

Hikrobot Co., Ltd.

# XoCLink Area Scan Camera

User Manual

**HIKROBOT**

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

| 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 YoCLink Area Scan Camera.

## Contact Information

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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.
- Do not block the ventilation openings or place them near the ventilation openings of other devices.

## 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.

## 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 Contact Cleaning**

---

 **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

Designed for industrial applications, the XoCLink area scan camera adopts XoCLink interface for real-time transmission, and features compact and lightweight design with flexible mounting options, applicable to high-speed motion scenes.

### 3.2 Key Features

- Low power consumption design reduces heat flux density, resulting in low temperature drift.
- Single-cable PoC enables power supply, control, and data transmission, with a transmission distance of up to 15 meters.
- Isolated ground design ensures enhanced immunity to interference.
- High-performance sensors and algorithms achieve clear and accurate images to meet high-standard inspection requirements.

### 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 XoCLink interface.

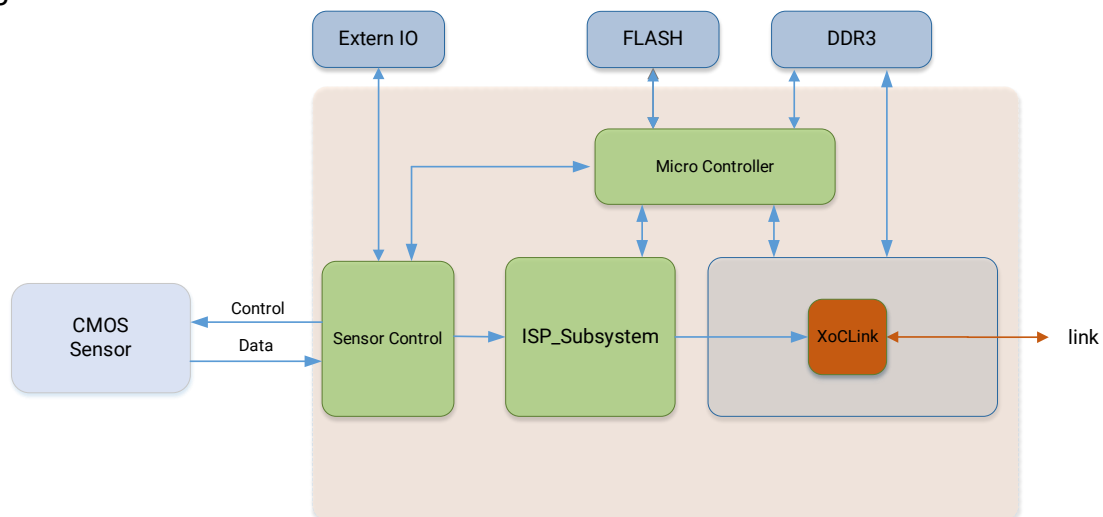


Figure 3-1 Operating Principle

## Chapter 4 Device Hardware

### 4.1 Appearance

#### Note

- The images below are 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.

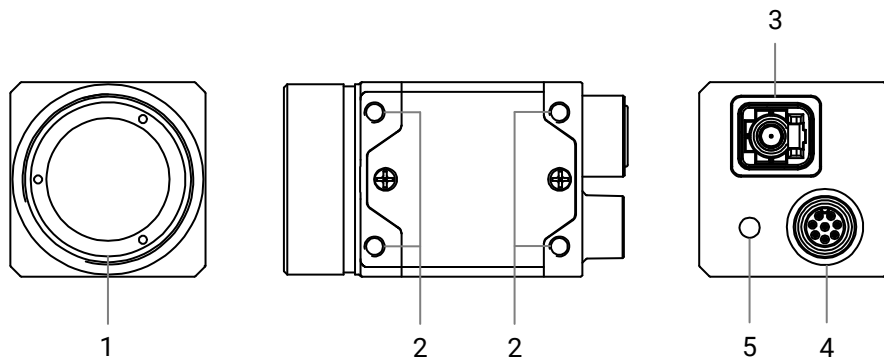


Figure 4-1 Appearance

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 refers to the M3 screw hole for fixing the device to the installation position. The screw holes are located on the top, bottom, or side of the device. |
| 3   | XoCLink Interface (XoC)       | It refers to the XoCLink interface for data transmission.                                                                                                 |
| 4   | Power and I/O Connector (PWR) | It refers to 8-pin M8 A-Code connector, providing power supply and I/O function. Refer to section <a href="#">Power and I/O Connector</a> for details.    |
| 5   | LED Indicator                 | It indicates the device's status. Refer to section <a href="#">Indicator</a> for details.                                                                 |

## 4.2 Power and I/O Connector

The device has an 8-pin M8 A-Code connector as the power and I/O connector that provides power supply and I/O function.

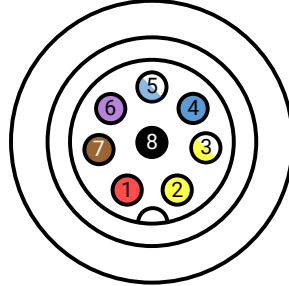


Figure 4-2 8-Pin M8 A-Code Connector

Table 4-2 Pin Definitions of 8-Pin M8 A-Code Connector

| No. | Signal    | I/O Signal Source | Color        | Description                              |
|-----|-----------|-------------------|--------------|------------------------------------------|
| 1   | DC_PWR    | --                | Red          | Device power supply                      |
| 2   | OPTO_IN+  | Line 0+           | Yellow       | Opto-isolated input positive             |
| 3   | OPTO_IN-  | Line 0-           | White/Yellow | Opto-isolated input negative             |
| 4   | OPTO_OUT+ | Line 1+           | Blue         | Opto-isolated output positive            |
| 5   | OPTO_OUT- | Line 1-           | White/Blue   | Opto-isolated output negative            |
| 6   | GPIO      | Line 5+           | Purple       | Bi-directional configurable input/output |
| 7   | GPIO      | Line 2+           | Brown        | Bi-directional configurable input/output |
| 8   | GND       | Line 2-/5-        | Black        | Device power supply ground               |

### Note

- Refer to the table above and the label attached to the power and I/O cable to wire the device.
- 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's indicator is used to indicate the operation status of the device.

### Note

- The indicator status may differ by device models, and actual devices you purchased shall prevail.
- When the indicator is lit up, flashing rapidly, flashing slowly, or flashing very slowly, its unlit interval is 5 sec, 0.2 sec, 1 sec, or 2 sec respectively.
- The indicator sometimes may show a purple color when red and blue colors flashing at the same time.

**Table 4-3 Indicator Description**

| No. | Indicator Color | Status                  | Device Status Description                                                                                                                                                                                                                   |
|-----|-----------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Red             | Flashing very slowly    | The device's wiring exception occurs. Reconnect the cable.                                                                                                                                                                                  |
| 2   | Red             | Solid                   | <ul style="list-style-type: none"> <li>• The firmware update exception occurs. Reconnect the device or start acquisition again.</li> <li>• Exception occurs during device startup. Check the device power or network connection.</li> </ul> |
| 3   | Blue            | Flashing slowly         | The device is acquiring images in trigger mode.                                                                                                                                                                                             |
| 4   | Blue            | Flashing rapidly        | The device is acquiring images normally.                                                                                                                                                                                                    |
| 5   | Blue            | Solid                   | The device is in an idle status.                                                                                                                                                                                                            |
| 6   | Red and blue    | Flashing in alternative | The function of finding me is executed, or the firmware is updating.                                                                                                                                                                        |

## Chapter 5 Power Supply and Heat Dissipation

### 5.1 Device Power Supply

The device provides two ways of power supply: PoC (Power over Coaxial) power supply and external DC power supply.

When the external DC power supply and PoC power supply are executed at the same time, the DC power supply takes priority. If the DC power supply is disconnected, the device will switch to PoC power supply and may restart.

#### 5.1.1 PoC Power Supply

You can connect a coaxial cable to the device's XoCLink interface for power supply.

#### 5.1.2 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.

---

#### 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

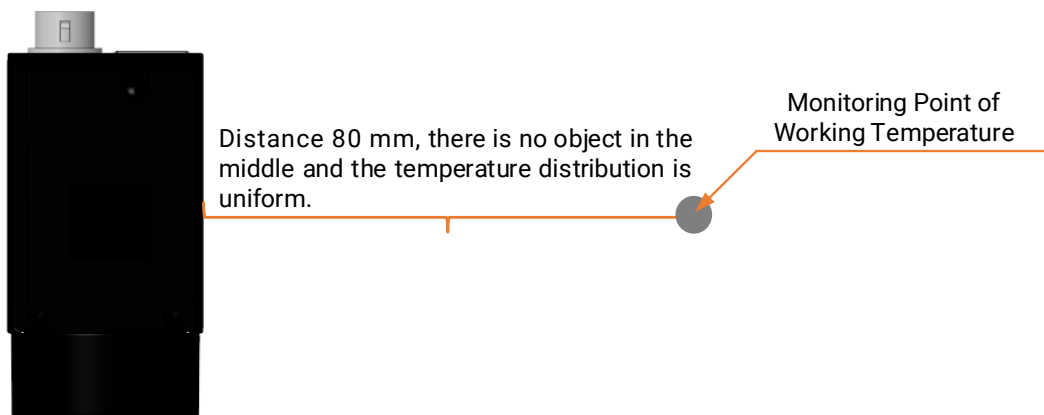
The device contains photosensitive components. If the device's temperature rises, it will have a certain impact on the quality of the acquired image. Based on the above situation, this section will introduce the temperature parameters and installation suggestions to achieve better heat dissipation effect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

### 5.2.1 Temperature Parameter

#### Working Temperature

The temperature of the key components of industrial cameras is a key factor affecting image quality, operation stability and long-term reliability. The upper limit of the working environment temperature in the specification of the industrial camera 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 monitoring point of the working environment temperature of the device is 80 mm away from the main housing of the device, as shown 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. If the on-site installation environment can add some heat dissipation measures, the temperature of electronic components can be reduced, and the image quality and reliability of the device can be further improved.



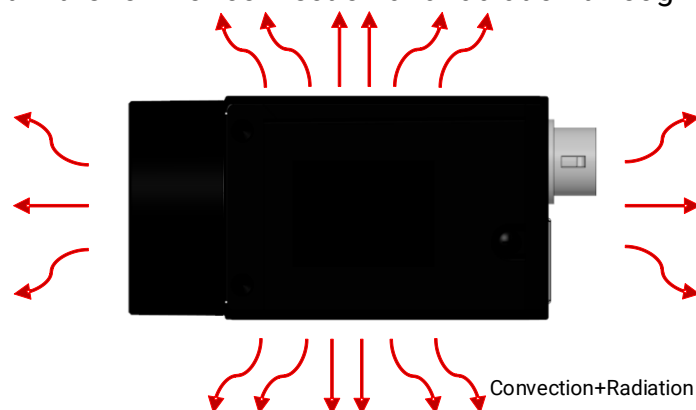
**Figure 5-1 Monitoring Point of Working Temperature**

### Housing Temperature

After the heat generated by the electronic components is conducted to the device's housing, if the device does not have any additional heat dissipation measures, the heat is dissipated to the external environment in the form of convection and radiation through the device's housing.

The temperature of the device's housing will gradually rise during the heat dissipation process, and when the thermal equilibrium state is finally reached, the temperature tends to be stable. 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.

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. Device's housing temperature is affected by power consumption, housing size, ambient temperature, and additional heat dissipation measures. Without additional heat dissipation measures, the temperature of the housing is the highest at this time. If some additional heat dissipation measures are added during field installation, the heat is dissipated to the external environment in the form of convection and radiation through the device's housing.



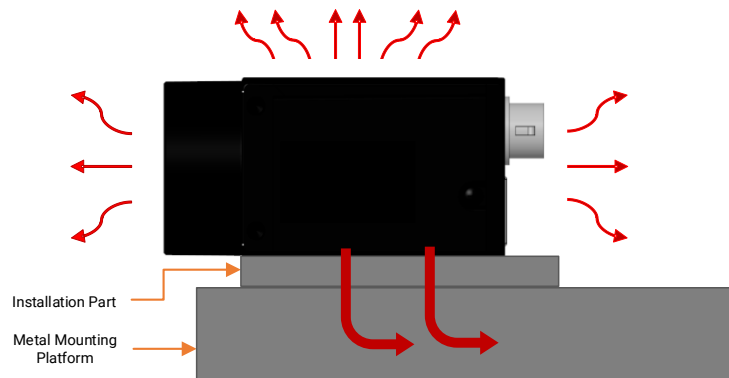
**Figure 5-2 Housing Temperature**

## 5.2.2 Heat Dissipation Measures

### 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.



**Figure 5-3 Heat Dissipation via Installation Part**

- **Installation Part Material**

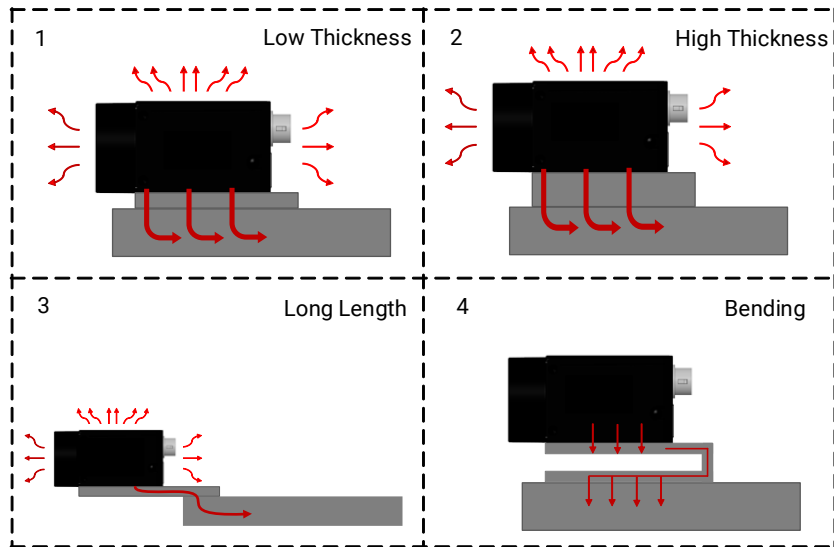
- Use materials with high heat conduction, such as aluminum and copper, which can quickly transfer heat away.
- At the same time, it is best to fix the installation part on the mounting platform of metal material to conduct heat to the metal parts and dissipate it.
- Minimize the use of materials with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

- **Heat Conduction Path**

- The heat conduction path of the installation part should be as short as possible to improve the heat conduction efficiency.
- The thickness, length, and bending of the installation part will affect the heat conduction path distance of the device.

As shown in the installation method 1 and 2 in figure below, the thickness of the installation part should be reduced as much as possible to shorten the heat conduction path from the device to the metal mounting platform via the installation part.

As shown in the installation method 3 and 4 in figure below, the extension of the length of the installation part and the use of bent metal will lead to the lengthening of the heat conduction path of the device.



**Figure 5-4 Heat Conduction Path of Different Installation Methods**

- **Installation Part Section**

The cross section area along the heat conduction direction should be as large as possible, so that the heat conduction resistance can be reduced. For some installation parts have to use extended or bent metal (as shown in installation methods 3 and 4 in figure above), the thickness of the sheet metal needs to be increased as much as possible to increase the cross section of the device heat conduction path and strengthen the heat conduction.

- **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. The flatness of the installation part should be within 0.1 mm, in case the actual contact surface is not completely close, affecting the heat dissipation effect.

### Heat Dissipation via Cooling Fan

For cases where the installation parts are made of plastic and other materials with poor heat conduction, ventilation equipment such as cooling fans and air conditioners can be used to increase the air flow on the surface of the device and reduce the air temperature around the device, thereby enhancing the convective heat dissipation of the device into the air.

### 5.2.3 Low Heat Conduction Material

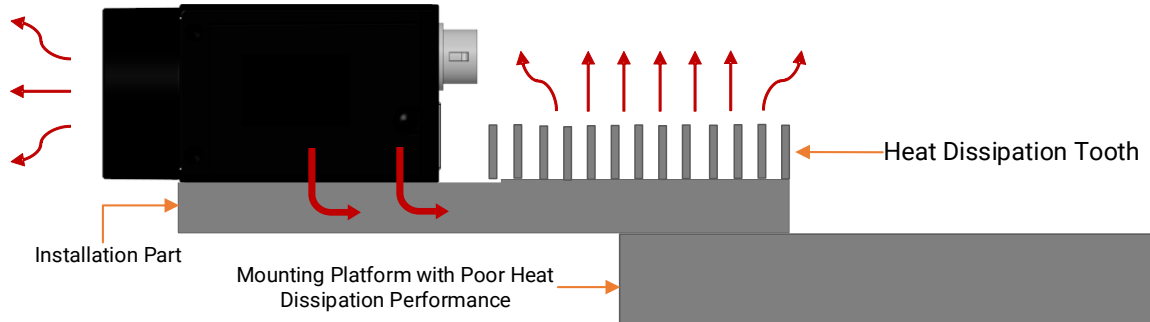
If the mounting platform is made of materials with very poor heat conduction such as plastic and wall, heat dissipation can be improved in the following ways:

- **Increase the surface area of the installation part.**

If the installation part is in good contact with the device, it can be regarded as a part of the device's housing. The larger the heat dissipation area of the housing, the better the

heat dissipation effect. Therefore, the larger the surface area of the installation part, the better the heat dissipation effect.

- The installation part can be made into a metal heat dissipation tooth shape, or a large area flat plate to improve the heat dissipation effect.



**Figure 5-5 Add Heat Dissipation Tooth**

- The surface of the installation part should be in contact with air as much as possible, not with a mounting platform with poor heat conduction.
- While increasing the heat dissipation area of the installation part, painting and oxidation can be used to increase the radiation heat exchange of the installation part to the external environment and strengthen the heat dissipation of the device.

## Chapter 6 Accessories

### 6.1 Lens

#### 6.1.1 Lens Mount

The device supports standard C-mount and M12-mount lenses. The thread depth of C-mount lens is not less than 7 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: 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.

---

#### 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

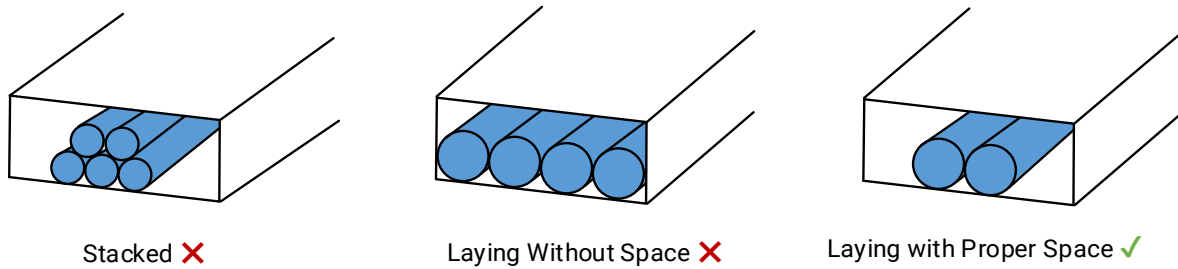
According to the cable performance, it can be divided into standard, flexible, high flexible, and super flexible cables. You need to select cables according to different scenarios.

- 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

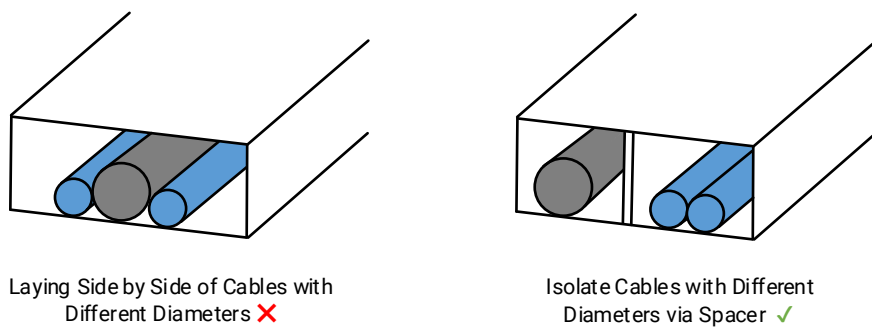
Regarding the power and I/O cable and coaxial cable, attention should be paid to the application requirements of scenarios such as high-frequency communication and high-frequency motion. In such scenarios, if the cables are arranged in an inappropriate manner, various problems may be caused in use, such 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.



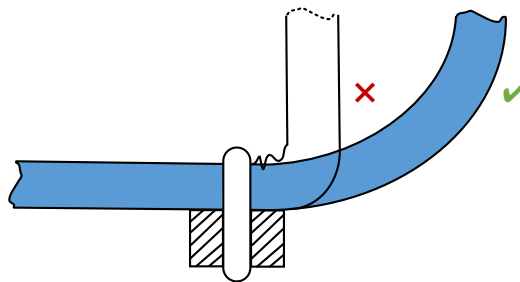
**Figure 6-1 Cable Laying**

- 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.



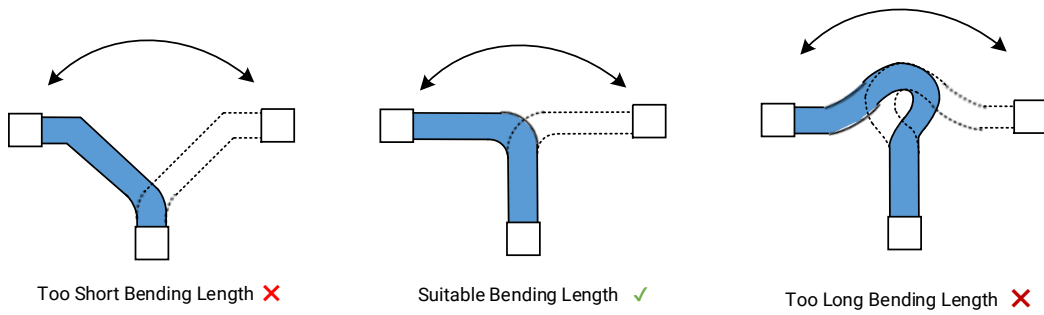
**Figure 6-2 Isolated via Spacer**

- 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.



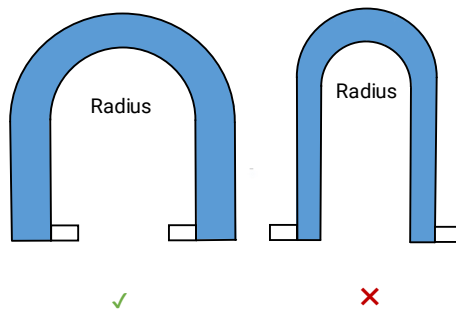
**Figure 6-3 Vertically Bended Prohibited**

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



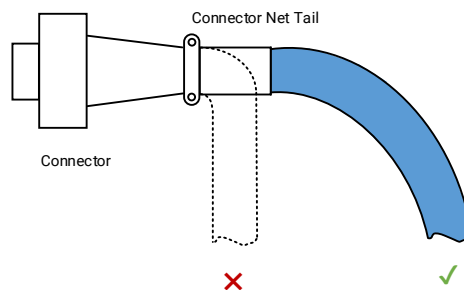
**Figure 6-4 Suitable Bending Length**

- Please keep a sufficient bending radius.



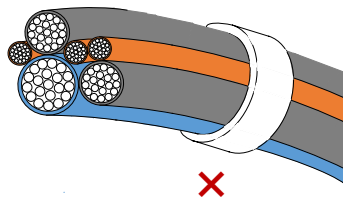
**Figure 6-5 Sufficient Bending Radius**

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



**Figure 6-6 Assemble Connector**

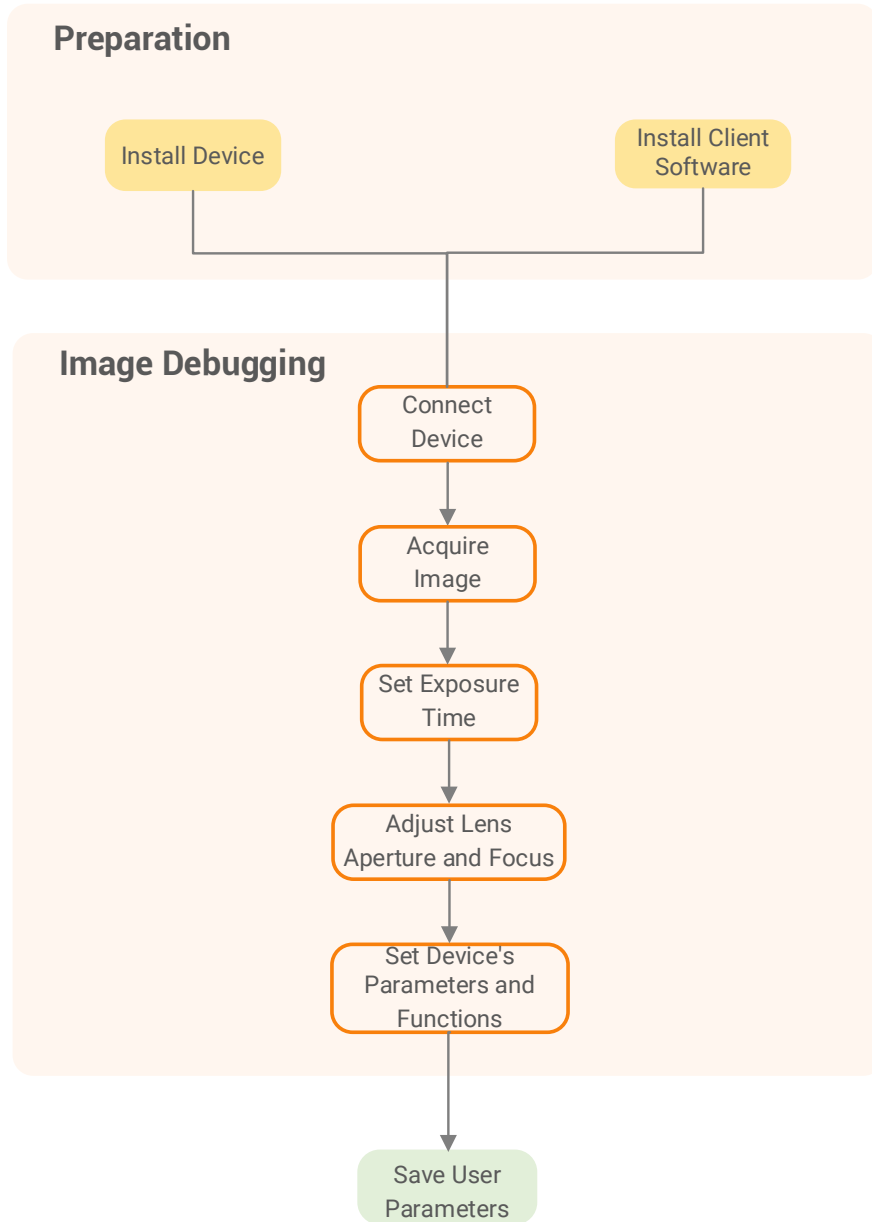
- Do not bind cables of different diameters together.



**Figure 6-7 Improper Binding**

## Chapter 7 Quick Start Guide

The overall workflow of using the device is shown below:



**Figure 7-1 Workflow**

## 7.1 Device Installation

### 7.1.1 Installation Preparation

You need to prepare following accessories before device installation.

**Table 7-1 Accessories**

| No. | Name                | Quantity | Description                                                                                                                                                                                                                                              |
|-----|---------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Frame Grabber       | 1        | It refers to the self-developed YoCLink coaxial frame grabber. You need to purchase separately.                                                                                                                                                          |
| 2   | Power and I/O Cable | 1        | It refers to the 8-pin M8 A-Code power and I/O cable. You need to purchase separately.<br> <b>Note</b><br>Refer to device's specification for details of I/O connector. |
| 3   | DC Power Supply     | 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.                                                                                                 |
| 4   | Coaxial Cable       | 1        | It refers to the YoCLink coaxial cable. You need to purchase separately.                                                                                                                                                                                 |
| 5   | Lens                | 1        | It refers to the lens that is suitable for the device. You need to purchase separately.                                                                                                                                                                  |
| 6   | Lens Adapter        | 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**

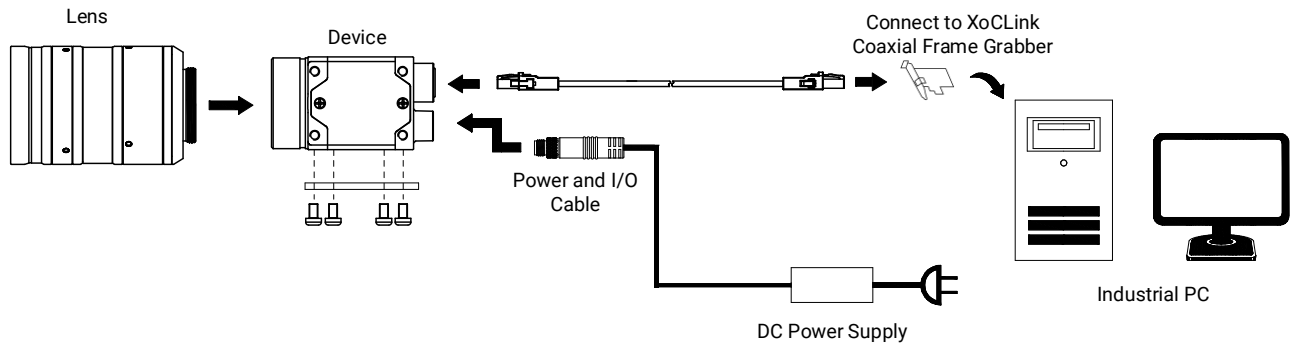
- The device mentioned in this manual is an electronic product that requires operation and storage under dry conditions. In case of hot and humid, acidic and alkaline environment, please take isolation and protection measures to avoid corrosion damage of the device's internal components.
- For proper and safe device operation, make sure the DC power supply or adapter provides a 24 V output.
- When using the lens, it is necessary to prevent humid environment and avoid steam from entering inside, causing fogging.

### 7.1.2 Install Device

The topology diagram of the device is shown below.

## Note

The topology diagram is for reference only.



**Figure 7-2 Topology Diagram of Device**

### Before You Start

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

### Steps

1. Fix the device to the installation position, select an appropriate lens, and install the lens on 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](#) in the device manual for details.

2. Use the coaxial cable to connect the device to the XoCLink coaxial frame grabber.
3. Use one of the following methods for power supply.
  - Direct plug-in power supply: Use the 8-pin M8 A-Code power and I/O cable to connect device to a proper power adapter. Refer to section [Power and I/O Connector](#) for details.
  - PoC power supply: It is valid for the devices that support the PoC function only. You can use the coaxial cable to connect the device to XoCLink coaxial frame grabber. Refer to the device's specification for PoC information.

## 7.2 Install Client Software

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

## Note

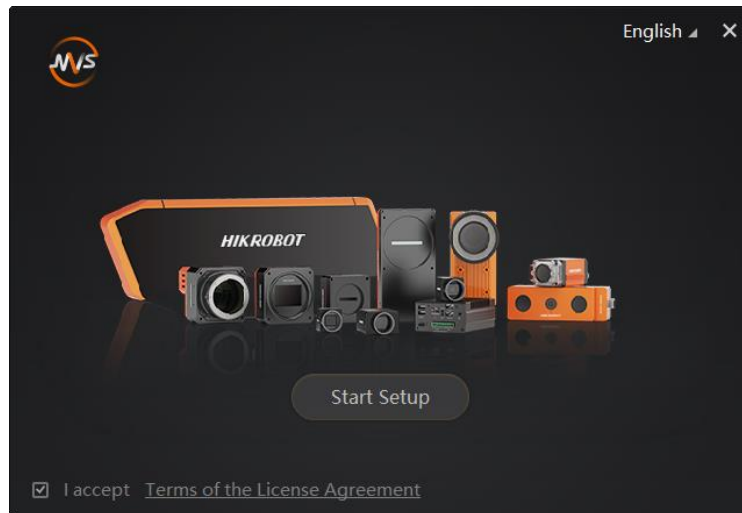
- The MVS client software is compatible with 32/64-bit Windows 7/10, 64-bit Windows 11, and 32/64-bit Linux operating systems. Here we take Windows as an example.
- The graphic user interface may differ by different versions of the client software you

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 7-3 Installation Interface**

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 **PCle-CML**, **PCle-CXP**, **PCle-GEV**, **PCle-XoF** to enumerate the corresponding frame grabbers.

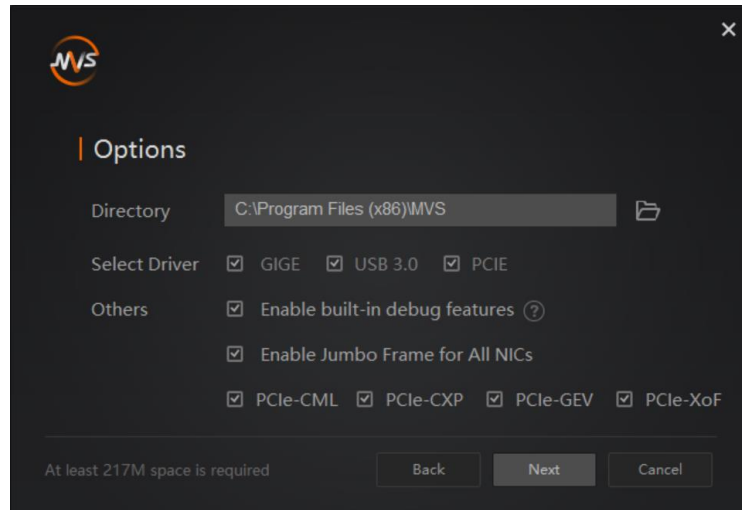


Figure 7-4 Installation Options

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### Note

- Regarding options, it is recommended to keep default settings.
  - **PCle-CML, PCle-CXP, PCIE-GEV, PCIE-XoF** can be checked only when **PCIE** is selected.
  - **PCle-CML, PCle-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

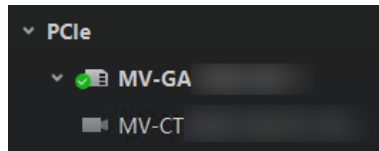
After the client software is installed, you can connect the device and set related parameters. Refer to the ***MVS Client Software User Manual*** for more details.



Figure 7-5 MVS Client Software User Manual

### Steps

1. Run the MVS client software.
2. Click  in **PCle** 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.

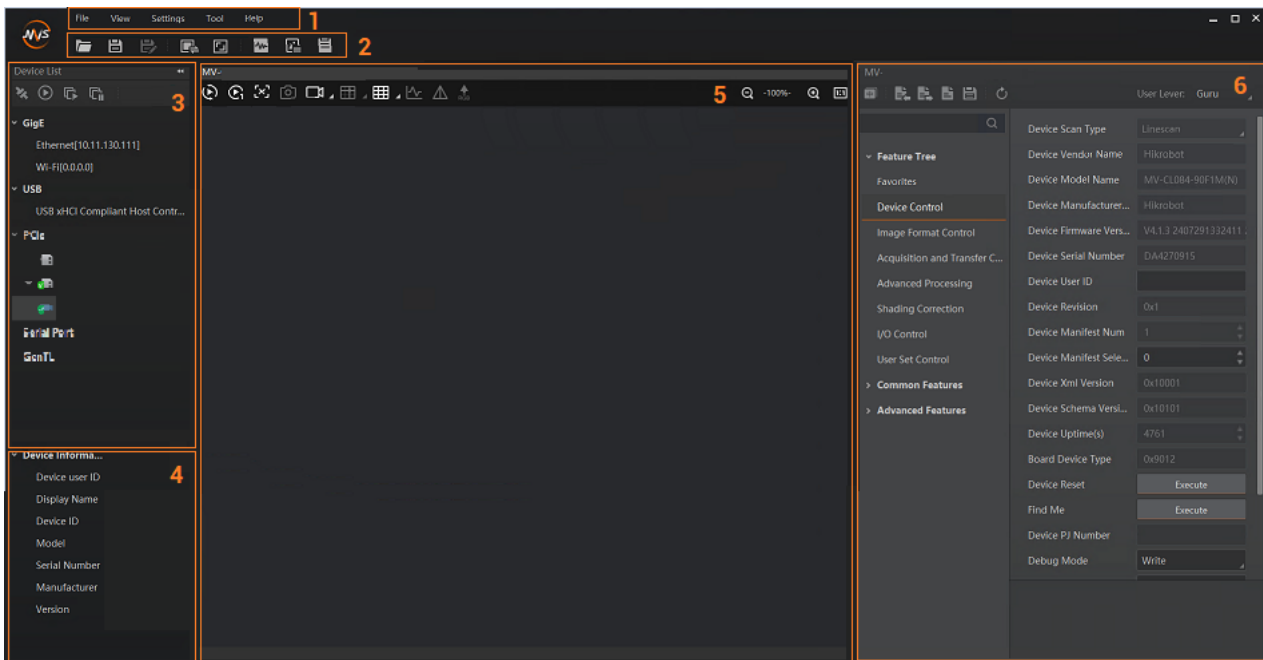


**Figure 7-6 Connect Device to Client Software**

## Note

The image is for reference only.

4. Double-click the device name, 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 or                                                                                                    |

| No. | Name                     | Description                                                                                          |
|-----|--------------------------|------------------------------------------------------------------------------------------------------|
|     |                          | 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.

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# Chapter 8 I/O Electrical Features and Wiring

## 8.1 I/O Electrical Features

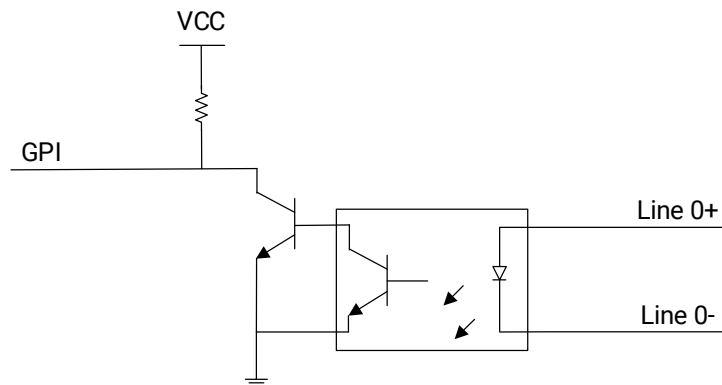
The device has one opto-isolated input signals, one opto-isolated output signals, and two bi-directional non-isolated I/O signals.

### 8.1.1 Input Signal

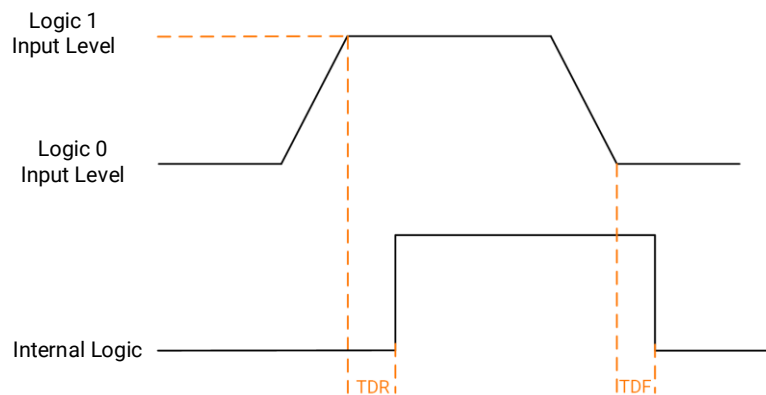
The internal circuit of opto-isolated input (Line 0) is as follows.

#### 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 is 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 is shown below.

**Table 8-2 Input Electrical Feature**

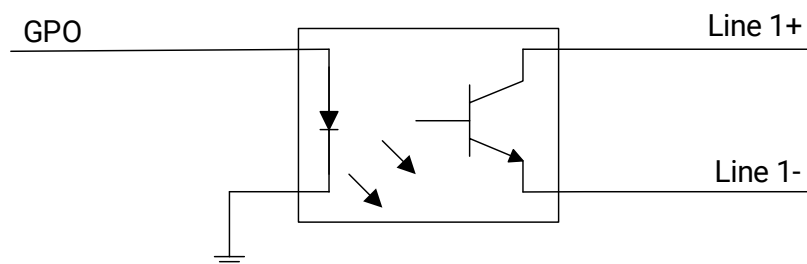
| Parameter Name         | Parameter Symbol | Value                        |
|------------------------|------------------|------------------------------|
| Input Logic Level Low  | VL               | 0 VDC to 1 VDC               |
| Input Logic Level High | VH               | 3.3 VDC to 24 VDC            |
| 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

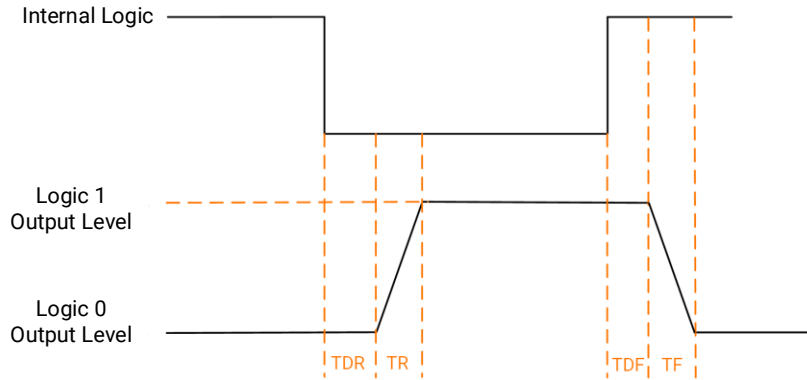
The internal circuit of opto-isolated output (Line 1) is as follows.

### 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 is 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 is shown below.

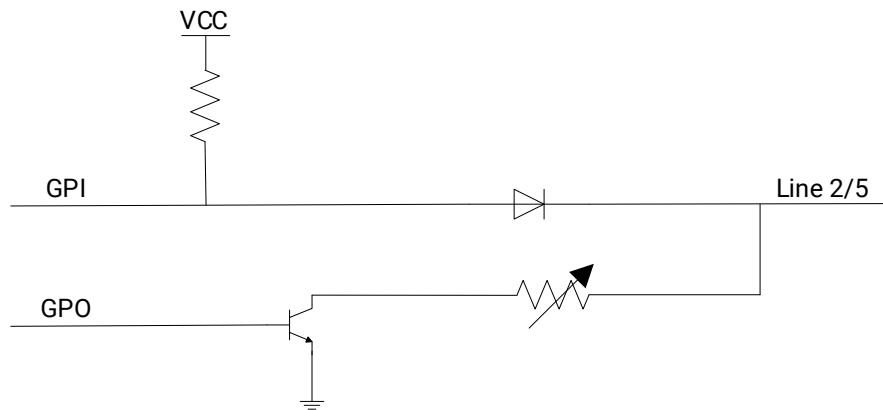
**Table 8-4 Output Electrical Feature**

| 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   |

### 8.1.3 Bi-Directional Signal

The device has two bi-directional non-isolated I/O signals (Line 2/5), and you can set them

as input signal or output signal according to demands. Its internal circuit is as follows.



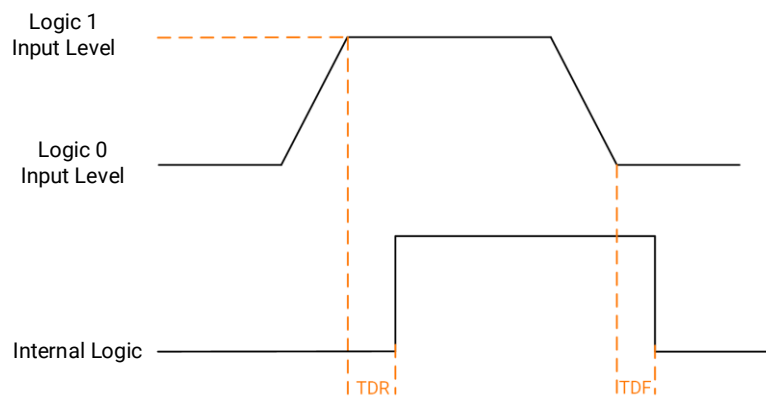
**Figure 8-5 Internal Circuit of Bi-Directional Signal**

### 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 2/5.

The logic level and electrical feature when Line 2/5 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 8-5 Input Electrical Feature**

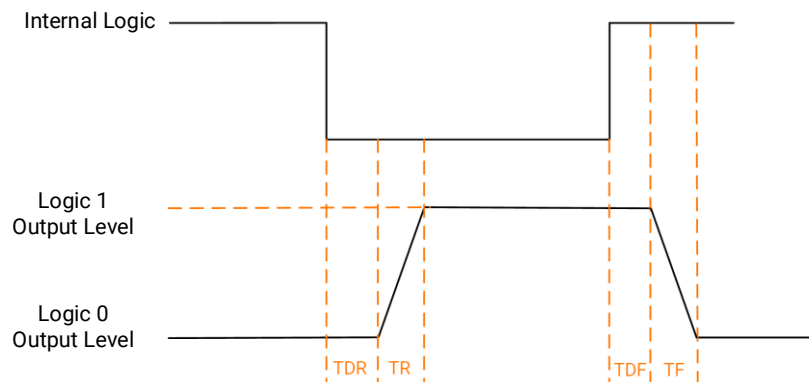
| Parameter Name         | Parameter Symbol | Value             |
|------------------------|------------------|-------------------|
| Input Logic Level Low  | VL               | 0 VDC to 1 VDC    |
| Input Logic Level High | VH               | 3.3 VDC to 24 VDC |
| Input Rising Delay     | TDR              | < 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 logic level and electrical feature when Line 2/5 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 K $\Omega$ , the electrical features of output is shown below.

**Table 8-6 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 $\mu$ s to 0.9 $\mu$ s |
| 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 K $\Omega$ , the electrical features of output is shown below.

**Table 8-7 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 $\mu$ s to 4.48 $\mu$ s |
| 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 8-8 Factors Affecting Transmission Delay of I/O Lines**

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

- The appearance here is for reference only, and the actual device you purchased shall prevail.
  - The orange arrow in the wiring diagram indicates the direction of current after wiring.
- 

### 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.

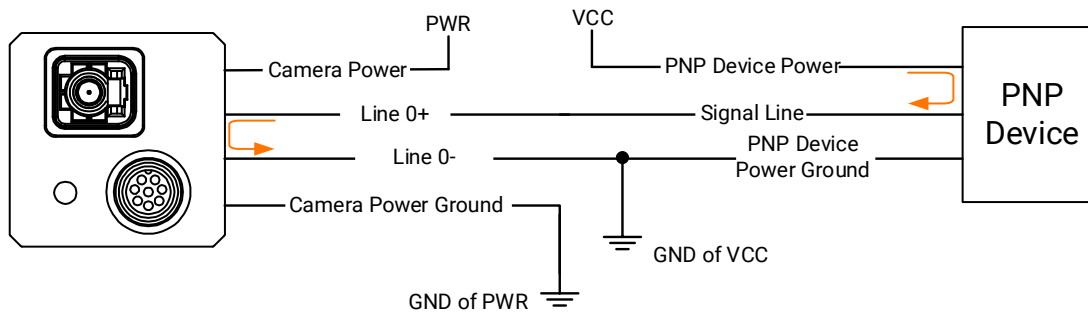
---

#### Note

Input signal wiring may differ by the external device type.

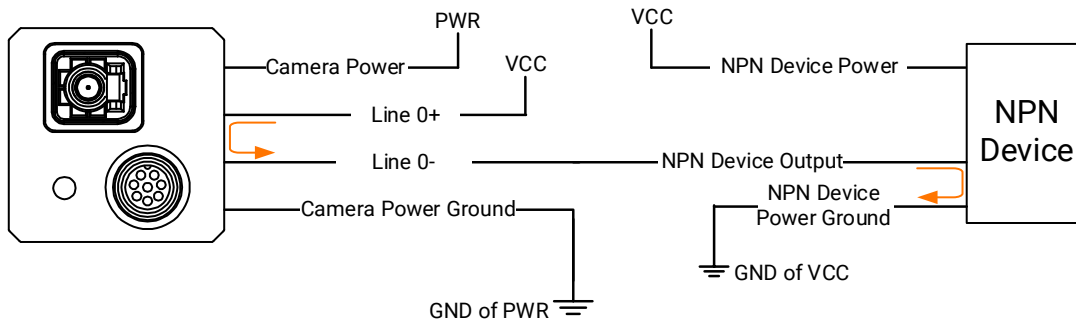
---

## PNP Device



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

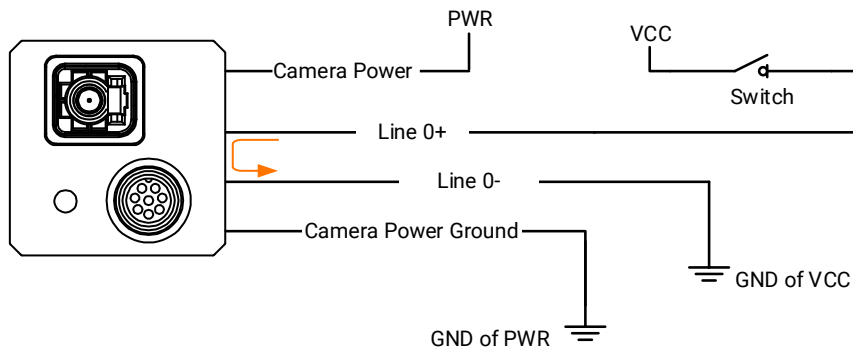
## NPN Device



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

## Switch

If the VCC of switch is 24 VDC, it is recommended to connect 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

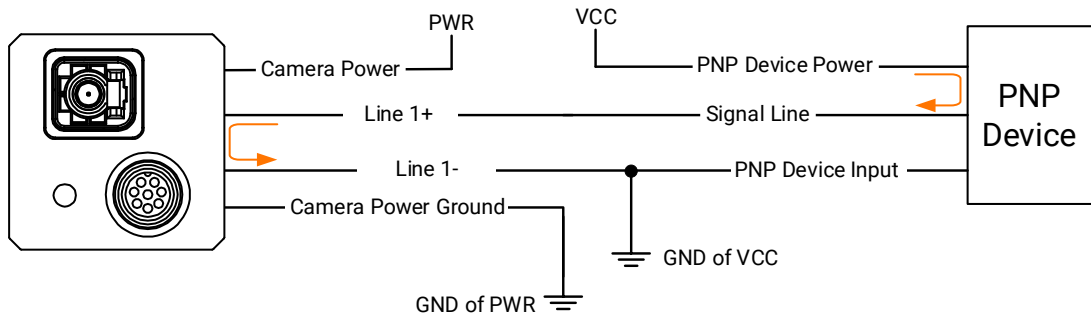


Figure 8-11 Output Signal Connects to PNP Device

#### NPN Device

- If the pull-up resistor is not used, the recommended wiring is shown below.

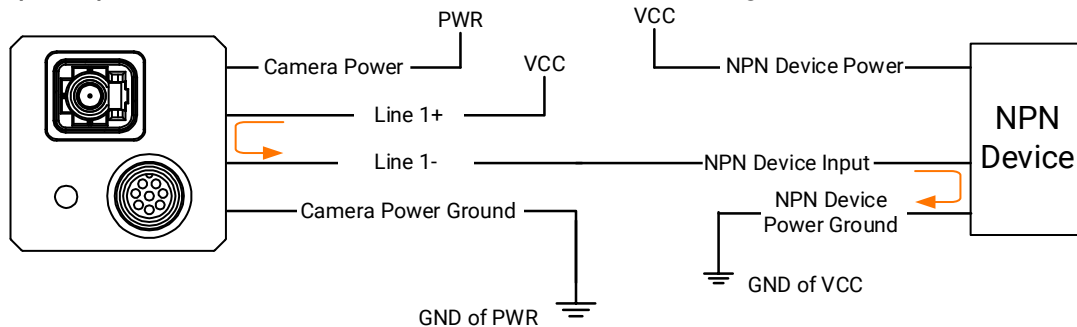


Figure 8-12 Output Signal Connects to NPN Device (Pull-Up Resistor Not Used)

- 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.

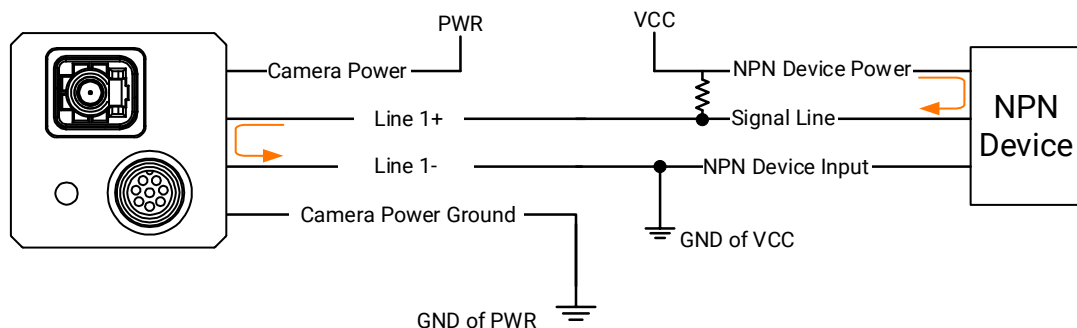


Figure 8-13 Output Signal Connects to NPN Device (Pull-Up Resistor Used)

### 8.2.3 Bi-Directional Signal Wiring

The device's Line 2/5 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 2/5 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.

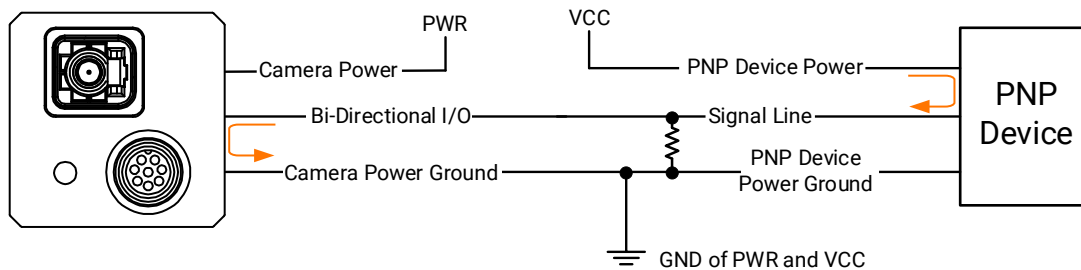


Figure 8-14 Input Signal Connects to PNP Device

#### Note

When connecting to PNP device, line 0 as the input is recommended. It is not recommended to use Line 2/5 as the input, which will cause the device to overheat severely.

#### 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.

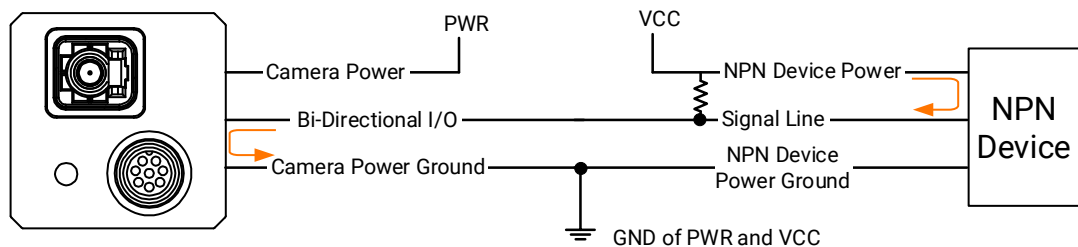
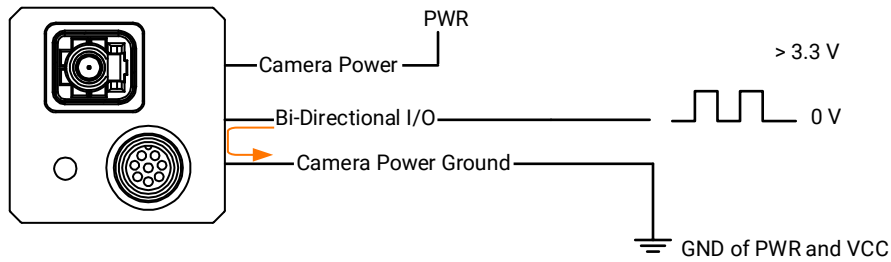


Figure 8-15 Input Signal Connects to NPN Device

## Switch

The switch value can provide low electrical level to trigger Line 2/5.



**Figure 8-16 Input Signal Connects to Switch**

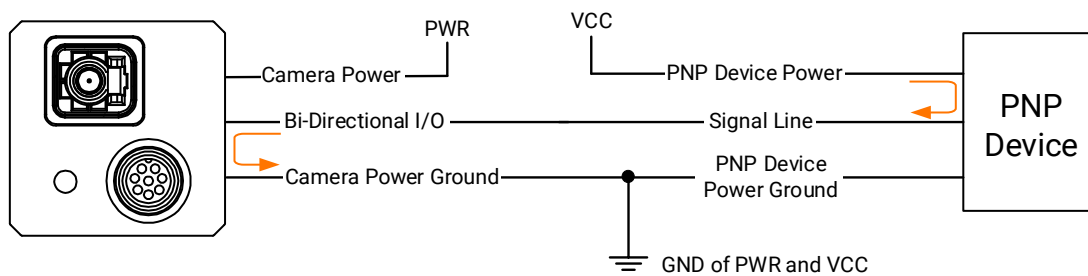
## Configured as Output Signal

The output signal wiring is shown below when the device's Line 2/5 is configured as the output signal.

### Note

Output signal wiring may differ by the external device type.

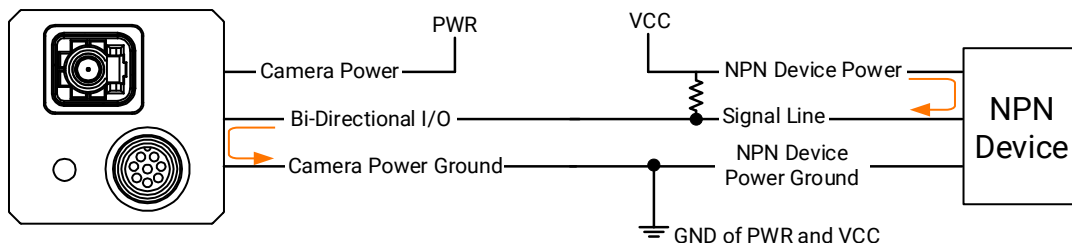
## PNP Device



**Figure 8-17 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 8-18 Output Signal Connects to NPN Device**

# Chapter 9 Trigger Input and Output

## 9.1 Trigger Input

The input settings allow you to configure the trigger-related parameters. You can enable trigger mode to let the acquisition of image data occur only when the trigger source is generated.

### 9.1.1 Set Trigger Mode

The device supports 4 trigger modes, including internal trigger mode, external trigger mode, exposure start mode, and exposure end mode.

**Table 9-1 Trigger Mode Description**

| Trigger Mode          | Trigger Selector Parameter | Trigger Mode Parameter | Description                                                                                                                                                                                                                                   |
|-----------------------|----------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal Trigger Mode | Frame Burst Start          | Off                    | In this mode, the device acquires images via its internal signals.                                                                                                                                                                            |
| External Trigger Mode |                            | On                     | In this mode, the device acquires images via external signals like software signal and hardware signal. The trigger source of external trigger mode includes multiple modes. Refer to section <a href="#">Set Trigger Source</a> for details. |
| Exposure Start Mode   | Exposure Start             | On                     | In this mode, the device starts exposure via external signals like software signal and hardware signal. The trigger source of external trigger mode includes multiple modes. Refer to section <a href="#">Set Trigger Source</a> for details. |
|                       |                            | Off                    |                                                                                                                                                                                                                                               |
| Exposure End Mode     | Exposure End               | On                     | In this mode, the device ends exposure via external signals like software signal and hardware signal. The trigger source of external trigger mode includes multiple modes. Refer to section <a href="#">Set Trigger Source</a> for details.   |
|                       |                            | Off                    |                                                                                                                                                                                                                                               |

#### Note

If the shutter mode of the device is rolling shutter, you need to enable Global Reset function first, and then set **Exposure Start Mode** and **Exposure End Mode**. Refer to section [Rolling Shutter](#) for more details.

## 9.1.2 Set Trigger Source

### External Trigger Source

Go to **Acquisition Control** → **Trigger Source**, and select **Trigger Source** according to actual demands. Refer to the table below to see the supported trigger sources.

**Table 9-2 Trigger Source Description**

| External Trigger Source | Parameter                  | Description                                                                                                                        |
|-------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Software Trigger        | Software<br>Software1/2/3  | The software sends trigger signal to the device via data interface to acquire images.                                              |
| Hardware Trigger        | Line 0<br>Line 2<br>Line 5 | External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images. |
| Link Trigger            | LinkTrigger 0              | The frame grabber sends trigger signal to the device to acquire images.                                                            |

#### 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 to acquire images.

#### Steps

1. Go to **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Software** or **Software1/2/3** as **Trigger Source**.
3. If **Software** is selected, you can click **Execute** in **Trigger Software** to execute software trigger.
4. If **Software1/2/3** is selected, you can click **Execute** in **Trigger Software** to execute software trigger or go to **Software Signal Control** → **Software Signal Selector** to select the signal source consistent with that in **Trigger Source**, and click **Execute** in **Software Signal Trigger** to trigger the signal source.

#### Note

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in the 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/Line 2/Line 5** as **Trigger Source** according to actual demands.

The device has one opto-isolated input (Line 0), and two bi-directional I/O signals (Line 2/Line 5) that can be configured as input signal. Follow the steps below to make sure that Line 2/Line 5 is input signal if you want to use it as trigger source.

### Steps

1. Go to **Digital IO Control** and select **Line 2/Line 5** as **Line Selector**.
2. Select **Input** as **Line Mode**.

---

### Note

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

---

## Set and Execute Link Trigger

In link trigger, the 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**.

---

### Note

- Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in the 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, trigger arm delay, 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**

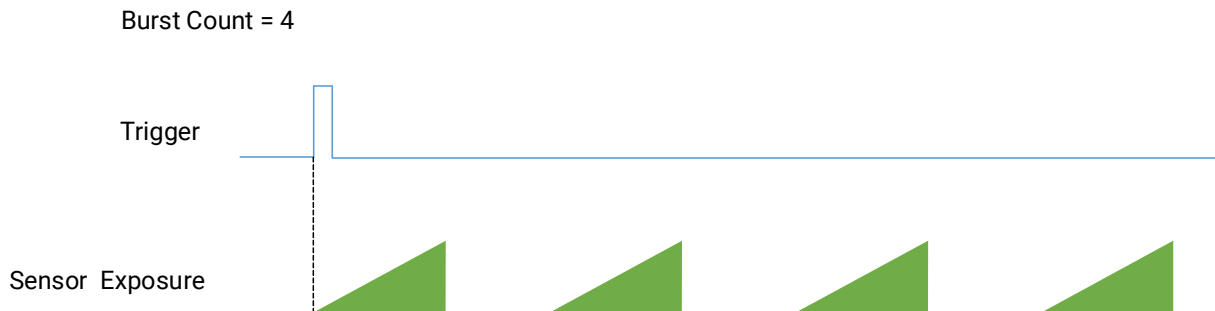
| Trigger Source<br>Trigger Parameters | Software<br>Trigger | Hardware<br>Trigger | Link Trigger |
|--------------------------------------|---------------------|---------------------|--------------|
| Acquisition Burst Frame Count        | √                   | √                   | √            |
| Trigger Delay                        | √                   | √                   | √            |
| Trigger Cache                        | √                   | √                   | √            |
| Trigger Activation                   | ×                   | √                   | ×            |
| Trigger Arm Delay                    | ×                   | √                   | ×            |
| Trigger Debouncer                    | ×                   | √                   | ×            |

## 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.

### Note

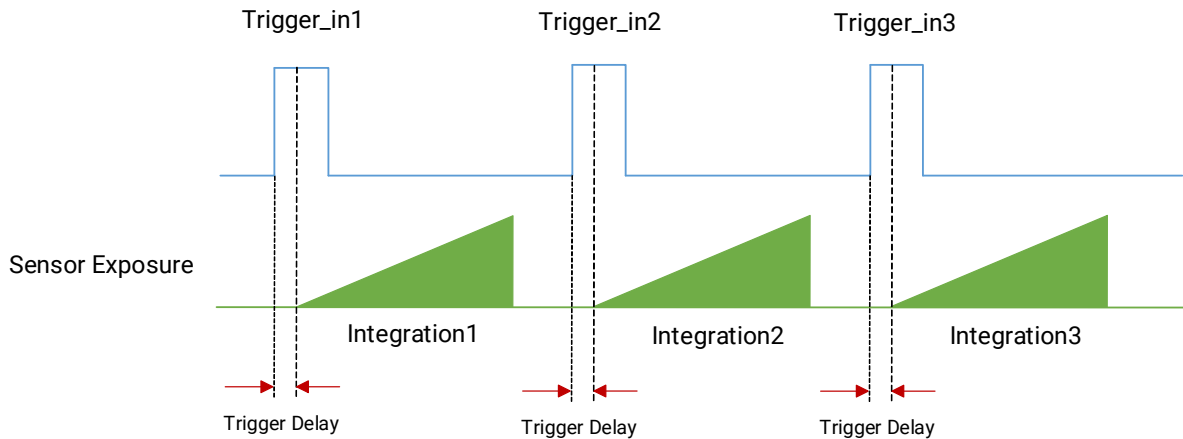
- If **Acquisition Burst Frame Count** is 1, the device is in single frame trigger mode. If **Acquisition Burst Frame Count** is larger than 1, the device is in multi-frame trigger mode.
- If **Acquisition Burst Frame Count** is n, when input 1 trigger signal to the device, the device stops acquiring images after exposing n times and outputting n frame images.
- The sequence diagram below uses rising edge as trigger activation.


**Figure 9-1 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 is  $\mu\text{s}$ .



**Figure 9-2 Sequence Diagram of Trigger Delay**

---

### **Note**

The sequence diagram above uses rising edge as trigger activation.

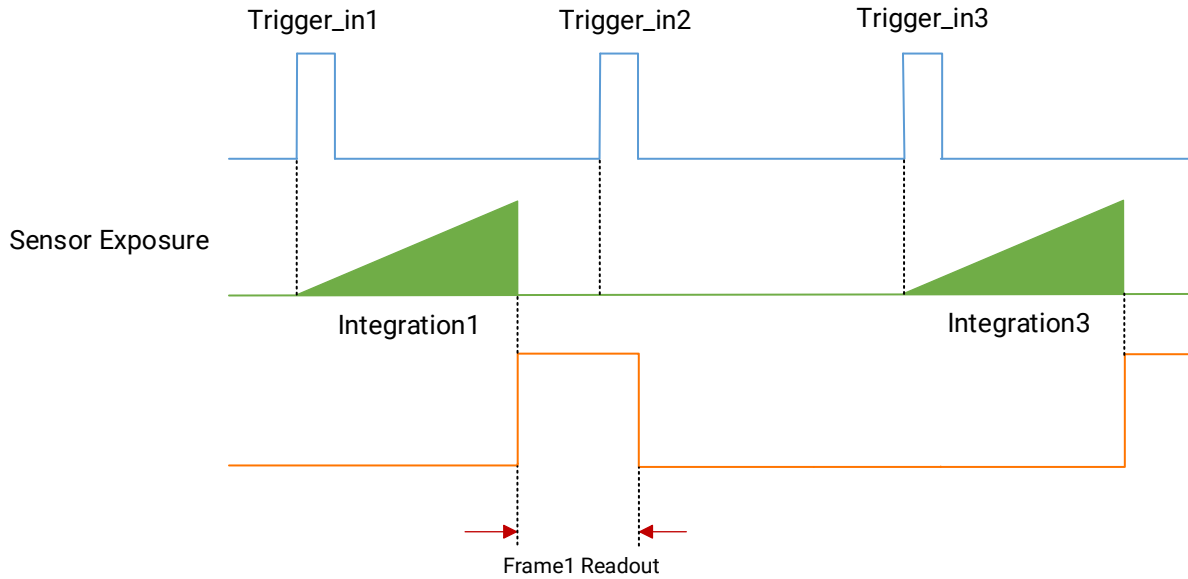
---

## 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**.

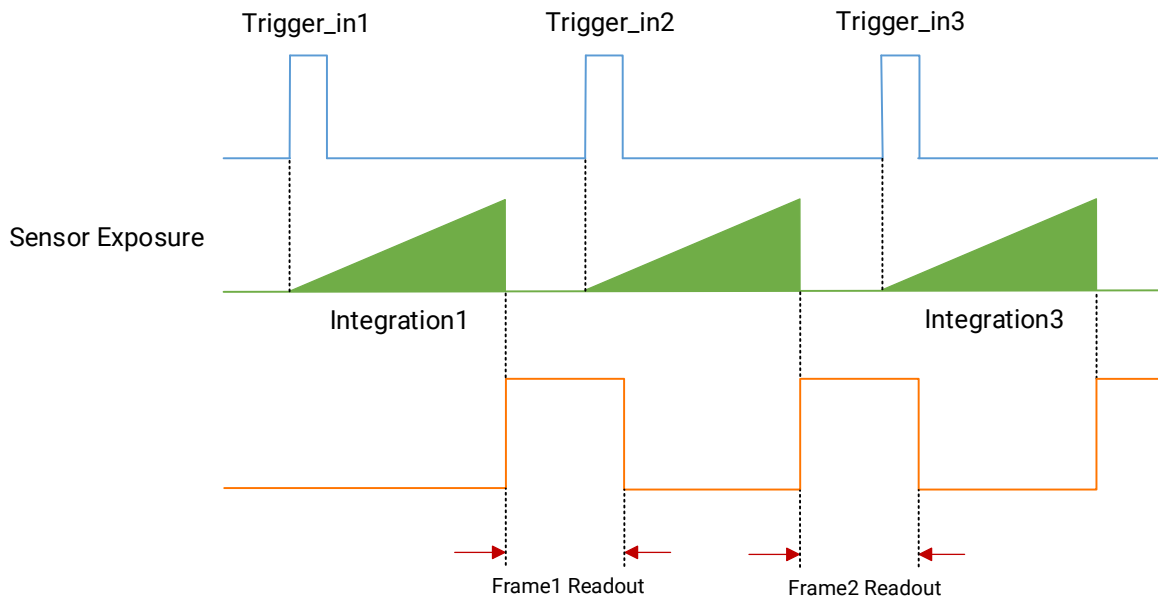
For example, if the device receives the 2nd trigger signal when it is processing the 1st trigger signal, and the result will be different depending on whether **Trigger Cache Enable** is enabled or not.

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



**Figure 9-3 Second Frame Filtered**

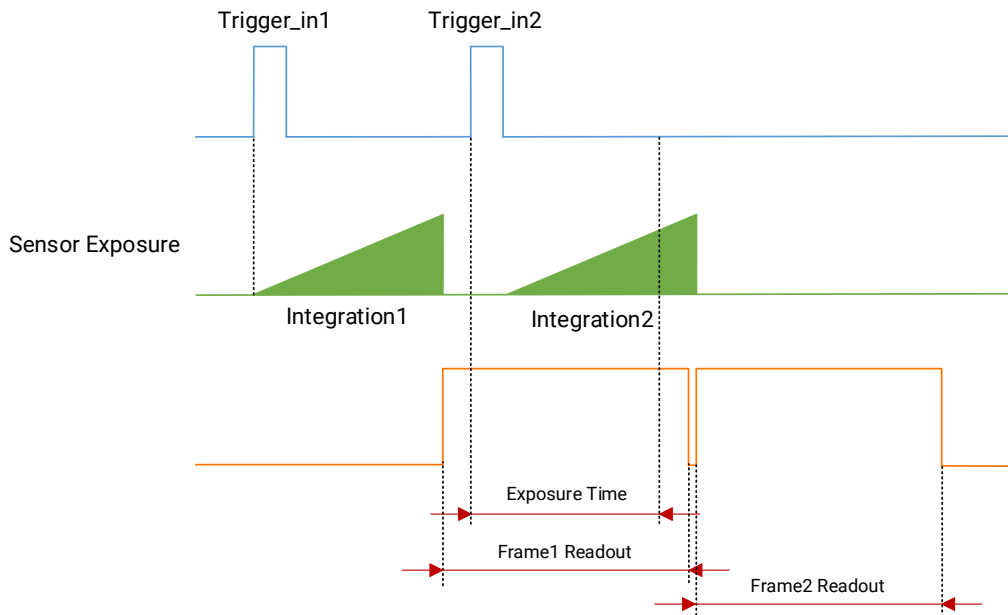
- The 2nd trigger signal will be saved if **Trigger Cache Enable** is enabled.
  - If the 1st frame image's exposure time of the 2nd trigger signal is not earlier than the device's last frame creation time of the 1st trigger signal, and then the 2nd trigger signal's 1st frame image is created normally.



**Figure 9-4 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 9-5 Sequence Diagram**

---

### Note

The 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.

---

### Note

The trigger activation mode may differ by the trigger mode.

---

## Set Trigger Arm Delay

The function allows the device to only respond to the first received trigger signal within the configured time period and ignore all subsequent signals.

Go to **Digital IO Control** → **Line Trigger Arm Delay(μs)**, and enter **Line Trigger Arm Delay** according to actual demands.

## 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.

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

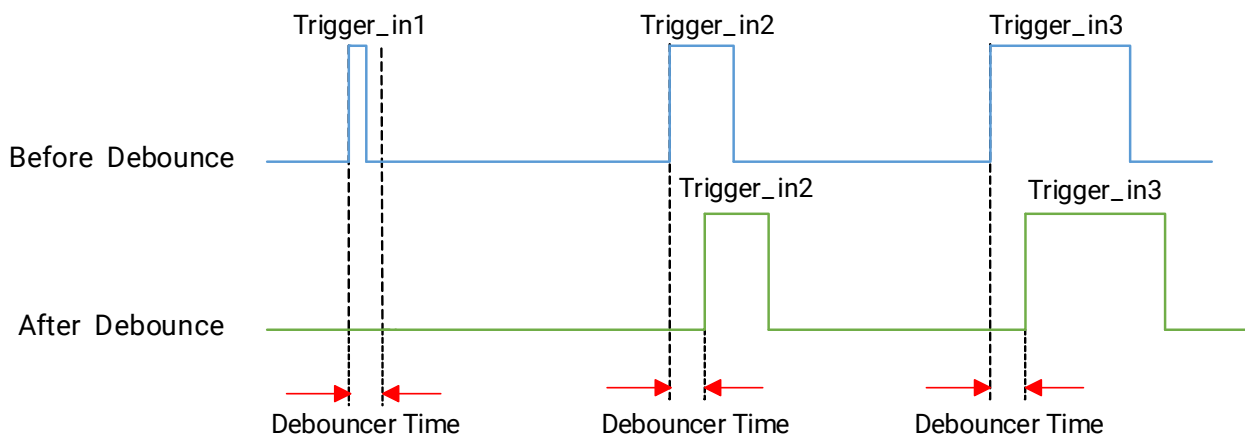


Figure 9-6 Sequence Diagram of Trigger Debouncer

### Note

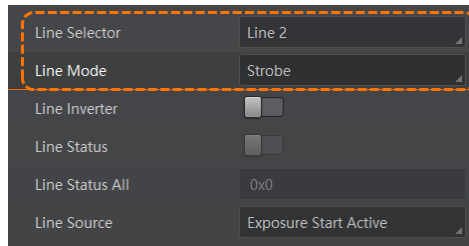
- The sequence diagram above uses rising edge as trigger activation.
- When you use the trigger debouncer function, there may be a delay in the signal.

## 9.2 Trigger Output

The device has one opto-isolated output (Line 1), and two bi-directional I/O signals (Line 2/Line 5) 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/Line 5** as **Line Selector**.
2. Set **Strobe** as **Line Mode**.

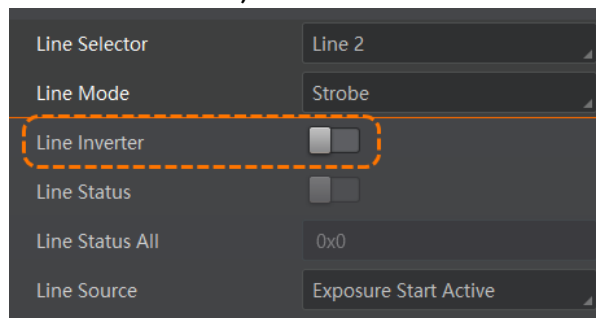


**Figure 9-7 Select Output Signal**

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 9-8 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**.

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.              |

---

 **Note**

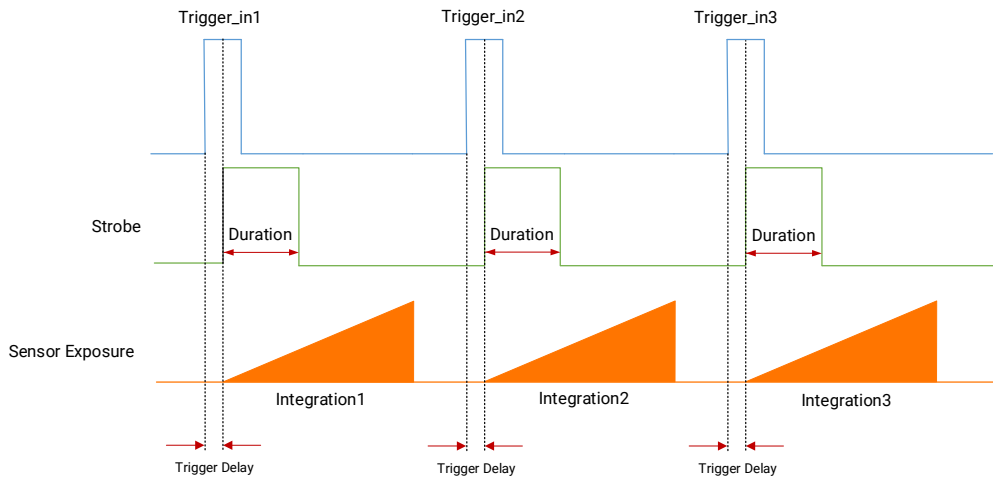
The specific line sources may differ by device models.

---

### 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 9-9 Sequence Diagram of Strobe Line Duration**

## Note

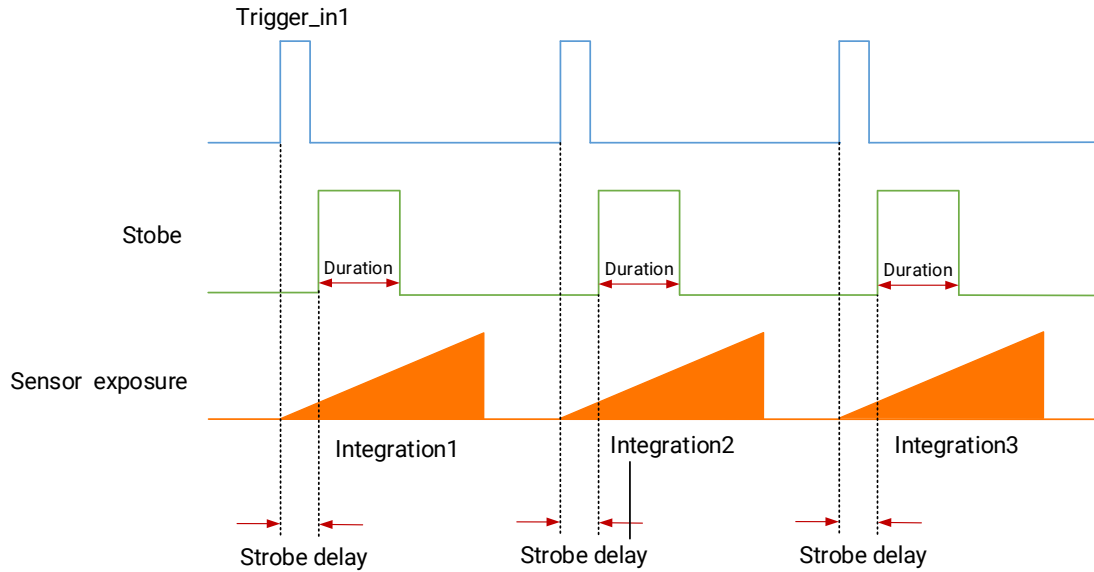
- When **Strobe Line Duration** value is 0, the strobe duration is equal to the exposure time.
- When **Strobe Line Duration** value is not 0, the strobe duration is the value you set.

## 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  $\mu\text{s}$  to 10000  $\mu\text{s}$ .

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.

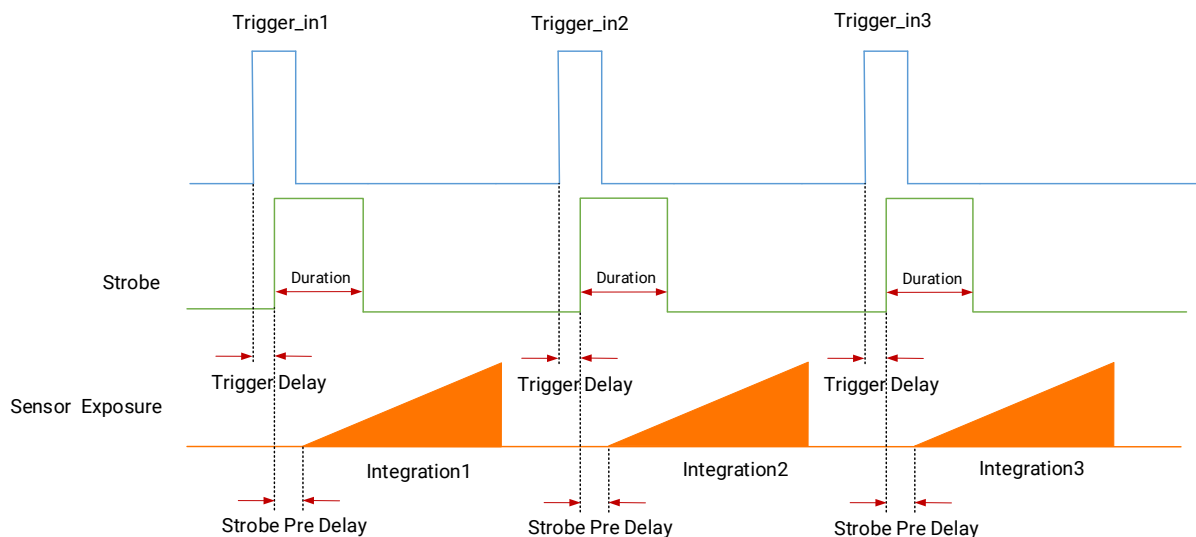


**Figure 9-10 Sequence Diagram of Strobe Line Delay**

## 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. 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 9-11 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.

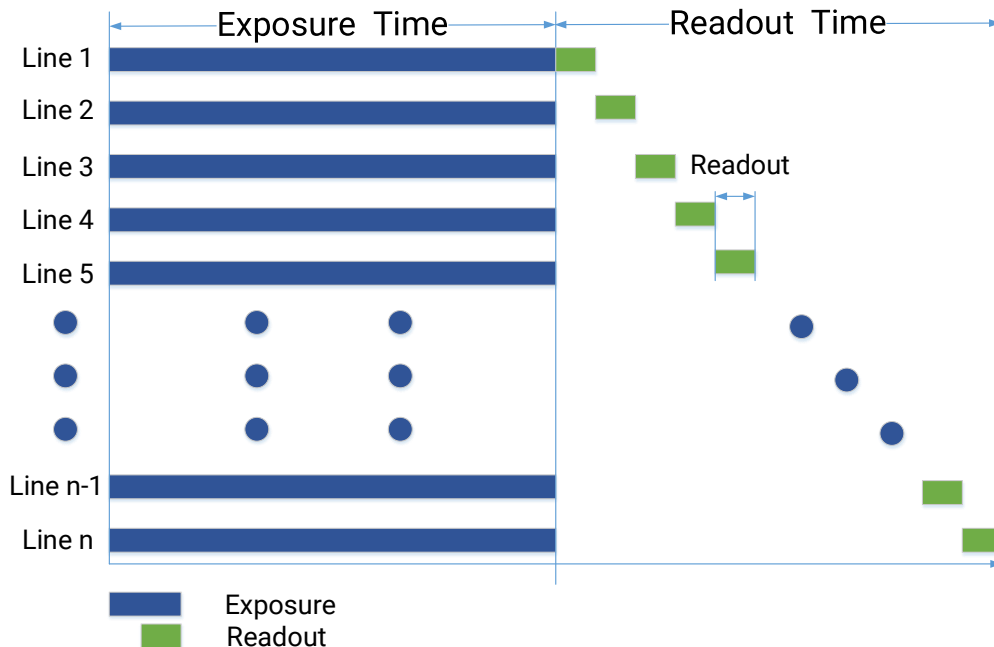


Figure 10-1 Global Shutter

### 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.

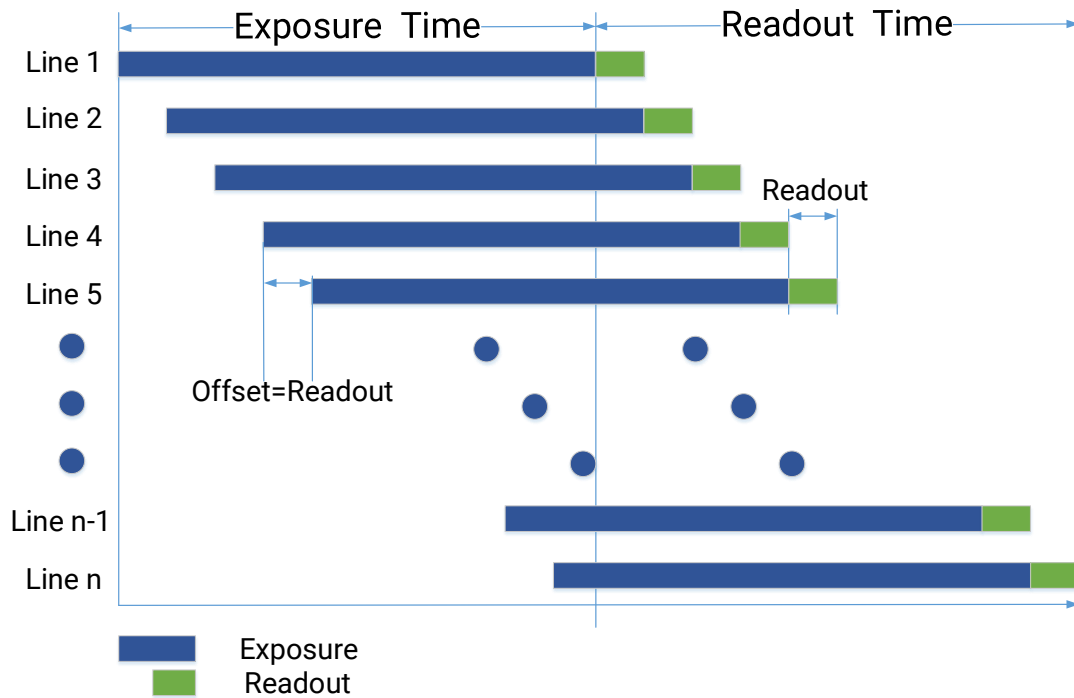


Figure 10-2 Rolling Shutter

## Global Reset

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

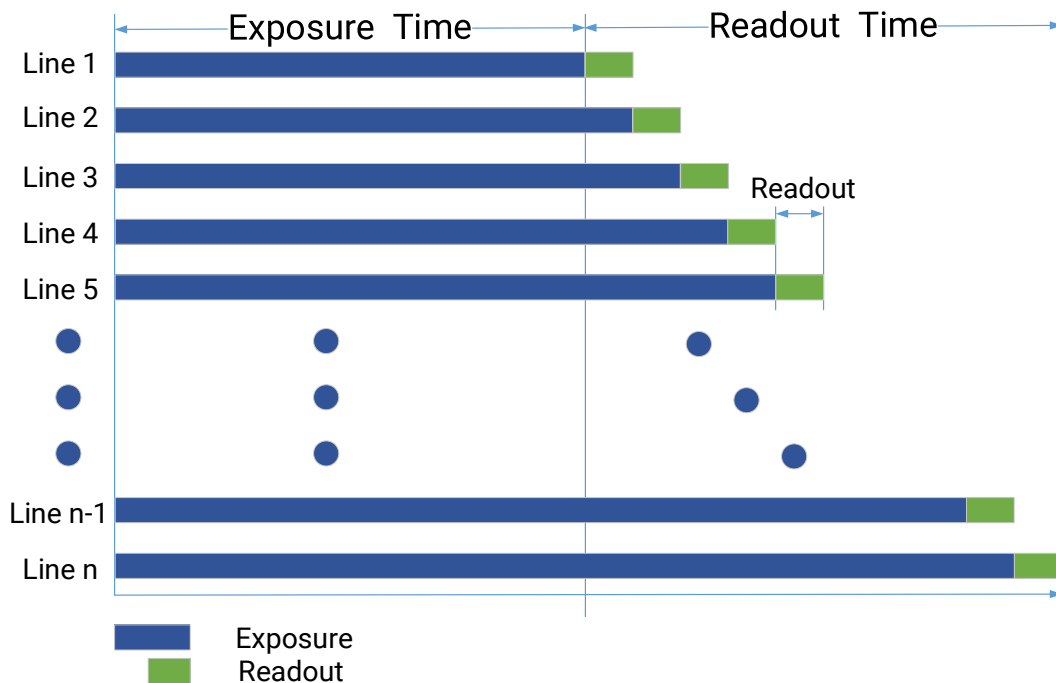
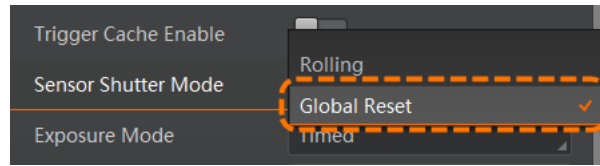


Figure 10-3 Global Reset

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



**Figure 10-4 Select Global Reset**

### Note

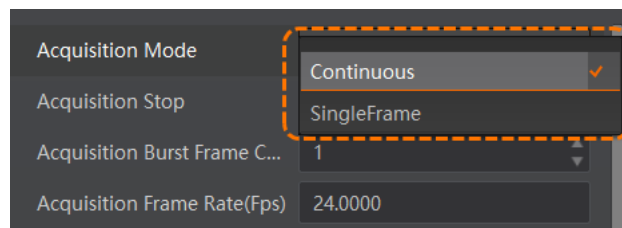
When Global Reset function is enabled, different exposure times for each line of the image may result in different brightness of each line. Therefore, it is recommended to use this function together with an industrial light source in a completely dark environment. By enabling the light source during 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**

You can also go to **Acquisition Control** → **Acquisition Start / Acquisition Stop** to start/stop image acquisition.

### Note

- When the acquisition is stopped and **Acquisition Start** is executed, some devices cannot be edited. If you need to adjust these parameters, execute **Acquisition Stop** first.
  - **Acquisition Start** and **Acquisition Stop** are supported by some devices.
-

## 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**.

---

### 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**.

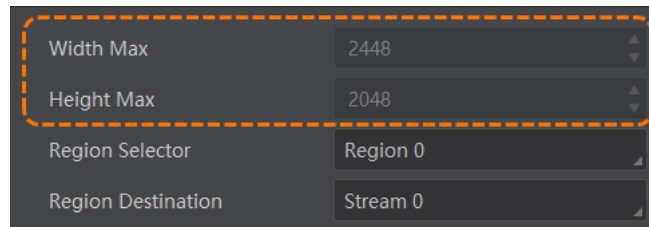
# Chapter 11 Image Parameter

## 11.1 Set Resolution and ROI

### Note

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

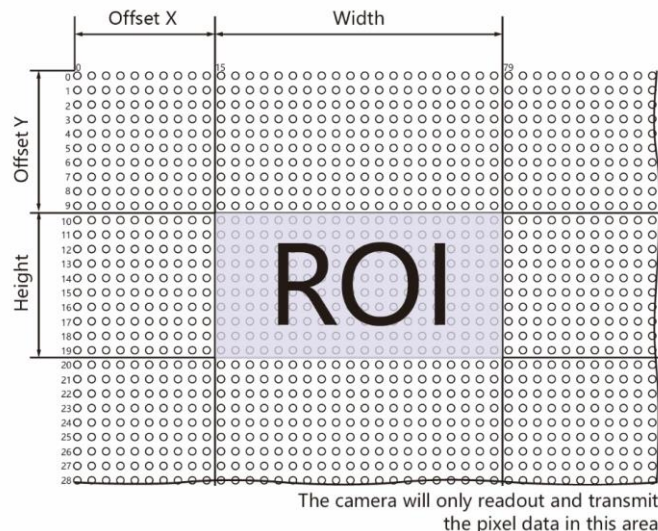
Go to **Image Format Control**, and you can view resolution by reading **Width Max** and **Height Max**. **Width Max** stands for the max. pixels per inch in width direction, and **Height Max** stands for the max. pixels per inch in height direction.



**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.
- 

### **Quick Drawing of ROI**

You can go to **Advanced Features** → **ROI** to draw ROI quickly. There are three methods.

- Click **ReDraw**, and then drag the cursor on the image to draw ROI. It will take effect after image acquisition starts.
  - Click **Edit**, and then the ROI will cover the whole image. You can move the cursor to the edge of the rectangle, and then drag the two-way arrow to adjust the ROI. It will take effect after image acquisition starts.
  - Before image acquisition starts, you can adjust the **Offset X**, **Offset Y**, **Width**, and **Height** to set the ROI. It will take effect immediately.
- 

### **Note**

During ROI settings, parameter stepping may differ by device model.

---

## 11.2 Set Image Reverse

---

### **Note**

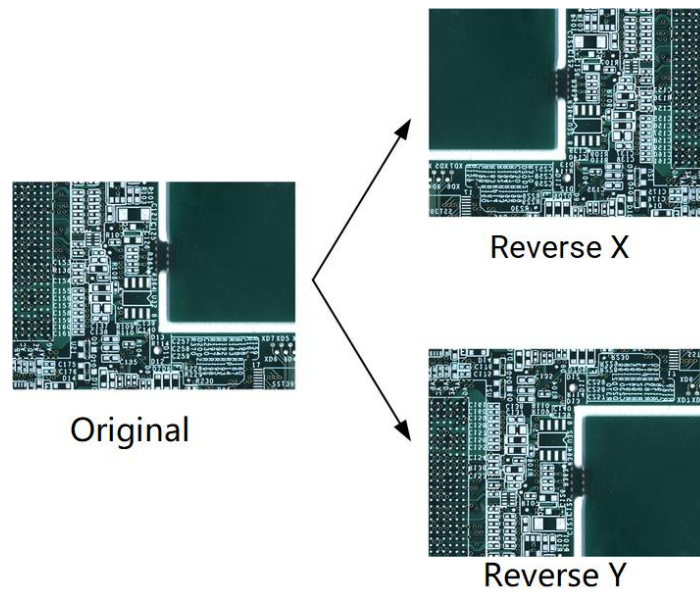
For different models of device, the image reverse function may be different, please refer to the actual one you got.

---

**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

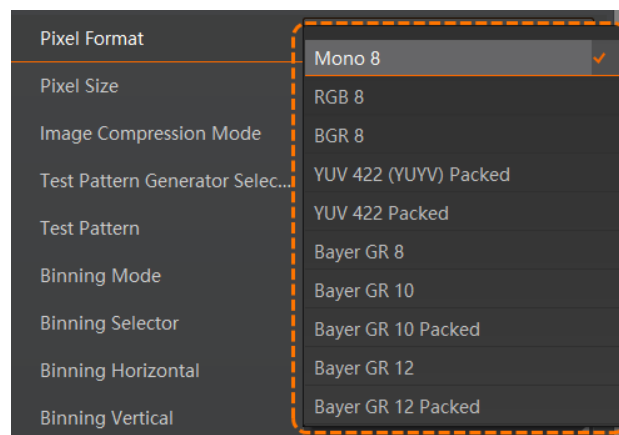
actual demands.



**Figure 11-3 Image Reverse Comparison**

## 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.



**Figure 11-4 Set Pixel Format**

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

can be output as Mono 8 format.

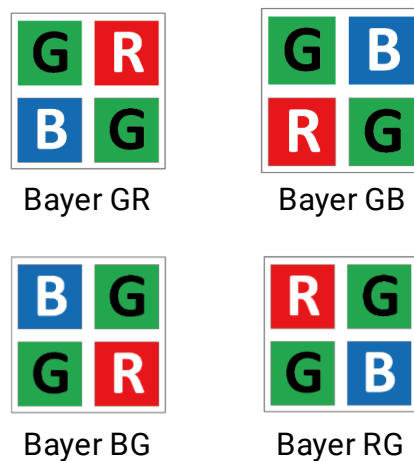
---

### Note

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

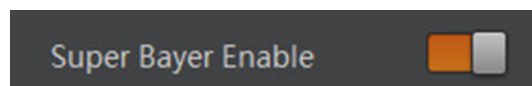
---

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



**Figure 11-5 Pixel Patterns**

In Bayer pixel format, some color devices support [Set Gamma Correction](#), [Set Sharpness](#), [Set Contrast Ratio](#), [Set Super Palette Control](#), [Set CCM](#), and [Set LUT](#) functions after you enable **Super Bayer Enable**. Go to **Image Format Control** → **Super Bayer Enable**, and enable it according to actual demands.



**Figure 11-6 Set Super Bayer**

### Note

- For different models of device, the super Bayer function may be different. Refer to the actual one you got.
  - The super Bayer function is only valid in the Bayer pixel format.
  - After you enable the super Bayer function, the related functions will be shown in the feature tree. If you select other pixel formats, you can set the related parameters under the pixel format.
  - The frame rate is the same in the Bayer pixel format before and after you enable the **Super Bayer Enable**.
- 

In other pixel formats, you can set functions such as [Set Gamma Correction](#), [Set Sharpness](#), [Set Contrast Ratio](#), [Set Super Palette Control](#), [Set CCM](#), and [Set LUT](#) directly.

## 11.4 Set ADC Bit Depth

Some device models support setting ADC bit depth. 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. Go to **Image Format Control** → **ADC Bit Depth**, and set **ADC Bit Depth** according to actual demands.

### Note

- The ADC bit depth function may differ by device models.
- The max. frame rate may differ by ADC bit depth and pixel format.

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) |
|---------------|-------------------|-------------------------|
| 10            | Mono 8, Bayer 8   | 8                       |
|               | Mono10, Bayer 10  | 10                      |
|               | Mono 12, Bayer 12 | 12                      |
|               | RGB 8, BGR 8      | 24                      |
| 12            | Mono 8, Bayer 8   | 8                       |
|               | Mono10, Bayer 10  | 10                      |
|               | Mono 12, Bayer 12 | 12                      |

## 11.5 Set Test Pattern

### Note

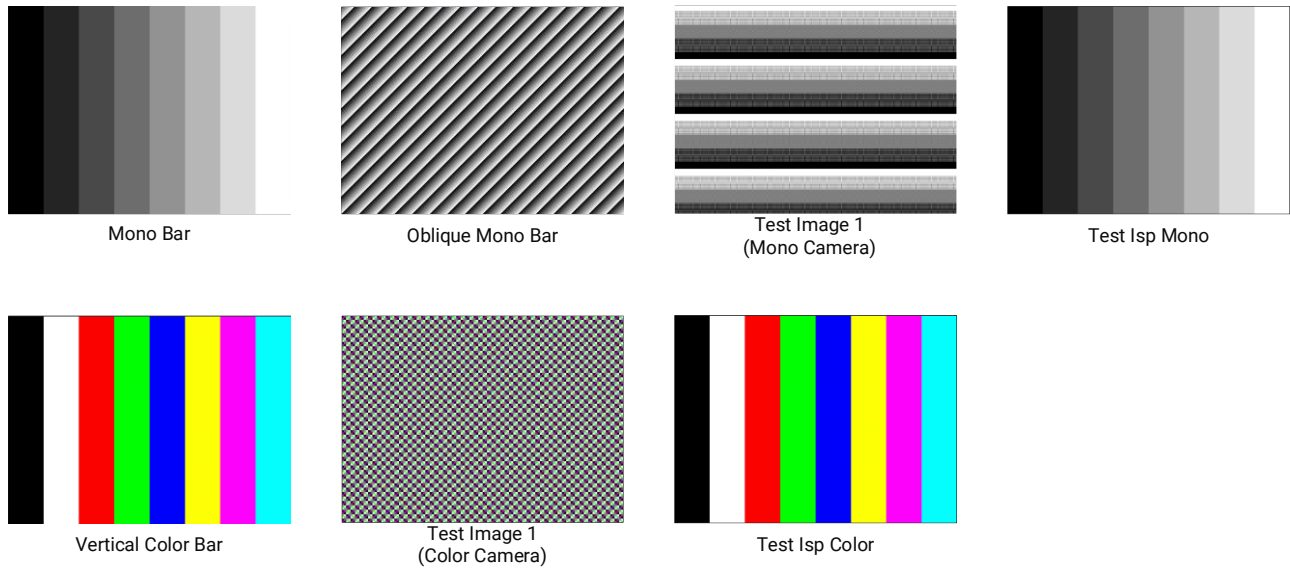
The test pattern may differ by device models.

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. The supported patterns are shown below.

### Note

- The mono device does not support the patterns of color device.
- The supported patterns may differ by the device model.

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



**Figure 11-7 Test Patterns**

## 11.6 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. The device can merge the pixel values of adjacent pixels of the same color horizontally or vertically, as shown below.



Horizontal Binning = 2      Vertical Binning = 2

**Figure 11-8 Binning Settings (Color Device as an Example)**

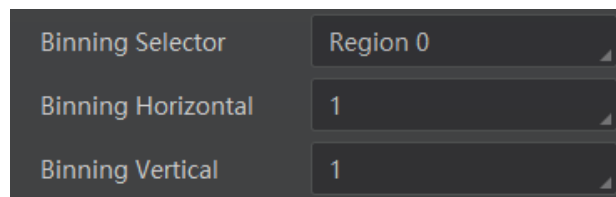
If the horizontal binning coefficient and the vertical binning coefficient of the device are both configured to 2, the device merges the 4 adjacent sub-pixels of the same color according to the corresponding position, and outputs the merged pixel value as a sub-

pixel, as shown below.



**Figure 11-9 Horizontal/Vertical Binning 2 × 2 (Color Device as an Example)**

Click **Binning Selector**, and set **Binning Horizontal** and **Binning Vertical** according to actual demands.



**Figure 11-10 Set Binning**

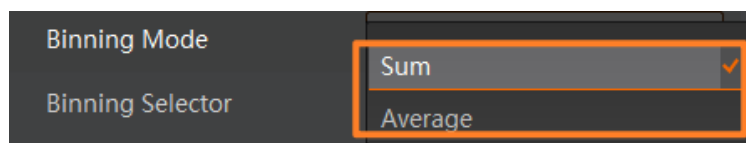
#### Note

- **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.

Some devices also support binning mode function. 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.

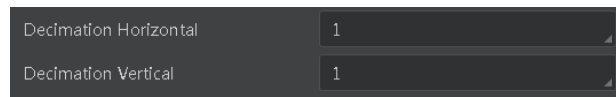


**Figure 11-11 Set Binning Mode**

## 11.7 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 11-12 Set Decimation**

### Note

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

## 11.8 Set Exposure Mode

Exposure controls the duration that the image sensor is exposed to light. By adjusting the exposure time, the device can control image brightness, ensuring image clarity. The device supports 3 types of exposure modes, including **Timed**, **Trigger Width**, and **Trigger Controlled**.

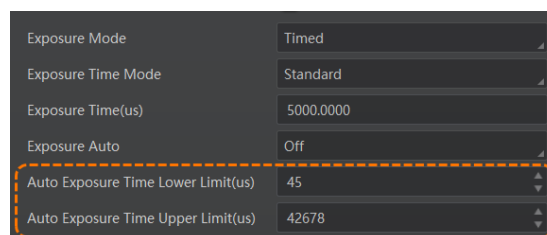
### Timed

If the **Exposure Mode** is **Timed**, the device's exposure time is controlled by **Exposure Auto** and **Exposure Time**.

In this mode, 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 11-13 Set Exposure Time Under Once or Continuous Mode**

---

### Note

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

---

## Trigger Width

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.

### Steps

1. Set the device's **Trigger Mode** as **On**.
2. Select **Line 0/Line 2/Line 5** as **Trigger Source**.
3. Set **Trigger Activation** as **Level High** or **Level Low**.
4. Select **Trigger Width** as **Exposure Mode**, and the device's exposure time is controlled by the signal duration.

## Trigger Control

If the **Exposure Mode** is **Trigger Controlled**, the exposure time is related to the time when the device receives an external trigger signal, and **Exposure Auto** and **Exposure Time** are invalid.

### Steps

1. (Optional) If the shutter mode of the device is rolling shutter, you need to enable Global Reset function first.

---

### Note

If the shutter mode of the device is global shutter, you can skip this step.

---

2. Set **Exposure Start** as **Trigger Selector**, and Set the device's **Trigger Mode** as **On**. In this mode, the device will start exposure when it receives the configured trigger signal. And then you can set the trigger source for the exposure start.
  3. Set **Exposure End** as **Trigger Selector**, and Set the device's **Trigger Mode** as **On**. In this mode, the device will end exposure when it receives the configured trigger signal. And then you can set the trigger source for the exposure end.
- 

### Note

- When **Exposure Start** or **Exposure End** is selected in **Trigger Selector**, and **Trigger Mode** is **On**, the **Exposure Mode** will be automatically set to **Trigger Controlled**, and **Timed** or **Trigger Width** cannot be set.
- **Exposure Start** mode and **Exposure End** mode should be configured simultaneously. If only **Exposure Start** mode is set, the device will execute continuous exposure. If only **Exposure End** mode is configured, there are no exposure and no image output.
- It is not recommended to configure the same signal source and the same trigger polarity for both **Exposure Start** mode and **Exposure End** mode. Because under this condition, when the device simultaneously receives start and end signals, it will only take effect

according to the minimum exposure time of the sensor and output images.

- Refer to section [Set Trigger Mode](#) for details.
- 

## 11.9 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.

### 11.9.1 Set Analog Gain

---

#### Note

The range of analog gain may differ by device models. Refer to device's specification for details.

---

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

- **Off**: The device adjusts gain according to the value configured by user in **Gain**.
- **Once**: The device adjusts the gain automatically according to the image brightness. After adjusting, it will switch to **Off** mode.
- **Continuous**: The device adjusts the gain continuously according to the image brightness.

When the gain mode is set as **Once** or **Continuous**, the gain should be within the range of **Auto Gain Lower Limit (dB)** and **Auto Gain Upper Limit (dB)**.

### 11.9.2 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.

---

#### Note

- The value in **Digital Shift** is 0 by default.
  - **Digital Shift Enable** is disabled by default.
-

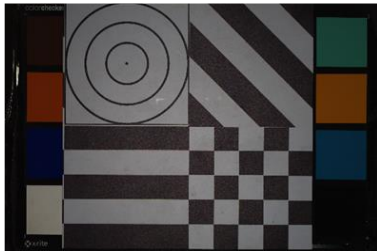
## 11.10 Set Brightness

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

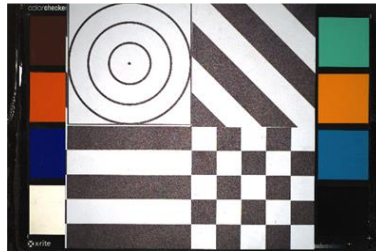
Go to **Analog Control** → **Brightness**, and enter **Brightness** according to actual demand.

### Note

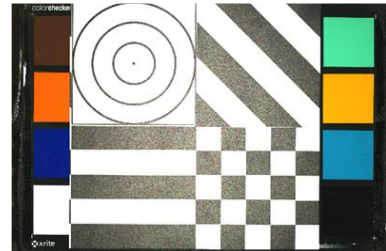
- You should enable **Once** or **Continuous** exposure mode or gain mode first before setting brightness. Refer to section [Set Exposure Mode](#) and section [Set Analog Gain](#) for details.
- After setting brightness, the device will automatically adjust exposure time or analog gain to let image brightness 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.



Brightness = 25



Brightness = 75



Brightness = 100

Figure 11-14 Brightness Example

## 11.11 Set Sharpness

### Note

- The sharpness function is valid in Mono and YUV pixel formats, and is disabled by default.
- Regarding the color device in Bayer 8 pixel format, you need to enable **Super Bayer Enable** first before using sharpness function.

The device supports sharpness function that can adjust the sharpness level of the image edge. You can set sharpness as shown below.

Go to **Analog Control** → **Sharpness Enable**, enable **Sharpness Enable**, and enter

**Sharpness** according to actual demands.

## 11.12 Set Contrast Ratio

---

### Note

- Make sure that the live view is enabled, and Gamma correction and LUT function are disabled before using the contrast ratio function.
  - Regarding the color device in Bayer pixel format, you need to enable **Super Bayer Enable** first before using contrast ratio function.
- 

The device supports the contrast ratio function that adjusts the intensity of light/darkness and color. The larger the contrast ratio, and more clear the image is.

Go to **Analog Control**, enable **Contrast Ratio Enable**, and set **Contrast Ratio** according to actual demands.

## 11.13 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 value of 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**.

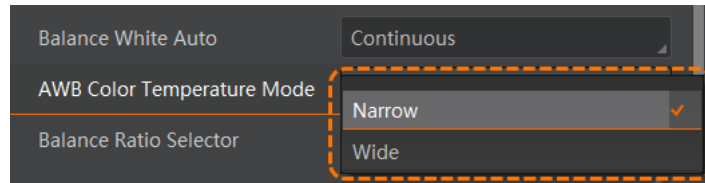


Figure 11-15 Set AWB Color Temperature Mode

## 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

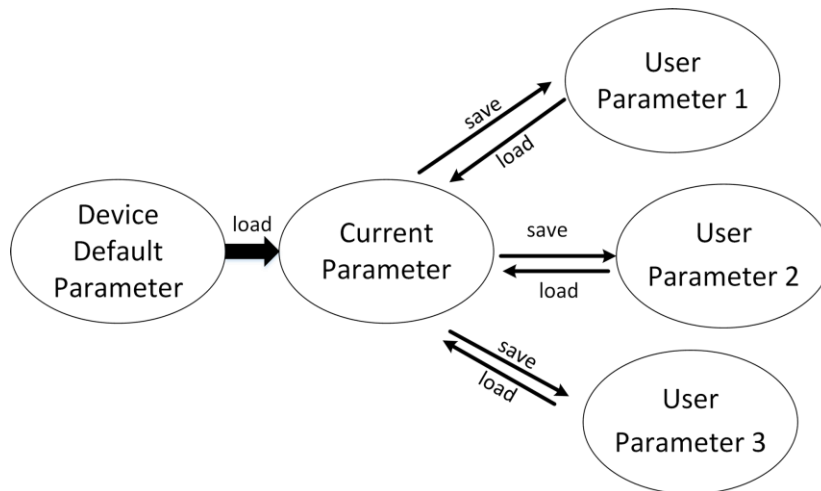
- For specific **Balance Ratio Selector** value, please refer to the actual condition.
  - In order to avoid repeated correction after restarting the device, it is recommended to save white balance parameter to **User Set** after white balance correction. You can refer to the section [Save User Set](#) and [Load User Set](#) for details.
  - If the light source and color temperature change, you need to correct white balance again.
  - If the pixel format is Bayer, you can correct white balance via the white balance tool in the client software with 3.2.0 version and later. Refer to **Machine Vision Software User Manual** for details.
- 

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.

## 11.14 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 11-16 Parameter Relation**

---

### Note

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

---

## 11.14.1 Save User Set

### Steps

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

## 11.14.2 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**.
2. Click **Execute** in **User Set Load** to load parameter.

## 11.14.3 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

---

## Chapter 12 Advanced Functions

### 12.1 Set Sensor Mode

---

#### Note

The sensor mode function may differ by device models.

---

The device provides two types of sensor mode, including high full well capacity and high sensitivity.

Go to **Analog Control** → **Sensor Mode**, and select **Sensor Mode** according to actual demands.

- **High Full Well Capacity**: It provides a higher dynamic range, enhancing image clarity and reducing noise. It is applicable for the environment with low illumination.
- **High Sensitivity**: It improves the image's sensitivity. In this mode, the device provides better photosensitivity performance and the brighter image.

### 12.2 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.

### 12.3 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.

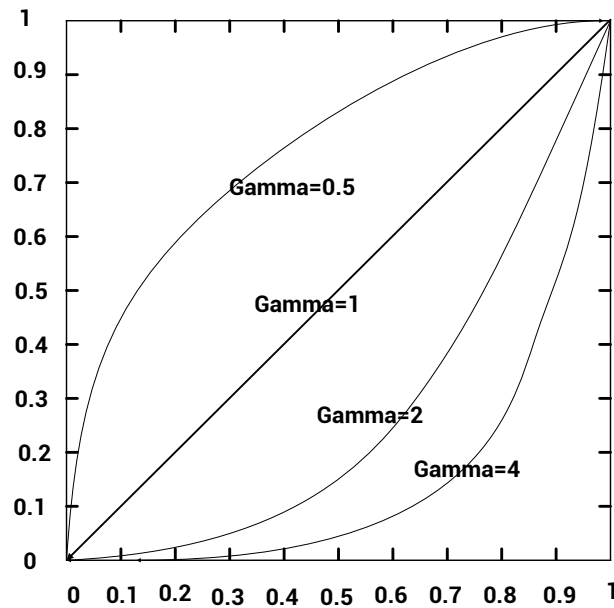


Figure 12-1 Set Gamma Correction

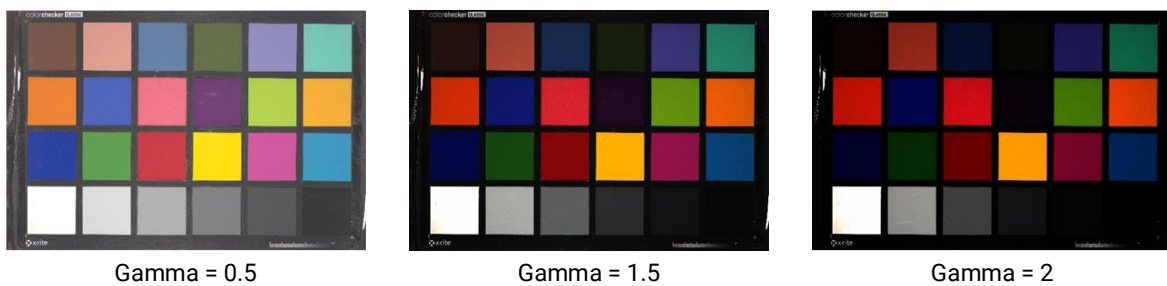


Figure 12-2 Gamma Correction Example

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.

## sRGB Mode

### Steps

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

## 12.4 Set AOI

---

### Note

AOI 1 is used to adjust the brightness when the device is in once or continuous exposure mode, and AOI 2 is used to adjust the white balance when the color device is in once or continuous white balance mode.

---

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

### Steps

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

## 12.5 Set CCM

---

### Note

The function of CCM is only available for color devices.

---

After the image is processed by the white balance, the overall image will be dark, and at the same time, various colors may deviate from their standard values to varying degrees. At this time, it is necessary to multiply the color of the image by the correction matrix to correct each color to its standard value, so that the overall color of the image is more vivid. The CCM function is implemented by multiplying each RGB component by a correction matrix. The currently supported color conversion module is RGB to RGB.

---

### Note

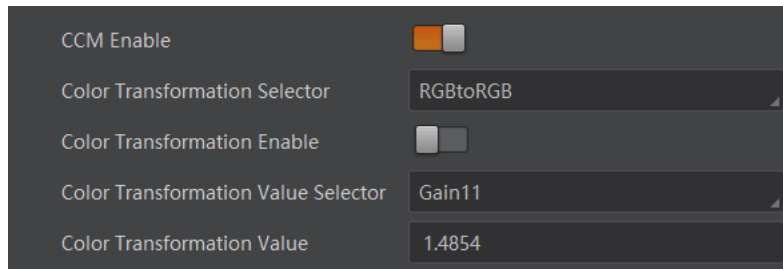
- The CCM function is valid in RGB and YUV pixel formats.
  - Regarding the color device in Bayer pixel format, you need to enable Super Bayer Enable first before using CCM function.
-

Two methods are available to set CCM function.

- **Method 1:**

**Steps**

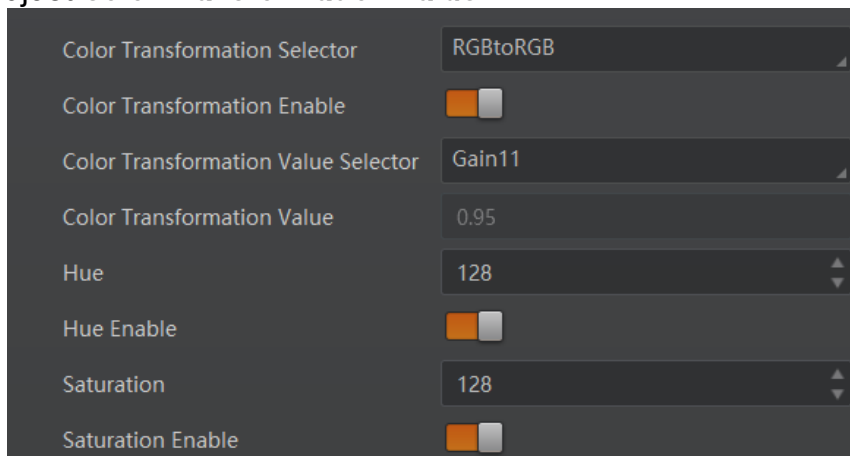
1. Go to **Color Transformation Control**, and enable **CCM Enable**.
2. Select parameter in **Color Transformation Value Selector**, and set **Color Transformation Value** according to actual demand.



**Figure 12-3 Method 1**

- **Method 2:**

Go to **Color Transformation Control**, enable **Color Transformation Enable**, set **Hue** and **Saturation** to adjust **Color Transformation Value**.



**Figure 12-4 Method 2**

---

 **Note**

- **CCM Enable** is used to enable CCM function. If the device you purchased does not have **CCM Enable**, then the CCM function is enabled by default.
  - The CCM function is achieved by adjusting the values of the parameters in **Color Transformation Value Selector**, where Gain00, Gain10, and Gain20 adjust the R component of the red pixel, Gain01, Gain11, and Gain21 adjust the G component of the green pixel, and Gain02, Gain12, and Gain22 adjust the B component of the blue pixel.
- 

### 12.5.1 Set Hue

### Note

- The hue function is only available for color devices.
  - In Mono pixel format, hue function is not supported.
- 

Adjusting the hue shifts the colors of the image. After hue is set, the device will perform CCM function based on the hue value to bring the image tone to the target value. For example, when hue is set to 128, the red in the image appears as real red. When hue is 0, the hue is reversed 128 degrees counterclockwise, and red becomes blue. When hue is 255, the hue rotates 128 degrees clockwise, and red becomes green. Image examples of different hue values are shown below.



**Figure 12-5 Hue Example**

### **Before You Start**

Make sure the **Pixel Format** of the color device is **Bayer**, **YUV**, **RGB**, or **BGR**.

### **Steps**

1. Go to **Color Transformation Control**, and enable **Hue Enable**.
  2. Enter **Hue** according to actual demands.
- 

### Note

It is not recommended to edit the default values. If you have any questions, please contact technical support.

---

## 12.5.2 Set Saturation

### Note

- The saturation function is only available for color devices.
  - In Mono pixel format, saturation function is not supported.
- 

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

values are shown below.



**Figure 12-6 Saturation Example**

### **Before You Start**

Make sure the **Pixel Format** of the color device is **Bayer**, **YUV**, **RGB**, or **BGR**.

### **Steps**

1. Go to **Color Transformation Control**, and enable **Saturation Enable**.
2. Enter **Saturation** according to actual demands.

## 12.6 Set Super Palette Control

---

### **Note**

- Regarding the color device in Bayer pixel format, you need to enable **Super Bayer Enable** first before using super palette control function.
- The super palette control function is valid in RGB and YUV pixel formats.

The super palette control function allows you to select different color areas in the image to set customized hue and saturation values.

### **Steps**

1. Go to **Super Palette Control**, and enable **Super Palette Enable**.
2. Select **Super Palette Selector**.
3. Set corresponding **Super Palette Hue** and **Super Palette Saturation** according to actual demands.

## 12.7 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 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.

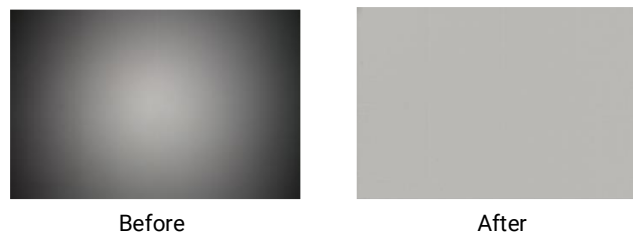
- For different LUTs, after you set **LUT Index** and **LUT Value**, you should click **Execute** in **LUT Save** respectively.
  - The LUT function is not supported for the color device in Bayer format.
- 

### Steps

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

## 12.8 Set 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 LSC Correction**

### Steps

1. Go to **Shading Correction**, and select **LSC Correction** as **Shading Selector**.
2. Select **Brightest** or **Setting Value** in **LSC Calib Select** to calculate the data.
  - **Brightest**: Use the brightest area in the image as a reference to calculate brightness differences of other areas, and then correct the other parts of the image based on the calculated brightness differences.
  - **Setting Value**: You can customize the brightness value, and then the current image will be corrected to match the set brightness value. After selecting **Setting Value**, you can set the effective brightness via **LSC Target Gray**.
3. Enable **LSC Enable**.
4. After the device starts image acquisition, you can click **Execute** in **Activate Shading** to let the client software automatically calculate the data

---

### Note

- LSC correction should be executed in full resolution. If you are only interested in a certain region of the image, you can set a Region of Interest (ROI) after correction.
  - If the light source and color temperature change, you need to execute LSC correction again.
-

## 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. Some parameters in **Device Control** are shown below.

**Table 13-1 Parameters of Device Control**

| 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 about the device.                                                                                                                                                           |
| Device Firmware Version     | Read Only    | It is the device firmware version.                                                                                                                                                                             |
| Device Serial Number        | Read Only    | It is device's serial number.                                                                                                                                                                                  |
| Device Revision             | Read Only    | It is the version of device.                                                                                                                                                                                   |
| Device Manifest Size        | Read Only    | It is the quantity of GenlCam XML.                                                                                                                                                                             |
| Device Manifest Selector    | Read & Write | It is the ID of GenlCam XML.                                                                                                                                                                                   |
| Device XML Version          | Read Only    | It is version of GenlCam XML.                                                                                                                                                                                  |
| Device Schema Version       | Read Only    | It is the schema version of GenlCam.                                                                                                                                                                           |
| Device Uptime (s)           | Read Only    | It is the device's operation time.                                                                                                                                                                             |
| Board Device Type           | Read Only    | It is the device type.                                                                                                                                                                                         |
| Device Max Throughput (bps) | Read Only    | It is the maximum flow of device operation.                                                                                                                                                                    |
| Device User ID              | Read & Write | It is the device name and 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.</li> </ul> |

| Parameter                   | Read/Write   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             |              | If you set it, the client software displays the User ID you set.                                                                                                                                                                                                                                                                                                                                                                                             |
| Device Reset                | Read & Write | Click <b>Execute</b> to reset the device.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Device Temperature Selector | Read & Write | It selects device sensor temperature.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Device Temperature          | Read Only    | It displays the temperature of the sensor.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Find Me                     | Read & Write | Click <b>Execute</b> to let red and blue indicators flash alternatively, and find device.                                                                                                                                                                                                                                                                                                                                                                    |
| Device Standby Mode         | Read & Write | <p>After it is enabled, the device will enter into standby mode. In this mode, the device stops image acquisition to reduce power consumption, but still supports ISP test image outputting and parameter settings.</p> <p> <b>Note</b></p> <p>The mode settings apply globally. When it is enabled, loading device default parameters will not reset to default value.</p> |

## 13.2 Transport Layer Control

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

### Note

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

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

| Parameter                   | Read/Write | Description                                                                         |
|-----------------------------|------------|-------------------------------------------------------------------------------------|
| Payload Size                | Read Only  | It is the device's load size.                                                       |
| Sensor Trigger Count        | Read Only  | It displays the count of trigger signals sent to the sensor.                        |
| External Trigger Count      | Read Only  | It displays the count of external trigger signals received by the camera.           |
| External Over Trigger Count | Read Only  | It displays the count of external trigger signals received by the camera that could |

| Parameter                         | Read/Write | Description                                                  |
|-----------------------------------|------------|--------------------------------------------------------------|
|                                   |            | not be responded to due to exceeding the frame rate.         |
| Stream Transfer Frame Start Count | Read Only  | It displays the count of stream transmission frame starting. |
| Stream Transfer Frame End Count   | Read Only  | It displays the count of stream transmission frame ending.   |

## 13.3 File Access Control

The file access function can import or export the device's feature files and save them in mfa format.

### 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**.

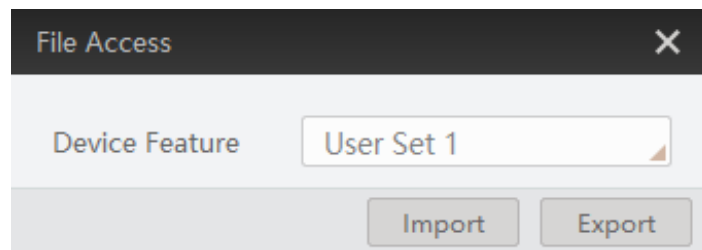


Figure 13-2 Import or Export

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, and LUT 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 **DPC** is selected as device feature, it will take effect immediately after importing. DPC means defective pixel data after calibration.
- 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.

- **License Notice** supports exporting only.
- **Log File** supports exporting only.

### 13.4 Update Firmware

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

#### 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.

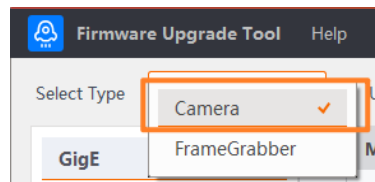


Figure 13-3 Select Camera

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

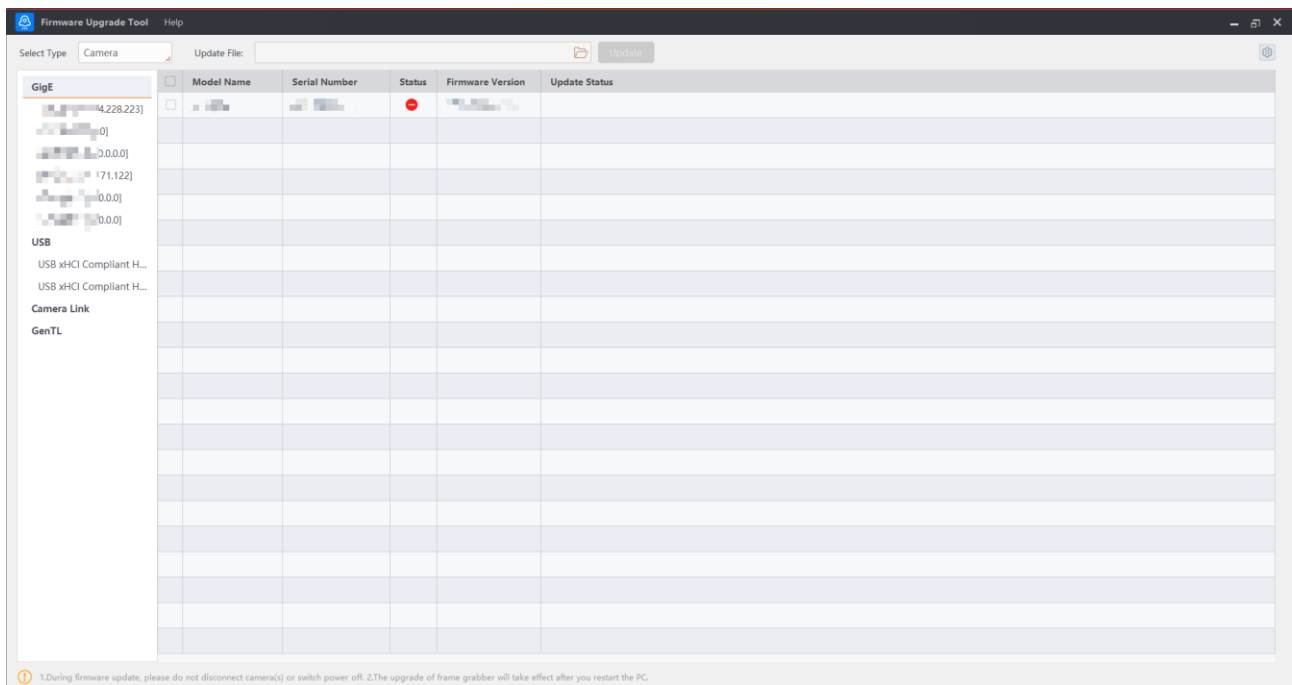


Figure 13-4 Update Firmware

### 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.
- 

## 13.5 Device Encryption via Dongle Tool

---

### Note

You can contact the technical support to get the dongle tool.

---

The dongle tool is used to encrypt and decrypt devices for protecting data.

### Steps

1. Run the dongle tool, and click **Enumerate** to select a device.
2. Enter a secret key manually, or click **Create Random Secret Key** to generate a secret key automatically.
3. Click **Write Secret Key** to finish device encryption.
4. Enter plaintext that should be no more than 15 characters, and click **Verify** to verify and decrypt the device.
5. (Optional) If you forget the password, please refer to Step 2 to regenerate a secret key.



The screenshot shows a software interface for device encryption. It is divided into four steps:

- Step 1 : Enumerate**: A button labeled "Enumerate" and a dropdown menu showing "USB - XOC LINK AREA SCAN CAMERA (COM1) (0x0403:6010)".
- Step 2 : Enter Secret Key**: A text input field, a button labeled "Create Random Secret Key", and a note: "The encryption key is composed of 64 hexadecimal digits, or an English string of 32 characters. The user can manually enter or click Create Encryption Key."
- Step 3**: A button labeled "Write Secret Key".
- Step 4 : Verify and Decrypt**: A text input field containing "Plaintext1234" and a button labeled "Verify". Below this is a note: "The plaintext is set to the camera, and the camera returns the encrypted one. The encryption tool decrypts the encryption key, and verifies whether the decrypted result is consistent with the plaintext."

**Figure 13-5 Encrypt Device via Dongle Tool**

## 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 connection by observing the device's indicator, and check coaxial cable connection. |
| Incorrect coaxial cable connection. |                                                                                                                     |

### 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. |
| The value of exposure time is too low.     | Increase the exposure time.        |

### 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 the device cannot get images required by the

## algorithm although 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  |
|---------|---------------|-------------------|
| V1.0.0  | Jul. 7, 2026  | 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 Revision              |                                        |
| Device Manifest Size         |                                        |
| Device Manifest Selector     |                                        |
| Device Xml Version           |                                        |
| Device Schema Version        |                                        |
| Device Uptime(s)             |                                        |
| Board Device Type            |                                        |
| Device Reset                 |                                        |
| Device Temperature Selector  |                                        |
| Device Temperature           |                                        |
| Find Me                      |                                        |
| Device Max Throughput (Kbps) |                                        |
| Device Standby Mode          |                                        |

## A.2 Image Format Control

Table A-2 Image Format Control

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

## A.3 Acquisition Control

Table A-3 Acquisition Control

| Parameters       | Section                                  |
|------------------|------------------------------------------|
| Acquisition Mode | Section <a href="#">Acquisition Mode</a> |

| Parameters                                | Section                                                    |
|-------------------------------------------|------------------------------------------------------------|
| Acquisition Stop                          |                                                            |
| Acquisition Burst Frame Count             | Section <a href="#">Set 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="#">Global Shutter and 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) |                                                            |

## A.4 Software Signal Control

**Table A-4 Software Signal Control**

| Parameters               | Section                                                  |
|--------------------------|----------------------------------------------------------|
| Software Signal Selector | Section <a href="#">Set and Execute Software Trigger</a> |
| Software Signal Trigger  |                                                          |

## A.5 Analog Control

Table A-5 Analog Control

| Parameters                        | Section                                      |
|-----------------------------------|----------------------------------------------|
| Gain                              | Section <a href="#">Set Gain</a>             |
| Gain Auto                         |                                              |
| Auto Gain Lower Limit (dB)        |                                              |
| Auto Gain Upper Limit (dB)        |                                              |
| Digital Shift                     |                                              |
| Digital Shift Enable              |                                              |
| Sensor Mode                       | Section <a href="#">Set Sensor Mode</a>      |
| 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                      |                                              |
| Sharpness                         | Section <a href="#">Set Sharpness</a>        |
| Sharpness Enable                  |                                              |
| Contrast Ratio                    | Section <a href="#">Set Contrast Ratio</a>   |
| Contrast Ratio 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 |                                              |

| Parameters                            | Section |
|---------------------------------------|---------|
| Auto Function AOI Usage White Balance |         |

## A.6 Color Transformation Control

Table A-6 Color Transformation Control

| Parameters                          | Section                                |
|-------------------------------------|----------------------------------------|
| CCM Enable                          | Section <a href="#">Set CCM</a>        |
| Color Transformation Selector       |                                        |
| Color Transformation Enable         |                                        |
| Color Transformation Value Selector |                                        |
| Color Transformation Value          |                                        |
| Hue                                 | Section <a href="#">Set Hue</a>        |
| Hue Enable                          |                                        |
| Saturation                          | Section <a href="#">Set Saturation</a> |
| Saturation Enable                   |                                        |

## A.7 Super Palette Control

Table A-7 Super Palette Control

| Parameters               | Section                                           |
|--------------------------|---------------------------------------------------|
| Super Palette Enable     | Section <a href="#">Set Super Palette Control</a> |
| Super Palette Selector   |                                                   |
| Super Palette Hue        |                                                   |
| Super Palette Saturation |                                                   |

## A.8 LUT Control

Table A-8 LUT Control

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

| Parameters | Section |
|------------|---------|
| LUT Enable |         |
| LUT Index  |         |
| LUT Value  |         |
| LUT Save   |         |

## A.9 Shading Correction

Table A-9 Shading Correction

| Parameters       | Section                                    |
|------------------|--------------------------------------------|
| Shading Selector | Section <a href="#">Set LSC Correction</a> |
| LSC Calib Select |                                            |
| LSC Target Gray  |                                            |
| LSC Enable       |                                            |
| Activate Shading |                                            |

## A.10 Digital IO Control

Table A-10 Digital IO Control

| Parameters                 | Section                                |
|----------------------------|----------------------------------------|
| Line Selector              | Section <a href="#">Trigger Output</a> |
| Line Mode                  |                                        |
| Line Inverter              |                                        |
| Line Status                |                                        |
| Line Status All            |                                        |
| Line Trigger Arm Delay(us) |                                        |
| Line Debouncer Time (μs)   |                                        |
| Line Source                |                                        |
| Strobe Enable              |                                        |
| Strobe Line Duration (μs)  |                                        |
| Strobe Line Delay (μs)     |                                        |

| Parameters                 | Section |
|----------------------------|---------|
| Strobe Line Pre Delay (μs) |         |

## A.11 File Access Control

Table A-11 File Access Control

| Parameters              | Section                                     |
|-------------------------|---------------------------------------------|
| File Selector           | Section <a href="#">File Access Control</a> |
| File Operation Selector |                                             |
| File Operation Execute  |                                             |
| File Open Mode          |                                             |
| File Operation Status   |                                             |
| File Operation Result   |                                             |
| File Size(B)            |                                             |

## A.12 Transport Layer Control

Table A-12 Transport Layer Control

| Parameters                        | Section                                         |
|-----------------------------------|-------------------------------------------------|
| Payload Size                      | Section <a href="#">Transport Layer Control</a> |
| Sensor Trigger Count              |                                                 |
| External Trigger Count            |                                                 |
| External Over Trigger Count       |                                                 |
| Stream Transfer Frame Start Count |                                                 |
| Stream Transfer Frame End Count   |                                                 |

## A.13 User Set Control

Table A-13 User Set Control

| Parameters       | Section                          |
|------------------|----------------------------------|
| User Set Current | Section <a href="#">User Set</a> |

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



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