

Hikrobot Co., Ltd.

# XoFLink Area Scan Camera

User Manual

**HIKROBOT**


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

## Available Model

This manual is applicable to the XoFLink Area Scan Camera.

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# 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 the specific power consumption of the device, please refer to the device's specifications.
- Do not cover the device's plug or outlet for disconnecting power supply.
- It is strictly forbidden to wire, maintain, and disassemble the device is powered on.

Otherwise, there is a danger of electric shock.

- 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.
- Keep clean of the device's image acquisition window. It is recommended to use cleaning water (not the alcohol-based corrosive solutions) to wipe off the dust. When the device is not in use, please add a dust cover to protect the image acquisition window.
- 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).
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

### **Note:**

- 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.
- 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 Cleaning Instruction

### 2.1 Device and Lens Cleaning

Four ways are available to clean the device and lens when they have dust or stains. Refer to the following table for different devices and their supported cleaning methods.

**Table 2-1 Device and Cleaning Method**

Cleaning Method	Device	
	Camera	Lens
Rubber Dust Air Blower	Support	Support
Mirror Brush Cleaning	Not Support	Support
Lens Wiping	Support	Support
Lens Cleaning Paper	Not Support	Support

#### 2.1.1 Rubber Dust Air Blower

You can use a rubber dusk air blower to clean the dust on the surface of the device filter and lens. The specific operation steps are as follows:

**Steps**

1. Blow the rubber dusk air blower downward several times to blow out the dust inside.
2. Hold the device or lens and tilt it down so that the air blower port and the device lens are at an angle of 45 degrees.
3. Blow to clean the dust on the surface of the device filter and lens.



**Figure 2-1 Cleaning by Rubber Dust Air Blower**

## Note

- Do not go too far into the device's lens mount and avoid direct contact with the dust glass when cleaning.
  - It is strictly forbidden to blow the lens directly from the mouth, and avoid spattering saliva particles onto the glass surface, causing serious secondary pollution.
- 

## 2.1.2 Mirror Brush Cleaning

If the dust on the surface of the lens cannot be cleaned by rubber dusk air blower, use a mirror brush to gently remove the dust on the surface of the lens.

---

## Note

Do not touch the bristles directly with your hands.

---

## 2.1.3 Lens Wiping

For the stubborn stains on device filter or lens surface, such as finger marks, liquid stains, etc., it is recommended to use a fat-free cotton swab or dust-free cloth with high purity alcohol to wipe clean. Take the fat-free cotton swab as an example, and the specific operation steps are as follows:

### **Steps**

1. Take a clean fat-free cotton swab, and dip it in proper amount of alcohol or cleaning liquid.

---

## Note

Do not touch the head of the cotton swab by fingers.

---

2. Tilt the fat-free cotton swab about 60 degrees, resist the device filter or lens surface, clean from left to right, turn cotton swab over one side, and clean again from right to left.
3. Take another fat-free cotton swab that is not stained with alcohol or cleaning liquid and swipe the device filter or lens to absorb the remaining alcohol or cleaning liquid.
4. Check whether there is still a stain. If the stain changes position, repeat steps above, until the stain is cleaned.



**Figure 2-2 Lens Wiping**

---

**Note**

If the stains on the lens cannot be wiped or clean, please clean by using lens cleaning paper. For specific operation steps, please refer to the next section.

---

### 2.1.4 Lens Cleaning Paper

For lens stains that cannot be cleaned by a fat-free cotton swab or dust-free cloth, use lens cleaning paper to clean them.

#### **Before You Start**

- Use lens paper purchased from a regular, professional photography store.
- Use freshly opened lens cleaning paper in a wet state.
- Make sure there is no hard dust on the lens.

Tear off the outer package of the lens cleaning paper, fold the pre-moistened paper to a suitable wiping state, and slowly spiral wipe it in the same direction from the center of the lens outward.

---

**Note**

- Do not use hard paper, paper towels, or napkins to clean the lens. These products contain scratching wood pulp, which will seriously damage delicate coating on the lens.
  - Do not press the lens surface hard when cleaning it the lens cleaning paper. Otherwise, the fragile coating on the lens surface will be wiped off.
- 

After completing the lens cleaning, no dust or water stains should be visible from all directions on the lens. If stains still exist, please contact us to return the device for cleaning.

## 2.2 Device Housing Cleaning

When cleaning the device, try to clean it in a closed room to avoid a large amount of dust in the environment. The specific operation steps are as follows:

### **Steps**

1. Disconnect the device's power supply.
2. Take a soft lint-free cloth that will not cause static electricity during cleaning and soak it with a neutral detergent.
3. Wipe the device's housing with a soaked, lint-free cloth as appropriate.
4. Wait for the residual moisture to evaporate after wiping. When the moisture has completely evaporated, you can reconnect the device to the power supply.

---

### **Note**

Do not use compressed air to accelerate evaporation.

---

After inspecting and confirming that the device lens and its housing are cleaned, install the device lens cap with the mount facing downwards, or store the lens properly.

## Chapter 3 Overview

### 3.1 Introduction

The XoFLink area scan camera supports the XoFLink protocol. It adopts QSFP+ ports to transmit non-compressed images in real time. Parameters can be set via the MVS client software or SDK. The image acquisition process is realized via its matched 50 Gbps fiber port frame grabber and QSFP+ optical module.

The camera is applicable to PCB AOI, 3D applications, electronic semiconductor, motion capture, and other industries.

### 3.2 Key Features

- Supports auto or manual adjustment of gain, exposure time, manual adjustment of LUT, and Gamma correction, etc.
- Supports the hardware trigger, software trigger, anyway mode, etc.
- Supports data transmission through 50 Gbps fiber port and multiple Link transmission.
- Compatible with the XoFLink protocol, and supports secondary development.

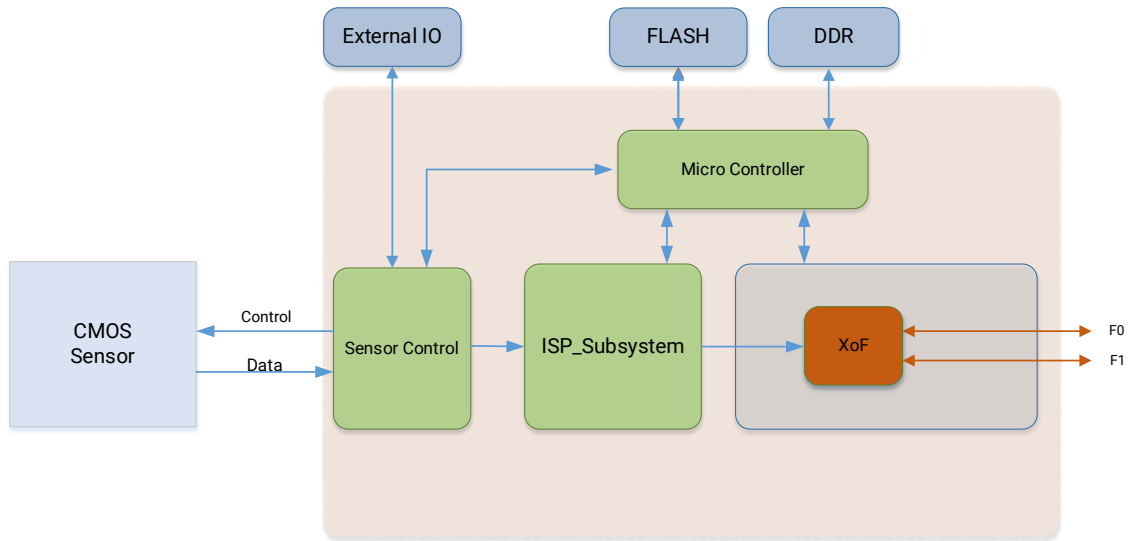
---

 **Note**

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

### 3.3 Operating Principle

The onboard block diagram of the device is shown below. After the image sensor receives the image data, it completes the image data processing through various built-in ISP image-processing algorithms, and finally completes the high-speed transmission of image data through the XoFLink protocol.



**Figure 3-1 Operating Principle**

## Chapter 4 Device Hardware

### 4.1 Appearance

Refer to the figures below for device appearance and the table below for component description.

**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.

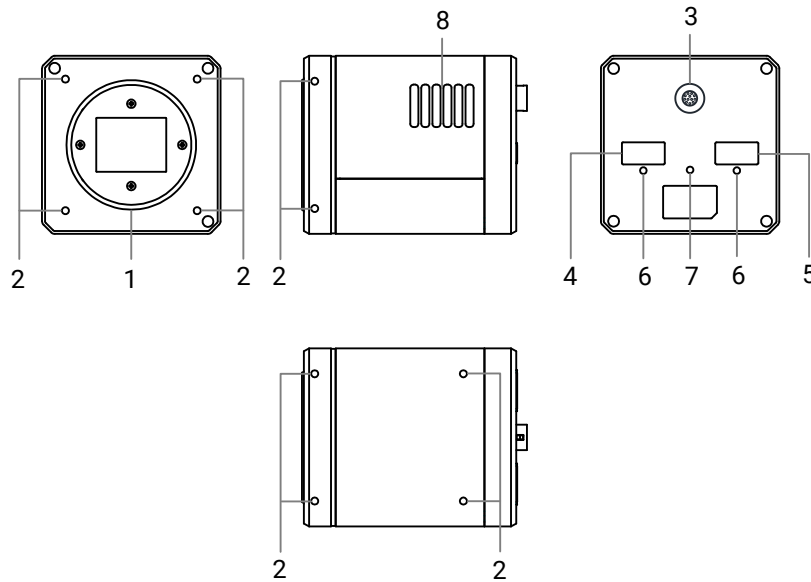
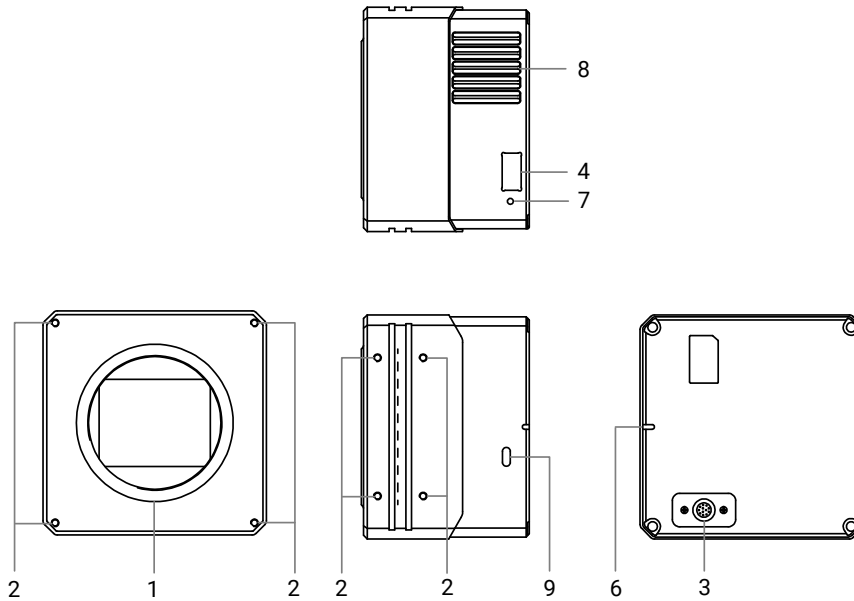


Figure 4-1 Appearance of Type I



**Figure 4-2 Appearance of Type II**

**Table 4-1 Component Description**

No.	Component	Description
1	Lens Mount	It is used to install the lens. Refer to the device's datasheet for specific lens mount information.
2	Screw Hole	It is used to fix the device to the installation position. The screw holes are located on the top, bottom, or side of the device. Refer to the device's datasheet for specific screw information.
3	Power and I/O Connector	It provides power supply, I/O, and serial port function. Refer to section <a href="#">Power and I/O Connector</a> for details.
4	F0 Interface	It is the first XoFLink fiber port for transmitting data. The data interface is QSFP+ port.
5	F1 Interface	It is the second XoFLink fiber port for transmitting data. The data interface is QSFP+ port.
6	Device LED Indicator	It is used to show the operation status of the device. Refer to section <a href="#">Indicator</a> for details.
7	Fiber Port LED Indicator	It is used to show the connection status of the fiber port. Refer to section <a href="#">Indicator</a> for details.
8	Cooling Fan	It is used to cool the device to ensure its normal operation.
9	USB Interface	It refers to the Type-C interface, and is used for firmware update. Refer to section <a href="#">Firmware Update</a> for details.

## 4.2 Power and I/O Connector

The device has a 12-pin P10 connector serving as the power and I/O connector that provides power supply, I/O, and serial port function, as shown below.

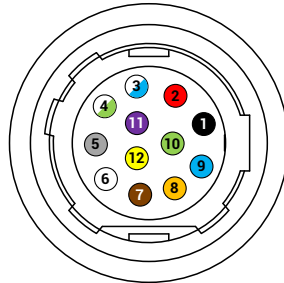


Figure 4-3 12-Pin P10 Connector

Table 4-2 Pin Definitions of 12-Pin P10 Connector

No.	Color	Signal	I/O Signal Source	Description
1	Black	GND	Line 2-	Device power supply ground
2	Red	DC_PWR	--	Device power supply
3	White/Blue	DC_PWR	--	Device power supply
4	White/Green	OPT_IN-	Line 0-	Opto-isolated input signal ground
5	Gray	OPT_OUT-	Line 1-	Opto-isolated output signal ground
6	White	GND	--	Device power supply ground
7	Brown	GND	--	Device power supply ground
8	Orange	232_RXD	--	RS-232 receives
9	Blue	232_TXD	--	RS-232 transmits
10	Green	GPIO2	Line 2+	Can be configured as input or output
11	Purple	OPT_OUT+	Line 1+	Opto-isolated output
12	Yellow	OPT_IN+	Line 0+	Opto-isolated input

### Note

- Refer to the table above and the label attached to the power and I/O cable to wire the device.
- For the cable sold by our company, pin 1, 6, and 7 are twisted together, while pin 2 and 3 are twisted together to provide power to the camera.
- The wire cores shown in the figure and table above are only the wire sequence and the corresponding wire core color of the cables sold by our company. If the cables are not purchased from our company, please refer to the actual wire sequence and the corresponding wire core color.

## 4.3 Indicator

The device has two kinds of indicators, including device LED indicator and fiber port LED indicator. The device LED indicator indicates the device's operation status, and fiber port LED indicator indicates the connection status between the optical fiber patch cord and the device.

### Note

- The indicator status may differ by device models, and actual devices you purchased shall prevail.
- When the indicator is flashing rapidly, flashing slowly, or flashing very rapidly, its unlit interval is 0.2 sec, 1 sec, and 0.08 sec respectively.
- The indicator sometimes may show a purple color when red and blue colors flashing at the same time.

### 4.3.1 Device LED Indicator

Refer to the table below for device LED indicator description.

**Table 4-3 Device LED Indicator Description**

No.	Indicator Color	Status	Device Status Description
1	Red	Solid	The device exception occurs.
2	Blue	Solid	The device is in an idle status.
3	Blue	Unlit	The device is not powered on.
4	Blue	Flashing rapidly	The device is acquiring images in continuous mode.
5	Blue	Flashing slowly	The device is acquiring images in trigger mode.
6	Red and blue	Flash alternatively	The device is updating firmware.

### 4.3.2 Fiber Port LED Indicator

Refer to the table below for fiber port LED indicator description.

**Table 4-4 Fiber Port LED Indicator Description**

No.	Indicator Color	Status	Device Status Description
1	Unlit		<ul style="list-style-type: none"> <li>• The device is not powered on.</li> <li>• The device is powered on but the optical fiber patch cord is not connected to the frame grabber and the device.</li> </ul>

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No.	Indicator Color	Status	Device Status Description
2	Green	Solid	The device is connected but no data transmission occurs.
3	Green	Flashing very rapidly	The device is acquiring images in continuous mode.
4	Orange	Flashing slowly	The device is acquiring images in trigger mode.

## Chapter 5 Power Supply and Heat Dissipation

### 5.1 Device Power Supply

The device provides only one way of power supply: external DC power supply. Connect the external DC power supply to the I/O connector through the I/O cable to power the device. Refer to the device's label for the specific voltage range of power supply.

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#### Note

- Using a DC power supply that exceeds the specified voltage range may cause damage or abnormal operation of the device.
  - Inserting a connector that does not match the I/O connector may cause damage or abnormal operation of the device. Refer to section [Power and I/O Connector](#) for details.
  - Do not short-circuit the power supply and ground.
- 

You can use an industrial power supply to provide DC power supply for the device. When using it, please observe the following precautions:

- Before carrying out any installation or maintenance work, make sure that the power supply is disconnected from the AC power and that there is no risk of accidental reconnection due to human negligence or wiring issues.
- Do not install the power supply in a humid environment, near liquid, in high-temperature conditions, in direct sunlight, or near flame sources.
- The industrial power supply has exposed high-voltage terminals. Please install it in an enclosed case or cabinet to prevent accidental contact by personnel.
- Maintain sufficient insulation distance between the internal components of the power supply and the screws.
- Ensure that the cooling fan and holes for heat dissipation are unobstructed. If adjacent equipment generates heat, keep it at least 10 cm to 15 cm away from the power supply.
- Make sure the power supply is properly grounded before use.
- When using the power supply, do not exceed the upper limit of its output current and output power. Refer to the power supply's nameplate for specific parameters.
- Non-standard installations or using the power supply in high-temperature environments will increase the temperature of the internal components, potentially reducing output power.
- The power supply contains high-voltage circuits that pose a risk. If any abnormalities occur, disconnect the power first and have it inspected by a technician with professional electrical qualifications. Do not attempt to open the casing yourself.
- Avoid touching the power supply terminals within 5 minutes after the power has been cut off to prevent the risk of electric shock.

## 5.2 Heat Dissipation

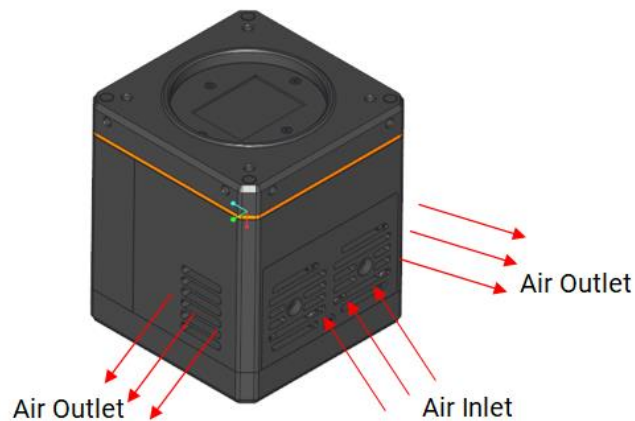
The device contains photosensitive components, if the device's temperature rises, and it will have a certain impact on the quality of the acquired image. Based on the above situation, this section will introduce the temperature parameters and installation suggestions to achieve better heat dissipation effect and improve the image quality and reliability of the device.

### 5.2.1 Temperature Parameter

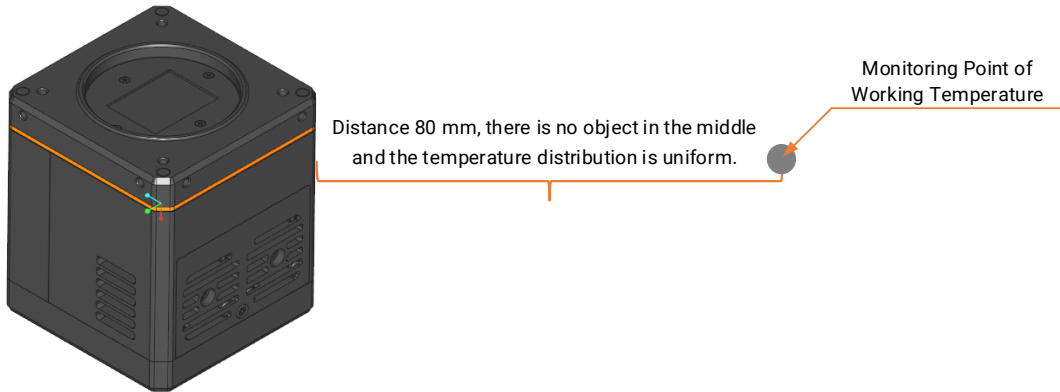
#### Working Temperature

The upper limit of the working environment temperature in the specification of device refers to the maximum ambient temperature that the device can meet without any additional heat dissipation measures. Running within the working temperature can meet the temperature requirements on the electronic components and ensure the reliable operation of the device.

The heat dissipation mode of the device is fan cooling, and the air inlet and outlet are shown in the first figure below. The monitoring point of the working environment temperature is 80 mm away from the air inlet as shown in the second figure below. In the space where the device and the temperature measuring point are located, there is no object in the middle and the temperature distribution is uniform.



**Figure 5-1 Air Inlet and Outlet of the Device**



**Figure 5-2 Monitoring Point of Working Temperature**

## Housing Temperature

Some components inside the device have done heat conduction measures to guide the heat to the housing to ensure that the temperature of the components meets the specification requirements, which also leads to a higher local temperature of the housing. Therefore, we often feel that the device's housing has a certain temperature, or feel hot, which is a normal phenomenon of device heat dissipation.

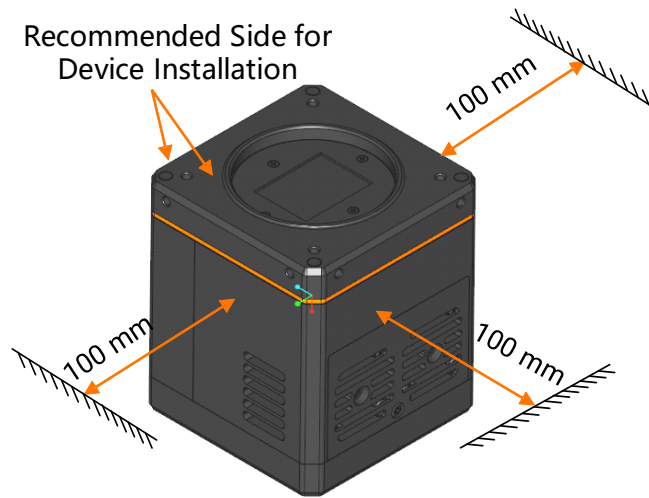
### 5.2.2 Heat Dissipation Measures

The temperature of the device's key components is a key factor affecting image quality, operation stability, and long-term reliability. Therefore, the correct installation is beneficial to the heat dissipation of the device, so as to obtain better image quality and reliability. This section will specify the requirements of the surrounding environment and installation parts.

#### Heat Dissipation via Cooling Fan

The device adopts cooling fans to realize heat dissipation. Thus, it is necessary to ensure that the device is installed in a well-ventilated environment, and avoid placing it in a closed environment that will affect the normal operation of the fan. The device should be installed away from the air inlet and outlet. As shown in the figure below, there should be no object

within 100 mm around the air inlet and outlet of the device.



**Figure 5-3 Surrounding Environment for Heat Dissipation**

### Heat Dissipation via Installation Part

Since most industrial cameras are fixed by the installation part, most of the heat can be guided to the metal mounting platform through the installation part during field installation, so as to dissipate the heat and greatly improve the heat dissipation efficiency of the device.

The heat discharged through the installation part depends on the heat conduction of the installation part itself and the installation method.

- **Installation Part Material**

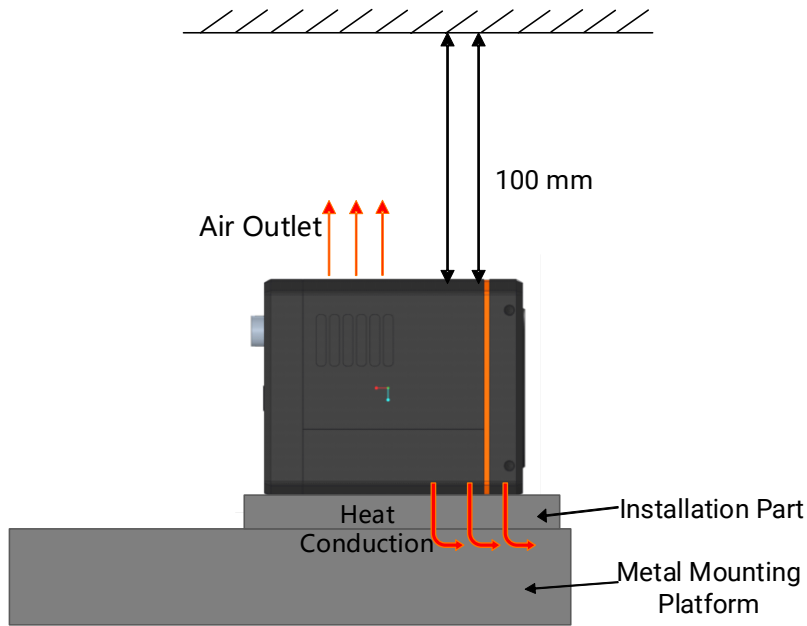
- Use materials with high heat conduction, such as aluminum and copper, which can quickly transfer heat away.
- At the same time, it is best to fix the installation part on the mounting platform of metal material to conduct heat to the metal parts and dissipate it.
- Minimize the use of materials with low heat conduction, such as plastic and rubber.

- **Installation Part Section**

- Installation part with lower thickness is recommended.
- Avoid using extended or bent installation parts.

- **Contact Area**

- Surface contact should be used between the device, installation parts and the mounting platform, and the contact area between installation surfaces should be increased as much as possible to improve the heat dissipation of the device.
- Avoid using point contact between the device, installation parts and the mounting platform.



**Figure 5-4 Heat Dissipation via Installation Part**

If the installation part is made of plastic, rubber, or other materials with poor heat conduction, the application of ventilation equipment such as fans or air conditioners can increase the airflow over the device's surface. This reduces the ambient air temperature around the device, enhancing heat dissipation through convection and thereby reducing the temperature of housing. As a result, the image quality and reliability of the device are improved.

## Chapter 6 Accessories

### 6.1 Lens

#### 6.1.1 Lens Mount

The device supports standard M58-mount and M72-mount lenses. The thread depth of M58-mount or M72-mount lens is not less than 5 mm.

#### 6.1.2 Lens Selection

In order to meet the image acquisition needs of industrial cameras, our company provides a variety of lenses with high performance, high definition, low distortion rate, and other features. You should consider following factors when selecting a lens:

- Lens mount: The device supports standard M58-mount and M72-mount lenses. When selecting lens, select lens with the same mount. When the mount of the device and the lens are different, part of the lens mounts may be switched using corresponding lens adapter.
- Flange back length: The flange back length of different lenses is varied. It is necessary to select the lens with the matched flange back length.
- Sensor size: Make sure that the target surface of the lens is larger than or equal to the size of the device's sensor.
- Resolution: It represents the ability of the lens to record the details of an object. It is generally measured in the number of line pairs that can be distinguished per millimeter: line pairs/millimeter (lp/mm). The higher the resolution of the lens, the clearer the image. Make sure that the accuracy required by the system is less than the resolution of the lens when selecting the lens.
- Working distance: It refers to the distance from the first working surface of the lens to the measured object. Make sure that the working distance is greater than the minimum object distance of the lens when selecting a lens.
- Focal length: The distance from the center point of the lens to the clear image formed on the focal plane. The smaller the focal length value is, the larger the field of view of the image captured by the digital camera is. According to the focal length of the lens, the appropriate working distance can be set up, or the appropriate lens can be selected according to the requirements of the working distance.

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#### Note

In order to better provide a suitable lens model, you can go to the official website of our company (<https://en.hikrobotics.com/>): **Products** → **Lens** → **Lens Selector** to enter your application parameters, and you will find a suitable lens model. If you have any

problems, please contact our technical support.

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## 6.2 Cable

### 6.2.1 Cable Selection

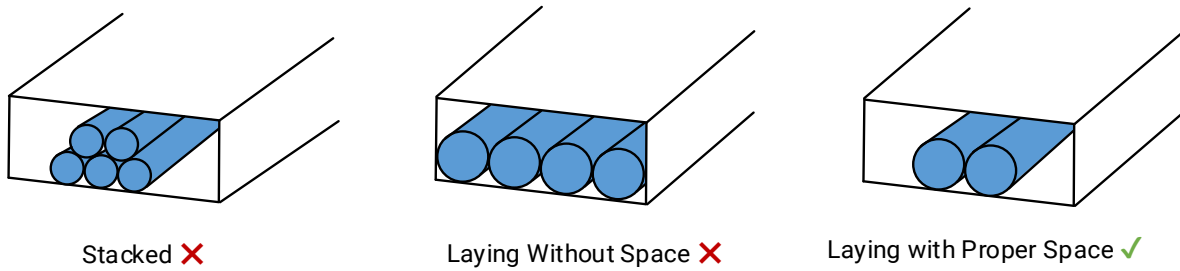
According to the cable performance, it can be divided into standard, flexible, high flexible, and super flexible cables. You need to select cables according to different scenarios.

- Standard cable: It is applicable to static scenario only.
- Flexible cable: It can withstand 100,000 times of drag chain or bending movement.
- High flexible cable: It can withstand 5 million times of drag chain movement.
- Super flexible cable: It can withstand 10 million times of drag chain movement, 3 million times of bending movement or 5 million times of twisting movement.

### 6.2.2 Wiring Principle

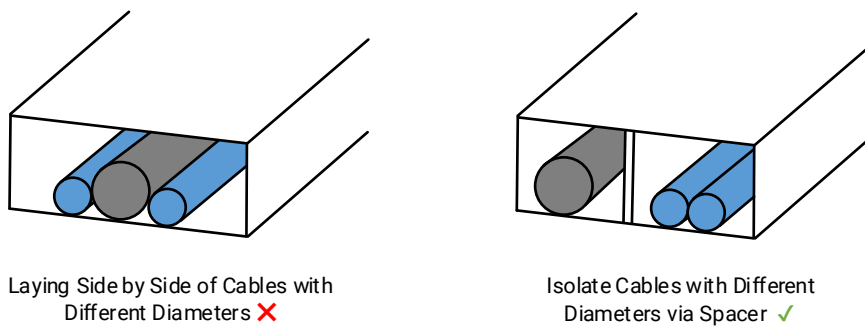
Regarding the power and I/O cable and optical fiber patch cord, attention should be paid to the application requirements of scenarios such as high-frequency communication and high-frequency motion. In such scenarios, if the cables are arranged in an inappropriate manner, various problems may be caused in use, such as cable skin wear, internal conductor breakage, and device packet loss. Based on the above situation, this section introduces the basic wiring principles and precautions of sports cables to help you install and use related products correctly and improve the overall healthy operating life of the system.

- The minimum bending radius of the chain rail during wiring should be controlled at more than 10 to 12 times the wire diameter (the larger the bending radius, the longer the cable movement life).
- Make sure that the cable does not spin in the chain rail, and the cable should be spread horizontally along the chain rail.
- If the cable is laid too tightly, the cable sheath and the chain rail will produce friction during the movement, which will cause the sheath to wear. Therefore, in the wiring process, the laying tension on the cable should be avoided.
- If the cable is fixed at the moving part of the chain rail, stress concentration will occur at the fixed position during the movement. Therefore, both ends of the cable can be fixed, but not at the middle moving section.
- Multiple cables may interfere with each other when moving in the chain rail. At this time, the chain rail with sufficient width should be selected to ensure that there is still a certain space after the cables are laid horizontally. The use of spacers is also an effective way to avoid interference. Note that there should also be at least 2 mm clearance between the spacer and the cable. Do not drain cables without spacers.
- Please keep the space factor occupied by the cable after laying within 30%, as shown below.



**Figure 6-1 Cable Laying**

- In the same chain rail, if there are cables with different thicknesses and diameters, the cables with small outer diameter are easily squeezed to the bottom by the cables with large outer diameter. In this case, use spacers for classification and isolation, as shown below.



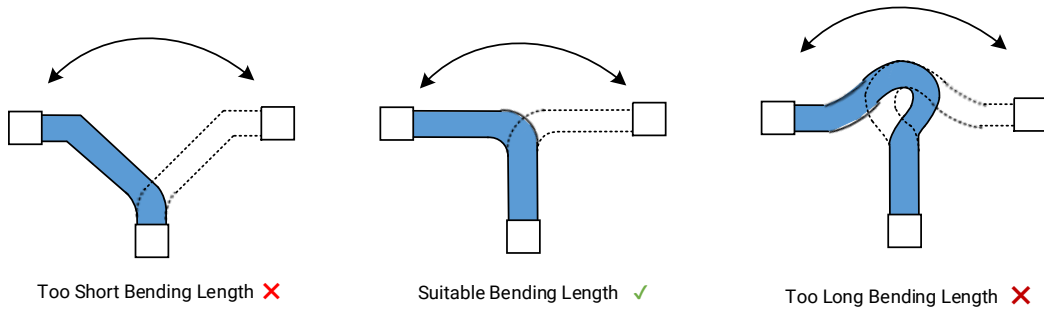
**Figure 6-2 Isolated via Spacer**

- If the wiring is in the same track as the hard object such as the air pipe, use a spacer to isolate it.
- If the chain rail is damaged, replace the chain rail and cable at the same time, because the damaged chain rail may aggravate the damage to the cable.
- Do not bend the cable vertically on the fixed point.



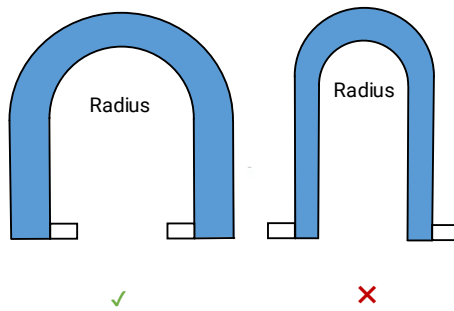
**Figure 6-3 Vertically Bended Prohibited**

- Make sure to reserve a suitable bending length for the cable.



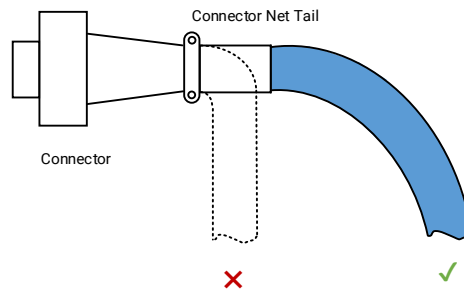
**Figure 6-4 Suitable Bending Length**

- Please keep a sufficient bending radius.



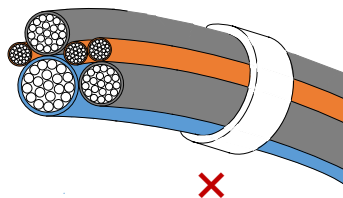
**Figure 6-5 Sufficient Bending Radius**

- When assembling the connector, please fix it on the connector net tail instead of the cable body.



**Figure 6-6 Assemble Connector**

- Do not bind cables of different diameters together.



**Figure 6-7 Improper Binding**



## Chapter 7 Quick Start Guide

### 7.1 Install Device

#### 7.1.1 Installation Preparation

You need to prepare following accessories before device installation.

**Table 7-1 Accessories**

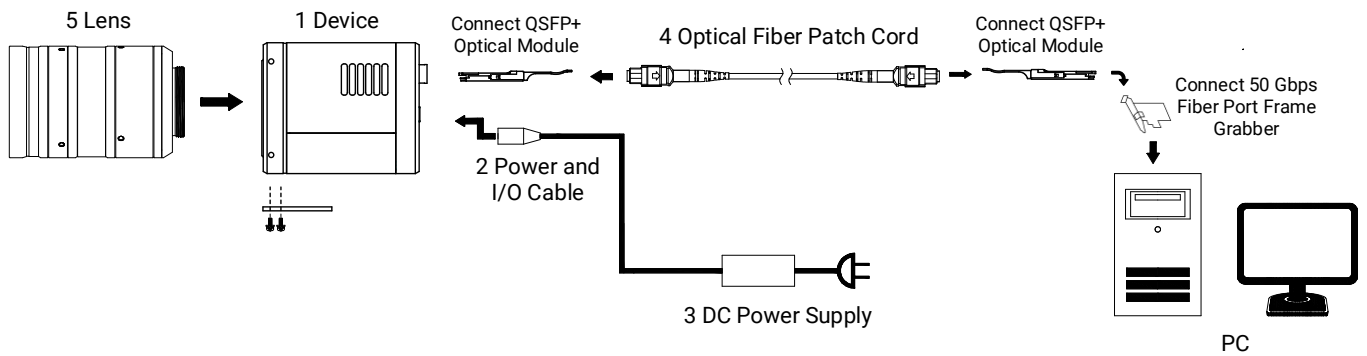
No.	Name	Quantity	Description
1	Power and I/O Cable (Required)	1	It refers to the 12-pin power and I/O cable. You need to purchase separately.
2	DC Power Supply (Required)	1	You should select a suitable power adapter or switch power supply according to the device power supply and consumption. You need to purchase separately.
3	Frame Grabber (Required)	2	It refers to the 50 Gbps fiber port frame grabber. You need to purchase separately.
4	Optical Module (Required)	4	<p>The device needs optical module to convert the electrical signal to an optical signal. You need to purchase optical modules for the device and the fiber port frame grabber separately according to the required quantity.</p> <p> <b>Note</b> The device and frame grabbers should be equipped with optical modules of the same model to ensure compatibility.</p>
5	Optical Fiber Patch Cord (Required)	2	<p>You can use 2 optical fiber patch cords to transmit data. You need to purchase separately.</p> <p> <b>Note</b> The length of 2 optical fiber patch cords should be the same.</p>
6	Lens (Required)	1	It refers to the lens that is suitable for the device. You need to purchase separately.

No.	Name	Quantity	Description
7	Lens Adapter (Optional)	1	If the lens you used does not match with lens mount of the device, you should use a lens adapter. You need to purchase separately.

**Note**

- The device mentioned in this manual is an electronic product that requires operation and storage under dry conditions. In case of hot and humid, acidic and alkaline environment, please take isolation and protection measures to avoid corrosion damage of the device's internal components.
- Refer to the specifications of devices for corresponding models of frame grabber, XoF optical module, and XoF optical fiber patch cord, which need to be purchased separately.
- When using the lens, it is necessary to prevent humid environment and avoid steam from entering inside, causing fogging.

## 7.1.2 Install Device



**Figure 7-1 Topology Diagram**

**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.

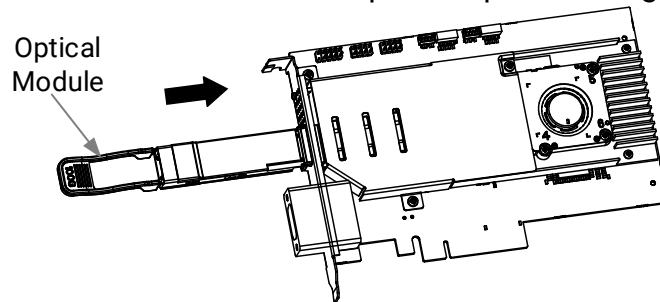
**Steps**

1. Fix the device to the installation position, and install the lens to the device.

**Note**

During device installation, heat dissipation measures of installation parts can be taken to improve the efficiency of heat dissipation. Refer to section [Heat Dissipation Measures](#) for details.

2. Install one QSFP+ optical module to the 50 Gbps fiber port frame grabber.

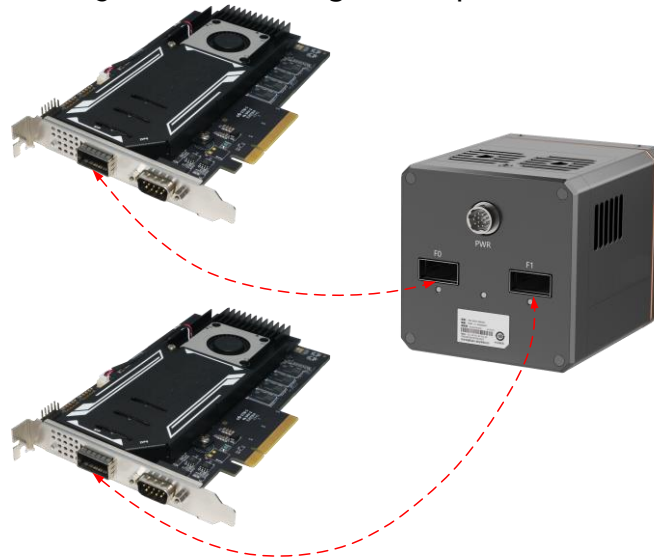


**Figure 7-2 Install Optical Module to Frame Grabber**

3. Install another QSFP+ optical module to the device.

4. Use a XoFLink optical fiber patch cord to connect two QSFP+ optical modules mentioned above. Upon hearing a “click” sound, it indicates that the connector of the optical fiber patch cord and the optical module have been successfully connected.

- Select the correct XoFLink optical fiber patch cord based on specifications for corresponding models.
- For the device with two XoFLink fiber ports, data transmission will occur normally only when both XoFLink fiber ports are connected simultaneously.
- When using both fiber ports, the link configuration of the device is set to 8 Link 12.5 Gbps with total bandwidth of 100 Gbps. You can view and set the device’s link configuration mode through the **LinkConfiguration** parameter in the **XoFLink**.



**Figure 7-3 Install Device and Frame Grabber (Two XoFLink Fiber Ports)**

5. Connect the device to a proper power adapter or power supply. For the definition of I/O connector, refer to section [Power and I/O Connector](#) for details.

## 7.2 Install Client Software

MVS client software is used to connect and set device’s parameters, and upgrade

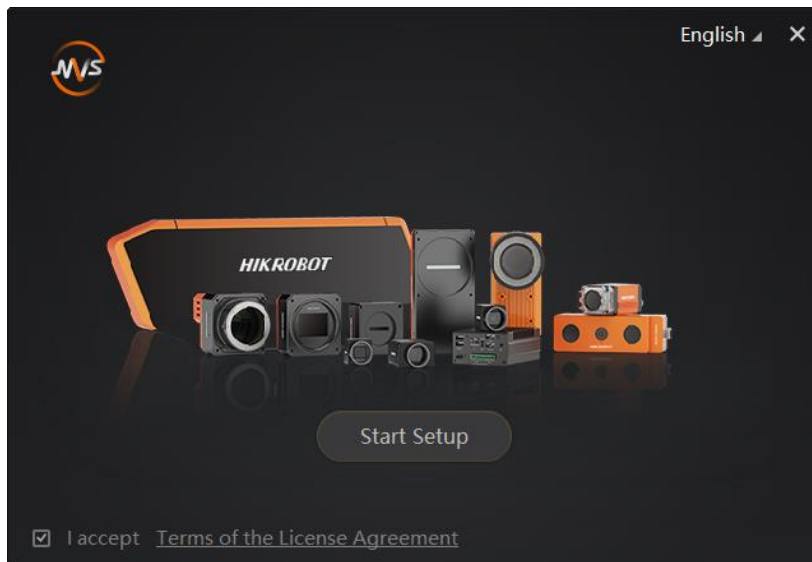
firmware. The MVS client version 3.4.0 or later supports access to XoFLink line scan cameras.

### Note

- The MVS client software is compatible with 32/64-bit Windows 7/10, 64-bit Windows 11, and 32/64-bit Linux operating systems. Here we take Windows as an example.
- The graphic user interface may differ by different versions of the client software you use.
- The client software has integrated driver required by hardware, and no need to download and install other drivers.
- You can download the client software from [en.hikrobotics.com](http://en.hikrobotics.com).

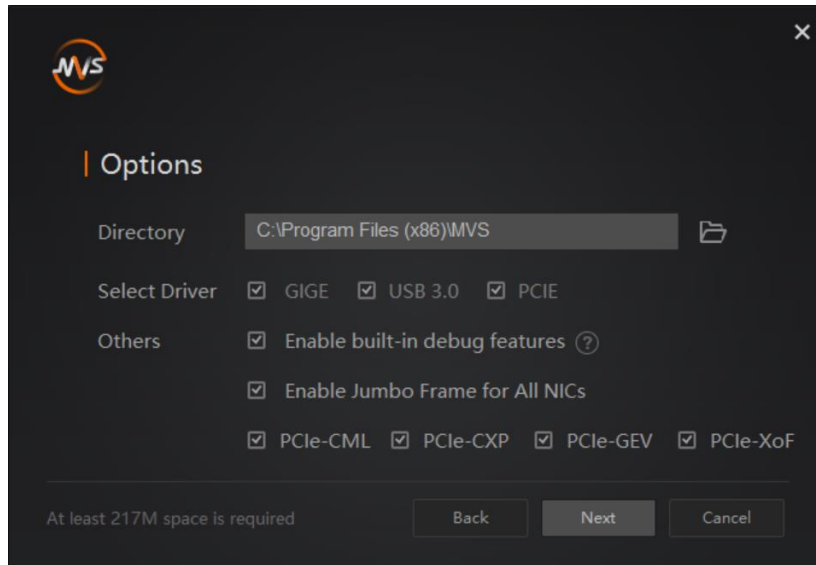
### Steps

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



**Figure 7-4 Installation Window**

4. Click **Start Setup**.
5. Select installation directory, driver and others.
  - **Select Driver:** You can check **GIGE**, **USB 3.0** and **PCIE** according to actual demands.
  - **Others:** Check **Enable built-in debug features** to make it easier to use breakpoints while the device is connected and streaming images. Check **Enable Jumbo Frame for All NICs** to enhance network transmission performance. Check **PCIE-CML**, **PCIE-CXP**, **PCIE-GEV**, **PCIE-XoF** to enumerate the corresponding frame grabbers.



**Figure 7-5 Installation Options**

---

### Note

- Regarding options, it is recommended to keep default settings.
- **PCIe-CML, PCIe-CXP, PCIe-GEV, PCIe-XoF** can be checked only when **PCIE** is selected.
- **PCIe-CML, PCIe-CXP, PCIe-GEV, PCIe-XoF** supports frame grabbers developed by our company only.

- 
6. Click **Next** to install.
  7. Finish the installation process according to the prompts.

## 7.3 Basic Operation



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### Note

Refer to the user manual of the device and client software for detailed operations.

---

### Steps


1. Run the MVS client software.
2. Click  in **PCIE** in the device list, and the client software will enumerate the frame grabber automatically.
3. Click  in the specific frame grabber name to connect it. The client software will enumerate and connect the device under the frame grabber automatically.

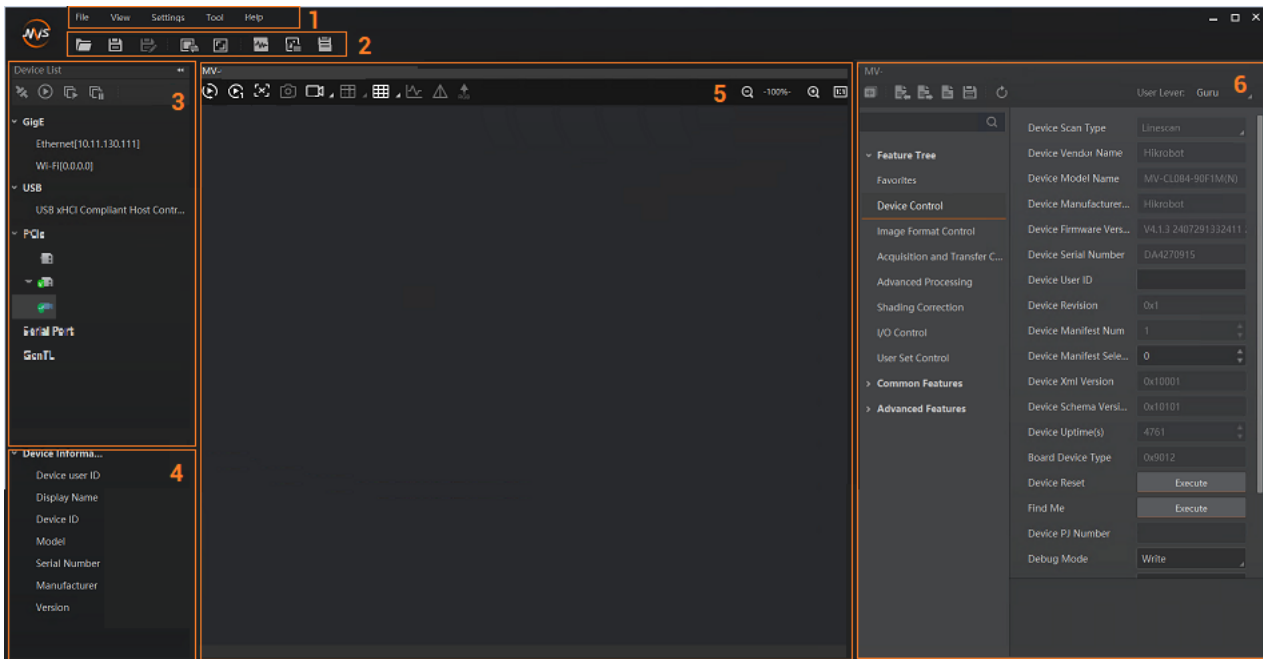


**Figure 7-6 Connect Device to MVS Client Software**

## Note

The image is for reference only.

4. Click  to connect to the device, and the client software will display the device's information after connecting, as shown below.



**Figure 7-7 Main Window**

## Note

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

**Table 7-2 Main Window Description**

No.	Name	Description
1	Menu Bar	The menu bar displays function modules, including <b>File</b> , <b>View</b> , <b>Settings</b> , <b>Tool</b> , and <b>Help</b> .
2	Control Toolbar	The control toolbar provides quick operations for the device, such as file function, window division, and viewing of device status, embedded information, and log.
3	Device List Panel	This panel displays the list of devices, and you can connect

No.	Name	Description
		or disconnect device.
4	Device Information Panel	This panel displays the detailed information of connected device.
5	Display Window	This area displays the acquired images in real time.
6	Feature Panel	This panel displays the device's parameters, and you can configure them according to actual demands.

5. Set the device's pixel format, exposure time, etc., in the feature panel.

6. Click  in the display window to acquire images continuously.

7. Adjust the device's aperture and focus to have clear images.

8. (Optional) Set the device's other parameters in the feature panel.

---

### Note

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

---

# Chapter 8 I/O Electrical Features and Wiring

## 8.1 I/O Electrical Features

### 8.1.1 Input Signal

The internal circuit of opto-isolated input (Line 0) is as follows.

**Note**

- The maximum input current of Line 0 is 25 mA.
- Make sure that the input voltage is not from 1 VDC to 3.3 VDC, because the electric status between these two values are not stable.
- The breakdown voltage is 30 VDC. Keep voltage stable.

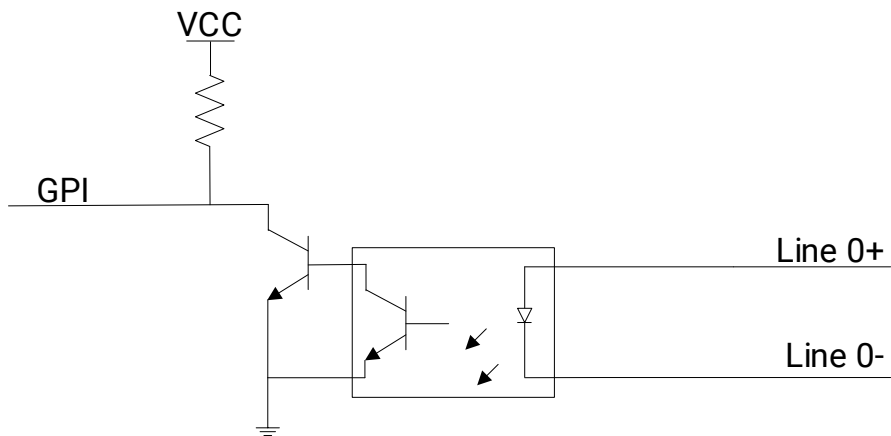


Figure 8-1 Internal Circuit of Input Signal

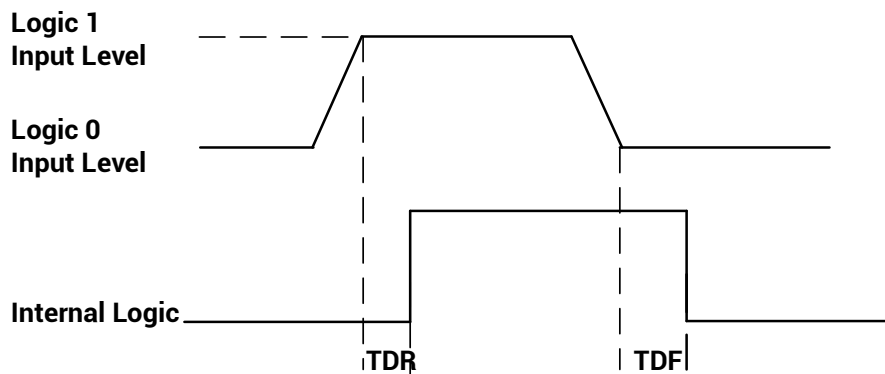


Figure 8-2 Input Logic Level

When the external voltage is 12 VDC and the external pull-up resistor is 1 K $\Omega$ , the electrical features of opto-isolated input are shown below.

**Table 8-1 Input Electrical Feature**

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 VDC to 1 VDC
Input Logic Level High	VH	3.3 VDC to 24 VDC
Input Rising Delay	TDR	1.28 $\mu$ s to 2.04 $\mu$ s
Input Falling Delay	TDF	25.6 $\mu$ s to 28 $\mu$ s

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 K $\Omega$ , the electrical features of opto-isolated input are shown below.

**Table 8-2 Input Electrical Feature**

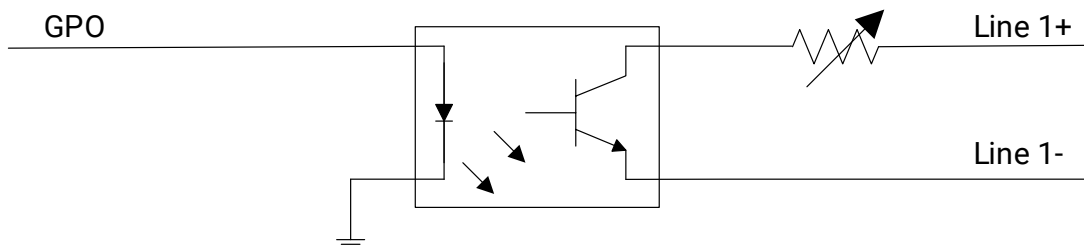
Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 VDC to 1 VDC
Input Logic Level High	VH	3.3 VDC to 24 VDC
Input Rising Delay	TDR	2.32 $\mu$ s to 3.08 $\mu$ s
Input Falling Delay	TDF	22.6 $\mu$ s to 27.2 $\mu$ s

### 8.1.2 Output Signal

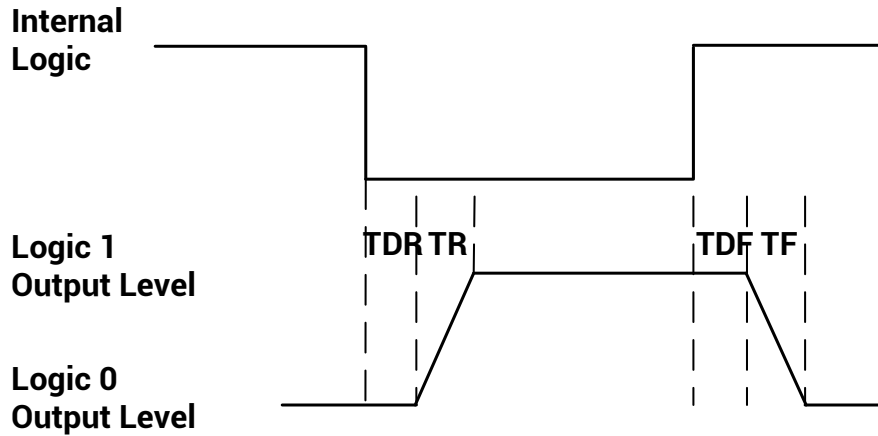
The internal circuit of opto-isolated output (Line 1) is as follows.

**Note**

The maximum output current of Line 1 is 25 mA.



**Figure 8-3 Internal Circuit of Output Signal**



**Figure 8-4 Output Logic Level**

When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of opto-isolated output are shown below.

**Table 8-3 Output Electrical Feature**

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	1.1 VDC to 1.46 VDC
Output Logic Level High	VH	2.54 VDC to 11.3 VDC
Output Rising Time	TR	17.6 μs to 104 μs
Output Falling Time	TF	0.4 μs to 2 μs
Output Rising Delay	TDR	26.8 μs to 72 μs
Output Falling Delay	TDF	0.44 μs to 1.92 μs

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of opto-isolated output are shown below.

**Table 8-4 Output Electrical Feature**

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC to 1.3 VDC
Output Logic Level High	VH	2.26 VDC to 22.4 VDC
Output Rising Time	TR	21.6 μs to 144 μs
Output Falling Time	TF	0.4 μs to 1.6 μs
Output Rising Delay	TDR	22.4 μs to 96 μs
Output Falling Delay	TDF	0.44 μs to 1.12 μs

With different external voltage and resistance, the corresponding current and the

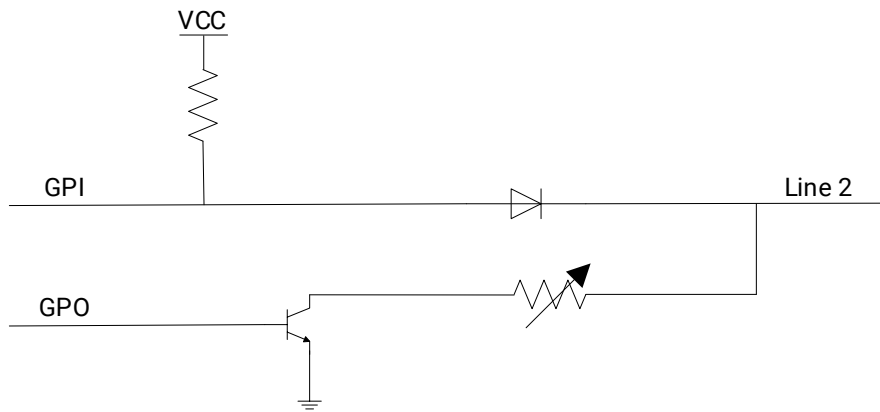
parameter of output logic level low are shown below.

**Table 8-5 Parameters of Output Logic Level Low**

External Voltage	External Resistance	VL	Output Current
3.3 VDC	1 KΩ	575 mV	2.7 mA
5 VDC	1 KΩ	840 mV	4.1 mA
12 VDC	2.4 KΩ	915 mV	4.6 mA
24 VDC	4.7 KΩ	975 mV	4.9 mA

### 8.1.3 Bi-Directional Signal

The device has one bi-directional non-isolated I/O signal (Line 2), and you can set it as input signal or output signal according to demands. Its internal circuit is as follows.



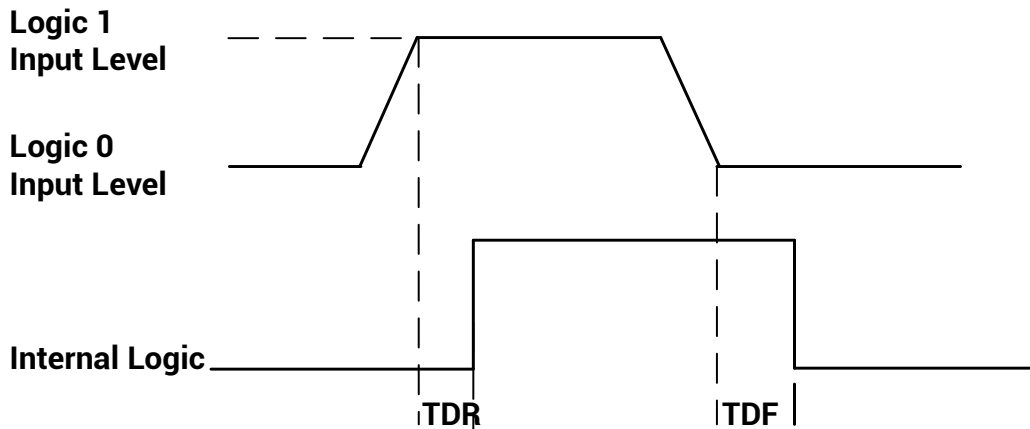
**Figure 8-5 Internal Circuit of Bi-Directional Signal**

#### Configured as Input Signal

**Note**

- Make sure that the input voltage is not from 1 VDC to 3.3 VDC, because the electric status between these two values are not stable.
- The breakdown voltage is 30 VDC. Keep voltage stable.
- To prevent damage to the GPIO pin, please connect GND first, and then input voltage in Line 2.

The logic level and electrical feature when Line 2 is configured as input are shown below.



**Figure 8-6 Input Logic Level**

When the external voltage is 12 VDC and the external pull-up resistor is 1 K $\Omega$ , or when the external voltage is 24 VDC and the external pull-up resistor is 4.7 K $\Omega$ , the electrical features of input are shown below.

**Table 8-6 Input Electrical Feature**

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 VDC to 1 VDC
Input Logic Level High	VH	3.3 VDC to 24 VDC
Input Rising Delay	TDR	< 1 $\mu$ s
Input Falling Delay	TDF	< 1 $\mu$ s

## Configured as Output Signal

**Note**

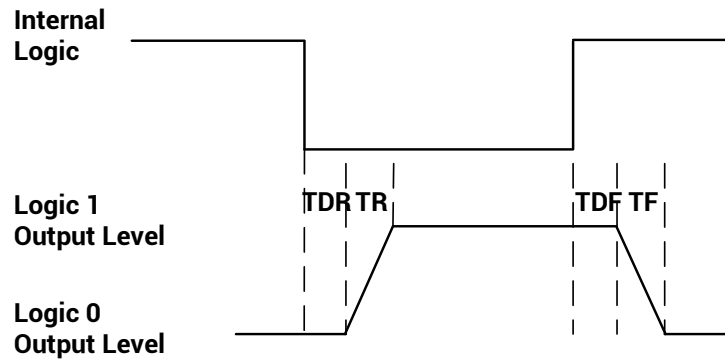
The maximum current is 25 mA and the output impedance is 40  $\Omega$ .

The relation among external voltage, resistance, and the output level low is shown below.

**Table 8-7 Parameters of Output Logic Level Low**

External Voltage	External Resistance	VL (GPIO2)
5 VDC	1 K $\Omega$	0 V
12 VDC	1 K $\Omega$	0 V
24 VDC	1 K $\Omega$	0 V to 1 V

The logic level and electrical feature when Line 2 is configured as output are shown below.



**Figure 8-7 Output Logic Level**

When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of output are shown below.

**Table 8-8 Output Electrical Feature**

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC
Output Logic Level High	VH	7.8 VDC to 11.8 VDC
Output Rising Time	TR	0.46 μs to 0.9 μs
Output Falling Time	TF	42 ns to 70 ns
Output Rising Delay	TDR	500 ns to 600 ns
Output Falling Delay	TDF	34 ns to 42 ns

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of output are shown below.

**Table 8-9 Output Electrical Feature**

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC to 0.2 VDC
Output Logic Level High	VH	5 VDC to 23.2 VDC
Output Rising Time	TR	0.44 μs to 4.48 μs
Output Falling Time	TF	34 ns to 88 ns
Output Rising Delay	TDR	0.54 ns to 1.52 ns
Output Falling Delay	TDF	34 ns to 232 ns

### 8.1.4 Factors Affecting Transmission Delay of I/O Lines

The factors that affect the transmission delay of I/O lines are shown below, where ★ represents the main influencing factor and ☆ represents the secondary factor.

**Table 8-10 Factors Affecting Transmission Delay of I/O Lines**

Factors Lines	Working Temperature	Production Differences of Electronic Components	Aging	External I/O Power Supply Voltage	Load Resistance	Load Current
Opto-Isolated Input Lines	★	★	★	★	-	-
GPIO Input Lines	☆	☆	-	-	-	-
Opto-Isolated Output Lines	★	★	★	★	★	★
GPIO Output Lines	☆	☆	-	☆	☆	☆

Regarding the factors that affect the transmission delay of I/O lines in the table above, we provide the following explanations and suggestions:

- Use the I/O circuit at the recommended working temperature of the device. See the device's datasheet for the working temperature.
- Applying current to the input and output circuits of the opto-coupler will accelerate the aging rate of the opto-coupler. Keep the current to a minimum level, and ensure a stable transmission delay.
- In order to reduce the low-speed transmission delay, it is recommended to use an external I/O supply voltage of about 5 V.
- For a better quick trigger, use the recommended pull-up resistor.
- Generally, the trigger input-output frequency of an opto-coupler circuit rarely exceeds 10 kHz, and the trigger input-output frequency of a GPIO circuit rarely exceeds 1 MHz. Keep the trigger input-output frequency of the circuit within this range.
- If you need to reduce the transmission delay, it is recommended to use the GPIO line, which has a shorter transmission delay than the opto-coupler delay. But the GPIO line has the risk of burning out, so please use it with caution.

- The bounce of the trigger signal may cause the internal bounce of the device to increase. To avoid bounce, keep the edge of the trigger signal step to reduce the internal bounce of the device (preferably less than 1  $\mu$ s).

## 8.2 I/O Wiring

This section introduces how to wire the device via its I/O connector.

### Note

- Here we take the type I device as an example to introduce I/O wiring.
  - The appearance here is for reference only, and the actual device you purchased shall prevail.
- 

### 8.2.1 Input Signal Wiring

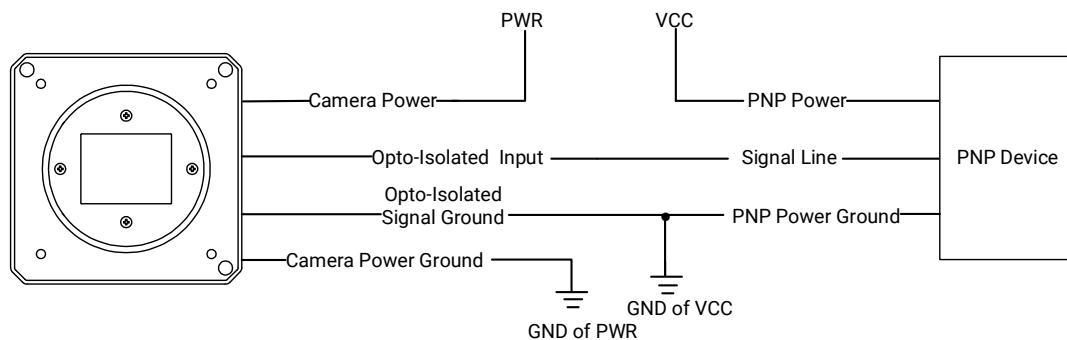
The input signal wiring is shown below when the device uses Line 0 as trigger source in external trigger mode.

### Note

Input signal wiring may differ by the external device type.

---

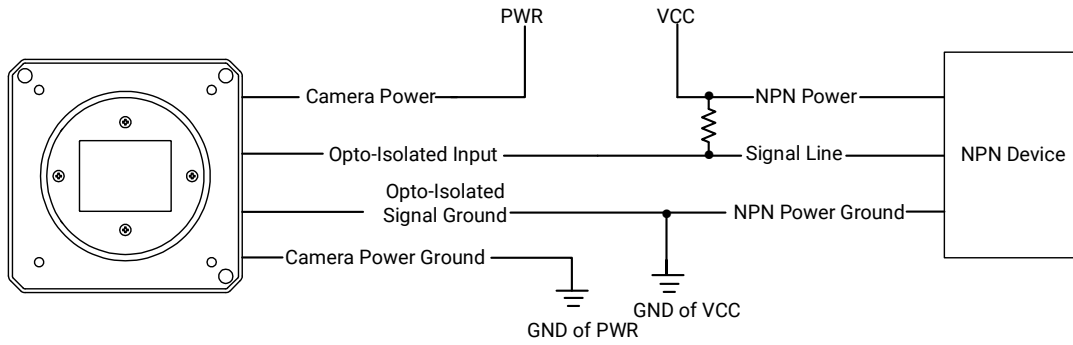
#### PNP Device



**Figure 8-8 Input Signal Connects to PNP Device**

#### NPN Device

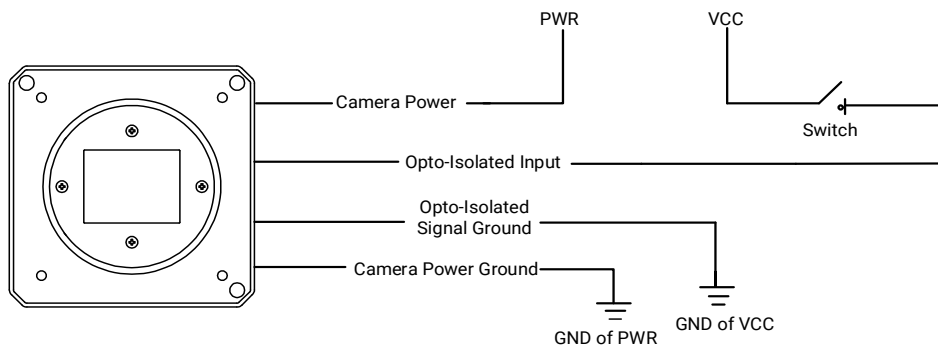
- If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 K $\Omega$  pull-up resistor.
- If the VCC of NPN device is 12 VDC, it is recommended to use a 1 K $\Omega$  pull-up resistor.



**Figure 8-9 Input Signal Connects to NPN Device**

## Switch

If the VCC of switch is 24 VDC, it is recommended to connect to a 4.7 KΩ resistor in series with the switch to protect circuit.



**Figure 8-10 Input Signal Connects to Switch**

## 8.2.2 Output Signal Wiring

The output signal wiring is shown below when the device uses Line 1 as the output signal.

---

### Note

Output signal wiring may differ by the external device type.

---

## PNP Device

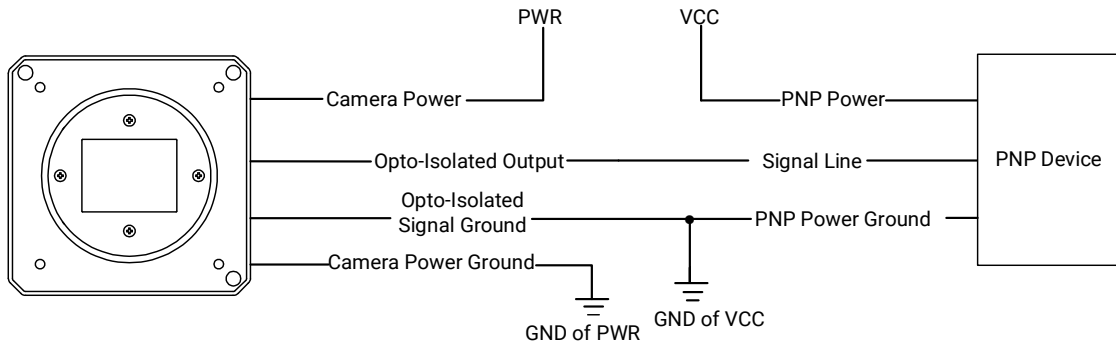


Figure 8-11 Output Signal Connects to PNP Device

## NPN Device

- If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 K $\Omega$  pull-up resistor.
- If the VCC of NPN device is 12 VDC, it is recommended to use a 1 K $\Omega$  pull-up resistor.

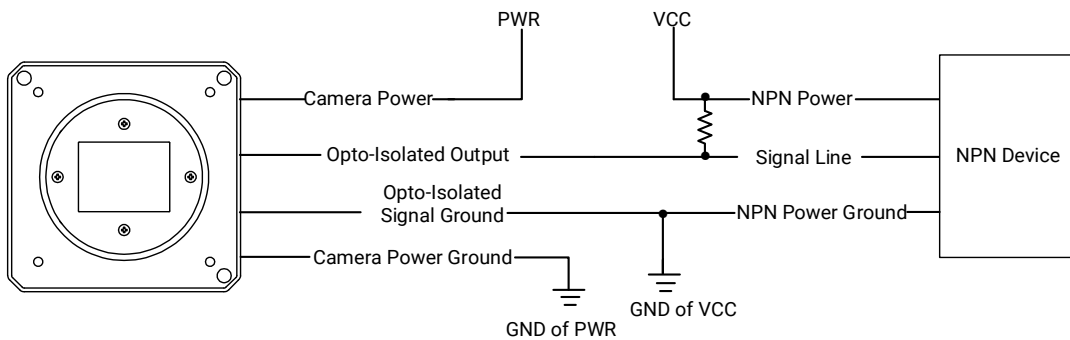


Figure 8-12 Output Signal Connects to NPN Device

## 8.2.3 Bi-Directional Signal Wiring

The device's Line 2 can be used as input signal and output signal.

### Configured as Input Signal

The input signal wiring is shown below when the device's Line 2 is configured as the input signal.

---

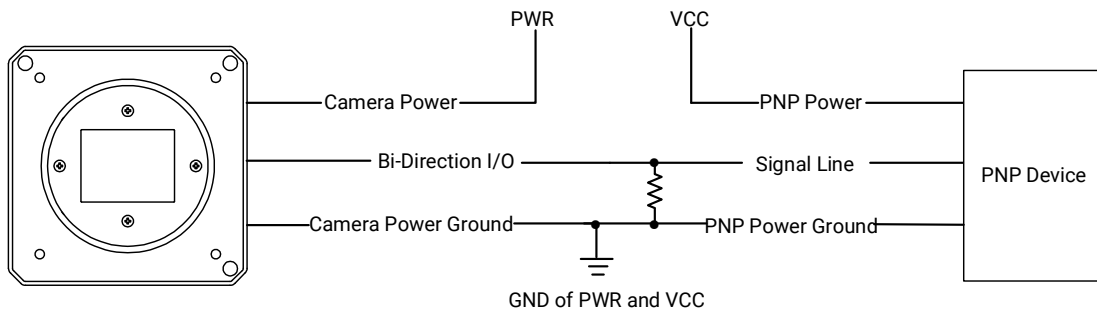
#### Note

Input signal wiring may differ by the external device type.

---

## PNP Device

It is recommended to use a 330  $\Omega$  pull-down resistor.



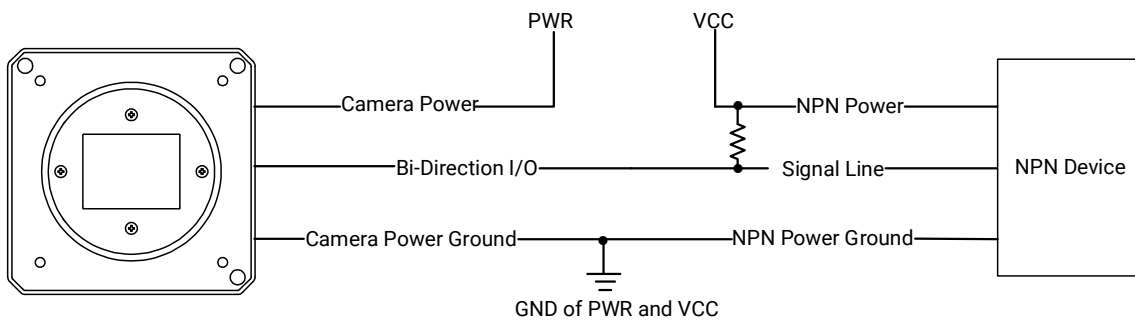
**Figure 8-13 Input Signal Connects to PNP Device**

### Note

When connecting to PNP device, it is not recommended to use Line 2 as the input, which will cause the device to overheat severely. Line 0 as the input is recommended.

## NPN Device

- If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 K $\Omega$  pull-up resistor.
- If the VCC of NPN device is 12 VDC, it is recommended to use a 1 K $\Omega$  pull-up resistor.



**Figure 8-14 Input Signal Connects to NPN Device**

## Switch

The switch value can provide low electrical level to trigger Line 2.

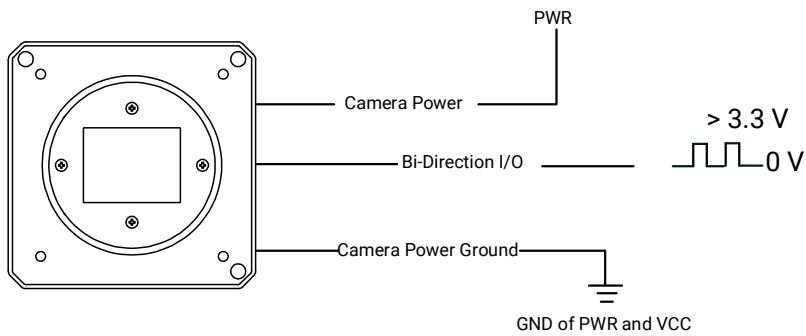


Figure 8-15 Input Signal Connects to Switch

## Configured as Output Signal

The output signal wiring is shown below when the device's Line 2 is configured as the output signal.

### Note

Output signal wiring may differ by the external device type.

## PNP Device

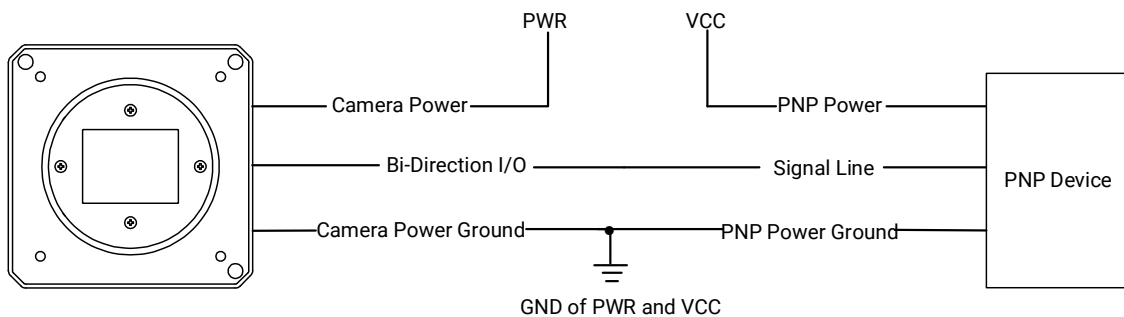
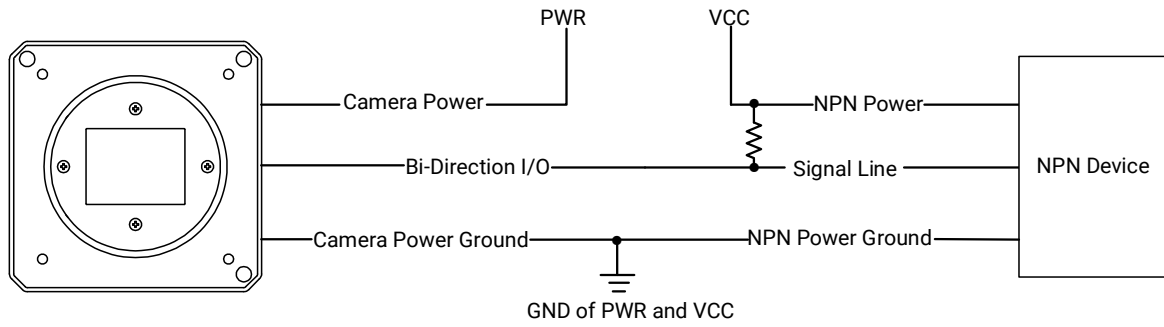


Figure 8-16 Output Signal Connects to PNP Device

## NPN Device

- If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 K $\Omega$  pull-up resistor.
- If the VCC of NPN device is 12 VDC, it is recommended to use a 1 K $\Omega$  pull-up resistor.



**Figure 8-17 Output Signal Connects to NPN Device**

# Chapter 9 Trigger Input and Output

## 9.1 Trigger Input

### 9.1.1 Set Trigger Mode

The device supports 2 trigger modes, including internal trigger mode and external trigger mode.

- **Internal Trigger Mode:** In this mode, the device acquires images via its internal signals.
- **External Trigger Mode:** In this mode, the device acquires images via external signals like software signal and hardware signal. The trigger source of external trigger mode includes software trigger, hardware trigger, counter trigger, link trigger, and anyway mode.

#### Enable Internal Trigger Mode

Go to **Acquisition Control** → **Trigger Mode**, and select **Off** as **Trigger Mode**.

---

 **Note**

**Off** refers to the internal trigger mode.

---

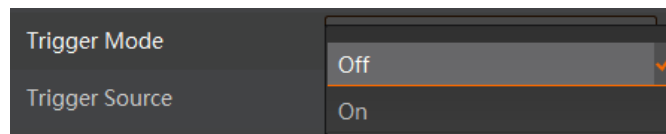


Figure 9-1 Enable Internal Trigger Mode

#### Enable External Trigger Mode

Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.

---

 **Note**

**On** refers to the external trigger mode.

---

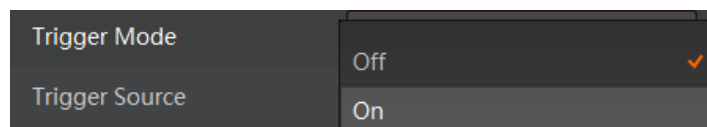


Figure 9-2 Enable External Trigger Mode

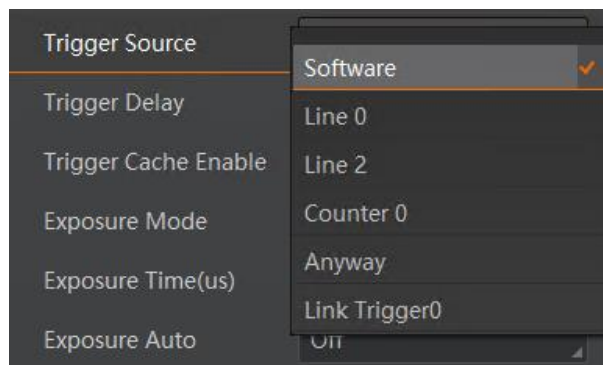
## 9.1.2 Set Trigger Source

### External Trigger Source

The device’s external trigger source includes software trigger, hardware trigger, counter trigger, link trigger, and anyway mode. Go to **Acquisition Control** → **Trigger Source**, and select **Trigger Source** according to actual demands.

**Table 9-1 Trigger Source Description**

External Trigger Source	Parameter	Description
Software Trigger	Software	The software sends trigger signal to the device via Gigabit Ethernet to acquire images.
Hardware Trigger	Line 0 Line 2	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.
Counter Trigger	Counter 0	The counter sends trigger signal to the device to acquire images.
Anyway	Anyway	The device can receive software trigger, hardware trigger, or action command trigger to acquire images.
Link Trigger	Link Trigger 0	The frame grabber sends trigger signal to the device to acquire images. Refer to section <a href="#">Set and Execute Link Trigger</a> for details



**Figure 9-3 External Trigger Source**

**Note**

These external trigger sources are valid only when the **Trigger Mode** is **On**.

## Set and Execute Software Trigger

In software trigger, the software sends trigger signal to the device via Gigabit Ethernet to acquire images.

### Steps

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

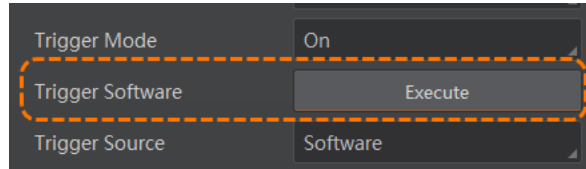


Figure 9-4 Set and Execute Software Trigger

---

### Note

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in this external trigger source.

---

## Set and Execute Hardware Trigger

In hardware trigger, external device sends trigger signal to the device to acquire images via I/O connector.

### Steps

1. Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Line 0** or **Line 2** as **Trigger Source** according to actual demands.

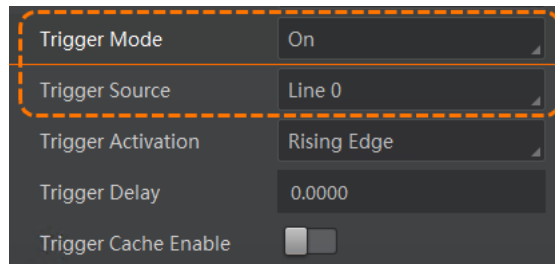


Figure 9-5 Set Line 0 or Line 2 as Input Signal

The device has one opto-isolated input (Line 0), and one bi-directional I/O (Line 2) that can be configured as input signal. Make sure that Line 2 is input signal if you want to use it as trigger source.

### Steps

1. Go to **Digital IO Control** and select **Line 2** as **Line Selector**.
2. Select **Input** as **Line Mode**.

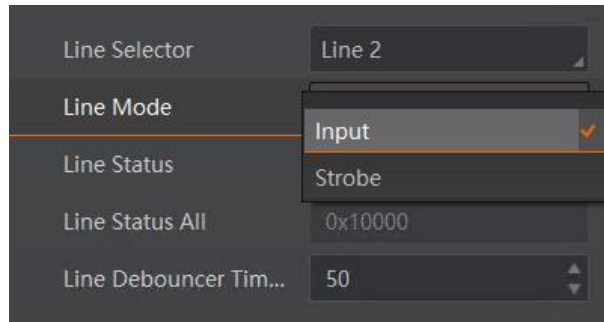


Figure 9-6 Set Line 2 as Input Signal

**Note**

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in this external trigger source.

### Set and Execute Counter Trigger

In counter trigger, the counter sends trigger signal to the device to acquire images.

**Steps**

1. Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Counter 0** as **Trigger Source**.

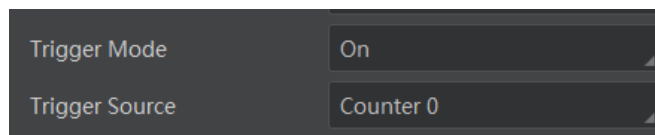


Figure 9-7 Set and Execute Counter Trigger

When using counter trigger, you need to set parameters of **Counter And Timer Control** as shown below.

Table 9-2 Parameters of Counter And Timer Control

Parameter	Read/Write	Description
Counter Selector	Read & Write	It selects counter source. <b>Counter 0</b> is available only at present.
Counter Event Source	Read & Write	It selects the signal source of counter trigger. <b>Off, Line 0, Line 2, or Link Trigger0</b> is available.
Counter Reset Source	Read & Write	It selects the signal source of resetting counter. <b>Off</b> or <b>Software</b> is available.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed only when <b>Software</b> is selected as <b>Counter Reset Source</b> .

Parameter	Read/Write	Description
Counter Value	Read & Write	It is the counter value with the range of 1 to 1023. If the parameter is set to n, the n external trigger signals can perform one counter trigger and acquire one frame of image.
Counter Current Value	Read Only	It displays the number of executed external triggers.

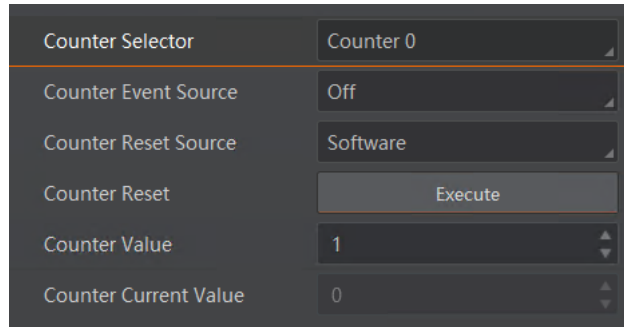


Figure 9-8 Counter and Timer Control

**Note**

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in this external trigger source.

### Set and Execute Anyway Mode

In the anyway mode, the device can receive software trigger, hardware trigger, and link trigger to acquire images.

**Steps**

1. Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Anyway** as **Trigger Source**.

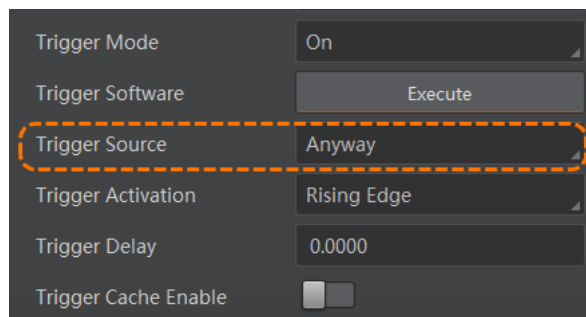


Figure 9-9 Set and Execute Free Trigger

## Note

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in this external trigger source.

---

## Set and Execute Link Trigger

In link trigger, the 50 Gbps fiber port frame grabber sends trigger signal to the device to acquire images.

### Steps

1. Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Link Trigger0** as **Trigger Source**.

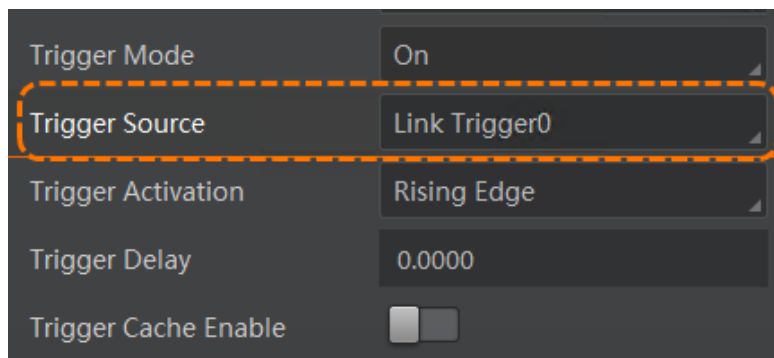


Figure 9-10 Set and Execute Link Trigger

---

## Note

- Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in this external trigger source.
  - Refer to frame grabber user manual for frame grabber trigger.
- 

## 9.1.3 Set Trigger Related Parameters

In external trigger mode, you can set related parameters, including acquisition burst frame count, trigger delay, trigger cache, trigger activation, and trigger debouncer.

---

## Note

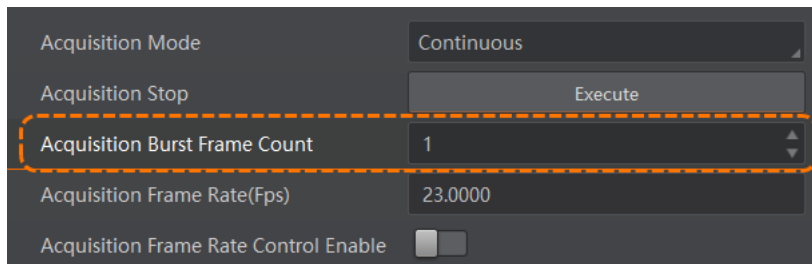
- Different trigger sources can set various parameters in external trigger mode.
  - √ is supported, and × is not supported.
-

**Table 9-3 Trigger Source and Trigger Related Parameters**

Trigger Source Trigger Parameters	Software Trigger	Hardware Trigger	Counter Trigger	Anyway Mode	Link Trigger
Acquisition Burst Frame Count	√	√	√	√	√
Trigger Delay	√	√	√	√	√
Trigger Cache	√	√	√	√	√
Trigger Activation	×	√	√	×	√
Trigger Debouncer	×	√	√	Partial Support	√

### Set Acquisition Burst Frame Count

In external trigger mode, you can set acquisition burst frame count. Go to **Acquisition Control** → **Acquisition Burst Frame Count**, and enter **Acquisition Burst Frame Count** according to actual demands.

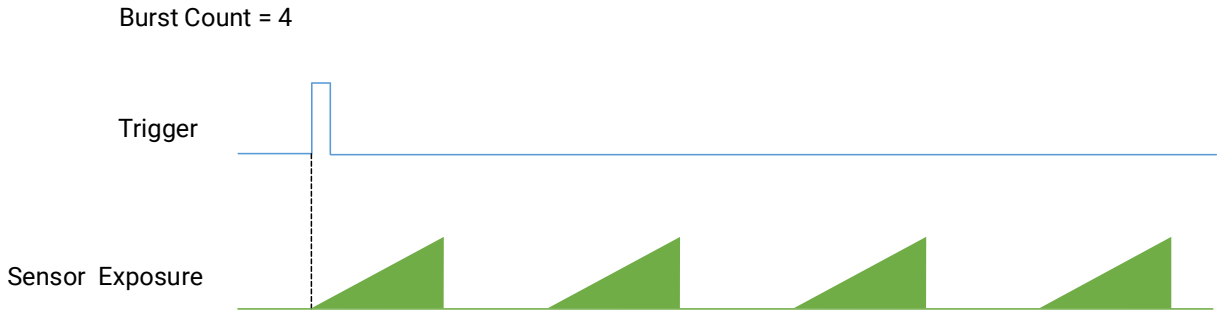


**Figure 9-11 Set Acquisition Burst Frame Count**

---

#### **Note**

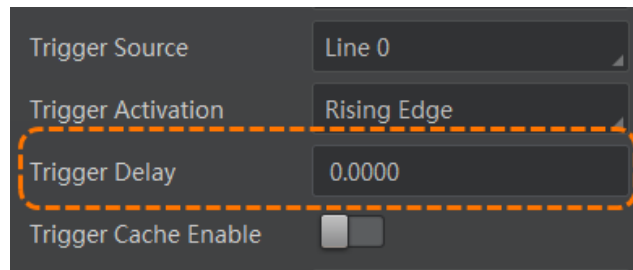
- The range of **Acquisition Burst Frame Count** is from 1 to 1023.
  - If **Acquisition Burst Frame Count** is 1, the device is in single frame trigger mode. If **Acquisition Burst Frame Count** is larger than 1, the device is in multi-frame trigger mode.
  - If **Acquisition Burst Frame Count** is 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 below uses rising edge as trigger activation.
-



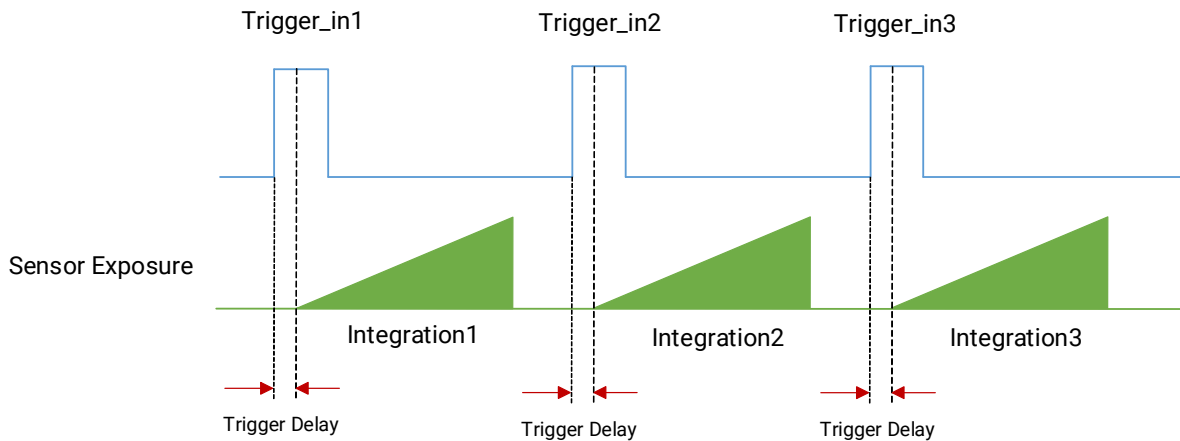
**Figure 9-12 Sequence Diagram of Acquisition Burst Frame Count**

## 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**. The unit of this value is  $\mu\text{s}$ .



**Figure 9-13 Set Trigger Delay**



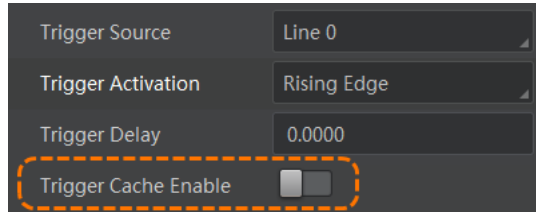
**Figure 9-14 Sequence Diagram of Trigger Delay**

### Note

The sequence diagram above uses rising edge as trigger activation.

## Set Trigger Cache

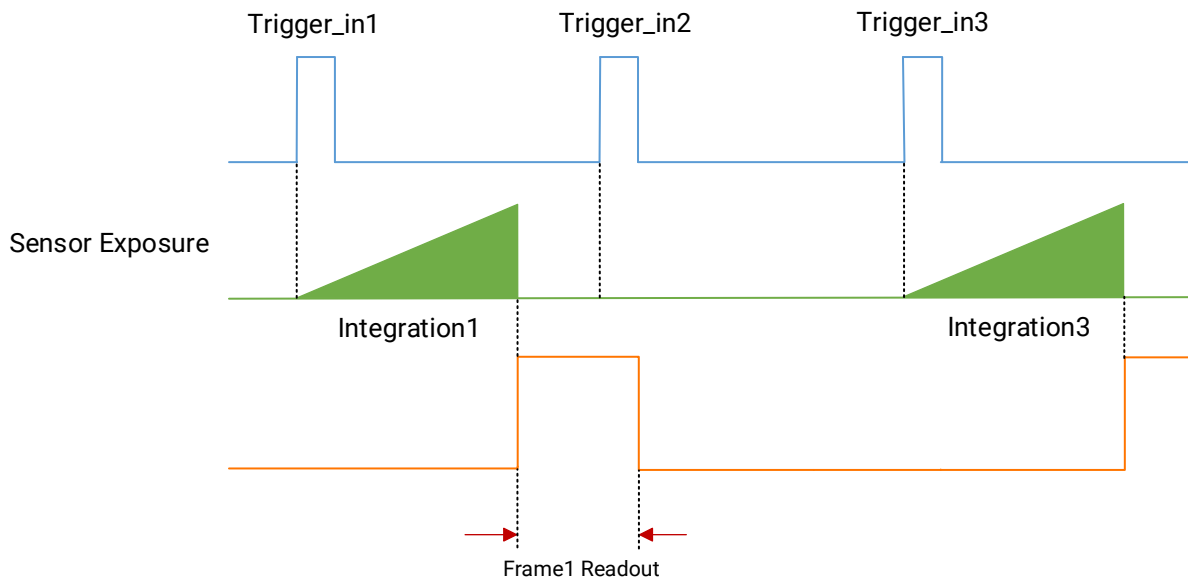
The trigger cache function allows the device to save and process new signal during trigger stage, and the device can save and process three trigger signals at most. Go to **Acquisition Control** → **Trigger Cache Enable**, and enable **Trigger Cache Enable**.



**Figure 9-15 Set Trigger Cache**

For example, if the device receives the 2nd trigger signal when it is processing the 1st trigger signal, and the result will be different depending on whether **Trigger Cache Enable** is enabled or not.

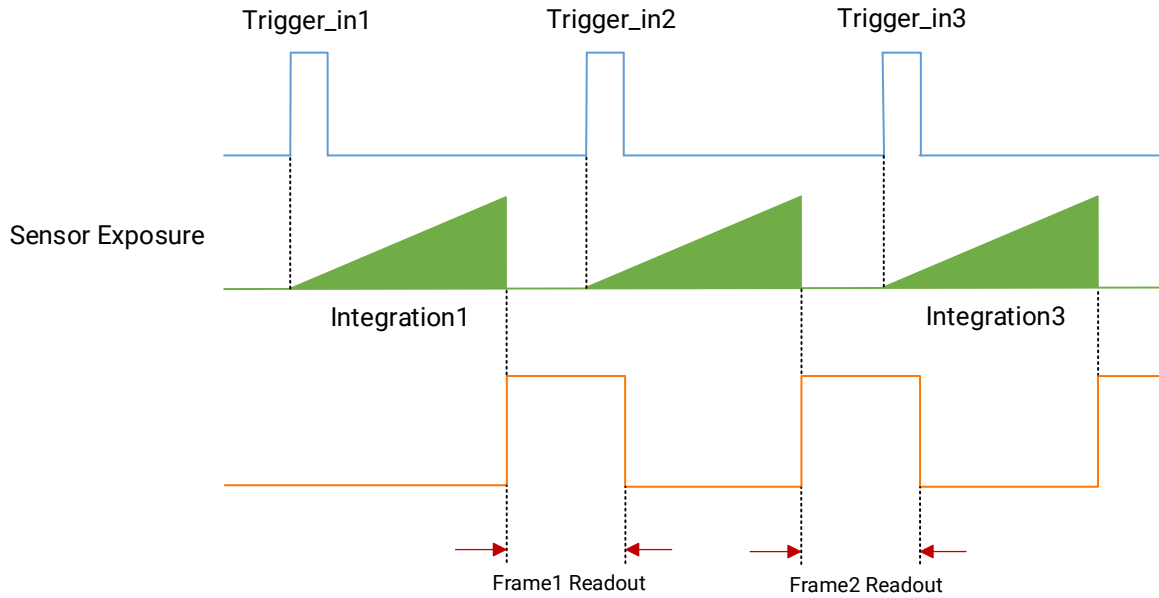
- The 2nd trigger signal will be filtered without processing if **Trigger Cache Enable** is disabled.



**Figure 9-16 Second Frame Filtered**

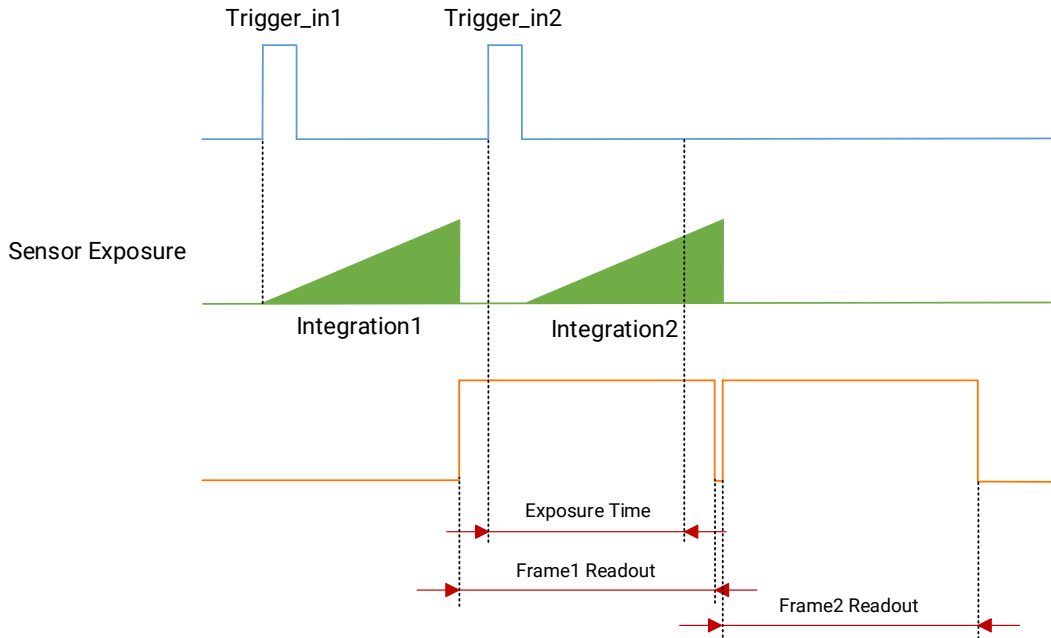
- The 2nd trigger signal will be saved if **Trigger Cache Enable** is enabled. If the 1st frame image's exposure time of the 2nd trigger signal is not earlier than the device's last frame creation time of the 1st trigger signal, and then the 2nd trigger signal's

1st frame image is created normally.



**Figure 9-17 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 9-18 Sequence Diagram**

## Note

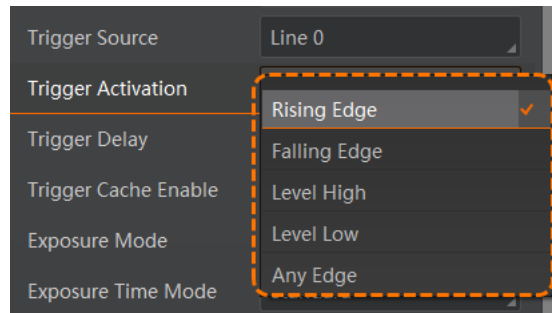
The three sequence diagrams above use rising edge as trigger activation.

---

## 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**, **Any Edge**, **Level High**, or **Level Low** 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.
- **Any Edge**: It means that when the level signal sent by external device is in rising or 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.



**Figure 9-19 Set Trigger Activation**

## Note

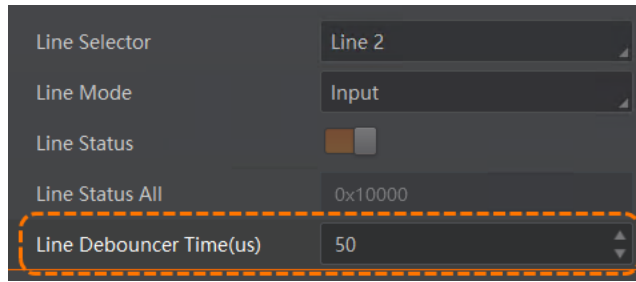
The trigger activation mode may differ by the trigger mode.

---

## Set Trigger Debouncer

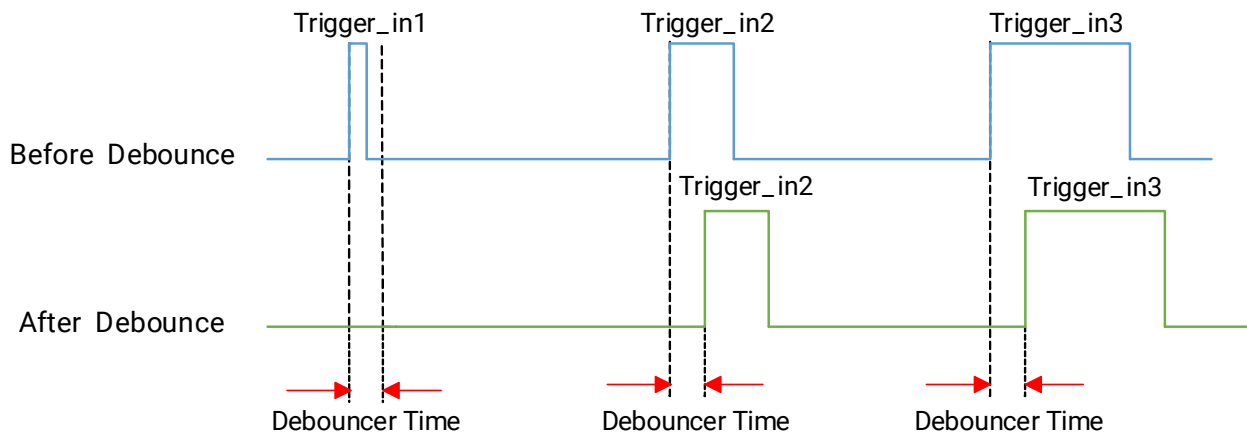
The trigger debouncer function allows the device to filter out unwanted short external trigger signal that is input to the device.

Go to **Digital IO Control** → **Line Debouncer Time**, and enter **Line Debouncer Time** according to actual demands. The range of **Line Debouncer Time** is from 0  $\mu\text{s}$  to 1000000  $\mu\text{s}$ .



**Figure 9-20 Set Trigger Debouncer**

If the **Line Debouncer Time** you set is greater than the time of trigger signal, this trigger signal will be ignored.



**Figure 9-21 Sequence Diagram of Trigger Debouncer**

**Note**

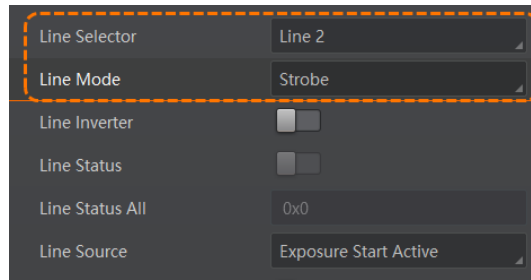
- The sequence diagram above uses rising edge as trigger activation.
- When you use the trigger debouncer function, there may be a delay in the signal.

## 9.2 Trigger Output

The device has one opto-isolated output (Line 1), and one bi-directional I/O (Line 2) that can be configured as output signal. The method of setting bi-directional configurable line as output line is as follows:

**Steps**

1. Go to **Digital IO Control**, and select **Line 2** as **Line Selector**.
2. Set **Strobe** as **Line Mode**.

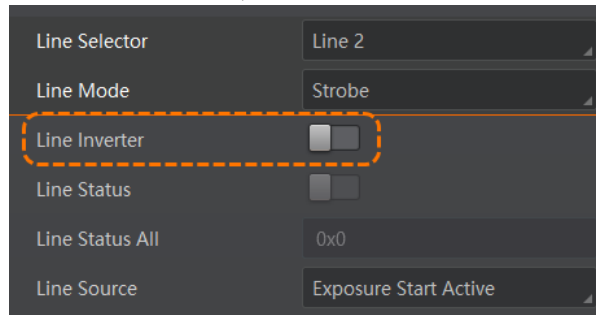


**Figure 9-22 Select Output Signal**

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 9-23 Enable Line Inverter**

---

### Note

The line inverter function is disabled by default.

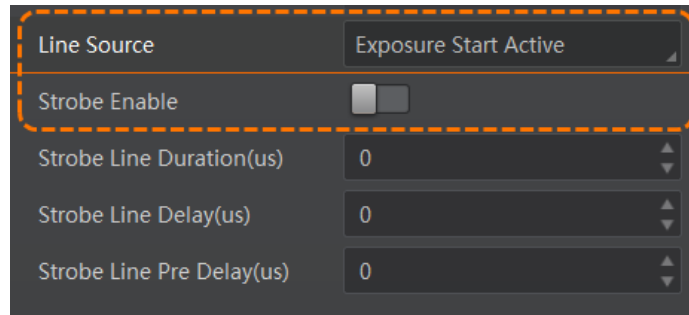
---

## 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.

### Steps

1. Go to **Digital IO Control** → **Line Source**, and select **Line Source** according to actual demands.
2. Enable **Strobe Enable**.



**Figure 9-24 Enable Strobe Signal**

The supported line sources are as follows:

**Table 9-4 Line Source Description**

Line Source	Description
Exposure Start Active	The device outputs signals to external devices when it starts exposure.
Exposure End Active	The device outputs signals to external devices when it stops 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 Trigger Wait	The device is currently waiting for a frame start trigger.
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.

## Note

The specific line sources may differ by device models.

- If **Timer Active** is selected as **Line Source**, you can click **Execute** in **Line Trigger Software**, and enter **Strobe Line Delay** according to actual demands. The device will output signals whose duration is configured in **Strobe Line Duration**.

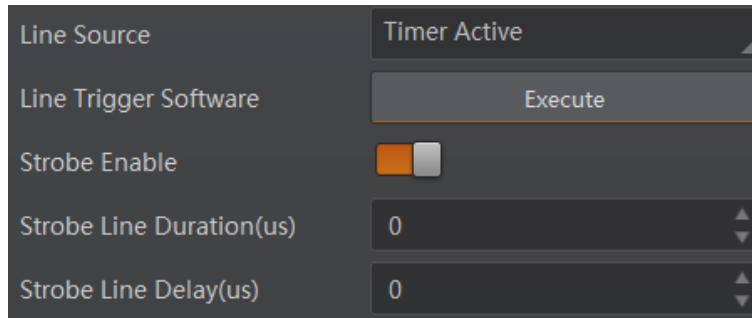


Figure 9-25 Timer Active Parameters

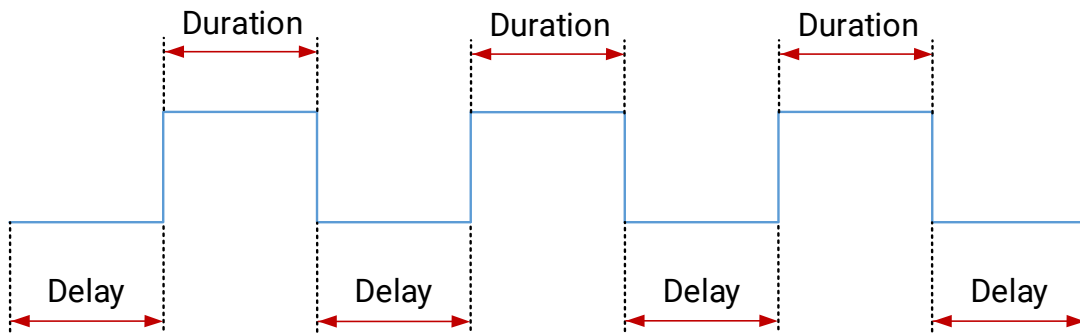


Figure 9-26 Sequence Diagram of Timer Active

## Set Strobe Line Duration

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

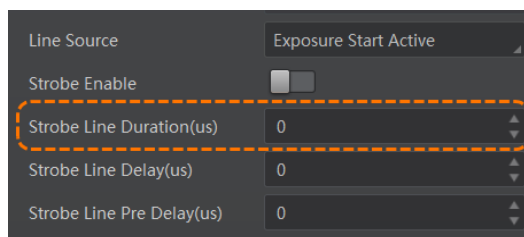
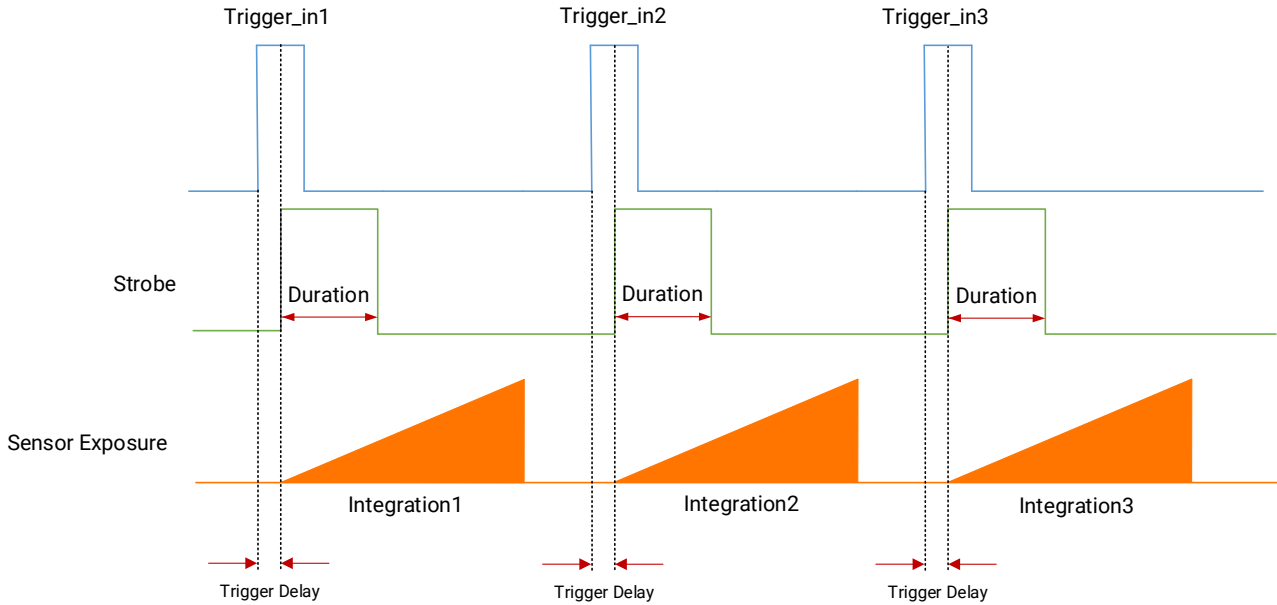


Figure 9-27 Set Strobe Line Duration



**Figure 9-28 Sequence Diagram of Strobe Line Duration**

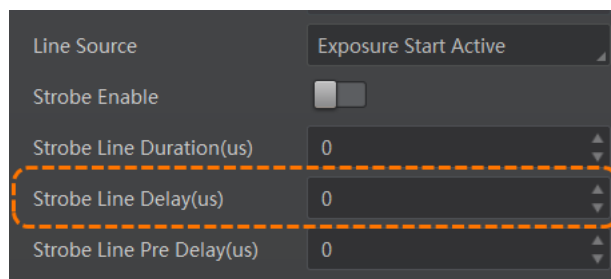
## Note

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

## Set Strobe Line Delay

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

Go to **Digital IO Control** → **Strobe Line Delay**, and enter it according to actual demands. The range of **Strobe Line Delay** is from 0  $\mu$ s to 10000  $\mu$ s.



**Figure 9-29 Set Strobe Line Delay**

Take **Exposure Start Active** selected as an example. When the exposure starts, the strobe output is delayed based on the value set in **Strobe Line Delay**. The sequence diagram of strobe line delay is shown below.

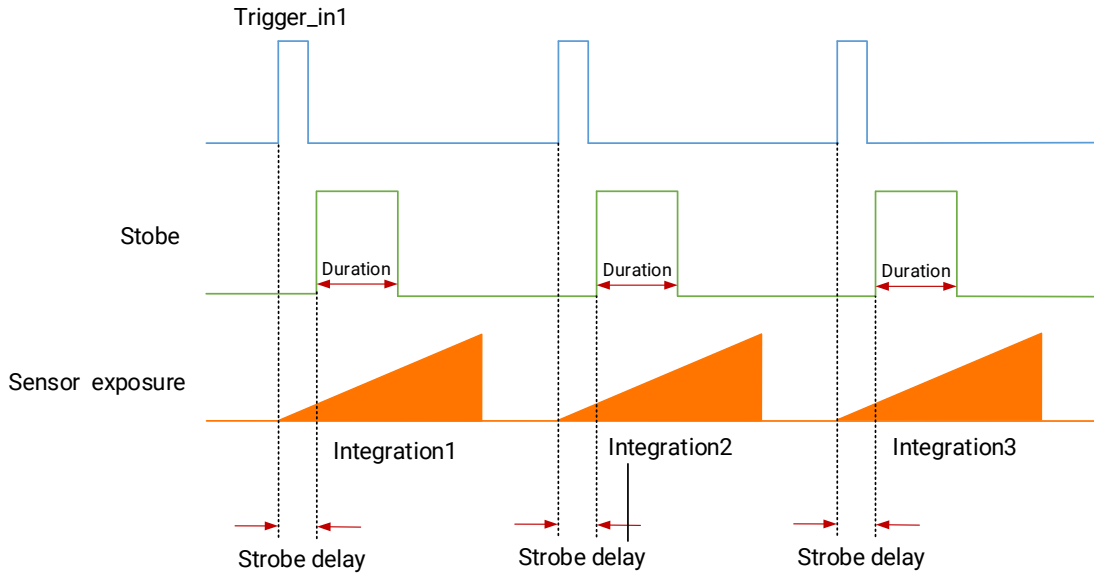


Figure 9-30 Sequence Diagram of Strobe Line Delay

### 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.

Click **Digital IO Control** → **Strobe Line Pre Delay**, and enter **Strobe Line Pre Delay** according to actual demands. The range of **Strobe Line Pre Delay** is from 0  $\mu$ s to 5000  $\mu$ s.

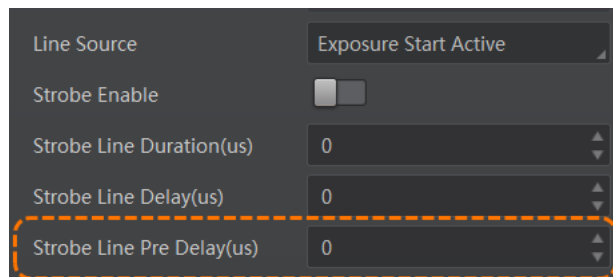


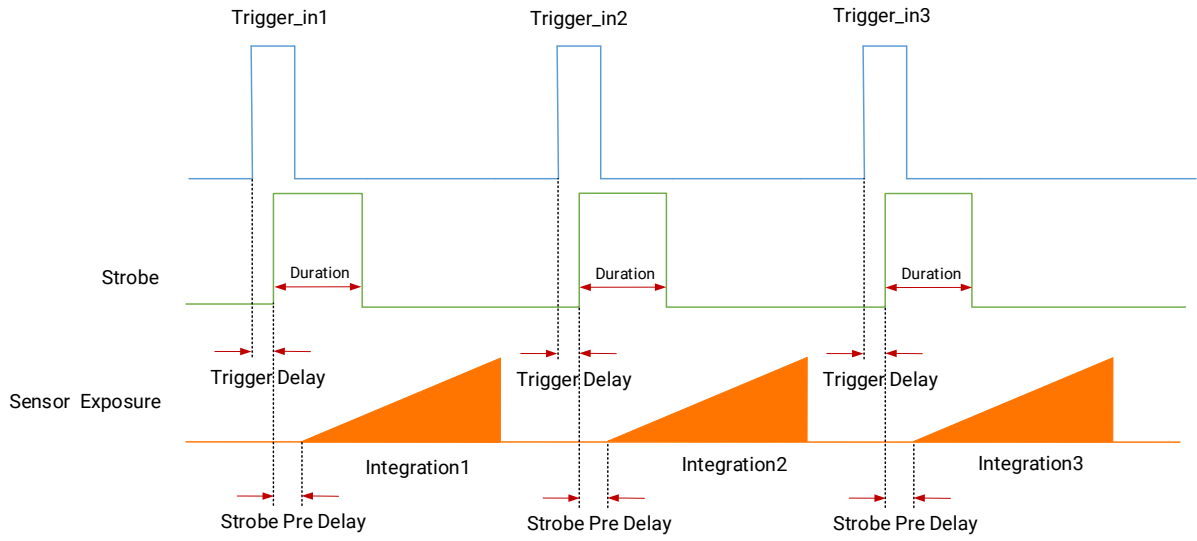
Figure 9-31 Set Strobe Pre Line Delay

#### Note

For the device supporting rolling shutter, the **Strobe Line Pre Delay** is valid only when **Global Reset** is selected as **Sensor Shutter Mode**. Refer to section [Global Reset](#) for details.

Taking **Exposure Start Active** selected as an example, the device will delay exposure start time based on the value set in **Strobe Line Pre Delay**. The sequence diagram of strobe line

pre delay is shown below.



**Figure 9-32 Sequence Diagram of Strobe Pre Line Delay**

# Chapter 10 Image Acquisition and Transmission

## 10.1 Global Shutter and Rolling Shutter

The shutter mode of the device is divided into global shutter and rolling shutter. The shutter mode is determined by the characteristics of the sensor used by the device.

### 10.1.1 Global Shutter

For device that supports global shutter, its exposure starts and ends in each line simultaneously. After the exposure, data readout starts line by line. All pixels expose at the same time, and then read out at different time.

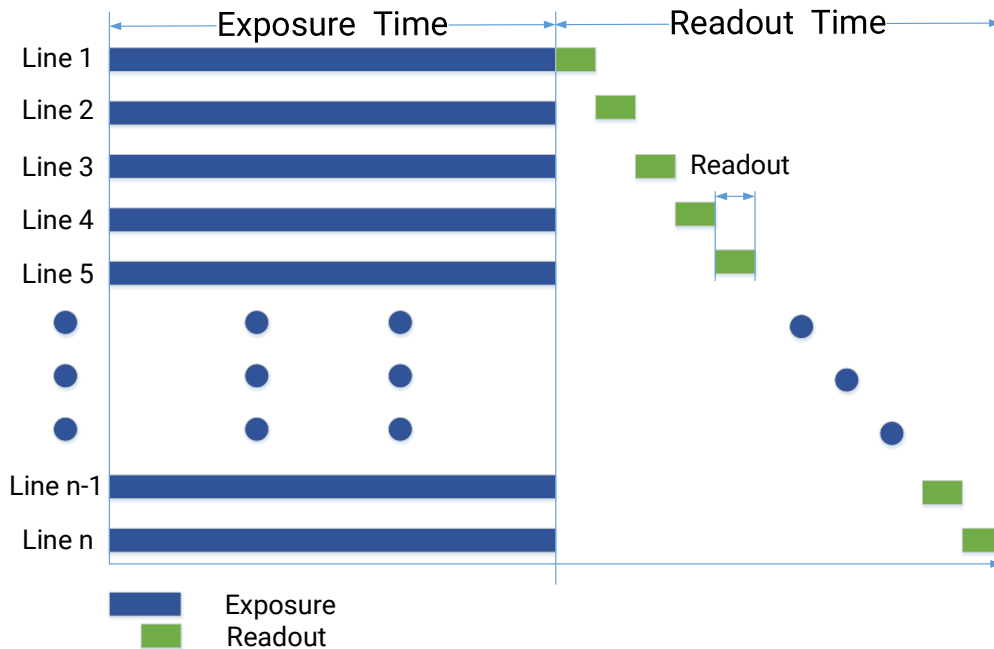


Figure 10-1 Global Shutter

### 10.1.2 Rolling Shutter

#### Working Principle

For device that supports rolling shutter, as soon as the exposure ends, the data readout starts simultaneously. After the whole action, the rest of rows start to expose and read out one by one. All pixels expose at the same time, and then read out at different time.

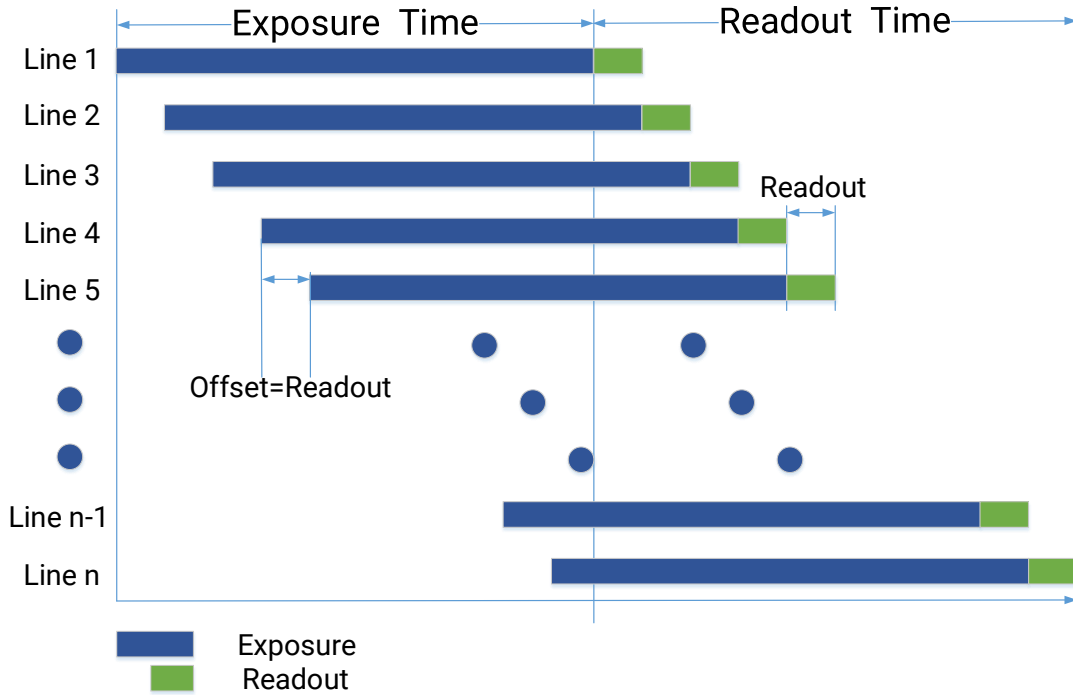


Figure 10-2 Rolling Shutter

### Global Reset

Global reset means that all of the sensor's pixels start exposing at the same time, but stop exposing at different time.

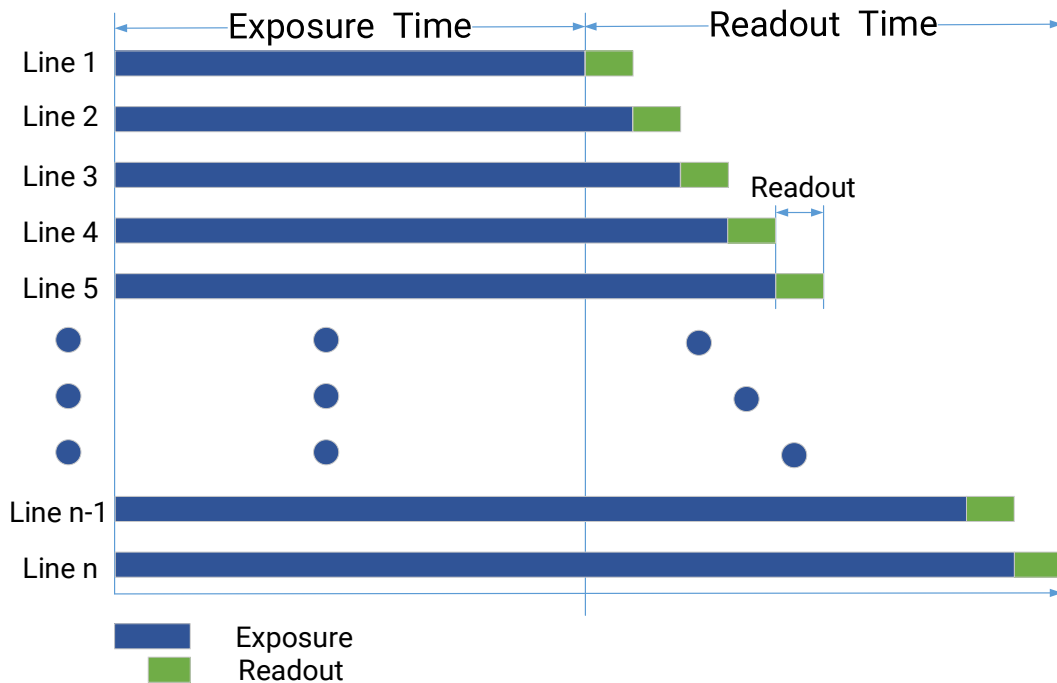
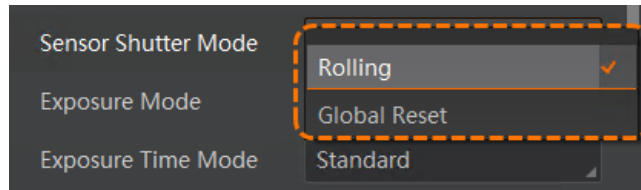


Figure 10-3 Global Reset

You can go to **Acquisition Control** → **Sensor Shutter Mode**, and select **Global Reset** as **Sensor Shutter Mode**.



**Figure 10-4 Select Global Reset**

---

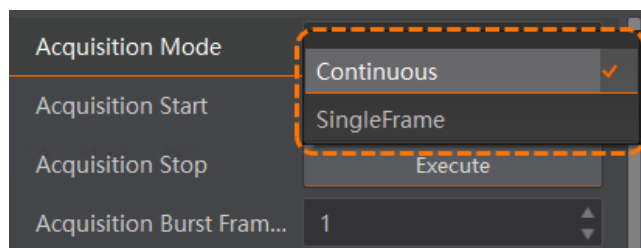
## Note

- The Global Reset function may differ by device models.
  - When Global Reset function is enabled, different exposure times for each line of the image may result in different brightness of each line. Therefore, it is recommended to use this function together with an industrial light source in a completely dark environment. By enabling the light source during the exposure time and disabling at other times, each line of the image will be illuminated equally during the same exposure time.
- 

## 10.2 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 10-5 Set Acquisition Mode**

## 10.3 Frame Rate

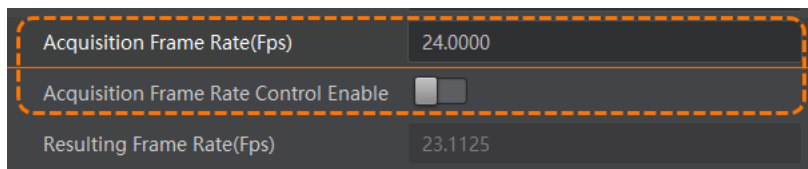
Frame rate refers to the image quantity that is acquired by the device per second. The higher frame rate, and shorter time used for image acquisition will be. The following

factors determine the device's frame rate in real-time.

- Frame readout time: The frame readout time is related with device's sensor performance and image height. The lower the image height and less the frame readout time, and the higher the frame rate will be.
- Exposure time: If the reciprocal of max. frame rate that the device supports is  $t$ , and when the configured exposure time is larger than  $t$ , the less the exposure time, the higher the frame rate will be. When the configured exposure time is less than or equal to  $t$ , exposure time will not influence the frame rate.
- Bandwidth: The larger the bandwidth, the higher the frame rate will be.
- Pixel format: The more bytes pixel format occupy, the lower the frame rate will be.

### Steps

1. Go to **Acquisition Control** → **Acquisition Frame Rate**, and enter **Acquisition Frame Rate**.
2. Enable **Acquisition Frame Rate Control Enable**.



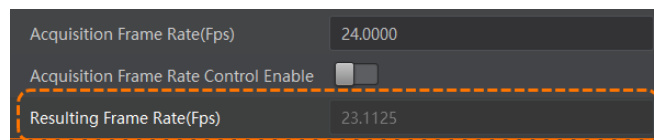
**Figure 10-6 Set Frame Rate**

---

### Note

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

3. View the device's final frame rate in **Resulting Frame Rate**.



**Figure 10-7 View Resulting Frame Rate**

---

### Note

- You can go to **Acquisition Control** → **Acquisition Start / Acquisition Stop** to start or stop image acquisition.
- After you click **Execute** in **Acquisition Start**, some parameters cannot be edited. If you want to edit, click **Execute** in **Acquisition Stop** first.

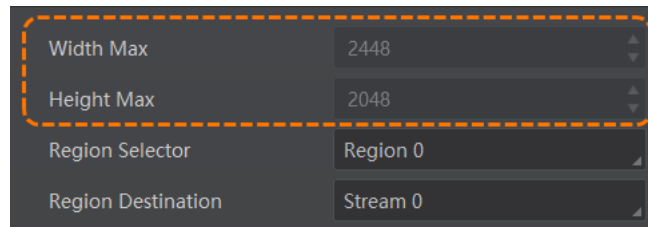
# Chapter 11 Image Parameter

## 11.1 Set Resolution and ROI

**Note**

The device displays the image with max. resolution by default.

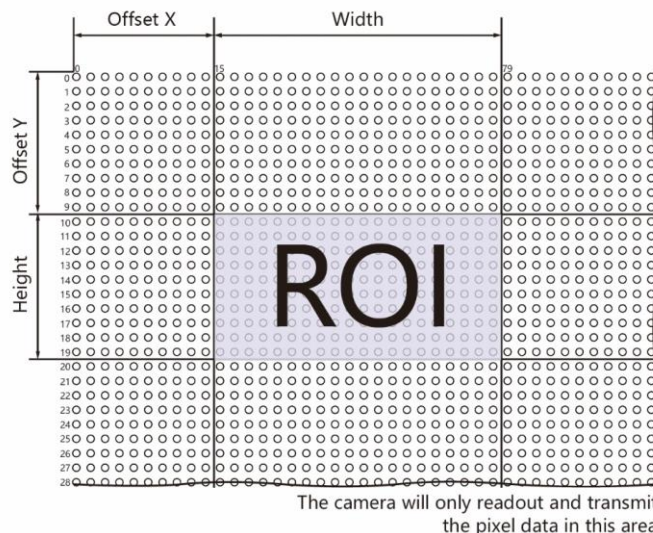
Go to **Image Format Control**, and you can view resolution by reading **Width Max** and **Height Max**. **Width Max** stands for the max. pixels per inch in width direction, and **Height Max** stands for the max. pixels per inch in height direction.



**Figure 11-1 View Resolution**

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

When you are only interested in some details in the image, image cropping is needed. That is, an ROI setting is performed on the device to output an image of the region of interest. Setting the region of interest can reduce the transmission data bandwidth and may improve the device’s frame rate to a certain extent.



**Figure 11-2 ROI**

## Note

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

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

- **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.
- **Offset Y**: It refers to the vertical coordinate of the upper-left corner of the ROI.

## Note

- The **Width** plus **Offset X** should not be larger than **Width Max**, and **Height** plus **Offset Y** not be larger than **Height Max**.
- During ROI settings, parameter stepping may differ by device model.

## 11.2 Set Image Reverse

### Note

For different models of device, the image reverse function may be different, please refer to the actual one you got.

**Reverse X** refers to the image reverses in a horizontal way, and **Reverse Y** refers to the image reverses in a vertical way.

You can click **Image Format Control**, and enable **Reverse X** or **Reverse Y** according to actual demands.

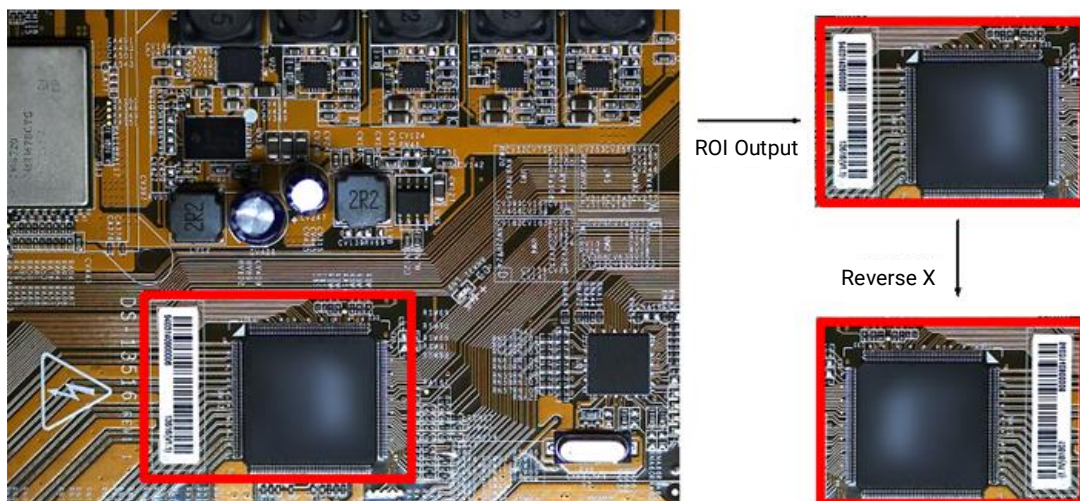


Figure 11-3 Image Reverse Comparison (Reverse X as an Example)

## 11.3 Set Pixel Format

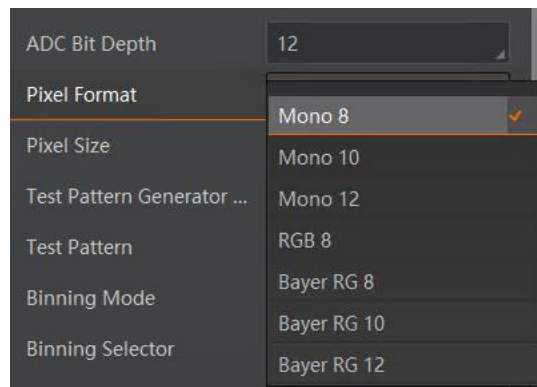
This function allows you to set the pixel format of the image data transmitted by the device. Go to **Image Format Control** → **Pixel Format**, and set **Pixel Format** according to actual demands.

### Note

- The specific pixel formats may differ by device models.
- With different ADC bit depth, the pixel format and pixel size may differ.

**Table 11-1 Pixel Format and Pixel Size**

ADC Bit Depth	Pixel Format	Pixel Size (Bits/Pixel)
8	Mono 8	8
12	Mono 8, Bayer 8	8
	Mono10, Bayer 10	10
	Mono12, Bayer 12	12
	RGB 8	24



**Figure 11-4 Image Pixel Format**

With different ADC bit depths and pixel formats, the device's max. frame rate may differ. The larger the device's ADC bit depth value, the better the device's image quality, and the lower the device's frame rate will be.

### Note

The ADC bit depth function may differ by device models.

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. The RGB format can be converted into YUV format, and Y component of YUV

can be output as Mono 8 format.

## Note

If there is no need to identify the color of the object, it is recommended to use a mono camera.

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

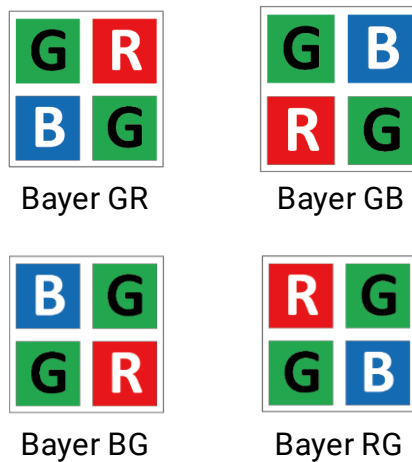


Figure 11-5 Pixel Patterns

## 11.4 Set Test Pattern

The device supports test pattern function. When there is an 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 output image by the device is real-time image. If this function is enabled, the output image by the device is test image. Go to **Image Format Control** → **Test Pattern**, and set **Test Pattern** according to actual demands.

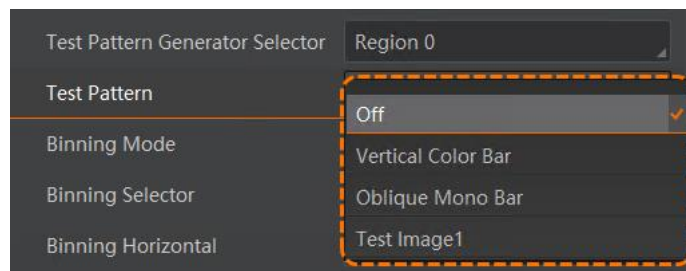
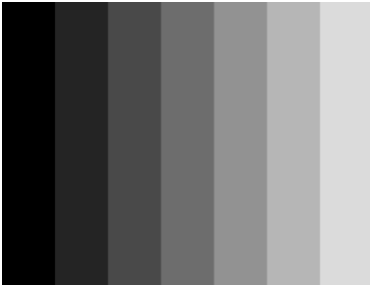
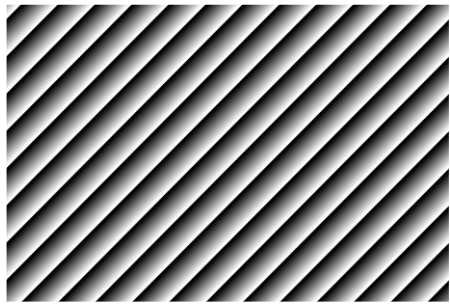
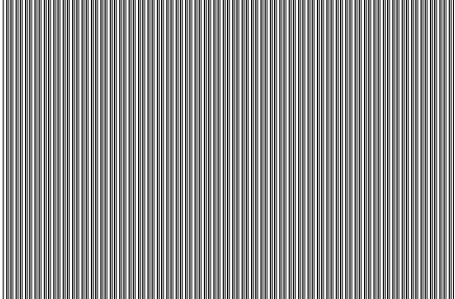


Figure 11-6 Set Test Pattern

The mono device offers 3 test patterns, including **Mono Bar**, **Oblique Mono Bar**, and **Test Image 1**.

**Table 11-2 Test Pattern**

Test Pattern	Image
Mono Bar	
Oblique Mono Bar	
Test Image 1	

---

 **Note**

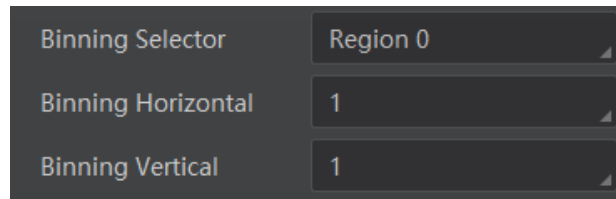
The pattern of the test image 1 may differ by device models.

---

## 11.5 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 11-7 Set Binning**

---

### Note

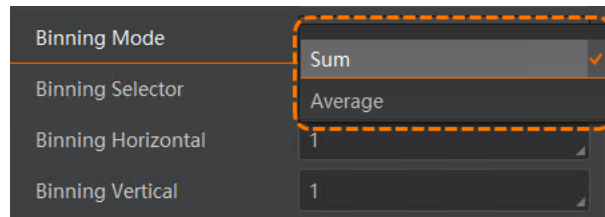
- **Binning Horizontal** is the image's width and offset X, and **Binning Vertical** is the image's height and offset Y.
- The binning function may differ by device models.

---

The device also supports binning mode function, which defines how pixels are combined. Click **Binning Mode**, and select **Sum** or **Average** according to actual demands.

- **Sum**: The values of the affected pixels are summed. This improves the signal-to-noise ratio, but also increases the device's response to light.
- **Average**: The values of the affected pixels are averaged. This greatly improves the signal-to-noise ratio without affecting the device's response to light.

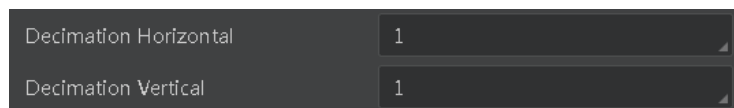
Both binning modes (Sum and Average) reduce the amount of image data to be transferred.



**Figure 11-8 Set Binning Mode**

## 11.6 Set Decimation

The decimation feature allows you to reduce the number of sensor pixel columns or rows that are transmitted by the device. This procedure is also known as subsampling. It reduces the amount of data to be transferred and may increase the device's frame rate. Click **Image Format Control**, and set **Decimation Horizontal** and **Decimation Vertical** according to actual demands.



**Figure 11-9 Set Decimation**

## Note

- **Decimation Horizontal** is the image's width and offset X, and **Decimation Vertical** is the image's height.
- The decimation function may differ by device models.

## 11.7 Set Exposure Mode

### Note

The exposure mode may differ by device models.

The device supports 2 types of exposure modes, including **Timed** and **Trigger Width**.

- If the **Exposure Mode** is **Timed**, the device's exposure time is controlled by **Exposure Auto** and **Exposure Time**.
- If the **Exposure Mode** is **Trigger Width**, exposure time and level signal duration should be the same, and **Exposure Auto** and **Exposure Time** are invalid.

### Note

When the device's **Trigger Mode** is **On**, **Trigger Source** is **Line 0** or **Line 2**, and **Trigger Activation** is **Level High** or **Level Low**, **Trigger Width** can be selected as **Exposure Mode** and the device's exposure time is controlled by the signal duration.

When the exposure mode is **Timed**, 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 adjustment, 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)**.

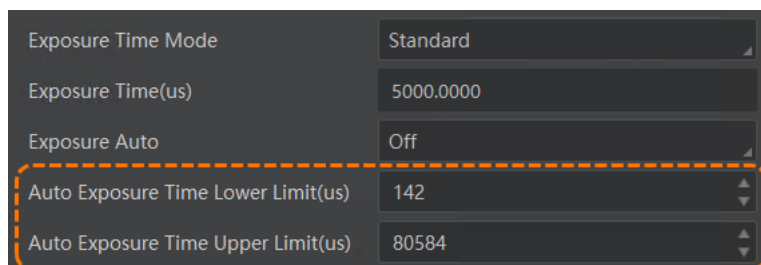


Figure 11-10 Set Exposure Time Under Once or Continuous Mode

**Note**

The adjustment of exposure mode may affect the brightness of the device.

## 11.8 Set Brightness

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

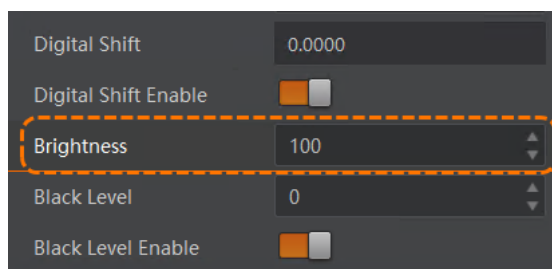
**Note**

- You should enable **Once** or **Continuous** exposure mode or gain mode first before setting brightness. Refer to section [Set Exposure Mode](#) and section [Set Analog Gain](#) for details.
- After setting brightness, the device will automatically adjust exposure time or analog gain to let image brightness reach target one. Under **Once** or **Continuous** exposure mode, the higher the brightness value, the brighter the image will be under auto exposure mode or auto gain mode.
- The range of brightness is between 0 and 255.



**Figure 11-11 Brightness Example**

Go to **Analog Control** → **Brightness**, and enter **Brightness** according to actual demand.



**Figure 11-12 Set Brightness**

## 11.9 Set HDR

The device supports HDR (High Dynamic Range) function, which allow you to configure

multiple groups of parameters to acquire images.

---

## Note

- The HDR function may differ by device models.
  - The device supports HDR (High Dynamic Range) function that the device acquires images based on customized settings, and each with its own exposure time and gain.
  - The images are not combined to form an HDR image in the HDR mode.
- 

## Steps

1. Go to **Acquisition Control** → **HDR Enable**, and enable **HDR Enable**.
  2. Enter **HDR Number** according to actual demands. Up to 8 HDR groups can be configured.
- 

## Note

- The **HDR Number** can be set for some device models. Please refer to the actual one.
  - The supported number of groups may differ by the device model.
- 

3. Set **HDR Selector** and corresponding **HDR Shutter** and **HDR Gain**.
- 

## Note

Up to 4 groups of parameters can be configured.

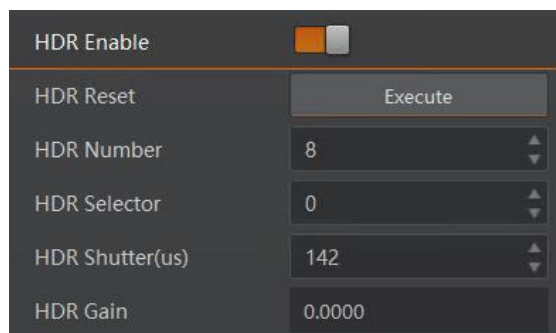
---

4. (Optional) Click **Execute** in **HDR Reset** to reset the HDR. The HDR will be executed from the first group.
- 

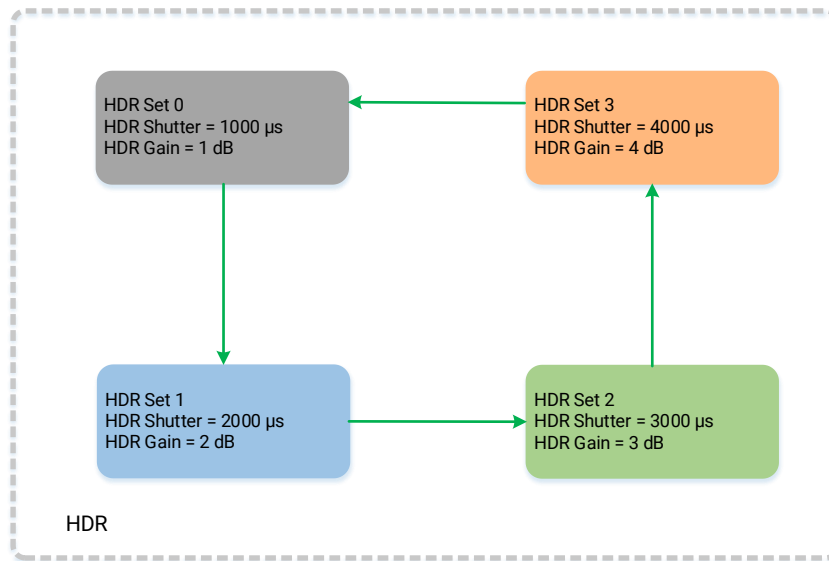
## Note

The **HDR Reset** may differ by device model.

---



**Figure 11-13Set HDR**



**Figure 11-14 HDR Demonstration (Four Groups)**

## 11.10 Set Gain

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.

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. It is recommended to use analog gain first, and then to adjust digital gain if the analog gain cannot meet demands.

### 11.10.1 Set Analog Gain

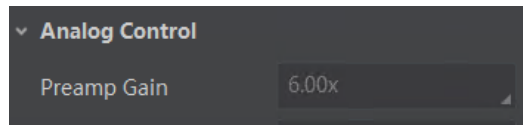
#### Note

- The range of analog gain may differ by device models. Refer to device's specification for details.
- The analog gain parameter name may differ by device models or firmware. The analog gain parameter name can be **Preamp Gain** or **Gain** which have different settings methods.
- 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 11-15 Preamp Gain**

## Gain

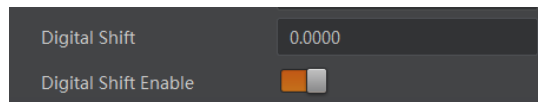
The device supports 3 types of gain mode, including **Off**, **Once** and **Continuous**. Click **Analog Control** → **Gain Auto**, and select **Gain Auto** according to actual demands.

- **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.

### 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 11-16 Set Digital Gain**

---

#### Note

- The value in **Digital Shift** is between  $-24.082399$  dB and  $23.999836$ .
  - **Digital Shift Enable** is disabled by default.
- 

## 11.11 Set White Balance

---

#### Note

White balance is only available for color devices. In Mono pixel format, this function is not supported.

---

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** → **Balance White Auto**, and select **Balance White 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.

### Auto Correction

#### 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.

---

#### Note

It is recommended to set image pixel value between 120 and 160.

---

3. Select **Wide** as **AWB Color Temperature Mode** to let the device adjust white balance again if the image's color effect is not good under the default condition of **Balance White Auto** is **Continuous** and **AWB Color Temperature Mode** is **Narrow**.

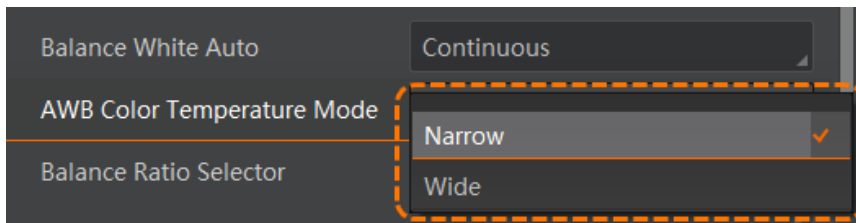


Figure 11-17 Set AWB Color Temperature Mode

### Manual Correction

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

#### Steps

---

#### Note

- For specific **Balance Ratio Selector** value, please refer to the actual condition.
- In order to avoid repeated correction after restarting the device, it is recommended to save white balance parameter to **User Set** after white balance correction. You can refer to the section [Save User Set](#) and [Load User Set](#) for details.

- If the light source and color temperature 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**.
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.

## 11.12 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.

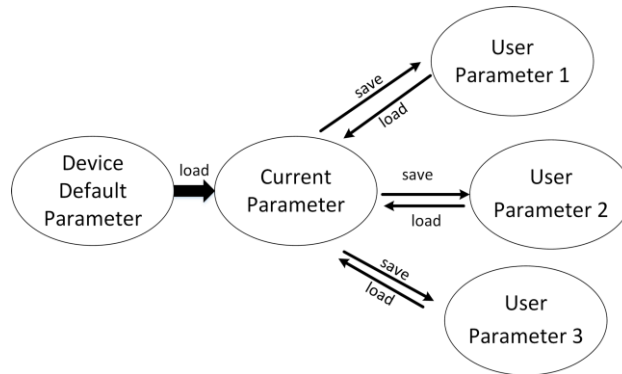


Figure 11-18 Parameter Relation

---

### Note

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

---

### 11.12.1 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.
-

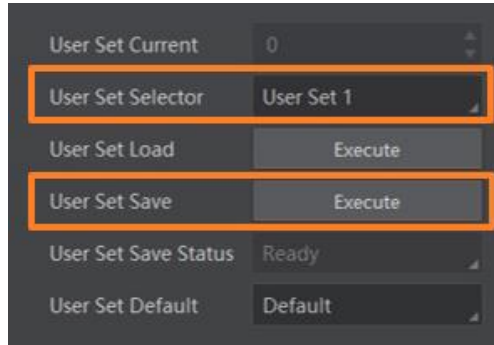


Figure 11-19 Save User Set

---

### Note

The parameter of **User Set Save Status** may differ by device models.

---

## 11.12.2 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.

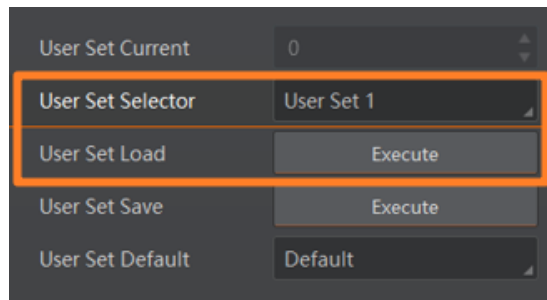


Figure 11-20 Load User Set

## 11.12.3 Set User Default

You can also set default parameter by going to **User Set Control** and selecting a user set in

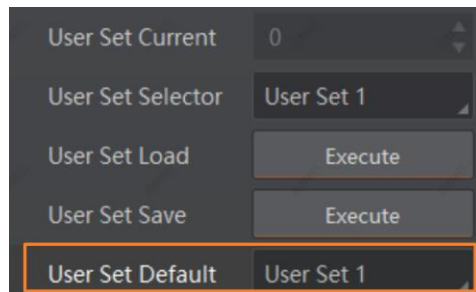
---

## User Set Default.

---

### Note

- The User Set Default is the user set that will be loaded upon power cycling the camera
  - Here we take selecting **User Set 1** as an example.
- 



**Figure 11-21 Set User Default**

## Chapter 12 Advanced Functions

### 12.1 Set Black Level

---

#### Note

The default value of black level may differ by device models.

---

The black level function can adjust the gray value offset of the output data, determining the average gray value when the sensor is not exposed to light.

Go to **Analog Control** → **Black Level Enable**, enable **Black Level Enable**, and enter **Black Level** according to actual demands. The value should be between 0 and 4095.

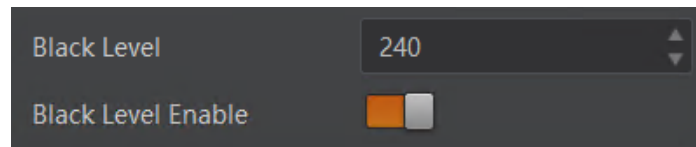


Figure 12-1 Set Black Level

### 12.2 Set Gamma Correction

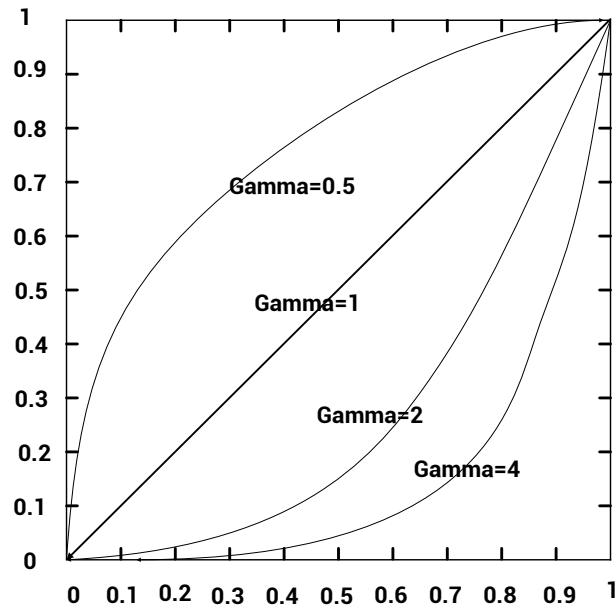
---

#### Note

- The Gamma correction function may differ by device models or pixel formats.
  - The Gamma correction function is not supported in Bayer format for color device.
  - The Gamma correction function is disabled by default.
- 

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 between 0.5 and 1: image brightness increases, dark area becomes brighter.
- Gamma between 1 and 4: image brightness decreases, dark area becomes darker.



**Figure 12-2 Set Gamma Correction**



**Figure 12-3 Gamma Correction Example**

There are 2 types of Gamma correction, including **User** mode and **sRGB** mode. Settings method is different as shown below.

## 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.

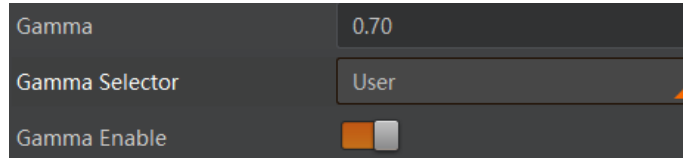


Figure 12-4 Set User Mode

## sRGB Mode

### Steps

1. Go to **Analog Control** → **Gamma Selector**.
2. Select **sRGB** as **Gamma Selector**.
3. Enable **Gamma Enable** to enable it.

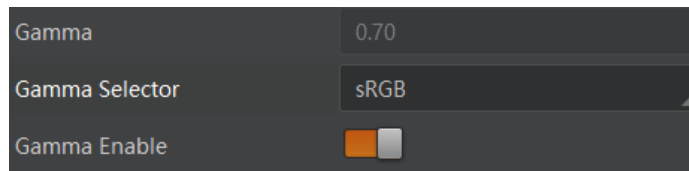


Figure 12-5 Set sRGB Mode

## 12.3 Set AOI

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

### Steps

1. Click **Analog Control** → **Auto Function AOI Selector**, and select **AOI 1**.
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**.

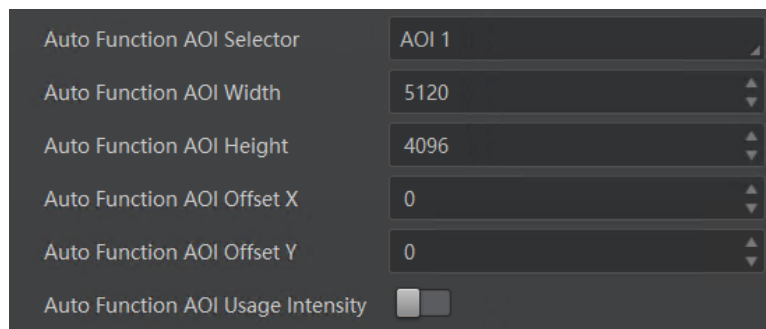


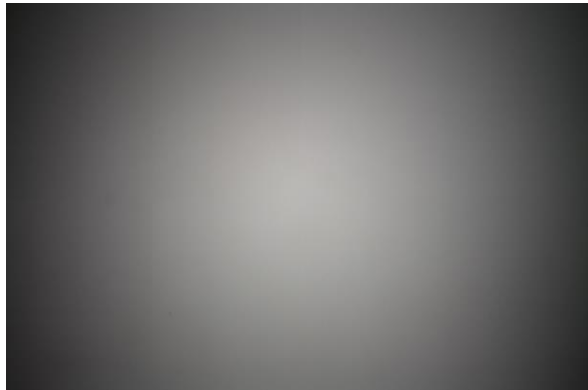
Figure 12-6 Set AOI

## 12.4 Set Shading Correction

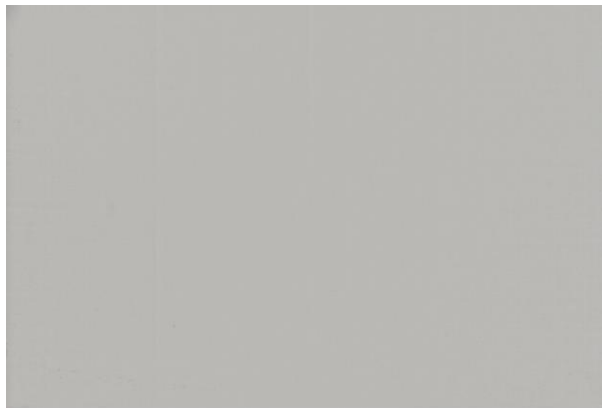
The device supports shading correction function that improves the image uniformity when you acquire a non-uniformity image due to external conditions. The shading correction type includes LSC correction and LSC sequencer.

### 12.4.1 LSC Correction

LSC correction stands for Lens Shading Correction that eliminates non-uniform illumination brought by lens. The images before LSC correction and after correction are shown below.



**Figure 12-7 Before LSC Correction**



**Figure 12-8 After LSC Correction**

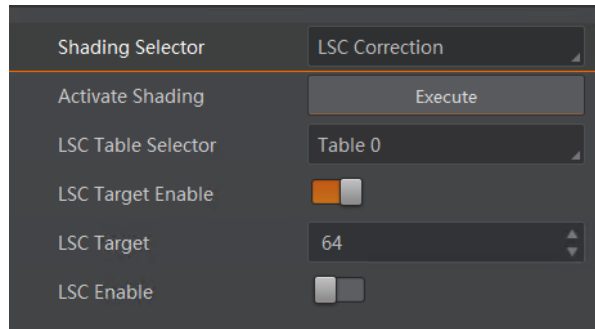
The device support correcting image via setting parameters to adjust the image brightness according to different scenarios.

---

#### **Note**

If the light source and color temperature change, you need to execute LSC correction again.

---



**Figure 12-9 Correcting Image via Setting Parameters**

### Steps

1. Select **LSC Correction** as **Shading Selector**.
2. Select tables from **LSC Table Selector** ranging from **Table 0** to **Table 7** according to actual demands.

---

#### **Note**

For some color device models, you can correct image via **LSC Target R/G/B**.

3. Enable **LSC Target Enable**, and set **LSC Target** according to actual demands.

---

#### **Note**

The larger value configured in **LSC Target**, and brighter the image is.

4. Click **Execute** in **Activate Shading**.
5. Enable **LSC Enable**. At the same time, the image correction will be executed according to the settings, and the table that is used for LSC correction cannot be edited.

---

#### **Note**

- If you click **Execute** in **Activate Shading** first, and then enable **LSC Enable** when the **LSC Target Enable** is disabled, the image correction will be executed according to the maximum brightness of the image.
- The LSC correction can be executed only when the device is in full resolution. If you are only interested in certain details in the image, you can use the ROI function. And there is no need to repeat the correction at this time.

---

## 12.4.2 LSC Sequencer

Without stopping device's image streams, LSC sequencer function can periodically take pictures of collected images via setting multiple groups of brightness parameter tables according to the default sequencer parameter group or manually setting sequencer parameter group. Therefore, the device can process images of inconsistent uniformity due

to different light sources.

---

**Note**

The LSC sequencer function may differ by device models.

---

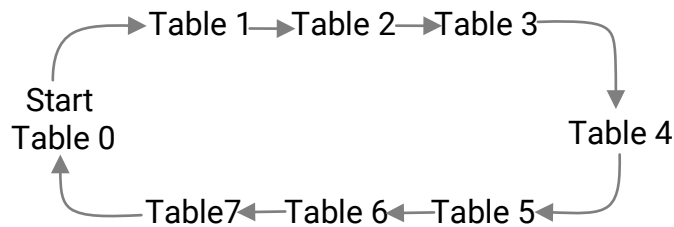
**Steps**

1. Select **LSC Correction** as **Shading Selector**.
  2. Select tables from **LSC Table Selector** ranging from **Table 0** to **Table 7** according to actual demands.
- 

**Note**

When using eight LSC tables, the default sequencer order is from Table 0 to Table 7 in turn.

---



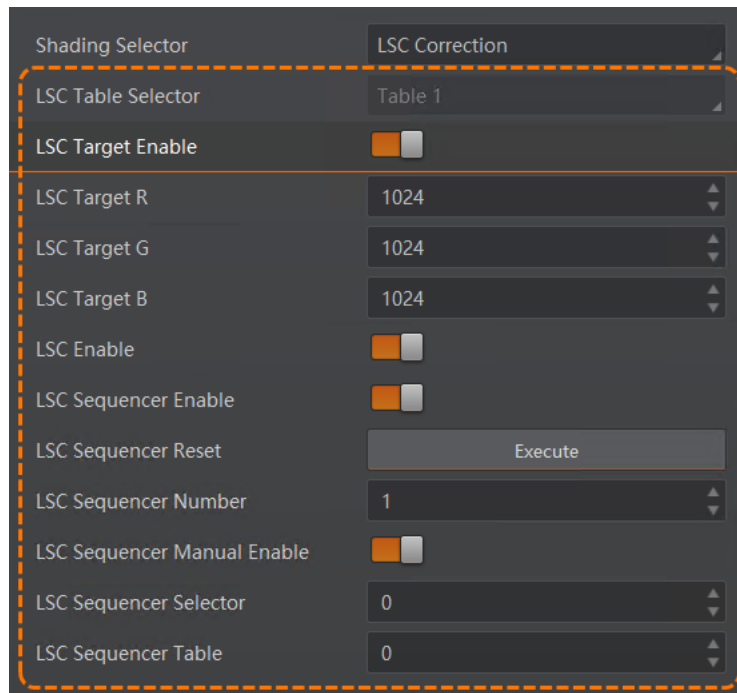
**Figure 12-10 Sequencer Order**

3. Enable **LSC Target Enable** and set **LSC Target**.
- 

**Note**

- The larger value configured in **LSC Target**, and brighter the image is.
  - The table that is used for LSC correction cannot be edited.
-

4. Click **Execute** in **Activate Shading**.
5. Enable **LSC Enable**.
6. Enable **LSC Sequencer Enable**.



**Figure 12-11 LSC Sequencer**

---

### **Note**

If **LSC Sequencer Enable** is disabled, the LSC sequencer will not be executed, and the image will be generated according to the settings in **LSC Target**.

---

7. Set **LSC Sequencer Number** to configure how many tables to participate the sequencer.
8. (Optional) Click **Execute** in **LSC Sequencer Reset** to reset the sequencer.
9. (Optional) Enable **LSC Sequencer Manual Enable** if you need to set the sequencer order manually, and set **LSC Sequencer Selector** and **LSC Sequencer Table** according to actual demands.

## 12.5 Set LUT

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

---

### **Note**

- You cannot use Gamma correction function and LUT function at the same time.
- The range of the LUT index is from 0 to 1023.

- The value of LUT value is four times the value of LUT index by default. With different ADC bit depth, the range of the LUT value may differ.
  - 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 LUTs, after you set **LUT Index** and **LUT Value**, you should click **Execute** in **LUT Save** respectively.
  - The LUT function is not supported for the color device in Bayer format.
- 

### Steps

1. Click **LUT Control**, and enable **LUT Enable**.
2. Select one group in the **LUT Selector**.
2. Enter **LUT Index** and **LUT Value** according to actual demands.
3. Click **Execute** in **LUT Save** to save it.

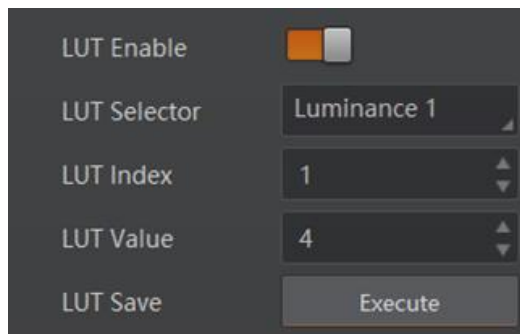


Figure 12-12 Set LUT

## Chapter 13 Other Functions

### 13.1 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 13-1 Parameter Description**

Parameter	Read/Write	Description
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.
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 User ID	Read & Write	Device name and it is empty by default. You can set according to your preference. <ul style="list-style-type: none"> <li>• If User ID is empty, the client software displays the device model (device serial number).</li> <li>• If you set it, the client software displays the User ID you set (device serial number).</li> </ul>
Device Revision	Read Only	It is the version of XoFLink protocol.
Device Manifest Size	Read Only	It is the quantity of GenICam XML.
Device Manifest Selector	Read & Write	It is the ID of GenICam XML.
Device XML Version	Read Only	It is version of GenICam XML.
Device Schema Version	Read Only	It is the schema version of GenICam.
Device Uptime (s)	Read Only	It is the device's operation time.
Board Device Type	Read Only	It is the device type.

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Parameter	Read/Write	Description
Device Reset	Read & Write	Click <b>Execute</b> to reset the device.
Device Fan Enable	Write	After enabled, the device's fan is running.
TEC Enable	Read & Write	You can enable it to enable TEC function.
TEC Temperature	Read & Write	It sets the maximum temperature of sensor. <ul style="list-style-type: none"> <li>● If actual sensor's temperature is lower than this parameter, the TEC function is not enabled.</li> <li>● If actual sensor's temperature is higher than this parameter and <b>TEC Enable</b> is enabled, the TEC function is enabled.</li> </ul>
Device Temperature Selector	Read & Write	It selects device component to view its temperature. Currently, sensor can be selected.
Device Temperature	Read Only	It displays the temperature of selected components in <b>Device Temperature Selector</b> .
Relative Humidity	Read Only	It displays the relative humidity of the device.
Fan Control Mode	Read & Write	It sets the fan mode. <ul style="list-style-type: none"> <li>● In <b>Auto</b> mode, it includes three-level fan speed: 70, 85, and 100. According to the difference between the configured maximum temperature of sensor (TEC Temperature parameter) and the actual temperature, adjustment is made every 30 seconds. When the difference between the actual temperature and the set temperature is greater than 2 degrees, fan speed will increase. Otherwise, fan speed will decrease.</li> <li>● In <b>Manual</b> mode, the fan speed is decided by the value set in <b>Fan Speed</b>.</li> </ul>
Fan Speed	Read & Write	It sets the fan speed, and its range is from 40 to 100.
Find Me	Read & Write	Click <b>Execute</b> to find the currently operating device, and the device red indicator flashes once.
Device PJ Number	Read Only	It is the device's project number.

## 13.2 Transport Layer Control

You can go to **Transport Layer Control** to view the device’s payload size, image stream ID, etc.

 **Note**

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

**Table 13-2 Parameters of Transport Layer Control**

Parameter	Read/Write	Description
Payload Size	Read Only	It is the device’s load size.
Device Tap Geometry	Read & Write	It is the device’s tap geometry.
Image 1 Stream ID	Read Only	It is the ID of image 1.
Image 2 Stream ID	Read Only	It is the ID of image 2.

## 13.3 XoFLink Parameters

You can go to **XoFLink** to view and set the parameters of fiber port.

 **Note**

The specific XoFLink parameters may differ by device models.

**Table 13-3 XoFLink Parameters**

Parameter	Read/Write	Description
Device Connection ID	Read Only	It is the device’s connection ID.
Master Host Connection ID	Read, and Write if not Acquisition	It is connected master host ID.
Control Packet Max Size	Read Only	It is the max. size of single control packet.
Device Steam Max Size	Read, and Write if not Acquisition	It is the max. size of single stream packet.
LinkConfiguration	Read, and Write if not Acquisition	It sets link configuration mode, as show below.
LinkConfigurationPreferred	Read Only	It is recommended link configuration mode. You can click <b>Execute</b> in <b>User Set Save</b> after configuring <b>Link Configuration</b> to save it. At this time, <b>Link Configuration Preferred</b> is

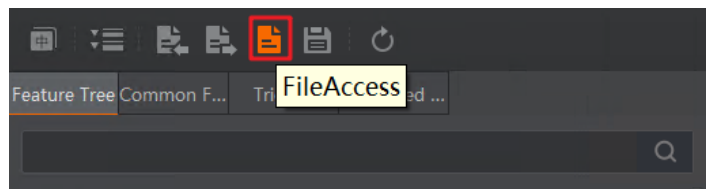
Parameter	Read/Write	Description
		related with <b>Link Configuration</b> .
ConnectionTestMode	Read & Write	It checks test data sent between the device and frame grabber.
TestErrorCountSelector	Read & Write	It selects link that needs checking test results.
TestErrorCount	Read & Write	It is error count of current link.
TestPacketCountTx	Read & Write	It is transmitted test data quantity of current link.
TestPacketCountRx	Read & Write	It is received test data quantity of current link.
TestPacketModeTx	Read & Write	It is transmitted test data mode of current link. You can select <b>Mode 1</b> and <b>Mode 2</b> . <ul style="list-style-type: none"> <li>• If you select <b>Mode 1</b>, the test data is a byte-by-byte incrementing loop from zero to 255.</li> <li>• If you select <b>Mode 2</b>, the test data is a specified value, i.e., the value of <b>TestPackedValue</b>.</li> </ul>
TestPacketGroupTx	Read & Write	It is the group number of transmitted test data of current link.
TestPackedValue	Read & Write	It is the transmitted test data value of current link.

## 13.4 File Access Control

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, DPC, LUT Luminance 1/2/3, MPRNUC, HPRNUC, and License Notice.

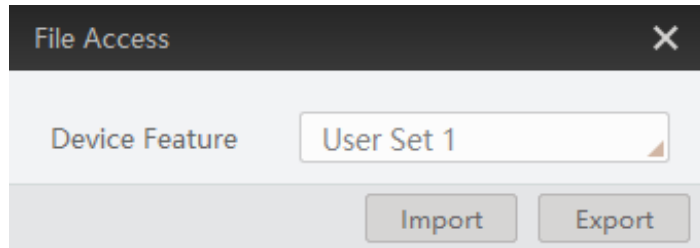
### Steps

1. Select a device in the device list, and click  to open the file access dialogue box.



**Figure 13-1 File Access**

2. Select **Device Feature** and click **Import** or **Export**.



**Figure 13-2 Import or Export**

3. Select a file in MFA format from local PC to import, or select a saving path and enter file name to save and export.

---

### Note

- Importing and exporting the device feature, DPC data, LUT, MPRNUC, and HPRNUC among the same model and same firmware of devices are supported.
  - 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, it will take effect only when you select the same parameters in LUT Selector.
  - If the DPC/MPRNUC/HPRNUC is selected as device feature, it will take effect immediately after importing. DPC means defect pixel correction, MPRNUC is vertical line correction file, and HPRNUC is horizontal line correction file.
  - **License Notice** supports exporting only.
- 

## 13.5 Firmware Update

The device supports updating firmware via the firmware upgrade tool or the USB interface.

---

### Note

The USB interface may differ by device models.

---

### Update Firmware via Firmware Upgrade Tool

---

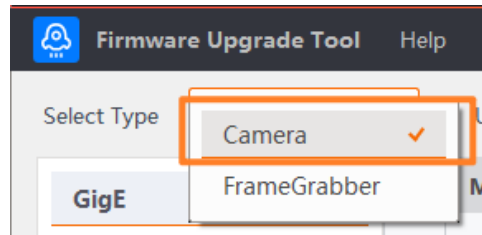
#### Note

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


---

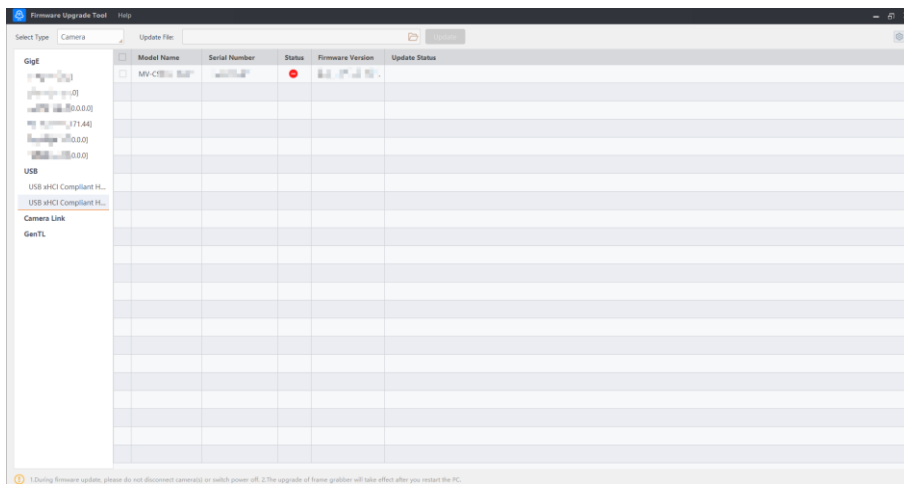
#### Steps

1. Go to **Tool** → **Toolkit** → **Firmware Upgrade Tool** to open the MVS Tool Kit.
2. Select **Camera** in the **Select Type**. The tool will automatically refresh and show all enumerated devices.



**Figure 13-3 Select Camera**

3. Select the device in available status to update.
4. Click  to select firmware upgrade package (dav file).
5. Click **Update** to start updating.



**Figure 13-4 Update Firmware**

---

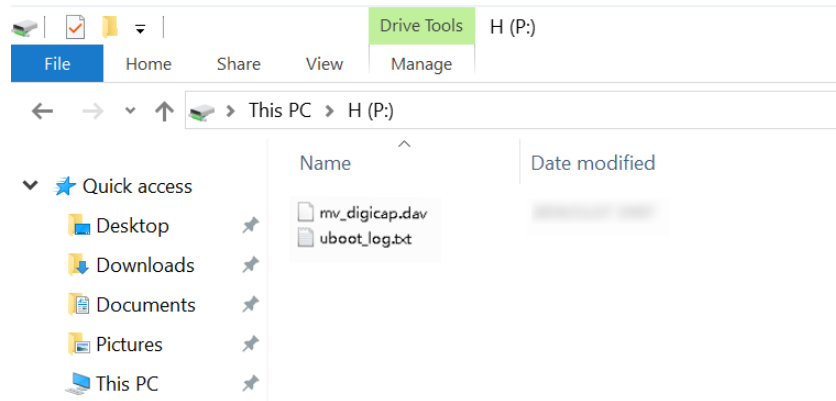
## Note

- The device will restart 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, otherwise it may cause device damage.
- 

## Update Firmware via USB Interface

### Steps

1. Power on the device, and connect the device to the PC via USB data cable.
2. Copy the dav file of the device into the added disk.



**Figure 13-5 Copy Files**

3. Restart the device to update firmware.

---

### Note

- This method may differ by device models.
  - The USB data cable should have data transmission function. If the USB data cable cannot transmit data, the PC will not find the disk.
  - Do not power off the device during firmware updating. If the device is powered off, format disk manually first and then update firmware again.
-

## Chapter 14 FAQ (Frequently Asked Question)

### 14.1 Why the client software cannot list devices?

Table 14-1 Question 1

Possible Cause	Solution
The device is not powered on.	Check the device's power supply and cable connection by observing the device LED indicator and fiber port LED indicator.
Incorrect connection of optical fiber patch cord.	

### 14.2 Why the live view is black?

Table 14-2 Question 2

Possible Cause	Solution
The device's lens aperture is not removed.	Remove the device's lens aperture.

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

Table 14-3 Question 3

Possible Cause	Solution
The trigger mode is not enabled or the device is not triggered.	Enable the trigger mode and make sure that the selected trigger source matches with the corresponding I/O signal.
Incorrect trigger wiring.	Check if the input of trigger signal and wiring are correct or not.

### 14.4 Why images required by algorithm cannot get

## although the live view and trigger signal are normal?

Table 14-4 Question 4

Possible Cause	Solution
The image's output format is not matched with the algorithm.	Check the image format required by the algorithm, and configure the device's image output format in the client software.

## 14.5 Why the device cannot reach full frame rate or full bandwidth during image acquisition?

Table 14-5 Question 5

Possible Cause	Solution
The specification of frame grabber slot does not meet the requirements.	Check the specification of frame grabber slot.
The PC to which the device is connected is not equipped with dual-channel memory modules.	Adopt dual-channel memory modules for the PC to which the device is connected.
The buffer quantity on both the frame grabber and client software is insufficient.	Configure a higher value of buffer quantity on both the frame grabber and client software.
The live view function is enabled during image acquisition.	Disable the live view function during image acquisition.

## Chapter 15 Revision History

Table 15-1 Revision History

Version	Revision Date	Revision Details
V2.0.0	Nov. 25, 2025	<ul style="list-style-type: none"> <li>● Edit Section <a href="#">Appearance</a>.</li> <li>● Edit Section <a href="#">Basic Operation</a>.</li> <li>● Edit Section <a href="#">Input Signal</a>.</li> <li>● Edit Section <a href="#">Output Signal</a>.</li> <li>● Edit Section <a href="#">Bi-Directional Signal</a>.</li> <li>● Add Section <a href="#">Rolling Shutter</a>.</li> <li>● Edit Section <a href="#">Set Pixel Format</a>.</li> <li>● Edit Section <a href="#">Set HDR</a>.</li> <li>● Edit Section <a href="#">Set Analog Gain</a>.</li> <li>● Add Section <a href="#">Set White Balance</a>.</li> <li>● Add Section <a href="#">LSC Sequencer</a>.</li> <li>● Edit Section <a href="#">Device Control</a>.</li> <li>● Add Section <a href="#">Update Firmware via USB Interface</a>.</li> </ul>
V1.0.0	Aug. 12, 2024	Original version.

## Appendix A Device Parameter Index

Here list all parameters of the device mentioned in different sections of this user manual. You can quickly locate parameters in different sections by viewing tables below.

### A.1 Device Control

Table A-1 Device Control

Parameters	Section
Device Scan Type	Section <a href="#">Device Control</a>
Device Vendor Name	
Device Model Name	
Device Manufacturer Info	
Device Firmware Version	
Device Serial Number	
Device User ID	
Device Revsion	
Device Manifest Size	
Device Manifest Selector	
Device Xml Version	
Device Schema Version	
Device Uptime(s)	
Board Device Type	
Device Reset	
Device Fan Enable	
TEC Enable	
TEC Temperature	
Device Temperature Selector	
Device Temperature	
Relative Humidity	
Fan Control Mode	

Parameters	Section
Fan Speed	
Find Me	

## A.2 Image Format Control

**Table A-2 Image Format Control**

Parameters	Section
Width Max	Section <a href="#"><u>Set Resolution and ROI</u></a>
Height Max	
Region Selector	
Width	
Height	
Offset X	
Offset Y	
Reverse X	Section <a href="#"><u>Set Image Reverse</u></a>
Reverse Y	
ADC Bit Depth	Section <a href="#"><u>Set Pixel Format</u></a>
Pixel Format	
Pixel Size	
Test Pattern Generator Selector	Section <a href="#"><u>Set Test Pattern</u></a>
Test Pattern	
Binning Mode	Section <a href="#"><u>Set Binning</u></a>
Binning Selector	
Binning Horizontal	
Binning Vertical	
Decimation Horizontal	Section <a href="#"><u>Set Decimation</u></a>
Decimation Vertical	

## A.3 Acquisition Control

Table A-3 Acquisition Control

Parameters	Section
Acquisition Mode	Section <a href="#">Acquisition Mode</a>
Acquisition Start	
Acquisition Stop	
Acquisition Burst Frame Count	Section <a href="#">Frame Rate</a>
Acquisition Frame Rate (Fps)	
Acquisition Frame Rate Control Enable	
Resulting Frame Rate (Fps)	
Trigger Selector	Section <a href="#">Trigger Input</a>
Trigger Mode	
Trigger Software	
Trigger Source	
Trigger Activation	
Trigger Delay ( $\mu$ s)	
Trigger Cache Enable	
Sensor Shutter Mode	Section <a href="#">Rolling Shutter</a>
Exposure Mode	Section <a href="#">Set Exposure Mode</a>
Exposure Time Mode	
Exposure Time ( $\mu$ s)	
Exposure Auto	
Auto Exposure Time Lower Limit ( $\mu$ s)	
Auto Exposure Time Upper Limit ( $\mu$ s)	
HDR Enable	Section <a href="#">Set HDR</a>
HDR Number	
HDR Selector	
HDR Shutter ( $\mu$ s)	
HDR Gain	

## A.4 Analog Control

**Table A-4 Analog Control**

Parameters	Section
Preamp Gain	Section <a href="#">Set Gain</a>
Gain	
Gain Auto	
Digital Shift	
Digital Shift Enable	
Brightness	Section <a href="#">Set Brightness</a>
Black Level	Section <a href="#">Set Black Level</a>
Black Level Enable	
Balance White Auto	Section <a href="#">Set White Balance</a>
AWB Color Temperature Mode	
Balance Ratio Selector	
Balance Ratio	
Gamma	Section <a href="#">Set Gamma Correction</a>
Gamma Selector	
Gamma Enable	
Auto Function AOI Selector	Section <a href="#">Set AOI</a>
Auto Function AOI Width	
Auto Function AOI Height	
Auto Function AOI Offset X	
Auto Function AOI Offset Y	
Auto Function AOI Usage Intensity	

## A.5 LUT Control

**Table A-5 LUT Control**

Parameters	Section
LUT Selector	Section <a href="#">Set LUT</a>

Parameters	Section
LUT Enable	
LUT Index	
LUT Value	
LUT Save	

## A.6 Shading Correction

**Table A-6 Shading Correction**

Parameters	Section
Shading Selector	Section <a href="#">LSC Correction</a>
Activate Shading	
LSC Table Selector	
LSC Target Enable	
LSC Target	
LSC Target R	
LSC Target G	
LSC Target B	
LSC Enable	
LSC Sequencer Enable	Section <a href="#">LSC Sequencer</a>
LSC Sequencer Reset	
LSC Sequencer Number	
LSC Sequencer Manual Enable	
LSC Sequencer Selector	
LSC Sequencer Table	

## A.7 Digital IO Control

**Table A-7 Digital IO Control**

Parameters	Section
Line Selector	Section <a href="#">Trigger Output</a>

Parameters	Section
Line Mode	
Line Inverter	
Line Status	
Line Status All	
Line Debouncer Time ( $\mu$ s)	
Line Source	
Strobe Enable	
Strobe Line Duration ( $\mu$ s)	
Strobe Line Delay ( $\mu$ s)	
Strobe Line Pre Delay ( $\mu$ s)	

## A.8 Counter and Timer Control

**Table A-8 Counter and Timer Control**

Parameters	Section
Counter Selector	Section <a href="#">Set Trigger Source</a>
Counter Event Source	
Counter Reset Source	
Counter Reset	
Counter Value	
Counter Current Value	

## A.9 File Access Control

**Table A-9 File Access Control**

Parameters	Section
File Selector	Section <a href="#">File Access Control</a>
File Operation Selector	
File Operation Execute	
File Open Mode	

Parameters	Section
File Operation Status	
File Operation Result	
File Size(B)	

## A.10 Transport Layer Control

Table A-10 Transport Layer Control

Parameters	Section
Payload Size	Section <a href="#">Transport Layer Control</a>
Device Tap Geometry	
Image 1 Stream ID	
Image 2 Stream ID	

## A.11 User Set Control

Table A-11 User Set Control

Parameters	Section
User Set Current	Section <a href="#">User Set Customization</a>
User Set Selector	
User Set Load	
User Set Save Status	
User Set Save	
User Set Default	

## A.12 XoFLink

Table A-12 XoFLink

Parameters	Section
Device Connection ID	Section <a href="#">XoFLink Parameters</a>
Master Host Connection ID	

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Parameters	Section
Control Packet Max Size	
Device Stream Max Size	
LinkConfiguration	
LinkConfigurationPreferred	
ConnectionTestMode	
TestErrorCountSelector	
TestErrorCount	
TestPacketCountTx	
TestPacketCountRx	
TestPacketModeTx	
TestPacketGroupRx	
TestPacketValue	



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