Hangzhou Hikrobot Technology Co.,Ltd.

GigE Line Scan Camera

User Manual

HIKROBOT

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Note

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FCC Information

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Compliance

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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Conditions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
● This device may not cause harmful interference.
● This device must accept any interference received, including interference that may cause undesired operation.

EU Conformity Statement

This product and - if applicable - the supplied accessories too are marked with "CE" and comply therefore with the applicable harmonized European standards listed under the Directive 2014/30/EU(EMCD),Directive 2001/95/EC(GPSD) and Directive 2011/65/EU(RoHS).

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Warning: This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠️Danger	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.
⚠️Caution	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results.
🛈Note	Provides additional information to emphasize or supplement important points of the main text.

Available Model

This manual is applicable to the GigE line scan camera.

Contact Information

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Contents

Chapter 1 Safety Instruction

The safety instructions are intended to ensure that the user can use the device correctly to avoid danger or property loss. Read and follow these safety instructions before installing, operating and maintaining the device.

1.1 Safety Claim

- To ensure personal and device safety, when installing, operating, and maintaining the device, follow the signs on the device and all safety instructions described in the manual.
- The note, caution and danger items in the manual do not represent all the safety instructions that should be observed, but only serve as a supplement to all the safety instructions.
- The device should be used in an environment that meets the design specifications, otherwise it may cause malfunctions, and malfunctions or component damage caused by non-compliance with relevant regulations are not within the scope of the device's quality assurance.
- Our company will not bear any legal responsibility for personal safety accidents and property losses caused by abnormal operation of the device.

1.2 Safety Instruction

⚠**Caution**:
- Do not install the device if it is found that the device and accessories are damaged, rusted, water ingress, model mismatch, missing parts, etc., when unpacking.
- Avoid storage and transportation in places such as water splashing and rain, direct sunlight, strong electric fields, strong magnetic fields, and strong vibrations.
- Avoid dropping, smashing or vigorously vibrating the device and its components.
- It is forbidden to install the indoor device in an environment where it may be exposed to water or other liquids. If the device is damp, it may cause fire and electric shock hazard.
- Place the device in a place out of direct sunlight and ventilation, away from heat sources such as heaters and radiators.
- In the use of the device, you must be in strict compliance with the electrical safety regulations of the nation and region.
- Use the power adapter provided by the official manufacturer. The power adapter must meet the Limited Power Source (LPS) requirements. For specific requirements, please refer to the device's technical specifications.
- If the device emits smoke, odor or noise, please turn off the power and unplug the power cord immediately, and contact the dealer or service center in time.

- It is strictly forbidden to touch any terminal of the device when operating it. Otherwise there is a danger of electric shock.
- It is strictly forbidden for non-professional technicians to detect signals during device operation, otherwise it may cause personal injury or device damage.
- It is strictly forbidden to maintain the device is powered on, otherwise there is a danger of electric shock.
- Avoid aiming the lens at strong light (such as lighting, sunlight, or laser beams, etc.), otherwise the image sensor will be damaged.
- If it is necessary to clean the device, use a damp paper towel or a soft clean cloth to moisten a little pure water, gently wipe off the dust, and do not use alcohol-based corrosive solutions. Make sure to power off the device and unplug the power socket when cleaning.
- Keep clean of the device's image acquisition window. It is recommended to use cleaning water to wipe off the dust.
- If the device does not work properly, please contact your dealer or the nearest service center. Never attempt to disassemble the device yourself (we shall not assume any responsibility for problems caused by unauthorized repair or maintenance).
- Caution: If the device has battery, risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

i̇Note:

- Check whether the device's package is in good condition, whether there is damage, intrusion, moisture, deformation, etc. before unpacking.
- Check the surface of the device and accessories for damage, rust, bumps, etc. when unpacking.
- Check whether the quantity and information of the device and accessories are complete after unpacking.
- Store and transport the device according to the storage and transport conditions of the device, and the storage temperature and humidity should meet the requirements.
- It is strictly prohibited to transport the device in combination with items that may affect or damage the device.
- Quality requirements for installation and maintenance personnel:
  ○ Qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills.
  ○ The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
  ○ The ability to comprehend the contents of this manual.
- Please read the manual and safety instructions carefully before installing the device.
- Please install the device strictly according to the installation method in this manual.
- The case of the device may be overheated, and it needs to be powered off for half an hour before it can be touched.

● The device should not be placed with exposed flame sources, such as lighted candles.

1.3 Electromagnetic Interference Prevention

● Make sure that the shielding layer of cables is intact and 360° connected to the metal connector when using shielded cables.
● Do not route the device together with other equipment (especially servo motors, high-power devices, etc.), and control the distance between cables to more than 10 cm. Make sure to shield the cables if unavoidable.
● The control cable of the device and the power cable of the industrial light source must be wired separately to avoid bundled wiring.
● The power cable, data cable, signal cable, etc. of the device must be wired separately. Make sure to ground them if the wiring groove is used to separate the wiring and the wiring groove is metal.
● During the wiring process, evaluate the wiring space reasonably, and do not pull the cables hard, so as not to damage the electrical performance of the cables.
● If the device is powered on and off frequently, it is necessary to strengthen the voltage isolation, and consider adding a DC/DC isolation power supply module between the device and the adapter.
● Use the power adapter to supply power to the device separately. If centralized power supply is necessary, make sure to use a DC filter to filter the power supply of the device separately before use.
● The unused cables of the device must be insulated.
● When installing the device, if you cannot ensure that the device itself and all equipment connected to the device are well grounded, you should isolate the device with an insulating bracket.
● To avoid the accumulation of static electricity, ensure that other equipment (such as machines, internal components, etc.) and metal brackets on site are properly grounded.
● Make sure that the connector metal barrier of the device is well connected to the PC and other chassis, and if necessary, copper foil should be used to enhance the grounding effect.
● During the installation and use of the device, high voltage leakage must be avoided.
● Use a figure-eight bundle method if the device cable is too long.
● When connecting the device and metal accessories, they must be connected firmly to maintain good conductivity.
● Use a shielded network cable to connect to the device. If you use a self-made network cable, make sure that the shielding shell at the aviation head is well connected to the aluminum foil or metal braid of the shielding cable.

Chapter 2 Overview

2.1 Introduction

The GigE line scan camera uses the GigE interface to transmit non-compressed images in real time, and it acquires images and sets parameters via the client software or SDK. The GigE line scan camera is applicable to the printing, textiles, railway, logistics, metallurgy, food, pharmaceutical manufacturing, material sorting, etc.

2.2 Key Feature

- Supports auto and manual adjustment for gain, exposure time and white balance, manual adjustment for Look-Up Table (LUT), Gamma correction, etc.
- Adopts the image interpolation algorithm for the color reproduction.
- Supports the hardware trigger, software trigger, free run, etc.
- Adopts GigE interface and max. transmission distance of 100 meters without relay.
- Compatible with the GigE Vision Protocol, the GenICam Standard, and the third-party software based on the protocol and standard.

Note
- The specific functions may differ by device models.
- Refer to the device's specifications for specific parameters.

Chapter 3 Appearance

> **Note**
> ● The device's appearance may differ by device models. The image below is for reference only. For specific appearance and dimension, please refer to the device's specification for details.
> ● The appearance is subject to change, and the actual device you purchased shall prevail.
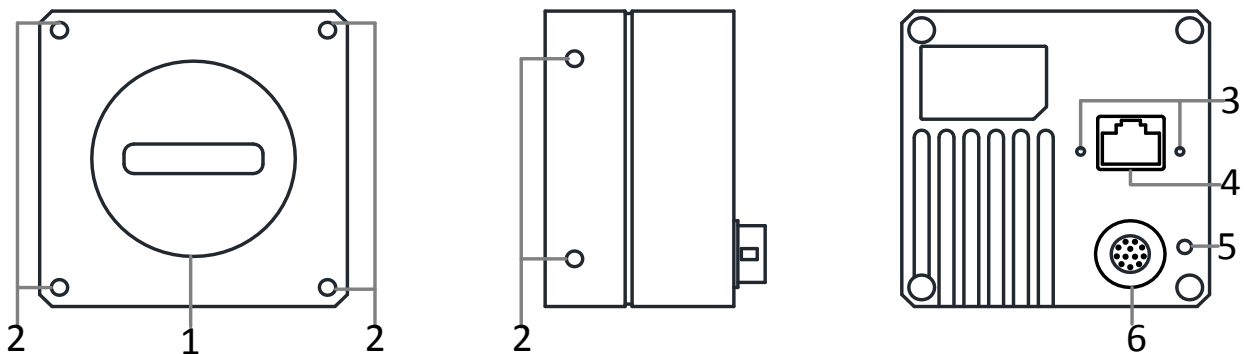
Figure 3-1 Appearance

Table 3-1 Component Description

No.	Component	Description
1	Lens Mount	It is used to install the lens. Refer to the device's specification for specific lens mount information.
2	Screw Hole	It is used to fix the device to the installation position. Refer to the device's specification for specific screw information.
3	Screw Hole of GigE Interface	It refers to the M2 screw hole for fixing the network cable.
4	GigE Interface	It refers to the GigE interface for transmitting data.
5	LED Indicator	It indicates the device's status.
6	Power and I/O Connector	It provides power supply, input/output signal and serial port function.

Chapter 4 I/O Connector and Indicator

4.1 Power and I/O Connector

All GigE line scan cameras have a 12-pin P10 connector, as shown below. However, the specific pin definitions differ by device models. Currently, two types of pin definitions are available.
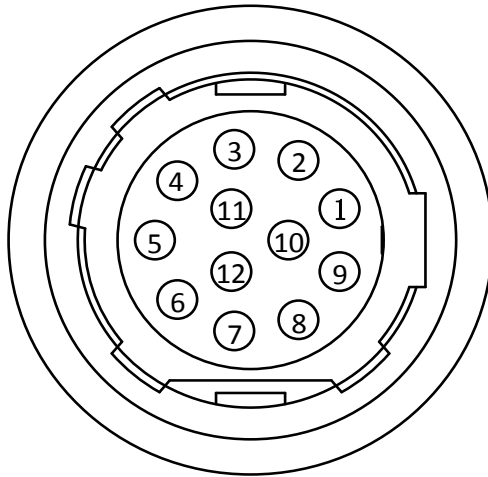
Figure 4-1 12-Pin P10 Connector

First Type of Pin Definitions

The first type of pin definitions is applicable to MV-CL021-40GM and MV-CL022-40GC.

☐**i** **Note**

Refer to the table below and the label attached to the power and I/O cable to wire the device.

Table 4-1 First Type of Pin Definitions

No.	Signal	I/O Signal Source	Description
1	GND	--	Power supply ground
2	DC_PWR	--	DC power supply positive
3	IO_IN0_P	Line 0+	Differential input IO 0+
4	IO_IN0_N	Line 0-	Differential input IO 0-
5	GND	Line 2-	Power supply ground

No.	Signal	I/O Signal Source	Description
6	IO_IN1_P	Line 3+	Differential input IO 1+
7	IO_IN1_N	Line 3-	Differential input IO 1-
8	IO2	Line 2+	Bi-directional IO
9	IO_OUT0_P	Line 1+	Differential output IO 0+
10	IO_OUT0_N	Line 1-	Differential output IO 0-
11	IO_OUT1_P	Line 4+	Differential output IO 1+
12	IO_OUT1_N	Line 4-	Differential output IO 1-

Second Type of Pin Definitions

The second type of pin definitions is applicable to other models of devices.

ⓘ**Note**

Refer to the table below and the label attached to the power and I/O cable to wire the device.

Table 4-2 Second Type of Pin Definitions

No.	Signal	I/O Signal Source	Description
1	GND	--	Power supply ground
2	DC_PWR	--	DC power supply positive
3	LINE0_P	Line 0+	Differential input/output IO 0+
4	LINE0_N	Line 0-	Differential input/output IO 0-
5	GND	--	Power supply ground
6	LINE3_P	Line 3+	Differential input/output IO 3+
7	LINE3_N	Line 3-	Differential input/output IO 3-
8	LINE4_P	Line 4+	Differential input/output IO 4+
9	LINE1_P	Line 1+	Differential input/output IO 1+
10	LINE1_N	Line 1-	Differential input/output IO 1-
11	DC_PWR	--	DC power supply positive
12	LINE4_N	Line 4-	Differential input/output IO 4-

4.2 Indicator

The device's indicator is used to indicate the operation status of the device.

ⓘNote

● When the indicator is flashing rapidly, flashing slowly, or flashing very slowly, its unlit interval is 0.2 sec, 1 sec, and 2 sec respectively.
● The indicator sometimes may show a purple color when red and blue colors flashing at the same time.

Table 4-3 Indicator Description

No.	Indicator Color	Status	Device Status Description
1	Red	Flashing very slowly	The device's wiring exception occurs.
2	Red	Solid	The device exception occurs.
3	Blue	Flashing slowly	The device is acquiring images in trigger mode.
4	Blue	Flashing rapidly	The device is acquiring images normally.
5	Blue	Solid	The device is in an idle status.
6	Red and blue	Flash alternatively	The function of finding me is executed, or the firmware is updating.

Chapter 5 Installation

5.1 Installation Preparation

You need to prepare following accessories before device installation.

Table 5-1 Accessories

No.	Name	Quantity	Description
1	Power and I/O Cable	1	It refers to the 12-pin power and I/O cable. You need to purchase separately.
2	DC Power Supply	1	You should select suitable power adapter or switch power supply according to the device power supply and consumption. You need to purchase separately.
3	Network Cable	1	It refers to CAT-5e network cable or above. You need to purchase separately.
4	Lens	1	It refers to the lens that is suitable for the device. You need to purchase separately.
5	Lens Adapter	1	If the lens you used does not match with lens mount of the device, you need to use a lens adapter. You need to purchase separately.

5.2 Install Device

Before You Start
- Make sure that the device in package is in good condition and all assembly parts are included.
- Make sure that all related devices are powered off during the installation.

Steps
1. Fix the device to the installation position.
2. Install the lens to the device.
3. Use a proper network cable to connect device with a GigE switch or a network interface card.
4. Select a power supply method:
- Direct power supply: Use the 12-pin power and I/O cable to connect device to a proper power adapter.
- PoE (Power over Ethernet): For the device that supports PoE, use a network cable to connect the device to a switch that supports PoE or a network interface card.

Chapter 6 Device Connection

Device connection to the client software is required for device's configurations and remote operations. This section introduces how to install the client software, connect the device to the client software, etc.

6.1 Install MVS Client Software

MVS client software is used to connect and set device's parameters, and acquire images.

⬜ⓘNote
- The MVS client software is compatible with 32/64-bit Windows XP/7/10, 32/64-bit Linux, and 64-bit MacOS operating systems. Here we take Windows as an example.
- The graphic user interface may differ by different versions of the client software you use.
- You can download the client software from *en.hikrobotics.com*.

Steps

1. Double click the MVS installation package.
2. Select the language.
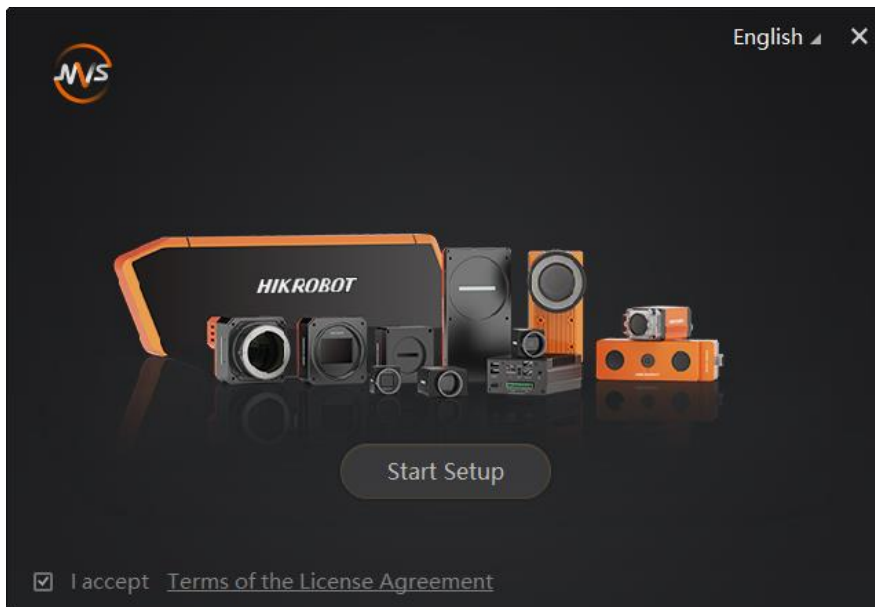3. Read and check **Terms of the License Agreement**.

Figure 6-1 Installation Interface

4. Click **Start Setup**.
5. Keep default settings, and click **Next**.
6. Finish the installation according to the interface prompts.

6.2 Set PC Environment

To ensure stable client running and data transmission, you are recommended to set PC environment.

6.2.1 Turn off Firewall

Steps

☐**Note**

For different Windows versions, the path name or interface may differ. Please refer to the actual condition.

1. Go to Windows Firewall.
- Windows XP system: Click **Start** → **Control Panel** → **Security Center** → **Windows Firewall**.
- Windows 7 system: Click **Start** → **Control Panel** → **Windows Firewall**.
- Windows 10 system: Click **Start** → **Control Panel** → **System and Security** → **Windows Defender Firewall**.
2. Click **Turn Windows Defender Firewall on or off** on the left.
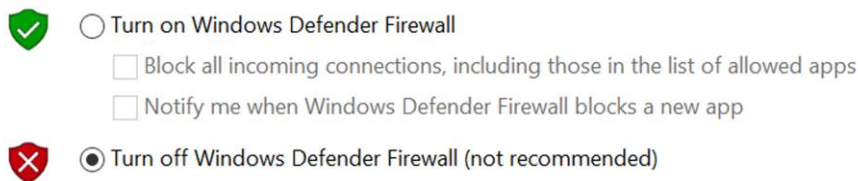3. Select **Turn off Windows Defender Firewall (not recommended)**.

Figure 6-2 Windows Defender Firewall

4. Click **OK**.

6.2.2 Set PC Network

Steps

☐**Note**

For different Windows versions, the specific setting path and interface may differ. Please refer to the actual condition.

1. Go to PC network settings page: **Start** → **Control Panel** → **Network and Internet** → **Network and Sharing Center** → **Change adapter settings**.
2. Select NIC and set the IP obtainment mode.

● Select **Obtain an IP address automatically** to get an IP address of the PC automatically.
● Or select **Use the following IP address** to set an IP address for the PC manually.
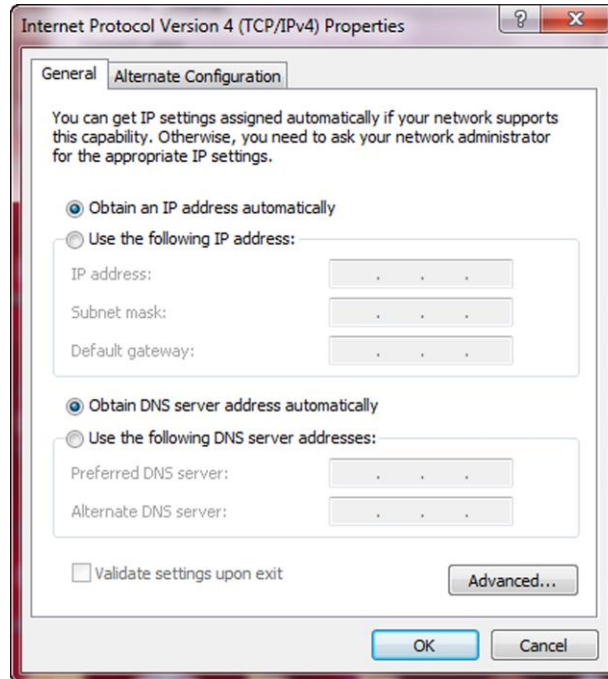

Figure 6-3 Set PC Network

3. Set NIC property via the PC.
   1) Go to NIC settings page: **Control Panel** → **Hardware and Sound** → **Device Manager** → **Network Adapter**.
   2) Select corresponding network interface card, and click **Advanced**.
   3) Set **Jumbo Packet** value to 9014 Bytes, **Transmit Buffers** and **Receive Buffers** to 2048, **Interrupt Moderation Rate** to **Extremum**.
4. (Optional) Set NIC property via the MVS.
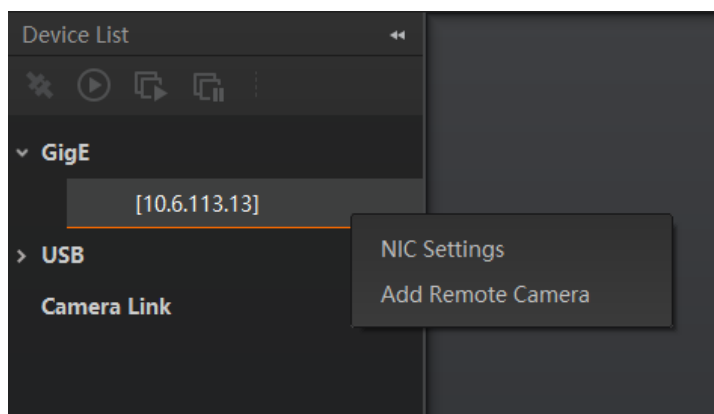   1) Right click the **GigE**, and click **NIC Settings**.

Figure 6-4 Click NIC Settings

2) Enable **Jumbo Frame**, and set **Receive Buffers** and **Transmit Buffers** to 2048.
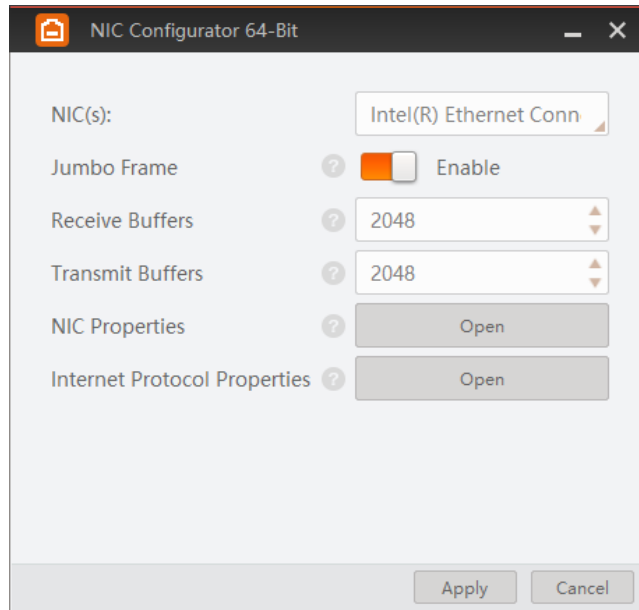
Figure 6-5 NIC Configurator

⎙**Note**

The max. value of receive buffers and transmit buffers may differ by network interface cards.

6.3 Set Device Network

You can set and operate the device in the client software only when the device is in the same network segment with the PC where the client software is installed.

Steps

1. Double click the client software to run it.
2. Click 🔄 in device list to search the device.
3. Select a device to be connected.
4. Right click the device and click **Modify IP**.
5. Set the IP address of the device in the same network segment with the PC.
6. Click **OK**.

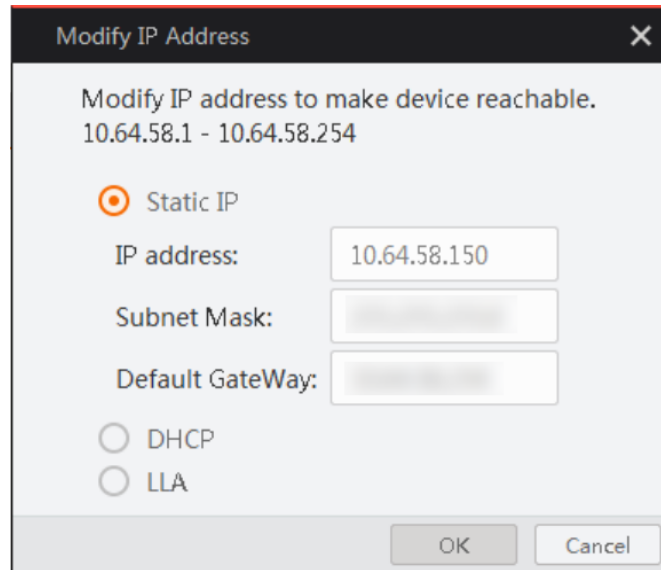**Figure 6-6 Set Device Network**

6.4 Connect Device to MVS Client Software

Note

Make sure that your device's IP address is in the same network segment with the PC where you installed the client software before connecting the device to it.

Double click the device name in the device list, or click [icon] to connect the device to the client software.

Chapter 7 Client Software Layout

After connecting to the device, the client software can read the its attributes and display them.
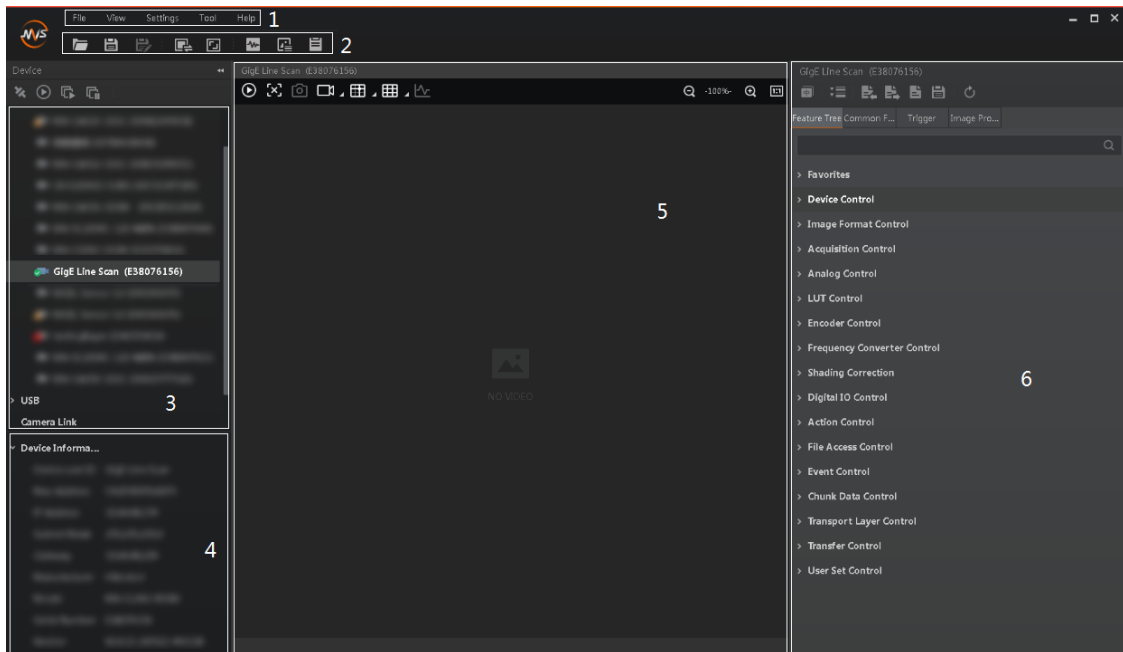
Figure 7-1 Main Window

⚠️ **Note**

For specific main window of the client software, please refer to the actual one you got.

Table 7-1 Main Window Description

No.	Name	Description
1	Menu Bar	The menu bar displays function modules, including File, View, Settings, Tool, and Help.
2	Control Toolbar	The control toolbar provides quick operations for the device.
3	Device List Panel	This panel displays device list, and you can connect or disconnect device, modify device IP address, etc.
4	Device Information Panel	This panel displays the detailed device information.
5	Display Window	This area displays the acquisition images in real-time. You can click different icons to capture and save image, record, etc.

No.	Name	Description
6	Feature Panel	You can view and set features of the selected device, and perform operations such as importing, exporting, and saving features.

Click ▶ in the device's feature panel to unfold the specific parameters, and set them according to actual demands.

ⓘNote

The device's feature tree and parameters may differ by device models.

Table 7-2 Feature Tree Description

Feature Name	Description
Device Control	You can view the device information, edit its name, reset the device, etc.
Image Format Control	You can view and set the device's resolution, image reverse function, pixel format, region of interest, test pattern, etc.
Acquisition Control	You can view and set the device's acquisition mode, line rate, trigger mode, exposure time, etc.
Analog Control	You can view and set the device's gain, black level, Gamma correction, sharpness, etc.
Color Transformation Control	You can view and set the device's color transformation related parameters like hue and saturation.
LUT Control	You can view the Look-Up Table (LUT), and set its index and value.
Encoder Control	You can set encoder control to convert source signal of external trigger into internal signal.
Frequency Converter Control	You can set frequency converter control to convert external signal of different frequencies into internal signal.
Shading Correction	You can set shading correction to correct shade.
Digital IO Control	You can set the different input and output signals.
Action Control	You can view and set the device's action control related parameters.
Counter and Timer Control	You can view and set the counter-related parameters when selecting counter active as line source.
File Access Control	You can view and set the device's file access control related parameters.

Feature Name	Description
Event Control	You can view and set the device's event control related parameters to let the device generate an event and transmit a related message to the PC.
Chunk Data Control	You can view and set the device's chunk data control related parameters to generate supplementary image data and append it to images.
Transport Layer Control	You can view and set the parameters of the device's transport layer.
Transfer Control	You can view the device' transfer status.
User Set Control	You can save or load the device's parameters.

Chapter 8 Image Acquisition

8.1 Set Line Rate

□i Note

The image compression function may differ by device models. Refer to section **Set Image Compression Mode** for details.

Line rate refers to the image line number that is output by the device per second. The frame rate of the device is proportional to its line rate, and is inversely proportional to the image height, that is, Fps = Lps (line rate)/Height (image height). The following five factors determine the device's line rate in real-time.

● Readout time: The less the readout time and the higher the line rate will be.
● Exposure time: The less the exposure time, the higher the line rate will be.
● Pixel format: The more bytes pixel format occupy, the lower the line rate will be.
● Bandwidth: The larger the bandwidth, the higher the line rate will be.
● Image compression mode: This function is used to compress data before transmitting to the PC, and increase the frame rate to some extent.

Steps

1. Go to **Acquisition Control** → **Acquisition Line Rate(Hz)**, and enter **Acquisition Line Rate(Hz)**.
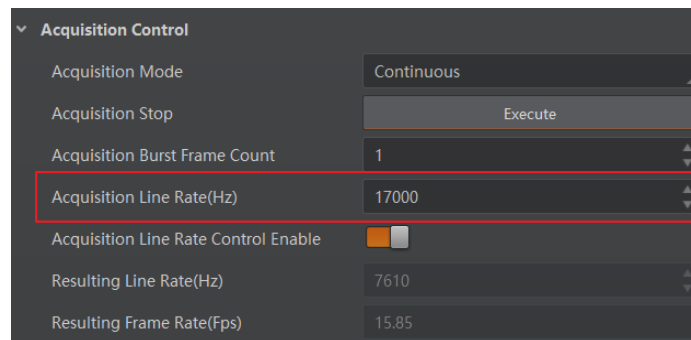2. Enable **Acquisition Line Rate Control Enable**.

Figure 8-1 Set Frame Rate

□i Note

● If the real-time line rate is smaller than the value you set, the device acquires images by the real-time line rate.
● If the real-time line rate is larger than the value you set, the device acquires images by the value you set.

3. View **Reference Line Rate (Hz)** if you enable the image compression function to set line rate for reference.

⬚ⁱNote

If the line rate is smaller than **Reference Line Rate (Hz)**, the device acquires images in stable way. If the line rate is larger than **Reference Line Rate (Hz)**, the device may lose images.

4. View the device's final line rate and frame rate in **Resulting Line Rate(Hz)** and **Resulting Frame Rate(Hz)**.

8.2 Set Frame Timeout

⬚ⁱNote

The frame timeout function may differ by device models.

The device supports frame timeout function that affects the device's acquisition and image output mechanism.
Go to **Acquisition Control**, enable **Frame Timeout Enable**, and select **Partial Image Output Mode** according to actual demands.
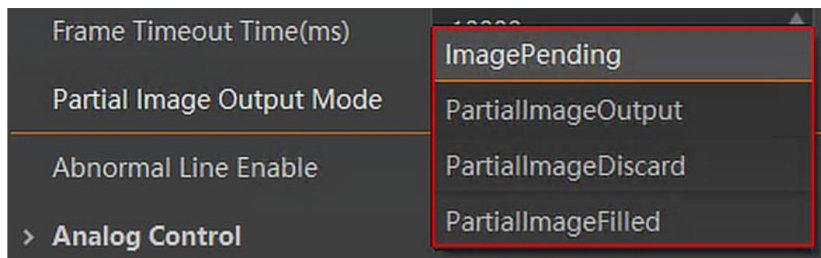

Figure 8-2 Set Frame Timeout

Table 8-1 Partial Image Output Mode Description

Parameter	Description
Image Pending	After the number of lines output by the device reaches the configured image height (height parameter), one frame of the image will be outputted. If the number of output lines does not reach the image height (height parameter), the SDK will not output the image, and the SDK will wait for the line data until it reaches the image height before outputting the image.
Partial Image Output	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame

Parameter	Description
	timeout period, the SDK will output the image according to the actual height.
Partial Image Discard	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame timeout period, the SDK discards the image.
Partial Image Filled	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame timeout period, SDK will output the image after filling the black according to the height parameter for the remaining part.

Note

If **Frame Timeout Enable** is not enabled, the image output is related with configured trigger mode. When the **Trigger Mode** is **Off**, only **Image Pending** is supported. When the **Trigger Mode** is **On** and **Trigger Activation** is **Level High** or **Level Low**, all image output modes are supported, and the device outputs last frame of image in accordance with configured image output mode.

8.3 Set Abnormal Line Function

Note

The line discard function may differ by device models.

Due to the inherent functional features of the sensor or the device itself, the first few lines of image acquisition may have abnormal images and need to be discarded. The device provides line discard function, which can adjust and control the number of external line trigger signals to ensure that the image acquisition meets the usage requirements.

You can go to **Acquisition Control**, and enable **Abnormal Line Enable** according to actual demands.

● When this function is enabled, the external device needs to send N more trigger signals to meet the line height of image acquisition, and the first N lines of abnormal images are discarded.

● When this function is not enabled, the quantity of external trigger signal is equal to that of the device's line height, and any abnormal lines that may exist are not discarded.
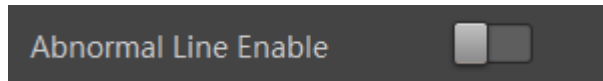
Figure 8-3 Set Abnormal Line Function

8.4 Set Acquisition Mode

The device supports two types of acquisition modes, including **SingleFrame** mode and **Continuous** mode. Go to **Acquisition Control** → **Acquisition Mode**, and select **Continuous** or **SingleFrame** as **Acquisition Mode** according to actual demands.

● **SingleFrame**: When device starts image acquisition, it acquires one image only, and then stops.
● **Continuous**: When device starts image acquisition, it acquires images continuously. Real-time frame rate decides the acquisition frame number per second. You can stop image acquisition manually.
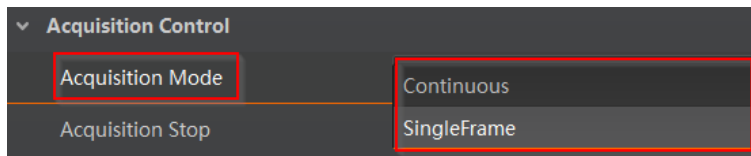

Figure 8-4 Set Acquisition Mode

8.5 Set Trigger Mode

The device has 4 types of trigger modes, including internal trigger mode, line trigger mode, frame trigger mode, and line + frame trigger mode. The trigger mode is controlled by **Trigger Selector** and **Trigger Mode** in **Acquisition Control**.

Table 8-2 Trigger Mode Description

Trigger Mode	Trigger Selector Parameter	Trigger Mode Parameter	Description
Internal Trigger	Line Start	Off	The device acquires images per lines via its internal signal and outputs images per frames according to configured parameters.
	Frame Burst Start	Off	
Line Trigger	Line Start	On	The device acquires images per lines via the external signal and outputs images per frames according to configured parameters.
	Frame Burst Start	Off	
Frame Trigger	Line Start	Off	The device acquires images after receiving the external signal, and acquires images per lines via its internal signal.
	Frame Burst Start	On	
Line + Frame	Line Start	On	The device acquires images after

Trigger Mode	Trigger Selector Parameter	Trigger Mode Parameter	Description
Trigger	Frame Burst Start	On	receiving the external signal, and acquires images per lines via another external signal.

8.6 Set Trigger Source

Note
- The specific trigger source may differ by device models.
- Apart from internal trigger, you need to select trigger source if line trigger signal or frame trigger signal comes from external signal.
- Software trigger and action command trigger sources are valid for frame trigger only, and shaft encoder control is valid for line trigger only.
- Make sure to configure corresponding trigger mode before select specific trigger source.
- In line + frame trigger mode, when the trigger source selected by the frame trigger and the line trigger and the trigger-related parameters are the same, the first signal of trigger source will be used as the frame trigger signal to make the device start to acquire images, and the subsequent signals as line trigger signal to acquire images per lines until the processing of one frame of image is completed, and then the processing of the next frame of image is performed.

The device's trigger source includes software trigger, hardware trigger, shaft encoder control, frequency converter control, action command trigger, and free trigger. Go to **Acquisition Control → Trigger Source**, and select **Trigger Source** according to actual demands.

Table 8-3 Trigger Source Description

Trigger Source	Parameter Value	Description
Software Trigger	Software	The software sends trigger signal to the device via GigE interface to acquire images. **Note** The software trigger is available only when frame trigger is enabled.
Hardware Trigger	Line*	External device connects device via its I/O connector. External device sends trigger signal to device to acquire images.

Trigger Source	Parameter Value	Description
Shaft Encoder Control	Encoder Module Out	This trigger source uses shaft encoder module to receive signal A and signal B with phase difference. After internal computing of the module, the outputted signal can be used as device's trigger signal. ⬚**i Note** The shaft encoder control is available only when line trigger is enabled.
Frequency Converter Control	Frequency Converter	This trigger source allows different frequency between trigger device signal and required input signal.
Action Command Trigger	Action 1	This trigger source is applied in PTP function. Refer to section **Set Action Command** for details.
Free Trigger	Anyway	Use trigger sources mentioned above to send trigger signal to the device to acquire images.

Set and Execute Software Trigger

In software trigger, the software sends trigger signal to the device via GigE interface to acquire images.

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Frame Burst Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
3. Select **Software** as **Trigger Source**.
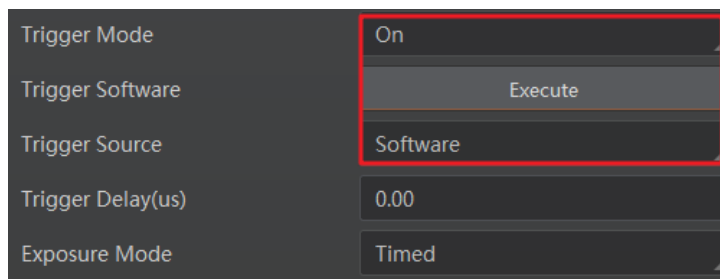4. Click **Execute** in **Trigger Software**.

Trigger Mode	On
Trigger Software	Execute
Trigger Source	Software
Trigger Delay(us)	0.00
Exposure Mode	Timed

Figure 8-5 Set and Execute Software Trigger

Set and Execute Hardware Trigger

If the device enables the frame trigger or line trigger, you can select specific lines as

trigger source to enable hardware trigger. At this time, external devices send commands to the device to acquire images.

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Frame Burst Start** or **Line Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
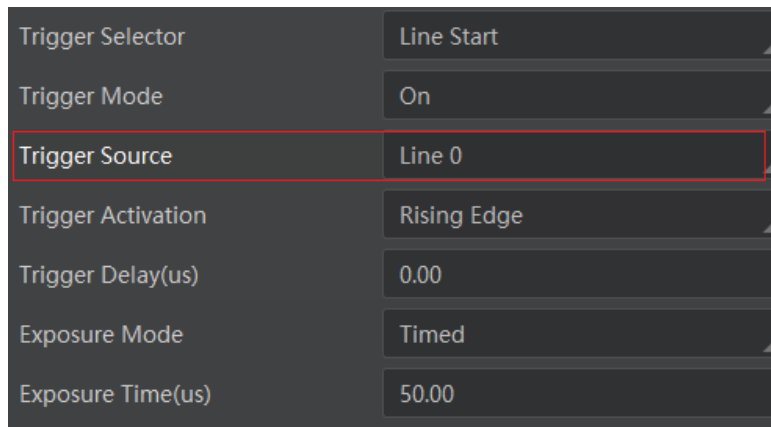3. Select specific line as **Trigger Source**.

Trigger Selector	Line Start
Trigger Mode	On
Trigger Source	Line 0
Trigger Activation	Rising Edge
Trigger Delay(us)	0.00
Exposure Mode	Timed
Exposure Time(us)	50.00

Figure 8-6 Set and Execute Hardware Trigger

When selecting bi-directional configurable line as the hardware trigger source, you need to make sure that its line mode is input. Go to **Digital IO Control**, select specific line as **Line Selector**, and **Input** as **Line Mode**.

Note

Here we take Line 2 as an example to introduce how to set bi-directional configurable line as the hardware trigger source. Refer to the device you got for the actual condition.
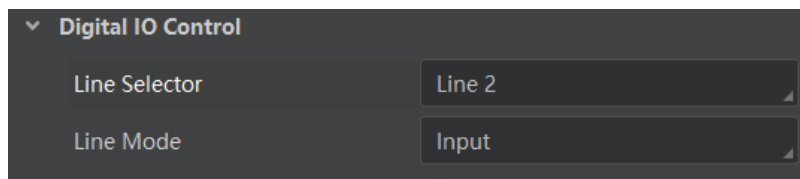
∨ **Digital IO Control**	
Line Selector	Line 2
Line Mode	Input

Figure 8-7 Select Line 2 as Line Selector

You can also set the signal type for the selected bi-directional configurable line. Go to **Digital IO Control**, and set **Line Format** according to actual demands.

Note

The line format function may differ by device models.

- **SingleEnded**: It can receive single-ended input signal.
- **Differential**: It can receive TTL & LVTTL standard input signal.

📖**Caution**

You need to select line format according to the external device connected. Otherwise, I/O may be damaged.
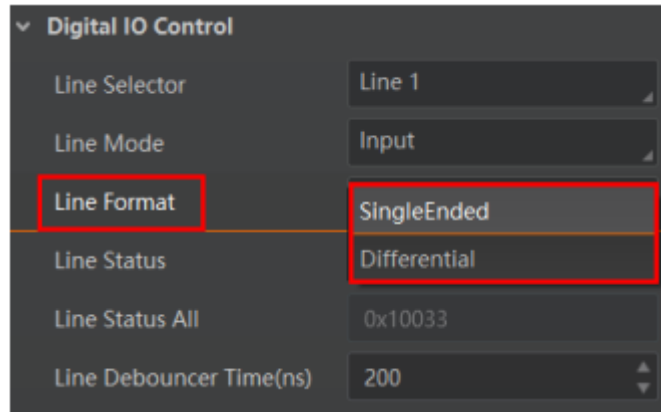

Figure 8-8 Set Line Format

Set and Execute Shaft Encoder Control

If the device enables the line trigger, you can select **Encoder Module Out** as trigger source. At this time, the device will receive signal A and signal B with phase difference. After internal computing, the outputted signal can be used as device's trigger signal. The function demonstration of shaft encoder module is shown below.
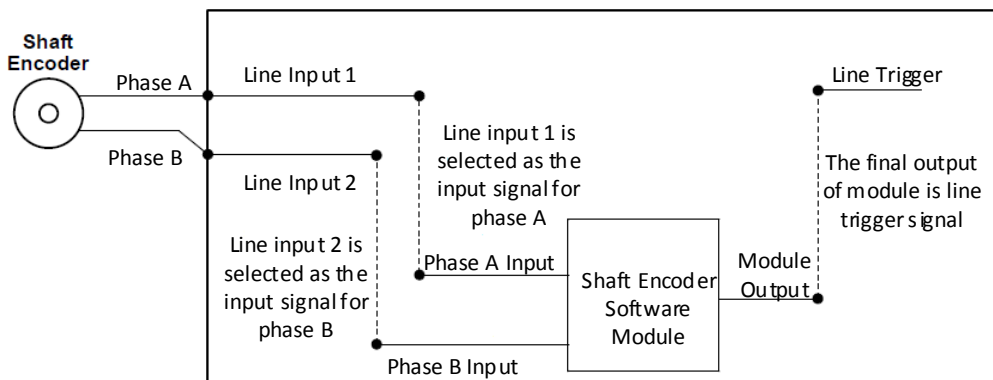
Figure 8-9 Function Demonstration

The advantages of shaft encoder are as follows:
● Encoder output pulse frequency is proportional to rotating speed.
● The output pulse acts as a trigger signal for line scan device.
● Synchronize acquisition speed and sample movement of device.
● Non-uniform motion can also be a perfect match.
● A trigger signal can be set as acquiring multiple lines or multiple frames with adjustable ratio.

Follow steps below to set shaft encoder control.

Steps

1. Click **Encoder Control**, and set **Encoder Source A** and **Encoder Source B** according to actual demands.
2. Set **Encoder Trigger Mode**.
● **Any Direction** means that both forward and backward direction will trigger.
● **Forward Only** mean that only forward direction will trigger.
● **Backward Only** mean that only backward direction will trigger.

⬚**i̇Note**

The 2K device outputs one signal in one source signal, and the 4K and 8K devices output four signal in one source signal.

3. (Optional) Regarding MV-CL021-40GM and MV-CL022-40GC devices, you can set **Encoder Trigger Frequency** to let the device output multiple signals, including 1 Tick, 2 Tick and 4 Ticks.
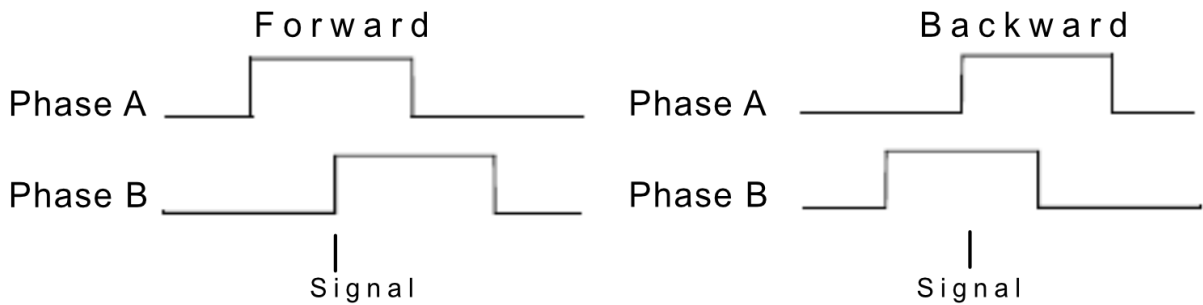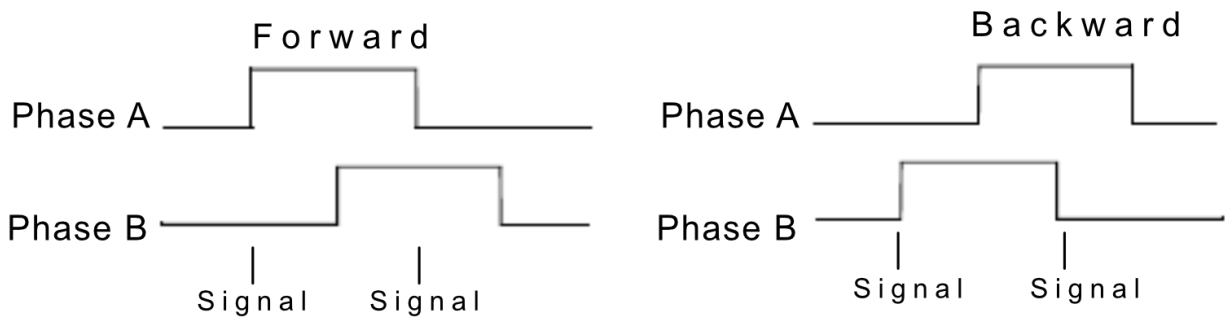

Figure 8-10 Process Logic of 1 Tick
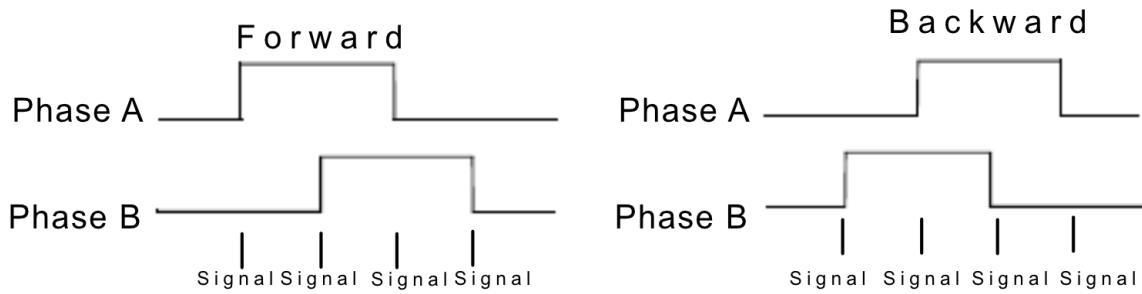

Figure 8-11 Process Logic of 2 Ticks

Figure 8-12 Process Logic of 4 Ticks

ⓘNote

For other device models, **Encoder Trigger Frequency** outputs 4 signals by default.

4. Set **Encoder Counter Mode**.
- **Ignore Direction** means that both forward and backward direction will count.
- **Follow Direction** means that the forward direction is valid, and **Encode Counter** will increase.
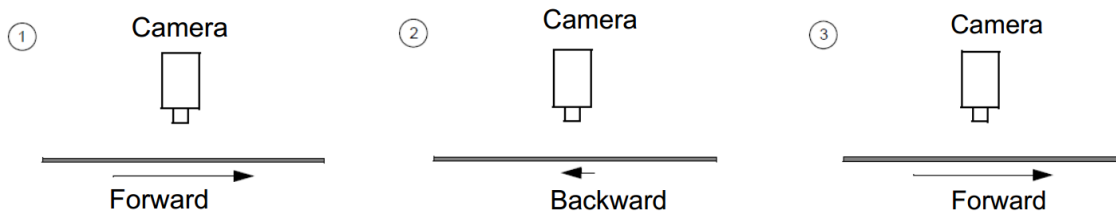- **Backward Direction** means that the backward direction is valid, and **Encode Counter** will increase.

Figure 8-13 Counter Description

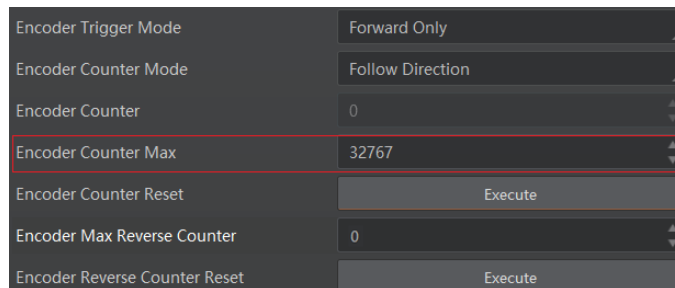5. (Optional) Set max. counter value (0 to 4294967295) in **Encoder Counter Max**.

Encoder Trigger Mode	Forward Only
Encoder Counter Mode	Follow Direction
Encoder Counter	0
Encoder Counter Max	32767
Encoder Counter Reset	Execute
Encoder Max Reverse Counter	0
Encoder Reverse Counter Reset	Execute

Figure 8-14 Set Encoder Counter Max

ⓘNote

- The range of **Encoder Counter Max.** may differ by device models.
- After reaching the max. value, it will be cleared automatically or you can clear manually by clicking **Encoder Counter Reset**.

6. (Optional) Set **Encoder Max Reverse Counter** to avoid outputting images if the object moves backward accidently during measurement, and click **Execute** in **Encoder Reverse Counter Reset** to let the device to output images again.

Set and Execute Frequency Converter Control

If the device enables the frame trigger or the line trigger, you can select Frequency Converter as trigger source. The hardware signal trigger or shaft encoder control signal can be converted into the signal frequency of frame trigger or line trigger by device's frequency converter module.

The frequency converter module includes PreDivider, Multiplier and PostDivider. The signal after being processed by these 3 modules is the device's final trigger signal.

PreDivider

The input signal first enters the PreDivider module, which reduces source signal frequency via integer division, and then the signal is sent to the Multiplier module.

The PreDivider module reduces periodic jitter on the input signal, and signals above 100 kHz must go through the PreDivider module to reduce the frequency for the Multiplier can only receive signals in the range of 10 Hz to 100 kHz frequency range. The periodic jitter of shaft encoder signal is accepted.

Multiplier

After the signal is processed by the PreDivider, it is sent to the Multiplier. The Multiplier multiplies the signal by an integer to increase its signal frequency, and then the signal is sent to the PostDivider.

Parameter can be set as rising or falling edge. If a rising edge is set, each rising edge of the signal coming from the PreDivider will be locked to match the signal of the rising edge, and vice versa.

During this process, make sure do not increase signal frequency via too larger multipliers to avoid trigger signal frequency beyond the max. line rate of the device. Even if a smaller multiplier is selected, an excessively high frequency may be generated in the frequency adjustment, exceeding the max. line rate of the device.

PostDivider

PostDivider reduces signal frequency via an integer factor, and uses the newly generated frequency signal as the device's trigger signal.

Follow steps below to set frequency converter control.

Steps

1. Click **Frequency Converter Control**, and select specific line or **Encoder Module Out** as **Input Source** according to actual demands.
2. Set **Rising Edge** or **Falling Edge** as **Signal Alignment** according to actual demands.
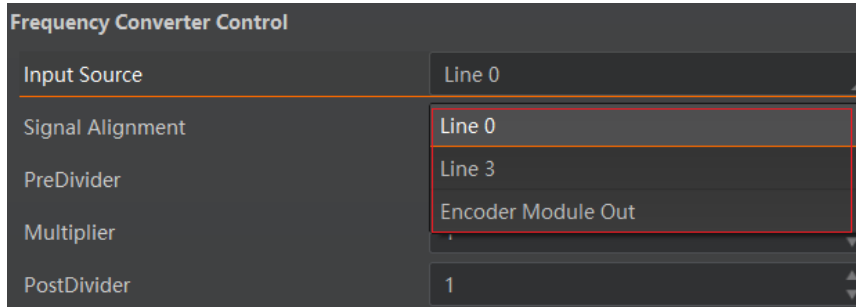3. Set **PreDivider**, **Multiplier** and **PostDivider**.

Figure 8-15 Set and Execute Frequency Converter Control

Some device models support displaying trigger line rate.

[ℹ️]**Note**

- Parameters of trigger line rate and resulting trigger line rate may differ by device models.
- Make sure that line trigger is enabled and input source value of frequency converter control and trigger source value of acquisition control is the same before viewing trigger line rate.

- **Trigger Line Rate**: It refers to the external trigger raw line rate after filtering, and it only involves external trigger signals.
- **Resulting Trigger Line Rate**: It refers to the external trigger frequency devices received after the external trigger raw line rate is calculated via frequency converter control. It only involves external trigger signals.

You need to select external trigger sources as **Input Source** to display specific values in **Trigger Line Rate** and **Resulting Trigger Line Rate**. If **N/A** is selected as **Input Source**, these two parameter values will be 0.
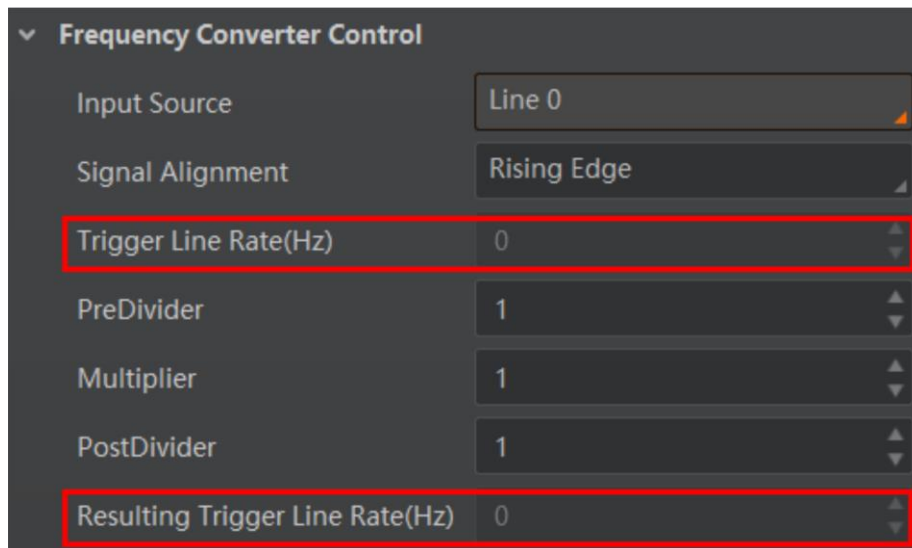

Figure 8-16 View Trigger Line Rate

Set and Execute Free Trigger

If the device enables the frame trigger or line trigger, you can select **Anyway** as trigger source to enable the free trigger. At this time, the device can receive signals of all trigger sources.

Steps

1. Go to **Acquisition Control → Trigger Selector**, and select **Frame Burst Start** or **Line Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
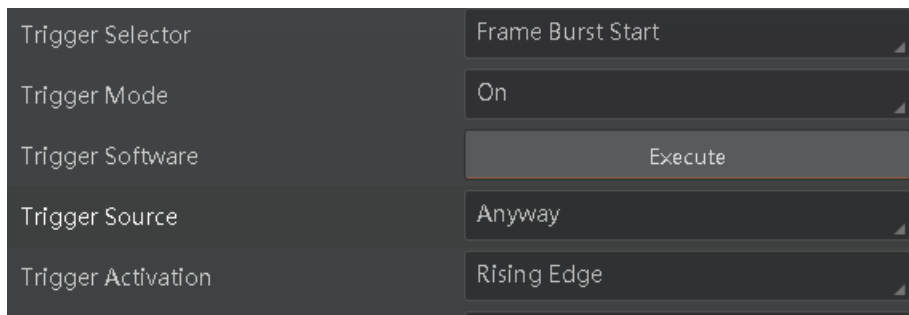3. Select **Anyway** as **Trigger Source**.

Figure 8-17 Set and Execute Free Trigger

8.7 Set Trigger Related Parameters

If the device enables the frame trigger or line trigger, you can set trigger related parameters, including acquisition burst frame count, trigger activation, trigger delay, trigger cache, and trigger debouncer.

⌐ⁱ**Note**

● Different trigger sources and trigger modes can set various parameters.
● Frame trigger cache and line trigger cache may differ by device models.
● √ is supported, and × is not supported.

If the frame trigger is enabled, the relation between trigger source and trigger related parameters is shown below.

Table 8-4 Trigger Source and Trigger Related Parameters

Trigger Source / Trigger Parameters	Software Trigger	Hardware Trigger	Frequency Converter Control	Free Trigger
Acquisition Burst Frame Count	√	√	√	√
Trigger Activation	×	√	√	√
Trigger Delay	√	√	√	√
Frame Trigger Cache	√	√	√	√
Trigger Debouncer	×	√	√	√

If the line trigger is enabled, the relation between trigger source and trigger related parameters is shown below.

Table 8-5 Trigger Source and Trigger Related Parameters

Trigger Source / Trigger Parameters	Hardware Trigger	Shaft Encoder Control	Frequency Converter Control	Free Trigger
Trigger Activation	√	√	√	√
Trigger Delay	√	√	√	√
Line Trigger Cache	√	√	√	√
Trigger Debouncer	√	×	×	√

Set Acquisition Burst Frame Count

If the device enables the frame trigger, you can set the acquisition burst frame count. Go to **Acquisition Control** → **Acquisition Burst Frame Count**, and enter **Acquisition Burst Frame Count** according to actual demands.
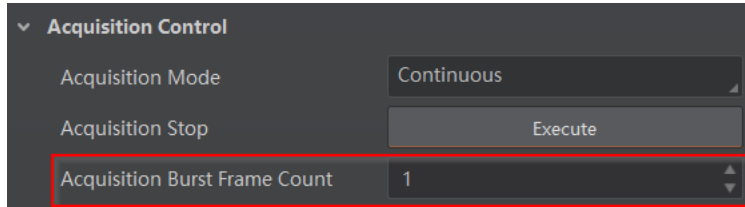
Figure 8-18 Set Acquisition Burst Frame Count

ⓘNote

● The range of **Acquisition Burst Frame Count** is from 1 to 1023.
● If **Acquisition Burst Frame Count** is 1, the device is in single frame trigger mode. If **Acquisition Burst Frame Count** is larger than 1, the device is in multi-frame trigger mode.
● If **Acquisition Burst Frame Count** is n, when input 1 trigger signal to the device, the device stops acquiring images after exposing n times and outputting n frame images.
● The sequence diagram above uses rising edge as trigger activation, and the device's height parameter is 4.
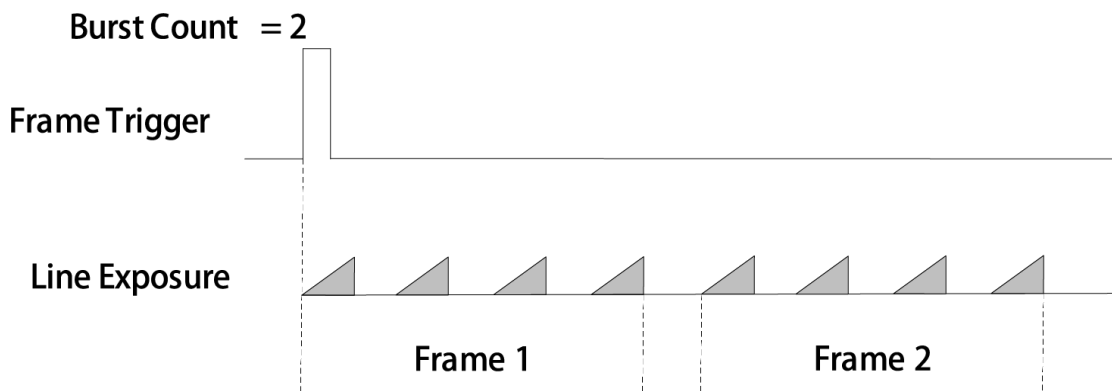
Figure 8-19 Sequence Diagram of Acquisition Burst Frame Count

Set Trigger Activation

The device supports triggering image acquisition in the rising edge, falling edge, level high, level low or any edge of the external signal. Go to **Acquisition Control** → **Trigger Activation**, and select **Rising Edge**, **Falling Edge**, **Level High**, **Level Low**, or **Any Edge** as **Trigger Activation**.
● **Rising Edge**: It means that when the level signal sent by external device is in rising edge, the device receives trigger signal and starts to acquire images.
● **Falling Edge**: It means that when the level signal sent by external device is in falling edge,

the device receives trigger signal and starts to acquire images.

● **Level High**: The level high of the trigger signal is valid. As long as the trigger signal is in level high, the device is in image acquisition status.

● **Level Low**: The level low of the trigger signal is valid. As long as the trigger signal is in level low, the device is in image acquisition status.

● **Any Edge**: It means that when the level signal sent by external device is in rising edge, falling edge, level high or level low, the device receives trigger signal and starts to acquire images.

☐**Note**

The setting method for trigger activation is different in frame trigger and line trigger.

Set Trigger Activation in Frame Trigger

Go to **Acquisition Control**, and set **Trigger Activation** according to actual demands.

● When rising edge, falling edge or any edge is selected as **Trigger Activation**, you can set **Trigger Delay**. After enabling **Line Delay Enable**, set line quantity to be triggered in delay in **Trigger Delay**. If **Line Delay Enable** is not enabled, set trigger delay time in **Trigger Delay**.

Trigger Selector	Frame Burst Start
Trigger Mode	On
Trigger Source	Line 0
Trigger Activation	Rising Edge
Line Delay Enable	
TriggerDelay	0.0000
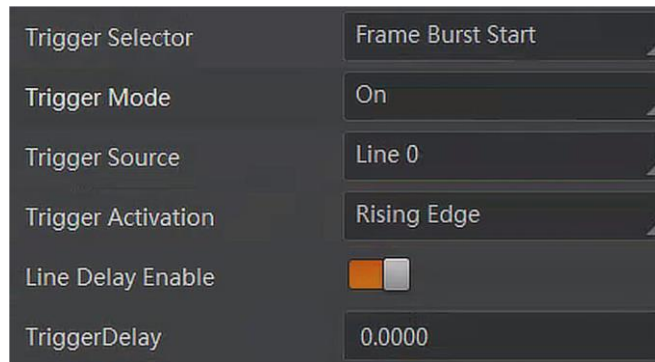
Figure 8-20 Edge Trigger in Frame Trigger

● When level high or level low is selected as **Trigger** Activation, you can set **Trigger Partial Close**. True means that images after complement is outputted after the level trigger ends, and false means that images output according to the settings of the frame timeout after the level trigger ends.
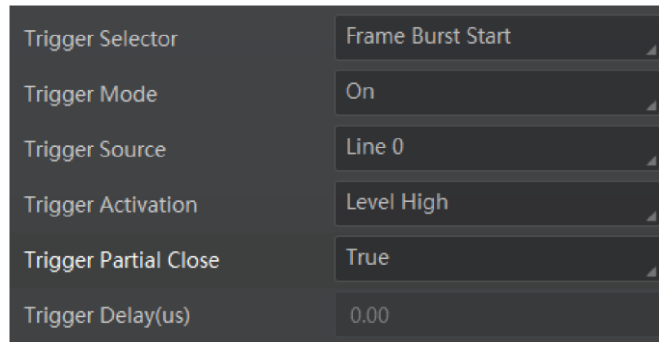
Figure 8-21 Level Trigger in Frame Trigger

Set Trigger Activation in Line Trigger

In the line trigger mode, the trigger activation is related with **Exposure Mode**.

● When **Timed** is selected as **Exposure Mode**, you can select **Rising Edge** or **Falling Edge** as **Trigger Activation**, and **Exposure Auto** and **Exposure Time** determine the exposure time.

● When **Trigger Width** is selected as **Exposure Mode**, you can select **Level Low** or **Level High** as **Trigger Activation**, and exposure time is determined by the duration of the level signal only.
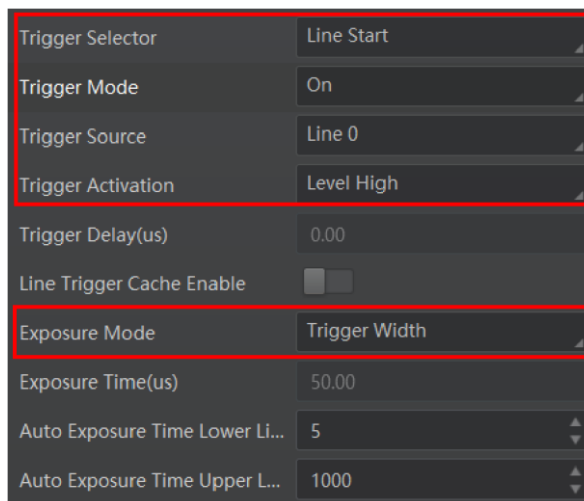
Figure 8-22 Set Trigger Activation in Line Trigger

⌷**Note**

The trigger width function may differ by device models.

Set Trigger Delay

The trigger delay function allows the device to add a delay between the receipt of trigger signal and the moment the trigger becomes active. Go to **Acquisition Control** → **Trigger Delay**, and enter **Trigger Delay**, and the unit is μs.

Trigger Selector	Frame Burst Start
Trigger Mode	Off
Trigger Source	Line 0
Trigger Activation	Rising Edge
Line Delay Enable	
Trigger Delay(us)	0.0000
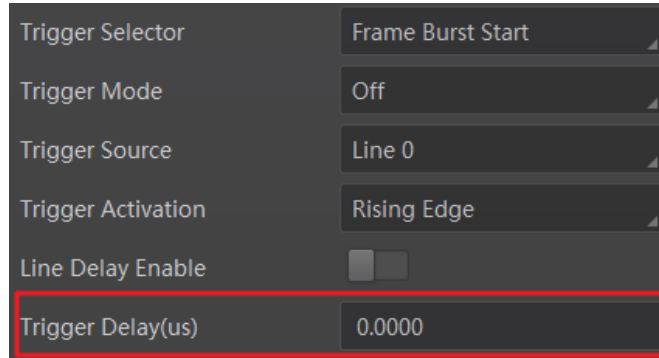
Figure 8-23 Set Trigger Delay under Frame Trigger

Trigger Selector	Line Start
Trigger Mode	Off
Trigger Source	Line 0
Trigger Activation	Rising Edge
Trigger Delay(us)	0.0000
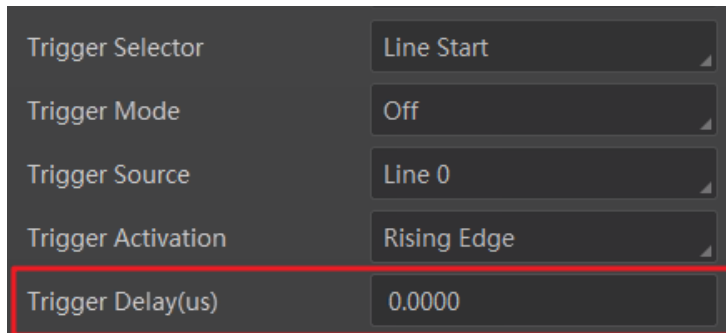
Figure 8-24 Set Trigger Delay under Line Trigger
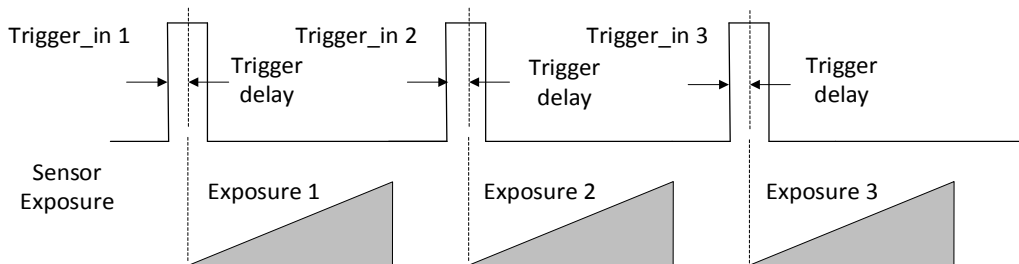
Figure 8-25 Sequence Diagram of Trigger Delay

ⓘ**Note**

The sequence diagram above uses rising edge as trigger activation.

Set Frame/Line Trigger Cache

ⓘNote

● The frame/line trigger cache function may differ by device models.
● The setting method for trigger cache is different in frame trigger and line trigger.

If the device enables the frame trigger or line trigger, it has the frame/line trigger cache function. During the triggering process, if the device receives new trigger signal, it will save and process the signal if you enable this function. Trigger cache enable can save up to 3 trigger signals.

Set Trigger Cache in Frame Trigger

Steps

1. Go to **Acquisition Control → Trigger Selector**, and select **Frame Burst Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
3. Enable **Trigger Cache Enable**.
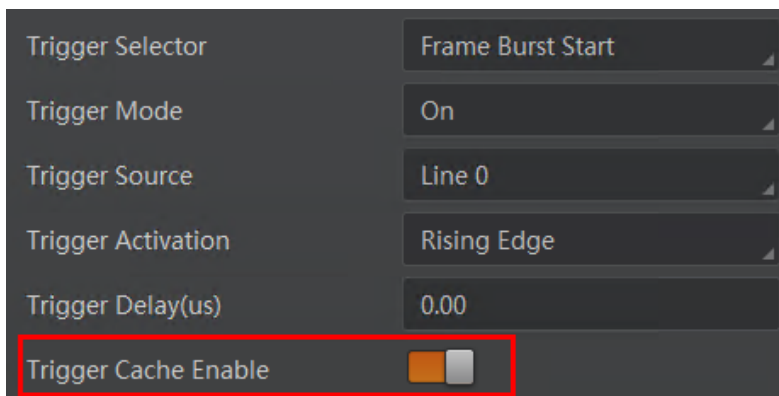
Figure 8-26 Set Trigger Cache in Frame Trigger

If the device receives the 1st trigger signal first, and the device receives the 2nd trigger signal during processing the 1st trigger signal.

● Disable Trigger Cache Enable: the 2nd trigger signal will be filtered without processing.
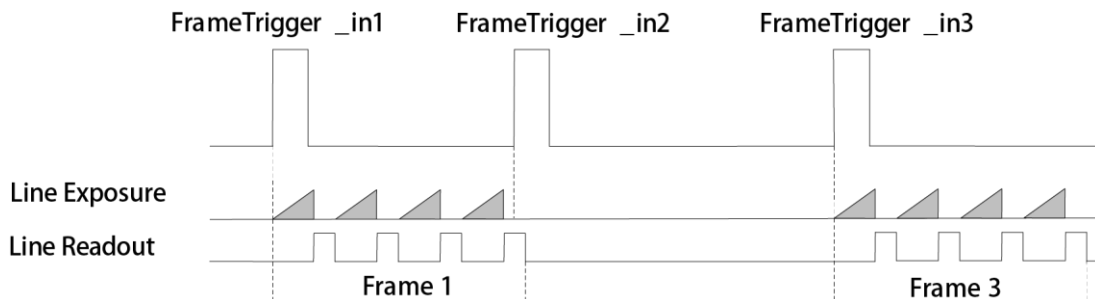
Figure 8-27 Second Frame Filtered

● Enable Trigger Cache Enable: the 2nd trigger signal will be saved.

If the 1st frame image's exposure time of the 2nd trigger signal is not earlier than the device's last frame creation time of the 1st trigger signal, and then the 2nd trigger signal's 1st frame image is created normally.
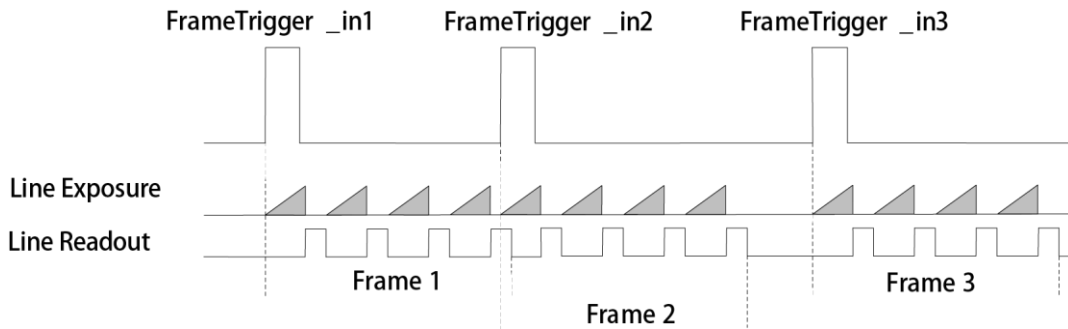

Figure 8-28 Second Frame Created Normally

If the 1st frame image's exposure time of the 2nd trigger signal is earlier than the device's last frame creation time of the 1st trigger signal, and then the device will delay this exposure time. Thus making sure this exposure time is not earlier than the device's last frame creation time of the 1st trigger signal.
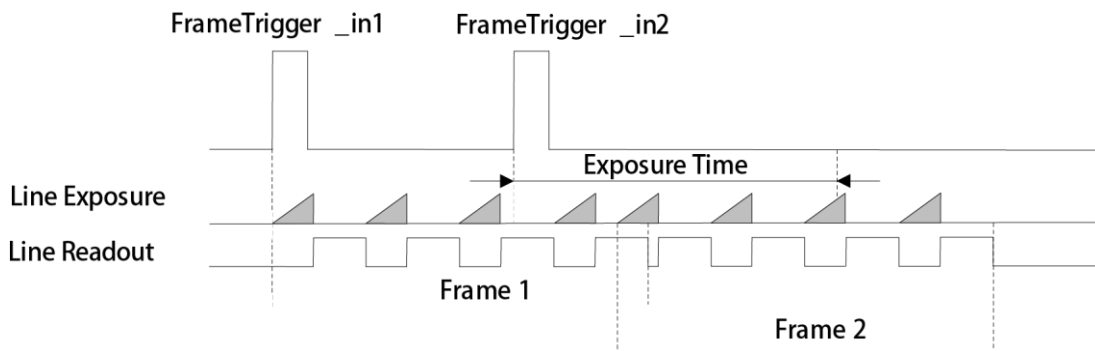
Figure 8-29 Sequence Diagram

⌐**i**Note

The three sequence diagrams above use rising edge as trigger activation, and the device's height parameter is 4.

Set Trigger Cache in Line Trigger

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Line Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
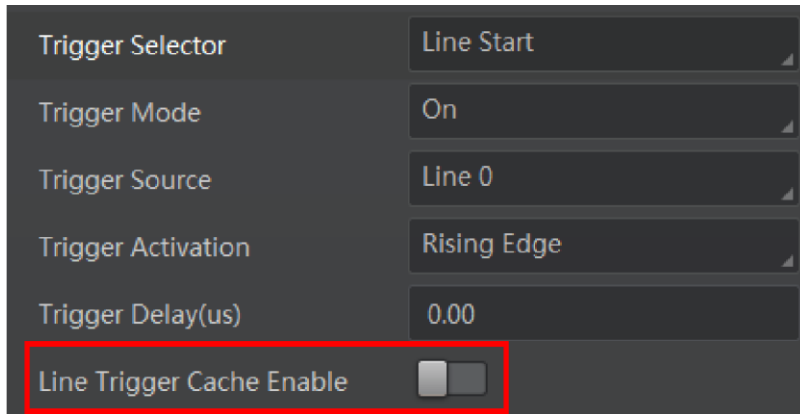3. Enable **Line Trigger Cache Enable**.

Figure 8-30 Set Trigger Cache in Line Trigger

Set Trigger Debouncer

The trigger debouncer function allows the device to filter out unwanted short external trigger signal that is input to the device.

Go to **Digital IO Control** → **Line Debouncer Time**, and enter **Line Debouncer Time** according to actual demands.

⎡i**Note**

● If the **Line Debouncer Time** you set is greater than the time of trigger signal, this trigger signal will be ignored.
● The unit of **Line Debouncer Time** may differ by device models.
● The sequence diagram below uses rising edge as trigger activation.
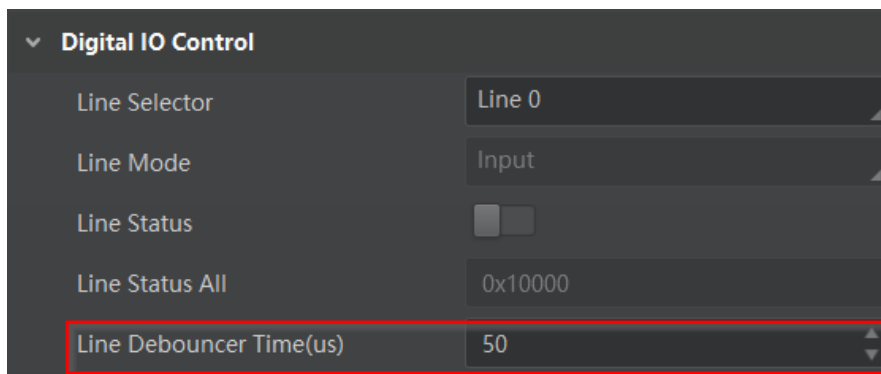
Figure 8-31 Set Trigger Debouncer
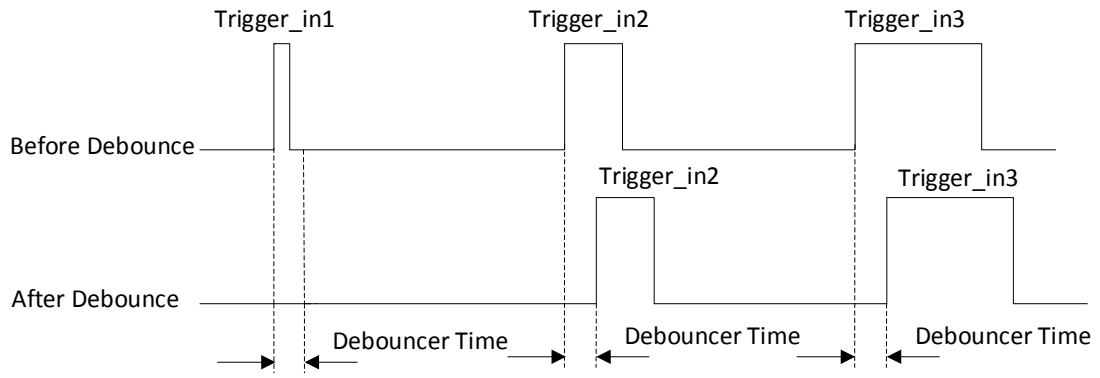
Figure 8-32 Sequence Diagram of Trigger Debouncer

Chapter 9 Trigger Output

9.1 Select Output Signal

Note

The selectable output signal line may differ by device models.

The device has multiple differential output lines or bi-directional configurable lines. The method of setting bi-directional configurable line as output line as follows:

Steps
1. Go to **Digital IO Control**, and select specific line as **Line Selector**.
2. Set **Strobe** as **Line Mode**.
2. (Optional) Set **Line Format** according to actual demands.
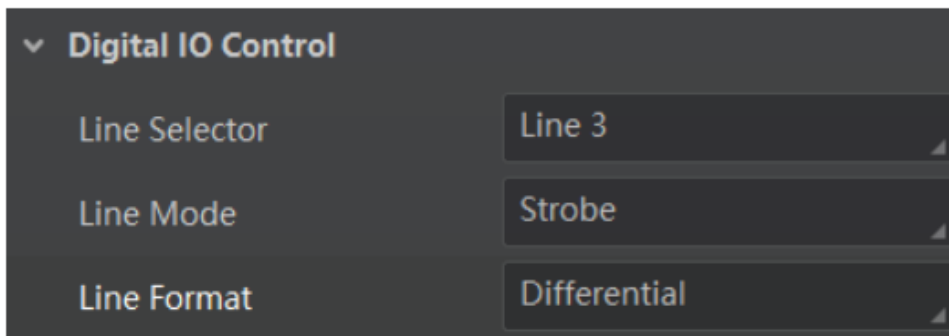
Figure 9-1 Select Output Signal

Note
- The line format function may differ by device models.
- Differential stands for the differential signal.
- If a bi-directional configurable line signal is selected as **Line Selector** and **Line Mode** is **Input** currently, but you cannot set **Strobe** as **Line Mode**. The reason is that the bi-directional configurable line signal is selected as trigger source in one of line trigger/frame trigger/shaft encoder control/ frequency converter control settings. You should set other line signals as trigger source in line trigger/frame trigger/shaft encoder control/ frequency converter control settings all.

9.2 Set Output Signal

The output signal of the device is switch signal that can be used to control external devices such as light source, PLC, etc. There are two ways to set output signal, including line inverter and strobe signal.

9.2.1 Enable Line Inverter

The line inverter function allows the device to invert the electrical signal level of an I/O line. Go to **Digital IO Control** → **Line Inverter**, and enable it.
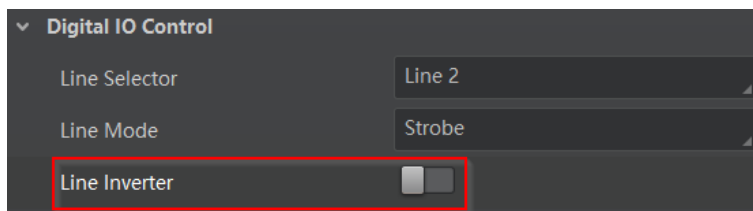

Figure 9-2 Enable Line Inverter

⊡**Note**
The line inverter function is disabled by default.

9.2.2 Enable Strobe Signal

The strobe signal is used to directly output I/O signal to external devices when the device's event source occurs.
If you need to let the device output signals when it outputs one frame image, follow steps below to set it.

Steps
1. Click **Digital IO Control**, and set **Exposure Start Active** as **Line Source**.
2. Select **Frame Mode** as **Strobe Source Selector**.
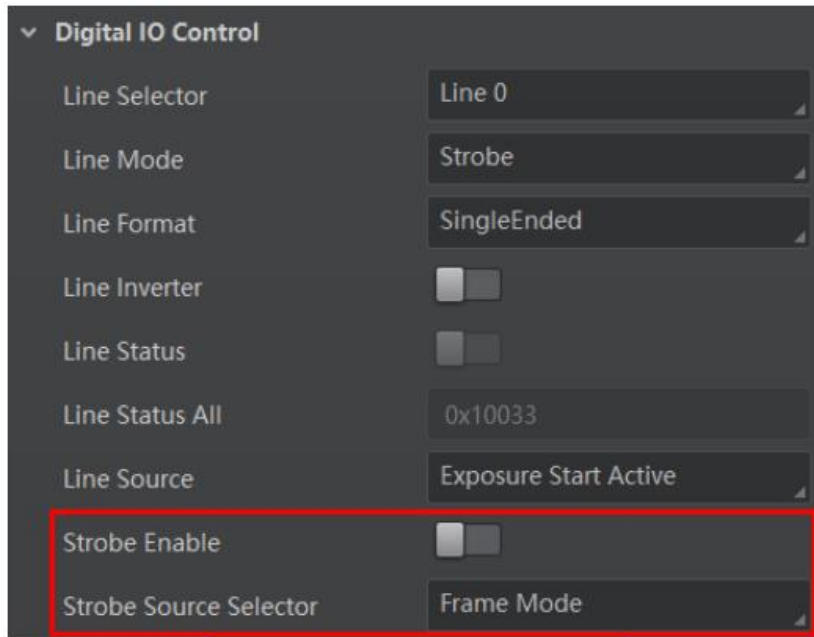3. Enable **Strobe Enable**.

Figure 9-3 Select Frame Mode as Strobe Source Selector

If you need to let the device output signals when event sources occur that are corresponding to each line image, follow steps below to set it.

Steps

1. Click **Digital IO Control**, and select **Line Mode** as **Strobe Source Selector**.
2. Set **Line Source** according to actual demands.
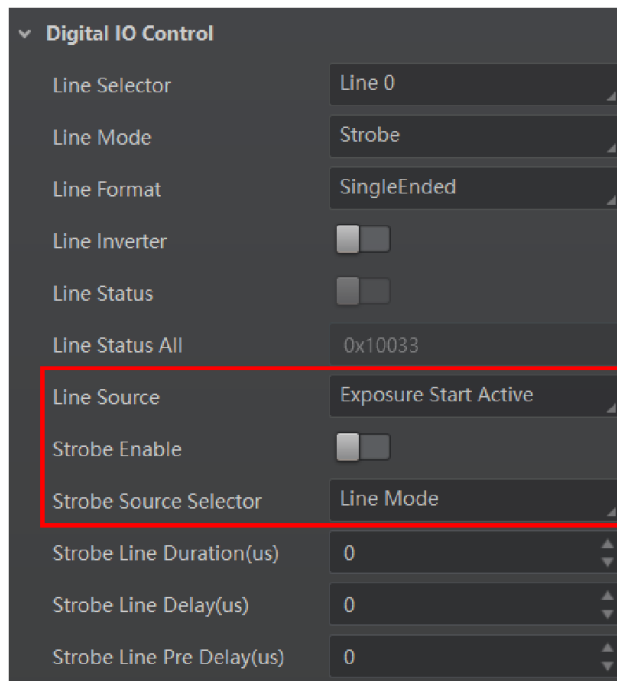3. Enable **Strobe Enable**.

Figure 9-4 Select Line Mode as Strobe Source Selector

After selecting a specific line source, an event information will be generated, and the device will output a Strobe signal at the same time. The supported line sources are as follows:

ⓘ**Note**

The specific line sources may differ by device models.

Table 9-1 Line Source Description

Line Source	Description
Exposure Start Active	The device outputs signals to external devices when it starts exposure.
Acquisition Start Active	The device outputs signals to external devices when it starts acquiring images.
Acquisition Stop Active	The device outputs signals to external devices when it stops acquiring images.
Frame Burst Start Active	The device outputs signals to external devices when the device's frame burst starts.
Frame Burst End Active	The device outputs signals to external devices when the device's frame burst stops.
Frame Start Active	The device outputs signals to external devices when it starts doing the capture of a frame.
Frame End Active	The device outputs signals to external devices when it stops doing the capture of a frame.
Soft Trigger Active	The device outputs signals to external devices when it has a software trigger.
Hard Trigger Active	The device outputs signals to external devices when it has a hardware trigger.
Counter Active	The device outputs signals to external devices when it has a counter trigger.
Timer Active	The device outputs signals to external devices when it has a timer trigger.

When **Counter Active** is selected as **Line Source**, you can go to **Counter and Timer Control** and set specific parameters according to actual demands.

Table 9-2 Description of Counter and Timer Control

| Parameter	Read/Write	Description
Counter Selector	Read and write	It selects counter source. **Counter 0** is available only at present.
Counter Event Source	Read and write	It selects the signal source of counter trigger, and **Line 0/1/3/4** is available. It is disabled by default.
Counter Event Activation	Read and write	It selects the activation mode of the selected counter event source, including rising edge, falling edge, and any edge.
Counter Reset Source	Read and write	It selects the signal source of resetting counter. **Software** is available only. It is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed when selecting **Software** as **Counter Reset Source**.
Counter Value	Read and write	It is the counter value with the range of 1 to 4294967295. 📖**Note** The specific range of counter value may differ by device models.
Counter Current Value	Read only	It displays the number of executed external trigger.
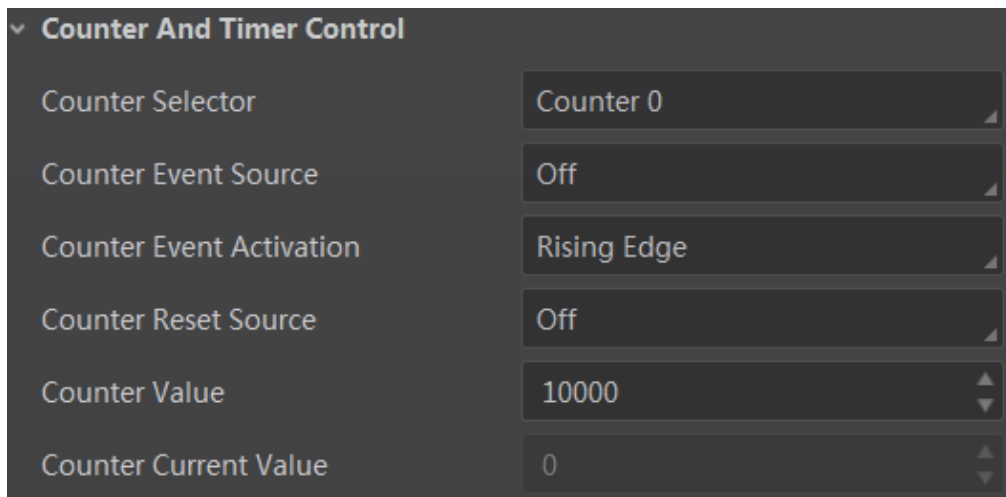
Figure 9-5 Counter and Timer Control

If **Timer Active** is selected as **Line Source**, you can set **Strobe Line Duration** and **Strobe Line Delay**, and the device will output signal correspondingly after click **Execute** in **Line Trigger Software**.
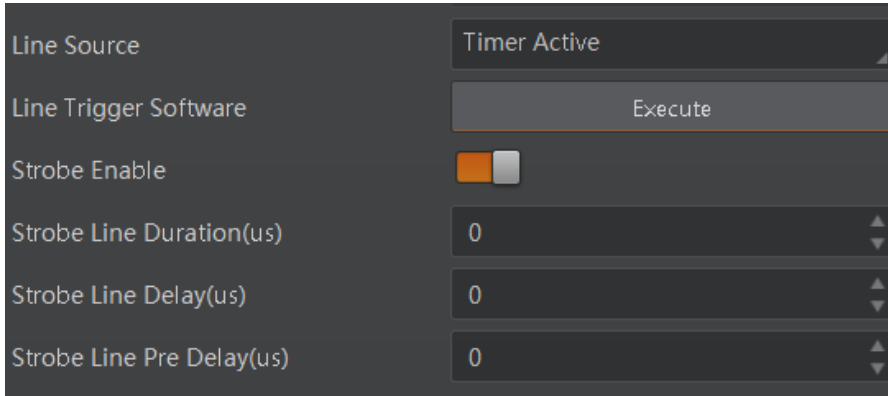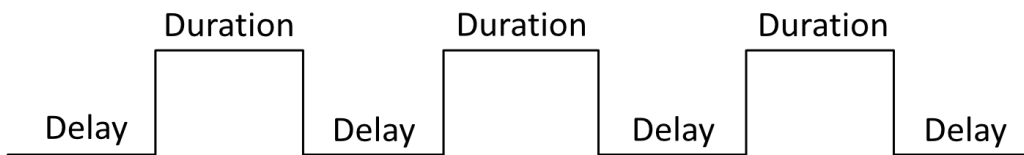
Figure 9-6 Timer Active Parameter

Figure 9-7 Sequence Diagram of Timer Active

When selecting **Line Mode** as **Strobe Source Selector**, you can also set duration, delay and pre delay for outputted signal.

⌐**i**Note

● For some device models, in frame mode, you can set duration, delay and pre delay for outputted signal.
● Here we take **Line Mode** as **Strobe Source Selector** as an example to introduce how to set duration, delay and pre delay.

Set Strobe Line Duration

After enabling strobe signal, you can set its duration. Go to **Digital IO Control** → **Strobe Line Duration**, and enter **Strobe Line Duration**.
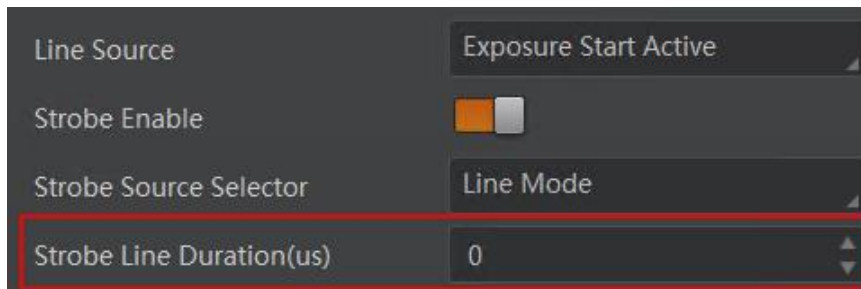

Figure 9-8 Set Strobe Line Duration

- When the **Strobe Line Duration** value is 0, the strobe duration is equal to the exposure time.
- When the **Strobe Line Duration** value is not 0, the strobe duration is equal to **Strobe Line Duration** value.

Set Strobe Line Delay

The device supports setting strobe line delay to meet actual demands. When exposure starts, the strobe output doesn't take effect immediately. Instead, the strobe output will delay according to the strobe line delay setting.

Go to **Digital IO Control** → **Strobe Line Delay**, and enter **Strobe Line Delay** according to actual demands. The sequence diagram of strobe line delay is shown below.
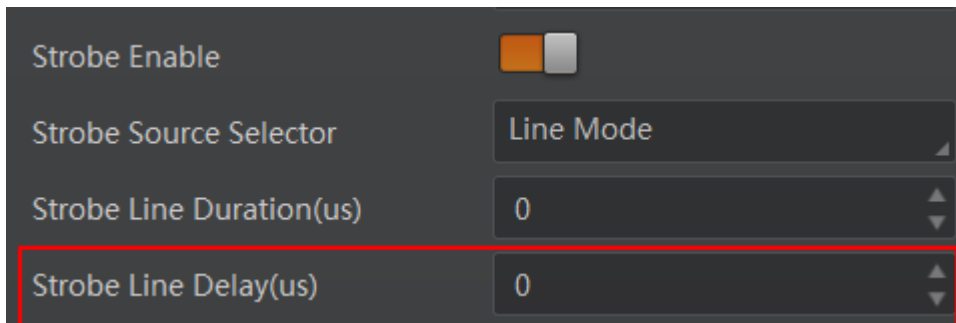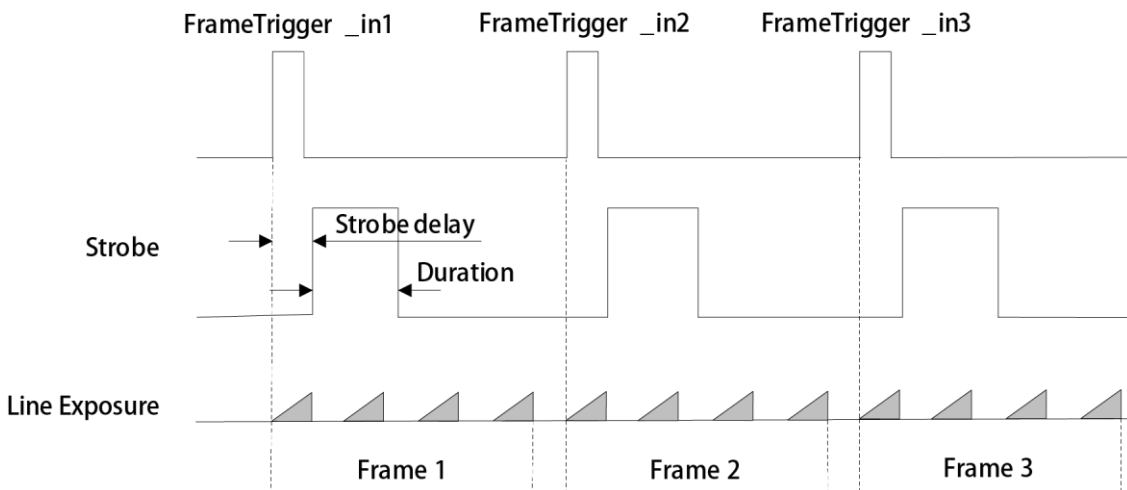

Figure 9-9 Set Strobe Line Delay

Figure 9-10 Sequence Diagram of Strobe Line Delay

The device's height parameter is 4 in the sequence diagram above.

Set Strobe Line Pre Delay

The device also supports the function of strobe line pre delay, which means that the strobe signal takes effect early than exposure. This function is applied to the external devices that have slow response speed.

Go to **Digital IO Control** → **Strobe Line Pre Delay**, and enter **Strobe Line Pre Delay** according to actual demands. The sequence diagram of strobe line pre delay is shown below.
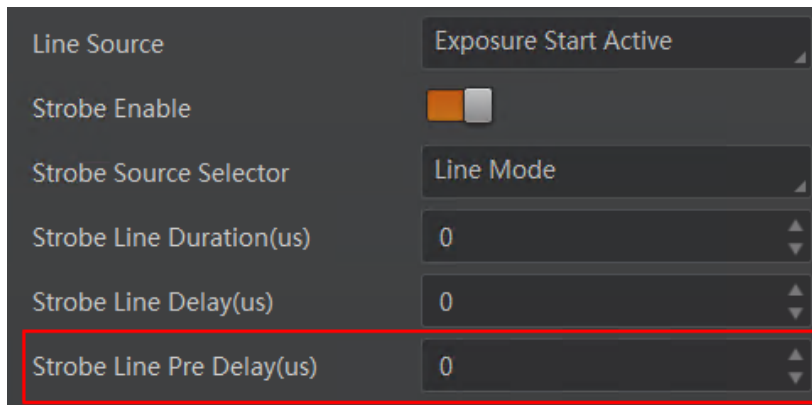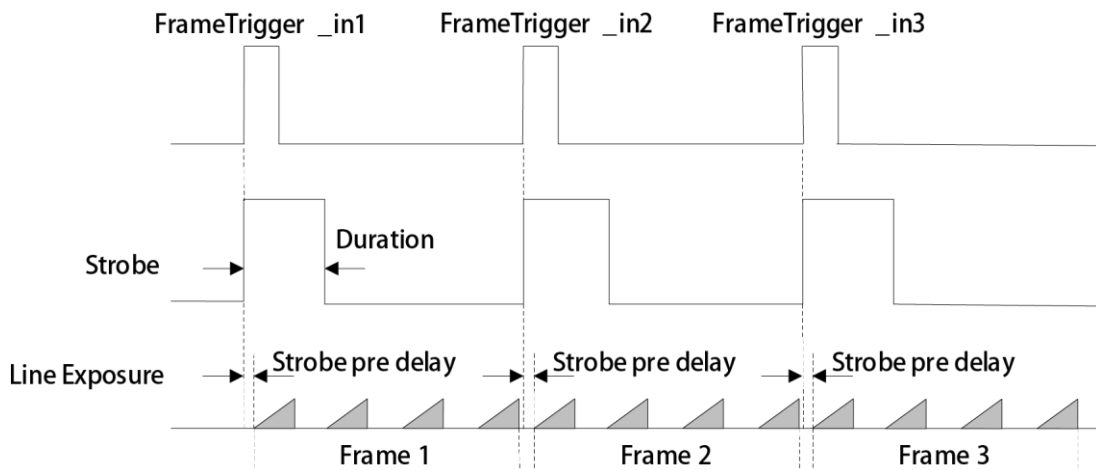

Figure 9-11 Set Strobe Line Pre Delay

Figure 9-12 Sequence Diagram of Strobe Line Pre Delay

☐**i****Note**

The device's height parameter is 4 in the sequence diagram above.

Chapter 10 I/O Electrical Features and Wiring

10.1 I/O Introduction

There are two types of I/O signals in accordance with pin definitions.
● The first type: Two differential input signals (Line 0/3), two differential output signals (Line 1/4), and one bi-directional configurable signal (Line 2).
● The second type: Four configurable input or output signals (Line 0/1/3/4), and these lines can be configured as differential input or differential output according to actual demands.

10.2 I/O Electrical Features

10.2.1 Differential Input Circuit

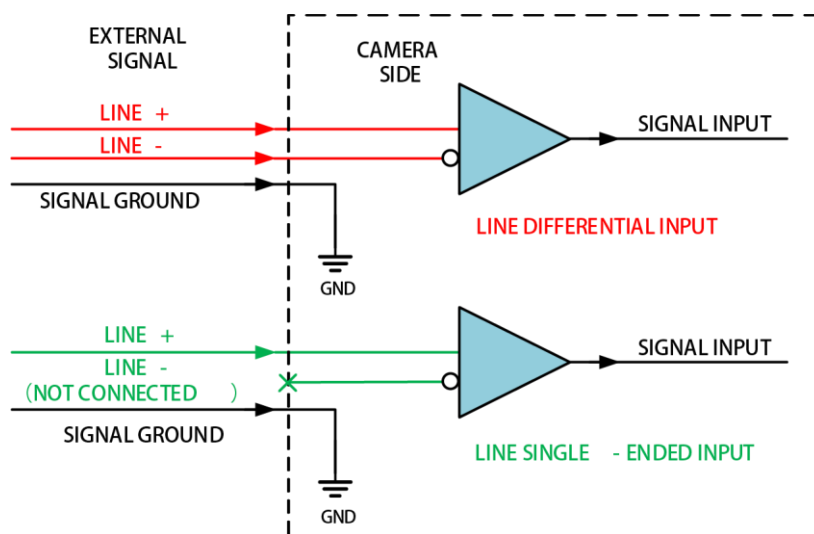The differential input signal in I/O signals supports the single-ended input, and its internal circuit is shown below.

Figure 10-1 Internal Circuit of Differential Input

The RS-422 standard, RS-644 standard and TTL&LVTTL standard input signal are applied to the differential input.

RS-422 Standard Input

In order to make sure the normal operation of input circuit, it is required to connect

device's ground signal with external ground signal if the differential input adopts RS-422 standard signal.

RS-422 standard defines the connection of the bus structure, and the inputs of several devices can be connected to the RS-422. Up to 10 devices can be connected at the same time, of which only one device is the main dispenser and other devices are receivers. The circuit length between the receiver and the bus should be as short as possible. The bus must have a 120 Ω terminal resistance.

When the device is the last receiver on the bus structure, the device's terminal resistance needs to be enabled, and the rest device's terminal resistance need to be disabled. Multiple terminal resistance should not be enabled on the bus structure, which will reduce signal reliability and may cause damage to the RS-422 device.

RS-644 Standard Input

If the differential input adopts RS-644 standard signal, the input terminal must enable 120 Ω terminal resistance.

TTL&LVTTL Standard Input

If the differential input adopts TTL&LVTTL standard signal, the input terminal's 120 Ω terminal resistance must be disabled, and its input electrical feature requirement is shown below.

Table 10-1 Electrical Feature Requirement of TTL&LVTTL

Voltage Range	Description
0 V to 1 V	Level low
1 V to 3 V	Unstable voltage, and it is not recommended to use it.
3.3 V to 24 V	Level high

10.2.2 Differential Output Circuit

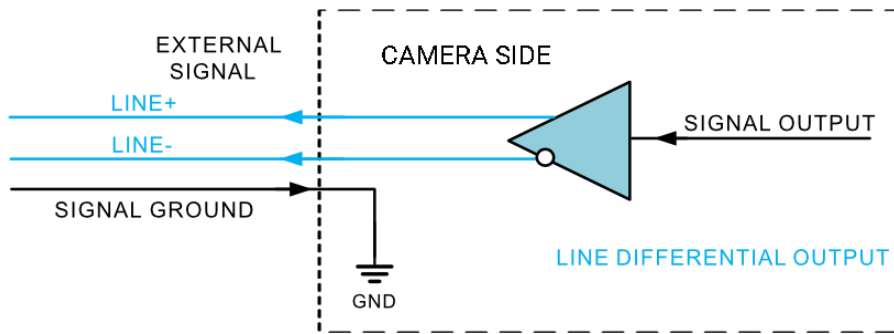The internal circuit of differential output signal in I/O signals is shown below.

Figure 10-2 Internal Circuit of Differential Output

The RS-422 standard and RS-644 standard are applied to the differential output.

RS-422 Standard Output

In order to make sure the normal operation of output circuit, it is required to connect device's ground signal with external ground signal. The output interface can be connected to the RS-422 bus structure as a main dispenser.

RS-644 Standard Output

The device adopting RS-422 standard output signal cannot directly connect to RS-644 standard. When connecting RS-644 standard output, it is required to add a resistance network in device's output location. In order to make sure the normal operation of output circuit, it is required to connect device's ground signal with external ground signal.

10.2.3 Bi-Direction I/O Circuit

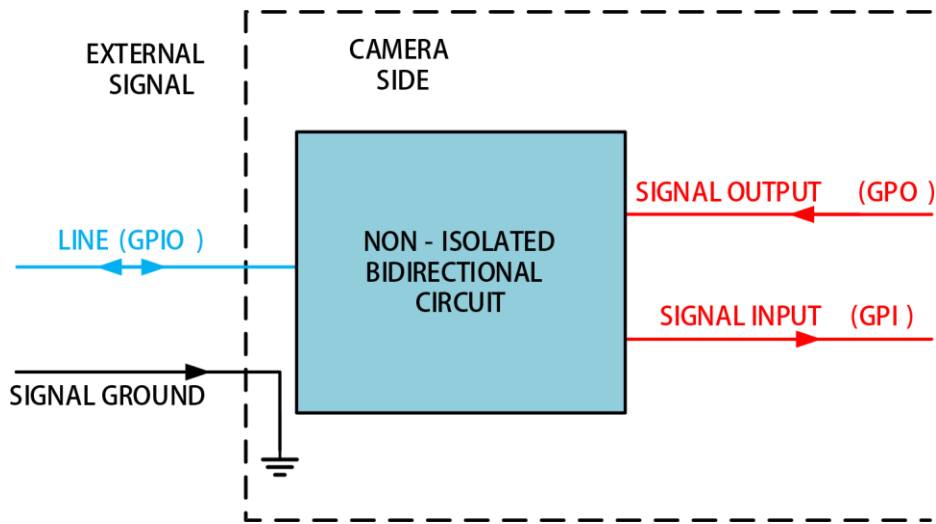The bi-directional I/O can be used as the input signal and output signal, and its internal circuit is shown below.

Figure 10-3 Bi-Direction I/O Circuit

Configure to Input Signal

Logic 0 input level: 0 VDC to 0.5 VDC (GPIO2 pin).
Logic 1 input level: 1.5 VDC to 30 VDC (GPIO2 pin).
With the condition of 100 Ω and 5 VDC, the logic level and electrical feature of configuring GPIO2 as input are shown below.
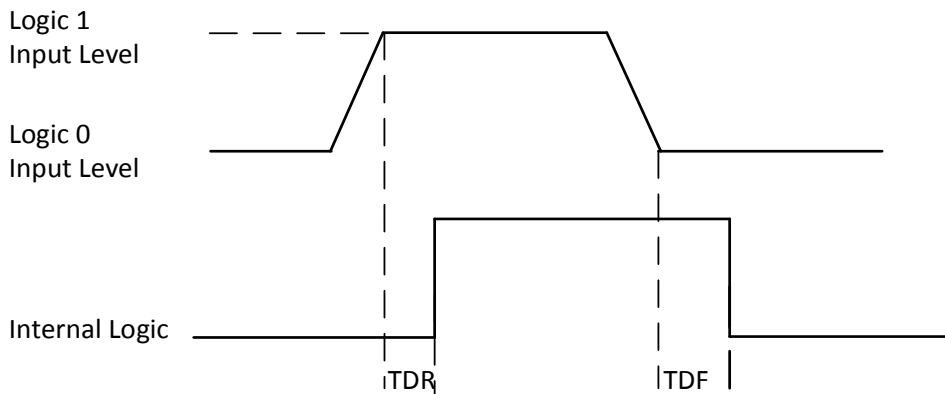

Figure 10-4 Input Logic Level

ⓘNote

● Make sure that the input voltage is not from 1 VDC to 1.5 VDC. The circuit status between the two values is not stable.
● The breakdown voltage is 30 VDC, and keep voltage stable.
● To prevent damage to the GPIO pin, connect GND first and then input voltage in Line 2 pin.

Table 10-2 Electrical Feature of Line 2 Input

Parameter Name	Parameter Symbol	Value
Input Rising Time	TR	0.06 µs
Input Falling Time	TF	0.016 µs
Input Rising Delay	TDR	< 1 µs
Input Falling Delay	TDF	< 1 µs

Configure to Output Signal

Note

The maximum current is 25 mA and the output impedance is 40 Ω.

When the environment temperature is 25 °C (77 °F), the relation among external voltage, resistance and the output low level is shown below.

Table 10-3 Parameters of Output Logic Level Low

External Voltage	External Resistance	VL
3.3 VDC	1 KΩ	160 mV
5 VDC	1 KΩ	220 mV
12 VDC	1 KΩ	460 mV
24 VDC	1 KΩ	860 mV
30 VDC	1 KΩ	970 mV

When the voltage of external resistance (1 KΩ) is pulled up to 5 VDC, the logic level and electrical features of configuring Line 2 to output are shown below.
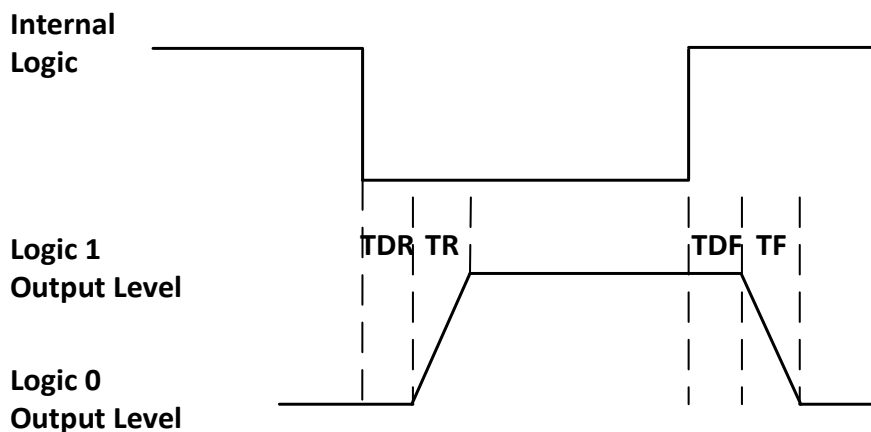

Figure 10-5 Output Logic Level

Table 10-4 Output Electrical Feature

Parameter Name	Parameter Symbol	Value
Output Rising Time	TR	0.06 µs
Output Falling Time	TF	0.016 µs
Output Rising Delay	TDR	0 µs to 4 µs
Output Falling Delay	TDF	< 1 µs

10.3 Input Signal Wiring

The device can receive inputted signals via the hardware trigger to acquire images. The inputted signals include differential signal and single-ended signal.

The input wiring has two types according to the device's pin definitions. The first type of input wiring corresponds to the first type of pin definitions mentioned in Table 4-1, and the second type of input wiring corresponds to the second type of pin definitions mentioned in Table 4-2.

⃞ⁱNote

● Make sure that the hardware trigger signals have been configured as input signal.
● Here we take one type of GigE line scan cameras as an example to introduce the input signal wiring. The appearance here is for reference only.

10.3.1 First Type of Input Signal Wiring

Differential Signal

⃞ⁱNote

The wiring may differ by voltages of differential signal sources.

● The voltage of the differential signal source is 5 V.
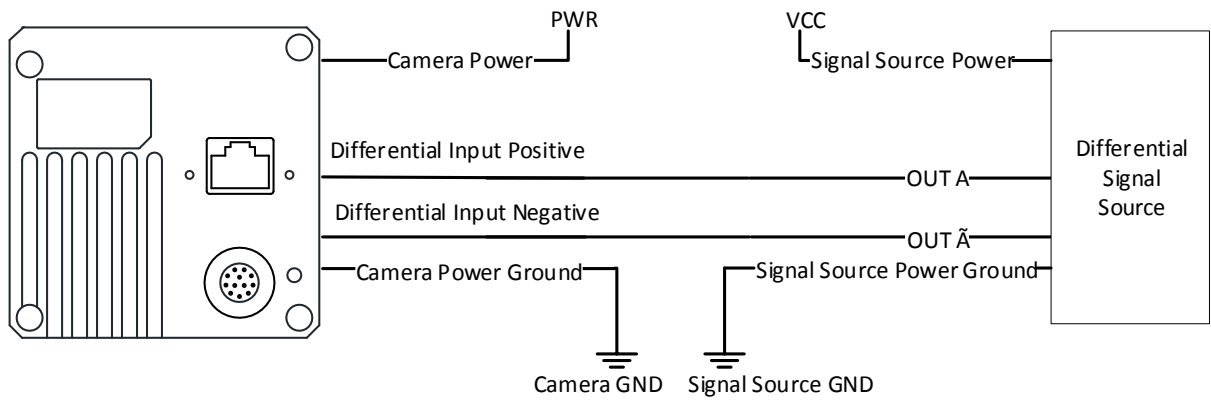
Figure 10-6 5 V Differential Signal Source Outputs Differential Signal

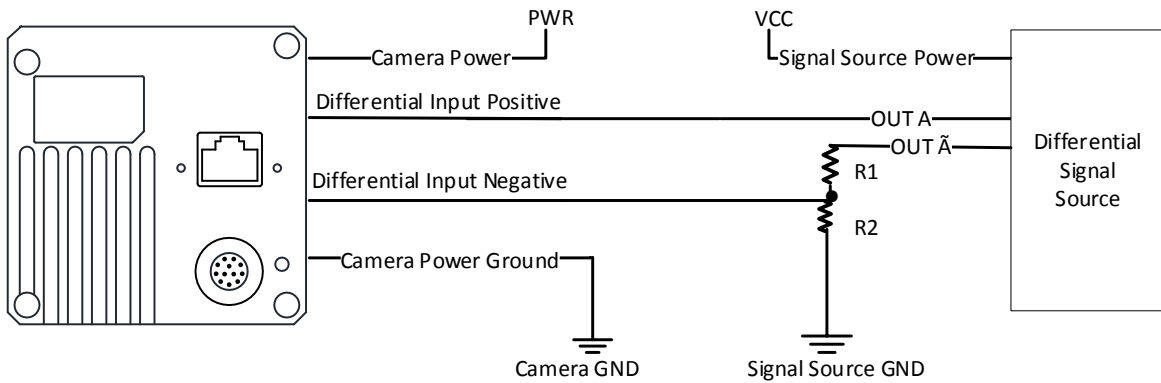● The voltage of the differential signal source is 12 V or 24 V.

Figure 10-7 12 V and 24 V Differential Signal Sources Output Differential Signal

With different voltages of differential signal sources, the respective resistance values in wiring are also different, as shown below.

Table 10-5 Relation between Voltage and Resistance

VCC	R1	R2
12 VDC	6.2 K	4.7 K
24 VDC	18 K	4.7 K

Single-Ended Signal

The single-ended signals that the device receives can be from the differential signal source or the single-ended signal source.

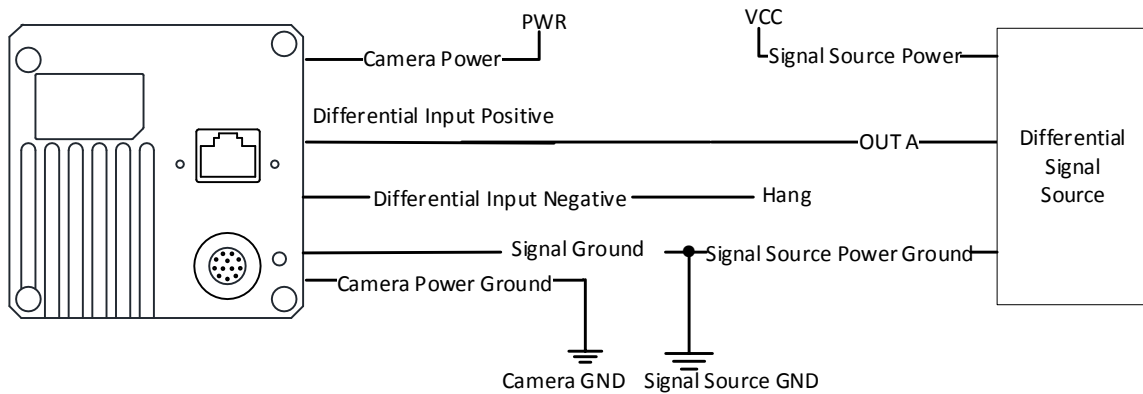● The VCC of the differential signal source is 5 V, 12 V or 24 V.

Figure 10-8 Differential Signal Source Outputs Single-Ended Signal

● When the PNP single-ended signal source provides signal, and the device's differential input is used as single-ended input. The VCC of PNP single-ended signal source is 5 V, 12 V or 24V.
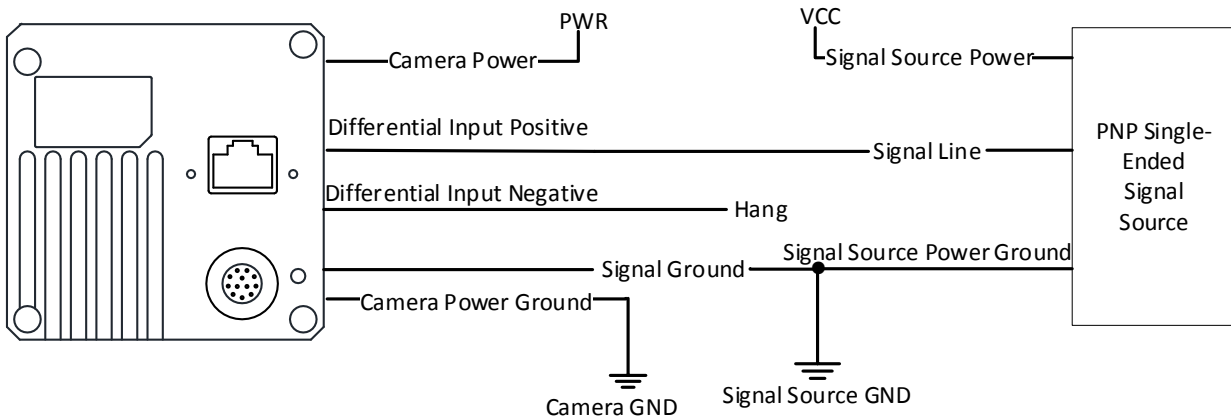

Figure 10-9 PNP Single-Ended Signal Source Connects Differential Input

● When the PNP single-ended signal source provides bi-directional I/O to the device, the wiring is shown below. The VCC of PNP single-ended signal source is 12 V or 24 V.
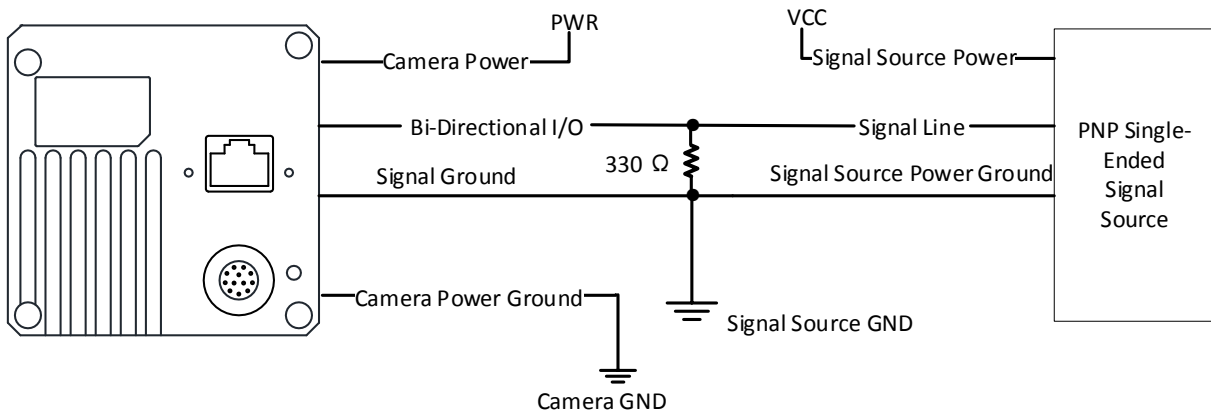

Figure 10-10 PNP Single-Ended Signal Source Connects Bi-Directional I/O

● When the NPN single-ended signal source provides signal, and the device's differential input is used as single-ended input. The VCC of NPN single-ended signal source is 5 V, 12 V or 24 V.
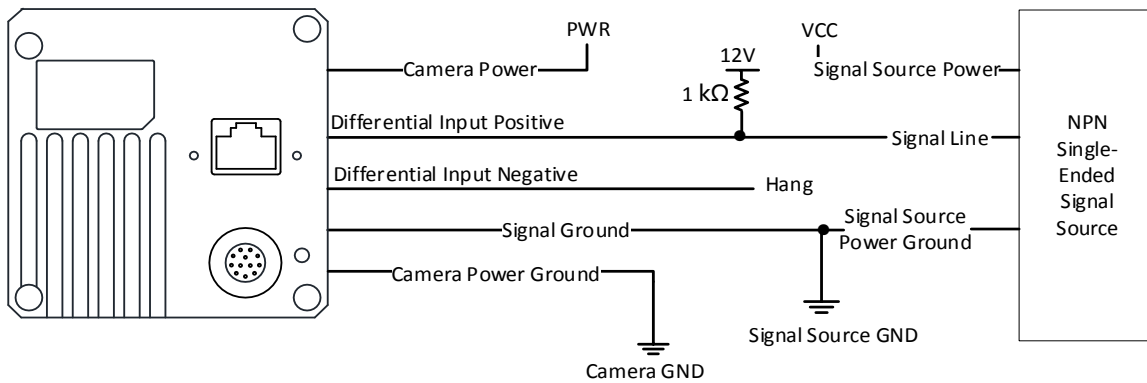

Figure 10-11 NPN Single-Ended Signal Source Connects Differential Input

● When the NPN single-ended signal source provides bi-directional I/O to the device, the wiring is shown below. The VCC of NPN single-ended signal source is 12 V or 24 V.
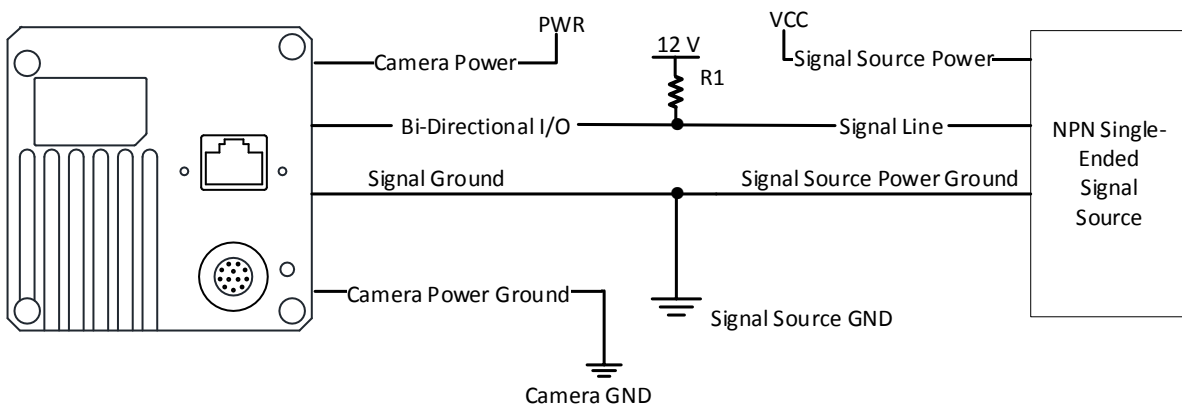

Figure 10-12 NPN Single-Ended Signal Source Connects Bi-Directional I/O

The R1 resistance values in the figure above is different by the voltages of NPN single-ended signal source, as shown blow.

Table 10-6 Relation between Voltage and Resistance

VCC	R1
12 VDC	1 K
24 VDC	4.7 K

10.3.2 Second Type of Input Signal Wiring

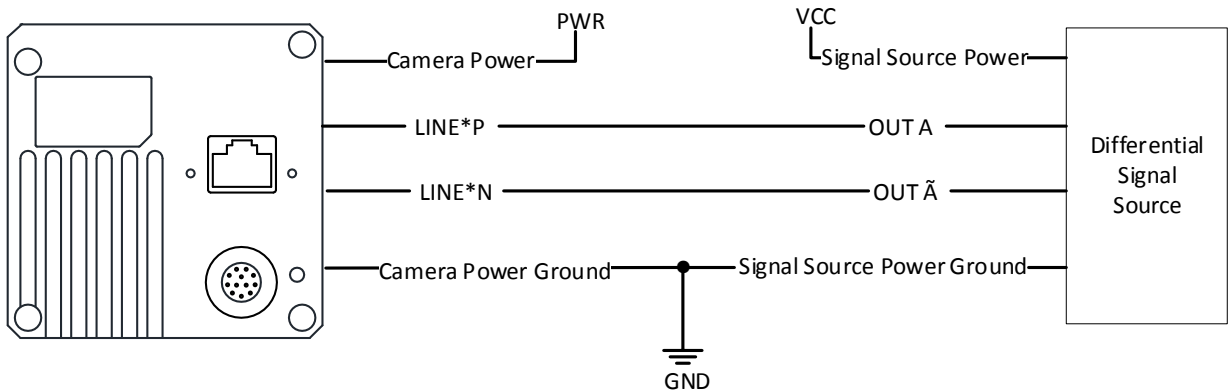● The differential signal source provides trigger signals.

Figure 10-13 Differential Input Wiring

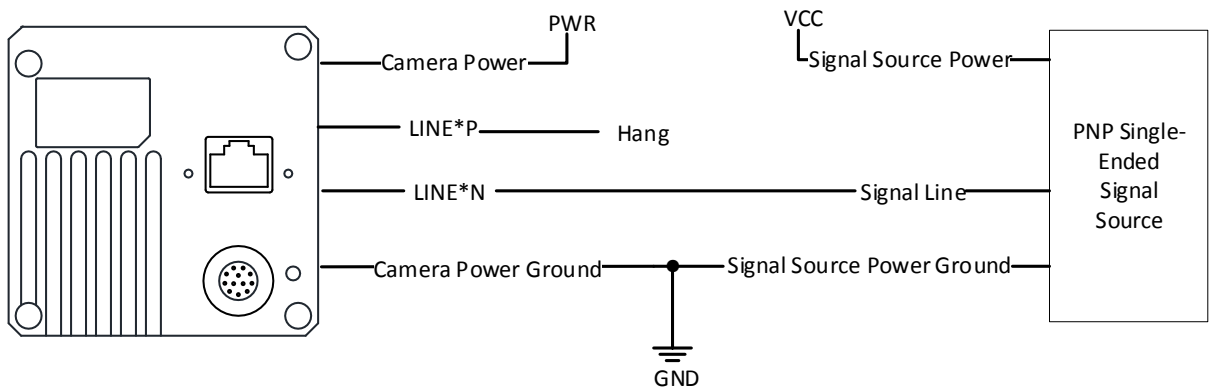● When the PNP single-ended signal source provides signal, there are two different wirings as shown below.

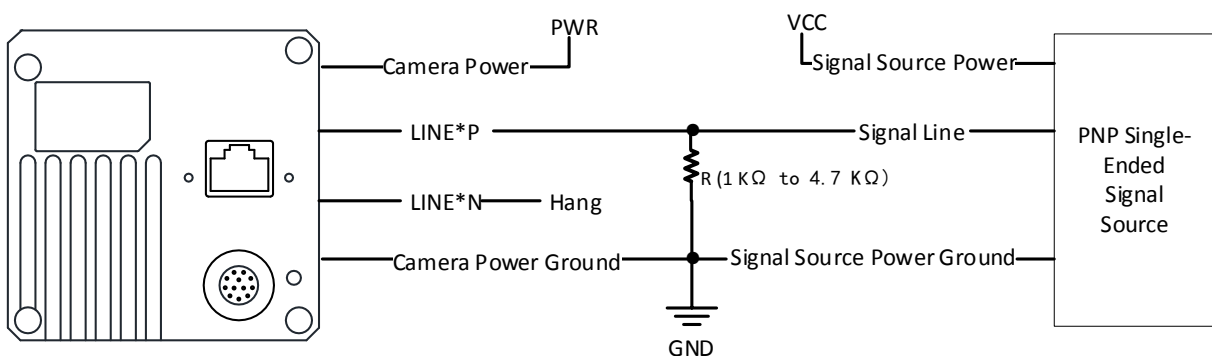**Figure 10-14 PNP Single-Ended Input Wiring without Pull-Down Resistor**

Figure 10-15 PNP Single-Ended Input Wiring with Pull-Down Resistor

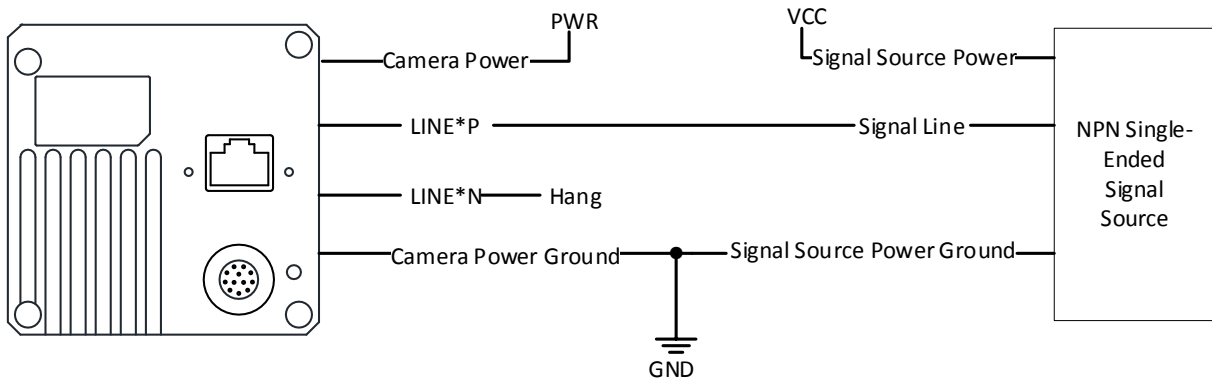● When the NPN single-ended signal source provides signal, there are two different wirings as shown below.

Figure 10-16 NPN Single-Ended Input Wiring without Pull-Up Resistor
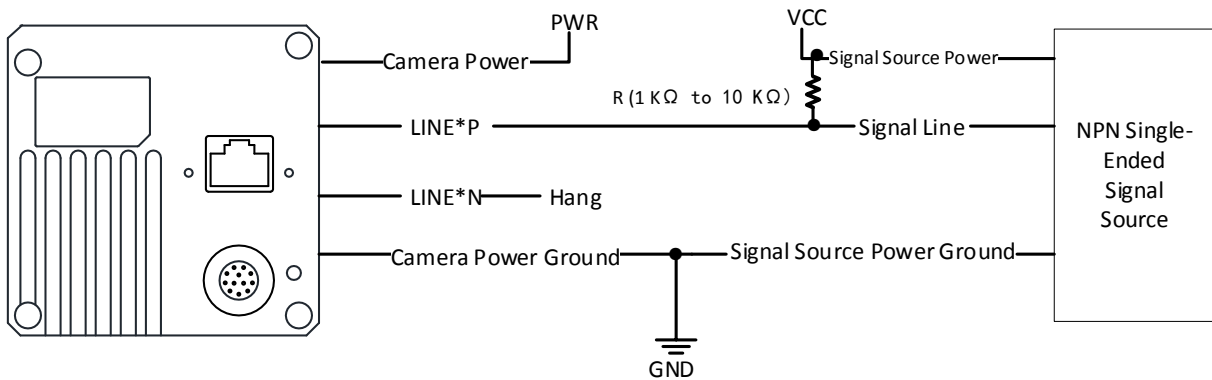
Figure 10-17 NPN Single-Ended Input Wiring with Pull-Up Resistor

10.4 Output Signal Wiring

Regarding the second type of I/O signals, four bi-directional I/Os can be configured to output signals to trigger other devices.

ⓘNote
● The wiring may differ by I/O signals used as differential output or single-ended output.
● Here we take one type of GigE line scan cameras as an example to introduce the output signal wiring. The appearance here is for reference only.

● When I/O signals are used as differential output, the wiring is shown below.
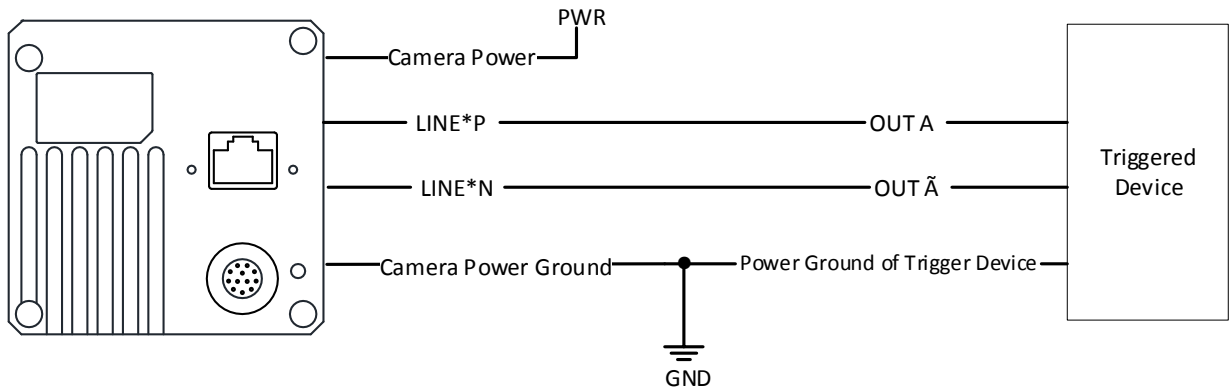

Figure 10-18 Differential Output Wiring

● When I/O signals are used as single-ended output, you should add a pull-up resistor between 1 KΩ and 10 KΩ.

ⓘ**Note**

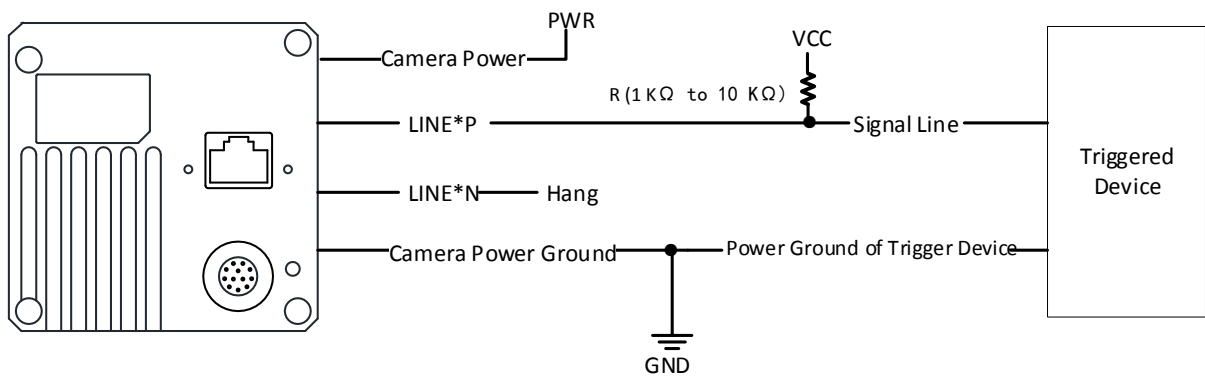The voltage of VCC should match with the trigger voltage.

Figure 10-19 Single-Ended Output Wiring

Chapter 11 Image Parameter

11.1 View Resolution

> **Note**
> The device displays the image with max. resolution by default.

Go to **Image Format Control**, and you can view resolution by reading **Width Max** and **Height Max**. **Width Max** stands for the max. pixels per inch in width direction, and **Height Max** stands for the max. pixels per inch in height direction.
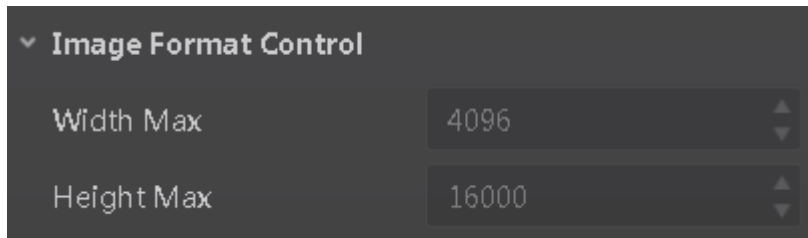
Figure 11-1 View Resolution

11.2 Set ROI

If you are only interested in a certain region of the image, you can set a Region of Interest (ROI) for the device.

> **Note**
> - The device currently supports one ROI only, and you can select **Region 0** as **Region Selector**.
> - Region of interest can be set only when you stop real-time acquisition.

Go to **Image Format Control** → **Region Selector**, and enter **Width**, **Height**, and **Offset X**.

> **Note**
> The **Width** plus **Offset X** should not be larger than **Width Max**, and **Height** should not be larger than **Height Max**.

- **Width**: It stands for horizontal resolution in ROI area.
- **Height**: It stands for vertical resolution in ROI area.
- **Offset X**: It refers to the horizontal coordinate of the upper left corner of the ROI.
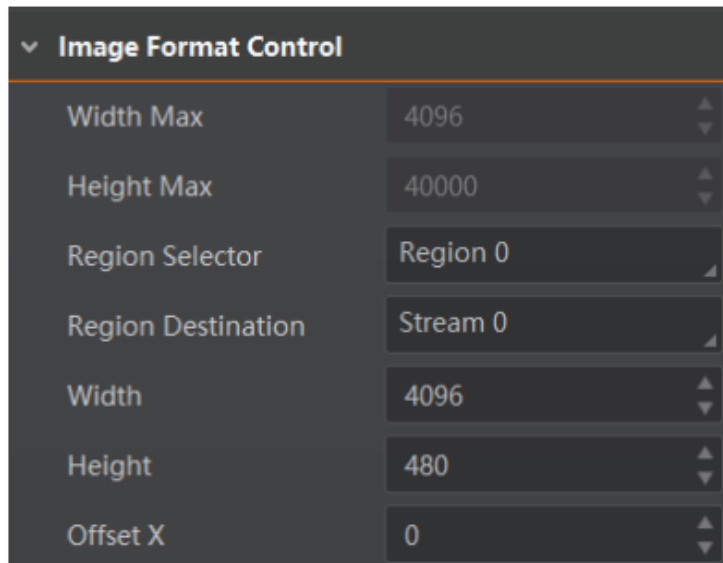
Figure 11-2 Set ROI

11.3 Set Image Reverse

The device supports reversing images in a horizontal way. Go to **Image Format Control**, and enable **Reverse X** according to actual demands.
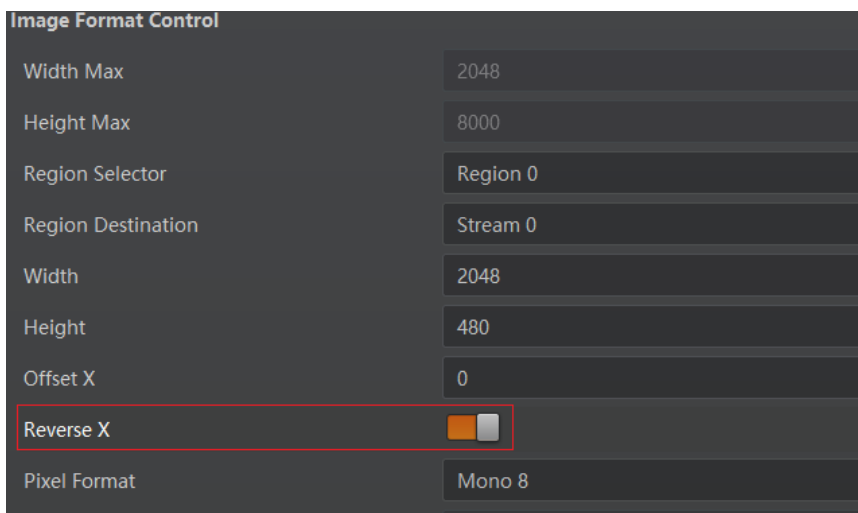
Figure 11-3 Set Image Reverse

11.4 Set Pixel Format

This function allows you to set the pixel format of the image data transmitted by the device. Go to **Image Format Control** → **Pixel Format**, and set **Pixel Format** according to actual demands.

⌷**i̇Note**

The specific pixel formats may differ by device models.

Table 11-1 Pixel Format and Pixel Size

Pixel Format	Pixel Size (Bits/Pixel)
Mono 8, Bayer 8, Bayer RBGG 8	8
Mono 10Packed, Mono 12Packed, Bayer 10Packed, Bayer12 Packed	12
Mono 10/12, Bayer 10/12, YUV 422 Packed, YUV 422 (YUYV) Packed	16
RGB 8, BGR 8	24
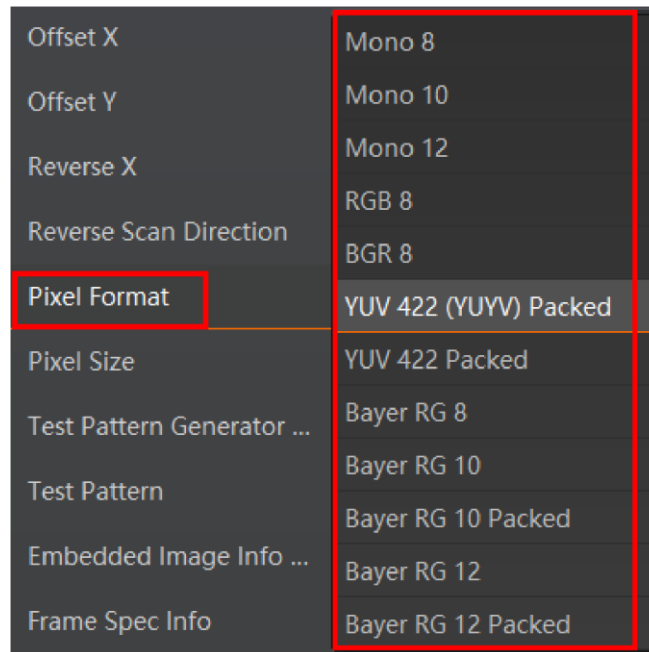
Figure 11-4 Set Pixel Format

The default output data format of mono device is Mono 8. The default output data format of color device is Bayer 8, and it can be converted into RGB format via pixel interpolation algorithm. RGB format can be converted into YUV format via the algorithm, and YUV format can be converted into Mono 8 format. RGB format can be converted into BGR format via the order adjustment.

Bayer GR, Bayer GB, Bayer BG, Bayer RG and Bayer RBGG patterns are shown below.

Figure 11-5 Bayer GR Pixel Pattern

Figure 11-6 Bayer GB Pixel Pattern

Figure 11-7 Bayer BG Pixel Pattern

Figure 11-8 Bayer RG Pixel Pattern
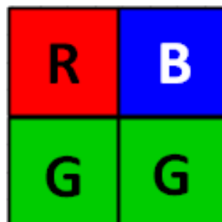
Figure 11-9 Bayer RBGG Pixel Pattern

11.5 Set Image Compression Mode

☐ⓘNote

The function of the image compression is related with device models, firmware and pixel format, and the actual product you purchased should prevail.

Without affecting image quality, this function allows the device to compress data before transmitting to the external devices, and lower the usage of bandwidth.
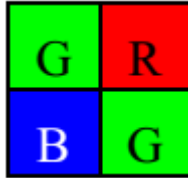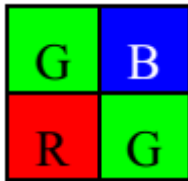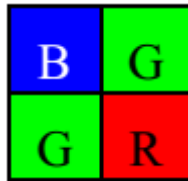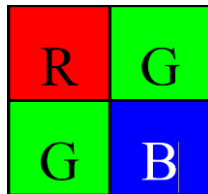
Steps

1. Go to **Image Format Control** → **Image Compression Mode**.
2. Select **HB** as **Image Compression Mode**.
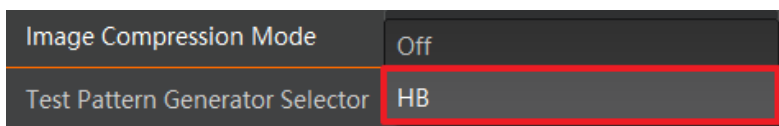
Figure 11-10 Set Image Compression Mode

3. Vew the image compression mode's related parameters like **HB Abnormal Monitor** and **HB Version** in the **Device Control** attribute.
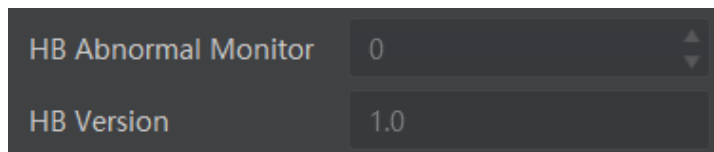
Figure 11-11 HB Abnormal Monitor and Version

● HB abnormal monitor is used to monitor image stream condition. If the size of compressed image is larger than that of raw image under HB function, this parameter will increase. When this parameter increases rapidly, it is recommended to disable the image compression mode.
● HB version refers to the version of this function.

11.6 Set Test Pattern

☐ⓘNote

The test pattern may differ by device models.

The device supports test pattern function. When there is exception in real-time image, you can check whether image of test mode have similar problem to determine the reason. This function is disabled by default, and at this point, the outputted image by the device is real-time image. If this function is enabled, the outputted image by the device is test image.

Go to **Image Format Control** → **Test Pattern Generator Selector** → **Test Pattern**, and set

Test Pattern according to actual demands.
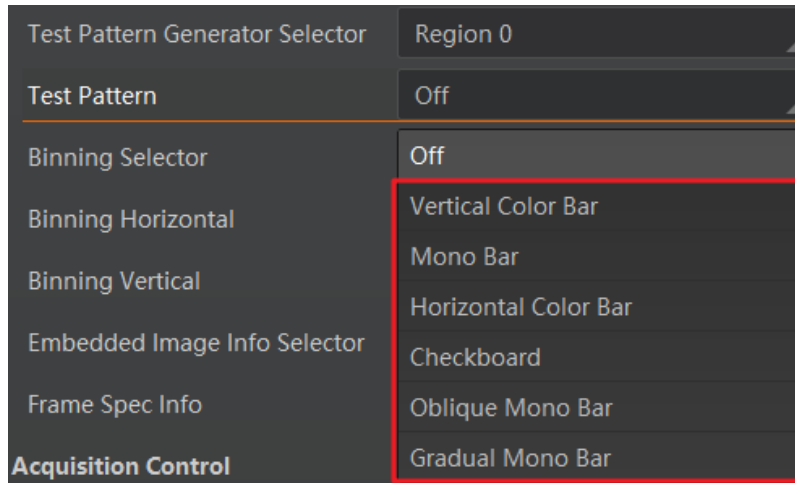
Figure 11-12 Set Test Pattern

The mono device offers 5 test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, and **Test Image 1**.

The color device offers 7 test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, **Vertical Color Bar**, **Horizontal Color Bar**, and **Test Image 1**.

Figure 11-13 Mono Bar Test Pattern
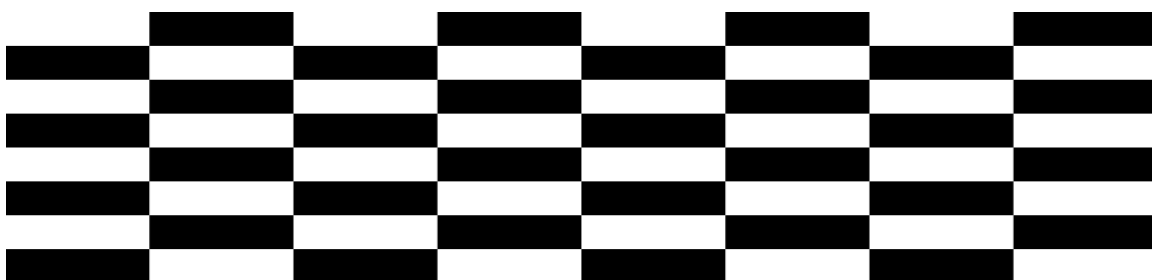
Figure 11-14 Checkboard Test Pattern
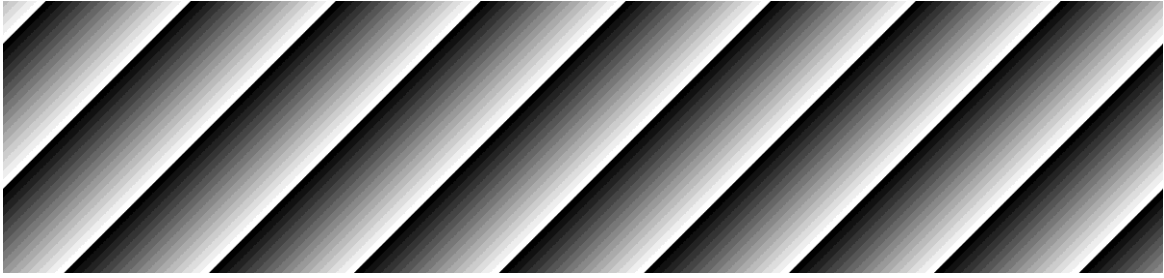
Figure 11-15 Oblique Mono Bar Test Pattern

Figure 11-16 Gradual Mono Bar Test Pattern
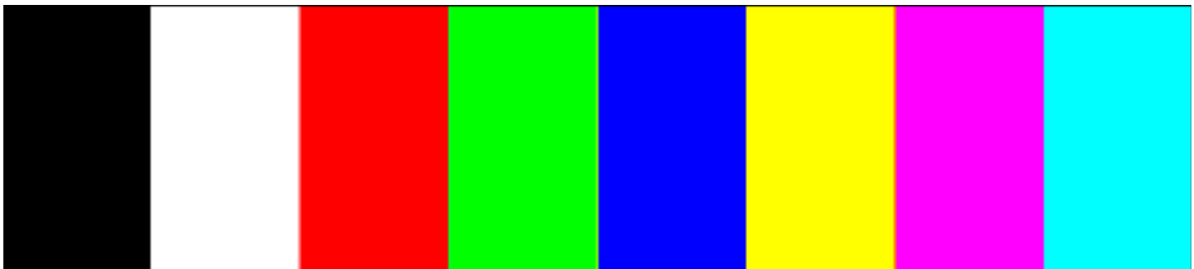
Figure 11-17 Vertical Color Bar Test Pattern

Figure 11-18 Horizontal Color Bar Test Pattern

Figure 11-19 Test Image 1

📖**Note**

The pattern of the test image 1 may differ by device models.

11.7 Set Binning

The purpose of setting binning is to enhance sensibility. With binning, multiple sensor pixels are combined as a single pixel to reduce resolution and improve image brightness. Click **Binning Selector**, and set **Binning Horizontal** and **Binning Vertical** according to actual demands.
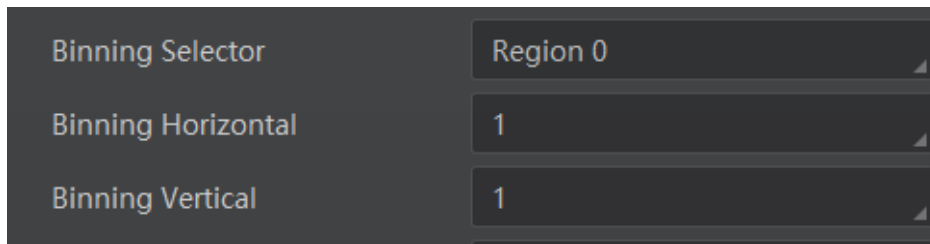
Figure 11-20 Set Binning

📖**Note**
- **Binning Horizontal** is the image's width, and **Binning Vertical** is the image's height.
- If the device's vertical resolution is 1, and then there is no **Binning Vertical**.
- The binning function may differ by device models.

11.8 Set Exposure Auto

The device supports 3 types of exposure mode, including **Off**, **Once** and **Continuous**. Click **Acquisition Control → Exposure Auto**, and select **Exposure Auto** according to actual demands.
- **Off**: The device exposures according to the value set in **Exposure Time (μs)**.
- **Once**: The device adjusts the exposure time automatically according to the image brightness. After adjusting, it will switch to **Off** mode.
- **Continuous**: The device adjusts the exposure time continuously according to the image brightness.

When the exposure mode is set as **Once** or **Continuous**, the exposure time should be within the range of **Auto Exposure Time Lower Limit (μs)** and **Auto Exposure Time Upper Limit (μs)**.

Exposure Mode	Timed
Exposure Time(us)	326009.00
Exposure Auto	Continuous
Auto Exposure Time Lower Limit(us)	16
Auto Exposure Time Upper Limit(us)	1000000
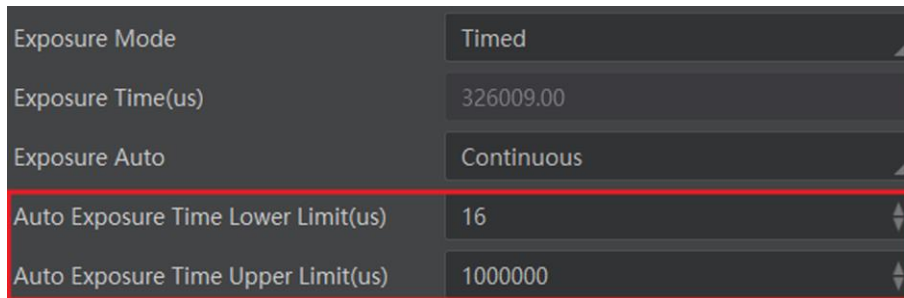
Figure 11-21 Set Exposure Time under Once or Continuous Mode

Note

● If the device is under **Continuous** exposure mode, once external trigger mode is enabled, the device will automatically switch to **Off** exposure mode.
● Some models of the device do not support **Once** or **Continuous** exposure mode. You can enter **Exposure Time (μs)** directly.

11.9 Set HDR

Note

● The HDR function may differ by device models.
● For some models of devices, you need to enable TDI function first. Refer to section *TDI Function* for details.

Steps

1. Go to **Acquisition Control** → **HDR Enable**, and enable **HDR Enable**.
2. Select **0** as **HDR Selector** and to set first group of **HDR Shutter.**
3. Select **1** as **HDR Selector** and to set second group of **HDR Shutter.**

Note

Up to 2 HDR groups can be configured.
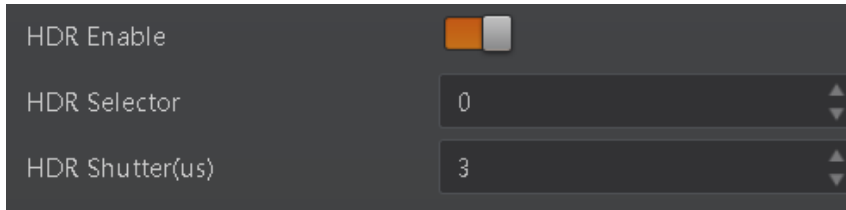
Figure 11-22 Set HDR

11.10 Set Gain

Note

The gain function may differ by device models.

The device has 2 types of gain, including the analog gain and digital gain. The analog gain is applied before the signal from the device sensor is converted into digital values, while digital gain is applied after the conversion.

11.10.1 Set Analog Gain

Note

- The analog gain parameter name may differ by device of different models or firmware. The analog gain parameter name can be **Preamp Gain** or **Gain** which have different settings method.
- When the analog gain parameter is **Preamp Gain**, you can set it manually only.

Preamp Gain

Go to **Analog Control** → **Preamp Gain**, and set **Preamp Gain** according to actual demands.
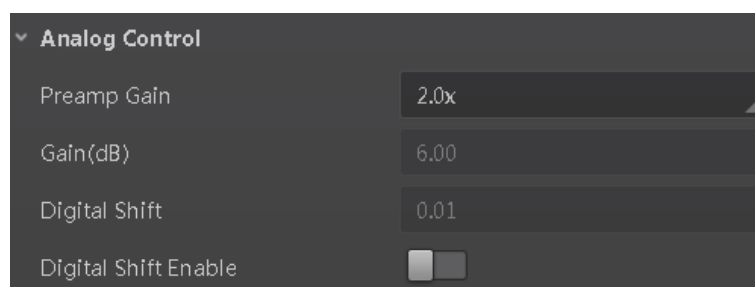
Figure 11-23 Set Preamp Gain

Gain

The device supports 3 types of gain mode, including **Off**, **Once** and **Continuous**. Click **Analog Control** → **Gain Auto**, and select **Gain Auto** according to actual demands.
● **Off**: The device **adjusts** gain according to the value configured by user in **Gain**.
● **Once**: The device adjusts the gain automatically according to the image brightness. After adjusting, it will switch to **Off** mode.
● **Continuous**: The device **adjusts** the gain continuously according to the image brightness.
When the gain mode is set as **Once** or **Continuous**, the gain should be within the range of **Auto Gain Lower Limit (dB)** and **Auto Gain Upper Limit (dB)**.
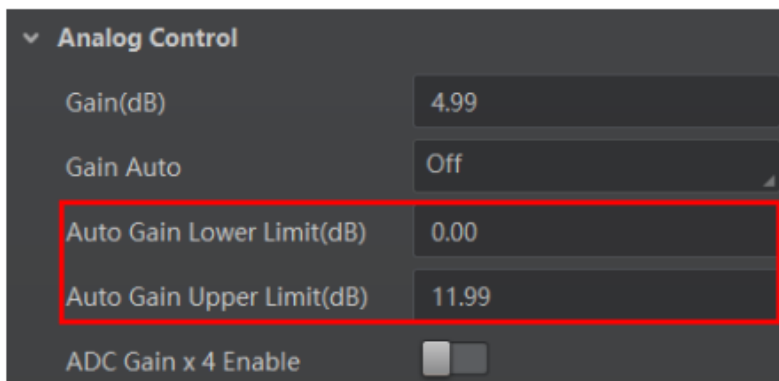
Figure 11-24 Set Gain under Once or Continuous Mode

If the image is still dark after settings above, you can enable **ADC Gain x4 Enable** to enlarge the gain by 12 dB.
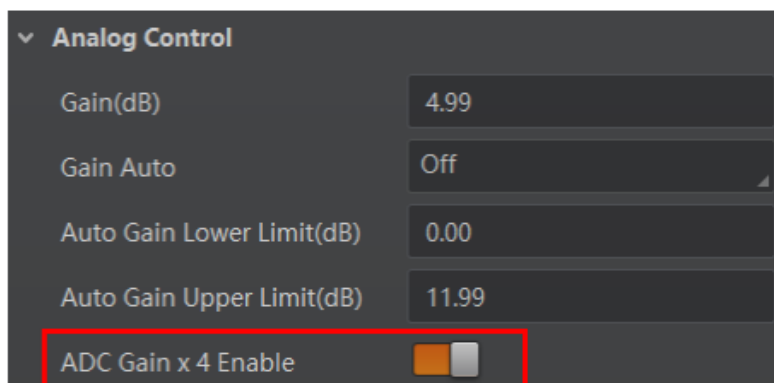
Figure 11-25 Enable ADC Gain x4 Enable

> **Note**
> ● When increasing gain, the image noise will increase too, which will influence image quality. If you want to increase image brightness, it is recommended to increase the device's exposure time first. If the exposure time reaches its upper limit, and at this point, you can increase gain.
> ● Some models of the device do not support **Once** or **Continuous** gain mode. You can

enter **Gain (dB)** directly.

11.10.2 Set Digital Gain

Apart from analog gain, the device supports digital gain function. When analog gain reaching its upper limit and the image is still too dark, it is recommended to improve image brightness via digital gain.

Click **Analog Control**, enable **Digital Shift Enable**, and enter **Digital Shift** according to actual demands.

Figure 11-26 Set Digital Gain

Note

When increasing the digital gain, the image noise will greatly increase too, which will severely influence image quality. It is recommended to use analog gain first, and then to adjust digital gain if the analog gain cannot meet demands.

11.11 Set Sensor Mode

Note

● The sensor mode function may differ by device models.
● The sensor mode is related to the TDI function. The sensor mode may not display when TDI is 1 line.

The device provides two types of sensor mode, including high full well capacity and high sensitivity.
● High Full Well Mode: It greatly improves the overall brightness of images and is applicable to low-light environment.
● High Sensitivity: It improves the image's sensitivity.
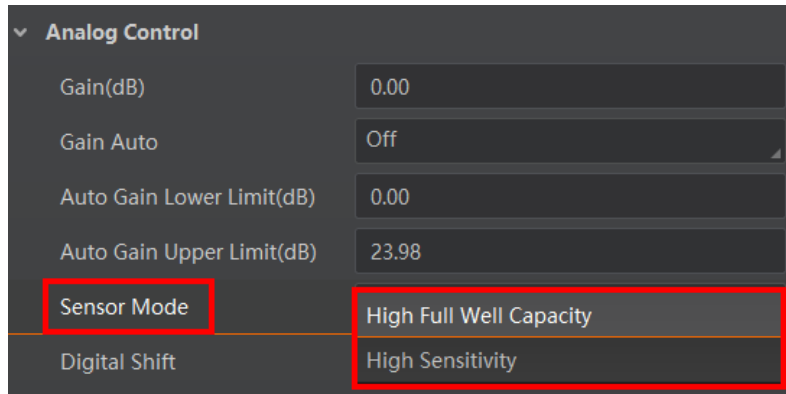
Figure 11-27 Set Sensor Mode

11.12 Set Brightness

The device brightness refers to the brightness when the device adjusts image under **Once** or **Continuous** exposure mode, or **Once** or **Continuous** gain mode.

___

i̇Note

- You should enable **Once** or **Continuous** exposure mode, or **Once** or **Continuous** gain mode first before setting brightness.
- After setting brightness, the device will automatically adjust exposure time to let image brightness reach target one. Under **Once** or **Continuous** exposure mode, or **Once** or **Continuous** gain, the higher the brightness value, the brighter the image will be.
- The range of brightness is between 0 and 255.

___

Go to **Analog Control** → **Brightness**, and enter **Brightness** according to actual demand.
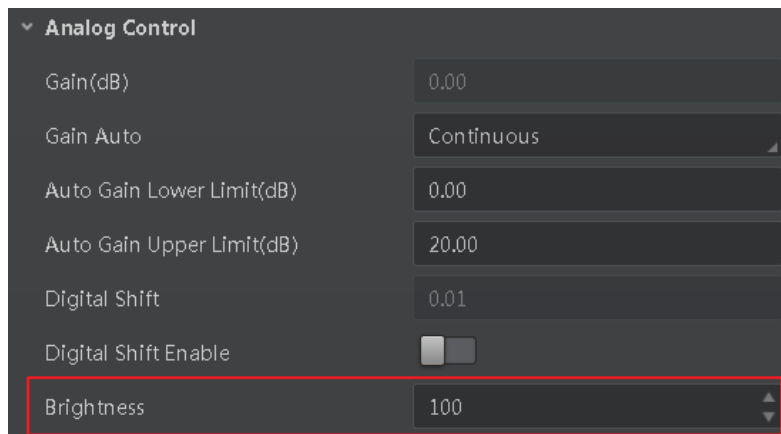
Figure 11-28 Set Brightness

11.13 Set Black Level

Note

The black level may differ by device models.

The device supports black level function that allows you to change the overall brightness of an image by changing the gray values of the pixels by a specified amount.
Go to **Analog Control** → **Black Level Enable**, enable **Black Level Enable**, and enter **Black Level** according to actual demands.
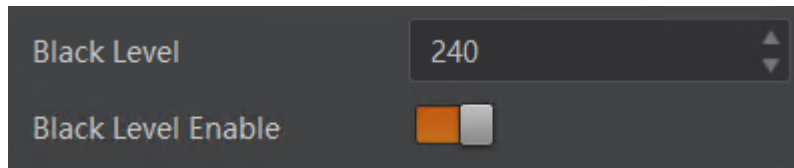
Figure 11-29 Set Black Level

11.14 Set White Balance

Note

● White balance is only available for color devices.
● The function of white balance is disabled by default, that is, **Balance White Auto** is **Off**.

The white balance refers to the device color adjustment depending on different light sources. Adjust the R/G/B ratio to ensure that the white regions are white under different color temperatures. Ideally, the proportion of R/G/B in the white region is 1:1:1.
The device supports 3 types of white balance mode, including **Off**, **Once** and **Continuous**.
Click **Analog Control** → **White Balance Auto**, and select **White Balance Auto** according to actual demands.
● **Off**: You need to set the R, G, B ratio manually via **Balance Ratio Selector** and **Balance Ratio**. The range is from 1 to 16376, and 1024 means ratio is 1.0.
● **Once**: Adjust the white balance for a certain amount of time then stop.
● **Continuous**: Adjust the white balance continuously.
It is recommended to correct white balance when there is great difference between the device's color effect and actual effect. You can correct white balance as shown below.

Steps

1. Put a white paper in the range of the device's field of view, and make sure the paper covers the entire field of view.
2. Set exposure and gain. It is recommended to set image brightness value between 120 and 160.

3. Select **Once** as **Balance White Auto**, and the device will automatically adjust white balance for once.

If there is still great difference between correction effect and actual color, it is recommended to correct white balance according to following steps.

Steps

⊡Note

● Here we take **Green** as an example. For specific **Balance Ratio Selector** value, please refer to the actual condition.
● In order to avoid repeated correction after rebooting the device, it is recommended to save white balance parameter to **User Set** after white balance correction. You can refer to the Section **Save and Load User Set** for details.
● If the light source and color temperature in environment change, you need to correct white balance again.

---

1. Select **Off** as **Balance White Auto**. At this time, **Balance Ratio** is 1024.
2. Find corresponding R/G/B channel in **Balance Ratio Selector**. Here we take **Green** as an example.
3. Find device's R/G/B value.
4. Take **Green** as correction standard, and manually adjust other two channels (R channel and B channel) to let these three channels have same value.

11.15 Set Gamma Correction

⊡Note

● The Gamma correction function may differ by device models.
● Under Bayer pixel format, the MV-CL022-40GC device does not support Gamma correction function.

The device supports Gamma correction function. Generally, the output of the device's sensor is linear with the photons that are illuminated on the photosensitive surface of the sensor. Gamma correction provides a non-linear mapping mechanism as shown below.
● Gamma value between 0.5 and 1: image brightness increases, dark area becomes brighter.
● Gamma value between 1 and 4: image brightness decreases, dark area becomes darker.
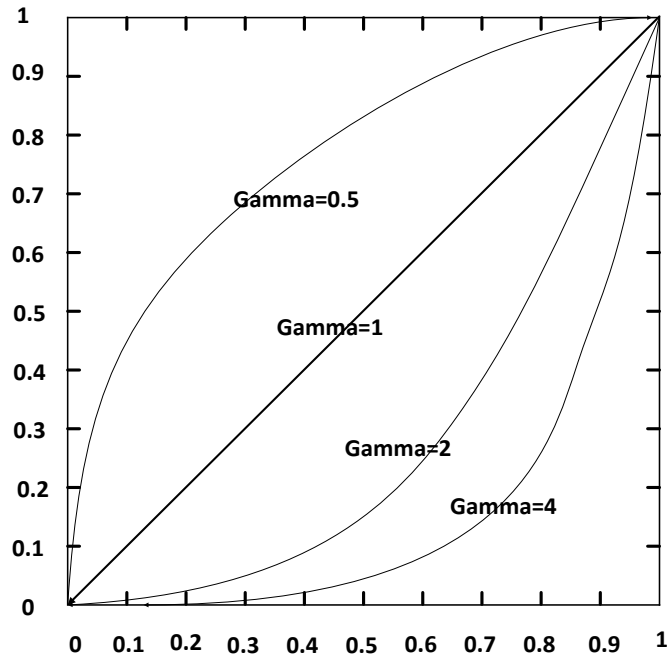
Figure 11-30 Set Gamma Correction

There are 2 types of Gamma correction, including **User** mode and **sRGB** mode.

User Mode

Steps

1. Go to **Analog Control** → **Gamma Selector**.
2. Select **User** as **Gamma Selector**.
3. Enable **Gamma Enable** to enable it.
4. Enter **Gamma** according to actual demands, and its range is from 0 to 4.
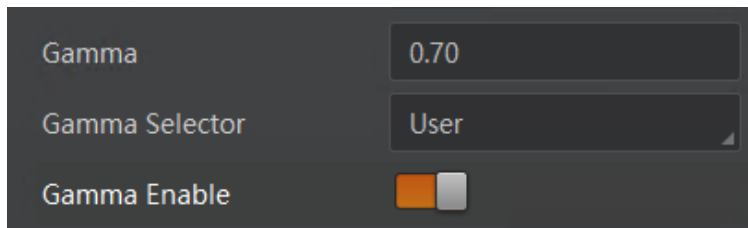
Figure 11-31 Set User Mode

sRGB Mode

Steps

1. Go to **Analog Control** → **Gamma Selector**.
2. Select **sRGB** as **Gamma Selector**.

3. Enable **Gamma Enable** to enable it.
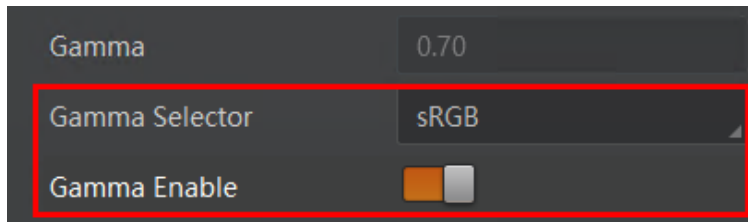
Figure 11-32 Set sRGB Mode

11.16 Set AOI

☐**i**Note

● The AOI function may differ by device models.
● AOI 1 is used when the device is in once or continuous exposure mode, and AOI 2 is used when the device is in once or continuous white balance mode.

The device supports AOI function that can adjust the brightness and white balance of the entire image based on the area you selected.

Steps

1. Click **Analog Control** → **Auto Function AOI Selector**, and select **AOI 1** or **AOI 2 Auto Function AOI Selector**.
2. Enter **Auto Function AOI Width**, **Auto Function AOI Height**, **Auto Function AOI Offset X**, and **Auto Function AOI Offset Y** according to actual demands.
3. Enable **Auto Function AOI Usage Intensity** if **AOI 1** is selected as **Auto Function AOI Selector**. Or enable **Auto Function AOI Usage White Balance** if **AOI 2** is selected as **Auto Function AOI Selector**.
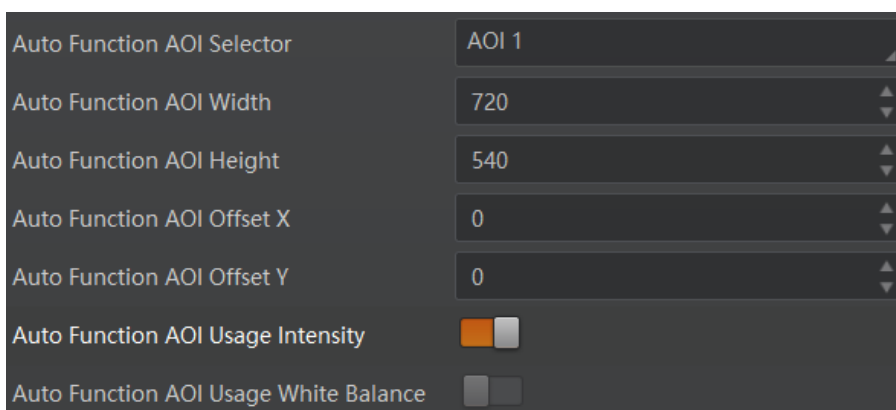
Figure 11-33 Set AOI

11.17 Set Color Transformation Control

> **Note**
> - The function of color transformation control is only available for color devices.
> - Currently, **RGB to RGB** is available for **Color Transformation Selector** only.
> - Under Bayer pixel format, the MV-CL022-40GC device does not support color transformation control function.

After the process of the white balance, the color device's overall images will look darker, and multiple colors may deviate from their standard values to some extent. At this time, you need to correct these colors by multiplying correction matrix to let them back to the standard value, so that the overall color of images is more vivid.
The color correction function is realized by multiplying each RGB component by a correction matrix. Currently, the supported color conversion module is RGB to RGB. Two methods are available to set color transformation control.

Method 1

Steps

1. Go to **Color Transformation Control**, and enable **CCM Enable**.

> **Note**
> The parameter of CCM enable may differ by device models.

2. Select **Color Transformation Value Selector**.
3. Set **Color Transformation Value** according to actual demand.
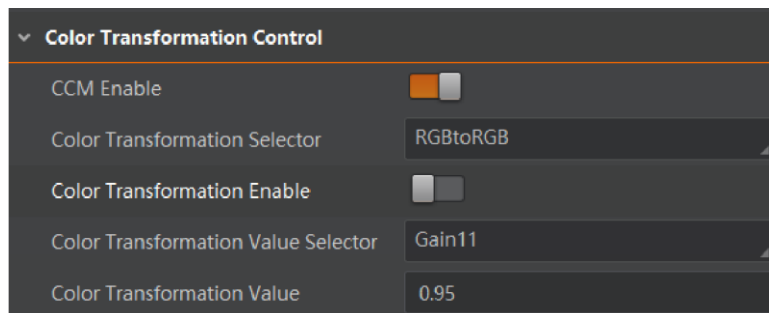
Figure 11-34 Method 1

Method 2

Steps

1. Go to **Color Transformation Control**, and enable **CCM Enable**.

⌷ⓘNote

The parameter of CCM enable may differ by device models.

2. Enable **Color Transformation Enable**, and select **Color Transformation Value Selector**.
3. Set **Hue** and **Saturation** to adjust **Color Transformation Value**.
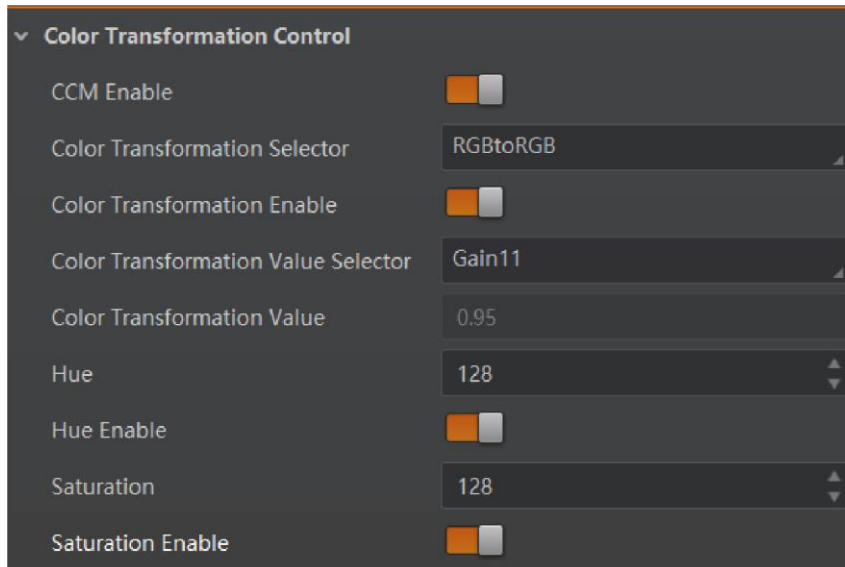
Figure 11-35 Method 2

11.18 Set Hue

⌷ⓘNote

● The hue function is only available for color devices.
● Only the pixel format is YUV, RGB or BGR, the MV-CL022-40GC device supports hue function.
● In Mono pixel format, hue function is not supported.
● The range of hue is between 0 and 255.

Adjusting the hue shifts the colors of the image. After hue is set, the device will perform color correction based on the hue value to bring the image tone to the target value. For example, when hue is set to 128, the red in the image appears as real red. When hue is 0, the hue is reversed 128 degrees counterclockwise, and red becomes blue. When hue is 255, the hue rotates 128 degrees clockwise, and red becomes green.

Steps

1. Go to **Color Transformation Control**, and enable **CCM enable**.
2. Enable **Color Transformation Enable**, and enable **Hue Enable**.
3. Enter **Hue** according to actual demands.
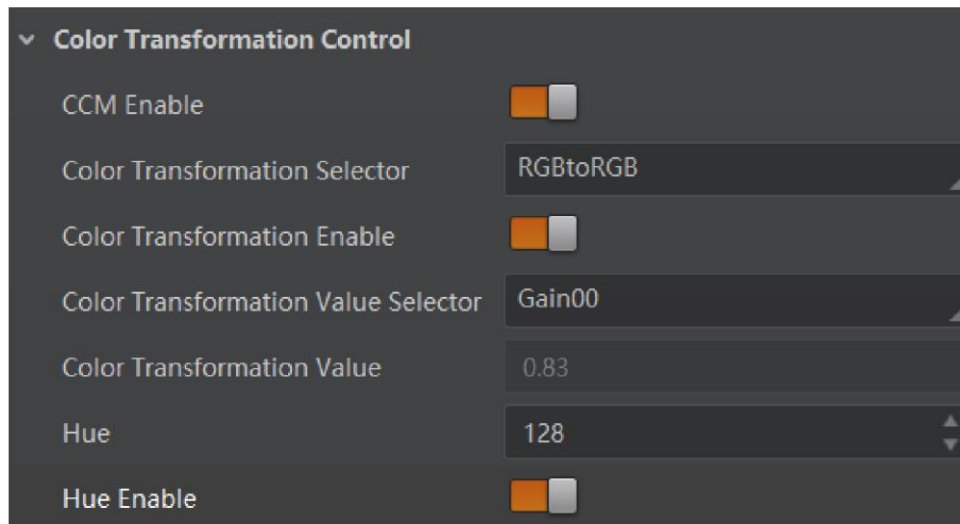
Figure 11-36 Set Hue

11.19 Set Saturation

☐ⁱ**Note**

- The saturation function is only available for color devices.
- Only the pixel format is YUV, RGB or BGR, the MV-CL022-40GC device supports saturation function.
- In Mono pixel format, hue function is not supported.
- The range of saturation is between 0 and 255.

Adjusting the saturation changes the colorfulness of the colors. A higher saturation, for example, makes colors easier to distinguish.

Steps

1. Go to **Color Transformation Control**, and enable **CCM enable**.
2. Enable **Color Transformation Enable**, and enable **Saturation Enable**.
3. Enter **Saturation** according to actual demands.
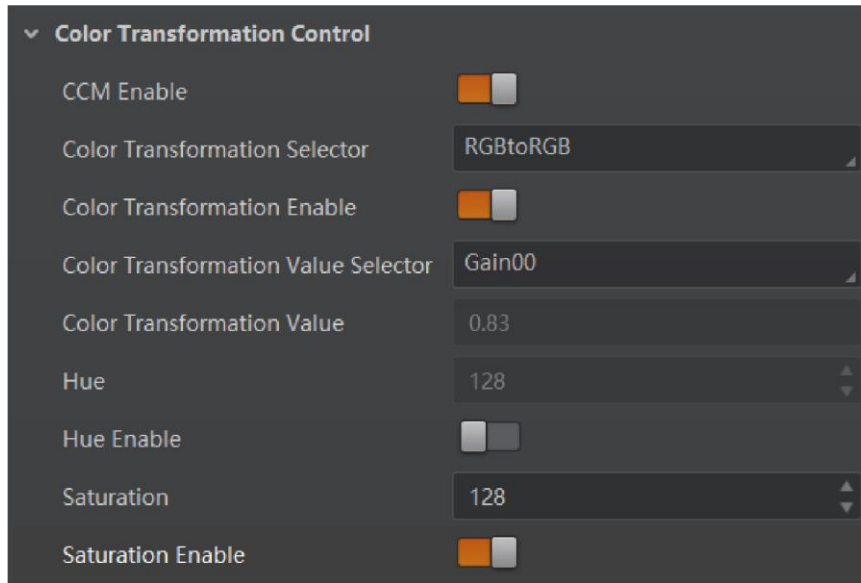
Figure 11-37 Set Saturation

11.20 Set Color Adjustment

Note

● The color adjustment function may differ by device models.
● In Bayer and Mono pixel formats, color devices do not support this function.

The color adjustment function allows you to select different color areas in the image to set customized hue and saturation value.

Steps

1. Go to **Color Transformation Control**, and enable **Color Adjustment Enable**.
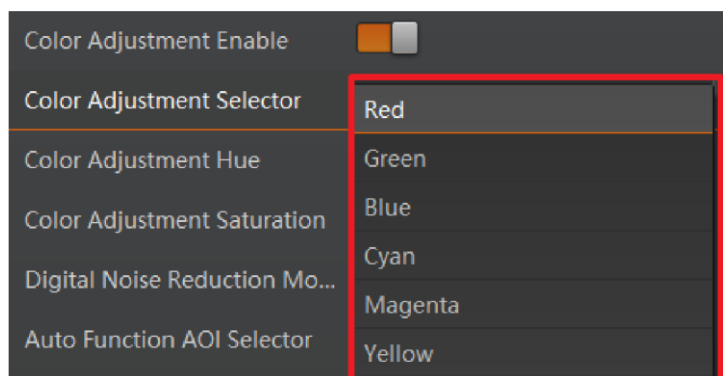
Figure 11-38 Color Adjustment Selector

2. Select **Color Adjustment Selector**, and set corresponding **Color Adjustment Hue** and **Color Adjustment Saturation** according to actual demands.
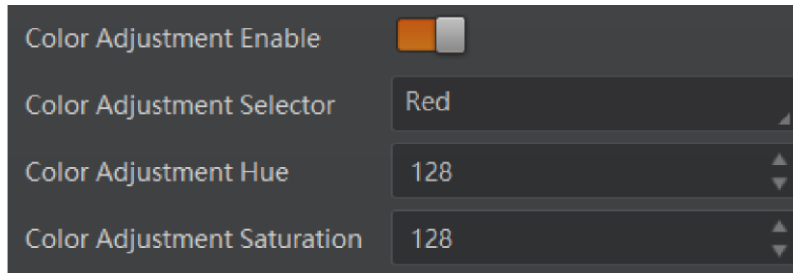
Figure 11-39 Set Color Adjustment

11.21 Set LUT

A Look-Up Table (LUT) is a customizable grayscale-mapping table. You can stretch, amplify the grayscale range that interests you. The mapping can be linear or customized curve.

ⓘ**Note**

- You cannot use Gamma correction function and LUT function at the same time.
- The parameter of **LUT Save** may differ by device models. If the device has no **LUT Save**, the settings you configured will be saved in the device in real time.
- For different models of device, the **LUT Index** and **LUT Value** range may differ, please refer to the actual one you got.
- In Bayer pixel format, the color device does not support LUT function.
- For devices that support TDI function, you should adjust LUT again after switching TDI mode.

Steps:

1. Click **LUT Control**, **and** enable **LUT Enable**.
2. Enter **LUT Index** and **LUT Value** according to actual demands.
3. Click **Execute** in **LUT Save** to save it.
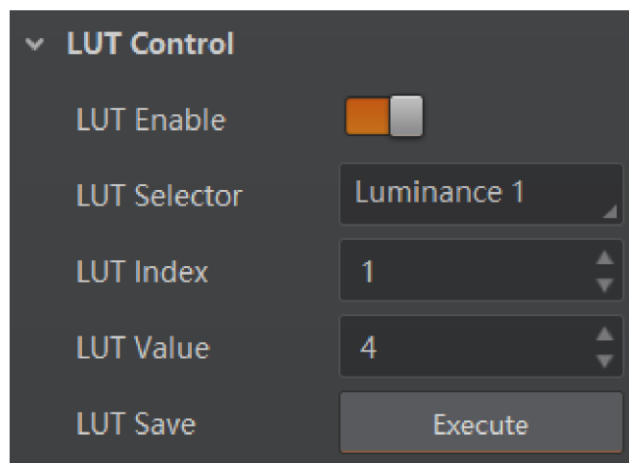
Figure 11-40 Set LUT

11.22 Set Shading Correction

Note

The flat field correction function and specific setting method may differ by device models.

The flat field correction (FFC) includes PRNUC correction and FPNC correction, and they are used to improve the image uniformity that may be impacted by the sensor, light sources, external conditions, etc.

11.22.1 Set FPNC Correction

Note

The device has completed FPNC correction by default and you do not need to set it again if the device has no FPNC correction function.

Steps

1. Click **Shading Correction**, and select **FPNC Correction** as **Shading Selector**.
2. Select one **User FPNC** from **FPNC User Selector**.

Figure 11-41 Set FPNC Correction

Note

Up to three groups of User FPNC can be selected.

3. Click **Execute** in **Activate Shading**, or click **Open Tool** in **Flat Field Correction Tool** and click **Perform FPN Calibration**.

Figure 11-42 Flat Field Correction Tool

4. Enable **FPNC User Enable**.

Note

Some models of the device support enabling **User Flat Field Correction** to use correction function.

11.22.2 Set PRNUC Correction

Note

The PRNUC correction function and specific setting method may differ by device models.

The device supports PRNUC (Photo-response Non-Uniformity Correction) function that eliminates vertical line on the images. Two correction methods are available, including global correction and ROI correction. The effect of PRNUC correction is shown blow.
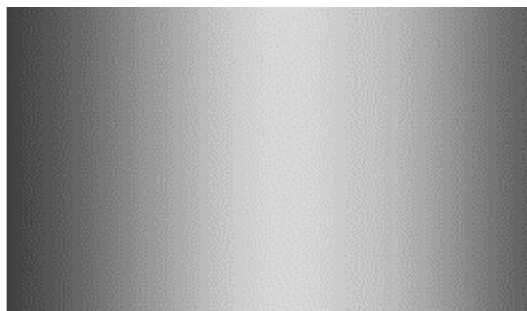
Figure 11-43 Before PRNUC Correction

Figure 11-44 After PRNUC Correction

Global PRNUC Correction

For MV-CL021-40GM device, follow steps below to set PRNUC correction:

Steps

1. Click **Shading Correction**, and click **Execute** in **Activate Shading**.
2. Enable **NUC Enable**, and **PRNUC Enable** will be enabled automatically.
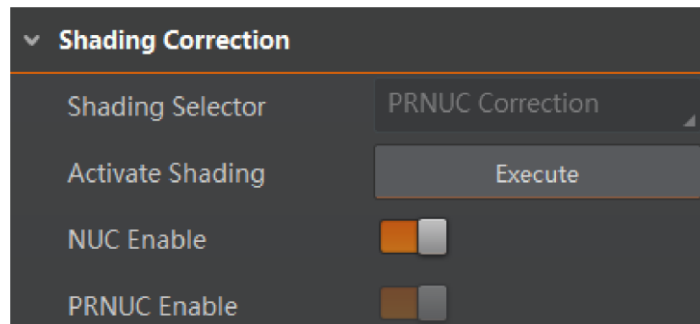
Figure 11-45 Set Shading Correction

For MV-CL022-40GC device, follow steps below to operate:

Steps

1. Click **Shading Correction**, and set PRNUC target related parameters according to actual demands.
● Select **Off** as **PRNUC Target Enable** if you want to use the device's auto correction standard. At this time, the device compares and corrects the average R/G/B component value of each column with the average R/G/B component value of the entire image.
● Select **On** as **PRNUC Target Enable** if you want to manually correct, and set **PRNUC Target R**, **PRNUC Target G**, and **PRNUC Target B** according to actual demands. At this time, the device compares and corrects the average R/G/B component value of each column with the configured R/G/B value.
2. Click **Execute** in **Activate Shading**.
3. Enable **NUC Enable**, and **PRNUC Enable** will be enabled automatically.
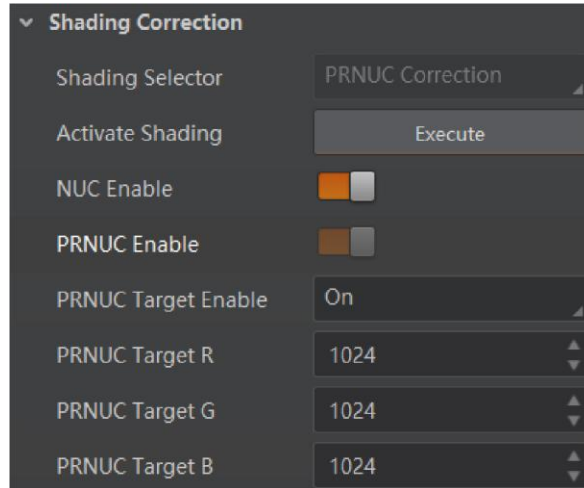
Figure 11-46 Set Shading Correction

For other device devices, follow steps below to operate:

Steps

1. Click **Shading Correction**, and select **PPNUC Correction** as **Shading Selector**.
2. Select **PRNUC User Selector**.
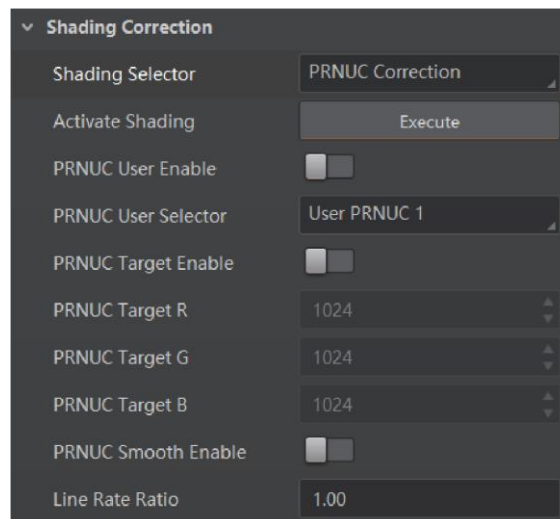
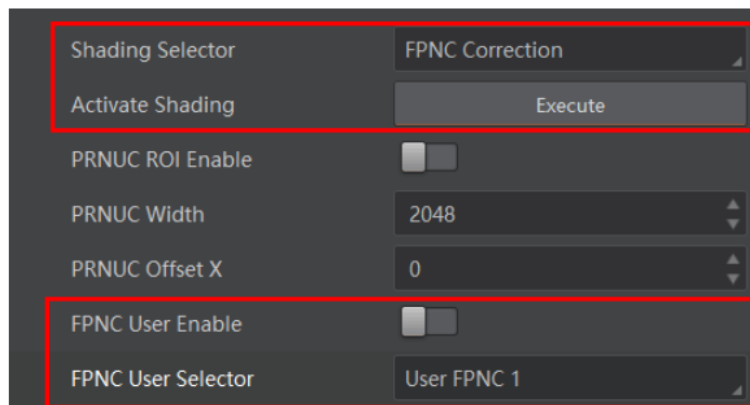**Figure 11-47 Set Shading Correction**

3. Set PRNUC target related parameters according to actual demands.

● Disable **PRNUC Target Enable** if you want to use the device's auto correction standard. At this time, the device compares and corrects the average R/G/B component value of each column with the average R/G/B component value of the entire image.

● Enable **PRNUC Target Enable** if you want to manually correct. For mono devices, set **PRNUC Target**, and for color devices, set **PRNUC Target R**, **PRNUC Target G**, and **PRNUC Target B** according to actual demands. At this time, the device compares and corrects the average gray value or R/G/B component value of each column with the configured gray value or R/G/B value.

4. Click **Execute** in **Activate Shading**, or click **Open Tool** in **Flat Field Correction Tool** and click **Perform PRNU Calibration**.
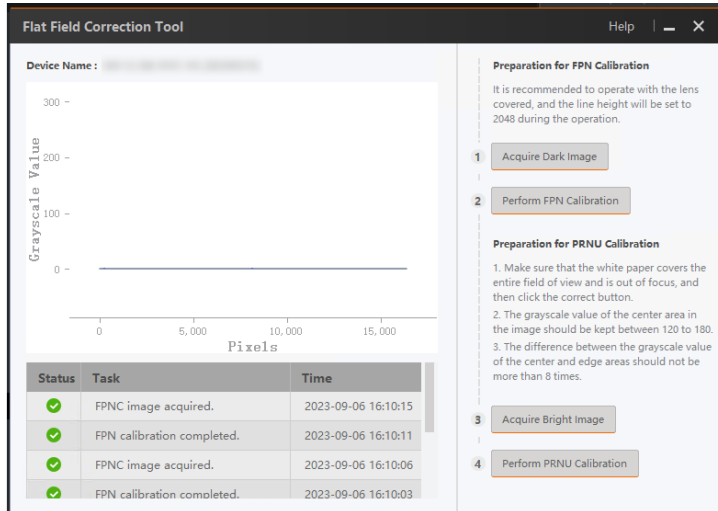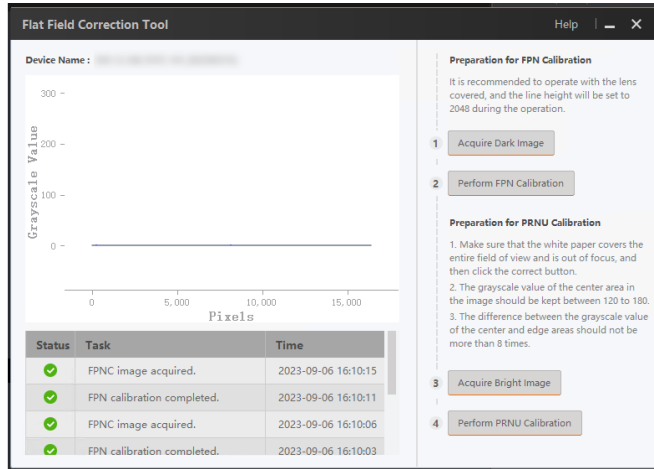

Figure 11-48 Flat Field Correction Tool

5. Enable **PRNUC User Enable**.
6. (Optional) Enable **PRNUC Smooth Enable** to reduce the dust impact during calibration process.

Note

Some models of the device support enabling **User Flat Field Correction** to use correction function.

ROI PRNUC Correction

If you want to execute PRNUC correction for specific areas, set **PRNUC Width** and **PRNUC Offset X** according to actual demands, and enable **PRNUC ROI Enable**.
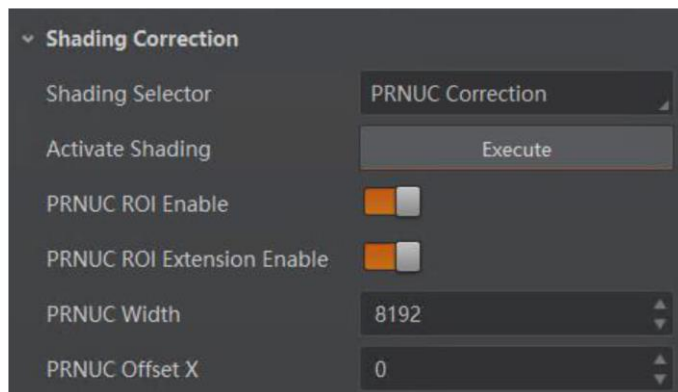
Figure 11-49 ROI PRNUC Correction

11.23 Set Space Correction
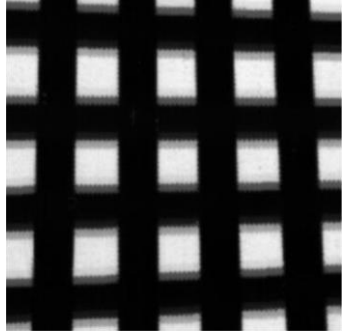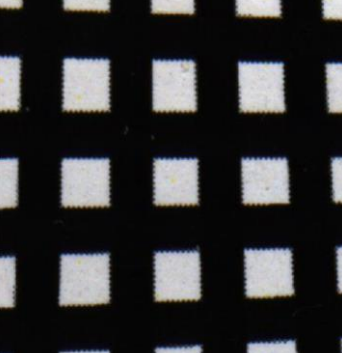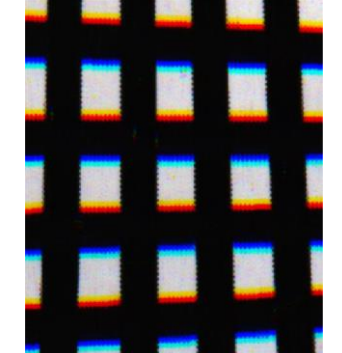
The space correction (SC) includes line rate deviation correction and parallax deviation correction, and they are used to reduce image details deviation caused by line rate deviation or pixel deviation.

11.23.1 Set Line Rate Ratio

You can go to **Shading Correction**, and set **Line Rate Ratio** according to actual demands. Line rate ratio is used to adjust the ratio between the device's line rate and that of the actual object to adjust the pixel deviation between upper line and lower line in images. Refer to the table below for effect contrast.

Table 11-2 Effect Contrast of Line Rate Ratio

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

- It is recommended to set line rate ratio larger than 1 when the device's line rate is larger than that of the object.
- It is recommended to set line rate ratio smaller than 1 when the device's line rate is smaller than that of the object.
- It is recommended to set line rate ratio as 1 when the device's line rate is equal to that of the object.
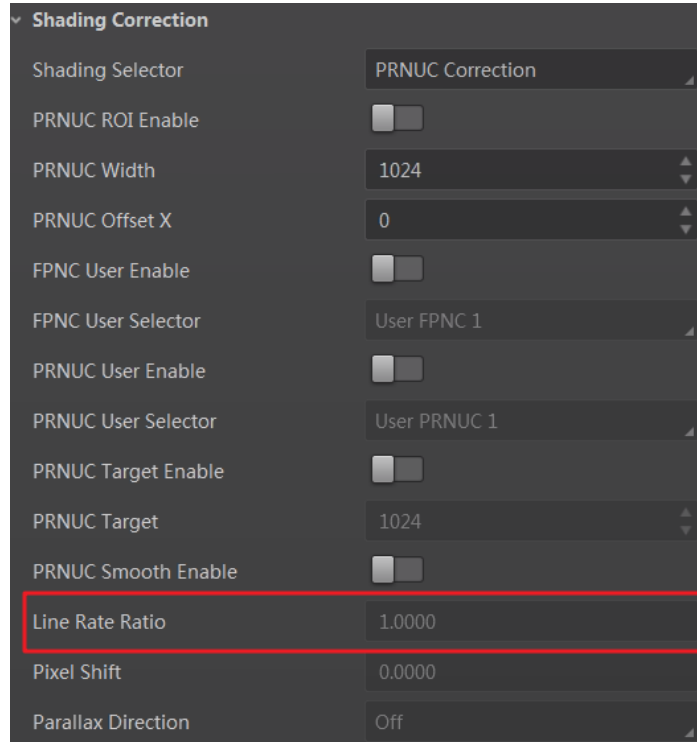
Figure 11-50 Set Line Rate Ratio

11.23.2 Set Pixel Shift and Parallax Direction
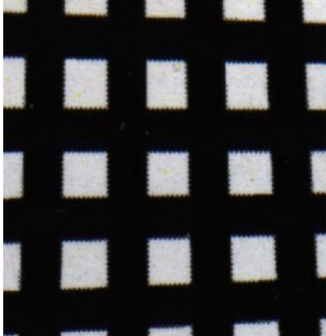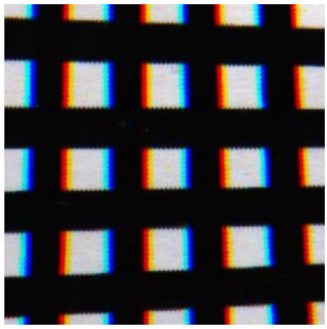
When pixel deviation occurs, images of mono devices are vague and images of color devices are dispersive. If you find the image's edge has pixel deviation via observation, follow steps below to alleviate it. Refer to the table below for effect contrast.

⊡ⁱNote

If the overall image has the phenomenon below, it may be caused by lens optical structure deviation.

Table 11-3 Effect Contrast of Pixel Shift

Device Type	Normal Image	Abnormal Image
Mono Device		

Device Type	Normal Image	Abnormal Image
Color Device		

Steps

1. Set **Off** as **Parallax Direction** if the image's edge does not have pixel deviation.

2. Set **Parallax Direction** according to actual conditions if the image's edge has pixel deviation.

● For the mono device, if its upper sensor is closer to the measured objects, and select **Start Line** as **Parallax Direction**. Otherwise, select **End Line** instead.

● For the color device, if its sensor's B line is closer to the measured objects, and select **Blue** as **Parallax Direction**. If its sensor's R line is closer to the measured objects, and select **Red** instead.

3. Set **Pixel Shift** to have a best effect.
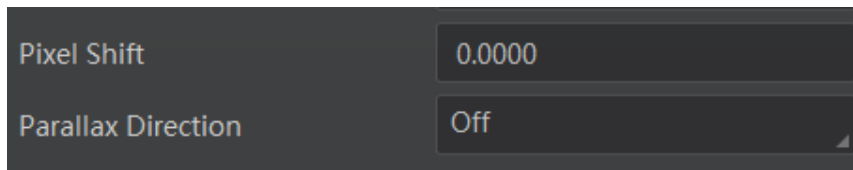
Figure 11-51 Set Pixel Shift and Parallax Direction

11.24 Set Color Abnormal Correction

ⓘNote

● The color abnormal correction function may differ by device models.

● The CAC will be performed only when the edge strength is higher than the configured threshold.

The color abnormal correction (CAC) is used to eliminate abnormal color on image edges.
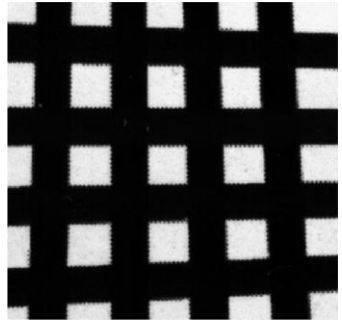
Steps

1. Go to **Shading Correction** → **CAC Enable**, and enable **CAC Enable**.

2. Enter **CAC Edge Threshold** according to actual demands.
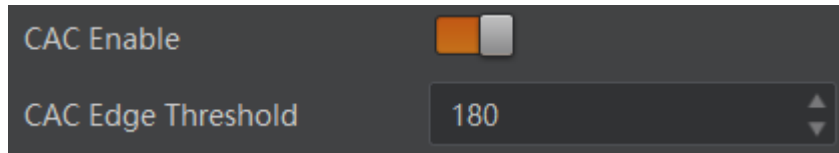
Figure 11-52 Set Color Abnormal Correction

Chapter 12 Other Functions

12.1 Device Control

⌐Note

The specific device control parameters may differ by device models.

In **Device Control**, you can view device information, edit device name, reset device, etc. The specific parameters in **Device Control** are shown below.

Table 12-1 Parameter Description

Parameter	Read/Write	Description
Device Type	Read Only	It is the device type.
Device Scan Type	Read Only	It is the scan type of the device's sensor.
Device Vendor Name	Read Only	It is the name of the manufacturer of the device.
Device Model Name	Read Only	It is the model of the device.
Device Manufacturer Info.	Read Only	It is the manufacturer information about the device.
Device Version	Read Only	It is the version of the device.
Device Firmware Version	Read Only	It is the firmware version of the device.
Device Serial Number	Read Only	It is device's serial number.
Device ID	Read Only	It is the device's ID.
Device User ID	Read & Write	Device name and it is empty by default. You can set according to your preference. ● If User ID is empty, the client software displays the device model. ● If you set it, the client software displays the User ID you set.
Device Uptime (s)	Read Only	It is the period of time when device is powered up.
Board Device Type	Read Only	It is the device type.
Device Connection Selector	Read & Write	It selects which Connection of the device to control.

Parameter	Read/Write	Description
Device Connection Speed (Mbps)	Read Only	It indicates the speed of transmission of the specified connection.
Device Link Selector	Read & Write	It selects which Link of the device to control
Device Link Speed (Mbps)	Read Only	It indicates the speed of transmission negotiated on the specified link.
Device Link Connection Count	Read Only	It returns the number of physical connection of the device used by a particular link.
Device Link Heartbeat Mode	Read & Write	It activates or deactivates the link's heartbeat.
Device Stream Channel Count	Read Only	It indicates the number of streaming channels supported by the device.
Device Stream Channel Selector	Read & Write	It selects the stream channel to control.
Device Stream Channel Type	Read Only	It reports the type of the stream channel.
Device Stream Channel Link	Read Only	It is the index of device's Link to use for streaming the specified stream channel.
Device Stream Channel Endianness	Read Only	It is the endianness of multi-byte pixel data for this stream.
Device Stream Channel Packet Size (B)	Read & Write	It specifies the stream packet size, in bytes, to send on the selected channel for a transmitter or specifies the maximum packet size supported by a receiver.
Device Event Channel Count	Read Only	It indicates the number of event channels supported by the device.
Device Character Set	Read Only	It is character set used by the strings of the device's bootstrap registers.
Device Reset	Read Only	Click **Execute** to reset the device.
Device Temperature Selector	Read & Write	It selects device component to view its temperature. Currently, only sensor can be selected only.
Device Temperature	Read Only	It displays the temperature of selected components in **Device Temperature Selector**.
Find Me	Read & Write	The function of finding me is executed. Click **Execute** to find the currently operating device.

Parameter	Read/Write	Description
Device Max Throughput (Kbps)	Read Only	It is max. bandwidth of the data that can be streamed out of the device.
Device PJ Number	Read Only	It is the device's project number.
HB Abnormal Monitor	Read Only	It monitors image stream condition.
HB Version	Read Only	It is the version of the image compression mode.

12.2 Embed Information into Image

The device supports embedding information into image data. The information will be embedded into the image according to the enabling condition of each type of information in the order of the image embedding information listed in the table below.

[i] **Note**
- **White Balance** is only available for the color devices.
- **Width**, **Height**, **Offset X**, **Offset Y** and **Pixel Format** are image embedding information that the device supporting Chunk function has.

Table 12-2 Image Embedding Information

Image Embedding Information	Byte	Data Format
Timestamp	4	Refer to figure 11-1
Gain	4	4 bytes are used to transfer the gain information. Each low 8 bits of the 4 valid data are combined to transfer the gain information. Value Range: 0 to 1023. Note: High bits will be complemented with 0 automatically.
Exposure	4	4 bytes are combined to show the exposure time, and the unit is µs.
Brightness Info	4	Ranges from 0 to 4095
White Balance	8	R/G/B occupies 2 bytes each. Value Range: 0 to 4095.
Frame Counter	4	Ranges from 0 to 2^{32}-1
Ext Trigger Count	4	Ranges from 0 to 2^{32}-1
Line Input Output	4	The 1st byte is input, and each bit corresponds to 1 input. The 2nd byte is output, 3rd and 4th bytes are reserved.

Image Embedding Information	Byte	Data Format
Width	4	Ranges from 0 to 2^{32}-1
Height	4	Ranges from 0 to 2^{32}-1
Offset X	4	Ranges from 0 to 2^{32}-1
Offset Y	4	Ranges from 0 to 2^{32}-1
Pixel Format	4	Ranges from 0 to 2^{32}-1
ROI Position	8	The starting coordinates occupy two bytes each with the column coordinates at the front and the row coordinates at the back. The length and width coordinates each occupy two bytes.
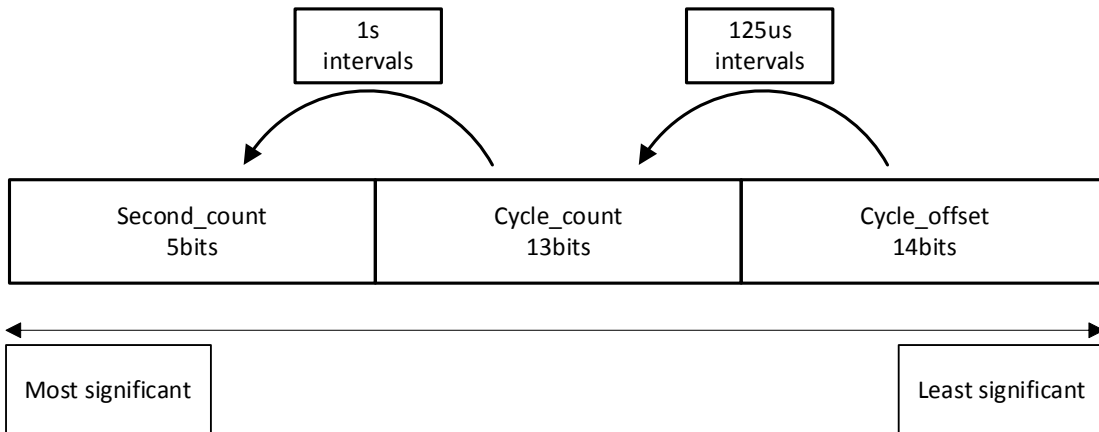
Figure 12-1 Data Format of Timestamp

There are two ways to embed information into the image, including watermark function and Chunk function.

☐**i̇Note**

● Watermark function is not available if the device enables image compression mode.
● The Chunk function may differ by device models.
● The device uses Chunk function in priority if it supports both watermark and Chunk function.

Watermark Settings

Steps

1. Go to **Image Format Control** → **Embedded Image Info Selector**, and select **Embedded Image Info Selector** according to actual demands.
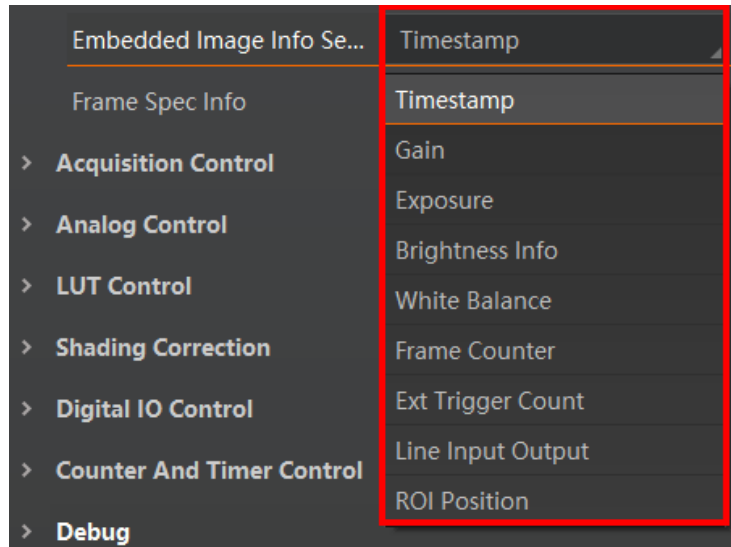
Figure 12-2 Select Embedded Image Info Selector

2. Enable **Frame Spec Info** to add watermark into images.
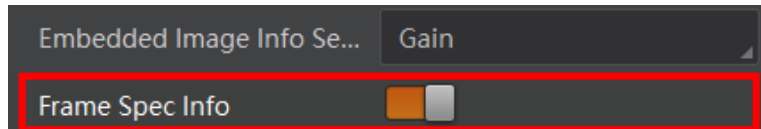
Figure 12-3 Enable Frame Spec Info

3. (Optional) Repeat steps above to add multiple watermarks.

4. Click ⬛ on the control toolbar of the client software to view specific watermark information.

📖**Note**

The watermark is embedded into the starting position of the first line of image data. If the ROI is small and the first line of image data is insufficient to embed information, the information will be embedded into the second line of image data.

Chunk Settings

Steps

1. Go to **Chunk Data Control** → **Chunk Mode Active**, and **Chunk Mode Active**.
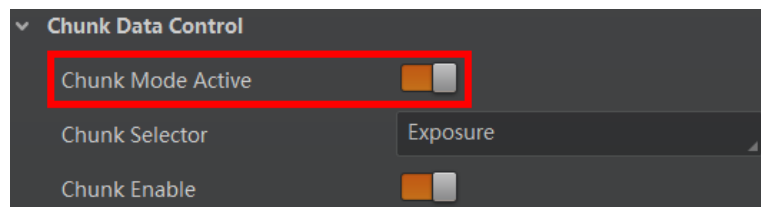
Figure 12-4 Enable Chunk Mode Active

2. Select **Chunk Selector** according to actual demands.
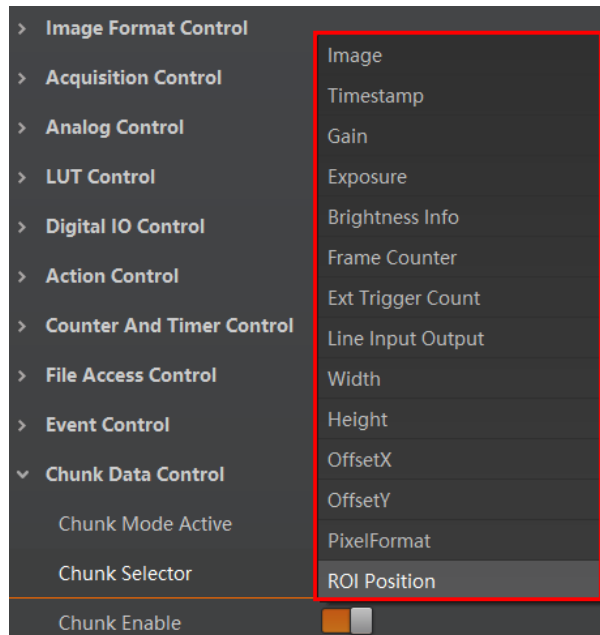
Figure 12-5 Select Chunk Selector

3. Enable **Chunk Enable** to embed information into the image.
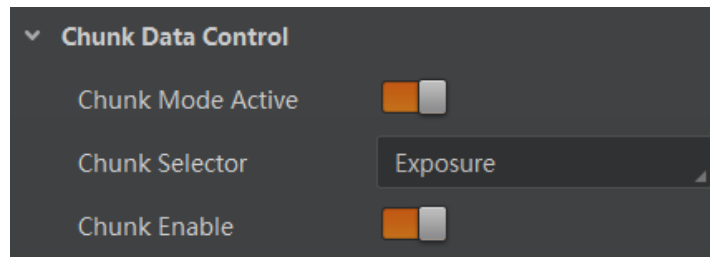
Figure 12-6 Chunk Enable

4. (Optional) Repeat steps above to add multiple Chunk information types.
5. Click 📇 on the control toolbar of the client software to view specific information.

12.3 TDI Function

> **⌐i Note**
> ● The TDI function may differ by device models.
> ● When switching TDI Mode, the device may have short period (3 s to 5 s) of image exception, which is a normal phenomenon.

TDI refers to Time Delay Integration, and it is a method of line scanning which provides dramatically increased responsivity compared to other video scanning methods. It permits much greater scanning speeds in low light, or allows reduced lighting levels (and costs) at conventional speeds. In general, there are 3 TDI modes, including 1 line, 2-TDI and 4-TDI.

● 1 line refers to single line mode, and the device selects 1 line data as output result.
● 2-TDI means that the device overlaps 2 adjacent line data, and outputs 1 line data as final result.
● 4-TDI means that the device overlaps 4-line data, and outputs 1 line data as final result.

Go to **Image Format Control → TDI Mode**, and set **TDI Mode** according to actual demands.
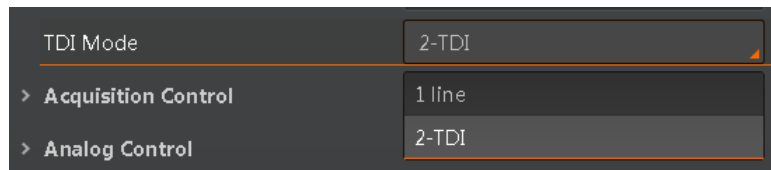
Figure 12-7 Set TDI Mode

12.4 Scan Direction

Note

● The scan direction function may differ by device models.
● Make sure that the scan direction and the moving direction of objects are matched. Otherwise, acquired images may be abnormal.

The scan direction function is used to change the scan direction of the sensor used on measured objects. The figures below are the actual effects.
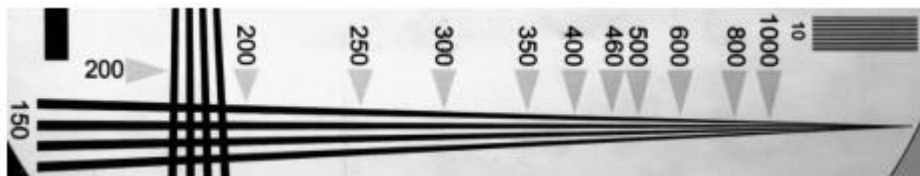
Figure 12-8 Image when Direction Matched of Mono Device
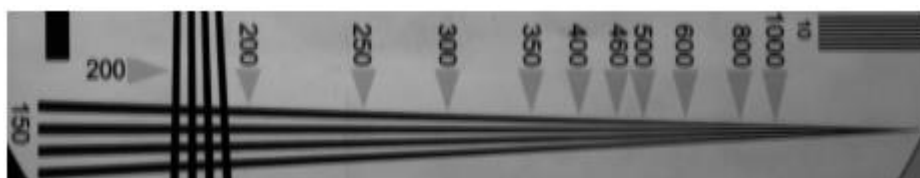
Figure 12-9 Image when Direction Mismatched of Mono Device
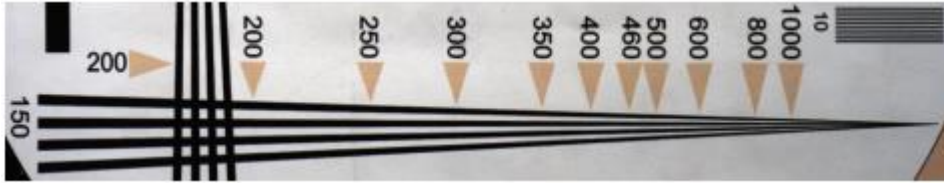
Figure 12-10 Image when Direction Matched of Color Device
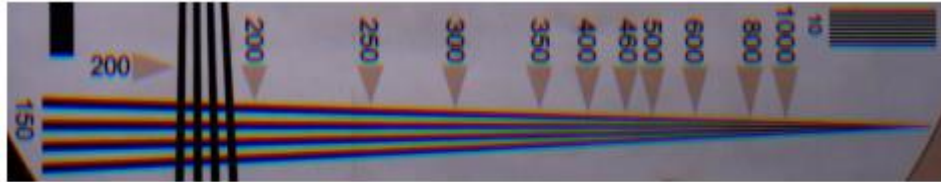
Figure 12-11 Image when Direction Mismatched of Color Device

Note

The specific method of setting scan direction may differ by device models.

Regarding MV-CL043-A1GM device, after selecting **2-TDI** or **3-TDI** as **TDI Mode**, follow steps below to set scan direction.

Steps

1. Go to **Image Format Control** → **Direction Source**.
2. Set **Direction Source** according to actual demand.
3. (Optional) Select **Internal** as **Direction Source** and enable **Reverse Scan Direction** if you want to use the internal signal to achieve reverse scan function.
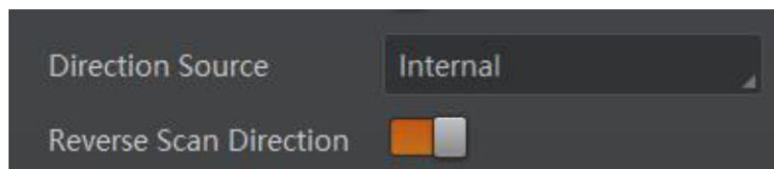
Figure 12-12 Internal Direction Source

4. (Optional) Select **Line 3 Level** as **Direction Source** and the device will switch to forward scan direction if Line 3 is in high level. Otherwise, the device will switch to backward scan direction.
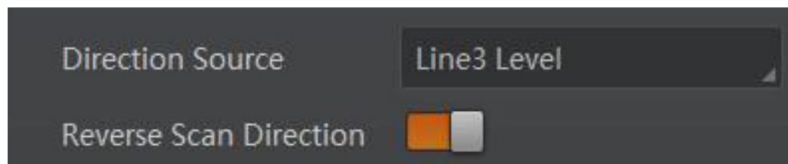
Figure 12-13 Line 3 Level

5. (Optional) Select **Line 3 Edge** as **Direction Source** and the device will switch scan direction if Line 3 is in rising edge.

Figure 12-14 Line 3 Edge

Regarding other types of the device, go to **Image Format Control** → **Reverse Scan Direction** to enable **Reverse Scan Direction** according to actual demands, and observe the image effect at the same time.
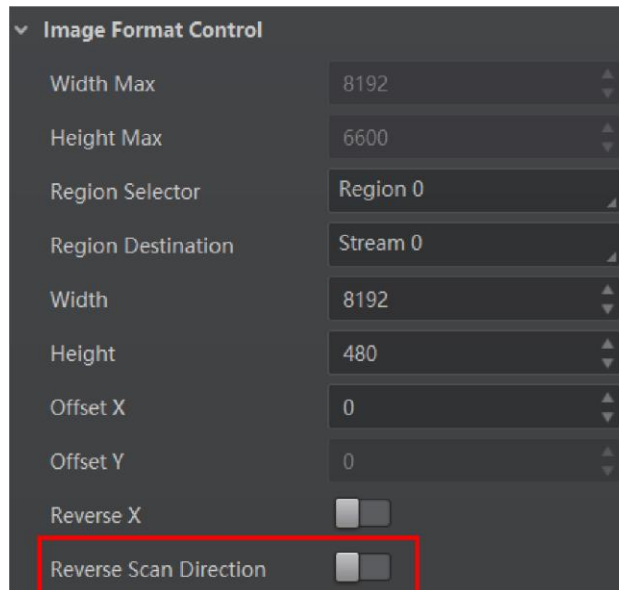
Figure 12-15 Set Scan Direction

12.5 Set Action Command

⌐**i**Note

● The action command function may differ by device models.
● Only V3.1.0 and above version of MVS client software support GigE Vision action command.

The action command allows you to execute actions on multiple devices at roughly the same time by using a single broadcast protocol message.

Steps

1. Go to **Transport Layer Control** → **GEV IEEE 1588**, and enable **GEV IEEE 1588**.
2. Go to **Acquisition Control** → **Trigger Selector**, and select **Frame Burst Start**.
3. Select **On** as **Trigger Mode**.
4. Select **Action 1** as **Trigger Source**.
5. Go to **Tool** → **GigE Vision Action Command** in the menu bar.
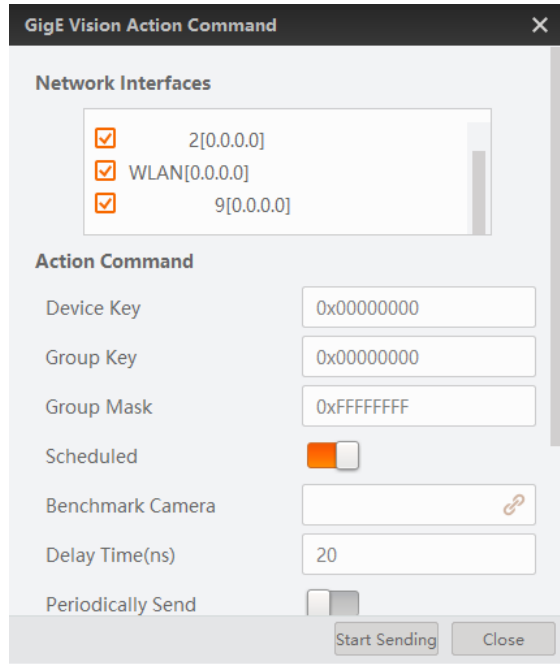
Figure 12-16 GigE Vision Action Command

6. Select **Network Interfaces** to set the subnet that the command to be sent to.
7. Enter **Device Key**, **Group Key**, and **Group Mask**.

Table 12-3 Parameter Description

MVS Parameter Name	Device Parameter Name	Description
Device Key	Action Control → Action Device Key	The parameter value should be the same.
Group Key	Action Control → Action Group Key	The parameter value should be the same.
Group Mask	Action Control → Action Group Mask	The bitwise AND operation of the **Group Mask** against the **Action Group Mask** feature should results in non-zero.

8. Enable **Scheduled**.
9. Click 🔗 in **Benchmark Camera** to select one device as benchmark device. Once benchmark device is selected, other devices keep time synchronization with it.
10. (Optional) Enter **Delay Time** according to actual demands.

Note

● The delay time should NOT be shorter than the maximum time required to transmit the command across the network.
● When the benchmark device receives the command, all devices will trigger certain

actions simultaneously after the specified delay time.

11. (Optional) Enable **Periodically Send** to enable the client to send commands periodically, and enter **Sending Interval** according to actual demands.

Note

The default value of sending interval is 1000 ms, and its range is from 1 ms to 3600000 ms.

12. (Optional) Enable **Request Acknowledgement** to display the acknowledgement messages.
13. Click **Start Sending**.

12.6 File Access Control

Note

The file access control function may differ by device model.

The file access function can import or export the device's feature files and save them in mfa format. The supported feature files include User Set 1/2/3, LUT Luminance 1/2/3, USER PRNUC 1/2/3, and USER FPNC 1/2/3.

Steps

1. Select a device in the device list, and click ![icon] to open the file access dialogue box.
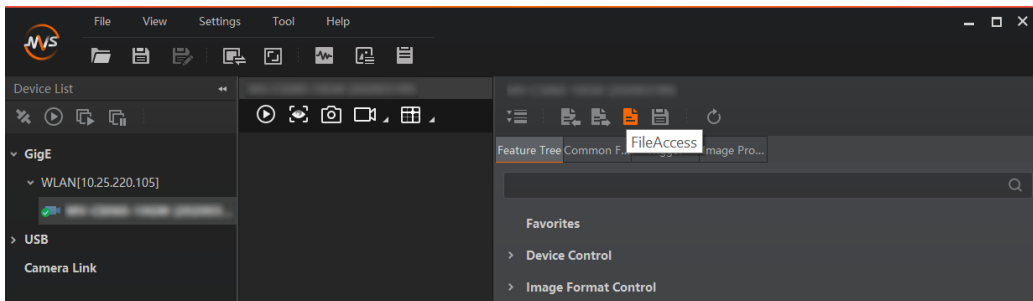
Figure 12-17 File Access

2. Select **Device Feature** and click **Import** or **Export**.
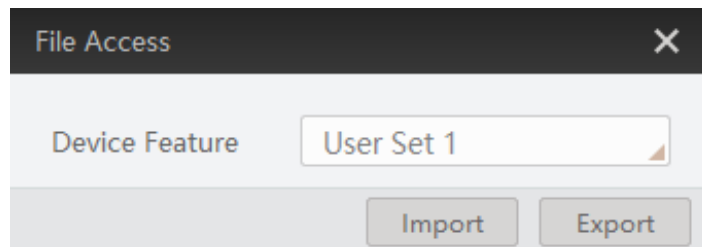
Figure 12-18 Import or Export

3. Select a mfa file from local PC to import or select a saving path and enter file name to save and export.

ⓘNote

- If User Set 1/2/3 is selected as device feature, you need to load the corresponding user set you selected to take effect.
- If LUT Luminance 1/2/3 is selected as device feature, and they will take effect only when you select the same parameters in LUT Selector.
- USER PRNUC 1/2/3 has the same mechanism with LUT Luminance 1/2/3 mentioned above.
- If USER FPNC 1/2/3 is selected as device feature, and they will take effect immediately when FPNC User Enable is enabled.
- Importing and exporting the device feature among the same model of devices are supported.

12.7 Event Control

ⓘNote

The event control function may differ by device model.

The event control can record events happen to the device and allow you to view them.

Steps

1. Go to **Event Control** → **Event Selector**, and select **Event Selector** according to actual demands.

ⓘNote

The specific events may differ by device models.
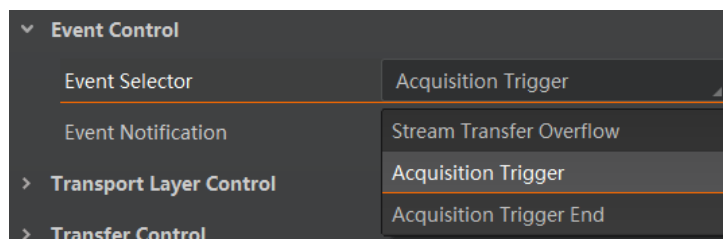
Figure 12-19 Event Selector

2. Select **Notification On** as **Event Notification** to output event.
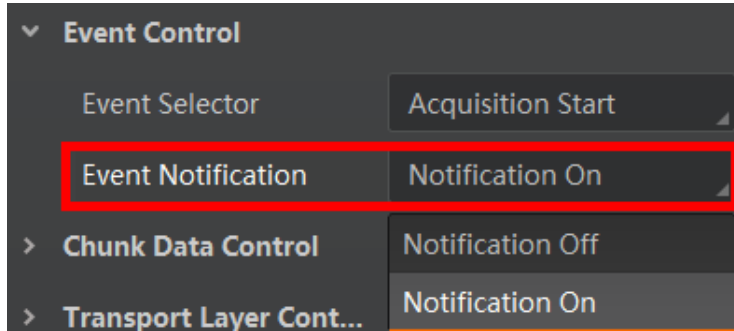
Figure 12-20 Set Event Control

3. Right click the connected device and click **Event Monitor**.
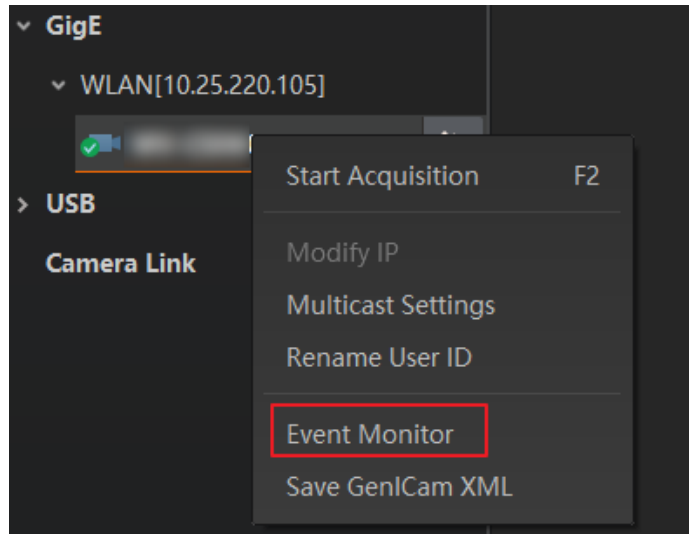
Figure 12-21 Event Monitor

4. Check **Messaging Channel Event**, and view the specific event after the device starts live view.
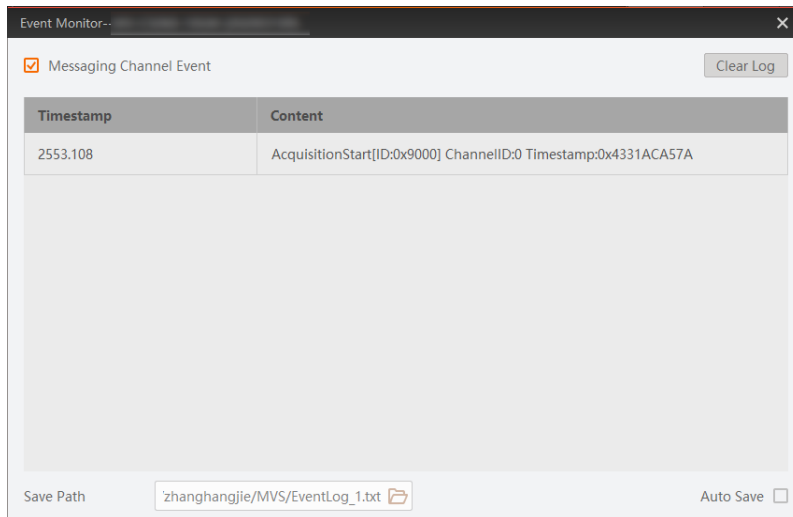
Figure 12-22 Event Monitor Window

12.8 Transport Layer Control

You can go to **Transport Layer Control** to view the device's payload size, GenCP version, etc.

ⓘ**Note**

The specific parameters of transport layer control may differ by device models.

Table 12-4 Parameters of Transport Layer Control

Parameter	Read/Write	Description
Paylode Size	Read Only	It is the device's load size.
Streaming Mode	Read & Write	It is the network transmission mode. ● Quick Frame Mode: After the device acquires a data package, the package will be transferred to the PC via network immediately, and acquisition speed improves. ● Standard Mode: After the device acquires a complete frame, the image will be transferred to the PC via network.
GenCP Version Major	Read Only	It is the major version in GenCP version.
GenCP Version Minor	Read Only	It is the minor version in GenCP version.
GEV Device Mode Is Big Endian	Read Only	It is the endianness in device's register.
GEV Device Mode Character Set	Read Only	It is the character set in device's register.
GEV Interface Selector	Read Only	It sets which physical network interface to be controlled.
GEV MAC Address	Read Only	It is the MAC address of the network interface.
GEV Supported Option Selector	Read & Write	It selects the GEV option to interrogate for existing support.
GEV Supported Option	Read Only	It indicates whether the selected GEV option is supported or not.
GEV Current IP Configuration LLA	Read Only	It indicates whether the Link Local Address IP configuration scheme is activated on the given network interface.
GEV Current IP	Read & Write	It indicates whether the DHCP IP

Parameter	Read/Write	Description
Configuration DHCP		configuration scheme is activated on the given network interface.
GEV Current IP Configuration Persistent IP	Read & Write	It indicates whether persistent IP configuration scheme is activated on the given network interface.
DEV PAUSE Frame Reception	Read & Write	It controls whether incoming pause frames are handled on the given logical link.
GEV Current IP Address	Read Only	It is the current IP address for the given network interface.
GEV Current Subnet Mask	Read Only	It is the current subnet mask of the given interface.
GEV Current Default Gateway	Read Only	It is the default gateway IP address to be used on the given network interface.
GEV First URL	Read Only	It is the first choice of URL for the XML device description file.
GEV Second URL	Read Only	It is the second choice of URL to the XML device description file.
GEV Number of Interfaces	Read Only	It indicates the number of physical network interfaces supported by this device.
GEV Persistent IP Address	Read & Write	It indicates the persistent IP address for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Subnet Mask	Read & Write	It indicates the persistent subnet mask associated with the persistent IP address on this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Default Gateway	Read & Write	It indicates the persistent default gateway for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Link Speed	Read Only	It indicates the speed of transmission negotiated by the given network interface in Mbps.
GEV Message Channel Count	Read Only	It indicates the number of message channels supported by this device.

Parameter	Read/Write	Description
GEV Stream Channel Count	Read Only	It indicates the number of stream channels supported by this device.
GEV Heartbeat Timeout (ms)	Read & Write	It indicates the current heartbeat timeout in milliseconds.
GEV Heartbeat Disable	Read & Write	It disables the GEV Heartbeat.
GEV Timestamp Tick Frequency (Hz)	Read & Write	It indicates the number of timestamp ticks in 1 second (frequency in Hz).
Timestamp Control Latch	Read & Write	It latches the current timestamp value of the device.
Timestamp Control Reset	Read & Write	It resets the timestamp value for the device.
Timestamp Control Latch Reset	Read & Write	It resets the timestamp control latch.
Timestamp Value	Read Only	It is a read only element. It indicates the latched value of the timestamp.
GEV CCP	Read & Write	It controls the device access privilege of an application.
GEV MCP Host Port	Read & Write	It controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GEV MCDA	Read & Write	It controls the destination IP address for the message channel.
GEV MCTT (ms)	Read & Write	It provides the transmission timeout value in milliseconds.
GEV MCRC	Read & Write	It controls the number of retransmissions allowed when a message channel message times out.
GEV MCSP	Read Only	It indicates the source port for the message channel.
GEV Stream Channel Selector	Read Only	It selects the stream channel to control.
GEV SCP Interface Index	Read Only	It is the Index of network interface to be used.
GEV SCP Host Port	Read & Write	It is the host port of the channel
GEV SCP Direction	Read Only	It transmits or receives the channel.

Parameter	Read/Write	Description
GEV SCPS Fire Test Packet	Read Only	It sends a test packet.
GEV SCPS Do Not Fragment	Read & Write	The state of this feature is copied into the "do not fragment" bit of the IP header of each stream packet.
GEV SCPS Big Endian	Read Only	It is the Endianness of multi-byte pixel data for this stream.
GEV SCPS Packet Size(B)	Read & Write	It specifies the stream packet size (in bytes) to send on this channel.
Auto SCPD	Read & Write	After enabling, the client software automatically adjusts SCPD value and optimize data transmission process.
GEV SCPD	Read & Write	It indicates the delay (in timestamp counter units) to insert between each packet for this stream channel.
GEV SCDA	Read & Write	It indicates the destination IP address for this stream channel.
GEV SCSP	Read Only	It indicates the source UDP port address for this stream channel.
Gev IEEE 1588	Read & Write	It enables the IEEE 1588 Precision Time Protocol to control the timestamp register.
Gev IEEE 1588 Slave Only	Read & Write	After enabling, the device serves as a sub device in IEEE 1588 mode.
Gev GVSP Extended ID Mode	Read & Write	It enables the extended ID mode.

12.9 Transfer Control

You can go to **Transfer Control** to view the device's transfer sources, transfer mode, queue information, etc.

Note

The specific parameters of transfer control may differ by device models.

Table 12-5 Parameters of Transfer Control

Parameter	Read/Write	Description
Transfer Selector	Read & Write	It selects the transfer source.

Parameter	Read/Write	Description
Transfer Control Selector	Read & Write	It selects the transfer mode.
Transfer Queue Max Block Count	Read Only	It displays the max. image quantity that the device's memory can save before the compression.
Transfer Queue Current Block Count	Read Only	It displays the current saved image quantity. When the quantity is smaller than 1 GB, it displays 0 or 1.
Transfer Queue Over Flow Count	Read & Write	It is the image quantity discarded by FPGA.
Transfer Queue Mode	Read & Write	It is the operating mode of memory queue.

12.10 User Set Customization

This function allows you to save or load device settings. The device supports four sets of parameters, including one default set and three user sets, and the relation among four sets of parameters is shown below.
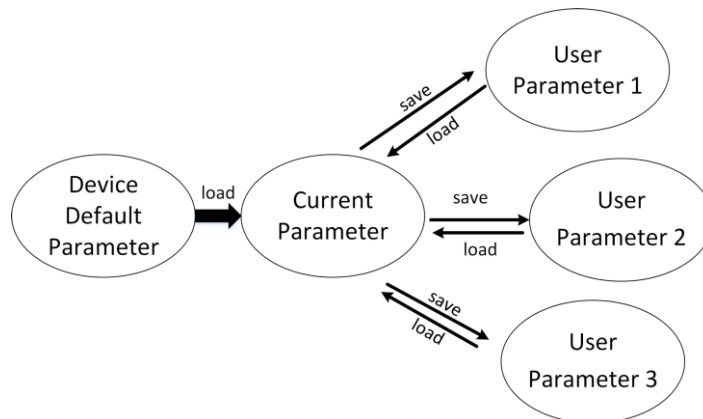
Figure 12-23 Parameter Relation

☐**i** **Note**

After setting user parameters, it is recommended to save user parameters and select them as the default parameters.

12.10.1 Save User Set

Steps

1. Go to **User Set Control**, and select a user set in **User Set Selector**.

⊡Note

Here we take selecting **User Set 1** as an example.

2. Click **Execute** in **User Set Save** to save parameter.
3. View **User Set Save Status**:
● Saving: User parameters are being saved.
● Ready: User parameters have been saved.
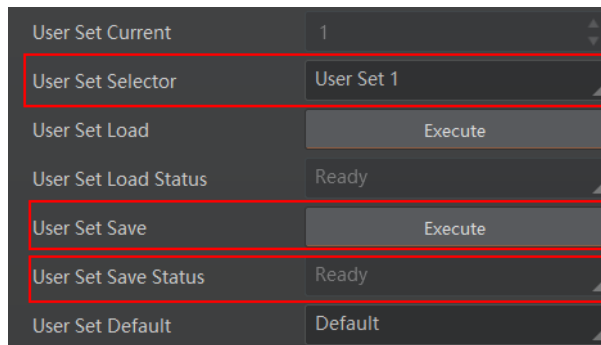
Figure 12-24 Save User Set

12.10.2 Load User Set

⊡Note

Loading user set is available only when the device is connected but without live view.

Steps

1. Go to **User Set Control**, and select a user set in **User Set Selector**.

⊡Note

Here we take selecting **User Set 1** as an example.

2. Click **Execute** in **User Set Load** to load parameter.
3. View **User Set Load Status**:
● Saving: User parameters are being loaded.
● Ready: User parameters have been loaded.
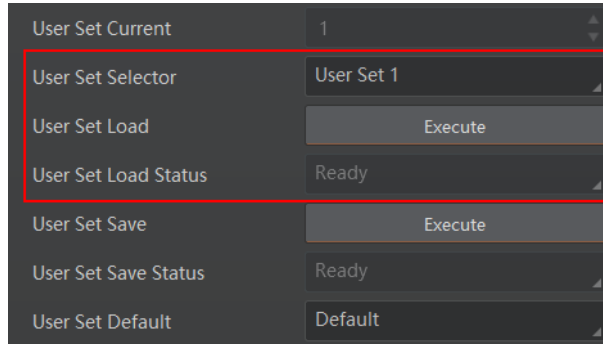
Figure 12-25 Load User Set

12.10.3 Set User Default

You can also set default parameter by going to **User Set Control**, and select a user set in **User Set Default**.

☐**i****Note**
Here we take selecting **User Set 1** as an example.
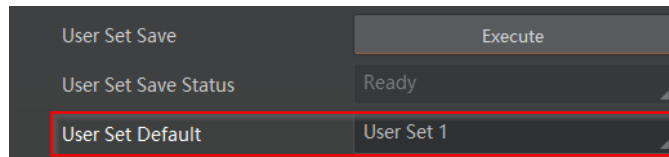
Figure 12-26 Set User Default

12.11 Multicast Function

The multicast function enables multiple PCs to access the same device at the same time. At the same time, the same device can only be connected by one client in controller and data receiver mode or controller mode, but can be connected by multiple clients in data receiver mode. The multicast mode of each device within the client is controlled individually. The description of three multicast modes is shown below.

Table 12-6 Multicast Mode Description

Multicast Mode	Description
Controller and Data Receiver	This mode allows you to read and edit the device's parameters, and get its image data.
Controller	This mode allows you to read and edit the device's parameters, but you cannot get its image data.
Data Receiver	This mode allows you read the device's parameters and get its image data, but you cannot edit its parameters.

When the multicast function is enabled, the device icon on the client software of other PCs will become , and you can connect the device via the data receiver mode.
You can set multicast function for both the available device and connected device in the device list, but the specific settings are different.

12.11.1 Set Multicast (Available Status)

Follow steps below to set multicast function if the device is in available status.

Steps

1. Right click the available device, and click **Multicast Settings**.
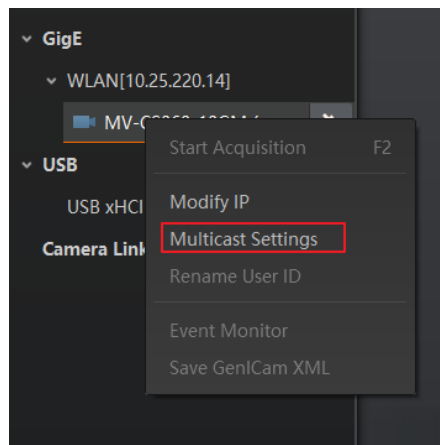
Figure 12-27 Multicast Settings

2. Select **Role**, and enter the **IP Address** and **Port**.

📖**Note**

● The available status device can use multicast function in Controller and Data Receiver mode or Controller mode.
● The IP address should be class D IP address, and the port ranges from 0 to 65535.
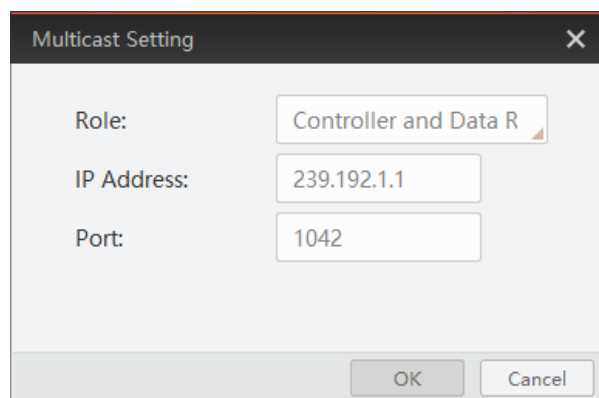
Figure 12-28 Set Parameters

3. Click **OK**.

12.11.2 Set Multicast (Connected Status)

Follow steps below to set multicast function if the device is in connected status.

Steps

1. Right click the available device, and click **Multicast Settings**.
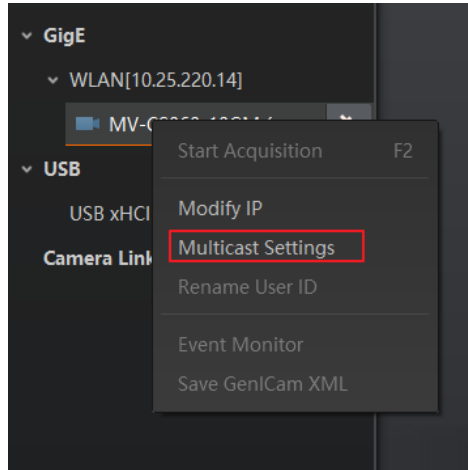
Figure 12-29 Multicast Settings

2. Enable the multicast function, and edit the **IP Address** and **Port**.

⎰**i**Note

● The connected status device can use multicast function in Controller and Data Receiver mode only.
● The IP address should be class D IP address, and the port ranges from 0 to 65535.
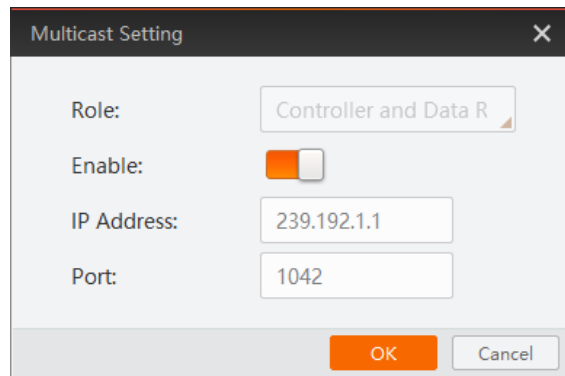
Figure 12-30 Set Parameters

3. Click **OK**.

12.12 Update Firmware

You can use the MVS Tool Kit to update the device's firmware.

⌊ⁱ⌋**Note**

The MVS Tool Kit is installed by default when you install the MVS client software.

Steps

1. Go to **All** → **Configuration Tool** → **Firmware Upgrade Tool** after running MVS Tool Kit.
2. Click ↻ in **GigE** to enumerate devices.
3. Click ▭ to select firmware upgrade package (dav file).
4. Click **Update** to start updating.
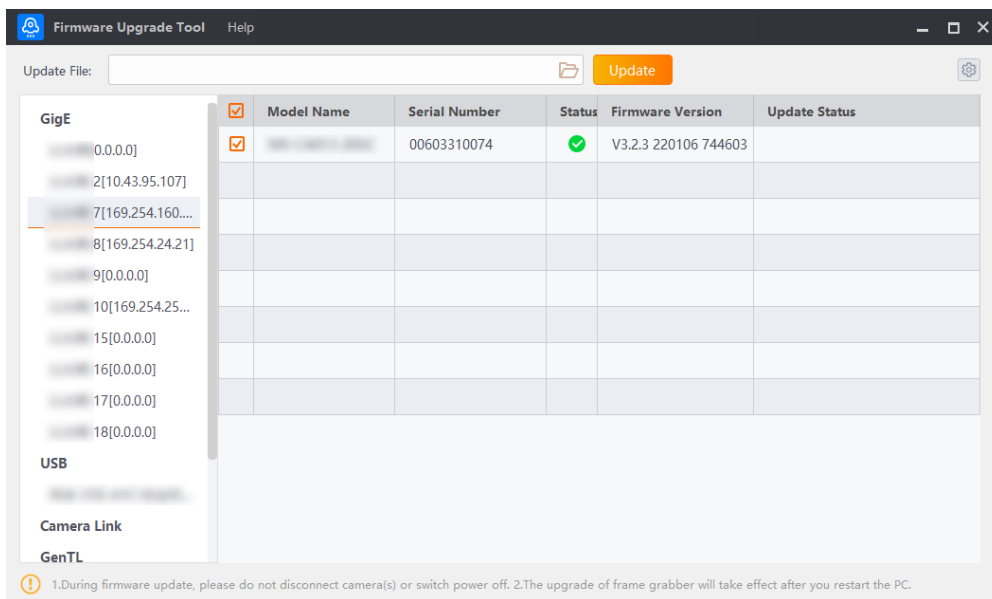
Figure 12-31 Update Firmware

⌊ⁱ⌋**Note**

● The device will reboot automatically after updating the firmware.
● The firmware updating process may take a few minutes, please wait patiently.
● During firmware updating, do not disconnect the device or switch power off.

Chapter 13 FAQ (Frequently Asked Question)

13.1 Why the client software cannot list devices?

Reason
● The device is not powered on.
● Incorrect network cable connection.

Solution
Check the device's power supply and network connection by observing the device's indicator and network link indicator.

13.2 Why device connection fails after the device is listed in the client software?

Reason
● The device and the client software are not in the same network segment.
● The device has been connected by other programs.

Solution
● Use IP configurator tool to edit the device's IP address to make sure that the device and the client software are in the same network segment.
● Disconnect the device with other programs, and reconnect it to the client software.

13.3 Why the live view is back?

Reason
● The device's lens aperture is not removed.
● The device exception occurs.

Solution
● Remove the device's lens aperture.
● Power off and restart the device.

13.4 Why the device cannot be triggered although the live view is normal?

Reason

● The trigger mode is not enabled or the device is not triggered.
● Incorrect trigger wiring.

Solution

● Enable the trigger mode and make sure that the selected trigger source matches with the corresponding I/O signal.
● Check if the input of trigger signal and wiring are correct or not.

13.5 Why the network changes from GigE Ethernet to Fast Ethernet?

Reason

The network cable may be damaged.

Solution

Check the network cable, and replace it if it is damaged.

Appendix A Device Parameter Index

Table Appendix A-1 Device Parameter Index

Attribute	Parameters	Section
Device Control	Device Type	Section Device Control
	Device Scan Type	
	Device Vendor Name	
	Device Model Name	
	Device Manufacturer Info.	
	Device Version	
	Device Firmware Version	
	Device Serial Number	
	Device ID	
	Device User ID	
	Device Uptime (s)	
	Board Device Type	
	Device Connection Selector	
	Device Connection Speed (Mbps)	
	Device Link Selector	
	Device Link Speed (Mbps)	
	Device Link Connection Count	
	Device Link Heartbeat Mode	
	Device Stream Channel Count	
	Device Stream Channel Selector	
	Device Stream Channel Type	
	Device Stream Channel Link	
	Device Stream Channel Endianness	
	Device Stream Channel Packet Size (B)	
	Device Event Channel Count	
	Device Character Set	

Attribute	Parameters	Section
	Device Reset	
	Device Temperature Selector	
	Device Temperature	
	Find Me	
	Device Max Throughput (Kbps)	
	Device PJ Number	
	HB Abnormal Monitor	
	HB Version	
Image Format Control	Width Max	Section View Resolution
	Height Max	
	Region Selector	Section Set ROI
	Region Destination	
	Width	
	Height	
	Offset X	
	Reverse X	Section Set Image Reverse
	Direction Source	Section Scan Direction
	Reverse Scan Direction	
	Pixel Format	Section Set Pixel Format
	Pixel Size	
	Image Compression Mode	Section Set Image Compression Mode
	Test Pattern Generator Selector	Section Set Test Pattern
	Test Pattern	
	Binning Selector	Section Set Binning
	Binning Horizontal	
	Binning Vertical	
	Embedded Image Info Selector	Section Embed Information into Image
	Frame Spec Info	

Attribute	Parameters	Section
	TDI Mode	Section TDI Function
Acquisition Control	Acquisition Mode	Section Set Acquisition Mode
	Acquisition Stop	
	Acquisition Burst Frame Count	Section Set Line Rate
	Acquisition Line Rate (Hz)	
	Acquisition Line Rate Control Enable	
	Resulting Line Rate (Hz)	
	Resulting Frame Rate (Fps)	
	Reference Line Rate	
	Trigger Selector	Section Set Trigger Source
	Trigger Mode	
	Trigger Software	
	Trigger Source	
	Trigger Activation	
	Trigger Partial Close	
	Line Delay Enable	
	Trigger Delay (μs)	
	Trigger Cache Enable	
	Exposure Mode	Section Set Exposure Auto
	Exposure Time (μs)	
	Exposure Auto	
	Auto Exposure Time Lower Limit (μs)	
	Auto Exposure Time Upper Limit (μs)	
	Frame Timeout Enable	Section Set Frame Timeout
	Frame Timeout Time (ms)	
	Partial Image Output Mode	
	Abnormal Line Enable	Section Set Abnormal Line Function
	HDR Enable	Section Set HDR
	HDR Selector	

Attribute	Parameters	Section
	HDR Shutter (µs)	
Analog Control	Preamp Gain	Section Set Analog Gain
	Gain (dB)	
	Gain Auto	
	Auto Gain Lower Limit	
	Auto Gain Upper Limit	
	Sensor Mode	Section Set Sensor Mode
	Digital Shift	Section Set Digital Gain
	Digital Shift Enable	
	Brightness	Section Set Brightness
	Black Level	Section Set Black Level
	Black Level Enable	
	Balance White Auto	Section Set White Balance
	AWB Color Temperature Mode	
	Balance Ratio Selector	
	Balance Ratio	
	Gamma	Section Set Gamma Correction
	Gamma Selector	
	Gamma Enable	
	Auto Function AOI Selector	Section Set AOI
	Auto Function AOI Width	
	Auto Function AOI Height	
	Auto Function AOI Offset X	
	Auto Function AOI Offset Y	
	Auto Function AOI Usage Intensity	
	Auto Function AOI Usage White Balance	
Color Transformation Control	CCM Enable	Section Set Color Transformation Control
	Color Transformation Selector	
	Color Transformation Enable	
	Color Transformation Value Selector	

Attribute	Parameters	Section
	Color Transformation Value	
	Hue	Section Set Hue
	Hue Enable	
	Saturation	Section Set Saturation
	Saturation Enable	
	Color Adjustment Enable	Section Set Color Adjustment
	Color Adjustment Selector	
	Color Adjustment Hue	
	Color Adjustment Saturation	
LUT Control	LUT Selector	Section Set LUT
	LUT Enable	
	LUT Index	
	LUT Value	
	LUT Save	
Encoder Control	Encoder Selector	Section Set and Execute Shaft Encoder Control
	Encoder Source A	
	Encoder Source B	
	Encoder Trigger Mode	
	Encoder Counter Mode	
	Encoder Counter	
	Encoder Counter Max	
	Encoder Counter Reset	
	Encoder Max Reverse Counter	
	Encoder Reverse Counter Reset	
Frequency Converter Control	Input Source	Section Set and Execute Frequency Converter Control
	Signal Alignment	
	Trigger Line Rate(Hz)	
	PreDivider	
	Multiplier	
	PostDivider	

Attribute	Parameters	Section
	Resulting Trigger Line Rate(Hz)	
Shading Correction	Shading Selector	Section Set Shading Correction
	Activate Shading	
	NUC Enable	
	FPNC Enable	
	PRNUC Enable	
	PRNUC ROI Enable	
	PRNUC Width	
	PRNUC Offset X	
	FPNC User Enable	
	FPNC User Selector	
	PRNUC User Enable	
	PRNUC User Selector	
	PRNUC Target Enable	
	PRNUC Target	
	PRNUC Target R	
	PRNUC Target G	
	PRNUC Target B	
	PRNUC Smooth Enable	
	Line Rate Ratio	Section Set Space Correction
	Pixel Shift	
	Parallax Direction	
Digital IO Control	Line Selector	Section Trigger Output
	Line Mode	
	Line Format	
	Line Inverter	
	Line Status	
	Line Status All	
	Line Debouncer Time (µs)	
	Line Source	

Attribute	Parameters	Section
	Strobe Enable	
	Strobe Source Selector	
	Strobe Line Duration	
	Strobe Line Delay	
	Strobe Line Pre Delay	
Action Control	Action Unconditional Mode	Section Set Action Command
	Action Device Key	
	Action Queue Size	
	Action Selector	
	Action Group Mask	
	Action Group Key	
Counter and Timer Control	Counter Selector	Section Enable Strobe Signal
	Counter Event Source	
	Counter Event Activation	
	Counter Reset Source	
	Counter Reset	
	Counter Value	
	Counter Current Value	
File Access Control	File Selector	Section File Access Control
	File Operation Selector	
	File Operation Excute	
	File Open Mode	
	File Operation Status	
	File Operation Result	
	File Size(B)	
Event Control	Event Selector	Section Event Control
	Event Notification	
Chunk Data Control	Chunk Mode Active	Section Embed Information into Image
	Chunk Selector	
	Chunk Enable	

Attribute	Parameters	Section
Transport Layer Control	Payload Size(B)	Section Transport Layer Control
	GEV Version Major	
	GEV Version Minor	
	GEV Device Mode Is Big Endian	
	GEV Device Mode Character Set	
	GEV Interface Selector	
	GEV MAC Address	
	GEV Supported Option Selector	
	GEV Supported Option	
	GEV Current IP Configuration LLA	
	GEV Current IP Configuration DHCP	
	GEV Current IP Configuration Persistent IP	
	GEV PAUSE Frame Reception	
	GEV Current IP Address	
	GEV Current Subnet Mask	
	GEV Current Default Gateway	
	GEV First URL	
	GEV Second URL	
	GEV Number Of Interfaces	
	GEV Persistent IP Address	
	GEV Persistent Subnet Mask	
	GEV Persistent Default Gateway	
	GEV Link Speed	
	GEV Message Channel Count	
	GEV Stream Channel Count	
	GEV Heartbeat Timeout(ms)	
	GEV Heartbeat Disable	
	GEV Timestamp Tick Frequency(Hz)	
	Timestamp Control Latch	

Attribute	Parameters	Section
	Timestamp Control Reset	
	Timestamp Control Latch Reset	
	Timestamp Value	
	GEV CCP	
	GEV MCP Host Port	
	GEV MCDA	
	GEV MCTT(ms)	
	GEV MCRC	
	GEV MCSP	
	GEV Stream Channel Selector	
	GEV SCP Interface Index	
	GEV SCP Host Port	
	GEV SCP Direction	
	GEV SCPS Fire Test Packet	
	GEV SCPS Do Not Fragment	
	GEV SCPS Big Endian	
	GEV SCPS Packet Size(B)	
	GEV SCPD	
	GEV SCDA	
	GEV SCSP	
	GEV IEEE 1588	
	GEV GVSP Extended ID Mode	
Transfer Control	Transfer Selector	Section Transfer Control
	Transfer Control Selector	
	Transfer Queue Max Block Count	
	Transfer Queue Current Block Count	
	Transfer Queue Over Flow Count	
	Transfer Queue Mode	
User Set Control	User Set Current	Section User Set Customization
	User Set Selector	

Attribute	Parameters	Section
	User Set Load	
	User Set Save	
	User Set Default	

Appendix B Revision History

Table Appendix B-1 Revision History

Version	Document No.	Revision Date	Revision Details
V3.8.0	UD35749B	Nov. 17, 2023	● Modify section Set Abnormal Line Function. ● Add section Set Color Abnormal Correction. ● Modify section Update Firmware.
V3.7.0	UD34602B	Aug. 14, 2023	● Modify section I/O Connector and Indicator. ● Modify section Set Abnormal Line Function. ● Modify section Differential Output Circuit.
V3.6.0	UD32754B	Apr. 3, 2023	● Modify section Power and I/O Connector. ● Modify section Set Trigger Activation. ● Modify section Scan Direction.
V3.5.0	UD28749B	May 30, 2022	● Modify section Appearance. ● Modify section I/O Connector and Indicator ● Modify section Client Software Layout. ● Add section Set Frame Timeout. ● Add section Set Line Discard Function. ● Modify section Enable Strobe Signal. ● Modify section Transport Layer Control. ● Modify section Appendix A Device Parameter Index
V3.4.32	UD24388B	Jun. 11, 2021	● Modify section Appearance. ● Modify section Interface and Indicator. ● Modify section Set Shaft Encoder Control. ● Add section View Trigger Line Rate. ● Modify section Enable Strobe Signal. ● Modify section I/O Introduction. ● Modify section Input Wiring. ● Modify section Set Pixel Format. ● Modify section Set Gamma Correction. ● Modify section Set Color Transformation Control.

Version	Document No.	Revision Date	Revision Details
			• Modify section Set Hue. • Modify section Set Saturation. • Modify section Set LUT. • Add section Set Flat Field Correction. • Add section Set Space Correction. • Modify section File Access Control.
V3.4.14	UD22897B	Feb. 1, 2021	• Modify section Appearance. • Modify section Interface and Indicator. • Add section Set Frame Timeout. • Modify section Set Hardware Trigger. • Modify section Trigger Related Parameters. • Modify section Frame/Line Tigger Cache. • Modify section Select Output Signal. • Modify section Enable Strobe Signal. • Add section I/O Introduction. • Modify section I/O Electrical Feature. • Modify section Input Wiring. • Modify section Set Test Pattern. • Modify section Set Color Transformation Control. • Add section Color Adjustment. • Modify section Troubleshooting.
V3.4.13	UD19990B	Jun. 2, 2020	• Add section Overview. • Modify section Appearance. • Modify section Interface and Indicator. • Add section Set Image Compression Mode. • Modify section Set Shading Correction. • Modify section Device Control. • Add section TDI Function.
V1.2.0	UD17632B	Dec. 5, 2019	• Modify section Client Software Layout. • Modify section Set Line Rate. • Modify section Event Control. • Add section Set Pixel Format. • Add section Transfer Control.
V1.1.0	UD16661B	Oct. 10, 2019	• Modify section Appearance. • Add section Set Test Pattern. • Add section Set AOI. • Add section Color Transformation Control. • Add section File Access Control.

Version	Document No.	Revision Date	Revision Details
			● Add Appendix A Camera Parameter Index.
V1.0.0	UD14254B	April. 12, 2019	● Original version.

HIKROBOT

SHAPE OUR FUTURE INTELLIGENTLY

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