Hikrobot Co., Ltd.

XoFLink Line 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 XoFLink Line 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 specific requirements, please refer to the device’s technical specifications.
- The device’s plug or socket is a power disconnection mechanism. Please do not block it for ease of plugging and unplugging.

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

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.
- It is recommended to block the fiber port of the device and cables to avoid dust.

1.3 Electromagnetic Interference Prevention

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

Chapter 2 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

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

2.1.1 Rubber Dust Air Blower

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

Steps

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

Figure 2-1 Cleaning by Rubber Dust Air Blower

Note

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

2.1.2 Mirror Brush Cleaning

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

Note

Do not touch the bristles directly with your hands.

2.1.3 Lens Wiping

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

Steps

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

Note

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

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

Figure 2-2 Lens Wiping

Note

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

2.1.4 Lens Cleaning Paper

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

Before You Start

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

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

Note

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

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

2.2 Device Housing Cleaning

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

Steps

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

Note

Do not use compressed air to accelerate evaporation.

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

Chapter 3 Overview

3.1 Introduction

The camera adopts high-sensitivity CMOS sensor and supports transmission protocol of XoFLink. It transmits non-compressed images in real time, and sets parameters via the MVS client software or SDK. The image acquisition process is realized via fiber port frame grabber and SFP+ module.
The camera is applicable to new energy, panel, consumer, PCB, and other industries.

3.2 Key Features

- Supports exposure control and gain adjustment.
- Supports PRNUC correction, FPNC correction, LUT, Gamma correction, etc.
- Supports flexible I/O trigger parameter configuration.
- Compact design and flexible installation.
- Compatible with the GenICam Standard.

Note

- The specific functions may differ by device models.
- Refer to the device's specifications for specific parameters.
- Dropped frames when streaming may happen if the PC has low performance.

3.3 Operating Principle

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

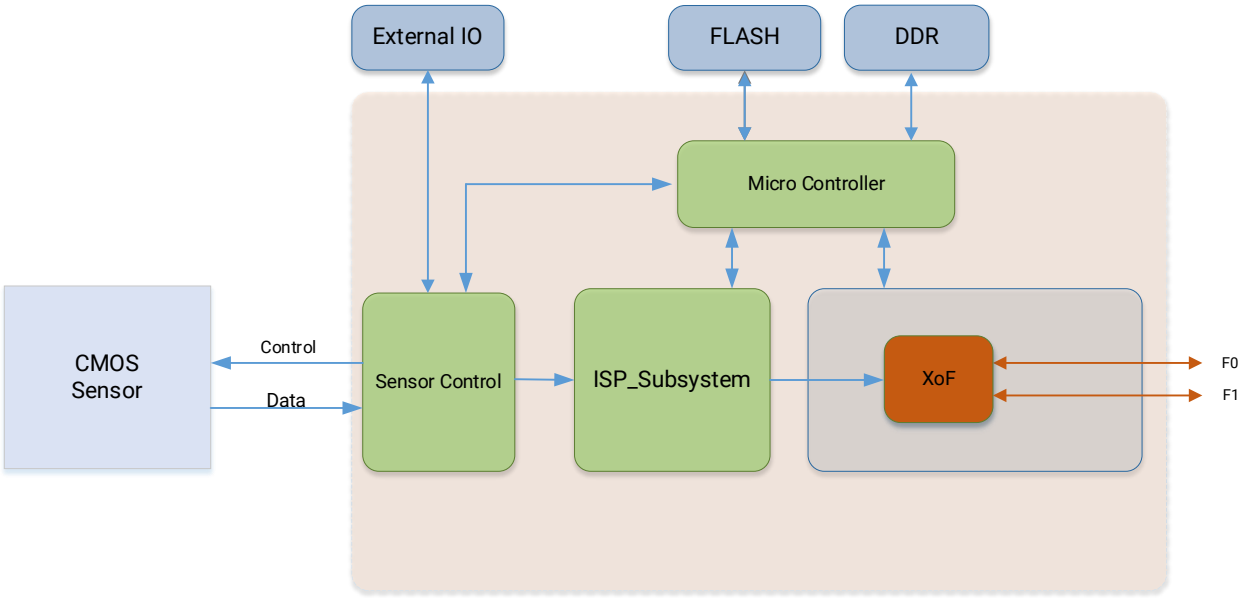


Figure 3-1 Operating Principle

Chapter 4 Device Hardware

4.1 Appearance

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

Note

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

Table 4-1 Device Model and Appearance Type

Device Appearance Type	Device Model
Type I Device	MV-CL082-91F2M
	MV-CL083-91F2C
	MV-CL084-91F2M
	MV-CL162-91F2M
Type II Device	MV-CL082-91F1M
Type III Device	MV-CL042-91FC
Type IV Device	MV-CL166-91F2C
Type V Device	MV-CL086-B0F1C
Type VI Device	MV-CL084-90F1M

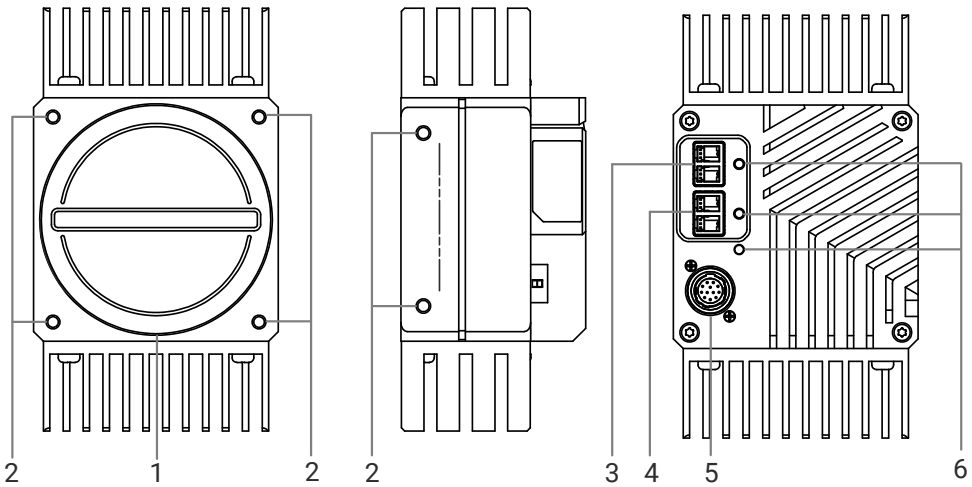


Figure 4-1 Appearance (Type I)

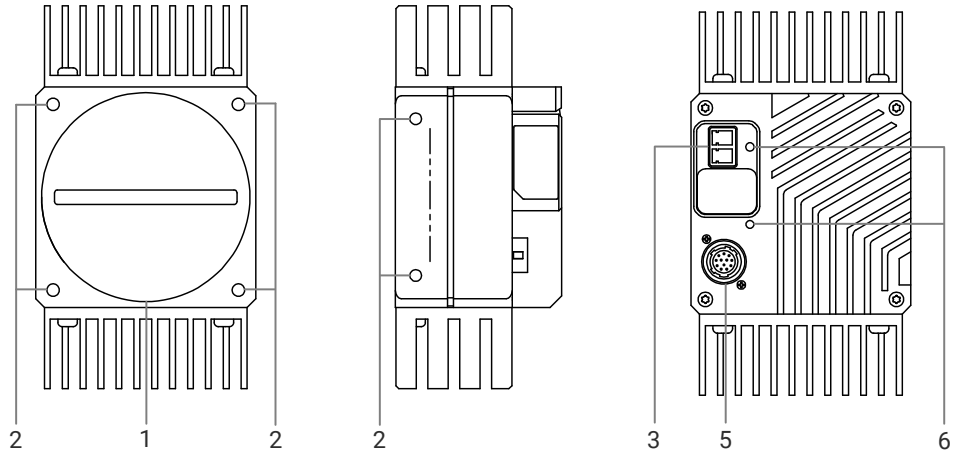


Figure 4-2 Appearance (Type II)

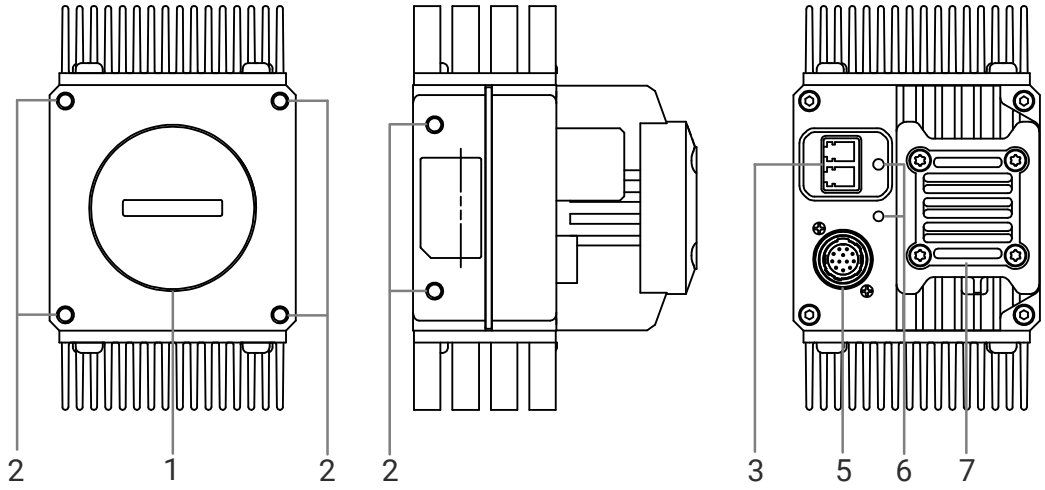


Figure 4-3 Appearance (Type III)

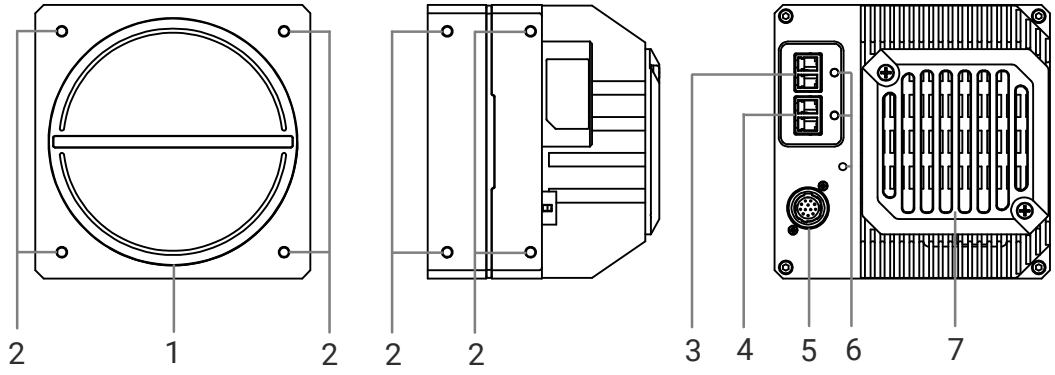


Figure 4-4 Appearance (Type IV)

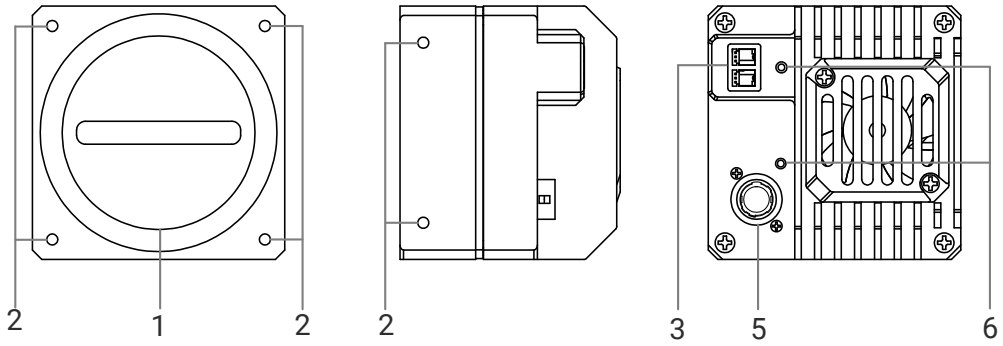


Figure 4-5 Appearance (Type V)

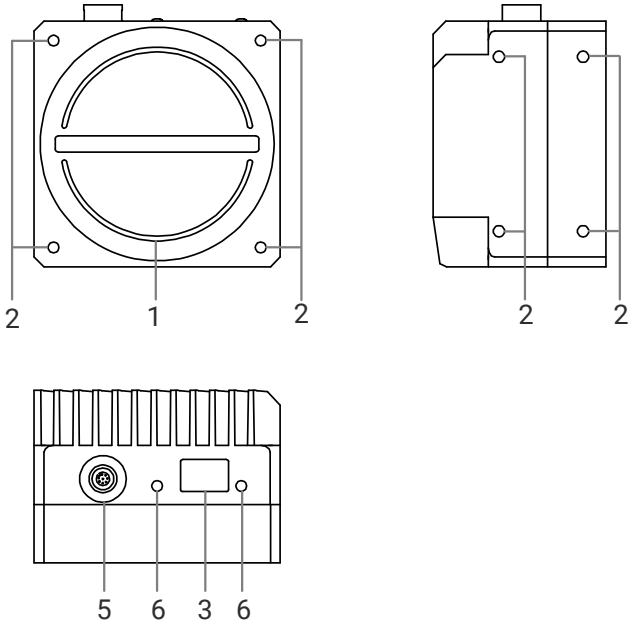


Figure 4-6 Appearance (Type VI)

Table 4-2 Component Description

No.	Component	Description
1	Lens Mount	It is used to install the lens. Refer to the device's specification for specific lens mount information.
2	Screw Hole	It is used to fix the device to the installation position. Refer to the device's specification for specific screw information.
3	F0 Connector	It is the first fiber port for transmitting data. The connector is LC fiber connector. **Note** The first fiber port of some device models of previous version is F1.
4	F1 Connector	It is the second fiber port for transmitting data. The connector is LC fiber connector.

No.	Component	Description
		Note The second fiber port of some device models of previous version is F2.
5	Power and I/O Connector	It provides power supply, I/O, and serial port function. **Note** The power and I/O connectors of the MV-CL084-90F1M device and MV-CL086-B0F1C device provide power supply only.
6	LED Indicator	It includes the device LED indicator and the fiber port LED indicator.
7	Cooling Fan	It is used to cool the device to ensure its normal operation.

4.2 Power and I/O Connector

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

Note

- Refer to the table below and the label attached to the power and I/O cable to wire the device.
- The power and I/O connectors of the MV-CL084-90F1M device and MV-CL086-B0F1C device provide power supply only.
- The figure and the table below show the cable sold by our company.

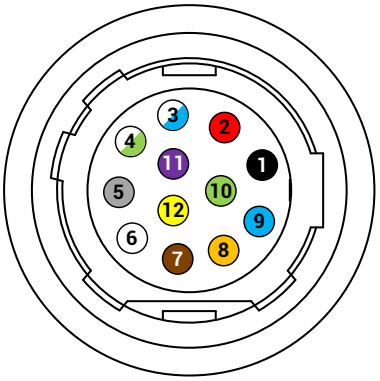


Figure 4-7 12-Pin P10 Connector

Table 4-3 Pin Definitions

No.	Color	Signal	I/O Signal Source	Description
1	Black	GND	--	Power supply ground

No.	Color	Signal	I/O Signal Source	Description
2	Red	DC_PWR	--	DC power supply+
3	White/Blue	LINE0_P	Line 0+	Differential input/output IO 0+
4	White/Green	LINE0_N	Line 0-	Differential input/output IO 0-
5	Gray	GND	--	Power supply ground
6	White	LINE3_P	Line 3+	Differential input/output IO 3+
7	Brown	LINE3_N	Line 3-	Differential input/output IO 3-
8	Orange	LINE4_P	Line 4+	Differential input/output IO 4+
9	Blue	LINE1_P	Line 1+	Differential input/output IO 1+
10	Green	LINE1_N	Line 1-	Differential input/output IO 1-
11	Purple	DC_PWR	--	DC power supply+
12	Yellow	LINE4_N	Line 4-	Differential input/output IO 4-

4.3 Indicator

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

Note

When the indicator is flashing rapidly, flashing slowly, or flashing very rapidly, its unlit interval is 0.2 sec, 1 sec, and 0.08 sec respectively.

4.3.1 Device LED Indicator

Refer to the table below for device LED indicator description.

Table 4-4 Device LED Indicator Description

No.	Indicator Color	Status	Device Status Description
1	Red	Solid	The device exception occurs.
2	Blue	Solid	The device is in an idle status.
3	Blue	Unlit	The device is not powered on.
4	Blue	Flashing rapidly	The device is acquiring images in continuous

No.	Indicator Color	Status	Device Status Description
			mode.
5	Blue	Flashing slowly	The device is acquiring images in trigger mode.
6	Red and blue	Flash alternatively	The device is updating firmware.

4.3.2 Fiber Port LED Indicator

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

Table 4-5 Fiber Port LED Indicator Description

No.	Indicator Color	Status	Device Status Description
1	Unlit		● The device is not powered on. ● The device is powered on but the optical fiber patch cord is not connected to the frame grabber and the device.
2	Orange	Solid	The device is being powered on.
3	Red	Flashing slowly	The device is powered on but the fiber port link is not connected.
4	Green	Solid	The device is connected but no data transmission.
5	Green	Flashing very rapidly	The device is acquiring images in continuous mode.
6	Orange	Flashing very rapidly	The device is connected to the PC and is transmitting data.
7	Orange	Flashing slowly	The device is acquiring images in trigger mode.

Chapter 5 Power Supply and Heat Dissipation

5.1 Device Power Supply

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

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.

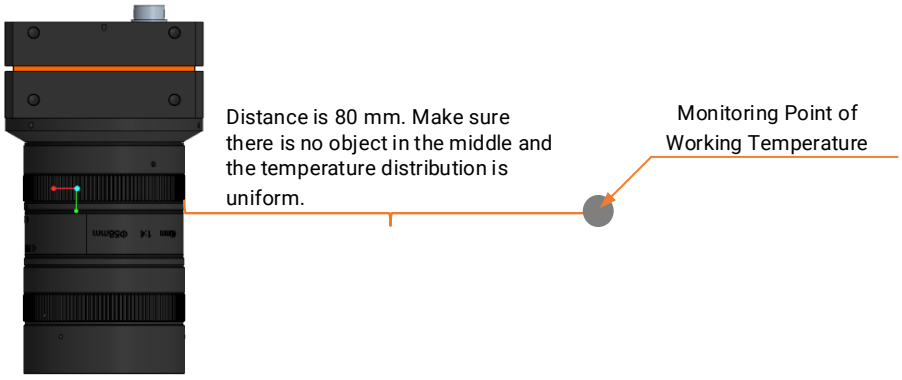


Figure 5-1 Monitoring Point of Working Temperature

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.
The temperature of the internal electronic components is a key factor affecting image quality, device operating stability, and long-term reliability. Therefore, better image quality and reliability can be obtained by lowering the temperature of the housing and the internal electronic components.

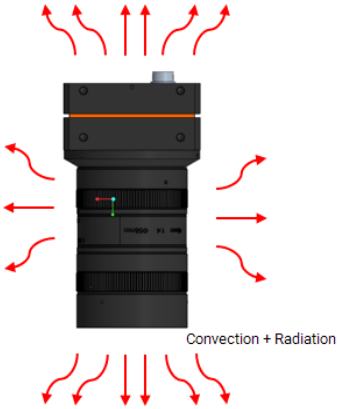


Figure 5-2 Housing Temperature

5.2.2 Heat Dissipation Measures

The temperature of the device housing is influenced by the power consumption, the device size, the environment, and additional heat dissipation measures. By designing the camera to be mounted in the field, additional camera cooling measures can quickly dissipate the heat from the housing to the outside environment.
In the industrial field, the heat of the camera housing can be dissipated through the mounting parts and fixed platforms, and the cooling effect of such cooling measures depends on the thermal conductivity of the material and the mounting parts. This section will be respectively on the material and mounting methods to do specific instructions.

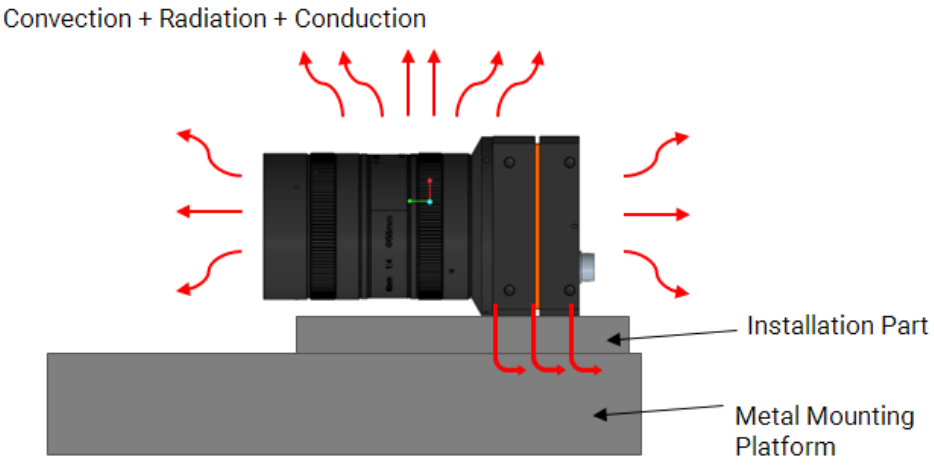


Figure 5-3 Heat Dissipation via Installation Part

- **Installation Part Material**
  - Use materials with high heat conduction, such as aluminum and copper, which can quickly transfer heat away.
  - Minimize the use of materials with low heat conduction, such as plastic and rubber.

Note

The heat dissipation mentioned in the following part (heat conduction path and contact area) is for materials with high heat conductivity.

- **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 the 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 the 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.

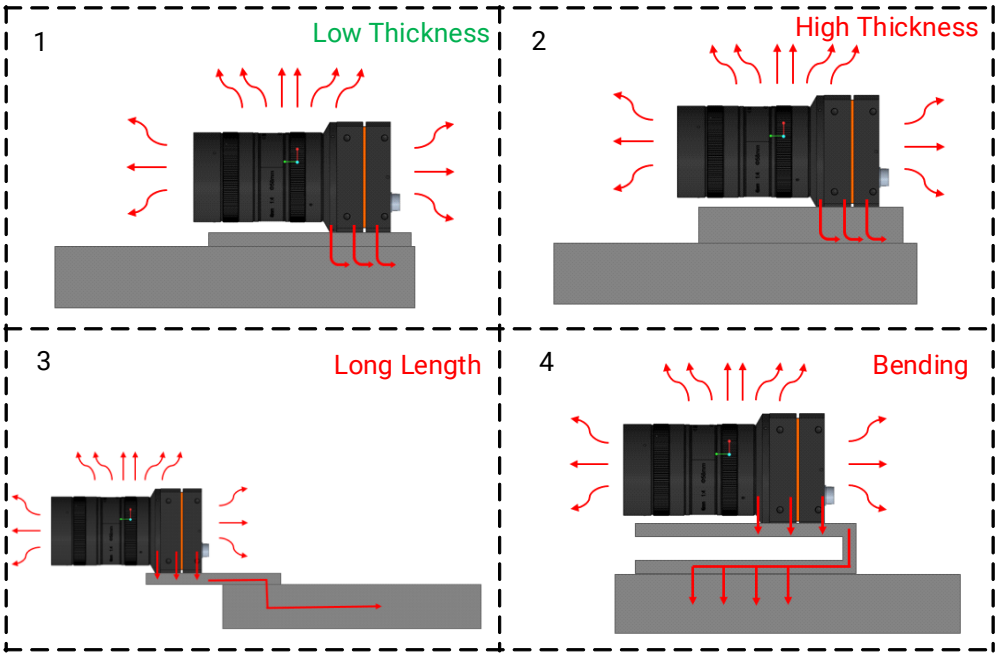


Figure 5-4 Heat Conduction Path of Different Installation Methods

- **Contact Area**

  Surface contact should be used among 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.

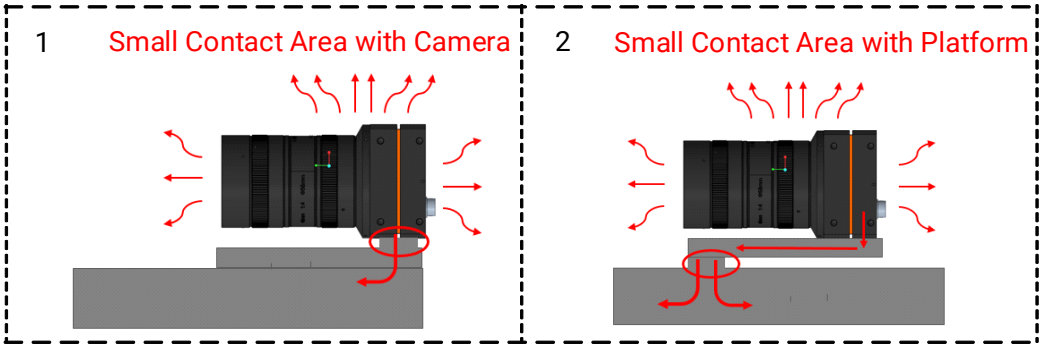


Figure 5-5 Contact Area

5.2.3 Low Heat Conduction Material

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

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.

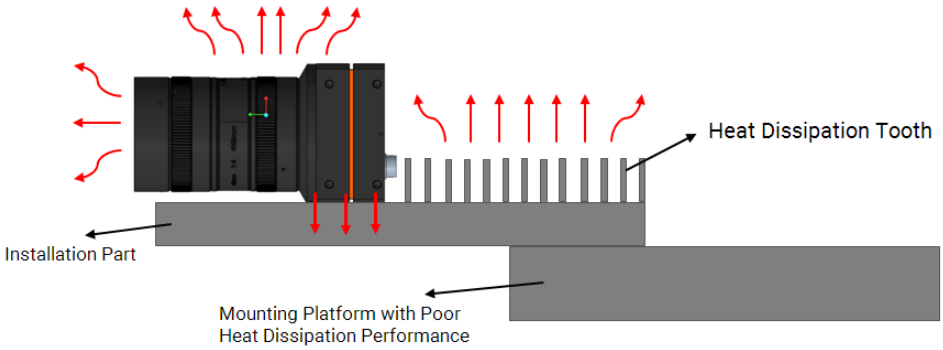


Figure 5-6 Add Heat Dissipation Tooth

- 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 M42-mount lenses, M72-mount lenses, and M90-mount lenses.
The M42-mount lenses can be connected to F-mount, C-mount, and other lenses via the adapter ring, and the M72-mount and M90-mount ones be connected to F-mount lenses via the adapter ring.
The thread depth of the M42-mount lens is not less than 5.5 mm, and the thread depth of the M72-mount and M90-mount ones 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 M42-mount lenses, M72-mount lenses, and M90-mount lenses. When selecting lens, select lens with the same mount. When the mounts of the device and the lens are different, part of the lens mounts may be connected by using the corresponding adapter ring.
- 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 size.
- 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 optical fiber patch cord, attention should be paid to the application requirements of scenarios such as high-frequency communication and high-frequency motion. In such scenarios, if the cables are arranged in an inappropriate manner, various problems may be caused in use, such as cable skin wear, internal conductor breakage, and device packet loss. Based on the above situation, this section introduces the basic wiring principles and precautions of sports cables to help you install and use related products correctly and improve the overall healthy operating life of the system.

- The minimum bending radius of the chain rail during wiring should be controlled at more than 10 to 12 times the wire diameter (the larger the bending radius, the longer the cable movement life).
- Make sure that the cable does not spin in the chain rail, and the cable should be spread horizontally along the chain rail.
- If the cable is laid too tightly, the cable sheath and the chain rail will produce friction during the movement, which will cause the sheath to wear. Therefore, in the wiring process, the laying tension on the cable should be avoided.
- If the cable is fixed at the moving part of the chain rail, stress concentration will occur at the fixed position during the movement. Therefore, both ends of the cable can be fixed, but not at the middle moving section.
- Multiple cables may interfere with each other when moving in the chain rail. At this time, the chain rail with sufficient width should be selected to ensure that there is still a

certain space after the cables are laid horizontally. The use of spacers is also an effective way to avoid interference. Note that there should also be at least 2 mm clearance between the spacer and the cable. Do not drain cables without spacers.

- Please keep the space factor occupied by the cable after laying within 30%, as shown below.

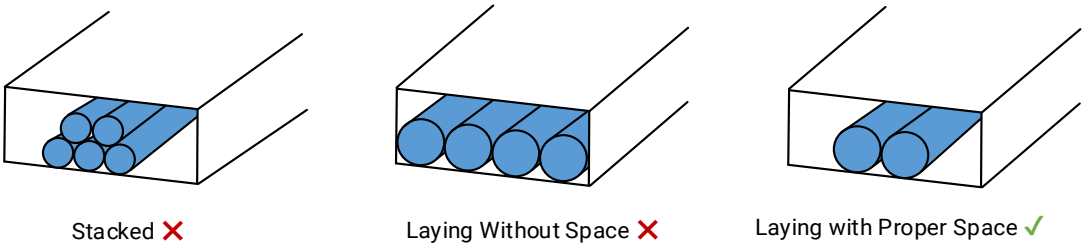


Figure 6-1 Cable Laying

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

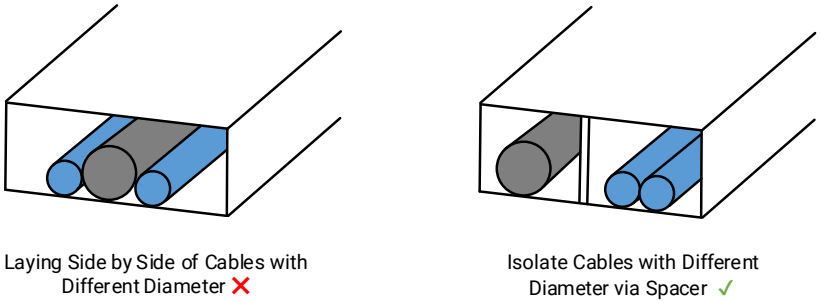


Figure 6-2 Isolated via Spacer

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

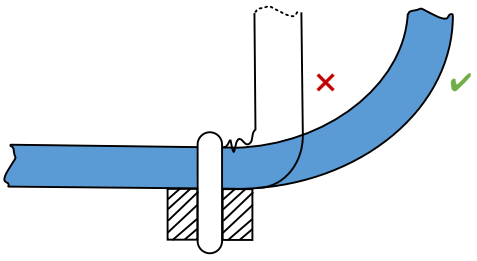


Figure 6-3 Vertically Bended Prohibited

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

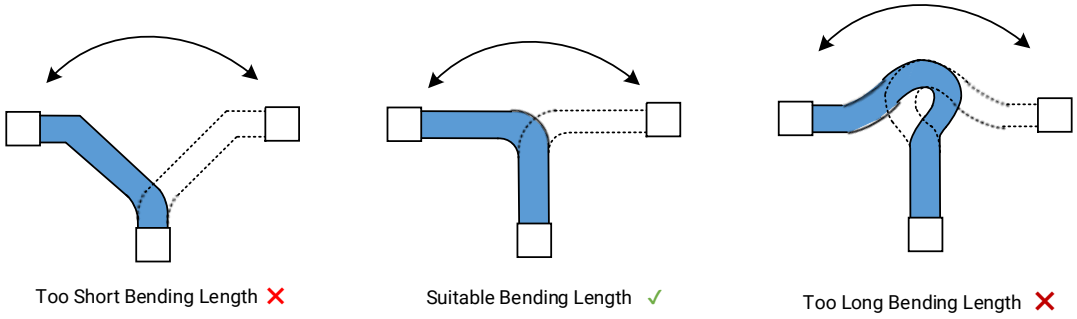


Figure 6-4 Suitable Bending Length

- Please keep a sufficient bending radius.

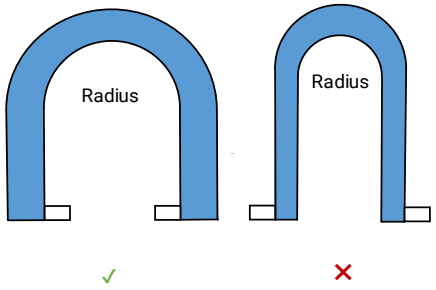


Figure 6-5 Sufficient Bending Radius

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

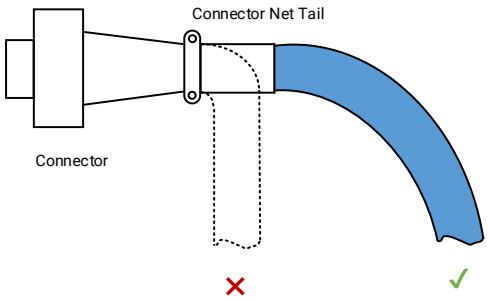


Figure 6-6 Assemble Connector

- Do not bind cables of different diameters together.

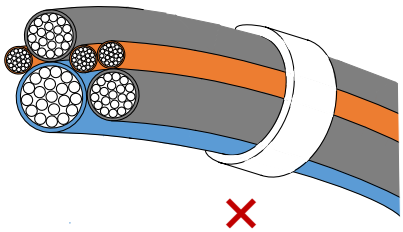


Figure 6-7 Improper Binding

Chapter 7 Quick Start Guide

7.1 Install Device

7.1.1 Installation Preparation

You need to prepare following accessories before device installation.

Table 7-1 Accessories

No.	Name	Quantity	Description
1	Power and I/O Cable (Required)	1	It refers to the 12-pin power and I/O cable. You need to purchase separately.
2	DC Power Supply (Required)	1	You should select suitable power adapter or switch power supply according to the device power supply and consumption. You need to purchase separately.
3	Frame Grabber (Required)	1	It refers to the 10 Gbps fiber port frame grabber. You need to purchase separately.
4	SFP+ Module (Required)	1/2	If the device has SFP+ module, you need to separately purchase a SFP+ module for the frame grabber. If the device does not have SFP+ module, you need to purchase two SFP+ modules for the device and the frame grabber.
5	Optical Fiber Patch Cord (Required)	1/2	You can use 1 or 2 optical fiber patch cord(s) to transmit data. You need to purchase separately. **Note** The length of 2 optical fiber patch cords should be the same.
6	Lens (Required)	1	It refers to the lens that is suitable for the device. You need to purchase separately.
7	Lens Adapter (Required)	1	If the lens you used does not match with lens mount of the device, you need to use a lens adapter. You need to purchase

No.	Name	Quantity	Description
			separately.

Note

You can refer to the device's technical specifications for the recommended models of frame grabber, SFP+ module, and optical fiber patch cord.

7.1.2 Install Device

The topology diagram of the device is shown below.

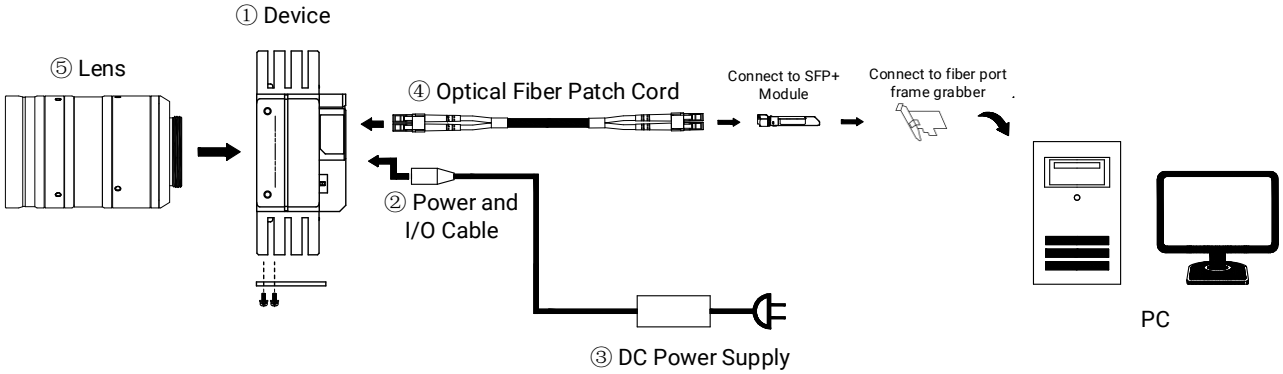


Figure 7-1 Topology Diagram

Before You Start

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

Steps

1. Fix the device to the installation position.
2. Install the lens to the device.
3. Insert the SFP+ module into the 10 Gbps fiber port frame grabber.

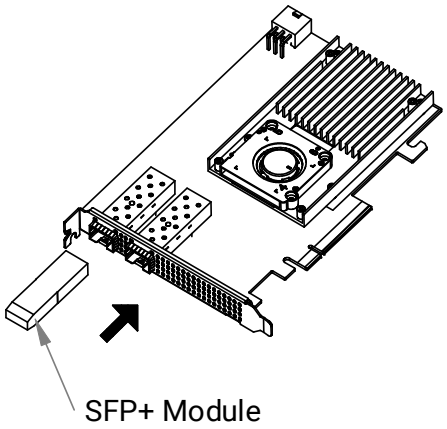


Figure 7-2 Insert SFP+ Module

4. Use the optical fiber patch cord to connect the device and the SFP+ module.

Note

- Make sure that the device is not access to the power supply when connecting.
- Select correct optical fiber patch cord according to cable protocol, mount type, and deployment method.
- The device provides fiber port for connection, and the link configuration varies depending on how many fiber ports used.

Table 7-2 Device Fiber Port and Link Configuration

Used Fiber Port Quantity	Device Fiber Port Name	Link Configuration
1	F0	1 Link 10 Gbps
2	F0, F1	1 Link 10 Gbps, 2 Link 10 Gbps

5. Use the power and I/O cable to connect the device to a suitable power adapter or switch power supply. Refer to section ***Power and I/O Connector*** for details.

Note

The first and second fiber ports of some device models of previous version is F1 and F2 respectively.

7.2 Install Client Software

MVS client software is used to connect and set device's parameters, and upgrade firmware. The MVS client version 3.4.0 or later supports access to XoFLink line scan cameras.

Note

- The MVS client software is compatible with 32/64-bit Windows XP/7/10, 32/64-bit Linux, 64-bit MacOS, and Android 4.4 to 9.0 operating systems. Here we take Windows as an example.
- The graphic user interface may differ by different versions of client software you use. Please refer to the actual condition.
- 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**.

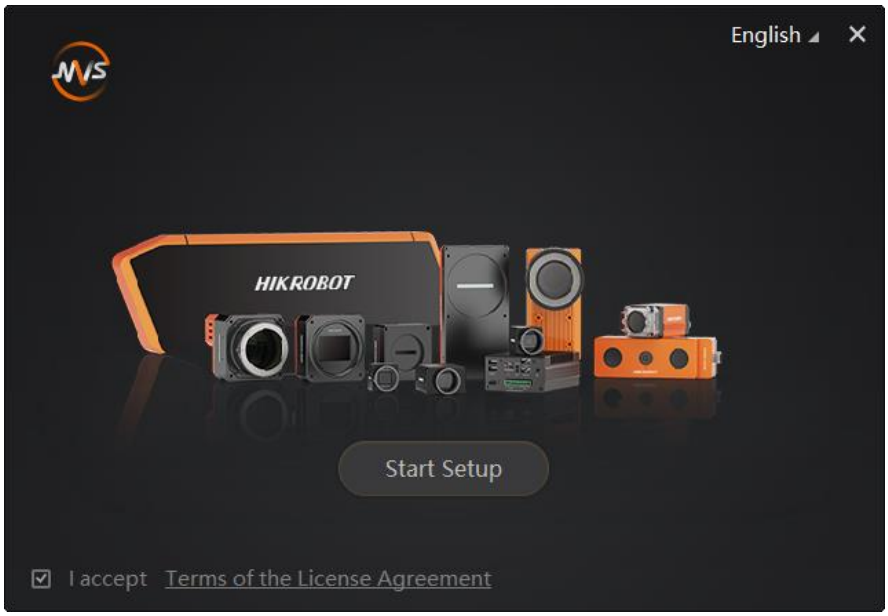


Figure 7-3 Installation Interface

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.

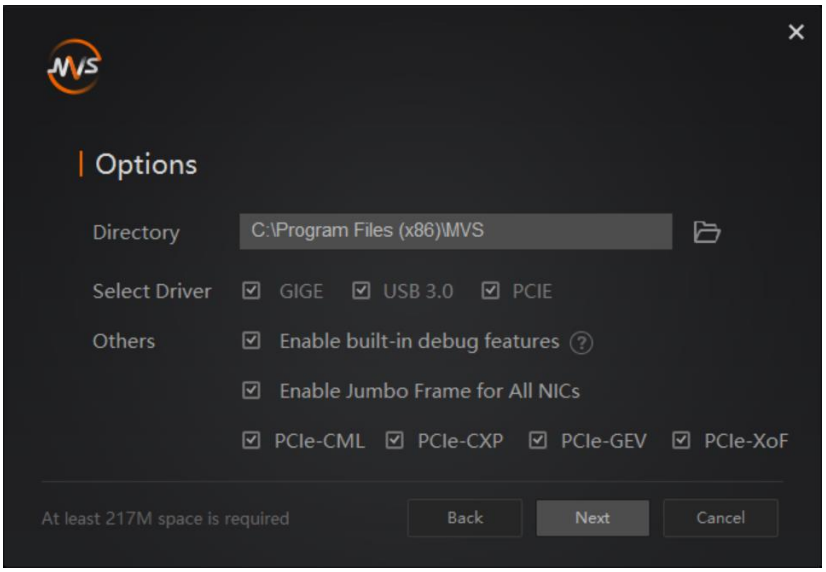


Figure 7-4 Installation Options

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 checked.

- **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 of Client Software

Steps

Note

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

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.

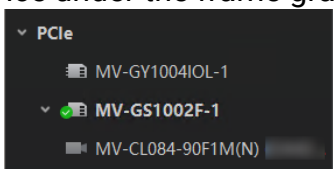


Figure 7-5 Connect Device to MVS Client Software

Note

The image is for reference only.

The client software displays the device's information after connecting, as shown below.

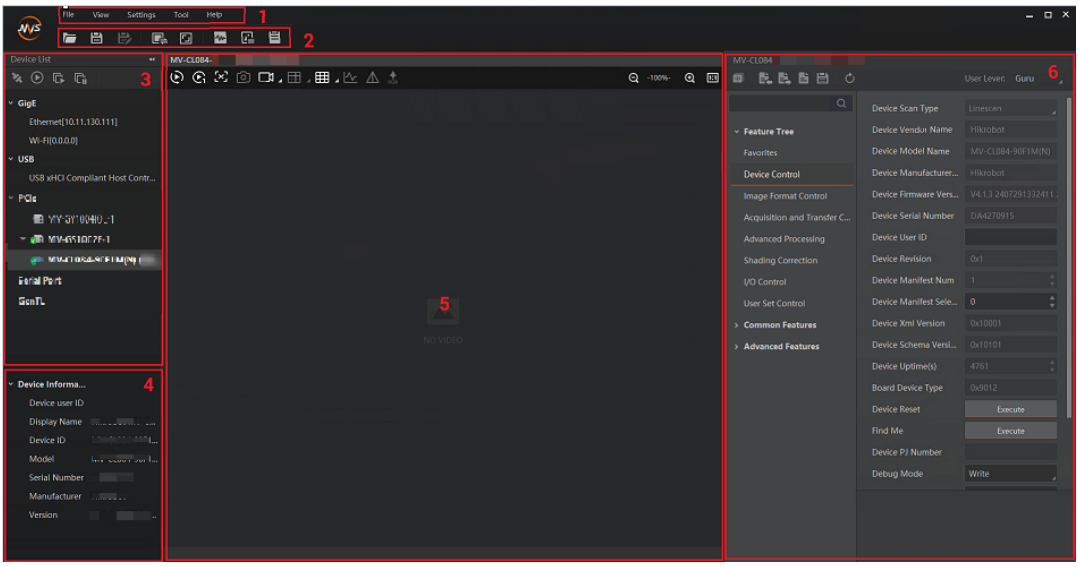


Figure 7-6 Main Window

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.
3	Device List Panel	This panel displays device list, and you can connect or disconnect device.
4	Device Information Panel	This panel displays the detailed information of connected device.
5	Display Window	This area displays the acquired images in real time.
6	Feature Panel	This panel displays the device's parameters, and you can configure them according to actual demands.

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.

Note

The white balance settings are required for the color camera in order to output a true color image.

7. In MVS software, capture an image and check if the image brightness is normal. If the image is too bright or too dark, you may add an additional light source, or adjust the lens aperture to improve the brightness.
8. Check whether the captured image is in focus. If not, you may perform the following steps:

1) Place a legend with clear edges that can distinguish between dark and bright, and make sure the legend is in the range of the camera's field of view.
2) Adjust the focus knob on the lens to ensure the dark and bright edges can be clearly distinguished.
3) If the edges occupies within 3 pixels in width, it means that the image is in focus.

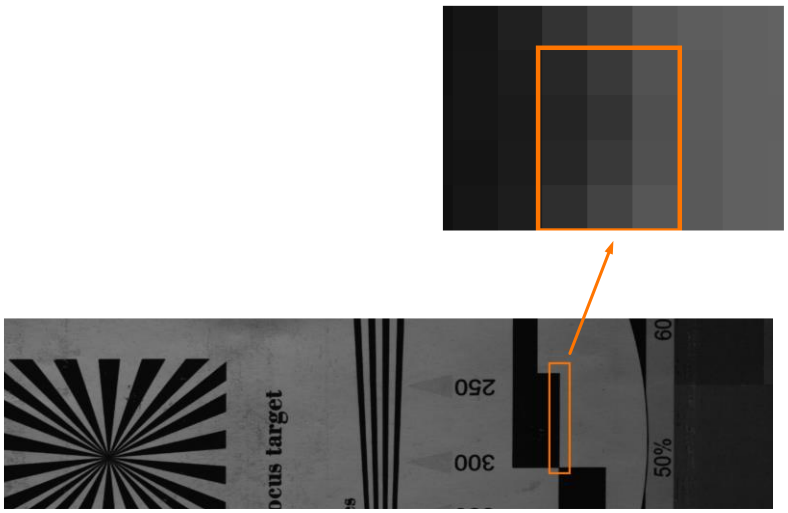


Figure 7-7 Legend

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

Note

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

Chapter 8 I/O Electrical Features and Wiring

The device has 4 configurable input or output lines (Line 0/1/3/4), and these lines can be configured as differential input/output or single-ended input/output according to actual demands.

Note

The power and I/O connector of the MV-CL084-90F1M device supports power supply only.

8.1 I/O Electrical Features

8.1.1 Differential Input Circuit

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

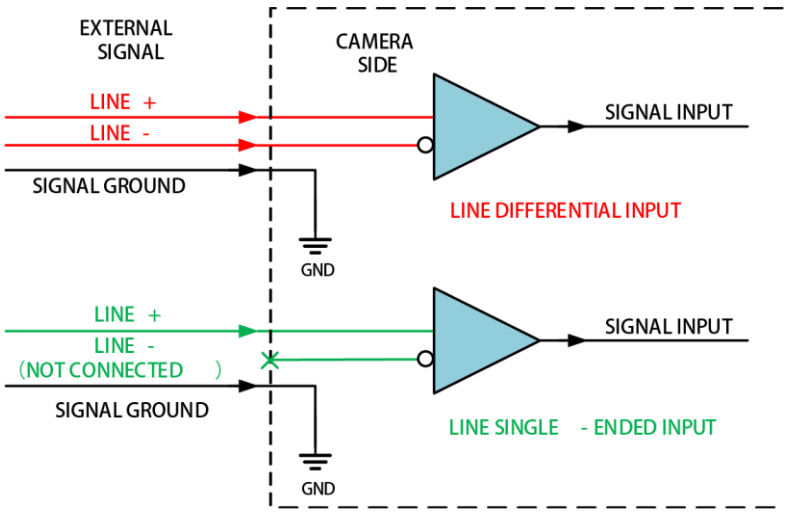


Figure 8-1 Internal Circuit of Differential Input

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

RS-422 Standard Input

In order to make sure the normal operation of input circuit, it is required to connect device's ground signal with external ground signal if the differential input adopts RS-422 standard signal.

RS-422 standard defines the connection of the bus structure, and the inputs of several devices can be connected to the RS-422. Up to 10 devices can be connected at the same

time, of which only one device is the main dispenser (D) and other devices are receivers (R). The circuit length between the receiver and the bus should be as short as possible. The bus must have a 120 Ω terminal resistance (RT).
When the device is the last receiver on the bus structure, the device's terminal resistance needs to be enabled, and the rest device's terminal resistances need to be disabled. Multiple terminal resistance should not be enabled on the bus structure, which will reduce signal reliability and may cause damage to the RS-422 device.

RS-644 Standard Input

If the differential input adopts RS-644 standard signal, the input terminal's 120 Ω terminal resistance should be enabled.

TTL & LVTTL Standard Input

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

Table 8-1 Electrical Feature Requirement of TTL & LVTTL

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

8.1.2 Differential Output Circuit

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

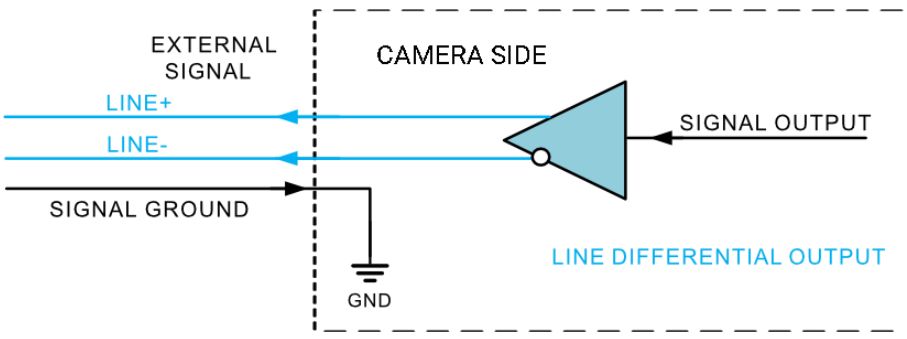


Figure 8-2 Internal Circuit of Differential Output

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

RS-422 Standard Output

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

RS-644 Standard Output

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

8.2 Signal Wiring

This section takes the Type I device as an example to introduce how to wire the device according to its pin definitions.

8.2.1 Input Signal Wiring

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

Note

- Make sure that the hardware trigger signals have been configured as input signal.
- Signal source means the device that is directly connected to the device's I/O.
- It is recommended to connect Line 1 and Line 3 if the device uses line trigger mode.
- It is recommended to connect Line 0 if the device uses frame trigger mode.

The wiring is shown below if the differential signal source provides trigger signal.

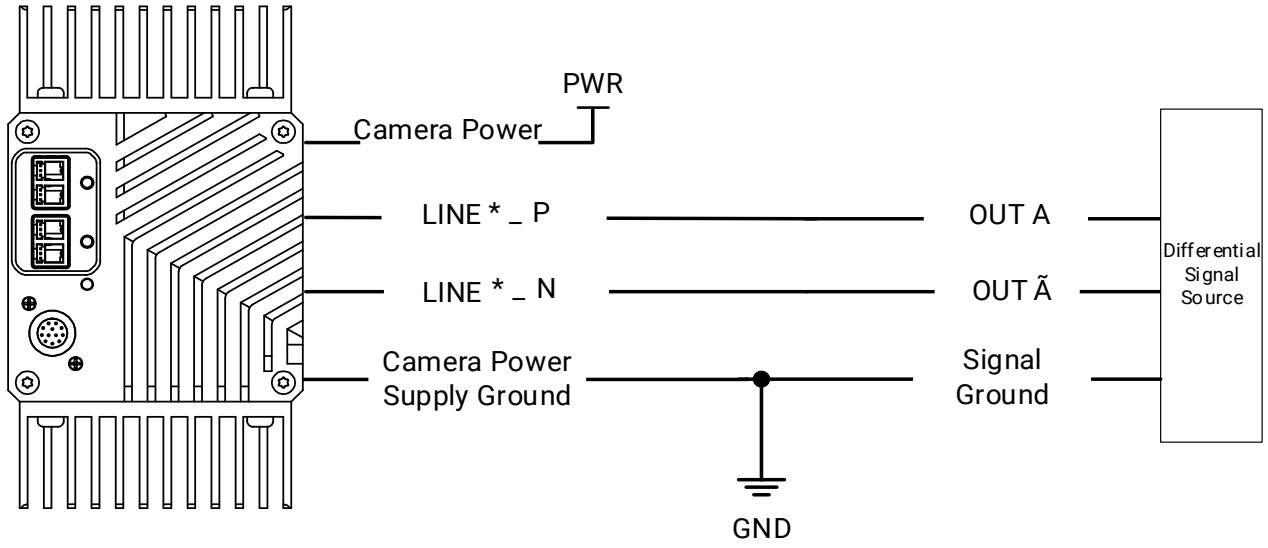


Figure 8-3 Differential Input Wiring

Note

The device's power supply ground should connect the signal ground of the differential signal source if the differential signal source provides signal.

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

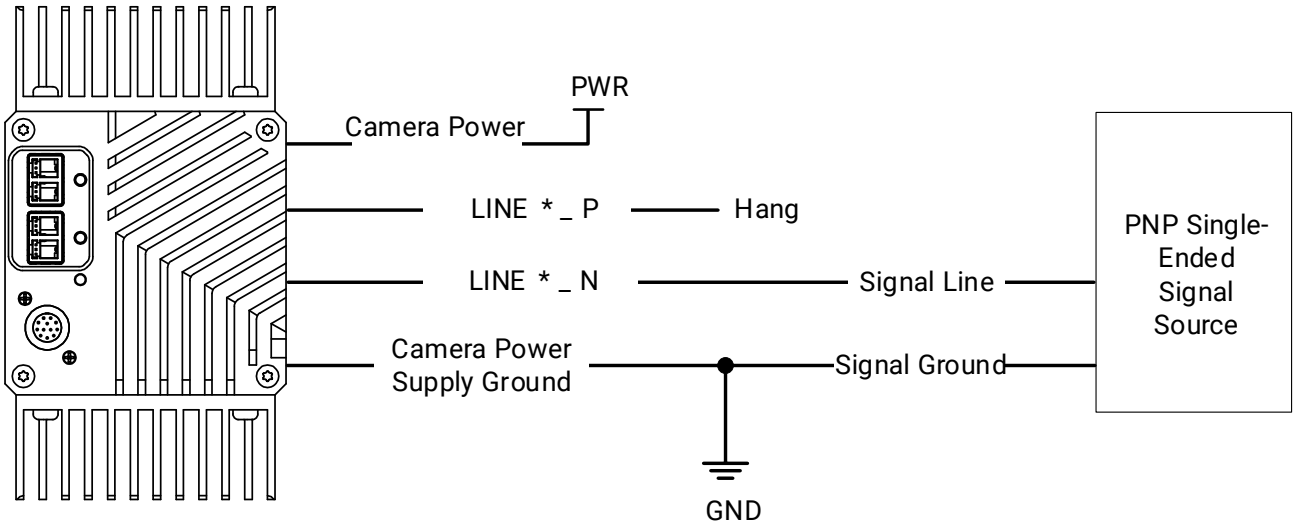


Figure 8-4 PNP Single-Ended Input Wiring Without Pull-Down Resistor

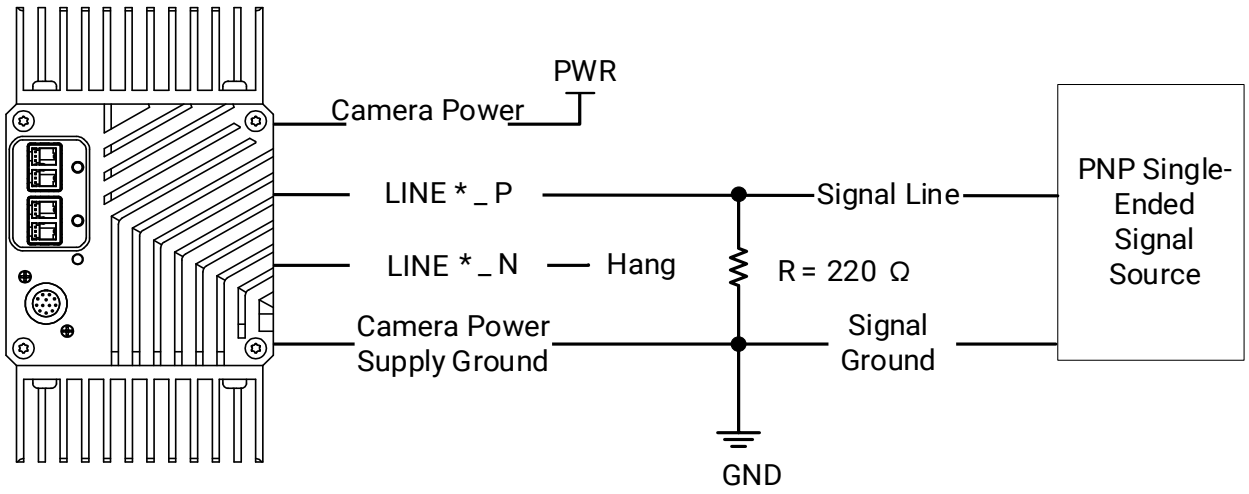


Figure 8-5 PNP Single-Ended Input Wiring with Pull-Down Resistor

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

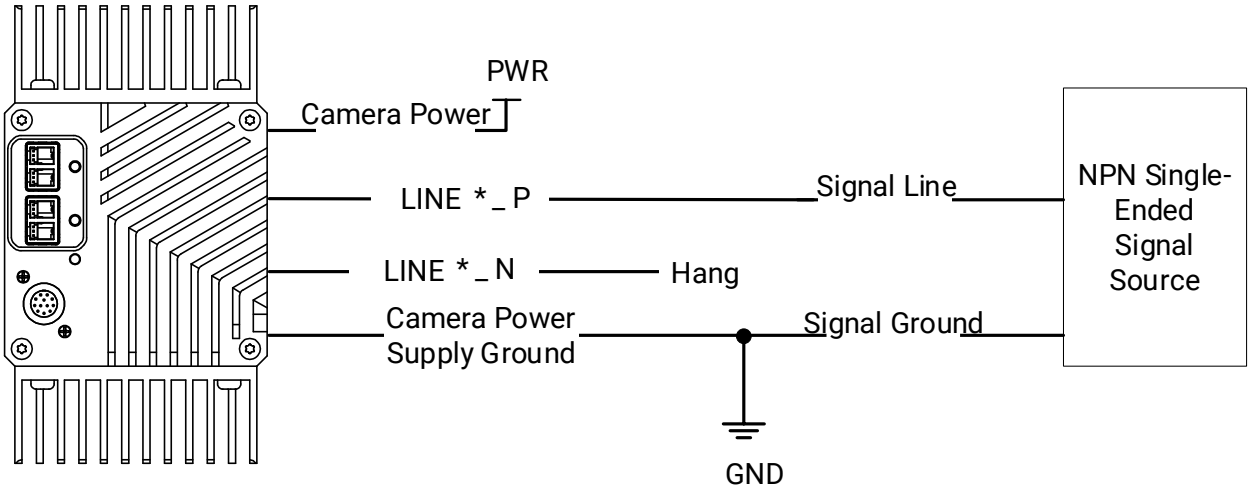
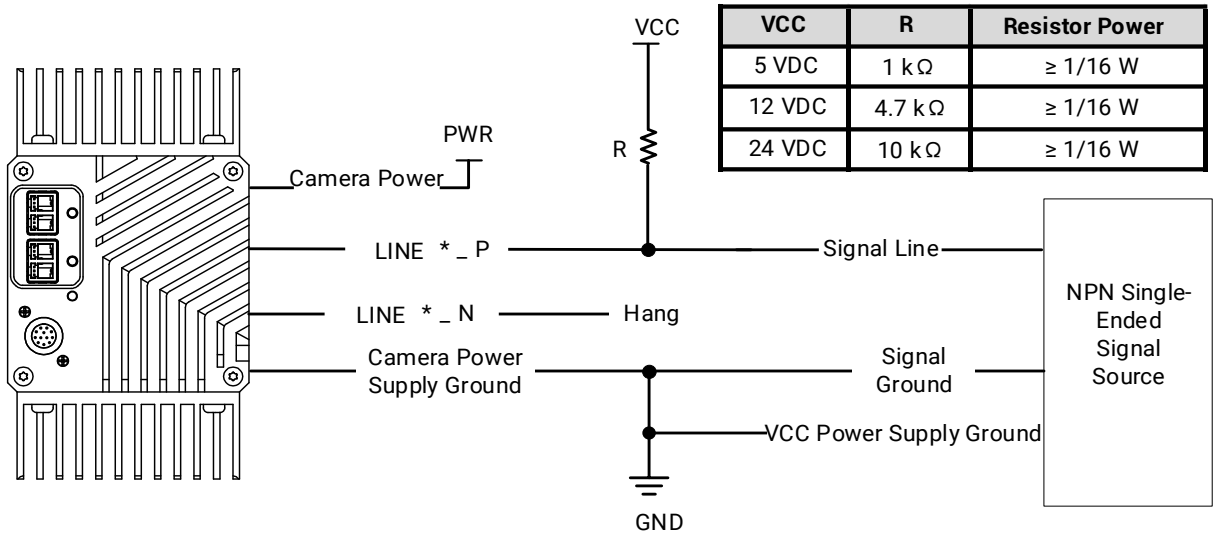


Figure 8-6 NPN Single-Ended Input Wiring Without Pull-Up Resistor



VCC	R	Resistor Power
5 VDC	1 kΩ	≥ 1/16 W
12 VDC	4.7 kΩ	≥ 1/16 W
24 VDC	10 kΩ	≥ 1/16 W

Figure 8-7 NPN Single-Ended Input Wiring with Pull-Up Resistor

Note

The power range of R is ≥ 1/16 W.

8.2.2 Output Signal Wiring

The device's 4 configurable lines can be configured to output signal to trigger other devices.

Note

Wiring varies depending on I/O signal is configured as differential output or single-ended output.

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

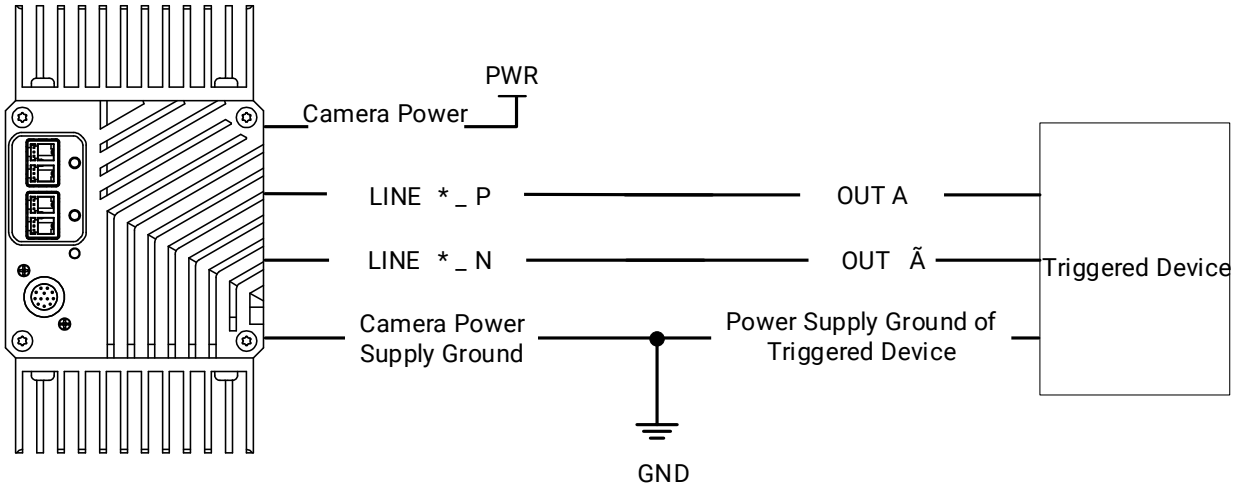
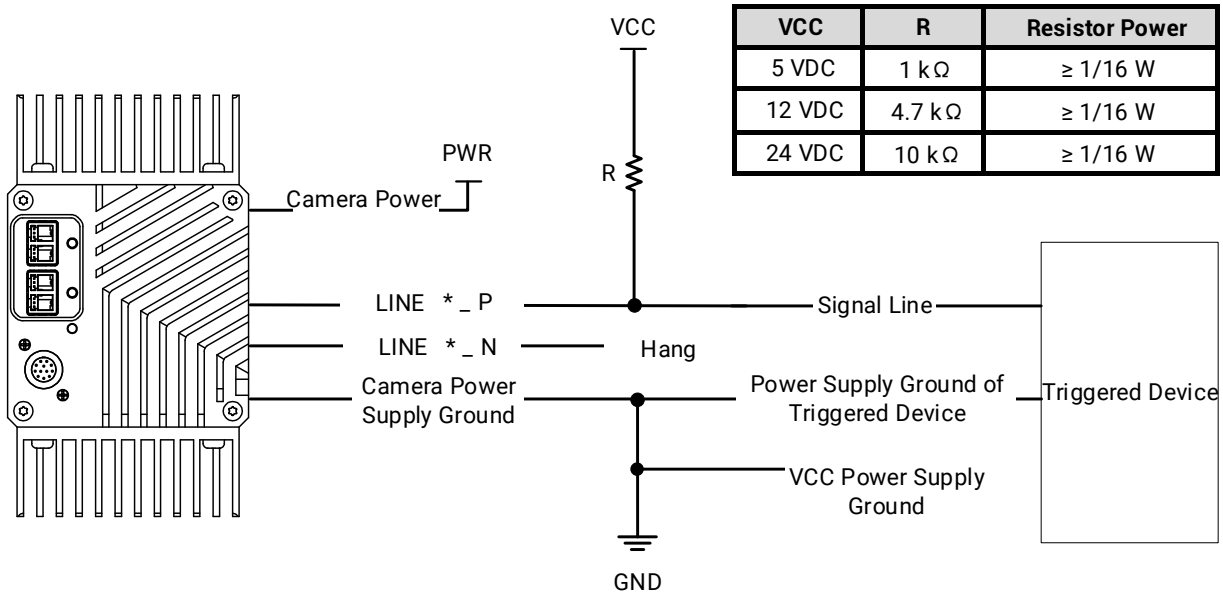


Figure 8-8 Differential Output Wiring

If I/O signals are used as single-ended output, the triggered device needs to be triggered at a LVTTL level of 3.3 VDC or more. At this time, a pull-up resistor of 1 kΩ to 10 kΩ needs to be added.



VCC	R	Resistor Power
5 VDC	1 kΩ	≥ 1/16 W
12 VDC	4.7 kΩ	≥ 1/16 W
24 VDC	10 kΩ	≥ 1/16 W

Figure 8-9 Single-Ended Output Wiring with Pull-Up Resistor

Note

- The power range of R is ≥ 1/16 W.
- The VCC voltage value should match the required trigger voltage value.
- It is recommended that VCC use device power or triggered device power. If a third-party power supply is used, the power supply should be shared with the device power supply and the triggered device power supply.

Chapter 9 Trigger Input and Output

9.1 Trigger Input

9.1.1 Set Trigger Mode

The device has 4 types of trigger modes, including internal trigger mode, line trigger mode, frame trigger mode, and line + frame trigger mode. The trigger mode is controlled by **Scan Mode** in **Acquisition and Transfer Control**, **FrameTrigger Mode** in **Frame Trigger Control**, and **LineTrigger Mode** in **Line Trigger Control**.

Note

The **Frame Trigger Control** can be set only if the **Frame Scan** is selected as **Scan Mode**.

Table 9-1 Trigger Mode Description

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

9.1.2 Set Trigger Source

The device's trigger source includes software trigger, hardware trigger, shaft encoder control, frequency converter control, free trigger, and link trigger. Refer to the tables below to see the trigger source under frame trigger mode or in line trigger mode.

Note

- The specific trigger source may differ by device models.
- The trigger sources in the tables below are valid for frame trigger mode, line trigger mode, or line + frame trigger mode.
- In line + frame trigger mode, when the trigger source selected by the frame trigger and the line trigger and the trigger-related parameters are the same, the first signal of trigger source will be used as the frame trigger signal to make the device start to acquire images, and the subsequent signals as line trigger signal to acquire images per lines until the processing of one frame of image is completed, and then the processing of the next frame of image is performed.

Table 9-2 Trigger Source Description in Frame Trigger Mode

External Trigger Source	Path	Parameter	Description
Software Trigger	**Acquisition and Transfer Control → Frame Trigger Control → FrameTrigger Source**	Software	The software sends trigger signal to the device via XoFLink interface to acquire images.
Hardware Trigger		Line *	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.
Frequency Converter Control		Frequency Converter	This trigger source sends trigger signal to the device through frequency conversion to acquire images.
Free Trigger		Anyway	This trigger source uses trigger sources mentioned above to send trigger signal to the device to acquire images.
Link Trigger		Link Trigger*	The frame grabber sends trigger signal to the device to acquire images.

Table 9-3 Trigger Source Description in Line Trigger Mode

External Trigger Source	Path	Parameter	Description
Hardware Trigger	**Acquisition and Transfer Control →**	Line *	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.

External Trigger Source	Path	Parameter	Description
Shaft Encoder Control	**Line Trigger Control → LineTrigger Source**	Encoder Module Out	This trigger source sends trigger signal to the device through shaft encoder module to acquire images.
Frequency Converter Control		Frequency Converter	This trigger source sends trigger signal to the device through frequency conversion to acquire images.
Free Trigger		Anyway	This trigger source uses trigger sources mentioned above to send trigger signal to the device to acquire images.
Link Trigger		Link Trigger*	The frame grabber sends trigger signal to the device to acquire images.

Set and Execute Software Trigger

The software trigger is valid when the frame trigger is enabled.

Steps

1. Go to **Acquisition and Transfer Control → Scan Mode**, and select **Frame Scan**.
2. Enable **FrameTrigger Mode** in **Acquisition and Transfer Control → Frame Trigger Control**.
3. Select **Software** as **FrameTrigger Source**.
4. Click **Execute** in **FrameTrigger Software**.

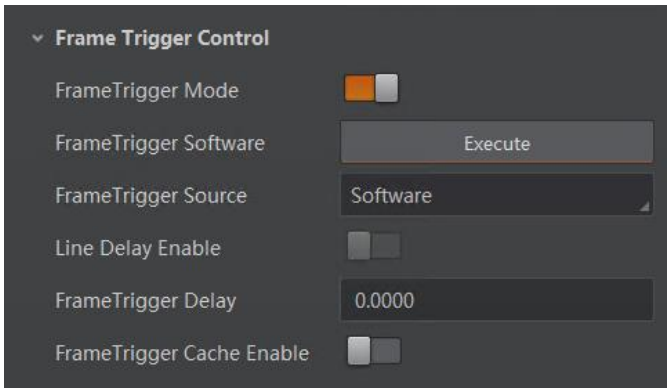


Figure 9-1 Set and Execute Software Trigger

Note

Refer to section ***Set Trigger Related Parameters*** for parameters that can be configured in the trigger source, including acquisition burst frame count, trigger delay, trigger debouncer, and trigger cache.

Set and Execute Hardware Trigger

The hardware trigger is valid when the frame trigger or line trigger is enabled. In hardware trigger, external device sends trigger signal to the device to acquire images via I/O connector.

Note

Different device models have different hardware trigger signal sources. Refer to section *Power and I/O Connector* for details.

Steps

1. Go to **Acquisition and Transfer Control** → **Scan Mode**, and select **Frame Scan** or **Line Scan**.
2. Enable **FrameTrigger Mode** in **Frame Trigger Control** or **LineTrigger Mode** in **Line Trigger Control**.
3. Select **Line** * as **FrameTrigger Source** or **LineTrigger Source** according to actual demands.

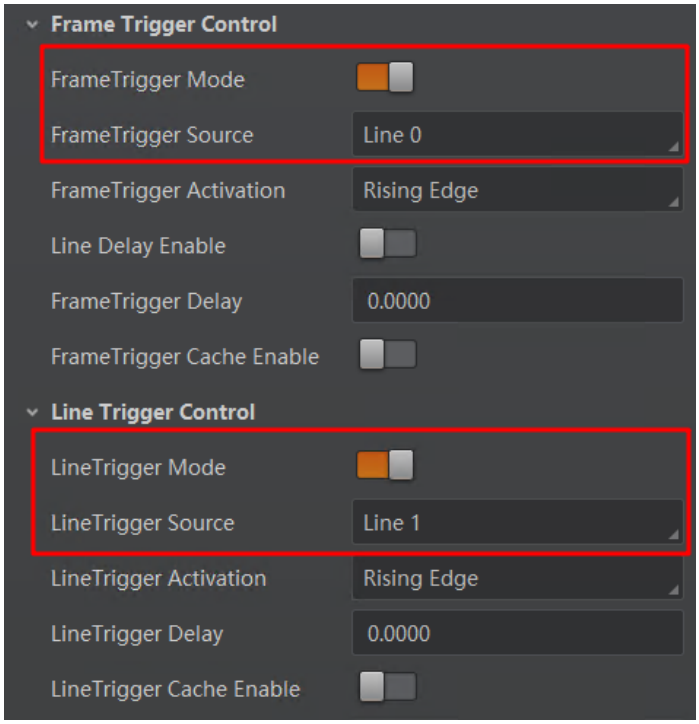


Figure 9-2 Set and Execute Hardware Trigger

Note

Refer to section *Set Trigger Related Parameters* for parameters that can be configured in the trigger source, including acquisition burst frame count, trigger delay, and trigger cache.

When selecting bi-directional configurable line as the hardware trigger source, you need to make sure that its line mode is input. Go to **I/O Control**, select specific line as **Line**

Selector, and **Input** as **Line Mode**.

Note

Here we take Line 1 as an example to introduce how to set bi-directional configurable line as the hardware trigger source. Refer to the device you got for the actual condition.

Figure 9-3 Line Selector

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

Note

The line format function may differ by device models.

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

Caution

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

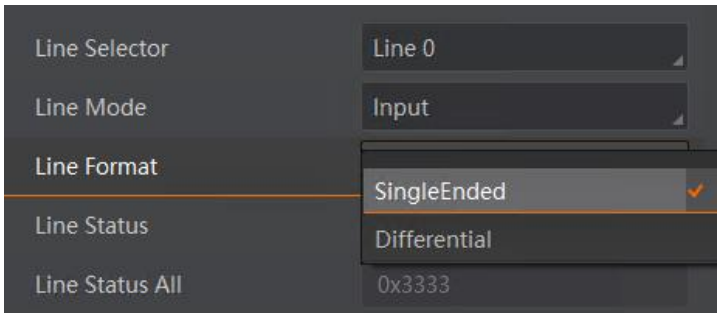


Figure 9-4 Set Line Format

Set and Execute Shaft Encoder Control

If the device enables the line trigger, you can select shaft encoder control as trigger source. At this time, the device will receive signal A and signal B with phase difference. The function demonstration of shaft encoder module is shown below.

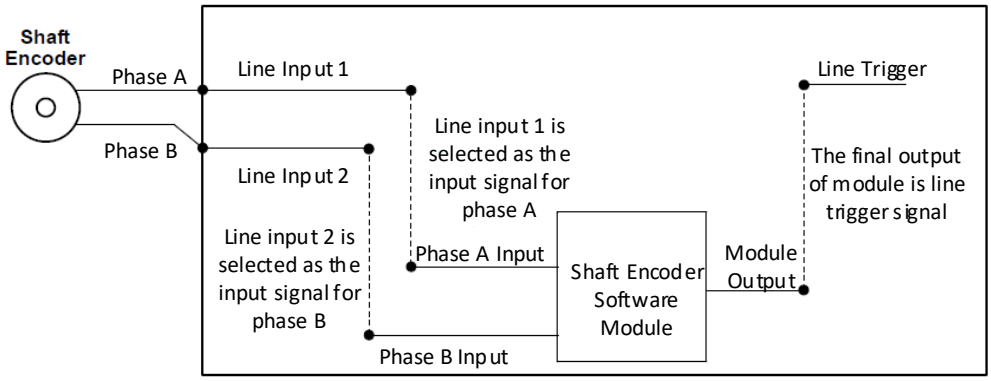


Figure 9-5 Function Demonstration

The advantages of shaft encoder are as follows:

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

Follow steps below to set shaft encoder control.

Steps

1. Click **Encoder Control**, and set **Encoder Source A** and **Encoder Source B** according to actual demands.

Note

It is recommended to select different signal sources for source A and source B. If the same signal source is selected for A and B, the shaft encoder will not output the signal.

2. Set **Encoder Trigger Mode**.

- **Any Direction** means that both forward and backward direction will trigger.
- **Forward Only** mean that only forward direction will trigger.
- **Backward Only** mean that only backward direction will trigger.

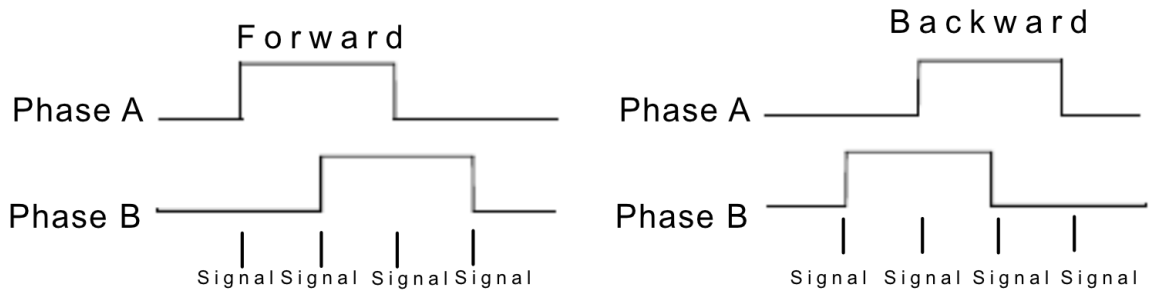


Figure 9-6 Process Logic

Note

Phase A and phase B of the encoder corresponds 4 signals each, as shown below.

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

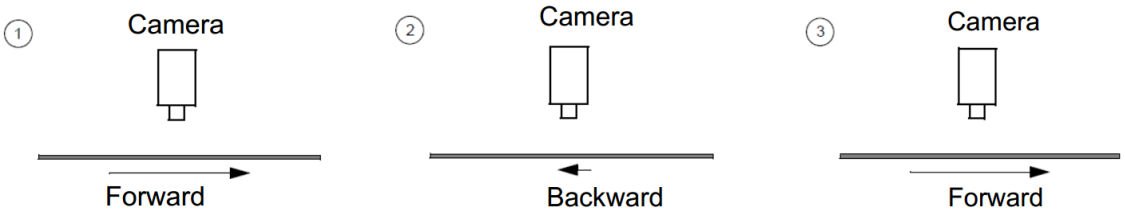


Figure 9-7 Counter Description

4. (Optional) Set max. counter value in **Encoder Counter Max**.

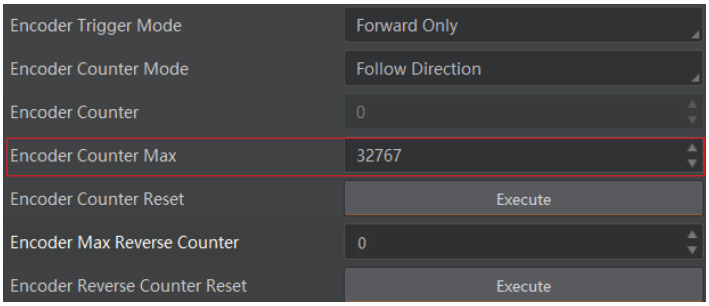


Figure 9-8 Set Encoder Counter Max

Note

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

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

Set and Execute Frequency Converter Control

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

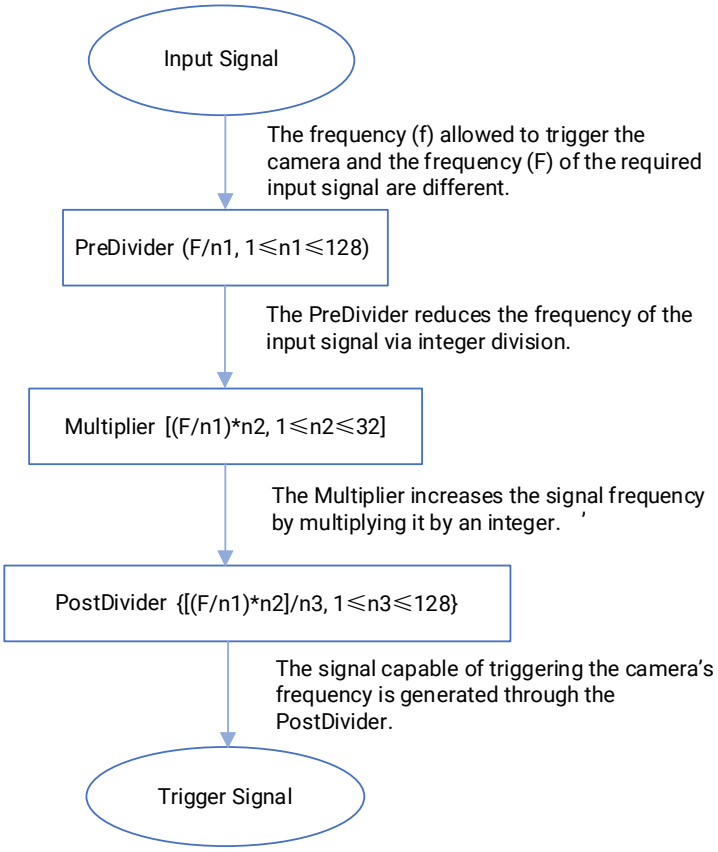


Figure 9-9 Encoder Frequency Converter Control

PreDivider

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

Multiplier

After the signal is processed by the PreDivider, it is sent to the Multiplier. The Multiplier multiplies the signal by an integer to increase its signal frequency, and then the signal is sent to the PostDivider.
Parameter can be set as rising or falling edge. If a rising edge is set, each rising edge of the signal coming from the PreDivider will be locked to match the signal of the rising edge, and vice versa.
During this process, make sure do not increase signal frequency via too larger multipliers to avoid trigger signal frequency beyond the max. line rate of the device. Even if a smaller multiplier is selected, an excessively high frequency may be generated in the frequency adjustment, exceeding the max. line rate of the device.

PostDivider

PostDivider reduces signal frequency via an integer factor, and uses the newly generated frequency signal as the device's trigger signal.
Follow steps below to set frequency converter control.

Steps

1. Click **Frequency Converter Control**, and select specific line, **Encoder Module Out** or **N/A** as **Input Source** according to actual demands.

Note

N/A means that the signal source is not selected.

2. Set **Rising Edge** or **Falling Edge** as **Signal Alignment** according to actual demands.
3. Set **PreDivider**, **Multiplier** and **PostDivider**.

Some device models support displaying trigger line rate.

Note

- Parameters of trigger line rate and resulting trigger line rate may differ by device models.
- Make sure that line trigger is enabled and input source value of frequency converter control and trigger source value of acquisition control is the same before viewing trigger line rate.
- The trigger line rate is valid when the external trigger source is selected as the **Input Source**. If N/A is selected, the trigger line rate is 0.

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

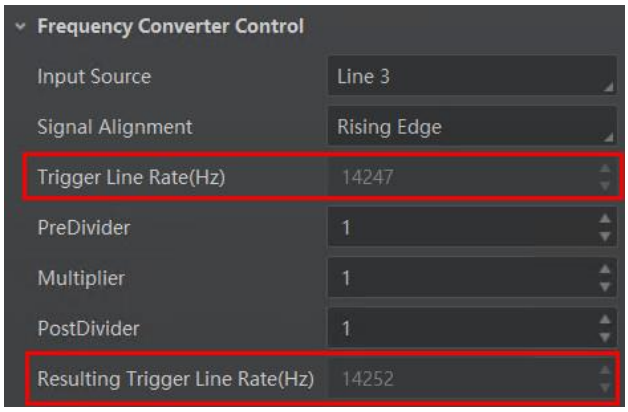


Figure 9-10 View Trigger Line Rate

Set and Execute Free Trigger

When the device enables the frame trigger or the line trigger, you can select Free Trigger as trigger source. In free trigger, the device can receive all trigger source signals to acquire images.

Steps

1. Go to **Acquisition and Transfer Control** → **Scan Mode**, and select **Frame Scan** or **Line Scan**.
2. Enable **FrameTrigger Mode** in **Frame Trigger Control** or **LineTrigger Mode** in **Line Trigger Control**.
3. Select **Anyway** as **FrameTrigger Source** or **LineTrigger Source**.

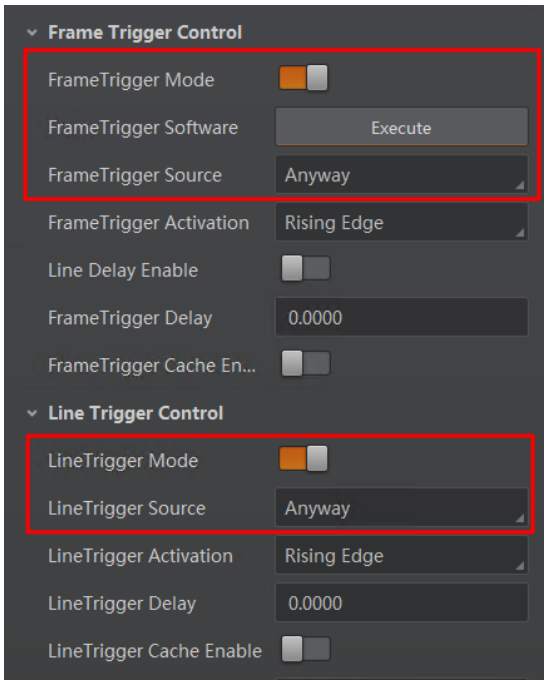


Figure 9-11 Set and Execute Free Trigger

Note

Refer to section *Set Trigger Related Parameters* for parameters that can be configured in the trigger source, including acquisition burst frame count, trigger delay, and trigger cache.

Set and Execute Link Trigger

When the device enables the frame trigger or the line trigger, you can select Link Trigger as trigger source. In link trigger, the 10 Gbps fiber port frame grabber sends trigger signal to the device to acquire images.

Steps

1. Go to **Acquisition and Transfer Control** → **Scan Mode**, and select **Frame Scan** or **Line Scan**.
2. Enable **FrameTrigger Mode** in **Frame Trigger Control** or **LineTrigger Mode** in **Line Trigger Control**.
3. Select **Link Trigger*** as **FrameTrigger Source** or **LineTrigger Source**.

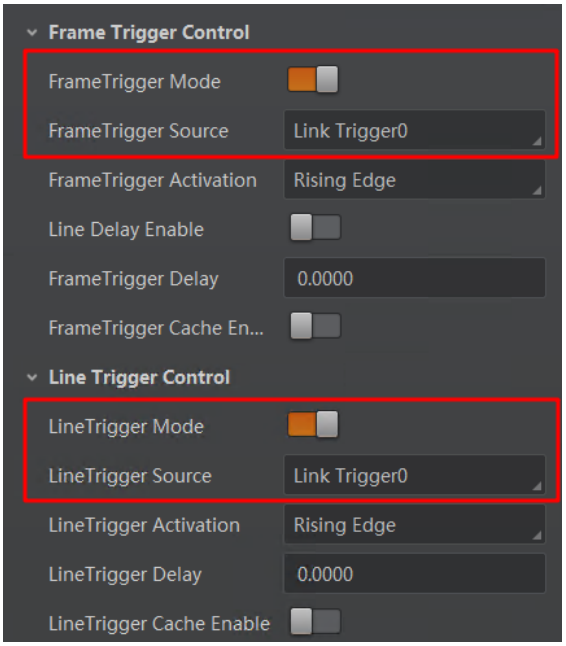


Figure 9-12 Set and Execute Link Trigger

Note

- Refer to section *Set Trigger Related Parameters* for parameters that can be configured in the trigger source, including acquisition burst frame count, trigger delay, and trigger cache.
- Refer to frame grabber user manual for frame grabber trigger.

9.1.3 Set Trigger Related Parameters

When the line trigger mode or frame trigger mode is enabled, you can set some related parameters, including acquisition burst frame count, trigger delay, trigger cache, trigger activation, and trigger debouncer.

Note

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

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

Table 9-4 Trigger Source and Trigger Related Parameters in Frame Trigger Mode

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

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

Table 9-5 Trigger Source and Trigger Related Parameters in Line Trigger Mode

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

Note

When the frame trigger mode and the line trigger mode are enabled at the same time, the trigger delay is supported for all frame trigger sources and line trigger sources.

Set Acquisition Burst Frame Count

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

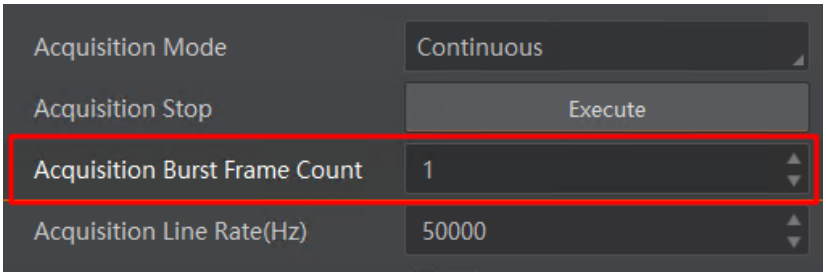


Figure 9-13 Set Acquisition Burst Frame Count

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.
- The sequence diagram above uses rising edge as trigger activation, and the device's height parameter is 4.

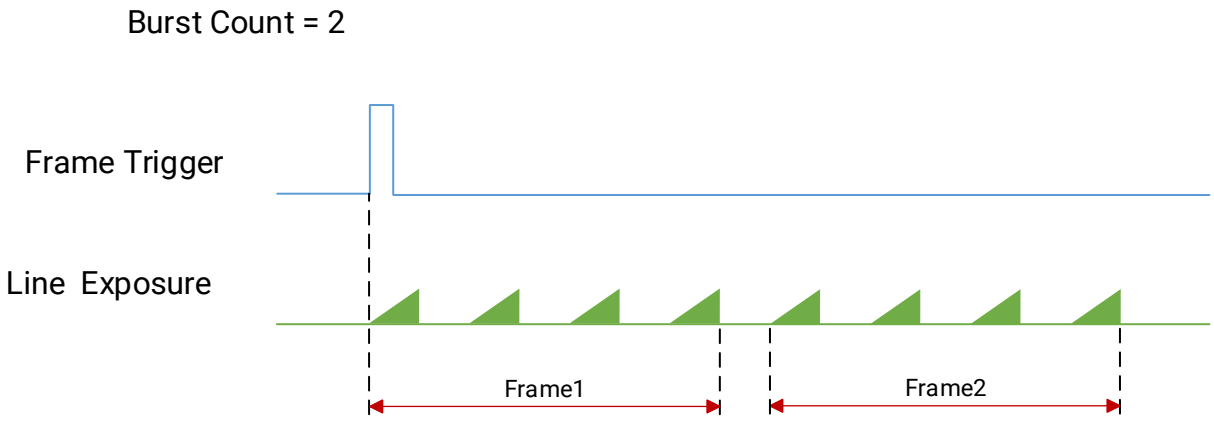


Figure 9-14 Sequence Diagram of Acquisition Burst Frame Count

Set Trigger Activation

The device supports triggering image acquisition in the rising edge, falling edge, level high, level low, or any edge of the external signal.

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

Note

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

Set Trigger Activation in Frame Trigger

Go to **Acquisition and Transfer Control** → **Frame Trigger Control**, and set **FrameTrigger Activation** according to actual demands.

- When rising edge, falling edge, or any edge is selected as **FrameTrigger Activation**, you can set trigger delay. When **Line Delay Enable** is enabled, set the number of trigger lines for delay in the **FrameTrigger Delay**, or when the **Line Delay Enable** is disabled, set the trigger time for delay in the **FrameTrigger Delay**.

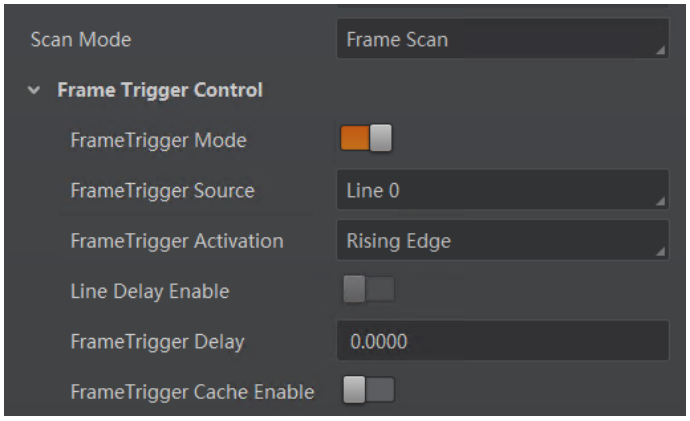


Figure 9-15 Set Trigger Activation in Frame Trigger

Note

The **Line Delay Enable** is valid only when the line trigger mode is enabled.

- When level high or level low is selected as **FrameTrigger Activation**, the device will be triggered according to selected method.

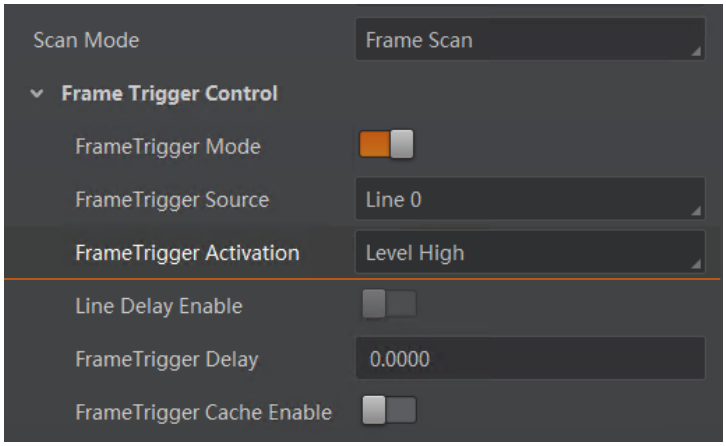


Figure 9-16 Level Trigger in Frame Trigger

Note

When Line 0/1/3 is selected as the trigger source in the frame trigger mode, the images are output during the level high by default.

Set Trigger Activation in Line Trigger

Go to **Acquisition and Transfer Control** → **Line Trigger Control**, and set **LineTrigger Activation** according to actual demands.

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

- When you select **Rising Edge**, **Falling Edge**, or **Any Edge** as **LineTrigger Activation**, you can select **Timed** as **Exposure Mode** only, and **Exposure Auto** and **Exposure Time** determine the exposure time.
- When you select **Level Low** or **Level High** as **LineTrigger Activation**, you can select **Timed** or **Trigger Width** as **Exposure Mode**. Exposure time is determined by the duration of the level signal only if **Trigger Width** is selected.

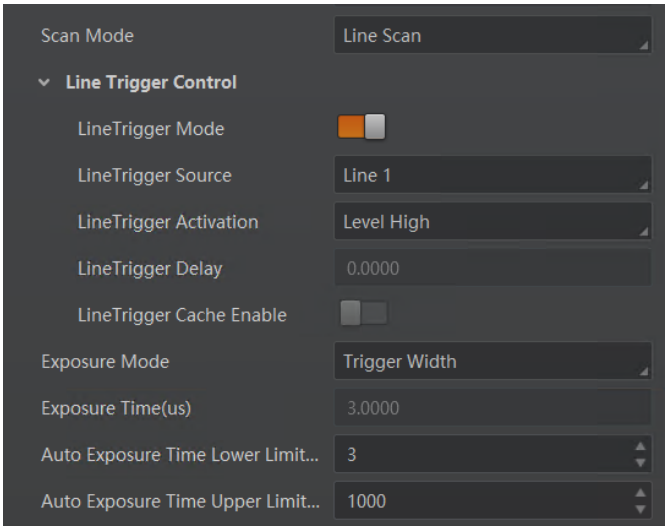


Figure 9-17 Set Trigger Activation in Line Trigger

Note

The trigger width function may differ by device models.

Set Trigger Cache

Note

- The trigger cache in frame trigger or line trigger modes may differ by device models.
- The setting method for trigger cache is different in frame trigger and line trigger.

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

Set Trigger Cache in Frame Trigger

Go to **Acquisition and Transfer Control** → **Frame Trigger Control**, and enable **FrameTrigger Cache Enable**.

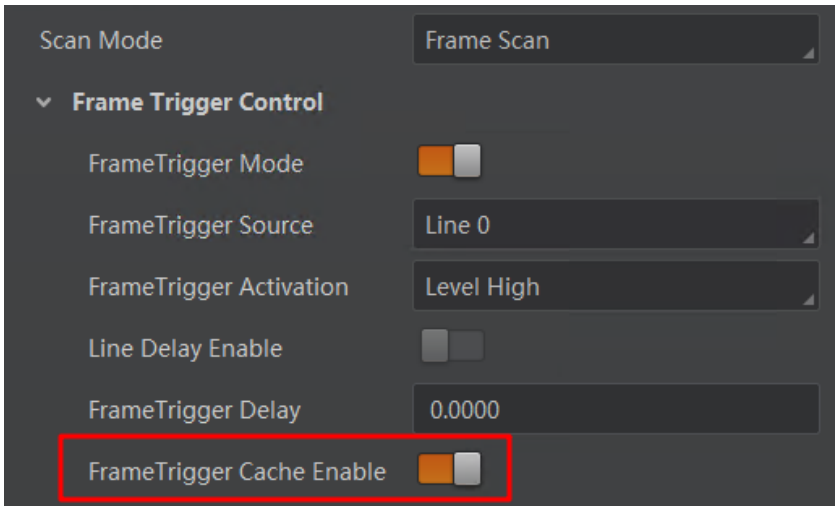


Figure 9-18 Set Trigger Cache in Frame Trigger

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

- Disable Trigger Cache Enable: the 2nd trigger signal will be filtered without processing.

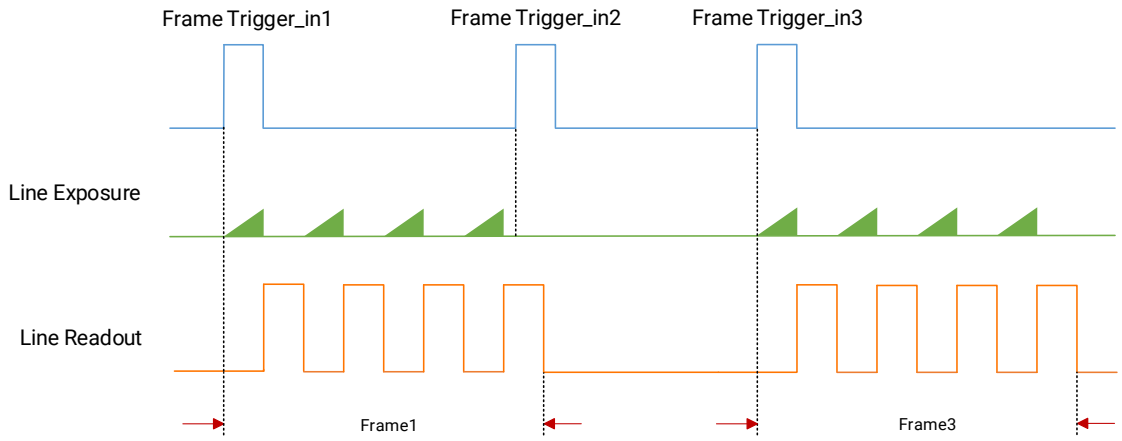


Figure 9-19 Second Frame Filtered

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

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

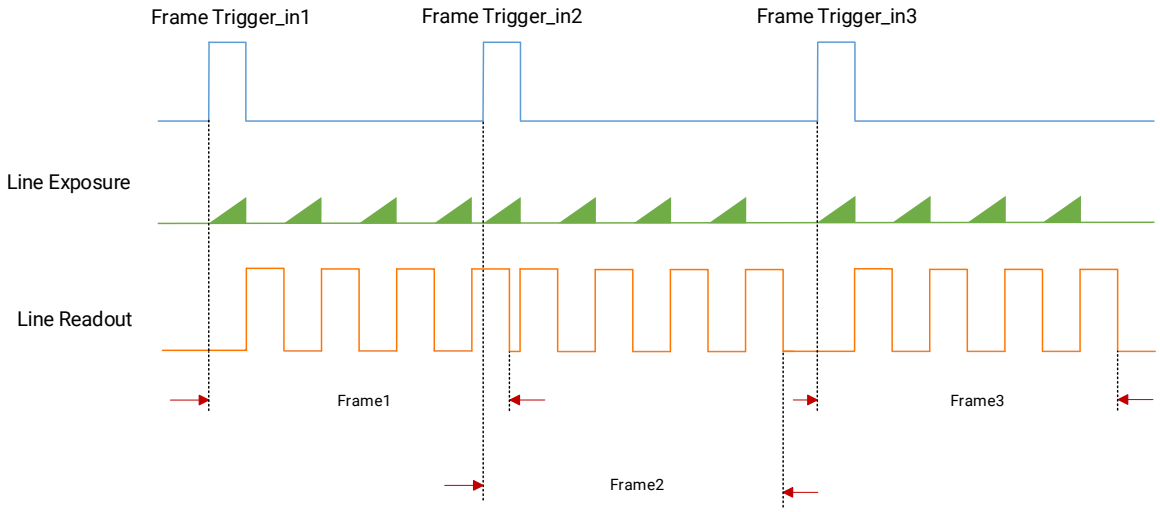


Figure 9-20 Second Frame Created Normally

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. Make sure this exposure time is not earlier than the device's last frame creation time of the 1st trigger signal.

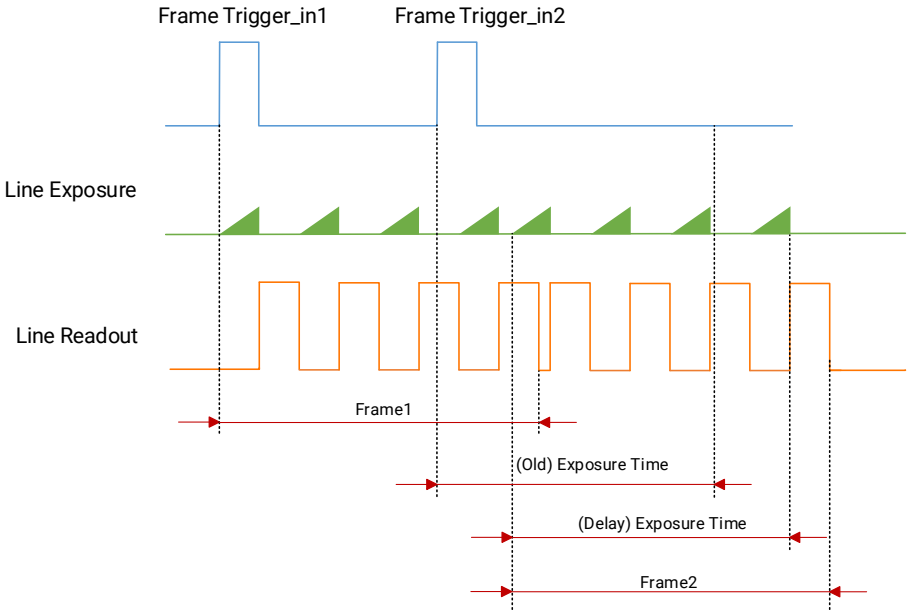


Figure 9-21 Sequence Diagram

Note

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

Set Trigger Cache in Line Trigger

Go to **Acquisition and Transfer Control** → **Line Trigger Control**, and enable **LineTrigger Cache Enable**.

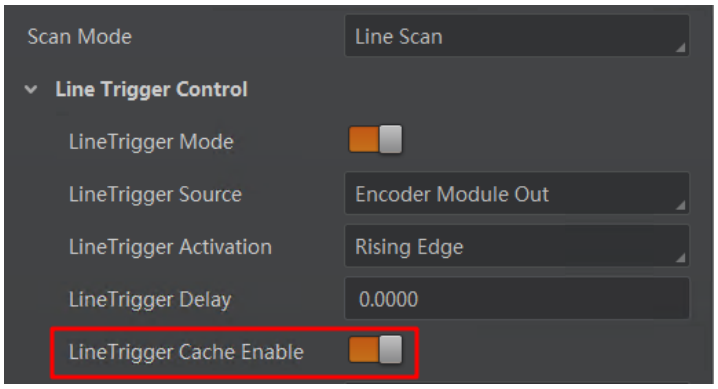


Figure 9-22 Set Trigger Cache in Line Trigger

Set Trigger Debouncer

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

Go to **I/O Control** → **Line Debouncer Time**, and enter **Line Debouncer Time** according to actual demands. The range of **Line Debouncer Time** is from 0 μs to 1000000 μs, and the step is 100 ns.

Note

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

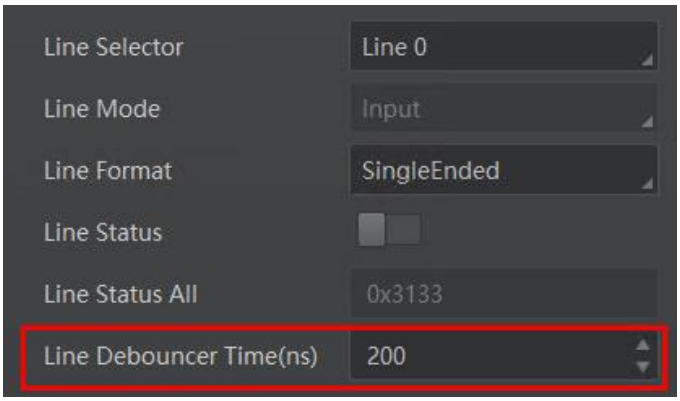


Figure 9-23 Set Trigger Debouncer

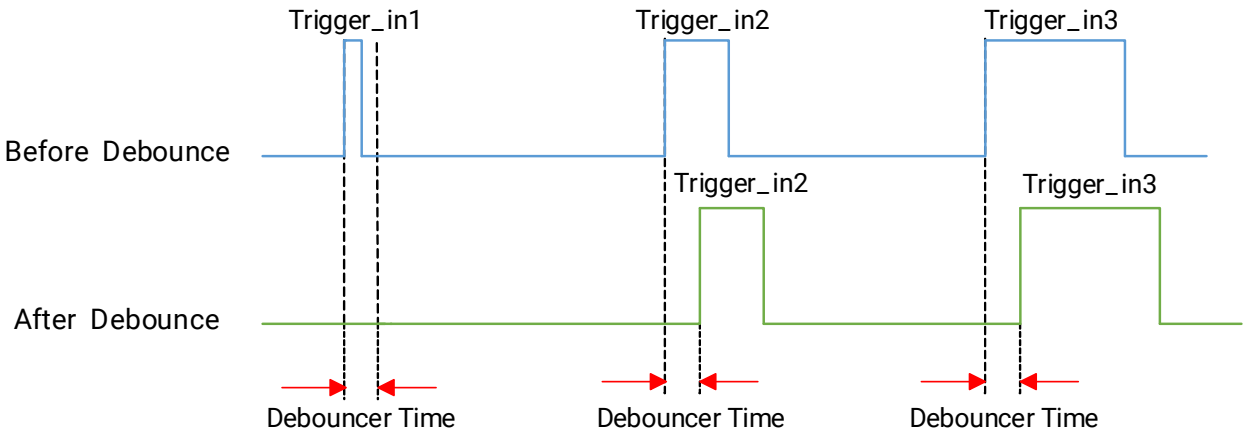


Figure 9-24 Sequence Diagram of Trigger Debouncer

Note

The sequence diagram above uses rising edge as trigger activation.

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 and Transfer Control** → **Frame Trigger Control**, and enable **Line Delay Enable** and set **FrameTrigger Delay**.

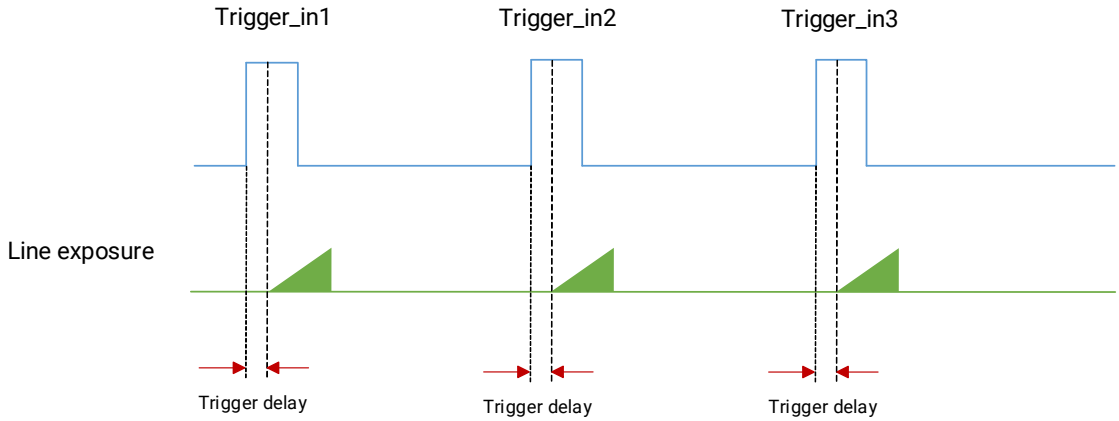


Figure 9-25 Sequence Diagram of Trigger Delay

Note

- The sequence diagram above uses rising edge as trigger activation.
- When **Line Delay Enable** is enabled, set the number of trigger lines for delay in the **FrameTrigger Delay**, or when the **Line Delay Enable** is disabled, set the trigger time for delay in the **Trigger Delay**.
- The **Line Delay Enable** is valid only when the line trigger mode is enabled.

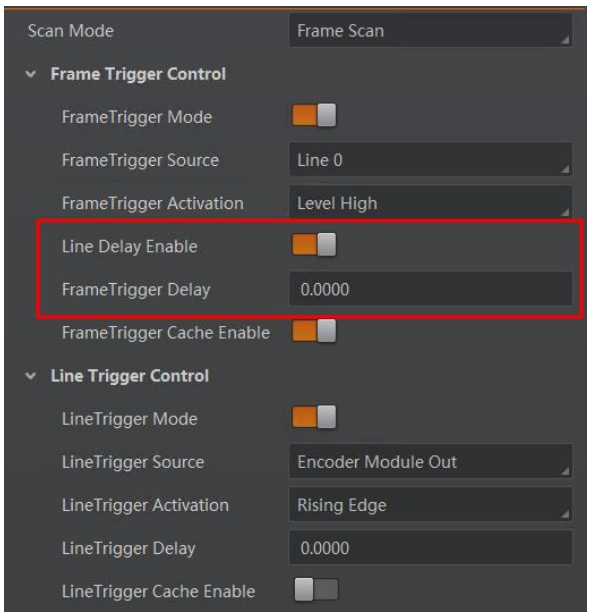


Figure 9-26 Set Trigger Delay

9.2 Trigger Output

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

Steps

1. Go to **I/O Control**, and select specific line as **Line Selector**.
2. Set **Strobe** as **Line Mode**.
3. Set **Line Format** according to actual demands.

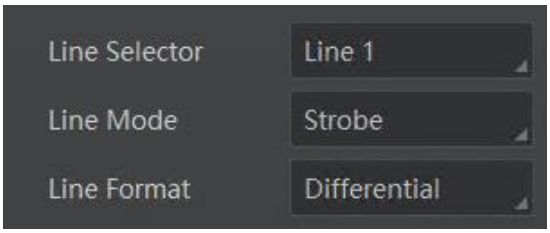


Figure 9-27 Select Output Signal

Note

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

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 **I/O Control** → **Line Inverter**, and enable it.

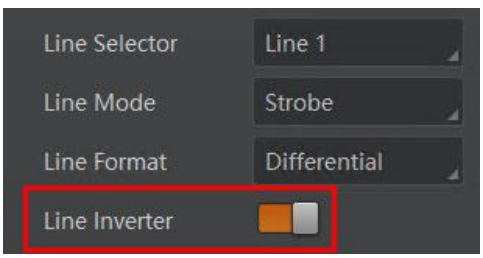


Figure 9-28 Enable Line Inverter

Note

The line inverter function is disabled by default.

9.2.2 Enable Strobe Signal

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

Steps

1. Click **I/O Control**, and set **Exposure Start Active** as **Line Source**.
2. Select **Frame Mode** as **Strobe Source Selector**.
3. Enable **Strobe Enable**.

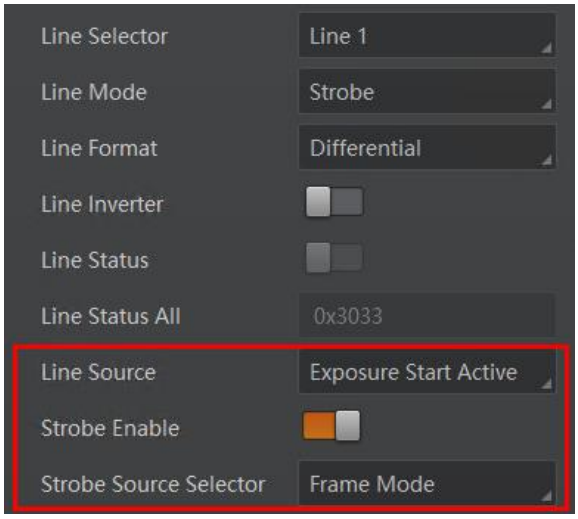


Figure 9-29 Select Frame Mode as Strobe Source Selector

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

Steps

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

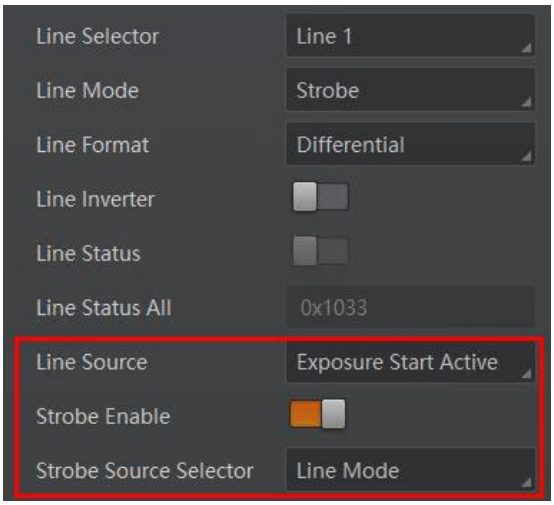


Figure 9-30 Select Line Mode as Strobe Source Selector

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

Note

The specific line sources may differ by device models.

Table 9-6 Line Source Description

Line Source	Description
Exposure Start Active	The device outputs signals to external devices when it starts 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.
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.
Frame Start Active	The device outputs signals to external devices when it starts doing the capture of a frame.

Line Source	Description
Frame End Active	The device outputs signals to external devices when it stops doing the capture of a frame.

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

Table 9-7 Description of Counter and Timer Control

Parameter	Read/Write	Description
Counter Selector	Read and write	It selects counter source. **Counter 0** is available only at present.
Counter Event Source	Read and write	It selects the signal source of counter trigger, and **Off**, **Line 0/1/3/4** or **Link Trigger0/1/2/3** is available. It is disabled by default.
Counter Event Activation	Read and write	It selects the activation mode of the selected counter event source, including rising edge, falling edge, and any edge.
Counter Reset Source	Read and write	It selects the signal source of resetting counter. **Software** is available only. It is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed when selecting **Software** as **Counter Reset Source**.
Counter Value	Read and write	It is the counter value with the range of 1 to 4294967295. **Note** The specific range of counter value may differ by device models.
Counter Current Value	Read only	It displays the number of executed external trigger.

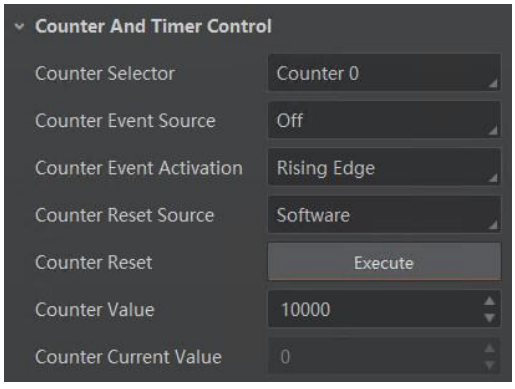


Figure 9-31 Counter and Timer Control

If **Timer Active** is selected as **Line Source**, you can set **Strobe Line Duration** and **Strobe Line Delay**, and the device will output signal correspondingly after click **Execute** in **Line**

Trigger Software.

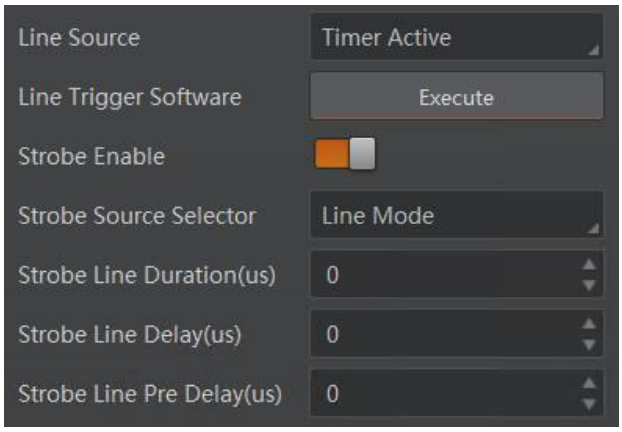


Figure 9-32 Timer Active Parameter

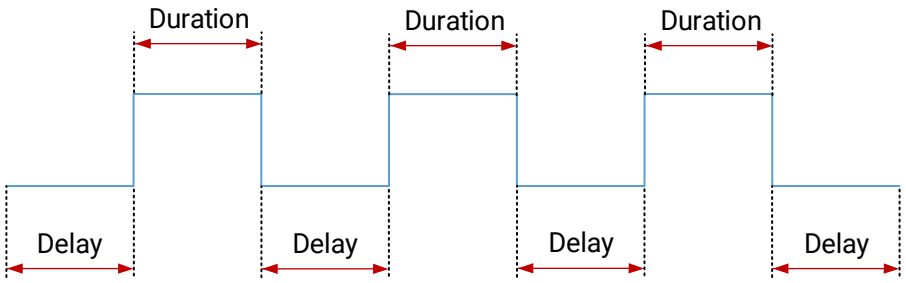


Figure 9-33 Sequence Diagram of Timer Active

Set Strobe Line Duration

After enabling strobe signal, you can set its duration. The unit is μs.
Go to **I/O Control** → **Strobe Line Duration**, and enter it according to actual demands.

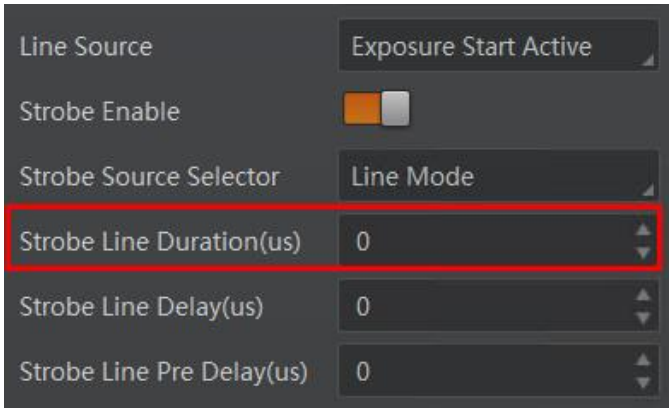


Figure 9-34 Set Strobe Line Duration

Note

- When the **Strobe Line Duration** value is 0, the strobe duration is equal to the exposure

time.

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

Set Strobe Line Delay

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

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

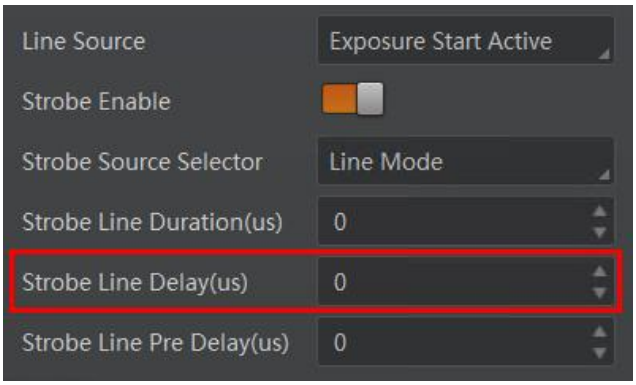


Figure 9-35 Set Strobe Line Delay

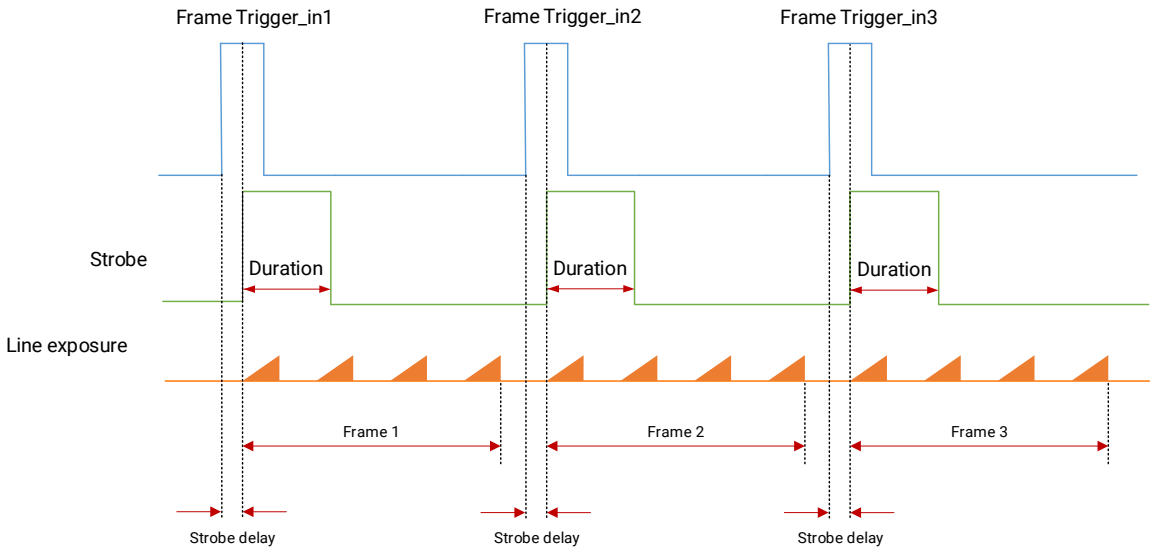


Figure 9-36 Sequence Diagram of Strobe Line Delay

Note

- The device's height parameter is 4 in the sequence diagram above.
- The range of the strobe line delay is from 0 to 10000, and the unit is μs.

Set Strobe Line Pre Delay

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

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

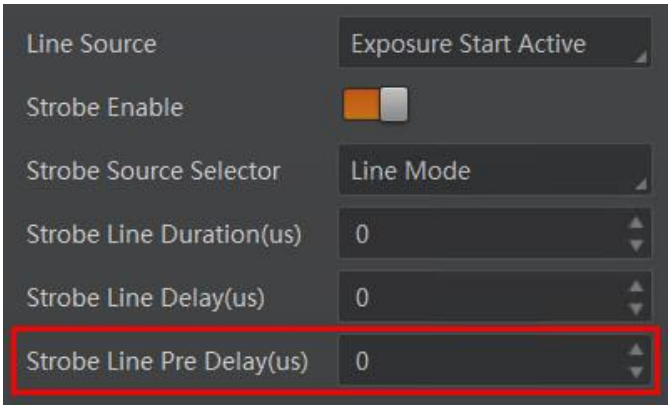


Figure 9-37 Set Strobe Line Pre Delay

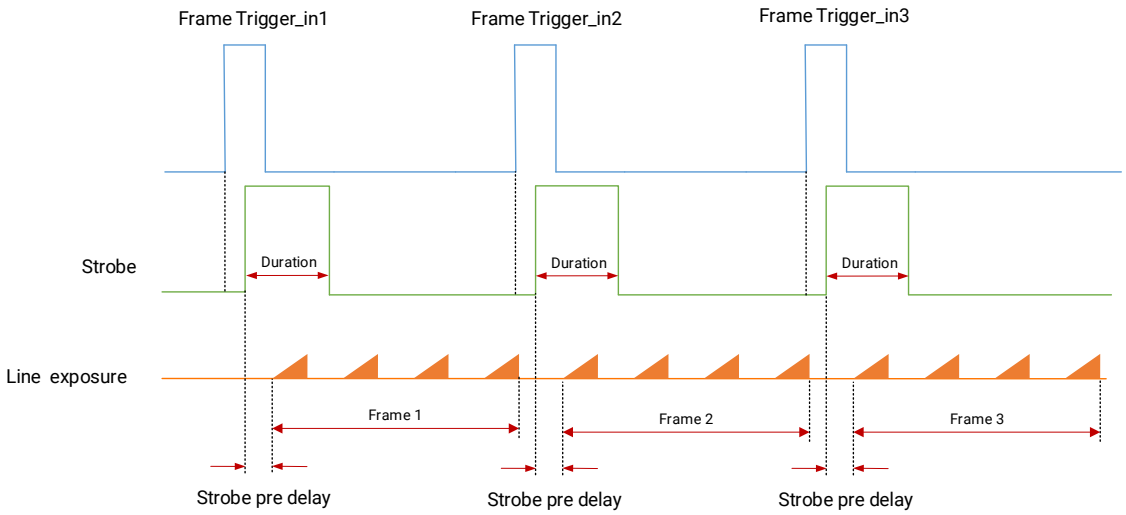


Figure 9-38 Sequence Diagram of Strobe Line Pre Delay

Note

- The device's height parameter is 4 in the sequence diagram above.
- The range of the strobe line delay is from 0 to 10, and the unit is μs.

Chapter 10 Image Acquisition

10.1 Set Line Rate

10.1.1 Line Rate Overview

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

- Readout time: The less the readout time and the higher the line rate will be.
- Exposure time: The less the exposure time, the higher the line rate will be.
- Pixel format: The more bytes pixel format occupy, the lower the line rate will be.
- Link quantity: The more optical fiber patch cords are used, the larger transmitted data and the higher the line rate will be.

Steps

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

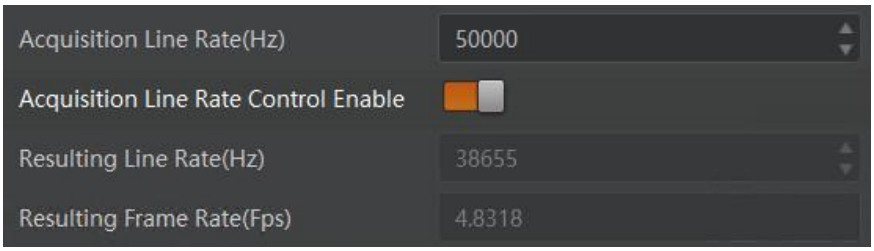


Figure 10-1 Set Line Rate

Note

- If the real-time line rate is smaller than the value you set, the device acquires images by the real-time line rate.
- If the real-time line rate is larger than the value you set, the device acquires images by the value you set.
- You can start image acquisition via **Acquisition and Transfer Control → Acquisition Start**, and stop acquisition via **Acquisition Stop**.
- When the camera streaming is stopped, part of parameters cannot be edited after you execute **Acquisition Start**. Please execute **Acquisition Stop** first, and edit the parameters.

10.1.2 Adjust Line Rate

Image compression and image stretching may occur when the captured line rate does not match with the moving speed of the target object.

- **Normal**: Captured line rate = moving speed of the target object
- **Image stretching**: Captured line rate > moving speed of the target object
- **Image compression**: Captured line rate < moving speed of the target object

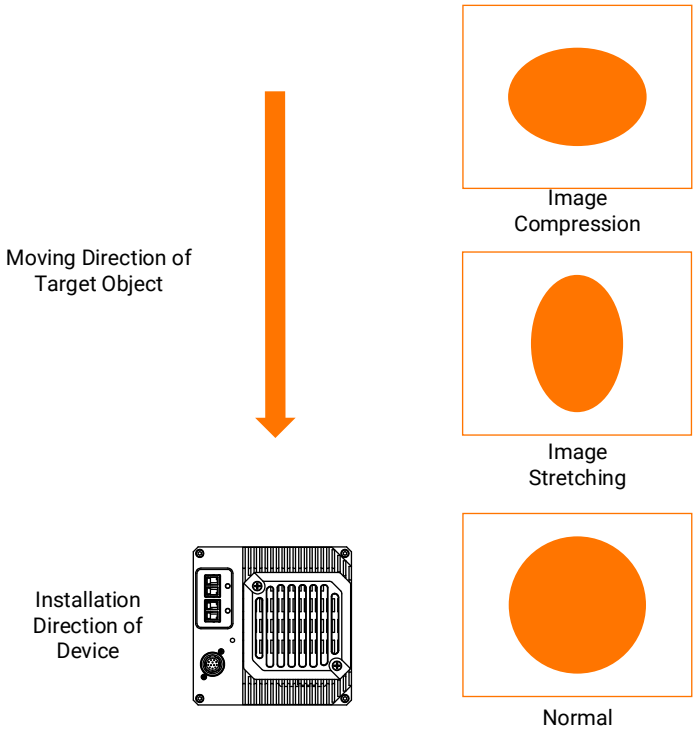


Figure 10-2 Adjust Line Rate

You can adjust the pixel ratio in both the length and width directions of a circular or square object to 1:1. Image compression or image stretching can be adjusted by increasing and decreasing the line rate, respectively.

The method of adjusting the line rate varies depending on the moving speed of the target object.

- When the target object is moving at a uniform speed, set the **Acquisition Line Rate(Hz)** to the line rate calculated from the object's moving speed.

The calculation formula of line rate is shown below. The Pixel is the lateral resolution of the camera, V is the moving speed of the target object, and L is the lateral length of the object.

$$\text{Hz (Line Rate)} = \frac{\text{Pixel} \times \text{V}}{\text{L}}$$

- When the target object is moving at a non-uniform speed, you can change to line trigger mode, and adjust the line rate by setting the pre-divider, multiplier and post-divider. Refer to section ***Set Trigger Mode*** and section ***Set and Execute Frequency Converter Control***.

10.2 Set Scan Mode

Note

The scan mode function may differ by device models.

The device supports selecting different methods of reading image data, including frame scan and line scan. Go to **Acquisition and Transfer Control** → **Scan Mode** to select it according to actual demands.

- **Frame Scan**: The device outputs a frame of image after its output line quantity reaches configured image height.
- **Line Scan**: The device outputs one line of image after each exposure.

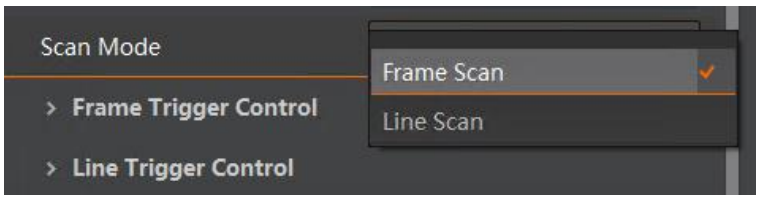


Figure 10-3 Set Scan Mode

Note

- If the **Scan Mode** selects **Line Scan**, the **Line Trigger Control** can be set only.
- The scan mode of the camera should be the same as that of the frame grabber. Refer to ***10 Gbps Fiber Port Frame Grabber User Manual*** for details.

10.3 Set Scan Direction

Note

- The scan direction function may differ by device models.
- Make sure that the scan direction and the moving direction of objects are matched. Otherwise, acquired images may be abnormal.
- The scan direction can be set only when **2/3/4-TDI** is selected as **TDI Mode**. Refer to ***Set TDI Function*** for details.

The scan direction function is used to change the scan direction of the sensor used on measured objects. The figures below are the actual effects.

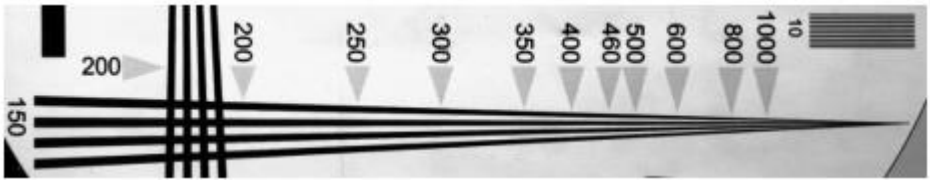


Figure 10-4 Image when Direction Matched of Mono Device

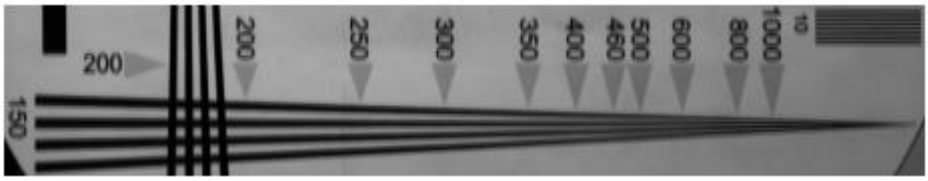


Figure 10-5 Image when Direction Mismatched of Mono Device

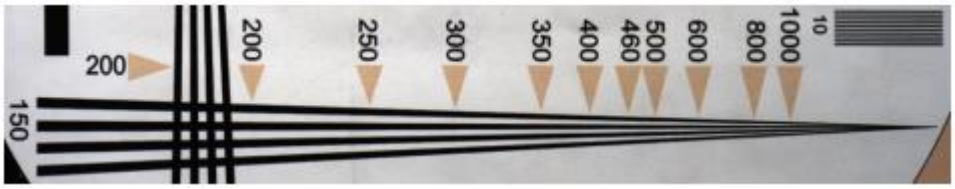


Figure 10-6 Image when Direction Matched of Color Device

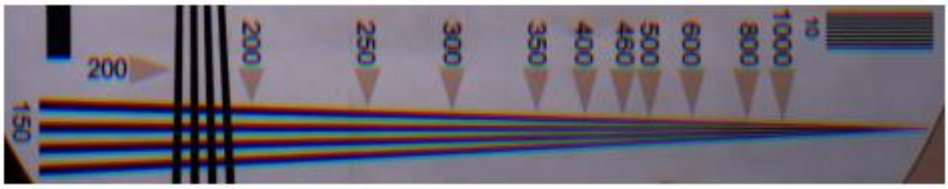


Figure 10-7 Image when Direction Mismatched of Color Device

Steps

1. Go to **Image Format Control** → **Direction Source**.
2. Set **Direction Source** according to actual demand.

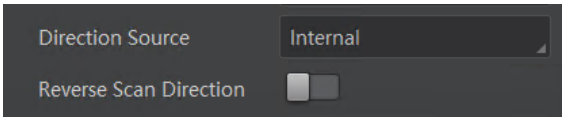


Figure 10-8 Internal Direction Source

3. (Optional) Select **Internal** as **Direction Source** and enable **Reverse Scan Direction** if you want to use the internal signal to achieve reverse scan function.
4. (Optional) Select **Line3 Level** as **Direction Source** and the device will switch to forward scan direction if Line 3 is in high level. Otherwise, the device will switch to backward scan direction.
5. (Optional) Select **Line3 Edge** as **Direction Source** and the device will switch scan direction if Line 3 is in rising edge.

10.4 Set Frame Timeout

Note

The frame timeout function may differ by device models.

The device supports frame timeout function that affects the device's acquisition and

image output mechanism.
Go to **Acquisition and Transfer Control**, enable **Frame Timeout Enable**, and select **Partial Image Output Mode** according to actual demands.

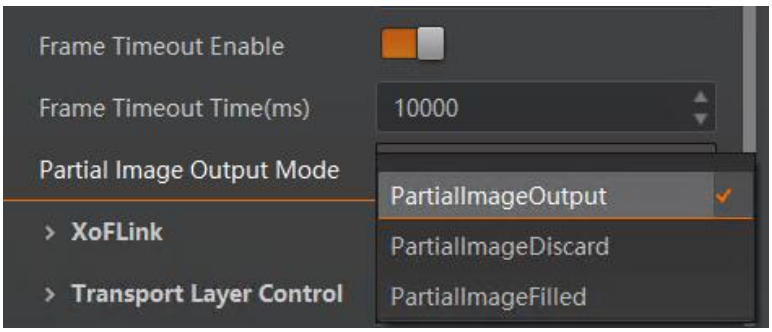


Figure 10-9 Set Frame Timeout

Table 10-1 Partial Image Output Mode Description

Parameter	Description
Image Pending	After the number of lines output by the device reaches the configured image height (height parameter), one frame of the image will be outputted. If the number of output lines does not reach the image height (height parameter), the SDK will not output the image, and the SDK will wait for the line data until it reaches the image height before outputting the image.
PartialImageOutput	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame timeout period, the SDK will output the image according to the actual height.
PartialImageDiscard	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame timeout period, the SDK discards the image.
PartialImageFilled	When the number of lines output by the device reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the device does not reach the configured image height (height parameter) within the frame timeout period, SDK will output the image after filling the black according to the height parameter for the remaining part.

Note

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

10.5 Set Line Discard Function

Note

The line discard function may differ by device models.

Due to the inherent functional features of the sensor or the device itself, the first few lines of image acquisition may have abnormal images and need to be discarded. The device provides line discard function, which can adjust and control the number of external line trigger signals to ensure that the image acquisition meets the usage requirements.
You can go to **Image Format Control**, and enable **Abnormal Line Enable** according to actual demands.

- When this function is enabled, the external device needs to send N more trigger signals to meet the line height of image acquisition, and the first N lines of abnormal images are discarded.
- When this function is not enabled, the quantity of external trigger signal is equal to that of the device's line height, and any abnormal lines that may exist are not discarded.

Note

- The lines of abnormal images that are discarded is determined by internal logic of the camera.
- Regarding devices with advanced TDI function, they may have abnormal lines of TDI + 25 in each frame.

Chapter 11 Image Parameter

11.1 Set Resolution and ROI

Note

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

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

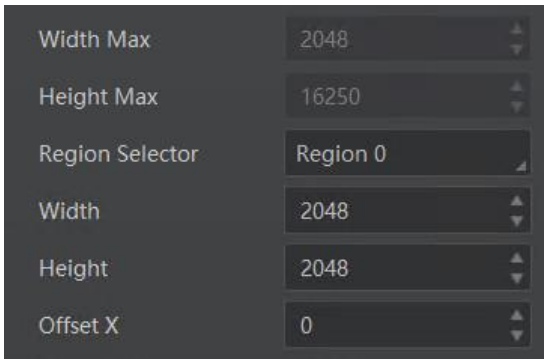


Figure 11-1 Set Resolution and ROI

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

Note

- 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** should not be larger than **Height Max**.
- When **Line Scan** is selected as **Scan Mode**, **Height** cannot be set.

11.2 Set Image Reverse

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

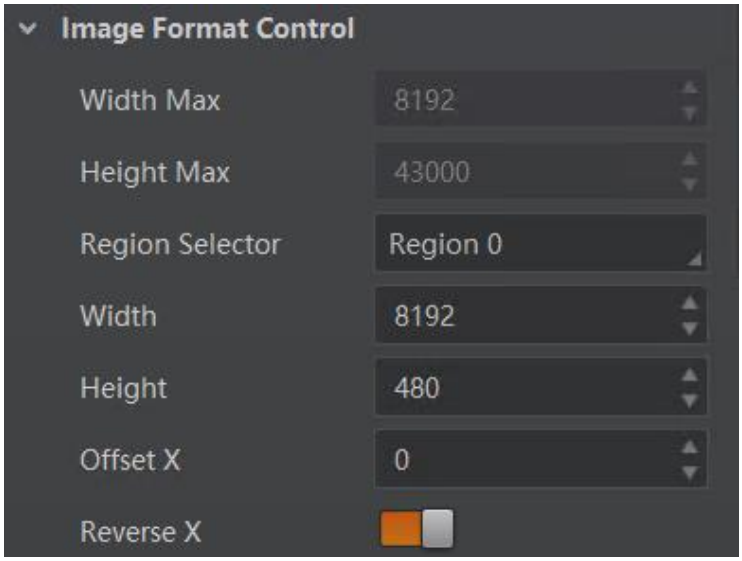


Figure 11-2 Set Image Reverse

11.3 Set Pixel Format

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

Note

The specific pixel formats may differ by device models.

Table 11-1 Pixel Format and Pixel Size

Pixel Format	Pixel Size (Bits/Pixel)
Mono 8, Bayer 8, Bayer RGBG 8	8
Mono 10, Bayer 10	10
Mono 12, Bayer 12	12
RGB 8, BGR 8	24

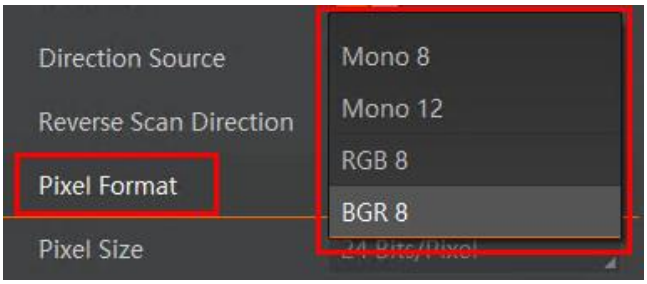


Figure 11-3 Set Pixel Format

The default output data format of mono device is Mono 8. The default output data format of color device is Bayer 8, and it can be converted into RGB format via pixel interpolation algorithm. RGB format can be converted into BGR format via the order adjustment.
Bayer GR, Bayer GB, Bayer BG, Bayer RG and Bayer RBGG patterns are shown below.

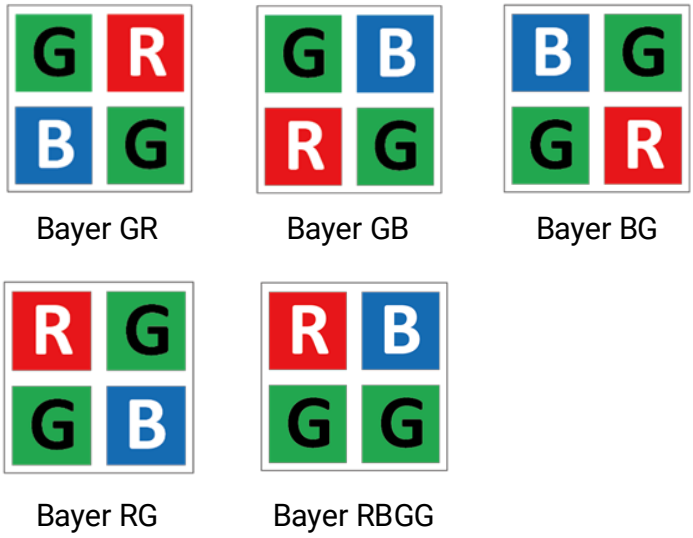


Figure 11-4 Pixel Pattern

11.4 Set Test Pattern

Note

The test pattern may differ by device models.

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

Go to **Image Format Control** → **Test Pattern**, and set **Test Pattern** according to actual demands.

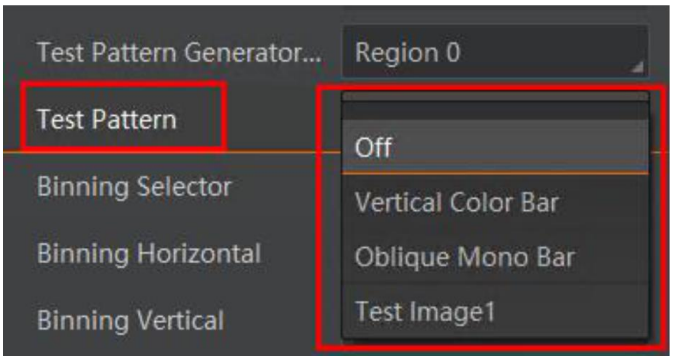


Figure 11-5 Set Test Pattern

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

The color device offers 4 test patterns, including **Vertical Color Bar**, **Mono Bar**, **Oblique Mono Bar**, and **Test Image 1**.

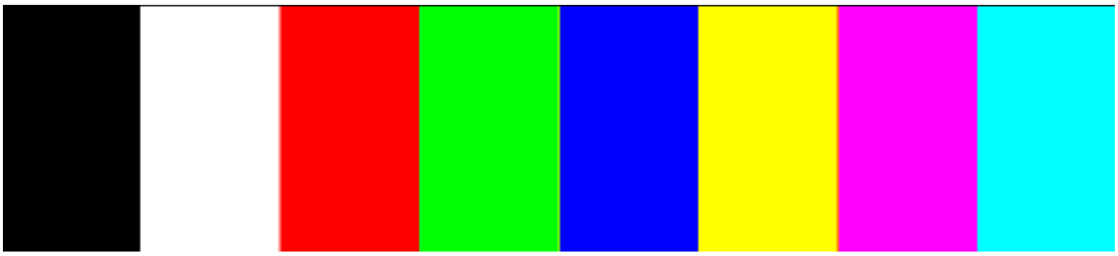


Figure 11-6 Vertical Color Bar Test Pattern

Figure 11-7 Mono Bar Test Pattern

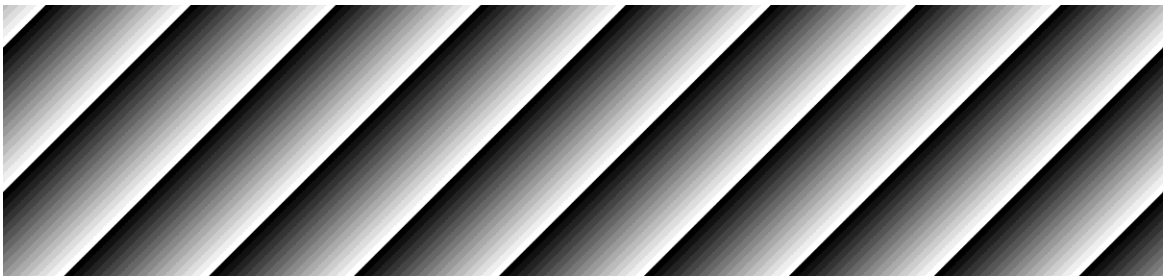


Figure 11-8 Oblique Mono Bar Test Pattern

Figure 11-9 Test Image 1

Note

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

11.5 Set Binning

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

Figure 11-10 Binning Horizontal 2

Figure 11-11 Binning Vertical 2

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 11-12 Binning Horizontal 2 and Binning Vertical 2

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

Figure 11-13 Set Binning

Note

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

11.6 Set Exposure Mode

The exposure mode supports **Timed** and **Trigger Width**. When selecting **Timed**, you can set **Exposure Auto** and **Exposure Time**. When you select **Trigger Width**, the exposure time and level signal time are the same, and **Exposure Auto** and **Exposure Time** are invalid.

Note

The **Trigger Width** can be selected as the **Exposure Mode** when the requirements below are met:

- **LineTrigger Mode** in **Line Trigger Control** is enabled.
- **Line** ⋆ is selected as the **LineTrigger Source**.
- **Level High** or **Level Low** is selected as **LineTrigger Activation.**

The **Exposure Auto** supports 3 types, including **Off**, **Once** and **Continuous**. Go to **Acquisition and Transfer Control** → **Exposure Auto**, and select **Exposure Auto** according to actual demands.

- **Off**: The device exposures according to the value set in **Exposure Time (μs)**.

- **Once**: The device adjusts the exposure time automatically according to the image brightness. After adjusting, it will switch to **Off** mode.
- **Continuous**: The device adjusts the exposure time continuously according to the image brightness.

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

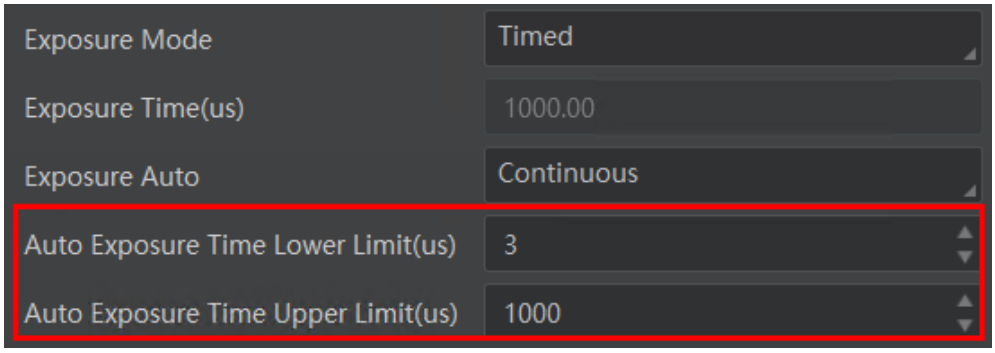


Figure 11-14 Set Exposure Time under Once or Continuous Mode

Note

The exposure auto function may differ by device models.

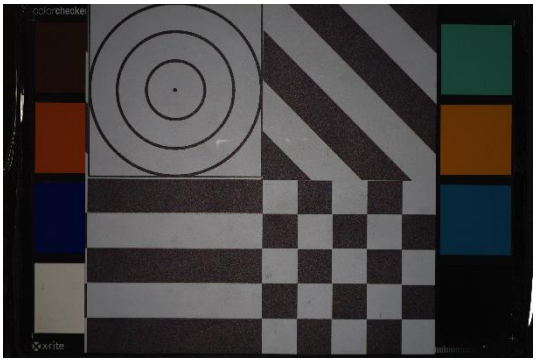
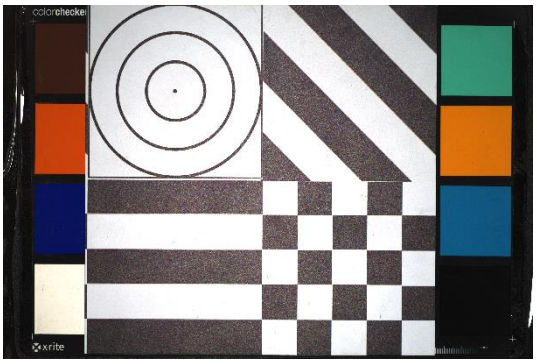
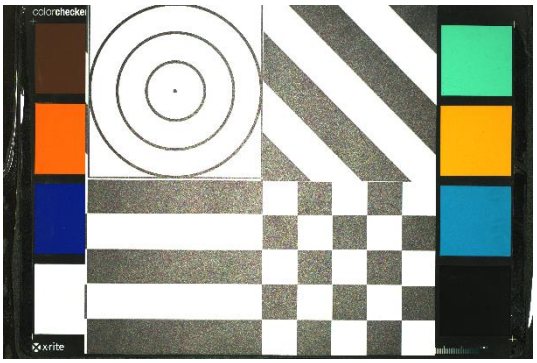
11.7 Set Brightness

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

Table 11-2 Brightness Example

Brightness Value	Image
Brightness=25	
Brightness=75	
Brightness=120	

Go to **Advanced Processing** → **Brightness**, and enter **Brightness** according to actual demand.

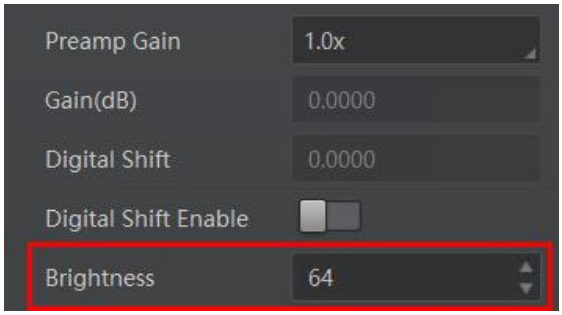


Figure 11-15 Set Brightness

11.8 Set White Balance

Note

White balance is only available for color devices.

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 **Advanced Processing** → **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 10376, 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 brightness value between 120 and 160.

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

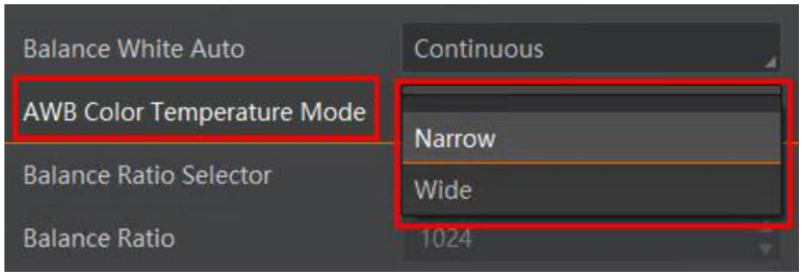


Figure 11-16 Set Parameters

Manual Correction

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

Steps

Note

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

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

11.9 Set Multi ISP

The MV-CL086-B0F1C device supports multi ISP function. You can set multiple groups of white balance parameters for image processing. The device equipped with frame grabber can control 2 light sources which are installed at different angles to illuminate according to the set sequence.

Before You Start

The MV-CL086-B0F1C device should be used with the specific firmware version of MV-GS1002F frame grabber. Please contact technical support for details.

Go to **Advanced Processing** → **Multi ISP Selector**, and set the parameters according to the actual demands.

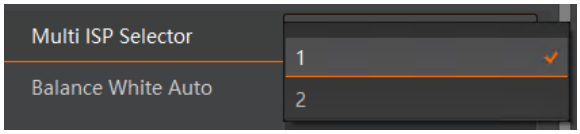


Figure 11-17 Set Multi ISP

Note

- The **Multi ISP Selector** is valid when **Line Scan** is set as **Scan Mode**, and the current pixel format is not Bayer.
- After Multi ISP function is enabled, color abnormal correction (CAC), digital noise

reduction, and Binning vertical cannot be set. Please refer to the actual one you got.

- **1** means the multi ISP function is disabled. The device executes 1 group of white balance parameter only.
- **2** means the multi ISP function is enabled. You can set 2 groups of white balance parameters (Balance Ratio Selector, Balance Ratio, Balance Ratio Selector2, and Balance Ratio2). Balance Ratio Selector and Balance Ratio are parameters of light source 1. You can refer to section ***Set White Balance*** to set white balance. Balance Ratio Selector2 and Balance Ratio2 are parameters of light source 2. Only manual white balance can be performed.

11.10 Set Black Level

Note

The black level may differ by device models.

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

Figure 11-18 Set Black Level

11.11 Set Gamma Correction

Note

The Gamma correction function may differ by device models.

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

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

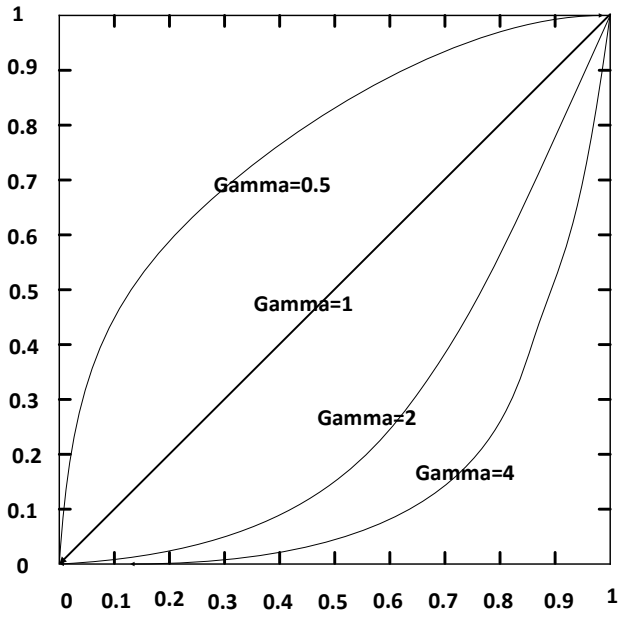
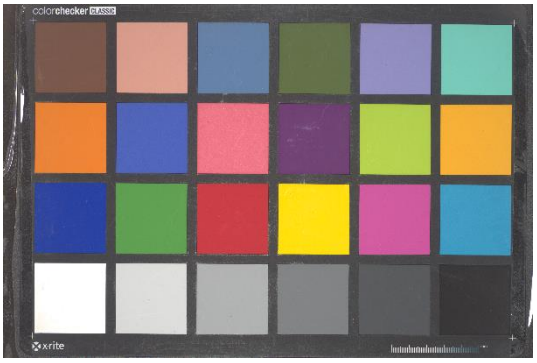


Figure 11-19 Set Gamma Correction

Table 11-3 Gamma Correction Example

Gamma Value	Image
Gamma=0.5	
Gamma=1.5	

Gamma Value	Image
Gamma=2	

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

Figure 11-20 Set User Mode

sRGB Mode

Steps

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

Figure 11-21 Set sRGB Mode

11.12 Set Gain

Note

The gain function may differ by device models.

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

11.12.1 Set Analog Gain

Go to **Advanced Processing** → **Preamp Gain**, and set **Preamp Gain** according to actual demands.

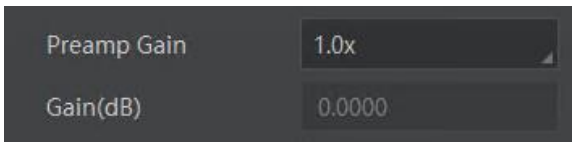


Figure 11-22 Set Analog Gain

11.12.2 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 **Advanced Processing**, enable **Digital Shift Enable**, and enter **Digital Shift** according to actual demands.

Figure 11-23 Set Digital Gain

Note

- The digital gain function is disabled by default, and its value range is from –24.082399 to 23.999836.
- When increasing the digital gain, the image noise will greatly increase too, which will severely influence image quality. It is recommended to use analog gain first, and then to adjust digital gain if the analog gain cannot meet demands.

11.13 Set AOI

Note

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

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

Steps

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

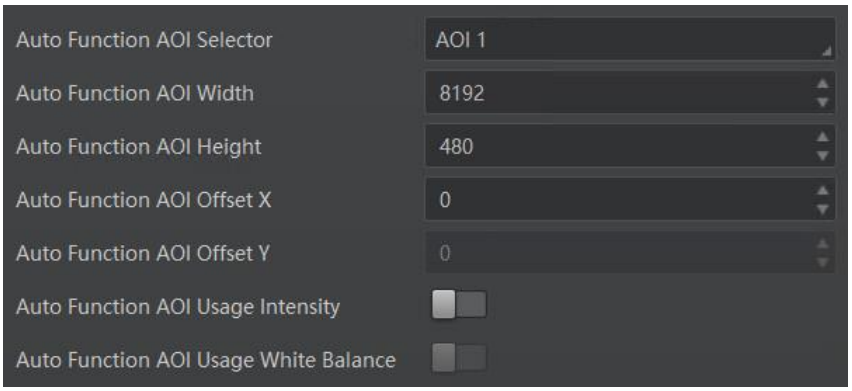


Figure 11-24 Set AOI

11.14 Set Color Transformation Control

Note

- The function of color transformation control is only available for color devices.
- Currently, **RGB to RGB** is available for **Color Transformation Selector** only.

After the process of the white balance, the color device's overall images will look darker, and multiple colors may deviate from their standard values to some extent. At this time, you need to correct these colors by multiplying correction matrix to let them back to the standard value, so that the overall color of images is more vivid.

The color correction function is realized by multiplying each RGB component by a correction matrix. Currently, the supported color conversion module is RGB to RGB. Two methods are available to set color transformation control.

Method 1

Steps

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

Note

The parameter of CCM enable may differ by device models.

2. Select **Color Transformation Value Selector**.
3. Set **Color Transformation Value** according to actual demand.

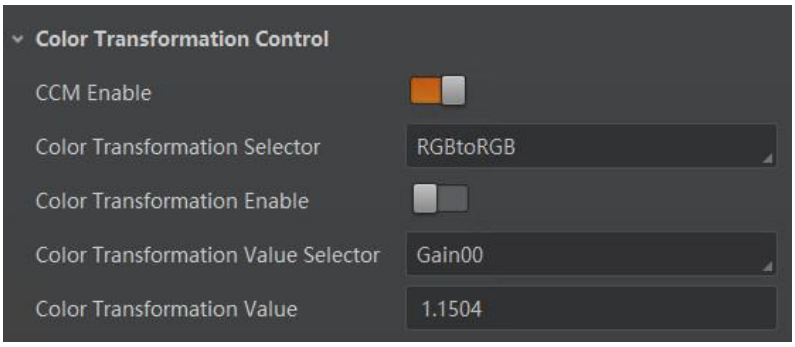


Figure 11-25 Method 1

Method 2

Steps

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

Note

The parameter of CCM enable may differ by device models.

2. Enable **Color Transformation Enable**, and select **Color Transformation Value Selector**.
3. Set **Hue** and **Saturation** to adjust **Color Transformation Value**.

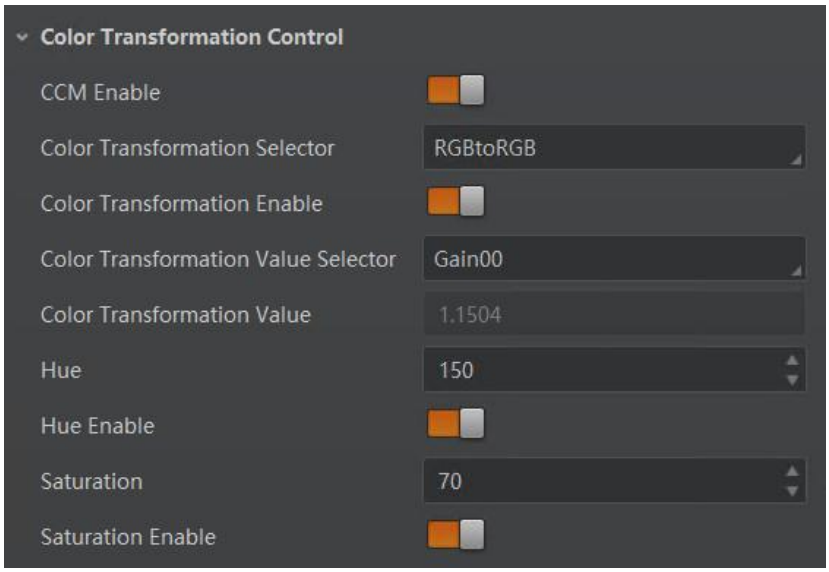


Figure 11-26 Method 2

11.15 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 correction based on the hue value to bring the image tone to the target value. For example, when hue is set to 128, the red in the image appears as real red. When hue is 0, the hue is reversed 128 degrees counterclockwise, and red becomes blue. When hue is 255, the hue rotates 128 degrees clockwise, and red becomes green. Image examples of different hue values are shown below.

Table 11-4 Hue Example

Hue Value	Image
Hue=0	

Hue Value	Image
Hue=128	
Hue=255	

Before You Start

Make sure that the device's pixel format is RGB format.

Steps

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

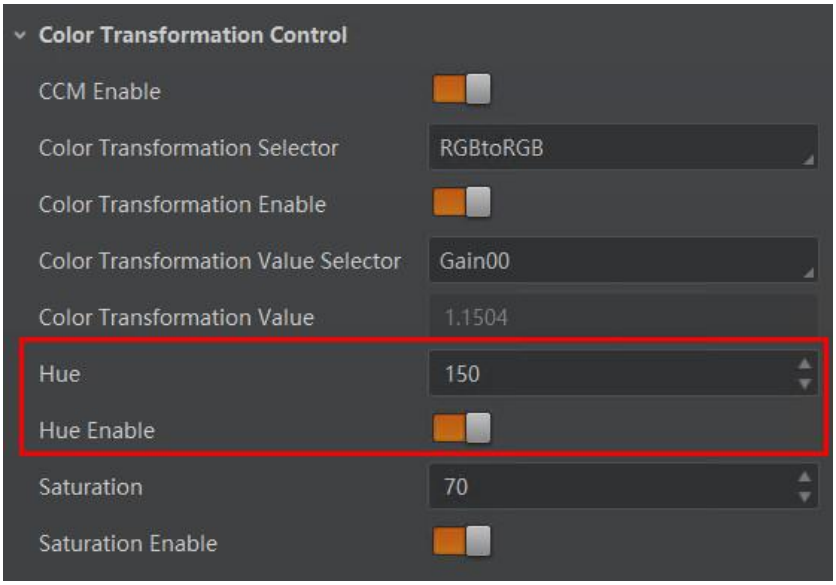


Figure 11-27 Set Hue

11.16 Set Saturation

Note

- The saturation function is only available for color devices.
- In Mono pixel format, 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.

Table 11-5 Saturation Example

Saturation Value	Image
Saturation=0	
Saturation =128	
Saturation =255	

Before You Start

Make sure that the device's pixel format is RGB format.

Steps

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

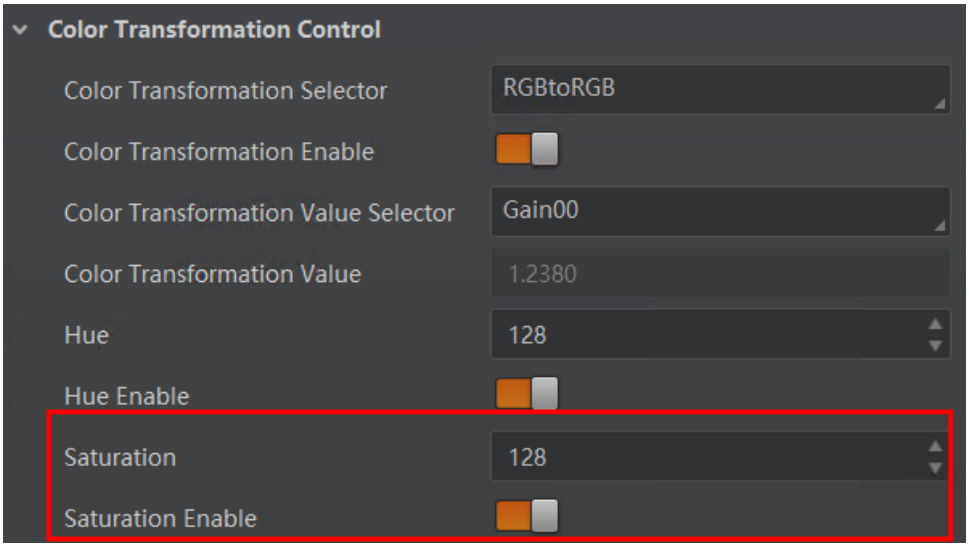


Figure 11-28 Set Saturation

11.17 Set Super Palette Control

Note

- The function of super palette control may differ by device models.
- Only in RGB, BGR, Bayer and YUV pixel formats, the color device supports super palette control function.

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

Steps

1. Go to **Super Palette Control**, and enable **Super Palette Enable**.
2. Select **Super Palette Selector**.

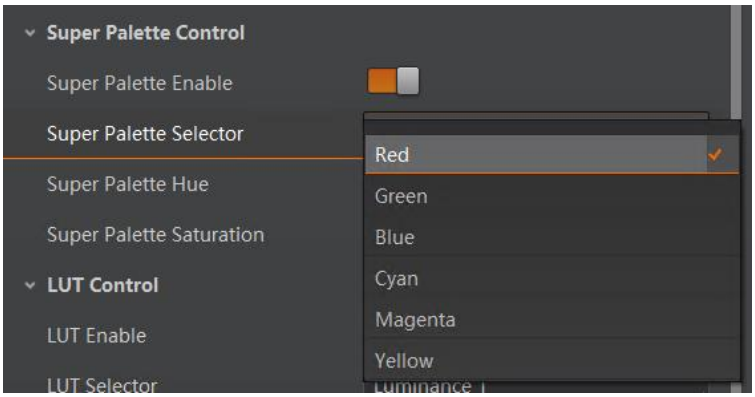


Figure 11-29 Super Palette Selector

3. Set **Super Palette Hue** and **Super Palette Saturation** according to actual demands.

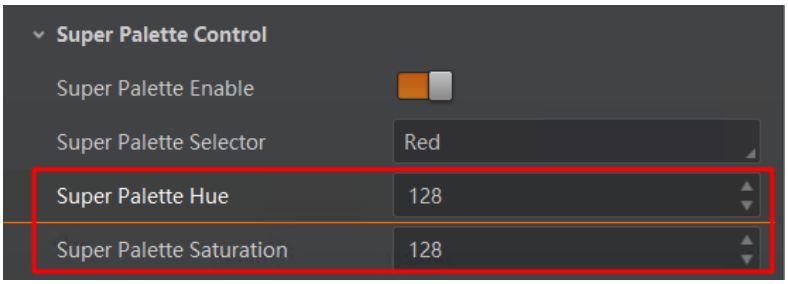


Figure 11-30 Super Palette Hue and Super Palette Saturation

11.18 Set Sensor Mode

Note

- The sensor mode function may differ by device models.
- The sensor mode can be set only when **2/3/4-TDI** is selected as **TDI Mode**. Refer to ***Set TDI Function*** for details.

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

- **High Full Well Mode**: It greatly improves SNR.
- **High Sensitivity**: It improves the overall brightness of images and is applicable to low-light environment.

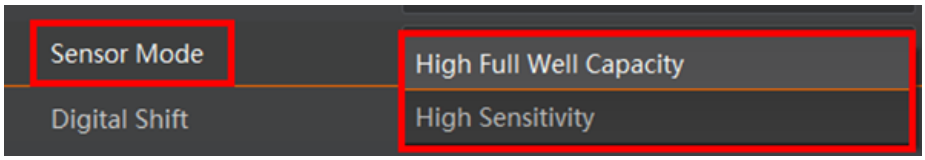


Figure 11-31 Set Sensor Mode

11.19 Set Sequence

If the device supports sequencer, you can configure multiple groups of parameters including exposure time and digital gain. The principle of the sequencer is shown below.

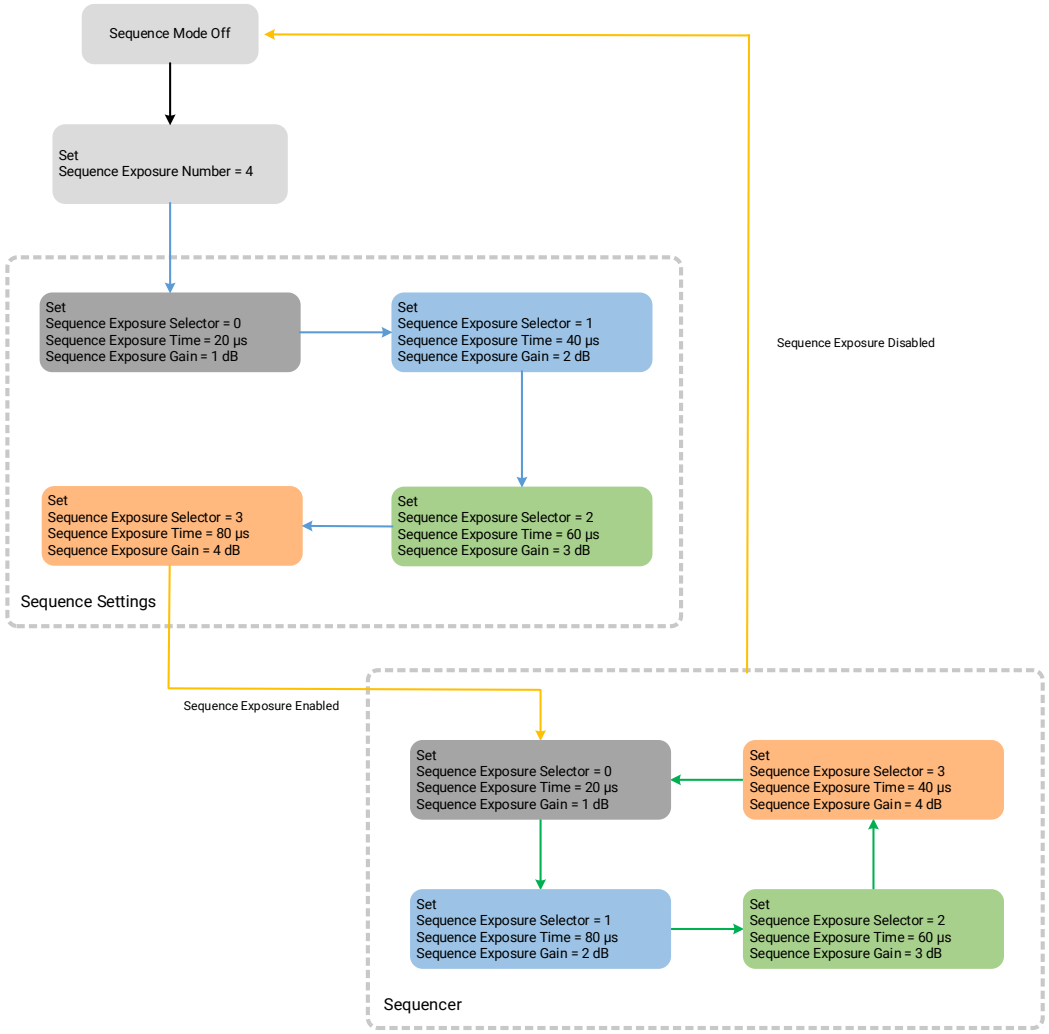


Figure 11-32 Principle of Sequencer

Steps

1. Go to **Image Format Control**, and set **Sequence Exposure Number** to configure how many groups to join sequencer according to actual demands.

Note

Up to 2 groups of parameters can be configured.

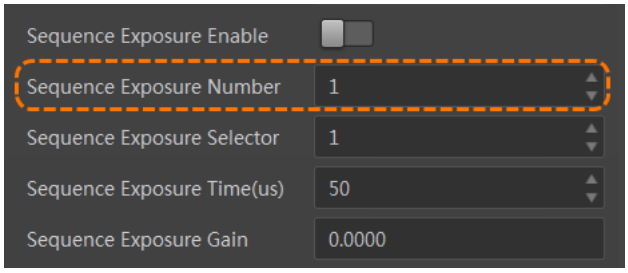


Figure 11-33 Set Sequence Exposure Number

2. Set **Sequence Exposure Selector** to select one group of parameters.
3. Set the exposure time and digital gain of the selected parameter in **Sequence Exposure Time** and **Sequence Exposure Gain**.

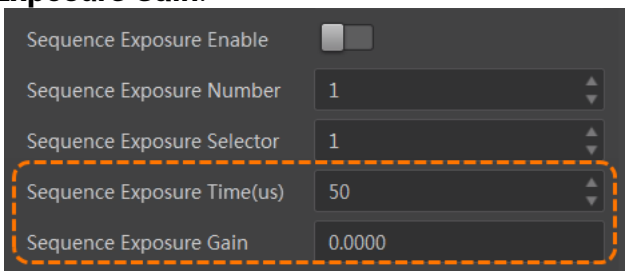


Figure 11-34 Set Sequence Exposure Time and Gain

4. Repeat step 2 to step 3 to configure other group of parameters.
5. Enable **Sequence Exposure Enable** to start sequencer after configuration.

Note

When the sequence mode function is enabled, the device will automatically adjust the related parameters. Please refer to the actual one you got.

11.20 Set TDI Function

Note

The TDI function may differ by device models.

TDI refers to Time Delay Integration, and it is a method of line scanning which provides dramatically increased responsivity compared to other video scanning methods. It permits much greater scanning speeds in low light, or allows reduced lighting levels (and costs) at conventional speeds. In general, there are 5 TDI modes.

- **1 Line** refers to single line mode, and the device selects 1 line data as output result.
- **2-TDI** means that the device overlaps 2 adjacent line data, and outputs 1 line data as final result.
- **3-TDI** means that the device overlaps 3 adjacent line data, and outputs 1 line data as final result.
- **4-TDI** means that the device overlaps 4 adjacent line data, and outputs 1 line data as final result.

- **4-TDI-HFWCM** means that the device first averages 2 adjacent line data to generate 2 lines as intermediate result, and then combines those two intermediate lines into one line for final outputting.

Go to **Image Format Control** → **TDI Mode**, and set **TDI Mode** according to actual demands.

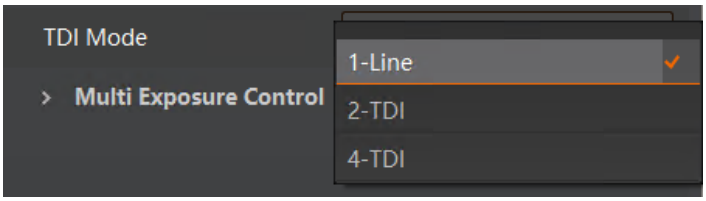


Figure 11-35 Set TDI Mode

Refer to the table below for the relation between device model and supported TDI mode.

Table 11-6 Device Model and Supported TDI Mode

Device Model	Supported TDI Mode
MV-CL042-91FC	1-Line
MV-CL082-91F2M	1-Line, 2-TDI
MV-CL082-91F1M	
MV-CL083-91F2C	
MV-CL162-91F2M	
MV-CL084-91F2M	1-Line, 2-TDI, 4-TDI
MV-CL084-90F1M	
MV-CL086-B0F1C	1-Line, 2-TDI, 4-TDI, 4-TDI-HFWCM
MV-CL166-91F2C	1-Line, 2-TDI, 3-TDI, 4-TDI

11.21 Set Multiple Lights Control

Method for MV-CL084-91F2M

MV-CL084-91F2M supports function of multiple lights control, which the device can control up to four lights installed at different angles to light up in accordance with configured strobe logic. Then the device can get multiple images of the same target illuminated from different angles.

Note

Settings for level inverter and strobe signal will be invalid when the function of multiple lights control is enabled.

Click **Image Format Control** → **Multi Light Control**, and select **Multi Light Control** according to actual demands.

- **Off**: The function of multiple lights control is disabled if **Off** is selected as **Multi Light Control**. At this time, the device does not output the light source synchronized control signal.
- **1 Light**: Light 1 is turned on if **1 Light** is selected as **Multi Light Control**.
- **2 Lights**: Light 1 and light 2 are turned on if **2 Lights** is selected as **Multi Light Control**.
- **3 Lights**: Light 1, light 2 and light 3 are turned on if **3 Lights** is selected as **Multi Light Control**.
- **4 Lights**: Light 1, light 2, light 3 and light 4 are turned on if **4 Lights** is selected as **Multi Light Control**.
- **MultiExposure**: The function of multiple lights control is disabled and multiple exposure mode is enabled. At this time, the device supports configuring two sets of exposure time and gain, namely, **Multi Exposure0 (us)**, **MultiGain0 (dB)**, **Multi Exposure1 (us)**, and **Multi Gain1 (dB)**.

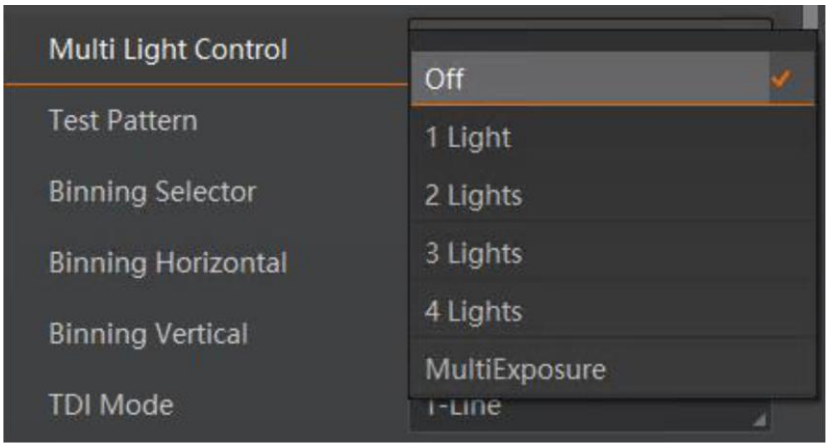


Figure 11-36 Set Multiple Lights Control

Note

- When **TDI Mode** is **1-Line**, **Multi Light Control** supports setting **Off**, **1/2/3/4 Lights**, and **MultiExposure**.
- When **TDI Mode** is **2-TDI**, **Multi Light Control** only supports setting **Off** and **1/2 Lights**.
- When **TDI Mode** is **4-TDI**, **Multi Light Control** only supports setting **Off** and **1 Light**.

The device uses four I/Os (Line 0/1/3/4) to output trigger signals, and light 1 to light 4 are turned on correspondingly. The output pulse diagram of four I/Os is shown below.

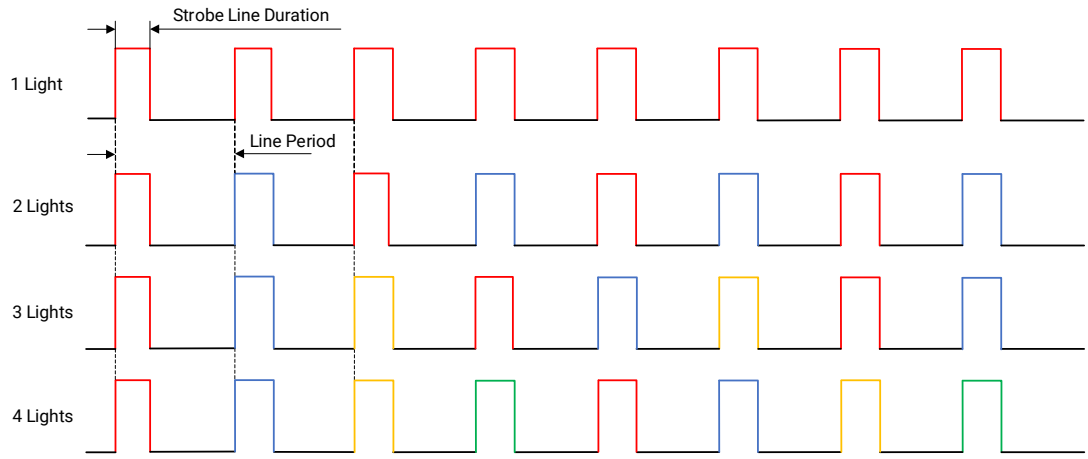


Figure 11-37 Pulse Diagram

Note

- Red, blue, yellow, and green colors represent output pluses by Line 0, Line 1, Line 3, and Line 4 correspondingly.
- You can set **Strobe Line Duration** and **Strobe Line Delay** of **I/O Control** when function of multiple lights control is enabled. The unit of **Strobe Line Duration** and **Strobe Line Delay** is μs.
- The sum of **Strobe Line Duration** and **Strobe Line Delay** should be smaller than or equal to line period time due to the device's limitation. If the sum is larger than line period time, the device will use max. value instead.

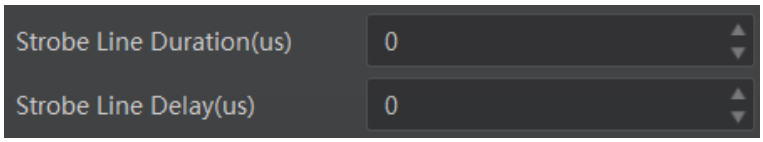


Figure 11-38 Strobe Line Duration and Strobe Line Delay

Method for MV-CL084-90F1M

MV-CL084-90F1M supports function of multiple lights control, which the device can configure multiple sets of parameters for image acquisition, and control up to four lights installed at different angles to light up in accordance with configured strobe logic.

Note

The MV-CL084-90F1M device and the MV-GS1002F frame grabber should be used together to achieve this function.

For the camera, the **LineTrigger Mode** in **Line Trigger Control** should be enabled, and **Rising Edge** is selected as **LineTrigger Activation**. When the frame grabber receives the

rising edge trigger signal from the external device, the camera will execute exposure and turn on the lights via link trigger signal.

Note

If the **LineTrigger Mode** is disabled, the camera will execute this function via internal trigger signal.

Click **Image Format Control** → **Multi Light Control**, and select **Multi Light Control** according to actual demands.

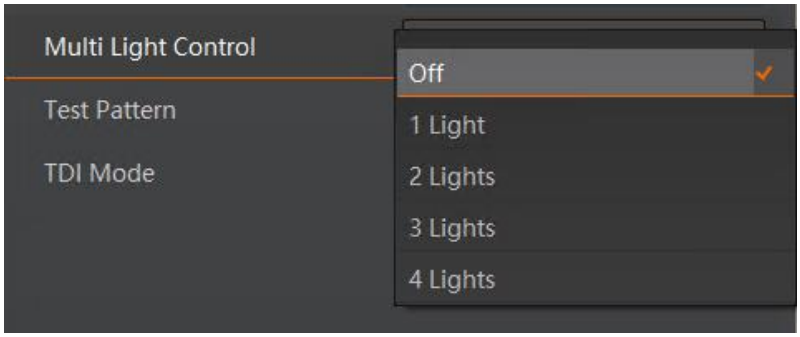


Figure 11-39 Set Multiple Lights Control

When **TDI Mode** is **1-Line**, **Multi Light Control** supports setting **1/2/3/4 Lights**.

- **Off**: If **Off** is selected as **Multi Light Control**, the function of multiple lights control is disabled.
- **1 Light**: If **1 Light** is selected as **Multi Light Control**, light 1 is turned on, and you can go to **Image Format Control** → **Multi Exposure Control** → **Multi Exposure Set 0** to configure 1 set of parameters, such as **Multi Cam Gain 0**, **Strobe0 Delay**, **Strobe0 Duration**, **Exposure0 Delay**, and **Exposure0 Duration**.
- **2 Lights**: If **2 Lights** is selected as **Multi Light Control**, light 1 and light 2 are turned on, and you can go to **Image Format Control** → **Multi Exposure Control** → **Multi Exposure Set 0/1** to configure 2 sets of parameters.
- **3 Lights**: If **3 Lights** is selected as **Multi Light Control**, light 1, light 2, and light 3 are turned on, and you can go to **Image Format Control** → **Multi Exposure Control** → **Multi Exposure Set 0/1/2** to configure 3 sets of parameters.
- **4 Lights**: If **4 Lights** is selected as **Multi Light Control**, light 1, light 2, light 3, and light 4 are turned on, and you can go to **Image Format Control** → **Multi Exposure Control** → **Multi Exposure Set 0/1/2/3** to configure 4 sets of parameters.

When the camera is acquiring images, the frame grabber will control the camera to execute the 1/2/3/4 set(s) of the parameters according to the settings, and the corresponding lights are turned on.

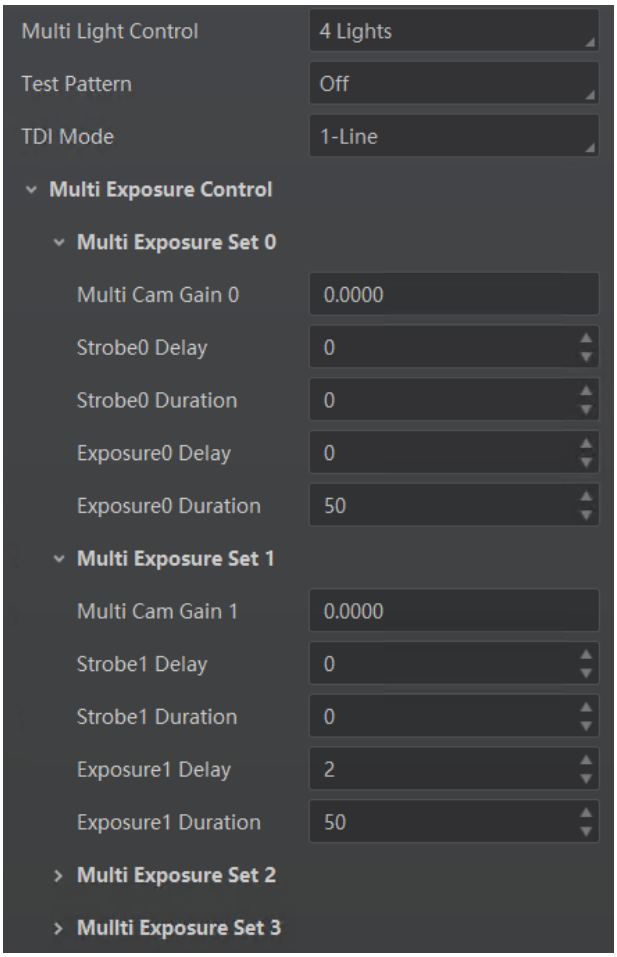


Figure 11-40 Set Multiple Lights Control

Take the 4 lights as an example. The frame grabber receives an external trigger signal, and controls the camera to execute exposure and light source according to the settings in the camera. Refer to the trigger diagram and the result in the client below.

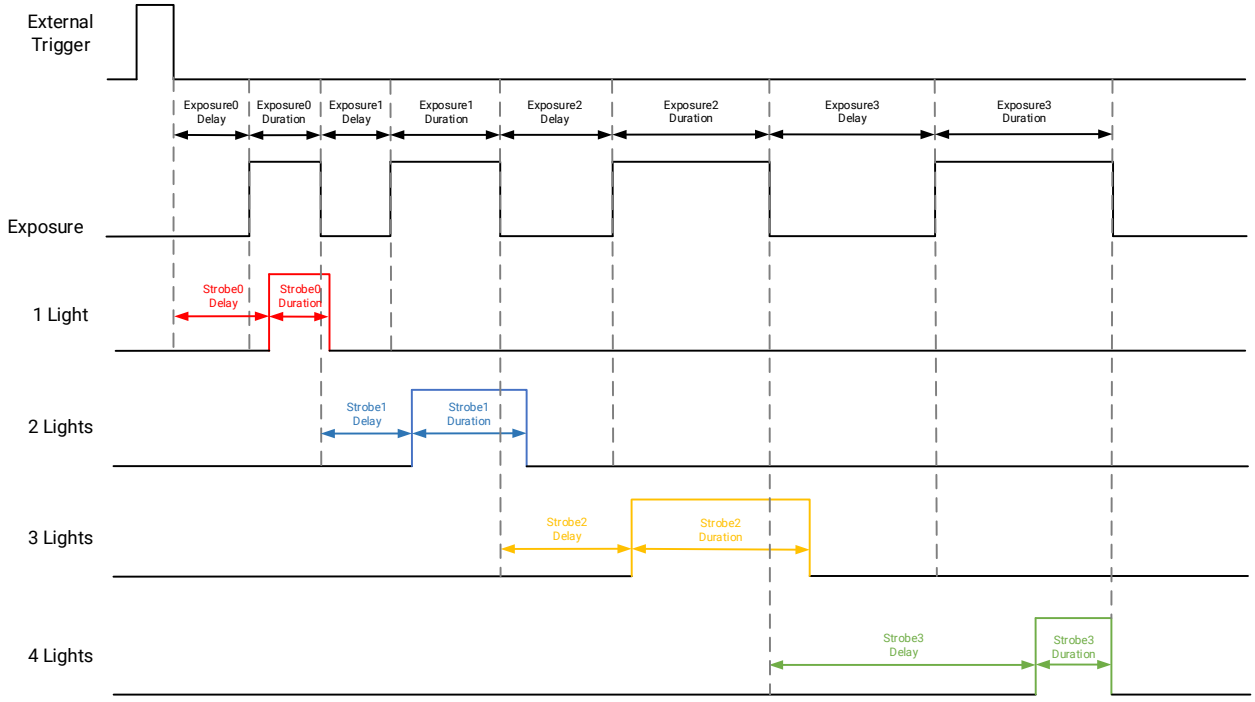


Figure 11-41 Trigger Diagram of 4 Lights

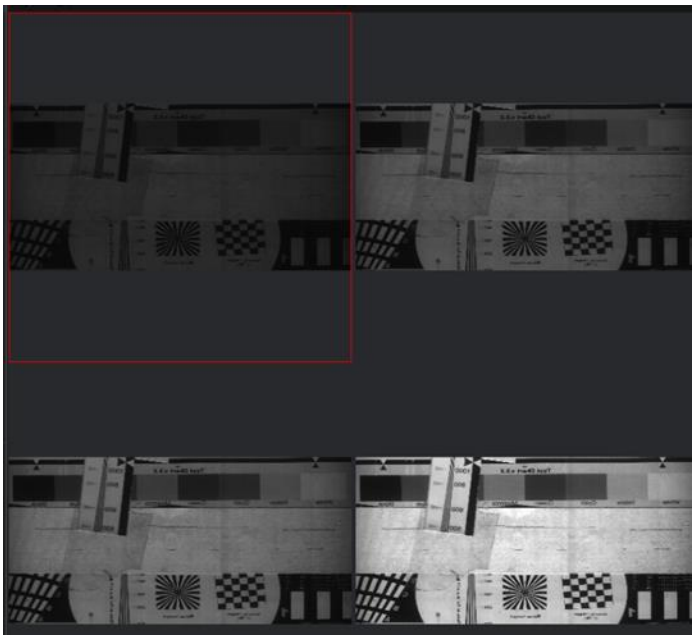


Figure 11-42 4 Lights Result in Client

11.22 Set Digital Noise Reduction

Note

- The digital noise reduction function may differ by device models.
- Excessive noise reduction will affect the image details.

The function of digital noise reduction can increase the image's SNR and improve its quality.

Steps

1. Go to **Advanced Processing** → **Digital Noise Reduction Mode**.
2. Select **Expert** as **Digital Noise Reduction Mode**.
3. Enter **Denoise Strength** and **Noise Correct** according to actual demands.

- **Denoise Strength** refers to the intensity of the digital noise reduction. You can increase it to have a better effect.
- **Noise Correct** refers to the noise horizontal correction value, and it is used to adjust the noise curve.

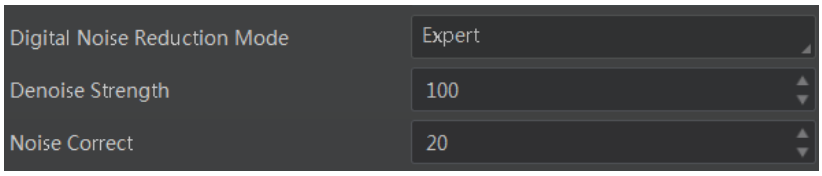


Figure 11-43 Set Digital Noise Reduction

11.23 Set LUT

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

Note

- You cannot use Gamma correction function and LUT function at the same time.
- The parameter of **LUT Save** may differ by device models. If the device has no **LUT Save**, the settings you configured will be saved in the device in real time.
- For different models of device, the **LUT Index** and **LUT Value** range may differ. Please refer to the actual one you got.
- The range of the LUT index is from 0 to 1023.
- The range of the LUT value is from 0 to 4095. The value of LUT value is four times the value of LUT index by default.

Steps:

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

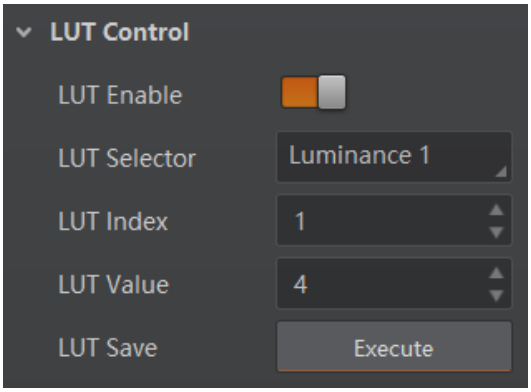


Figure 11-44 Set LUT

11.24 Set Shading Correction

Note

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

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

11.24.1 Set FPNC Correction

Note

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

Steps

1. Click **Shading Correction**, and **User Flat Field Correction** is disabled by default.

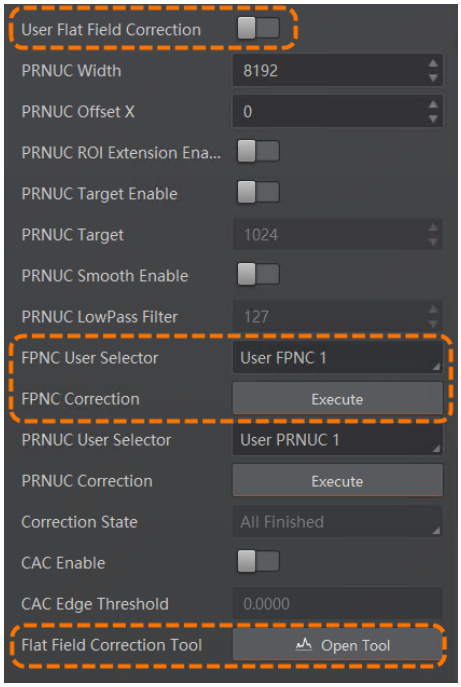


Figure 11-45 Set FPNC Correction

2. Select **Factory** or **User** in **FPNC Flat Field Mode Selector**.
- **Factory**: Execute FPNC correction according to the factory settings.
- **User**: Execute FPNC correction according to the custom settings.

Note

- The **FPNC Flat Field Mode Selector** function may differ by device models.
- If the device has no **FPNC Flat Field Mode Selector** function, it means the device has user FPNC by default.

3. Select one **User FPNC** from **FPNC User Selector**.

Note

- Up to three groups of User FPNC can be selected.
- The **FPNC User Selector** can be set when the device supports **FPNC Flat Field Mode Selector** function and **User** is selected.

4. Click **Open Tool** in **Flat Field Correction Tool** and click **Perform FPN Calibration**.

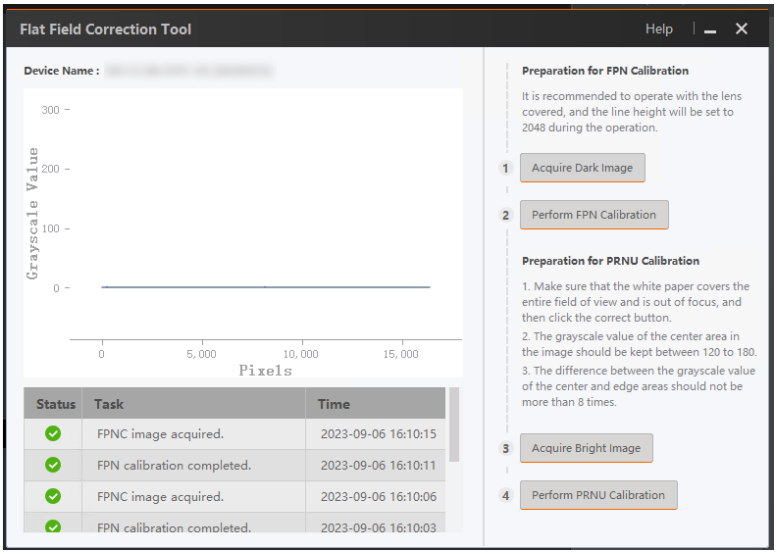


Figure 11-46 Flat Field Correction Tool

Note

- Refer to ***Flat Field Correction Tool User Manual*** for details.
- When the device supports **FPNC Flat Field Mode Selector** and **User** is selected, you can click **Execute** in **FPNC Correction** to calculate correction data.

4. Enable **User Flat Field Correction**.

Note

After **User Flat Field Correction** is enabled, you can enable FPNC correction and PRNUC correction at the same time.

The status of FPNC correction process can be viewed via **Correction State**. There are five statuses in total:

- **All Finished**: It means that the correction is done.
- **Doing Correction**: It means that the correction is executing.
- **Saving Data**: It means that the correction data is saving.
- **Transferring Data**: It means that the correction data is sending.
- **Error**: It means that the correction fails.

Note

The status of PRNUC correction process can also be viewed via **Correction State**.

11.24.2 Set PRNUC Correction

Note

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

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

Figure 11-47 Before PRNUC Correction

Figure 11-48 After PRNUC Correction

Global PRNUC Correction

Steps

1. Click **Shading Correction**, and **User Flat Field Correction** is disabled by default.

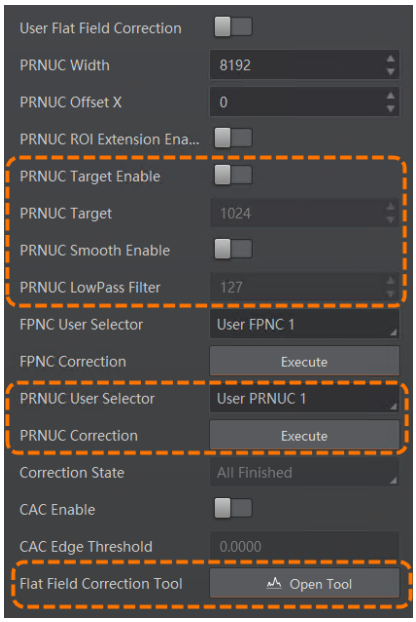


Figure 11-49 Set Shading Correction

2. Select **Factory** or **User** in **PRNUC Flat Field Mode Selector**.
- **Factory**: Execute PRNUC correction according to the factory settings.
- **User**: Execute PRNUC correction according to the custom settings.

Note
- The **PRNUC Flat Field Mode Selector** function may differ by device models.
- If the device has no **PRNUC Flat Field Mode Selector** function, it means the device has user PRNUC by default.

3. Select one **User PRNUC** from **PRNUC User Selector**.

Note
- Up to three groups of User PRNUC can be selected.
- The **PRNUC User Selector** can be set when the device supports **PRNUC Flat Field Mode Selector** function and **User** is selected.

4. Set PRNUC target related parameters according to actual demands.
- Disable **PRNUC Target Enable** if you want to use the device's auto correction standard. At this time, the device compares and corrects the average R/G/B component value of each column with the average R/G/B component value of the entire image.
- Enable **PRNUC Target Enable** if you want to manually correct. For mono devices, set **PRNUC Target**, and for color devices, set **PRNUC Target R**, **PRNUC Target G**, and **PRNUC Target B** according to actual demands. At this time, the device compares and corrects the average gray value or R/G/B component value of each column with the configured gray value or R/G/B value.

5. Click **Open Tool** in **Flat Field Correction Tool** and click **Perform PRNUC Calibration**.

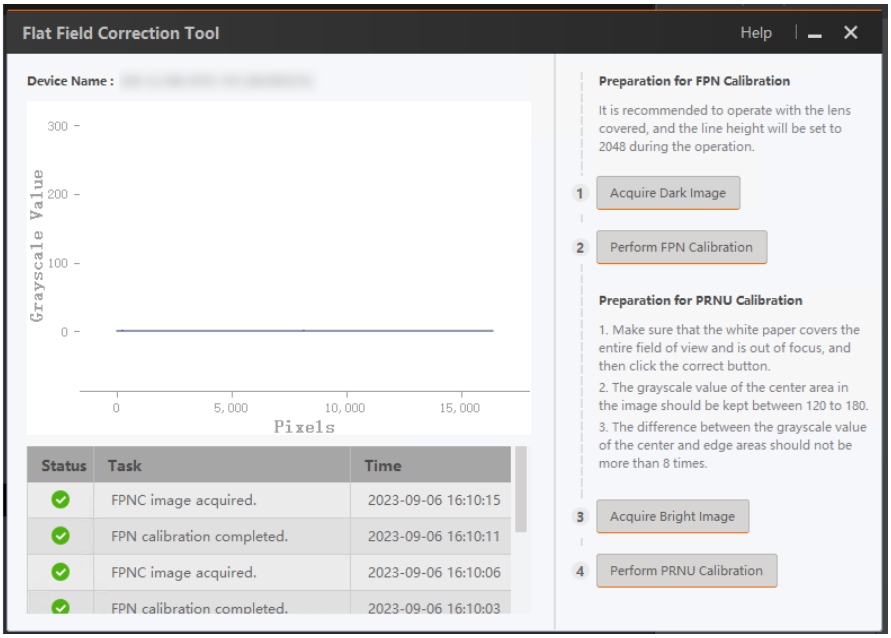


Figure 11-50 Flat Field Correction Tool

Note

- Refer to ***Flat Field Correction Tool User Manual*** for details.
- When the device supports **PRNUC Flat Field Mode Selector** and **User** is selected, you can click **Execute** in **PRNUC Correction** to calculate correction data.

6. Enable **User Flat Field Correction**.

Note

After **User Flat Field Correction** is enabled, you can enable FPNC correction and PRNUC correction at the same time.

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

Note

Some models of the device support enabling **PRNUC Smooth Enable**.

8. (Optional) After **PRNUC Smooth Enable** is enabled, you can set **PRNUC LowPass Filter** to adjust vertical line in image. Higher values reduce dust interference during calibration and enhance clarity of vertical line in the image. Lower values weaken the smoothing effect, resulting in more blurred line features. When the value is set as 0, it has the same effect as **PRNUC Smooth Enable** disabling.

ROI PRNUC Correction

If you want to execute PRNUC correction for specific areas, set **PRNUC Width** and **PRNUC Offset X** to set ROI, and enable **PRNUC ROI Extension Enable** to execute PRNUC Correction out of the ROI.

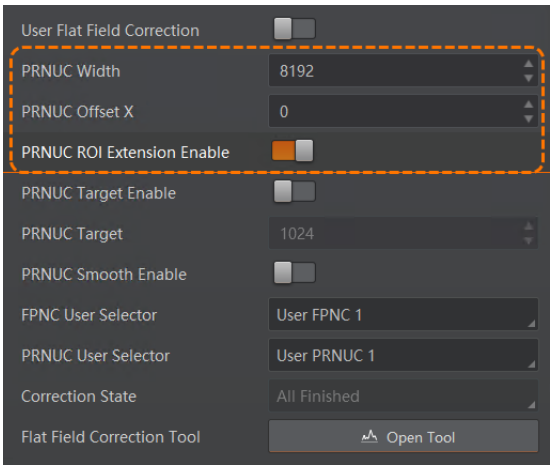


Figure 11-51 ROI PRNUC Correction

Note

Refer to section *Global PRNUC Correction* and ***Flat Field Correction Tool User Manual*** for

details of flat field correction tool.

11.25 Set Space Correction

Note

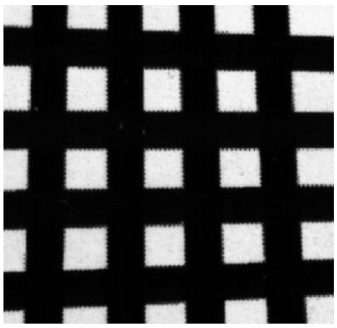
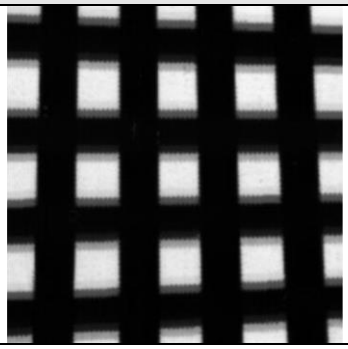
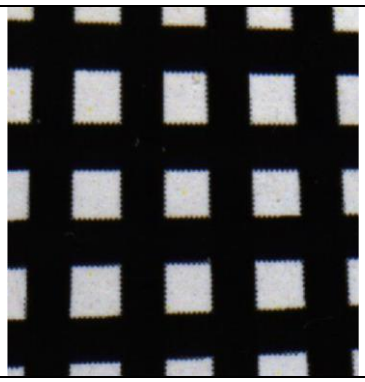
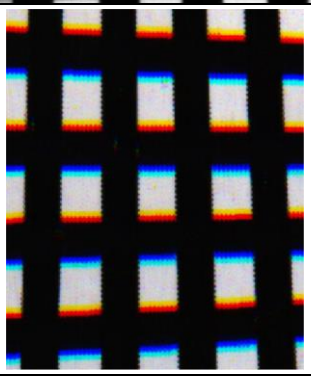
The space correction function may differ by device models.

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

11.25.1 Set Line Rate Ratio

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

Table 11-7 Effect Contrast of Line Rate Ratio

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

- It is recommended to set line rate ratio larger than 1 when the device's line rate is larger than that of the object.
- It is recommended to set line rate ratio smaller than 1 when the device's line rate is

smaller than that of the object.
- It is recommended to set line rate ratio as 1 when the device's line rate is equal to that of the object.

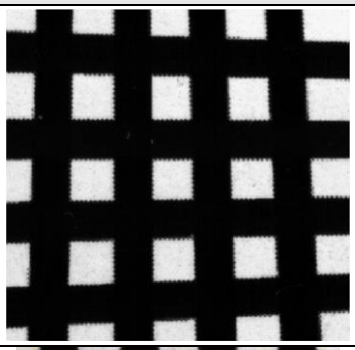
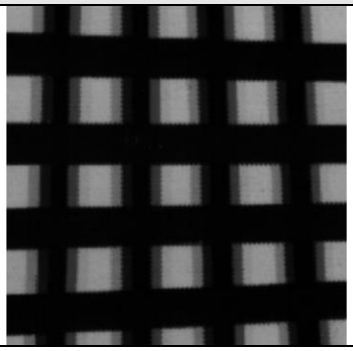
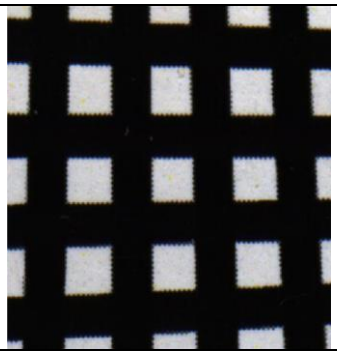
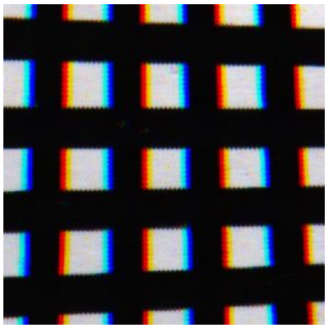
11.25.2 Set Pixel Shift and Parallax Direction

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

Note

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

Table 11-8 Effect Contrast of Pixel Shift

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

Steps

1. Set **Off** as **Parallax Direction** if the image's edge does not have pixel deviation.
2. Set **Parallax Direction** according to actual conditions if the image's edge has pixel deviation.
- For the mono device, if its upper sensor is closer to the measured objects, and select **Start Line** as **Parallax Direction**. Otherwise, select **End Line** instead.
- For the color device, if its sensor's B line is closer to the measured objects, and select **Blue** as **Parallax Direction**. If its sensor's R line is closer to the measured objects, and select **Red** instead.

3. Set **Pixel Shift** to have a best effect.

11.26 Set Color Abnormal Correction

Note

- The color abnormal correction function may differ by device models.
- The CAC will be performed only when the edge strength is higher than the configured threshold.

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

Steps

1. Go to **Shading Correction** → **CAC Enable**, and enable **CAC Enable**.
2. Enter **CAC Edge Threshold** according to actual demands.

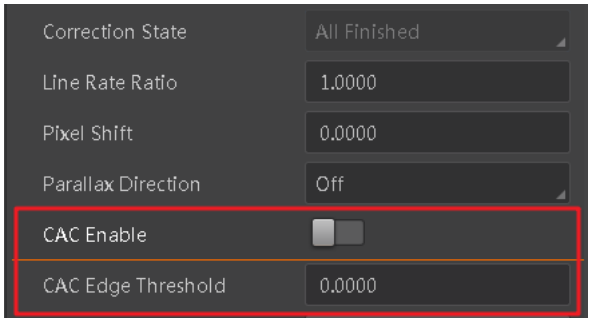


Figure 11-52 Set Color Abnormal Correction

Chapter 12 Other Functions

12.1 Device Control

Note

The specific device control parameters may differ by device models.

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

Table 12-1 Parameter Description

Parameter	Read/Write	Description
Device Scan Type	Read Only	It is the scan type of the device's sensor.
Device Model Name	Read Only	It is the model of the device.
Device Firmware Version	Read Only	It is the firmware version of the device.
Device Serial Number	Read Only	It is device's serial number.
Device User ID	Read & Write	Device name and it is empty by default. You can set according to your preference. ● If User ID is empty, the client software displays the device model (device serial number). ● If you set it, the client software displays the User ID you set (device serial number).
Device Uptime (s)	Read Only	It is the device's operation time.
Board Device Type	Read Only	It is the device type.
Device Reset	Write	Click **Execute** to reset the device.
Device Fan Enable	Write	After enabling, the device's fan is running.
Device Temperature Selector	Read & Write	It selects device component to view its temperature. Currently, sensor or mainboard can be selected.
Device Temperature	Read Only	It displays the temperature of selected components in **Device Temperature Selector**.
Link Temperature Selector	Read & Write	It selects device Link to view its

Parameter	Read/Write	Description
		temperature.
Link Temperature	Read Only	It displays the temperature of selected Link in **Link Temperature Selector**.
Find Me	Read & Write	Click **Execute** to find the currently operating device, and the device red indicator flashes once.

12.2 Transport Layer Control

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

Note

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

Table 12-2 Parameters of Transport Layer Control

Parameter	Read/Write	Description
Payload Size	Read Only	It is the device's load size.
Image1 Stream ID	Read Only	It is the ID of image 1.
Image2 Stream ID	Read Only	It is the ID of image 2.
Dictionary URL	Read Only	It is the XML node translation mode.

12.3 XoFLink Parameters

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

Note

The specific XoFLink parameters may differ by device models.

Table 12-3 XoFLink Parameters

Parameter	Read/Write	Description
Device Connection ID	Read Only	It is the device's connection ID.
Master Host Connection ID	Read, and Write if not Acquisition	It is connected master host ID.

Parameter	Read/Write	Description
Control Packet Max Size	Read Only	It is the max. size of single control packet.
Device Steam Max Size	Read, and Write if not Acquisition	It is the max. size of single stream packet.
LinkConfiguration	Read, and Write if not Acquisition	It sets link configuration mode, as show below.
LinkConfigurationPreferred	Read Only	It is recommended link configuration mode. You can click **Execute** in **User Set Save** after configuring **Link Configuration** to save it. At this time, **Link Configuration Preferred** is related with **Link Configuration**.
ConnectionTestMode	Read & Write	It checks test data sent between the device and frame grabber.
TestErrorCountSelector	Read & Write	It selects link that needs checking test results.
TestErrorCount	Read & Write	It is error count of current link.
TestPacketCountTx	Read & Write	It is transmitted test data quantity of current link.
TestPacketCountRx	Read & Write	It is received test data quantity of current link.
TestPacketModeTx	Read & Write	You can select the mode of transmitted test data of current link. **Mode 1** or **Mode 2** can be selected. ● When **Mode 1** is selected, the test data consists of a 0 to 255 byte-wise incremental cycle. ● When **Mode 2** is selected, the test data is a fixed value which is configured in **TestPackedValue** parameter.
TestPacketGroupTx	Read & Write	It is transmitted test data group quantity of current link.
TestPackedValue	Read & Write	It is transmitted test data value of current link.

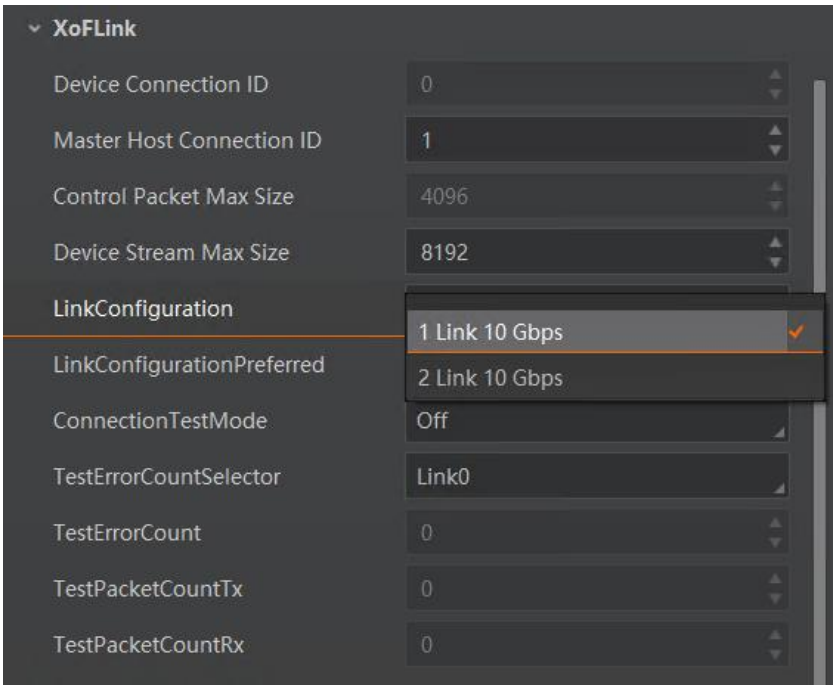


Figure 12-1 Link Configuration

12.4 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.

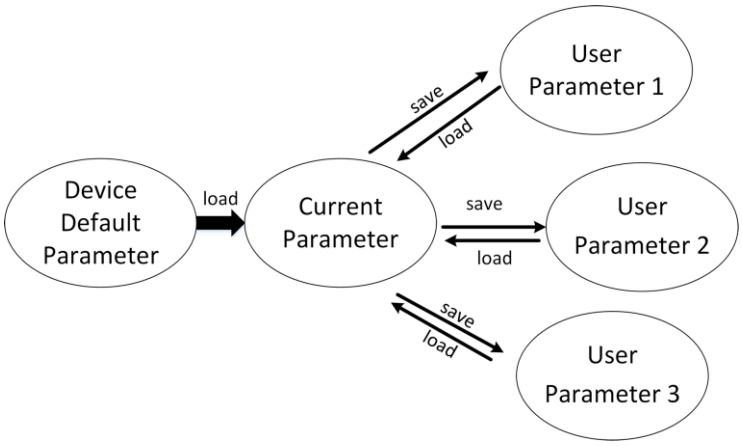


Figure 12-2 Parameter Relation

Note

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

12.4.1 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.

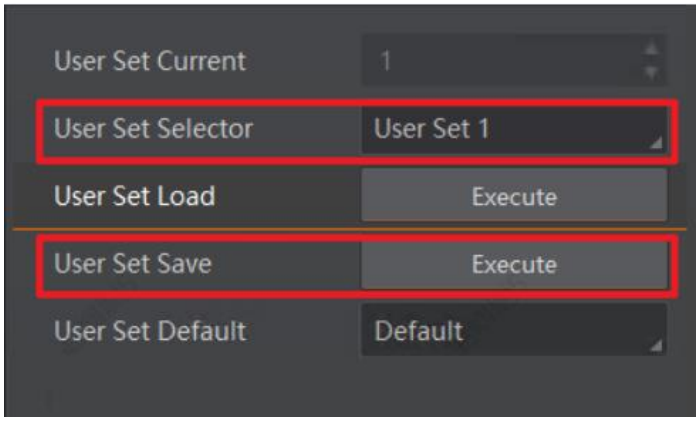


Figure 12-3 Save User Set

12.4.2 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.

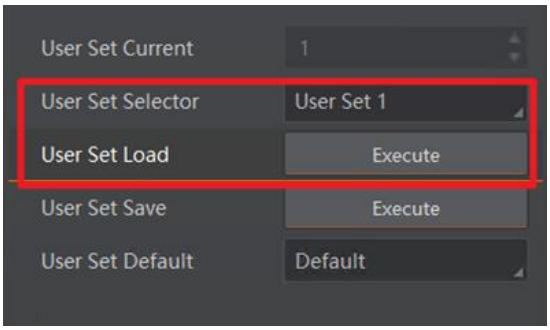


Figure 12-4 Load User Set

12.4.3 Set User Default

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

Note

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

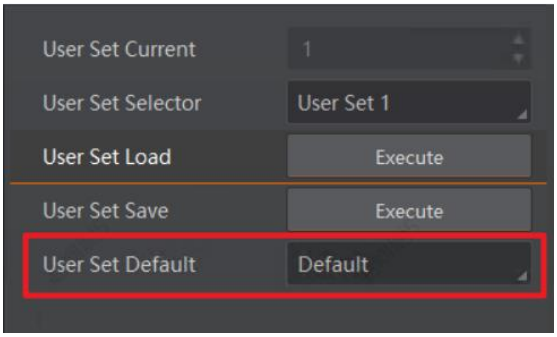


Figure 12-5 Set User Default

12.5 File Access Control

Note

- The file access control function may differ by device model.
- Importing and exporting the device feature among the same model of devices and same firmware versions are supported.

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

Steps

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

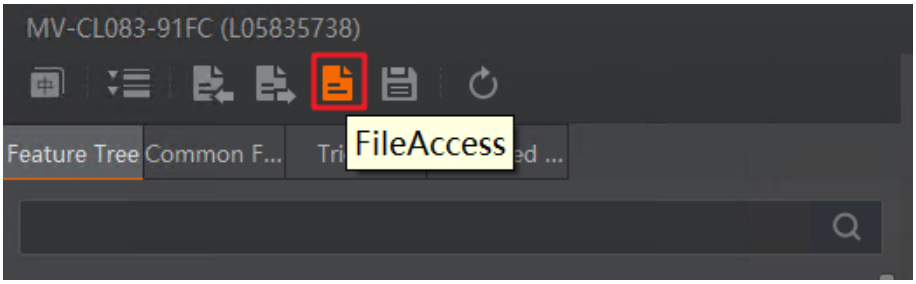


Figure 12-6 File Access

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

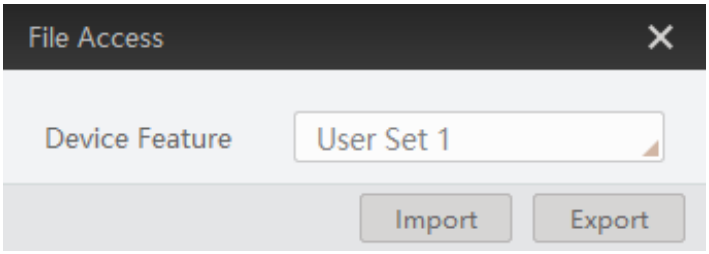


Figure 12-7 Import or Export

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

Note

- If User Set 1/2/3 is selected as device feature, you need to load the corresponding user set you selected to take effect.
- If LUT Luminance 1/2/3 is selected as device feature, and they will take effect only when you select the same parameters in LUT Selector.
- USER PRNUC 1/2/3 has the same mechanism with LUT Luminance 1/2/3 mentioned above.
- If USER FPNC 1/2/3 is selected as device feature, and they will take effect immediately when **FPNC User Enable** is enabled.
- If License Notice is selected as device feature, and it will take effect immediately when it is imported.

12.6 Firmware Update

You can use the **Firmware Upgrade Tool** to update the device's firmware.

Note

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

Steps

1. Go to **Tool** → **Toolkit** to open MVS Tool Kit.

2. Go to **All** → **Configuration Tool** → **Firmware Upgrade Tool** after running MVS Tool Kit.
3. Select **Camera** from **Select Type**.
4. The tool automatically refreshes and enumerates all the devices searched by the frame grabber.
5. Click to select firmware upgrade package (dav file).
6. Click **Update** to start updating.

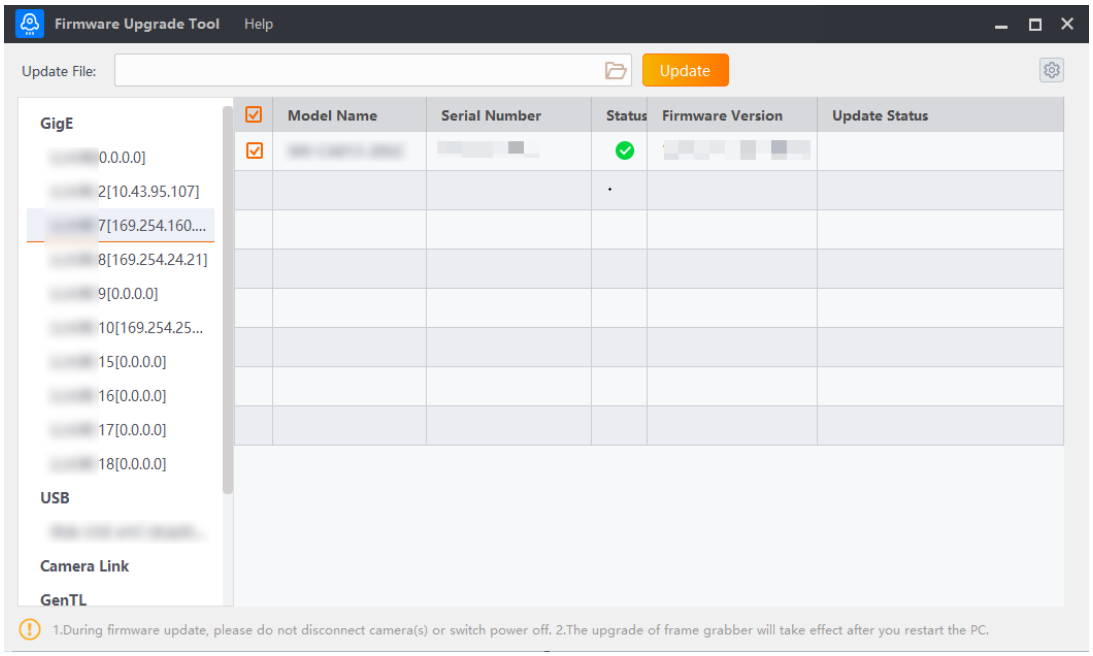


Figure 12-8 Update Firmware

Note

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

Chapter 13 FAQ (Frequently Asked Question)

13.1 Why the client software cannot list devices?

Table 13-1 Question 1

Possible Cause	Solution
The device is not powered on.	Check the device's power supply by observing the device LED indicator.
Connection of optical fiber patch cord exception occurs.	Check connection of optical fiber patch cord.

13.2 Why the live view is black?

Table 13-2 Question 2

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

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

Table 13-3 Question 3

Possible Cause	Solution
The trigger mode is not enabled.	Enable the trigger mode and make sure that the selected trigger source matches with the corresponding I/O signal.
Incorrect trigger wiring.	Check wirings of different trigger modes.

13.4 Why images required by algorithm cannot get although the live view and trigger signal are normal?

Table 13-4 Question 4

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

Chapter 14 Revision History

Table 14-1 Revision History

Version	Revision Date	Revision Details
V2.1.0	Aug. 16, 2025	● Edit Section ***Appearance***. ● Add Section ***Set Multi ISP***. ● Add Section ***Set Sequence***. ● Edit Section ***Set TDI Function***. ● Edit Section ***Set PRNUC Correction***. ● Edit Section ***Device Control***. ● Edit Section ***XoFLink Parameters***.
V2.0.0	Sep. 18, 2024	● Add Chapter Cleaning Instruction. ● Add Section Operating Principle. ● Edit Section Appearance. ● Edit Section Power and I/O Connector. ● Add Section Lens. ● Add Section Cable. ● Add Chapter Power Supply and Heat Dissipation. ● Edit Section Basic Operation of MVS Client Software. ● Edit Chapter Trigger Input and Output. ● Add Section Adjust Line Rate. ● Edit Section Set Pixel Format. ● Edit Section Set Binning. ● Edit Section Set Brightness. ● Edit Section Set Sensor Mode. ● Edit Section Set TDI Function. ● Edit Section Set Multiple Lights Control. ● Edit Section Device Parameter Index.
V1.4.0	Feb. 20, 2024	● Add Section Multiple Lights Control. ● Edit Section Set TDI Function.
V1.3.0	Dec. 11, 2023	● Edit Section Appearance. ● Edit Section Set Shading Correction.
V1.2.1	Oct. 12, 2023	Edit Section Appearance.
V1.2.0	Sep. 7, 2023	● Edit Section Appearance. ● Edit Section Basic Operation of MVS Client Software. ● Edit Section Set TDI Function. ● Add Section Set Supper Palette Control. ● Edit Section Set Shading Correction.
V1.1.0	Jul. 18, 2023	● Edit Section Appearance. ● Add Section Set Scan Mode. ● Edit Section Set and Execute Link Trigger.

Version	Revision Date	Revision Details
		● Edit Section Set TDI Function. ● Add Section Set Sensor Mode. ● Add Section Set Digital Noise Reduction. ● Edit Section Set Shading Correction.
V1.0.0	Feb. 13, 2023	Original version.

Appendix A Device Parameter Index

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 Firmware Version	
Device Serial Number	
Device User ID	
Device Revision	
Device Manifest Num	
Device Manifest Size	
Device Manifest Selector	
Device XML Version	
Device Schema Version	
Device Uptime (s)	
Board Device Type	
Device Reset	
Device Fan Enable	
Device Temperature Selector	
Device Temperature	
Link Temperature Selector	
Link Temperature	
Find Me	
Device PJ Number	

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	
Reverse X	Section *Set Image Reverse*
Direction Source	Section *Set Scan Direction*
Reverse Scan Direction	
Pixel Format	Section *Set Pixel Format*
Pixel Size	
Multi Light Control	Section *Set Multiple Lights Control*
Multi Exposure0 (us)	
Multi Gain0 (dB)	
Multi Exposure1 (us)	
Multi Gain1 (dB)	
Sequence Exposure Enable	Section *Set Sequence*
Sequence Exposure Number	
Sequence Exposure Selector	
Sequence Exposure Time(us)	
Sequence Exposure Gain	
Test Pattern Generator Selector	Section *Set Test Pattern*
Test Pattern	
Binning Selector	Section *Set Binning*
Binning Horizontal	
Binning Vertical	
TDI Mode	Section *Set TDI Function*

Sensor Mode Selector	Section *Set Sensor Mode*
Abnormal Line Enable	Section *Set Line Discard Function*
Line Rate Ratio	Section *Set Space Correction*
Pixel Shift	
Parallax Direction	

A.3 Acquisition and Transfer Control

Table A-3 Acquisition and Transfer Control

Parameters	Section
Acquisition Start	Section *Set Line Rate*
Acquisition Stop	
Acquisition Burst Frame Count	Section *Set Acquisition Burst Frame Count*
Acquisition Line Rate (Hz)	Section *Set Line Rate*
Acquisition Line Rate Control Enable	
Resulting Line Rate (Hz)	
Resulting Frame Rate (Fps)	
Scan Mode	Section *Set Scan Mode*
FrameTrigger Mode	Section *Trigger Input*
FrameTrigger Source	
FrameTrigger Activation	
Line Delay Enable	
FrameTrigger Delay	
FrameTrigger Cache Enable	
LineTrigger Mode	
LineTrigger Source	
LineTrigger Activation	
LineTrigger Delay	
LineTrigger Cache Enable	

Exposure Mode	Section *Set Exposure Mode*
Exposure Time (μs)	
Exposure Auto	
Auto Exposure Time Lower Limit (μs)	
Auto Exposure Time Upper Limit (μs)	
Frame Timeout Enable	Section *Set Frame Timeout*
Frame Timeout Time (μs)	
Partial Image Output Mode	
Device Connection ID	Section *XoFLink Parameters*
Master Host Connection ID	
Control Packet Max Size	
Device Stream Max Size	
LinkConfiguration	
LinkConfigurationPreferred	
ConnectionTestMode	
TestErrorCountSelector	
TestErrorCount	
TestPacketCountTx	
TestPacketCountRx	
TestPacketModeTx	
TestPacketGroupTx	
TestPacketValue	
Payload Size	Section *Transport Layer Control*
Image1StreamID	
Image2StreamID	

A.4 Advanced Processing

Table A-4 Advanced Processing

Parameters	Section
Preamp Gain	Section *Set Analog Gain*

Gain (dB)	
Digital Shift	Section ***Set Digital Gain***
Digital Shift Enable	
Brightness	Section ***Set Brightness***
Black Level	Section ***Set Black Level***
Black Level Enable	
Multi ISP Selector	Section ***Set Multi ISP***
Balance Ratio Selector2	
Balance Ratio2	
Balance White Auto	Section ***Set White Balance***
AWB Color Temperature Mode	
Balance Ratio Selector	
Balance Ratio	
Gamma	Section ***Set Gamma Correction***
Gamma Selector	
Gamma Enable	
Auto Function AOI Selector	Section ***Set AOI***
Auto Function AOI Width	
Auto Function AOI Height	
Auto Function AOI Offset X	
Auto Function AOI Offset Y	
Auto Function AOI Usage Intensity	
Auto Function AOI Usage White Balance	
Digital Noise Reduction Mode	Section ***Set Digital Noise Reduction***
Denoise Strength	
Noise Correct	
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	
Super Palette Enable	Section *Set Super Palette Control*
Super Palette Selector	
Super Palette Hue	
Super Palette Saturation	
LUT Selector	Section *Set LUT*
LUT Enable	
LUT Index	
LUT Value	
LUT Save	

A.5 Shading Correction

Table A-5 Shading Correction

Parameters	Section
User Flat Field Correction	Section *Set Shading Correction*
FPNC Flat Field Mode Selector	
PRNUC Flat Field Mode Selector	
PRNUC Width	
PRNUC Offset X	
PRNUC ROI Extension Enable	
PRNUC Target Enable	
PRNUC Target	
PRNUC Smooth Enable	
PRNUC LowPass Filter	
FPNC User Selector	
PRNUC User Selector	
FPNC Correction	

PRNUC Correction	
Correction State	
Flat Field Correction Tool	
CAC Enable	Section ***Set Color Abnormal Correction***
CAC Edge Threshold	

A.6 I/O Control

Table A-6 I/O Control

Parameters	Section
Line Selector	Section ***Trigger Output***
Line Mode	
Line Format	
Line Inverter	
Line Status	
Line Status All	
Line Debouncer Time (ns)	
Line Source	
Strobe Enable	
Strobe Source Selector	
Strobe Line Duration (μs)	
Strobe Line Delay (μs)	
Strobe Line Pre Delay (μs)	
Encoder Selector	Section ***Set and Execute Shaft Encoder Control***
Encoder Source A	
Encoder Source B	
Encoder Trigger Mode	
Encoder Counter Mode	
Encoder Counter	
Encoder Counter Max	
Encoder Counter Reset	

Encoder Max Reverse Counter	
Encoder Reverse Counter Reset	
Input Source	Section ***Set and Execute Frequency Converter Control***
Signal Alignment	
Trigger Line Rate(Hz)	
PreDivider	
Multiplier	
PostDivider	
Resulting Trigger Line Rate(Hz)	
Counter Selector	Section ***Enable Strobe Signal***
Counter Event Source	
Counter Event Activation	
Counter Reset Source	
Counter Reset	
Counter Value	
Counter Current Value	

A.7 User Set Control

Table A-7 User Set Control

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

HIKROBOT

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