

Hikrobot Co., Ltd.

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

Available Model

This manual is applicable to the Camera Link Area Scan Camera.

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Chapter 1 Safety Instruction

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

1.1 Safety Claim

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

1.2 Safety Instruction

Caution:

- Do not install the device if it is found that the device and accessories are damaged, rusted, water ingress, model mismatch, missing parts, etc., when unpacking.
- Avoid storage and transportation in places such as water splashing and rain, direct sunlight, strong electric fields, strong magnetic fields, and strong vibrations.
- Avoid dropping, smashing or vigorously vibrating the device and its components.
- It is forbidden to install the indoor device in an environment where it may be exposed to water or other liquids. If the device is damp, it may cause fire and electric shock hazard.
- Place the device in a place out of direct sunlight and ventilation, away from heat sources such as heaters and radiators.
- In the use of the device, you must be in strict compliance with the electrical safety regulations of the nation and region.
- Use the power adapter provided by the official manufacturer. The power adapter must meet the Limited Power Source (LPS) requirements. For the specific power consumption of the device, please refer to the device's specifications.
- Do not cover the device's plug or outlet for disconnecting power supply.
- It is strictly forbidden to wire, maintain, and disassemble the device is powered on.

Otherwise, there is a danger of electric shock.

- If the device emits smoke, odor or noise, please turn off the power and unplug the power cord immediately, and contact the dealer or service center in time.
- It is strictly forbidden to touch any terminal of the device when operating it. Otherwise there is a danger of electric shock.
- It is strictly forbidden for non-professional technicians to detect signals during device operation, otherwise it may cause personal injury or device damage.
- It is strictly forbidden to maintain the device is powered on, otherwise there is a danger of electric shock.
- Avoid aiming the lens at strong light (such as lighting, sunlight, or laser beams, etc.), otherwise the image sensor will be damaged.
- Keep clean of the device's image acquisition window. It is recommended to use cleaning water (not the alcohol-based corrosive solutions) to wipe off the dust. When the device is not in use, please add a dust cover to protect the image acquisition window.
- If the device does not work properly, please contact your dealer or the nearest service center. Never attempt to disassemble the device yourself (we shall not assume any responsibility for problems caused by unauthorized repair or maintenance).
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

Note:

- Check whether the device's package is in good condition, whether there is damage, intrusion, moisture, deformation, etc. before unpacking.
- Check the surface of the device and accessories for damage, rust, bumps, etc. when unpacking.
- Check whether the quantity and information of the device and accessories are complete after unpacking.
- Store and transport the device according to the storage and transport conditions of the device, and the storage temperature and humidity should meet the requirements.
- It is strictly prohibited to transport the device in combination with items that may affect or damage the device.
- Quality requirements for installation and maintenance personnel:
 - Qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills.
 - The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
 - The ability to comprehend the contents of this manual.
- Please read the manual and safety instructions carefully before installing the device.
- Please install the device strictly according to the installation method in this manual.
- The case of the device may be overheated, and it needs to be powered off for half an hour before it can be touched.
- The device should not be placed with exposed flame sources, such as lighted candles.

1.3 Electromagnetic Interference Prevention

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

Chapter 2 Cleaning Instruction

2.1 Device and Lens Cleaning

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

Table 2-1 Device and Cleaning Method

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

2.1.1 Rubber Dust Air Blower

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



Figure 2-1 Cleaning by Rubber Dust Air Blower

Note

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

2.1.2 Mirror Brush Cleaning

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

Note

Do not touch the bristles directly with your hands.

2.1.3 Lens Wiping

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

Steps

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

Note

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

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



Figure 2-2 Lens Wiping

Note

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

2.1.4 Lens Cleaning Paper

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

Before You Start

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

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

Note

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

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

2.2 Device Housing Cleaning

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

Steps

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

Note

Do not use compressed air to accelerate evaporation.

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

Chapter 3 Overview

3.1 Introduction

The Camera Link area scan camera uses the Camera Link connector to transmit non-compressed images in real time, and it acquires images and sets parameters via the client software, the frame grabber software, SDK, etc. The serial port tool can be used for parameter settings only.

3.2 Key Features

- Provides high SNR, wide dynamic range, and high-quality image.
- Supports auto and manual adjustment of gain, exposure time, and white balance, and manual adjustment of Look-Up Table (LUT) and Gamma correction.
- Supports the hardware trigger, software trigger, and anyway mode.
- Supports configuration modes of Base, Medium, Full and 80-bit.
- Compatible with Camera Link Protocol and GenICam Standard.

Note

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

3.3 Operating Principle

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

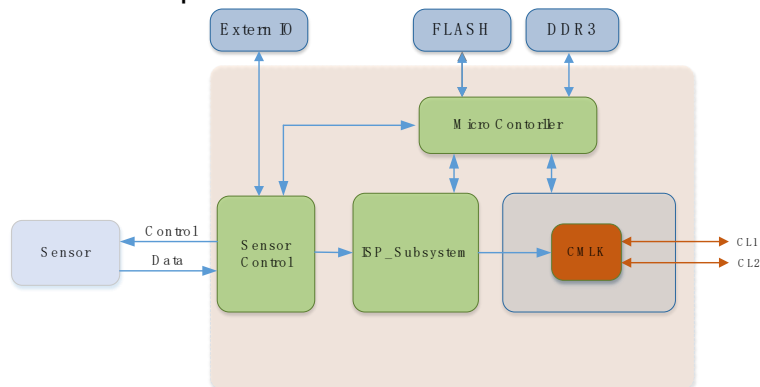


Figure 3-1 Operating Principle

Chapter 4 Device Hardware

4.1 Appearance

Note

- The device's appearance may differ by device models. 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.
- TEC stands for Thermo-Electric Cooler that is able to keep the device's sensor temperature around environment temperature to ensure the normal operation of the device.

The specific device appearance types are as follows:

- Type I device: It is a device with C-mount.
- Type II device: It is a device with M72-mount and cooling fan.
- Type III device: It is a device with M72-mount and TEC.

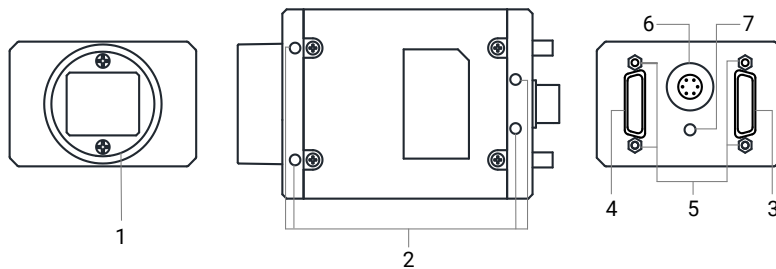


Figure 4-1 Appearance of Type I (C-Mount)

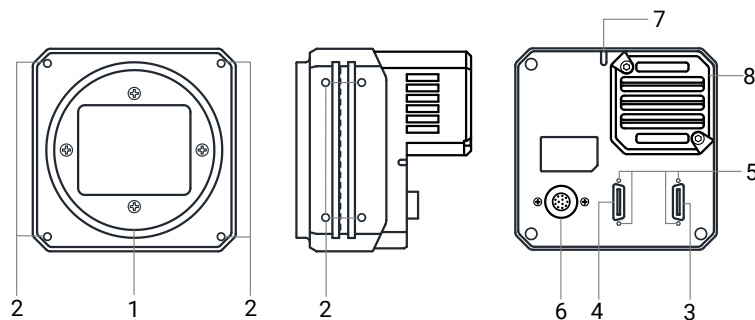


Figure 4-2 Appearance of Type II (M72-Mount and Cooling Fan)

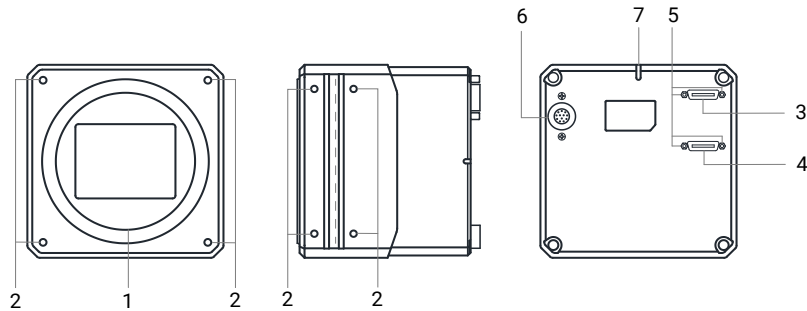


Figure 4-3 Appearance of Type III (M72-Mount and TEC)

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 screw hole for fixing the device to the installation position. For the type I and type II devices, you can use M3 screws, and for the type III, use M4 screws.
3	CL1 Interface	It refers to the Camera Link 1 with SDR connector, and it is used for data transmission and serial port communication.
4	CL2 Interface	It refers to the Camera Link 2 with SDR connector, and it is used for data transmission.
5	Screw Hole of Camera Link Connector	It refers to the screw hole for fixing the Camera Link cable.
6	Power and I/O Connector	It refers to 6-pin P7 or 12-pin P10 connector, providing power supply, I/O, and serial port functions. Refer to section Power and I/O Connector for details.
7	LED Indicator	It indicates the device's status. Refer to section Indicator for details.
8	Cooling Fan or TEC	It is used to cool the device to ensure its normal operation.

4.2 Power and I/O Connector

The device has a 6-pin P7 connector or 12-pin P10 connector as the power and I/O connector that provides power supply, I/O, and serial port functions.

4.2.1 6-Pin P7 Connector

The 6-pin P7 connector is applicable to the device with C-mount.

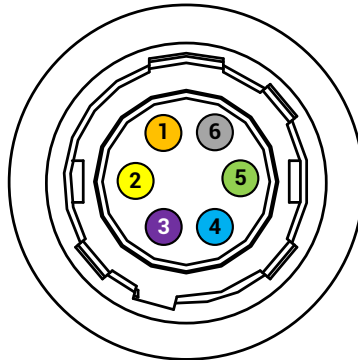


Figure 4-4 6-Pin P7 Connector

Table 4-2 Pin Definitions of 6-Pin P7 Connector

No.	Color	Signal	I/O Signal Source	Description
1	Orange	DC_PWR	--	Device's power supply
2	Yellow	OPTO_IN	Line 0+	Opto-isolated input
3	Purple	GPIO	Line 2+	Can be configured as input or output
4	Blue	OPTO_OUT	Line 1+	Opto-isolated output
5	Green	OPTO_GND	Line 0-/1-	Opto-isolated signal ground
6	Gray	GND	Line 2-	Device's 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.

4.2.2 12-Pin P10 Connector

The 12-pin P10 connector is applicable to the device with M72-mount.

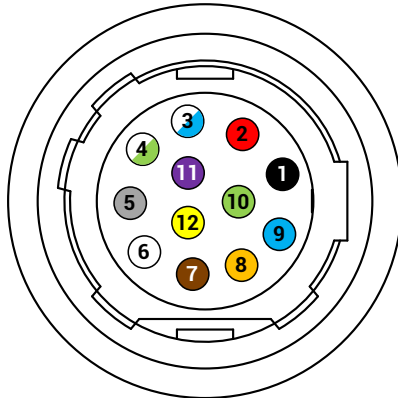


Figure 4-5 12-Pin P10 Connector

Table 4-3 Pin Definitions of 12-Pin P10 Connector

No.	Color	Signal	I/O Signal Source	Description
1	Black	GND	Line 2-	Device's power supply ground
2	Red	DC_PWR	--	Device's power supply
3	White/Blue	DC_PWR	--	Device's power supply
4	White/Green	OPT_IN-	Line 0-	Opto-isolated input signal ground
5	Gray	OPT_OUT-	Line 1-	Opto-isolated output signal ground
6	White	GND	--	Device's power supply ground
7	Brown	GND	--	Device's power supply ground
8	Orange	232_RXD	--	RS-232 receives
9	Blue	232_TXD	--	RS-232 transmits
10	Green	GPI02	Line 2+	Can be configured as input or output
11	Purple	OPT_OUT+	Line 1+	Opto-isolated output
12	Yellow	OPT_IN+	Line 0+	Opto-isolated input

Note

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

purchased from our company, please refer to the actual wire sequence and the corresponding wire core color.

4.3 Indicator

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

Table 4-4 Indicator Description

No.	Indicator Color	Status	Device Status Description
1	Red	Solid	Exception occurs.
2	Blue	Unlit	The device is not started.
3	Blue	Flashing slowly	The device is acquiring images in trigger mode.
4	Blue	Flashing rapidly	The device is acquiring images in continuous mode.
5	Red and blue	Flashing in alternative	The firmware is updating.

Chapter 5 Power Supply and Heat Dissipation

5.1 Device Power Supply

The device provides two ways of power supply, including PoCL power supply and external DC power supply.

When the external DC power supply and PoCL power supply are executed at the same time, the external DC power supply preferentially supplies power to the device. If the external DC power supply is unplugged at this time, the device will switch to PoCL power supply, and it is possible to restart the device.

5.1.1 PoCL Power Supply

Some devices can be powered via Power over Camera Link (PoCL). You can insert the Camera Link cable into the SDR connector.

 **Note**

- The PoCL power supply supported or not may differ by the device model. Please refer to the actual one you got.
 - If the PoCL power supply is required for the device, the connected Camera Link frame grabber should also support the PoCL 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.

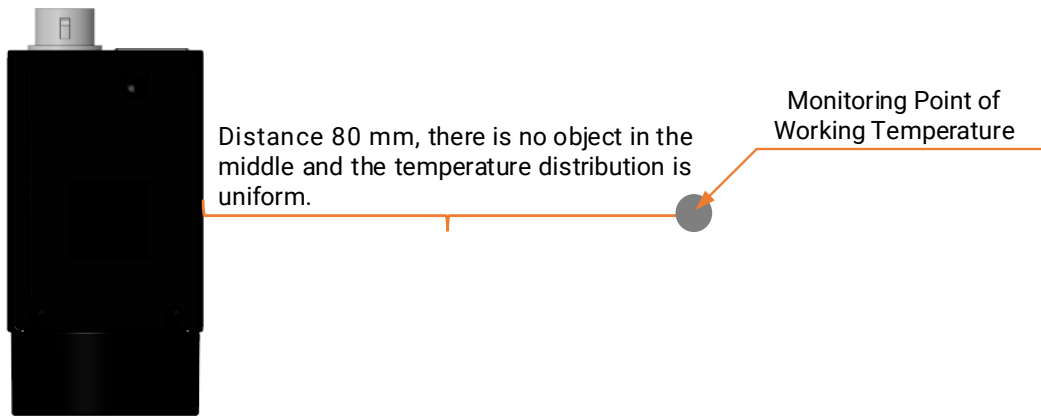


Figure 5-1 Monitoring Point of Working Temperature

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.

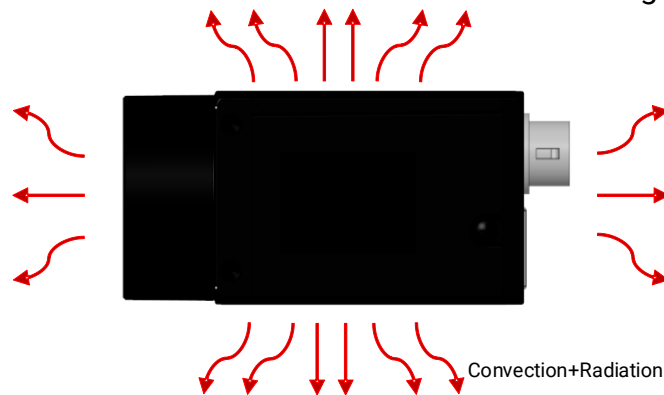


Figure 5-2 Housing Temperature

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.

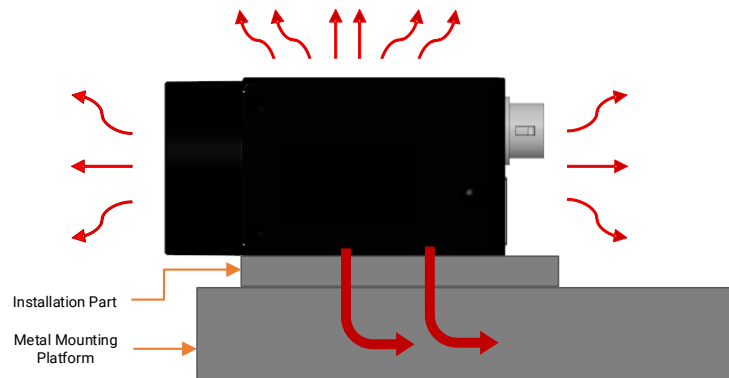


Figure 5-3 Heat Dissipation via Installation Part

- **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.

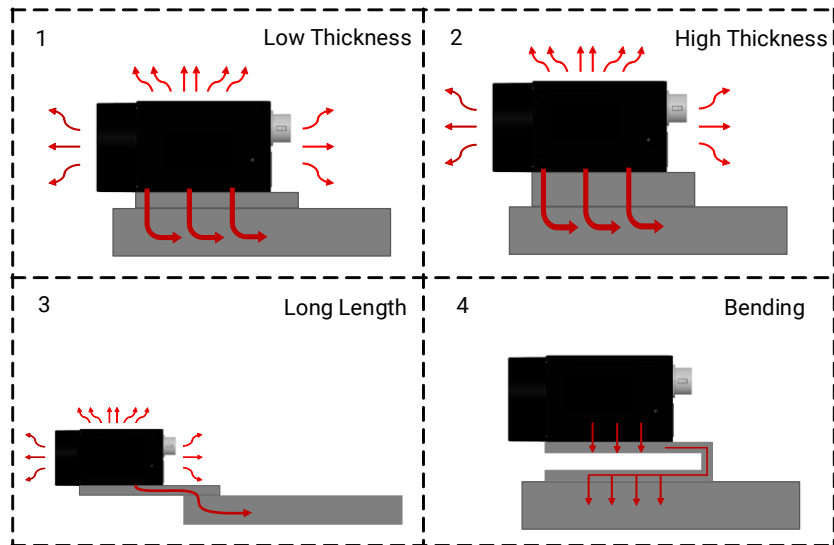


Figure 5-4 Heat Conduction Path of Different Installation Methods

- **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.

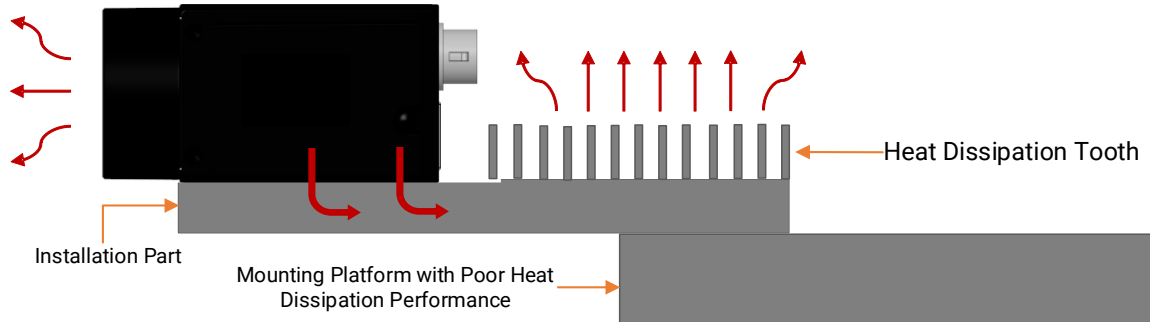


Figure 5-5 Add Heat Dissipation Tooth

- 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 M72-mount lenses. The thread depth of C-mount lens is not less than 7 mm, and that of M72-mount lens is not less than 5 mm.

6.1.2 Lens Selection

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

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

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.

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 Camera Link 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.

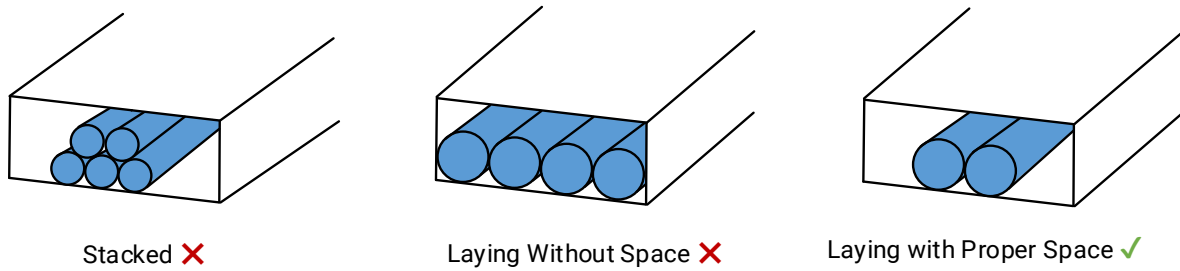


Figure 6-1 Cable Laying

- 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.

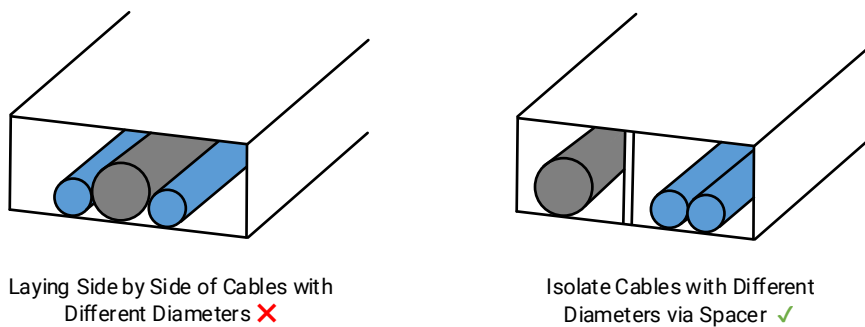


Figure 6-2 Isolated via Spacer

- 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.

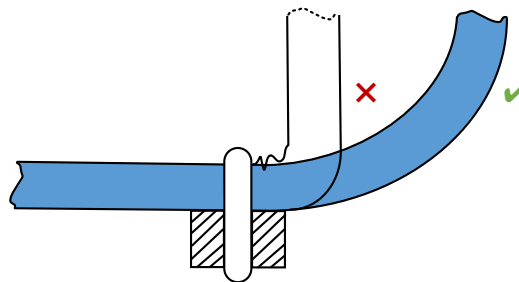


Figure 6-3 Vertically Bended Prohibited

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

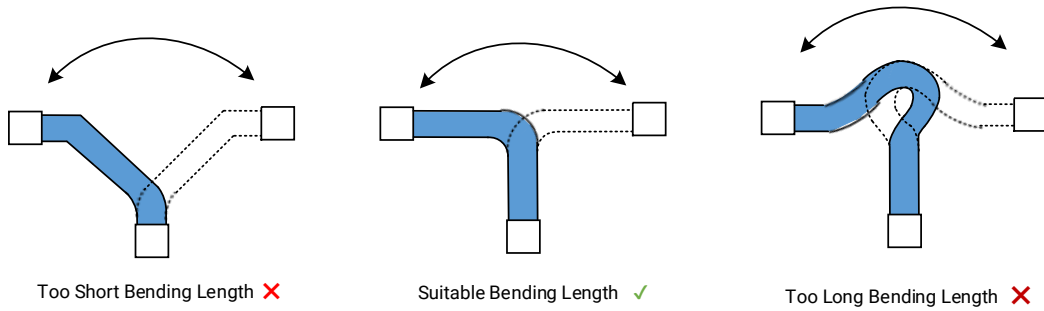


Figure 6-4 Suitable Bending Length

- Please keep a sufficient bending radius.

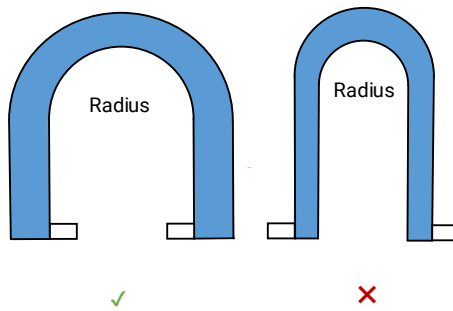


Figure 6-5 Sufficient Bending Radius

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

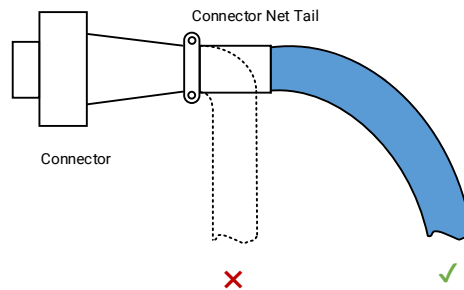


Figure 6-6 Assemble Connector

- Do not bind cables of different diameters together.

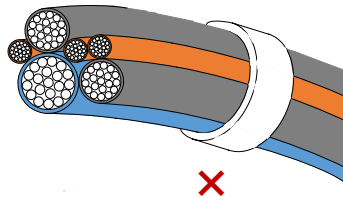


Figure 6-7 Improper Binding

Chapter 7 Quick Start Guide

The overall workflow of using the device is shown below:

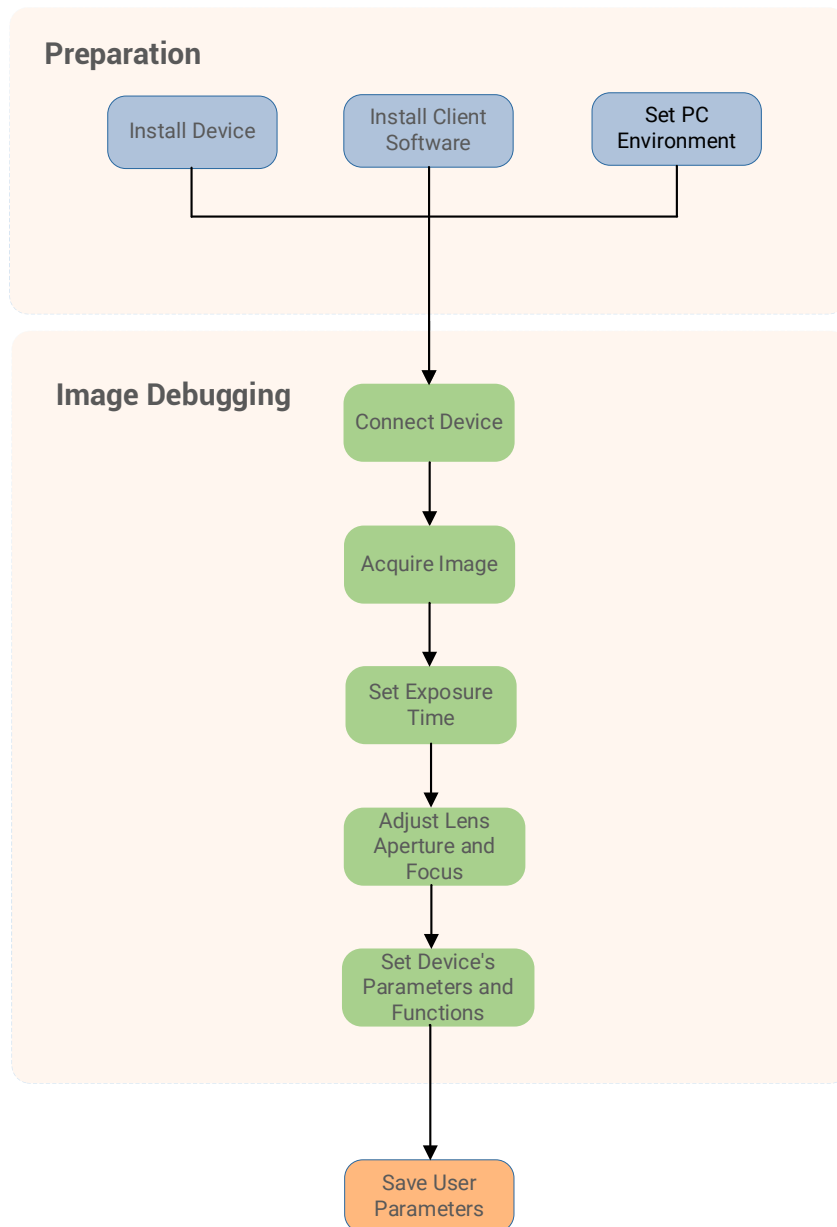


Figure 7-1 Workflow

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 Camera Link frame grabber that you need to purchase separately.
2	Power and I/O Cable	1	It refers to the 6-pin or 12-pin power and I/O cable. You need to purchase separately.
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	Camera Link Cable	1/2	It refers to the Camera Link cable. One end of the cable connected to the device is a SDR connector, while the other end connected to the frame grabber should be selected based on the model of frame grabber. You can use 1/2 Camera Link cable(s) to transmit data, and need to purchase cables separately. When two cables are used, their lengths should be the same
5	Lens	1	You need to purchase separately in accordance with device's lens mount.
6	Lens Adapter	1	If other lenses are used, you need to purchase the lens adapter 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.
- 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.

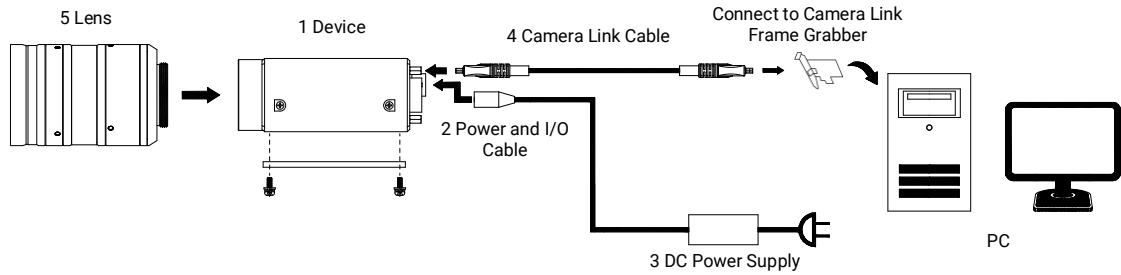


Figure 7-2 Topology Diagram

Note

The topology diagram is for reference only.

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 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](#) for details.

2. Connect the device to Camera Link frame grabber via Camera Link cable(s) before connecting to the power supply.

Note

- The Camera Link connector on the device is a SDR connector. You should select the appropriate cable for connection, and make sure the connector order of the device corresponds to that of the frame grabber.
- The device has 2 Camera Link connectors which can transmit data. The configuration mode and device interface vary with the number of connectors.
- The configuration mode is determined by three factors: device compatibility, frame grabber compatibility, the number of used connectors.

Table 7-2 Interface Quantity and Device Interface

Used Connector Quantity	Device Interface	Configuration Mode
1	CL1	Base
2	CL1, CL2	Medium, Full, 80-bit

3. Connect the device to an applicable power adapter or switching power supply via power and I/O cable. Refer to section [Power and I/O Connector](#) for details.

7.2 Client Software Installation

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.

Steps

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

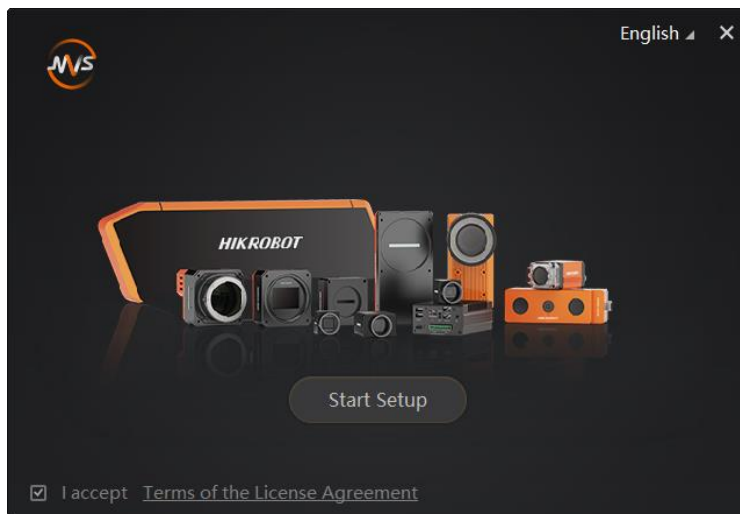


Figure 7-3 Installation Interface

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

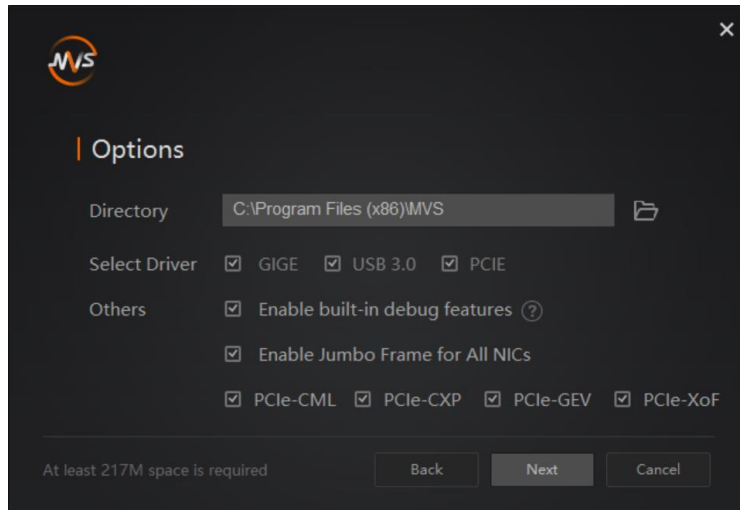


Figure 7-4 Installation Options

Note

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

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


7.3 Basic Operation

You can set the device's parameters, acquire images, etc. via the MVS client software.

Note

- MVS client software of version 3.1.0 or above supports connecting Camera Link devices.
- You can use either frame grabber software or MVS client software to set the device's parameters, but do not use them at the same time.
- Some manufacturers of the frame grabber do not support GenTL protocol or provide CTI file. You can use their frame grabber software to set the device's parameters or acquire images.
- Refer to the user manual of the device and client software for detailed operations.

Steps

1. Run the MVS client software.
2. Click  in **PCIE** in the device list, and the client software will enumerate the frame grabber automatically.


3. Click  in the specific frame grabber name to connect it. The client software will enumerate and connect the device under the frame grabber automatically.



Figure 7-5 Connect Device

After device connection, the client software displays the device’s information, as shown below.

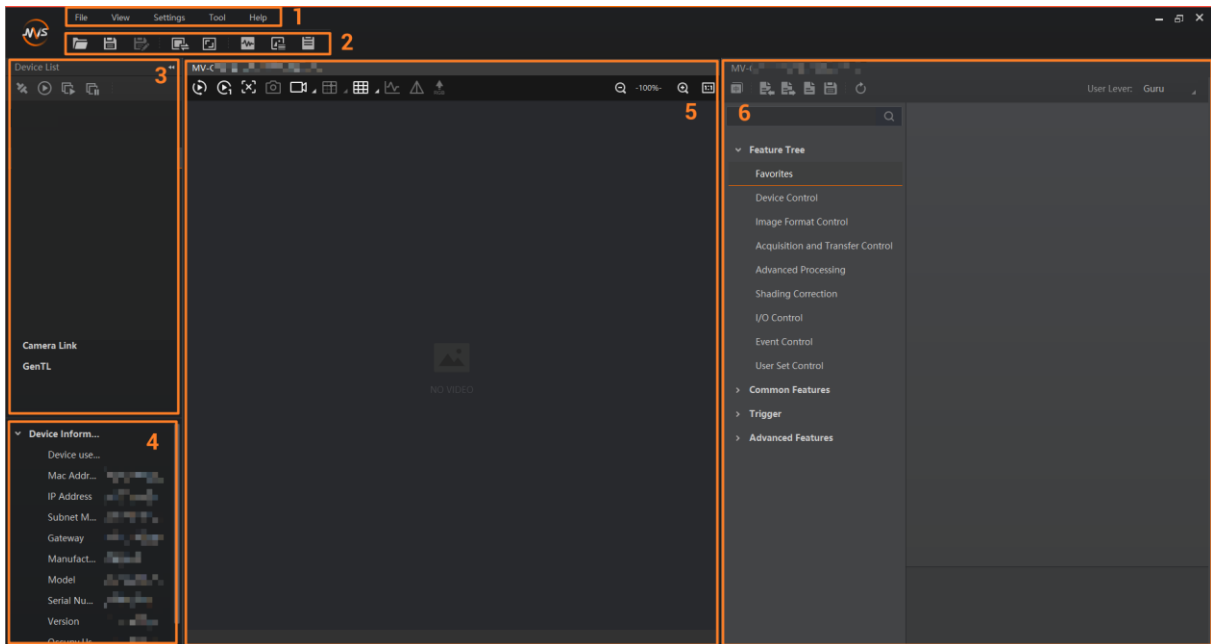


Figure 7-6 Main Window


 **Note**

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

Table 7-3 Main Window Description

No.	Name	Description
1	Menu Bar	The menu bar displays function modules, including File, View, Settings, Tool, and Help .
2	Control Toolbar	The control toolbar provides quick operations for the device, 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 disconnect device.

No.	Name	Description
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.

4. Set the device's pixel format, exposure time, etc., in the feature panel.
5. Click  in the display window to acquire images continuously.
6. Adjust the device's aperture and focus to have clear images.
7. (Optional) Set the device's other parameters in the feature panel.

Note

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

8. Go to **Transport Layer Control** → **Device Tap Geometry** to check or set the tap geometry. The **CI Configuration** displays the mode that the device adopts currently.
-

Note

The device's tap geometry should match with that of the frame grabber, and inconsistent parameters may lead to image exception.

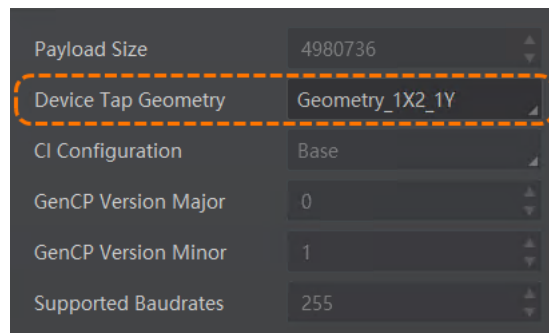


Figure 7-7 Set Tap Geometry

Chapter 8 I/O Electrical Features and Wiring

8.1 I/O Electrical Features

8.1.1 Input Signal

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

Note

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

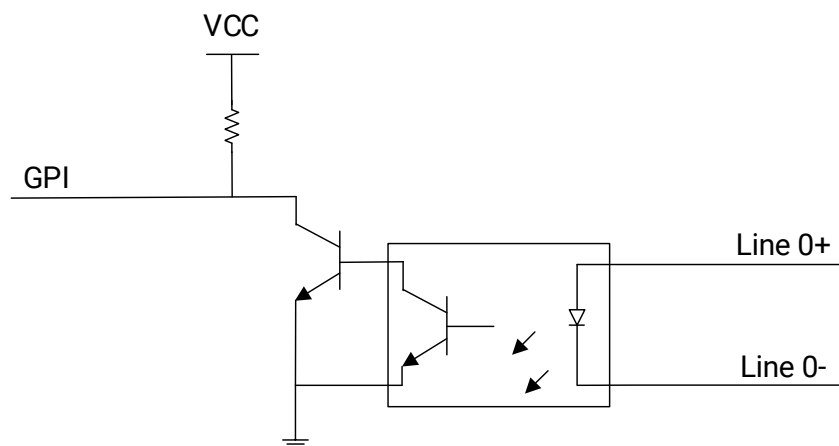


Figure 8-1 Internal Circuit of Input Signal

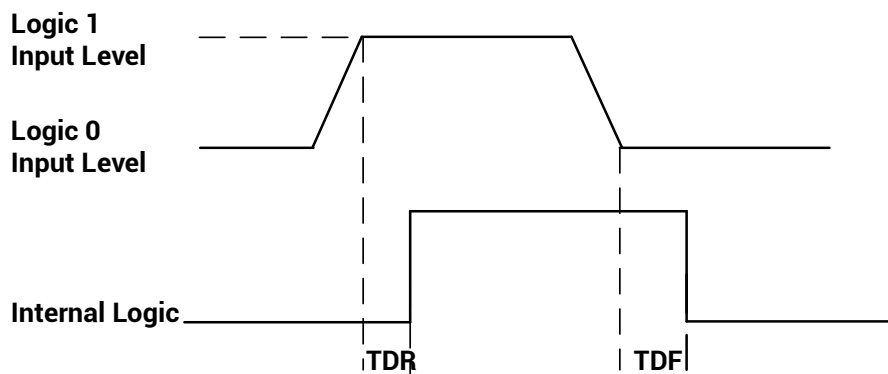


Figure 8-2 Input Logic Level

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

Table 8-1 Input Electrical Feature

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

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

Table 8-2 Input Electrical Feature

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

8.1.2 Output Signal

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

Note

The maximum output current of Line 1 is 25 mA.

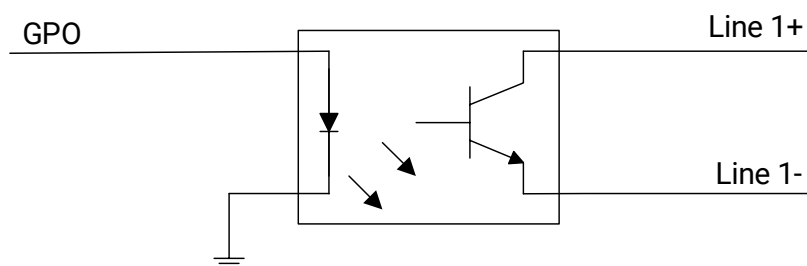


Figure 8-3 Internal Circuit of Output Signal

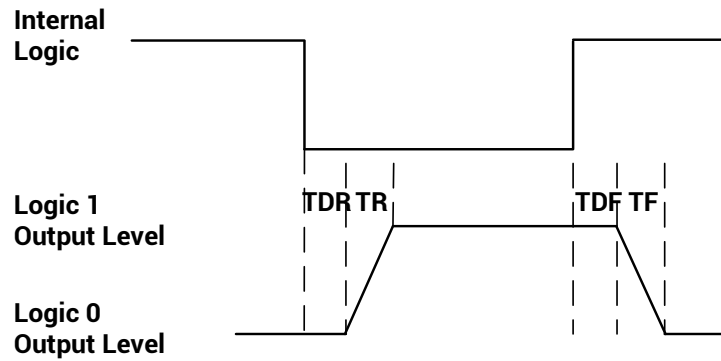


Figure 8-4 Output Logic Level

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

Table 8-3 Output Electrical Feature

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

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

Table 8-4 Output Electrical Feature

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

With different external voltage and resistance, the corresponding current and the parameter of output logic level low are shown below.

Table 8-5 Parameters of Output Logic Level Low

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

8.1.3 Bi-Directional Signal

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

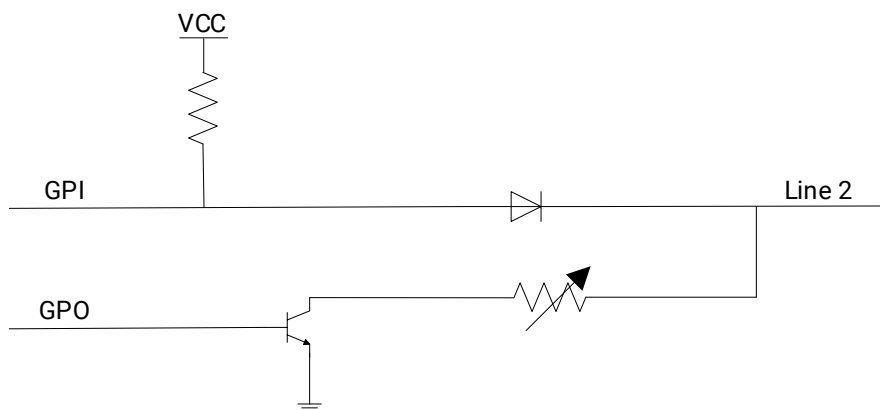


Figure 8-5 Internal Circuit of Bi-Directional Signal

Configured as Input Signal

Note

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

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

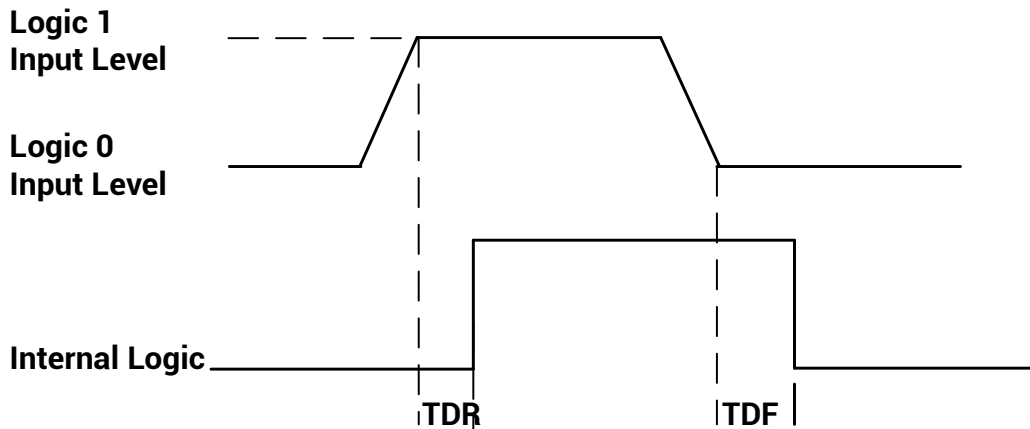


Figure 8-6 Input Logic Level

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

Table 8-6 Input Electrical Feature

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

Configured as Output Signal

Note

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

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

Table 8-7 Parameters of Output Logic Level Low

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

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

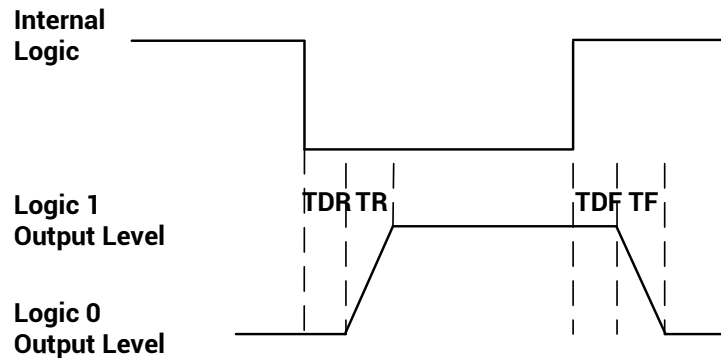


Figure 8-7 Output Logic Level

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

Table 8-8 Output Electrical Feature

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC
Output Logic Level High	VH	7.8 VDC to 11.8 VDC
Output Rising Time	TR	0.46 μ s to 0.9 μ 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 Ω , the electrical features of output are shown below.

Table 8-9 Output Electrical Feature

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC to 0.2 VDC
Output Logic Level High	VH	5 VDC to 23.2 VDC
Output Rising Time	TR	0.44 μ s to 4.48 μ 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 8-10 Factors Affecting Transmission Delay of I/O Lines

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

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

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

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

8.2 I/O Wiring

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

Note

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

8.2.1 Input Signal Wiring

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

Note

Input signal wiring may differ by the external device type.

PNP Device

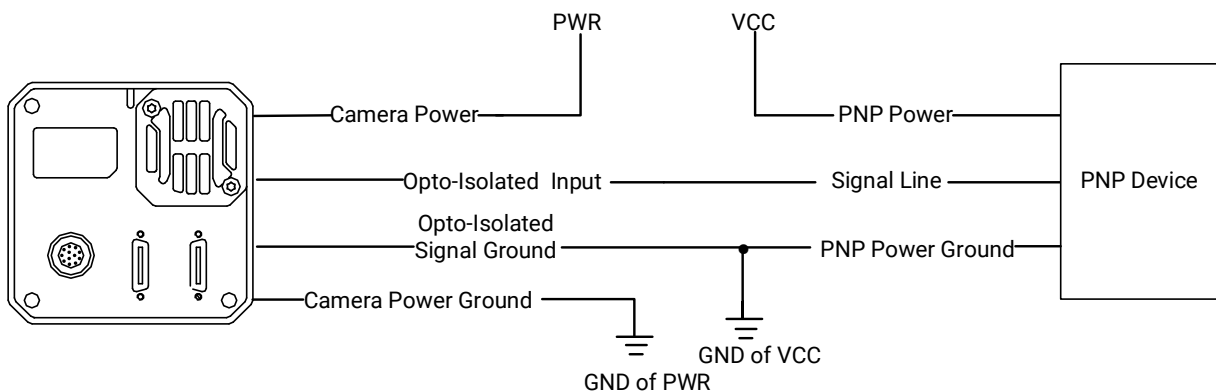


Figure 8-8 Input Signal Connects to PNP Device

NPN Device

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

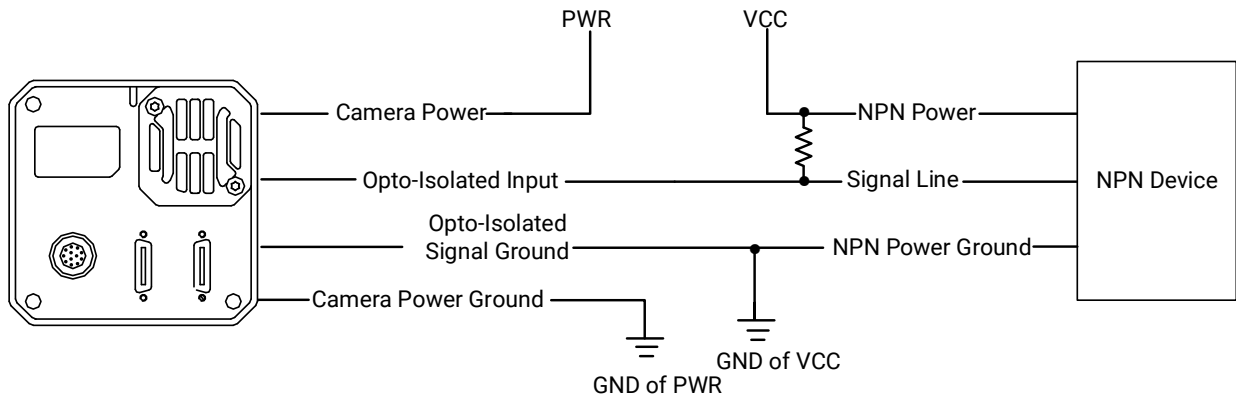


Figure 8-9 Input Signal Connects to NPN Device

Switch

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

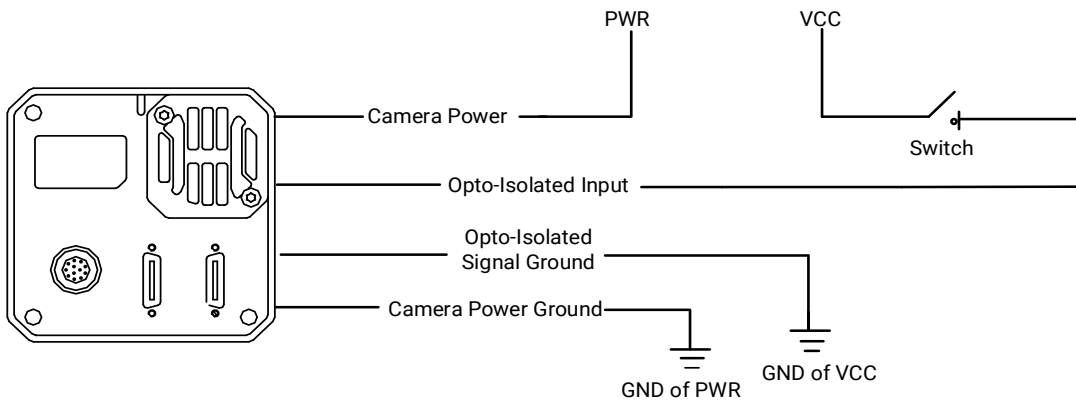


Figure 8-10 Input Signal Connects to Switch

8.2.2 Output Signal Wiring

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

Note

Output signal wiring may differ by the external device type.

PNP Device

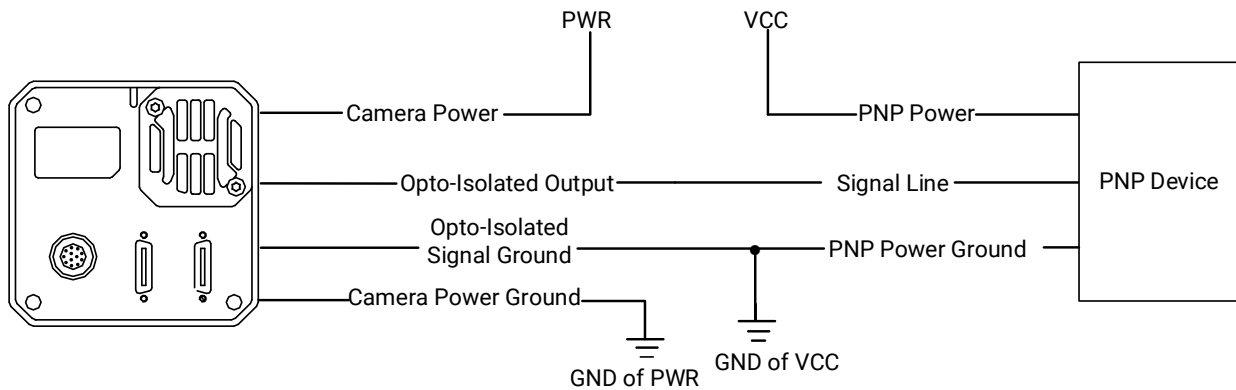


Figure 8-11 Output Signal Connects to PNP Device

NPN Device

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

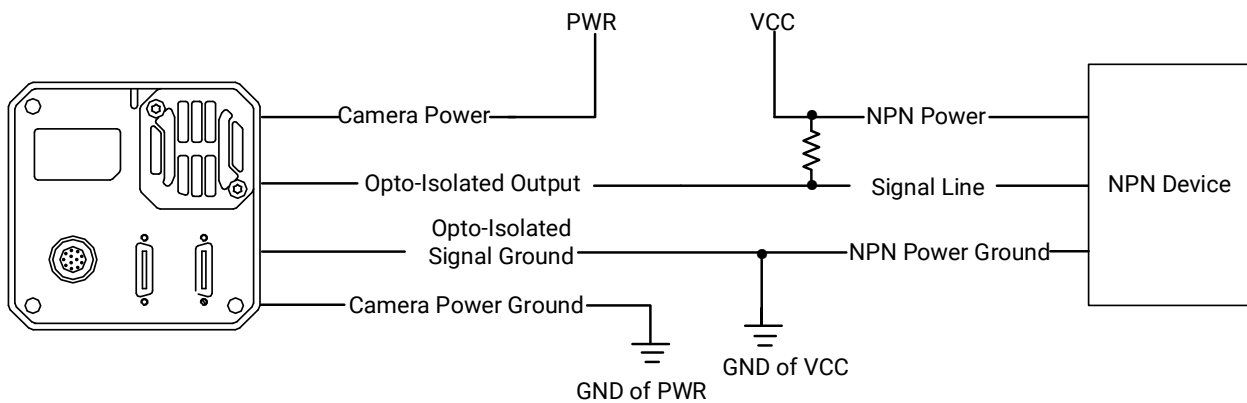


Figure 8-12 Output Signal Connects to NPN Device

8.2.3 Bi-Directional Signal Wiring

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

Configured as Input Signal

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

Note

Input signal wiring may differ by the external device type.

PNP Device

It is recommended to use a 330 Ω pull-down resistor.

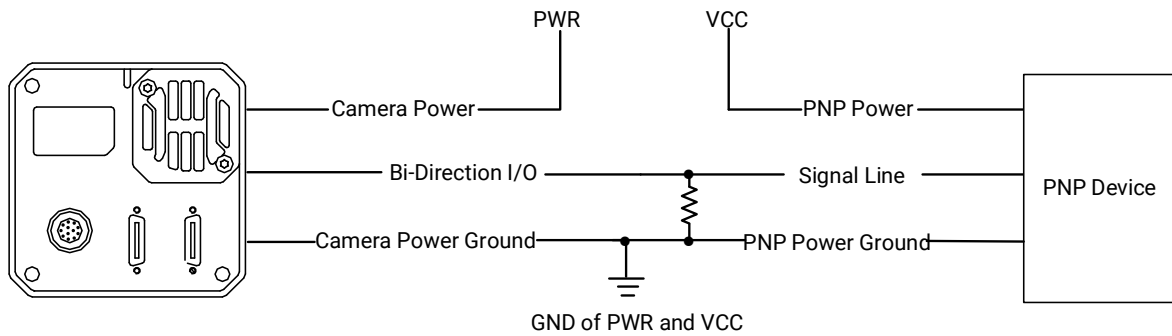


Figure 8-13 Input Signal Connects to PNP Device

Note

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

NPN Device

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

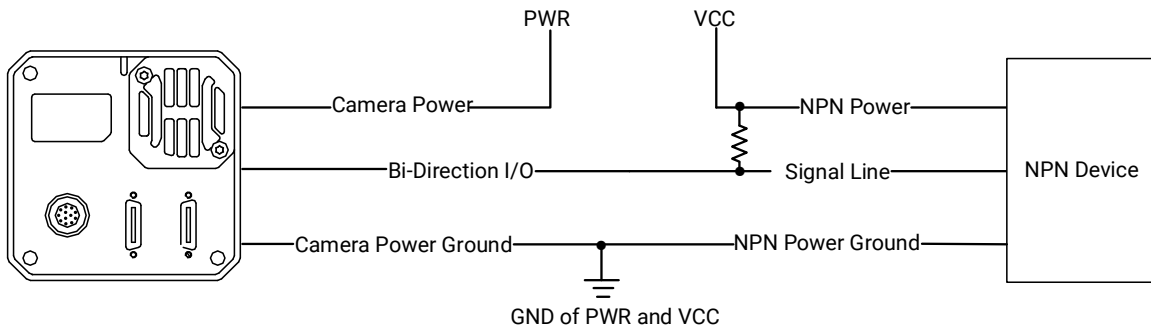


Figure 8-14 Input Signal Connects to NPN Device

Switch

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

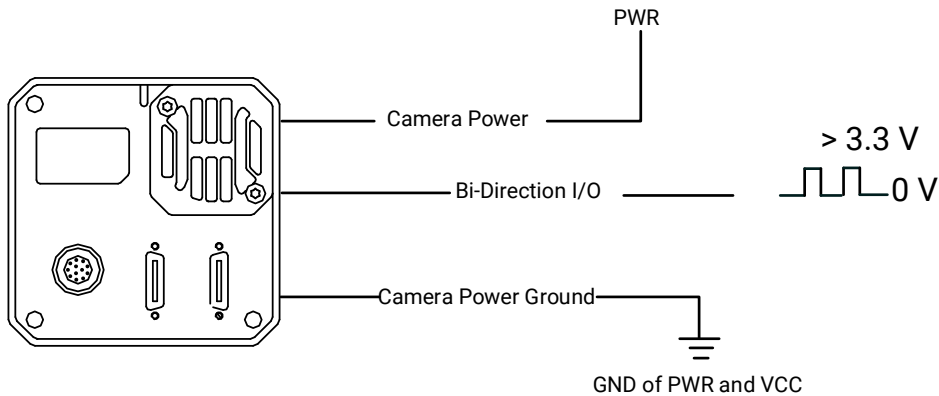


Figure 8-15 Input Signal Connects to Switch

Configured as Output Signal

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

Note

Output signal wiring may differ by the external device type.

PNP Device

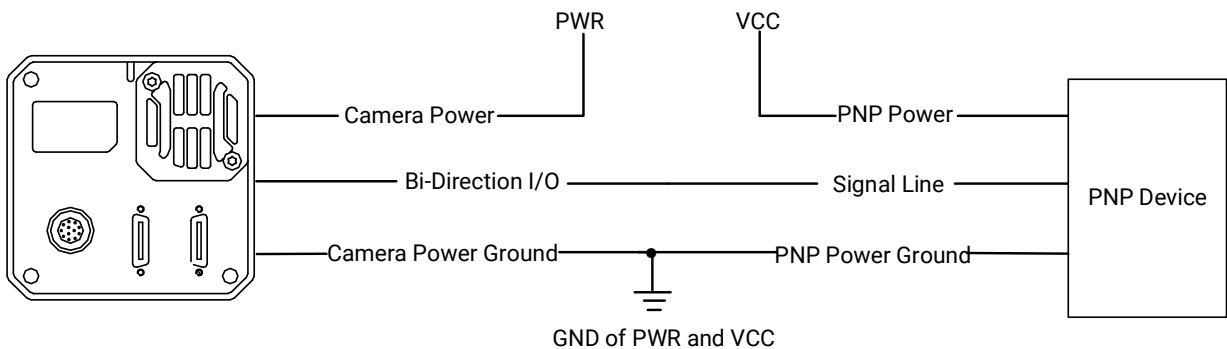


Figure 8-16 Output Signal Connects to PNP Device

NPN Device

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

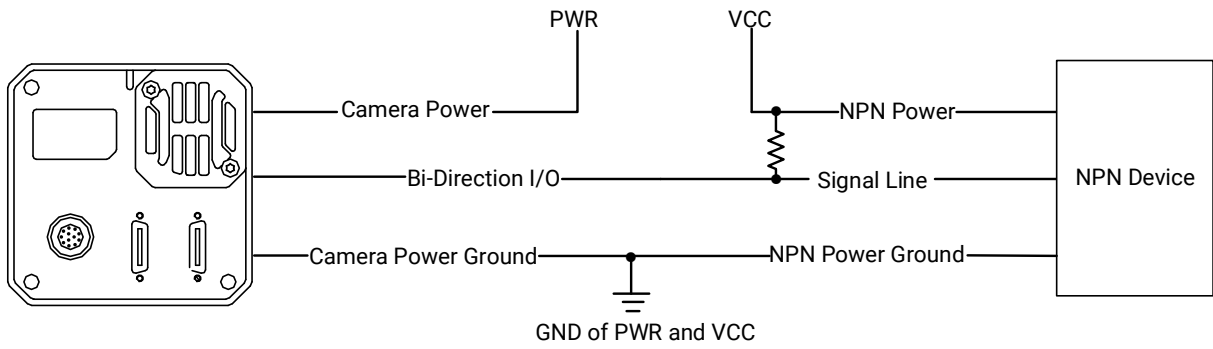


Figure 8-17 Output Signal Connects to NPN Device

Chapter 9 Trigger Input and Output

9.1 Trigger Input

9.1.1 Set Trigger Mode

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

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

Enable Internal Trigger Mode

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

 **Note**

Off refers to the internal trigger mode.

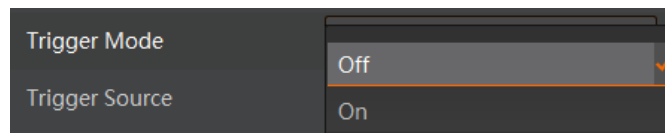


Figure 9-1 Enable Internal Trigger Mode

Enable External Trigger Mode

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

 **Note**

On refers to the external trigger mode.

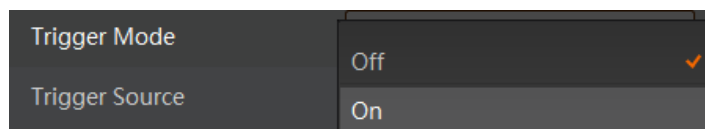


Figure 9-2 Enable External Trigger Mode

9.1.2 Set Trigger Source

Set External Trigger Source

The device's external trigger source includes software trigger, hardware trigger, counter trigger, and frame grabber trigger. Go to **Acquisition Control** → **Trigger Source**, and select **Trigger Source** according to actual demands.

Table 9-1 Trigger Source Description

External Trigger Source	Parameter	Description
Software Trigger	Software	The software sends trigger signal to the device via Camera Link connector to acquire images.
Hardware Trigger	Line 0 Line 2	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.
Counter Trigger	Counter 0	The counter sends trigger signal to the device to acquire images.
Frame Grabber Trigger	CC 1/2/3/4	The frame grabber sends trigger signals to the device to acquire images.

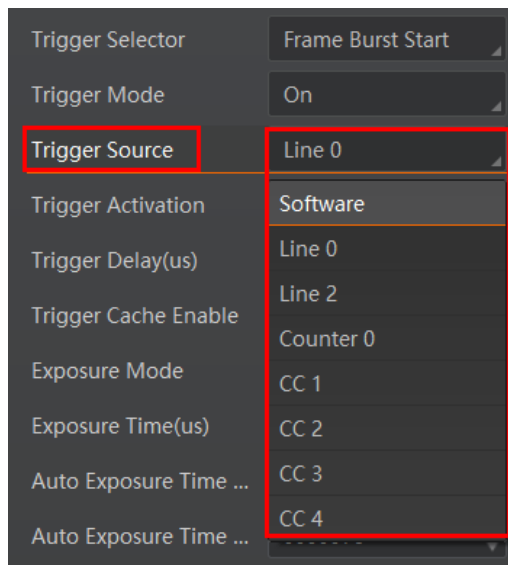


Figure 9-3 External Trigger Source

Note

- These external trigger sources are valid only when the **Trigger Mode** is **On**.
- The parameters of frame grabber trigger may differ by device models.

Set and Execute Software Trigger

In software trigger, the software sends trigger signal to the device via Camera Link connector to acquire images.

Steps

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

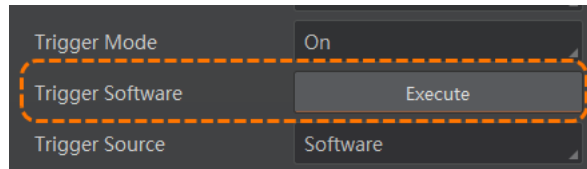


Figure 9-4 Set and Execute Software Trigger

Note

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

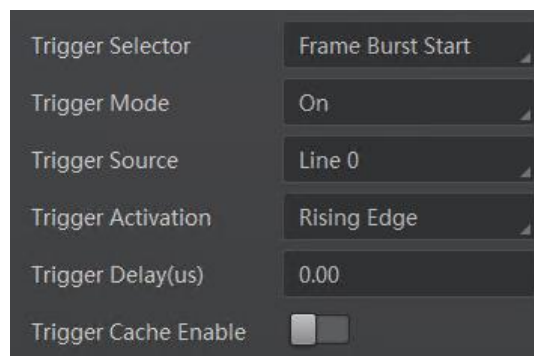


Figure 9-5 Set Line 0 or Line 2 as Input Signal

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

Steps

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

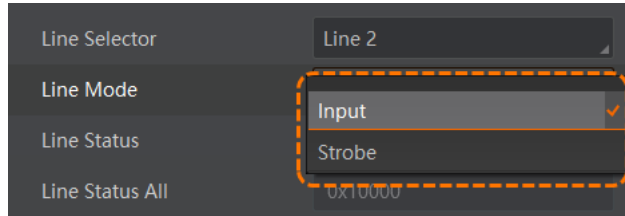


Figure 9-6 Set Line 2 as Input Signal

Note

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

Set and Execute Counter Trigger

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

Steps

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

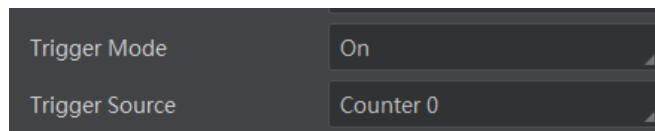


Figure 9-7 Set and Execute Counter Trigger

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

Table 9-2 Parameters of Counter And Timer Control

Parameter	Read/Write	Description
Counter Selector	Read & Write	It selects counter source. Counter 0 is available only at present.
Counter Event Source	Read & Write	It selects the signal source of counter trigger. Line 0/2 and CC 1/2/3/4 are available. This parameter is disabled by default.
Counter Reset Source	Read & Write	It selects the signal source of resetting

Parameter	Read/Write	Description
		counter. Software is available only. This parameter is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed only when Software is selected as Counter Reset Source .
Counter Value	Read & Write	It is the counter value with the range of 1 to 1023. If the parameter is set to n, the n external trigger signals can perform one counter trigger and acquire one frame of image.
Counter Current Value	Read Only	It displays the number of executed external triggers.

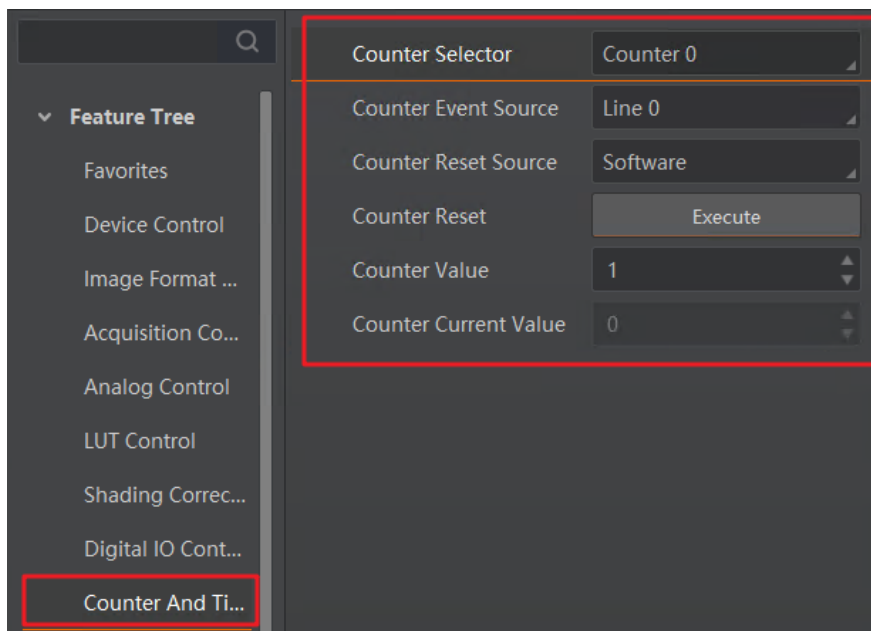


Figure 9-8 Counter And Timer Control

Note

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

Set and Execute Frame Grabber Trigger

When selecting **CC 1/2/3/4** as **Trigger Source**, the device is in frame grabber trigger status. Frame grabber triggers device to acquire images by sending signal via Camera Link connector.

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Frame Burst Start** or **Line Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
3. Select **CC 1/CC 2/CC 3/CC 4** as **Trigger Source**.

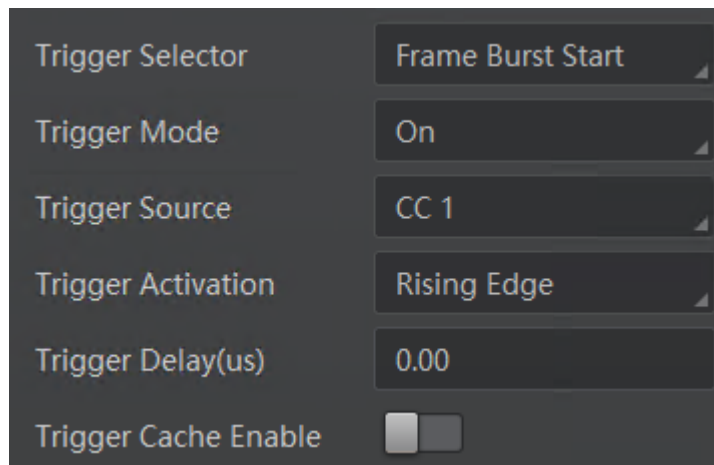


Figure 9-1 Set and Execute Frame Grabber Trigger

Note

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

9.1.3 Set Trigger Related Parameters

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

Note

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

Table 9-3 Trigger Source and Trigger Related Parameters

Trigger Source Trigger Parameters	Software Trigger	Hardware Trigger	Counter Trigger	Frame Grabber Trigger
Acquisition Burst Frame Count	√	√	√	√
Trigger Delay	√	√	√	√
Trigger Cache	√	√	√	√
Trigger Activation	×	√	√	√
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.

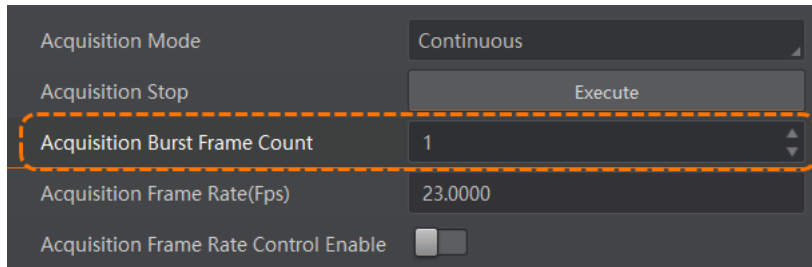


Figure 9-9 Set Acquisition Burst Frame Count

Note

- The range of **Acquisition Burst Frame Count** is from 1 to 1023.
- If **Acquisition Burst Frame Count** is 1, the device is in single frame trigger mode. If **Acquisition Burst Frame Count** is larger than 1, the device is in multi-frame trigger mode.
- If **Acquisition Burst Frame Count** is n, when input 1 trigger signal to the device, the device stops acquiring images after exposing n times and outputting n frame images.
- The sequence diagram below uses rising edge as trigger activation.

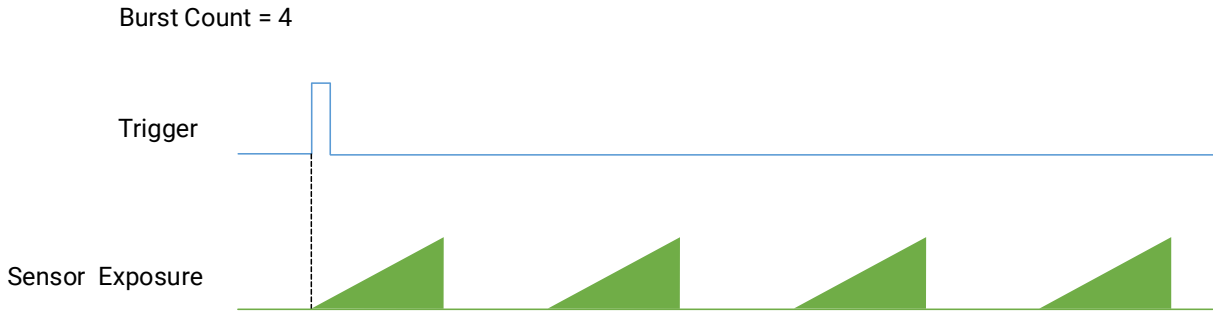


Figure 9-10 Sequence Diagram of Acquisition Burst Frame Count

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 value should be between 0 and 16000000, and the unit is μs .

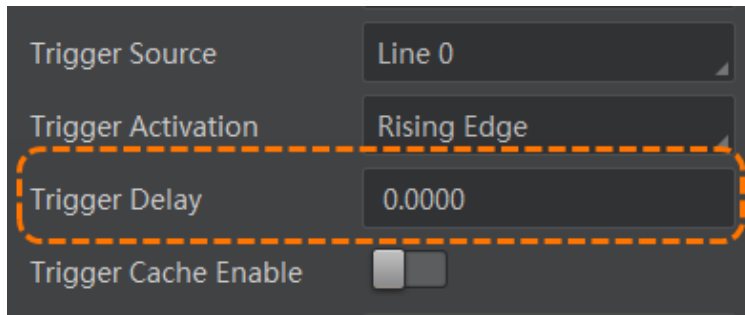


Figure 9-11 Set Trigger Delay

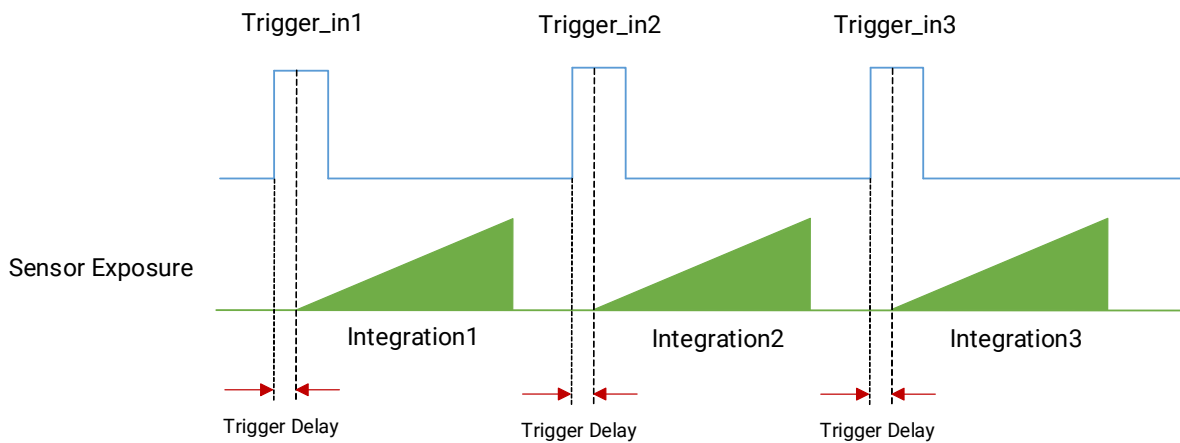


Figure 9-12 Sequence Diagram of Trigger Delay

Note

The sequence diagram above uses rising edge as trigger activation.

Set Trigger Cache

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

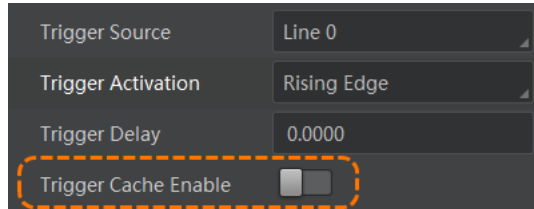


Figure 9-13 Set Trigger Cache

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

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

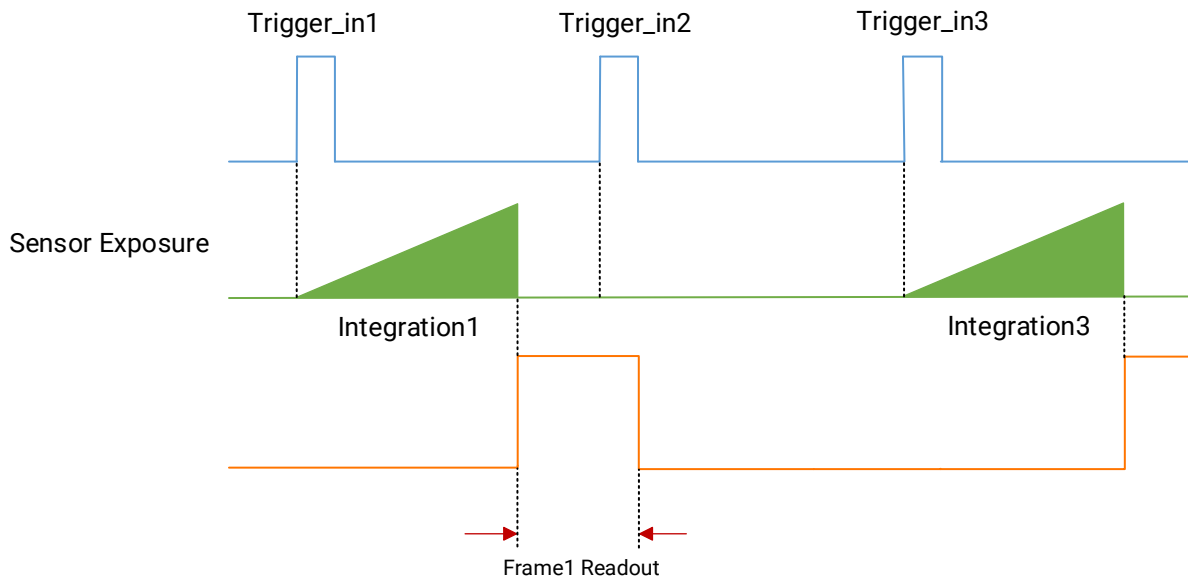


Figure 9-14 Second Frame Filtered

- 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.

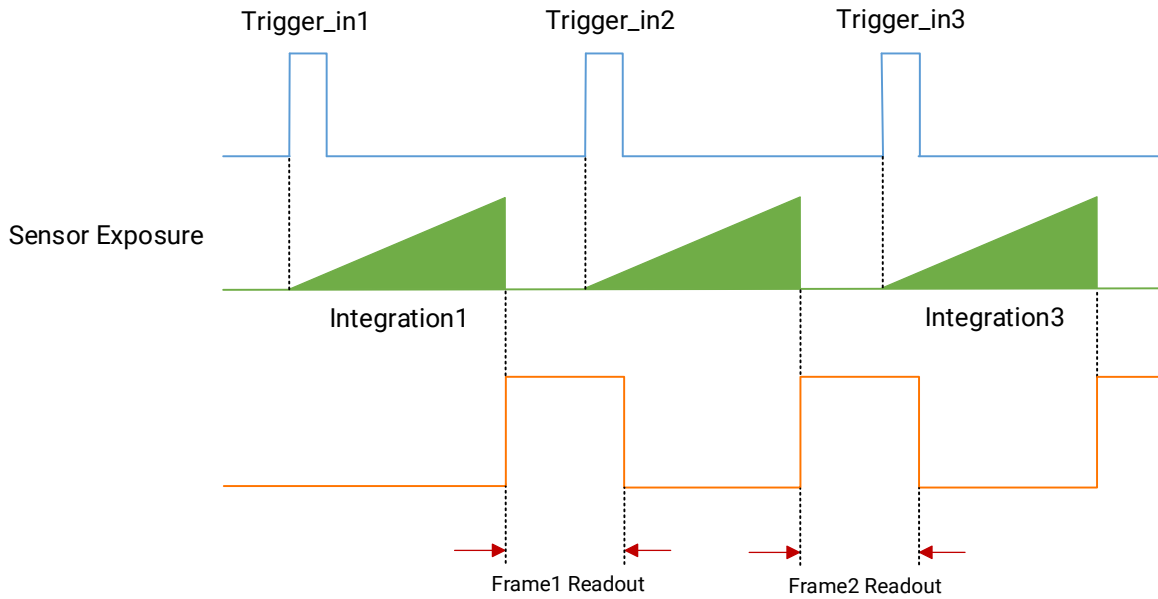


Figure 9-15 Second Frame Created Normally

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.

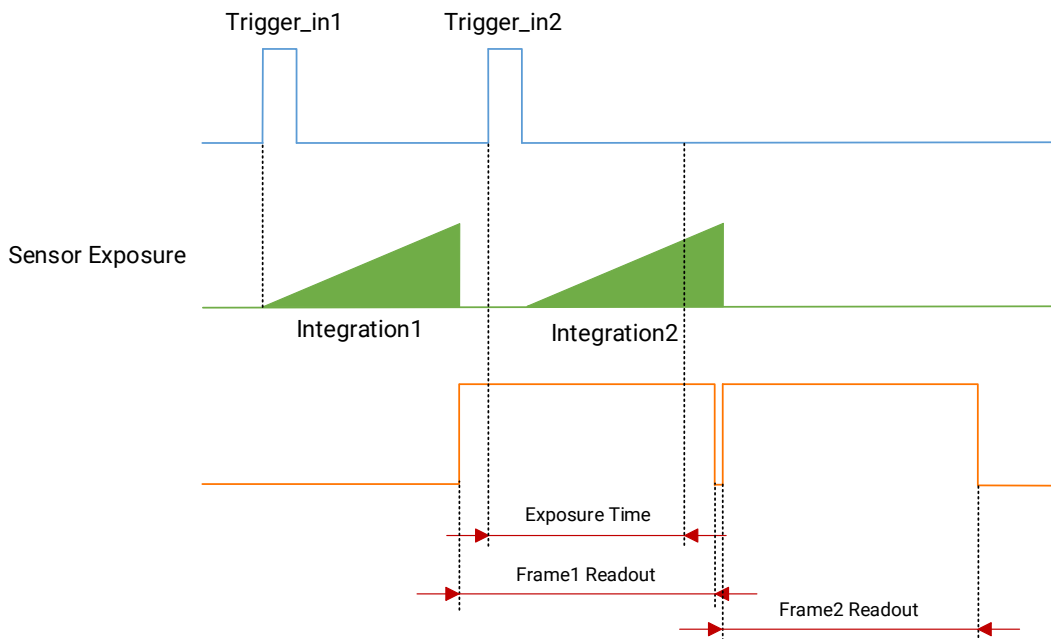


Figure 9-16 Sequence Diagram

Note

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

Set Trigger Activation

The device supports triggering image acquisition in the rising edge, falling edge, level high, level low or any edge of the external signal. Go to **Acquisition Control** → **Trigger Activation**, and select **Rising Edge**, **Falling Edge**, **Any Edge**, **Level High**, or **Level Low** as **Trigger Activation**.

- **Rising Edge**: It means that when the level signal sent by external device is in rising edge, the device receives trigger signal and starts to acquire images.
- **Falling Edge**: It means that when the level signal sent by external device is in falling edge, the device receives trigger signal and starts to acquire images.
- **Any Edge**: It means that when the level signal sent by external device is in rising or falling edge, the device receives trigger signal and starts to acquire images.
- **Level High**: The level high of the trigger signal is valid. As long as the trigger signal is in level high, the device is in image acquisition status.
- **Level Low**: The level low of the trigger signal is valid. As long as the trigger signal is in level low, the device is in image acquisition status.

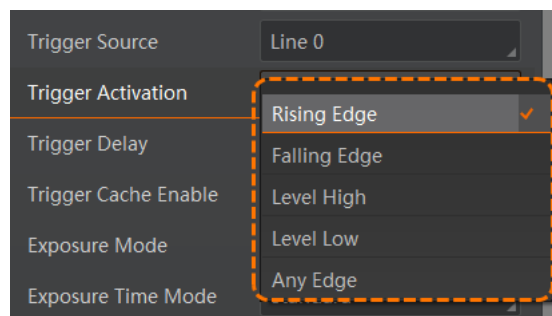


Figure 9-17 Set Trigger Activation

Note

The trigger activation mode may differ by the trigger mode.

Set Trigger Debouncer

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

Go to **Digital IO Control** → **Line Debouncer Time**, and enter **Line Debouncer Time** according to actual demands. The range of **Line Debouncer Time** is from 0 μ s to 1000000 μ s.

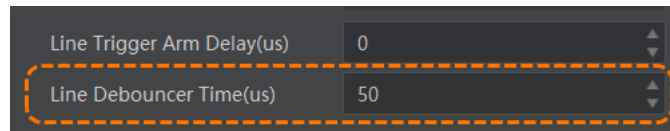


Figure 9-18 Set Trigger Debouncer

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

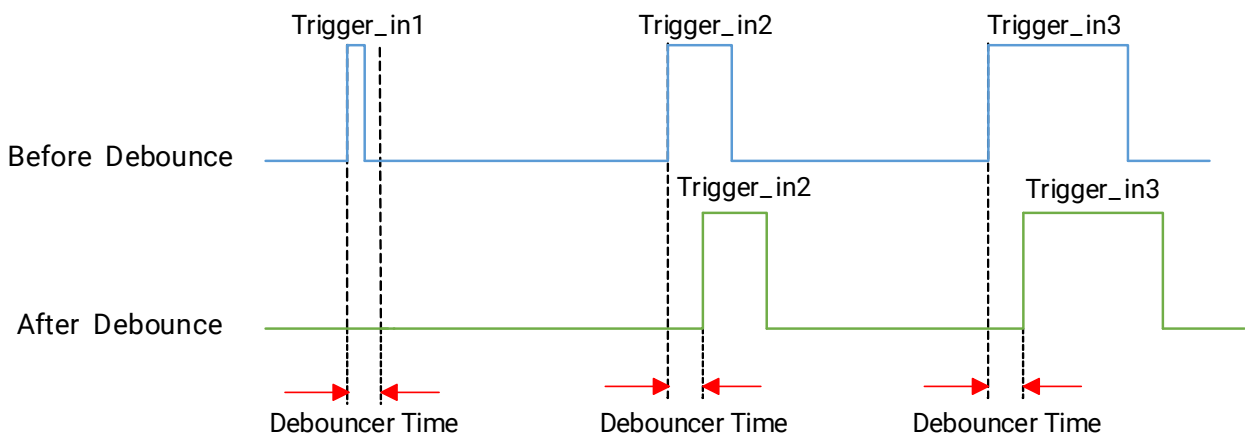


Figure 9-19 Sequence Diagram of Trigger Debouncer

Note

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

9.2 Trigger Output

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

Steps

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

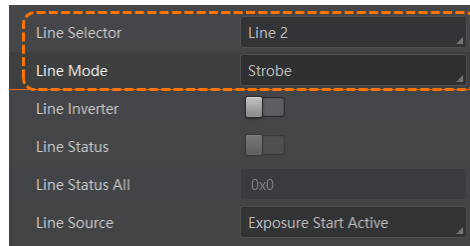


Figure 9-20 Select Output Signal

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.

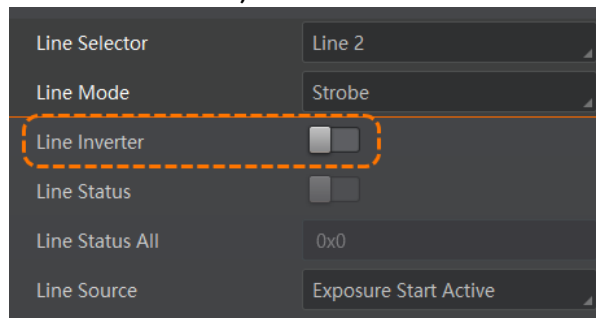


Figure 9-21 Enable Line Inverter

Note

The line inverter function is disabled by default.

9.2.2 Enable Strobe Signal

The strobe signal is used to directly output I/O signal to external devices when the device's event source occurs.

Steps

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

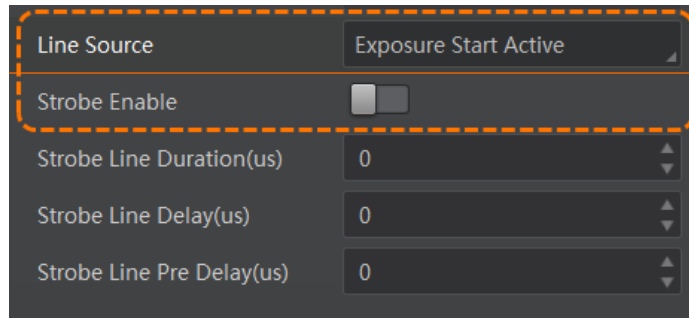


Figure 9-22 Enable Strobe Signal

The supported line sources are as follows:

Table 9-4 Line Source Description

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

Note

The specific line sources may differ by device models.

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

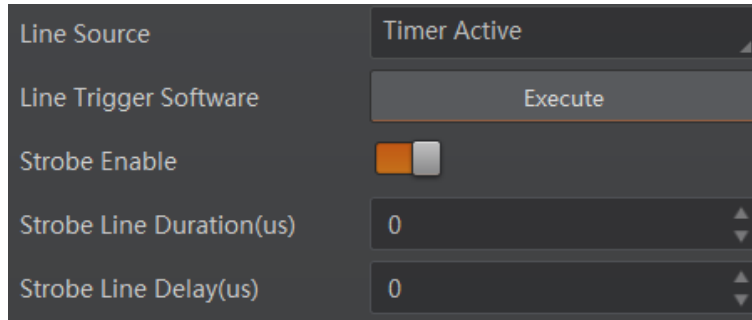


Figure 9-23 Timer Active Parameters

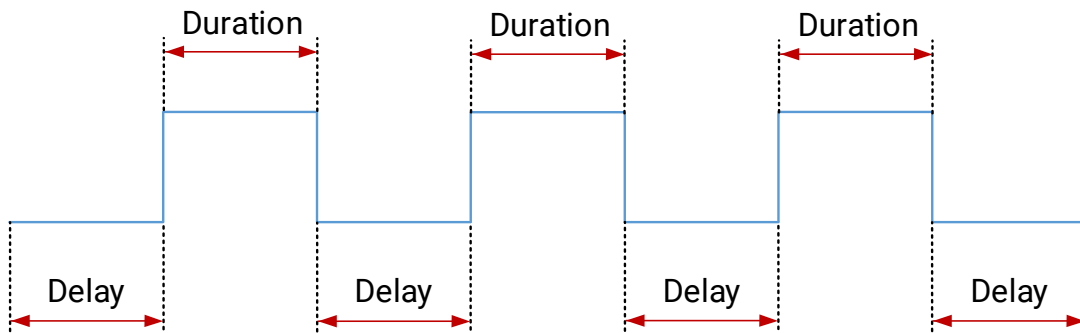


Figure 9-24 Sequence Diagram of Timer Active

Set Strobe Line Duration

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

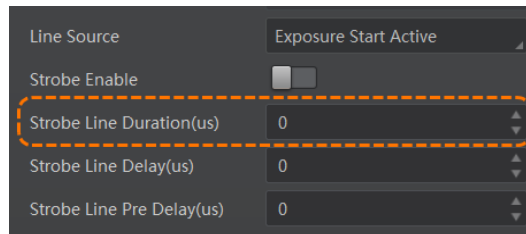


Figure 9-25 Set Strobe Line Duration

Take **Exposure Start Active** selected as an example. When the exposure starts, the strobe output is executed immediately. The sequence diagram of strobe line duration is shown below.

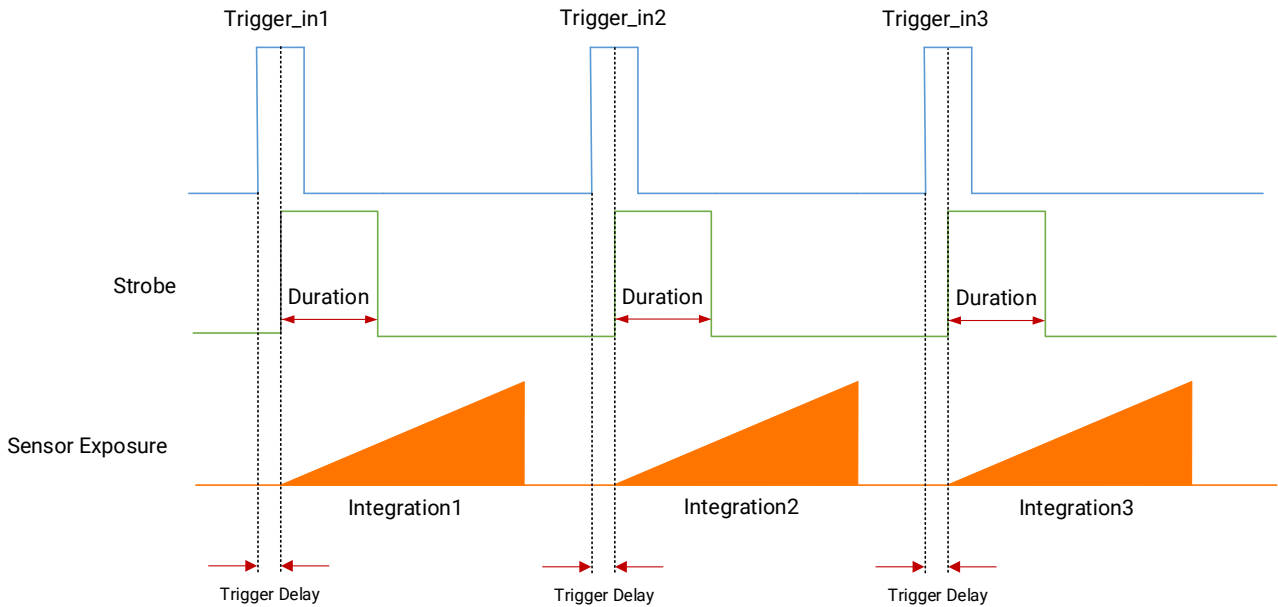


Figure 9-26 Sequence Diagram of Strobe Line Duration

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 μ s to 10000 μ s.

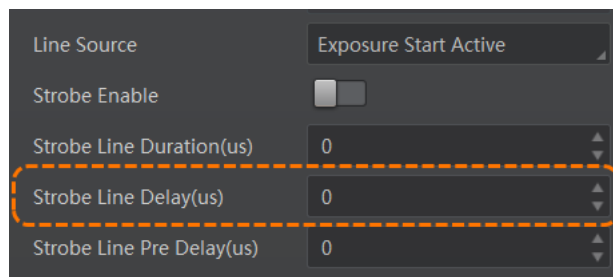


Figure 9-27 Set Strobe Line Delay

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

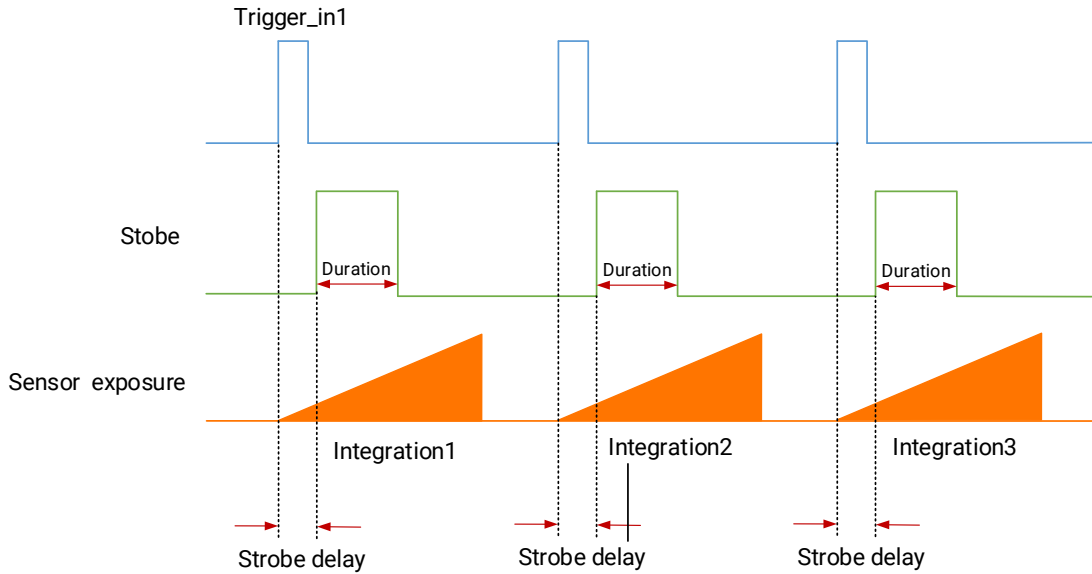


Figure 9-28 Sequence Diagram of Strobe Line Delay

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 μ s to 5000 μ s.

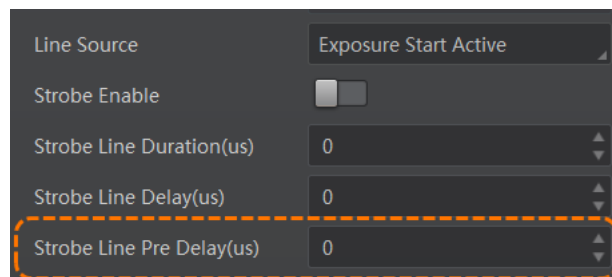


Figure 9-29 Set Strobe Pre Line Delay

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.

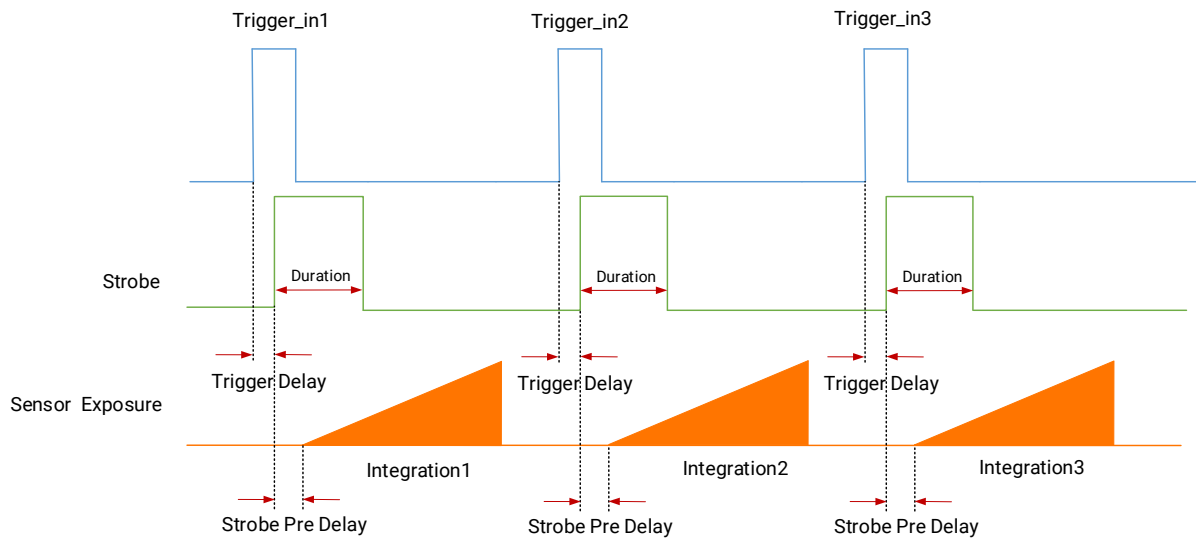


Figure 9-30 Sequence Diagram of Strobe Pre Line Delay

Chapter 10 Image Acquisition

10.1 Global Shutter and Rolling Shutter

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

10.1.1 Global Shutter

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

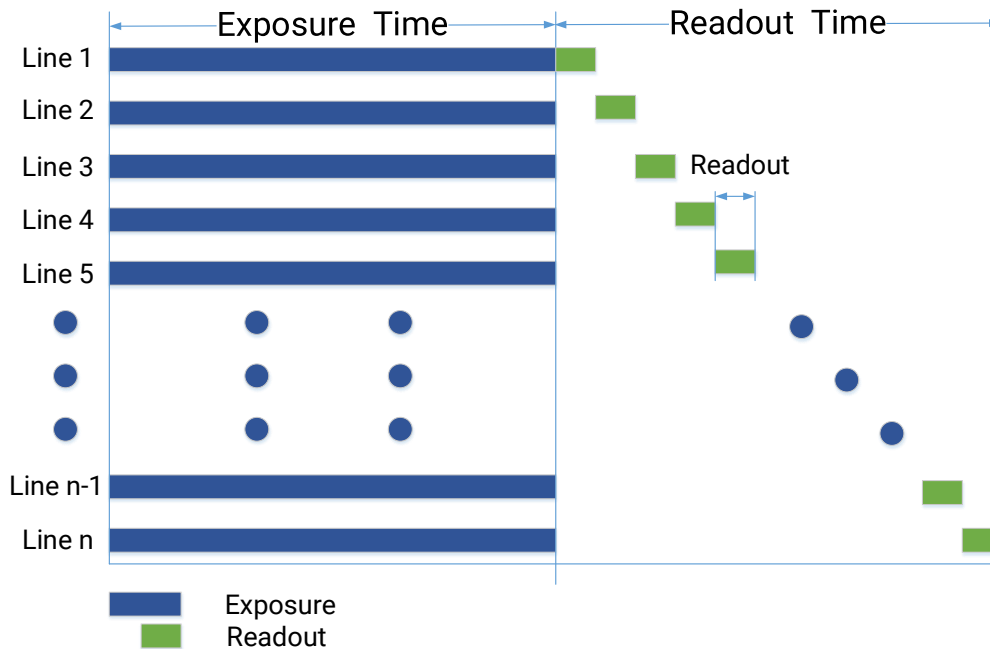


Figure 10-1 Global Shutter

10.1.2 Rolling Shutter

Working Principle

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

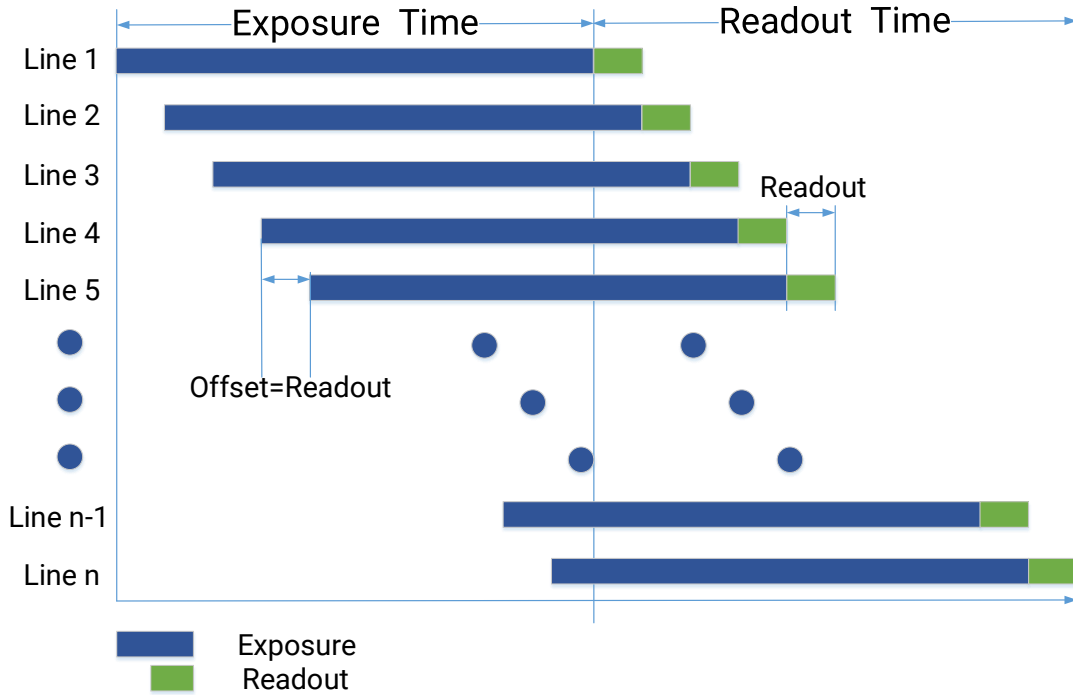


Figure 10-2 Rolling Shutter

Global Reset

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

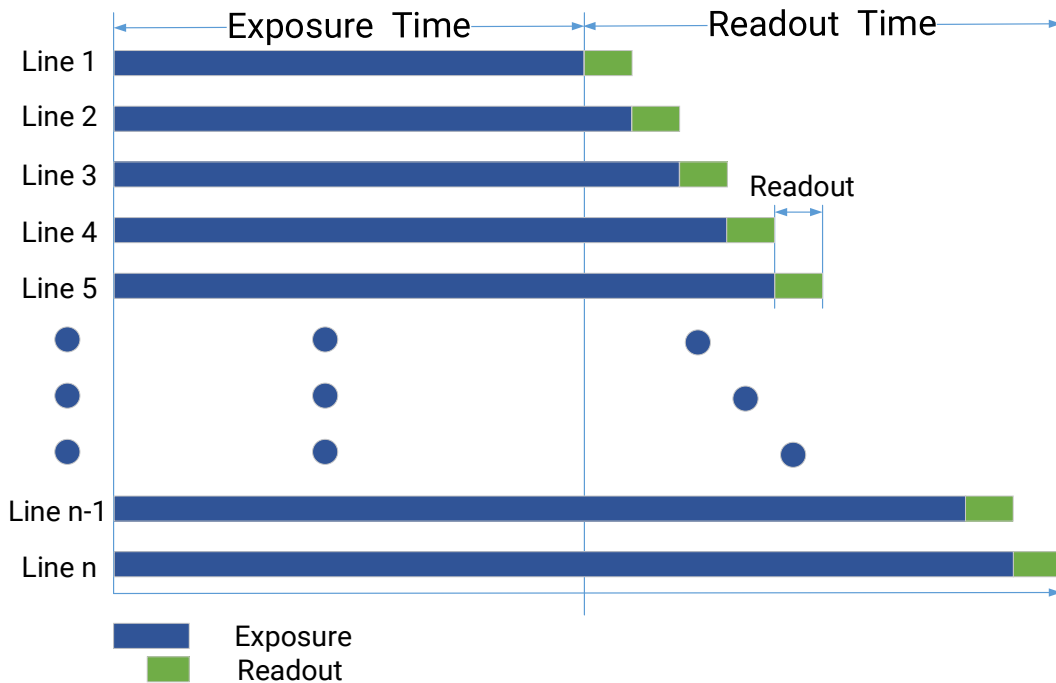


Figure 10-3 Global Reset

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

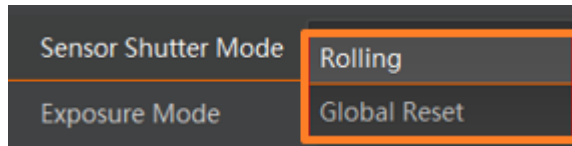


Figure 10-4 Select Global Reset

Note

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

10.2 Overlap Exposure

The process that the device captures one frame of image includes two stages, exposure and readout. According to the overlap relation between the exposure time and the readout time, devices with different sensors can be divided into overlap exposure and non-overlap exposure. The Camera Link area scan camera supports overlap exposure.

Overlap exposure refers to the overlap between the current frame exposure and the previous frame readout. In other words, when the previous frame starts to read out, the current frame starts to expose simultaneously. The overlap exposure's frame period is no greater than the sum of the exposure time and the readout time, as shown below.

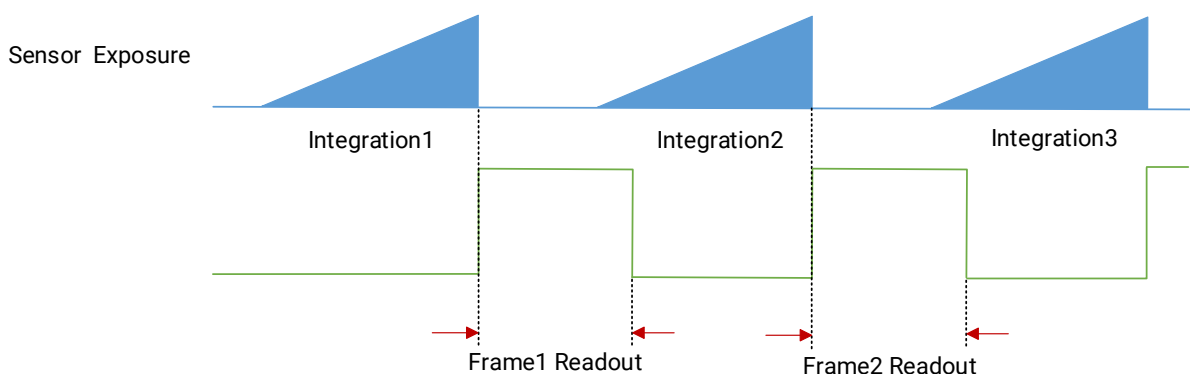


Figure 10-5 Internal Trigger Overlap Exposure

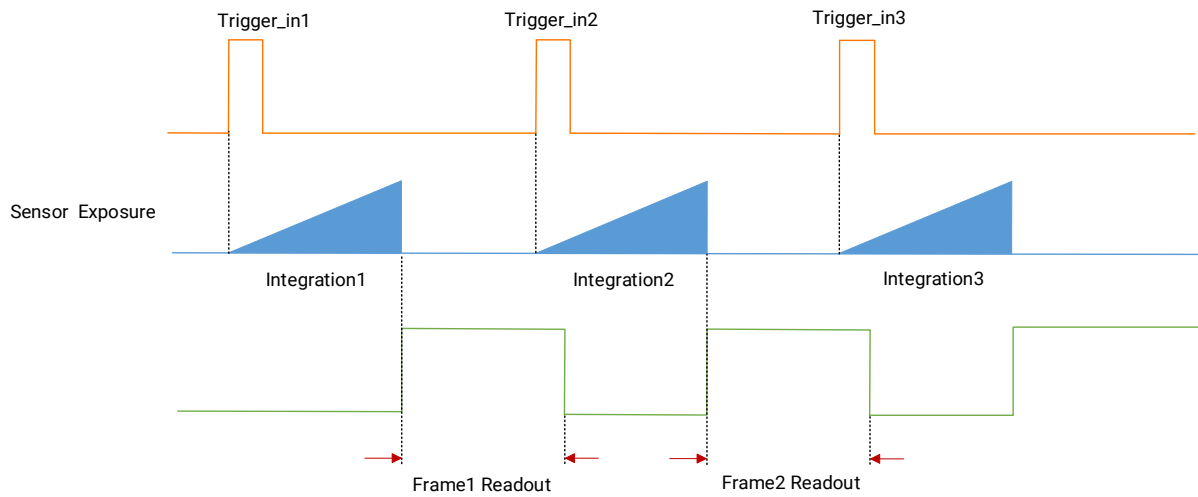


Figure 10-6 External Trigger Overlap Exposure

Note

The overlap exposure is supported in the continuous mode and trigger mode.

Chapter 11 Image Transmission

11.1 Set Frame Rate

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

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

Steps

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

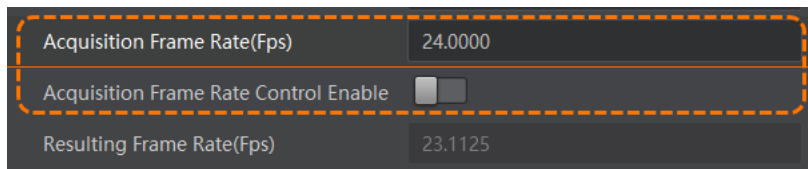


Figure 11-1 Set Frame Rate

Note

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

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

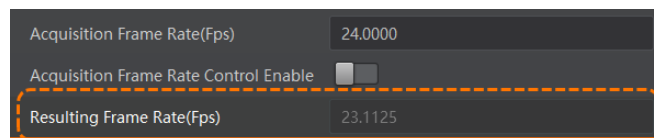


Figure 11-2 View Resulting Frame Rate

Note

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

11.2 Set Geometry Mode

The image output method may differ by different geometry modes. The geometry mode of the camera should be matched with the configuration mode of the frame grabber, otherwise the image exception will occur.

Go to **Transport Layer Control** → **Device Tap Geometry** to select geometry mode. **Geometry_1X2_1Y**, **Geometry_1X4_1Y**, **Geometry_1X8_1Y**, and **Geometry_1X10_1Y** can be selected.

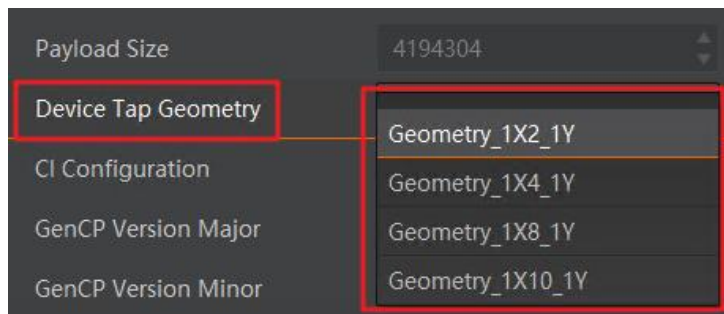


Figure 11-3 Set Geometry Mode

Image Output Method in Geometry_1X2_1Y



Figure 11-4 Image Output Method in Geometry_1X2_1Y

Image Output Method in Geometry_1X4_1Y

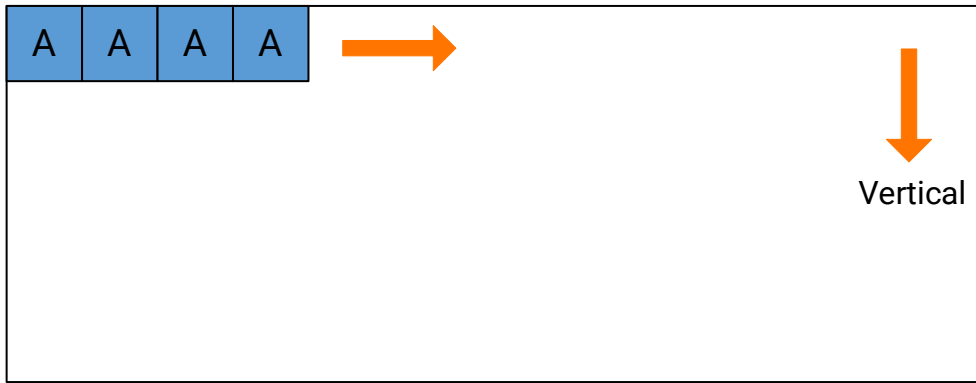


Figure 11-5 Image Output Method in Geometry_1X4_1Y

 **Note**

Other image output methods follow the same logic as the two cases above.

Chapter 12 Image Parameter

12.1 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.

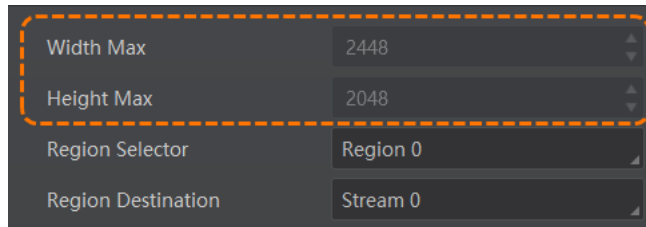


Figure 12-1 View Resolution

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.

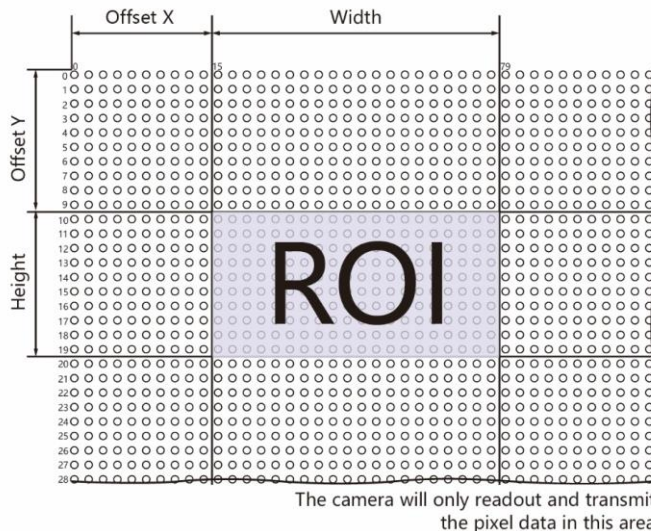


Figure 12-2 ROI

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.

12.2 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.

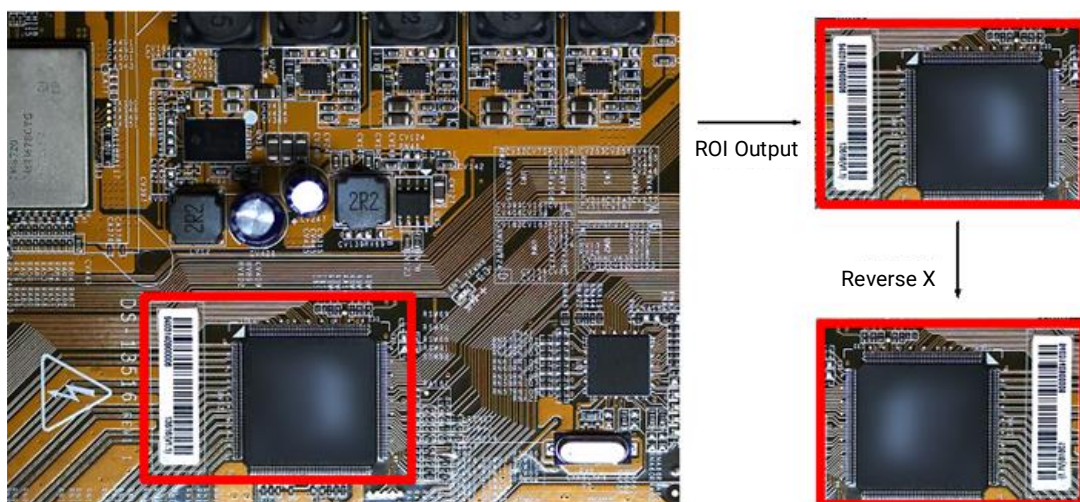


Figure 12-3 Image Reverse Comparison (Reverse X as an Example)

12.3 Set Pixel Format

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

Note

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

Table 12-1 Pixel Format and Pixel Size

ADC Bit Depth	Pixel Format	Pixel Size (Bits/Pixel)
10	Mono 8	8
	Mono 10	10
	Mono 12	12



Figure 12-4 Set Pixel Format

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

Note

The ADC bit depth function may differ by device models.

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

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.

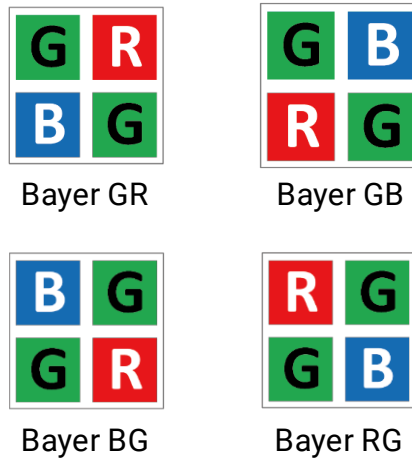


Figure 12-5 Pixel Patterns

12.4 Set Test Pattern

The device supports test pattern function. When there is an exception in real-time image, you can check whether image of test mode have similar problem to determine the reason. This function is disabled by default, and at this point, the output image by the device is real-time image. If this function is enabled, the output image by the device is test image. Go to **Image Format Control** → **Test Pattern**, and set **Test Pattern** according to actual demands.

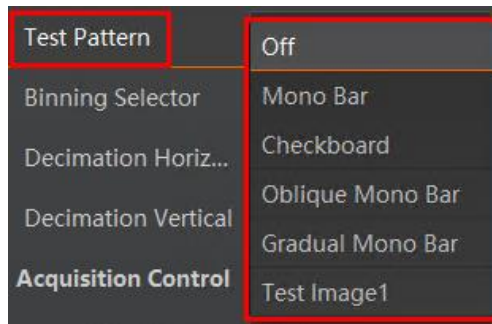


Figure 12-6 Set Test Pattern

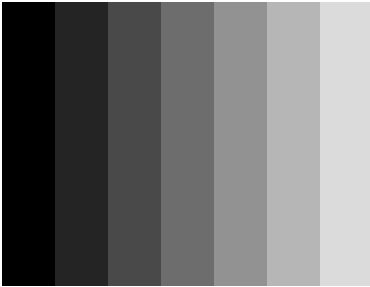
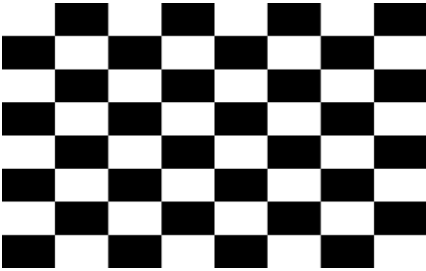
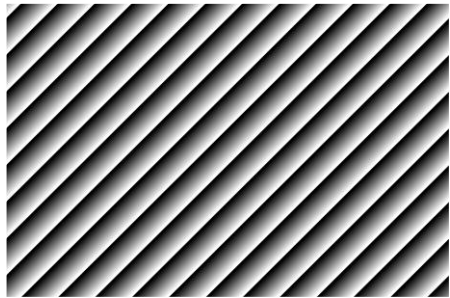


The mono device provides test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, and **Test Image 1**.

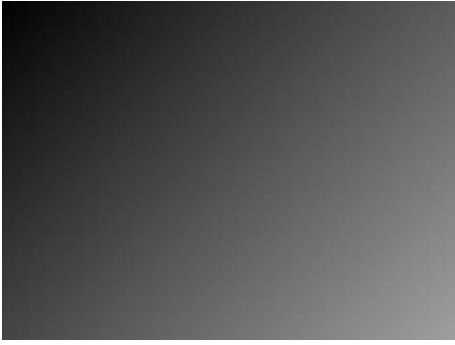
The color device provides test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, **Horizontal Color Bar**, and **Test Image 1**.

Note

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

Table 12-2 Test Pattern

Test Pattern	Image
Mono Bar	
Checkboard	
Oblique Mono Bar	
Gradual Mono Bar	
Horizontal Color Bar	

Test Pattern	Image
Test Image 1	

12.5 Set Binning

The purpose of setting binning is to enhance sensibility. With binning, multiple sensor pixels are combined as a single pixel to reduce resolution and improve image brightness. The color device can merge the pixel values of adjacent pixels of the same color horizontally or vertically, as shown below.

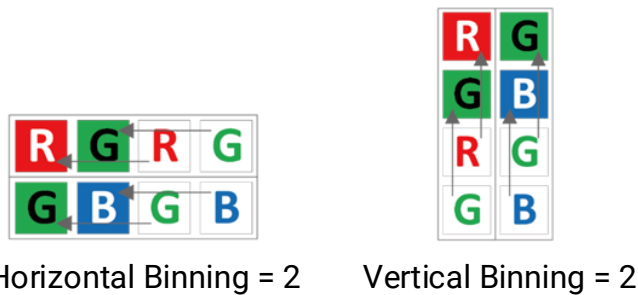


Figure 12-7 Binning Settings (Color Device as an Example)

If the horizontal binning coefficient and the vertical binning coefficient of the color 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 12-8 Horizontal/Vertical Binning 2 × 2 (Color Device as an Example)

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

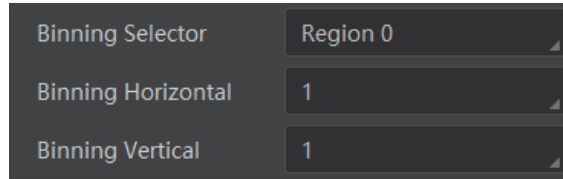


Figure 12-9 Set Binning

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 if the binning is 2×2 and above. The binning mode defines how pixels are combined if the binning is 2×2 and above. 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.

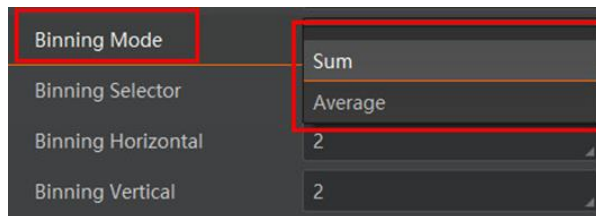


Figure 12-10 Set Binning Mode

12.6 Set Decimation

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

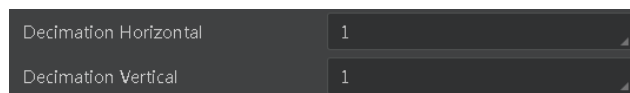


Figure 12-11 Set Decimation

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.
-

12.7 Set Exposure Mode

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

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

Note

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

The device offers 2 types of exposure time modes, including **Ultrashort** mode and **Standard** mode.

Note

The range of exposure time may differ by the device model and exposure time mode. Refer to the device's specifications for specific parameters.

12.7.1 Set Ultrashort Mode

In ultrashort mode, the device takes very little exposure time, and the exposure time can only be adjusted manually. Because the exposure time is small, it needs to be used with the light source.

Go to **Acquisition Control** → **Exposure Time Mode**, and set **Exposure Time Mode** according to actual demands.

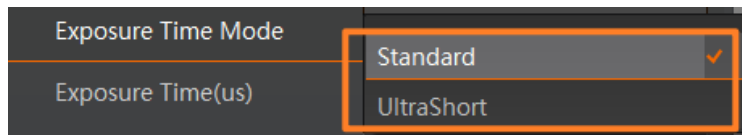


Figure 12-12 Set Ultrashort Mode

Note

- The exposure time mode may differ by device models.
-

- If the device you got does not support ultrashort exposure time mode, there is no **Exposure Time Mode** parameter, and the device supports **Standard** exposure time mode only by default.
-

12.7.2 Set Standard Mode

In standard 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)**.

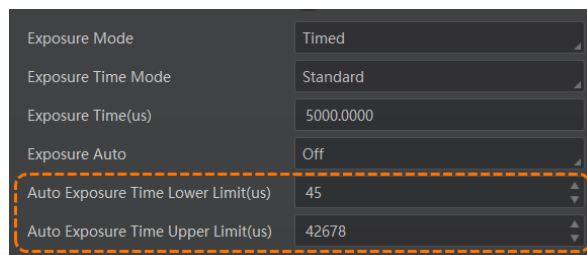


Figure 12-13 Set Exposure Time Under Once or Continuous Mode

Note

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

12.8 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.

12.8.1 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)**.

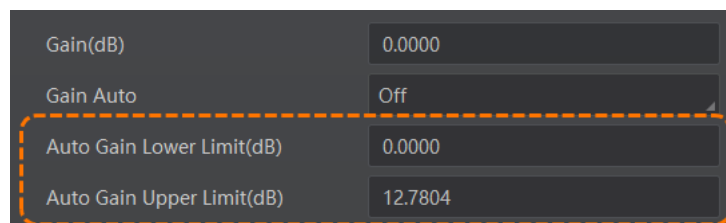


Figure 12-14 Set Gain under Once or Continuous Mode

12.8.2 Set Digital Gain

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

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

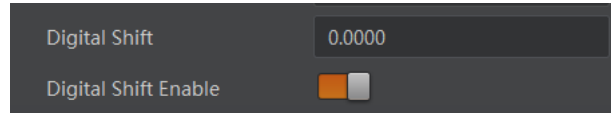


Figure 12-15 Set Digital Gain

Note

- The value in **Digital Shift** is between -24 dB and 24 dB, and is 0 by default. Please refer to the actual device.
- **Digital Shift Enable** is disabled by default.

12.9 Set Brightness

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

Note

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



Figure 12-16 Brightness Example

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

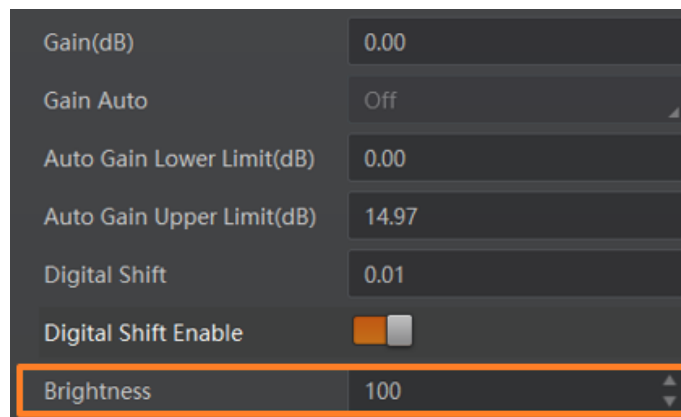


Figure 12-17 Set Brightness

12.10 Set Sharpness

Note

- The sharpness function is valid in Mono pixel formats, and is disabled by default.
- The range of sharpness is between 0 and 100.

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.

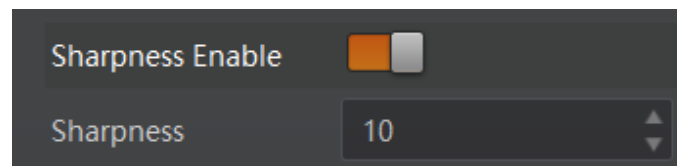


Figure 12-18 Set Sharpness

12.11 Set White Balance

Note

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

The white balance refers to the device color adjustment depending on different light sources. Adjust the R/G/B ratio to ensure that the white regions are white under different color temperatures. Ideally, the proportion of R/G/B in the white region is 1:1:1.

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

- **Off**: You need to set the R, G, B ratio manually via **Balance Ratio Selector** and **Balance Ratio**. The range is from 1 to 4095, and 1024 means ratio is 1.0.
- **Once**: Adjust the white balance for a certain amount of time then stop.
- **Continuous**: Adjust the white balance continuously.

It is recommended to correct white balance when there is great difference between the device's color effect and actual effect. You can correct white balance as shown below.

Auto Correction

Steps

1. Put a white paper in the range of the device's field of view, and make sure the paper covers the entire field of view.
2. Set exposure and gain.

Note

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

3. Select **Once** as **Balance White Auto** to let the device adjust white balance automatically.

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.

12.12 Set HDR

The device supports HDR (High Dynamic Range) function that the device acquires images based on customized settings, and each with its own exposure time and gain.

Note

- The HDR function may differ by device models.
- The images are not combined to form an HDR image in the HDR mode.

Steps

1. Go to **Acquisition Control** → **HDR Enable**, and enable **HDR Enable**.
2. Set **HDR Selector** and corresponding **HDR Shutter** and **HDR Gain**.

Note

- The number of parameter groups may differ by device model.
- HDR gain function may differ by device model.

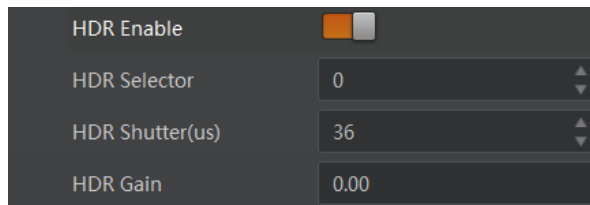


Figure 12-19 Set HDR

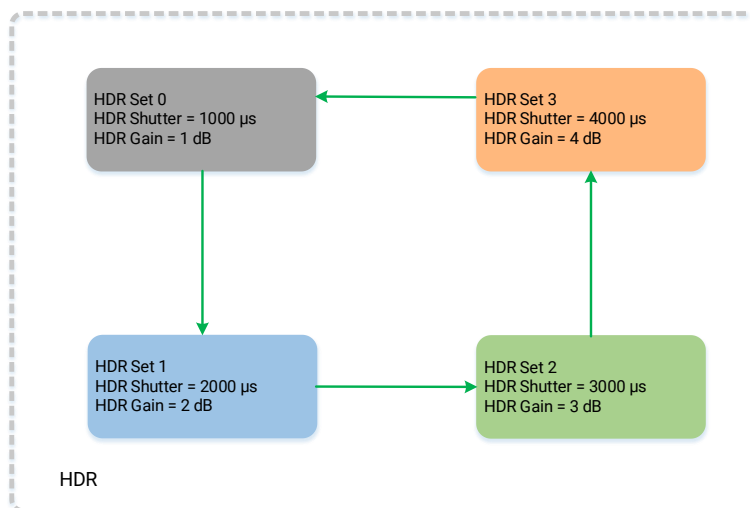


Figure 12-20 HDR Demonstration (Four Groups)

12.13 User Set Customization

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

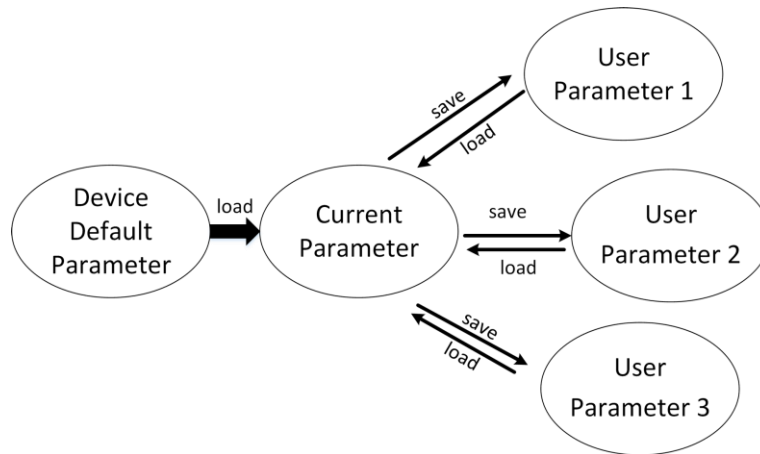


Figure 12-21 Parameter Relation

Note

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

12.13.1 Save User Set

Steps

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

Note

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

2. Click **Execute** in **User Set Save** to save parameter.

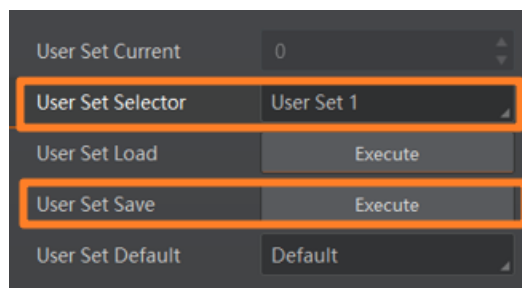


Figure 12-22 Save User Set

12.13.2 Load User Set

Note

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

Steps

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

Note

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

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

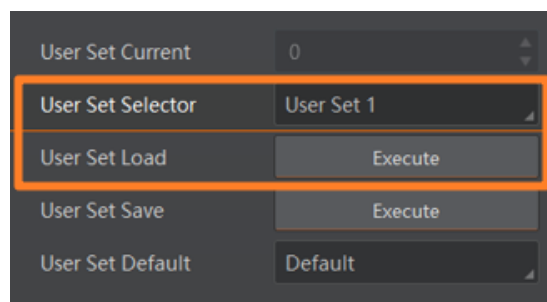


Figure 12-23 Load User Set

12.13.3 Set User Default

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

Note

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

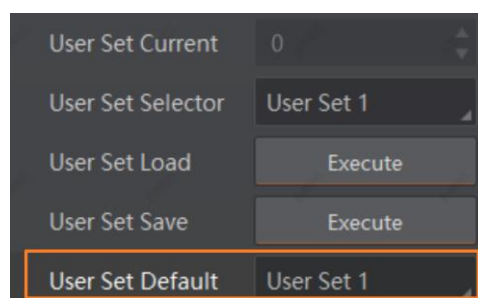


Figure 12-24 Set User Default

Chapter 13 Advanced Functions

13.1 Set Black Level

Note

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

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

Go to **Analog Control** → **Black Level Enable**, enable **Black Level Enable**, and enter **Black Level** according to actual demands.

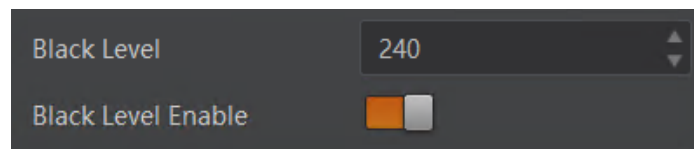


Figure 13-1 Set Black Level

13.2 Set Gamma Correction

Note

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

The device supports Gamma correction function. Generally, the output of the device's sensor is linear with the photons that are illuminated on the photosensitive surface of the sensor. Gamma correction provides a non-linear mapping mechanism as shown below.

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

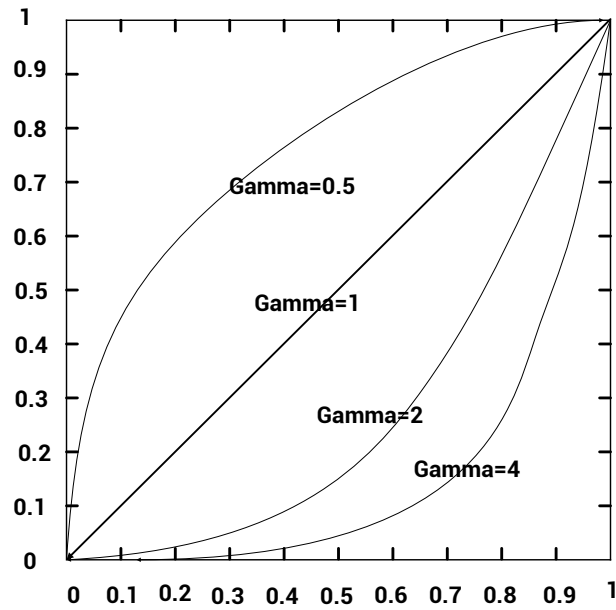


Figure 13-2 Set Gamma Correction



Figure 13-3 Gamma Correction Example

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

User Mode

Steps

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

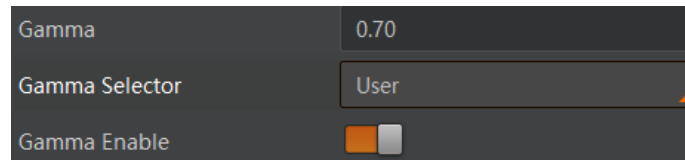


Figure 13-4 Set User Mode

sRGB Mode

Steps

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

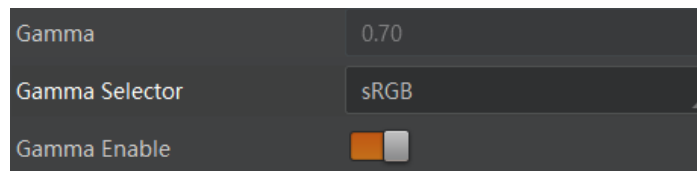


Figure 13-5 Set sRGB Mode

13.3 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**.

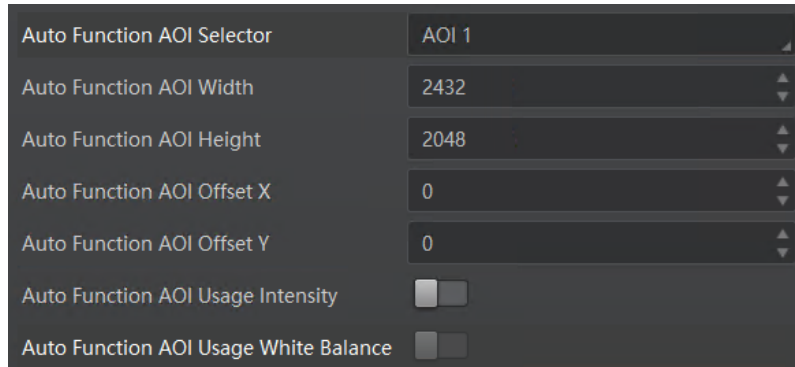


Figure 13-6 Set AOI

13.4 Set Color Transformation Control

Note

- The function of color transformation control is only available for color devices, and may differ by device model.
 - Currently, **RGB to RGB** is available for **Color Transformation Selector** only.
-

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 color transformation control function is implemented by multiplying each RGB component by a correction matrix. The currently supported color conversion module is RGB to RGB.

Two methods are available to set color transformation control 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.

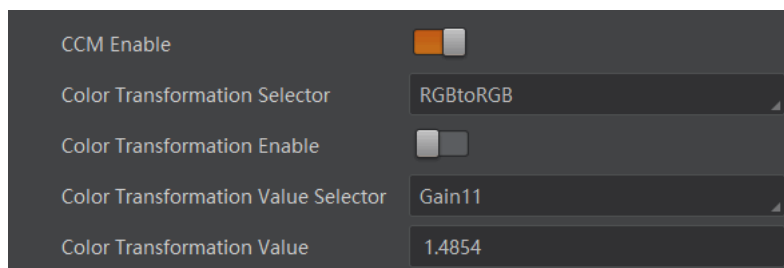


Figure 13-7 Method 1

● **Method 2:**

Go to **Color Transformation Control**, enable **Color Transformation Enable**, set **Hue** and **Saturation** to adjust **Color Transformation Value**. Refer to section [Set Hue](#) and [Set Saturation](#) for details.

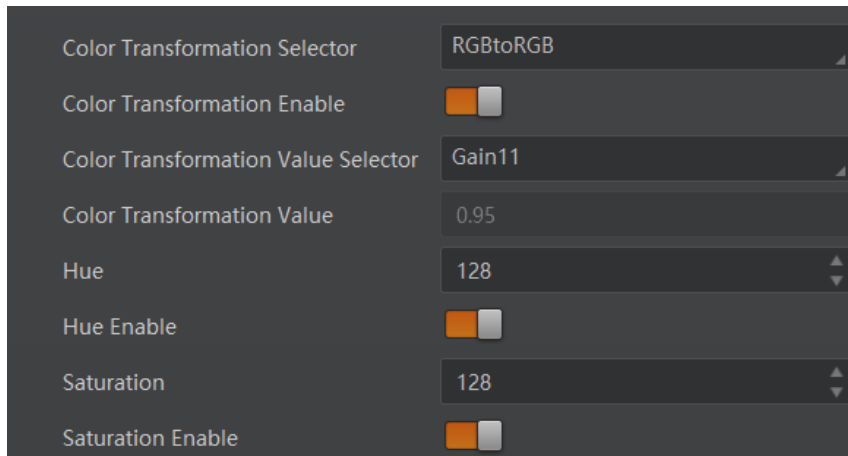


Figure 13-8 Method 2

Note

- **CCM Enable** is used to enable color transformation control function. If the device you purchased does not have **CCM Enable**, then the color transformation control function is enabled by default.
 - The color transformation control 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.
-

13.5 Set Hue

Note

- The hue function is only available for color devices.
 - In Mono pixel format, hue function is not supported.
 - The range of hue is between 0 and 255.
-

Adjusting the hue shifts the colors of the image. After hue is set, the device will perform color transformation control 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 13-9 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.

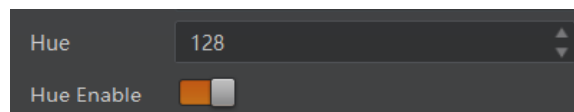


Figure 13-10 Set Hue

13.6 Set Saturation

Note

- The saturation function is only available for color devices.
 - In Mono and Bayer pixel formats, saturation function is not supported.
 - The range of saturation is between 0 and 255.
-

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



Figure 13-11 Saturation Example

Steps

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

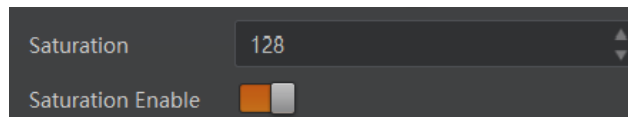


Figure 13-12 Set Saturation

13.7 Set Channel Correct Mode

Note

The channel correct mode function may differ by device models.

The channel correction function allows you to adjust the image's uniformity, and you can set channel correct mode as shown below.

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

- **Active Mode** adjusts channel difference in accordance with actual images in real time.
- **Passive Mode** adjusts channel difference in accordance with configured parameters in real time.

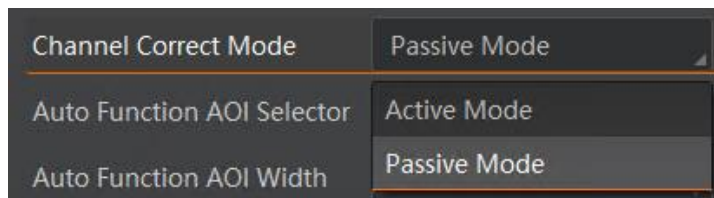


Figure 13-13 Set Channel Correct Mode

13.8 Set Shading Correction

Note

The specific shading correction types and configuration methods may differ by device models.

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

13.8.1 NUFFC Correction

The non-uniformity flat field correction (NUFFC) is used to remove imaging variations via the per-pixel processing (including variations caused by the pixels themselves and the lens).

Before You Start

The uniform light source is required for the object.

Steps

1. Select **NUFFC Correction** as **Shading Selector**.
2. Click **Execute** in **Activate Shading**.
3. Enable **NUFFC Enable**. At the same time, the image correction will be executed according to the settings.

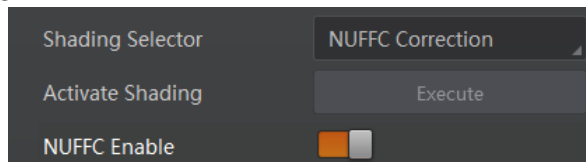


Figure 13-14 NUFFC Correction

13.8.2 FFC Correction

The flat field correction (FFC) is used to improve the image uniformity that may be impacted by the sensor, light sources, external conditions, etc.

Steps

1. Select **FFC Correction** as **Shading Selector**.
2. Click **Execute** in **Activate Shading**.
3. Enable **FFC Enable**. At the same time, the image correction will be executed according to the settings.

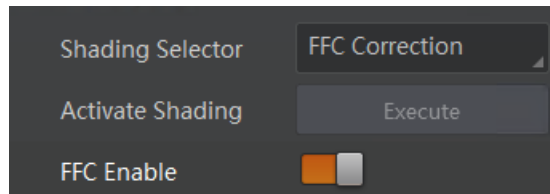


Figure 13-15 FFC Correction

13.8.3 LSC Correction

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

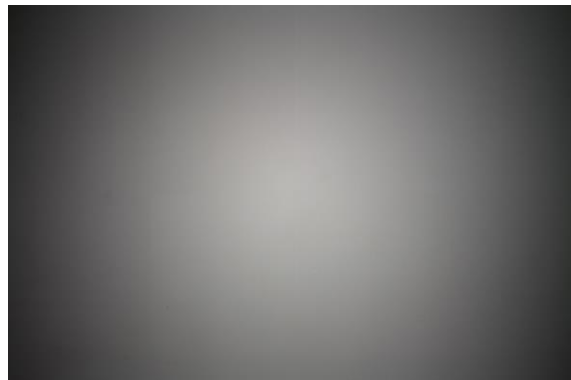


Figure 13-16 Before LSC Correction

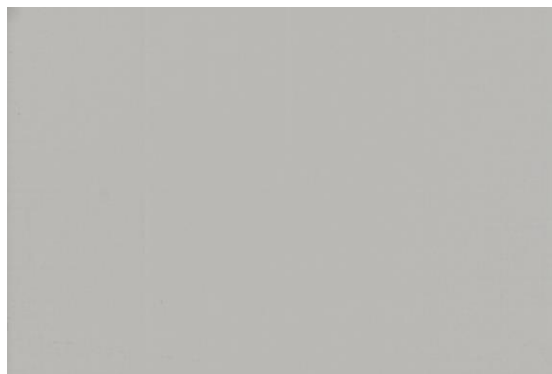


Figure 13-17 After LSC Correction

Note

- The specific LSC correction method may differ by device models.
 - If the light source and color temperature change, you need to execute LSC correction again.
-

The LSC correction supports two correction methods, including auto image correction or correcting image via setting parameters.

Auto Image Correction

Steps

1. Select **LSC Correction** as **Shading Selector**.
2. Click **Execute** in **Activate Shading**.
3. Enable **LSC Enable**.

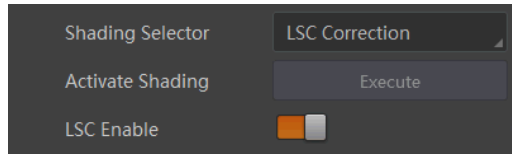


Figure 13-18 Auto Image Correction

Image Correction via Setting Parameters

Some device models support image correction via setting parameters to adjust the image brightness according to different scenarios.

Steps

1. Select **LSC Correction** as **Shading Selector**.
2. Select tables from **LSC Table Selector** ranging from **Table 0** to **Table 7** according to actual demands.
3. Enable **LSC Target Enable**, and set **LSC Target R/G/B** according to actual demands.

Note

- The larger value configured in **LSC Target R/G/B**, and brighter the image is.
- Some device models support to set brightness via **LSC Target R/G/B**.

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

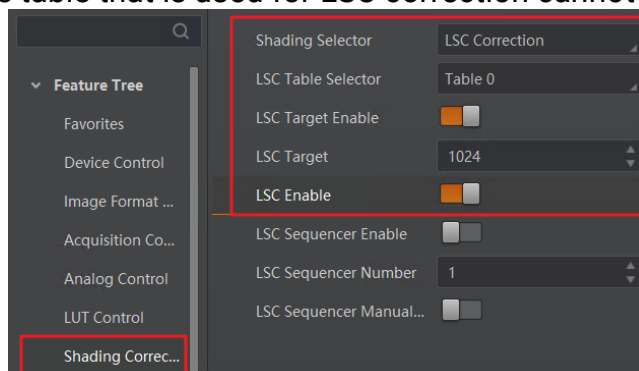


Figure 13-19 Correct Image via Setting Parameters

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.

13.8.4 LSC Sequencer

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

Note

The LSC sequencer function may differ by device models.

Steps

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

Note

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

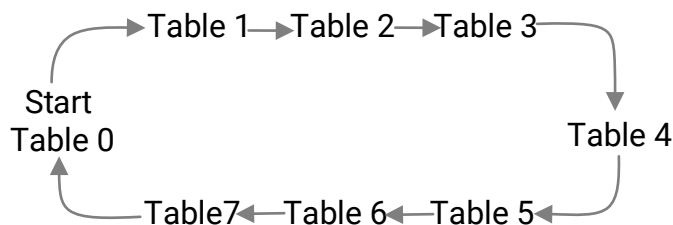


Figure 13-20 Sequencer Order

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

Note

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

4. Enable **LSC Sequencer Enable**.

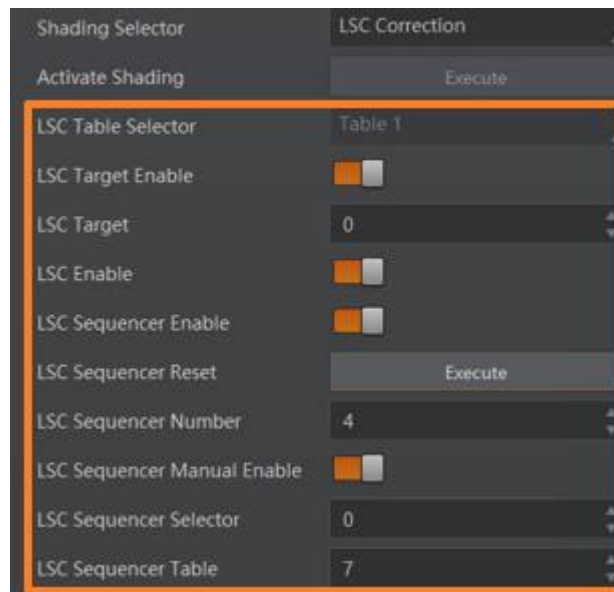


Figure 13-21 LSC Sequencer

Note

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

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

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

Steps

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

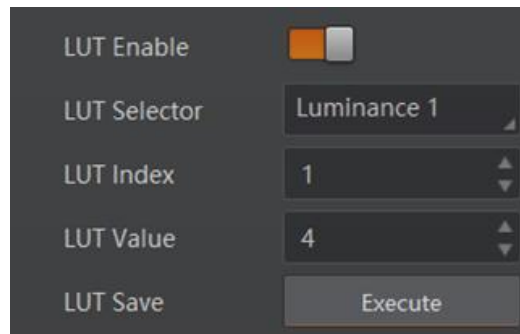


Figure 13-22Set LUT

13.10 Set Cooling Fan

 **Note**

- The cooling fan may differ by device models.
- The temperature unit here is Celsius degree.

For device with cooling fan, you can go to **Analog Control** → **Fan Open Threshold** to set fan parameters.

When the device's temperature is higher than the value you set in **Fan Open Threshold**, the fan starts to work. Otherwise, the fan stops working.

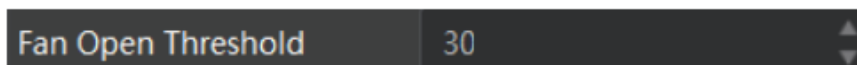


Figure 13-23Set Cooling Fan

Chapter 14 Other Functions

14.1 Device Control

 **Note**

The specific device control parameters may differ by device models.

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

Table 14-1 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 Family Name	Read Only	It is the series name of the device.
Device Version	Read Only	It is the device version.
Device Firmware Version	Read Only	It is the device firmware version.
Device Serial Number	Read Only	It is device's serial number.
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"> ● If User ID is empty, the client software displays the device model. ● If you set it, the client software displays the User ID you set.
Maximum Device Response Time	Read Only	It is the maximum response time of the device. If no response is received beyond this duration, it is considered that the device is disconnected.
Device Manifest Table Address	Read Only	It is the ID of GenlCam XML.

Parameter	Read/Write	Description
Device SBRM Address	Read Only	It refers to the protocol-specific register base address.
Device Uptime (s)	Read Only	It is the period of time when device is powered up.
Board Device Type	Read Only	It is the device type.
Device Command Timeout	Read only	It counts the timeout of command.
Device Stream Channel Count	Read Only	It indicates the number of streaming channels supported by the device.
Device Reset	Read & Write	Click Execute to restart the device.
Device Clock Selector	Read & Write	It selects the clock frequency to access from the device.
Device Clock Frequency	Read & Write	It sets the frequency of the selected clock. The higher the frequency, the greater the line frequency support.
Device Temperature Selector	Read & Write	It selects sensor or mainboard for temperature viewing.
Device Temperature	Read Only	It displays the temperature of the selected component.
TEC Enable	Read & Write	You can enable it to enable TEC function.
TEC Temperature	Read & Write	It sets the maximum temperature of sensor. <ul style="list-style-type: none"> • If actual sensor's temperature is lower than this parameter, the TEC function is not enabled. • If actual sensor's temperature is higher than this parameter and TEC Enable is enabled, the TEC function is enabled.
TEC Fan Speed	Read & Write	It sets the fan speed.

14.2 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 14-2 Parameters of Transport Layer Control

Parameter	Read/Write	Description
Payload Size(B)	Read Only	It is the device's load size.
Device Tap Geometry	Read & Write	The value of device sensor geometry in the frame grabber software should be the same with that of Device Tap Geometry. Inconsistent parameters may lead to image exception.
CI Configuration	Read only	It is the configuration mode. It switches automatically in accordance with different tap configuration modes.
GenCP Version Major	Read only	It is the major version in GenCP version.
GenCP Version Minor	Read only	It is the minor version in GenCP version.
Supported Baudrates	Read only	It displays the supported baud rates.

14.3 Update Firmware

You can use the MVS Tool Kit to update the device's firmware via a Camera Link cable.

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**.

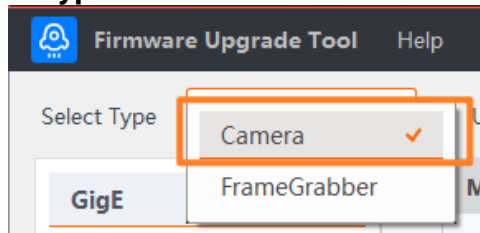



Figure 14-1 Select Camera

3. Select **PCIe**, and the tool automatically refreshes and enumerates all the devices searched by the frame grabber.
4. Click  to select firmware upgrade package (dav file).
5. Click **Update** to start updating.

Chapter 15 Serial Port Tool

Apart from the MVS client software and frame grabber software, the serial port tool can be used to detect the device's status, read and set its parameters.

You can set the device's parameters by connecting Camera Link serial port cable. When accessing the device or using the terminal in the application software, you are required to set the parameters as follows.

Table 15-1 Serial Port Parameters

Serial Port Parameter	Parameter Value
Baud Rate	9600 bps
Data Bit	8-bit
Parity Bit	None
Stop Bit	1-bit
Stream Control	None

Note

The default value of the device's baud rate is 9600 bps. If the value is edited in the client software, it should be entered according to the actual demands.

The serial port tool can detect the device status, configure a valid serial port for the detected device, and configure parameters for the detected device.

The commands for setting device's parameters via serial port is sent in the format of ASCII code. The commands are sent by user's application. After receiving commands, the device will return a value (success or fail).

The specific command format is **< Command > < Node Name > < Value> <\r>**, and refer to the table below for details.

Table 15-2 Command Description

Reading/Writing Command Example	Return Value
Writing command is configured successfully.	Success! <\r> <\n>
Reading command is configured successfully.	<ul style="list-style-type: none"> • Success! <\r> <\n> <\r> <\n> • get < Note Name >: <Value> <\r> <\n>
Configuring writing or reading command failed.	<ul style="list-style-type: none"> • Failed! <\r> <\n> <\r> <\n> • Wrong input format. <\r> <\n>

Executing the reading or writing command is as follows.

Table 15-3 Command Example

Command for writing:

The following example is to set the exposure as 1000 μ s.

Command:

w ExposureTime 1000 <\r>

Returned value:

Setting succeeded: **Success! <\r> <\n>**

Setting failed: **Failed! <\r> <\n> <\r> <\n> or Wrong input format. <\r> <\n>**

Command for reading:

The following example is to get the exposure as 1000 μ s.

Command:

r ExposureTime <\r>

Returned value:

Reading succeeded: **Success! <\r> <\n> <\r> <\n> or get ExposureTime: 1000 <\r> <\n>**

Reading failed: **Failed! <\r> <\n> <\r> <\n> or Wrong input format. <\r> <\n>**

 **Note**

- The device's parameters can be set via the client software, frame grabber software, or serial port tool, but you cannot use them at same time.
 - Refer to section [Serial Communication Command List](#) for more details.
-

Chapter 16 FAQ (Frequently Asked Question)

16.1 Why the client software or frame grabber software cannot list devices?

Table 16-1 Question 1

Possible Cause	Solution
The device is not powered on.	Check the power supply and LED indicator on the device.
Exception occurred in the Camera Link frame grabber	Check the frame grabber via the indicator on the frame grabber.
Incorrect connection of Camera Link cable.	Check the wiring connection by observing the indicator on the frame grabber or checking in the serial port tool.
Exception occurred in the software.	Check the software version, and reinstall the driver or software.

16.2 Why there is no live view in frame grabber software and the indicator is solid blue?

Table 16-2 Question 2

Possible Cause	Solution
Wrong settings exist in frame grabber software.	Refer to section Frame Grabber Software to check the parameter settings.
The trigger mode is enabled	Disable the trigger mode.

16.3 Why the live view is black?

Table 16-3 Question 3

Possible Cause	Solution
The device's lens aperture is not removed.	Remove the device's lens aperture.
The device exception occurs.	Power off and restart the device.

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

Table 16-4 Question 4

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.

Chapter 17 Revision History

Table 17-1 Revision History

Version	Revision Date	Revision Details
V3.0.0	Jan. 7, 2026	Edit the overall structure and content.

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 Device Control
Device Vendor Name	
Device Model Name	
Device Manufacturer Info	
Device Family Name	
Device Version	
Device Firmware Version	
Device Serial Number	
Device User ID	
Maximum Device Response Time	
Device Manifest Table Address	
Device SBRM Address	
Device Uptime (s)	
Board Device Type	
Device Command Timeout	
Device Stream Channel Count	
Device Reset	
Device Clock Selector	
Device Clock Frequency	
Device Temperature Selector	
Device Temperature	
TEC Enable	

Parameters	Section
TEC Temperature	
TEC Fan Speed	

A.2 Image Format Control

Table A-2 Image Format Control

Parameters	Section
Width Max	Section Set Resolution and ROI
Height Max	
Region Selector	
Width	
Height	
Offset X	
Offset Y	
Reverse X	Section Set Image Reverse
Reverse Y	
ADC Bit Depth	Section Set Pixel Format
Pixel Format	
Pixel Size	
Test Pattern Generator Selector	Section Set Test Pattern
Test Pattern	
Binning Mode	Section Set Binning
Binning Selector	
Binning Horizontal	
Binning Vertical	
Decimation Horizontal	Section Set Decimation
Decimation Vertical	

A.3 Acquisition Control

Table A-3 Acquisition Control

Parameters	Section
Acquisition Burst Frame Count	Section Set Frame Rate
Acquisition Frame Rate (Fps)	
Acquisition Frame Rate Control Enable	
Resulting Frame Rate (Fps)	
Trigger Selector	Section Trigger Input
Trigger Mode	
Trigger Software	
Trigger Source	
Trigger Activation	
Trigger Delay (μ s)	
Trigger Cache Enable	Section Global Shutter and Rolling Shutter
Sensor Shutter Mode	
Exposure Mode	Section Set Exposure Mode
Exposure Time Mode	
Exposure Time (μ s)	
Exposure Auto	
Auto Exposure Time Lower Limit (μ s)	
Auto Exposure Time Upper Limit (μ s)	
HDR Enable	Section Set HDR
HDR Selector	
HDR Shutter(us)	
HDR Gain	

A.4 Analog Control

Table A-4 Analog Control

Parameters	Section
Gain(dB)	Section Set Gain
Gain Auto	
Auto Gain Lower Limit (dB)	
Auto Gain Upper Limit (dB)	
Digital Shift	
Digital Shift Enable	
Brightness	Section Set Brightness
Black Level	Section Set Black Level
Black Level Enable	
Balance White Auto	Section Set White Balance
Balance Ratio Selector	
Balance Ratio	
Gamma	Section Set Gamma Correction
Gamma Selector	
Gamma Enable	
Sharpness	Section Set Sharpness
Sharpness Enable	
Channel Correct Mode	Section Set Channel Correct Mode
Fan Open Threshold	Section Set Cooling Fan
Auto Function AOI Selector	Section Set AOI
Auto Function AOI Width	
Auto Function AOI Height	
Auto Function AOI Offset X	
Auto Function AOI Offset Y	
Auto Function AOI Usage Intensity	
Auto Function AOI Usage White Balance	

A.5 Color Transformation Control

Table A-5 Color Transformation Control

Parameters	Section
CCM Enable	Section Set Color Transformation Control
Color Transformation Selector	
Color Transformation Enable	
Color Transformation Value Selector	
Color Transformation Value	
Hue	Section Set Hue
Hue Enable	
Saturation	Section Set Saturation
Saturation Enable	

A.6 LUT Control

Table A-6 LUT Control

Parameters	Section
LUT Selector	Section Set LUT
LUT Enable	
LUT Index	
LUT Value	
LUT Save	

A.7 Shading Correction

Table A-7 Shading Correction

Parameters	Section
Shading Selector	Section Set Shading Correction
Activate Shading	
FCC Enable	

Parameters	Section
NUFFC Enable	
LSC Table Selector	
LSC Target Enable	
LSC Target	
LSC Enable	
LSC Sequencer Enable	
LSC Sequencer Reset	
LSC Sequencer Number	
LSC Sequencer Manual Enable	
LSC Sequencer Selector	
LSC Sequencer Table	

A.8 Digital IO Control

Table A-8 Digital IO Control

Parameters	Section
Line Selector	Section Trigger Output
Line Mode	
Line Inverter	
Line Status	
Line Status All	
Line Debouncer Time (μs)	
Line Source	
Strobe Enable	
Strobe Line Duration (μs)	
Strobe Line Delay (μs)	
Strobe Line Pre Delay (μs)	

A.9 Counter and Timer Control

Table A-9 Counter and Timer Control

Parameters	Section
Counter Selector	Section Set Trigger Source
Counter Event Source	
Counter Reset Source	
Counter Reset	
Counter Value	
Counter Current Value	

A.10 Transport Layer Control

Table A-10 Transport Layer Control

Parameters	Section
Payload Size(B)	Section Transport Layer Control
Device Tap Geometry	
CI Configuration	
GenCP Version Major	
GenCP Version Minor	
Supported Baudrates	

A.11 User Set Control

Table A-11 User Set Control

Parameters	Section
User Set Current	Section User Set Customization
User Set Selector	
User Set Load	
User Set Save	
User Set Default	

Appendix B Serial Communication Command List

 **Note**

The commands listed below are common ones only. For other commands, please contact technical support for detailed information.

Table B-1 Serial Communication Command List

Parameter	R/W	Command	Value	Description
DeviceReset	W	w DeviceReset x	x: 1 – restart	E.g., w DeviceReset 1
TECEnable	W	w TEC_enable x	x: 0 – disable 1 – enable	
	R	r TEC_enable		
TECTemperature	W	w TEC_tmp_set x	x: TEC Temperature * 100	
	R	r TEC_tmp_set		
TECFanSpeed	W	w TEC_speed_set x	x: 0 – 100	
	R	r TEC_speed_set		
DeviceClockFrequency	W	w DeviceClock Frequency x	x: 0 – 85 M 1 – 70 M	E.g., w DeviceClockFrequency 1

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Parameter	R/W	Command	Value	Description
			2 – 60 M	
	R	r DeviceClock Frequency		
Width	W	w Width x	Value	E.g., w Width 4096
	R	r Width		
Height	W	w Height x	Value	E.g., w Height 2000
	R	r Height		
OffsetX	W	w OffsetX x	Value	E.g., w OffsetX 200
	R	r OffsetX		
OffsetY	W	w OffsetY x	Value	E.g., w OffsetY 200
	R	r OffsetY		
Reverse X	W	w ReverseX x	x: 0 – disable 1 – enable	E.g., w ReverseX 1
	R	r ReverseX		
Reverse Y	W	w ReverseY x	x: 0 – disable 1 – enable	E.g., w ReverseY 1
	R	r ReverseY		
PixelFormat	W	w PixelFormat x	x: 0x1080001 – mono8 0x1100003 – mono10 0x1100005 – mono12 0x02180014 – RGB 8 0x01080009 – BayerRG8 0x0110000d –	E.g., w PixelFormat 0x1080001

Parameter	R/W	Command	Value	Description
			BayerRG10 0x01100011 – BayerRG12	
	R	r PixelFormat		Note: The returned value is decimal system and it needs to be converted to hexadecimal.
TestPattern	W	w TestPattern x	x: 0 – off 11 – MonoBar 12 – HorizontalColorBar 13 – Checkboard 14 – ObliqueMonoBar 16 – GradualMonoBar 17 – TestImage1	E.g., w TestPattern 14
	R	r TestPattern		
Binning	W	w Binning x	x: bit31-bit16: BinningVertical bit15-bit0: BinningHorizontal	
	R	r Binning		
Decimation	W	w Decimation x	x: bit31-bit16: DecimationVertical bit15-bit1: DecimationHorizontal	
	R	r Decimation		
AcquisitionBurstFrameCount	W	w Acquisition BurstFrame Count x	Value	Number of frames to acquire for each FrameBurstStart trigger. E.g., w AcquisitionBurstFrameCount 100

Parameter	R/W	Command	Value	Description
	R	r Acquisition BurstFrame Count		
AcquisitionFrameRate	W	w AcquisitionFrameRate x	<p>x: It refers to the written frame rate value and frame rate is enabled.</p> <p>y: It refers to the frame rate value you want to set (you can write directly, and disable frame rate when writing)</p> <p>$x = y + 1073741824$</p>	<p>E.g., w AcquisitionFrameRate 1073841824, it means setting frame rate as 100000, and enabling frame rate.</p> <p>E.g., w AcquisitionFrameRate 100000, it means setting frame as 100000, and disabling frame rate.</p>
	R	r AcquisitionFrameRate	When value is larger than 10737441824, frame rate is enabled.	<p>If frame rate is enabled, reading and writing x are available, and frame rate is $y = x - 1073741824$.</p> <p>If frame rate is disabled, reading value is y.</p>
TriggerMode	W	w TriggerMode x	<p>x:</p> <p>0 – Disable line trigger and frame trigger</p> <p>64 – Enable frame trigger mode</p>	
	R	r TriggerMode		
TriggerSoftware	W	w TriggerSoftware x	x: 6	

Parameter	R/W	Command	Value	Description
TriggerSource	W	w TriggerSource+6 x	x: 0 – Line0 1 – Line1 2 – Line2 4 – Counter0 7 – Software 9 – CC1 11 – CC2 12 – CC3 13 – CC4	
	R	r TriggerSource+6		Read the frame trigger source.
TriggerActivation	W	w TriggerActivation+6 x	x: 0 – Rising edge 1 – Falling edge	E.g., w TriggerActivation+6 0
	R	r TriggerActivation+6		
TriggerDelay	W	w TriggerDelayAbsVal+6 x	Value	E.g., w TriggerDelayAbsVal+6 100.
	R	r TriggerDelayAbsVal+6		
TriggerCacheEnable	W	w TriggerCacheEnable x	x: 0 – Disable 1 – Enable	
	R	r TriggerCacheEnable		

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Parameter	R/W	Command	Value	Description
ExposureAuto	W	w ExposureAuto x	x: 0 – Off 1 – Once 2 – Continues	E.g., w ExposureAuto 2
	R	r ExposureAuto		
ExposureTime	W	w ExposureTime x	Value	E.g.,w ExposureTime 1000
	R	r ExposureTime		
GainAbsVal	W	w GainAbsVal x	x: Gain / 0.0359 + 64	
	R	r GainAbsVal		
GainCtrl	W	w GainCtrl x	x: 0 – Off 1 – Once 2 – Continues	
	R	r GainCtrl		
BalanceWhiteAuto	W	w BalanceWhiteAuto	x: 0 – Off 1 – Continue 2 – Once	E.g., w BalanceWhiteAuto 2
	R	r BalanceWhiteAuto		
BlackLevel	W	w BlackLevel x	x:	E.g., w BlackLevel 5

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Parameter	R/W	Command	Value	Description
			0 – 4095	
	R	r BlackLevel		
BlackLevelEnable	W	w BlackLevelCtrl x	x: 0 – Disable 1 – Enable	E.g., w BlackLevelCtrl 1
	R	r BlackLevelCtrl		
GammaAbsVal	W	w GammaAbsVal x×100+y	x: Game value y: 0x20000 – represents sRGB 0x10000 – represents User	E.g., w GammaAbsVal 2 × 100+0 × 10000
	R	r GammaAbsVal		X = Read value/100
GammaEnable	W	w GammaCtrl x	x: 0 – Disable 1 – Enable	E.g., w GammaCtrl 1
	R	r GammaCtrl		
BalanceRatio	W	w BalanceRatio+x y	x: 0 – Red 1 – Green 2 – Blue y: 1 – 16376	E.g., w BalanceRatio+1 800
	R	r BalanceRatio+x		E.g., r BalanceRatio+1
SharpnessVal	W	w SharpnessV	Value, range: 0 to 100	

Parameter	R/W	Command	Value	Description
		al x		
	R	r SharpnessVal		
SharpnessCtrl	W	w SharpnessCtrl x	x: 0 – Disable 0x10000 – Enable	
	R	r SharpnessCtrl		
SaturationAbsVal	W	w SaturationAbsVal x	x: 0 – 255	E.g., w SaturationAbsVal 128
	R	r SaturationAbsVal		
SaturationCtrl	W	w SaturationCtrl x	x: 0 – Off 0x10000 – On	E.g., w SaturationCtrl 0x10000
	R	r SaturationCtrl		
FanOpenThreshold	W	w FanOpenThreshold x	x: 0 – 100	
	R	r FanOpenThreshold		

Parameter	R/W	Command	Value	Description
LineMode	W	w LineMode+x y	x: 0 – Line0 1 – Line1 2 – Line2 5 – CC1 6 – CC2 7 – CC3 8 – CC4 y: 0 – Input 8 – Strobe	
	R	r LineMode+x		
LineInverter	W	w LineInverter x	x: 0 – Disable 1 – Enable	
	R	r LineInverter		
LineSource	W	w LineSource+ x	x: 0 – ExposureActive	
	R	r LineSource		
LineStrobe	W	w LineStrobe x	x: bit1 – Disable all bit2 – Enable Line1 only bit4 – Enable Line4 only	

Parameter	R/W	Command	Value	Description
	R	r LineStrobe		
StrobeLineDuration	W	w StrobeLineDuration+ x y	x: 0 – Line0 1 – Line1 2 – Line2 5 – CC1 6 – CC2 7 – CC3 8 – CC4	
	R	r StrobeLineDuration+ x	y: 0 to 2000000	
StrobeLineDelay	W	w StrobeLineDelay+ x y	x: 0 – Line0 1 – Line1 2 – Line2 5 – CC1 6 – CC2 7 – CC3 8 – CC4	
	R	r StrobeLineDelay+ x	y: 0 to 10000	
StrobeLinePreDelay	W	w StrobeLinePreDelay+ x	x: 0 – 5000	E.g., w StrobeLinePreDelay+ 300
	R	r StrobeLinePreDelay		E.g., r StrobeLinePreDelay

Parameter	R/W	Command	Value	Description
LineDebounce rTime	W	w LineDeboun cerTimeNs+ x y	x: 0 – Line0 1 – Line1 2 – Line2 5 – CC1 6 – CC2 7 – CC3 8 – CC4	
	R	r LineDeboun cerTime+n1	y: 0 to 1000000	
DeviceTapGe ometry	W	w DeviceTapG eometry x	x: 0x01010101 – Geometry_1X_1Y 0x01020101 – Geometry_1X2_1Y 0x01020102 – Geometry_1X2_1Y2 0x0a0b0c0d – Geometry_aXb_cYd	
	R	r DeviceTapG eometry		
CIConfiguratio n	R	r CIConfigura tion x	x: 0 – Base 1 – Medium 2 – Full 4 – EightyBit	

Parameter	R/W	Command	Value	Description
UserSetSelector	W	w UserSetSelector x	x: 0 – Default 1 – userset1 2 – userset2 3 – userset3	E.g., w UserSetSelector 2
	R	r UserSetSelector		
UserSetLoad	W	w UserSetLoad 1	Execute	
UserSetSave	W	w UserSetSave 1	Execute	
UserSetDefaultSelector	W	w UserSetDefaultSelector x	x: 0 – Default 1 – userset1 2 – userset2 3 – userset3	E.g., w UserSetSelector 2
	R	r UserSetDefaultSelector		

Appendix C Frame Grabber Software

When connecting third-party frame grabber to the Camera Link area scan camera, you need to install the frame grabber software and set related parameters.

Note

It is recommended to use the frame grabber sold by our company, and you can refer to the user manual of the corresponding frame grabber for details.

C.1 Install Frame Grabber Software

The frame grabber software is used to set frame grabber parameters, view and set the device's parameters, and acquire images.

Steps

1. Get the installation package of the frame grabber software from frame grabber supplier.
 2. Install the frame grabber software and its drivers.
-

Note

- If the frame grabber driver is not installed accordingly, the frame grabber cannot be identified properly or acquire image normally.
 - Refer to the user manual of the frame grabber you purchased for details.
-

C.2 Set Frame Grabber Software

After installing the device, you are required to set frame grabber parameters via the frame grabber software. Incorrect parameters or not setting parameters may make the device fail to output images. Here we take Dalsa and Matrox frame grabbers as examples.

Note

- The specific parameter names may differ by frame grabbers.
 - Refer to the user manual of the frame grabber you purchased for more operations.
-

Table C-1 Parameters of Dalsa Frame Grabber

Frame Grabber Parameters	Device Parameters
Pixel Clock Input Frequency	Pixel Clock
Camera Link configuration	Configuration Mode
# of Segment per Line(TAPS)	Tap Number

Frame Grabber Parameters	Device Parameters
Camera Sensor Geometry Setting	Tap Geometry

Table C-2 Parameters of Matrox Frame Grabber

Frame Grabber Parameters	Device Parameters
Pixel Clock Frequency	Pixel Clock
Camera Link config	Configuration Mode
Taps	Tap Number
Device Tap Configuration	Tap Geometry



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