel2ExtendedChunkData
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	False	False	This item is not supported. (fixed at False)
GevPAUSEFrameTransmission	False	False	This item is not supported. (fixed at False)
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. (None, PersistentIP, DHCP, LLA, ForceIP)
GevPersistentIPAddress	—	—	Set the persistent IP address.
GevPersistentSubnetMask	—	—	Set the persistent subnet mask.
GevPersistentDefaultGateway	—	—	Set the persistent default gateway.
GevIEEE1588	True, False	False	Enables the IEEE 1588 Precision Time Protocol to control the timestamp register.
GevIEEE1588ClockAccuracy	—	—	Indicates the expected accuracy of the device clock when it is the grandmaster, or in the event it becomes the grandmaster. [Setting range] 0:Within25ns, 1:Within100ns, 2:Within250ns, 3:Within1us, 4:Within2p5u, 5:Within10us, 6:Within25us, 7:Within100us, 8:Within250us, 9:Within1ms, 10:Within2p5ms, 11:Within10ms, 12:Within25ms, 13:Within100ms, 14:Within250ms, 15:Within1s, 16:Within10s, 17:GreaterThan10s, 18:AlternatePTPProfile, 19:Unknown, 20:Reserved
GevIEEE1588Status	—	—	Display the current status. 0: Initializing, 1: Faulty, 2: Disabled 3: Listening, 4: PreMaster, 5: Master 6: Passive, 7: Uncalibrated, 8: Slave
GevGVCPExtendedStatusCodesSelector	0:Version1_1, 1:Version2_0	—	Selects the GigE Vision version to control extended status codes for.
GevGVCPExtendedStatusCodes	True, False	False	Enables the generation of extended status codes.
GevGVCPPendingAck	True, False	False	Enables the generation of PENDING_ACK.
GevGVSPExtendedIDMode	Off, On	Off	Enables the extended IDs mode.
GevCCP	0: OpenAccess, 1: ExclusiveAccess, 2: ControlAccess	—	Controls the device access privilege of an application.
GevPrimaryApplicationSocket	—	—	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	—	—	Returns the address of the primary application.
GevMCPHostPort	0	0	Controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GevMCDA	0	0	Controls the destination IP address for the message channel.
GevMCSP	—	0	This feature indicates the source port for the message channel.

Item	Setting range	Default value	Description
GevStreamChannelSelector	0(fixed)	0	Selects the stream channel to control.
GevSCPHostPort	0	0	Controls the port to which the device must send messages. Setting this value to 0 closes the message 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	1476～16366	－	This GigE Vision specific feature corresponds to DeviceStreamChannelPacketSize and should be kept in sync with it. It specifies the stream packet size, in bytes, to send on the selected channel for a GVSP transmitter or specifies the maximum packet size supported by a GVSP receiver.
GevSCPD	0～4294967295	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel. This can be used as a crude flow-control mechanism if the application or the network infrastructure cannot keep up with the packets coming from the device.
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**
ImageFormatControl			Configure image format settings.
SensorWidth	2064	2064	Display the maximum image width.
SensorHeight	1544	1544	Display the maximum image height.
SensorDigitizationBits	10: Ten, 12: Twelve	Ten	It shows how many bits the sensor is operating.
WidthMax	2064	2064	Display the maximum image width.
HeightMax	1544	1544	Display the maximum image height.
Width	16～2064 step 16	2064	Set the image width.
Height	8～1544 step 4	1544	Set the image height.
OffsetX	0～2064 step 16	0	Set the horizontal offset.
OffsetY	0～1544 step 4	0	Set the vertical offset.
BinningHorizontalMode	Average, Sum	Sum	Set the mode for horizontal binning.
BinningHorizontal	1,2	1	Set the number of pixels in the horizontal direction for which to perform binning.
BinningVerticalMode	Sum	Sum	Set the mode for vertical binning. (Sum fixed)
BinningVertical	1,2	1	Set the number of pixels in the vertical direction for which to perform binning.
PixelFormat	RGB8, RGB10V1Packed, RGB10p32, RGB12V1Packed	RGB8	Set the pixel format. *) RGB12V1Packed can be set only when [VideoProcessBypassMode] is set to [On].
TestPattern	－	Off	Select the test image. [Setting range] 0:Off 1:GreyHorizontalRamp 2:GreyVerticalRamp 3:GreyHorizontalRampMoving 4:HorizontalColorBar 5:VerticalColorBar 6:HorizontalColorBarMoving

Item	Setting range	Default value	Description
MultiROIControl			Configure settings for Multi ROI.
MultiRoiMode	0: Off, 1: On	Off	Enable/disable Multi Roi.
MultiRoiIndex	0 ～ 7	0 ～ 7	Select the index for the Multi Roi mode.
MultiRoiWidth	—	—	Set the width for the selected Multi Roi index.
MultiRoiHeight	—	—	Set the height for the selected Multi Roi index.
MultiRoiOffsetX	—	—	Set the horizontal offset for the selected Multi Roi index.
MultiRoiOffsetY	—	—	Set the vertical offset for the selected Multi Roi index.
MultiRoiHorizontalEnableNumber	1 ～ 8	—	Set the maximum number of valid horizontal index numbers.
MultiRoiVerticalEnableNumber	1 ～ 8	—	Set the maximum number of valid vertical index numbers.
AcquisitionControl			Configure image capture settings.
AcquisitionMode	0:SingleFrame, 1:MultiFrame, 2:Continuous	Countinuous	Select the image capture mode.
AcquisitionStart	—	—	Start image capture.
AcquisitionStop	—	—	Stop image capture.
AcquisitionFrameCount	1～65535	1	In [MultiFrame] mode, set the number of frames to capture.
AcquisitionFrameRate	0.125～		Display the frame rate as a frequency. (unit: Hz) The maximum value varies depending on the PixelFormat setting and the ROI setting.
TriggerSelector	0:AcquisitionStart, 1:AcquisitionEnd, 3:FrameStart	AcquisitionStart	Select the trigger operation.
TriggerMode	0:Off, 1:On	Off	Select the trigger mode.
TriggerSoftware	—	—	Execute the software trigger.
TriggerSource	—	—	Select the trigger signal source. [Setting range] 7: PulseGenerator0, 8: PulseGenerator1, 9: PulseGenerator2 10: PulseGenerator3, 11: UserOutput0, 12: UserOutput1 13: UserOutput2, 14: UserOutput3, 19: Software, 23: Line4, 24: Line5 25: Line6, 29: Line10, 36: Nand0Out 37: Nand1Out
TriggerActivation	1:RisingEdge 2:FallingEdge 3:LevelHigh 4:LevelLow	RisingEdge	Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).
TriggerOverlap	1:ReadOut	ReadOut	Select the trigger overlap operation. (ReadOut fixed)
TriggerDelay	0～500000	0	Set the time of exposure start from trigger input. (unit: μs)
ExposureMode	0: Off, 1: Timed, 2: TriggerWidth	Timed	Select the exposure mode.
ExposureTimeMode	Common, Individual	Comon	When set to Individual, ExposureTime can be adjusted for RGB individually.
ExposureTimeSelector	Common, Red, Green, Blue	Common	
ExposureTime	1μs ～	—	Set the exposure time. (μs) The specifiable range varies depending on the [AcquisitionFrameRate] setting. The actual exposure time is the set value plus the image sensor offset 13.7 μs.
ExposureAuto	0: Off, 1: Once, 2: Continuous	Off	Set whether to enable auto exposure.
ExposureModeOption	0: Off, 1: RCT	Off	Set whether to enable RCT mode.

Item	Setting range	Default value	Description
DigitalIOcontrol			Configure settings for digital input/output.
LineSelector	—	Line2	Select the input/output to configure. [Setting range] 20: Line1, 21: Line2, 22: Line3, 23: Line4, 24: Line5 25: Line6, 27: Line8, 29: Line10 53: Nand0In1, 54: Nand0In2, 55: Nand1In1, 56: Nand1In2 63: TimeStampReset
LineMode	0: Input, 1: Output, 2: InternalConnection	—	Display the input/output status (whether it is input or output).
LineInverter	True, False	False	Enable/disable polarity inversion for the selected input signal or output signal.
LineStatus	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. [0]:Line1, [1]:Line2, [2]:Line3, [3]:Line4 [4]:Line5, [5]:Line6, [6]: - , [7]:Line8 [8]: -, [9]:Line10, [10]:- , [11]:- [12]: -, [13]:-, [14]:- , [15]:-
LineSource	—	—	Select the line source signal for the item selected in [Line Selector]. [Setting range] 0:Off (LineSelector=TimestampReset Only) 1:AcquisitionActive-Source0, 45:AcquisitionActive-Source1. 57:AcquisitionActive–Source2, 2:FrameActive-Source0, 46:FrameActive-Source1, 58:FrameActive–Source2, 4:ExposureActive-Source0, 48:ExposureActive-Source1, 60:ExposureActive–Source2 5:FVAL-Source0, 49:FVAL-Source1, 61:FVAL–Source2 6:LVAL-Source0, 50:LVAL-Source1, 62:LVAL–Source2 43:AcquisitionTriggerWait-Source0, 51:AcquisitionTriggerWait-Source1, 63:AcquisitionTriggerWait-Source2, 44:FrameTriggerWait-Source0, 52:FrameTriggerWait-Source1, 64:FrameTriggerWait-Source2 7-10:PulseGenerator0-3, 11-14:UserOutput0-3 23:Line4 TTL In1, 24:Line5 Opt In1, 25:Line6 Opt In2, 29:Line10 TTL In2 36:Nand0 Out, 37:Nand1 Out 40:- (Not selectable for Output) 41:Low, 42:High
LineFormat	2:TTL, 5:OptoCoupled, 7:Internal Signal	—	Display the signal format.
OptInFilter	Off, 10us, 100us, 500us, 1ms, 5ms, 10ms	Off	Select the filter to remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector	0: UserOutput0 1: UserOutput1 2: UserOutput2 3: UserOutput3	UserOutput0	Set the UserOutput signal.
UserOutputValue	True, False	False	Set the value for the UserOutput selected in [UserOutputSelector].

Item	Setting range	Default value	Description
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)	0.0181274～74.25	0.45	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base.
PulseGeneratorSelector	0: PulseGenerator0, 1: PulseGenerator1, 2: PulseGenerator2, 3: PulseGenerator3	PulseGenerator0	Select the pulse generator.
PulseGeneratorLength	1～1048575	30000	Set the maximum count-up value as a clock count.
PulseGeneratorLengthMs	1 / PulseGeneratorClock (MHz) ～1048575 / PulseGeneratorClock (MHz)	66.6667	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	PulseGeneratorClock (MHz) ÷ 1048575 x 1000000 ～ PulseGeneratorClock (MHz) x 1000000		Set the maximum count-up value as a frequency. This value is calculated using the [PulseGeneratorLength] value as a base.
PulseGeneratorStartPoint	0 ～ 1048574	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPointMs	0 ～ 1048575 / PulseGeneratorClock (MHz)	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.
PulseGeneratorEndPoint	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.
PulseGeneratorEndPointMs	1/ PulseGeneratorClock (MHz) ～ 1048575 / PulseGeneratorClock (MHz)		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	—	33.3333	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	0: Off, 1: RisingEdge, 2: FallingEdge, 3: LevelHigh, 4: LevelLow	Off	Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClearSource	—	—	Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClearSyncMode	0:AsyncMode, 1:SyncMode	AsyncMode	Select the sync mode for the count clear input signal.

Item	Setting range	Default value	Description
AnalogControl			Configure analog control settings.
IndividualGainMode	Off, On	Off	In IndividualGainMode, RGB can be configured individually for the entire gain adjustment range of the sensor.
GainSelector	—	AnalogAll	Select the gain to configure. [Setting range] **When IndividualGainModeOn:** DigitalRed, DigitalBlue, AnalogRed, AnalogGreen, AnalogBlue **When IndividualGainModeOff:** DigitalRed, DigitalBlue, AnalogAll, AnalogRed, AnalogBlue
Gain	—	x 1.0	Set the gain value for the gain setting selected in [GainSelector].
GainAuto	0:Off, 1:Once, 2:Continuous	Off	Enable/disable gain auto adjustment. [Once] automatically changes to [Off] when the signal level converges once.
BlackLevelSelector	0:All, 1:Red, 3:Blue	All	Select the black level to configure.
BlackLevel	All, -133～255 Red, -64～ 64 Blue -64～ 64	All, 0 Red, 0 Blue 0	Set the black level value.
BalanceWhiteAuto	0:Off, 1:Once, 2:Continuous, 3:Preset3200K, 4:Preset5000K, 5:Preset6500K, 6:Preset7500K	Off	Enable/disable auto white balance.
BalanceWhiteAutoAreaSelector	—	—	Select the area for which to configure [BalanceWhiteAutoAreaEnable]. [Setting range] 15:HighLeft, 14:HighMidLeft, 13:HighMidRight, 12:HighRight, 11:MidHighLeft, 10:MidHighMidLeft, 9:MidHighMidRight, 8:MidHighRight, 7:MidLowLeft, 6:MidLowMidLeft, 5:MidLowMidRight, 4:MidLowRight, 3:LowLeft, 2:LowMidLeft, 1:LowMidRight, 0:LowRight
BalanceWhiteAutoAreaEnable	True, False		Enable/disable the photometry area selected in [BalanceWhiteAutoAreaSelector].
BalanceWhiteAutoAreaEnableAll	True, False		True: Operate BalanceWhiteAuto with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [BalanceWhiteAutoAreaSelector]. False: Operate BalanceWhiteAuto according to the individual enabled/disabled photometry area states configured in [BalanceWhiteAutoAreaSelector].
BalanceWhiteAutoSpeed	1 to 8	4	Set the response speed for BalanceWhiteAuto. (8 is the fastest)
BalanceWhiteAutoResult	—	—	Display the results of BalanceWhiteAuto. 0: Idle (Balance White Auto is not executed yet.) 1: Processing (Balance White Auto is processing.) 2: Converging (Balance White Auto is converging.) 3:Succeeded (Balance White Auto was Succeeded.) 4: Error1 (G image was too bright) 5: Error2 (G image was too dark) 6: Error3 (Timeout error has occurred. Please try again.) 7: Error4 (Could not processing.) 8: Error5 (R or B image was out of range.)
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	0:Off, 1:Gamma, 2:LUT	Off	Select the LUT mode.

Item	Setting range	Default value	Description
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.
AutoLevelControl			Configure AutoLevelControl.
ALCControlReference			
ALCControlChannel			
ALCReference	30 ～ 95	50	Set the target level for ALC. (unit: %)
ALCAreaSelector	—	—	Select the area for which to configure [ALCAreaEnable]. [Setting range] 15:HighLeft, 14:HighMidLeft, 13:HighMidRight, 12:HighRight, 11:MidHighLeft, 10:MidHighMidLeft, 9:MidHighMidRight, 8:MidHighRight, 7:MidLowLeft, 6:MidLowMidLeft, 5:MidLowMidRight, 4:MidLowRight, 3:LowLeft, 2:LowMidLeft, 1:LowMidRight, 0:LowRight
ALCAreaEnable	True, False	True	Enable/disable the photometry area selected in [ALCAreaSelector].
ALCAreaEnableAll	True, False	True	True: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [ALCAreaSelector]. False: Operate ALC according to the individual enabled/disabled photometry area states configured in [ALCAreaSelector].
ALCControlSpeed	1 ～ 8	4	Set the response speed for ALC. (8 is the fastest.)
AutoControlStatus	—	Idle	Allows confirmation of the current operation area during ALC operation.
ExposureAutoControlMin	100 ～	—	Set the minimum value for the ExposureTime control range
ExposureAutoControlMax	101 ～	—	Set the maximum value for the ExposureTime control range
GainAutoControlMin	1 ～ 15	1	Set the minimum value for the GainAuto control range
GainAutoControlMax	2 ～ 16	16	Set the maximum value for the GainAuto control range
Color Transformation Control			
ColorTransformationMode	RGB, XYZ, HSI	RGB	Set the output image format.
ColorTransformationRGBMode	Off, sRGB, AdobeRGB, UserCustom	Off	Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector	—	ColorMatrixR-R	Select the ColorMatrix setting component. [Setting range] ColorMatrixR-R, ColorMatrixR-G, ColorMatrixR-B ColorMatrixG-R, ColorMatrixG-G, ColorMatrixG-B ColorMatrixB-R, ColorMatrixB-G, ColorMatrixB-B
ColorMatrixValue	-2.0 ～ 2.0	—	Set the Color Matrix value. [Initial value] ColorMatrixValue [ColorMatrixR-R] = 1.0 ColorMatrixValue [ColorMatrixR-G] = 0 ColorMatrixValue [ColorMatrixR-B] = 0 ColorMatrixValue [ColorMatrixG-R] = 0 ColorMatrixValue [ColorMatrixG-G] = 1.0 ColorMatrixValue [ColorMatrixG-B] = 0 ColorMatrixValue [ColorMatrixB-R] = 0 ColorMatrixValue [ColorMatrixB-G] = 0 ColorMatrixValue [ColorMatrixB-B] = 1.0
Imaging Control			
VideoProcessBypassMode	0:Off, 1:On		Enable/disable VideoProcessBypass mode.
EdgeEnhancerEnable	True, False		Enable/disable EdgeEnhancer.
EdgeEnhancerLevel	0:Low, 1:Middle, 2:High, 3:Strong		
ColorEnhancerEnable	True, False		Enable/disable ColorEnhancer.
ColorEnhancerSelector	Red, Cyan, Green, Magenta, Blue, Yellow		Index for advanced ColorEnhancer settings.
ColorEnhancerValue	0 ～ 1	0	Specify the ColorEnhancer emphasis levels for each color component.

Item		Setting range	Default value	Description
Shading				Configure shading correction settings.
ShadingCorrectionMode		0: FlatShading, 1: ColorShading	FlatShading	Select the shading correction method.
ShadingMode		0: Off, 1: User1, 2: User2, 3: User3	Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
PerformShadingCalibration		—	—	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.
ShadingDetectResult		—	—	Display the shading correction results. 0: Idle 1: Succeeded (Shading calibration was Succeeded.) 2: Error1 (Image was too bright.) 3: Error2 (Image was too dark.) 4: Error3 (Could not calibrated.) 5: Error4 (Correction Limit.)
BlemishControl				Configure settings for JAI white blemish correction.
BlemishEnable		True, False	True	Enable/disable blemish correction.
BlemishDetect		—	—	Execute blemish detection. This command can not be executed under the following conditions. ・When no image is output ・Outputting TestPattern ・In Sequencer mode ・In MultiRoi mode ・In single ROI mode
BlemishDetectionResult				
BlemishStore		—	—	Stores the Blemish data that to be entered by BlemishCompensationPositionX and BlemishCompensationPositionY.
BlemishCompensationChannnelSelector				
	BlemishDetectThreshold	1 ～ 99	10	Set the blemish detection threshold.
	BlemishCompensationIndex	1 ～ 1736	1	Select the index for the target blemish coordinates (BlemishDataPosition X/Y).
	BlemishCompensationPositionX	-1 ～ 2063	—	Display the X coordinate (horizontal pixel position) of the target blemish selected in [BlemishCompensationIndex]. You can also manually enter the X coordinate of the blemish you want to correct.
	BlemishCompensationPositionY	-1 ～ 1543	—	Display the Y coordinate (vertical pixel position) of the target blemish selected in [BlemishCompensationIndex]. You can also manually enter the Y coordinate of the blemish you want to correct.
	BlemishCompensationDataClear	—	—	Delete detected or specified blemish information selected in [BlemishCompensationIndex].
BlemishCompensationNumber		0 ～ 1736	0	Display the number of target blemishes.

Item		Setting range	Default value	Description
SequencerControl				Configure sequencer settings.
SequencerMode		Off, On	Off	Enable/disable [SequencerMode].
SequencerModeSelect		0:TriggerSequencerMode, 1:CommandSequencerMode	TriggerSequencerMode	Select the sequencer mode.
SequencerSetSelector		1～128	1	Select the index number to configure.
	SequencerWidth	16～2064 step 16	2064	Set the width of the selected SequencerIndex.
	SequencerHeight	8～1544 step 4	1544	Set the height of the selected SequencerIndex.
	SequencerOffsetX	0～2064 step 16	0	Set the horizontal offset value for the selected SequencerIndex.
	SequencerOffsetY	0～1544 step 4	0	Set the vertical offset value for the selected SequencerIndex.
	SequencerBinningHorizontal	0, 1	0	For the selected SequencerIndex, set the number of pixels in the horizontal direction for which to perform binning. In binning mode, the setting value of BinningHorizontalMode is applied.
	SequencerBinningVertical	0, 1	0	For the selected SequencerIndex, set the number of pixels in the vertical direction for which to perform binning. In binning mode, the setting of BinningVerticalMode is applied.
	SequencerFrameCount	—	—	Set the FrameCount value for the selected SequencerIndex.
	SequencerExposureTime	1µs ～	—	Set the exposure time for the selected SequencerIndex.
	SequencerGainAnalogAll	x1.0 ～ x16.0	x1.0	Set the GainAnalogAll value.
	SequencerGainDigitalRed	x0.447～x5.624	x1.0	Set the DigitalRed Gain value for the selected SequencerIndex.
	SequencerGainDigitalBlue	x0.447～x5.624	x1.0	Set the DigitalBlue Gain value for the selected SequencerIndex.
	SequencerBlackLevelAll	-133～255	0	Set the BlackLevelAll value for the selected SequencerIndex.
	SequencerLutEnable	True, False	False	Set the LutEnable value for the selected SequencerIndex.
	SequencerSetNext	0 ～ 128		Set the next index to be displayed for the selected SequencerIndex. (Enabled only for TriggerSequencer.) If 0 is specified, the operation of Sequencer is stopped.
SequencerRepetition		1～255	1	Set the repeat count for the sequencer.
SequencerSetActive		1～128	1	Displays the sequencer set number.
SequencerSetStart		1～128	1	Specify the first index number to switch to when starting [TriggerSequencerMode].
SequencerCommandIndex		1～128	1	Set this to change the SequencerIndex. (Enabled only for CommandSequencer.)
SequencerReset		—	—	In [TriggerSequencerMode], reset the current index number to the number configured in [SequencerSetStart].
CounterAndTimerControl				Configure counter settings. (This camera only supports counter functions.)
CounterSelector		0: Counter0 1: Counter1 2: Counter2 3: Counter3	—	Select the counter.
	CounterEventSource	—	Off	Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value. [Setting range] Counter0 0:Off, 1:FrameTrigger Counter1 0:Off, 1:ExposureStart Counter2 0:Off, 1:SensorReadOut Counter3 0:Off, 1:FrameTransferEnd
	CounterEventActivation	—	—	Set the count timing. The setting value is fixed with the following data. Counter0 RisingEdge Counter1 RisingEdge Counter2 RisingEdge Counter3 FallingEdge
	CounterReset	—	—	Reset the counter.
	CounterValue	0～65535	0	Display the count value.
	CounterStatus	—	—	Display the counter status. 0: CounterIdle: Idle 1: CounterTriggerWait 2: CounterActive: Counting 3: CounterCompleted:Complete counting 4: CounterOverflow: Count value exceeded the maximum valule.
ActionControl				Configure settings for action control.
ActionDeviceKey		0x00000000～ 0xFFFFFFFF	—	An action command is executed if this ActionDeviceKey matches the DeviceKey contained in the action command message.
ActionQueueSize				Indicates the size of ActionQueue.
ActionSelector		1,2	1	Select the ActionSelector.
	ActionGroupMask	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.
	ActionGroupKey	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
EventControl			
EventSelector	–	–	Select the event to send the event message. [Setting range] ExposureRedStart, ExposureRedEnd, ExposureGreenStart, ExposureGreenEnd ExposureBlueStart, ExposureBlueEnd Line1RisingEdge, Line1FallingEdge, Line2RisingEdge, Line2FallingEdge Line3RisingEdge, Line3FallingEdge, Line4RisingEdge, Line4FallingEdge Line5RisingEdge, Line5FallingEdge, Line6RisingEdge, Line6FallingEdge Line8RisingEdge, Line8FallingEdge, Line10RisingEdge, Line10FallingEdge AcquisitionTrigger, FrameStart, FrameEnd
EventNotification	On, Off	Off	Sets whether or not to send an event message when an event selected by [EventSelector] occurs.
EventExposureRedStartData	–	–	
EventExposureRedStart	–	–	Display the EventID(0x9302).
EventExposureRedStartTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureRedStartFrameID	–	–	Displays the FrameID value when an event occurs.
EventExposureRedEndData	–	–	
EventExposureRedEnd	–	–	Display the EventID(0x9303).
EventExposureRedEndTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureRedEndFrameID	–	–	Displays the FrameID value when an event occurs.
EventExposureGreenStartData	–	–	
EventExposureGreenStart	–	–	Display the EventID(0x9304).
EventExposureGreenStartTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureGreenStartFrameID	–	–	Displays the FrameID value when an event occurs.
EventExposureGreenEndData	–	–	
EventExposureGreenEnd	–	–	Display the EventID(0x9305).
EventExposureGreenEndTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureGreenEndFrameID	–	–	Displays the FrameID value when an event occurs.
EventExposureBlueStartData	–	–	
EventExposureBlueStart	–	–	Display the EventID(0x9306).
EventExposureBlueStartTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureBlueStartFrameID	–	–	Displays the FrameID value when an event occurs.
EventExposureBlueEndData	–	–	
EventExposureBlueEnd	–	–	Display the EventID(0x9307).
EventExposureBlueEndTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventExposureBlueEndFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine1RisingEdgeData	–	–	
EventLine1RisingEdge	–	–	Display the EventID(0x9310).
EventLine1RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine1RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine1FallingEdgeData	–	–	
EventLine1FallingEdge	–	–	Display the EventID(0x9318).
EventLine1FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine1FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine2RisingEdgeData	–	–	
EventLine2RisingEdge	–	–	Display the EventID(0x9311).
EventLine2RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine2RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine2FallingEdgeData	–	–	
EventLine2FallingEdge	–	–	Display the EventID(0x9319).
EventLine2FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine2FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine3RisingEdgeData	–	–	
EventLine3RisingEdge	–	–	Display the EventID(0x9312).
EventLine3RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine3RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine3FallingEdgeData	–	–	
EventLine3FallingEdge	–	–	Display the EventID(0x931A).
EventLine3FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine3FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine4RisingEdgeData	–	–	
EventLine4RisingEdge	–	–	Display the EventID(0x9313).
EventLine4RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine4RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine4FallingEdgeData	–	–	
EventLine4FallingEdge	–	–	Display the EventID(0x931B).
EventLine4FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine4FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine5RisingEdgeData	–	–	
EventLine5RisingEdge	–	–	Display the EventID(0x9314).
EventLine5RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine5RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine5FallingEdgeData	–	–	
EventLine5FallingEdge	–	–	Display the EventID(0x931C).
EventLine5FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine5FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine6RisingEdgeData	–	–	
EventLine6RisingEdge	–	–	Display the EventID(0x9315).
EventLine6RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine6RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.

Item	Setting range	Default value	Description
EventLine6FallingEdgeData	–	–	
EventLine6FallingEdge	–	–	Display the EventID(0x931D).
EventLine6FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine6FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine8RisingEdgeData	–	–	
EventLine8RisingEdge	–	–	Display the EventID(0x9317).
EventLine8RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine8RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine8FallingEdgeData	–	–	
EventLine8FallingEdge	–	–	Display the EventID(0x931F).
EventLine8FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine8FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine10RisingEdgeData	–	–	
EventLine10RisingEdge	–	–	Display the EventID(0x9341).
EventLine10RisingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine10RisingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventLine10FallingEdgeData	–	–	
EventLine10FallingEdge	–	–	Display the EventID(0x9361).
EventLine10FallingEdgeTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventLine10FallingEdgeFrameID	–	–	Displays the FrameID value when an event occurs.
EventAcquisitionTriggerData	–	–	
EventAcquisitionTrigger	–	–	Display the EventID(0x9002).
EventAcquisitionTriggerTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventAcquisitionTriggerFrameID	–	–	Displays the FrameID value when an event occurs.
EventFrameStartData	–	–	
EventFrameStart	–	–	Display the EventID(0x9300).
EventFrameStartTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventFrameStartFrameID	–	–	Displays the FrameID value when an event occurs.
EventFrameEndData	–	–	
EventFrameEnd	–	–	Display the EventID(0x9301).
EventFrameEndTimestamp	–	–	Displays the Timestamp value when an event occurs.
EventFrameEndFrameID	–	–	Displays the FrameID value when an event occurs.
ChunkDataControl			Configure chunk control settings.
ChunkModeActive	True, False	False	Set whether to enable ChunkData
ChunkBinningHorizontal	–	–	(ChunkID 2022h : DataType Float)
ChunkBinningVertical	–	–	(ChunkID 2023h : DataType Float)
ChunkTimestamp	–	–	(ChunkID 2014h : DataType Float)
ChunkLineStatusAllOnExposureStart	–	–	(ChunkID 2015h : DataType String)
ChunkLineStatusAllOnFVALStart	–	–	(ChunkID 2016h : DataType String)
ChunkCounterSelector	Counter0 - 3	–	Select the counter to display the ChunkCounterValue.
ChunkCounterValue	–	–	Display the value for selected conter.
ChunkExposureTime	–	–	(ChunkID 2004h : DataType Float)
ChunkGainSelector	–	–	Select the Gain to display the ChunkGain. [setting range] 0 : Analog All, 1 : Analog Red, 2 : Analog Green 3 : Analog Blue, 4 : Digital Red, 5 : Digital Blue
ChunkGain	–	–	(DataType Float) Gain[DigitalRed]: 2006h Gain[AnalogAll]: 201Fh Gain[DigitalBlue]: 2007h
ChunkBlackLevelSelector	0:All, 1:Red, 3:Blue	–	Select the BlackLevel to diplay the ChunkBlackLevel.
ChunkBlackLevel	–	–	(DataType Float) BlackLevel[DigitalRed]: 2009h BlackLevel[DigitalAll]: 2008h BlackLevel[DigitalBlue]: 200Ah
ChunkDeviceSerialNumber			(ChunkID 2017h : DataType String)
ChunkDeviceTemperatureSelector	0:Mainboard	–	Select the device to dipslay the ChunkDeviceTemperature.
ChunkDeviceTemperature	–	–	(ChunkID 2019h : DataType Float)
ChunkDeviceUserID	–	–	(ChunkID 2018h : DataType String)
TestControl			
TestPendingAck			
UserSetControl			Configure user settings.
UserSetSelector	0: Default, 1: UserSet1, 2: UserSet2, 3: UserSet3	Default	Select the user settings.
UserSetLoad	–	–	Load user settings. (If 0 is specified, the factory default setting is read.)
UserSetSave	–	–	Save the current setting values as user settings. (If 0 is specified, UserSetSave is invalid.)

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

<table>
<tr><th colspan="3">Item</th><th>AP-3200T-10GE</th></tr>
<tr><td colspan="3">Scanning system</td><td>Progressive scan</td></tr>
<tr><td colspan="3">Synchronization</td><td>Internal</td></tr>
<tr><td colspan="3">Interface</td><td>10GBase-T, 5GBase-T, 2.5GBase-T, 1000Base-T
(GigE Vision 2.0), IEEE 802.3af</td></tr>
<tr><td colspan="3">Image sensor</td><td>CMOS x 3</td></tr>
<tr><td colspan="3">image size (effective image)</td><td>1/1.8-inch 7.12mm(H) x 5.33mm(V) : 8.89mm(diagonal)</td></tr>
<tr><td colspan="3">Pixel size</td><td>3.45 μm (H) x 3.45μm(V)</td></tr>
<tr><td colspan="3">Effective image pixel (Image sensor)</td><td>2064(H) x 1544(V)</td></tr>
<tr><td>Acquisition Frame Rate (max)</td><td>8bit</td><td>Mono8</td><td>106.29 fps</td></tr>
<tr><td colspan="3">Video Dark S/N ratio</td><td>Gch : 58dB or more
(When 10bit, Gain=0dB, FrameRate=79.85fps, ExposureMode=Off, IndividualGainMode=off)</td></tr>
<tr><td rowspan="10">Digital image output format</td><td colspan="2">Full</td><td>2064(H) x 1544(V)</td></tr>
<tr><td rowspan="4">ROI</td><td>Width</td><td>16 ～ 2064 pixels 16 pixels/step</td></tr>
<tr><td>Offset X</td><td>0 ～ 2048 pixels 16 pixels/step</td></tr>
<tr><td>Height</td><td>8 ～ 1544 lines 4 lines/step</td></tr>
<tr><td>Offset Y</td><td>0 ～ 1540 lines 4 lines/step</td></tr>
<tr><td rowspan="2">Binning (H)</td><td>1</td><td>2064(H)</td></tr>
<tr><td>2</td><td>1032(H)</td></tr>
<tr><td rowspan="2">Binning (V)</td><td>1</td><td>1544(V)</td></tr>
<tr><td>2</td><td>772(V)</td></tr>
<tr><td colspan="2">Pixel Format</td><td>RGB8, RGB10V1Packed, RGB10p32, RGB12V1Packed</td></tr>
<tr><td colspan="3">Acquisition Mode</td><td>Continuous / SingleFrame / MultiFrame（1 ～ 65535)</td></tr>
<tr><td rowspan="3">Trigger Selector</td><td colspan="2">Acquisition</td><td>AcquisitionStart / AcquisitionStop</td></tr>
<tr><td colspan="2">Exposure</td><td>FrameStart</td></tr>
<tr><td colspan="2">Transfer</td><td>AcquisitionTransferStart（delayed readout)</td></tr>
<tr><td colspan="3">Opto filter</td><td>Off(Default), 10μs, 100 μs, 500 μs, 1ms, 5ms, 10ms</td></tr>
<tr><td colspan="3">Trigger overlap</td><td>Available</td></tr>
<tr><td colspan="3">Trigger input signals</td><td>PulseGenerator0-3, UserOutput0-3, Action0-3, Software, Line4 TTL In1, Line5 Opt In1, Line6 Opt In2, Line10 TTL In2, Nand0 Out, Nand1 Out</td></tr>
<tr><td rowspan="2">Exposure Mode</td><td colspan="2">Timed</td><td>14.73 μs*（min) ～ 8 s（max)
✣ Performance verified for up to 1 second.</td></tr>
<tr><td colspan="2">Trigger Witdh</td><td>14.73 μs*（min) ～ ∞ s（max)
✣ Performance verified for up to 1 second.</td></tr>
<tr><td colspan="3">Auto Exposure (Exposure Auto)</td><td>Off / Continuous / Once</td></tr>
<tr><td colspan="3">Auto exposure response speed （AGC/ASC Control Speed)</td><td>1 ～ 8</td></tr>
<tr><td colspan="3">Video send mode</td><td>NormalMode, TriggerSequencerMode,
CommandSequencerMode, MultiRoiMode</td></tr>
<tr><td colspan="3">Digital I/O</td><td>LineSelector
DC IN/TRIG connector (12-pin round),
AUX connector (10-pin)
: GPIO IN / GPIO OUT</td></tr>
<tr><td rowspan="3">Black Level adjustment</td><td colspan="2">Default level</td><td>8LSB@8bit</td></tr>
<tr><td colspan="2">Video level adjustment range</td><td>DigitalAll : -133 ~ +255 LSB @12bit
DigitalRed : -64 ~ +64 LSB @12bit
DigitalBlue : -64 ~ +64 LSB @12bit</td></tr>
<tr><td colspan="2">Resolution adjustment</td><td>1LSB@12bit</td></tr>
</table>

*) Refer to Exposure Mode section (Page 20) for details.

Gain adjustment	Manual adjustment range		**MasterMode** AnalogAll : 0dB ～ 18dB AnalogRed : -6.5dB ～ 12dB AnalogBlue : -6.5dB ～ 12dB DigitalRed : -0.915dB ～ 0.828dB DigitalBlue : -0.915dB ～ 0.828dB **IndividualMode** AnalogAll : 0dB ～ 36.13dB AnalogRed : 0dB ～ 36.13dB AnalogBlue : 0dB ～ 36.13dB DigitalRed : -0.915dB ～ 0.828dB DigitalBlue : -0.915dB ～ 0.828dB
	adjustment Auto gain		Off, Continuous, Once
White balance	WhiteBalanceGain		DigitalRed, DigitalBlue : -7dB ～ 15dB
	BalanceWhiteAuto		Off, Continuous, Once, ExposureOnce, ExposureContinuos, Preset3200K, Preset5000K, Preset6500K, Preset7500K
	Photometry area		16 (4 x 4) Area
	Adjustment range		3000K ～ 9000K
Blemish correction	Detection		Detect white blemishes using threshhold values (100 steps available) (black blemish correction performed only at factory)
	Correction		Interpolation using adjacent pixels (continuous blemishes not corrected)
	Correctable pixels		1736 pixels / sensor
ALC			Video level adjusted automatically using AGC and ASC
Gamma			0.45,0.5,0.55,0.6,0.65,0.75,0.8,0.9,1.0 (9 steps available)
LUT			OFF : γ= 1.0,ON = 257 points can be set
Vibration resistance			3G（20 Hz ～ 200 Hz X-Y-Z direction)
Impact resistance			50G
Power supply	12-pin Connector	Input range	DC + 10 V ～+ 25 V （Via input terminal)
		Consumption	11.6 W（typ.) (at 12 V input, default setting, 25 ℃ environment) 15.3 W（max.)
Lens mount			C-mount Lens mount protrusion length of 4 mm or less is supported
Flange back			17.526, tolerance: 0 mm to -0.05 mm
Optical filter			IR cut filter (Sensor 0/Stream 0)
Verified performance temperature / humidity			− 5℃～+ 45℃ / 20%～ 80%（non-condensing) (* It may change depending on the installation environment. Please refer to the Caution.)
Storage temperature / humidity			− 25℃～+ 60℃ / 20%～ 80%（non-condensing)
Regulations			CE(EN 55032:2015, EN 55035:2017), FCC part 15 class B, RoHS, WEEE
Dimensions (housing)			62 × 62 × 86.5mm (WHD) （excluding mount protrusions)
Weight			270 g

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

Optional accessories (not supplied)
MP-42 tripod mount

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 condition is met when operating the unit.

1) The camera's internal temperature sensor detects temperatures of 101°C or less during operation.

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

Maximum Frame Rate Reference

[When the maximum packet length is 1476 bytes and the packet delay is 0 ns]

[Theoretical value]

10Gbps

Full pixels	PixelFormat	Framerate
2064 x 1544	RGB8	106.29fps
2064 x 1544	RGB10V1Packed, RGB10p32	79.85fps
2064 x 1544	RGB12V1Packed	70.91fps

5Gbps

Full pixels	PixelFormat	Framerate
2064 x 1544	RGB8	55.93fps
2064 x 1544	RGB10V1Packed, RGB10p32	41.92fps
2064 x 1544	RGB12V1Packed	37.29fps

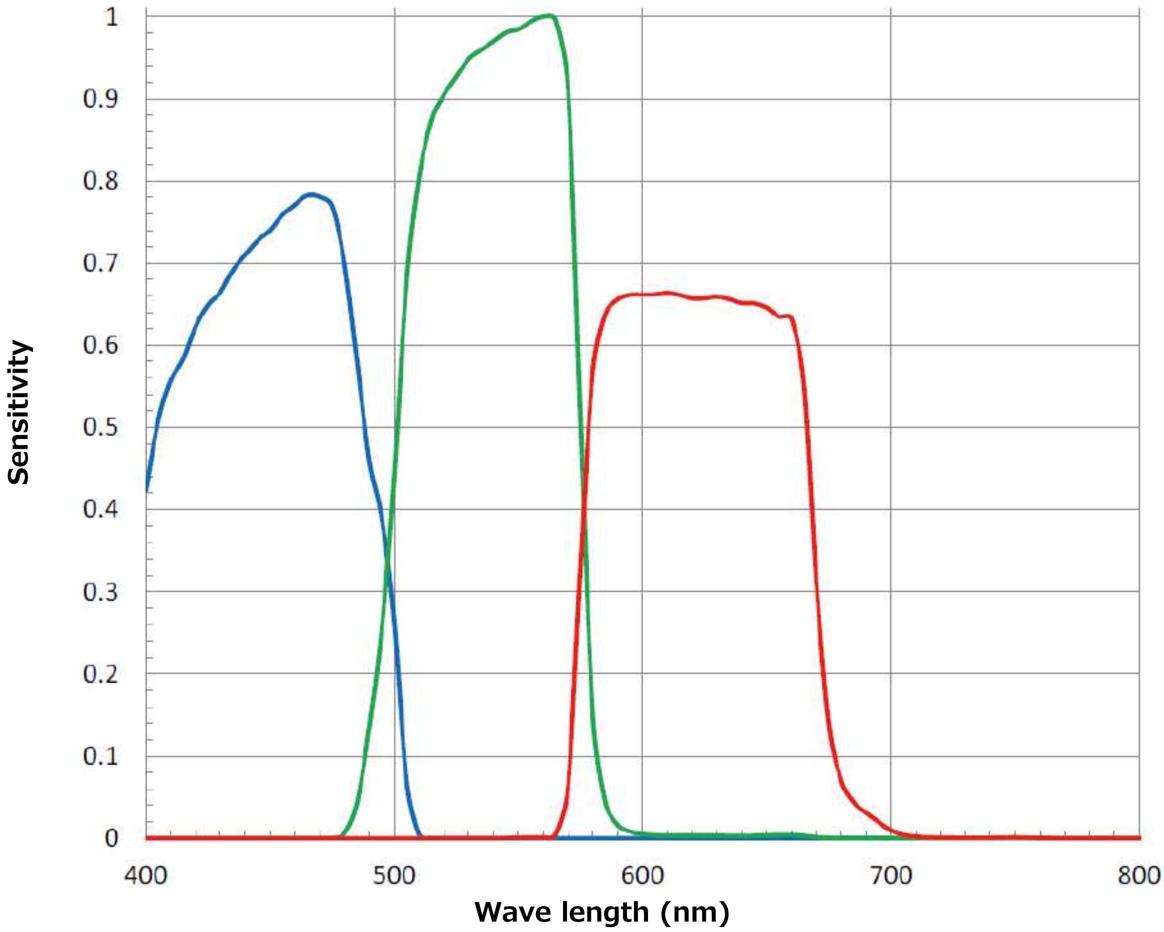
2.5Gbps

Full pixels	PixelFormat	Framerate
2064 x 1544	RGB8	27.65fps
2064 x 1544	RGB10V1Packed, RGB10p32	20.74fps
2064 x 1544	RGB12V1Packed	18.43fps

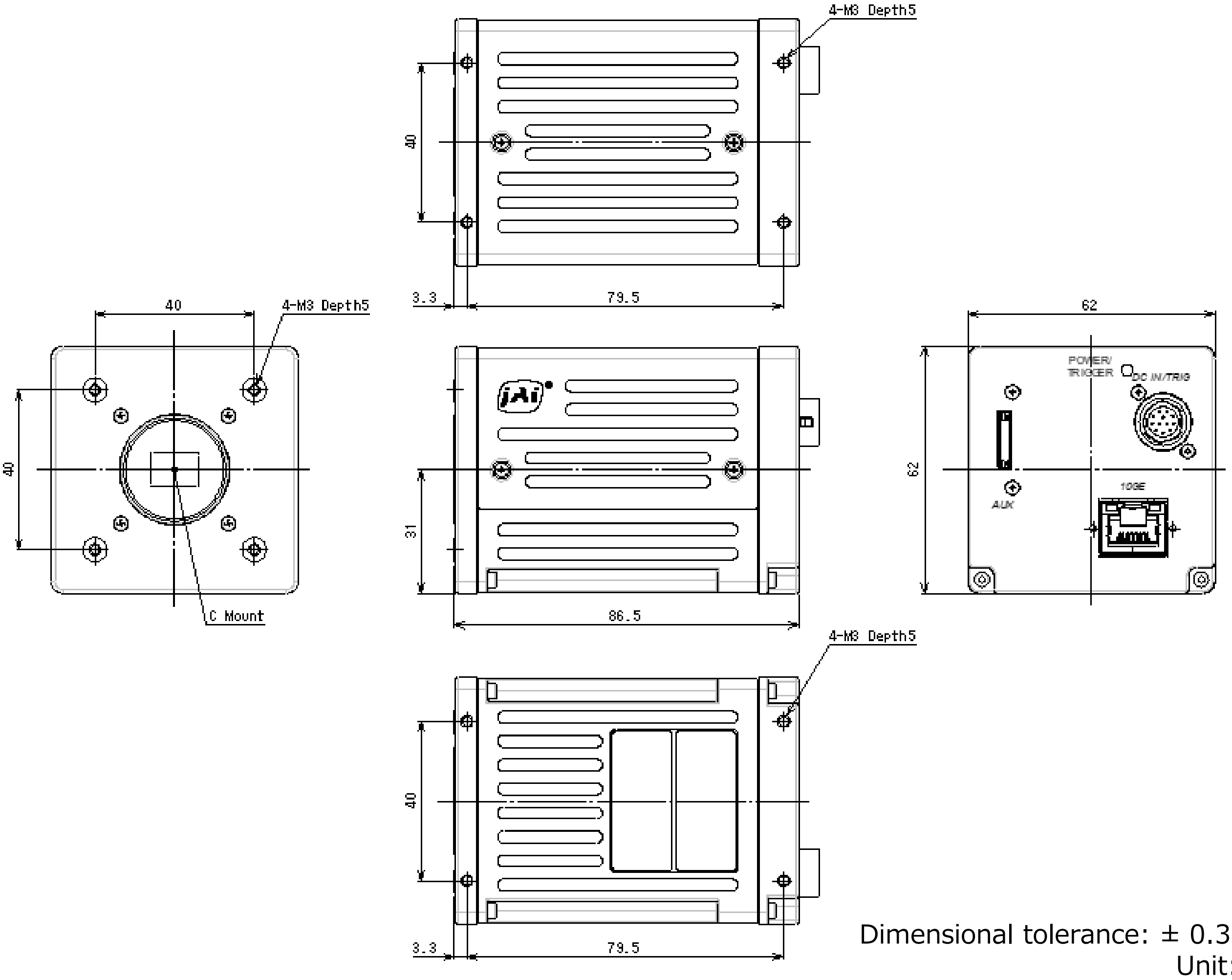
1Gbps

Full pixels	PixelFormat	Framerate
2064 x 1544	RGB8	11.4fps
2064 x 1544	RGB10V1Packed, RGB10p32	8.55fps
2064 x 1544	RGB12V1Packed	7.6fps

Spectral Response



Dimensions



Dimensional tolerance: ± 0.3mm
Unit: mm

Comparison of the Decibel Display and Multiplier Display

Decibels [db]	Multipliers [x]	Remarks
-7	0.447	
-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: AP-3200T-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	Sep.2020	First version
1.1	July 2022	Corrected China RoHS. Added the VideoProcessBypassMode and Non-Volatile Flash Memory topics. Added a Caution to the ROI Function (Multi ROI) topic.