See the possibilities

User Manual

Apex Series - GigE Vision Interface

AP-1600T-PGE
AP-3200T-PGE
AP-3200T-PGE-NF

Digital 3CMOS Progressive Scan RGB Color Camera

Document Version: 2.0

Date: 2024-03-28

Thank you for purchasing this product.

⚠Be sure to read this documentation before use.

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

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

Table of Contents

About Technical Note

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

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

Notice/Warranty

Notice

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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 AP-1600T-PGE and AP-3200T-PGE comply with the following provisions applying to their standards.

EN 61000-6-3 (Generic emission standard part 1)

EN 61000-6-2 (Generic immunity standard part 1)

FCC

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning

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

KC

제조년월은 제품상자의 라벨을 참조하십시오.

China RoHS

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

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

重要注意事项

有毒有害物质或元素名称及含量表

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

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
AP-1600T-PGE AP-3200T-PGE AP-3200T-PGE-NF	×	○	○	○	○	○
○:表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572-2011规定的限量要求以下。 ×:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572-2011规定的限量要求。						

环保使用期限

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

数字「15」为期限15年。

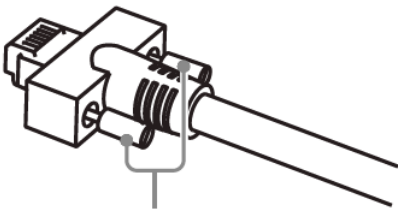
Usage Precautions

Notes on Cable Configurations

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

Notes on LAN Cable Connection

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



Caution: Secure manually. Do not secure too tightly.

Notes on Attaching the Lens

Technical Notes How to Clean a Sensor

Avoiding Dust Particles

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

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

Phenomena Specific to CMOS Image Sensors

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

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

Notes on Exportation

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

Features

This camera is an industrial progressive scan camera that uses three global shutter CMOS image sensors.

Enhanced color reproduction is achieved via the compact-designed 3CMOS C-mount 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 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.

	AP-1600T-PGE	AP-3200T-PGE
Image Sensor	Type 1/2.9 (F1.8 prism optical system)	Type 1/1.8 (F4 prism optical system)
Effective Pixels	1456 × 1088	2064 × 1544
Pixel Size	3.45 um × 3.45 um	
Max Frame Rate (Full)	24.2 fps	12.0 fps

This document covers the following models.

Camera Model	Description
AP-1600T-PGE	Standard model
AP-3200T-PGE	
AP-3200T-PGE-NF	No IR cut filter model for increasing sensitivity of Red/NIR.

Features Overview

- Compliance with GigE Vision and GenICam standards
- Lens mount: C-mount (flange back: 17.526 mm)
- Gamma correction circuit that uses lookup tables
- Color matrix that allows faithful color reproduction
- Color space conversion function (sRGB, Adobe RGB, HSI, XYZ) support
- Internal test signal for settings configuration

Package Contents, Accessories

- Camera (1)
- Sensor Protection Cap (1)
- Dear Customer Sheet (1)

Optional Accessories (Sold Separately)

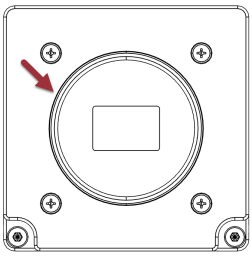
- MP-44 Tripod Mounting Plate
- AC Adapter

Parts Identification

> **Note:** See "Dimensions" for external view of the entire camera.

Lens Mount (C-Mount)

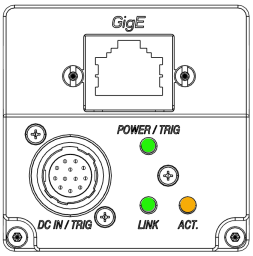
Mount a C-mount lens, microscope adapter, etc. here.



> **Note:** Before mounting a lens, be sure to refer to ① Lens and confirm the precautions for attaching a lens and the supported lens types.

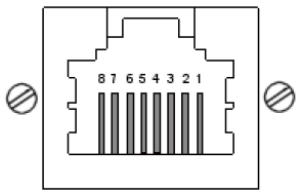
Connectors

Pin assignments for each connector are shown in this section.



RJ-45 Connector

Connect a Gigabit Ethernet compatible LAN cable (Category 5e or higher, Category 6 recommended) here.

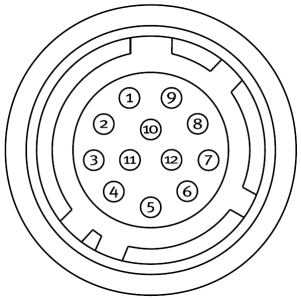


GigE Vision Interface

Pin No.	Input/Output	Signal
1	In/Out	MX1+ (DA+)
2	In/Out	MX1– (DA–)
3	In/Out	MX2+ (DB+)
4	In/Out	MX3+ (DC+)
5	In/Out	MX3– (DC–)
6	In/Out	MX2– (DB–)
7	In/Out	MX4+ (DD+)
8	In/Out	MX4– (DD–)

DC IN / Trigger IN Connector (12-pin Round)

Connect the cable for DC IN / Trigger IN here.

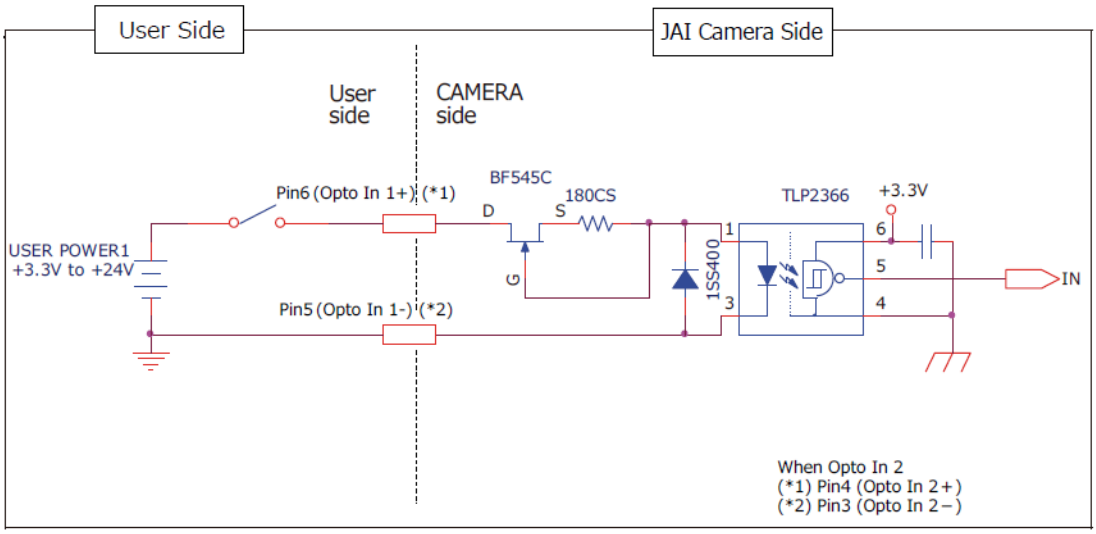


HR-10A-10R-12PB (71) (Hirose Electric or equivalent)

Pin No.	Input/Output	Signal	Description
1		GND	
2	Power In	DC In	DC 12 V ~ 24 V ± 10%
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			
11	Power In	DC In	DC 12 V ~ 24 V ± 10%
12		GND	

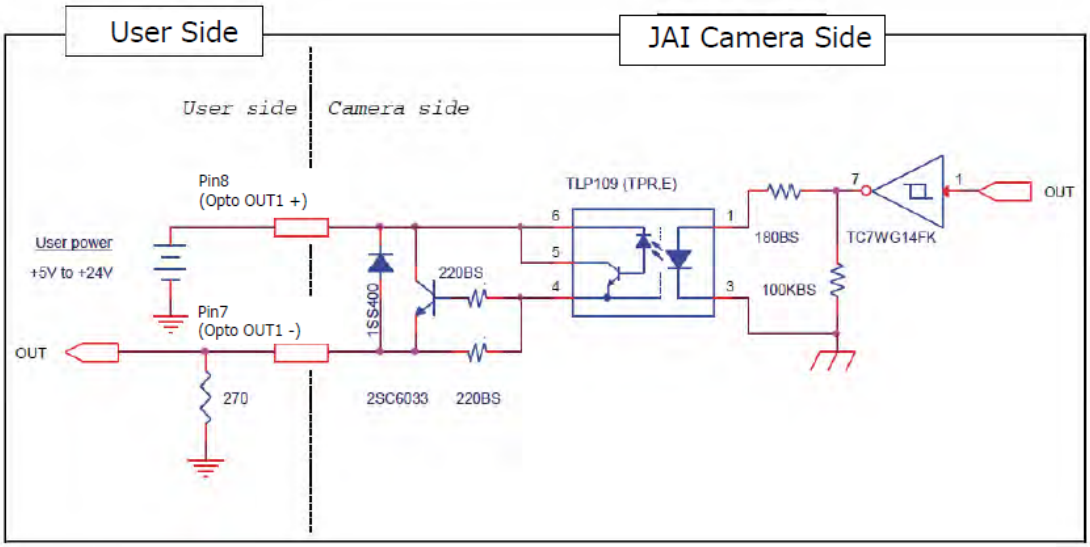
Note: DC power operates with supply to either Pin1/Pin2 or Pin11/Pin12.

Recommended External Input Circuit Diagram (Reference Example)



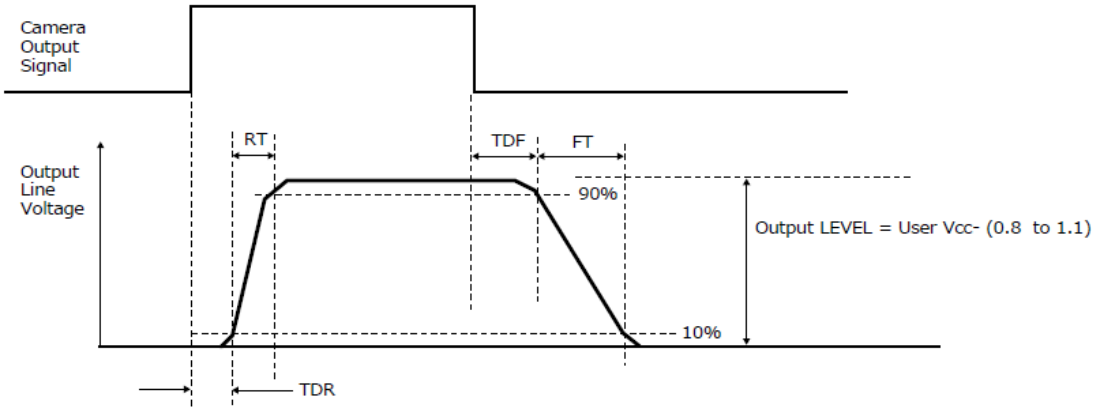
Recommended External Output Circuit Diagram (Reference Example)

Standard circuit diagram example



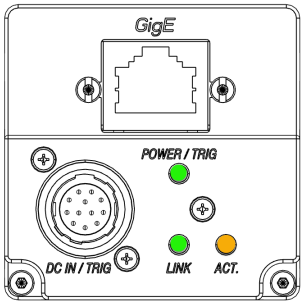
Characteristics of the Recommended Circuits for Opto OUT

OUTPUT LINE RESPONSE TIME



	User Power (VCC) 3.3 V ~ 24 V
TDR (Time Delay Rise)(us)	0.5 ~ 0.7
RT (Rise Time)(us)	1.2 ~ 3.0
TDF (Time Delay Fall)(us)	1.5 ~ 3.0
FT (Fall Time)(us)	4 ~ 7

LEDs



The table below shows the LED light and camera status.

LED	Light		Status
POWER TRIG		Lit amber	Camera initializing.
		Lit green	Camera in operation.
		Blinking green	During operation in trigger mode, trigger signals are being input. **Note:** The blinking interval is not related to the actual input interval of the external trigger.
ACT LED	Indicates the GigE network status.		
LINK LED	Indicates whether the GigE network connection is established or not.		

Mounting Holes (M3, 3mm depth)

Use these holes when attaching an MP-44 tripod adapter plate (optional) or mounting the camera directly to a structural system.

Top	M3, Depth 3mm x 4
Bottom	M3, Depth 3mm x 4

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

Preparation

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

1	**Step 1: Install the Software (First Time Only)** Install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.
2	**Step 2: Connect Devices** Connect the lens, cables, AC adapter, computer, and other devices.
3	**Step 3: Verify Camera Operation** Verify whether the camera is turned on and ready for use.
4	**Step 4: Verify the Connection between the Camera and PC** Verify whether the camera is properly recognized via Control Tool.
5	**Step 5: Change the Camera Settings** Refer to the procedure for changing the output format setting as an example and change various settings as necessary.
6	**Step 6: Adjust the Image Quality** Refer to the procedures for adjusting the gain and black level as examples and adjust the image quality.
7	**Step 7: Save the Settings** Save the current setting configurations in user memory.

Step 1: Install the Software (First Time Only)

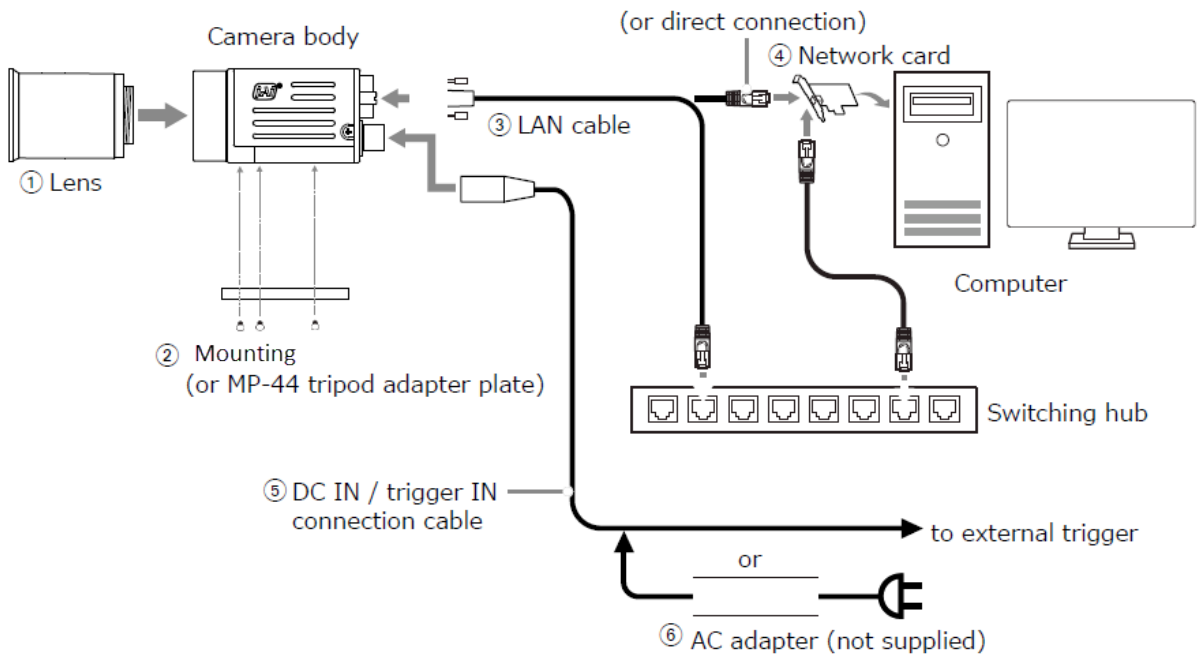
When using the camera for the first time, install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.

Notes:

- When you install eBUS SDK for JAI, eBUS Player for JAI will also be installed.
- For the operating system (OS) requirements for eBUS SDK for JAI, see the JAI Camera Software page (https://www.jai.com/support-software/jai-software) or eBUS Player User Guide.

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

Step 2: Connect Devices



① Lens

② Mounting (or Use MP-44 Tripod Adapter Plate)

③ LAN Cable

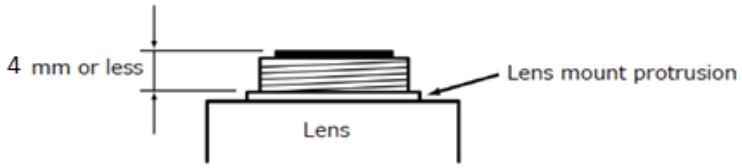
④ Network Card

⑤ DC IN / Trigger IN Connection Cable

⑥ AC adapter (Power Supply, If Necessary)

① Lens

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



- Use a lens designed for three-sensor cameras. Using a lens for single-sensor cameras may hinder full performance of the camera.
- See the table below for the diagonal of the camera's CMOS image sensor. To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the image sensor size.

	Image Sensor
AP-1600T-PGE	Type 1/2.9, 6.27 mm diagonal Some lens manufacturers offer lenses with a 6.27 mm format. If not, a 1/2.9-inch lens is recommended.
AP-3200T-PGE	Type 1/1.8, 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.

Cautions:

- 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.

Notes:
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

② Mounting (or Use MP-44 Tripod Adapter Plate)

When mounting the camera directly to a device, use screws that match the mounting holes on the camera. For more information on the mounting holes, see "Mounting Holes (M3, 3mm depth)".

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.

- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- When supplying power via PoE, connect to a PoE-compatible switching hub or a PoE-compatible network card.

  > **Note:** JAI does not recommend using a PoE injector. If a PoE injector is used, the camera may not be able to transmit images properly.

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

> **Caution:** See the Notes on LAN Cable Connection topic as well.

④ Network Card

Install this on the computer that will be used to configure and operate the camera. As the camera supports PoE, you can also use PoE-compatible network cards. Refer to the instruction manual of the network card and configure settings on the computer as necessary.

⑤ DC IN / Trigger IN Connection Cable

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

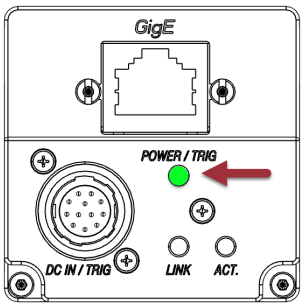
⑥ AC adapter (Power Supply, If Necessary)

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

Step 3: Verify Camera Operation

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

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



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

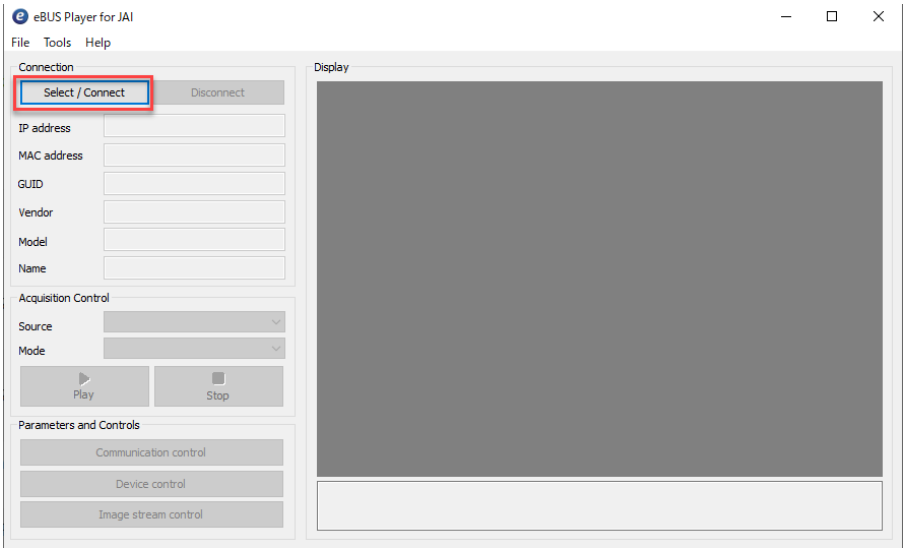
Step 4: Verify the Connection between the Camera and PC

Verify whether the camera is properly recognized eBUS Player for JAI.

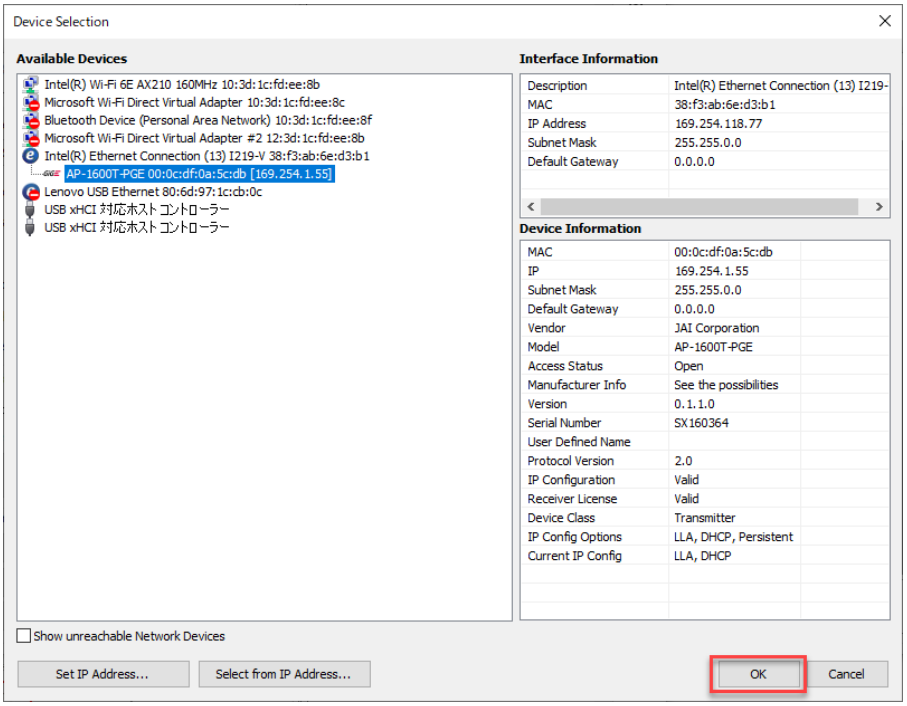
1. Launch eBUS Player for JAI

eBUS Player for JAI startup screen appears.

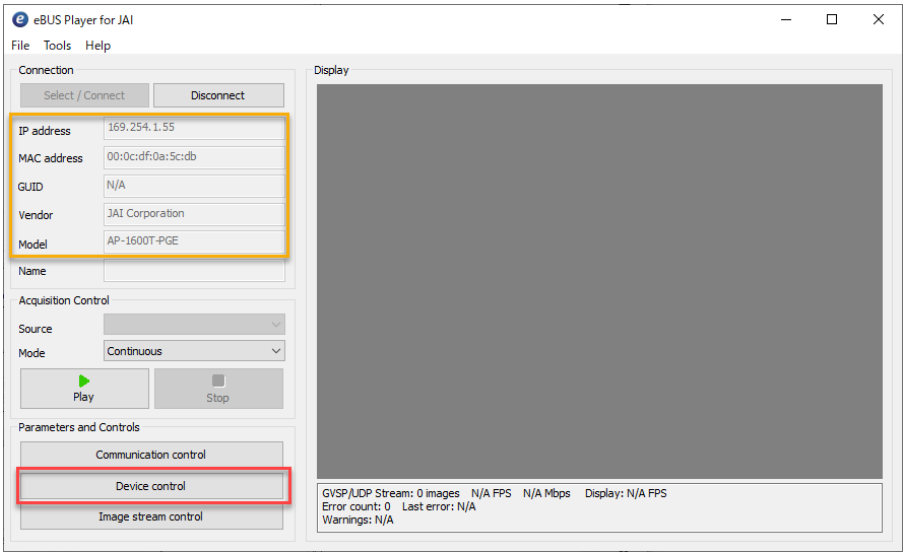
2. Select the camera you want to configure. Click the **Select / Connect** button.



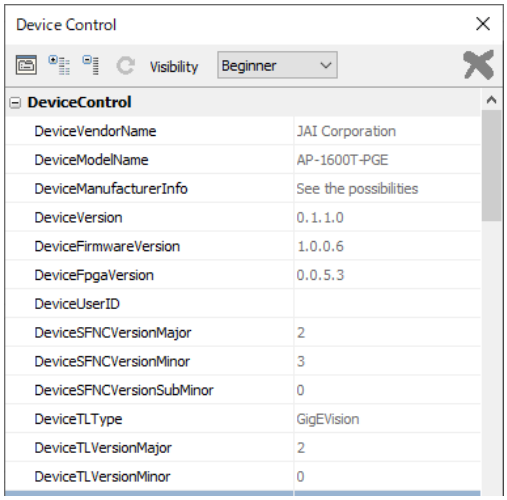
3. The connected camera is listed. Please select one camera and click **OK**.



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



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



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

Step 5: Change the Camera Settings

Related Setting Items: ImageFormatControl

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

Configure the Output Format

Configure the size, position, and pixel format of the images to be acquired. The factory settings are as follows. Change the settings as necessary.

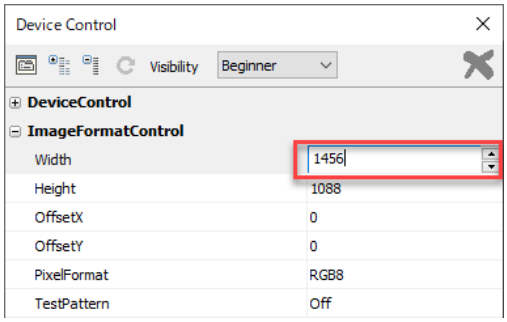
Factory Default Values

Item		AP-1600T-PGE	AP-3200T-PGE
ImageFormatControl	Width	1456	2064
	Height	1088	1544
	OffsetX (horizontal position)	0	0
	OffsetY (vertical position)	0	0
	PixelFormat	RGB8	RGB8

Note: You can specify the image acquisition area. For details, see "ROI (Regional Scanning Function)".

Example: Change the Width setting (ImageFormatControl)

1. By selecting the item "Width", you can change the value as shown below.



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

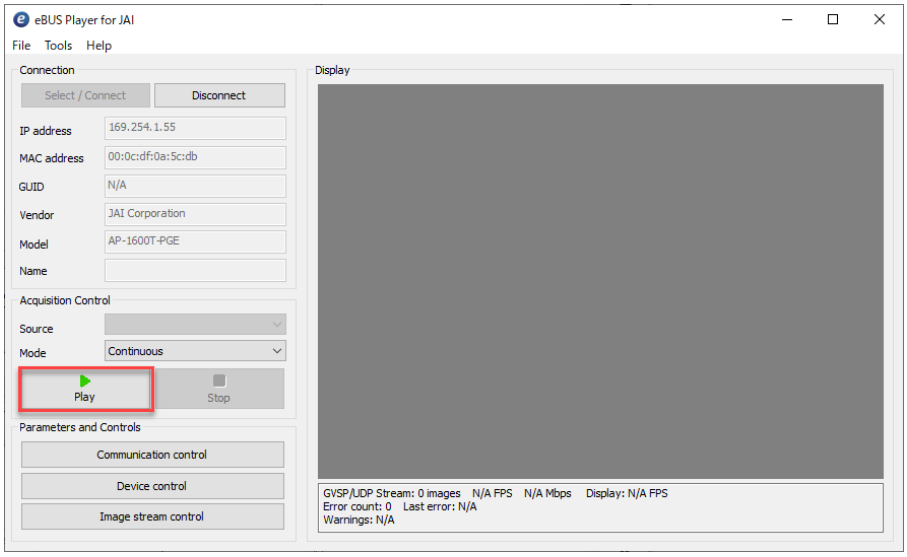
Step 6: Adjust the Image Quality

> **Related Setting Items:** AnalogControl

Display the camera image and adjust the image quality.

Display the Image

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



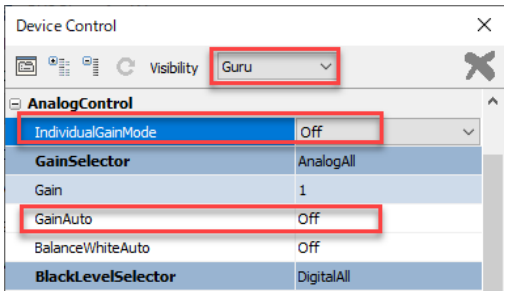
Adjust the Gain

Adjust the image quality using the gain and white balance functions. The display level must be changed from Beginner to **Guru**.

> **Note:** For details on gain control, see "Gain Control" in the Main Functions section.

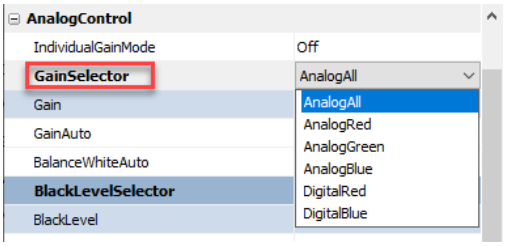
Manual Adjustment

1. Set **GainAuto** and **IndividualGainMode** (AnalogControl) to **Off**. (Default = Off)

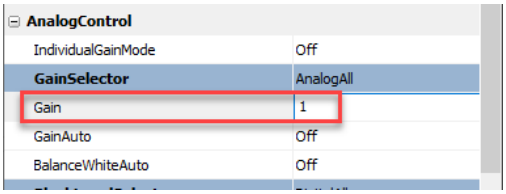


2. Configure the Gain.

   - Select the gain you want to configure in **GainSelector**.



   - 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".

Adjust the White Balance

Adjust the white balance using the automatic adjustment function.

Automatic White Balance Adjustment

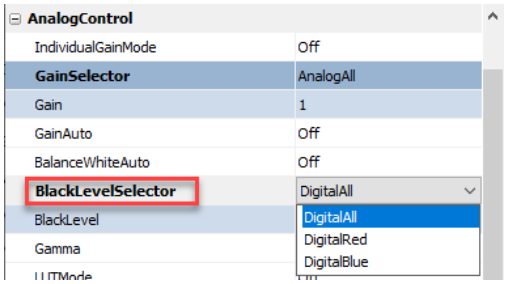
1. Place a white sheet of paper or similar object under the same lighting conditions as the intended subject, and zoom in to capture the white. White objects near the subject, such as a white cloth or wall, can also be used. Be sure to prevent the high-intensity spot lights from entering the screen.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

   The white balance is automatically adjusted.

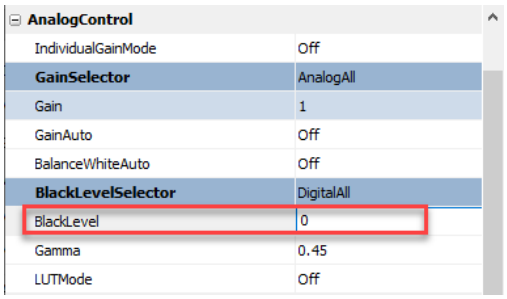
> **Notes:**
> - **Continuous** and **Once**: the white balance is adjusted via **Gain** adjustment.
> - **ExposureContinuous** and **ExposureOnce**: the white balance is adjusted via **ExposureTime**.

Adjust the Black Level

1. Select the black level you want to configure in **BlackLevelSelector**.



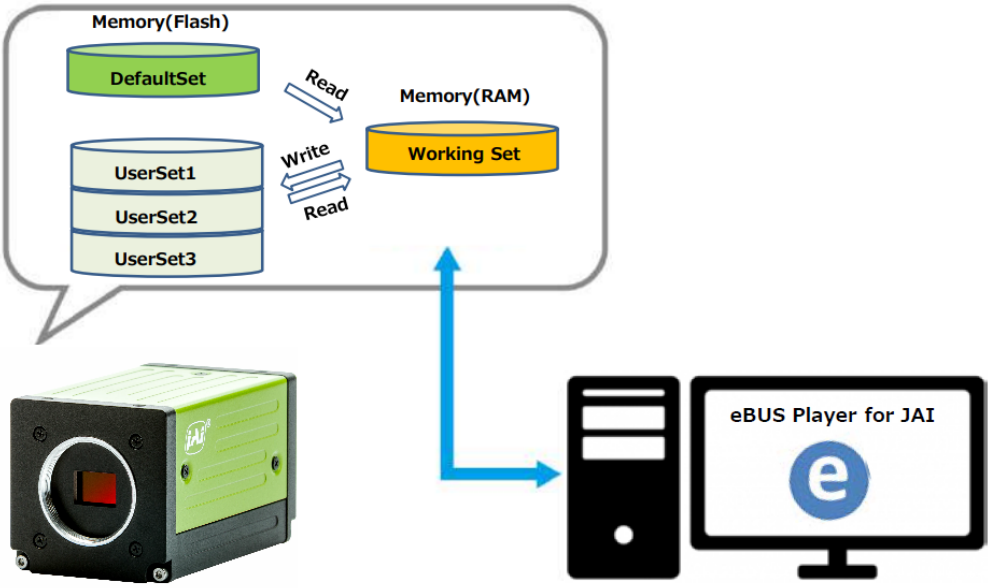
2. Specify the adjustment value in BlackLevel.



Step 7: Save the Settings

Related Setting Items: UserSetControl

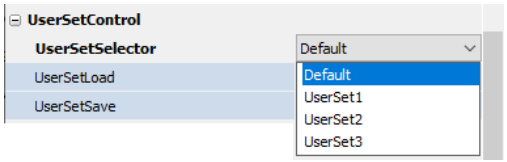
The configured setting values will be deleted when the camera is turned off. By saving current setting values to user memory, you can load and recall them whenever necessary. You can save up to three sets of user settings in the camera. (User Set1 to 3)



Note: Changes to settings are not saved to the computer (Control Tool).

To Save User Settings

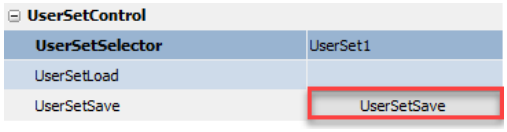
1. Stop image acquisition.
2. Expand **UserSetControl** and select the save destination (UserSet1 to UserSet3) in UserSetSelector.



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

> **Caution:** Settings can only be saved when image acquisition on the camera is stopped.

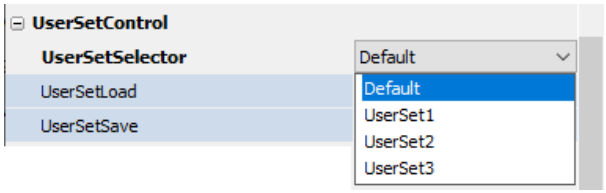
3. Select **UserSetSave** and click the **UserSetSave** button.



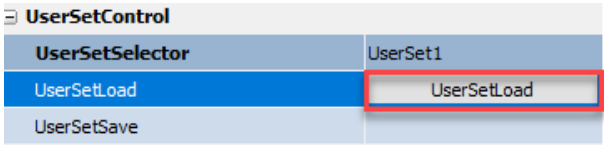
4. The current setting values are saved as user settings.

To Load User Settings

1. Stop image acquisition. User settings can only be loaded when image capture on the camera is stopped.
2. Select the settings to load (UserSet1 to UserSet3) in UserSetSelector.



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



4. The selected user settings are loaded.

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

Main Functions

This chapter describes the camera's main functions.

Basic Function Matrix

The combinations of settings for the basic functions that can be used together are as follows.

ExposureMode	FrameStartTrigger	BinningVertical / BinningHorizontal	ExposureTime	ROI	BalanceWhiteExposureAuto	BalanceWhiteGainAuto	GainAuto	ExposureAuto	TriggerSequencerMode	CommandSequencerMode
Off	Off	1 x 1 (Off)		●		●	●			
		1 x 2		●		●	●			
		2 x 1		●		●	●			
		2 x 2		●		●	●			
Timed	Off	1 x 1 (Off)	●	●	●	●	●	●		●
		1 x 2	●	●	●	●	●	●		●
		2 x 1	●	●	●	●	●	●		●
		2 x 2	●	●	●	●	●	●		●
Timed (EPS)	On	1 x 1 (Off)	●	●	●	●	●	●	●	●
		1 x 2	●	●	●	●	●	●	●	●
		2 x 1	●	●	●	●	●	●	●	●
		2 x 2	●	●	●	●	●	●	●	●
TriggerWidth	On	1 x 1 (Off)		●		●	●			
		1 x 2		●		●	●			
		2 x 1		●		●	●			
		2 x 2		●		●	●			
RCT	On	1 x 1 (Off)	●	●	●	●	●	●		
		1 x 2	●	●	●	●	●	●		
		2 x 1	●	●	●	●	●	●		
		2 x 2	●	●	●	●	●	●		

GPIO (Digital Input/Output Settings)

Related Setting Items: DigitalIOControl

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

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

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

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

Line Selector	Line Source	Line Inverter	Line Status*	Line Mode	Line Format	Line Status All**
Line1 - TTL Out1	User Specified	True/False	True/False	Output	TTL	bit0
Line2 - OptOut1	User Specified	True/False	True/False	Output	OptoCoupled	bit1
LIne5 - Opt In 1	Not Available	Not Available	True/False	Input	OptoCoupled	bit4
Line6 - Op In 2	Not Available	Not Available	True/False	Input	OptoCoupled	bit5
Time Stamp Reset	User Specified	True/False	True/False	Internal Connection	Internal Signal	bit11
Nand0In1	User Specified	True/False	False (Fixed)	Input	Internal Signal	bit12
Nand0In2	User Specified	True/False	False (Fixed)	Input	Internal Signal	bit13
Nand1In1	User Specified	True/False	False (Fixed)	Input	Internal Signal	bit14
Nand1In2	User Specified	True/False	False (Fixed)	Input	Internal Signal	bit15

Notes:

- *Line Status: "Low" signal level is indicated by **False**, and "High" signal level is indicated by **True**.
- **Line Status All: The current status of the Line signal is indicated by the above bit field.

Valid Input/Output Combinations

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

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

> **Note:** Blue cells indicate the default setting for each selector.

	TriggerSelector				LineSelector							PulseGenerator Selector			
Source Signal (Crosspoint Switch) \ Selector	AcquisitionStart	AcquisitionEnd	FrameStart	AcquisitionTransferStart	Line1 - TTLOut	Line2 - OptOut1	TimeStampReset	NANDGate0In1	NANDGate0In2	NANDGate1In1	NANDGate1In2	PulseGenerator0	PulseGenerator1	PulseGenerator2	PulseGenerator3
Low	●	●	●	●	●	●	OFF	●	●	●	●	●	●	●	●
High	●	●	●	●	●	●		●	●	●	●	●	●	●	●
Line5 - OptIn1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Line6 - OptIn2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UserOutput0	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UserOutput1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UserOutput2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UserOutput3	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Action1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Action2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PulseGenerator0	●	●	●	●	●	●	●	●	●	●	●		●	●	●
PulseGenerator1	●	●	●	●	●	●	●	●	●	●	●	●		●	●
PulseGenerator2	●	●	●	●	●	●	●	●	●	●	●	●	●		●
PulseGenerator3	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
NAND0Out	●	●	●	●	●	●	●			●	●	●	●	●	●
NAND1Out	●	●	●	●	●	●	●	●	●			●	●	●	●
ExposureActive	–	–	–	–	●	●		●	●	●	●	●	●	●	●
AcquisitionActive	–	–	–	–	●	●		●	●	●	●	●	●	●	●
AcquisitionTriggerWait	–	–	–	–	●	●		●	●	●	●	●	●	●	●
FrameTriggerWait	–	–	–	–	●	●		●	●	●	●	●	●	●	●
FrameActive	–	–	–	–	●	●		●	●	●	●	●	●	●	●
FVAL	–	–	–	–	●	●		●	●	●	●	●	●	●	●
LVAL	–	–	–	–				●	●	●	●	●	●	●	●
Software	●	●	●	●	–	–	–	–	–	–	–	–	–	–	–

Pixel Format

Related Setting Items: ImageFormatControl

Technical Notes Pixel Format Alignments for GigE Vision

Selectable PixelFormat is as follows.

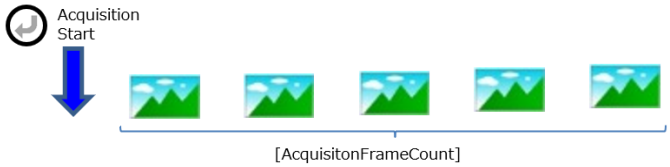
8 bit	RGB8
10 bit	RGB10V1Packed, RGB10p32
12 bit	RGB12V1Packed*

Note: *When **RGB12V1Packed** is selected, Video Process Bypass Mode is forced On. Also, in VideoProcessBypassMode, saturated level of brightness decreases.

Acquisition Control

Related Setting Items: AcquisitionControl

Perform operations and configure settings related to image capture in AcquisitionControl. This camera supports the following acquisition modes.

Acquisition Mode	Description
Single Frame	Acquire a single frame when the **AcquisitionStart** command is executed. 
Multi Frame	Acquire the number of frames specified in **Acquisition Frame Count** when the **Acquisition Start** command is executed. 
Continuous	Acquire images continuously until the **Acquisition Stop** command is executed. 

Changing the Frame Rate

When **Trigger Mode** is disabled, you can change the frame rate in **Acquisition Frame Rate**.

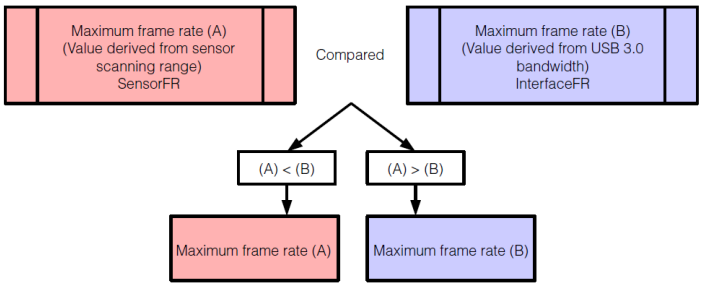
Notes:

- The shortest frame period varies depending on the ROI, PixelFormat, and Binning Mode selected. The longest frame period is 0.125 Hz (8 sec.).
- When **TriggerMode[FrameStart]** is enabled, the **Acquisition Frame Rate** setting is disabled.

Maximum Frame Rate Period Formula

> **Note:** The Frame Rate Calculator, which calculates the maximum frame rate or trigger rate, is available for download from the product page on the JAI website (www.jai.com).

The maximum frame rate is the smaller value between the Sensor_FR that is calculated from the readable range of the sensor and the Interface_FR that is limited by the GigE bandwidth.



H_Period

Full ROI

The H_Period at full ROI is shown below. The value is different for each PixelFormat.

PixelFormat	H_Period (µs)	
	AP-1600T-PGE	AP-3200T-PGE
RGB8	36.51	52.69
RGB10V1Packed, RGB10p32	48.69	70.25
RGB12V1Packed	54.76	79.03

When ROI Is Used

Calculate the H_Period value using the following formulas when using ROI (Regional Scanning Function).

```
GIGE_H_Count_Max =
Max (( Width x PackValue / 920) x (Height / (Height + A)) x PixelClock, (Width / 2 + 32))

H_Count = Max(Sensor_H_Count, GIGE_H_CountMax)

H_Period = H_Count / PixelClock
```

- **A, B**: The value is different depending on the camera model.

Camera Model	A	B
AP-1600T-PGE	44	20
AP-3200T-PGE	34	14

- **PackValue**: The value is different for each PixelFormat.

PixelFormat	PackValue
RGB8	24
RGB10V1Packed, RGB10p32	30
RGB12V1Packed	36

- **Sensor_H_Count**: The value is different depending on the camera model / Binning settings.

	Binning	Value
AP-1600T-PGE	1x1, 2x1, 1x2	612
	2x2	396
AP-3200T-PGE	NA	846

- **PixelClock**: 74.25 MHz

During Continuous Operation

This scenario is when **FrameStart** trigger is **Off** or **ExposureMode** is **Off**.

1. Maximum frame rate of sensor output

```
Sensor FR  =  1 / ((Height_s + A) x H_Period
```

2. Maximum frame rate by interface

```
Interface FR  =  920 × 1000000 / (Height_g × Width_g × PackValue)
```

3. **Maximum frame rate**

```
AP-1600T-PGE: FR_Cont  =  Min(Sensor FR, Interface FR)

AP-1600T-PGE: FR_Cont  =  Min x 3(Sensor FR, Interface FR)
```

Exposure time possible within frames

1. When the ExposureTime is longer than the FrameInterval

```
MaxExposureTime_longExp  =  (1 / FR_Cont)  -  (B × H Period)
```

2. Exposure time outside of Frame Interval

```
NonOverlapExposureTime  =  ExposureTime  - MaxExposureTime_longExp
```

> **Note:** However, MaxExposureTime_longExp calculation results that are 0 or below will be considered as 0. For TriggerWidth, the trigger pulse is equivalent to ExposureTime.

3. **Maximum frame rate**

```
FR_longExp  =  1/{(1/FR_Cont)  +  NonOverlapExposureTime}
```

When FrameStart trigger is On and TriggerOverLap is Off

1. Maximum frame rate of sensor output

```
Sensor FR  =  1 / {H Period × (Height + A )}
```

2. Maximum frame rate by interface

```
Interface FR  =  920 × 1000000 / (Height × Width × PackValue)
```

3. **Maximum frame rate**

```
FR_Cont  =  Min(Sensor FR, Interface FR)
```

1. When the ExposureTime is longer than the FrameInterval

```
MaxOverlapTime_TrOloff  =  (1 / FR_Cont)  -  (1 / Sensor FR)
```

2. Exposure time outside of Frame Interval

```
NonOverlapExposureTime_TrOloff = ExposureTime - MaxOverlapTime_TrOloff
```

> **Note:** However, NonOverlapExposureTime_TrOloff calculation results that are 0 or below will be considered as 0. For TriggerWidth, the trigger pulse is equivalent to ExposureTime.

3. **Maximum frame rate**

```
FR_TrOloff  =  1 / {(1 / FR_Cont)  +  NonOverlapExposureTime_TrOloff}
```

When FrameStart trigger is On and TriggerOverLap is Readout

1. Maximum frame rate of sensor output

```
Sensor FR  =  1 / {H Period × (Height + A )}
```

2. Maximum frame rate by interface

```
Interface FR  =  920 × 1000000 / (Height × Width × PackValue)
```

3. **Maximum frame rate**

```
FR_TrOloff  =  Min(Sensor FR, Interface FR)
```

1. Exposure time possible within frames

```
MaxOverlapTime_TrOloff  =  (1 / FR_Cont)  -  (B x H_Period)
```

2. Exposure time outside of Frame Interval

```
NonOverlapExposureTime_TrOlrd = ExposureTime - MaxOverlapTime_TrOlrd
```

> **Note:** However, NonOverlapExposureTime_TrOloff calculation results that are 0 or below will be considered as 0. For TriggerWidth, the trigger pulse is equivalent to ExposureTime.

3. **Maximum frame rate**

```
FR_TrOloff  =  1 / {(1 / FR_Cont)  +  NonOverlapExposureTime_TrOloff}
```

Exposure Mode

> **Related Setting Items:** AcquisitionControl

The following exposure modes are available on the camera.

Exposure Mode	Description
Off	Exposure control is not performed (free-running operation).
Timed	Mode in which control is performed using exposure time. Acquire images using an exposure time configured beforehand on an external trigger.
Trigger Width	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. This allows long exposure.

> **Note:** The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in "Trigger Control".

ExposureTimeMode

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

ExposureTimeMode	Description
Common (Default)	Set the common exposure time for Red, Green, and Blue.
Individual	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.

> **Note:** When **ExposureMode** is set other than **Timed**, **ExposureTimeMode** is fixed to **Common**.

Actual Exposure Time

The actual exposure time is the exposure time specified in **ExposureTime** plus the image sensor offset time below.

Image Sensor Offset Time	
AP-1600T-PGE	AP-3200T-PGE
14.26 µs	13.73 µs

When **ExposureMode** is set to **Timed** and **ExposureTime** is set to 1 µs, the actual exposure time will be as follows.

- **AP-1600T-PGE**: 1µ+ 14.26µs = 15.26 µs
- **AP-3200T-PGE**: 1µ+ 13.73µs = 14.73 µs

When **ExposureMode** is set to **TriggerWidth**, the exposure is slightly longer than the width of the trigger signal.

- **AP-1600T-PGE**: If the exposure time needs to be 15.26µs, set the width of the Trigger Signal to the camera to 1µ (= 15.26 - 14.26).
- **AP-3200T-PGE**: If the exposure time needs to be 14.73µs, set the width of the Trigger Signal to the camera to 1µ (= 15.26 - 14.26).

Trigger Control

> **Related Setting Items:** AcquisitionControl

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

TriggerSelector	Description
FrameStart	Start exposure in response to the external trigger signal input. Select this to perform exposure control using external triggers. **Note:** You can delay when exposure actually starts after a trigger is received by a specific amount of time by configuring **TriggerDelay**.
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.

TriggerSelector	Description
AcquisitionTransferStart	Output acquired images at a specified timing in response to an external trigger signal input. **Note**: There is a limit to the number of image frames that can be stored internally. The limits for each image format are as follows. 8bit: Up to 15 frames 10bit /12bit: Up to 7 frames

Note: The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in "Exposure Mode".

Shortest Repetition Period for Triggers

The reciprocal of the maximum frame rate is the time required to output one frame. The shortest repetition periods for triggers cannot be lower than that value.

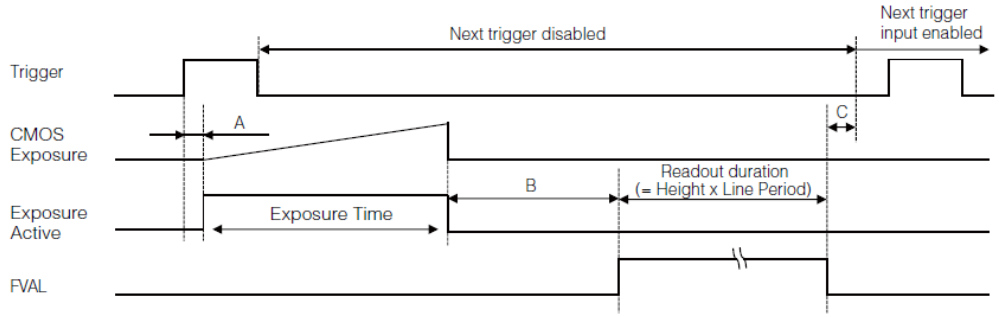
Scanning Range	AP-1600T-PGE				AP-3200T-PGE			
	Height	RGB8 (8bit)	RGB10p (10bit)	RGB12p (12bit)	Height	RGB8 (8bit)	RGB10p (10bit)	RGB12p (12bit)
Full	1088	41.3 ms	55.1 ms	62.1 ms	1544	83.1 ms	110.9 ms	124.7 ms
ROI (1/2)	544	20.7 ms	27.6 ms	31.0 ms	772	41.6 ms	55.4 ms	62.3 ms
ROI (1/4)	272	10.3 ms	13.8 ms	15.5 ms	386	20.8 ms	27.7 ms	31.2 ms
BinningVertical = 2	544	20.7 ms	27.6 ms	31.0 ms	772	83.1 ms	110.9 ms	124.7 ms

The above table indicates the shortest trigger periods for when **Trigger Overlap** is set to **Readout**. When **Trigger Overlap** is set to **Off**, the exposure time is added to the period.

ExposureMode = Timed (AP-1600T-PGE)

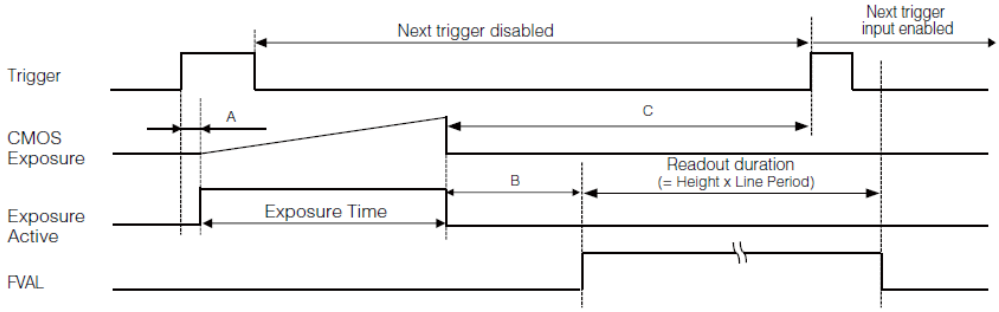
Example: When Trigger Source is set to Line 5 - OptIn1 and OptInFilterSelector is set to Off.

TriggerOverlap = Off (AP-1600T-PGE)



Pixelformat	Line Period (usec)	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B](usec)	Period from FVAL end to next trigger start[C](usec)
8bit	35.61	111	1365	320
10bit	48.69	147	1816	351
12bit	54.76	165	2040	369

TriggerOverlap = Readout (AP-1600T-PGE)

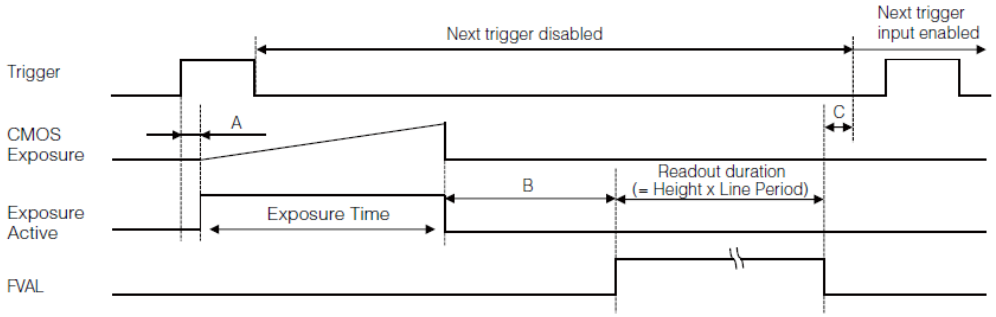


Pixelformat	Line Period (usec)	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B](usec)	Period from Exposure endd to next trigger start[C](usec)*
8bit	36.51	111	1365	41383
10bit	48.69	147	1816	55100
12bit	54.76	165	2040	61944
*ExposureTime: Mnimum				

ExposureMode = Timed (AP-3200T-PGE)

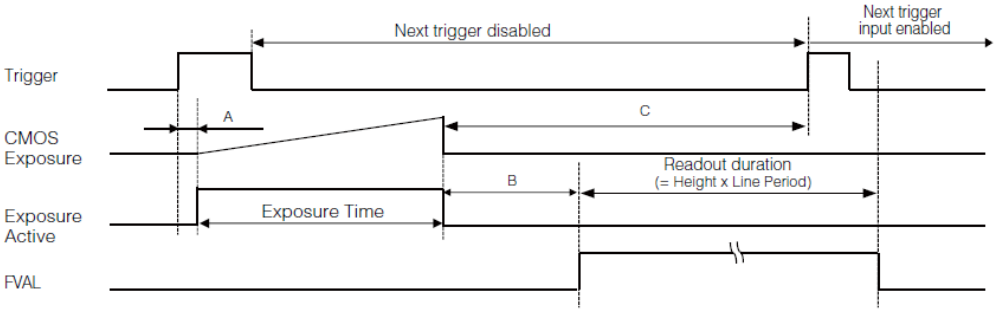
Example: When Trigger Source is set to Line 5 - OptIn1 and OptInFilterSelector is set to Off.

TriggerOverlap = Off (AP-3200T-PGE)



Pixelformat	Line Period (usec)	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B](usec)	Period from FVAL end to next trigger start[C](usec)
8bit	53.83	163	1356	340
10bit	71.8	217	1814	469
12bit	80.77	244	2039	531

TriggerOverlap = Readout (AP-3200T-PGE)

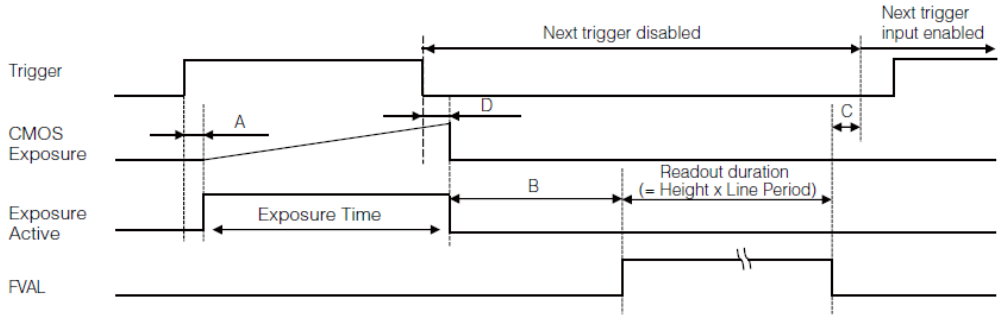


Pixelformat	Line Period (usec)	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B](usec)	Period from Exposure end to next trigger start[C](usec)*
8bit	53.83	163	1365	84824
10bit	71.8	217	1814	113149
12bit	80.77	244	2039	127239
*ExposureTime: Minimum				

ExposureMode = TriggerWidth (AP-1600T-PGE)

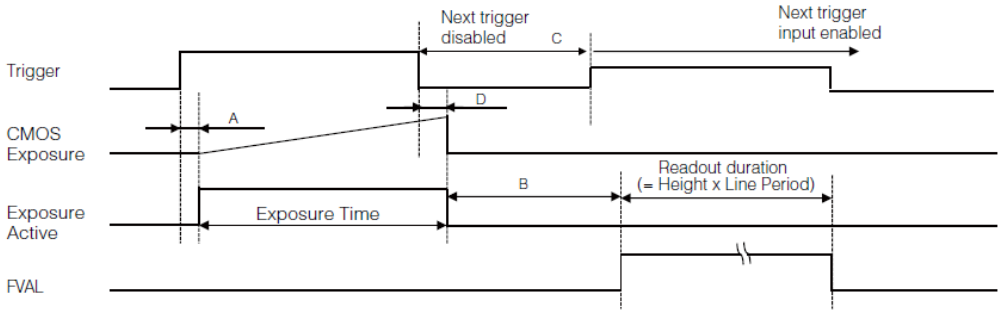
Example: When **TriggerSource** is set to **Line 5 - Optical In 1** and **OptInFilterSelector** is set to **Off**

TriggerOverlap = Off (AP-1600T-PGE)



PixelFormat	Line Period (usec)	Period from Trigger start edge to Exposure start[A] (usec)	Period from Exposure end to FVAL start[B] (usec)	Period from FVAL end to next trigger start[C] (usec)	Period from Trigger end edge to Exposure end[D] (usec)
8bit	36.51	111	1365	311	111
10bit	48.69	147	1816	344	147
12bit	54.76	165	2040	362	165

TriggerOverlap = Readout (AP-1600T-PGE)

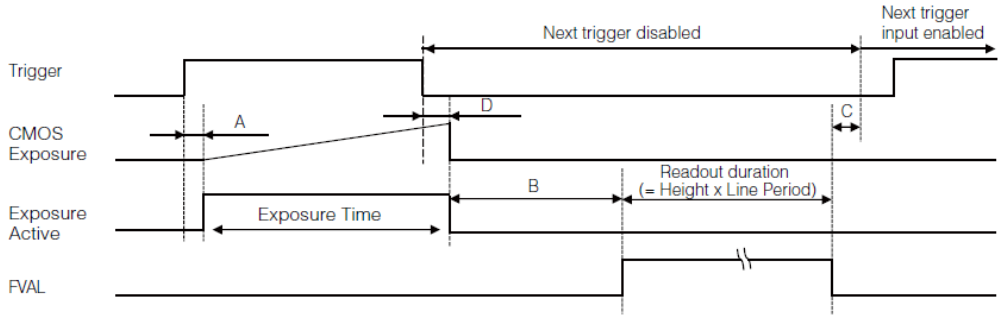


PixelFormat	Line Period (usec)	Period from Trigger start edge to Exposure start[A] (usec)	Period from Exposure end to FVAL start[B] (usec)	Next trigger start prohibited period[C] (usec)*	Period from Trigger end edge to Exposure end[D] (usec)
8bit	36.51	111	1365	733	111
10bit	48.69	147	1816	983	147
12bit	54.76	165	2040	1097	165
*ExposureTime: Minimum					

ExposureMode = TriggerWidth (AP-3200T-PGE)

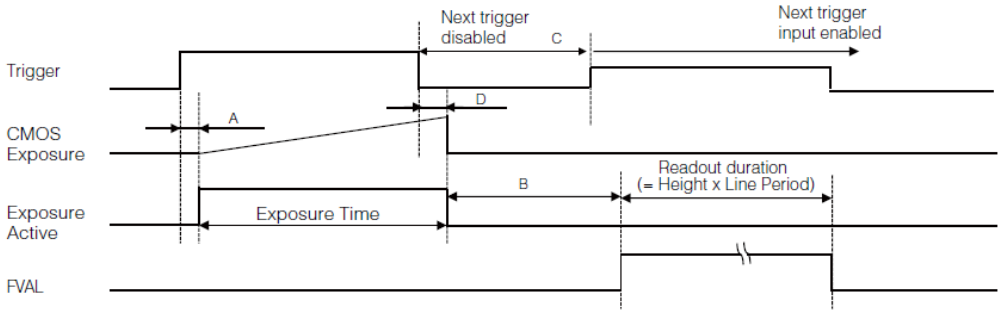
Example: When **TriggerSource** is set to **Line 5 - Optical In 1** and **OptInFilterSelector** is set to **Off**

TriggerOverlap = Off (AP-3200T-PGE)



PixelFormat	Line Period (usec)	Period from Trigger start edge to Exposure start[A] (usec)	Period from Exposure end to FVAL start[B] (usec)	Period from FVAL end to next trigger start[C] (usec)	Period from Trigger end edge to Exposure end[D] (usec)
8bit	53.83	163	1365	182	163
10bit	71.8	217	1814	253	217
12bit	80.77	244	2039	289	244

TriggerOverlap = Readout (AP-3200T-PGE)



PixelFormat	Line Period (usec)	Period from Trigger start edge to Exposure start[A] (usec)	Period from Exposure end to FVAL start[B] (usec)	Next trigger start prohibited period[C] (usec)	Period from Trigger end edge to Exposure end[D] (usec)*
8bit	53.83	163	1365	743	163
10bit	71.8	217	1814	990	217
12bit	80.77	244	2039	1000	244
*ExposureTime Minimum					

Gain Control

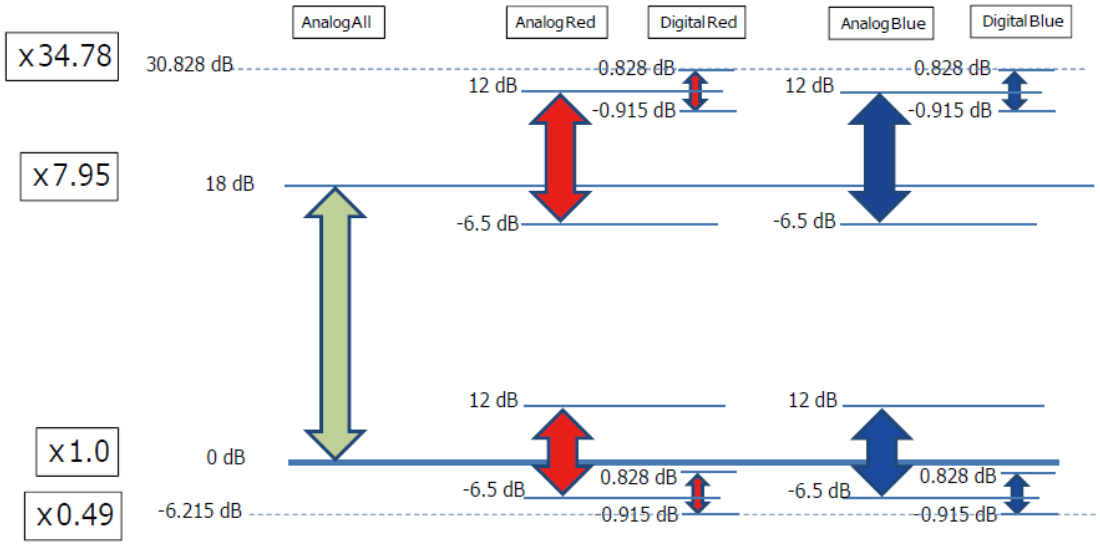
Related Setting Items: AnalogControl

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.



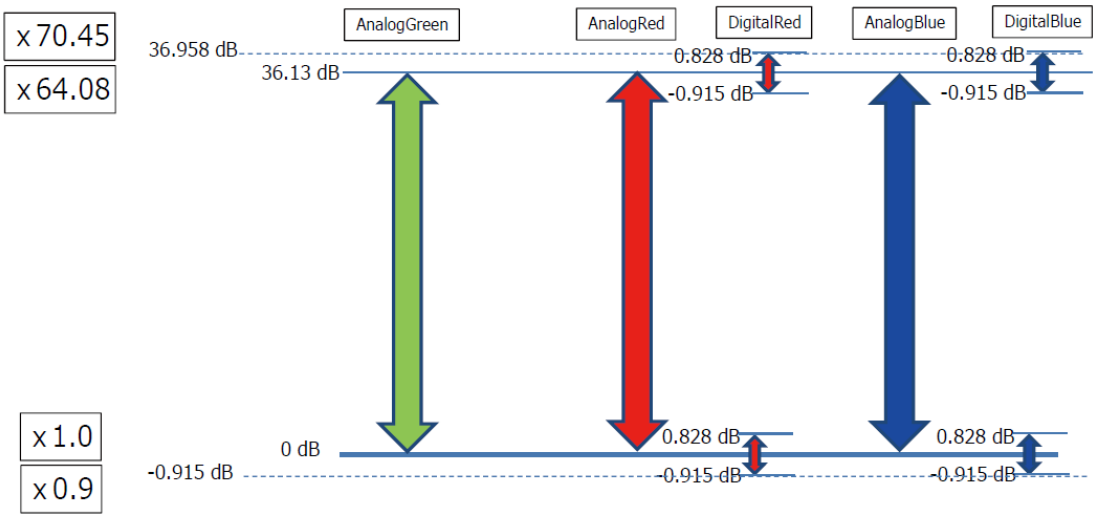
Adjusting the Gain Individually for RGB (Individual Mode)

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

GainAuto (AnalogControl) can be used to automatically control gain levels.

In combination with **ExposureAuto** (AcquisitionControl), GainAuto can be used to adjust various changes in brightness (ALC (Automatic Level Control)). In the ALC function, the automatic control of the gain level is called AGC (Auto Gain Control), and it automatically adjusts the Gain so that the average level of the ALC target area is equal to the level specified in ALCReference (JAI CustomControlALC).

GainAuto	Description
Off	No AGC (Auto Gain Control). The user-set Gain value is used.
Once	AGC automatically adjusts the Gain level only once. After that, GainAuto returns to Off.
Continuous	**ExposureAuto = Off**: AGC automatically adjusts the Gain level continuously. **ExposureAuto = On**: AGC and ASC (Auto Shutter Control) automatically adjust the brightness level, continuously. For more information, see "ALC (Automatic Level Control) ".

Notes:

- When **IndividualGainMode** is set to **On**, GainAuto will be fixed at **Off**.
- **Once** or **Continuous** will not be executed when:
  - The image is not output.
  - Outputting a Test Pattern.
  - In Sequencer Mode, MultiRoi mode, or SensorMultiRoi mode (AP-1600T-PGE only).
  - AGC (Auto Gain Control) cannot operate due to the ROI settings (Height is less than 4 pixels)
- The names of the ALC operations by Gain and by ExposureTime are as follows.
  - ALC operation by Gain: AGC (Auto Gain Control)
  - ALC operation by ExposureTime: ASC (Auto Shutter Control)

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

LUT (Lookup Table)

Related Setting Items: LUT Control

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).

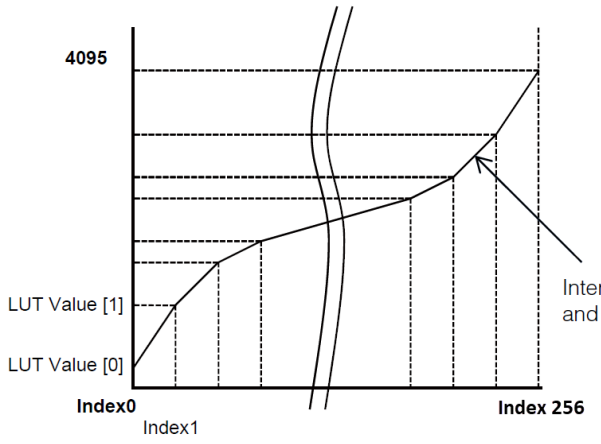
To use the LUT function

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
JAI LUT Mode	LUT	Use LUT.
LUT Selector	Red, Green, Blue	Select the LUT channel to control.
LUT Index	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.
LUT Value	0 ~ 4095	Set the LUT output value for the selected index.

LUT values

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

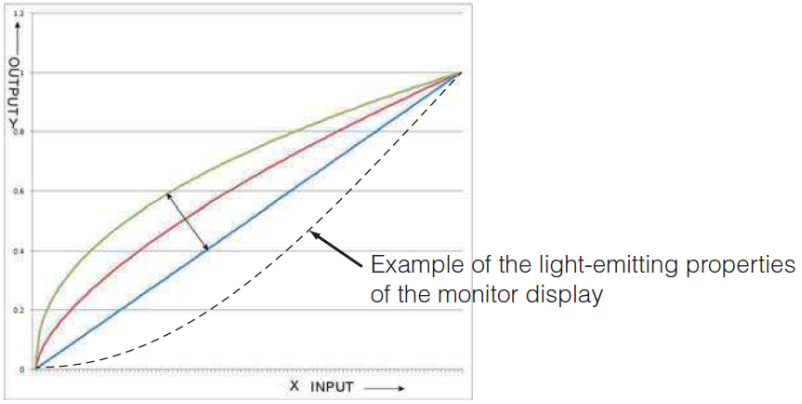


Gamma Function

> **Note:** AnalogControl

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

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



To use the gamma function

Configure the settings as follows.

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

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

BlemishCompensation

> **Related Setting Items:** JAI CustomControlBlemish

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 200 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 bright 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 using **BlemishDetectThreshold**.

   Up to 200 pixels can be corrected for each of the three sensors.

   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 **Blemish Detect** 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.

> **Note**: **BlemishDetect** cannot be executed when:
>
> - The image is not output.
> - Outputting a Test Pattern.
> - In Sequencer Mode, MultiRoi mode, or SensorMultiRoi mode (AP-1600T-PGE only).
> - When the ROI (Regional Scanning Function) is used (Not full ROI)

Manual Configuration

1. Select the index in **BlemishCompensationIndex**.

   You can select from 1 to 200. 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. Each point is saved to the camera's internal memory as you configure them.

   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.

   > **Note:** By executing **BlemishCompensationDataClear** (specify sensor) **BlemishCompensationIndex**, you can return a specific pixel correction setting to the default value (storage not required).

3. Execute **BlemishStore**. Blemish compensation data will be stored.

4. Set **BlemishEnable** to **True** , and execute interpolation. If **False** is specified, defective pixel interpolation is disabled.

Shading Correction

Related Setting Items: JAI CustomControlShading

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).

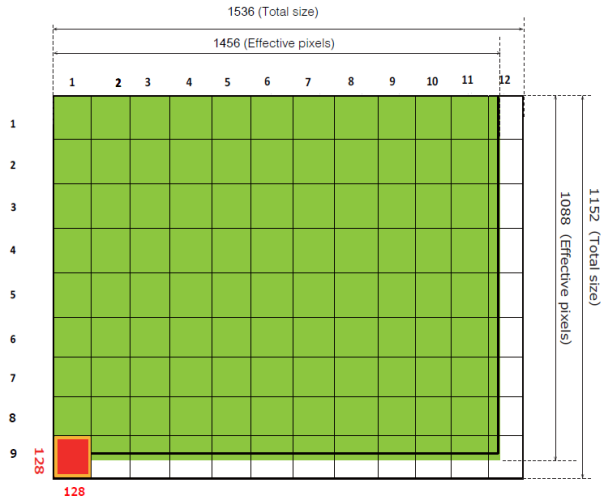
This function can be used even when the effective image area is limited (an area with both Width and Height set to more than 128 must be configured) by the ROI function. In such cases, the correction area is included in the image area configured by the ROI.

See the table below for the block size information for a full image. The ineffective peripheral areas will be deleted internally on the camera automatically.

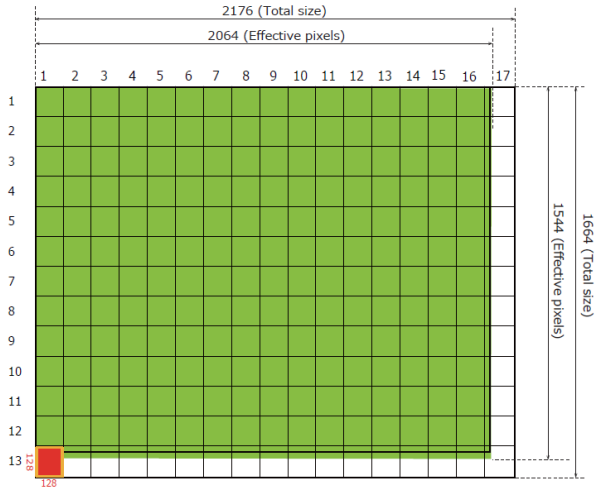
	AP-1600T-PGE	AP-3200T-PGE
Number of Correction Blocks	12 (H) × 9 (V) block	17 (H) × 13 (V) block
Block Size	128 × 128 pixels	
Total Size of Blocks	1536 (H) × 1152 (V)	2176 (H) × 1664 (V)
Effectrive Pixels	1456 (H) × 1088 (V)	2064 (H) × 1544 (V)

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

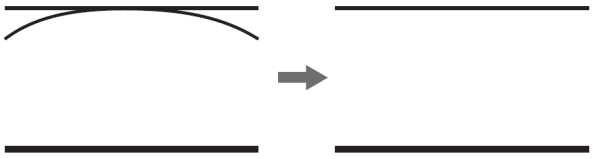
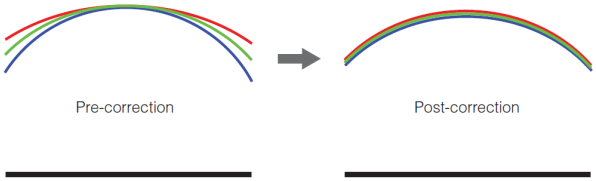
AP-1600T-PGE



AP-3200T-PGE



The following shading correction modes are available on the camera

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

Cautions:

- For FlatShading and ColorShading, the maximum amount of correction gain for all pixels is limited to twice the amount of gain before correction. (The amount of gain cannot be increased to more than twice 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

1. Specify the shading correction mode (**FlatShading** or **ColorShading**) in **ShadingCorrectionMode**.
2. Select the user area to which to save the shading correction value (User1, User2, or User3).
3. Display a white chart under a uniform light, and execute **PerformShadingCalibration**.
4. After shading correction is executed, the shading correction value is automatically saved to the user area selected in Shading Mode.

Note: **PerformShadingCalibration** will not be executed when:

- The image is not output.
- Outputting a Test Pattern.
- In Sequencer Mode, MultiRoi mode, or SensorMultiRoi mode (AP-1600T-PGE only), GainAuto = Continuous, ExposureAuto = Continuous, BalanceWhiteAuto = Continuous.
- Width and/or Height are less than 128 pixels.

ROI (Regional Scanning Function)

Related Setting Items: ImageFormatControl

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

ROI Settings

Specify the area to scan by specifying width, height, and horizontal/vertical offset values under ImageFormatControl.

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/OffsetX (Pixels)

	Horizontal Binning = 1	Horizontal Binning = 2	A, B = WidthMax
Width(pixels)	16 ~ (A - OffsetX), step 16	8 ~ (B - Offset X), step 8	
OffsetX (pixels)	0 ~ (A - Width), step 16	0 ~ (B - Width), step 8	

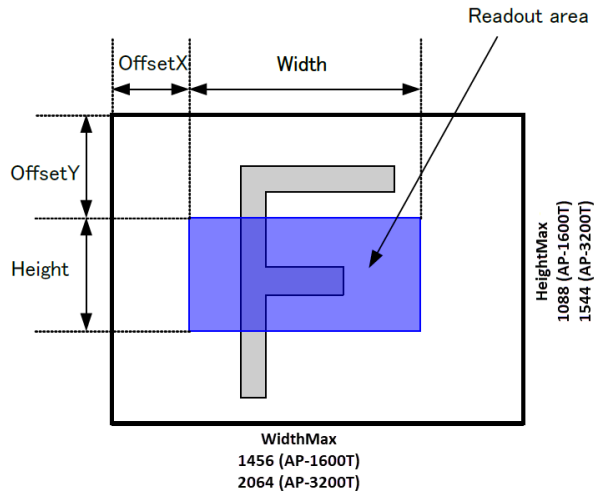
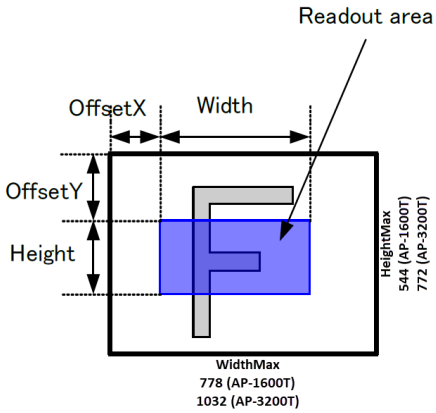
	A	B
AP-1600T	1456	728
AP-3200T	2064	1032

Height/OffsetY (Lines)

	Vertical Binning = 1	Vertical Binning = 2	C, D = HeightMax
Height (lines)	2 ~ (C - OffsetY), step 2	2 ~ (D - Offset Y), step 2	
OffsetY (lines)	0 ~ (C - Height), step 16	0 ~ (D - Height), step 2	

	C	D
AP-1600T	1088	544
AP-3200T	1544	772

Examples

Setting Example: 1	Setting Example: 2
Binning Horizontal = 1 Binning Vertical = 1	Binning Horizontal = 2 Binning Vertical = 2
	

Note: For details on the frame rates for common ROI sizes, see “Frame Rate Reference (Theoretical value)”.

Binning Function

Related Setting Items: ImageFormatControl

The Binning function allows you to combine the signal values of clusters of adjacent pixels to create improved virtual pixels. Using the function results in images with a lower pixel resolution and higher sensitivity in summing mode (Sum) or reduced noise in averaging mode (Average).

	AP-1600T-PGE	AP-3200T-PGE
Binning Horizontal Mode (Sum or Average)	Fixed to "**Sum**" when BinningVertical and BinningHorizontal are both set to **2**".	Always operates in conjunction with BinningVerticalMode (subject to whichever you set later).
Binning Horizontal	When BinningVertical = 1 (Off): Digital Binning (on FPGA) When BinningVertical = 2 (On): Analog Binning (on Sensor) **Note:** Disabled when **SensorMultiRoiMode** is set to **On**, and **BinningVertical** is set to **2**.	Digital Binning (on FPGA)
Binning Vertical Mode (Sum or Average)	Fixed to "**Sum**"	Always operates in conjunction with BinningHorizontalMode (subject to whichever you set later).
Binning Vertical	Analog Binning (on Sensor) **Note:** Disabled when **SensorMultiRoiMode** is set to **On**, and **BinningHorizontal** is set to **2**.	Digital Binning (on FPGA)

When VideoProcessBypassMode is On

When Video Process Bypass Mode is set to **On**, the Binning function will be disabled for Digital Binning.

Binning Horizontal	Binning Vertical	AP-1600T-PGE	AP-3200T-PGE
1	2	Enabled	Disabled
2	1	Disabled	Disabled
2	2	Enabled	Disabled

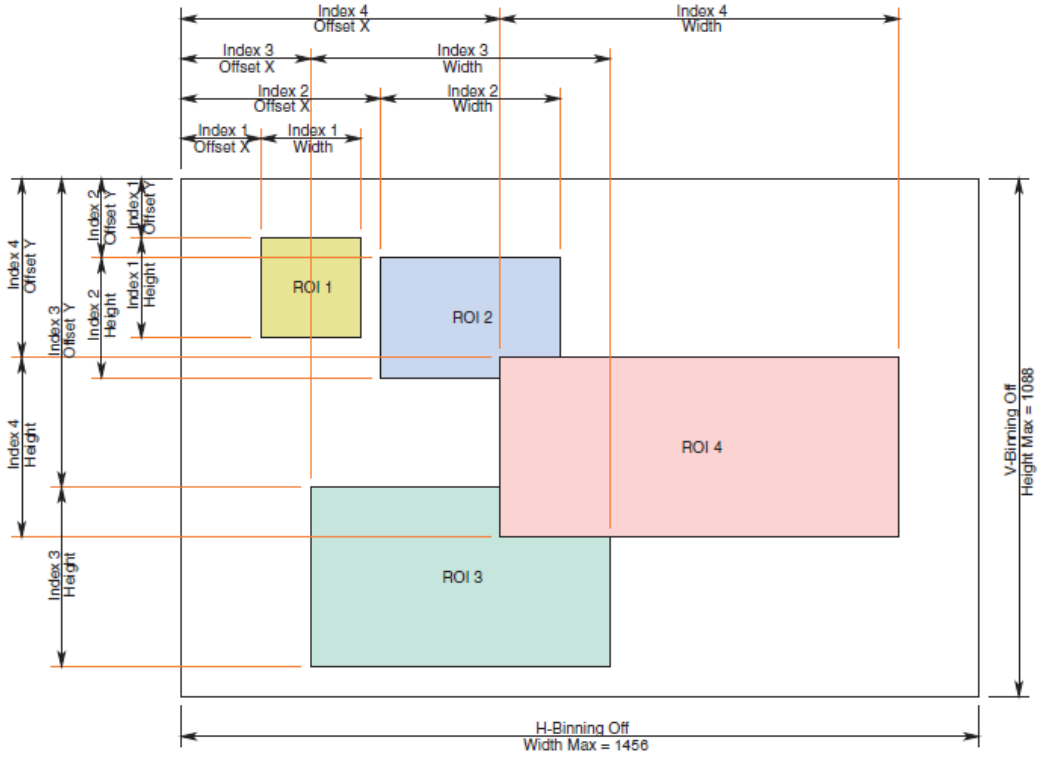
Overlap Multi ROI Mode

Related Setting Items: JAICustomControlOverlapMultiROI

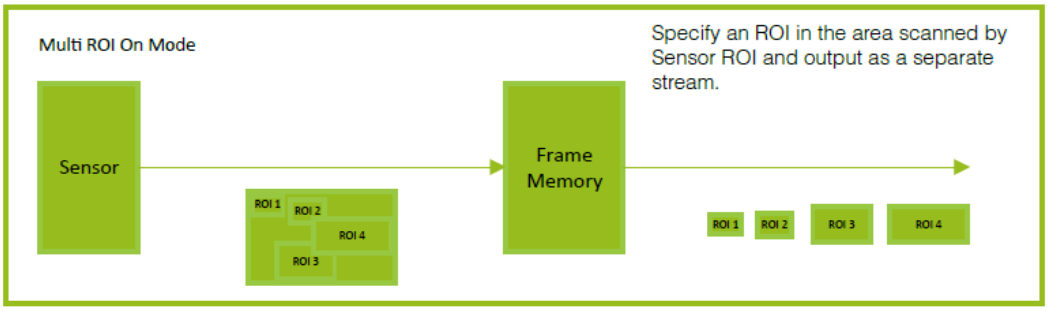
In Overlap Multi ROI mode, you can specify up to five scanning areas (Index 1 to 5) for a single frame image. The areas can overlap, and a separate frame will be output for each area.

Note: This mode cannot be used with the following functions.

- Sequencer Function
- Sensor Multi ROI Function (AP-1600T-PGE only)



Specify the areas by specifying width, height, and horizontal/vertical offset values for each index under JAICustomControlOverlapMultiROI.



Sensor Multi ROI Function

Related Setting Items: JAI CustomControlSensorMultiROI

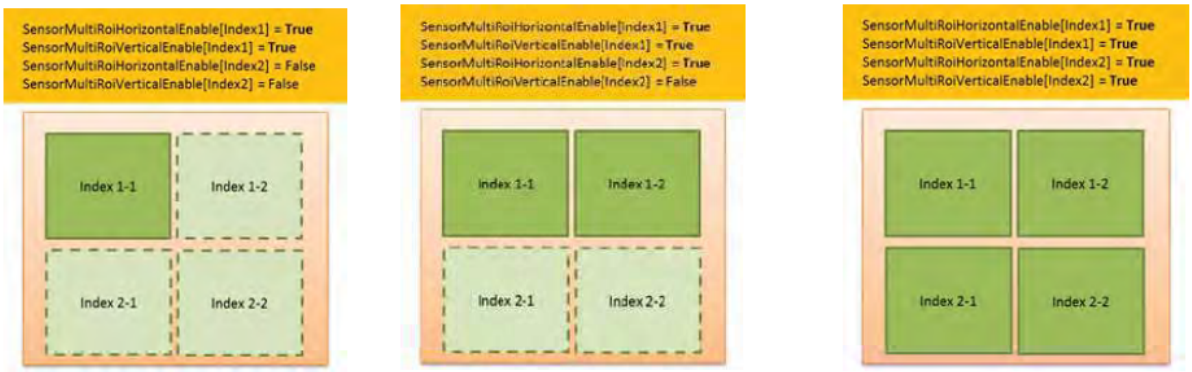
In this mode, the Multi ROI function built into the image sensor is used. Up to 4 areas can be specified. In this mode, areas cannot be overlapped.

Notes:

- This function is only supported on AP-1600T-PGE.
- This function cannot be used together with the following functions.
  - Sequencer Function, Overlap Multi ROI Mode
  - AP-1600T-PGE: when BinningVertical = 2 AND BinningVertical = 2 (Binning Function).

The setting is JAI CustomControlSensorMultiROI. Specify width, height, horizontal / vertical offset value for each index.

Please refer to the example in the figure below and set SensorMultiRoiHorizontalEnable, SensorMultiRoiVerticalEnable. For Index 1, both SensorMultiRoiHorizontalEnable and SensorMultiRoiVerticalEnable are fixed to True.



Caution: When using SensorMultiROI mode, if EdgeEnhancer is enabled, the boundaries of each area may be edge-emphasized depending on the acquired image.

Sequencer Function

> **Related Setting Items:** Sequencer Control

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 (Trigger Sequencer Mode and Command Sequencer Mode) are available for the Sequencer function.

> **Notes:**
> - The Sequencer function cannot be used together with Overlap Multi ROI Mode and Sensor Multi ROI Function (AP-1600T-PGE only).
> - When **SequencerMode** is **ON**, the Width, Height, OffsetX, and OffsetY settings (ImageFormatControl) cannot be changed. When changing SequencerMode from OFF to ON, the Width, Height, OffsetX, and OffsetY settings are returned to the default settings (= full ROI).
> - When changing **SequencerMode** from OFF to **ON**, the **ExposureModeOption** setting (AcquisitionControl) will be forced to **Off**.
> - When **SequencerMode** is **On**, the settings of each item associated with **SequencerSetSelector** cannot be changed.

About Indexes (imaging conditions)

Up to 128 indexes can be configured. The following settings can be configured for each index. However, SequencerFrameNumber and SequencerSetNext can only be configured in TriggerSequencer mode.

> **Note:** For more information on each setting item, see Sequencer Control.

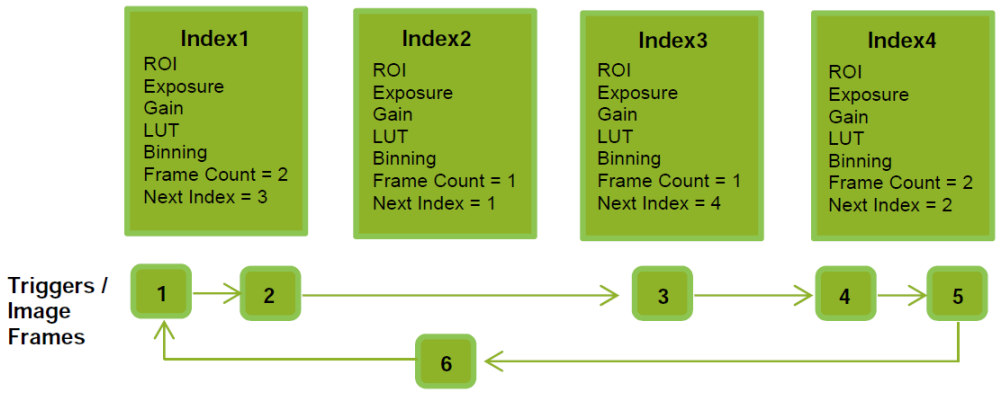
Trigger Sequencer Mode

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 commands.

> **Note:** In Trigger Sequencer Mode, when set **SequencerMode** to **On**, **FrameStart** (TriggerMode) is forced to be **On**. When **SequencerMode** is returned to **Off**, **FrrameStart**(TriggerMode) will remain **On**.

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 example above, you can also specify 0 to indicate the end of TriggerSequencer mode in [SequencerSetNext] of index 2, and specify the number of repetitions in [SequencerRepetition].

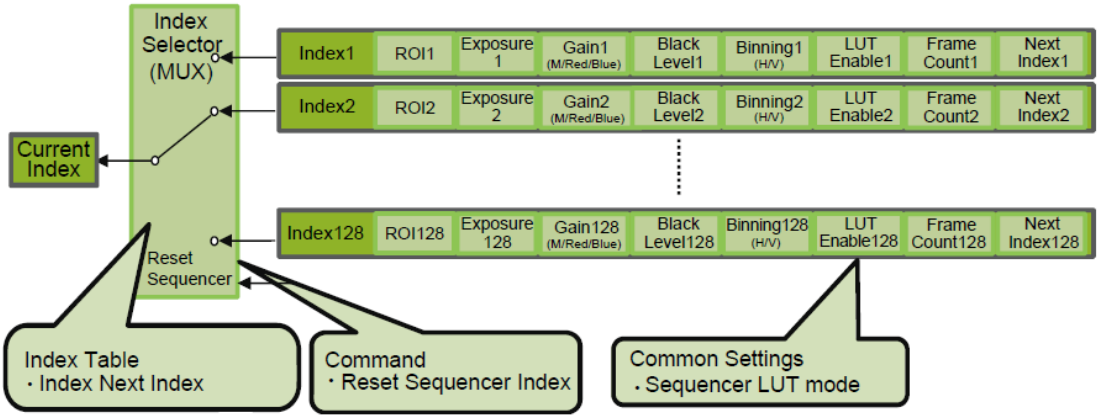
Command Sequencer Mode

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.

The same index table will be executed for subsequent triggers unless the CommandSequencerIndex value is changed.

Notes:

- 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.



Delayed Readout

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

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

Notes:
This function imposes a heavy processing load on the network bandwidth, as images from multiple cameras are read out simultaneously. The delayed readout buffer is 15 frames in length for 8-bit, 7 frames for 10-bit, and 7 frames for 12-bit.

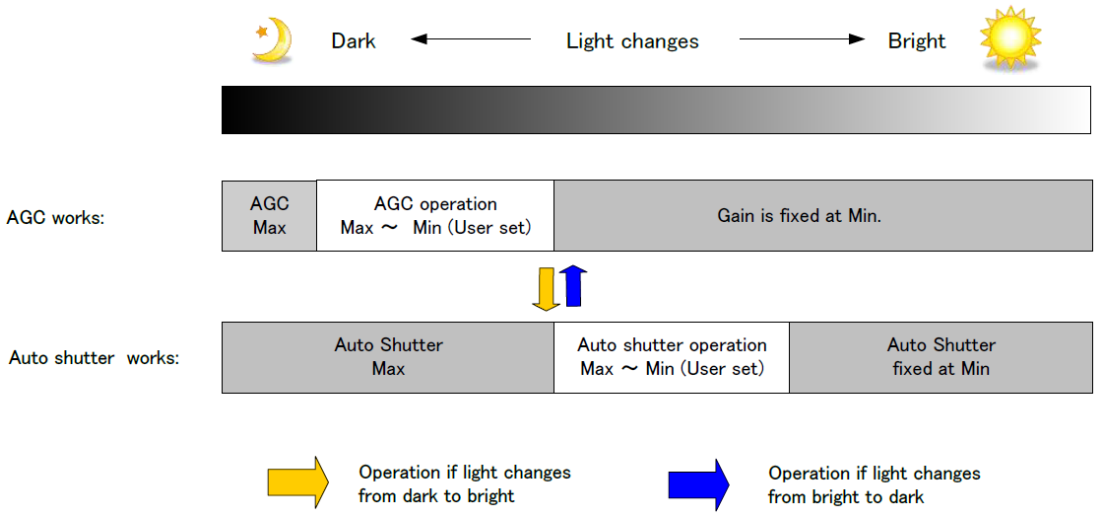
For more information, see "Trigger Control".

ALC (Automatic Level Control)

Related Setting Items: JAI CustomControlALC

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

1. Set **GainAuto** (AnalogControl) or **ExposureAuto** (AcquisitionControl) or both to **Continuous** mode.
2. Set the channel to be used as a reference in **ALCControlReference** (Peak Channel or Selected Channel). If set to **Selected Channel**, also configure **ALCControlChanel** (**Red**, **Green** or **Blue**).
3. Set the AGC and ASC reference levels in **ALCReference**. For example, if ALCReference is set to 95%, AGC and ASC will maintain video levels at 95%.
4. If necessary, specify the photometry area in **ALCAreaSelector** and set **ALCAreaEnable** to **True**.
5. Set the maximum and minimum values for AGC and ASC (**AutoShutterControlExposureMin/Max**, **AutoGainControlGainRawMin/Max**).
6. Set the ALC control speed in **ALCControlSpeed** (1 ~ 8).
7. You can confirm the ALC operation status using **ALCStatus** and **ALCControlStatus**.

Color Space Conversion (ColorTransformationControl)

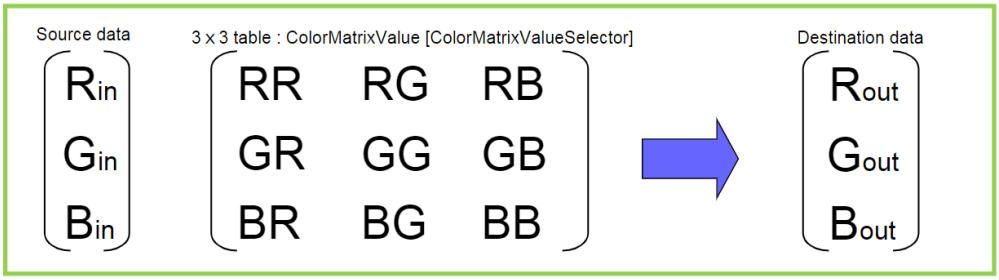
Related Setting Items: Color Transformation Control

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 desied color space by configuring ColorTransofrmationMode and ColorTransformationRGBMode as follows.

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

Note on RGB (UserCustom)

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



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

Configuration 3x3 table

1. Select the item you want to configure in ColorMatrixValueSelector.
2. Configure the value in ColorMatrixValue.
3. ColorMatrixValue can be set to a value from -2 to +2.

See Color Transformation Control for detailed information on the setting items.

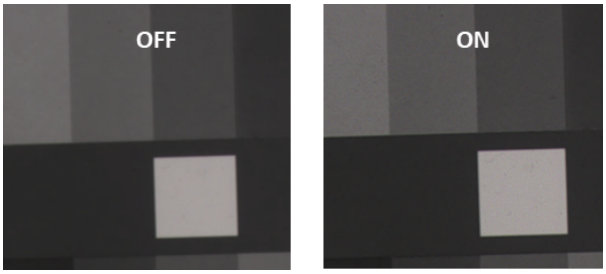
Edge Enhancer, Color Enhancer

> **Related Setting Items:** JAI CustomControlFeatureMisc

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

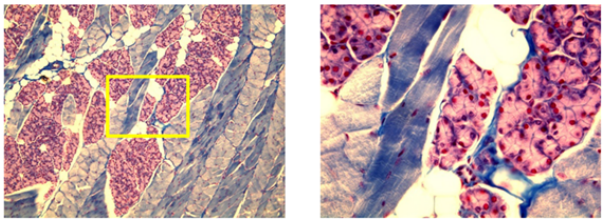
The Edge Enhancer function is enabled when EnhancerEnable[Edge] is set to **True**. Four enhancement levels are available: Low, Middle, High, and Strong.



Color Enhancer Function

The Color Enhancer function is enabled when EnhancerEnable[Color] is set to **True**. Set a value from 0 to 1.0 (0.1 steps) for ColorEnhancerValue to configure the enhancement level: 0 = no enhancement, 1.0 = approx. x2 the color level of the original data.

Six colors can be specified in ColorEnhancerSelector: Red, Cyan, Green, Magenta, Blue, and Yellow.



Counter and Timer Control

Related Setting Items: Counter and Timer Control

Note: This camera supports the Counter function only.

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

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

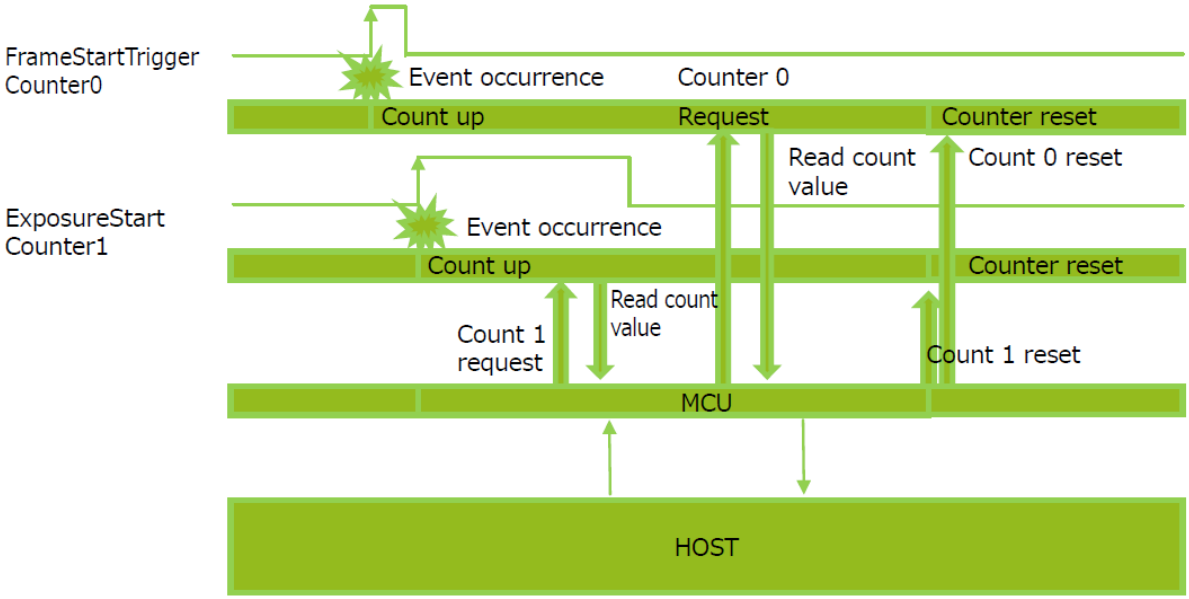
Four counters are available on this camera, and the functions that can be counted are fixed for each counter.

Counter Selector	Counter Event Source (Fixed)	Counter Event Activation
Counter0	Counts the number of **FrameStartTrigger** instances.	Rising Edge (Fixed)
Counter1	Counts the number of **ExposureStart** instances.	
Counter2	Counts the number of **SensorReadOut** instances.	
Counter3	Counts the number of **FrameTransferEnd** instances.	Falling Edge (Fixed)

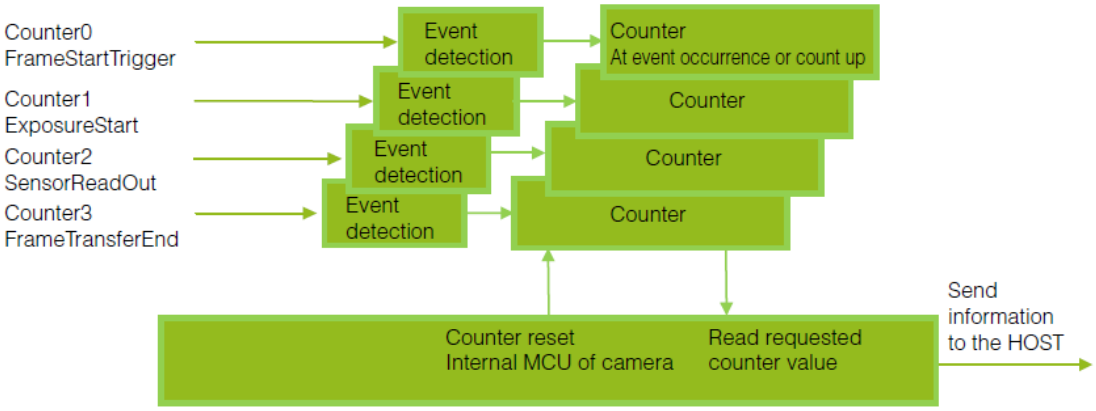
How to Configure

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

Counter Occurrence Diagram



Internal Camera Blocks



Video Process Bypass Mode

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. Operation using 12-bit outputs must be performed in bypass mode.

	ON	OFF
Camera Operation	The following functions will be disabled, regardless of their configurations. Gain[DigitalRed], Gain[DigitalBlue], BlackLevel, LUT, Shading, Binning (H,V)* (AP-3200T-PGE), Enhancement, ColorMatrix **Note:** The Binning function on AP-1600T-PGE is enabled or disabled depending on the Binning settings. For more information, see Binning Function.	All video processes are enabled.
Camera Output	8bit (RGB8) /10bit (RGB10VPacked, RGB10p32) / 12bit (RGB12V1Packed)	8bit (RGB8) /10bit (RGB10VPacked, 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 Video Process Bypass Mode

1. Set **VideoProcessBypassMode** (JAI CustomControlFeatureMisc) to **On** (Default = Off).

Note: In VideoProcessBypassMode, saturated level of brightness decreases.

Chunk Data Function

Related Setting Items: ChunkDataControl

The Chunk Data function adds camera configuration information to the image data that is output from the camera. In addition, when images are acquired 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**. (Default = False)
2. Selects which Chunk to enable or control in **ChunkSelector**.
3. Set **ChunkEnable** to **True**. (Default = False)

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

Action Control Function

Related Setting Items: ActionControl

Technical Notes How to use GigE Vision Action Commands

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

When the PTP (Precision Time Protocol) function is turned on, Scheduled Action Command (Action Control function) becomes available, which allows you to send Action Commands to multiple cameras synchronized with PTP at the same time.

Actions are performed when the following three conditions are met.

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

How to Configure

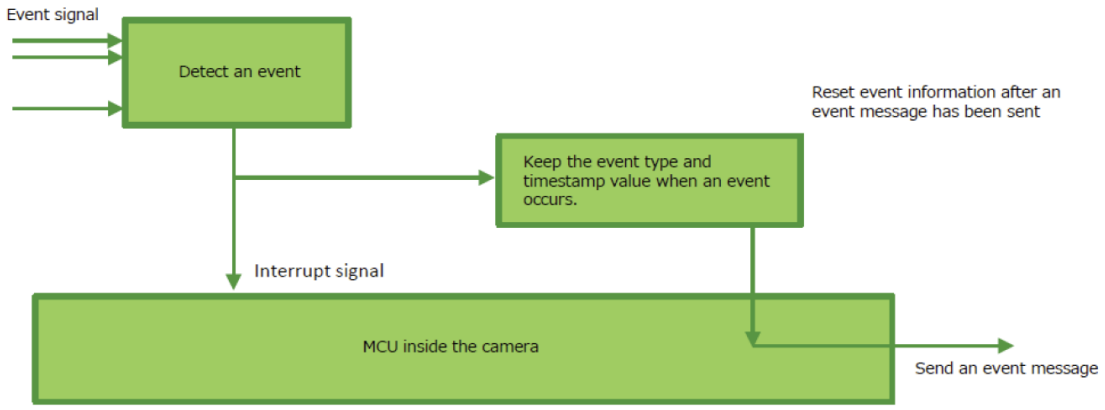
1. Specify ActionDeviceKey.
2. Then, specify two actions that can be configured on the camera.
    a. Action1
        1. Select 1 in ActionSelector.
        2. Specify ActionGroupMask [ActionSelector].
        3. Specify ActionGroupKey [ActionSelector].
    b. Action2
        1. Select 2 in ActionSelector.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

Event Control Function

Related Setting Items: EventControl

The Event Control function is a function that outputs a signal change point inside the camera as information indicative of an event occurrence (event message).

Flow from Detecting an Event to Sending an Event Message



How to Configure

1. Select the even you want to configure from **EventSelector**.
2. Set **EventNotification** to **On**.
3. When the enabled Event occurs, the following three Event data will be sent: **EvenID**, **EventTimeStamp**, and **EvenFrameID**.

   For example, when **AcquisitionTrigger** is selected from **EventSelector** and **EventNotification** is set to **On**, the following message will be sent when an Acquisition Trigger occurs.

EventAcquisitionTriggerData	Display the EventID 0x9002.
EventAcquisitionTriggerTimestamp	Display the Timestamp value when the Event "Acquisition Trigger" occurs.
EventAcquisitionTriggerFrameID	Display the FrameID. On this camera, the FrameID is fixed to "0".

Notes:

- See "EventControl" for the events for which the Event Control function is available and for the EventID of each event.
- On this camera, FrameID is fixed to "0" for each Event.

PTP (Precision Time Protocol)

Related Setting Items: Transport Layer Control

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

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

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

How To Configure

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

Note: When the PTP function is **On**, you can use Scheduled Action Command (ActionControl), which allows you to send action commands to multiple cameras synchronized with PTP at the same time.

Setting List (Feature Properties)

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

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

Beginner: For beginner users.

Expert: For users with deep knowledge of camera functions.

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

Selector

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

Instance Example:

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

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

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

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

LineSource[LineSelector-LineX] = High

LineInverter[LineSelector-LineX] = False

LineMode[LineSelector-LineX] = Input

LineFormat[LineSelector-LineX] = TTL

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

DeviceControl

Display/configure information related to the device.

DeviceControl Item	Setting Range	Default	Description
Device Vendor Name	-	“JAI Corporation”	Display the manufacturer name.
Device Model Name	-	AP-1600T-PGE AP-3200T-PGE	Display the model name.
Device Manufacturer Info	-	See the possibilities	Display manufacturer information.
Device Version	-	-	Display the software version.
Device Firmware Version	-	-	Display the firmware version.
Device Fpga Version	-	FPGA Ver. No.	Display the FPGA version.
DeviceSerialNumber	-	-	
Device User ID	Any	-	Set the user ID for the camera.
Device SFNC Version Major	-	SFNCMajorVersion	Display the SFNC version.
Device SFNC Version Minor	-	SFNCMinorVersion	Display the SFNC version.
Device SFNC Version SubMinor	-	SFNCSubMinorVersion	Display the SFNC version.
Device Manifest Entry Selector	1: XML1	1: XML1	Selects the manifest entry to reference. (Fixed to XML1)
Device Manifest XML Major Version	-	-	Indicates the major version number of the XML file of the selected manifest entry.
Device Manifest XML Minor Version	-	-	Indicates the minor version number of the XML file of the selected manifest entry.
Device Manifest XML SubMinor Version	-	-	Indicates the subminor version number of the XML file of the selected manifest entry.
Device Manifest Schema Major Version	-	-	Indicates the major version number of the schema file of the selected manifest entry.
Device Manifest Schema Minor Version	-	-	Indicates the minor version number of the schema file of the selected manifest entry.
Device Manifest Primary URL	-	-	◦ Display the PrimaryURL.
Device Manifest Secondary URL	-	-	Display the SecondaryURL.

DeviceControl Item	Setting Range	Default	Description
DeviceTLType	-	GigEVision	Diplay the Transport Layer type of the device.
Device TL Version Major	-	2	Display the major version number of the Transport Layer type.
Device TL Version Minor	-	0	Display the minor version number of the Transport Layer type.
DeviceLinkSelector	-	0	Selects which Link of the device to control. (Fixed to 0).
Device Link Speed	-	125000000 Bps	Displays the negotiated transmission rate.
Device Link Heartbeat Mode	0: Off 1: On	1: On	Display whether Heartbeat mode is enabled/disabled.
Device Link Heartbeat Timeout (us)	500000 ~ 2147483647000	3000000	Configure the timeout value for Heartbeat (unit: µs). Step: 1000
Device Stream Channel Count	-	1	Display the number of supported stream channels.
Device Event Channel Count	-	1	Display the number of supported message channels.
Device Character Set	-	UTF8	Display the character encoding.
Device Registers Endianness	-	1: Big	Endianness of the registers of the device.
Device Temperature Selector	Mainboard	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading.
Device Temperature (C)	-	-	Display the internal temperature (˚C) of the camera.
Timestamp	0 ~ 64-bit max (ns)	0	Display the timestamp value (ns). 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	0 ~ 64bit max (ns)		Returns the latched value of the timestamp counter.
Device Reset	-	-	Reset the device.

ImageFormatControl

Configure image format settings.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Image Format Control Item	Setting Range	Default	Description
Sensor Width	AP-1600T-PGE: 1456 AP-3200T-PGE: 2064		Display the maximum image width.
Sensor Height	AP-1600T-PGE: 1088 AP-3200T-PGE: 1544		Display the maximum image height.
SensorDigitizationBits	-	12 (Fixed)	Display the number of bits at which the sensor is operating.
Width Max	AP-1600T-PGE: 1456 (728) AP-3200T-PGE: 2064 (1032) ( ): BinningHorizontal = 2		Display the maximum image width.
Height Max	AP-1600T-PGE: 1088 (544) AP-3200T-PGE: 1544 (772) ( ): BinningVertical = 2		Display the maximum image height.
Width **Related Topic:** ROI (Regional Scanning Function)	16(8)* ~ [WidthMax - OffsetX], Step: 16 (8) ( ): BinningHorizontal = 2	WidthMax	Set the image width.
Height	2 ~ [HeightMax - OffsetY],Step: 2	HeightMax	Set the image height.
Offset X	0 ~ [WidthMax - Width], Step: 16 (8) ( ): BinningHorizontal = 2	0	Set the horizontal offset.
Offset Y	0 ~ [HeightMax - Height], step 2	0	Set the vertical offset.
BinningHorizontalMode **Related Topic:** Binning Function	Sum Average	Sum	Set the processing method for horizontal binning.
Binning Horizontal	1: Off 2: x2	1: Off	Set the number of pixels in the horizontal direction for which to perform binning.

Image Format Control Item	Setting Range	Default	Description
BinningVerticalMode	Sum* Average *AP-1600T-PGE: Fixed to **Sum**.	Sum	Set the processing method for vertical binning.
Binning Vertical	1: Off 2: x2	1: Off	Set the number of pixels in theoertical direction for which to perform binning.
Pixel Format	RGB8 (0x02180014) RGB10V1Packed (0x0220001C) RGB10p32 (0x0220001D) RGB12V1Packed (0x02240034)	RGB8	When RGB12V1Packed is selected, VideoProcessBypassMode is forced to On.
Test Pattern	Off GreyHorizontalRamp GreyVerticalRamp GreyHorizontalRamp Moving HorizontalColorBar VerticalColorBar MovingColorBar	0: Off	Select the test image.

AcquisitionControl

> **Related Topic:** Acquisition Control

Configure image capture settings.

> **Note:** ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Acquisition Control Item	Setting Range	Default	Description
Acquisition Mode **Related Topic:** Acquisition Control	0: SingleFrame 1: MultiFrame 2: Continuous	2: Continuous	Select the image capture mode.
Acquisition Start	-	-	Start image capture.
Acquisition Stop	-	-	Stop image capture.
Acquisition Frame Count	1 ~ 65535	1	In MultiFrame mode, set the number of frames to capture.
Acquisition Frame Rate (Hz) **Related Topic:** Maximum Frame Rate Period Formula	0.125 ~	-	Set the frame rate as a frequency. (unit: Hz) The maximum value varies depending on the PixelFormat and ROI settings. The table below shows the maximum frame rate when the ROI is set to full size. **Related Topic:** Frame Rate Reference (Theoretical value)
Trigger Selector **Related Topic:** Trigger Control	0: Acquisition Start 1: Acquisition End 2: Frame Start 3: Acquisition Transfer Start	0: AcquisitionStart	Select the trigger operation.
Trigger Mode	Off, On	Off	Enables/Disables the Trigger mode.
Trigger Software	-	-	Execute a software trigger.

<table>
<tr><th>Acquisition Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>Trigger Source</td><td>Low
High
Software
Pulse Generator 0 ~ 3
User Output 0 ~ 3
Action1 ~ 2
Line5 - OptIn1
Line6-OptIn2
NAND0 Out
NAND1 Out</td><td></td><td>Select the trigger signal source.
Default Settings
Low (AcquisitionStart)
Low (AcquisitionEnd)
Line5 - OptIn1 (FrameStart)
Low (AcquisitionTransferStart)</td></tr>
<tr><td>Trigger Activation</td><td>0: RisingEdge
1: FalingEdge
2: LevelHigh
3: LevelLow</td><td>Rising Edge</td><td>Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).</td></tr>
<tr><td>Trigger Overlap</td><td>Off
Readout</td><td>-</td><td>Select the trigger overlap operation. The below table shows the default values.<table><tr><th>TriggerSelector</th><th>TrigerOverlap Default</th></tr><tr><td>Acquisition Start, Acquisition End, Acquisition Transfer Start</td><td>Off</td></tr><tr><td>FrameStart</td><td>Readout</td></tr></table></td></tr>
<tr><td>TriggerDelay (μs)</td><td>0 ~ 500000</td><td>0</td><td>Set the time of exposure start from trigger input.</td></tr>
<tr><td>ExposureModeOption</td><td>Off
RCT</td><td>Off</td><td>Set whether to enable RCT mode.</td></tr>
<tr><td>Exposure Mode
Related Topic:
Exposure Mode</td><td>Off
Timed
Trigger Width</td><td>Timed(control via exposure time)</td><td>Select the exposure mode.</td></tr>
<tr><td>ExposureTimeMode</td><td>Common
Individual</td><td>Common</td><td>When set to Individual, ExposureTime can be adjusted for RGB individually.</td></tr>
<tr><td>ExposureTimeSelector</td><td>Common
Red
Green
Blue</td><td>Common</td><td>Selects which exposure time is controlled by the ExposureTime feature.</td></tr>
</table>

Acquisition Control Item	Setting Range	Default	Description
Exposure Time (us) **Related Topic:** Actual Exposure Time	1us ~	-	Set the exposure time. The specifiable range varies depending on the [StartTriggerMode] and [PixelFormat] setting. **Offset Time Duration** AP-1600T-PGE: 14.26us AP-3200T-PGE: 13.73us
Exposure Auto	Off Continuous Once	Off	Set whether to enable auto exposure.

AnalogControl

Configure analog control settings.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Analog Control Item	Setting Range	Default	Description
IndividualGainMode **Related Topic:** Gain Control	Off On	Off	In IndividualGainMode, RGB can be configured individually for the entire gain adjustment range of the sensor.
Gain Selector	0: AnalogAll 1: AnalogRed 2: AnalogGreen* 3: AnalogBlue 4: DigitalRed 5: DigitalBlue	Analog All	Select the gain to configure. **Note:** When IndividualGaiMode is set to Off, AnalogGreen's Gain value is fixed to "1".
Gain	-	x1	Set the gain value for the gain item selected with the GainSelector setting.
Gain Auto **Related Topic:** Automatic Gain Level Control	Off Continuous Once	Off	Enable/disable gain auto adjustment. Once automatically changes to Off when the signal level converges once.

Analog Control Item	Setting Range	Default	Description
Balance White Auto **Related Topic:** Adjust the White Balance	Off Continuous Once ExposureContinuous ExposureOnce Preset 3200K Preset 5000K Preset 6500K Preset7500K	Off	Enable/disable auto white balance.
Black Level Selector **Related Topic:** Adjust the Black Level	Digital All Digital Red Digital Blue	Digital All	Select the black level to configure.
Black Level	DigitalAll:-133 ~ 255 DigitalRed:-64 ~ 64 DigitalBlue:-64 ~ 64	0	Set the black level value.
Gamma **Related Topic:** Gamma Function	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0	0.45	Set the gamma value.
LUT Mode	Off Gamma LUT	Off	Select the JAI LUT mode.

LUT Control

Related Topic: LUT (Lookup Table)

Configure LUT settings.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

LUT Control Item	Setting Range	Default	Description
LUT Selector	Red Green Blue	Red	Select the LUT channel to control.
LUT Index	0 ~ 256	0	Set the LUT index table number.
LUT Value	0 ~ 4095	0	Set the LUT index table number.

Color Transformation Control

Related Topic: Color Space Conversion (ColorTransformationControl)

Configure LUT settings.

Color Transformation Control Item	Setting Range	Default	Description
ColorTransformationMode	RGB XYZ HSI	RGB	Set the output image format.
ColorTransformation RGBMode	Off sRGB AdobeRGB UserCustom	Off	Set the detailed mode when RGB is selected for the color space.
ColorMatrixValueSelector	0: ColorMatrixR-R 1: ColorMatrixR-G 2:ColorMatrixR-B 3: ColorMatrixG-R 4: ColorMatrixG-G 5: ColorMatrixG-B 6: ColorMatrixB-R 7: ColorMatrixB-G 8: ColorMatrixB-B	ColorMatrix R-R	Select the ColorMatrix setting component.
ColorMatrixValue	-2.0 ~ 2.0	-	Set the Color Matrix value. ColorMatrixR-R: 1.0 ColorMatrixR-G: 0 ColorMatrixR-B: 0 ColorMatrixG-R: 0 ColorMatrixG-G: 1.0 ColorMatrixG-B: 0 ColorMatrixB-R: 0 ColorMatrixB-G: 0 ColorMatrixB-B: 1.0

DigitalIOControl

Related Topic: GPIO (Digital Input/Output Settings)

Configure settings for digital input/output.

<table>
<tr><th>Digital IO Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>Line Selector</td><td>Line1-TTLOut1
Line2-OptOut1
Line5-OptIn1
Line6-OptIn2
TimeStampReset
NAND0In1
NAND0In2
NAND1In1
NAND1In2</td><td>Line2-OptOut1</td><td>Select the input/ output to configure.</td></tr>
<tr><td>LineSource</td><td>Low
High
Acquisition Trigger Wait
Acquisition Active
Frame Trigger Wait
Frame Active
Exposure Active
FVAL
Pulse Generator 0 ~ 3
User Output 0 ~ 3
Line5-OptoIn1
Line6-OptoIn2
Nand 0 Out
Nand 1 Out</td><td>-</td><td>Select the line source signal for the item selected in Line Selector.<table><tr><th>Default</th><th>Line Selector</th></tr><tr><td>Low</td><td>All except below</td></tr><tr><td>Exposure Active</td><td>Line1 - TTL Out1</td></tr><tr><td>Off</td><td>TimeStampReset</td></tr></table></td></tr>
<tr><td>Line Inverter</td><td>True
False</td><td>False</td><td>Enable/disable polarity inversion for the selected input signal or output signal.</td></tr>
<tr><td>Line Status</td><td>True
False</td><td>False</td><td>Display the status of the input signal or output signal (True: High, False: Low).</td></tr>
<tr><td>Line Mode</td><td>Input
Output</td><td>Output</td><td>Display the input/ output status (whether it is input or output).</td></tr>
<tr><td>Line Format</td><td>NoConnect
TTL
OptoCoupled
InternalSignal</td><td>-</td><td>Display the current I/F type.</td></tr>
<tr><td>LineStatusAll</td><td>-</td><td>-</td><td>Display the input/output signal status.</td></tr>
</table>

Digital IO Control Item	Setting Range	Default	Description
OptoInFilterSelector	Off 10μs 100μs 500μs 1ms 5ms 10ms	Off	Remove noise from the OptIn input signal of Digital I/O.
User Output Selector	User Output 0 User Output 1 User Output 2 User Output 3	0: User Output 0	Set the user output signal.
User Output Value	True False	False	Set the User Output value selected in User Output Selector.

Counter and Timer Control

Related Topic: Counter and Timer Control

Configure counter settings. (This camera only supports counter functions.)

Counter and Timer Control Item	Setting Range	Default	Description
CounterSelector	Counter0 ~ 3	Counter0	Select the counter.
CounterEventSource	Counter0: Off, FrameTrigger Counter1: Off, ExposureStart Counter2: Off, SensorReadOut Counter3: Off, FrameTransferEnd	Off	Select the counter event signal for which to read the count value.
Counter Event Activation	RisingEdge FallingEdge	-	Display the timing at which to count. Counter0~2: Default RisingEdge Counter3: Default FallingEdge
CounterReset	-	-	Reset the counter.
CounterRefresh	-	-	Update the count value.
Counter Value	-	-	Display the count value.

Counter and Timer Control Item	Setting Range	Default	Description
CounterStatus	CounterIdle CounterActive CounterOverflow	CounterIdle	Display the counter status. CounterIdle: Idle CounterActive: Counting CounterOverflow: Count value exceeded the maximum value

ActionControl

> **Related Topic:** Action Control Function

Configure action control settings.

Action Control Item	Setting Range	Default	Description
Action Device Key	-	0x00	Set the action device key.
Action Selector	1 ~ 2	1	Select the action.
Action Group Mask	-	0x00	Set the mask value that creates the action 0 group,
Action Group Key	-	0x00	Set the key that executes action 1.
Action Queue Size	-	255	Set the size of action queue.

EventControl

Related Topic: Event Control Function

Configure event control settings.

Event Control Item	Setting Range	Default	Description
Event Selector	AcquisitionTrigger FrameStart FrameEnd FVAL Start FVAL End ExposureStartRed ExposureEndRed ExposureStartGreen ExposureEndGreen ExposureStartBlue ExposureEndBlue Line1 Rising Edge Line1 Falling Edge Line2 Rising Edge Line2 Falling Edge Line5 Rising Edge Line5 Falling Edge Line6 Rising Edge Line6 Falling Edge	AcquisitionTrigger	Select the event for which to send notifications.
Event Notification	Off On	Off	Select whether to output event messages. When set to On, the following data will be displayed when the specified Event occurs. **EventxxxxxData**: Display the EventID. **EventxxxxxTimestamp**: Displays the Timestamp value when an event occurs. **EventxxxxxxFrameID**: Displays the FrameID value when an event occurs. On this camera, the value is fixed to 0.
EventAcquisitionTriggerData	-	-	Display data when the event AcquisitionTrigger occurs. EventID: 0x9002
EventFrameStartData	-	-	Display data when the event FrameStart occurs. EventID: 0x9300
EventFrameEndData	-	-	Display data when the event FrameEnd occurs. EventID: 0x9301

Event Control Item	Setting Range	Default	Description
EventFVALStartData	-	-	Display data when the event FVALStart occurs. EventID: 0x9320
EventFVALEndData	-	-	Display data when the event FVALEnd occurs. EventID: 0x9321
EventExposureStartRedData	-	-	Display data when the event ExposureStartRed occurs. EventID: 0x9302
EventExposureEndRedData	-	-	Display data when the event ExposureEndRed occurs. EventID: 0x9303
EventExposureStartGreenData	-	-	Display data when the event ExposureStartGreen occurs. EventID: 0x9304
EventExposureEndGreenData	-	-	Display data when the event ExposureEndGreen occurs. EventID: 0x9305
EventExposureStartBlueData	-	-	Display data when the event ExposureStartBlue occurs. EventID: 0x9306
EventExposureEndBlueData	-	-	Display data when the event ExposureEndBlue occurs. EventID: 0x9307
EventLine1RisingEdgeData	-	-	Display data when the event Line1RisingEdge occurs. EventID: 0x9310
EventLine1FallingEdgeData	-	-	Display data when the event Line1FallingEdge occurs. EventID: 0x9318
EventLine2RisingEdgeData	-	-	Display data when the event Line2RisingEdge occurs. EventID: 0x9311
EventLine2FallingEdgeData	-	-	Display data when the event Line2FallingEdge occurs. EventID: 0x9319
EventLine5RisingEdgeData	-	-	Display data when the event Line5RisingEdge occurs. EventID: 0x9314
EventLine5FallingEdgeData	-	-	Display data when the event Line5FallingEdge occurs. EventID: 0x931C
EventLine6RisingEdgeData	-	-	Display data when the event Line6RisingEdge occurs. EventID: 0x9315
EventLine6FallingEdgeData	-	-	Display data when the event Line6FallingEdge occurs. EventID: 0x931D

UserSetControl

> **Related Topic:** Step 7: Save the Settings

Load factory default settings or save/load user settings for camera settings.

> **Note:** ☐ Settings that can only be configured when image acquisition on the camera is stopped.

User Set Control Item	Setting Range	Default	Description
User Set Selector	Default User Set1 ~ 3	0: Default (factory default values)	Select the user settings.
User Set Load	-	-	Load user settings.
User Set Save	-	-	Save the current setting values as user settings.

Sequencer Control

Related Topic: Sequencer Function

Configure sequencer settings.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Sequencer Control Item	Setting Range	Default	Description
SequencerMode	On Off	Off	Enable/disable [SequencerMode].
SequencerModeSelect	Trigger Sequencermode Command Sequencermode	Trigger Sequencermode	Select the sequencer mode.
SequencerConfiguration Mode	On Off	On	Select **On** to change the settings within the index.
SequencerSetSelector	1 ~ 128	1	Select the TriggerSequencer mode and CommandSequencer mode index.
SequencerFrameNumber	1 ~ 255	1	Set the number of frames to display for the selected SequencerIndex. (Enabled only for TriggerSequencer.)
SequencerSetNext	1 ~ 128	1	) Set the next index to be displayed for the selected SequencerIndex. (Enabled only for TriggerSequencer.)
SequencerWidth	16(8)* ~ [WidthMax - SequencerOffsetX], Step: 16 (8), Default: WidthMax WidthMax: AP-1600T-PGE: 1456 (728) AP-3200T-PGE: 2064 (1032) ( ): BinningHorizontal = 2		Set the width of the selected SequencerIndex.
SequencerHeight	2 ~ [HeightMax - SequencerOffsetY],Step: 2, Default: HeightMax HeightMax: AP-1600T-PGE: 1088 (544) AP-3200T-PGE: 1544 (772) ( ): BinningVertical = 2		Set the height of the selected SequencerIndex.

<table>
<tr><th>Sequencer Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>SequencerOffsetX</td><td colspan="2">0 ~ [WidthMax - SequencerWidth], Step: 16 (8), Default: 0
WidthMax:
AP-1600T-PGE: 1456 (728)
AP-3200T-PGE: 2064 (1032)
( ): BinningHorizontal = 2</td><td>Set the horizontal offset.</td></tr>
<tr><td>SequencerOffsetY</td><td colspan="2">0 ~ [HeightMax - SequencerHeight], step 2, Deault: 0
HeightMax:
AP-1600T-PGE: 1088 (544)
AP-3200T-PGE: 1544 (772)
( ): BinningVertical = 2</td><td>Set the vertical offset.</td></tr>
<tr><td>SequencerGain AnalogAll</td><td colspan="2"><table><tr><th>IndividualGainMode</th><th>Setting Range</th></tr><tr><td>Off</td><td>1.0 (Default) ~ 8.0</td></tr><tr><td>On</td><td>1.0 Fixed</td></tr></table></td><td>Set the GainAnalogAll value.</td></tr>
<tr><td>SequencerGain AnalogRed</td><td colspan="2"><table><tr><th>IndividualGainMode</th><th>Setting Range</th></tr><tr><td>Off</td><td>0.47 ~ 4.0; Default = 1.0</td></tr><tr><td>On</td><td>1.0 (Default) ~ 64.0</td></tr></table></td><td>Set the GainAnalogRedl value.</td></tr>
<tr><td>SequencerGain AnalogGreen</td><td colspan="2"><table><tr><th>IndividualGainMode</th><th>Setting Range</th></tr><tr><td>Off</td><td>1.0 Fixed</td></tr><tr><td>On</td><td>1.0 (Default) ~ 64.0</td></tr></table></td><td>Set the GainAnalogGreenl value.</td></tr>
<tr><td>SequencerGain AnalogBlue</td><td colspan="2"><table><tr><th>IndividualGainMode</th><th>Setting Range</th></tr><tr><td>Off</td><td>0.47 ~ 4.0 ; Default = 1.0</td></tr><tr><td>On</td><td>1.0 (Default) ~ 64.0</td></tr></table></td><td>Set the GainAnalogBlue value.</td></tr>
<tr><td>SequencerExposure TimeCommon(us)
SequencerExposure TimeRed(us)
SequencerExposure TimeGreen(us)
SequencerExposure TimeBlue(us)</td><td colspan="2"><table><tr><th>TriggerMode*</th><th colspan="2">Setting Range</th></tr><tr><th></th><th>AP-1600T</th><th>AP-3200T</th></tr><tr><td>Off**</td><td>1 us (3us) ~</td><td>1 us ~</td></tr><tr><td>On***</td><td>1us (3us) ~ 8sec</td><td>1us ~ 8sec</td></tr><tr><td colspan="3">*TriggerMode = FrameStart
**TriggerMode = Off: Command Sequencer Mode
***TriggerMode = On: Trigger Sequencer Mode / Command Sequencer Mode
( ): When BinningHorizontal = 2 and BinningVertical = 2</td></tr></table></td><td>Set the exposure time for the selected SequencerIndex.</td></tr>
</table>

Sequencer Control Item	Setting Range	Default	Description
SequencerBinning Horizontal	1: Off 2: x2	1	For the selected SequencerIndex, set the number of pixels in the horizontal direction for which to perform binning. **Note:** See "Binning Function" for limitations when in VideoProcessBypassMode.
SequencerBinning Vertical	1: Off 2: x2	1	For the selected SequencerIndex, set the number of pixels in the vertical direction for which to perform binning. **Note:** See "Binning Function" for limitations when in VideoProcessBypassMode.
SequencerLutEnable	True False	False	Set the LutEnable setting of the selected SequencerIndex.
SequencerBlackLevel DigitalAll	- 133 ~ 255	0	Set the black level value for the selected SequencerIndex.
SequencerRepetition	1 ~ 255	1	This parameter applies to Trigger Sequencer patterns which include an index whose **Sequencer ROI Next Index** is set to **OFF**. When the index whose **Sequencer ROI Next Index** is set to **OFF** is finished executing, the value of Sequencer Repetition is decremented internally. If the result of the decrement is not zero, the Trigger Sequencer 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.
SequencerLutMode	Gamma LUT	Gamma	Define whether to apply gamma or LUT to the sequence. When **Gamma** is selected, the gamma setting defined in AnalogControl is applied to all exposures in the sequence. When **LUT** is selected, the LUT characteristics defined in AnalogControl are applied to indexes for which SequencerLUT enable is set to ON.
SequencerSetActive	1 ~ 128	1	This allows you to confirm the currently configured index number.
SequencerCommand Index	1 ~ 128	1	Set this to change the SequencerIndex. (Enabled only for CommandSequencer.)

Sequencer Control Item	Setting Range	Default	Description
SequencerSetStart	1 ~ 128	1	Configure the index number to execute at the start of TriggerSequencer mode.
SequencerReset	-	-	In TriggerSequencerMode, reset the current index number to the number configured in SequencerSetStart.

ChunkDataControl

Configure Chunk Control settings.

> **Related Topic:** Chunk Data Function

Chunk Data Control Items	Setting Range	Default	Description
ChunkModeActive	0: False 1: True	0: False	Set whether to enable ChunkData.
ChunkSelector	Selects which Chunk to enable or control. Options are listed below. OffsetX (Default), OffsetY, Width, Height, ExposureTimeMode, ExposureTimeCommon(Green), ExposureTimeRed, ExposureTimeBlue, IndividualGainMode, GainAnalogAll (Green), GainAnalogRed, GainAnalogBlue, BlackLevelDigitalAll, BlackLevelDigitalRed, BlackLevelDigitalBlue, BinningH/V, LUTEnable, SequencerSetActive, FrameTriggerCounter, ExposureStartCounter, FrameStartCounter, SensorReadOutStartCounter, FrameTransferEndCounter, PixelFormat, LineStatusAll, Timestamp, LineStatusAllOnExposureStart, LineStatusAllOnFVALStart, DeviceSerialNumber, DeviceUserID, DeviceTemperature		
ChunkEnable	0: False 1: True	0: False	Enables the inclusion of the selected Chunk data in the payload of the image.
ChunkOffsetX	-	-	Dispaly the OffsetX value (ImageFormatControl). ChunkID: 0x2000
ChunkOffsetY	-	-	Dispaly the OffsetY value (ImageFormatControl). ChunkID: 0x2001
ChunkWidth	-	-	Dispaly the Width value (ImageFormatControl). ChunkID: 0x2002
ChunkHeight	-	-	Dispaly the Height value (ImageFormatControl). ChunkID: 0x2003
ChunkPixelFormat	-	-	Dispaly the PixelFormat value (ImageFormatControl). ChunkID: 0x2012
ChunkTimestamp	-	-	Dispaly the Timestamp value (DeviceControl). ChunkID: 0x2014

Chunk Data Control Items	Setting Range	Default	Description
ChunkLineStatusAll	-	-	Display the LineStatusAll (DigitalIOControl) value. The data acquisition timing is on the falling edge of FVAL, and the displayed value is the value determined by the Line Inverter setting. ChunkID: 0x2013
ChunkExposureTimeMode	-	-	Display the ExposureTimeMode (AcquisitionControl) value. ChunkID: 0x201B
ChunkExposureTimeGreen	-	-	Display the ExposureTimeGreen (AcquisitionControl) value. ChunkID: 0x201B
ChunkExposureTimeRed	-	-	Display the ExposureTimeRed (AcquisitionControl) value. ChunkID: 0x201C
ChunkExposureTimeBlue	-	-	Display the ExposureTimeBlue (AcquisitionControl) value. ChunkID: 0x201D
ChunkIndividualGainMode	-	-	Display the IndividualGainMode (AnalogControl) value. ChunkID: 0x201E
ChunkGainAnalogAll(Green)	-	-	Display the GainAnalogAll(Green) (AnalogControl) value. ChunkID: 0x2005
ChunkGainAnalogRed	-	-	Display the GainAnalogRed (AnalogControl) value. ChunkID: 0x2006
ChunkGainAnalogBlue	-	-	Display the GainAnalogBlue (AnalogControl) value. ChunkID: 0x2007
ChunkBlackLevelDigitalAll	-	-	Display the BlackLevel[DigitalAll] (AnalogControl) value. ChunkID: 0x2008
ChunkBlackLevelDigitalRed	-	-	Display the BlackLevel[DigitalRed] (AnalogControl) value. ChunkID: 0x2009
ChunkBlackLevelDigitalBlue	-	-	Display the BlackLevel[DigitalBlue] (AnalogControl) value. ChunkID: 0x200A

Chunk Data Control Items	Setting Range	Default	Description
ChunkBinningHorizontalVertical_LUTEnable	-	-	Display the BinningHorizontal / BinningVertical (ImageFormatControl) and LUTEnable (LUT Control) values. ChunkID: 0x200B Bit Assignment 0: H-Binning ON/OFF (1: ON) 1: V-Binning ON/OFF (1: ON) 2: Binning Mode 0: Sum; 1: Average 3: LUT ON/OFF (1: ON) 4: Sensor V-Binning ON/OFF (AP-1600T-PGE only) 5: Sensor V-Binning ON/OFF (AP-1600T-PGE only) 6 ~ 31: Unused
ChunkSequencerSetActive	-	-	Displays the SequencerSet number currently set in TriggerSequenceMode or CommandSequencerMode. (1 is displayed in Normal Mode.) (SequencerControl) ChunkID: 0x200C
ChunkFrameTriggerCounter	-	-	Display the CounterValue[Counter0] (Counter and Timer Control) value. Data acquisition timing is FrameStart. ChunkID: 0x200E
ChunkExposureStartCounter	-	-	Display the CounterValue[Counter1] (Counter and Timer Control) value. Data acquisition timing is ExposureStart. ChunkID: 0x200F
ChunkSensorReadOutStartCounter	-	-	Display the CounterValue[Counter2] (Counter and Timer Control) value. Data acquisition timing is SensorReadOut. ChunkID: 0x2010
ChunkFrameTransferEndCounter	-	-	Display the CounterValue[Counter3] (Counter and Timer Control) value. Data acquisition timing is FrameTransferEnd. ChunkID: 0x2011
ChunkLineStatusAllOnExposureStart	-	-	Display the LineStatusAll (DigitalIOControl) value. The data acquisition timing is at the ExposureStart, and the displayed value is the value determined by the Line Inverter setting. ChunkID: 0x2015
ChunkLineStatusAllOnFVALStart	-	-	Display the LineStatusAll (DigitalIOControl) value. The data acquisition timing is at theFVALStart, and the displayed value is the value determined by the Line Inverter setting. ChunkID: 0x2016
ChunkDeviceTemperature	-	-	Display the DeviceTemperature (DeviceControl) value. ChunkID: 0x2019
ChunkDeviceSerialNumber	-	-	Display the DeviceSerialNumber (DeviceControl) value. ChunkID: 0x2017

Chunk Data Control Items	Setting Range	Default	Description
ChunkDeviceUserID	-	-	Display the DeviceUserID (DeviceControl) value. ChunkID: 0x2018

TestControl

Configure the test control setting.

Test Control Items	Setting Range	Default	Description
TestPendingAck	0 ~ 10000	0	PendingAck function test command. The camera waits for TestPendingAck (ms) time and returns an Ack response.

Transport Layer Control

Configure Transport Layer settings.

Transport Layer Control Item	Setting Range	Default	Description
PayloadSize	-	-	Display the payload size information.
DeviceTapGeometry	-	Geometry_1X_1Y	Display the TapGeometry information.
GigEVision			
GevCurrentPhysicalLink Configuration	-	SingleLink (Fixed)	Display the LinkConfiguration status.

Transport Layer Control Item	Setting Range	Default	Description
GevSupportedOption Selector	Select the supported options for GigEVision. The selections are as follows: SingleLink (Default), 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, StreamChannel, UnconditionalStreaming, StreamChannel0ExtendedChunkData , StreamChannel1BigAndLittleEndian, StreamChannel1MultiZone, StreamChannel1PacketResendDestination, StreamChannel1AllInTransmission, StreamChannel1UnconditionalStreaming, StreamChannel1ExtendedChunkData, StreamChannel2BigAndLittleEndian, StreamChannel2MultiZone, StreamChannel2PacketResendDestination, StreamChannel2AllInTransmission, StreamChannel2UnconditionalStreaming, StreamChannel2ExtendedChunkData		
GevSupportedOption	0: False 1: True	-	Displays whether the function selected by GevSupportOptionSelector is supported or not.
GevInterfaceSelector	-	0 (Fixed)	Selects which logical link to control.
GevMacAddress	-	-	Display the MAC address.
GevPAUSEFrameReception	-	False (Fixed)	Not supported on this camera.
GevPAUSEFrameTransmission	-	False (Fixed)	Not supported on this camera.
GevCurrentIPConfiguration LLA		True (Fixed)	Display whether the current IP configuration is calibrated by LLA (link-local address).
GevCurrentIPConfiguration DHCP	0: False 1: True	True	Select whether to set the IP configuration to DHCP.
GevCurrentIPConfiguration PersistentIP	0: False 1: True	False	Select whether to set the IP configuration to Persistent IP.
GevCurrentIPAddress	-	-	Display the IP address.
GevCurrentSubnetMask	-	-	Display the subnet.
GevCurrentDefaultGateway	-	-	Display the default gateway.
GevIPConfigurationStatus	None PersistantIP DHCP LLA ForceIP	-	Display the current IP configuration status.

Transport Layer Control Item	Setting Range	Default	Description
GevPersistentIPAddress	0.0.0.0. ~ 255.255.255.255		Set the persistent IP address.
GevCurrentSubnetMask			Set the persistent subnet mask.
GevPersistentDefaultGateway			Set the persistent default gateway.
GevIEEE1588	0: False 1: True	False	TRUE : Enables PTP FALSE: Disables PTP
GevIEEE1588ClockAccuracy	0 ~ 20	Unknown	Indicates clock accuracy. 0:Within25ns, 1:Within100ns, 2:Within250ns, 3:Within1us, 4:Within2p5u, 5:Within10us, 6:Within25us, 7:Within100us, 8:Within250us, 9:Within1ms. 10:Within2p5ms, 11:Within10ms, 12:Within25ms, 13:Within100ms, 14:Within250ms, 15:Within1s, 16:Within10s, 17:GreaterThan10s, 18:AlternatePTPProfile, 19:Unknown, 20:Reserved
GevIEEE1588Status	-	-	Display the IEEE 1588 Status. 1: Initializing, 2: Faulty, 3: Disabled, 4: Listening, 5: PreMaster, 6: Master, 7: Passive, 8: Uncalibrated, 9: Slave
GevGVCPExtendedStatus CodesSelector	0:Version1_1 1:Version2_0	Version1_1	Select the GevGVCPExtendedStatusCodes.
GevGVCPExtended StatusCodes	0: False 1: True	False	Enables the generation of extended status codes.
GevGVCPPendingAck	0: False 1: True	False	Enables/disables the PENDING_ACK.
GevGVSPExtendedIDMode	0: Off 1: On	Off	Enables/disables Extended ID Mode.
GevCCP	0:OpenAccess 1:ExclusiveAccess 2:ControlAccess	OpenAccess	Control access rights. **0:OpenAccess** - Access rights have not been obtained by the application. **1:ExclusiveAccess** - Once the application has made this setting, no other applications can control or reference the camera. **2:ControlAccess** - Access rights have been obtained by the application. Other applications cannot control the camera, but can refer to it.
GevPrimaryApplicationSocket	-	-	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	-	-	Returns the address of the primary application.

Transport Layer Control Item	Setting Range	Default	Description
GevMCPHostPort	-	0 (Fixed)	Controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GevMCDA	-	0 (Fixed)	Controls the destination IP address for the message channel.
GevMCTT	0 ~ 4294967295	300	Display/set the Transmission Timeout for Message Channel.
GevMCRC	0 ~ 4294967295	0	Display/set the Retry Count for Message Channel.
GevMCSP	-	-	This feature indicates the source port for the message channel.
GevStreamChannelSelector	-	0 (Fixed)	Selects the stream channel to control.
GevSCCFGPacket ResendDestination	0: False 1: True	False	Enables the alternate IP destination for stream packets resent due to a packet resend request.
GevSCCFGAllInTransmission	0: False 1: True	False	Enables the selected GVSP transmitter to use the single packet per data block All-in Transmission mode.
GevSCCFGUnconditional Streaming	0: False 1: True	False	Enables the camera to continue to stream, for this stream channel, if its control channel is closed or regardless of the reception of any ICMP messages (such as destination unreachable messages).
GevSCCFGExtended ChunkData	0: False 1: True	False	Enables cameras to use the extended chunk data payload type for this stream channel.
GevSCPInterfaceIndex	-	0 (Fixed)	Index of the logical link to use.
GevSCPHostPort	-	-	Controls the port to which the device must send messages.
GevSCPSFireTestPacket	0: False 1: True	True	Sends a test packet.
GevSCPSDoNotFragment	0: False 1: True	True	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 (byte)	1476 ~ 12036, step 4	1476	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 ~ 4000000, step 8	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel.

Transport Layer Control Item	Setting Range	Default	Description
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.

JAICustomControlPulseGenerators

Configure pulse generator settings.

Pulse Generators Item	Setting Range	Default	Description
Clock Pre-scaler	1~ 4096	165	Set the division value for the prescaler (12-bit) using the pixel clock as the base clock.
Pulse Generator Clock (MHz)	0.018127 ~ 74.25	0.45	Set the clock used for the pulse generator. This value is calculated based on the Clock Pre-Scaler value.
Pulse Generator Selector	Pulse Generator 0 ~ 3	Pulse Generator 0	Select the pulse generator.
Pulse GeneratorLength	1 ~ 1048575	30000	Set the maximum count up value using clock value.
Pulse Generator LengthMs (ms)	1 / PulseGeratorClock(MHz) ~ 1048575 / PulseGeneratorClock (MHz)	66.6667	Set the maximum count up value using ms. This value is calculated based on the Pulse Generator Length value. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Frequency (Hz)	((PulseGeneratorClock (MHz)) ÷ 1048575) x 1000000 ~ (PulseGeneratorClock (MHz) x 1000000)	15	Set the maximum count up value using frequency. This value is calculated based on the Pulse Generator Length value.
Pulse Generator Start Point	0 ~ 1048574	0	Set the start point for the High interval using clock value. When the counter reaches this value, the output becomes 1.
Pulse Generator Start PointMs (ms)	0 ~ (1048575 / PulseGeneratorClock (MHz))	0	Set the start point for the High interval using ms. When the counter reaches this value, the output becomes 1. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator End Point	1 ~ 1048575	15000	Set the start point for the Low interval using clock value. When the counter reaches this value, the output becomes 0.

Pulse Generators Item	Setting Range	Default	Description
Pulse Generator End PointMS (ms)	(1 / PulseGeneratorClock (MHz)) ~ (1048575 / PulseGeneratorClock (MHz))	33.3333	Set the start point for the Low interval using ms. When the counter reaches this value, the output becomes 0. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Pulse Width (ms)	-	33.3333	Display High interval width for the pulse in ms. This is a calculation of the time between the Start Point and End Point. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Repeat Count	0 ~ 255	0	Set the repeat count for the counter. When this is set to 0, the counter will be free-running with limitless repeating.
Pulse Generator Clear Activation	Off LevelHigh LevelLow Rising Edge Falling Edge	0: Off	Set the clear signal condition for the count clear input of the pulse generator.
Pulse Generator Clear Source	Low High AcquisitionTriggerWait AcquisitionActive FrameTriggerWait FrameActive ExposureActive FVAL LVAL PulseGenerator0 ~ 3 UserOutput 0 ~ 3 Action1 ~ 2 Line5-Opt In 1 Line6-OptoIn2 Nand0Out Nand1Out	0: Low	Select the count clear input signal source.
Pulse Generator Clear Inverter	True False	0: False	Select whether to invert the polarity of the count clear input signal.
Pulse Generator Clear Sync Mode	Async Mode Sync Mode	Async Mode	Select the sync mode for the count clear input signal.

JAI CustomControlALC

Related Topic: ALC (Automatic Level Control)

Configure JAI ALC settings. These settings are also used for AGC (auto gain control).

ALC Control Item	Setting Range	Default	Description
ALCControlReference	PeakChannel SelectedChannel	Selected Channel	PeakChannel: Use the channel with the highest average image level as a reference. SelectedChannel: Specify the channel (Red, Green, or Blue) to use as a reference in ALCControlChannel.
ALCControlChannel	Red Green Blue	Green	Select the channel to use as a reference. When ALCControlReference is se to PeakChannel, this setting is disabled.
ALCReference	30 ~ 95	50	Set the target level for ALC. (unit: %)
ALCAreaSelector	HighLeft / High MidLeft / High MidRight / HighRight MidHigh Left / MidHigh MidLeft / MidHigh MidRight / MidHigh Right MidLow Left / MidLow MidLeft / MidLow MidRight / MidLow Right LowLeft / Low MidLeft / Low MidRight / LowRight	LowRight	Select the area for which to configure ALCAreaEnable.
ALCAreaEnable	True False	True	Enable/disable the photometry area selected in ALCAreaSelector.
ALCAreaEnableAll	True False	True	On: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [ALCAreaSelector]. Off: Operate ALC according to the individual enabled/disabled photometry area states configured in [ALCAreaSelector].
AutoShutterControl ExposureMin	100 ~ (AutoShutterControlExpsoureMax - 1)	100	Set the minimum value for the ExposureAuto (ASC) control range.
AutoShutterControl ExposueMax	(AutoShutterControlExpsoureMax + 1) ~ (FramePeriod - 14H)	-	Set the maximum value for the ExposureAuto (ASC) control range.
AutoGainControlGainRaw Min	100 ~ (AutoGainControlGain RawMax - 1)	100	Set the minimum value for the GainAuto(ASC) control range.

ALC Control Item	Setting Range	Default	Description
AutoGainControlGainRaw Max	(AutoGainControlGain RawMin + 1) ~ 800	400 or 800	Set the maximum value for the GainAuto(ASC) control range. The default value depends on the Gain setting.
ALCControlSpeed	1 (slow) ~ 8 (fast)	4	Set the response speed for AGC/ ASC. (8 is the fastest.) (When ALCControlMode is set to Standard.)
ALCStatus	Off ASC AGC	-	Allows confirmation of the current operation area during ALC operation.
AutoControlStatus	Executing ASC Executing AGC Executing ASC and AGC Executing AWB Executing ASC and AWB Executing AGC and AWB Executing ASC and AGC and AWB Convergen Idle	-	Allows confirmation of the AGC, ASC, and AWB convergence status.

JAI CustomControlAWB

Related Topic: ALC (Automatic Level Control)

Configure AWB settings.

AWB Control Item	Setting Range	Default	Description
AWBAreaSelector	HighLeft / High MidLeft / High MidRight / HighRight MidHigh Left / MidHigh MidLeft / MidHigh MidRight / MidHigh Right MidLow Left / MidLow MidLeft / MidLow MidRight / MidLow Right LowLeft / Low MidLeft / Low MidRight / LowRight	LowRight	Select the area for which to configure AWBAreaEnable.
AWBAreaEnable	True False	True	Enable/disable the photometry area selected in AWBAreaSelector.
AWBAreaEnableAll	True False	True	True: Operate AWB with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [AWBAreaSelector]. False: Operate AWB according to the individual enabled/ disabled photometry area states configured in [AWBAreaSelector].
AWBControlSpeed	1 (slow) ~ 8 (fast)	4	Set the AWB control speed. (8 is the fastest.)
AWBControlStatus	Complete TooBright TooDark Timeout Executing TriggerError Convergent ConditionError Idle	Idle	

JAI CustomControlBlemish

Related Topic: BlemishCompensation

Configure settings for JAI white blemish correction.

Blemish Control Item	Setting Range	Default	Description
BlemishEnable	False True	True	Enable/disable blemish correction.
BlemishDetect	-	-	Execute blemish detection.
BlemishStore	-	-	Save the location information of detected blemishes.
BlemishSelector	Red Green Blue	-	Specify the sensor for which to configure Blemish.
BlemishDetect Threshold	1 ~ 100	10	Set the blemish detection threshold.
BlemishCompensation Index	1 ~ 200	-	Select the index for the target blemish coordinates (BlemishDataPosition X/Y).
BlemishCompensation PositionX	AP-1600T-PGE: -1 ~ 1455 AP-3200T-PGE: -1 ~ 2063	-1	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.
BlemishCompensation PositionY	AP-1600T-PGE: -1 ~ 1087 AP-3200T-PGE: -1 ~ 1543	-1	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.
BlemishCompensation DataClear	-	-	Delete detected or specified blemish information.
BlemishCompensation Number	0 ~ 200	0	Display the number of target blemishes.

JAI CustomControlShading

Related Topic: Shading Correction

Configure settings for other JAI functions.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Shading Control Item	Setting Range	Default	Description
ShadingCorrectionMode	FlatShading ColorShading	FlatShading	Select the shading correction method.
ShadingMode	Off User1 ~ 3	Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
PerformShading Calibration	-	-	Execute shading correction.
ShadingDetectResult	-	-	Display the shading correction results.

JAICustomControlOverlapMultiROI

Related Topic: Overlap Multi ROI Mode

Configure settings for JAI sensor multi ROI.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Overlap Multi ROI Control Item	Setting Range	Default	Description
MultiRoiMode	0: Off 1: On	Off	Enable/disable OverlapMultiROI mode.
MultiRoiIndex	1 ~ 5	1	Select the Index of the readout area.
MultiRoiWidth	16 (8) ~ [WidthMax - MultiRoiOffsetX] WidthMax: AP-1600T-PGE: 1456 (728) AP-3200T-PGE: 2064 (1032) ( ) = BinningHorizontal = 2	WidthMax	Execute shading correction.

Overlap Multi ROI Control Item	Setting Range	Default	Description
MultiRoiHeight	2 ~ [HeightMax - MultiRoiOffsetY] HeightMax: AP-1600T-PGE: 1088 (544) AP-3200T-PGE: 1544 (772) ( ): BinningVertical = 2	HeightMax	Execute shading correction.
MultiRoiOffsetX	0 ~ [WidthMax -MultiRoiWidth] WidthMax: AP-1600T-PGE: 1456 (728) AP-3200T-PGE: 2064 (1032) ( ) = BinningHorizontal = 2	0	Execute shading correction.
MultiRoiOffsetY	0 ~ [HeightMax -MultiRoiHeight] HeightMax: AP-1600T-PGE: 1088 (544) AP-3200T-PGE: 1544 (772) ( ): BinningVertical = 2	0	Execute shading correction.
MultiRoiIndexMax	1 ~5	1	Select the index for the Multi Roi mode.

JAI CustomControlSensorMultiROI

Related Topic: Sensor Multi ROI Function

Configure settings for sensor Multi ROI.

Notes:

- This function is only supported on AP-1600T-PGE.
- ☐ Settings that can only be configured when image acquisition on the camera is stopped.

SensorMultiROI Control Item	Setting Range	Default	Description
SensorMultiRoiMode	Off On	Off	Enable/disable sensor Multi Roi. *)This function can be enabled only when SequecerMode is Off and MultiRoiMode is Off.
SensorMultiRoiIndex	Index1 Index2	Index1	Select the index for the sensor Multi Roi mode.
SensorMultiRoiWidth	Min: 16 Step: 16 (8) ( ): BinningHorizontal = 2	Index1: 720 Index2: 720	Set the width for the selected sensor Multi Roi index. Max: Index1: (SensorMultiRoiOffsetX[Index2] - SensorMultiRoiOffsetX[Index1]) Index2: (WidthMax* - SensorMultiRoiOffsetX[Index2]) *WidthMax: 1456 (728) ( ) = BinningHorizontal = 2
SensorMultiRoiHeight	Min: 2 Step: 2	Index1: 544 Index2: 544	Set the height for the selected sensor Multi Roi index. Max: Index1: (SensorMultiRoiOffsetY[Index2] - SensorMultiRoiOffsetY[Index1]) Index2: (HeightMax* - SensorMultiRoiOffsetY[Index2]) *HeightMax: 1088 (544) ( ) = BinningVertical = 2
SensorMultiRoiOffsetX	Min: 0 Step: 16 (8) ( ): BinningHorizontal = 2	Index1: 0 Index2: 736	Set the horizontal offset for the selected sensor Multi Roi index. Max: Index1: (SensorMultiRoiOffsetX[Index2] - SensorMultiRoiWidth[Index1]) Index2: (WidthMax* - SensorMultiRoiWidth[Index2]) *WidthMax: 1456 (728) ( ) = BinningHorizontal = 2

SensorMultiROI Control Item	Setting Range	Default	Description
SensorMultiRoiOffsetY	Min: 0 Step: 2	Index1: 0 Index2: 544	Set the vertical offset for the selected sensor Multi Roi index. Max: Index1:(SensorMultiRoiOffsetY[Index2] - SensorMultiRoiHeight[Index1]) Index2: (HeightMax* - SensorMultiRoiHeight[Index2]) *HeightMax: 1088 (544) ( ) = BinningVertical = 2
SensorMultiROI HorizontalEnable	False True	Index1: True Index2: False	Enable / disable each SensorMultiRoiIndex.
SensorMultiROI VerticalEnable	False True	Index1: True Index2: False	Enable / disable each SensorMultiRoiIndex.

JAI CustomControlFeatureMisc

Configure settings for other JAI functions.

Note: ☐ Settings that can only be configured when image acquisition on the camera is stopped.

Misc. Control Item	Setting Range	Default	Description
VideoProcessBypassMode **Related Topic:** Video Process Bypass Mode	On Off	Off	Enable/disable VideoProcessBypass mode.
EnhancerSelector **Related Topic:** Edge Enhancer, Color Enhancer	Edge Color	-	Specify the operation mode for Enhancer.
EnhancerEnable	True False	-	Enable/disable EdgeEnhancer and ColorEnhancer.
ColorEnhancerSelector	Red Cyan Green Magenta Blue Yellow	-	Index for advanced ColorEnhancer settings.
ColorEnhancerValue	0 ~ 1.0	0	Specify the ColorEnhancer emphasis levels for each color component.
EdgeEnhancerLevel	Low Middle High Strong	Middle	Set the Level for EdgeEnhancer.
VideoSendMode	NormalMode TriggerSequencerMode CommandSequencerMode SensorMultiMode	NormalMode	Display the VideoSendMode.

Miscellaneous

Troubleshooting

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

Power Supply and Connections

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

Cause and Solution: Camera initialization may not be complete. Check the 12-pin cable connection.

Image Display

Issue: Gradation in dark areas is not noticeable.

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

Settings and Operations

Issue: Settings cannot be saved to user memory.

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

Issue: I want to restore the factory default settings.

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

Specifications

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Scanning system</td><td>Progressive scan, 1 tap</td></tr>
<tr><td>Synchronization</td><td>Internal</td></tr>
<tr><td>Interface</td><td>1000BASE-T Ethernet (GigE Vision 2.0), IEEE 802.3af</td></tr>
<tr><td>Image Sensor</td><td>CMOS × 3</td></tr>
<tr><td>Image Size (Effective Image)</td><td>AP-1600T-PGE: 5.02mm (H) × 3.75mm (V) 、6.27 mm Diagonal
AP-3200T-PGE: 7.12mm (H) × 5.33mm (V) 、8.89 mm Diagonal</td></tr>
<tr><td>Pixel Size</td><td>3.45 (H) × 3.45 (V) μm</td></tr>
<tr><td>Effective Image Pixel Output</td><td>AP-1600T-PGE: 1456 (H) × 1088 (V)
AP-3200T-PGE: 2064 (H) × 1544 (V)</td></tr>
<tr><td>Acquisition Frame Rate (Max)</td><td>
<table>
<tr><th colspan="2"></th><th>AP-1600T-PGE</th><th>AP-3200T-PGE</th></tr>
<tr><td rowspan="4">8bit (RGB8)</td><td>Full</td><td>24.2 fps</td><td>12.0 fps</td></tr>
<tr><td>Binning: H1, V2</td><td>48.4 fps</td><td>12.0 fps</td></tr>
<tr><td>Binning: H2, V1</td><td>48.4 fps</td><td>24.1 fps</td></tr>
<tr><td>Binning: H2, V2</td><td>96.7 fps</td><td>24.1 fps</td></tr>
<tr><td rowspan="4">10 bit (RGB10V1Packed, RGB10p32)</td><td>Full</td><td>18.2 fps</td><td>9.0 fps</td></tr>
<tr><td>Binning: H1, V2</td><td>36.3 fps</td><td>9.0 fps</td></tr>
<tr><td>Binning: H2, V1</td><td>36.3 fps</td><td>18.0 fps</td></tr>
<tr><td>Binning: H2, V2</td><td>72.6 fps</td><td>18.0 fps</td></tr>
<tr><td rowspan="4">12 bit (RGB12V1Packed)</td><td>Full</td><td>16.1 fps</td><td>8.0 fps</td></tr>
<tr><td>Binning: H1, V2</td><td>32.3 fps</td><td>8.0 fps</td></tr>
<tr><td>Binning: H2, V1</td><td>32.3 fps</td><td>16.0 fps</td></tr>
<tr><td>Binning: H2, V2</td><td>64.5 fps</td><td>16.0 fps</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Digital Image Output Format</td><td>
<table>
<tr><th colspan="2"></th><th>AP-1600T-PGE</th><th>AP-3200T-PGE</th></tr>
<tr><td colspan="2">Full</td><td>1456 (H) × 1088 (V)</td><td>2064 (H) × 1544 (V)</td></tr>
<tr><td rowspan="4">ROI</td><td>Width</td><td>16 ~ 1456 pixels
16 pixels / step</td><td>16 ~ 2064 pixels
16 pixels / step</td></tr>
<tr><td>Offset X</td><td>0 ~ 1440 pixels
16 pixels /step</td><td>0 ~ 2048 pixels
16 pixels /step</td></tr>
<tr><td>Height</td><td>2 ~ 1088 lines
2 line/step</td><td>2 ~ 1544 lines
2 line/step</td></tr>
<tr><td>Offset Y</td><td>0 ~ 1086 lines,
2 line / step</td><td>0 ~ 1542 lines,
2 line / step</td></tr>
<tr><td rowspan="4">Binning</td><td>H1</td><td>1456 (H)</td><td>2064 (H)</td></tr>
<tr><td>H2</td><td>728 (H)</td><td>1032 (H)</td></tr>
<tr><td>V1</td><td>1088 (V)</td><td>1544 (V)</td></tr>
<tr><td>V2</td><td>544 (V)</td><td>772 (V)</td></tr>
<tr><td colspan="2">PixelFormat</td><td colspan="2">RGB8, RGB10V1Packed, RGB10p32, RGB12V1Packed</td></tr>
</table>
</td></tr>
<tr><td>Acquisition Mode</td><td>Continuous / SingleFrame / MultiFrame (1 ~ 65535)</td></tr>
<tr><td rowspan="3">Trigger Selector</td><td>Acquisition: AcquisitionStart, AcquisitionEnd</td></tr>
<tr><td>Exposure: FrameStart</td></tr>
<tr><td>Transfer: AcquisitionTransferStart (Delayed Readout)</td></tr>
<tr><td>ExposureMode</td><td>Off, Timed, TriggerWidth (PWC)</td></tr>
<tr><td>Trigger Overlap</td><td>Off / Read out</td></tr>
<tr><td>Trigger Input Signals</td><td>Low, High, Software, PulseGenerator0-3, UserOutput0-3, Action1 ~ 2, Line5-Opt In 1, Line6-Opt In 2, NAND 0 Out, NAND 1 Out</td></tr>
<tr><td>Opto Filter</td><td>Off (Default) , 10 µs , 100 µs , 500 µs , 1ms , 5ms , 10ms</td></tr>
<tr><td>ExposureMode</td><td>
<table>
<tr><td rowspan="2">AP-1600T-PGE</td><td>Timed: 15.26 µs (8bit /10bit) (Min) * ~ 8 sec (Max)</td></tr>
<tr><td>TriggerWidth: 15.26 µs (8bit /10bit) (Min) * ~ ∞(Max)</td></tr>
<tr><td rowspan="2">AP-3200T-PGE</td><td>Timed: 14.73 µs (8bit/10bit) (Min) * ~ 8 秒 (Max)</td></tr>
<tr><td>TriggerWidth: 14.73 µs (8bit/10bit) (Min) * ~ ∞ (Max)</td></tr>
<tr><td colspan="2">Performance verified for up to 1 second.</td></tr>
</table>
*) The actual exposure time will be consist of the image sensor’s offset duration added to the setting configured on the camera. For more information, see "Actual Exposure Time".
</td></tr>
<tr><td>Exposure Auto</td><td>Off / Continuous / Once</td></tr>
<tr><td>AGC/ASC Control Speed)</td><td>1 ~ 8</td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Video send mode</td><td>NormalMode, TriggerSequencerMode, CommandSequencerMode, OverlapMultiRoiMode, SensorMultiMode</td></tr>
<tr><td>Digital I/O</td><td>LineSelector (12P) : GPIO IN / GPIO OUT</td></tr>
<tr><td>Black Level Adjustment</td><td>
<table>
<tr><td>Default Level</td><td>8LSB@8bit</td></tr>
<tr><td rowspan="3">Video Level Adjustment Range</td><td>DigitalAll : -133 ~ +255 LSB @12bit</td></tr>
<tr><td>DigitalRed : - 64 ~ +64 LSB @12bit</td></tr>
<tr><td>DigitalBlue : -64 ~ +64 LSB @12bit</td></tr>
<tr><td>Resolution Adjustment</td><td>1LSB@12bit</td></tr>
</table>
</td></tr>
<tr><td>Gain Adjustment</td><td>
<table>
<tr><td rowspan="2">Manual Adjustment Range</td><td>MasterMode</td><td>AnalogAll : 0dB ~ 18dB
AnalogRed : -6.5dB ~ 12dB
AnalogBlue : -6.5dB ~ 12dB
DigitalRed : -0.915dB ~ 0.828dB
DigitalBlue : -0.915dB ~ 0.828dB</td></tr>
<tr><td>IndividualMode</td><td>AnalogAll : 0dB ~ 36.13dB
AnalogRed : 0dB ~ 36.13dB
AnalogBlue : 0dB ~ 36.13dB
DigitalRed : -0.915dB ~ 0.828dB
DigitalBlue : -0.915dB ~ 0.828dB</td></tr>
<tr><td>Auto Gain</td><td colspan="2">Off, Continuous, Once</td></tr>
</table>
</td></tr>
<tr><td>White Balance</td><td>
<table>
<tr><td rowspan="2">White Balance Gain</td><td>AnalogRed, AnalogBlue : -6.5dB ~ 12dB</td></tr>
<tr><td>DigitalRed, DigitalBlue : -0.915dB ~ 0.828dB</td></tr>
<tr><td>Balance White Auto</td><td>Off, Continuous, Once, ExposureContinuous, ExposureOnce, Preset3200K, Preset5000K, Preset6500K, Preset7500K</td></tr>
<tr><td>Photometry Area</td><td>16 (4 x 4) Area</td></tr>
<tr><td>Adjustment Range</td><td>3000K ~ 9000K</td></tr>
</table>
</td></tr>
<tr><td>Blemish Correction</td><td>
<table>
<tr><td>Detection</td><td>Detect white blemishes using threshold values (100 steps available) (black blemish correction performed only at factory)</td></tr>
<tr><td>Correction</td><td>Interpolation using adjacent pixels (continuous blemishes not corrected)</td></tr>
<tr><td>Correctable Pixels</td><td>200 pixels per sensor</td></tr>
</table>
</td></tr>
<tr><td>ALC</td><td>Can be adjusted automatically together with AGC and auto exposure control</td></tr>
<tr><td>Gamma</td><td>0.45、0.5、0.55、0.6、0.65、0.75、0.8、0.9、1.0 (9 steps available)</td></tr>
<tr><td>LUT</td><td>OFF: γ = 1.0, ON = 257 points can be set</td></tr>
</table>

<table>
<tr><th>Item</th><th colspan="3">Description</th></tr>
<tr><td>Vibration resistance</td><td colspan="3">3G (20 Hz ~ 200 Hz X-Y-Z direction)</td></tr>
<tr><td>Impact resistance</td><td colspan="3">50G</td></tr>
<tr><td>Power supply</td><td colspan="3"><table>
<tr><td rowspan="2">12-pin</td><td>Input Range</td><td>DC + 12 V ~ + 24 V ± 10 % (via Input Terminal)</td></tr>
<tr><td>Consumption</td><td>5.4 W (typ.) (at 12V input, full pixel, Default setting, Environmental Temperature 25 °C) , 7.0W (max.)</td></tr>
<tr><td rowspan="2">PoE</td><td>Input Range</td><td>DC + 36 V ~ + 57 V</td></tr>
<tr><td>Consumption</td><td>7.5 W (typ.) (at 12V input, full pixel, Default setting, Environmental Temperature 25 °C) , 8.7W (max.)</td></tr>
</table></td></tr>
<tr><td>Lens Mount</td><td colspan="3">C-mount Lens mount protrusion length of 4 mm or less is supported</td></tr>
<tr><td>Flange back</td><td colspan="3">17.526, tolerance: 0 mm to -0.05 m</td></tr>
<tr><td>Optical filter</td><td colspan="3">IR Cut Filter</td></tr>
<tr><td>Verified performance temperature / humidity</td><td colspan="3">− 5°C ~ + 45°C / 20 % ~ 80 % (non-condensing)</td></tr>
<tr><td>Storage temperature / humidity</td><td colspan="3">− 25°C ~ + 60°C / 20 % ~ 80 % (non-condensing)</td></tr>
<tr><td>Regulations</td><td colspan="3">CE (EN61000-6-2 and EN61000-6-3) , FCC part 15 class B, RoHS, WEEE, KC</td></tr>
<tr><td>Dimensions (housing)</td><td colspan="3">44 × 44 × 84 mm (WHD) (excluding mount protrusions)</td></tr>
<tr><td>Weight</td><td colspan="3">200 g</td></tr>
</table>

Notes:

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

Cautions:

About the verified performance temperature:

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

- The camera's internal temperature should not exceed 72°C during operation.
- The top surface of the camera's should not exceed 57°C.

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

Frame Rate Reference (Theoretical value)

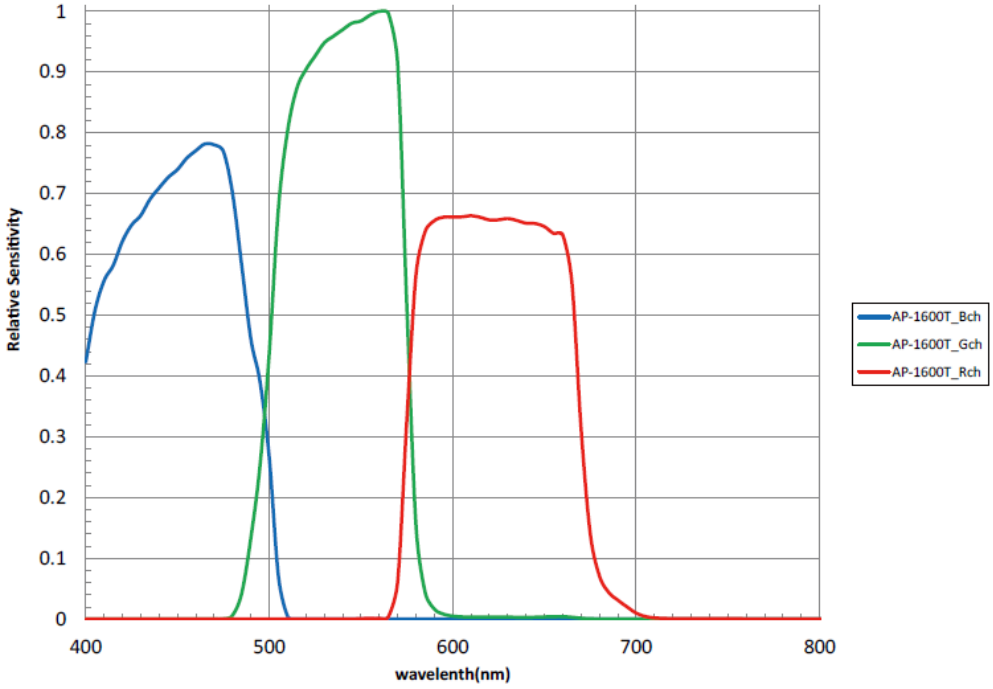
AP-1600T-PGE

Pixel Count	Resolution (Screen Size)	ROI/Binning	PixelSize (µm)	Image Size (mm)	Frame Rate
1.6 MP	1456 × 1088	Full Pixel	3.45 × 3.45	5.02 x 3.75 (6.27)	24.2 fps (@24 bit)
1.3 MP	1280 × 1024	ROI	3.45 × 3.45	4.42 x 3.53 (5.66)	29.2 fps (@24bit)
0.5 MP	800 × 600	ROI	3.45 × 3.45	2.76 x 2.07 (3.45)	79.8 fps (@24bit)
0.3 MP	640 × 480	ROI	3.45 × 3.45	2.21 x 1.66 (2.76)	124.8 fps (@24bit)
0.3 MP	640 × 480	ROI + 2x2 Binning	6.9 × 6.9	4.42 x 3.31 (5.52)	124.8 fps (@24bit)

AP-3200T-PGE

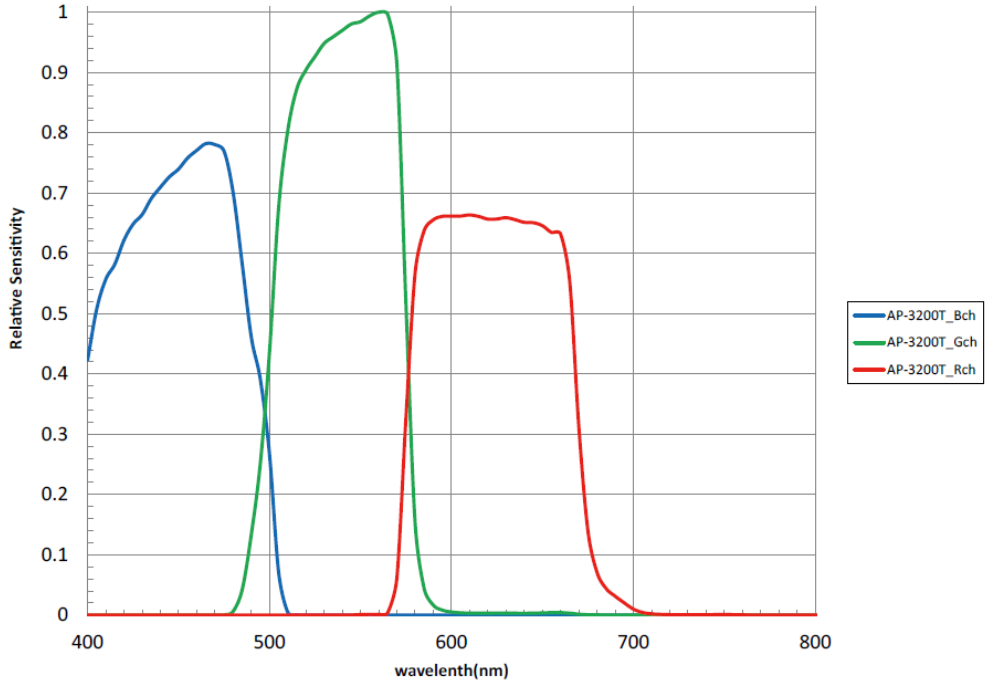
Pixel Count	Resolution (Screen Size)	ROI/Binning	PixelSize (µm)	Image Size (mm)	Frame Rate
3.2 MP	2064 × 1544	Full Pixel	3.45 × 3.45	1/1.8" (8.89 mm)	12.0 fps (@24 bit)
2 MP	1920 × 1080	ROI	3.45 × 3.45	1/2" (7.6 mm)	18.5 fps (@24 bit)
1.3 MP	1280 × 1024	ROI	3.45 × 3.45	1/2.8" (5.66 mm)	29.2 fps (@24 bit)
0.5 MP	800 × 600	ROI	3.45 × 3.45	1/4.6" (3.45 mm)	79.8 fps (@24 bit)
0.5 MP	800 × 600	ROI + 2 × 2 Binning	6.9 × 6.9	1/2.3" (6.9 mm)	39.9 fps (@24 bit)
0.3 MP	640 × 480	ROI	3.45 × 3.45	1/5.75" (2.76 mm)	124.8 fps (@24 bit)
0.3 MP	640 × 480	ROI + 2 × 2 Binning	6.9 × 6.9	1/2.9" (5.52 mm)	62.4 fps (@24 bit)

Spectral Response (AP-1600T-PGE)

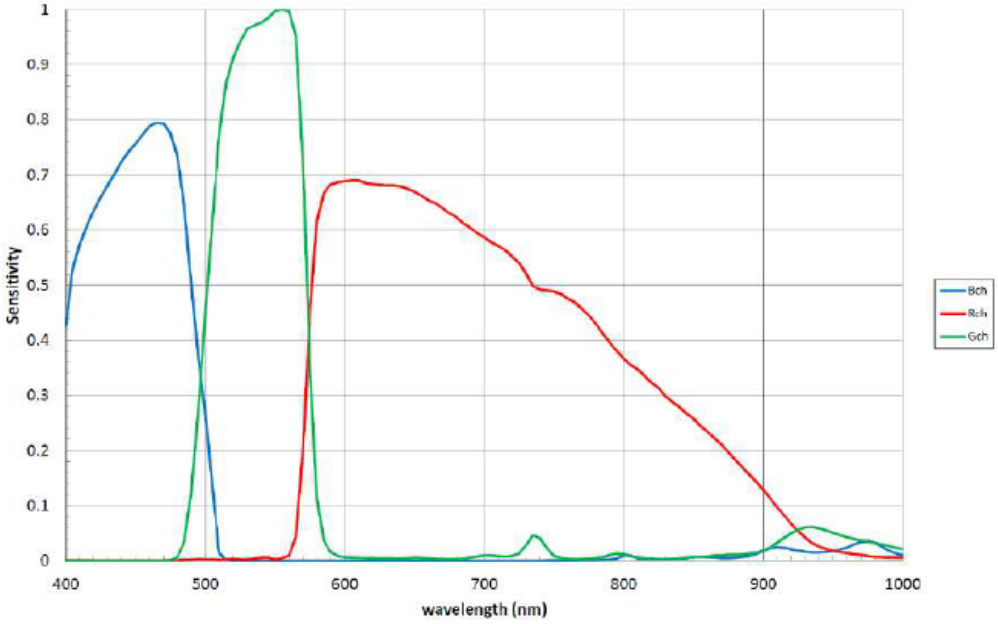


Spectral Response (AP-3200T-PGE)

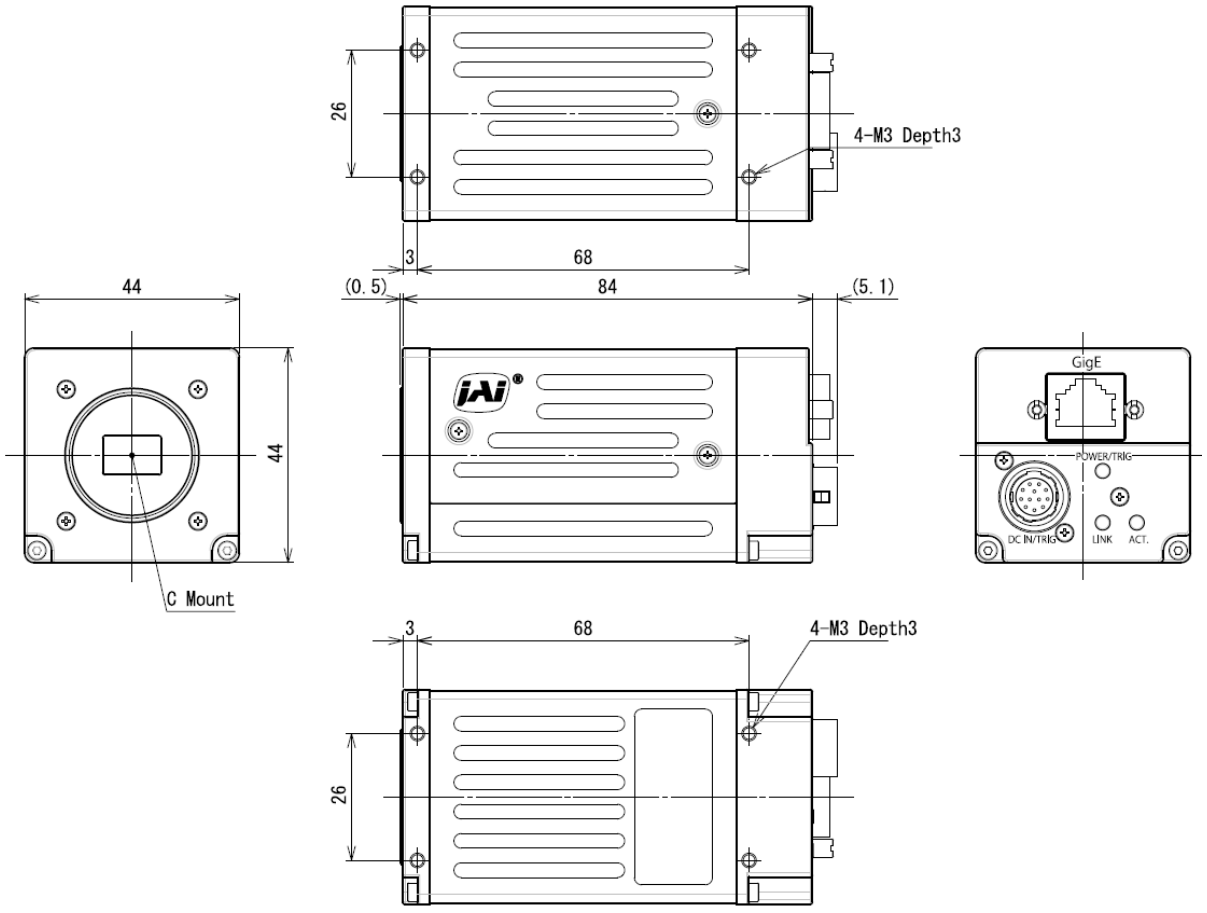
AP-3200T-PGE



AP-3200T-PGE-NF



Dimensions



Notes:

- Dimensional tolerance: ± 0.3mm
- Unit: mm

Comparison of the Decibel Display and Multiplier Display

Decibels (dB)	Multipliers (×)	Remarks
-6	0.501	Near minimum value of Gain[AnalogRed/AnalogBlue] 1)
-5	0.562	
-4	0.631	
-3	0.708	
-2	0.794	
-1	0.891	Near minimum value of Gain[DigitalRed/DigitalBlue] 2)
0	1	Minimum value of Gain[AnalogAll] Minimum value of Gain[AnalogIndividualRed/Green/Blue]
1	1.122	Near maximum value of Gain[DigitalRed/DigitalBlue] 3)
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	Near maximum value of Gain[AnalogRed/AnalogBlue] 4)
13	4.467	
14	5.012	
15	5.623	
16	6.31	
17	7.0790	
18	7.943	Near maximum value of Gain[AnalogAll] 5)
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	

Decibels (dB)	Multipliers (×)	Remarks
32	39.811	
33	44.668	
34	50.119	
35	56.235	
36	63.096	Near maximum value of Gain[AnalogIndividualRed/Green/Blue] 6)

Notes:

- 1) Actual minimum value is 47 (×0.47, -6.558 dB).
- 2) Actual minimum value is 90 (×0.9, -0.915 dB).
- 3) Actual maximum value is 110 (×1.1, +0.828 dB).
- 4) Actual maximum value is 400 (×4.0, +12.041 dB).
- 5) Actual maximum value is 800 (×8.0, +18.06 dB).
- 6) Actual maximum value is 6400 (×64.0, +36.123 dB).

User's Record

Model name: ……

Revision: ……

Serial No: ……

Firmware version: ……

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

Revision History

Revision	Date	Device Version	Changes
2.0	2024/03/28	DV0110	Combined the AP-1600T-PGE and AP-3200T-PGE user manuals. Added the following topics: "PTP (Precision Time Protocol)", "Acquisition Control (ActionControl)", "Event Control Function (EventControl)". Added ALCControlReference and ALCControlChannel (JAI CustomControlALC) and updated the "ALC (Automatic Level Control) " topic. Added the KC information (Certifications). Updated China RoHS. Corrected/updated topics, including Binning Function, GPIO (Digital Input/Output Settings), and Video Process Bypass Mode.

Previous Revisions

AP-1600T-PGE

Revision	Date	Changes
1.2	July 2022	Corrected the China RoHS information.
1.1	Jan. 2020	Timing Chart
1.0	Apr. 2018	First Version

AP-3200T-PGE

Revision	Date	Changes
1.3	Dec. 2022	Added the AP-3200T-PGE-NF model.
1.2	July 2022	Corrected the China RoHS information.
1.1	Jan. 2020	Timing Chart
1.0	Apr. 2018	First Version

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