



See the possibilities

# Tentative Version

# User Manual

*Wave Series SWIR Area Scan Cameras*

**WAA-1300-GE-TEC**



**High Performance SWIR Cameras with GigE Interface**

**Document Version: Tentative**

**Date: 2026-06-15**

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

<b>Table of Contents</b> .....	<b>2</b>
About Technical Note .....	5
<b>Notice and Warranty</b> .....	<b>6</b>
Notice .....	6
Warranty .....	6
Certifications .....	6
CE Compliance .....	6
FCC .....	6
Warning .....	7
KC .....	7
China RoHS .....	8
<b>Usage Precautions</b> .....	<b>9</b>
Notes on Cable Configurations .....	9
Notes on Attaching the Lens .....	9
Notes on LAN Cable Connection .....	9
Phenomena Specific to InGaAs Image Sensors .....	10
Notes on Exportation .....	10
<b>Features</b> .....	<b>11</b>
Package Contents .....	11
<b>Parts Identification</b> .....	<b>12</b>
Lens Mount (C-Mount) .....	12
Connectors .....	12
RJ-45 Connector .....	12
DC IN / TRIG Connector (12-Pin Round) .....	13
LED .....	14
POWER/TRIG LED .....	14
LINK LED .....	15
ACT LED .....	15
Mounting Holes .....	15
<b>Preparation</b> .....	<b>16</b>
Step 1: Install the Software (First Time Only) .....	16

Step 2: Connect Devices .....	17
1. Lens .....	17
2. Mounting .....	17
3. LAN Cable .....	18
4. Network Card .....	18
5. DC IN / Trigger IN Connection Cable .....	18
6. AC Adapter (Power Supply) (If Necessary) .....	19
Step 3: Verify Camera Operation .....	19
Step 4: Verify the Connection Between the Camera and PC .....	19
Step 5: Change the Camera Settings .....	22
Step 6: Adjust the Image Quality .....	23
Step 7: Save the Settings .....	25
<b>Main Functions .....</b>	<b>26</b>
Pixel Format .....	26
Change the Frame Rate .....	27
Max Frame Rates (Approximate) .....	27
Image Flip Function .....	28
Binning Function .....	28
ROI Settings .....	30
Gain Controls .....	31
Black Level Function .....	32
Gamma Function .....	32
LUT (Lookup Table) .....	33
Brightness Control .....	34
Contrast Control .....	35
Spatial Noise Reduction Control .....	36
Defective Pixel Correction (DPC) .....	37
Flat Field Correction (FFC) .....	39
<b>Miscellaneous .....</b>	<b>42</b>
Troubleshooting .....	42
Power Supply and Connections .....	42
Image Display .....	42
Settings and Operations .....	42

Specifications .....	43
Spectral Response .....	45
Dimensions .....	46
<b>Revision History .....</b>	<b>47</b>

## About Technical Note

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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 and Warranty

This section describes the notice and warranty of the camera.

## Notice

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

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

## Warranty

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

## Certifications

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### CE Compliance

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

Models	Comply with
WAA-1300-GE-TEC	EN 55032:2015+ A1 + A11 EN 55035:2017+ A11 EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019

### FCC

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference 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.

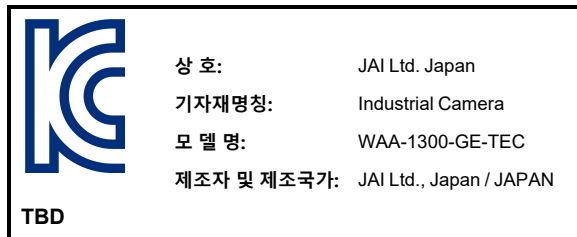
## Warning

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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

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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)
WAA-1300-GE-TEC	×	○	○	○	○	○

○: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

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

## Notes on Attaching the Lens

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### Technical Notes

#### How to Clean a Sensor

### Avoiding Dust Particles

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

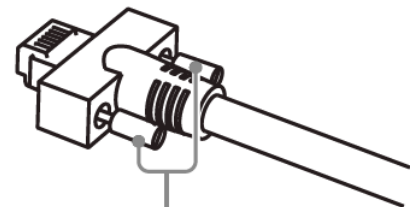
- Work in a clean environment.
- Do not remove the caps from the camera and lens until immediately before you attach the lens.
- To prevent dust from adhering to surfaces, point the camera and lens downward and do not allow the lens surface to come into contact with your hands or other objects.
- Always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

## Notes on LAN Cable Connection

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

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.

## Phenomena Specific to InGaAs Image Sensors

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The following phenomena are known to occur on cameras equipped with InGaAs 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 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.
- **Response Non-Uniformity (Fixed pattern noise):** Owing to inherent constraints in the manufacturing process, subtle discrepancies exist in the photo response characteristics of individual sensor pixels, which manifests as fixed columnar or linear artifacts in the image.
- **Dark Current Temperature Dependence:** As temperature rises, the dark current of the sensor increases exponentially. In dark-field imaging, this manifests as snowflake noise or striped noise on the video monitor screen, and the noise intensifies significantly with increasing temperature.
- **Pixel Cross-talk:** Infrared photons have a long diffusion distance in InGaAs material, which easily causes signal interference between adjacent pixels. It is intuitively reflected in blurred image edges and aliasing of fine textures (similar to details sticking together and being indistinguishable).
- **Defective pixels:** Defective pixels (white and black pixels) of the InGaAs 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

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

# Features

This camera is a high performance Visible + SWIR wide waveband area scan camera with TEC cooling. The interface is 1000BASE-T GigE Vision (Specification v2.0) . The table below shows the basic information of the camera.

Model Name	Image Sensor	Effective Pixels	Pixel Size	Max Frame Rate
WAA-1300-GE-TEC	InGaAs	1280 x 1024	5 $\mu\text{m}$ x 5 $\mu\text{m}$	90fps

## Features Overview

- Video output: Mono8, Mono10, Mono10p, Mono12, Mono12p
- Supports ROI, Binning and image flip
- Image calibration functions include FFC (Flat Field Correction), DPC (Defective Pixel Correction), brightness control, contrast control, spatial noise reduction control, black level control, gamma and LUT
- Exposure time range: 3 $\mu\text{s}$ ~983ms exposure control in 1 $\mu\text{s}$  step
- Dynamic Range (DR): 56dB (TBD)
- Signal-to-Noise Ratio (SNR): 50dB (TBD)
- Supports TEC cooling
- Lens mount: C-Mount

## Package Contents

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- Camera body (1)
- Dear Customer (sheet) (1)

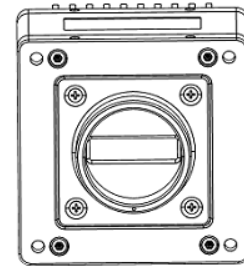
# Parts Identification

This section describes the lens mount, connectors, LEDs, and mounting holes of this camera.

## Lens Mount (C-Mount)

Mount a C-mount lens here.

- Back flange distance: 17.526 mm
- Thread pitch: 0.794 mm



**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

This section explains the connectors on this camera.

### RJ-45 Connector

Connect a LAN cable to the RJ-45 connector.

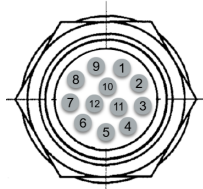
- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- Refer to the specifications of the cable for details on its bend radius.

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

	Pin No.	IO	Signal
<p><b>GigE Vision Interface (RJ45 with Locking Screws)</b></p>	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 / TRIG Connector (12-Pin Round)

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



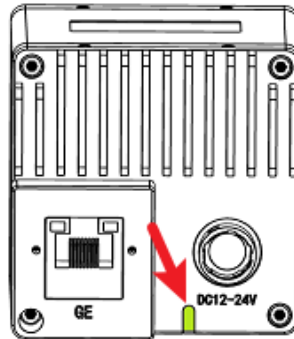
### WAA-1300-GE-TEC (Camera Side: HR10A-10R-12PB (71))








Pin No.	Input/Output	Signal	Description
1	GND	GND	Power Ground
2	Power IN	DC_PWR	Power In, DC+12V to 24V
3	Input	RS422_0_RX_A	Differential Input Positive
4	Input	RS422_0_RX_B	Differential Input Negative
5	Input	RS422_1_RX_A	Differential Input Positive
6	Input	RS422_1_RX_B	Differential Input Negative
7	Input	OPT_IN	Optocoupler isolated input
8		OPT_IN_GND	Optocoupler isolated input GND
9	Output	OPT_OUT	Optocoupler Isolated Output
10		OPT_OUT_GND	Optocoupler Isolated Output GND
11	Bidirectional IO	GPIO1_A	Multiplexed single-ended trigger I/O. Functions as either input or output, but not both simultaneously.
12	Bidirectional IO	GPIO1_B	Multiplexed single-ended trigger I/O. Functions as either input or output, but not both simultaneously.

## LED

### POWER/TRIG LED



Indicates the power and trigger status.






	LED	Status
	Solid orange	Camera initializing
	Solid green	Idle, waiting for image capture
	Blinking green (rapid)-100ms	Image acquisition in free run mode
	Blinking green (slow)-1000ms	Image acquisition in trigger mode
	Solid red	Fault
	Alternating between green and red -500ms	Firmware update
	Blinking red (rapid)-100ms	Link abnormal

## LINK LED

Indicates whether the GigE network connection is established or not.

LED		Status
	Off	The network link is not established
	Solid orange	1G Link is established

## ACT LED

LED		Status
	Off	No network connection established, or no physical connection
	Blinking green	(Tx) Network communication in progress (Rx) Network communication in progress
	Solid green	Link idle, no data transmission

## Mounting Holes

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

Location	Description
Front	M3, Depth 3mm
Top	M3, Depth 3mm
Bottom	M3, Depth 3mm
Side	M3, Depth 3mm

**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.

<b>1</b>	<b><u>Step 1: Install the Software (First Time Only)</u></b> Install the software for configuration and controlling the camera (eBUS SDK for JAI) on the computer.
<b>2</b>	<b><u>Step 2: Connect Devices</u></b> Connect the lens, LAN cable, AC adapter, computer, and other devices.
<b>3</b>	<b><u>Step 3: Verify Camera Operation</u></b> Verify whether the camera is turned on and ready for use.
<b>4</b>	<b><u>Step 4: Verify the Connection Between the Camera and PC</u></b> Verify whether the camera is properly recognized.
<b>5</b>	<b><u>Step 5: Change the Camera Settings</u></b> Refer to the procedure for changing the output format setting as an example and change various settings as necessary.
<b>6</b>	<b><u>Step 6: Adjust the Image Quality</u></b> Perform basic settings for image quality.
<b>7</b>	<b><u>Step 7: Save the Settings</u></b> Save the current setting configurations in user memory.

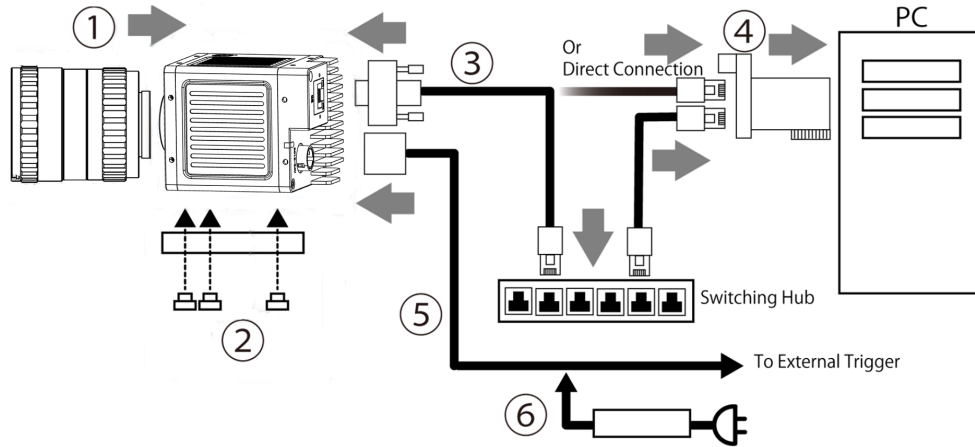
## Step 1: Install the Software (First Time Only)

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

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

1. Download the eBUS SDK for JAI from the [JAI website](#).
2. Install eBUS SDK for JAI on the computer.

## Step 2: Connect Devices



1. Lens

3. LAN Cable

5. DC IN / Trigger IN Connection Cable

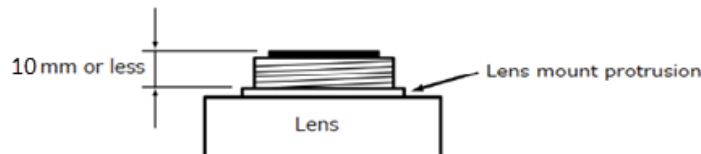
2. Mounting

4. Network Card

6. AC Adapter (Power Supply) (If Necessary)

### 1. Lens

C-mount lenses with lens mount protrusions of 10 mm or less can be attached.



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

### 2. Mounting

When mounting the camera directly to a device, use screws that match the mounting holes on the camera. ([Mounting Holes](#))

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

### 3. LAN Cable

Connect a LAN cable to the RJ-45 connector.

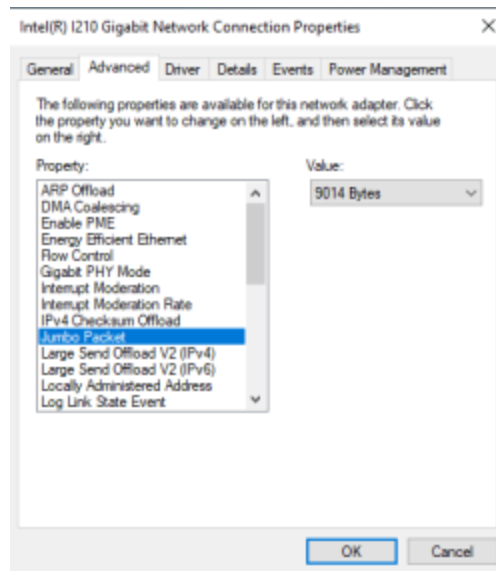
- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- Use a LAN cable that is STP cable.
- Refer to the specifications of the cable for details on its bend radius.

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

### 4. Network Card

Install this in the computer that will be used to configure and operate the camera, or use the computer's built-in Gigabit network card. Refer to the instruction manual of the network card, and configure settings on the computer as necessary.

Ensure to set 9014 Bytes for “Jumbo Packet” (in the network card properties).



### 5. DC IN / Trigger IN Connection Cable

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

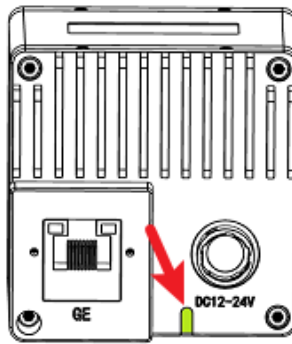
**Note:** Refer to the [DC IN / TRIG Connector \(12-Pin Round\)](#) topic as well.

## 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

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

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

### Step 4: Verify the Connection Between the Camera and PC

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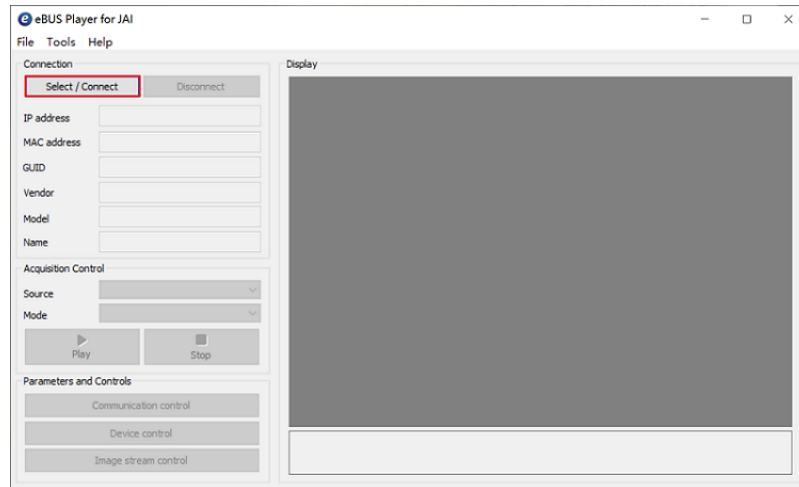
Verify whether the camera is properly recognized via Control Tool.

1. Launch eBUS Player for JAI.

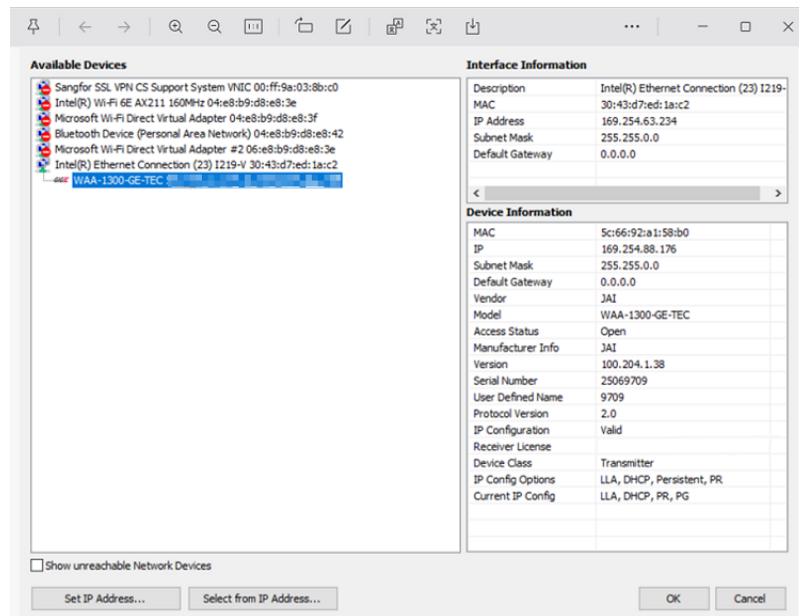


eBUS Player for JAI startup screen appears.

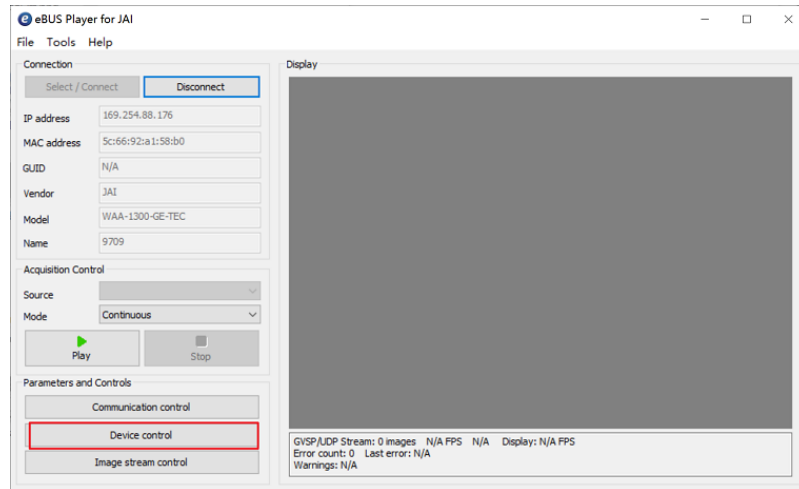
2. Select the camera you want to configure. Click the **Select / Connect** button.



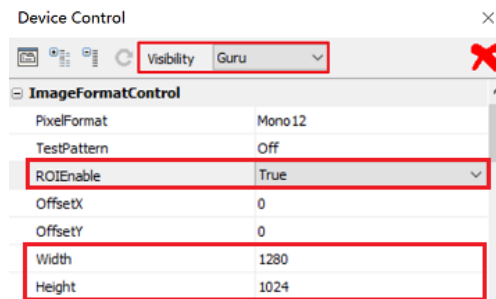
3. The connected camera is listed. Please select one camera and click **ok**.



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



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



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

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.

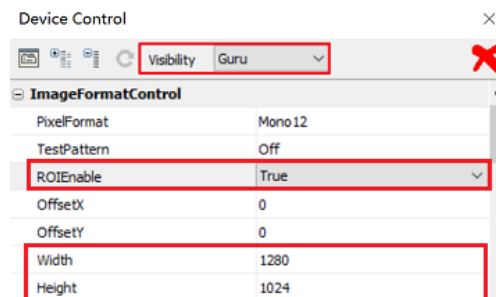
#### Factory Default Values (ImageFormatControl)

Item	Default Value
Width	1280
Height	1024
OffsetX	0
OffsetY	0
PixelFormat	Mono12

You can specify the image acquisition area. For details, see [ROI Settings](#).

### ■ Example: Configure the Width & Height of ImageFormatControl

The width and height parameters can only be configured when **ROIEnable** is **True**. Select the item after enabling ROI, you can change the value as shown below.



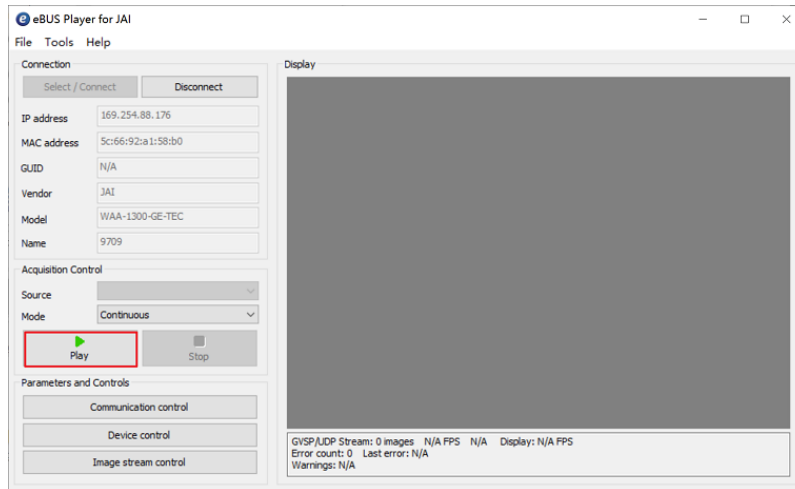
**Note:** Depending on the setting item, the user needs to change visibility. Please switch visibility (Beginner / Expert / Guru) as necessary.

## Step 6: Adjust the Image Quality

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 right area.



### ■ Adjust the FrameRate

Adjust the frame rate according to the system requirements using the **Acquisition Control** function. By selecting the item of **Acquisition Frame Rate**, you can change the value as shown below.

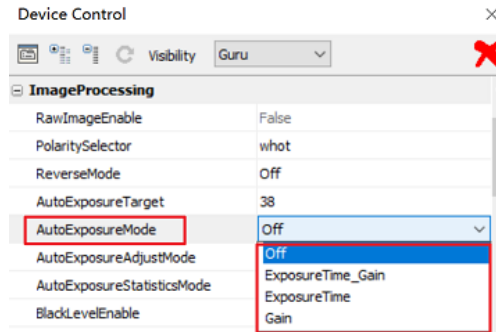
AcquisitionControl	
AcquisitionMode	Continuous
AcquisitionFrameCount	1
MultiFrameAcquisitionCommand	MultiFrameAcquisitionCommand
AcquisitionFrameRate	20 Hz
ExposureTime	2000 us

**Note:** If the camera's trigger mode is **On**, its frame rate will be adjusted according to the external trigger source.

## Adjust Exposure Time

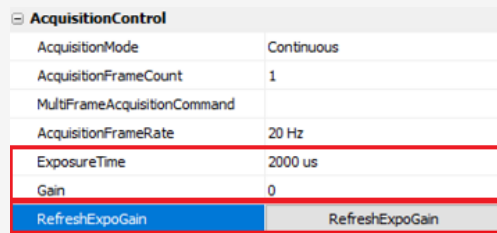
### 1. Automatic Adjustment:

**AutoExposureMode** is set to any mode other than **Off**, the **ExposureTime** and/or **Gain** will update automatically.



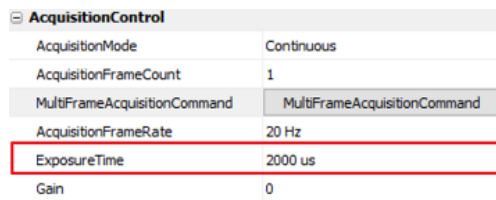
#### Notes:

- ExposureTime** and **Gain** parameters' changes can be viewed via **RefreshExpoGain**.
- By selecting **RefreshExpoGain**, the values could be viewed with **ExposureTime** and **Gain** as shown below.



### 2. Manual Adjustment

By selecting the item of **Exposure Time**, you can change the value as shown below.

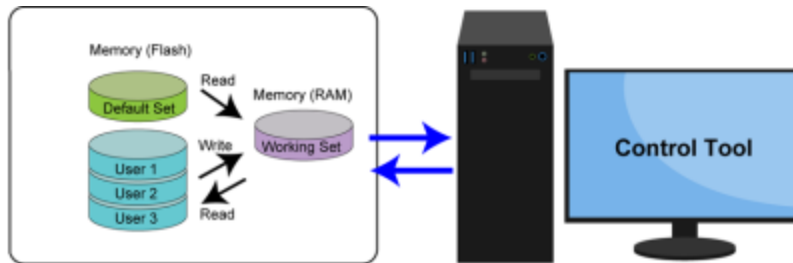


**Note:** Exposure time can only be adjusted when **AutoExposureMode** is **Off** or **Gain**.

## Step 7: Save the Settings

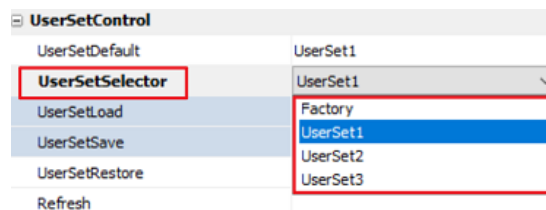
The setting values configured in eBUS player for JAI will be deleted when the camera is turned off. By saving current setting values to user memory, you can load and recall them whenever necessary. You can save up to three sets of user settings in the camera. (UserSet1 to 3)

**Note:** Changes to settings are not saved to the computer.

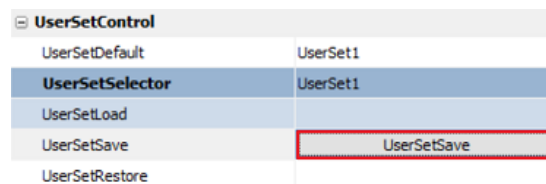


### To Save User Settings

1. Stop image acquisition.
2. Expand **User Set Control** and select the save destination (UserSet1, UserSet2, UserSet3) in **User Set Selector**.



3. Select **User Set Save** and click the **UserSetSave** button.



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



## Change the Frame Rate

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When **TriggerMode** is set to **Off**, you can set the frame rate using **AcquisitionFrameRate**.

**Note:** You can also save the setting, and have it applied whenever the power is subsequently turned on, but this requires additional operations. ([Step 7: Save the Settings](#))

## Max Frame Rates (Approximate)

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Below are the maximum frame rates at various settings.

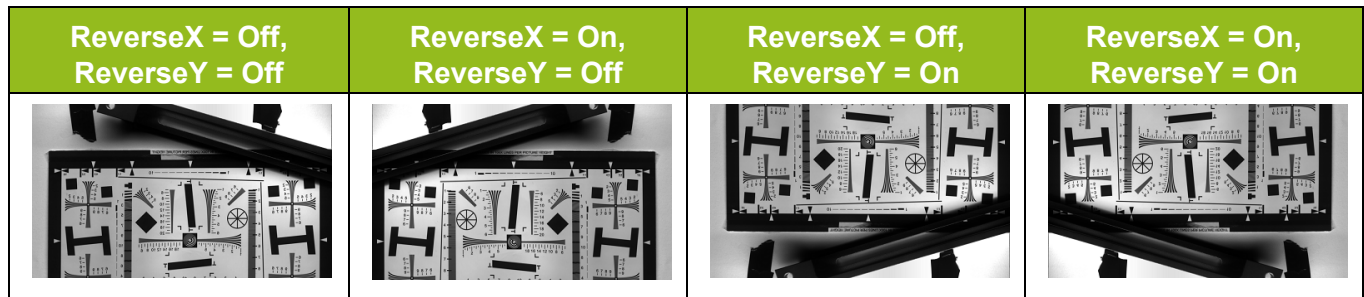
Width	Height	Mono8	Mono10	Mono12
16~1280	8	1848fps	924fps	924fps
	16	1602fps	801fps	801fps
	24	1413fps	706fps	706fps
	32	1264fps	632fps	632fps
	64	890fps	445fps	445fps
	120	586fps	293fps	293fps
	128	558fps	279fps	279fps
	240	338fps	169fps	169fps
	256	320fps	160fps	160fps
	480	183fps	91fps	91fps
	512	172fps	86fps	86fps
	600	149fps	74fps	74fps
	640	140fps	70fps	70fps
	720	125fps	62fps	62fps
	768	118fps	59fps	59fps
1024	90fps	45fps	45fps	

### Notes:

1. Only Height variations affect the frame rate, Width variations do not affect the frame rate. For details, see [ROI Settings](#).
2. The maximum frame rate values are tentative. For final values, please refer to User Manual Version 1.0 or later.

## Image Flip Function

The ReverseX and ReverseY function allows you to flip an image horizontally, vertically, or diagonally.



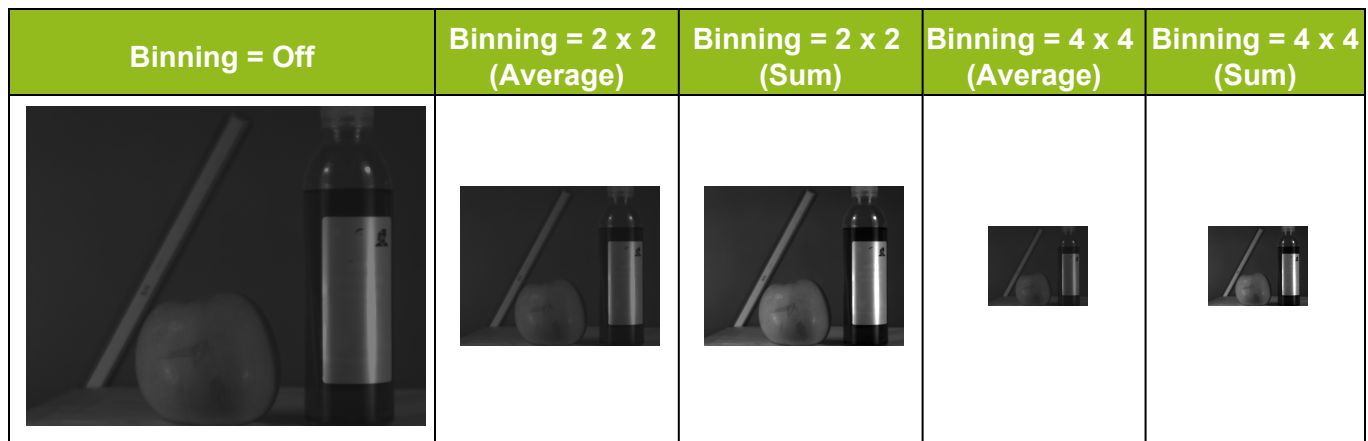
### How to Configure

1. Only Check **ReverseX** to enable the ReverseX settings to flip image horizontally.
2. Only Check **ReverseY** to enable the ReverseY settings to flip image vertically.
3. Check both **ReverseX** and **ReverseY** settings to flip image diagonally.

## Binning Function

The Binning function combines signal values from clusters of adjacent pixels to create larger, virtual pixels. This process reduces the image's pixel resolution while offering two key benefits:

- **Sum mode:** Increases sensitivity by summing pixel values.
- **Average mode:** Reduces noise by averaging pixel values.

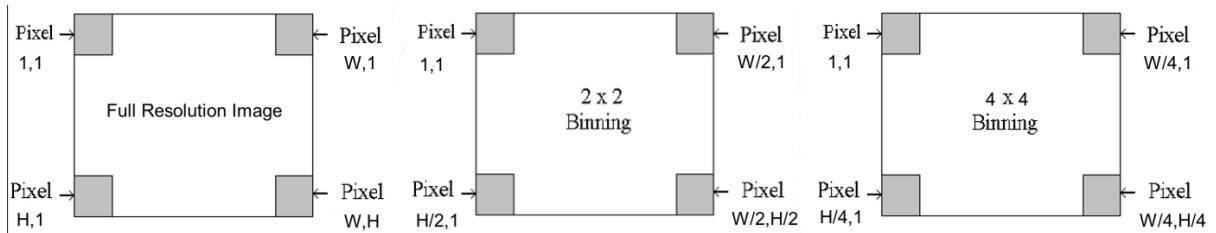


## How to Configure

1. Check **BinningEnable** to enable the Binning function.
2. Select **BinningMode: Average** (default), **Sum**.
3. Select **BinningSelector: 2 x 2** (default), **4 x 4**.

**Caution:** Binning Selector can only be adjusted when image acquisition on the camera is stopped.

## PixelSize, Resolution



Binning Off	Binning 2 x 2	Binning 4 x 4
PixelSize: 5 μm x 5 μm	PixelSize: 10 μm x 10 μm	PixelSize: 20 μm x 20 μm
Resolution: 1280 x 1024	Resolution: 640 x 512	Resolution: 320 x 256

### Notes:

1. Binning and ROI cannot be enabled simultaneously.
2. Enabling Binning does not change the frame rate.

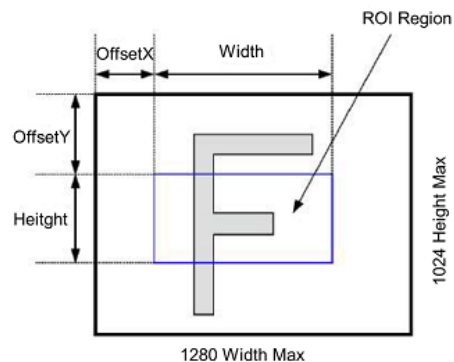
## ROI Settings

ROI refers to a selected pixel region on the sensor. During image acquisition, only pixel data within this region is transmitted to the PC while invalid data regions are skipped. This reduces the readout time and consequently increases the frame rate.

For some applications the user may not need the entire image, but only a portion of it. ROI function can accommodate this requirement.

### How to Configure

Specify the ROI by specifying width, height, and horizontal/vertical offset values.



1. Check **ROIEnable** to enable the ROI function. After enabling this function, the ROI region size of the camera can be configured via width, height, offsetX, and offsetY values.
2. **OffsetX**: Specify the horizontal offset value. Range: 0 ~ m (m + **Width** = 1280, m changes with **Width**), step: 16.
3. **OffsetY**: Specify the vertical offset value. Range: 0 ~ n (n + **Height** = 1024, n changes with **Height**), step: 8.
4. **Width**: Specify the ROI width value. Range: 16 ~ 1280, step: 16.
5. **Height**: Specify the ROI height value. Range: 8 ~ 1024, step: 8.

**Caution:** All the adjustment about ROI can only be adjusted when image acquisition on the camera is stopped.

#### Notes:

1. ROI and Binning cannot be enabled simultaneously.
2. When **ROIEnable** is True, the image resolution is reduced, resulting in an increase in the camera's maximum frame rate. For details, see [Max Frame Rates \(Approximate\)](#).
3. Only changes in **Height** affect the camera's maximum frame rate.

## Gain Controls

---

The camera provides two types of gain controls to adjust image brightness according to the application environment. Each gain method has different characteristics in terms of precision, and noise impact.

### ■ Gain

**Gain** is the camera's analog gain. All pixels in the sensor are affected by this setting.

The setting range is 0~180 (step: 1), corresponds to 0dB ~ 18dB, default: 0.

### ■ DigitalGain

Applied after digitization, digital gain multiplies the image signal numerically to fine-tune brightness.

The setting range is 181 ~ 420 (step: 1), corresponds to 18.1dB ~ 42dB.

#### **Cautions:**

When the gain is set in the range of 0 to 180 (0dB ~ 18dB), only analog gain is enabled. When the setting range is 181 to 420 (18.1dB ~ 42dB), both analog gain and digital gain take effect. The actual relationship is as below:

- 0 ~ 180 (0dB ~ 18dB): Analog gain only.
- 181 ~ 420 (18.1dB ~ 42dB): Analog gain (18 dB) + Digital gain (0.1 dB ~ 24 dB).

## Black Level Function

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The black level defines the reference signal level for "black" in an image. Proper black level adjustment is essential for maintaining image contrast, dynamic range, and noise suppression.

Applies a uniform offset (BlackLevel) across the entire image. No pixel-level or noise-adaptive correction is performed. This mode is recommended for applications that operate under stable lighting conditions where simple brightness adjustment is sufficient.

Enable Black Level when you want to adjust the overall brightness of the image with a fixed offset.

### How to Configure

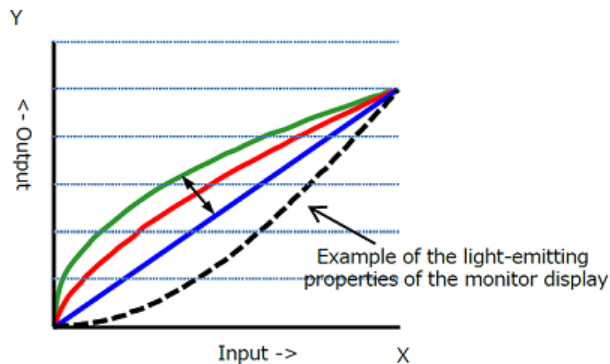
1. Check **BlackLevelEnable** to enable the black level.
2. Specify the black level adjustment value using **BlackLevel**. The setting range is -1023 ~ +1023 (step: 1). A negative value darkens the image, while a positive value brightens it.

## Gamma Function

---

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

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



### How to Configure

Set the Gamma value in **Gamma**. The setting range is from 0.1 to 5.0 (step: 0.1, default: 1)

**Note:** Set the Gamma value to less than 1 to increase image brightness, or greater than 1 to decrease it.

## LUT (Lookup Table)

---

The LUT (Look-Up Table) function allows you to apply a non-linear mapping between the sensor's captured signal values and the output values from the camera. This is useful for adjusting image tone, contrast, or dynamic range to suit specific application needs.

### ■ How to Configure

The camera supports three default LUT options, giving users the flexibility to optimize image output for a variety of industrial scenarios.

1. Check **LUTEnable** to enable the LUT settings.
2. Choose an option using **LUTMode**.
  - **GlareSuppression**: Reduces highlights in brightly lit scenes to prevent overexposure and detail loss. This option is ideal for environments with high-intensity LED lighting, and/or highly reflective metal or glossy surfaces
  - **BlacklightCompensation**: Enhances visibility in backlit scenes by lifting shadow areas. This option is ideal for objects darker than the background, and/or applications involving backlight inspection.
  - **HDR**: Expands dynamic range by balancing highlights and shadows to preserve detail. This option is ideal for high-contrast scenes, and/or inspections requiring fine gradation detection.

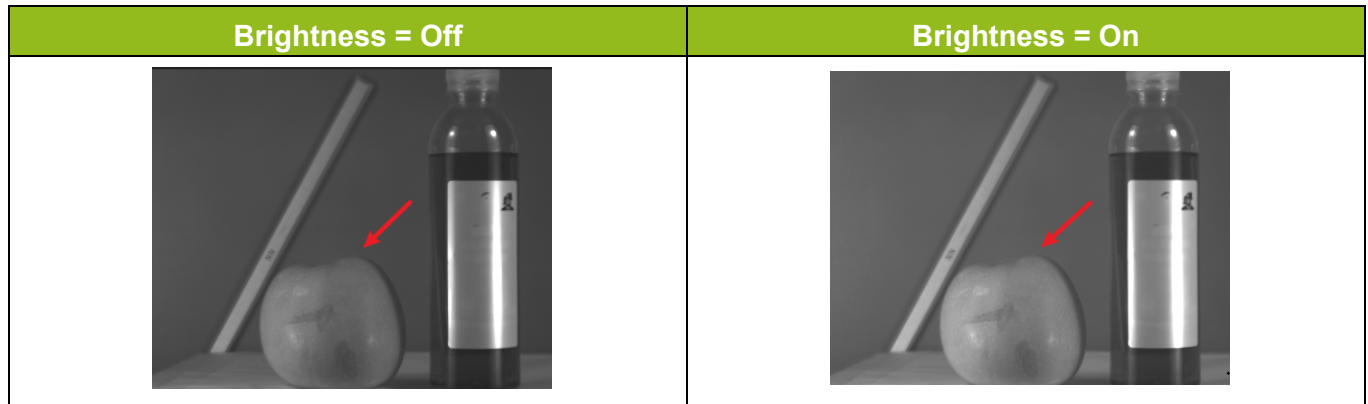
## Brightness Control

---

Due to limitations of the lighting scene, an image may have properly exposed bright areas while dark areas remain too dim. You can adjust the Brightness to optimize visual performance.

This function enhances details in dark regions without causing highlight overexposure, thus preserving more highlight information and improve the image dynamic range.

However, it will slightly reduce the image contrast. Therefore, it is recommended to use the **Brightness** and **Contrast Control** ([Contrast Control](#)) together in most scenarios.



### How to Configure

1. Check **BrightnessEnable** to enable the Brightness.
2. Specify the brightness adjustment value using **Brightness**. The setting range is -100 ~ +100 (step: 1). A negative value darkens the image, while a positive value brightens it.

## Contrast Control

---

Contrast plays a critical role in visual perception. Generally, higher contrast produces clearer, sharper images with vivid tones, while low contrast results in a dull, hazy image.

Adjusting contrast means expanding or reducing the difference between bright and dark areas while keeping the average brightness unchanged. This function modifies the luminance variation of the image without changing its overall brightness, thus improving the dynamic range.



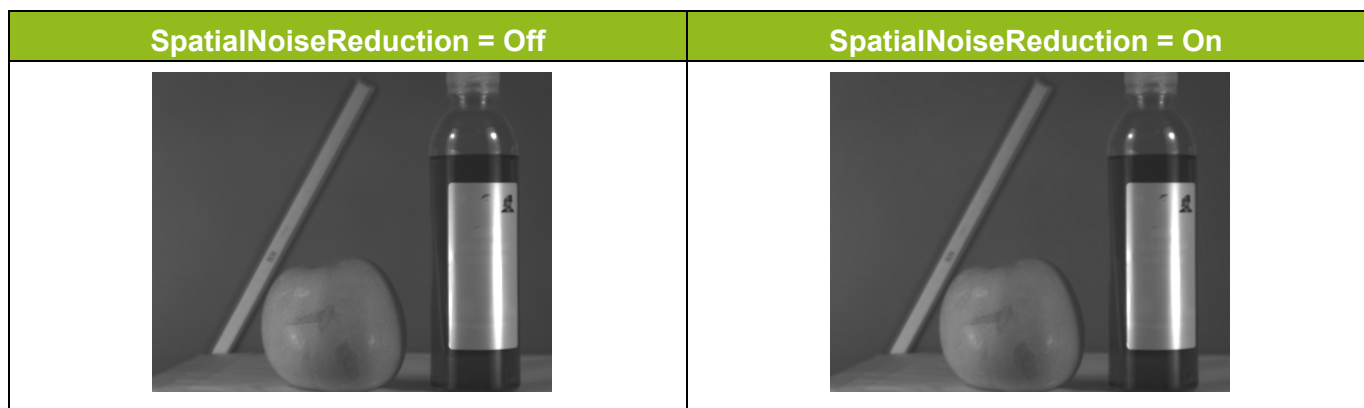
### How to Configure

1. Check **ContrastEnable** to enable the Contrast.
2. Specify the contrast adjustment value using **Contrast**. The setting range is -100 ~ +100 (step: 1).

## Spatial Noise Reduction Control

Spatial Noise Reduction is a filtering algorithm that processes pixel gray values via neighborhood operations directly in the image pixel space. Its core mechanism is to slide a filter template (convolution kernel) across the image, calculate the weighted value of pixels within the sliding window, and replace the original pixel value of the central pixel to eliminate noise. This function performs noise reduction on pixels of a single image independently, without relying on preceding or subsequent frames and only processing the current frame.

It is recommended to enable this function when Gaussian noise or grain noise appear in images under low light or low gain conditions. It is suitable for static scenes or scenarios with stationary objects with no motion blur. However, it is not recommended for high-speed movement or micro-defect inspection scenarios.



### How to Configure

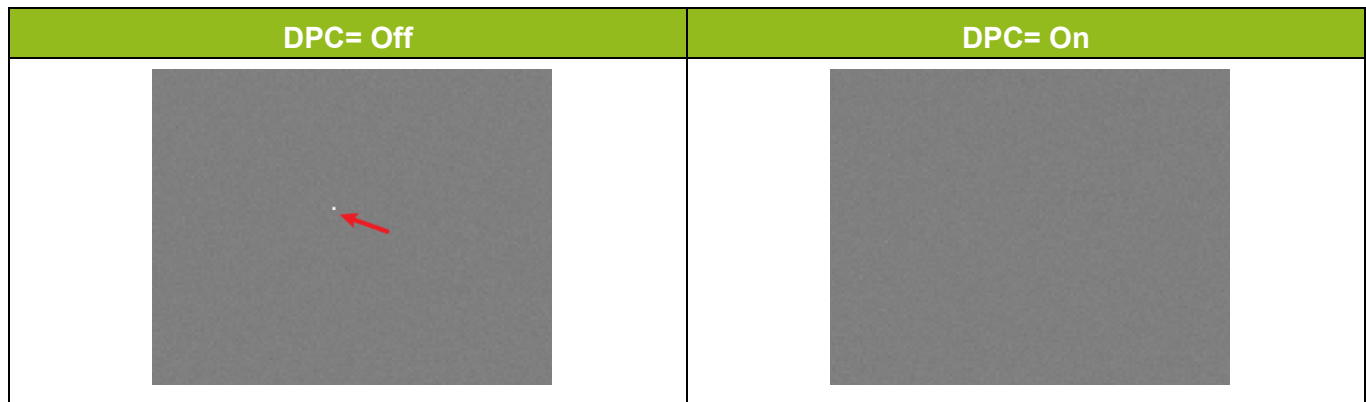
1. Check **SpatialNoiseReductionEnable** to enable the Spatial Noise Reduction.
2. Specify the spatial noise reduction adjustment value using **SpatialNoiseReductionValue**. The setting range is 1 ~ +100 (step: 1, default: 10).

**Note:** Higher spatial noise reduction value enhance filtering but make the image blurrier, yet results in greater loss of image details.

## Defective Pixel Correction (DPC)

Every sensor includes a number of defective pixels. A pixel is identified as defective when its response deviates from the local background beyond the preset threshold in dark image, corrected image, or a saturated image. Pixel defects arise from semiconductor sensor design flaws and manufacturing factors, and gradually accumulate throughout the sensor service life.

Some pixels on the sensor show abnormal response, resulting in obvious dark or bright pixels in the output images. This camera features a function that each defective pixel can be replaced with an interpolated value derived from its non-defective neighbors. Up to 4094 pixels can be corrected for the sensor. This way, the correction eliminates abnormal bright and dark pixels that may affect image quality.



### How to Configure

1. Check **DPCEnable** to enable the defective pixel correction.

#### Notes:

- **DPCEnable** is checked by default. Every camera has its own factory defective pixel correction data.
- Changes in ambient temperature, camera settings (e.g., high sensitivity and long exposure time), and other factors may cause new defective pixels to appear. Users need to execute **DefectPixelAdd** to add defective pixels manually to eliminate them.

2. Use **DefectivePixelX** to add the defective pixel's X position, range: 0 ~ 1279.
3. Use **DefectivePixelY** to add the defective pixel's Y position, range: 0 ~ 1023.
4. Execute **DefectPixelAdd** to add the defective pixel and check the effect.

#### Notes:

- If wrong defective pixel is added, delete it via execute **DefectPixelDelete**.
- To delete the previously added defective pixel, enter its coordinates in **DefectivePixelX** and **DefectivePixelY** then executing **DefectPixelDelete**. Otherwise, only the latest added defective pixel can be removed.

5. High gain combined with an exposure time exceeding 10ms, or prolonged sensor operation at high temperatures, may produce pixels whose gray values deviate from their neighbors. These appear as defective pixels in the image. Execute **DefectivePixelScan** to perform correction.

**Notes:**

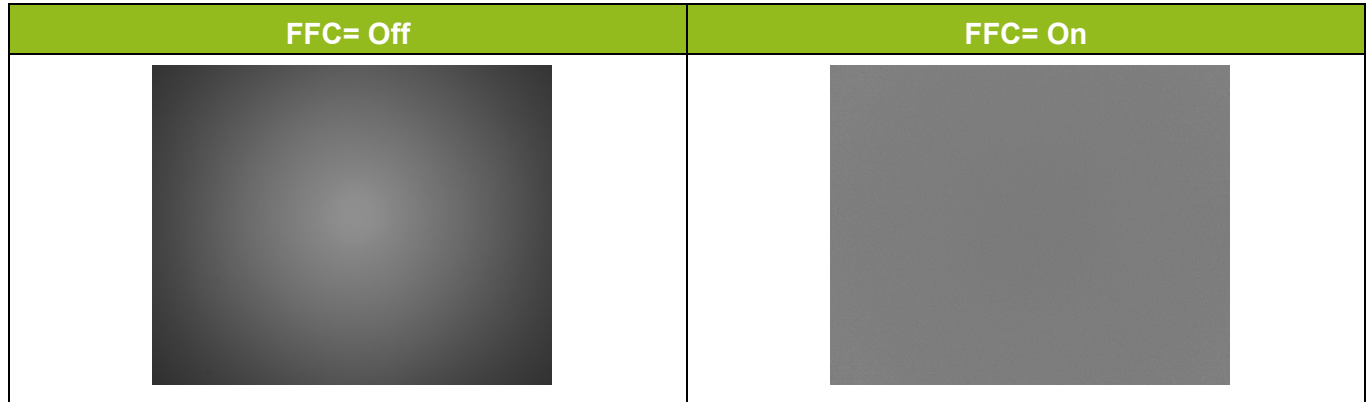
1. You must cover the lens cap or place the camera in a dark chamber to ensure the camera is in a dark environment without light, then execute **DefectivePixelScan**.
  2. Use **DefectivePixelScan** only when massive defective pixels appear under specific operating conditions. For a small number of defective pixels, please manually add them via **DefectPixelAdd** instead.
  3. You can use **DefectPixelScanRefresh** to refresh and check the progress in real time. When **DefectPixelScanProgress** shows 100, the calibration is complete. Check the image to verify the result.
  4. **DefectPixelScanThreshold** defines the threshold value used for **DefectivePixelScan**. Range: 0 ~ 100, default value: 50.
6. Execute **DefectPixelSave** to save the added and/or scanning defective pixels.

**Note:** After executing **DefectPixelSave**, the added and/or scanning defective pixels will stay effective even when the camera is powered off.

**Note:** You can execute **DefectPixelRestore** to restore the factory defective pixel correction data.

## Flat Field Correction (FFC)

Flat Field Correction (FFC) is a key image calibration process used in industrial line scan cameras to ensure high image uniformity and accuracy. This correction compensates for optical non-uniformities that may affect image quality. This correction help produce cleaner, more uniform images, enabling reliable inspection and analysis in industrial imaging applications.



### How to Configure

1. Use **FFCSelector** to select the FFC mode.

- **FPN**: Eliminates fixed pattern noise in dark field or low-light conditions, for low-illumination scenarios.

**Note:** When **FFCSelector** is set to **FPN**, only need to execute **FPNCalibration**.

- **PRNU**: Corrects photo response non-uniformity in bright field or uniform illumination conditions, for high-uniformity single-brightness scenarios.

**Note:** When **FFCSelector** is set to **PRNU**, only need to execute **PRNUCalibration**.

- **FPN\_PRNU**: Applicable to general scenarios.

**Note:** When **FFCSelector** is set to **FPN\_PRNU**, need to execute both **FPNCalibration** and **PRNUCalibration**.

2. Use **FFCFrameCount** to select the amount of frame to apply during FFC: 1, 2, 4, 8, 16, default: 4.

**Note:** A larger frame count delivers better calibration results, but also requires longer calibration time.

3. Set the calibration mode using **CalibrationMode**.

- **Target:** Uses a user-defined target brightness value (**CalibrationTarget**). Suitable for non-uniform lighting conditions. No brightness suppression will occur if the target value is properly selected.
  - **CalibrationTarget:** Specify the desired target brightness. If the scene is overly saturated, lower the value. If the scene is too dark, making correction difficult, increase the value.

**Note:** **CalibrationTarget** is enabled only when **CalibrationMode** is set to **Target**.

- **Average:** This mode automatically calculates FFC parameters using the mean value of bright-field images as the calibration target. It applies to calibration with uniform area light sources. If used under non-uniform lighting, the brightness of brighter areas may be suppressed.

4. Execute **FPNCalibration**.

**Notes:**

- Adjust the average gray value to 30% of the full-well gray value during calibration.
- The full-well gray value varies with the pixel format. (Mono8: 255 DN, Mono10: 1023 DN, Mono12: 4095 DN)
- For example, when the **PixelFormat** is **Mono8**, the corresponding full-well gray level is 255 DN. Before execute **FPNCalibration**, adjust the average gray value to approximately 76 DN.

5. Execute **PRNUCalibration**.

**Notes:**

- PRNU correction is performed under the condition that the image is flat with or without a lens attached. However, if there is shading due to a lens, light sources, etc., correction is performed to flatten the image including the effects of such shading.
- Adjust the average gray level to 70% of the full-well gray value during calibration.
- The full-well gray value varies with the pixel format. (Mono8: 255 DN, Mono10: 1023 DN, Mono12: 4095 DN)
- For example, when the **PixelFormat** is **Mono8**, the corresponding full-well gray level is 255DN. Before execute **PRNUcalibration**, adjust the average gray value to approximately 178 DN.

6. Execute **FFCCalculate** and wait for completion.

**Notes:**

1. Execute **FFCProgressRefresh** to refresh the calibration progress, for use with steps 4 ~ 6.
2. Execute **FFCProgress** to check the calibration progress, for use with **FFCProgressRefresh**.

7. Check **FFCEnable** to enable and validate the correction.
8. Execute **FFCSave** to store the correction parameters.

**Notes:**

- Use **FFCSetSelector** to select the userset for saving FFC calibration parameters. A total of 8 usersets are available: Userset1 ~ Userset8.
- After executing **FFCSave**, the FFC calibration parameters will stay effective even when the camera is powered off.

**Note:** You can execute **FFCSetRestore** to restore the factory FFC calibration data.

# Miscellaneous

## Troubleshooting

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

### Power Supply and Connections

**Issue:** The POWER LED does not turn green, even after power is supplied to the camera.

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

### Image Display

**Issue:** The output image is all black.

**Cause and Solution:** Maybe the F-number of the lens aperture is set too high, or the lens cap is not removed, or the light source is not turned on (SWIR illumination is typically invisible to the naked eye). Check the lens, appropriately reduce the aperture value, and check the light source.

### Settings and Operations

**Issue:** Settings cannot be saved to user memory.

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

**Issue:** I want to restore the factory default settings.

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

## Specifications

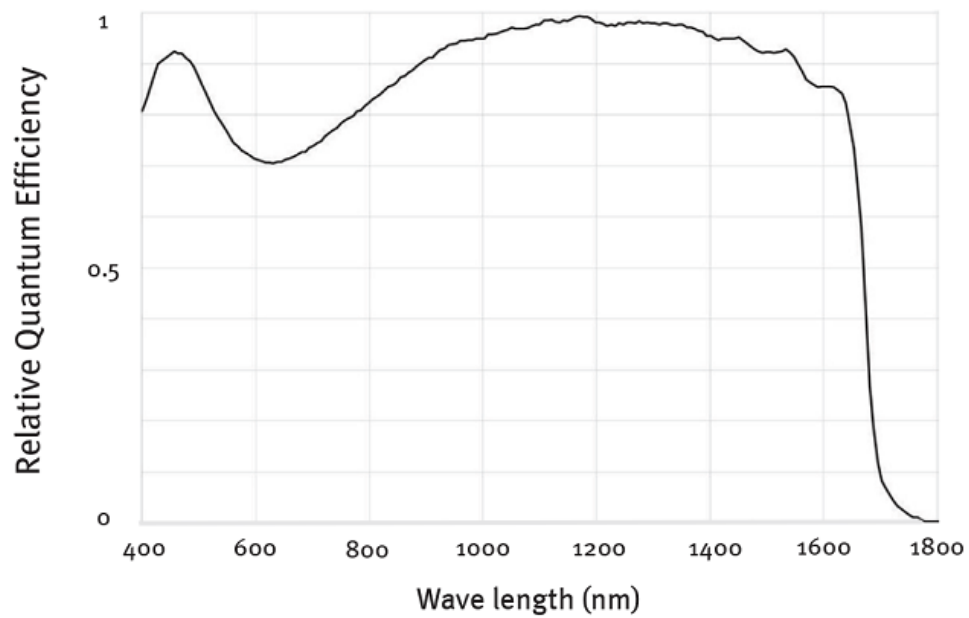
Item	Specifications
Image Sensor	1/2" InGaAs global shutter area scan image sensor (IMX990)
Effective Pixels	1280 x 1024
Pixel size	5 $\mu\text{m}$ x 5 $\mu\text{m}$
Spectral Range	400nm to 1700nm
Frame Rate	up to 90fps
Quantum Efficiency	77% @1200nm (typical peak value)
Dynamic Range	56dB (TBD)
Signal-to-Noise Ratio (EMVA1288)	50dB (TBD)
Temperature Control	Single-stage thermo-electric cooling (TEC1)
Interface	GigE Vision
Video Output	Mno8, Mono10, Mono10p, Mono12, Mono12p
Acquisition mode	Continuous / Single Frame / Multi Frame (1~1000)
Trigger Mode	Frame Trigger Mode
Trigger Source	Software, Line0, Line 1, Line 2, Line 3, Line 4
Trigger Activation	Rising Edge, Falling Edge, Level_High, Level_Low
Gain	0~420 (0dB ~ 42dB) Analog Gain: 0 ~180 Digital Gain: 181 ~ 420
Binning	Binning Mode: Sum, Average Binning Selector: 2 x 2, 4 x 4
Image Flip	ReverseX, ReverseY, Enable ReverseX and ReverseY simultaneously
ROI	Width: 16 ~ 1280, step: 16 Height: 8 ~ 1024, step: 8 The camera can deliver a higher frame rate when ROI is enabled.
Exposure Time	3 $\mu\text{s}$ ~ 983 ms @8bit 3 $\mu\text{s}$ ~ 614 ms @10bit 3 $\mu\text{s}$ ~ 628 ms @12bit
Black Level	-1023 ~ +1023

Item	Specifications
ISP	<b>DPC</b> (Defective Pixel Correction) <b>FFC (Flat Field Correction)</b> : FPN and PRNU corrections <b>LUT</b> : 1 user-defined, 3 preset options (GlareSuppression, BlacklightCompensation, HDR) <b>Brightness control</b> <b>Contrast control</b> <b>Spatial noise reduction control</b> <b>Black level</b> <b>Gamma</b>
Power Supply Voltage (12-pin)	Input Range: DC +12V ~ +24V +/-15%; Typical Power Consumption: 6.5W @12V DC (TEC = Off) (TBD) Max Power Consumption: 10W @12V DC (TEC = On) (TBD)
Lens Mount	C-Mount Lens mount protrusion length of 10 mm or less is supported.
Flange Back	17.526mm, tolerance: 0 mm to -0.05 mm
Verified Performance Temperature / Humidity	- 20°C to +55°C (20 to 80% non-condensing)
Storage Temperature / Humidity	- 40°C to + 60°C / 20% to 80% (non-condensing)
Vibration Resistance	10G (20 Hz~ 200 Hz X-Y-Z direction)
Shock Resistance	80G
Regulations	CE (EN 55032:2015+A1+A11, EN 55035:2017+A11, EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019), FCC Part15 Class A, KC, RoHS (TBD)
Dimensions (Housing)	60.0 mm x 60.0 mm x 80.5 mm
Weight	400g (TBD)

**Note:** This camera does not support PoE.

## Spectral Response

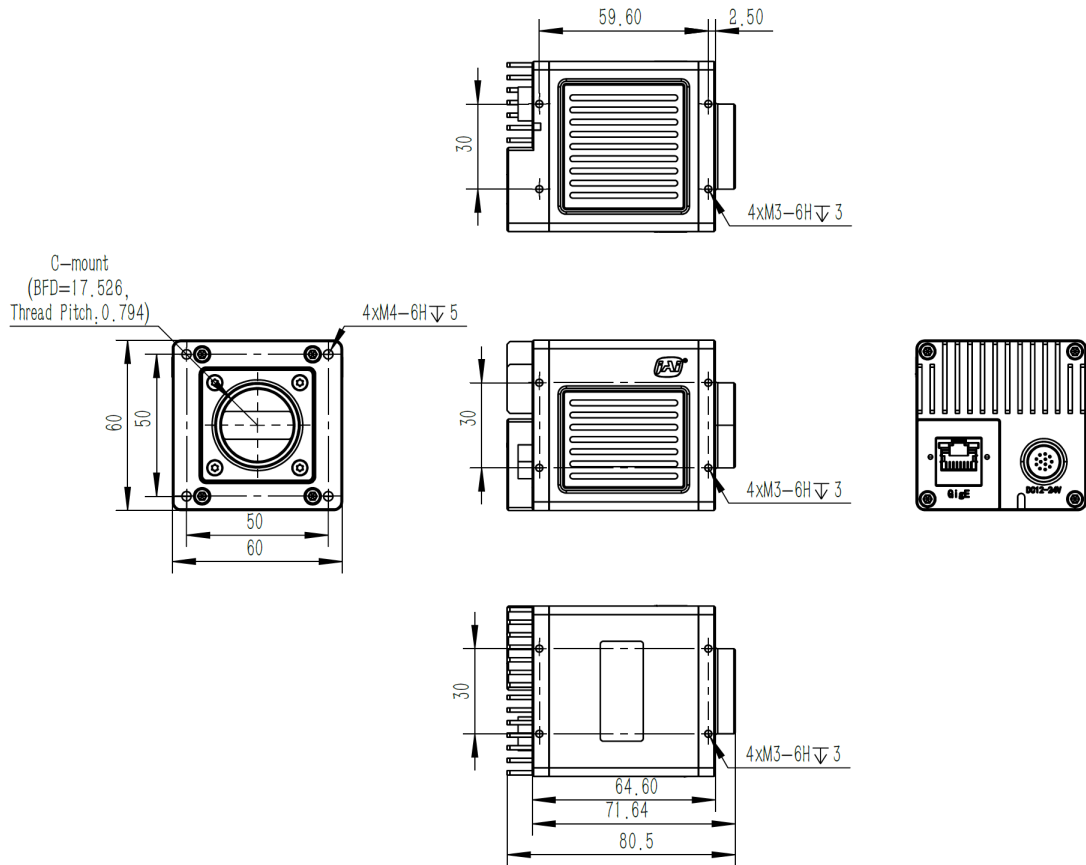
---



**Note:** The typical peak value is 77%.

# Dimensions

This section shows the dimensional drawings of the camera.



**Notes:**

- Dimensional Tolerance:  $\pm 0.2\text{mm}$
- Unit: mm

## Revision History

Revision	Date	Changes
Tentative	2026/06/15	for Marketing Launch

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