Hikrobot Co., Ltd.

CoaXPress Area Scan Camera

User Manual

HIKROBOT

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

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

Available Model

This manual is applicable to the CoaXPress area scan camera.

Contact Information

Hangzhou Hikrobot Co., Ltd.
E-mail: global.support@hikrobotics.com
Website: ***https://en.hikrobotics.com/***

Contents

Chapter 1 Safety Instruction

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

1.1 Safety Claim

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

1.2 Safety Instruction

Caution:

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

1.3 Electromagnetic Interference Prevention

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

Chapter 2 Cleaning Instruction

2.1 Device and Lens Cleaning

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

Table 2-1 Device and Cleaning Method

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

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

Steps

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

Note

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

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

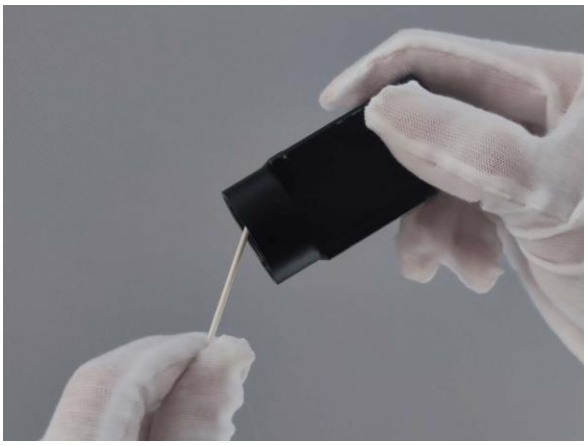


Figure 2-2 Contact Cleaning

Note

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

2.1.4 Lens Cleaning Paper

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

Before You Start

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

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

Figure 2-3 Cleaning by Lens Cleaning Paper

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 CoaXPress (CXP) area scan camera uses CoaXPress interface to transmit non-compressed images in real time, and it acquires images and sets parameters via client software or SDK based on CoaXPress frame grabber. It is applicable to electron semiconductor, PCB AOI, 3D application, motion capture, etc.

3.2 Key Feature

- Provides high dynamic range, Signal Noise Ratio (SNR), and high-quality image.
- Supports auto and manual adjustment for gain, exposure time, LUT, Gamma correction, etc.
- Adopts CoaXPress interface to transmit data.
- Compatible with CoaXPress Protocol and GenICam Standard.

Note

- The device functions may differ by models.
- For specific device functions, refer to the device's user manual.

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 CoaXPress protocol.

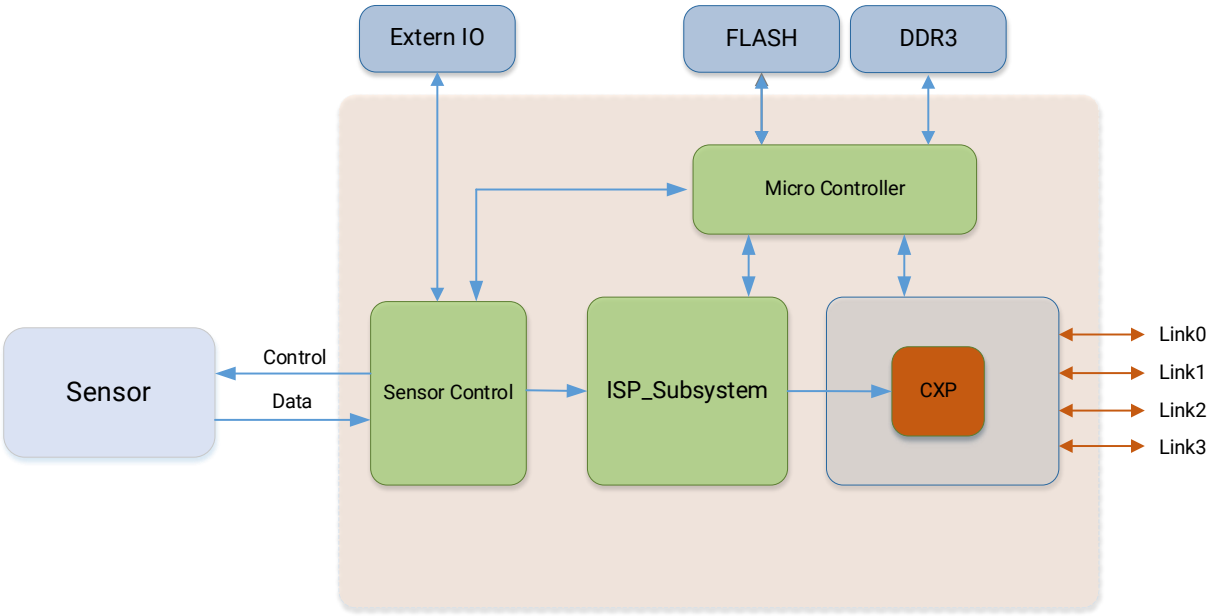


Figure 3-1 Operating Principle

Chapter 4 Device Hardware

4.1 Appearance

Note

- TEC stands for Thermo-Electric Cooler that is able to keep the device's sensor temperature around environment temperature to ensure the normal operation of the device.
- For specific appearance and dimension, refer to the device's specification for details.
- The appearance is subject to change, and the actual device you purchased shall prevail.

Refer to the table and figures below for the information and appearance of different device models.

Table 4-1 Appearance Description

Figure	Lens Mount	Cooling Fan	TEC	CXP Type
Figure 4-1, Type I Device	F-Mount	√	×	CXP-6
Figure 4-2, Type II Device	M58-Mount	√	×	CXP-6
Figure 4-3, Type III Device	M58-Mount	√	×	CXP-12
Figure 4-4, Type IV Device	M58-Mount	√	×	CXP-12
Figure 4-5, Type V Device	M58-Mount	×	×	CXP-6 & CXP-12
Figure 4-6, Type VI Device	M58-Mount	×	×	CXP-6 & CXP-12
Figure 4-7, Type VII Device	M72-Mount	√	×	CXP-6
Figure 4-8, Type VIII Device	M72-Mount	√	×	CXP-6
Figure 4-9, Type IX Device	M72-Mount	√	√	CXP-6
Figure 4-10, Type X Device	C-Mount	×	×	CXP-12
Figure 4-11, Type XI Device	C-Mount	×	×	CXP-12
Figure 4-12, Type XII Device	C-Mount	×	×	CXP-12
Figure 4-13, Type XIII Device	C-Mount	×	×	CXP-6 & CXP-12

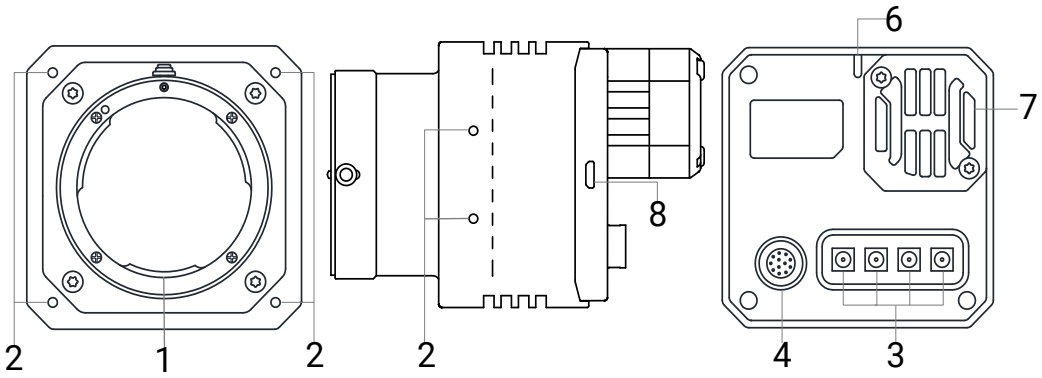


Figure 4-1 Appearance (Type I)

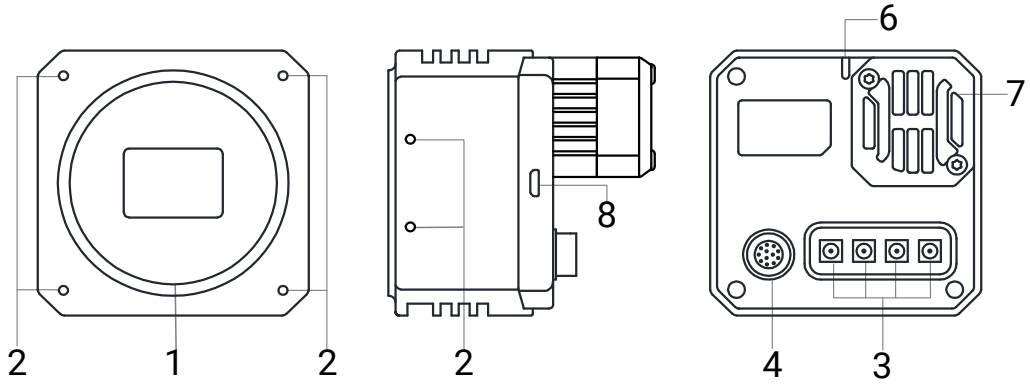


Figure 4-2 Appearance (Type II)

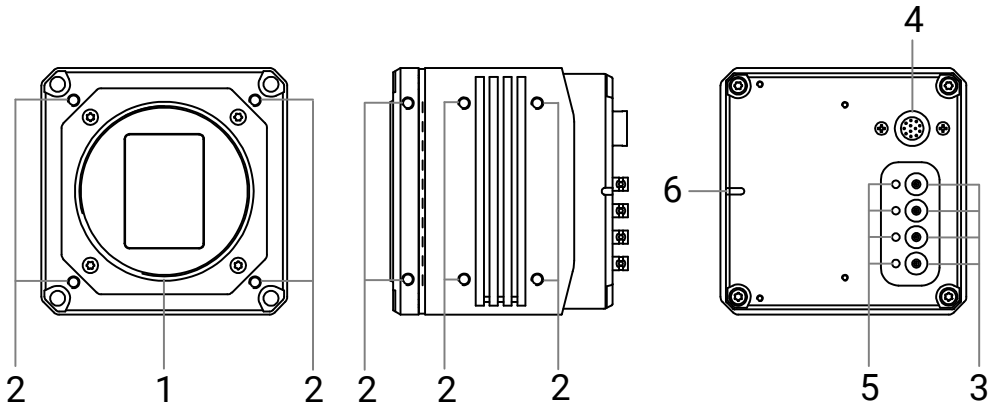


Figure 4-3 Appearance (Type III)

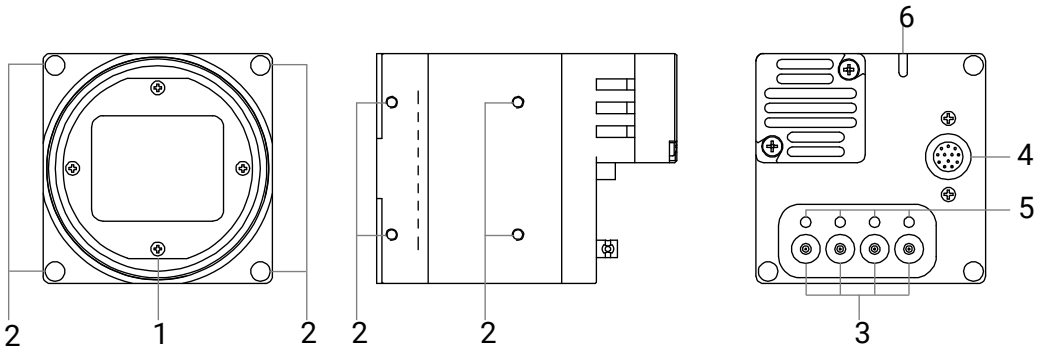


Figure 4-4 Appearance (Type IV)

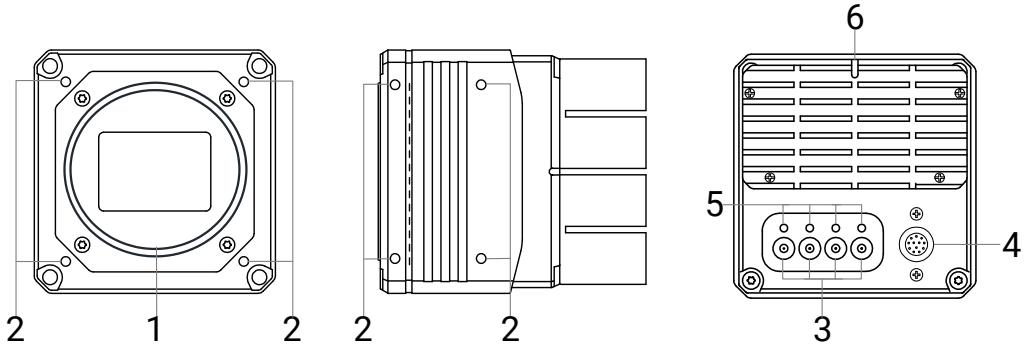


Figure 4-5 Appearance (Type V)

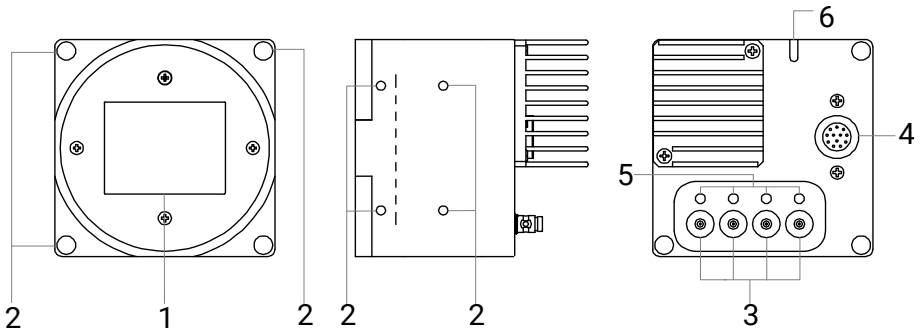


Figure 4-6 Appearance (Type VI)

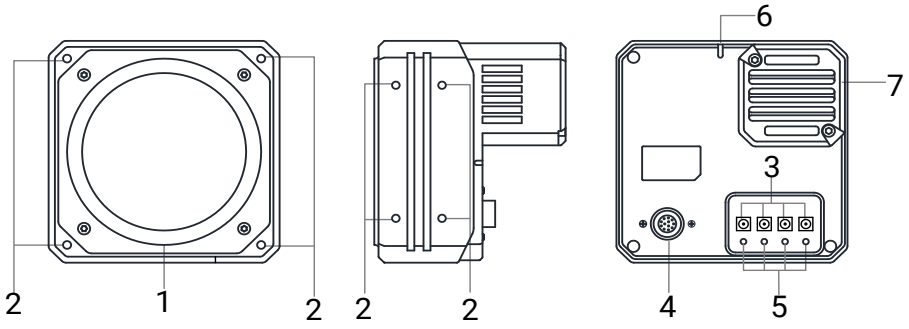


Figure 4-7 Appearance (Type VII)

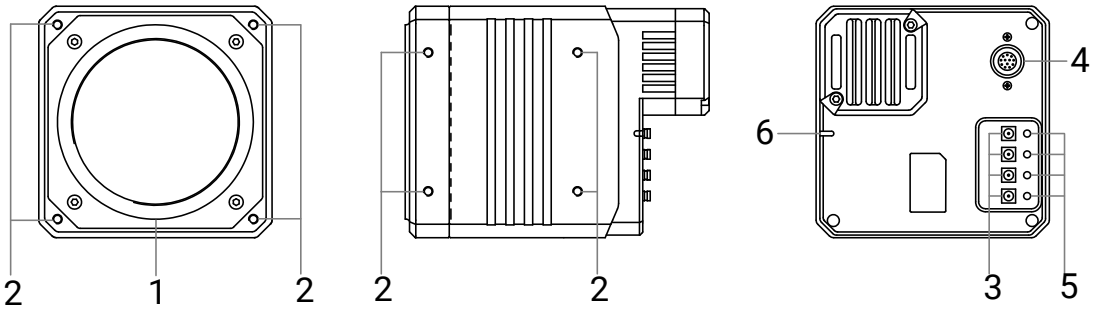


Figure 4-8 Appearance (Type VIII)

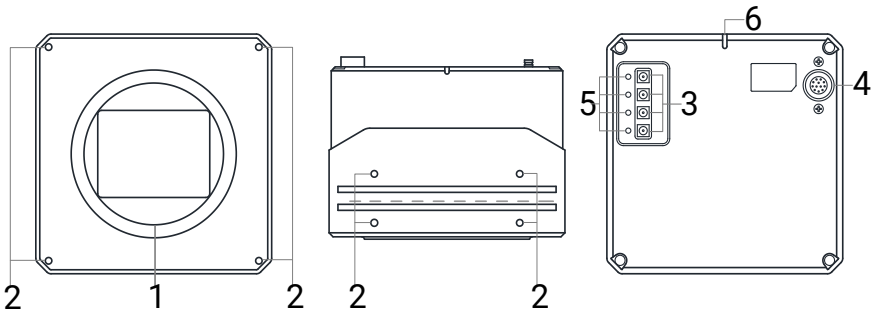


Figure 4-9 Appearance (Type IX)

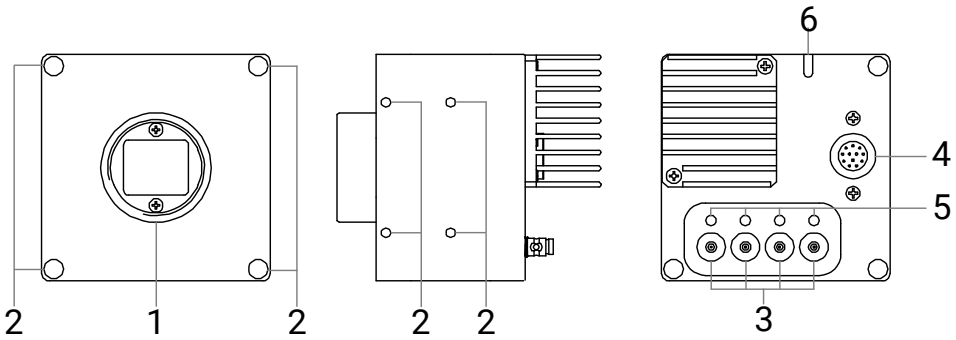


Figure 4-10 Appearance (Type X)

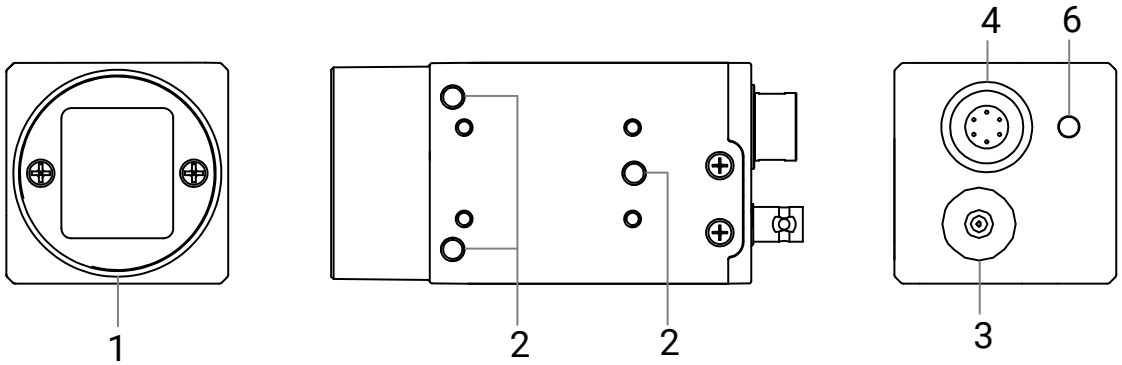


Figure 4-11 Appearance (Type XI)

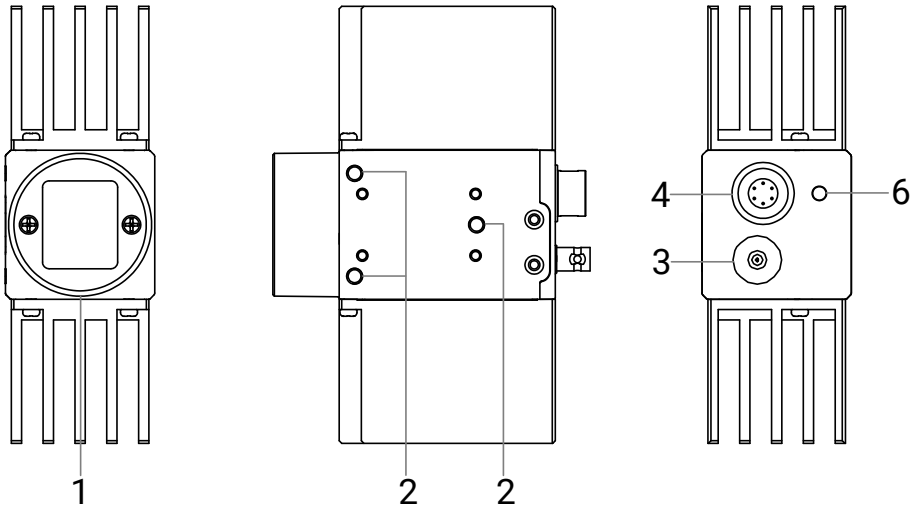


Figure 4-12 Appearance (Type XII)

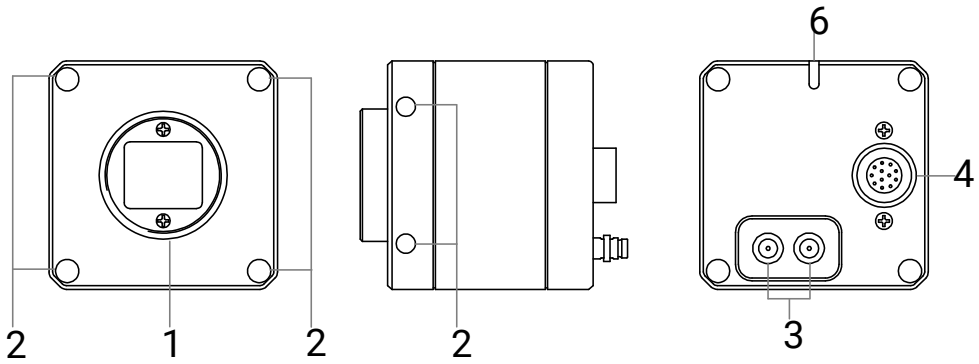


Figure 4-13 Appearance (Type XIII)

Table 4-2 Component Description

No.	Interface	Description
1	Lens Mount	It is used to install lens. Refer to the device's specification for details.
2	Screw Hole	It is used to fix the device to the installation position. The screws include M2, M3, M4, or M5. Refer to the device's specification for details.
3	CoaXPress Interface	It used for transmitting data. The device with CXP-6 interface supports DIN interface, and the device with CXP-12 interface supports Micro-BNC interface. The device has 1, 2, or 4 CoaXPress interface(s) on the back of the device. You can use 1, 2, or 4 CoaXPress cable(s). The data bandwidth varies with the number of interfaces. Refer to the device's specification for details.
4	Power and I/O	It provides power supply, I/O, and serial port function. It

No.	Interface	Description
	Connector	includes 6-pin P7 connector and 12-pin P10 connector. Refer to the device's specification and section ***Power and I/O Connector*** for details.
5	CoaXPress Linking Indicator	It indicates CoaXPress linking connection status via CoaXPress cable. It has 4 LEDs. See section ***CoaXPress Linking Indicator*** for details.
6	Device Indicator	It indicates the device's status. See section ***Device Indicator*** for details.
7	Cooling Fan or TEC	It is used to cool the device to ensure its normal operation.
8	USB Interface	It is used to update firmware.

4.2 Power and I/O Connector

The device has a 6-pin P7 connector or a 12-pin P10 connector serving as the power and I/O connector that provides power supply, I/O, and serial port function. Refer to the device's specification for details.

4.2.1 12-Pin P10 Connector

The 12-pin P10 connector and its definition are shown below.

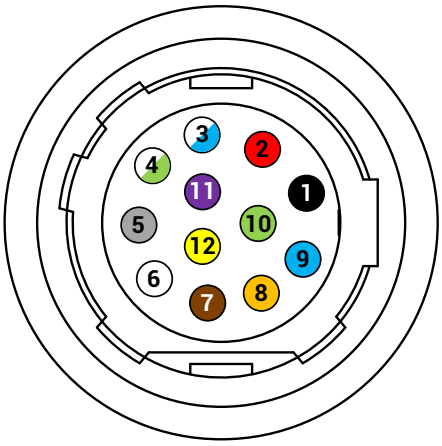


Figure 4-14 12-Pin P10 Connector

First Type of 12-Pin P10 Connector

The first type of 12-pin P10 connector can be used for Type I and Type II devices.

Table 4-3 Pin Definitions

No.	Color	Signal	I/O Signal Source	Description
1	Black	GND	Line 2-	Device power supply ground
2	Red	DC_PWR	--	Device power supply
3	White/Blue	--	--	NC
4	White/Green	--	--	NC
5	Gray	GND_IO	Line 0/1-	Opto-isolated signal ground
6	White	--	--	NC
7	Brown	--	--	NC
8	Orange	RS232_RXD	--	RS-232 receives
9	Blue	RS232_TXD	--	RS-232 transmits
10	Green	GPIO2	Line 2+	Configurable input/output
11	Purple	OPTO_OUT0	Line 1+	Opto-isolated output
12	Yellow	OPTO_IN0	Line 0+	Opto-isolated input

Note

- Refer to the table below and the label attached to the power and I/O cable to wire the device.
- The wire cores shown in figure and table are only the wire sequence and the corresponding wire core color of the cables sold by our company. If the cables are not purchased from our company, please refer to the actual wire sequence and the corresponding wire core color.

Second Type of 12-Pin P10 Connector

The second type of 12-pin P10 connector can be used for Type III, Type IV, Type V, Type VI, Type VII, Type VIII, Type IX, Type X, and Type XIII devices.

Table 4-4 Pin Definitions

No.	Color	Signal	I/O Signal Source	Description
1	Black	GND	Line 2-	Device power supply ground
2	Red	DC_PWR	--	Device power supply
3	White/Blue	DC_PWR	--	Device power supply

No.	Color	Signal	I/O Signal Source	Description
4	White/Green	OPT_IN-	Line 0-	Opto-isolated input signal ground
5	Gray	OPT_OUT-	Line 1-	Opto-isolated output signal ground
6	White	GND	--	Device power supply ground
7	Brown	GND	--	Device power supply ground
8	Orange	RS232_RXD	--	RS-232 receives
9	Blue	RS232_TXD	--	RS-232 transmits
10	Green	GPIO2	Line 2+	Configurable input/output
11	Purple	OPT_OUT+	Line 1+	Opto-isolated output
12	Yellow	OPT_IN+	Line 0+	Opto-isolated input

Note

- Refer to the table below and the label attached to the power and I/O cable to wire the device.
- The wire cores shown in figure and table are only the wire sequence and the corresponding wire core color of the cables sold by our company. If the cables are not purchased from our company, please refer to the actual wire sequence and the corresponding wire core color.

4.2.2 6-Pin P7 Connector

The 6-pin P7 connector can be used for Type XI and Type XII device, and its definition is shown below.

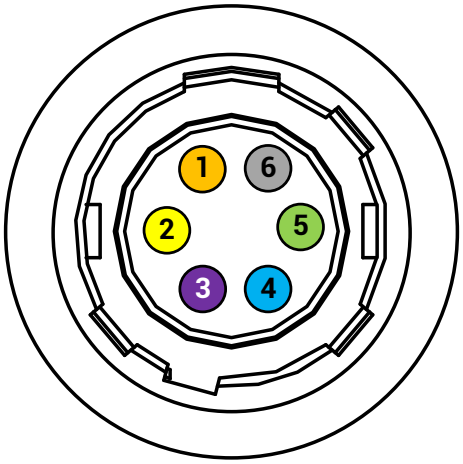


Figure 4-15 6-Pin P7 Connector

Table 4-5 Pin Definitions

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

Note

- Refer to the table below and the label attached to the power and I/O cable to wire the device.
- The wire cores shown in figure and table are only the wire sequence and the corresponding wire core color of the cables sold by our company. If the cables are not purchased from our company, please refer to the actual wire sequence and the corresponding wire core color.

4.3 Indicator

The device has different types of indicators with varied models, including device indicator and CoaXPress linking indicator.

Note

- When the indicator is flashing very rapidly, flashing rapidly, or flashing slowly, its unlit interval is 0.08 sec, 0.2 sec, and 1 sec respectively.
- Some device models do not have CoaXPress linking indicator. Refer to the device you purchased for actual conditions.
- During firmware upgrading, the indicators of some device models are unlit. Refer to the device you purchased for actual conditions.

4.3.1 Device Indicator

The device indicator is used to display different device statuses.

Table 4-6 Device Indicator

No.	Status	Description
1	Unlit	The device is powered off.

No.	Status	Description
2	Solid blue	There is no data transmission, or data transmission exception occurs after device starts up.
3	Rapid flashing blue	The device is acquiring images in continuous mode.
4	Slow flashing blue	The device is acquiring images in trigger mode.
5	Slow flashing blue and red in alternative	The device is updating its firmware.

4.3.2 CoaXPress Linking Indicator

The CoaXPress linking indicator is used to display CoaXPress linking connection status via CoaXPress cable.
For devices with CXP-6 interface, refer to the table below for the status of CoaXPress linking indicator.

Table 4-7 CoaXPress Linking Indicator (Devices with CXP-6 Interface)

No.	Status	Description
1	Unlit	No CoaXPress linking connected, or connection error occurs.
2	Solid green	CoaXPress linking is connected without data transmission, or data transmission error occurs.
3	Rapid flashing green	The device is acquiring images in continuous mode.
4	Slow flashing green	The device is acquiring images in trigger mode.

For devices with CXP-12 interface, refer to the table below for the status of CoaXPress linking indicator.

Table 4-8 CoaXPress Linking Indicator (Devices with CXP-12 Interface)

No.	Status	Description
1	Unit	The device is not powered on, CoaXPress wiring is incorrect, or linking is not locked.
2	Solid orange	The device system is starting.
3	Slow flashing red	The device is powered on, CoaXPress wiring is correct, and linking is locked, but the client software cannot list the device.
4	Solid green	The device is connected to the PC, but no data is being transferred.
5	Very rapid flashing	The device is acquiring images in continuous mode.

No.	Status	Description
	green	
6	Very rapid flashing orange	The device is connected to the PC, and data is being transferred.
7	Slow flashing orange	The device is acquiring images in trigger mode.

Note

For MV-CH250-20XM/C device, the CoaXPress linking indicator status of the device with CXP-6 interface is the same as that of the device with CXP-12 interface.

Chapter 5 Power Supply and Heat Dissipation

5.1 Device Power Supply

The device provides two ways of power supply: PoCXP power supply and external DC power supply.
When the external DC power supply and PoCXP power supply are executed at the same time, the DC power supply takes priority. If the DC power supply is disconnected, the device will switch to PoCXP power supply and may restart.

5.1.1 PoCXP Power Supply

The device will be powered via Power over CoaXPress (PoCXP). The number of power supply channels depends on the device model. Please refer to the actual one you got.

5.1.2 DC Power Supply

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

Note

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

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 is evenly distributed. If the on-site installation environment can add some heat dissipation measures, the temperature of electronic components can be reduced, and the image quality and reliability of the device can be further improved.

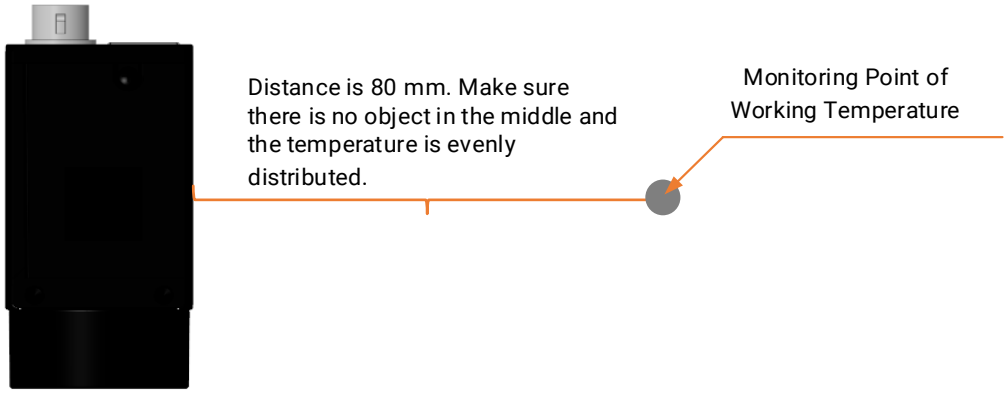


Figure 5-1 Monitoring Point of Working Temperature

Housing Temperature

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

The temperature of the device's housing will gradually rise during the heat dissipation process, and when the thermal equilibrium state is finally reached, the temperature tends to be stable. Therefore, we often feel that the device's housing has a certain temperature, or feel hot, which is a normal phenomenon of device heat dissipation.

Some components inside the device have done heat conduction measures to guide the heat to the housing to ensure that the temperature of the components meets the specification requirements, which also leads to a higher local temperature of the housing.

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

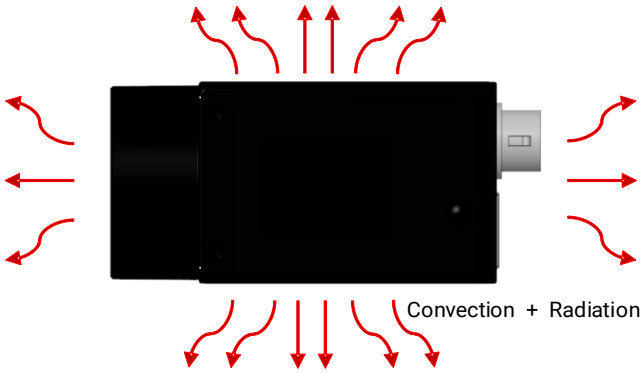


Figure 5-2 Housing Temperature

5.2.2 Heat Dissipation Measures

Heat Dissipation via Installation Part

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

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

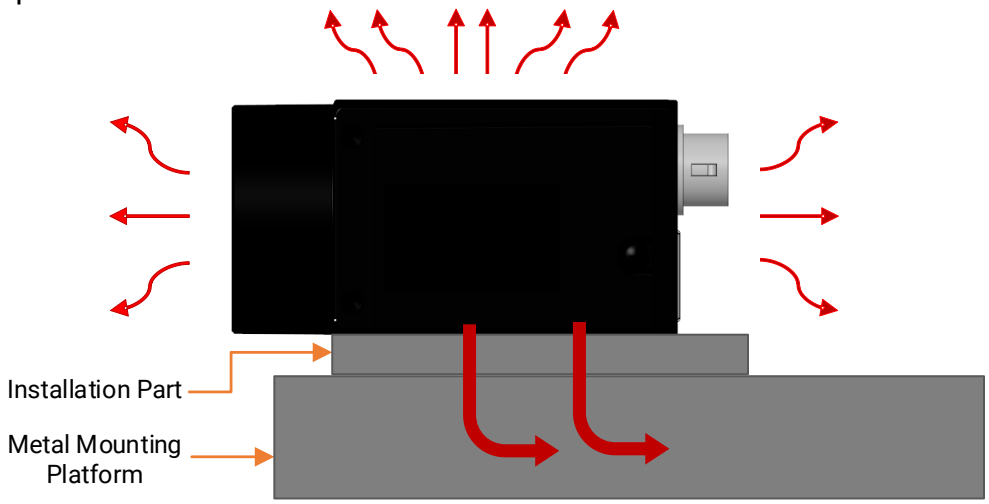


Figure 5-3 Heat Dissipation via Installation Part

- **Installation Part Material**
  - Use materials with high heat conduction, such as aluminum and copper, which can quickly transfer heat away.
  - 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.

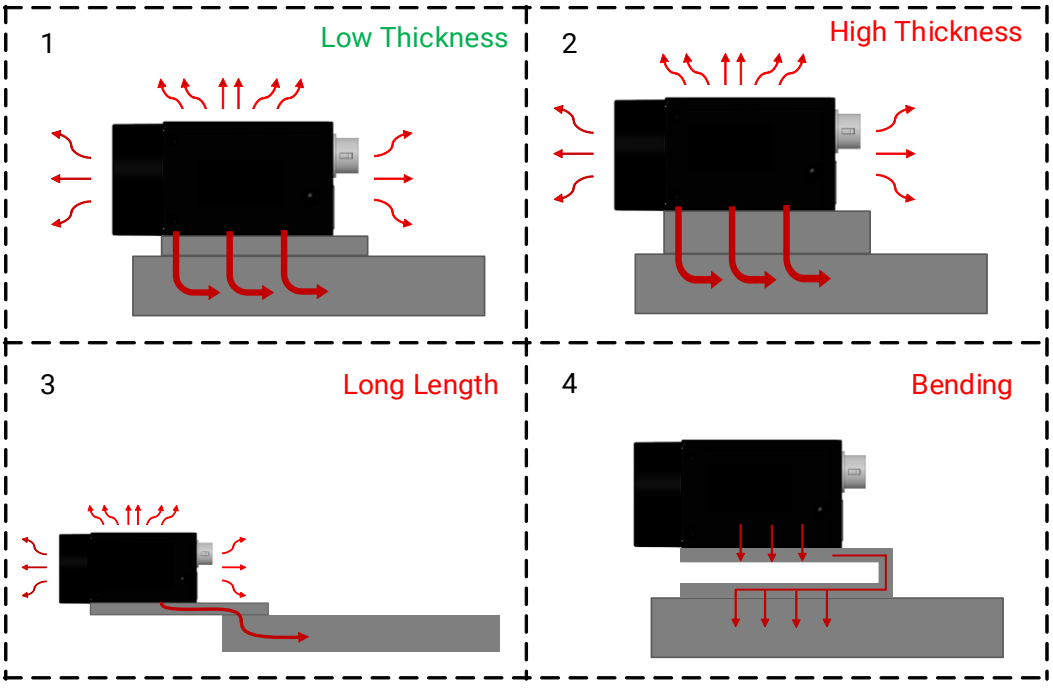


Figure 5-4 Heat Conduction Path of Different Installation Methods

- **Installation Part Section**

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

possible to increase the cross section of the device heat conduction path and strengthen the heat conduction.

- **Contact Area**
  Surface contact should be used 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.

Heat Dissipation via Cooling Fan

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

5.2.3 Low Heat Conduction Material

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

- Increase the surface area of the installation part.
  If the installation part is in good contact with the device, it can be regarded as a part of the device's housing. The larger the heat dissipation area of the housing, the better the heat dissipation effect. Therefore, the larger the surface area of the installation part, the better the heat dissipation effect.
- The installation part can be made into a metal heat dissipation tooth shape, or a large area flat plate to improve the heat dissipation effect.

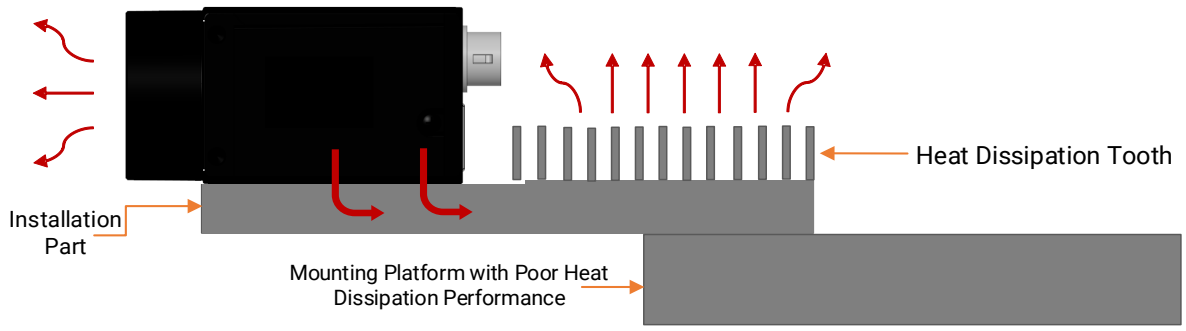


Figure 5-5 Add Heat Dissipation Tooth

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

Chapter 6 Accessories

6.1 Lens

6.1.1 Lens Mount

The device supports standard C-mount, M58-mount, M72-mount, and F-mount lenses. The thread depth of the C-mount lens is not less than 7 mm, and the thread depth of the M58-mount and M72-mount lenses is not less than 5 mm.

6.1.2 Lens Selection

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

- Lens mount: The device supports standard C-mount, M58-mount, M72-mount, and F-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 CoaXPress cable, attention should be paid to the application requirements of scenarios such as high-frequency communication and high-frequency motion. In such scenarios, if the cables are arranged in an inappropriate manner, various problems may be caused in use, such as cable skin wear, internal conductor breakage, and device packet loss. Based on the above situation, this section introduces the basic wiring principles and precautions of sports cables to help you install and use related products correctly and improve the overall healthy operating life of the system.

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

below.

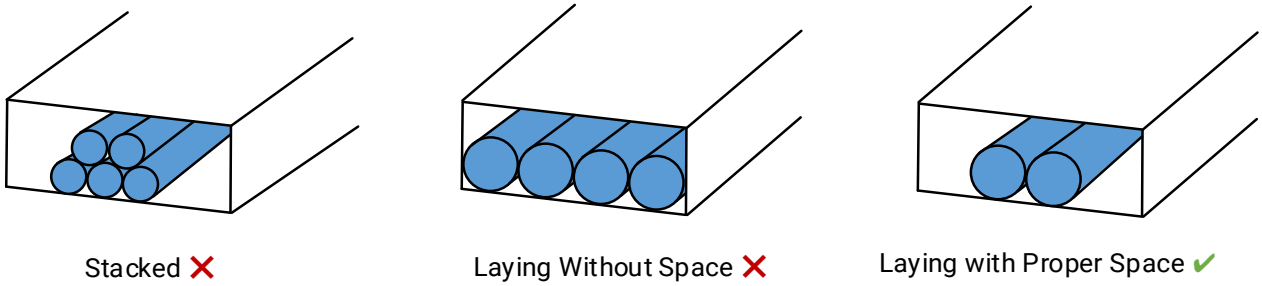


Figure 6-1 Cable Laying

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

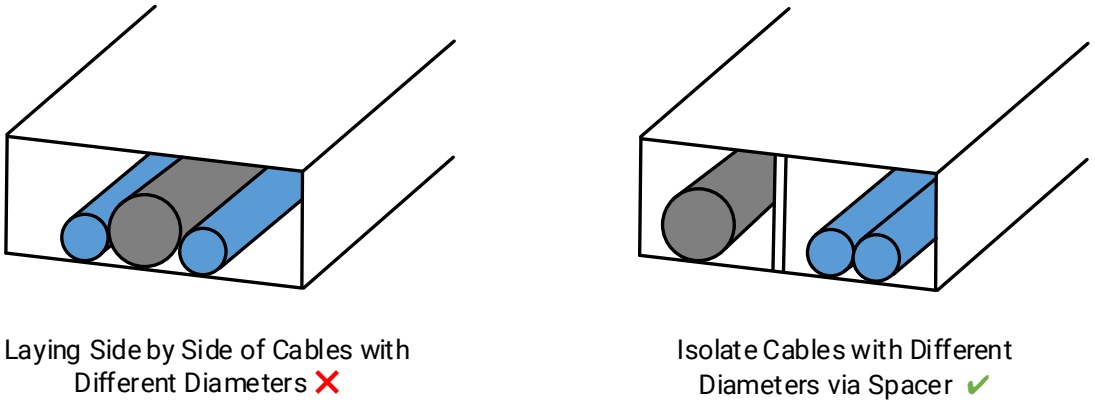


Figure 6-2 Isolated via Spacer

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

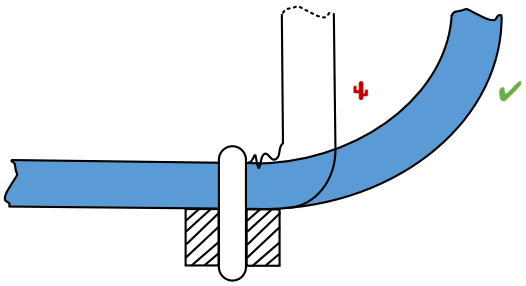


Figure 6-3 Vertically Bended Prohibited

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

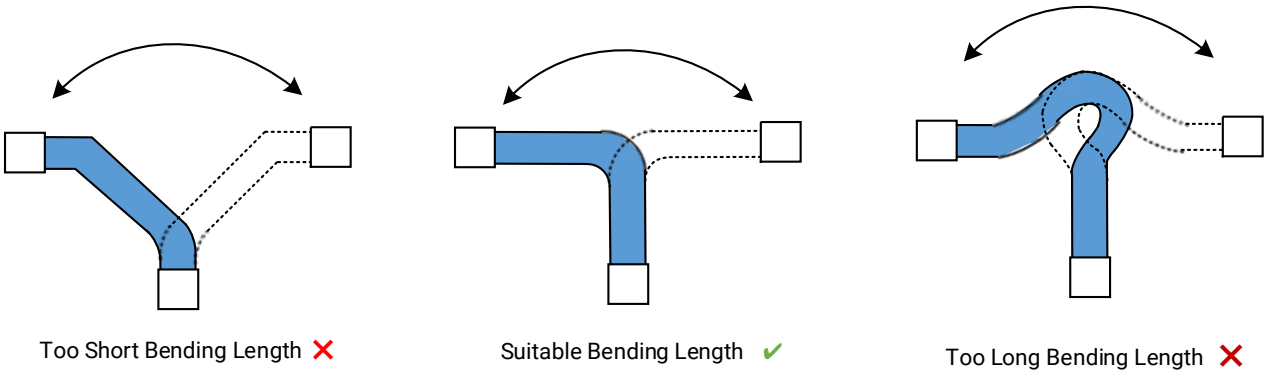


Figure 6-4 Suitable Bending Length

- Please keep a sufficient bending radius.

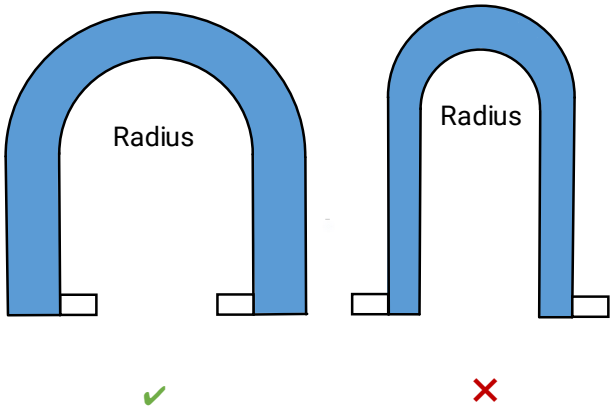


Figure 6-5 Sufficient Bending Radius

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

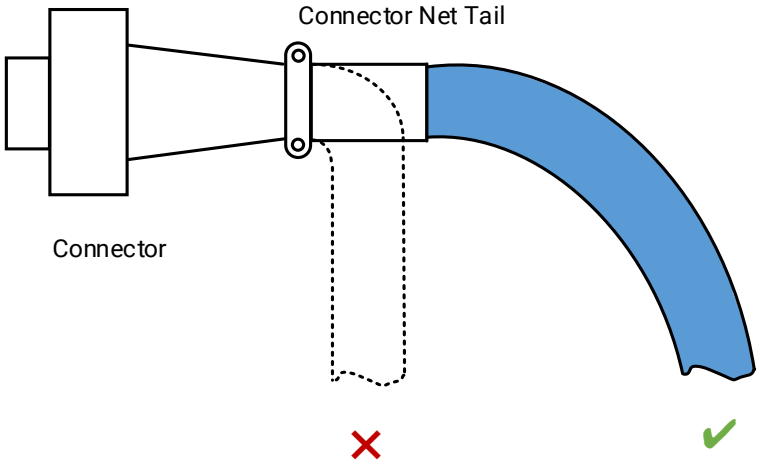


Figure 6-6 Assemble Connector

- Do not bind cables of different diameters together.

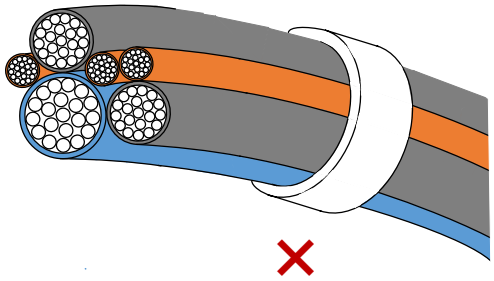


Figure 6-7 Improper Binding

Chapter 7 Quick Start Guide

The overall workflow of using the device is shown below:

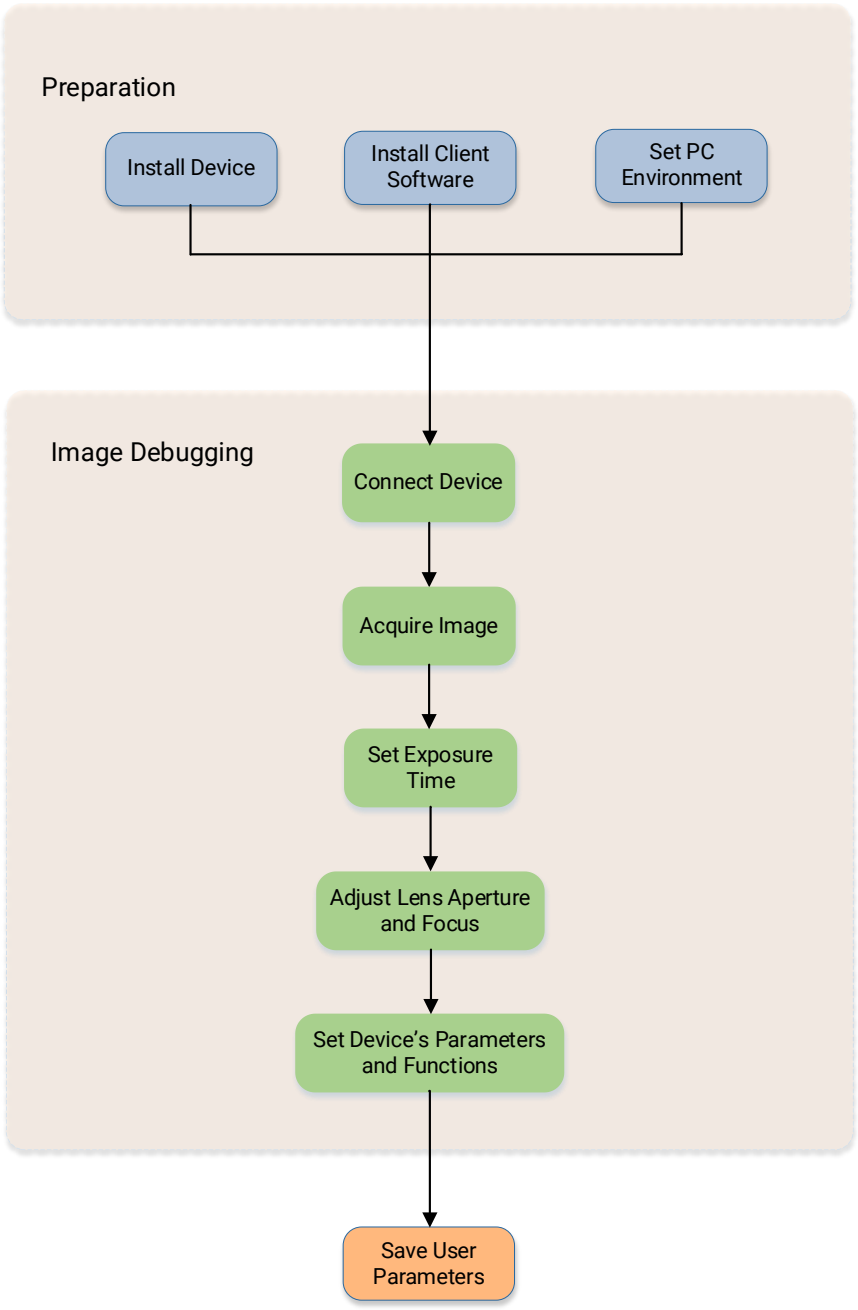


Figure 7-1 Workflow

7.1 Device Installation

7.1.1 Installation Preparation

You need to prepare following accessories before device installation.

Table 7-1 Accessories

No.	Name	Quantity	Description
1	Frame Grabber	1	It refers to the CoaXPress frame grabber that you need to purchase separately. It is recommended to use the frame grabber sold by our company.
2	Power and I/O Cable	1	It refers to the 12-pin power and I/O cable that you need to purchase separately.
3	DC Power Supply	1	It refers to suitable power adapter that you need to purchase it separately.
4	CoaXPress Cable(s)	1/2/4	It refers to the CXP-6 or CXP-12 cable. You can use 1/2/4 CoaXPress cable(s) to transmit data. You need to purchase separately in accordance with device's CoaXPress interface type, cable protocol, and frame grabber model.
5	Lens	1	You need to purchase separately in accordance with device's lens mount.
6	Lens Adapter	1	If other lens are used, you need to purchase the lens adapter separately.
7	Heat Sinks	Several	For some device models, you need to purchase the heat sinks separately.

Note

In order to ensure the normal operation of the device, you need to make sure that the output voltage of DC power supply or power adapter is between 12 V and 24 V.

7.1.2 Install Device

The topology diagram of the device is shown below.

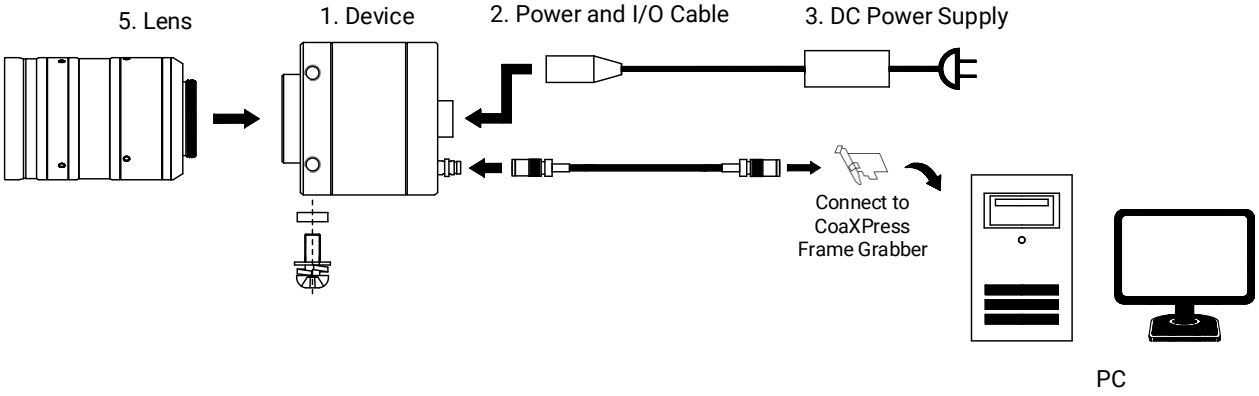


Figure 7-2 Topology Diagram

Note

The topology diagram is for reference only.

Before You Start

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

Steps

1. Fix the device to the installation position.
2. Install the lens to the device body.
3. Connect the device to CoaXPress frame grabber via CoaXPress cable(s).
4. Connect the device to an applicable power adapter via 12-pin power and I/O cable.

Note

- When fixing the device to the installation position, measures such as heat dissipation via the installation part or heat dissipation via the cooling fan can be taken to improve the heat dissipation efficiency of the device. Refer to section ***Heat Dissipation Measures*** for details.
- The device has 2 or 4 CoaXPress interfaces, and it can transmit data via 1, 2, or 4 CoaXPress cable(s). The data bandwidth and device interface vary with the number of interfaces.

Table 7-2 Interface Quantity and Device Interface

Used Interface Quantity	Device Interface	
1	CXP1	CXP0
2	CXP1, CXP2	CXP0, CXP1
4	CXP1, CXP2, CXP3, CXP4	CXP0, CXP1, CXP2, CXP3

7.2 Frame Grabber Software Installation

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

Get the frame grabber software installation package and driver package from frame grabber supplier, and install the frame grabber software and frame grabber driver accordingly. After installing, it is recommended to go to the PC's device manager to check if the installation is correct.

Note

- If the frame grabber driver is not installed correctly, the MVS client software cannot enumerate and find devices.
- Refer to the user manual of the frame grabber you purchased for frame grabber installation and operation.

7.3 Client Software Installation

MVS client software is used to connect and set device's parameters, and upgrade firmware.

Note

- The MVS client software is compatible with 32/64-bit Windows 7/10/11, 32/64-bit Linux, 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**.

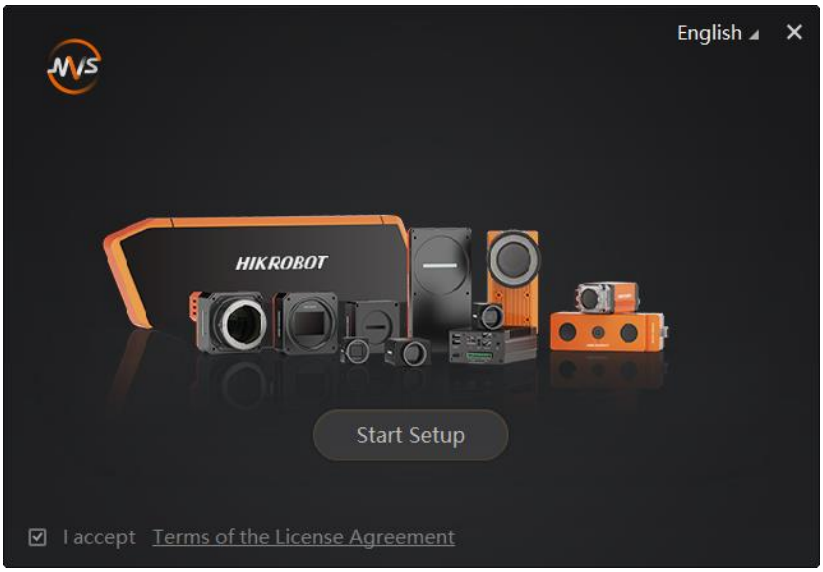


Figure 7-3 Installation Interface

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.

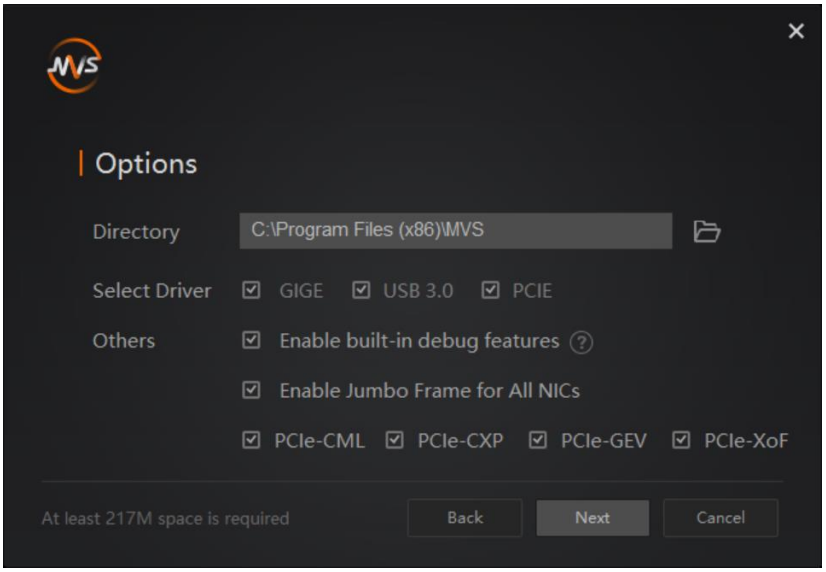


Figure 7-4 Installation Options

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.

7.4 Basic Operation

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

Note

- MVS client software of version 3.2.1 or above supports connecting CoaXPress devices.
- You can use either frame grabber software or MVS client software to set the device's parameters, but do not use them at the same time.
- Some manufacturers of the frame grabber do not support GenTL protocol or provide CTI file. You can use their frame grabber software to set the device's parameters or acquire images.
- Refer to the device's user manual and MVS's user manual for detailed operations.

Steps

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

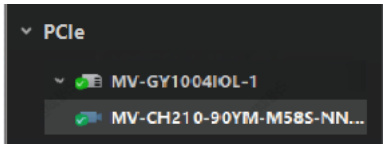


Figure 7-5 Connect Device

Note

The image is for reference only.

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

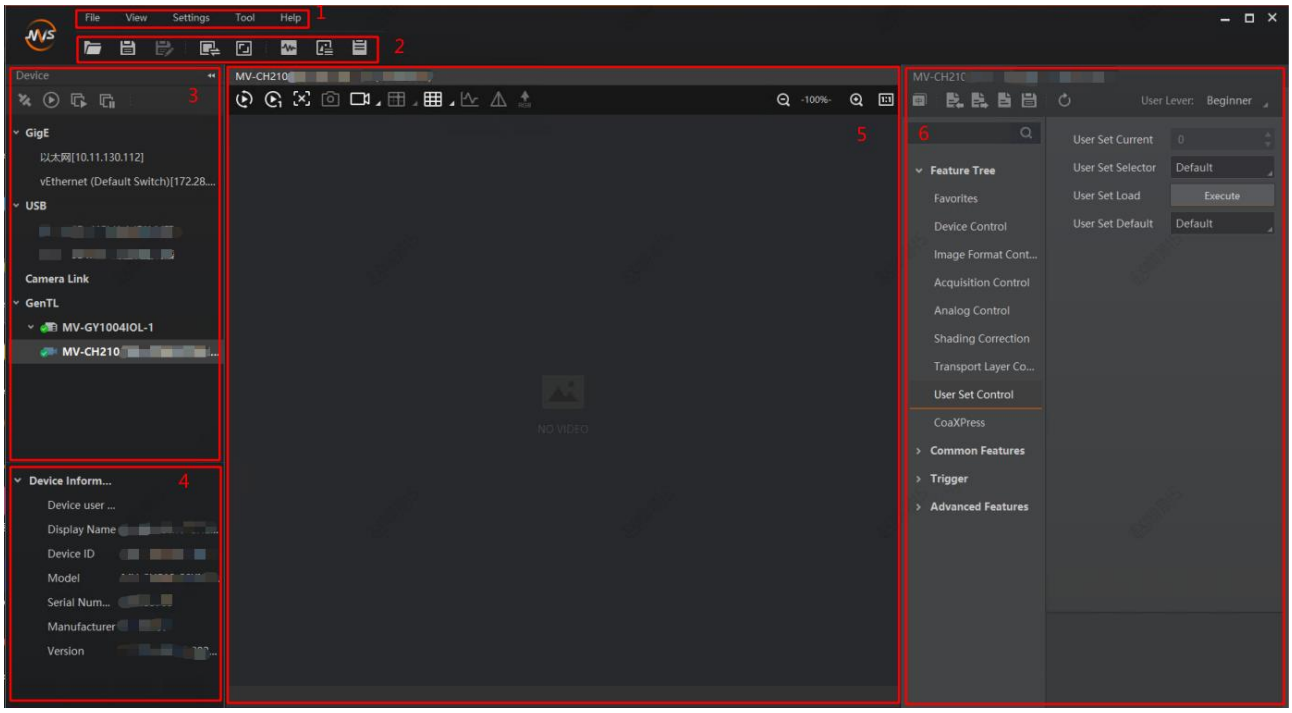


Figure 7-6 Main Window

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, modify device IP address, etc.
4	Device Information Panel	This panel displays the detailed device information.
5	Display Window	This area displays the acquisition images in real-time. You can click different icons to capture and save image, record, etc.
6	Feature Panel	You can view and set features of the selected device, and perform operations such as importing, exporting, and saving features.

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

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

Note

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

8. Go to **CoaXPress** → **LinkConfiguration** to set the device's Link configuration mode.

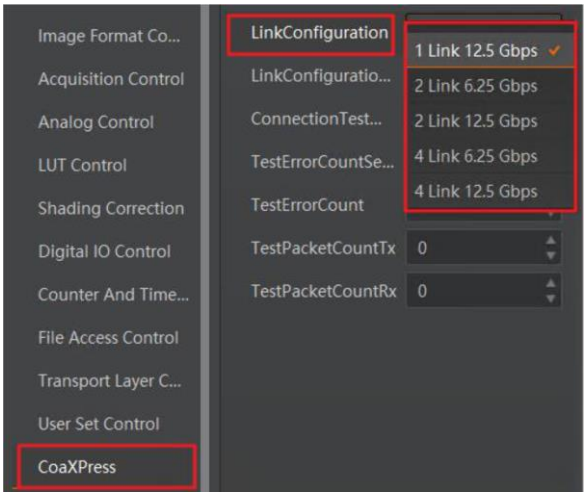


Figure 7-7 Link Configuration

Chapter 8 I/O Electrical Features and Wiring

8.1 I/O Electrical Features

8.1.1 Input Signal

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

Note

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

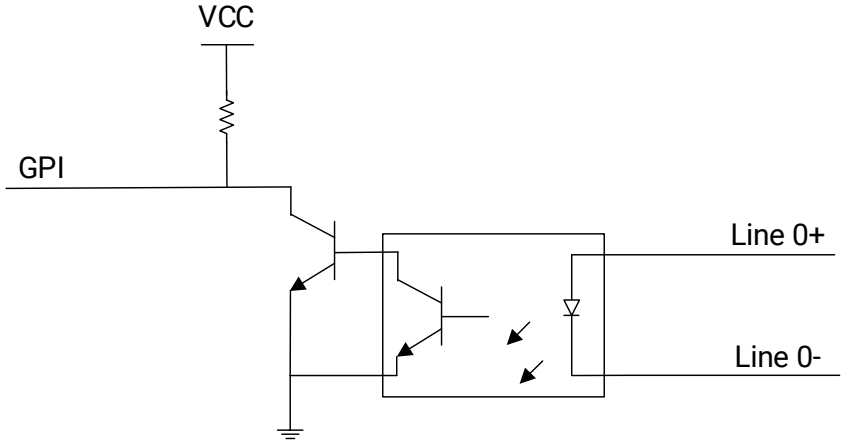


Figure 8-1 Internal Circuit of Input Signal

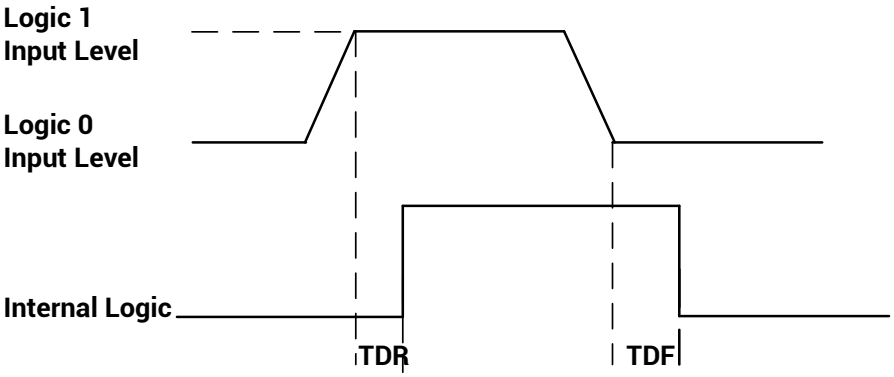


Figure 8-2 Input Logic Level

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

Table 8-1 Input Electrical Feature

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

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

Table 8-2 Input Electrical Feature

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

8.1.2 Output Signal

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

Note

The maximum output current of Line 1 is 25 mA.

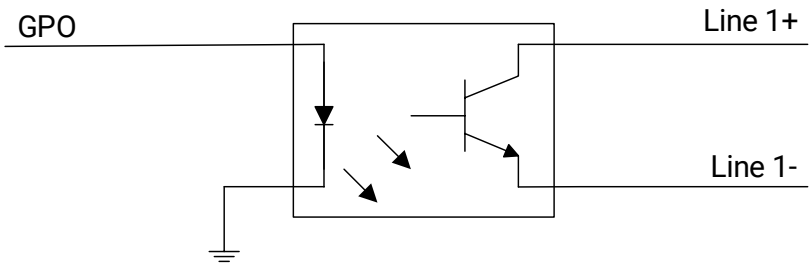


Figure 8-3 Internal Circuit of Output Signal

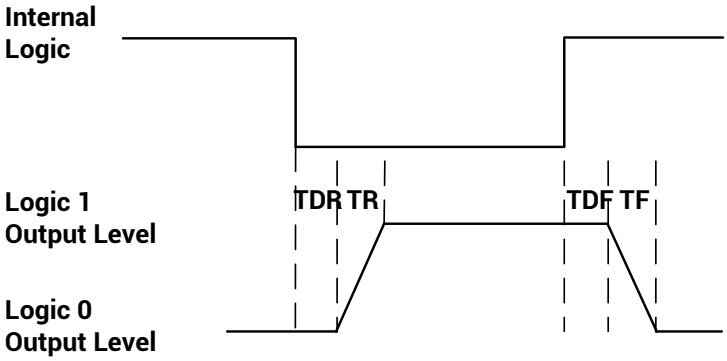


Figure 8-4 Output Logic Level

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

Table 8-3 Output Electrical Feature

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

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

Table 8-4 Output Electrical Feature

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

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

Table 8-5 Parameters of Output Logic Level Low

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

8.1.3 Bi-Directional Signal

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

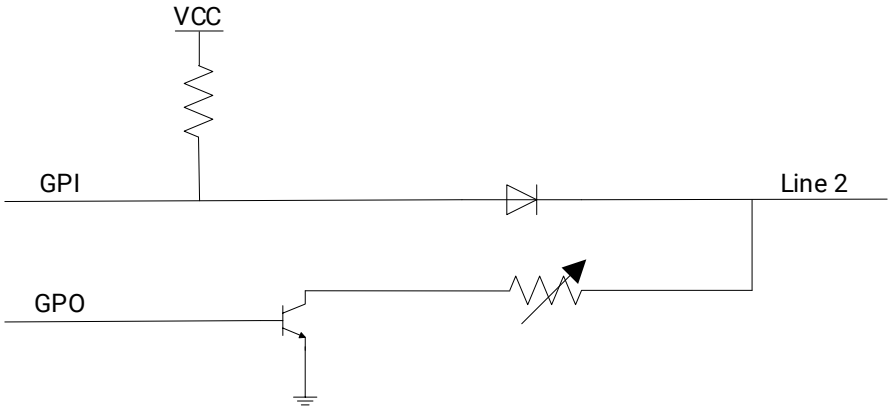


Figure 8-5 Internal Circuit of Bi-Directional Signal

Configured as Input Signal

Note

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

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

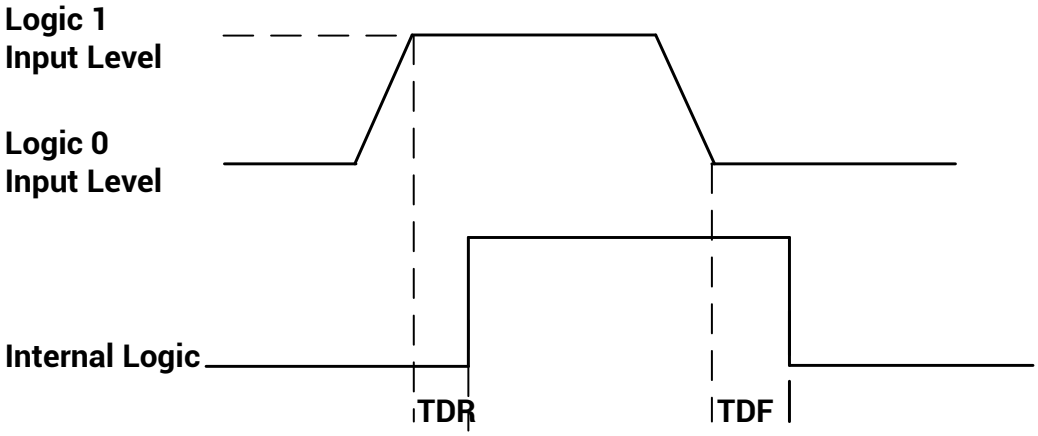


Figure 8-6 Input Logic Level

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

Table 8-6 Input Electrical Feature

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

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

Table 8-7 Input Electrical Feature

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

Configured as Output Signal

Note

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

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

Table 8-8 Parameters of Output Logic Level Low

External Voltage	External Resistance	VL (GPIO2)
3.3 VDC	1 KΩ	160 mV
5 VDC	1 KΩ	220 mV
12 VDC	1 KΩ	460 mV
24 VDC	1 KΩ	860 mV
30 VDC	1 KΩ	970 mV

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

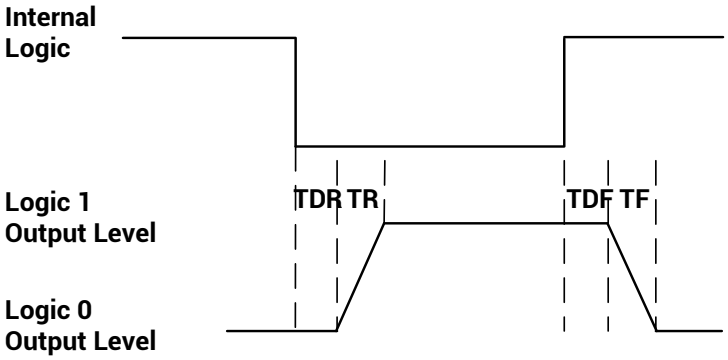


Figure 8-7 Output Logic Level

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

Table 8-9 Output Electrical Feature

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 VDC
Output Logic Level High	VH	7.8 VDC to 11.8 VDC
Output Rising Time	TR	0.46 μs to 0.9 μs
Output Falling Time	TF	42 ns to 70 ns
Output Rising Delay	TDR	500 ns to 600 ns
Output Falling Delay	TDF	24 ns to 42 ns

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

Table 8-10 Output Electrical Feature

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

8.1.4 Factors Affecting Transmission Delay of I/O Lines

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

Table 8-11 Factors Affecting Transmission Delay of I/O Lines

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

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

- Use the I/O circuit at the recommended working temperature of the device. See the device's datasheet for the working temperature.
- Applying current to the input and output circuits of the opto-coupler will accelerate the aging rate of the opto-coupler. Keep the current to a minimum level, and ensure a stable

transmission delay.

- In order to reduce the low-speed transmission delay, it is recommended to use an external I/O supply voltage of about 5 V.
- For a better quick trigger, use the recommended pull-up resistor.
- Generally, the trigger input-output frequency of an opto-coupler circuit rarely exceeds 10 kHz, and the trigger input-output frequency of a GPIO circuit rarely exceeds 1 MHz. Keep the trigger input-output frequency of the circuit within this range.
- If you need to reduce the transmission delay, it is recommended to use the GPIO line, which has a shorter transmission delay than the opto-coupler delay. But the GPIO line has the risk of burning out, so please use it with caution.
- The bounce of the trigger signal may cause the internal bounce of the device to increase. To avoid bounce, keep the edge of the trigger signal steep to reduce the internal bounce of the device (preferably less than 1 μs).

8.2 I/O Wiring

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

Note

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

8.2.1 Input Signal Wiring

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

Note

Input signal wiring may differ by the external device type.

PNP Device

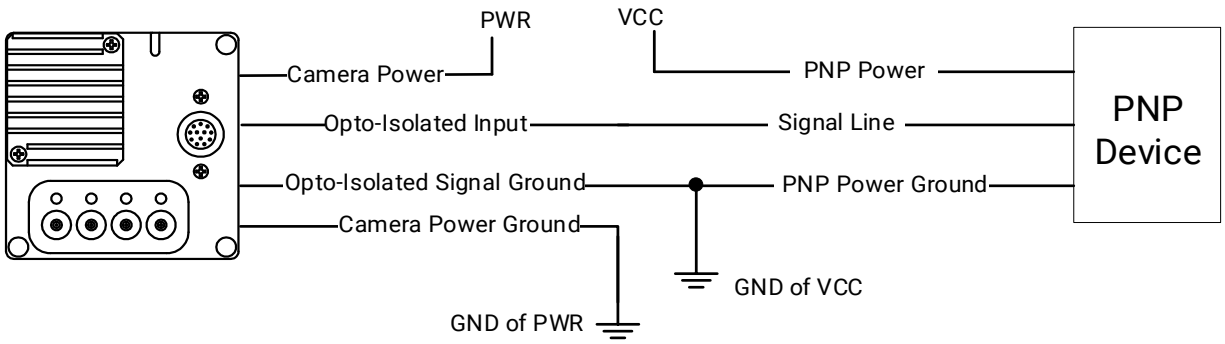


Figure 8-8 Input Signal Connects to PNP Device

NPN Device

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

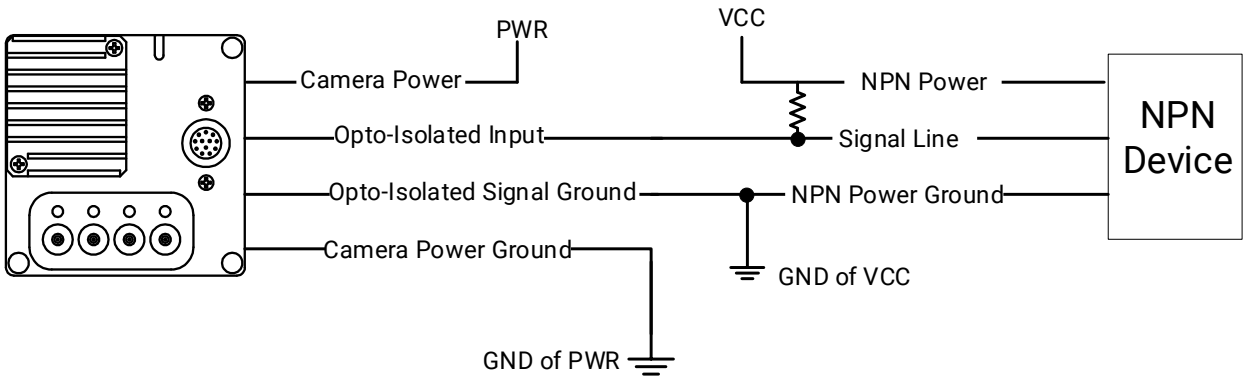


Figure 8-9 Input Signal Connects to NPN Device

Switch

If the VCC of switch is 24 VDC, it is recommended to use a 4.7 KΩ resistor to protect circuit.

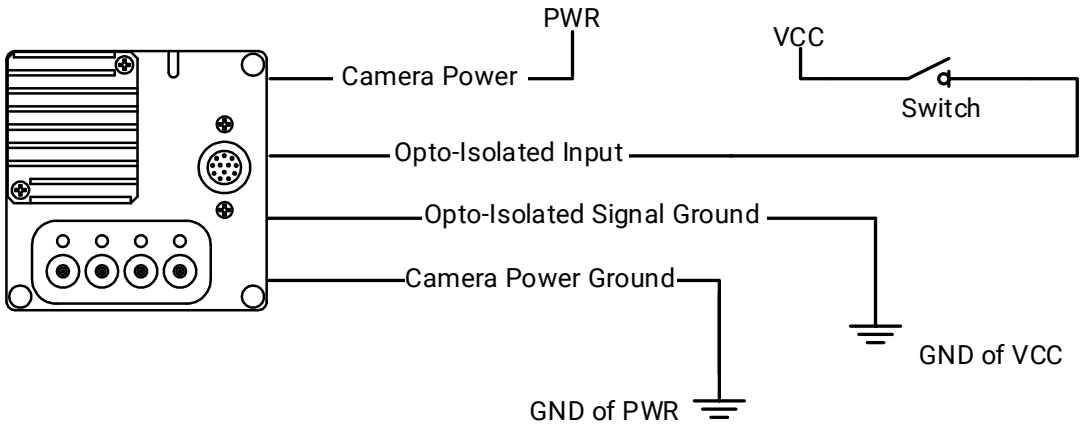


Figure 8-10 Input Signal Connects to Switch

8.2.2 Output Signal Wiring

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

Note

Output signal wiring may differ by the external device type.

PNP Device

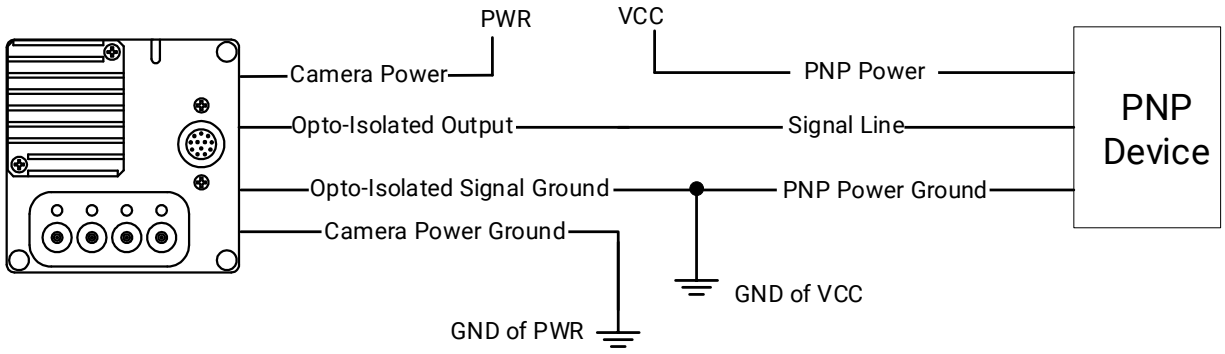


Figure 8-11 Output Signal Connects to PNP Device

NPN Device

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

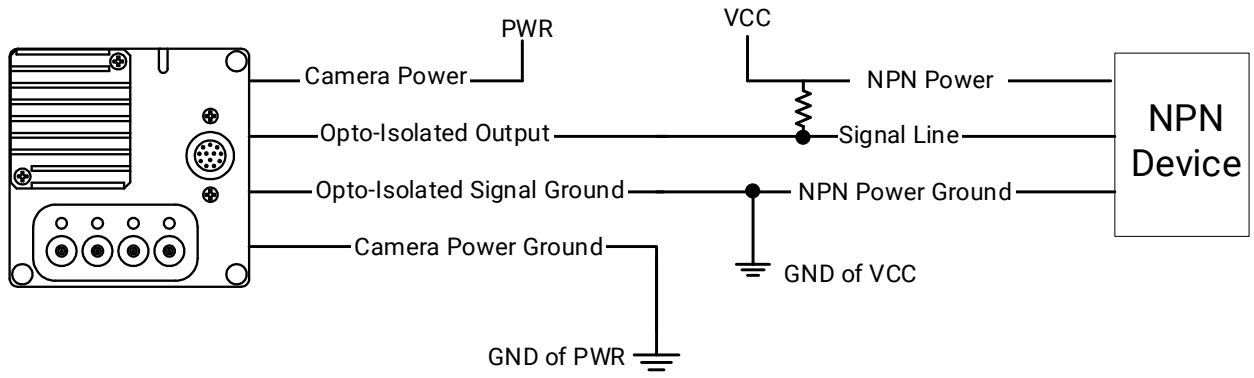


Figure 8-12 Output Signal Connects to NPN Device

8.2.3 Bi-Directional Signal Wiring

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

Configured as Input Signal

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

Note

Input signal wiring may differ by the external device type.

PNP Device

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

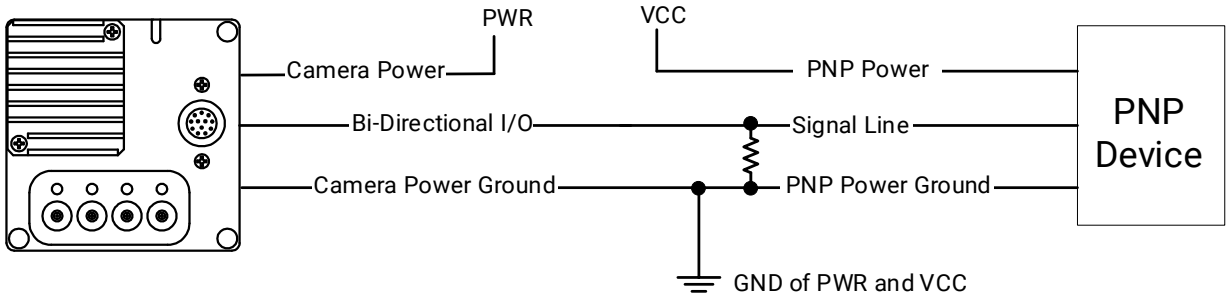


Figure 8-13 Input Signal Connects to PNP Device

Note

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

NPN Device

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

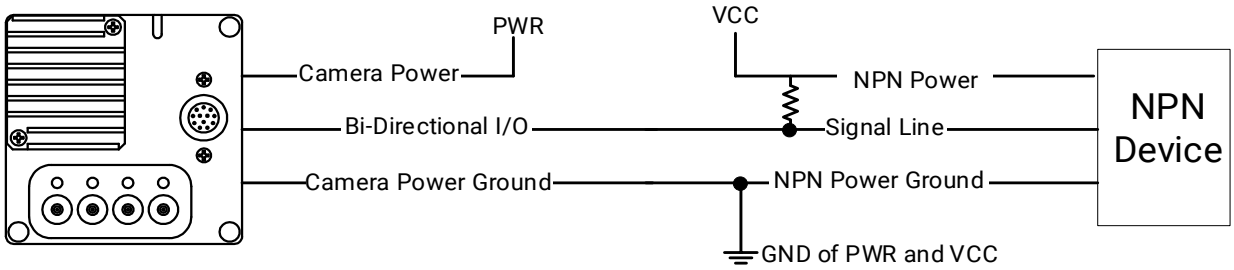


Figure 8-14 Input Signal Connects to NPN Device

Switch

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

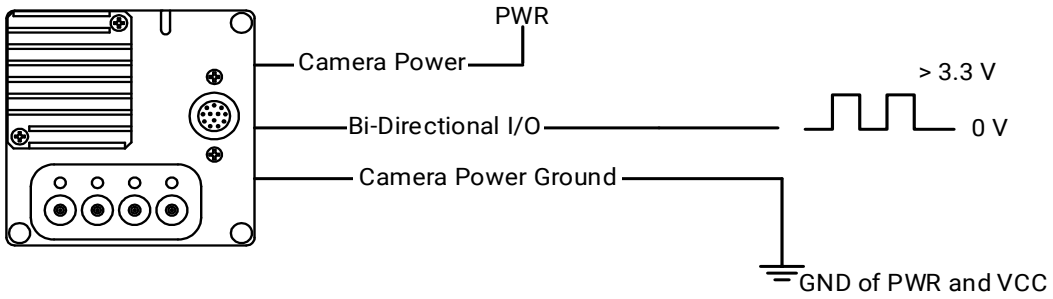


Figure 8-15 Input Signal Connects to Switch

Configured as Output Signal

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

Note

Output signal wiring may differ by the external device type.

PNP Device

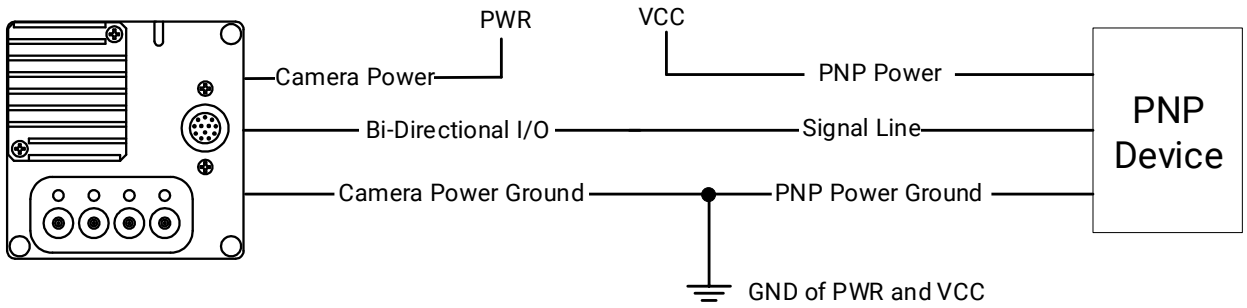


Figure 8-16 Output Signal Connects to PNP Device

NPN Device

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

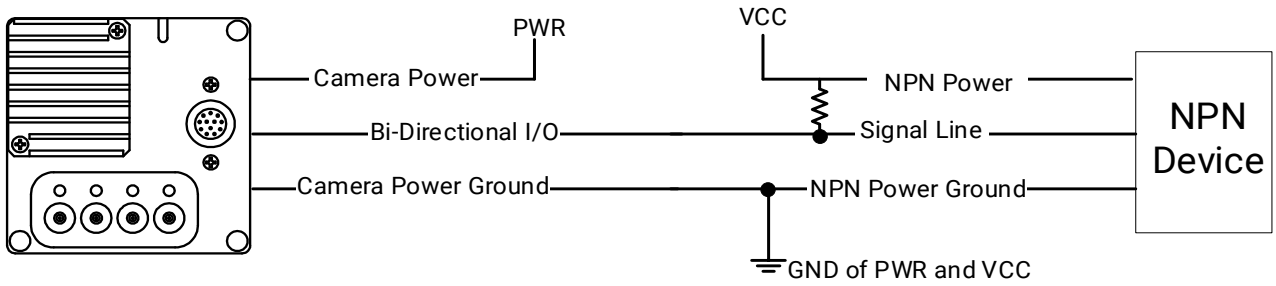


Figure 8-17 Output Signal Connects to NPN Device

Chapter 9 Trigger Input and Output

9.1 Trigger Input

9.1.1 Set Trigger Mode

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

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

Enable Internal Trigger Mode

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

Note

Off refers to the internal trigger mode.

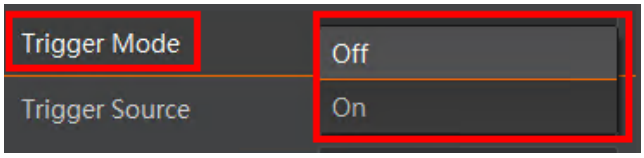


Figure 9-1 Enable Internal Trigger Mode

Enable External Trigger Mode

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

Note

On refers to the external trigger mode.

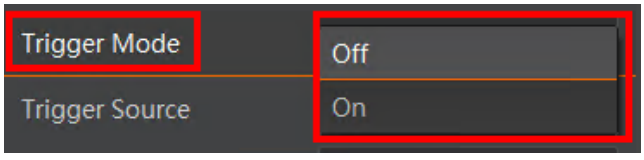


Figure 9-2 Enable External Trigger Mode

9.1.2 Set Trigger Source

External Trigger Source

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

Table 9-1 Trigger Source Description

External Trigger Source	Parameter	Description
Software Trigger	Software	The software sends trigger signal to the device via CoaXPress interface to acquire images.
Hardware Trigger	Line 0, Line 2	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.
Counter Trigger	Counter 0	The counter sends trigger signal to the device to acquire images.
Link Trigger	Link Trigger0	The frame grabber sends trigger signal to the device to acquire images.
Anyway	Anyway	The device can receive software trigger, hardware trigger, and link trigger to acquire images.

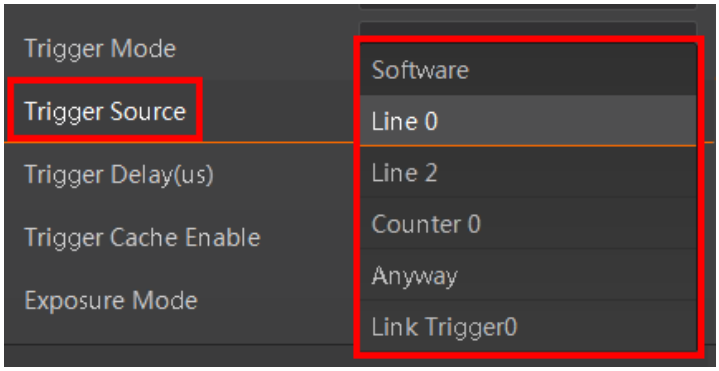


Figure 9-3 External Trigger Source

Note

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

Set and Execute Software Trigger

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

Steps

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

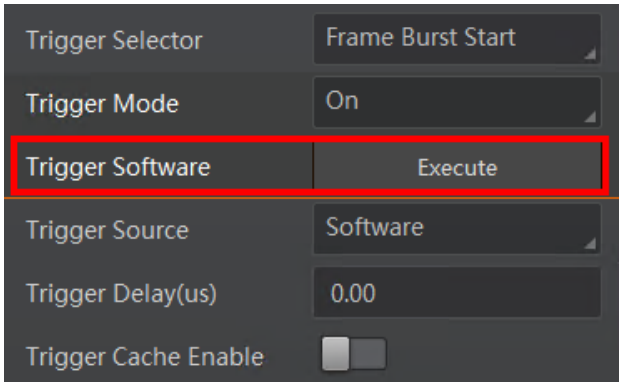


Figure 9-4 Set and Execute Software Trigger

Note

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

Set and Execute Hardware Trigger

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

Steps

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

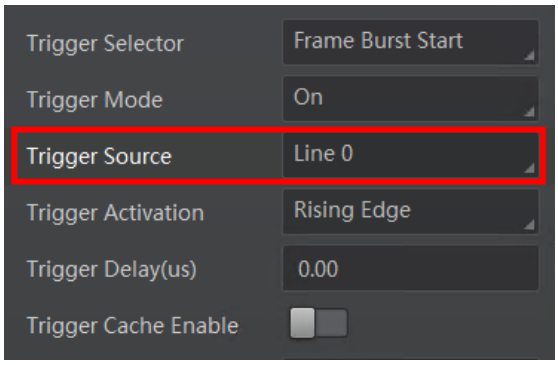


Figure 9-5 Set Line 0 or Line 2 as Input Signal

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

Steps

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

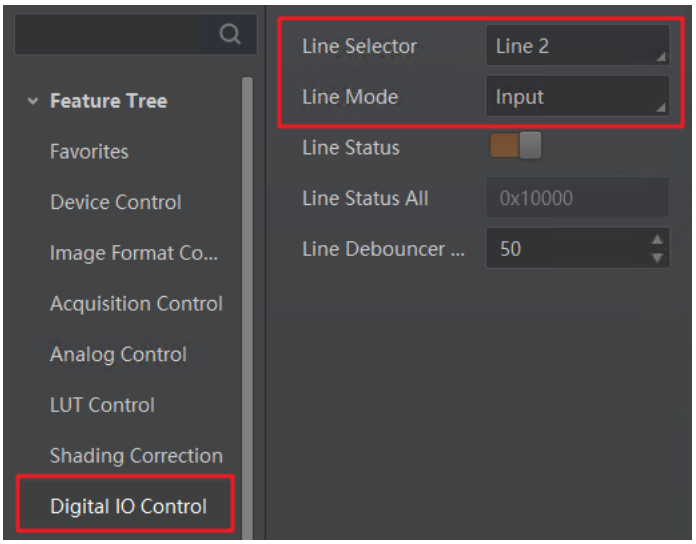


Figure 9-6 Set Line 2 as Input Signal

Note

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

Set and Execute Counter Trigger

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

Steps

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

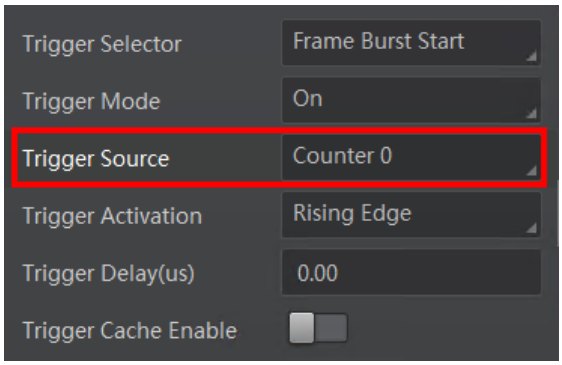


Figure 9-7 Set and Execute Counter Trigger

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

Table 9-2 Parameters of Counter And Timer Control

Parameter	Read/Write	Description
Counter Selector	Read & Write	It selects counter source. **Counter 0** is available only at present.
Counter Event Source	Read & Write	It selects the signal source of counter trigger. **Line 0**, **Line 2**, and **Link Trigger 0** are available. This parameter is disabled by default.
Counter Reset Source	Read & Write	It selects the signal source of resetting counter. **Software** is available only. This parameter is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed only when **Software** is selected as **Counter Reset Source**.
Counter Value	Read & Write	It is the counter value with the range of 1 to 1023. If the parameter is set to n, the n external trigger signals can perform one counter trigger and acquire one frame of image.
Counter Current Value	Read Only	It displays the number of executed external triggers.

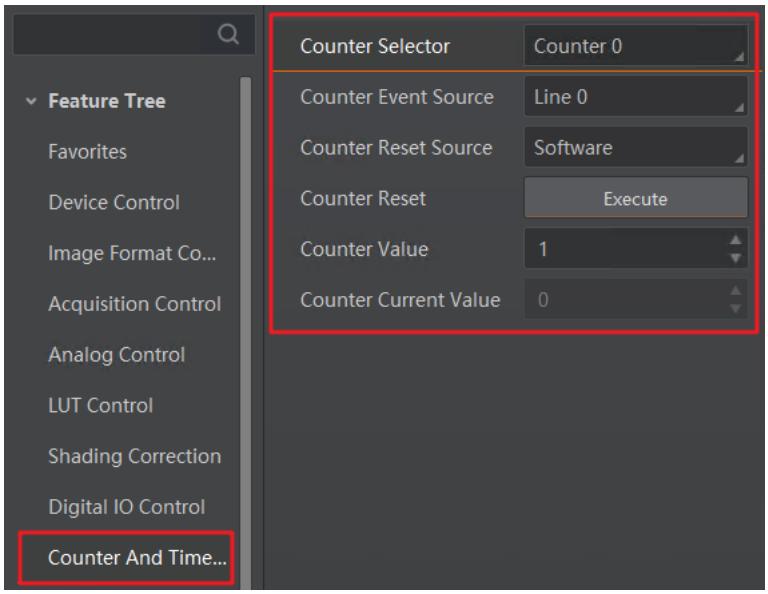


Figure 9-8 Counter And Timer Control

Note

- Refer to section ***Set Trigger Related Parameters*** for parameters that can be configured in the trigger source, including edge trigger, trigger delay, and trigger cache.
- The counter trigger may differ by the device models.

Set and Execute Link Trigger

In link trigger, the CoaXPress frame grabber sends trigger signal to the device to acquire images.

Steps

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

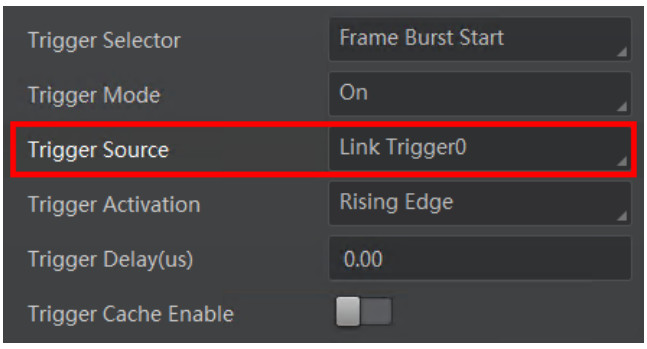


Figure 9-9 Set and Execute Link Trigger

Note

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

Set and Execute Anyway Mode

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

Steps

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

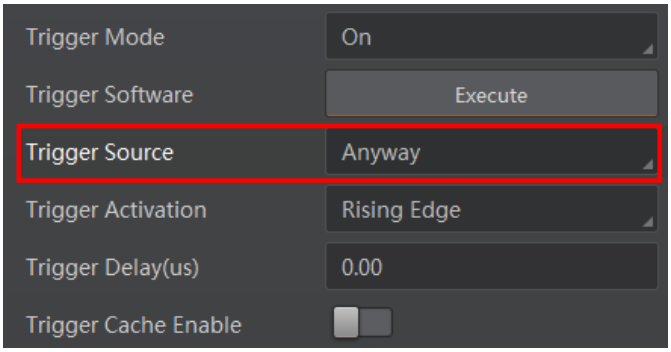


Figure 9-10 Set and Execute Anyway Mode

Note

- Refer to section *Set Trigger Related Parameters* for parameters that can be configured in the trigger source, including edge trigger, acquisition burst frame count, trigger delay, trigger cache, and trigger debouncer.
- The anyway mode is related to firmware program.

9.1.3 Set Trigger Related Parameters

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

Note

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

Table 9-3 Trigger Source and Trigger Related Parameters

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

Set Acquisition Burst Frame Count

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

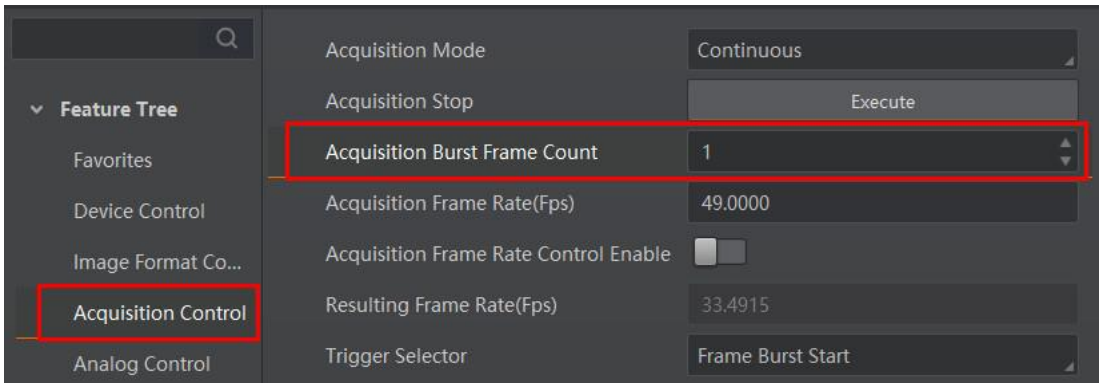


Figure 9-11 Set Acquisition Burst Frame Count

Note

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

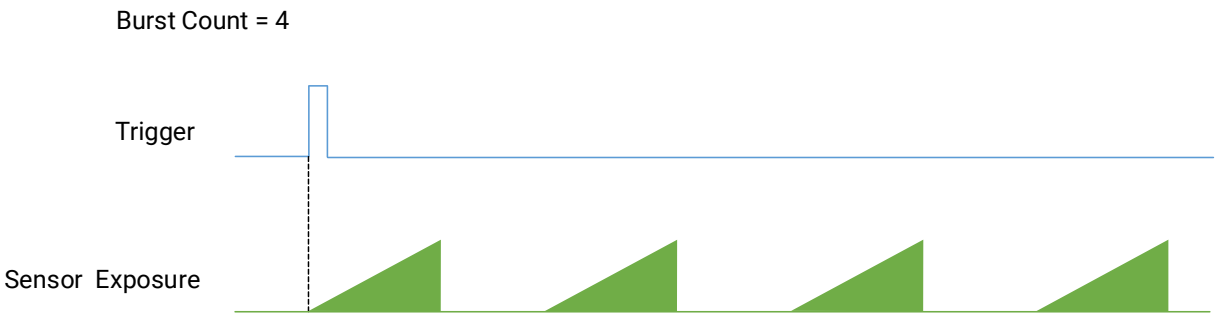


Figure 9-12 Sequence Diagram of Acquisition Burst Frame Count

Set Trigger Delay

The trigger delay function allows the device to add a delay between the receipt of trigger signal and the moment the trigger becomes active. Go to **Acquisition Control → Trigger Delay**, and enter **Trigger Delay**. The value should be between 0 and 16000000, and the unit is μs.

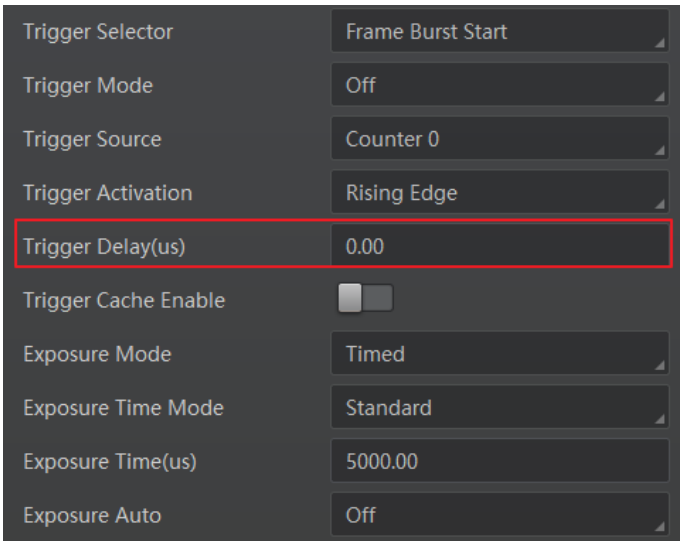


Figure 9-13 Set Trigger Delay

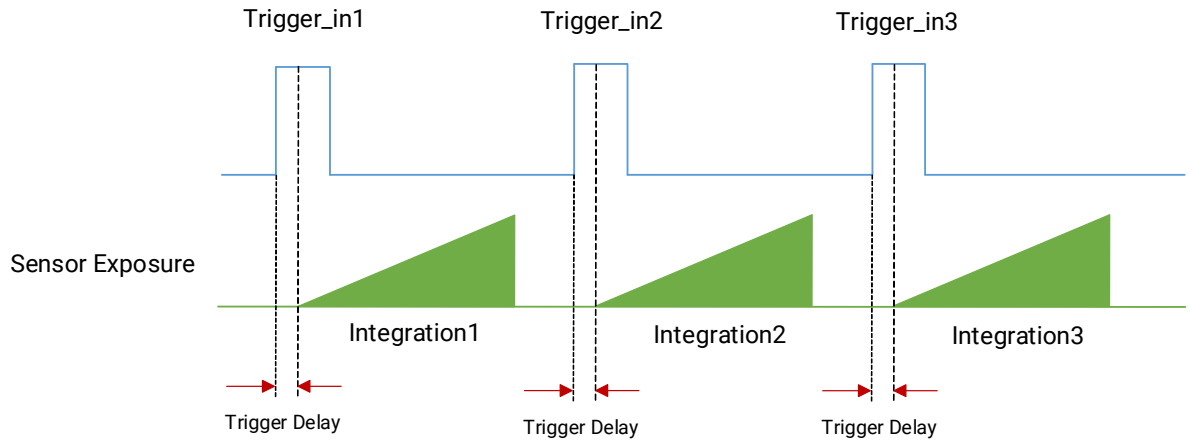


Figure 9-14 Sequence Diagram of Trigger Delay

Note

The sequence diagram above uses rising edge as trigger activation.

Set Trigger Cache

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

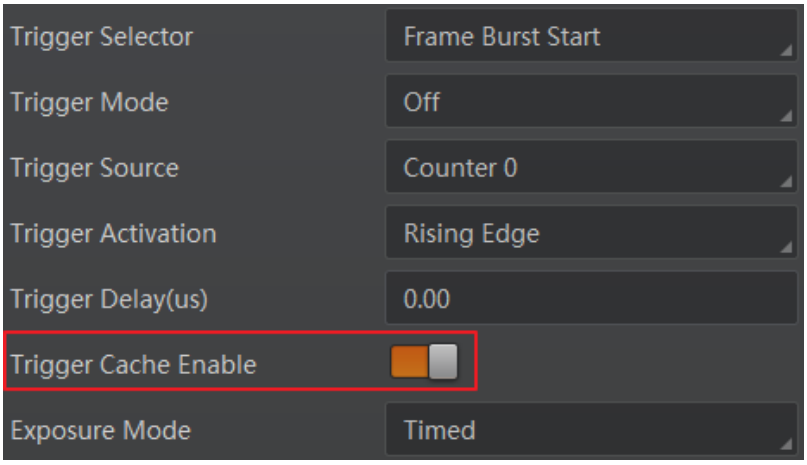


Figure 9-15 Set Trigger Cache

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

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

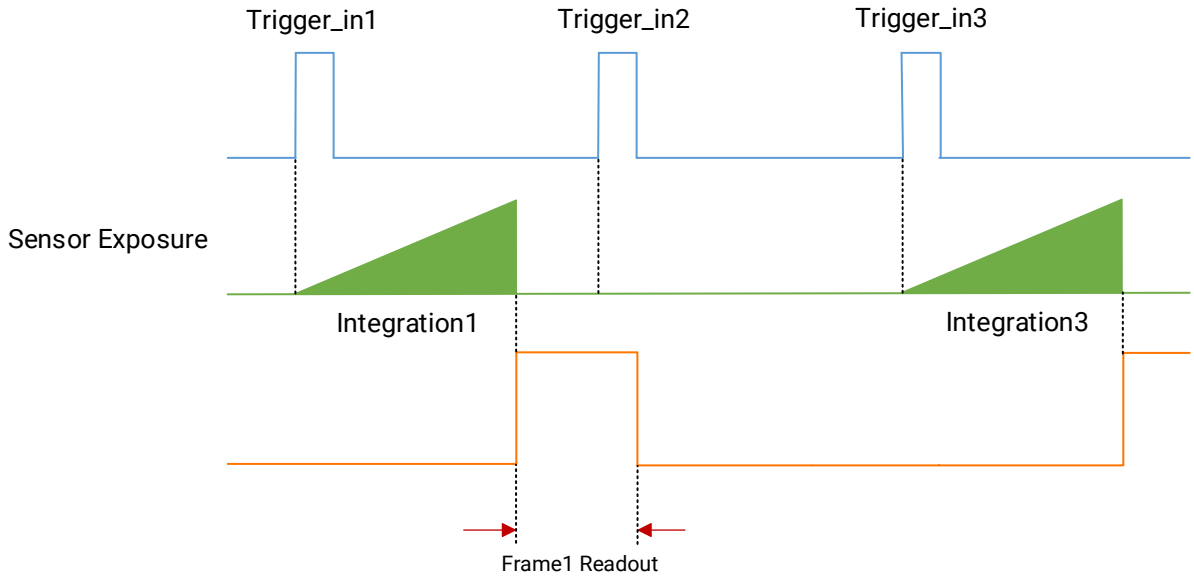


Figure 9-16 Second Frame Filtered

- The 2nd trigger signal will be saved if **Trigger Cache Enable** is enabled.

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

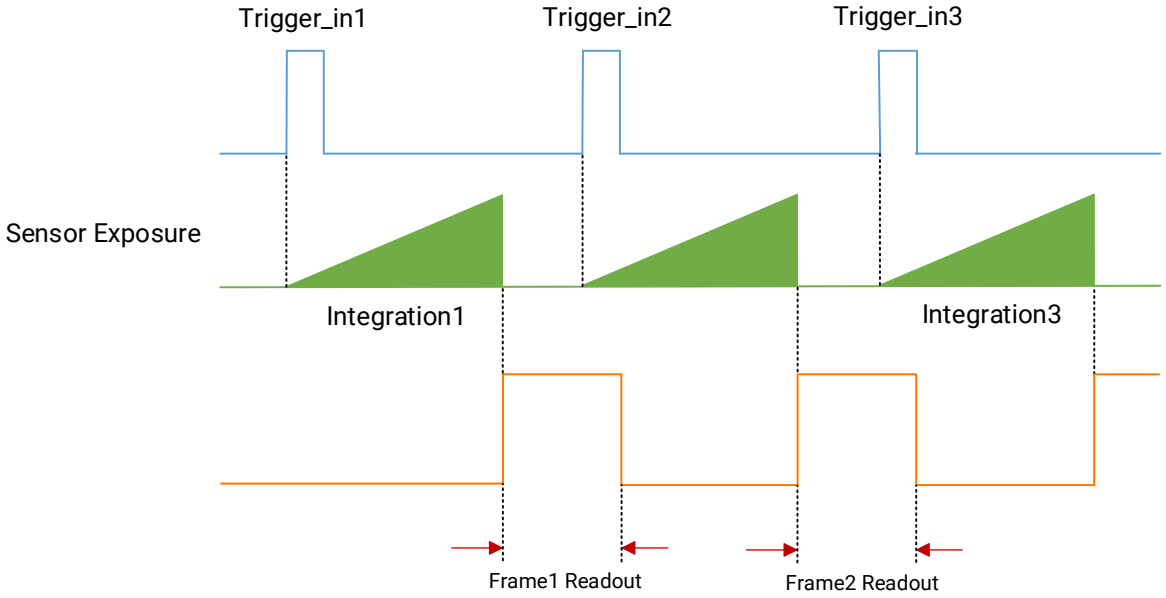


Figure 9-17 Second Frame Created Normally

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

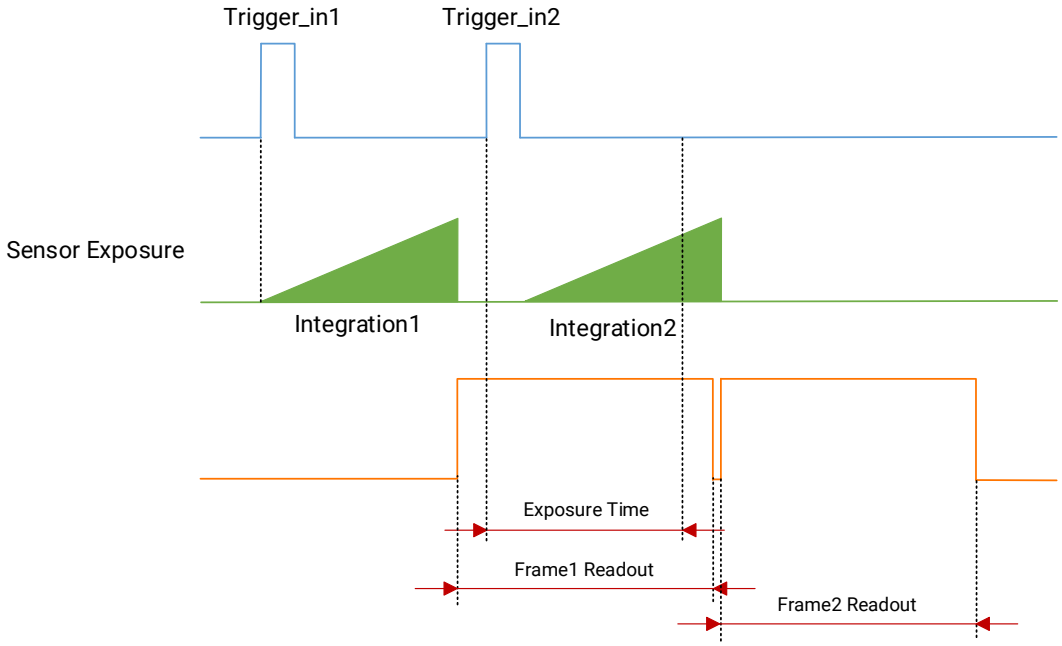


Figure 9-18 Sequence Diagram

Note

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

Set Trigger Activation

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

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

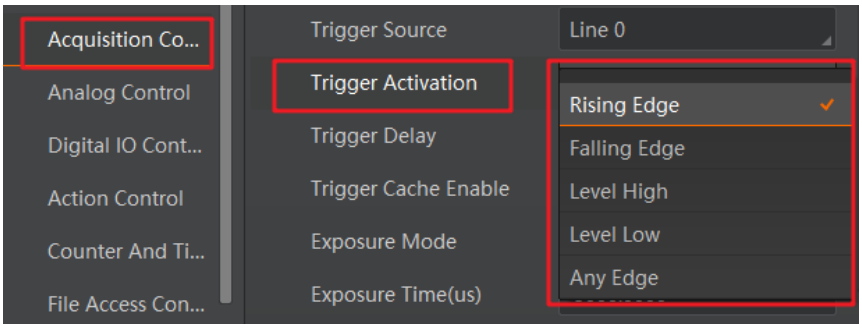


Figure 9-19 Set Trigger Activation

Set Trigger Debouncer

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

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

Note

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

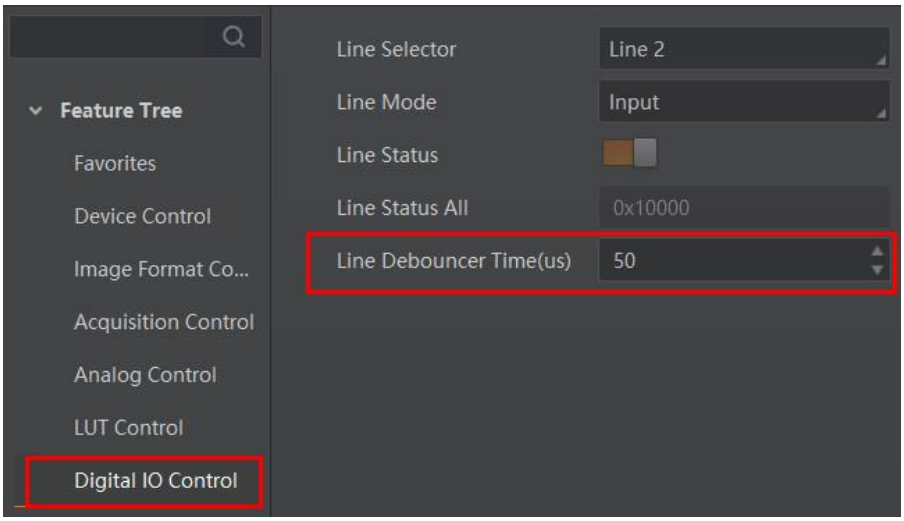


Figure 9-20 Set Trigger Debouncer

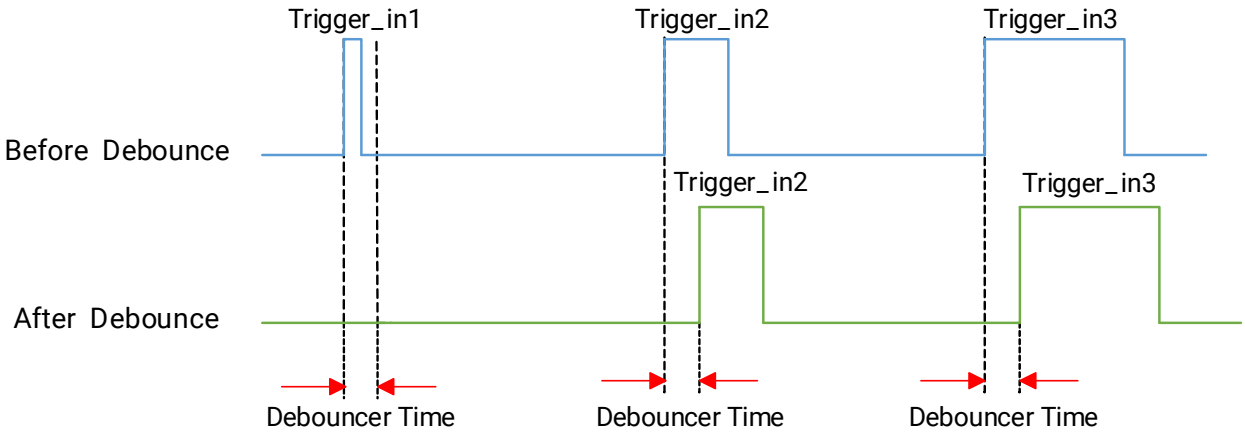


Figure 9-21 Sequence Diagram of Trigger Debouncer

Note

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

9.2 Trigger Output

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

Steps

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

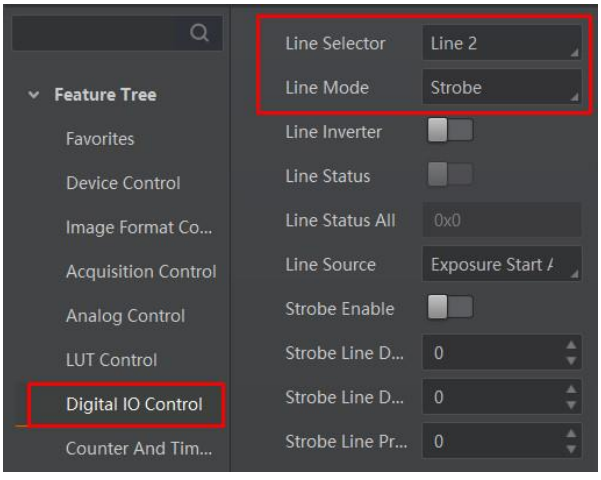


Figure 9-22 Select Output Signal

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

line inverter and strobe signal.

9.2.1 Enable Line Inverter

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

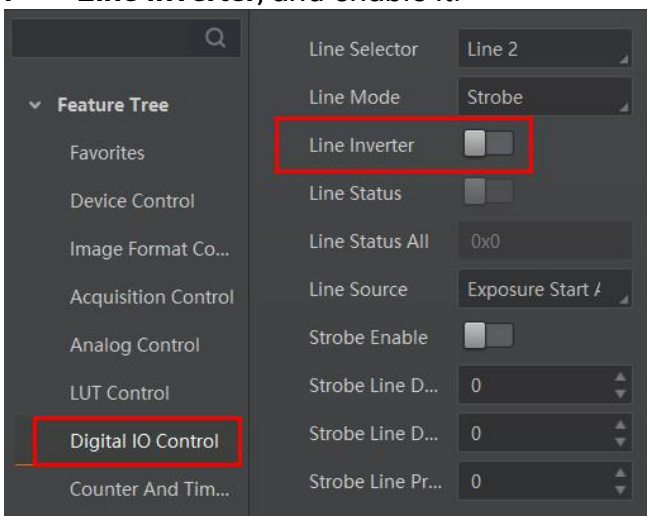


Figure 9-23 Enable Line Inverter

Note

The line inverter function is disabled by default.

9.2.2 Enable Strobe Signal

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

Steps

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

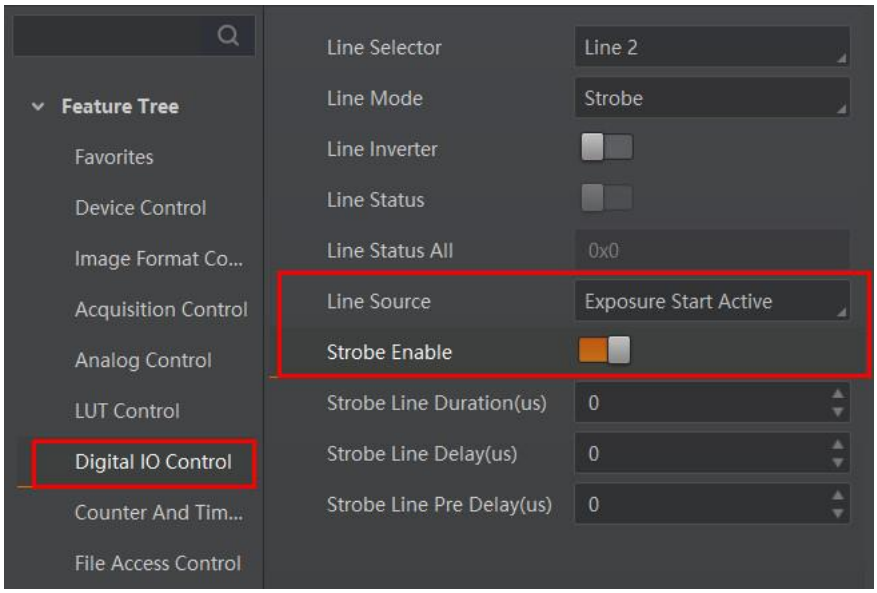


Figure 9-24 Enable Strobe Signal

The supported line sources are as follows:

Table 9-4 Line Source Description

Line Source	Description
Exposure Start Active	The device outputs signals to external devices when it starts exposure.
Exposure End Active	The device outputs signals to external devices when it stops exposure.
Acquisition Start Active	The device outputs signals to external devices when it starts acquiring images.
Acquisition Stop Active	The device outputs signals to external devices when it stops acquiring images.
Frame Burst Start Active	The device outputs signals to external devices when the device's frame burst starts.
Frame Burst End Active	The device outputs signals to external devices when the device's frame burst stops.
Frame Trigger Wait	The device is currently waiting for a frame start trigger.
Frame Start Active	The device outputs signals to external devices when it starts doing the capture of a frame.
Frame End Active	The device outputs signals to external devices when it stops doing the capture of a frame.
Soft Trigger Active	The device outputs signals to external devices when it has a software trigger.

Line Source	Description
Hard Trigger Active	The device outputs signals to external devices when it has a hardware trigger.
Counter Active	The device outputs signals to external devices when it has a counter trigger.
Timer Active	The device outputs signals to external devices when it has a timer trigger.

Note

The specific line sources may differ by device models.

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

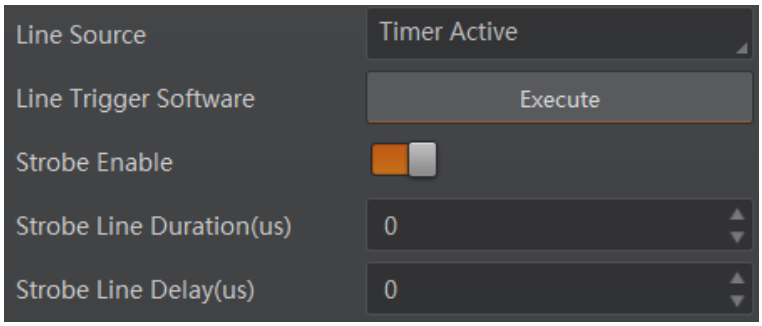


Figure 9-25 Timer Active Parameters

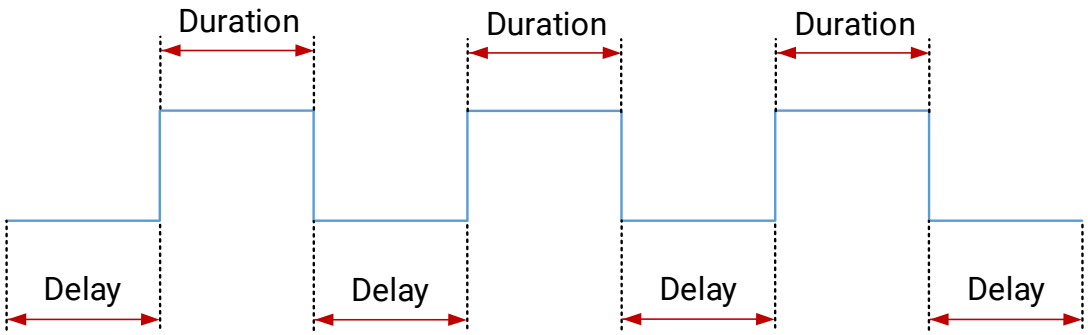


Figure 9-26 Sequence Diagram of Timer Active

Set Strobe Line Duration

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

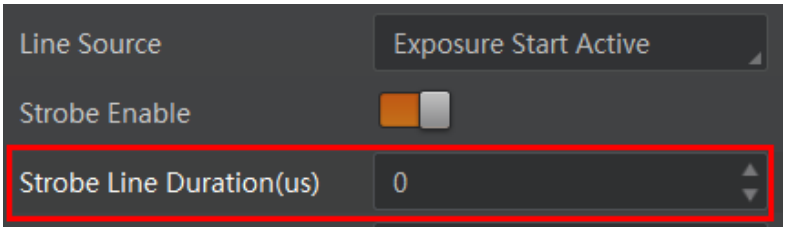


Figure 9-27 Set Strobe Line Duration

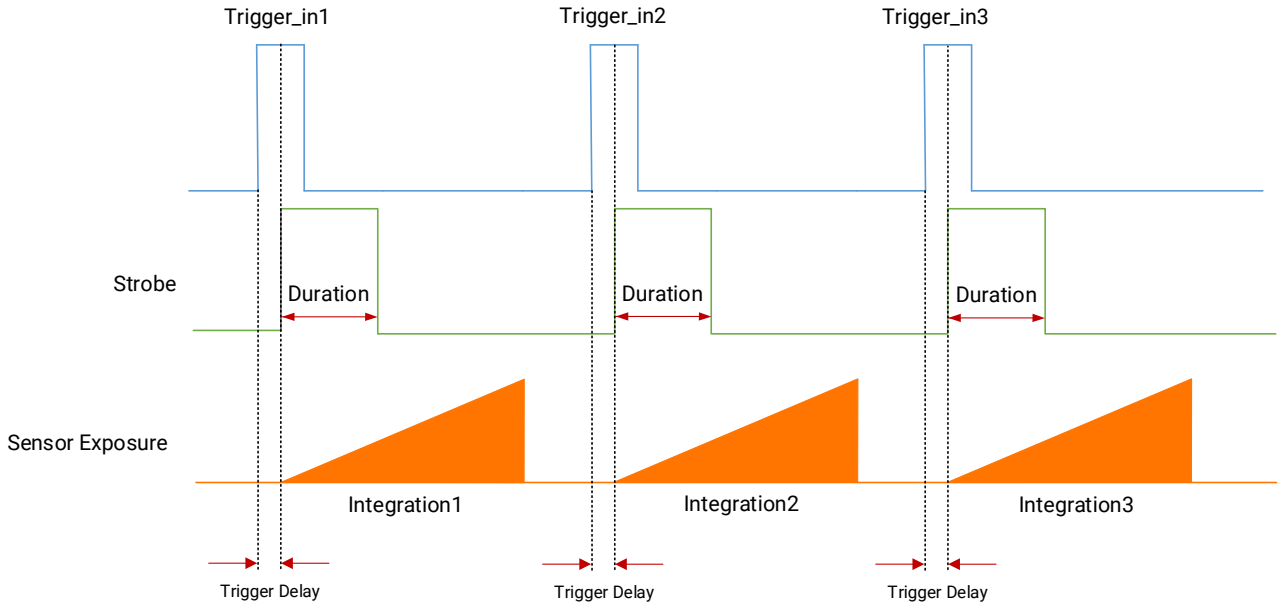


Figure 9-28 Sequence Diagram of Strobe Line Duration

Note

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

Set Strobe Line Delay

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

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

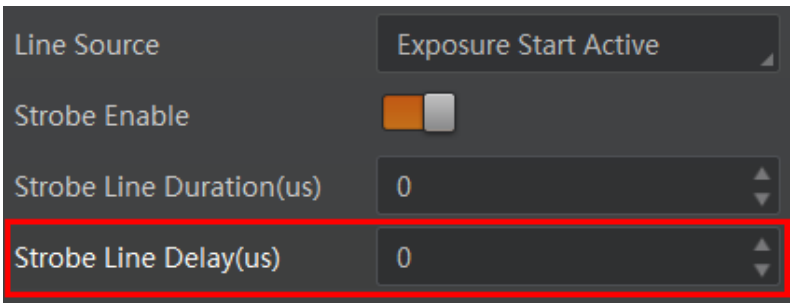


Figure 9-29 Set Strobe Line Delay

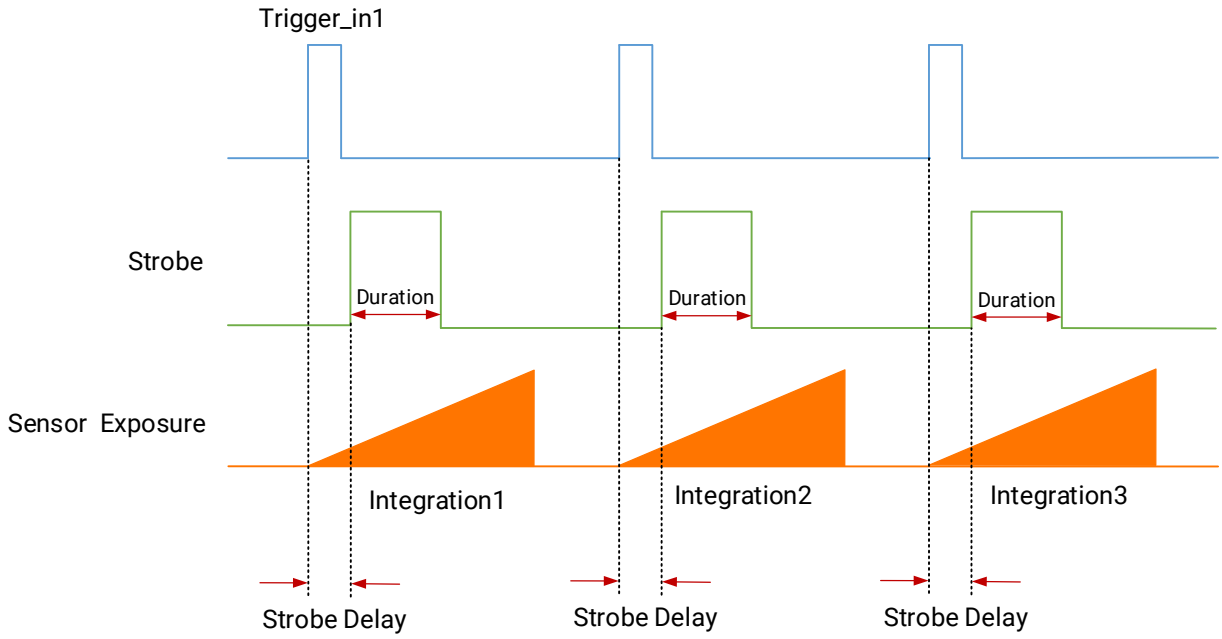


Figure 9-30 Sequence Diagram of Strobe Line Delay

Set Strobe Line Pre Delay

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

Click **Digital IO Control → Strobe Line Pre Delay**, and enter **Strobe Line Pre Delay** according to actual demands.

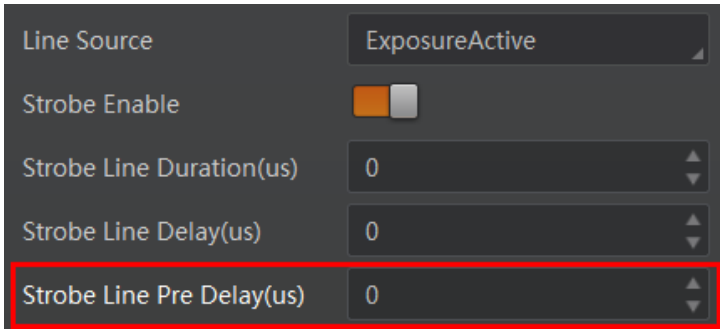


Figure 9-31 Set Strobe Pre Line Delay

The sequence diagram of strobe line pre delay is shown below.

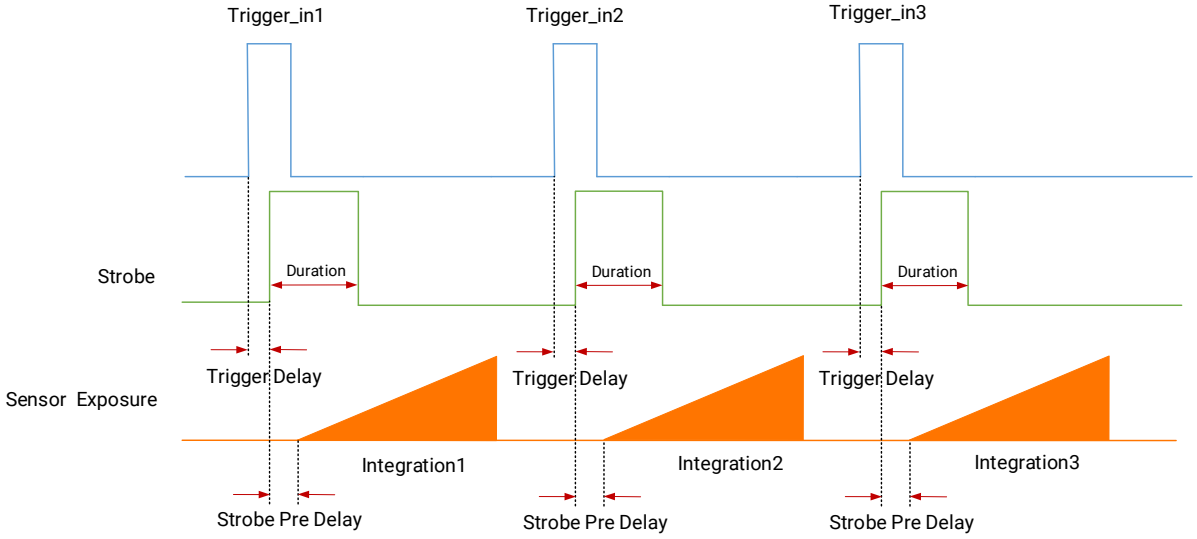


Figure 9-32 Sequence Diagram of Strobe Pre Line Delay

Chapter 10 Image Acquisition

10.1 Global Shutter and Rolling Shutter

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

10.1.1 Global Shutter

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

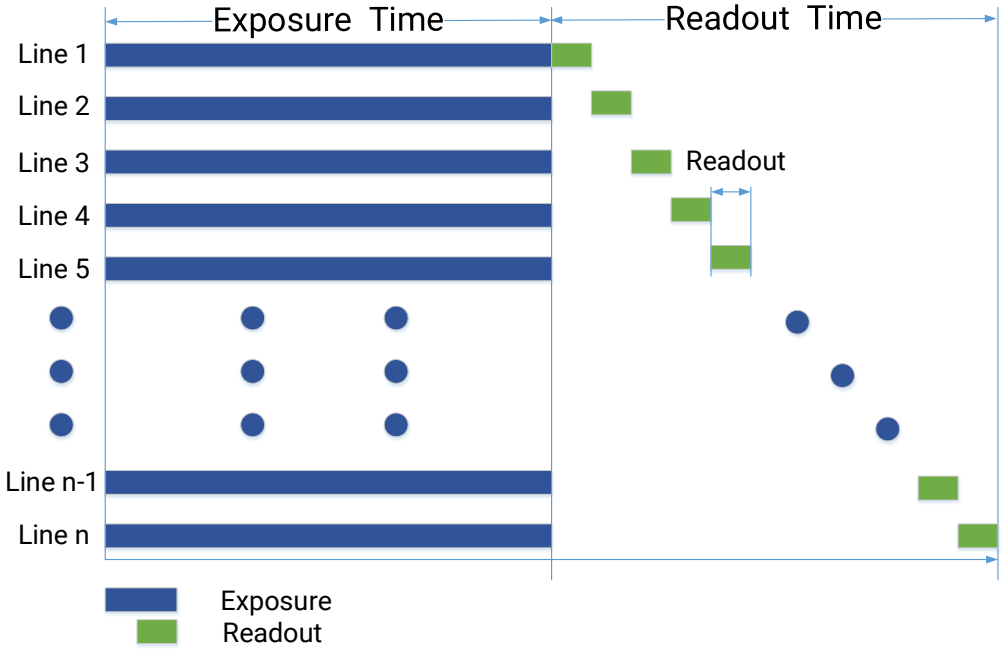


Figure 10-1 Global Shutter

10.1.2 Rolling Shutter

Working Principle

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

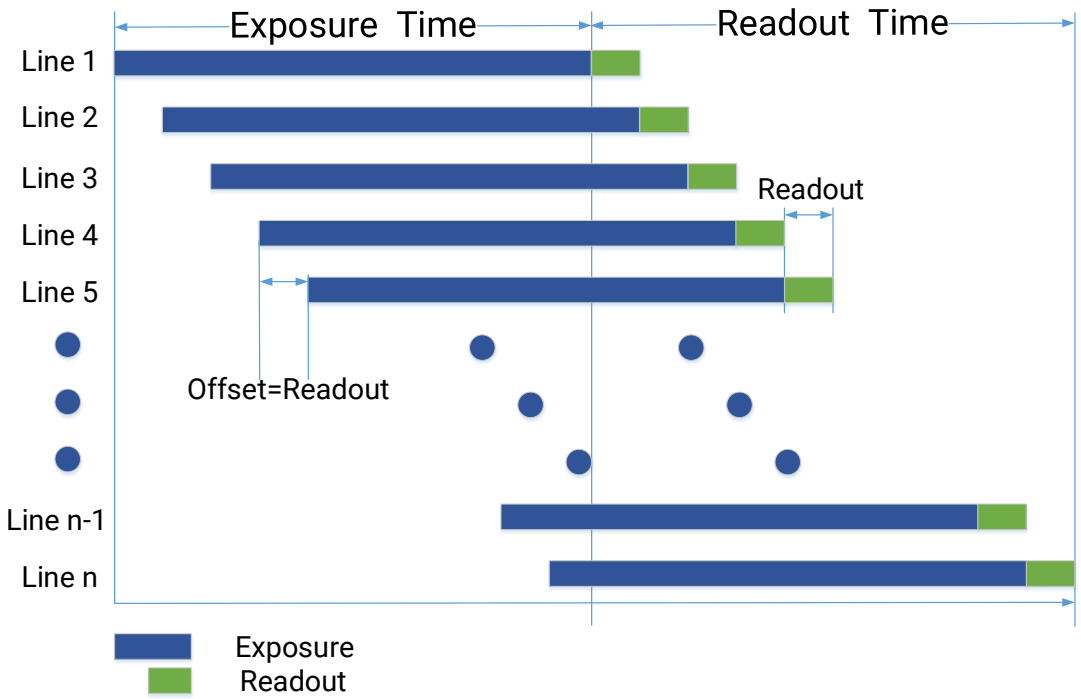


Figure 10-2 Rolling Shutter

Global Reset

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

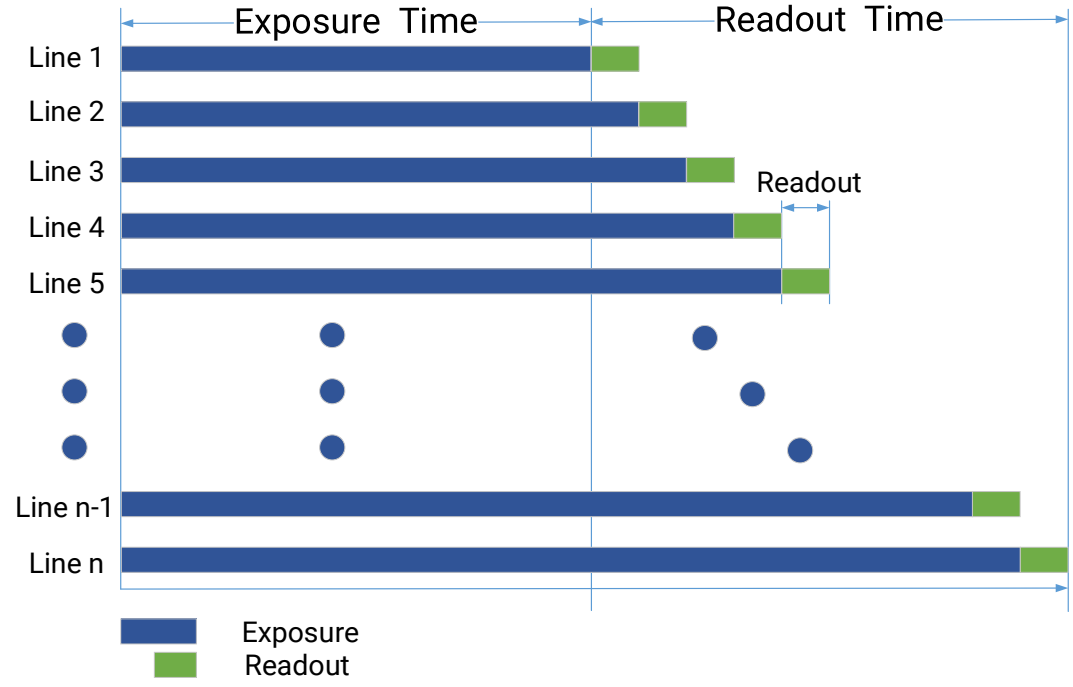


Figure 10-3 Global Reset

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

Figure 10-4 Select Global Reset

Note

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

10.2 Set Acquisition Mode

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

- **SingleFrame**: When device starts image acquisition, it acquires one image only, and then stops.
- **Continuous**: When device starts image acquisition, it acquires images continuously.

Real-time frame rate decides the acquisition frame number per second. You can stop image acquisition manually.

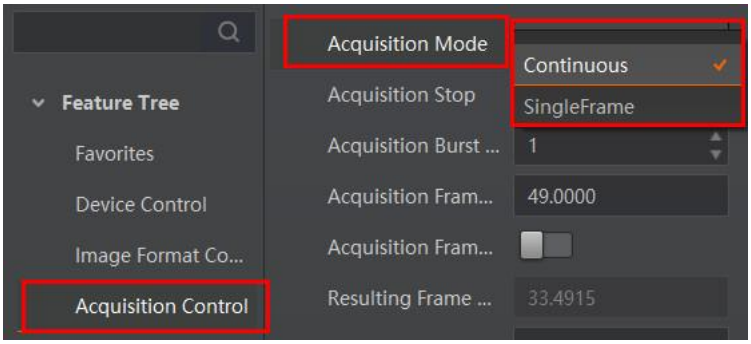


Figure 10-5 Set Acquisition Mode

10.3 Non-Overlap Exposure and Overlap Exposure

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

The device's overlap function is controlled by the overlap mode. Go to **Acquisition Control → Overlap Mode**, select **On** as **Overlap Mode** to have overlap exposure, and select **Off** as **Overlap Mode** to have non-overlap exposure.

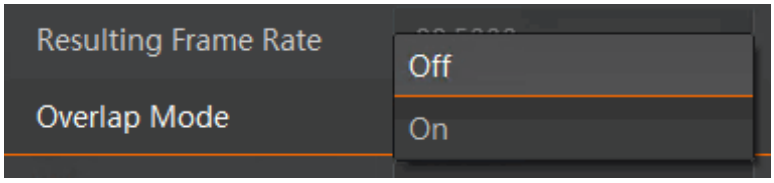


Figure 10-6 Set Overlap Mode

Note

The overlap mode function may differ by device models.

10.3.1 Non-Overlap Exposure

After completing the current frame's exposure and readout, the next frame starts to expose and read out. This process is called non-overlap exposure. The non-overlap exposure's frame period is larger than the sum of the exposure time and the readout time, as shown below.

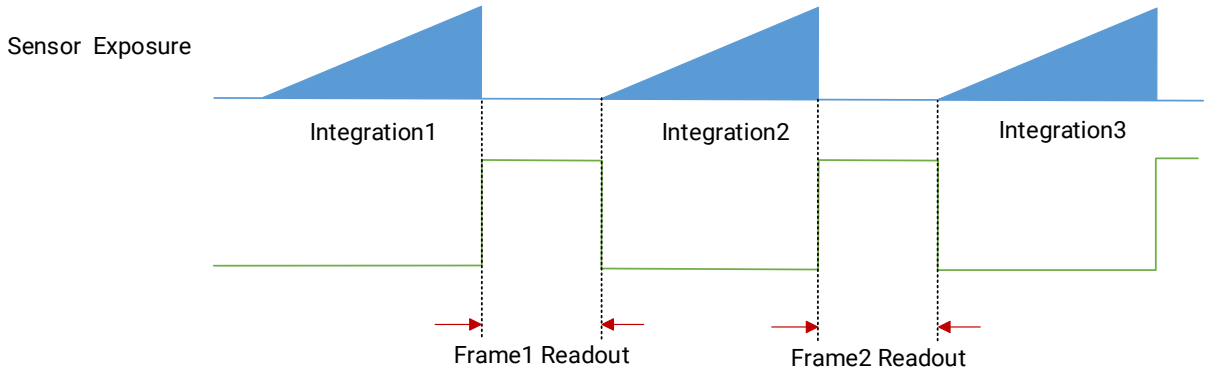


Figure 10-7 Internal Trigger Non-Overlap Exposure

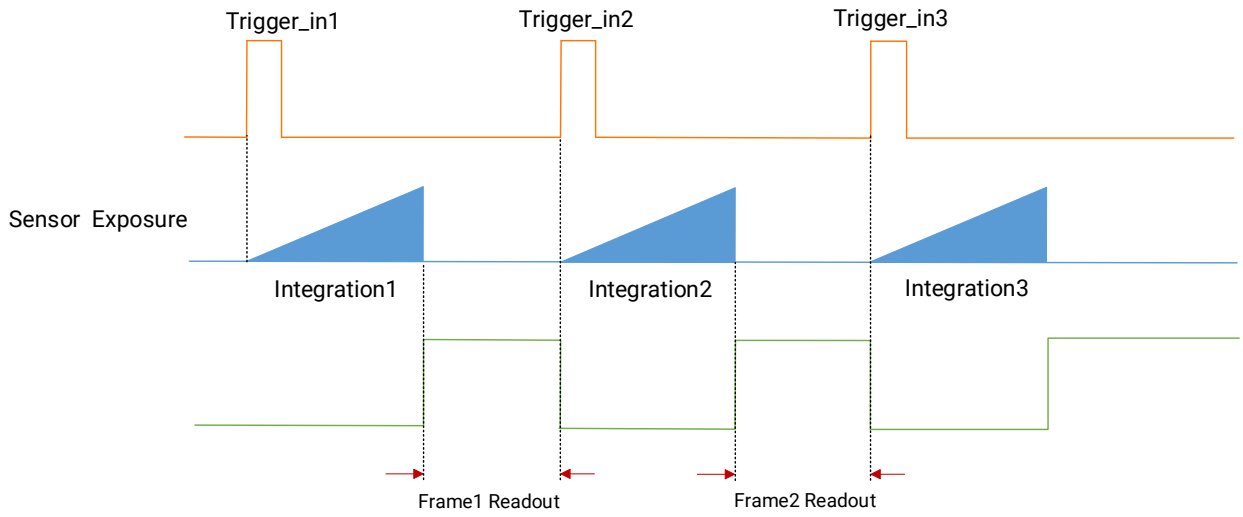


Figure 10-8 External Trigger Non-Overlap Exposure

Note

The device will ignore the external signal in the readout section under this mode.

10.3.2 Overlap Exposure

Overlap exposure refers to the overlap between the current frame exposure and the previous frame readout. In other words, when the previous frame starts to read out, the current frame starts to expose simultaneously, as shown below.

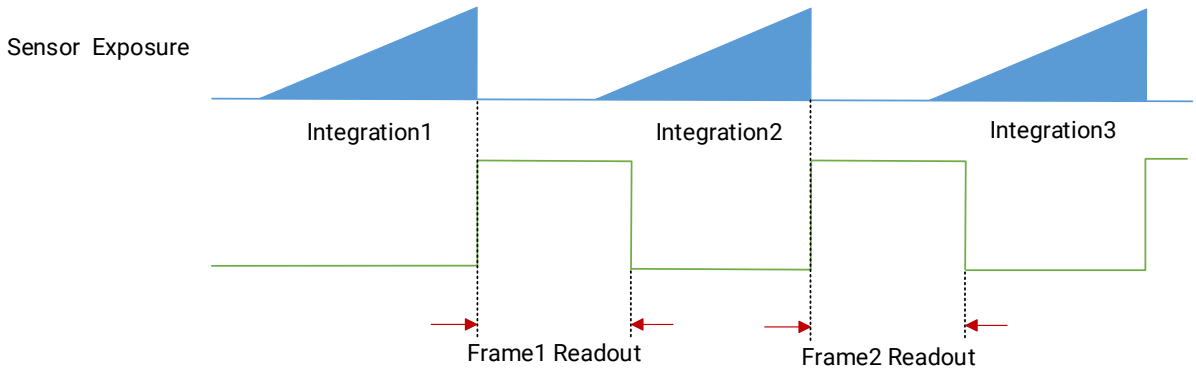


Figure 10-9 Internal Trigger Overlap Exposure

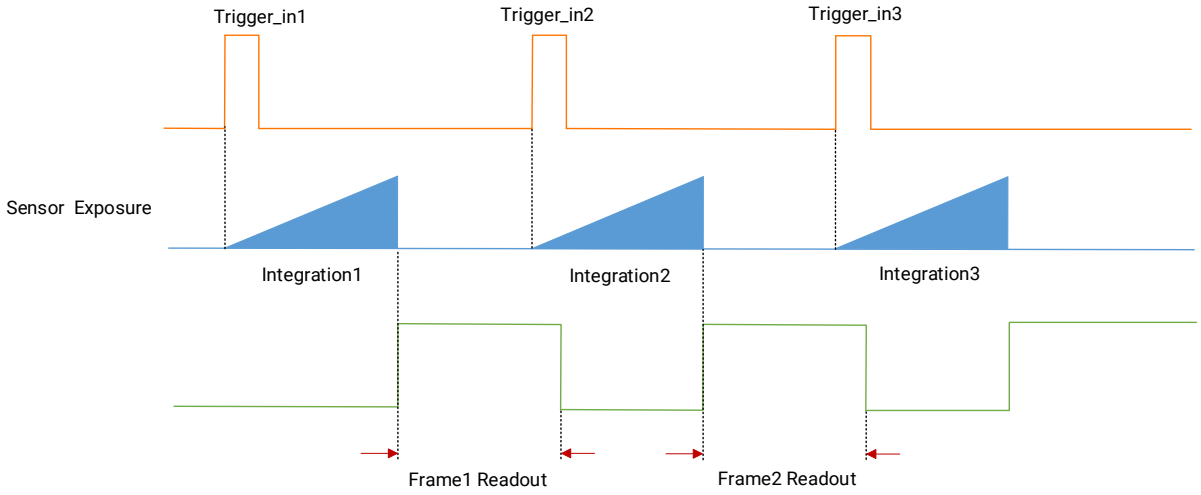


Figure 10-10 External Trigger Overlap Exposure

Note

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

Chapter 11 Image Transmission

11.1 Set Frame Rate

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

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

Steps

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

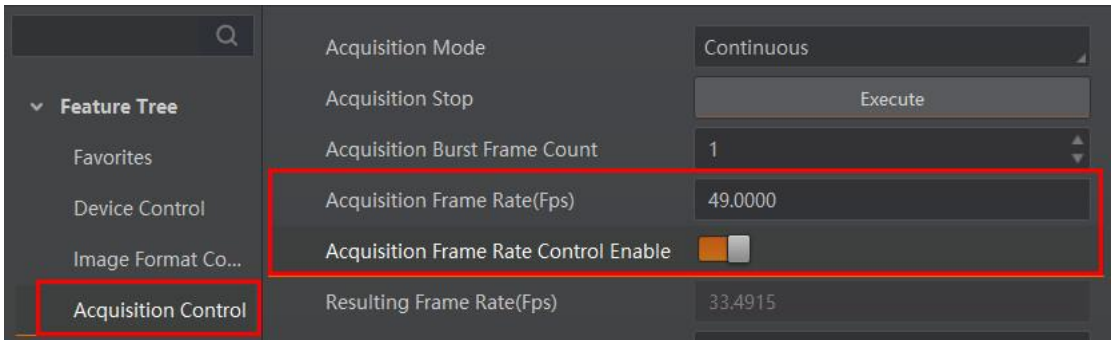


Figure 11-1 Set Frame Rate

Note

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

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

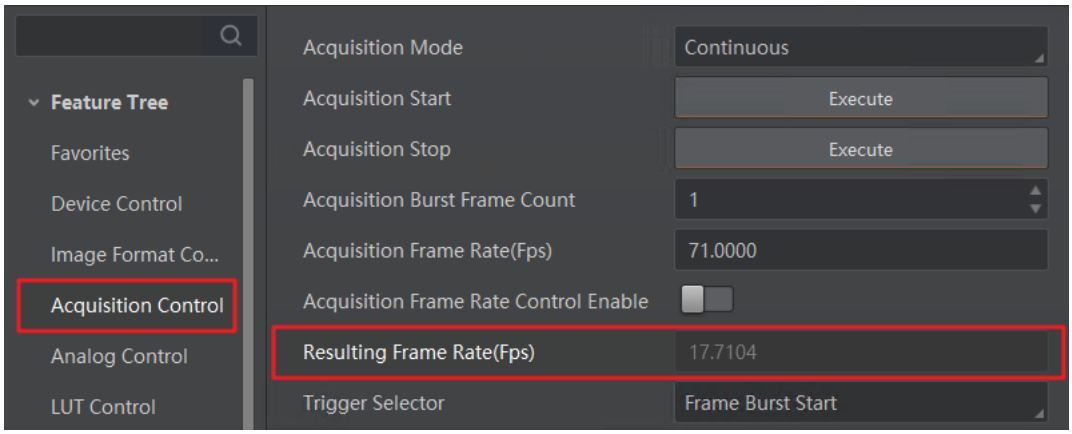


Figure 11-2 View Resulting Frame Rate

Note

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

11.2 Set Geometry Mode

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

Go to **Transport Layer Control** → **Device Tap Geometry** to select geometry mode. Only **Geometry_1X_1Y** and **Geometry_1X_2YE** can be selected.

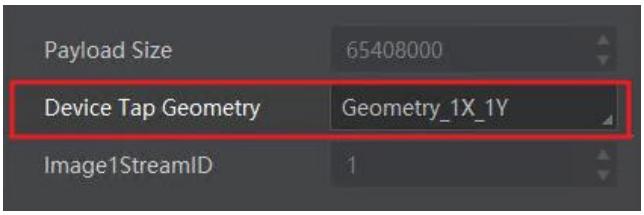


Figure 11-3 Set Geometry Mode

Image Output Method in Geometry_1X_1Y

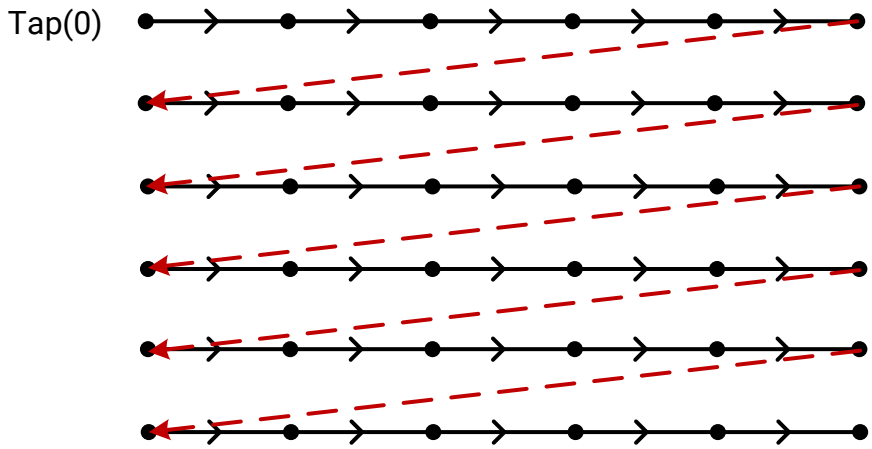


Figure 11-4 Image Output Method in Geometry_1X_1Y

Image Output Method in Geometry_1X_2YE

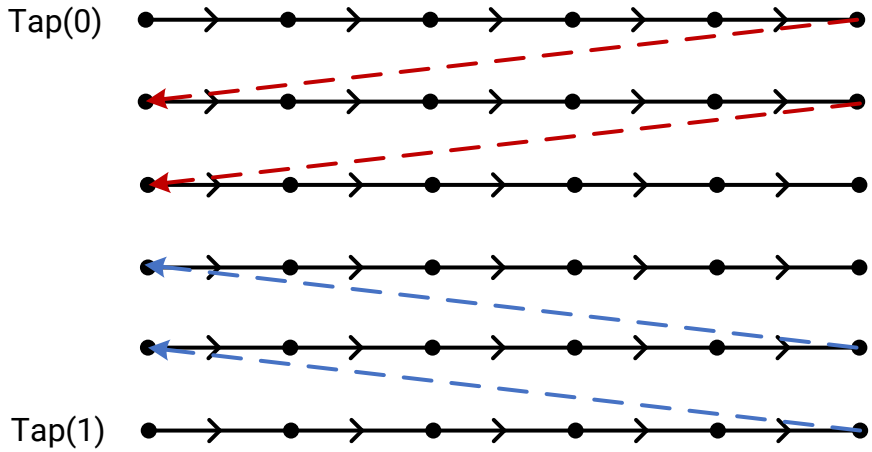


Figure 11-5 Image Output Method in Geometry_1X_2YE

Chapter 12 Basic Functions

12.1 Set Resolution and ROI

Note

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

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

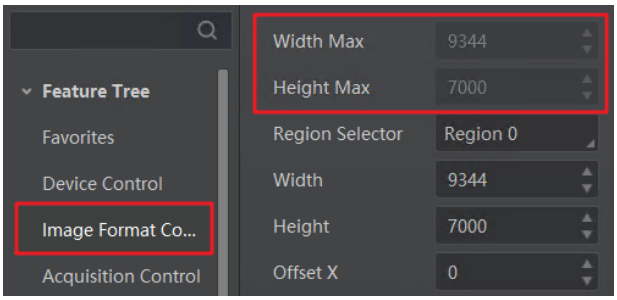


Figure 12-1 View Resolution

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

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

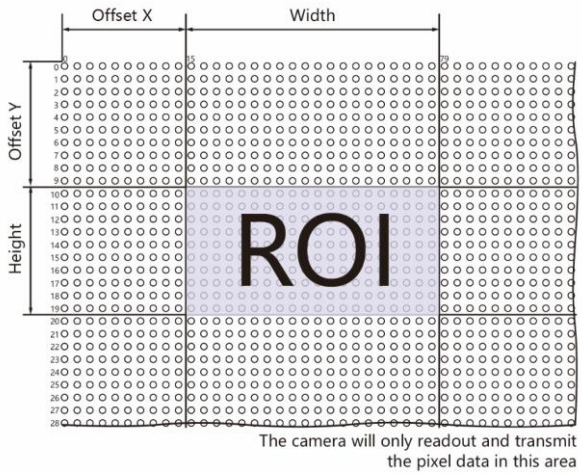


Figure 12-2 ROI

Note

- Region of interest can be set only when you stop real-time acquisition.
- The device currently supports one ROI only, and you can select **Region 0** as **Region Selector**.
- The **Width** plus **Offset X** should not be larger than **Width Max**, and **Height** plus **Offset Y** should not be larger than **Height Max**.

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.

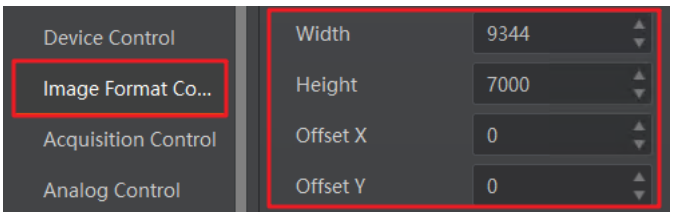


Figure 12-3 Set ROI

12.2 Set Image Reverse

Note

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

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

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

Figure 12-4 Set Image Reverse

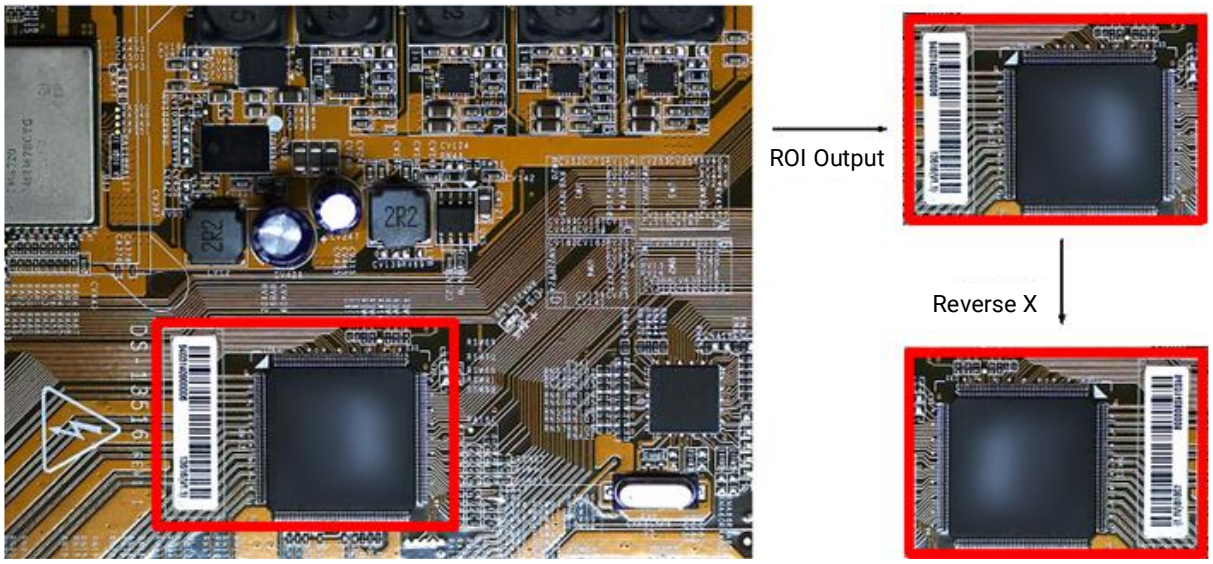


Figure 12-5 Image Reverse Comparison

12.3 Set Pixel Format

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

Note

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

Table 12-1 Pixel Format and Pixel Size

ADC Bit Depth	Pixel Format	Pixel Size (Bits/Pixel)
8	Mono 8	8
12	Mono 8, Bayer 8	8
	Mono 10, Bayer 10	10
	Mono 12, Bayer 12	12
	RGB 8	24
16	Mono 8, Bayer 8	8
	Mono 10, Bayer 10	10
	Mono 12, Bayer 12	12
	Mono 16, Bayer 16	16

ADC Bit Depth	Pixel Format	Pixel Size (Bits/Pixel)
	RGB 8	24

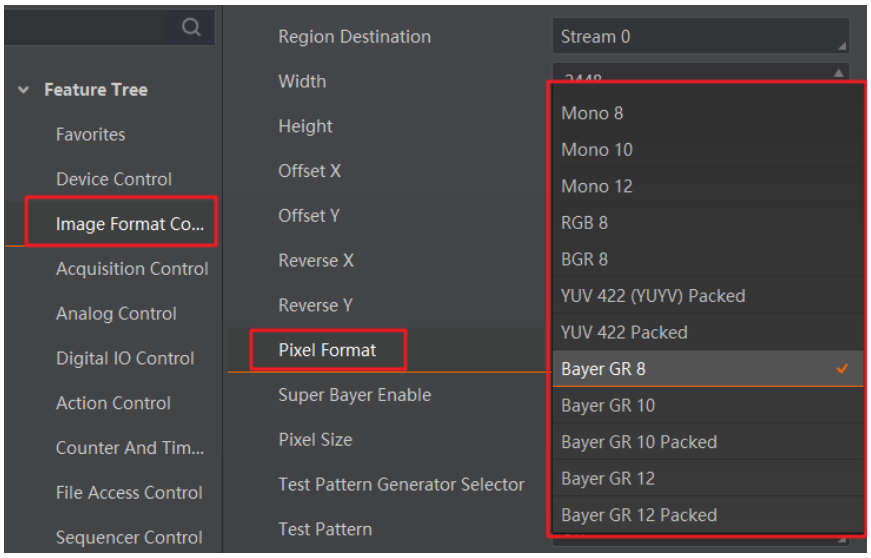


Figure 12-6 Set Pixel Format

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

Note

The ADC bit depth function may differ by device models.

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

Note

If color recognition is not required, the mono camera is recommended.

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

Figure 12-7 Bayer GR Pixel Pattern

Figure 12-8 Bayer GB Pixel Pattern

Figure 12-9 Bayer BG Pixel Pattern

Figure 12-10 Bayer RG Pixel Pattern

12.4 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 in 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 Generator Selector** → **Test Pattern**, and set **Test Pattern** according to actual demands.

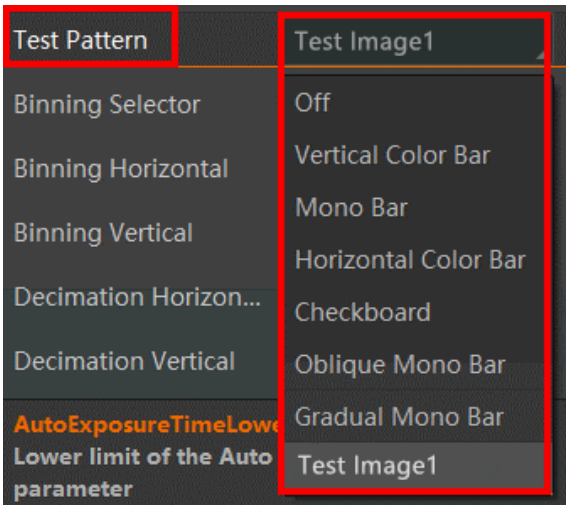


Figure 12-11 Set Test Pattern

The mono device offers 5 test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, and **Test Image 1**.
The color device offers 7 test patterns, including **Mono Bar**, **Checkboard**, **Oblique Mono Bar**, **Gradual Mono Bar**, **Vertical Color Bar**, **Horizontal Color Bar**, and **Test Image 1**.

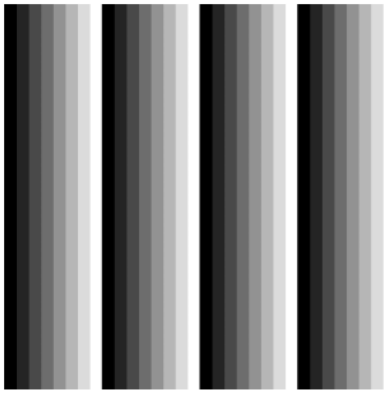


Figure 12-12 Mono Bar Test Pattern

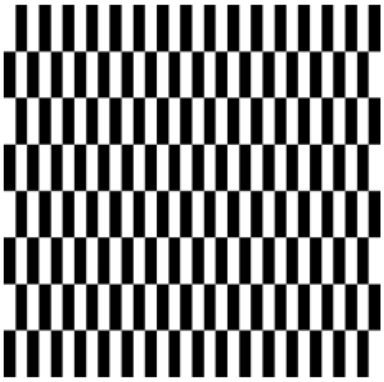


Figure 12-13 Checkboard Test Pattern

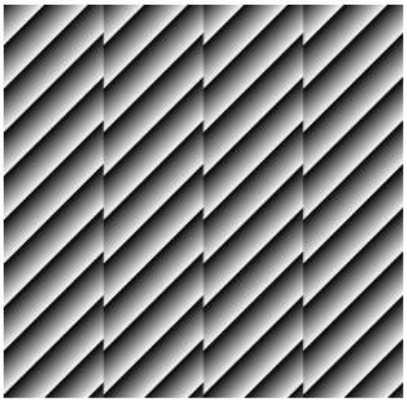


Figure 12-14 Oblique Mono Bar Test Pattern

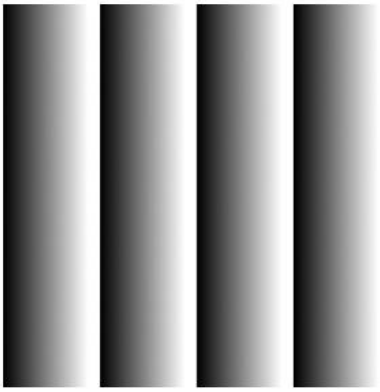


Figure 12-15 Gradual Mono Bar Test Pattern

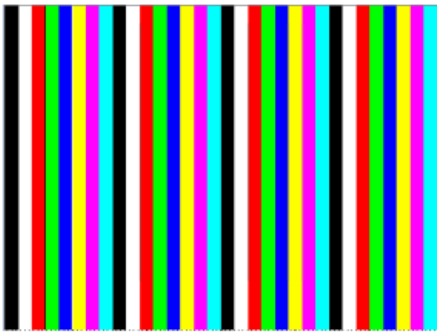


Figure 12-16 Vertical Color Bar Test Pattern

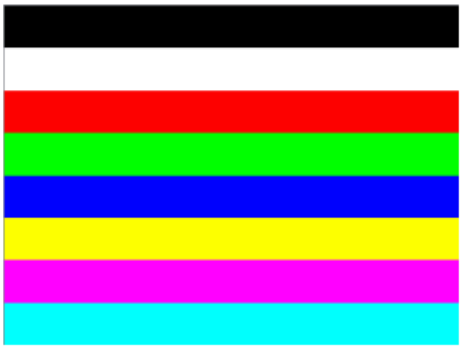


Figure 12-17 Horizontal Color Bar Test Pattern

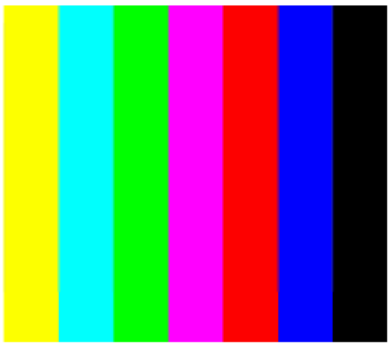


Figure 12-18 Test Image 1

Note

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

12.5 Set Binning

Note

- **Binning Horizontal** is the image's width, and **Binning Vertical** is the image's height.
- The binning-related functions may differ by device models.

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 12-19 Binning Horizontal 2

Figure 12-20 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 12-21 Binning Horizontal 2 and Binning Vertical 2

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

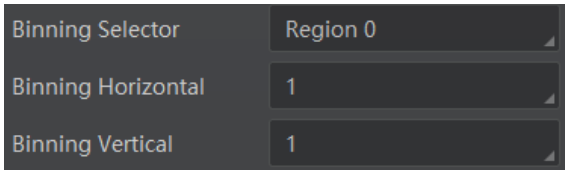


Figure 12-22 Set Binning

The device also supports binning mode function if the binning is 2 × 2 and above. The binning mode defines how pixels are combined if the binning is 2 × 2 and above. Click **Binning Mode**, and select **Sum** or **Average** according to actual demands.

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

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

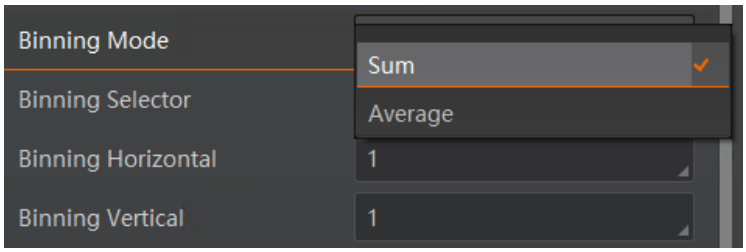


Figure 12-23 Set Binning Mode

12.6 Set Decimation

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

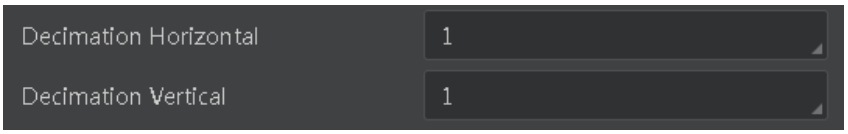


Figure 12-24 Set Decimation

Note

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

12.7 Set Exposure Mode

Note

The exposure mode may differ by device models.

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

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

Note

When the device's **Trigger Mode** is **On**, **Trigger Source** is **Line 0** or **Line 2**, and Trigger

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

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

12.7.1 Set Ultrashort Mode

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

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

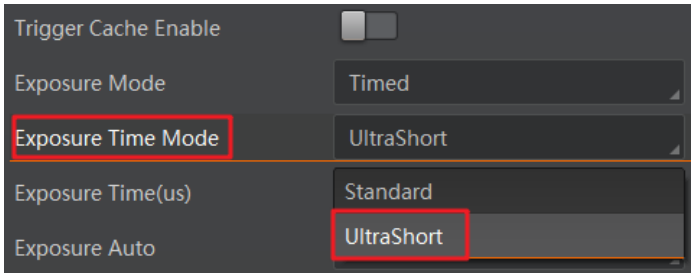


Figure 12-25 Set Ultrashort Mode

Note

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

12.7.2 Set Standard Mode

In standard mode, the device supports 3 types of exposure mode, including **Off**, **Once** and **Continuous**. Click **Acquisition Control** → **Exposure Auto**, and select **Exposure Auto** according to actual demands.

- **Off**: The device exposures according to the value set in **Exposure Time (μs)**.
- **Once**: The device adjusts the exposure time automatically according to the image brightness. After 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)**.

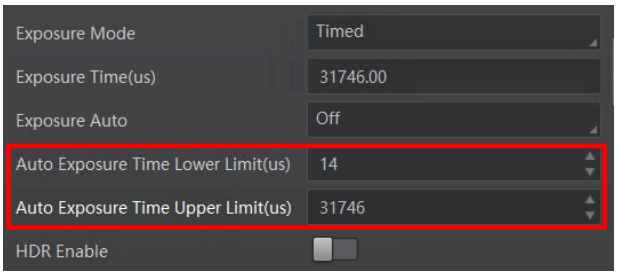


Figure 12-26 Set Exposure Time Under Once or Continuous Mode

Note

If the device is under **Continuous** exposure mode, once external trigger mode is enabled, the device will automatically switch to **Off** exposure mode.

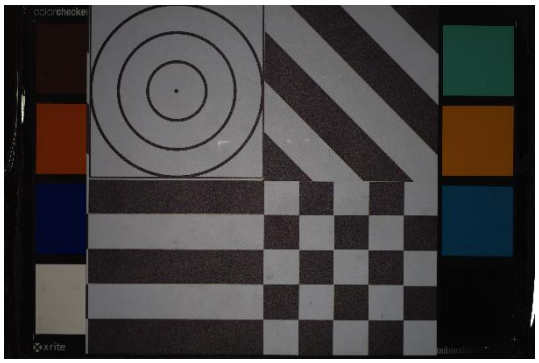
12.8 Set Brightness

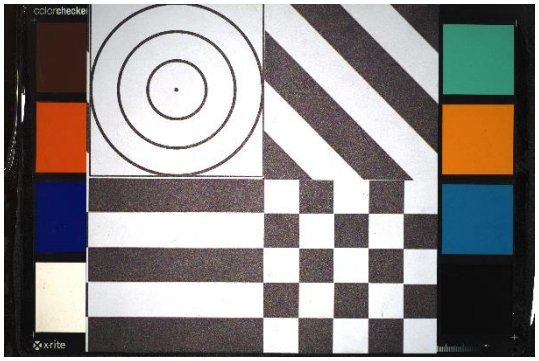
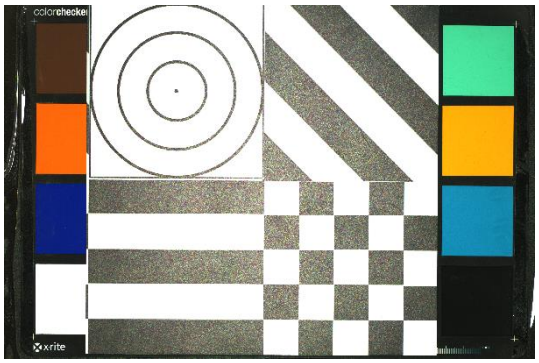
The device brightness refers to the brightness when the device adjusts image under **Once** or **Continuous** exposure mode.

Note

- You should enable **Once** or **Continuous** exposure mode 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 12-2 Brightness Example

Brightness Value	Image
Brightness=25	

Brightness Value	Image
Brightness=75	
Brightness=120	

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

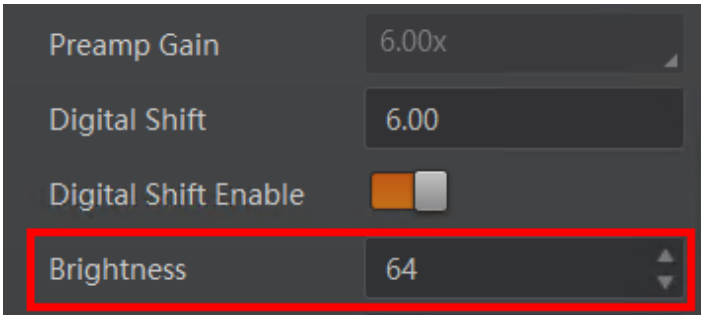


Figure 12-27 Set Brightness

12.9 Set Sharpness

Note

- The sharpness function may differ by device models, and is disabled by default.
- The range of sharpness is between 0 and 100.

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

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

Sharpness according to actual demands.

Figure 12-28 Set Sharpness

12.10 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 **Analog Control** → **White Balance Auto**, and select **White Balance Auto** according to actual demands.

- **Off**: You need to set the R, G, B ratio manually via **Balance Ratio Selector** and **Balance Ratio**. The range is from 1 to 16376, and 1024 means ratio is 1.0.
- **Once**: Adjust the white balance for a certain amount of time then stop.
- **Continuous**: Adjust the white balance continuously.

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

Steps

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

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**.

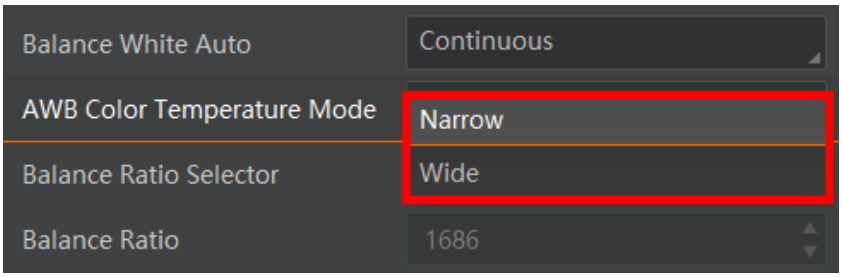


Figure 12-29 Set Parameters

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 restarting the device, it is recommended to save white balance parameter to **User Set** after white balance correction. You can refer to the section ***Save User Set*** and ***Load User Set*** for details.
- If the light source and color temperature change, you need to correct white balance again.

1. Select **Off** as **Balance White Auto**. At this time, **Balance Ratio** is 1024.
2. Find corresponding R/G/B channel in **Balance Ratio Selector**. 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.

12.11 Set HDR

Note

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

Steps

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

Note

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

3. Set **HDR Selector** and corresponding **HDR Shutter**, **HDR Gain**, and **HDR Balance Ratio R/G/B**.

Note

The **HDR Balance Ratio R/G/B** can be set for some color device models. Please refer to the actual one.

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

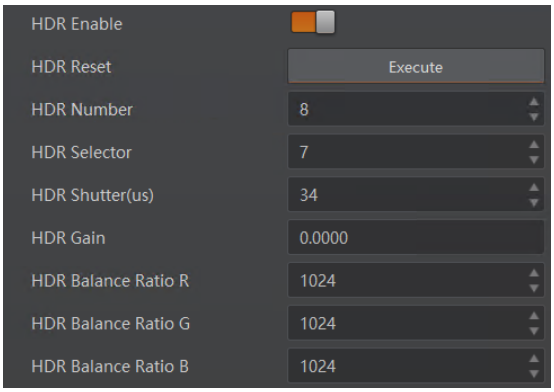


Figure 12-30 Set HDR

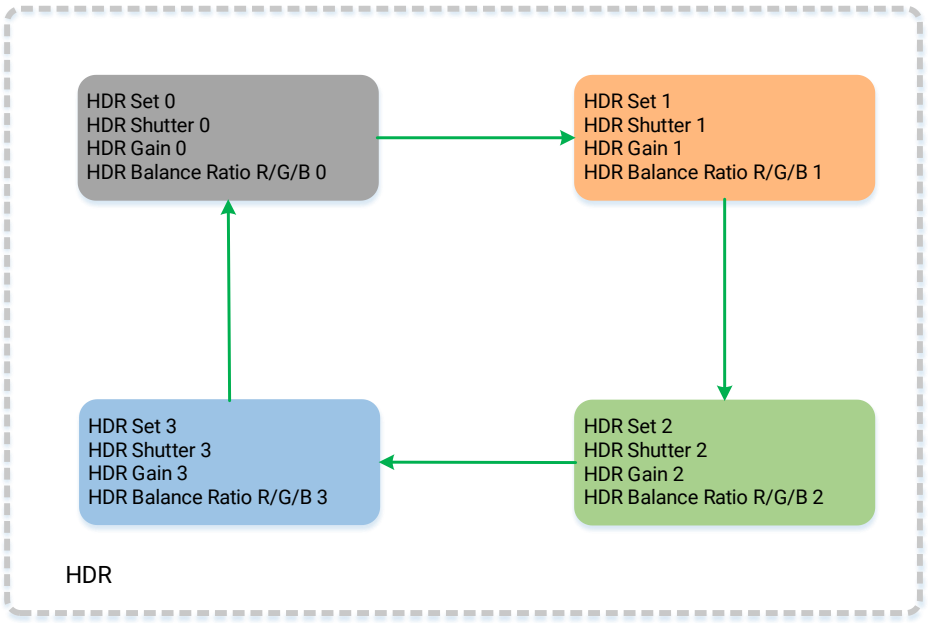


Figure 12-31 HDR Demonstration (Four Groups)

12.12 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.

12.12.1 Set Analog Gain

Note

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

Preamp Gain

Go to **Analog Control** → **Preamp Gain**, and set **Preamp Gain** according to actual demands.

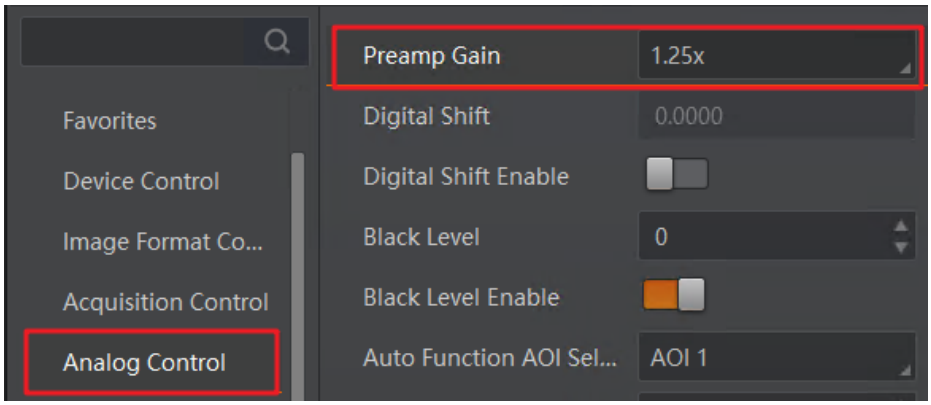


Figure 12-32 Preamp Gain

Gain

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

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

- **Continuous**: The device adjusts the gain continuously according to the image brightness.

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

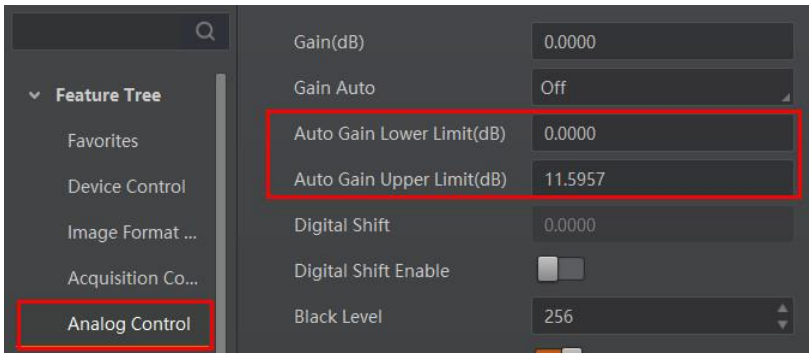


Figure 12-33 Set Gain under Once or Continuous Mode

Note

When increasing gain, the image noise will increase too, which will influence image quality. If you want to increase image brightness, it is recommended to increase the device's exposure time first. If the exposure time reaches its upper limit, and at this point, you can increase gain.

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

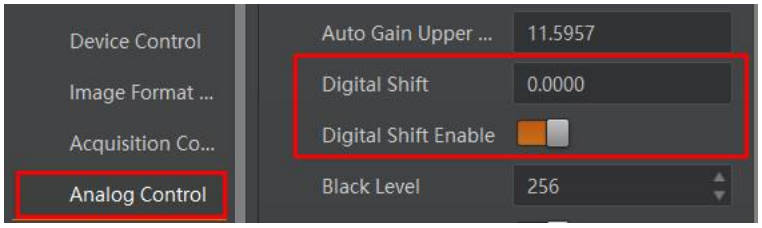


Figure 12-34 Set Digital Gain

Note

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

12.13 User Set Customization

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

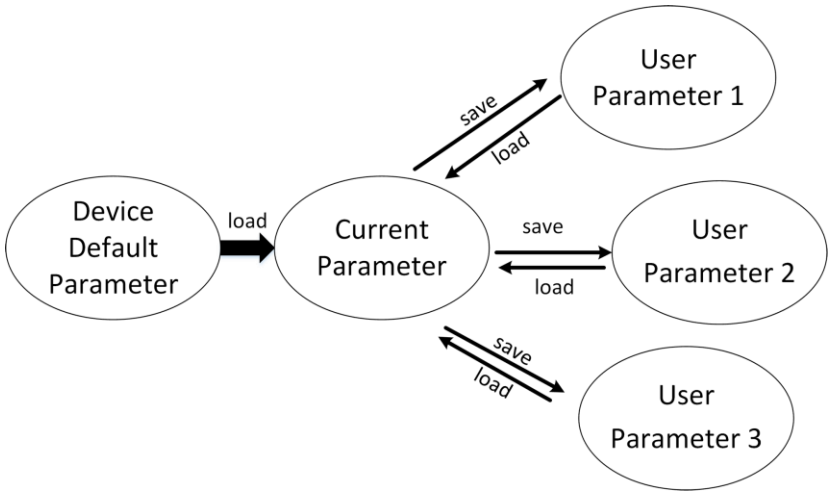


Figure 12-35 Parameter Relation

Note

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

12.13.1 Save User Set

Steps

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

Note

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

2. Click **Execute** in **User Set Save** to save parameter.
3. View **User Set Save Status**:

- Saving: User parameters are being saved.
- Ready: User parameters have been saved.

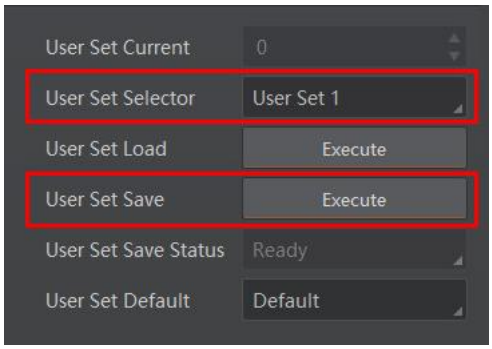


Figure 12-36 Save User Set

Note

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

12.13.2 Load User Set

Note

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

Steps

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

Note

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

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

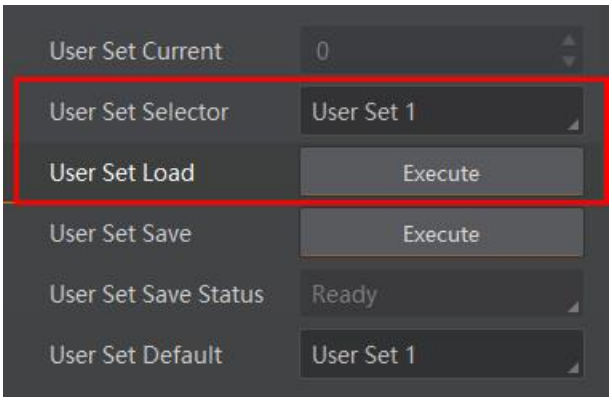


Figure 12-37 Load User Set

12.13.3 Set User Default

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

Note

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

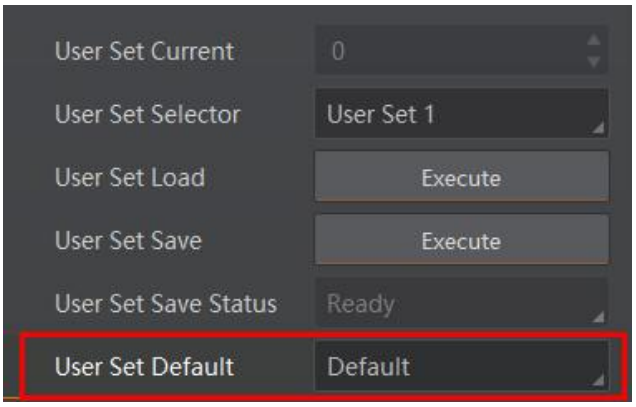


Figure 12-38 Set User Default

Chapter 13 Advanced Functions

13.1 Set Black Level

Note

The black level may differ by device models.

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

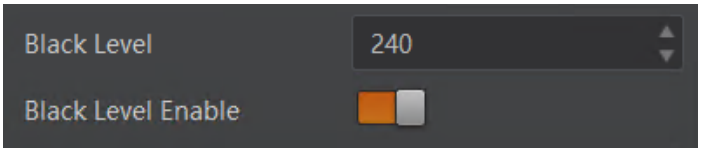


Figure 13-1 Set Black Level

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

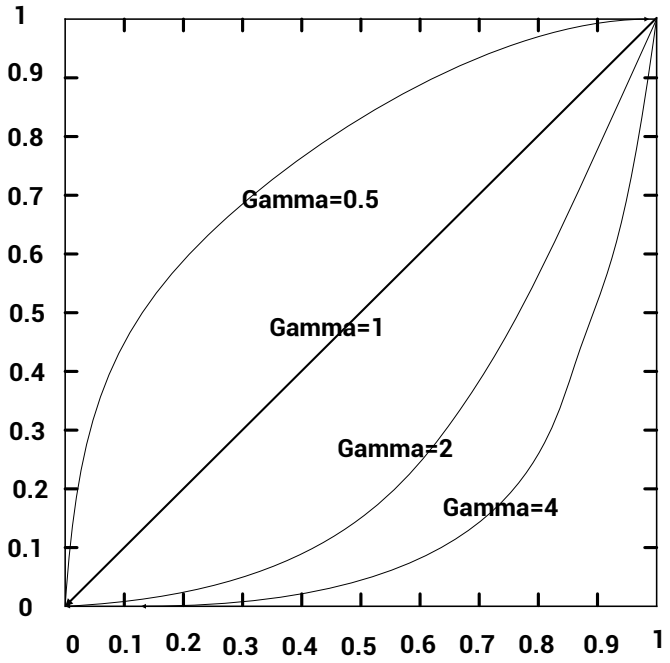


Figure 13-2 Set Gamma Correction

Table 13-1 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 **Analog Control** → **Gamma Selector**.
2. Select **User** as **Gamma Selector**.
3. Enable **Gamma Enable** to enable it.
4. Enter **Gamma** according to actual demands, and its range is from 0 to 4.

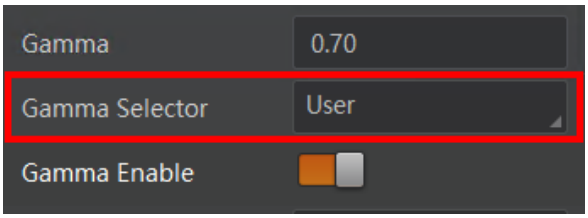


Figure 13-3 Set User Mode

sRGB Mode

Steps

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

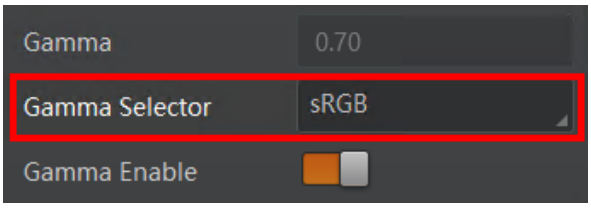


Figure 13-4 Set sRGB Mode

13.3 Set AOI

Note

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

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

Steps

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

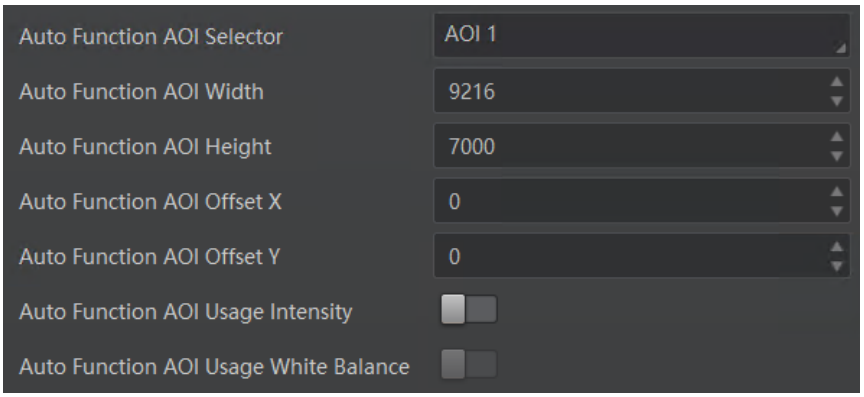


Figure 13-5 Set AOI

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

Steps

1. Go to **Color Transformation Control**, and select in **Color Transformation Value Selector**.
2. Set **Color Transformation Value** according to actual demand.
3. Enable **Color Transformation Enable**.

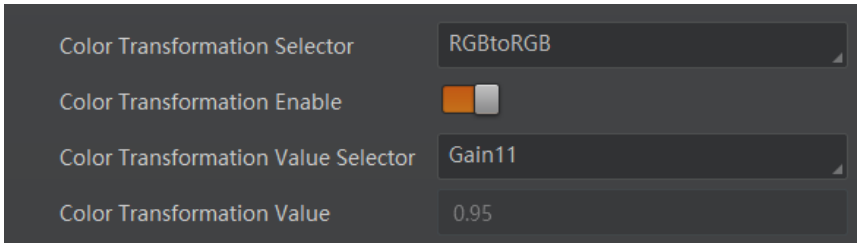


Figure 13-6 Set Color Transformation

Note

- Color correction is achieved by adjusting the values of the parameters in **Color Transformation Value Selector**, where Gain00, Gain10, and Gain20 adjust the R component of the red pixel, Gain01, Gain11, and Gain21 adjust the G component of the green pixel, and Gain02, Gain12, and Gain22 adjust the B component of the blue pixel.

13.5 Set Hue

Note

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

Adjusting the hue shifts the colors of the image. After hue is set, the device will perform

color 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 13-2 Hue Example

Hue Value	Image
Hue=0	
Hue=128	
Hue=255	

Before You Start

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

Steps

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

Figure 13-7 Set Hue

13.6 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 13-3 Saturation Example

Saturation Value	Image
Saturation=0	
Saturation =128	

Saturation Value	Image
Saturation =255	

Before You Start

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

Steps

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

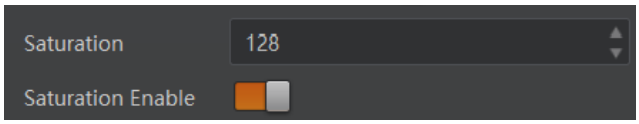


Figure 13-8 Set Saturation

13.7 Set Shading Correction

The device supports shading correction function that improves the image uniformity when you acquire a non-uniformity image due to external conditions. The shading correction type includes LSC correction, FFC correction, FPNC correction, user PRNUC correction, and other corrections.

Note

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

13.7.1 LSC Correction

LSC correction stands for Lens Shading Correction that eliminates non-uniform illumination brought by lens. The LSC correction supports two correction methods, including auto image correction or correcting image via setting parameters.

Note

- The specific LSC correction method may differ by device models.

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

Auto Image Correction

Steps

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

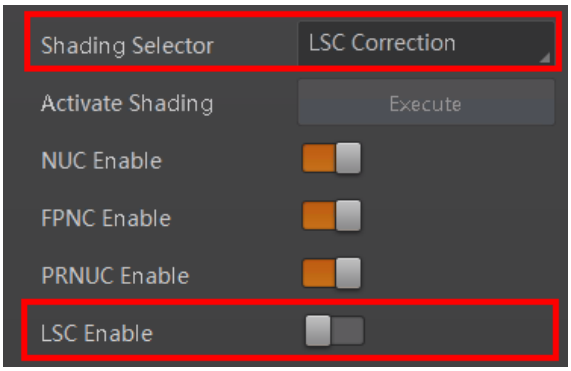


Figure 13-9 Auto Image Correction

Correcting Image via Setting Parameters

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

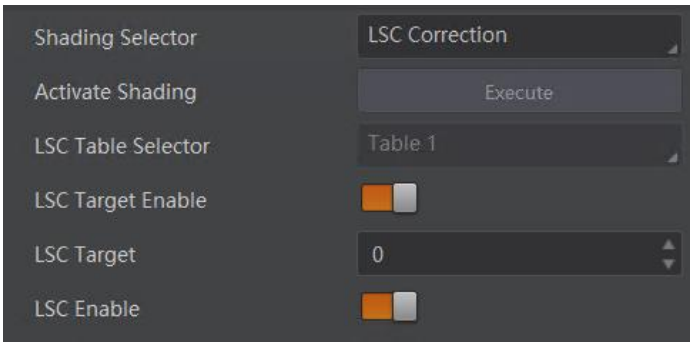


Figure 13-10 Correcting Image via Setting Parameters

Steps

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

Figure 13-11 Set LSC Target R/G/B

Note

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

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

Note

- If you click **Execute** in **Activate Shading** first, and then enable **LSC Enable** when the **LSC Target Enable** is disabled, the image correction will be executed according to the maximum brightness of the image.
- The LSC correction can be done only when the device is in full resolution. If you are only interested in certain details in the image, you can use the ROI function.

13.7.2 LSC Sequencer

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

Note

The LSC sequencer function may differ by device models.

Steps

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

actual demands.

Note

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

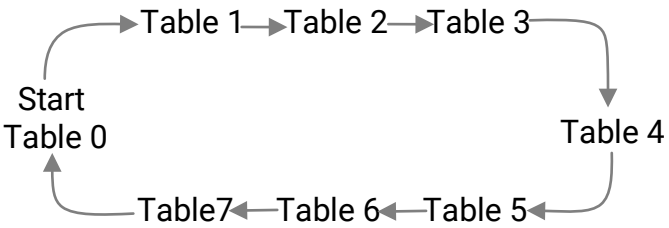


Figure 13-12 Sequencer Order

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

Note

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

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

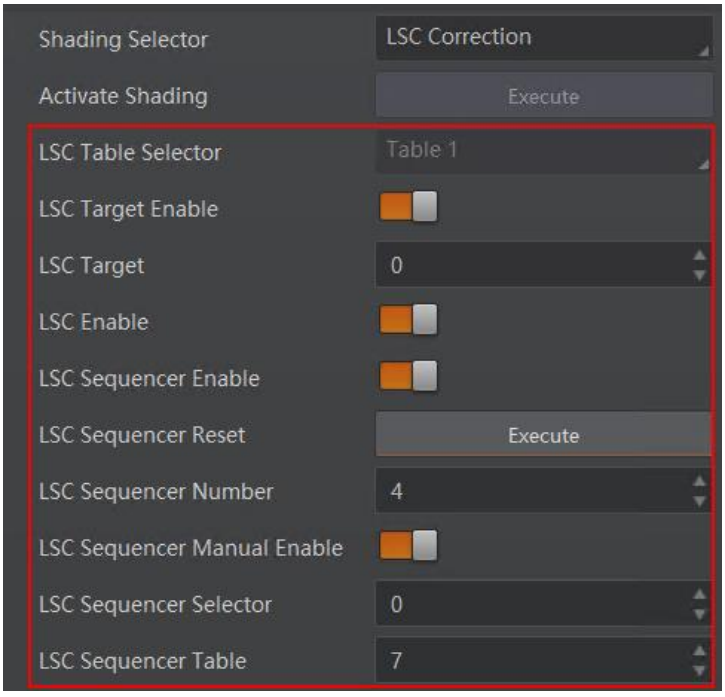


Figure 13-13 LSC Sequencer

Note

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

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

13.7.3 FFC Correction

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

Steps

1. Select **FFC Correction** as **Shading Selector**.
2. Click **Execute** in **Activate Shading**, and enable **FFC Enable**.

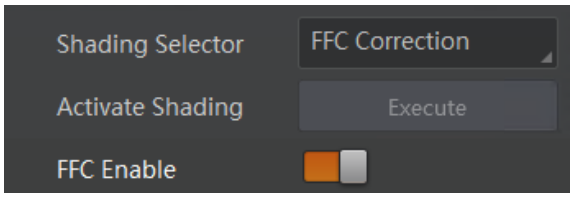


Figure 13-14 FFC Correction

13.7.4 User PRNUC Correction

The device currently supports user PRNUC (Photo-Response Non-Uniformity Correction) function that eliminates vertical line on the images.

Steps

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

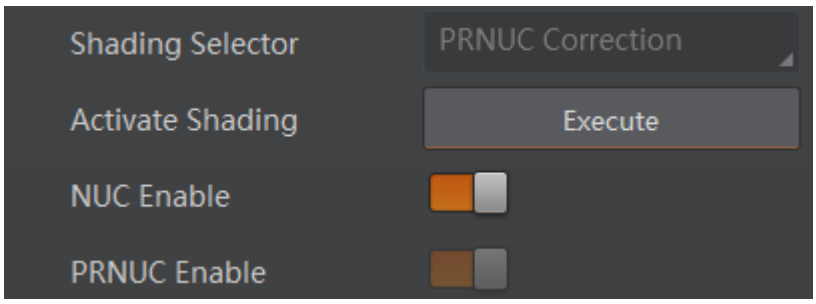


Figure 13-15 User PRNUC Correction

13.7.5 Other Corrections

Other corrections include FPNC correction and PRNUC correction. The images before correction and after correction are shown below.

Figure 13-16 Before Correction

Figure 13-17 After Correction

Go to **Shading Correction**, and enable **NUC Enable**. The **FPNC Enable** and **PRNUC Enable** will be automatically enabled or disabled according to the device's condition.

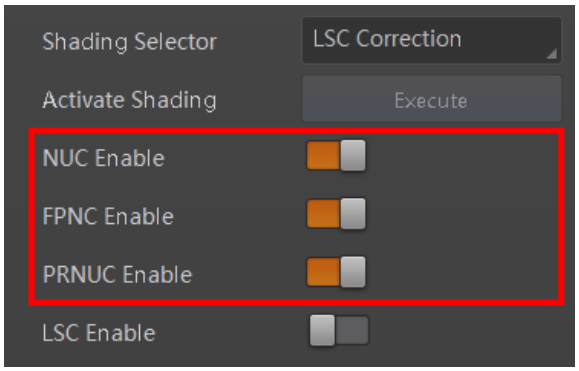


Figure 13-18 Other Corrections

Note

The correction function and operation may differ by device models.

13.8 Set LUT

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

Note

- You cannot use Gamma correction function and LUT function at the same time.
- The range of the LUT index is from 0 to 1023.
- The value of LUT value is four times the value of LUT index by default. With different ADC bit depth, the range of the LUT value may differ.
- The parameter of **LUT Save** may differ by device models. If the device has no **LUT Save**, the settings you configured will be saved in the device in real time.
- For different LUTs, after you set **LUT Index** and **LUT Value**, you should click **Execute** in **LUT Save** respectively.

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.

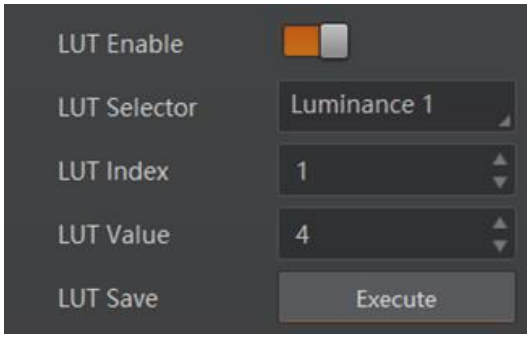


Figure 13-19 Set LUT

13.9 Set FTO Mode

Note

The FTO mode function may differ by device models.

FTO (Four to One) mode enables the device to combine four acquired images to one image of 604 MP, as shown below.

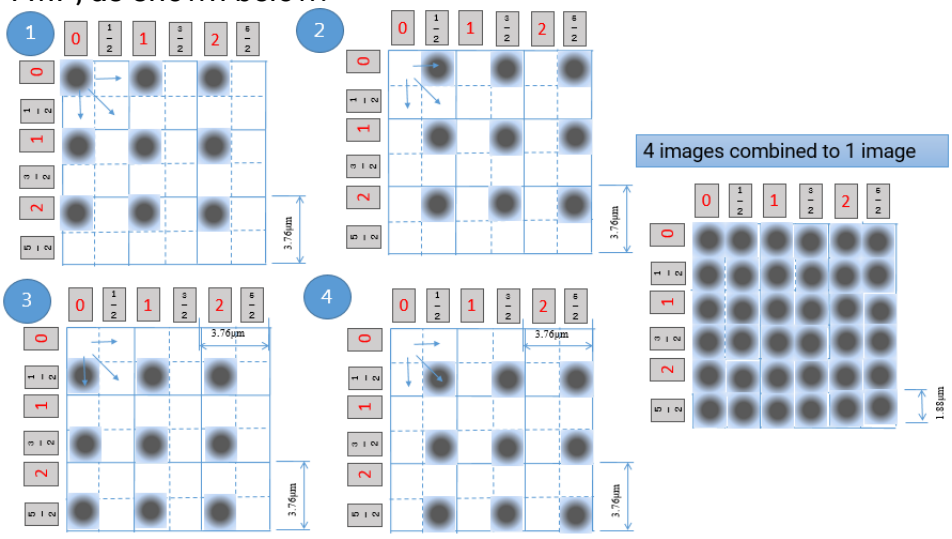


Figure 13-20 FTO Mode

Go to **Image Format Control**, and enable **FTO Mode** according to actual demands.

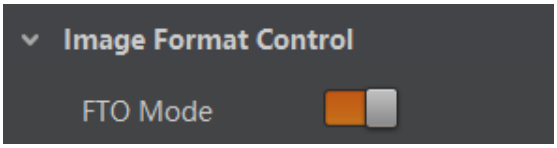


Figure 13-21 Enable FTO Mode

After enabling FTO mode, the device has pixel shifting function. This function shifts the image sensor to X and Y direction precisely using the 2D-Stage. The resulting image can be combined of 4 individual images captured by shifting the image sensor to X and Y direction. Thus, the output image offers improved resolution (4 Shot Result Image) in comparison with standard output image (1 Shot Result Image).

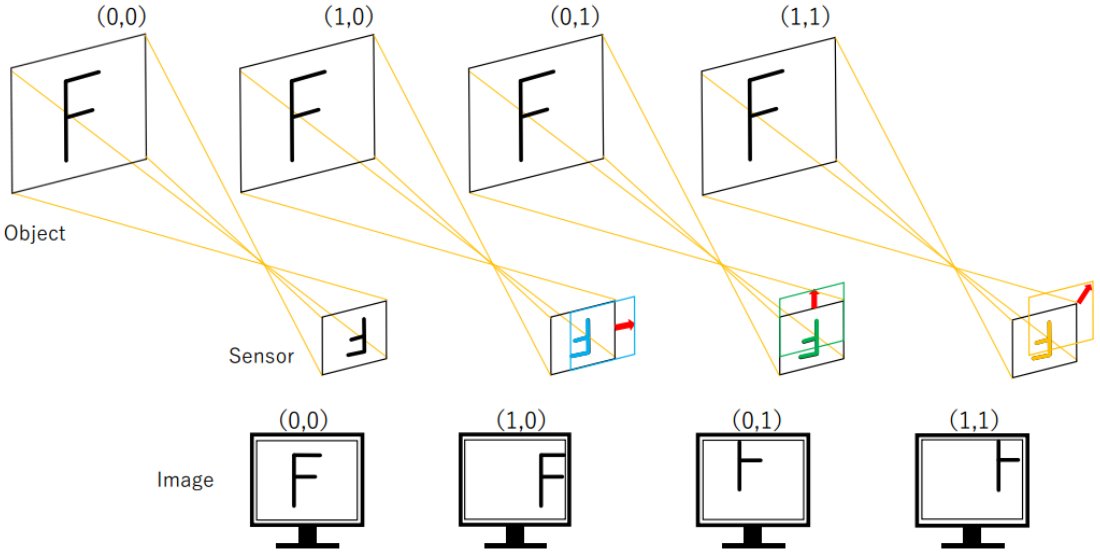


Figure 13-22 Pixel Shifting

Chapter 14 Other Functions

14.1 Device Control

Note

The specific device control parameters may differ by device models.

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

Table 14-1 Parameter Description

Parameter	Read/Write	Description
Device Scan Type	Read only	It is the scan type of the device's sensor.
Device Vendor Name	Read only	It is the name of the manufacturer of the device.
Device Model Name	Read only	It is the model of the device.
Device Manufacturer Info	Read only	It is the manufacturer information about the device.
Device Version	Read only	It is the version of the device.
Device Firmware Version	Read only	It is the firmware version of the device.
Device Serial Number	Read only	It is device's serial number.
Device User ID	Read and write	Device name and it is empty by default. You can set according to your preference.
Device Revision	Read only	It is CoaXPress protocol version.
Device Manifest Size	Read only	It is the quantity of GenICam XML in the device.
Device Manifest Selector	Read and write	It is the current ID of GenICam XML.
Device XML Version	Read only	It is the version of GenICam XML.
Device Schema Version	Read only	It is the structure version of GenICam.
Device Uptime (s)	Read only	It is the period of time when device is powered up.
Board Device Type	Read only	It is the device type.
TEC Enable	Read and write	Enable it to enable TEC function.
TEC Temperature	Read and write	It sets the maximum temperature of sensor. ● If actual sensor's temperature is lower than

Parameter	Read/Write	Description
		this parameter, and TEC function is not enabled. ● If actual sensor's temperature is higher than this parameter and TEC enable is enabled, and then TEC function is enabled.
Device Fan Enable	Read and write	It enables the device fan.
Device Temperature Selector	Read and write	It selects device temperature, including sensor and mainboard.
Device Temperature	Read only	It displays the real-time temperature of the device's motherboard you selected in **Device Temperature Selector**.
Sensor Board Temperature	Read only	It displays the real-time temperature of the device's sensor you selected in **Device Temperature Selector**.
Fan Control Mode	Read and write	It sets the fan mode. ● In auto mode, it includes three-level fan speed: 70, 85 and 100. According to the difference between the configured sensor temperature (TEC Temperature parameter) and the actual temperature, adjustment is made every 30 seconds. If actual temperature - configured temperature > 2 degrees, fan speed will increase. Otherwise, fan speed will decrease. ● In manual mode, the fan speed is decided by value set in **Fan Speed**.
Fan Speed	Read and write	It sets the fan speed, and its range is from 40 to 100.
Device Command Timeout	Read only	It counts the timeout of command.
Device Reset	Write only	Click **Execute** to reset the device.
Find Me	Read and write	Click **Execute** to let red indicator flash several times, and find device.
Device PJ Number	Read only	It is the device's project number.

14.2 Transfer Layer Control

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

Note

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

Table 14-2 Parameters of Transfer Layer Control

Parameter	Read/Write	Description
Paylode Size	Read only	It is the device's load size.
Device Tap Geometry	Read and write	It is the tap configuration mode.
GenCP Version Major	Read only	It is the major version in GenCP version.
GenCP Version Minor	Read only	It is the minor version in GenCP version.
Image1 StreamID	Read only	It is the ID of image 1.
Image2 StreamID	Read only	It is the ID of image 2.

14.3 CoaXPress Parameters

You can go to **CoaXPress** to view and set the parameters of CoaXPress interface.

Note

The specific **CoaXPress** parameters may differ by device models.

Table 14-3 CoaXPress Interface 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 main host ID.
Control Packet Max Size	Read Only	It is the max. size of single control packet.
Device Steam Max Size	Read, and Write if not Acquisition	It is the max. size of single stream packet.
LinkConfiguration	Read, and Write if not Acquisition	It sets link configuration mode.

Parameter	Read/Write	Description
LinkConfigurationPreferred	Read Only	It is recommended link configuration mode. You can click **Execute** in **User Set Save** after configuring **LinkConfiguration** to save it. At this time, **LinkConfigurationPreferred** is related with **LinkConfiguration**.
ConnectionTestMode	Read & Write	It checks test data sent between the device and frame grabber, and is disabled by default.
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.

14.4 File Access Control

Note

The file access control function may differ by device model.

The file access function can import or export the device's feature files and save them in mfa format. Currently, the device supports User Set 1/2/3, DPC, LUT Luminance 1/2/3, MPRNUC, HPRNUC, FFC, and DFFC.

Steps

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

Figure 14-1 File Access

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

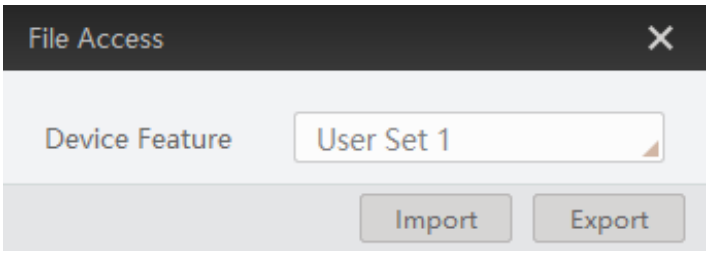


Figure 14-2 Import or Export

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

Note

- If User Set 1/2/3 is selected as device feature, you need to load the corresponding user set you selected to take effect.
- If LUT Luminance 1/2/3 is selected as device feature, and they will take effect only when you select the same parameters in LUT Selector.
- If DPC, MPRNUC, HPRNUC, FFC, or DFFC is selected as device feature, and it will take effect immediately after importing.
- Importing and exporting the device feature among the same model of devices are supported.

14.5 Update Firmware

The device supports updating firmware via the **Firmware Upgrade Tool** or the USB interface.

Note

The USB interface may differ by device models.

Update Firmware via Firmware Upgrade Tool

Note

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

Steps

1. Go to **Tool** → **Toolkit** 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. Select **PCIe**, and 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.

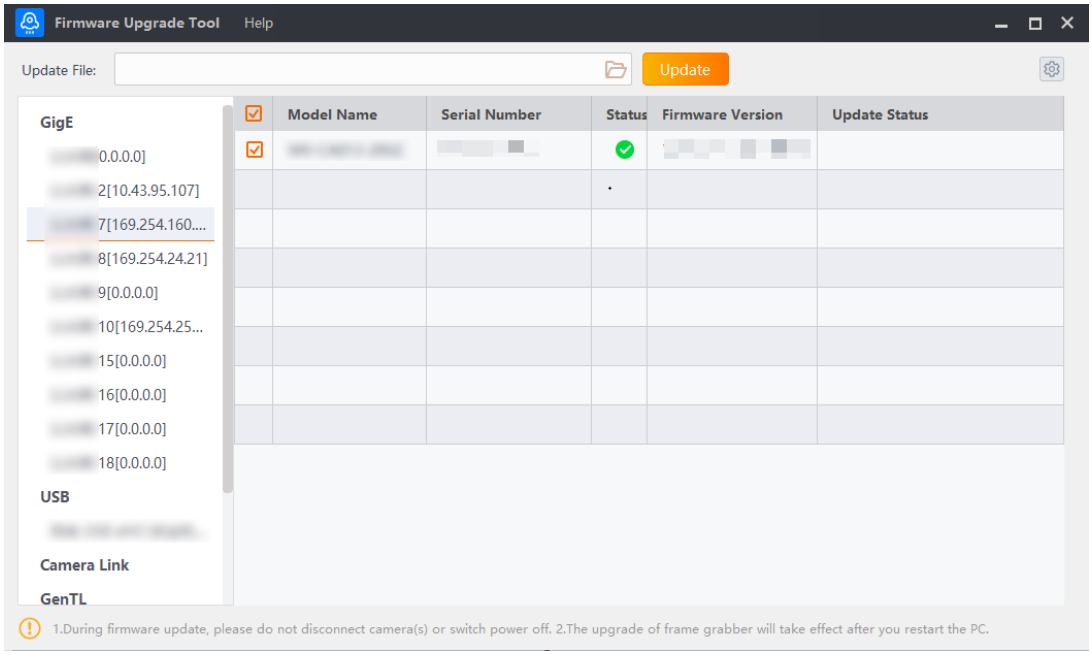


Figure 14-3 Update Firmware

Note

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

Update Firmware via USB Interface

Steps

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

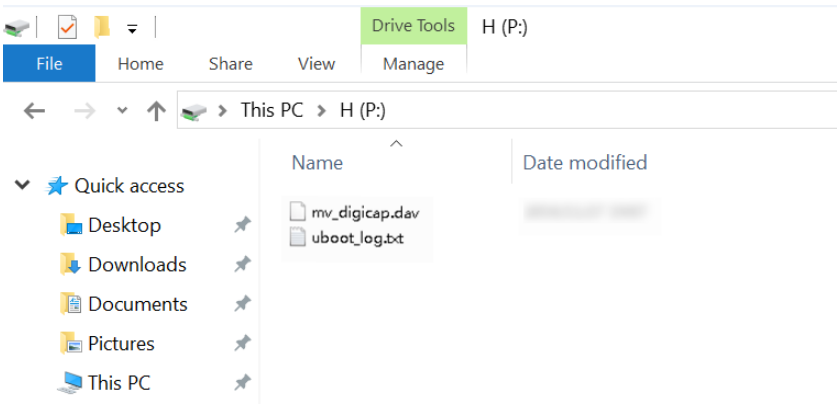


Figure 14-4 Copy Files

3. Restart the device to update firmware.

Note

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

Chapter 15 FAQ (Frequently Asked Question)

15.1 Why the client software is stuck when listing devices?

Reason

- The device is not connected correctly.
- The frame grabber is not installed firmly.

Solution

- Check the wiring between the device and the frame grabber.
- Reinstall the frame grabber.

15.2 Why the client software cannot list devices?

Reason

- After powering on the device, searching the device via frame grabber client software too early.
- When creating new project in frame grabber client software, virtual frame grabber is selected.

Solution

- After the blue indicator lights on the device, searching the device via frame grabber client software.
- When creating new project in frame grabber client software, select physical frame grabber rather than virtual one. If there is no frame grabber model, check PCIe card slot.

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

Reason

- Incorrect trigger wiring.
- The trigger mode is not enabled correctly.

Solution

- Check wirings of different trigger modes.
- Enable the trigger mode and make sure that the selected trigger source matches with the corresponding trigger signal.

15.4 Why the client software turns to the blue screen?

Reason

Close frame grabber client software with force during image acquisition.

Solution

Stop image acquisition first, and then close frame grabber client software.

15.5 Why the live view image in the client software is abnormal?

Reason

The device or frame grabber exception occurs.

Solution

Go to MVS Toolkit to check CRC Error Counter.

- If CRC Error Counter is 0, frame grabber exception occurs. Please contact frame grabber manufacturer.
- If CRC Error Counter is not 0, device exception occurs. Please contact our technical support personnel.

Chapter 16 Revision History

Table 16-1 Revision History

Version	Document No.	Revision Date	Revision Details
V3.0.0	UD40467B	Dec. 5, 2024	Edit the whole structure and content.
V2.2.0	UD32244B	Feb. 17, 2023	● Edit Appearance. ● Add Section Set FTO Mode.
V2.1.0	UD29923B	Aug. 25, 2022	● Edit Safety Instructions. ● Edit Appearance. ● Edit Indicator Description.
V2.0.9	UD26060B	Nov. 1, 2021	● Edit Section Set HDR. ● Edit Section LSC Correction.
V2.0.8	UD24053B	Aug. 10, 2021	● Edit Section Appearance. ● Edit Section Interface and Indicator. ● Edit Section Install MVS Client Software. ● Add Section Connect Device to MVS Client Software. ● Add Section Sensor Shutter Mode. ● Edit Section Set Shading Correction. ● Edit Section Device Control. ● Add Section File Access Control. ● Edit Update Firmware.
V2.0.3	UD22073B	Nov. 20, 2020	● Edit Section Appearance. ● Edit Section Interface and Indicator. ● Edit Section Installation Preparation. ● Edit Section Set External Trigger Source. ● Add Section Set Anyway Mode. ● Edit Section Set Trigger Activation. ● Edit Section Enable Strobe Signal. ● Edit Section Set Pixel Format. ● Edit Section Set Test Pattern.
V1.1.1	UD17793B	Dec. 17, 2019	Original version.

Appendix A Device Parameter Index

Table A-1 Device Parameter Index

Attribute	Parameters	Section
Device Control	Device Scan Type	Section Device Control
	Device Vendor Name	
	Device Model Name	
	Device Manufacturer Info	
	Device Version	
	Device Firmware Version	
	Device Serial Number	
	Device User ID	
	Device Revision	
	Device Manifest Size	
	Device Manifest Selector	
	Device Xml Version	
	Device Schema Version	
	Device Uptime (s)	
	Board Device Type	
	TEC Enable	
	TEC Temperature	
	Device Fan Enable	
	Device Temperature Selector	
	Device Temperature	
	Sensor Board Temperature	
	Fan Control Mode	
	Fan Speed	
	Device Command Timeout	
	Device Reset	
	Find Me	

Attribute	Parameters	Section
	Device PJ Number	
Image Format Control	FTO Mode	Section Set FTO Mode
	Width Max	Section Set Resolution and ROI
	Height Max	
	Region Selector	
	Width	
	Height	
	Offset X	
	Offset Y	
	Reverse X	Section Set Image Reverse
	Reverse Y	
	ADC Bit Depth	Section Set Pixel Format
	Pixel Format	
	Pixel Size	
	Test Pattern Generator Selector	Section Set Test Pattern
	Test Pattern	
	Binning Mode	Section Set Binning
	Binning Selector	
	Binning Horizontal	
	Binning Vertical	
	Decimation Horizontal	Section Set Decimation
	Decimation Vertical	
Acquisition Control	Acquisition Mode	Section Set Acquisition Mode
	Acquisition Start	
	Acquisition Stop	
	Acquisition Burst Frame Count	Section Set Acquisition Burst Frame Count
	Acquisition Frame Rate (Fps)	Section Set Frame Rate
	Acquisition Frame Rate Control Enable	
	Resulting Frame Rate (Fps)	

Attribute	Parameters	Section
	Overlap Mode	Section Non-Overlap Exposure and Overlap Exposure
	Trigger Selector	Section Set Trigger Source
	Trigger Mode	
	Trigger Software	
	Trigger Source	
	Trigger Activation	
	Trigger Delay (μs)	
	Trigger Cache Enable	
	Sensor Shutter Mode	Section Sensor Shutter Mode
	Exposure Time Mode	Section Set Exposure Time Mode
	Exposure Mode	Section Set Exposure Auto
	Exposure Time (μs)	
	Exposure Auto	
	Auto Exposure Time Lower Limit (μs)	
	Auto Exposure Time Upper Limit (μs)	
	HDR Enable	Section Set HDR
	HDR Reset	
	HDR Number	
	HDR Selector	
	HDR Shutter (μs)	
	HDR Gain	
	HDR Balance Ratio R	
	HDR Balance Ratio G	
	HDR Balance Ratio B	
Analog Control	Preamp Gain	Section Set Analog Gain
	Gain	
	Gain Auto	

Attribute	Parameters	Section
	Auto Gain Lower Limit	
	Auto Gain Upper Limit	
	Digital Shift	Section Set Digital Gain
	Digital Shift Enable	
	Brightness	Section Set Brightness
	Black Level	Section Set Black Level
	Black Level Enable	
	Balance White Auto	Section Set White Balance
	AWB Color Temperature Mode	
	Balance Ratio Selector	
	Balance Ratio	
	Gamma	Section Set Gamma Correction
	Gamma Selector	
	Gamma Enable	
	Sharpness	Section Set Sharpness
	Sharpness Enable	
	Auto Function AOI Selector	Section Set AOI
	Auto Function AOI Width	
	Auto Function AOI Height	
	Auto Function AOI Offset X	
	Auto Function AOI Offset Y	
	Auto Function AOI Usage Intensity	
	Auto Function AOI Usage White Balance	
Color Transformation Control	Color Transformation Selector	Section Set Color Transformation Control
	Color Transformation Enable	
	Color Transformation Value Selector	
	Color Transformation Value	
	Hue	Section Set Hue
	Hue Enable	
	Saturation	Section Set Saturation

Attribute	Parameters	Section
	Saturation Enable	
LUT Control	LUT Selector	Section Set LUT
	LUT Enable	
	LUT Index	
	LUT Value	
	LUT Save	
Shading Correction	Shading Selector	Section Set Shading Correction
	Activate Shading	
	FFC Enable	
	PRNUC Enable	
	NUC Enable	
	FPNC Enable	
	LSC Enable	
	LSC Table Selector	
	LSC Target Enable	
	LSC Target R	
	LSC Target G	
	LSC Target B	
	LSC Sequencer Enable	
	LSC Sequencer Reset	
	LSC Sequencer Number	
	LSC Sequencer Manual Enable	
	LSC Sequencer Selector	
	LSC Sequencer Table	
Digital IO Control	Line Selector	Section Trigger Output
	Line Mode	
	Line Inverter	
	Line Status	
	Line Status All	
	Line Debouncer Time (μs)	

Attribute	Parameters	Section
	Line Source	
	User Output Value	
	Strobe Enable	
	Strobe Line Duration (μs)	
	Strobe Line Delay (μs)	
	Strobe Line Pre Delay (μs)	
Counter and Timer Control	Counter Selector	Section Set and Execute Counter Trigger
	Counter Event Source	
	Counter Reset Source	
	Counter Reset	
	Counter Value	
	Counter Current Value	
File Access Control	File Selector	Section File Access Control
	File Operation Selector	
	File Operation Execute	
	File Open Mode	
	File Operation Status	
	File Operation Result	
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Transport Layer Control	Payload Size	Section Transport Layer Control
	Device Tap Geometry	
	GenCP Version Major	
	GenCP Version Minor	
	Image1StreamID	
	Image2StreamID	
User Set Control	User Set Current	Section User Set Customization
	User Set Selector	
	User Set Load	
	User Set Save	
	User Set Save Status	

Attribute	Parameters	Section
	User Set Default	
CoaXPress	Device Connection ID	Section CoaXPress Parameters
	Master Host Connection ID	
	Control Packet Max Size	
	Device Steam Max Size	
	LinkConfiguration	
	LinkConfigurationPreferred	
	ConnectionTestMode	
	TestErrorCountSelector	
	TestErrorCount	
	TestPacketCountTx	
	TestPacketCountRx	

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Hikrobot Co., Ltd.

Tel: 400-989-7998

Website: https://en.hikrobotics.com/

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