Camera Link Line Scan Camera

User Manual

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Note

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Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Conditions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

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CE

This product and - if applicable - the supplied accessories too are marked with "CE" and comply therefore with the applicable harmonized European standards listed under the Directive 2014/30/EU(EMCD),Directive 2001/95/EC(GPSD) and Directive 2011/65/EU(RoHS).

2012/19/EU (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling, return this product to your local supplier

upon the purchase of equivalent new equipment, or dispose of it at designated collection points. For more information see: http://www.recyclethis.info

2006/66/EC (battery directive): This product contains a battery that cannot be disposed of as unsorted municipal waste in the European Union. See the product documentation for specific battery information. The battery is marked with this symbol, which may include lettering to indicate cadmium (Cd), lead (Pb), or mercury (Hg). For proper recycling, return the battery to your supplier or to a designated collection point. For more information see: http://www.recyclethis.info

Warning: This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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Symbol Conventions

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

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

Available Model

This manual is applicable to the Camera Link line scan camera.

Safety Instruction

These 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.
- To ensure personal and device safety, when installing, operating, and maintaining the

device, follow the signs on the device and in the manual, 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.

⚠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 plug or socket of the device is a component for disconnecting the power supply, and do not block it.
- Make sure to disconnect the power supply when wiring, installing, disconnecting, etc. Do not operate with electricity, otherwise there will be 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).
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.
- 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.

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.
- 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.

Personnel Requirement

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.

Electromagnetic Interference Prevention

- Make sure that the shielding layer of cables is intact and 360° connected to the metal connector when using shielded cables.
- Do not route the device together with other equipment (especially servo motors, high-power devices, etc.), and control the distance between cables to more than 10 cm. Make sure to shield the cables if unavoidable.
- The control cable of the device and the power cable of the industrial light source must be wired separately to avoid bundled wiring.

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

Contact Information

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Contents

Chapter 1 Overview

1.1 Introduction

The Camera Link line scan camera uses the Camera Link interface to transmit non-compressed images in real time, and it can be set parameters via the client software, the frame grabber software, SDK, etc. The device is applicable to industries like printing, metallurgy, food, logistics, transportation, material sorting, pharmaceutical manufacturing, etc.

1.2 Key Feature

- Supports configuration modes of Base, Medium, Full and 80-bit via the Camera Link interface.
- Supports TDI function to select different image modes.
- Supports exposure time and gain adjustment, PRNUC correction, LUT, Gamma correction, etc.
- Compact design and flexible installation.
- Compatible with Camera Link Protocol and GenICam Standard.

Note

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

Chapter 2 Appearance

Note

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

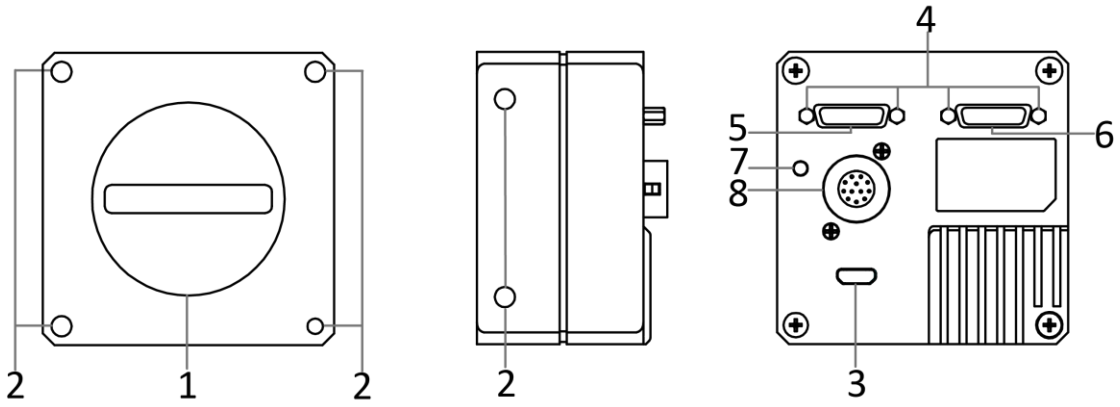


Figure 2-1 Appearance (Type I)

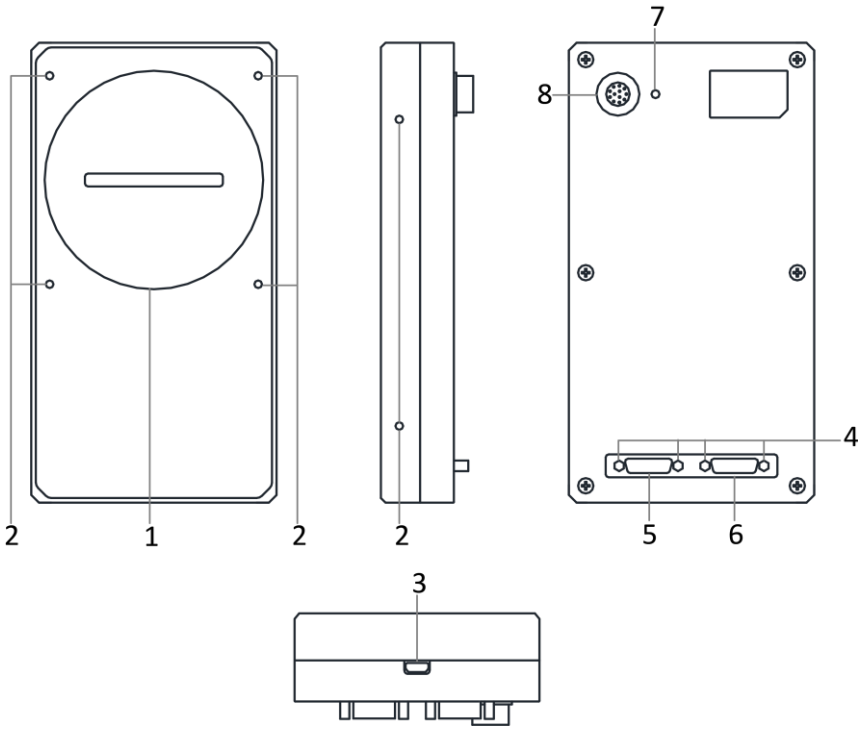


Figure 2-2 Appearance (Type II)

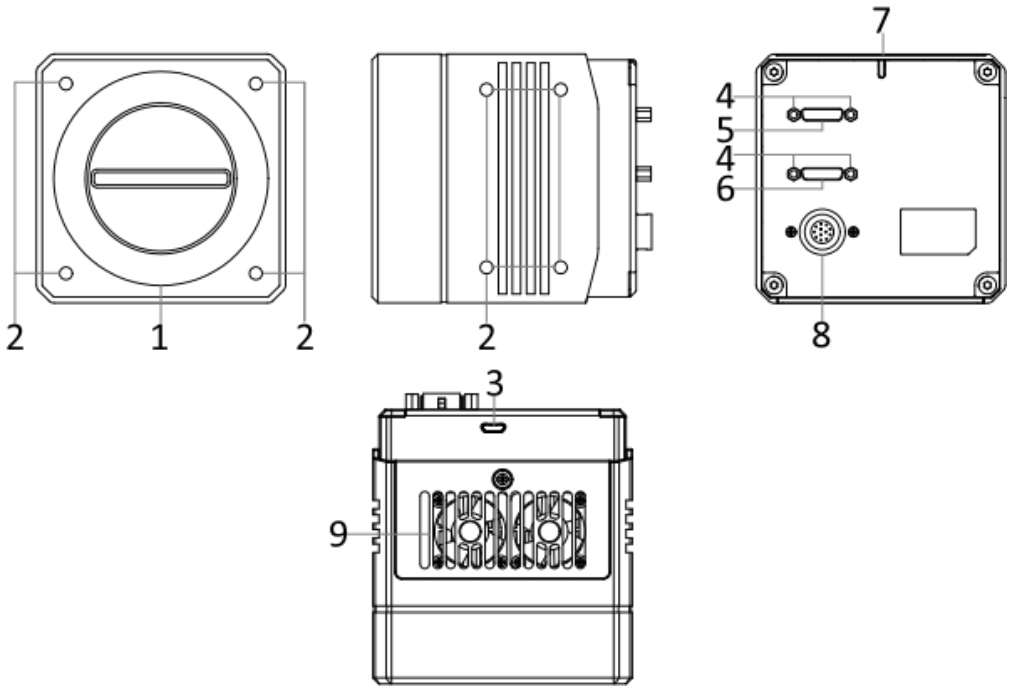


Figure 2-3 Appearance (Type III)

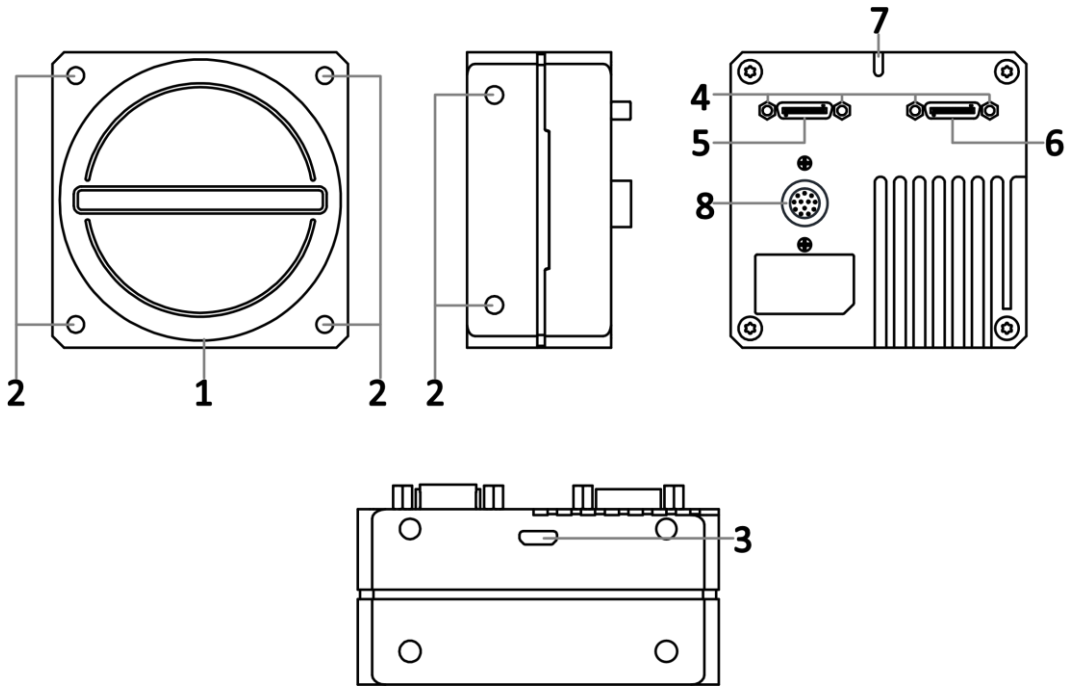


Figure 2-4 Appearance (Type IV)

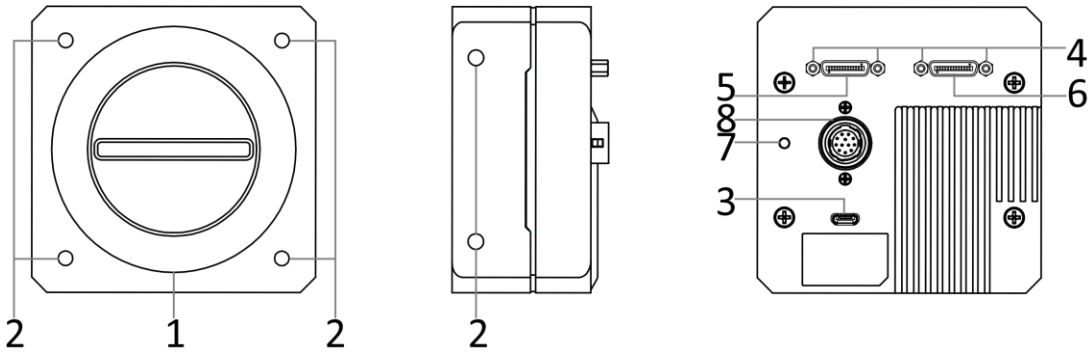


Figure 2-5 Appearance (Type V)

Table 2-1 Component Description

No.	Component	Description
1	Lens Mount	It is used to install lens.
2	Screw Hole	It is used to fix the device to the installation position. Refer to the device's specification for screw details.
3	USB Interface	It is used to update the device's firmware.
4	Screw Hole of Camera Link Interface	It is used to fix Camera Link cables.
5	CL1 Interface	It refers to the Camera Link1 with SDR interface, and it is used to transmit data.
6	CL2 Interface	It refers to the Camera Link2 with SDR interface, and it is used to transmit data.
7	LED Indicator	It indicates the device's status.
8	Power and I/O Connector	It refers to the 12-pin P10 connector that provides power, input and output signals, serial port function, etc.
9	Fan	It is used to cool the device.

Refer to the table below for the relation between device model and device appearance type.

Table 2-2 Device Model and Appearance Type

Device Model	Device Appearance Type
MV-CL042-91CM/CC	Type I device
MV-CL084-90CM, MV-CL086-90CC	Type II device
MV-CL086-91CC, MV-CL084-91CM-PRO, MV-CL086-91CC-PRO	Type III device
MV-CL081-41CM, MV-CL082-92CM, MV-CL083-92CC, MV-CL161-41CM, MV-CL161-91CM	Type IV device
MV-CL084-91CM, MV-CL086-91CC	Type V device

Chapter 3 I/O Connector and Indicator

3.1 Power and I/O Connector

All Camera Link line scan cameras have a 12-pin P10 connector, as shown below. However, the specific pin definitions differ by device models. Currently, two types of pin definitions are available.

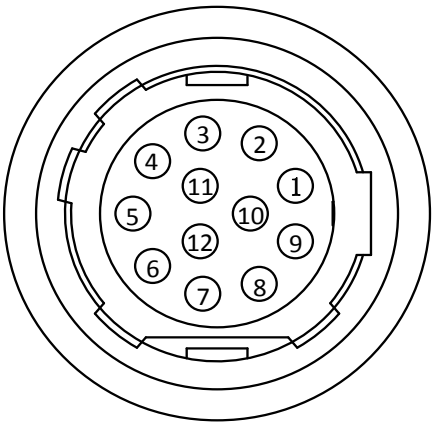


Figure 3-1 12-Pin P10 Connector

First Type of Pin Definitions

Regarding type I, type III, type IV and type V devices, read the table below to get their pin definitions.

Note

Refer to the table below and the label attached to the power and I/O cable to wire the device.

Table 3-1 First Type of Pin Definitions

No.	Signal	I/O Signal Source	Description
1	GND	--	Power supply ground
2	DC_PWR	--	DC power supply positive
3	LINE0_P	Line 0+	Differential input/output IO 0+
4	LINE0_N	Line 0-	Differential input/output IO 0-
5	GND	--	Power supply ground

No.	Signal	I/O Signal Source	Description
6	LINE3_P	Line 3+	Differential input/output IO 3+
7	LINE3_N	Line 3-	Differential input/output IO 3-
8	LINE4_P	Line 4+	Differential input/output IO 4+
9	LINE1_P	Line 1+	Differential input/output IO 1+
10	LINE1_N	Line 1-	Differential input/output IO 1-
11	DC_PWR	--	DC power supply positive
12	LINE4_N	Line 4-	Differential input/output IO 4-

Second Type of Pin Definitions

Regarding the type II device, read the table below to get its pin definitions.

Note

Refer to the table below and the label attached to the power and I/O cable to wire the device.

Table 3-2 Second Type of Pin Definitions

No.	Signal	I/O Signal Source	Description
1	GND	--	Power supply ground
2	DC_PWR	--	Power supply
3	IO_IN0_P	Line 0+	Differential input 0+
4	IO_IN0_N	Line 0-	Differential input 0-
5	GND	--	Signal ground
6	IO_IN1_P	Line 3+	Differential input 1+
7	IO_IN1_N	Line 3-	Differential input 1-
8	Reserved		
9	IO_OUT0_P	Line 1+	Differential output 0+
10	IO_OUT0_N	Line 1-	Differential output 0-
11	IO_OUT1_P	Line 4+	Differential output 1+
12	IO_OUT1_N	Line 4-	Differential output 1-

3.2 Indicator

The device's indicator is used to indicate the operation status of the device.

Note

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

Table 3-3 Indicator Description

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

Chapter 4 Installation

4.1 Installation Preparation

You need to prepare following accessories before device installation.

Table 4-1 Accessories

No.	Name	Quantity	Description
1	Power and I/O Cable	1	It refers to the 12-pin power and I/O cable that you need to purchase separately.
2	DC Power Supply	1	You should select suitable power adapter or switch power supply according to the device's power supply and consumption. You need to purchase it separately.
3	Camera Link Cables	1/2	It refers to the Camera Link cable, and the device's interface for connecting Camera Link cable is a SDR interface. You need to purchase cables separately in accordance with device interface and frame grabber interface.
4	Lens	1	You should purchase lens separately according to the device's lens mount.
5	Frame Grabber	1	It refers to Camera Link frame grabber that you need to purchase separately.
6	Lens Adapter	1	You should purchase lens adapter separately according to the device's lens mount and lens you use.

4.2 Install Device

Before You Start

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

Steps

1. Fix the device to the installation position.
2. Install the lens to the device.
3. Connect the device to a Camera Link frame grabber via the Camera Link cable(s).

Note

- The device's interface for connecting Camera Link cable is SDR, and you need to select

Camera Link cable according to the device's interface and frame grabber model you use, and connect the device's Camera Link interfaces to respective interfaces of the frame grabber.

- The device has 2 Camera Link interfaces, and it can transmit data via 1 or 2 Camera Link interface(s). If you need to use 1 interface, the corresponding interface number is CL1, and the Base configuration mode is available. If 2 interfaces are required, the corresponding interface number is CL1 and CL2, and the configuration mode of Base, Medium, Full or 80-bit is available.
- The configuration mode is decided by the device, frame grabber, and used Camera Link interface amount.

4. Connect the device to a suitable power adapter via a power and I/O cable.

Chapter 5 Device Connection

5.1 Install Frame Grabber Software

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

Steps

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

Note

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

5.2 Set Frame Grabber Software

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

Note

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

Table 5-1 Parameters of Dalsa Frame Grabber

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

Table 5-2 Parameters of Matrox Frame Grabber

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

5.3 Install MVS Client Software

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

Note

- The MVS client software is compatible with 32/64-bit Windows XP/7/10 operating systems.
- The graphic user interface may differ by different versions of the client software you use.
- 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**.

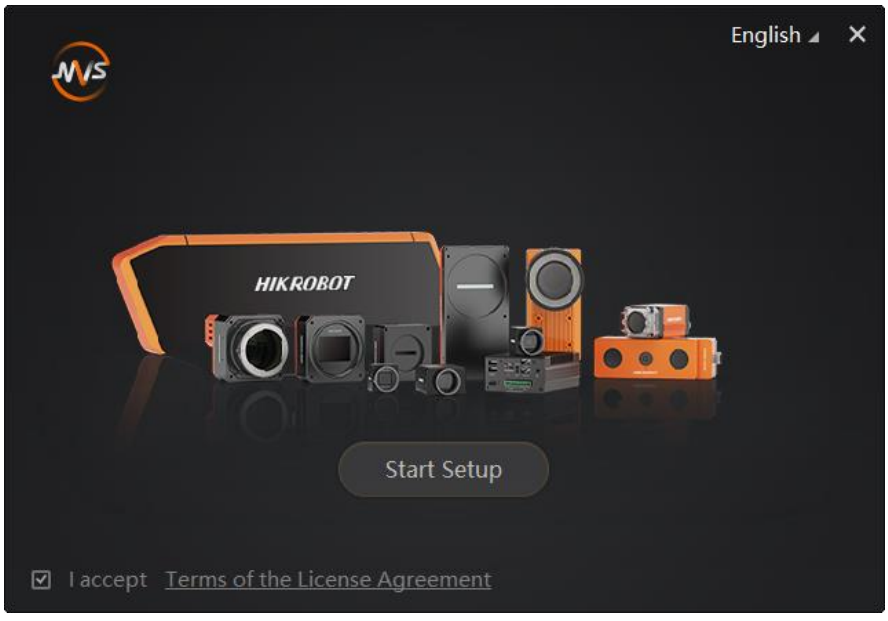


Figure 5-1 Installation Interface

4. Click **Start Setup**.

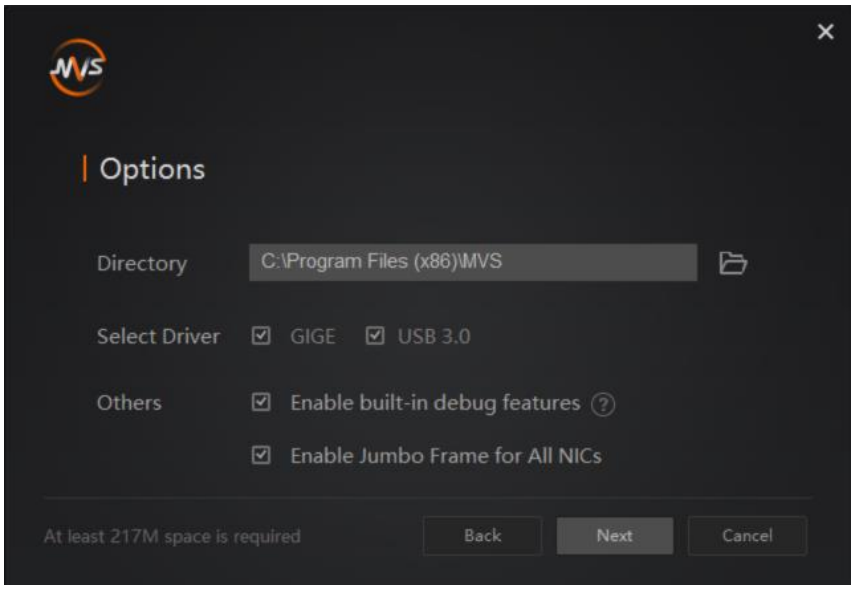


Figure 5-2 Default Settings

5. Keep default settings, and click **Next**.
6. Finish the installation according to the interface prompts.

5.4 Connect Device to MVS Client Software

Steps

1. Run the MVS client software.
2. Click  in Camera Link of the device list to search the device.

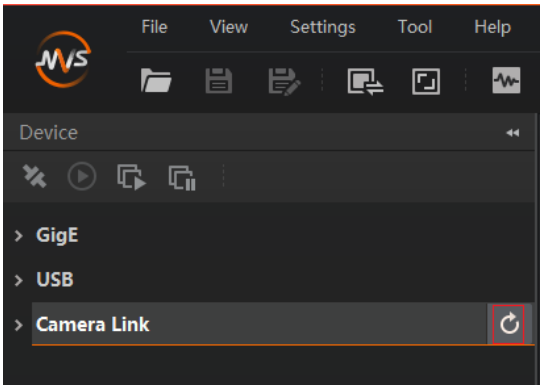


Figure 5-3 Search Device

Note

The refresh process may take a few minutes, please wait patiently.

3. Right click the device, and click **Baud Rate Settings** to set the baud rate to its max. value.
4. Double click the device, or click  to connect it to the client software.

Chapter 6 Quick Started with MVS

6.1 Client Software Layout

After connecting to the device, the client software can read the its attributes and display them.

Figure 6-1 Main Window

Note

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

Table 6-1 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.

No.	Name	Description
6	Feature Panel	You can view and set features of the selected device, and perform operations such as importing, exporting, and saving features.

Click ▸ in the device's feature panel to unfold the specific parameters, and set them according to actual demands.

Note

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

Table 6-2 Feature Tree Description

Feature Name	Description
Device Control	You can view the device information, edit its name, reset the device, etc.
Image Format Control	You can view and set the device's resolution, image reverse function, pixel format, region of interest, test pattern, etc.
Acquisition Control	You can view and set the device's line rate, trigger mode, exposure time, etc.
Analog Control	You can view and set the device's gain, black level, Gamma correction, sharpness, etc.
Color Transformation Control	You can view and set the device's color transformation related parameters like hue and saturation.
Super Palette Control	You can select different color areas in the image to set customized hue and saturation values.
LUT Control	You can view the Look-Up Table (LUT), and set its index and value.
Encoder Control	You can set encoder control to convert source signal of external trigger into internal signal.
Frequency Converter Control	You can set frequency converter control to convert external signal of different frequencies into internal signal.
Shading Correction	You can set shading correction to correct shade.
Digital IO Control	You can set the different input and output signals.
Counter and Timer Control	You can view and set the counter-related parameters when selecting counter active as line source.
File Access Control	You can view and set the device's file access control related parameters.

Feature Name	Description
Transport Layer Control	You can view and set the parameters of the device's transport layer.
User Set Control	You can save or load the device's parameters.

6.2 Transport Layer Control

The device's tap geometry should match with that of the frame grabber, and inconsistent parameters may lead to image exception.
In MVS client software, you can go to **Transport Layer Control** → **Device Tap Geometry** to check or set the tap geometry. The **CI Configuration** displays the mode that the device adopts currently.

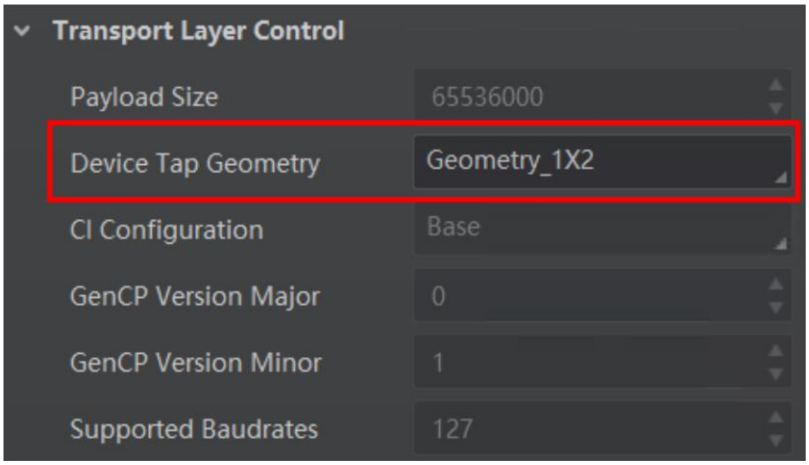


Figure 6-2 Device Tap Geometry

Note

The device's supported **Device Tap Geometry** and **CI Configuration** may differ by device models.

6.3 Serial Port Tool

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

6.3.1 View Serial Port Information

After installing the frame grabber, the PC will distribute a serial port to the frame grabber, and the MVS client software configures the device's parameters via this serial port. You

can view serial port information via the MVS client software or PC' s device manager.

Via MVS Client Software

After connecting the device, the MVS client software displays the serial port information in the device list, as shown below.

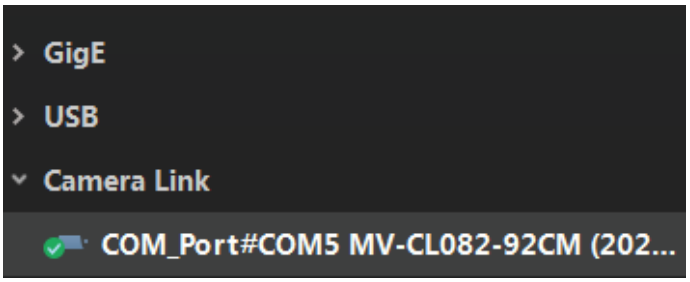


Figure 6-3 COM Port

Via Device Manager

In the PC's device manager, you can check whether the frame grabber driver is installed correctly. If the installation is correct, the device manager will display the installed frame grabber model and the corresponding serial port information. You can use the serial port tool to send commands to the corresponding serial port to check whether the connection is normal. For the specific setting method, refer to the user manual of the corresponding frame grabber.

6.3.2 Set Serial Port Parameters

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

Table 6-3 Serial Port Parameters

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

Note

- The default value of the device's baud rate is 9600 bps.
- The device's parameters can be set via the MVS client software, frame grabber software or serial port tool, but you cannot use them at same time.

The serial port tool can detect the device status, configure a valid serial port for the detected device, and configure parameters for the detected device.
The commands for setting device's parameters via serial port is sent in the format of ASCII code. The commands are send by user's application. After receiving commands, the device will return a value (success or fail).
The specific command format is ***< Command > < Node Name > < Value> <\r>***, and refer to the table below for details.

Table 6-4 Command Description

Reading/Writing Command Example	Return Value
If writing command is configured successfully.	Success! <\r> <\n>
If reading command is configured successfully.	● Success! <\r> <\n> <\r> <\n> ● get < Note Name >: <Value> <\r> <\n>
Configuring writing or reading command failed.	● Failed! <\r> <\n> <\r> <\n> ● Wrong input format. <\r> <\n>

Executing the reading or writing command is as follows.

Table 6-5 Command Example

Command for writing: The following example is to set the exposure as 1000 us. Command: ***w ExposureTime 1000 <\r>*** Returned value: Setting succeeded*: **Success! <\r> <\n>*** Setting failed*: **Failed! <\r> <\n> <\r> <\n> or Wrong input format. <\r> <\n>***
Command for reading: The following example is to get the exposure as 1000 us. Command: ***r ExposureTime <\r>*** Returned value: **Reading succeeded***: Success! <\r> <\n> <\r> <\n>* or *get ExposureTime: 1000 <\r> <\n>* **Reading failed***: Failed! <\r> <\n> <\r> <\n>* or *Wrong input format. <\r> <\n>*

Chapter 7 Image Acquisition

7.1 Set Line Rate

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

- Readout time: The less the readout time and the higher the line rate will be.
- Exposure time: The less the exposure time, the higher the line rate will be.
- Pixel format: The more bytes pixel format occupy, the lower the line rate will be.
- Quantity of connected Camera Link cables: The more connected Camera Link cables, the larger transmitted data, and the higher the line rate will be.

Steps

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

Figure 7-1 Set Frame Rate

Note

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

7.2 Set Scan Mode

Note

The scan mode function may differ by device models.

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

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

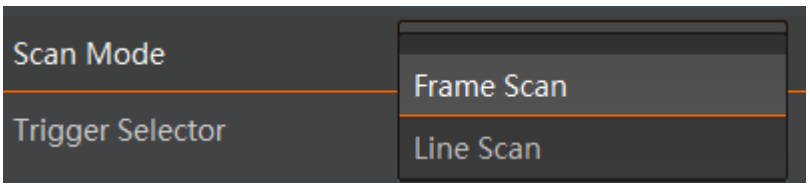


Figure 7-2 Set Scan Mode

Note

- If the **Scan Mode** selects **Line Scan**, the **Trigger Selector** can be **Line Start** only.
- If the device has no **Scan Mode**, the default mode is frame scan.

7.3 Set Frame Timeout

Note

The frame timeout function may differ by device models.

The device supports frame timeout function that affects the device's acquisition and image output mechanism.

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

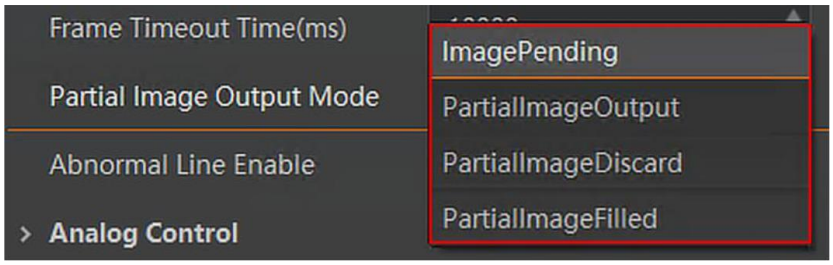


Figure 7-3 Set Frame Timeout

Table 7-1 Partial Image Output Mode Description

Parameter	Description
Image Pending	After the number of lines output by the device reaches the configured image height (height parameter), one frame of the image will be outputted. If the number of output lines does not reach the image height (height parameter), the SDK will not

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

Note

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

7.4 Set Line Discard Function

Note

The line discard function may differ by device models.

Additional trigger signals are required due to multi-line stacking and line frequency mismatched. The line discard function can control the number of external line trigger signals. You can go to **Acquisition Control**, and enable **Abnormal Line Enable** according to actual demands.

- The external device sends line trigger signal exceeding actual image height if **Abnormal Line Enable** is disabled.

- The external device sends line trigger signal matching actual image height if **Abnormal Line Enable** is enabled.

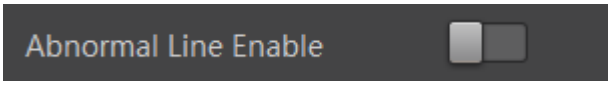


Figure 7-4 Set Line Discard Function

7.5 Set Trigger Mode

The device has 4 types of trigger modes, including internal trigger mode, line trigger mode, frame trigger mode, and line + frame trigger mode. The trigger mode is controlled by **Trigger Selector** and **Trigger Mode** in **Acquisition Control**.

Table 7-2 Trigger Mode Description

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

7.6 Set Trigger Source

Note

- The specific trigger source may differ by device models.
- Apart from internal trigger, you need to select trigger source if line trigger signal or frame trigger signal comes from external signal.
- Software trigger and action command trigger sources are valid for frame trigger only, and shaft encoder control is valid for line trigger only.
- Make sure to configure corresponding trigger mode before select specific trigger source.

- In line + frame trigger mode, when the trigger source selected by the frame trigger and the line trigger and the trigger-related parameters are the same, the first signal of trigger source will be used as the frame trigger signal to make the device start to acquire images, and the subsequent signals as line trigger signal to acquire images per lines until the processing of one frame of image is completed, and then the processing of the next frame of image is performed.

The device's trigger source includes software trigger, hardware trigger, shaft encoder control, frequency converter control, action command trigger, and free trigger. Go to **Acquisition Control → Trigger Source**, and select **Trigger Source** according to actual demands.

Table 7-3 Trigger Source Description

Trigger Source	Parameter Value	Description
Software Trigger	Software	The software sends trigger signal to the device via Camera Link interface to acquire images. **Note** The software trigger is available only when frame trigger is enabled.
Hardware Trigger	Line*	External device connects device via its I/O connector. External device sends trigger signal to device to acquire images.
Shaft Encoder Control	Encoder Module Out	This trigger source uses shaft encoder module to receive signal A and signal B with phase difference. After internal computing of the module, the outputted signal can be used as device's trigger signal. **Note** The shaft encoder control is available only when line trigger is enabled.
Frequency Converter Control	Frequency Converter	This trigger source allows different frequency between trigger device signal and required input signal.
Frame Grabber Trigger Control	CC 1/2/3/4	The frame grabber sends trigger signals to the device to acquire images.
Free Trigger	Anyway	Use trigger sources mentioned above to send trigger signal to the device to acquire images.

Set and Execute Software Trigger

In software trigger, the software sends trigger signal to the device via GigE interface to

acquire images.

Steps

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

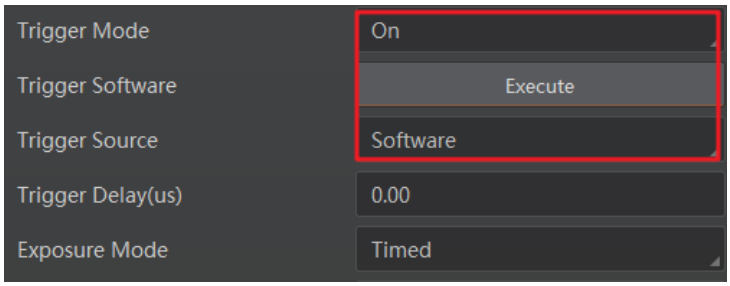


Figure 7-5 Set and Execute Software Trigger

Set and Execute Hardware Trigger

If the device enables the frame trigger or line trigger, you can select specific lines as trigger source to enable hardware trigger. At this time, external devices send commands to the device to acquire images.

Steps

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

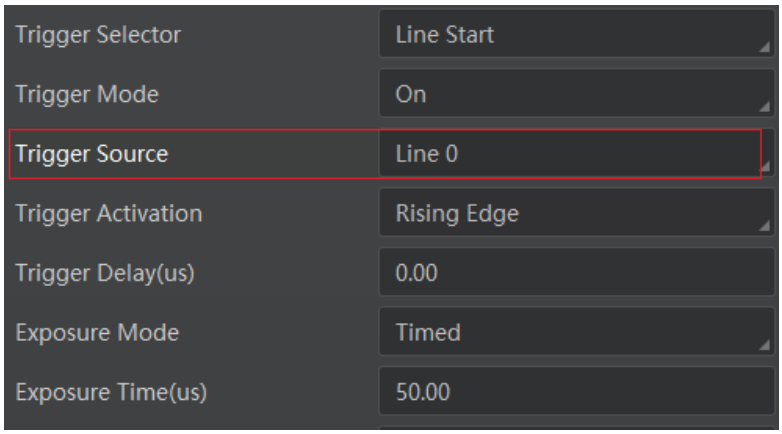


Figure 7-6 Set and Execute Hardware Trigger

When selecting bi-directional configurable line as the hardware trigger source, you need to make sure that its line mode is input. Go to **Digital IO Control**, select specific line as **Line Selector**, and **Input** as **Line Mode**.

Note

Here we take Line 2 as an example to introduce how to set bi-directional configurable line as the hardware trigger source. Refer to the device you got for the actual condition.

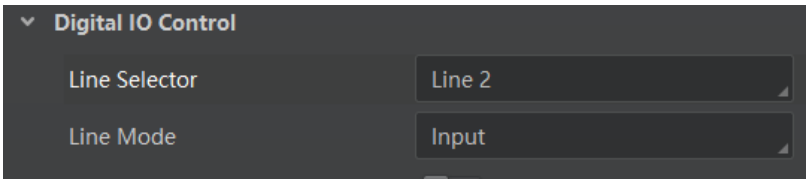


Figure 7-7 Select Line 2 as Line Selector

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

Note

The line format function may differ by device models.

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

Caution

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

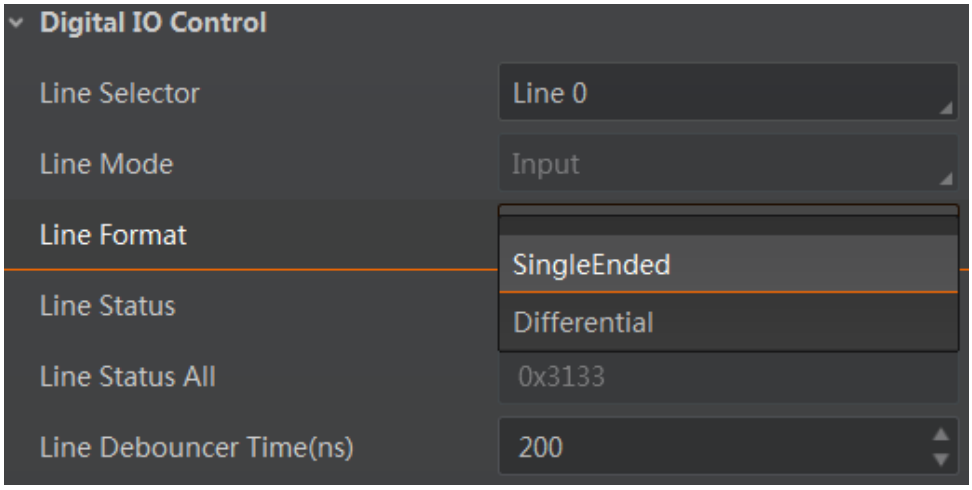


Figure 7-8 Set Line Format

Set and Execute Shaft Encoder Control

If the device enables the line trigger, you can select **Encoder Module Out** as trigger source. At this time, the device will receive signal A and signal B with phase difference. After internal computing, the outputted signal can be used as device's trigger signal. The function demonstration of shaft encoder module is shown below.

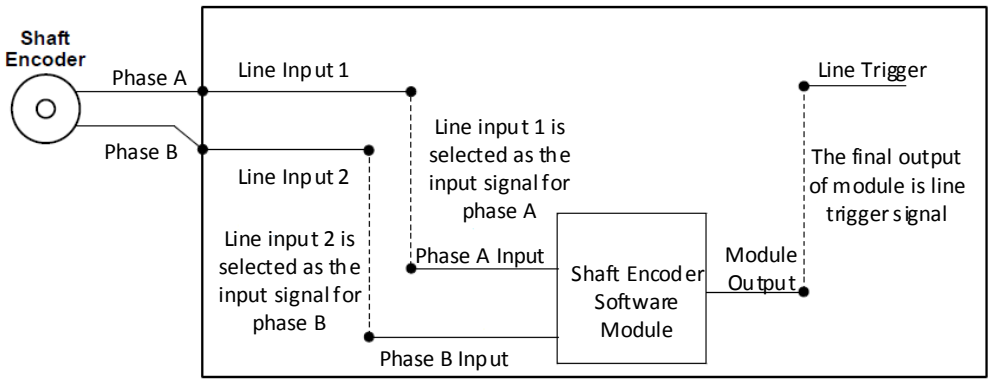


Figure 7-9 Function Demonstration

The advantages of shaft encoder are as follows:

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

Follow steps below to set shaft encoder control.

Steps

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

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

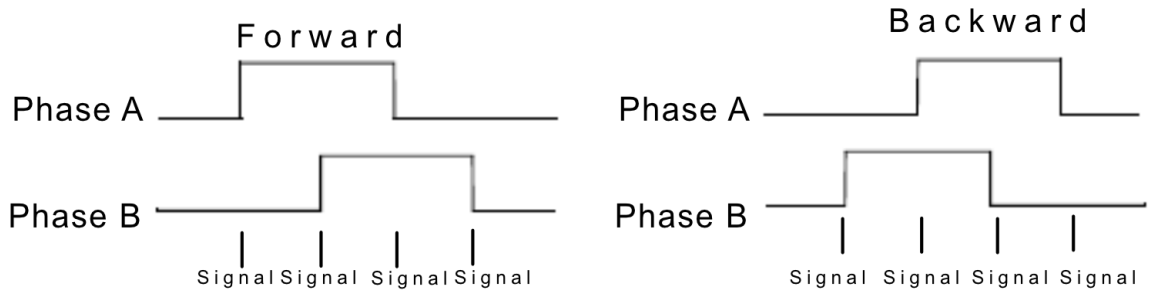


Figure 7-10 Process Logic

Note

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

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

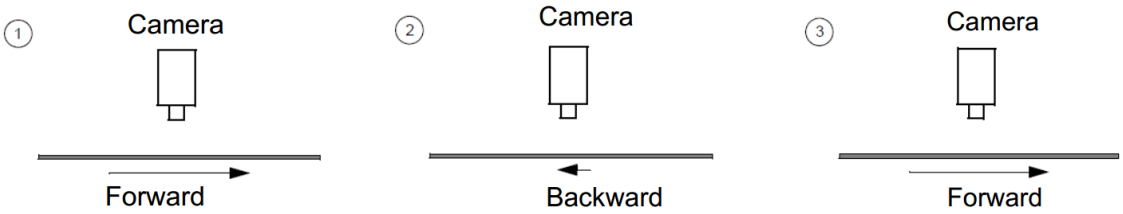


Figure 7-11 Counter Description

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

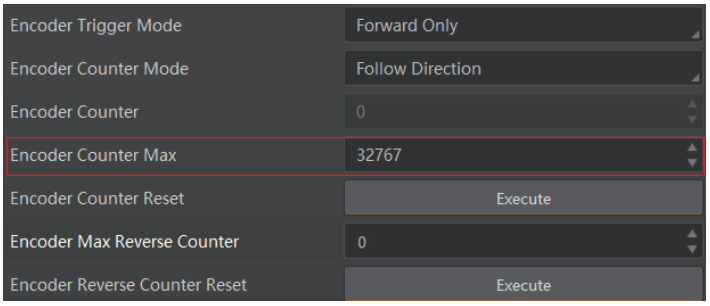


Figure 7-12 Set Encoder Counter Max

Note

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

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

Set and Execute Frequency Converter Control

If the device enables the frame trigger or the line trigger, you can select Frequency Converter as trigger source. The hardware signal trigger or shaft encoder control signal can be converted into the signal frequency of frame trigger or line trigger by device's frequency converter module.
The frequency converter module includes PreDivider, Multiplier and PostDivider. The signal after being processed by these 3 modules is the device's final trigger signal.

PreDivider

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

Multiplier

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

PostDivider

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

Steps

1. Click **Frequency Converter Control**, and select specific line, **Encoder Module Out** or CC 1/2/3/4 as **Input Source** according to actual demands.
2. Set **Rising Edge** or **Falling Edge** as **Signal Alignment** according to actual demands.
3. Set **PreDivider**, **Multiplier** and **PostDivider**.

Some device models support displaying trigger line rate.

Note

- Parameters of trigger line rate and resulting trigger line rate may differ by device models.
- Make sure that line trigger is enabled and input source value of frequency converter control and trigger source value of acquisition control is the same before viewing trigger line rate.

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

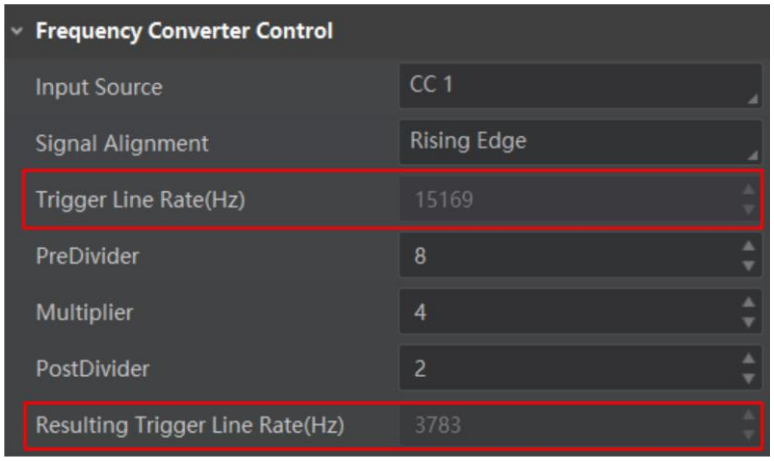


Figure 7-13 View Trigger Line Rate

Set and Execute Frame Grabber Trigger

When selecting **CC1/CC2/CC3/CC4** as **Trigger Source**, the device is in frame grabber trigger status. Frame grabber triggers device to acquire images by sending signal via Camera Link cable.

Steps

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

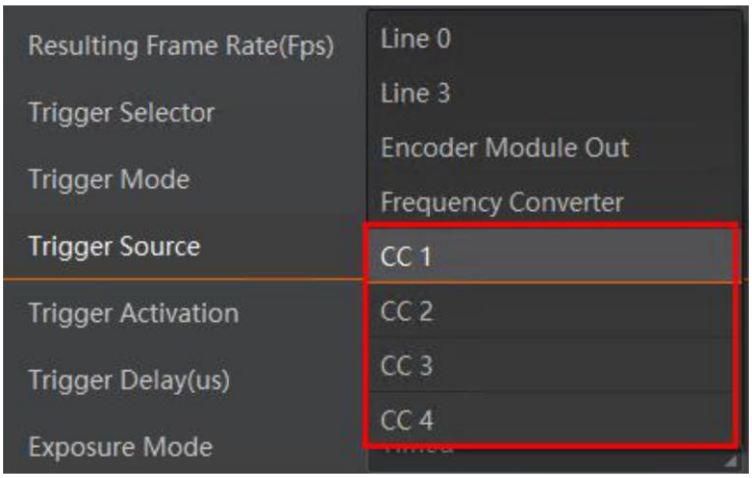


Figure 7-14 Set and Execute Frame Grabber Trigger

Set and Execute Free Trigger

If the device enables the frame trigger or line trigger, you can select **Anyway** as trigger source to enable the free trigger. At this time, the device can receive signals of all trigger sources.

Steps

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

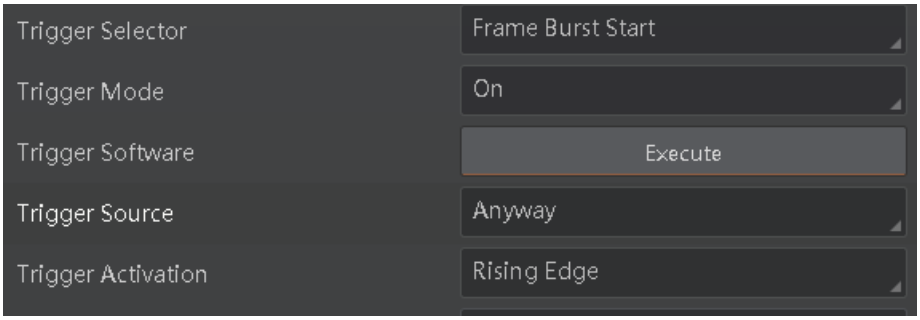


Figure 7-15 Set and Execute Free Trigger

7.7 Set Trigger Related Parameters

If the device enables the frame trigger or line trigger, you can set trigger related parameters, including acquisition burst frame count, trigger activation, trigger delay, trigger cache, and trigger debouncer.

Note

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

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

Table 7-4 Trigger Source and Trigger Related Parameters

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

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

Table 7-5 Trigger Source and Trigger Related Parameters

Trigger Source / Trigger Parameters	Hardware Trigger	Shaft Encoder Control	Frequency Converter Control	Frame Grabber Trigger	Free Trigger
Trigger Activation	√	√	√	√	√
Trigger Delay	√	√	√	√	√

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

Set Acquisition Burst Frame Count

If the device enables the frame trigger, you can set the acquisition burst frame count. Go to **Acquisition Control** → **Acquisition Burst Frame Count**, and enter **Acquisition Burst Frame Count** according to actual demands.

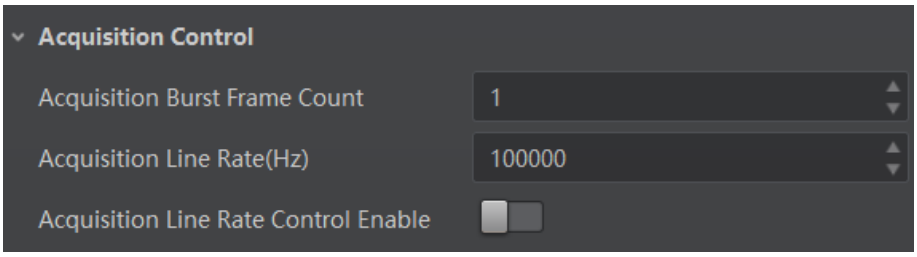


Figure 7-16 Set Acquisition Burst Frame Count

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

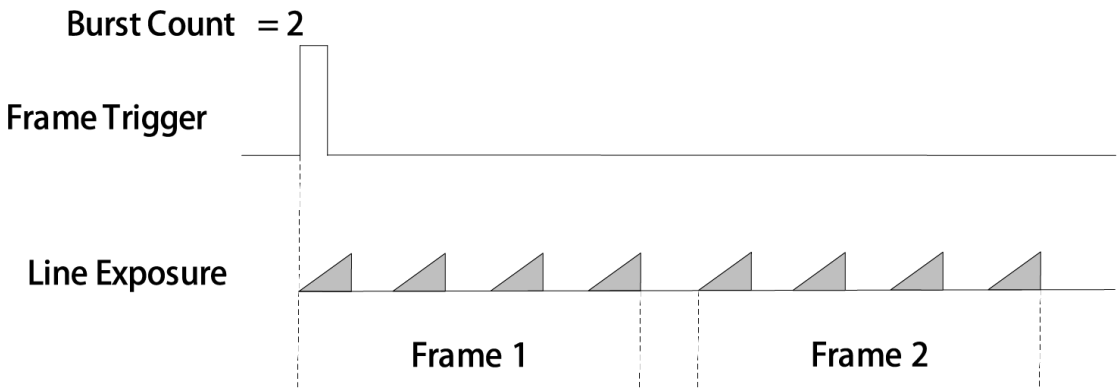


Figure 7-17 Sequence Diagram of Acquisition Burst Frame Count

Set Trigger Activation

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

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

Note

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

Set Trigger Activation in Frame Trigger

Go to **Acquisition Control**, and set **Trigger Activation** according to actual demands.

- When rising edge, falling edge or any edge is selected as **Trigger Activation**, you can set **Trigger Delay**.

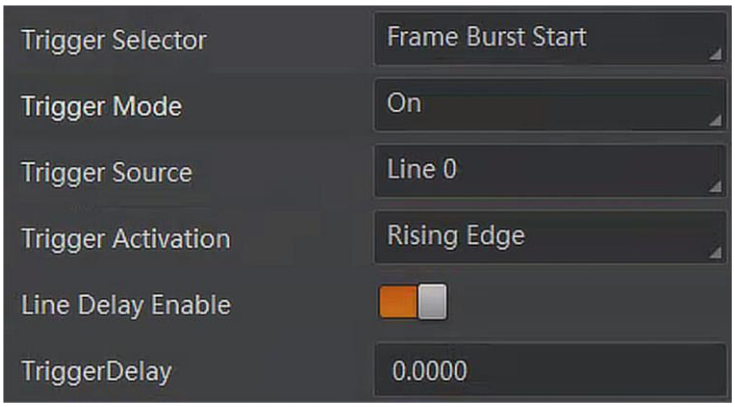


Figure 7-18 Edge Trigger in Frame Trigger

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

Figure 7-19 Level Trigger in Frame Trigger

Set Trigger Activation in Line Trigger

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

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

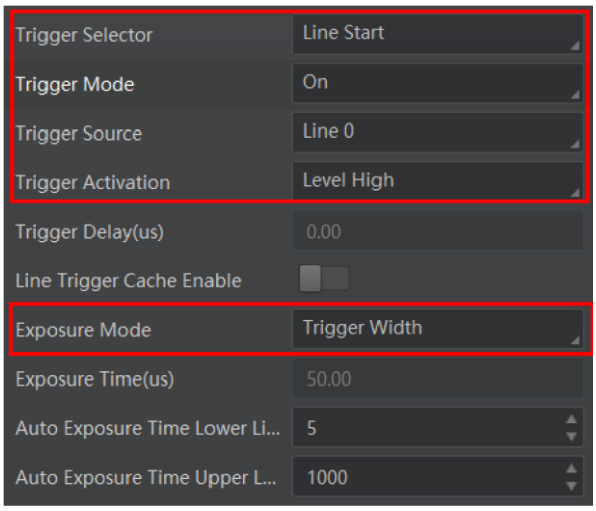


Figure 7-20 Set Trigger Activation in Line Trigger

Note

The trigger width function may differ by device models.

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**, and the unit is μs.

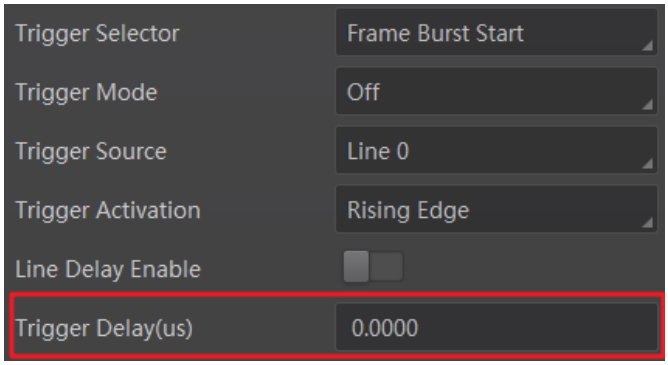


Figure 7-21 Set Trigger Delay under Frame Trigger

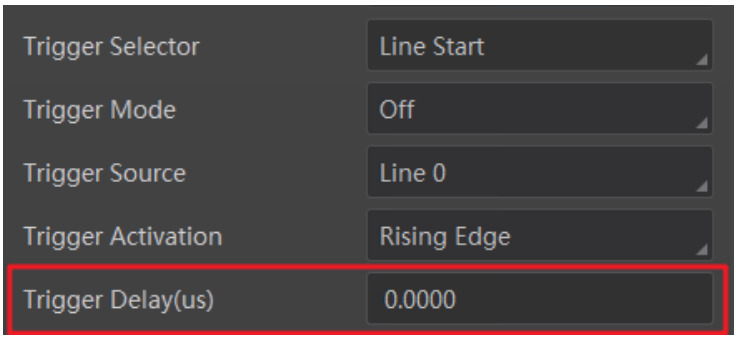


Figure 7-22 Set Trigger Delay under Line Trigger

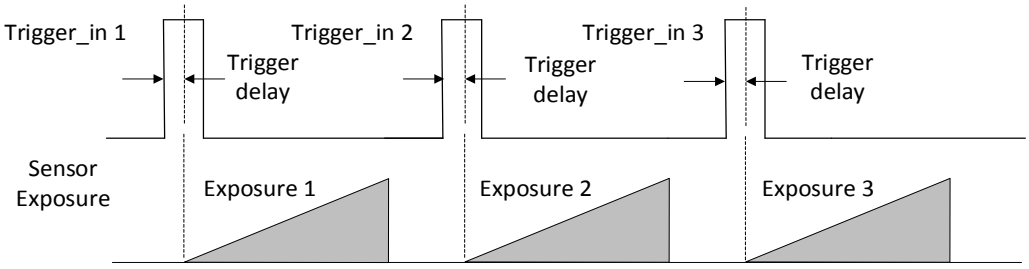


Figure 7-23 Sequence Diagram of Trigger Delay

Note

The sequence diagram above uses rising edge as trigger activation.

Set Frame/Line Trigger Cache

Note

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

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

Set Trigger Cache in Frame Trigger

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Frame Burst Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
3. Enable **Trigger Cache Enable**.

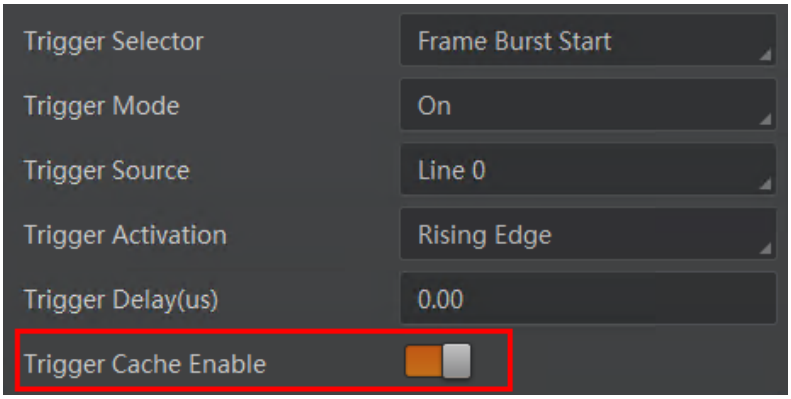


Figure 7-24 Set Trigger Cache in Frame Trigger

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

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

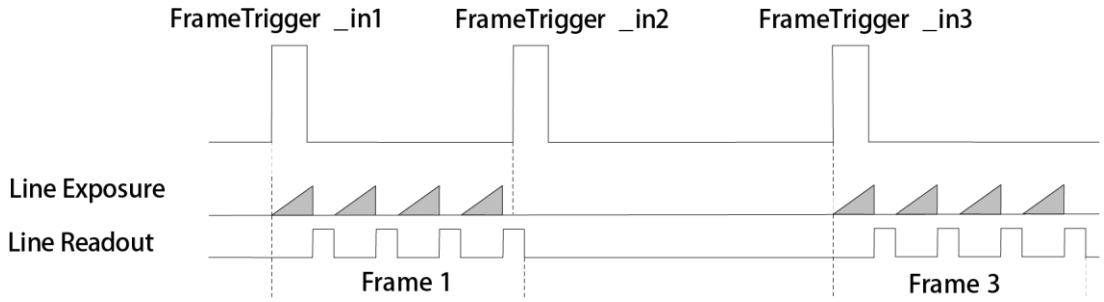


Figure 7-25 Second Frame Filtered

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

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

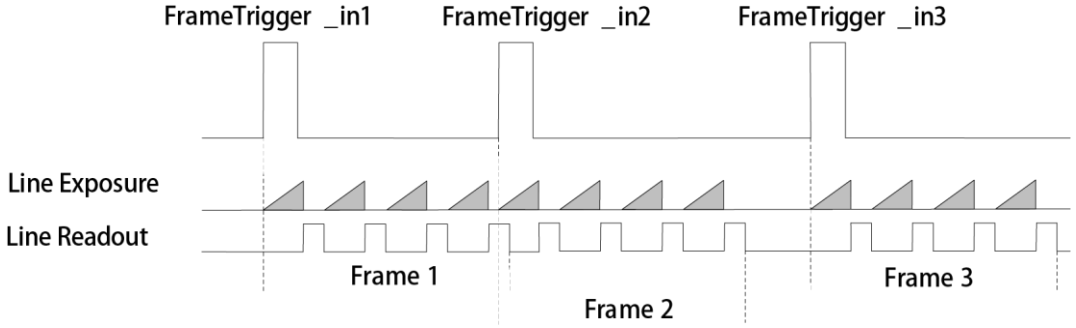


Figure 7-26 Second Frame Created Normally

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.

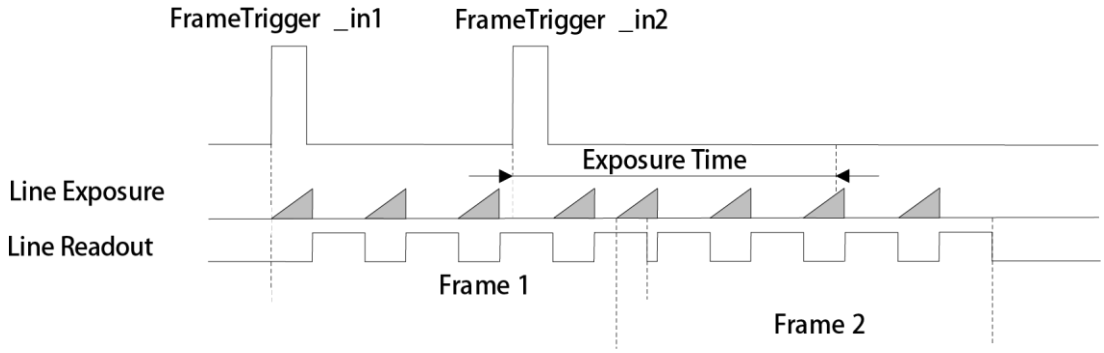


Figure 7-27 Sequence Diagram

Note

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

Set Trigger Cache in Line Trigger

Steps

1. Go to **Acquisition Control** → **Trigger Selector**, and select **Line Start** as **Trigger Selector**.
2. Select **On** as **Trigger Mode**.
3. Enable **Line Trigger Cache Enable**.

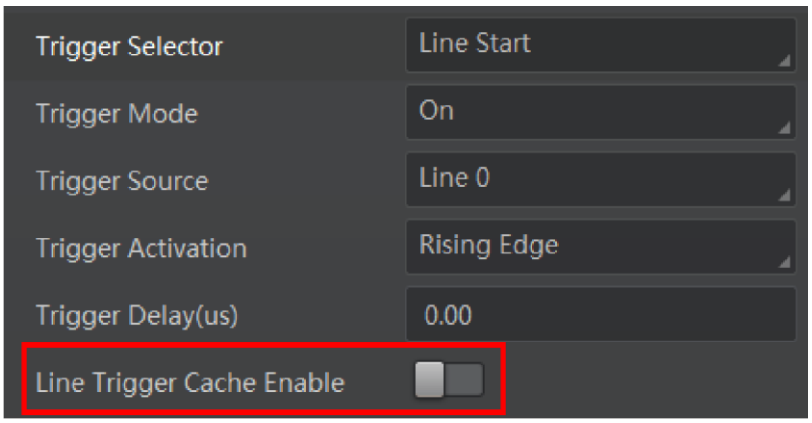


Figure 7-28 Set Trigger Cache in Line Trigger

Set Trigger Debouncer

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

Go to **Digital IO Control** → **Line Debouncer Time**, and enter **Line Debouncer Time** according to actual demands.

Note

- If the **Line Debouncer Time** you set is greater than the time of trigger signal, this trigger signal will be ignored.
- The unit of **Line Debouncer Time** may differ by device models.
- The sequence diagram below uses rising edge as trigger activation.

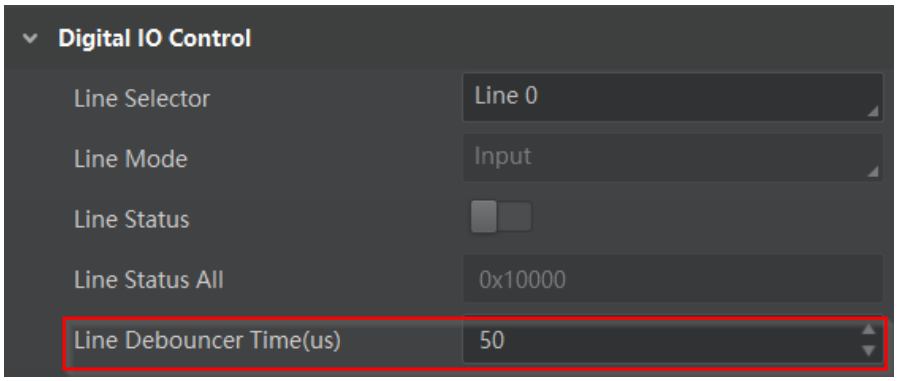


Figure 7-29 Set Trigger Debouncer

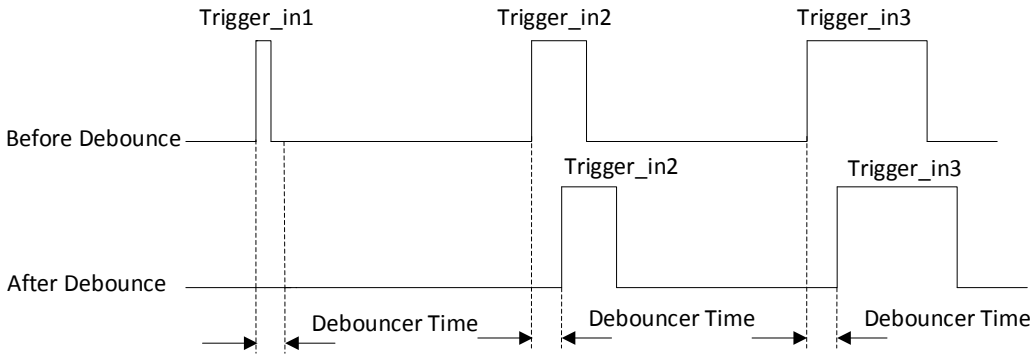


Figure 7-30 Sequence Diagram of Trigger Debouncer

7.8 IO Test Tool

Note

- The IO test tool function may differ by device models.
- Contact technical support personnel for detailed operation.

For some device models, the device supports checking whether the line or frame signal it received is stable or not via the IO test tool. Go to **Digital IO Control**, and enable **IO Test Tool Enable (Line)** according to actual demands.

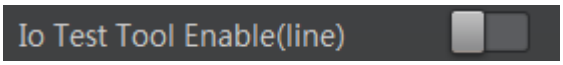


Figure 7-31 IO Test Tool

Chapter 8 Trigger Output

8.1 Select Output Signal

Note

The selectable output signal line may differ by device models.

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

Steps

1. Go to **Digital IO Control**, and select specific line as **Line Selector**.
2. Set **Strobe** as **Line Mode**.
2. (Optional) Set **Line Format** according to actual demands.

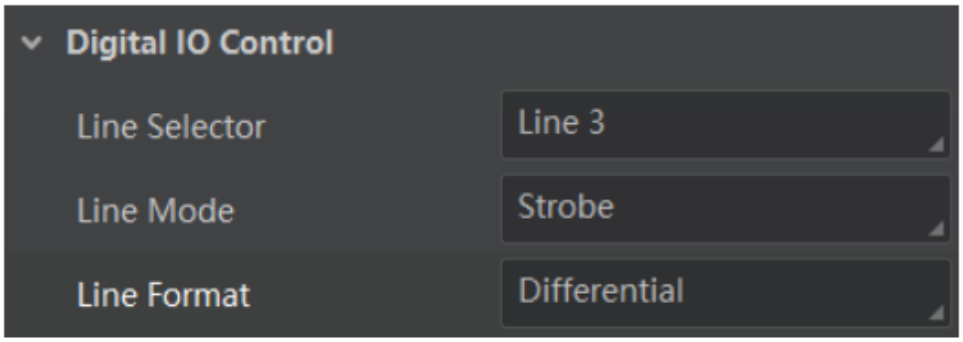


Figure 8-1 Select Output Signal

Note

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

8.2 Set 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.

8.2.1 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.

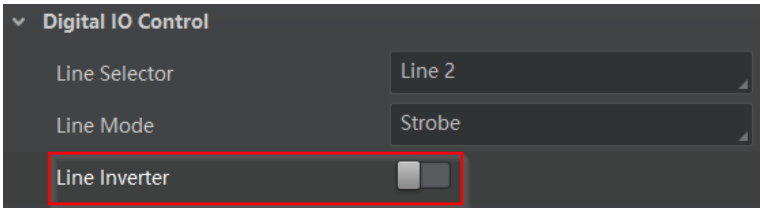


Figure 8-2 Enable Line Inverter

Note

The line inverter function is disabled by default.

8.2.2 Enable Strobe Signal

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

Steps

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

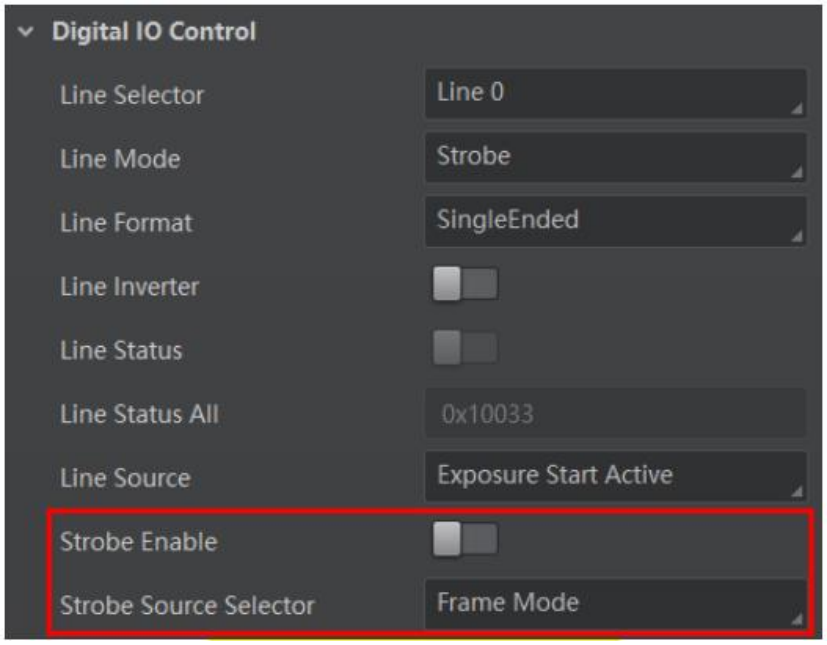


Figure 8-3 Select Frame Mode as Strobe Source Selector

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

Steps

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

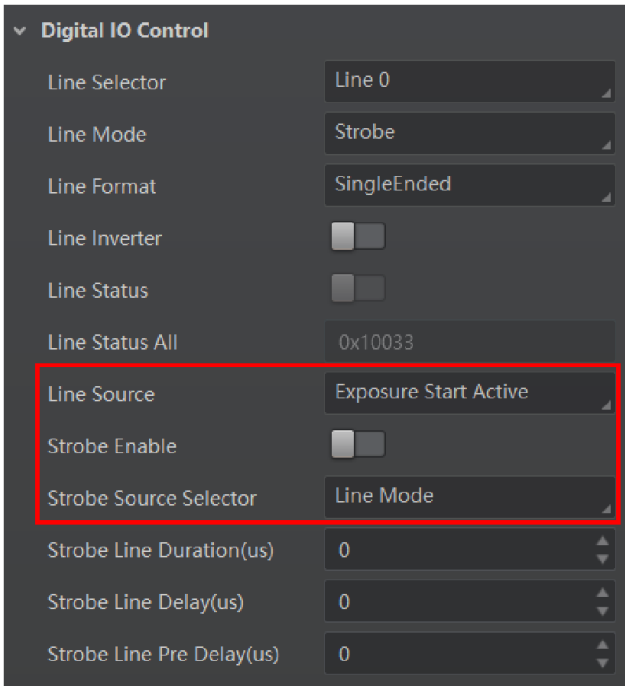


Figure 8-4 Select Line Mode as Strobe Source Selector

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

Note

The specific line sources may differ by device models.

Table 8-1 Line Source Description

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

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

Table 8-2 Description of Counter and Timer Control

Parameter	Read/Write	Description
Counter Selector	Read and write	It selects counter source. **Counter 0** is available only at present.
Counter Event Source	Read and write	It selects the signal source of counter trigger, and **Line 0/1/3/4** or CC 1/2/3/4 is available. It is disabled by default.
Counter Event Activation	Read and write	It selects the activation mode of the selected counter event source, including rising edge,

Parameter	Read/Write	Description
		falling edge, and any edge.
Counter Reset Source	Read and write	It selects the signal source of resetting counter. **Software** is available only. It is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed when selecting **Software** as **Counter Reset Source**.
Counter Value	Read and write	It is the counter value with the range of 1 to 4294967295. **Note** The specific range of counter value may differ by device models.
Counter Current Value	Read only	It displays the number of executed external trigger.

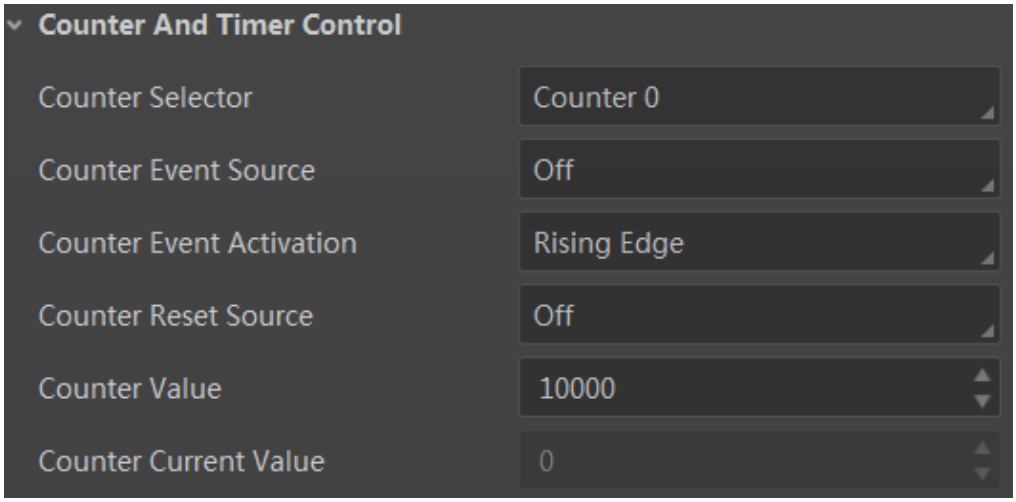


Figure 8-5 Counter and Timer Control

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

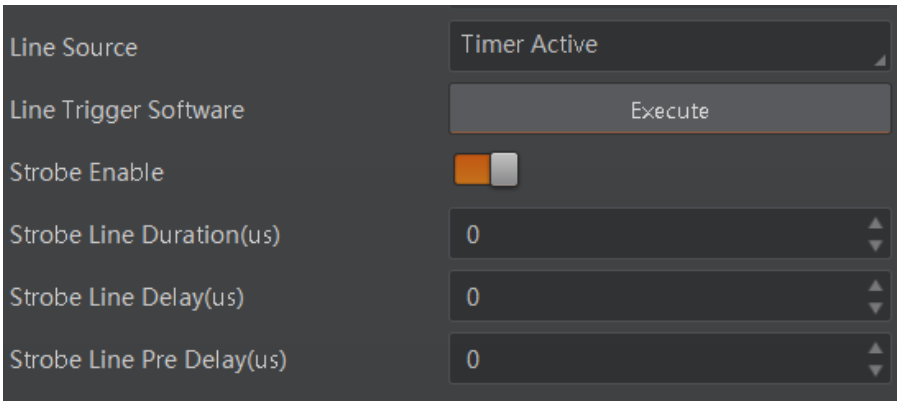


Figure 8-6 Timer Active Parameter

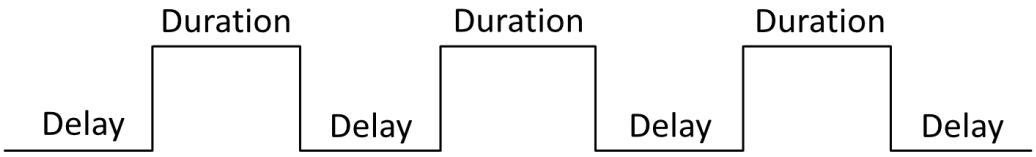


Figure 8-7 Sequence Diagram of Timer Active

Set Strobe Line Duration

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

Figure 8-8 Set Strobe Line Duration

Note

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

Set Strobe Line Delay

The device supports setting strobe line delay to meet actual demands. When exposure starts, the strobe output doesn't 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 **Strobe Line Delay** according to actual demands. The sequence diagram of strobe line delay is shown below.

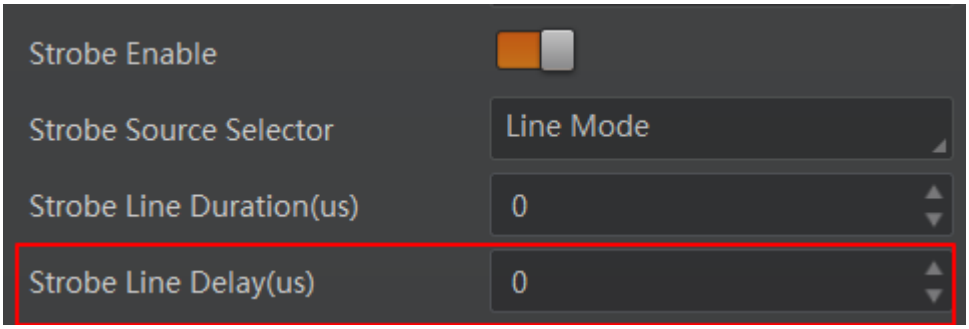


Figure 8-9 Set Strobe Line Delay

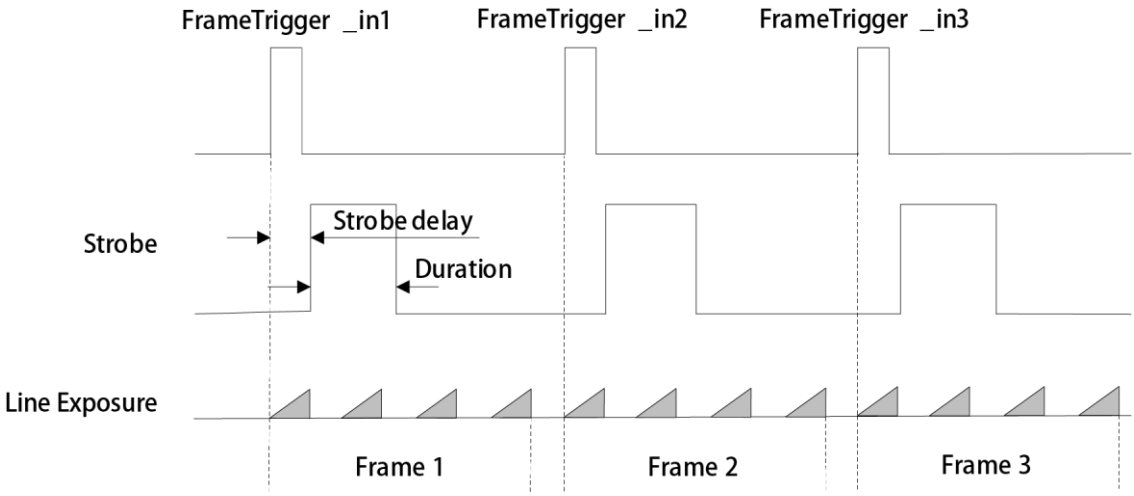


Figure 8-10 Sequence Diagram of Strobe Line Delay

Note

The device's height parameter is 4 in the sequence diagram above.

Set Strobe Line Pre Delay

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

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

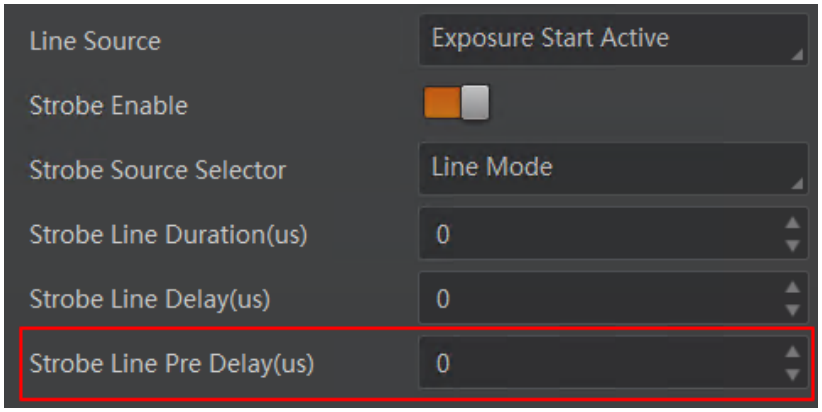


Figure 8-11 Set Strobe Line Pre Delay

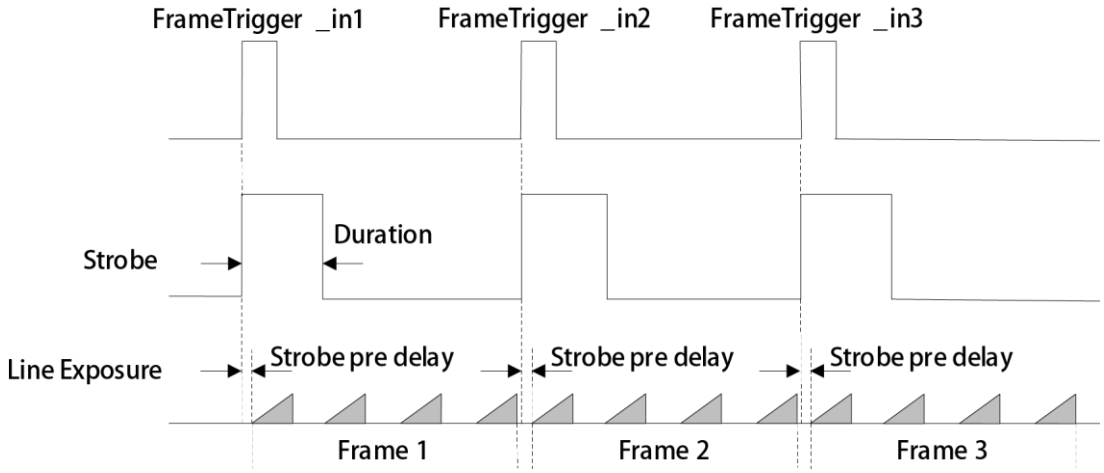


Figure 8-12 Sequence Diagram of Strobe Line Pre Delay

Note

The device's height parameter is 4 in the sequence diagram above.

Chapter 9 I/O Electrical Features and Wiring

9.1 I/O Introduction

There are two types of I/O signals in accordance with pin definitions.

- The first type: The I/O signals of type I, type III, type IV, and type V devices are four configurable input or output signals (Line 0/1/3/4). The Line 0/1/3/4 can be set as differential input or differential output according to actual demands.
- The second type: The I/O signals of type II device are two differential input signals (Line 0/3), and two differential output signals (Line 1/4).

9.2 I/O Electrical Features

9.2.1 Differential Input Circuit

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

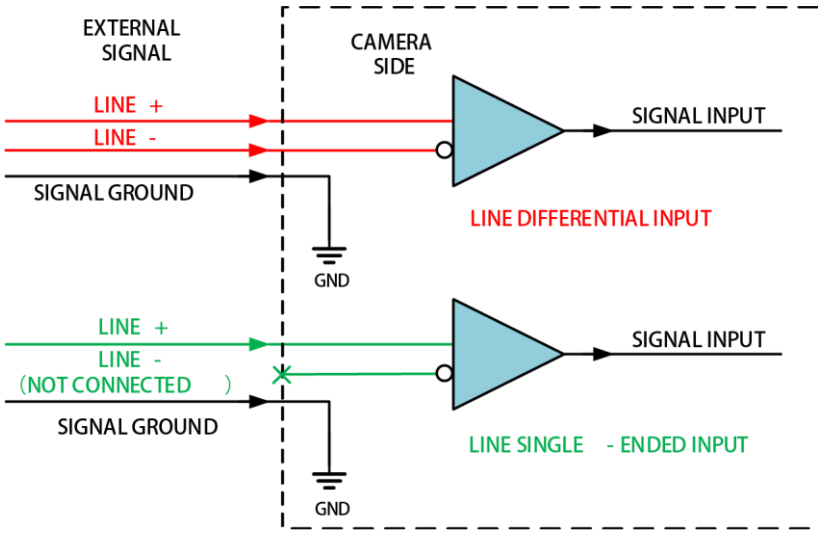


Figure 9-1 Internal Circuit of Differential Input

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

RS-422 Standard Input

In order to make sure the normal operation of input circuit, it is required to connect

device's ground signal with external ground signal if the differential input adopts RS-422 standard signal.
RS-422 standard defines the connection of the bus structure, and the inputs of several devices can be connected to the RS-422. Up to 10 devices can be connected at the same time, of which only one device is the main dispenser and other devices are receivers. The circuit length between the receiver and the bus should be as short as possible. The bus must have a 120 Ω terminal resistance.
When the device is the last receiver on the bus structure, the device's terminal resistance needs to be enabled, and the rest device's terminal resistance need to be disabled. Multiple terminal resistance should not be enabled on the bus structure, which will reduce signal reliability and may cause damage to the RS-422 device.

RS-644 Standard Input

If the differential input adopts RS-644 standard signal, the input terminal must enable 120 Ω terminal resistance.

TTL&LVTTL Standard Input

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

Table 9-1 Electrical Feature Requirement of TTL&LVTTL

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

9.2.2 Differential Output Circuit

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

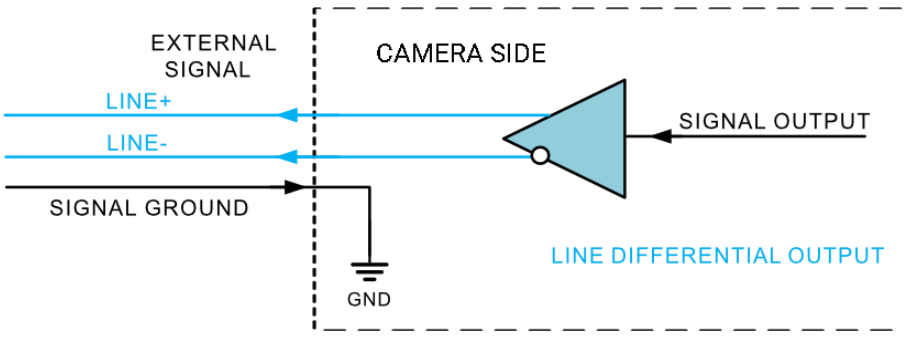


Figure 9-2 Internal Circuit of Differential Output

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

RS-422 Standard Output

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

RS-644 Standard Output

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

9.3 First Type of Signal Wiring

The first type of wiring corresponds to the first type of pin definitions mentioned in Table 3-1 (applicable to type I, III, IV and V devices).

Table 9-2 Device Model and Appearance Type

Device Model	Device Appearance Type
MV-CL042-91CM/CC	Type I device
MV-CL086-91CC, MV-CL084-91CM-PRO, MV-CL086-91CC-PRO	Type III device
MV-CL081-41CM, MV-CL082-92CM, MV-CL083-92CC, MV-CL161-41CM, MV-CL161-91CM	Type IV device
MV-CL084-91CM, MV-CL086-91CC	Type V device

9.3.1 Input Signal Wiring

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

Note

- Make sure that the hardware trigger signals have been configured as input signal.
- Here we take one type of Camera Link line scan cameras as an example to introduce the input signal wiring. The appearance here is for reference only.

Differential Signal

Note

The wiring may differ by voltages of differential signal sources.

If the differential signal source provides the trigger signal, and the wiring is shown below.

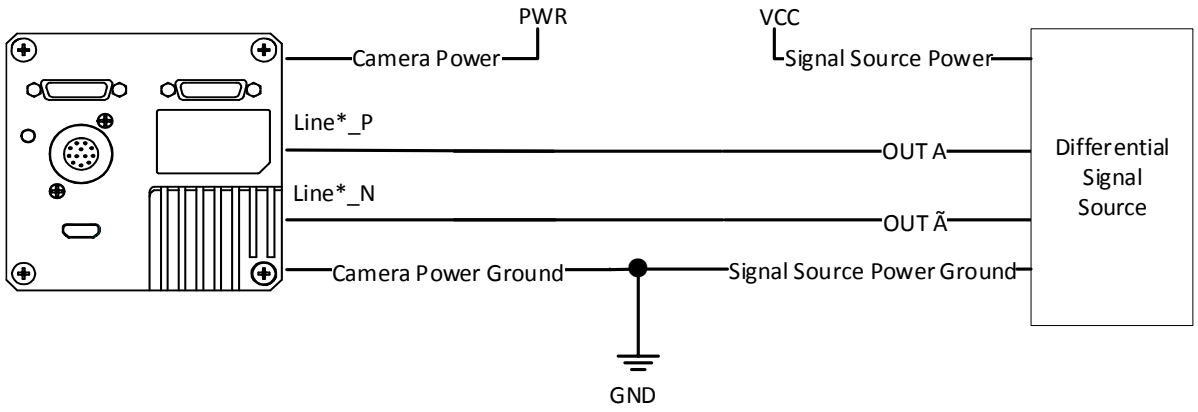


Figure 9-3 Differential Input Wiring

Single-Ended Signal

- **PNP Single-Ended Signal Source**

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

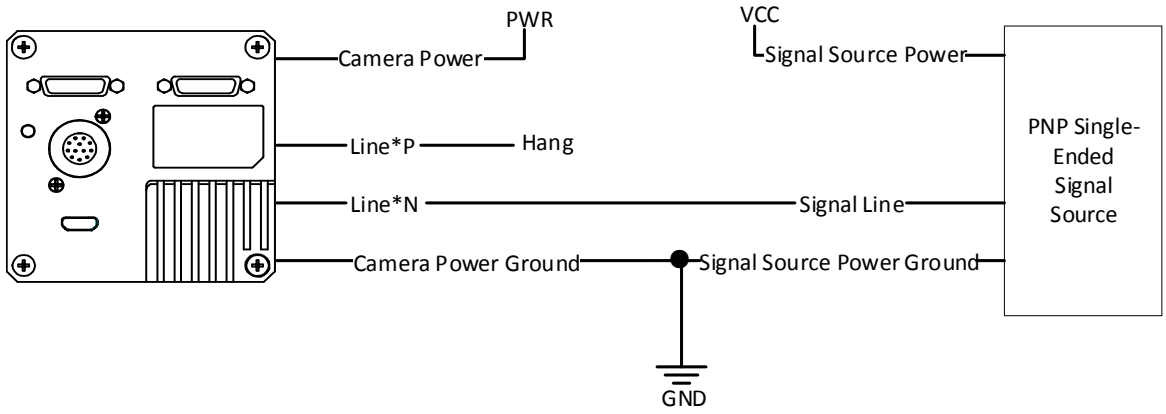


Figure 9-4 PNP Single-Ended Input Wiring without Pull-Down Resistor

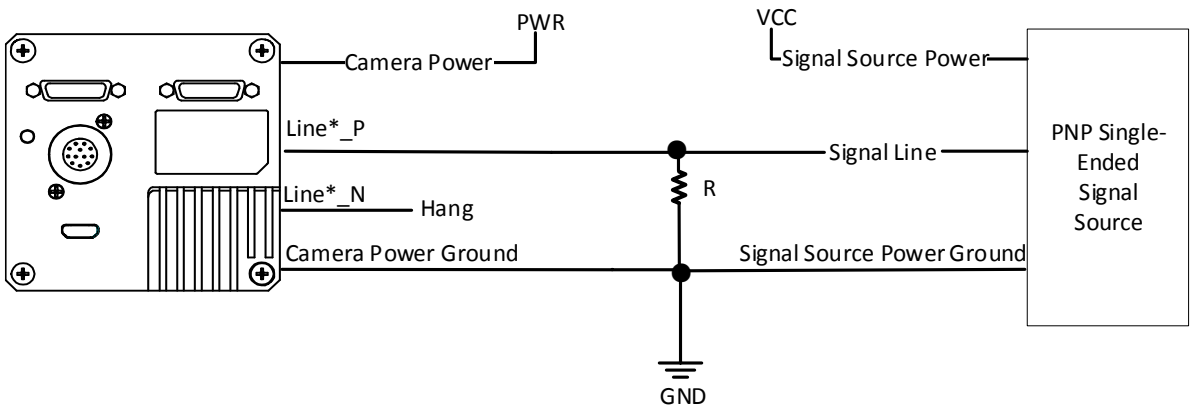


Figure 9-5 PNP Single-Ended Input Wiring with Pull-Down Resistor

- **NPN Single-Ended Signal Source**

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

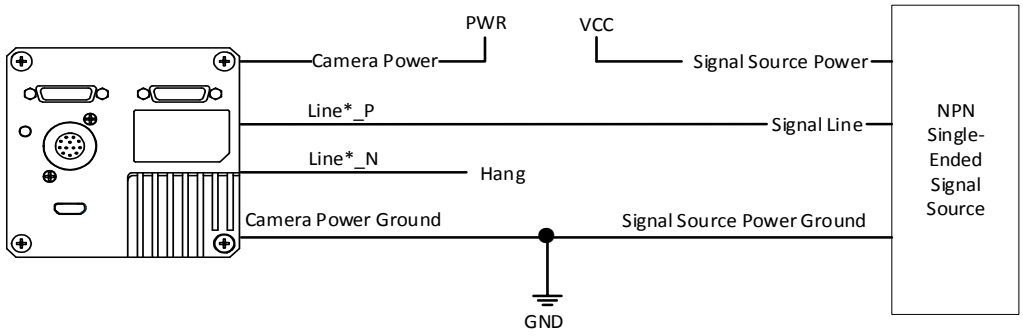


Figure 9-6 NPN Single-Ended Input Wiring without Pull-Down Resistor

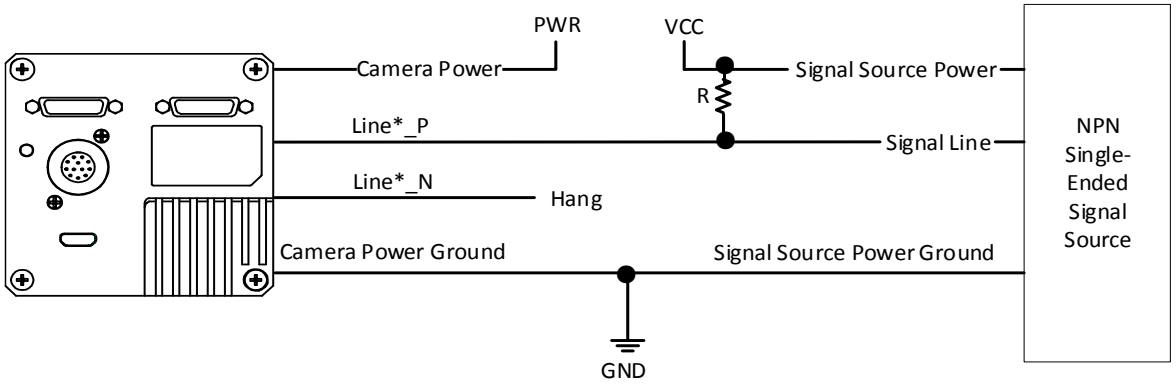


Figure 9-7 NPN Single-Ended Input Wiring with Pull-Down Resistor

Note

With different voltages of differential signal sources, the respective resistance values in wiring are also different, as shown below.

Table 9-3 Relation between Voltage and Resistance

VCC	R	Power of Resistance
5 VDC	1 KΩ	≥ 1/16 W
12 VDC	4.7 KΩ	≥ 1/16 W
24 VDC	10 KΩ	≥ 1/16 W

Note

The power range of resistance is R ≥ 1/16 W.

9.3.2 Output Signal Wiring

The I/O signal of type I, type III, type IV and type V devices can be configured as output to trigger other devices. Here we take the type I device as an example for introducing the output wiring.

Differential Output Signal

If the device's I/O signal is set as the differential output signal, and the wiring is shown below.

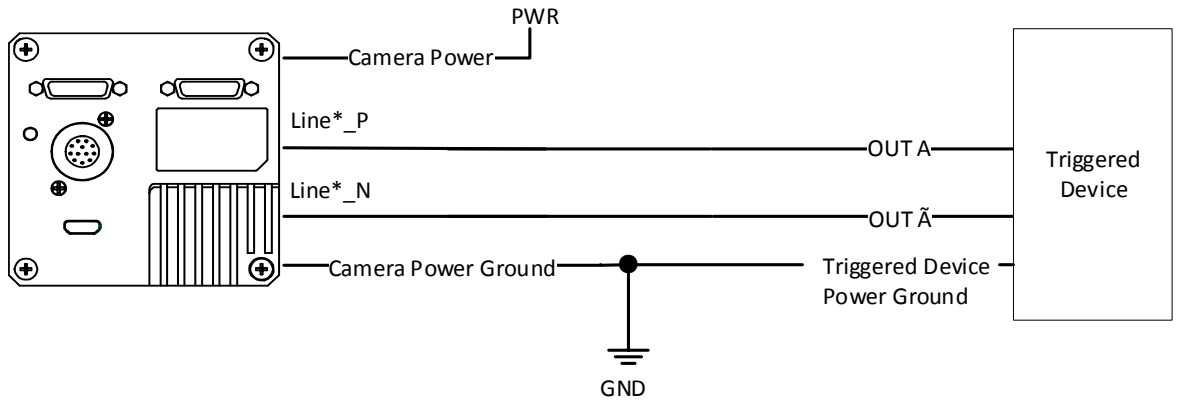


Figure 9-8 Differential Output Signal Wring

Single-Ended Output Signal

If the triggered device needs a LVTTL level trigger above 3.3 V, and a pull-up resistor ranging between 1 KΩ and 10 KΩ should be added.

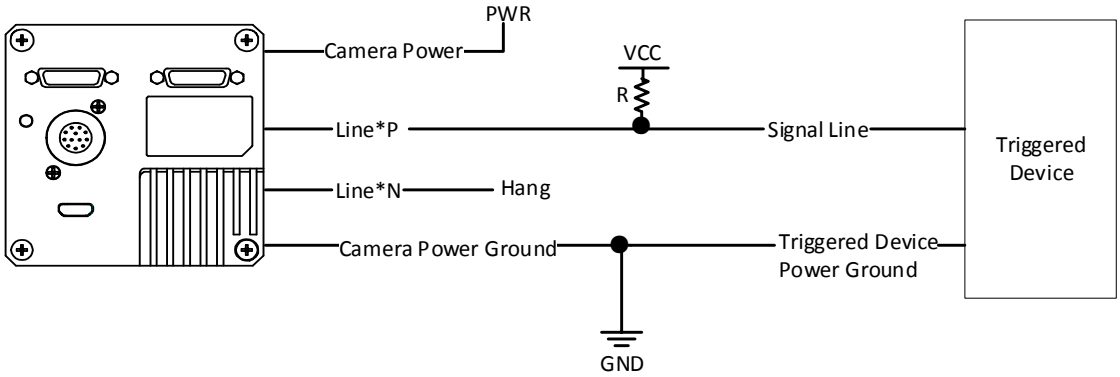


Figure 9-9 Single-Ended Output Signal Wiring with Pull-Up Resistor

The voltage of the VCC should be matched with the trigger voltage.

Table 9-4 Relation between Voltage and Resistance

VCC	R	Power of Resistance
5 VDC	1 KΩ	≥ 1/16 W
12 VDC	4.7 KΩ	≥ 1/16 W
24 VDC	10 KΩ	≥ 1/16 W

Note

- The power range of resistance is R ≥ 1/16 W.
- Generally, it is recommended that the VCC of pull-up resistor use the device's power supply or the triggered device power supply. If a third-party power supply is used, the power ground must be the same as the device's power ground and the triggered device power ground.

9.4 Second Type of Signal Wiring

The second type of input wiring corresponds to the second type of pin definitions mentioned in Table 3-2 (applicable to type II device).

Table 9-5 Device Model and Appearance Type

Device Model	Device Appearance Type
MV-CL084-90CM, MV-CL086-90CC	Type II device

Differential Signal

Note

The wiring may differ by voltages of differential signal sources.

If the voltage of the differential signal source is 5 V, and its wring is shown below.

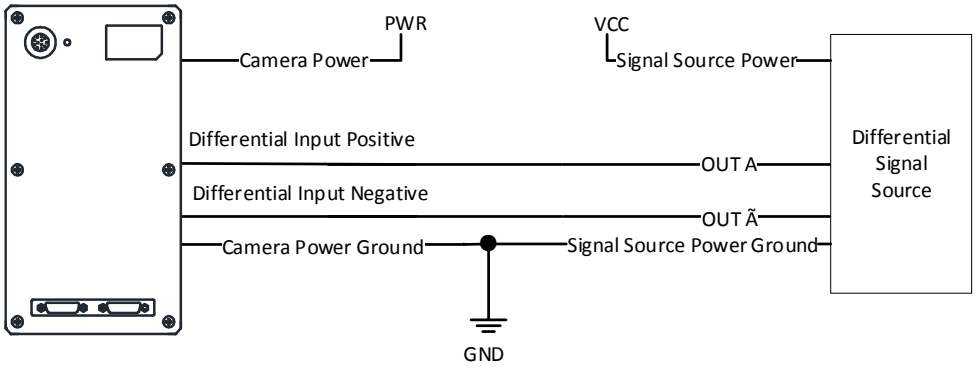


Figure 9-10 5 V Differential Signal Source Outputs Differential Signal

If the voltage of the differential signal source is 12 V or 24 V, and its wring is shown below.

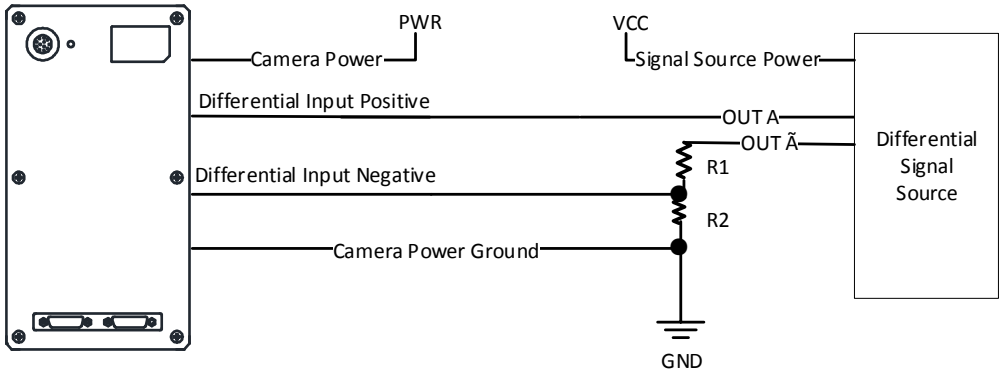


Figure 9-11 12 or 24 V Differential Signal Source Outputs Differential Signal

Note

With different voltages of differential signal sources, the respective resistance values in wiring are also different, as shown below.

Table 9-6 Relation between VCC and R1 and R2

VCC	R1	R2
12 VDC	6.2 KΩ	4.7 KΩ
24 VDC	18 KΩ	4.7 KΩ

Single-Ended Signal

The single-ended signals that the device receives can be from the differential signal source or the single-ended signal source.

- **Differential Signal Source**

The VCC of the differential signal source is 5 V, 12 V or 24 V, and its wiring is shown below.

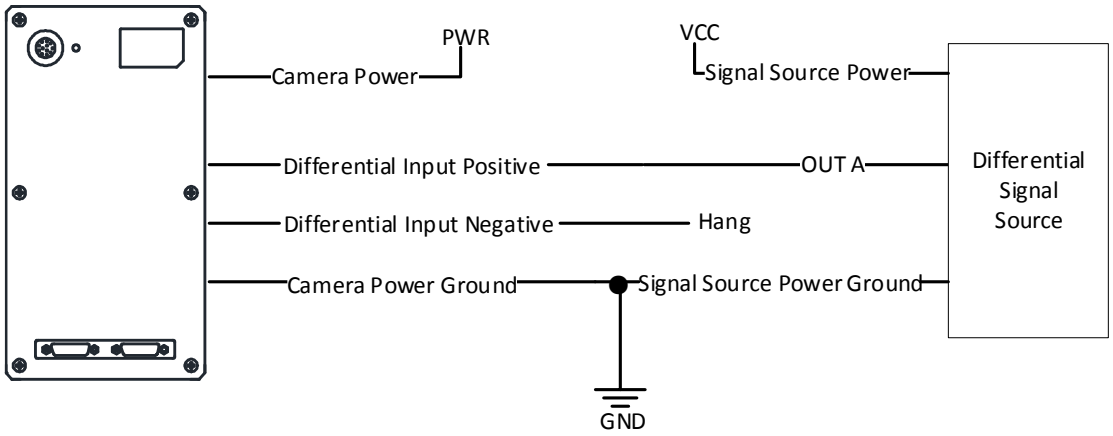


Figure 9-12 Differential Signal Source Outputs Single-Ended Signal

- **PNP Single-Ended Signal Source**

When the PNP single-ended signal source provides signal, and the device's differential input is used as single-ended input. The VCC of PNP single-ended signal source is 5 V, 12 V or 24 V.

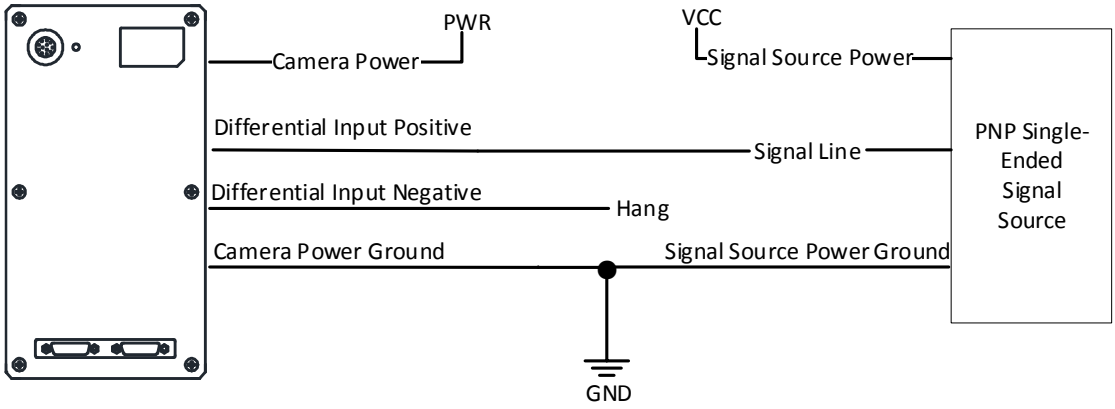


Figure 9-13 PNP Single-Ended Signal Source Connects Differential Input

- **NPN Single-Ended Signal Source**

When the NPN single-ended signal source provides signal, and the device's differential input is used as single-ended input. The VCC of NPN single-ended signal source is 5 V, 12 V or 24 V.

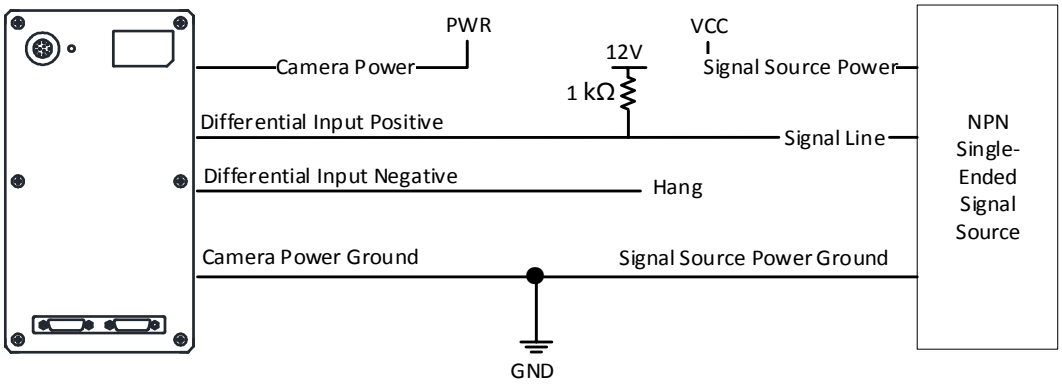


Figure 9-14 NPN Single-Ended Signal Source Connects Differential Input

Line Trigger Wring

The wiring of using 5 V encoder signal to trigger is shown below.

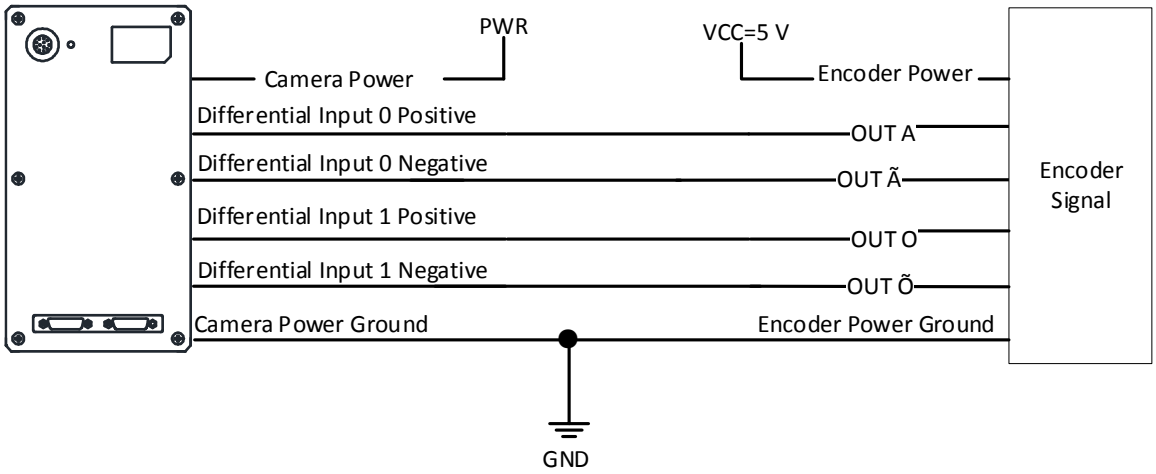


Figure 9-15 Line Trigger Wiring

Frame Trigger Wring

The wiring of using 5 V differential signal to trigger is shown below.

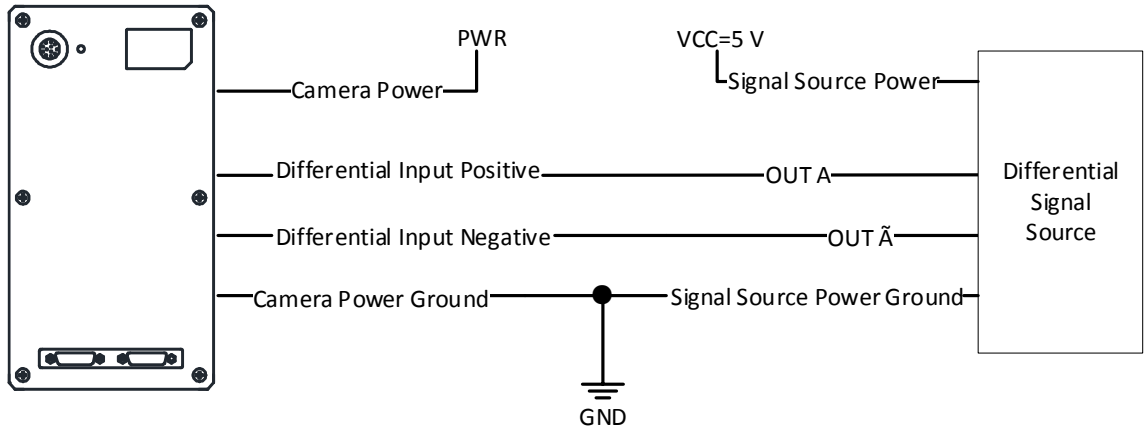


Figure 9-16 Frame Trigger Wiring

Line + Frame Trigger Wring

The wiring of using the frame grabber to have a frame trigger and using 5 V encoder signal to have a line trigger is shown below.

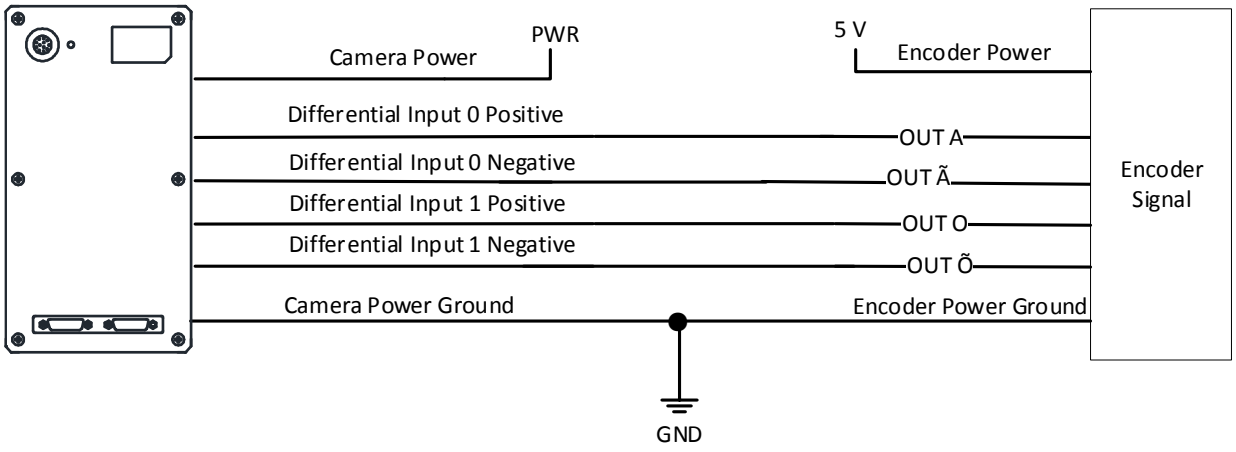


Figure 9-17 Line + Frame Trigger Wring (I)

The wiring of using the frame grabber to have a frame trigger and using 12 V or 24 V encoder differential signal to have a line trigger is shown below.

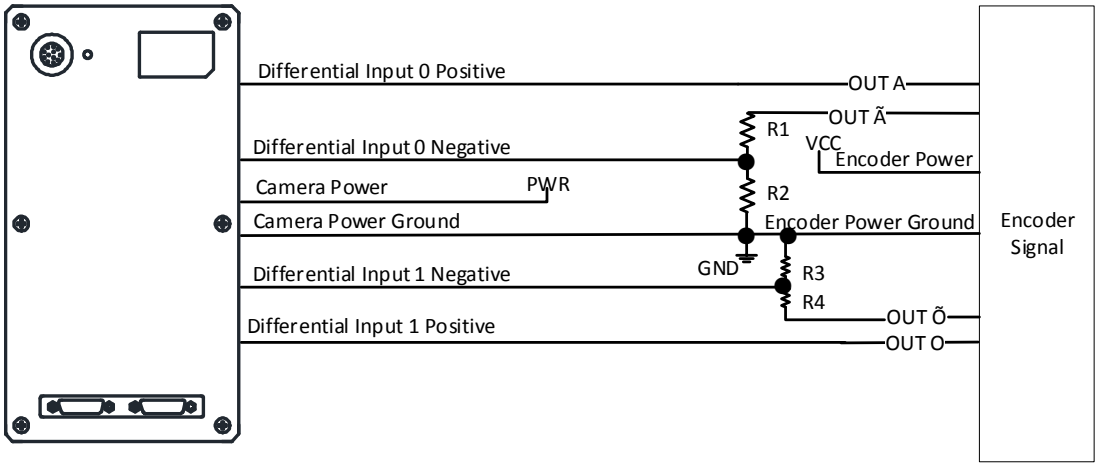


Figure 9-18 Line + Frame Trigger Wring (II)

Note

With different input voltages (VCCC) of the encoder signal, the respective resistance values are also different.

Table 9-7 Relation between VCC and R1/R2/R3/R4

VCC	R1	R2	R3	R4
12 VDC	6.2 KΩ	4.7 KΩ	4.7 KΩ	6.2 KΩ
24 VDC	18 KΩ	4.7 KΩ	4.7 KΩ	18 KΩ

The wiring of using the frame grabber to have a frame trigger and using 12 V or 24 V encoder differential signal as the single-ended signal to have a line trigger is shown below.

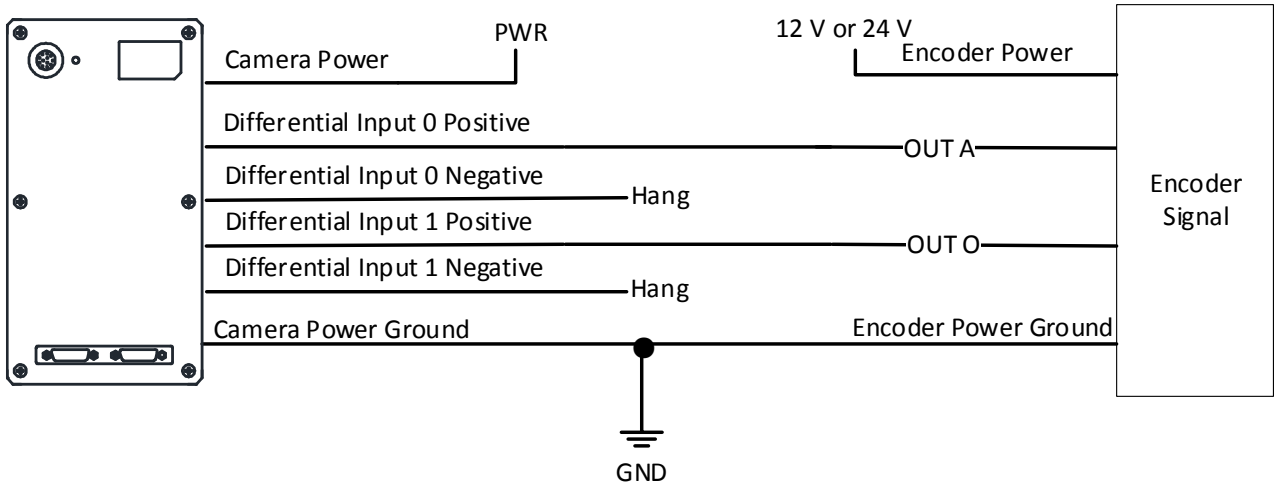


Figure 9-19 Line + Frame Trigger Wring (III)

Chapter 10 Image Parameter

10.1 View Resolution

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.

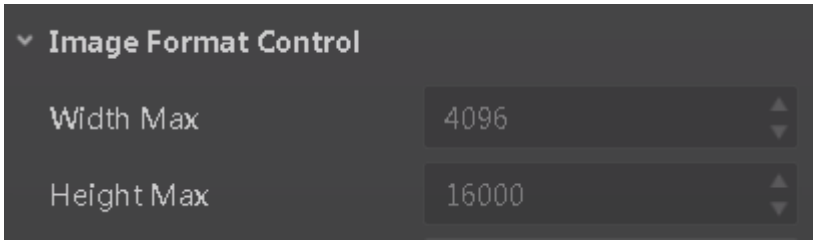


Figure 10-1 View Resolution

10.2 Set ROI

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

Note

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

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

Note

The **Width** plus **Offset X** should not be larger than **Width Max**, and **Height** should not be larger than **Height Max**.

- **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.

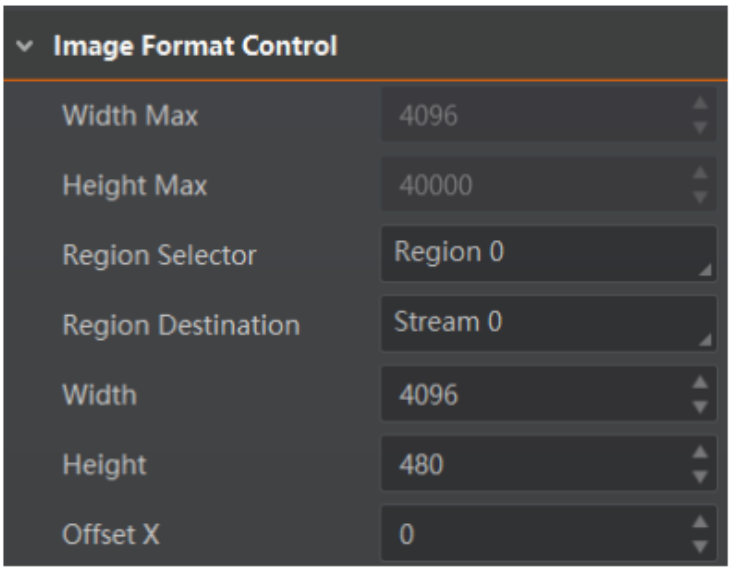


Figure 10-2 Set ROI

10.3 Set Image Reverse

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

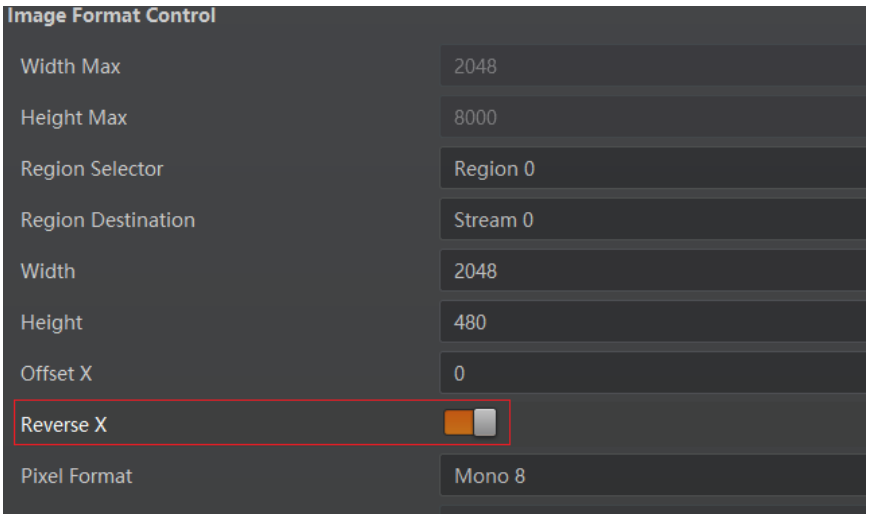


Figure 10-3 Set Image Reverse

10.4 Set Pixel Format

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

Note

The specific pixel formats may differ by device models.

Table 10-1 Pixel Format and Pixel Size

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

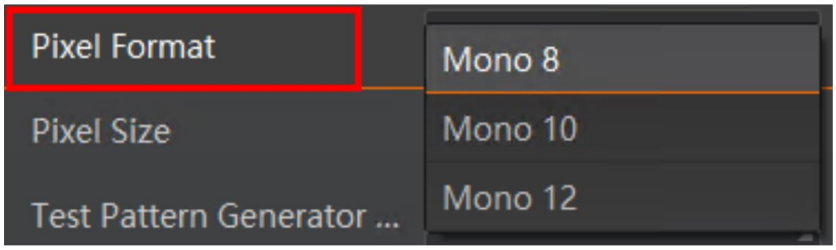


Figure 10-4 Set Pixel Format

10.5 Set Test Pattern

Note

The test pattern may differ by device models.

The device supports test pattern function. When there is exception in real-time image, you can check whether image of test mode have similar problem to determine the reason. This function is disabled by default, and at this point, the outputted image by the device is real-time image. If this function is enabled, the outputted 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 10-5 Set Test Pattern

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

Note

- The mono device does not support **Vertical Color Bar**.
- The pattern of **Mono Bar** and **Test Image 1** may differ by device models.

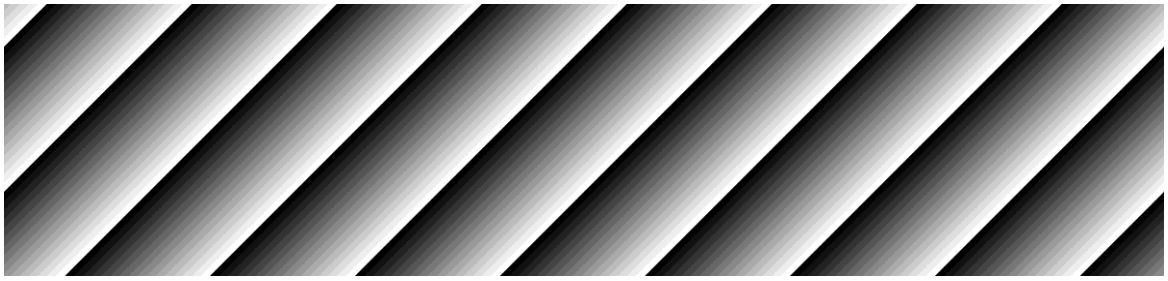


Figure 10-6 Oblique Mono Bar Test Pattern

Figure 10-7 Mono Bar Test Pattern

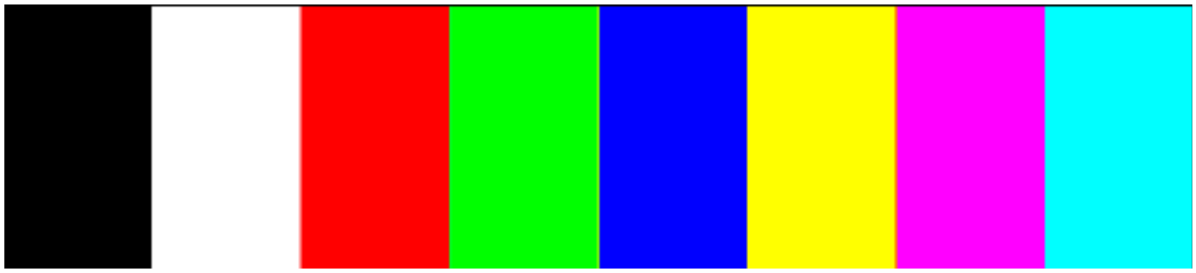


Figure 10-8 Vertical Color Bar Test Pattern

Figure 10-9 Test Image 1

10.6 Set Binning

The purpose of setting binning is to enhance sensibility. With binning, multiple sensor pixels are combined as a single pixel to reduce resolution and improve image brightness.
Click **Binning Selector**, and set **Binning Horizontal** and **Binning Vertical** according to actual demands.

Figure 10-10 Set Binning

Note

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

10.7 Set Exposure Auto

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)**.

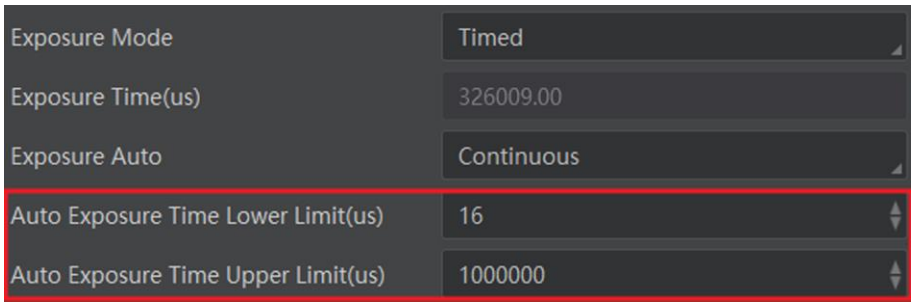


Figure 10-11 Set Exposure Time under Once or Continuous Mode

Note

- If the device is under **Continuous** exposure mode, once external trigger mode is enabled, the device will automatically switch to **Off** exposure mode.
- Some models of the device do not support **Once** or **Continuous** exposure mode. You can enter **Exposure Time (μs)** directly.

10.8 Set Multiple Lights Control

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

Note

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

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

- Off: The function of multiple lights control is disabled if Off is selected as Multi Light Control.
- 1 Light: Light 1 is turned on if 1 Light is selected as Multi Light Control.
- 2 Lights: Light 1 and light 2 are turned on if 2 Lights is selected as Multi Light Control.
- 3 Lights: Light 1, light 2 and light 3 are turned on if 3 Lights is selected as Multi Light Control.
- 4 Lights: Light 1, light 2, light 3 and light 4 are turned on if 4 Lights is selected as Multi Light Control.

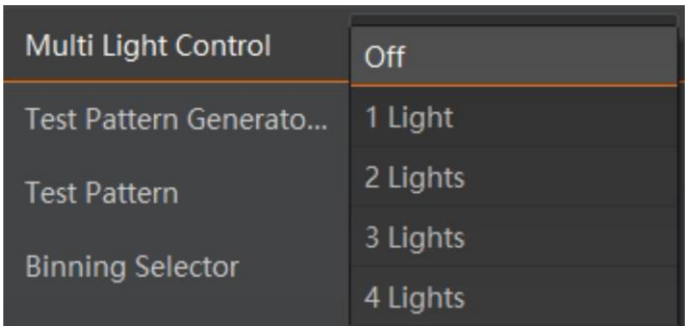


Figure 10-12 Set Multiple Lights Control

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

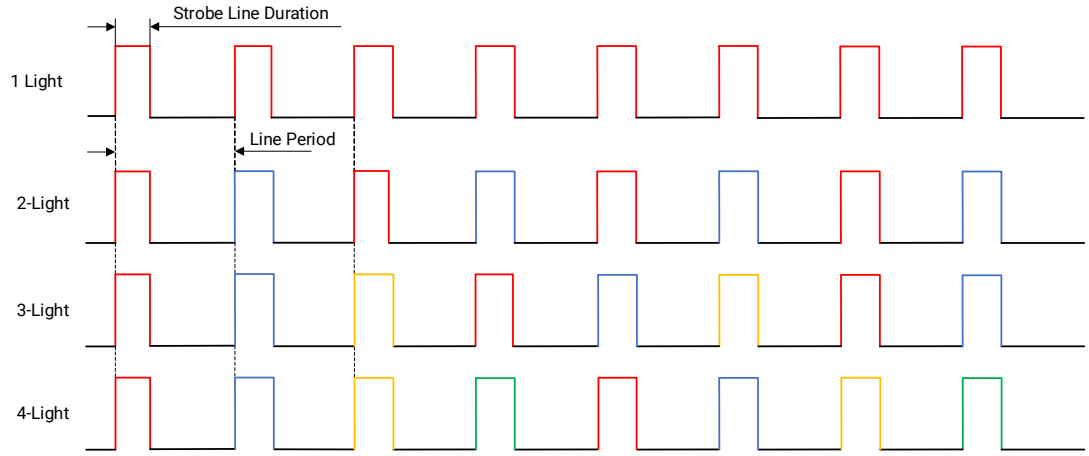


Figure 10-13 Pulse Diagram

Note

- Red, blue, yellow and green colors represent outputted pluses by Line 0, Line 1, Line 3, and Line 4 correspondingly.
- You can set **Strobe Line Duration** and **Strobe Line Delay** of **Digital IO Control** when function of multiple lights control is enabled. The unit of **Strobe Line Duration** and **Strobe Line Delay** is μs.
- The sum of **Strobe Line Duration** and **Strobe Line Delay** should be smaller than or equal to line period time due to the device's limitation. If the sum is larger than line period time, the device will use max. value instead.
- When the device enables 2 Lights, 3 Light or 4 Lights, if you set **Strobe Line Duration** and **Strobe Line Delay** for any I/O, other I/Os will have the same value.

10.9 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.

10.9.1 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.

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

Figure 10-14 Set Preamp Gain

10.9.2 Set Digital Gain

Apart from analog gain, the device supports digital gain function. When analog gain reaching its upper limit and the image is still too dark, it is recommended to improve image brightness via digital gain.
Click **Analog Control**, enable **Digital Shift Enable**, and enter **Digital Shift** according to actual demands.

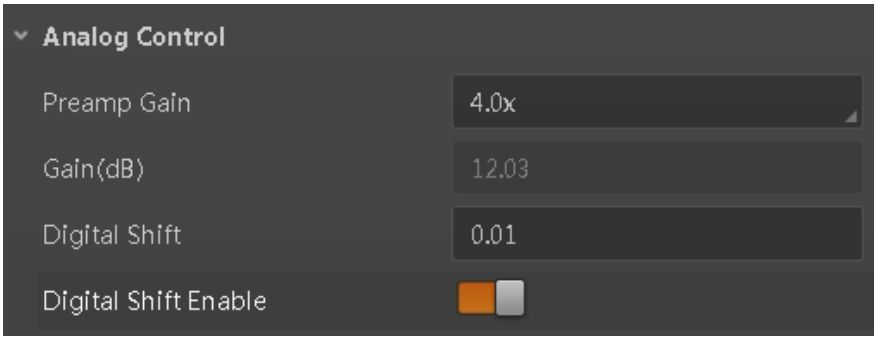


Figure 10-15 Set Digital Gain

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.

10.10 Set Brightness

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

Note

- You should enable **Once** or **Continuous** exposure mode, or **Once** or **Continuous** gain 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, or **Once** or **Continuous** gain, the higher the brightness value, the brighter the image will be.
- The range of brightness is between 0 and 255.

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

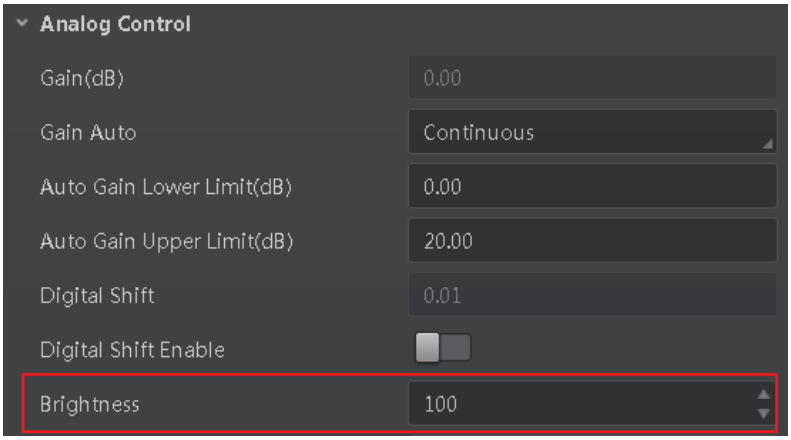


Figure 10-16 Set Brightness

10.11 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.

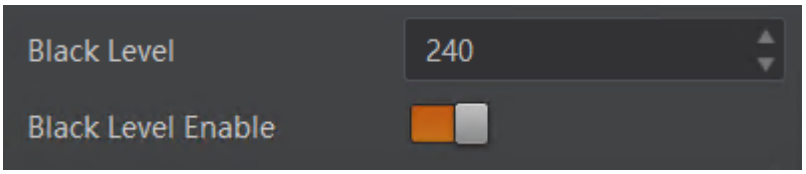


Figure 10-17 Set Black Level

10.12 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. It is recommended to set image brightness value between 120 and 160.
3. Select **Once** as **Balance White Auto**, and the device will automatically adjust white balance for once.

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

Steps

Note

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

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

10.13 Set Gamma Correction

Note

The Gamma correction function may differ by device models.

The device supports Gamma correction function. Generally, the output of the device's sensor is linear with the photons that are illuminated on the photosensitive surface of the

sensor. Gamma correction provides a non-linear mapping mechanism as shown below.

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

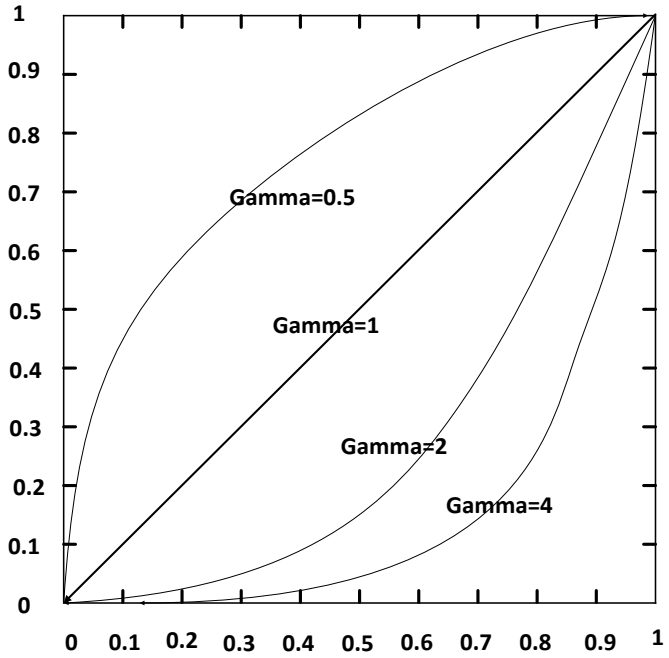


Figure 10-18 Set Gamma Correction

There are 2 types of Gamma correction, including **User** mode and **sRGB** mode.

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.

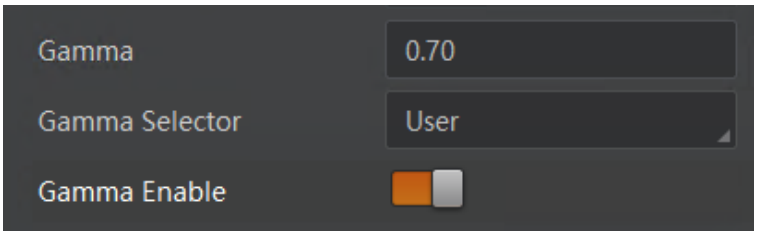


Figure 10-19 Set User Mode

sRGB Mode

Steps

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

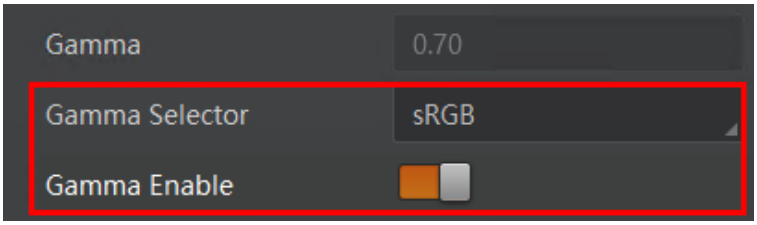


Figure 10-20 Set sRGB Mode

10.14 Set AOI

Note

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

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

Steps

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

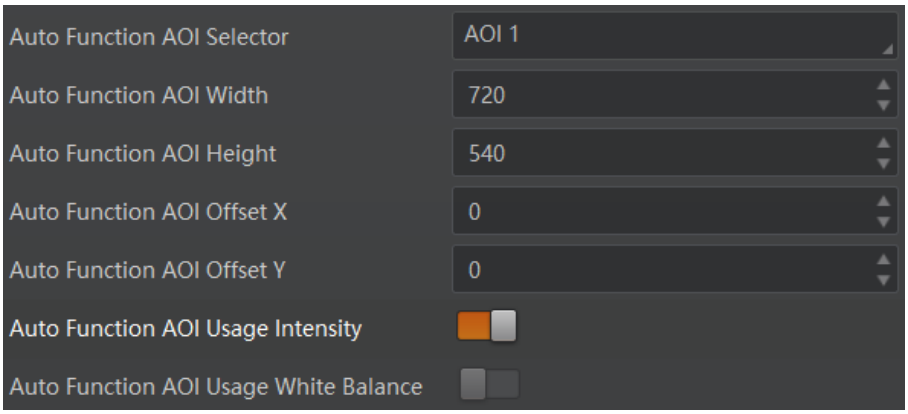


Figure 10-21 Set AOI

10.15 Set Color Transformation Control

Note

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

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

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

Method 1

Steps

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

Note

The parameter of CCM enable may differ by device models.

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

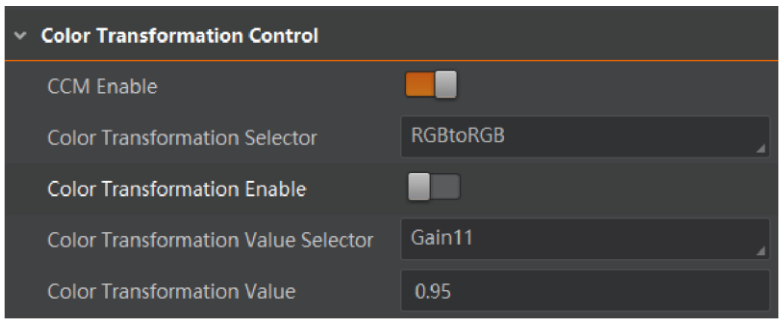


Figure 10-22 Method 1

Method 2

Steps

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

Note

The parameter of CCM enable may differ by device models.

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

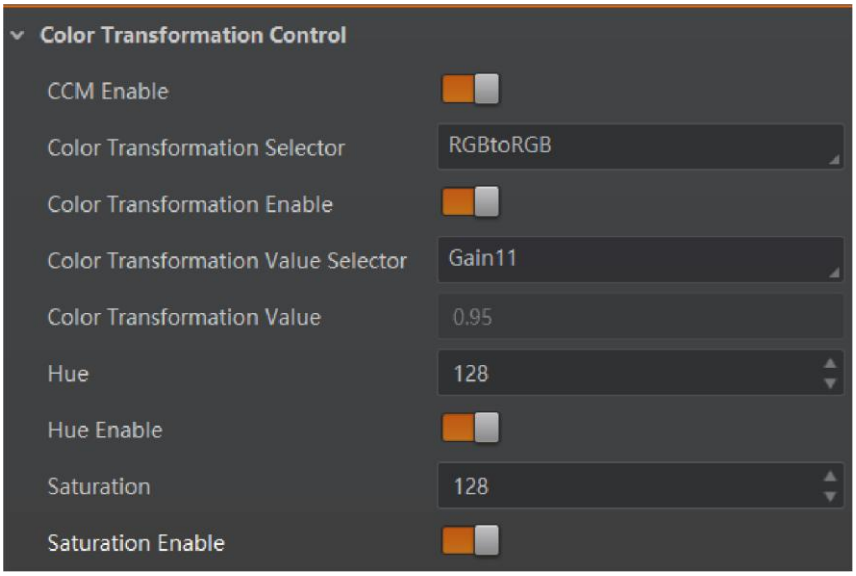


Figure 10-23 Method 2

10.16 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.

Steps

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

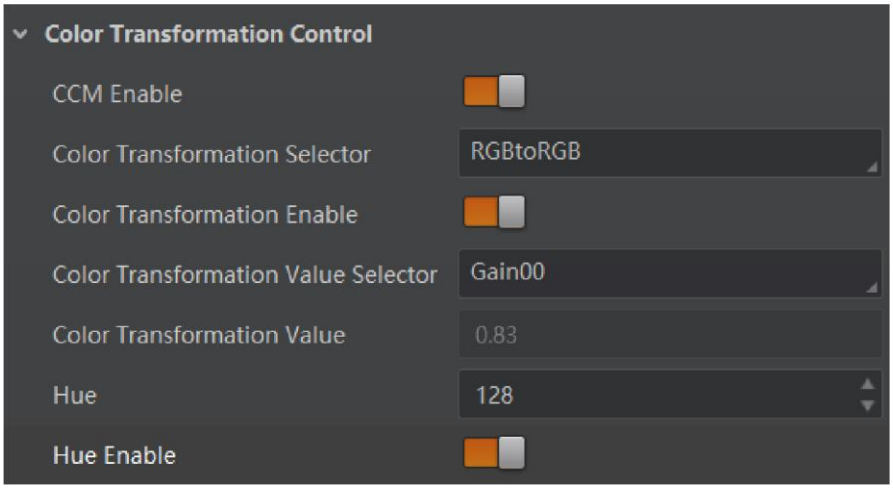


Figure 10-24 Set Hue

10.17 Set Saturation

Note

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

Steps

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

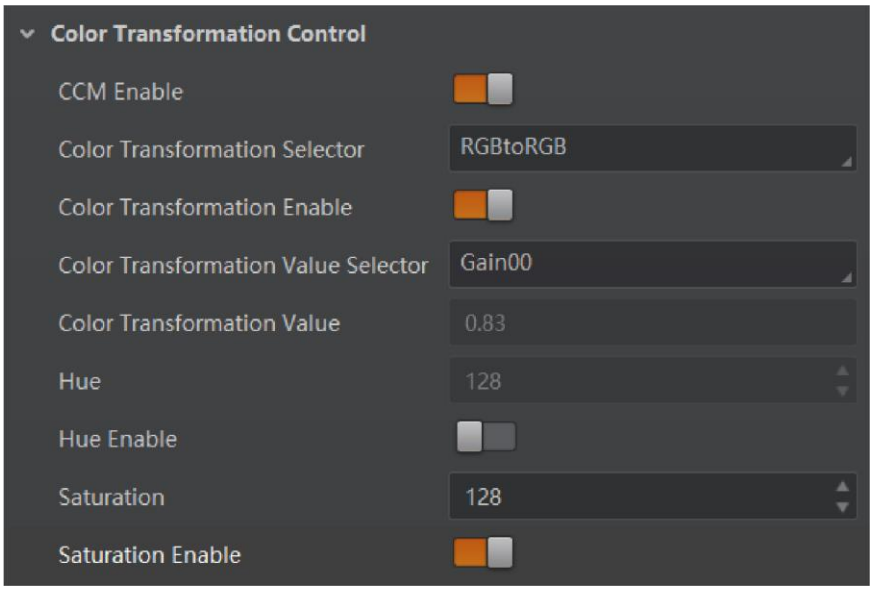


Figure 10-25 Set Saturation

10.18 Set Super Palette Control

Note

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

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

Steps

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

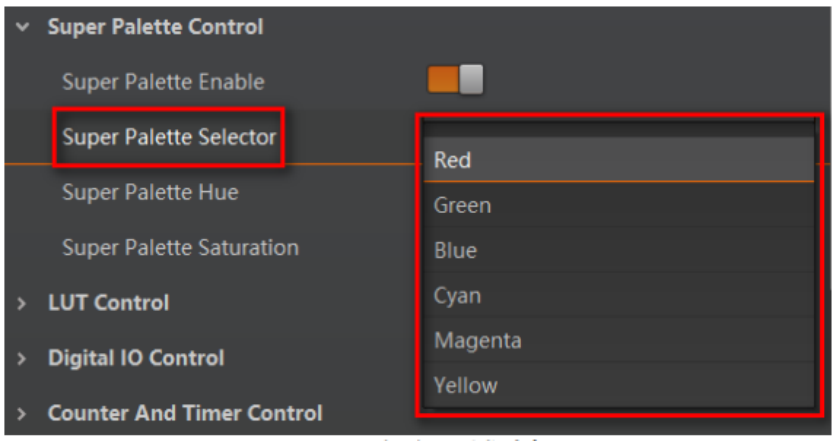


Figure 11-26 Super Palette Selector

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

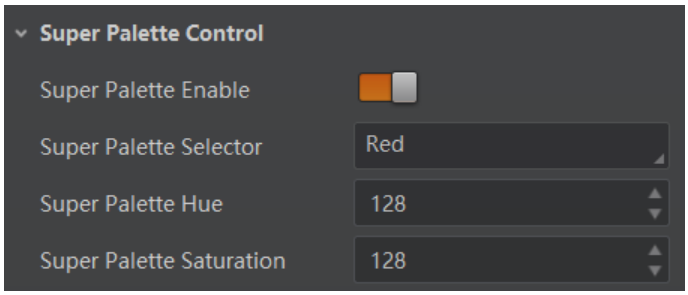


Figure 11-27 Set Super Palette Control

10.19 Set LUT

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

Note

- You cannot use Gamma correction function and LUT function at the same time.
- The parameter of **LUT Save** may differ by device models. If the device has no **LUT Save**, the settings you configured will be saved in the device in real time.
- For different models of device, the **LUT Index** and **LUT Value** range may differ, please refer to the actual one you got.

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.

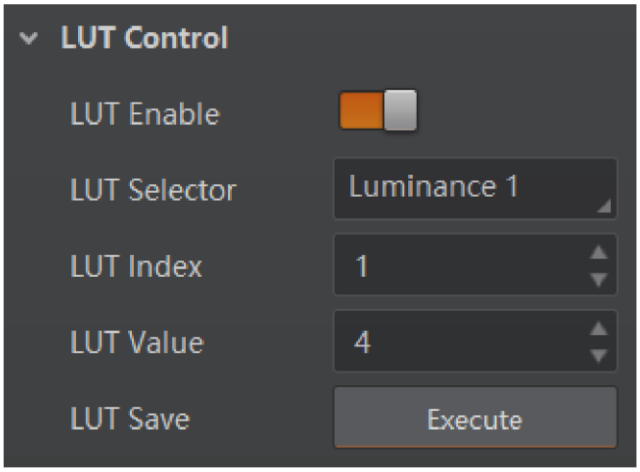


Figure 10-28 Set LUT

10.20 Set Shading Correction

Note

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

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

10.20.1 Set FPNC Correction

Note

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

Steps

1. Click **Shading Correction**, and select **FPNC Correction** as **Shading Selector**.
2. Select one **User FPNC** from **FPNC User Selector**.

Note

Up to three groups of User FPNC can be selected.

3. Click **Execute** in **Activate Shading**.

4. Enable **FPNC User Enable**.

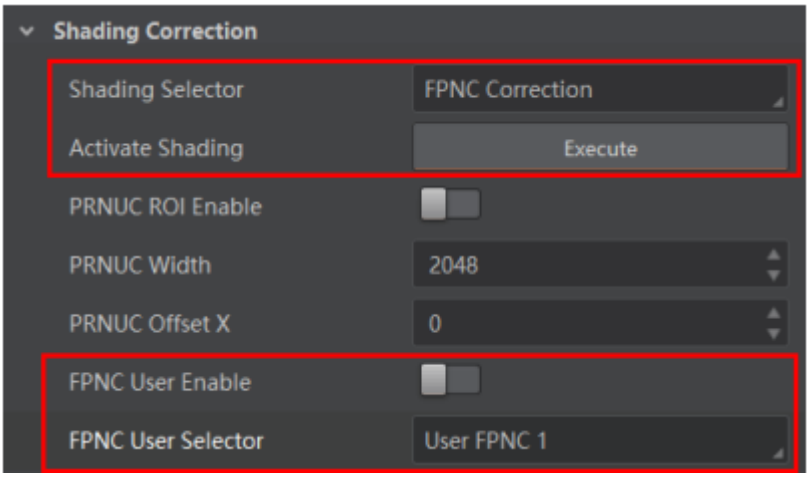


Figure 10-29 Set FPNC Correction

10.20.2 Set PRNUC Correction

Note

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

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

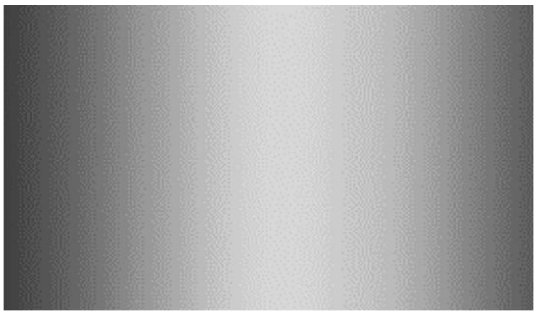


Figure 10-30 Before PRNUC Correction

Figure 10-31 After PRNUC Correction

Global PRNUC Correction

Steps

1. Click **Shading Correction**, select **PRNUC User Selector**, and the device starts to acquire images.
2. Set PRNUC target related parameters according to actual demands.
- Disable **PRNUC Target Enable** if you want to use the device's auto correction standard. At this time, the device compares and corrects the average R/G/B component value of each column with the average R/G/B component value of the entire image.
- Enable **PRNUC Target Enable** if you want to manually correct. For mono devices, set **PRNUC Target**, and for color devices, set **PRNUC Target R**, **PRNUC Target G**, and **PRNUC Target B** according to actual demands. At this time, the device compares and corrects the average gray value or R/G/B component value of each column with the configured gray value or R/G/B value.
3. Click **Execute** in **Activate Shading**, and enable **PRNUC User Enable**.
4. (Optional) Enable **PRNUC Smooth Enable** to reduce the dust impact during calibration process.

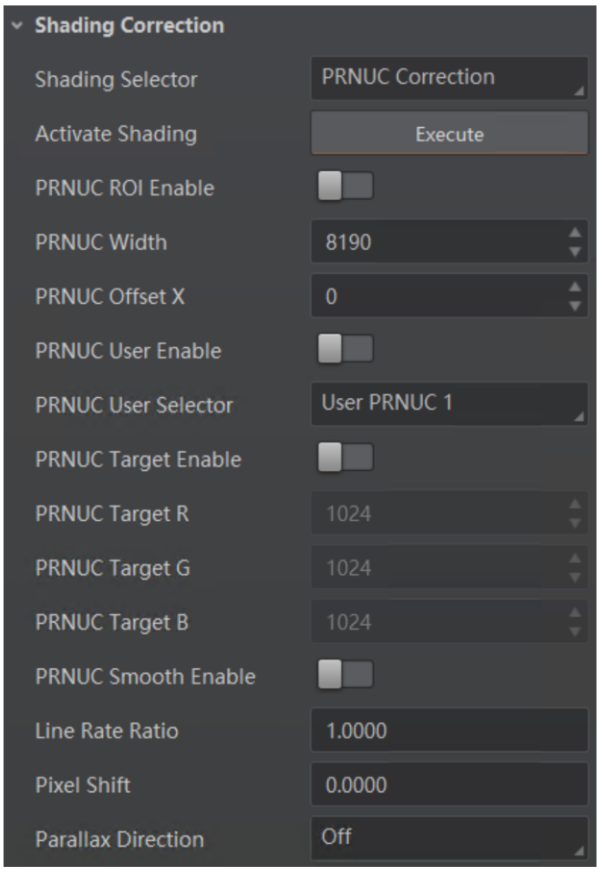


Figure 10-32 Set Shading Correction

ROI PRNUC Correction

If you want to execute PRNUC correction for specific areas, set **PRNUC Width** and **PRNUC Offset X** according to actual demands, and enable **PRNUC ROI Enable**.

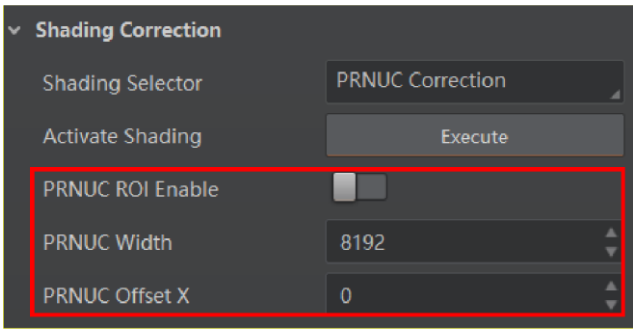


Figure 10-33 ROI PRNUC Correction

10.21 Set Space Correction

Note

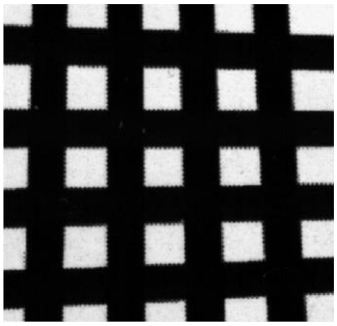
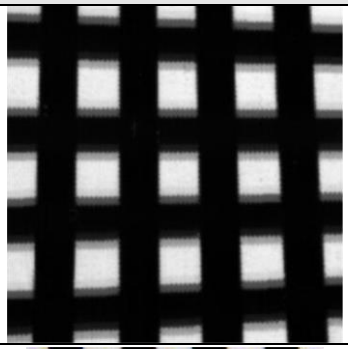
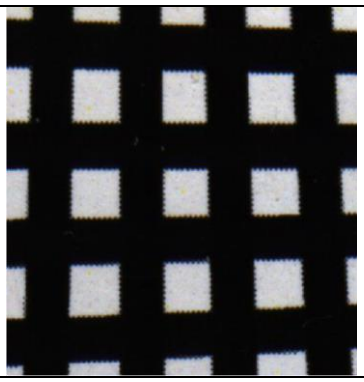
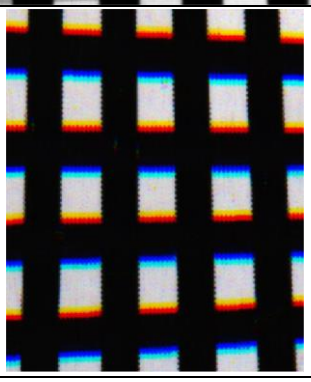
The space correction function may differ by device models.

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

10.21.1 Set Line Rate Ratio

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

Table 10-2 Effect Contrast of Line Rate Ratio

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

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

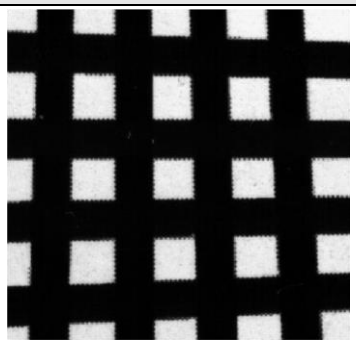
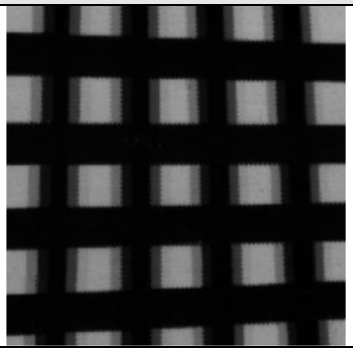
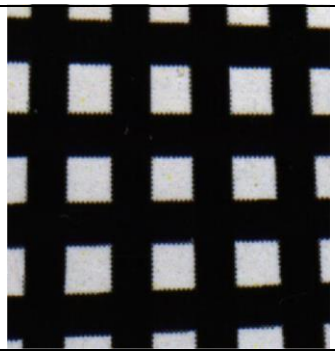
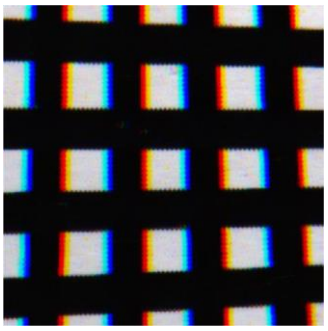
10.21.2 Set Pixel Shift and Parallax Direction

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

Note

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

Table 10-3 Effect Contrast of Pixel Shift

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

Steps

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

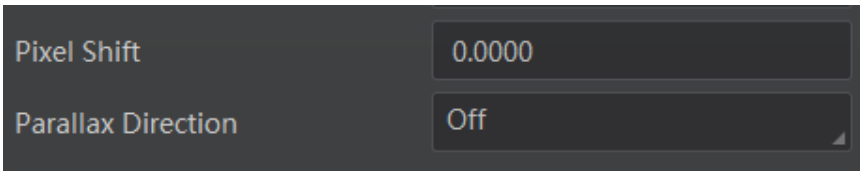


Figure 10-34 Set Pixel Shift and Parallax Direction

10.22 Set Color Abnormal Correction

Note

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

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

Steps

1. Set **Shading Correction**, and find **CAC Edge Threshold**.
2. Enter **CAC Edge Threshold** according to actual demands. The range of **CAC Edge Threshold** is between 0 and 2040.
3. Enable **CAC Enable**.

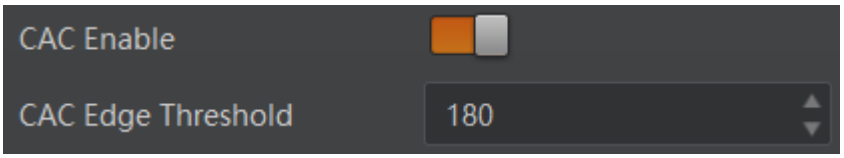


Figure 10-35 Set Color Abnormal Correction

Chapter 11 Other Functions

11.1 Device Control

Note

The specific device control parameters may differ by device models.

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

Table 11-1 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 Family Name	Read only	It is the series name of 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. ● If User ID is empty, the client software displays the device model. ● If you set it, the client software displays the User ID you set.
Maximum Device Response Time	Read only	It is the device's max. response time.
Device Manifest Table Address	Read only	The endianness of image data.
Device SBRM Address	Read only	It is address of the technology specific bootstrap register map.
Device Uptime (s)	Read only	It is the period of time when device is powered up.

Parameter	Read/Write	Description
Board Device Type	Read only	It is the device type.
Device Command Timeout	Read only	It counts the timeout of command.
Device Reset	Write only	Click **Execute** to reset the device.
Device Temperature Selector	Read and write	It selects sensor or motherboard to view their temperature.
Device Temperature	Read only	It is the temperature of selected one in **Device Temperature Selector.**
Device Clock Selector	Read and write	It selects the clock frequency to access from the device.
Device Clock Frequency	Read and write	It sets the frequency of the selected clock.
Device PJ Number	Read only	It is the device's project number.

11.2 TDI Function

Note

- The TDI function may differ by device models.
- When switching TDI Mode, the device may have short period (3 s to 5 s) of image exception, which is a normal phenomenon.

TDI refers to Time Delay Integration, and it is a method of line scanning which provides dramatically increased responsivity compared to other video scanning methods. It permits much greater scanning speeds in low light, or allows reduced lighting levels (and costs) at conventional speeds. In general, there are 3 TDI modes, including 1 line, 2-TDI and 4-TDI.

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

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

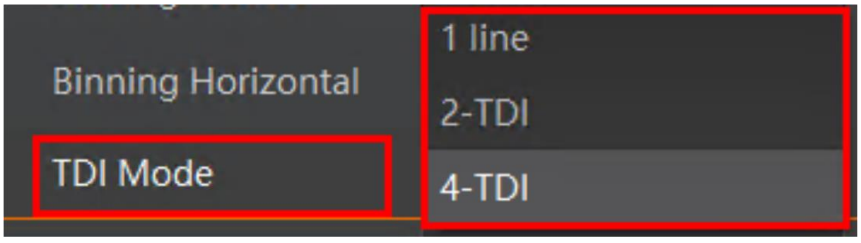


Figure 11-1 Set TDI Mode

11.3 Scan Direction

Note

- The scan direction function may differ by device models.
- Make sure that the scan direction and the moving direction of objects are matched. Otherwise, acquired images may be abnormal.

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

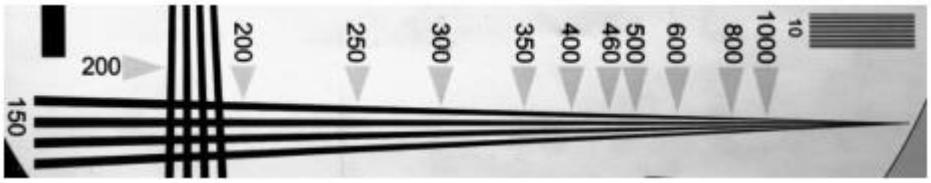


Figure 11-2 Image when Direction Matched of Mono Device

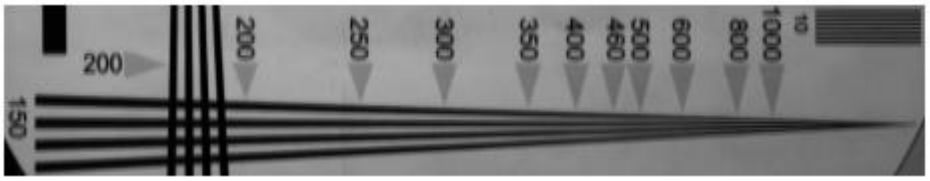


Figure 11-3 Image when Direction Mismatched of Mono Device

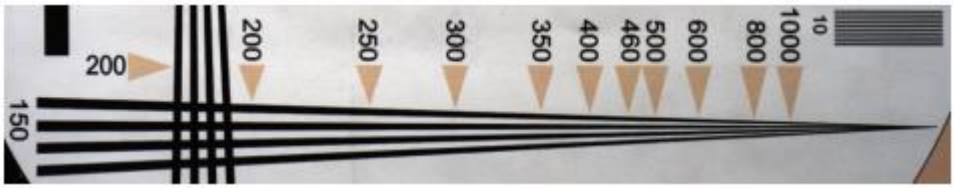


Figure 11-4 Image when Direction Matched of Color Device

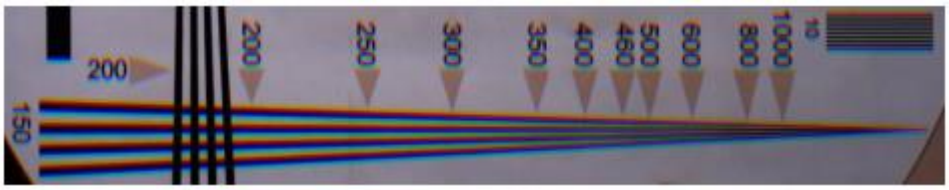


Figure 11-5 Image when Direction Mismatched of Color Device

The specific method of setting scan direction may differ by device models.

- Regarding type II device, go to **Image Format Control** → **Reverse Scan Direction** to enable **Reverse Scan Direction** to let the device to execute TDI function for backward moving object.

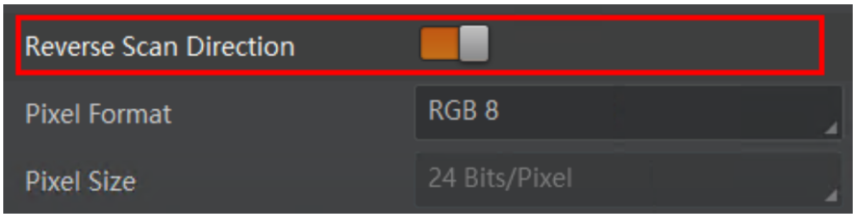


Figure 11-6 Enable Reserve Scan Direction

- Regarding MV-CL042-91CM, after selecting **2-TDI** as **TDI Mode**, follow steps below to set scan direction.

Steps

1. Go to **Image Format Control** → **Direction Source**.
2. Set **Direction Source** according to actual demand: Select **Internal** as **Direction Source** and enable **Reverse Scan Direction** if you want to use the internal signal to achieve reverse scan function.

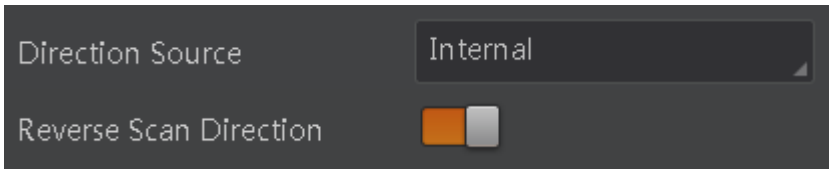


Figure 11-7 Internal Direction Source

4. (Optional) Select **CC 3** as **Direction Source** if you want to use CC 3 as trigger signal to achieve reverse scan function.

Figure 11-8 External Direction Source

- Regarding MV-CL042-91CC device, apart from selecting **Bayer RGBG 8** as **Pixel Format**, you can refer to steps of MV-CL042-91CM device above to set scan direction for other pixel formats.
- Regarding MV-CL084-91CM-PRO device, when selecting **2-TDI** or **4-TDI** as **TDI Mode** or **2 Lights**, **3 Lights** or **4 Lights** as **Multi Light Control**, you can set scan direction. Refer to steps of MV-CL042-91CM device above for details.

11.4 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. The supported feature files include User Set 1/2/3, LUT Luminance 1/2/3, USER PRNUC 1/2/3, and USER FPNC.

Steps

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

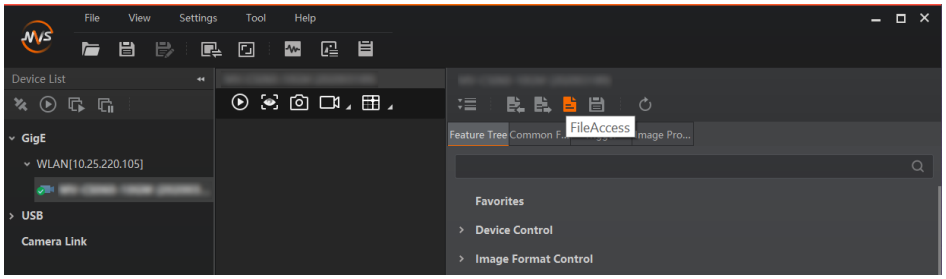


Figure 11-9 File Access

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

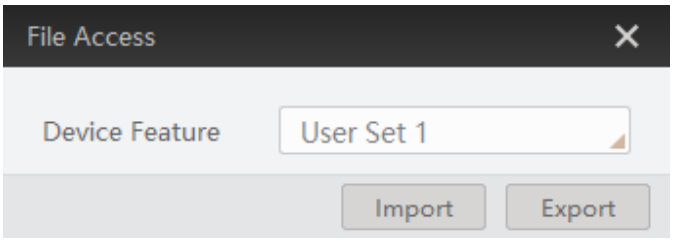


Figure 11-10 Import or Export

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.
- USER PRNUC 1/2/3 has the same mechanism with LUT Luminance 1/2/3 mentioned above.
- If USER FPNC is selected as device feature, and they will take effect immediately when FPNC User Enable is enabled.
- Importing and exporting the device feature among the same model of devices are supported.

11.5 Transport Layer Control

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

Note

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

Table 11-2 Parameters of Transport Layer Control

Parameter	Read/Write	Description
Paylode Size	Read only	It is the device's load size.
Device Tap Geometry	Read and write	The value of device sensor geometry in the frame grabber software should be the same with that of Device Tap Geometry. Inconsistent parameters may lead to image exception.
CI Configuration	Read only	It is the configuration mode. It switches automatically in accordance with different tap configuration 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.
Supported Baudrates	Read only	It displays the supported baud rates.

Note

For specific Device Tap Geometry that the device supports, refer to the actual one you got. Here we take Geometry_1X, Geometry_1X2 and Geometry_1X4 as an example.

- When **Device Tap Geometry** is Geometry_1X, the output order of tap is shown below.

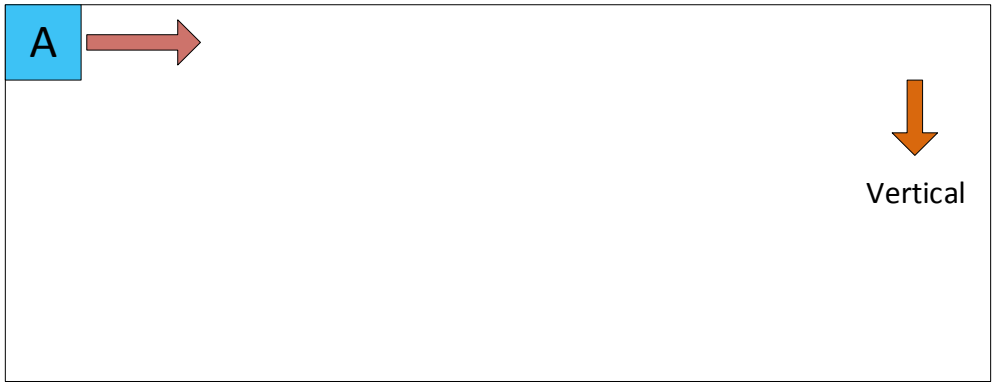


Figure 11-11 Geometry_1X

- When **Device Tap Geometry** is Geometry_1X2 the output order of tap is shown below.

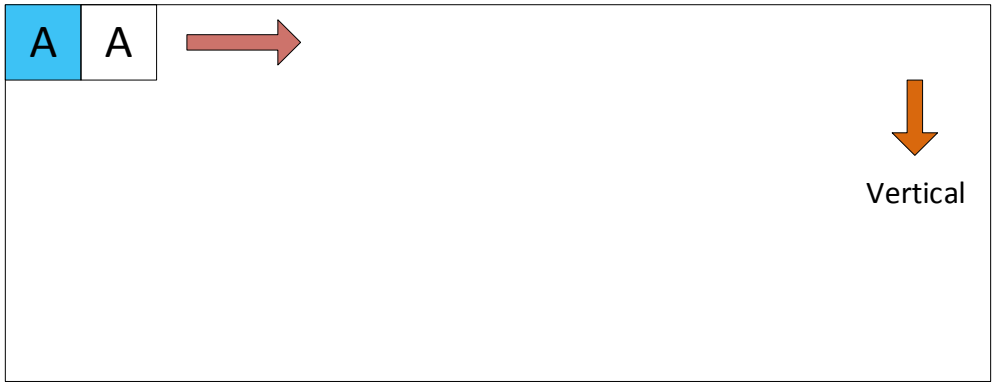


Figure 11-12 Geometry_1X2

- When **Device Tap Geometry** is Geometry_1X4, the output order of tap is shown below.

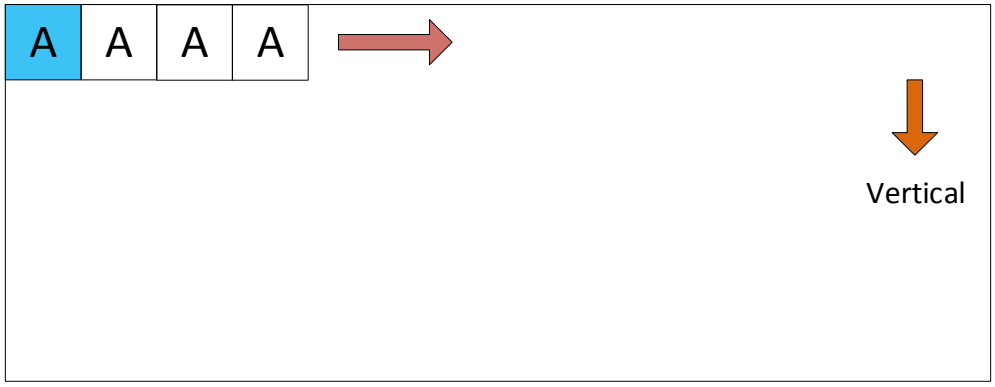


Figure 11-13 Geometry_1X4

11.6 User Set Customization

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

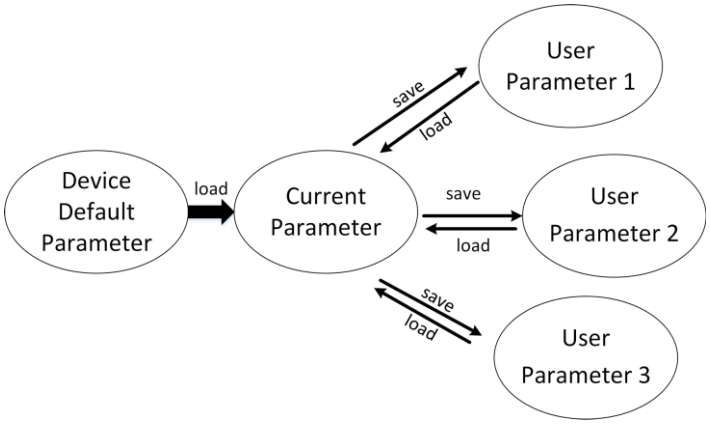


Figure 11-14 Parameter Relation

Note

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

11.6.1 Save User Set

Steps

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

Note

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

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

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

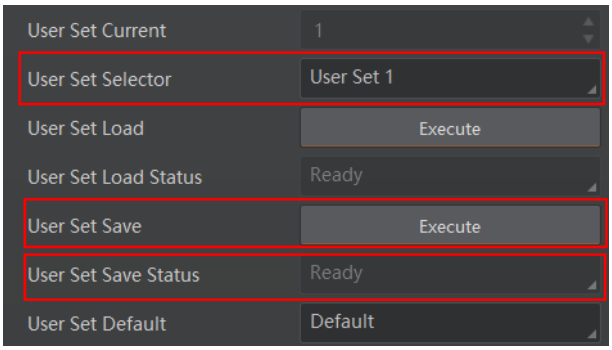


Figure 11-15 Save User Set

11.6.2 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.
3. View **User Set Load Status**:
- Saving: User parameters are being loaded.
- Ready: User parameters have been loaded.

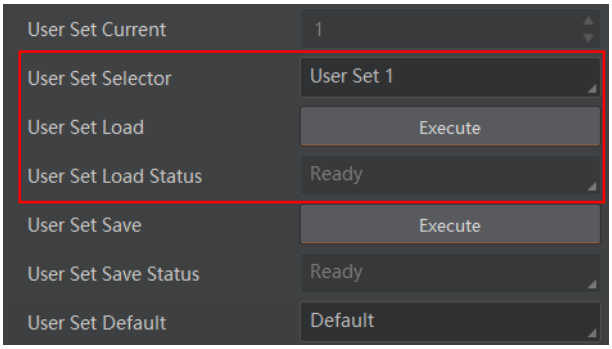


Figure 11-16 Load User Set

11.6.3 Set User Default

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

Note

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

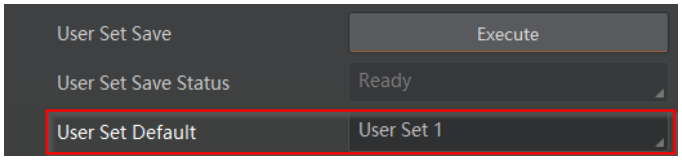


Figure 11-17 Set User Default

11.7 Update Firmware

The device supports updating firmware by using Camera Link cable or USB data cable.

Note

- Before updating, make sure power cable and others are properly connected.
- You should stop the live view and disconnect the device with MVS client software before updating the firmware.
- Uswthe firmware package of the corresponding device model for updating.

Update Firmware via Camera Link Cable

Steps

1. Go to **Tool** → **Firmware Updater** to open the update interface.
2. Click to select the device.
3. Click to select the update file in the local computer.
4. Click **Update**.

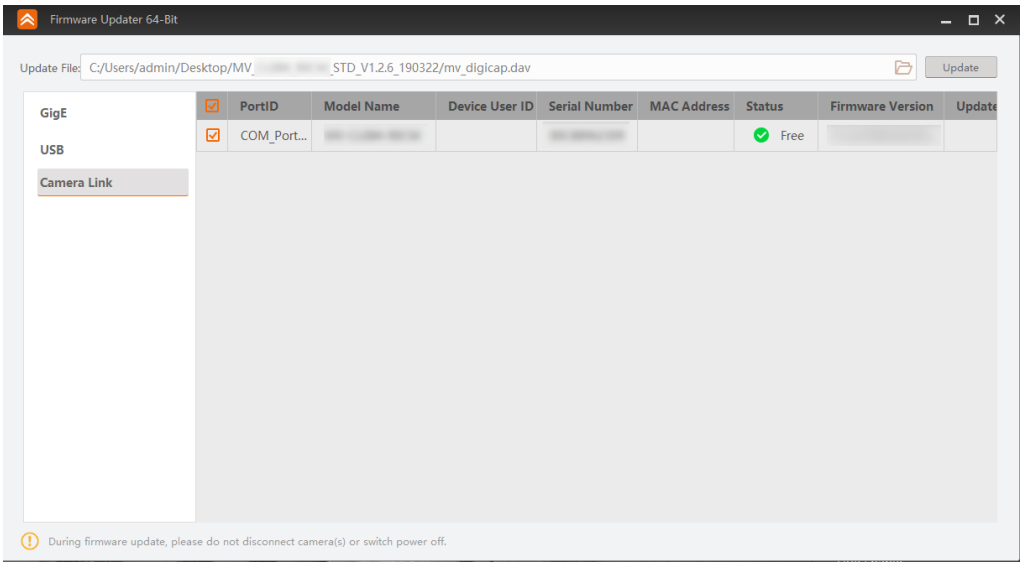


Figure 11-18 Update Firmware via Camera Link Cable

Update Firmware via USB Data Cable

Note

- The USB data cable you use 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.

Steps

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

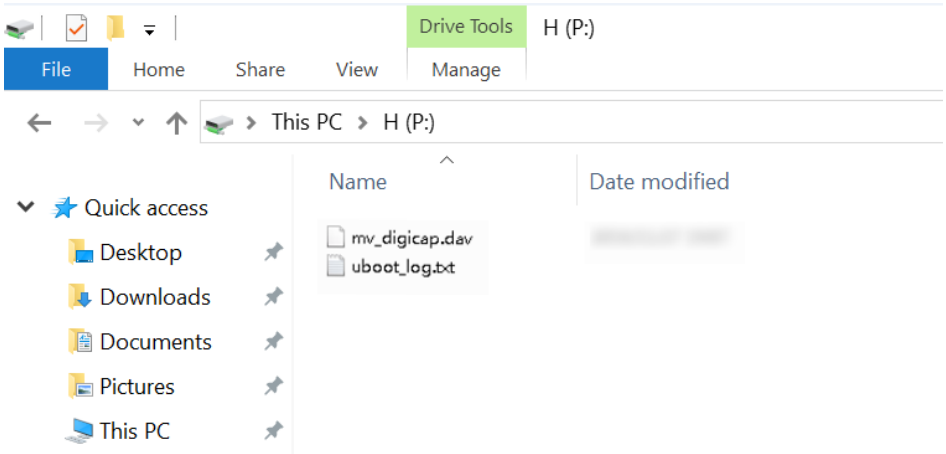


Figure 11-19 Update Firmware via USB Data Cable

Chapter 12 FAQ (Frequently Asked Question)

12.1 Why the client software cannot list devices?

Reason

- The device is not powered on normally.
- Incorrect Camera Link cable connection.

Solution

Check the device's power supply by observing the device's indicator, and check Camera Link cable connection.

12.2 Why the frame grabber software does not display images during preview and the indicator is solid blue?

Reason

- Incorrect parameter configuration of the frame grabber software, for example, device tap geometry parameter.
- The device is in trigger mode.

Solution

- Check the parameter configuration of the frame grabber software.
- Disable the trigger mode.

12.3 Why the live view is back?

Reason

The device's lens aperture is not removed.

Solution

Remove the device's lens aperture.

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

Reason

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

Solution

- Make sure that the trigger wiring is correct.
- Check if the device’s trigger mode and related trigger signal inputs are correct or not.

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

Reason

Incorrect output format of images.

Solution

Check the image format required by the algorithm, and adjust the output format of images in the client software.

Appendix A Device Parameter Index

Table Appendix 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 Family Name	
	Device Version	
	Device Firmware Version	
	Device Serial Number	
	Device User ID	
	Maximum Device Response Time	
	Device Manifest Table Address	
	Device SBRM Address	
	Device Uptime (s)	
	Board Device Type	
	Device Command Timeout	
	Device Reset	
	Device Temperature Selector	
	Device Temperature	
	Device Clock Selector	
	Device Clock Frequency	
	Device PJ Number	
Image Format Control	Width Max	Section View Resolution
	Height Max	
	Region Selector	Section Set ROI
	Width	
	Height	

Attribute	Parameters	Section
	Offset X	
	Reverse X	Section Set Image Reverse
	Direction Source	Section Scan Direction
	Reverse Scan Direction	
	Pixel Format	Section Set Pixel Format
	Pixel Size	
	Multi Light Control	Section Set Multiple Lights Control
	Test Pattern Generator Selector	Section Set Test Pattern
	Test Pattern	
	Binning Selector	Section Set Binning
	Binning Horizontal	
	Binning Vertical	
	TDI Mode	Section TDI Function
	TDI Direction	
Acquisition Control	Acquisition Burst Frame Count	Section Set Acquisition Burst Frame Count
	Acquisition Line Rate (Hz)	Section Set Line Rate
	Acquisition Line Rate Control Enable	
	Resulting Line Rate (Hz)	
	Resulting Frame Rate (Fps)	
	Scan Mode	Section Set Scan Mode
	Trigger Selector	Section Trigger Source
	Trigger Mode	
	Trigger Software	
	Trigger Source	
	Trigger Activation	
	Line Delay Enable	
	Trigger Delay (μs)	

Attribute	Parameters	Section
	Trigger Cache Enable	Section Set Trigger Related Parameters
	Line Trigger Cache Enable	
	Exposure Mode	Section Set Exposure Auto
	Exposure Time (μs)	
	Exposure Auto	
	Auto Exposure Time Lower Limit (μs)	
	Auto Exposure Time Upper Limit (μs)	
	Frame Timeout Enable	Section Set Frame Timeout
	Frame Timeout Time	
	Partial Image Output Mode	
	Abnormal Line Enable	Section Set Line Discard Function
Analog Control	Preamp Gain	Section Set Analog Gain
	Gain (dB)	
	Digital Shift	Section Set Digital Gain
	Digital Shift Enable	
	Brightness	Section Set Brightness
	Black Level	Section Set Black Level
	Black Level Enable	
	Balance White Auto	Section Set White Balance
	AWB Color Temperature Mode	
	Balance Ratio Selector	
	Balance Ratio	
	Gamma	Section Set Gamma Correction
	Gamma Selector	
	Gamma Enable	
	Auto Function AOI Selector	Section Set AOI
	Auto Function AOI Width	
	Auto Function AOI Height	
	Auto Function AOI Offset X	

Attribute	Parameters	Section
	Auto Function AOI Offset Y	
	Auto Function AOI Usage Intensity	
	Auto Function AOI Usage White Balance	
Color Transformation Control	CCM Enable	Section Set Color Transformation Control
	Color Transformation Selector	
	Color Transformation Enable	
	Color Transformation Value Selector	
	Color Transformation Value	
	Hue	Section Set Hue
	Hue Enable	
	Saturation	Section Set Saturation
	Saturation Enable	
Super Palette	Super Palette Enable	Section Super Palette Control
	Super Palette Selector	
	Super Palette Hue	
	Super Palette Saturation	
LUT Control	LUT Selector	Section Set LUT
	LUT Enable	
	LUT Index	
	LUT Value	
	LUT Save	
Encoder Control	Encoder Selector	Section Set and Execute Shaft Encoder Control
	Encoder Source A	
	Encoder Source B	
	Encoder Trigger Mode	
	Encoder Counter Mode	
	Encoder Counter	
	Encoder Counter Max	
	Encoder Counter Reset	
	Encoder Max Reverse Counter	

Attribute	Parameters	Section
	Encoder Reverse Counter Reset	
Frequency Converter Control	Input Source	Section Set and Execute Frequency Converter Control
	Signal Alignment	
	Trigger Line Rate(Hz)	
	PreDivider	
	Multiplier	
	PostDivider	
	Resulting Trigger Line Rate(Hz)	
Shading Correction	Shading Selector	Section Set Shading Correction
	Activate Shading	
	PRNUC ROI Enable	
	PRNUC Width	
	PRNUC Offset X	
	FPNC User Enable	
	FPNC User Selector	
	PRNUC User Enable	
	PRNUC User Selector	
	PRNUC Target Enable	
	PRNUC Target	
	PRNUC Target R	
	PRNUC Target G	
	PRNUC Target B	
	PRNUC Smooth Enable	
	Line Rate Ratio	Section Set Space Correction
	Pixel Shift	
	Parallax Direction	
	CAC Enable	Section Set Color Abnormal Correction
	CAC Edge Control	
Digital IO Control	Line Selector	Section Trigger Output
	Line Mode	

Attribute	Parameters	Section
	Line Format	
	Line Inverter	
	Line Status	
	Line Status All	
	Line Source	
	Strobe Enable	
	Strobe Source Selector	
	Strobe Line Duration(μs)	
	Strobe Line Delay(μs)	
	Strobe Line Pre Delay(μs)	
	Line Debouncer Time(μs)	
	IO Test Tool Enable(Line)	
Counter and Timer Control	Counter Selector	Section Enable Strobe Signal
	Counter Event Source	
	Counter Event Activation	
	Counter Reset Source	
	Counter Reset	
	Counter Value	
	Counter Current Value	
File Access Control	File Selector	Section File Access Control
	File Operation Selector	
	File Operation Excute	
	File Open Mode	
	File Operation Status	
	File Operation Result	
	File Size(B)	
Transport Layer Control	Paylode Size	Section Transport Layer Control
	Device Tap Geometry	
	CI Configuration	
	GenCP Version Major	

Attribute	Parameters	Section
	GenCP Version Minor	
	Supported Baudrates	
User Set Control	User Set Current	Section User Set Customization
	User Set Selector	
	User Set Load	
	User Set Save	
	User Set Default	

Appendix B Serial Communication Command List

Note

The commands listed below are common ones only. For other commands, please contact technical support personnel via e-mail: *tech_support@hikrobotics.com* for detailed information.

Table Appendix B-1 Serial Communication Command List

Parameter	Command	Value	Description
DeviceUserID	/	/	Read customized name.
DeviceReset	w DeviceReset	1	Reboot device. E.g., w DeviceReset 1.
DeviceClockSelector	r DeviceClockSelector	0—CameraLink	Select the clock frequency to access from the device.
DeviceClockFrequency	w DeviceClockFrequency x	0—85 M 1—70 M	Set the clock frequency. E.g., w DeviceClockFrequency 1.
	r DeviceClockFrequency	2—60 M 3—40 M	Read the clock frequency.
Width	w Width x	Value	Set width. E.g., w Width 4096.
	r Width	/	Read width.
Height	w Height	Value	Set the height. E.g., w Height 2000.
	r Height	/	Read the height.

Parameter	Command	Value	Description
OffsetX	w OffsetX x	Value	Set horizontal offset from the origin to the region of interest (in pixels). E.g., w OffsetX 200.
	r OffsetX	/	Read horizontal offset from the origin to the region of interest (in pixels).
OffsetY	w OffsetY x	Value	Set vertical offset from the origin to the region of interest (in pixels). E.g., w OffsetY 200.
	r OffsetY	/	Read vertical offset from the origin to the region of interest (in pixels).
Reverse X	w ReverseX x	0—disable 1—enable	Set image reverse X. E.g., w ReverseX 1.
	r ReverseX	/	Read image reverse X.
Direction Source	w DirectionSource x	0—Internal 1—CC 3	Set control source of scan direction. E.g., w DirectionSource 1.
	r DirectionSource	/	Read the control source of scan direction.
Reverse Scan Direction	w ReverseScanDirection x	0—forward direction 1—reverse direction	Set scan direction (internal control). E.g., w ReverseScanDirection 1.
	r ReverseScanDirection	/	Read scan direction.

Parameter	Command	Value	Description
PixelFormat	w PixelFormat x	x0x1080001--momo8 0x1100003--mono10 0x1100005--mono12 0x02180014--RGB 8	Set pixel format. E.g., w PixelFormat 0x1080001.
	r PixelFormat	/	Read pixel format. Note: The returned value is decimal system and it needs to be converted to hexadecimal.
PixelSize	r PixelSize	/	Read pixel size.
MultiLightControl	w MultiLightControl x	0—off 1—MLC_1_Light 2—MLC_2_Light 3—MLC_3_Light 4—MLC_4_Light	Set multiple lights control
	r MultiLightControl	/	Read multiple lights control
TestPattern	w TestPattern x	0—off 14—ObliqueMonoBar 16—GradualMonoBar	Set test pattern. E.g., w TestPattern 14.
	r TestPattern	/	Read test pattern.
Binning	w Binning x	0x20004 (2 stands for vertical and 4 stands for	Set combined pixel number. E.g., w Binning 0x20002

Parameter	Command	Value	Description
	r Binning	horizontal)	Read combined pixel number.
TDIMode	w TDIMode x	0—Line_1 1—TDI_2	Set TDI mode. E.g., w TDIMode 0.
	r TDIMode		Read TDI mode.
AcquisitionBurstFrameCount	AcquisitionBurstFrameCount x	/	Number of frames to acquire for each FrameBurstStart trigger. E.g., w AcquisitionBurstFrameCount 100
	r AcquisitionBurstFrameCount	/	Get number of frames to acquire for each FrameBurstStart trigger.
AcquisitionLineRate (ControlEnable)	w AcquisitionLineRate x or y	x: it refers to the written line rate value and enable line rate y: it refers to the line rate value you want to set (you can write directly, and disable line rate when writing) x=y+1073741824	Set line rate (enable). E.g., w AcquisitionLineRate 1073841824, it means setting line rate as 100000, and enabling line rate. E.g., w AcquisitionLineRate 100000, it means setting line rate as 100000, and disabling line rate.
	r AcquisitionLineRate	When value is larger than 10737441824, line rate is enabled	Read line rate: If line rate is enabled, you reading and writing x are available, and line rate is y=x-1073741824. If line rate is disabled, reading value is y.

Parameter	Command	Value	Description
Resulting LineRate	r ResultingLineRate	/	Read final (actual) line rate.
ResultingFrameRate	r ResultingFrameRate	x=read value y=value shown in MVS y= x/10000	Read final (actual) line rate.
ScanMode	w ScanMode x	x: 0—FrameScan 1—LineScan	Select frame scan mode or line scan mode. E.g., w ScanMode 0.
	r ScanMode	/	Read scan status.
TriggerSelector	w TriggerSelector	9—Line Start 6—Frame Burst Start	Set line trigger or frame trigger. E.g., w TriggerSelector 9
	r TriggerSelector	/	Read the current selected trigger mode.
TriggerMode	w TriggerMode x	0—Disable line trigger and frame trigger 64—Enable frame trigger mode 512—Enable line trigger mode 576—Enable frame trigger and line trigger mode	Set trigger mode. Note: Write operation cannot operate frame trigger and line trigger at the same time. If w TriggerMode 576 command is used, you must enable frame trigger or line trigger. Eg: First w TriggerMode 64, and then w TriggerMode 576, and frame trigger and line trigger can be enabled at the same time.

Parameter	Command	Value	Description
	r TriggerMode	/	Read trigger mode.
TriggerSource	w TriggerSource+6 x	0—Line0 1—Line1 3—Line3 5—Line4 6—EncoderModuleOut (line trigger supported only) 7—software (frame trigger supported only) 8—FrequencyConverter 9—CC1 11—CC2 12—CC3 13—CC4 25—anyway	Set the frame trigger source E.g., w TriggerSource+6 7.
	w TriggerSource+9 x		Set the line trigger source E.g., w TriggerSource+9 3.
	r TriggerSource+6	/	Read the frame trigger source.
	r TriggerSource+9		Read the line trigger source.
TriggerActivation	w TriggerActivation+6	0—Rising edge	Set rising trigger edge. Eg: w TriggerActivation+6 0.

Parameter	Command	Value	Description
		1—Falling edge	
	r TriggerActivation+6	0—Rising edge 1—Falling edge	Read trigger activation.
LineDelayEnable	w LineDelayEnable x	0—disable 1—enable	Eg: w LineDelayEnable 0
	r LineDelayEnable	/	/
TriggerDelay	w TriggerDelayAbsVal+6	Value	Set trigger delay. Eg: w TriggerDelayAbsVal+6 100.
	r TriggerDelayAbsVal+6	/	Read trigger delay time.
TriggerSoftware	w TriggerSoftware	6	Software trigger once. Eg: w TriggerSoftware 6.
TriggerCacheEnable	w TriggerCacheEnable x	0—Off 65—On	Enable trigger cache or not. E.g., w TriggerCacheEnable 65.
	r TriggerCacheEnable		/
ExposureAuto	w ExposureAuto x	1—once 2—auto 0—off	Set the auto exposure. E.g., w ExposureAuto 2.
	r ExposureAuto	/	Read the exposure mode.
ExposureTime	w ExposureTime	Value	E.g.,w ExposureTime 1000.

Parameter	Command	Value	Description
	r ExposureTime	/	Read the exposure time.
AutoExposureTimeLowerLimit	w AutoExposureTimeLowerLimit x	The device supports min. exposure time. AutoExposureTimeLowerLimit	Set auto exposure lower limit. E.g., w AutoExposureTimeLowerLimit 50.
	r AutoExposureTimeLowerLimit	/	Read auto exposure lower limit.
AutoExposureTimeUpperLimit	w AutoExposureTimeUpperLimit x	x: The device supports max. exposure time. AutoExposureTimeUpperLimit	Set auto exposure upper limit. E.g., w AutoExposureTimeUpperLimit 100.
	r AutoExposureTimeUpperLimit	/	Read auto exposure upper limit.
FrameTimeoutTime	w FrameTimeoutTime x	33-10000	Set frame timeout time. E.g., w FrameTimeoutTime 34.
	r FrameTimeoutTime	/	Read frame timeout time.
Partial Image Output Mode	w PartialImageOutputMode x	0—ImagePending 1—PartialImageOutput 2—PartialImageDiscard	E.g., w PartialImageOutputMode 0

Parameter	Command	Value	Description
		3—PartialImageFilled	
	r PartialImageOutputMode	/	/
FrameTimeoutEnable	w FrameTimeoutEnable x	0—disable 1—enable	Set frame timeout enable. E.g., w FrameTimeoutEnable 0.
	r FrameTimeoutEnable	/	Read frame timeout enable.
AbnormalLineEnable	w AbnormalLineEnable x	0—disable 1—enable	Enable abnormal line function.
PreampGain	w PreampGain x	Gain multiple value x 1000	Set gain value. E.g., w PreampGain 2700 (set the gain as 2.7 x)
	r PreampGain	/	Read gain value.
DigitalShift (Enable)	w DigitalShift y or z	x: the value you want to set y: write serial port value and disable digital shift z: write serial port value and enable digital shift y = (10^(x/20)) * 1024 (rounding) z = (10^(x/20)) * 1024 +	E.g., w DigitalShift 10240. It means setting gain as 20, and disabling digital shift. E.g., w DigitalShift 2147493888. It means setting gain as 20, and enabling digital shift. Note: the range of digital shift is -24 to 24.

Parameter	Command	Value	Description
		2147483648 (rounding)	
	r DigitalShift	Enable on state read data is m, take the lower 32-bit data.	If it is enabled, the reading result of the r DigitalShift is m, and the above 0xFFFFFFFF, get z; x = (log ((z-2147483648) / 1024) * 20. If it is disabled, the reading result of the r DigitalShift is y, x = (log (y / 1024)) * 20.
BalanceWhiteAuto	w BalanceWhiteAuto	0—off 1—continue 2—once	Set white balance mode. Eg: w BalanceWhiteAuto 2.
	r BalanceWhiteAuto	/	Read white balance mode.
BlackLevel	w BlackLevel x	0-4095	Set black level. E.g., w BlackLevel 5.
	r BlackLevel	/	Read black level.
BlackLevelEnable	w BlackLevelCtrl x	0—disable 1—enable	Set black level enable. E.g., w BlackLevelCtrl 1.
	r BlackLevelCtrl	/	Read black level enable.
GammaAbsVal	w GammaAbsVal x×100+y	x: game value y: 0x20000—represents sRgb 0x10000—represents User	Set Gama value, and GamaEnable on is availabe. Eg: w GammaAbsVal 2 × 100+0 × 10000.

Parameter	Command	Value	Description
	r GammaAbsVal	/	Read Gamma value. x= Read value/100.
GammaEnable	w GammaCtrl x	0—off 1—on	EnableGama. Eg: w GammaCtrl 1.
	r GammaCtrl	/	Read Gama status.
Brightness	w Brightness x	0-255	Set brightness value. Eg: w Brightness 66.
	r Brightness	/	Read brightness.
BalanceRatioSelector	/	/	/
	/	/	/
BalanceRatio	w BalanceRatio x	1-16376	Eg: w BalanceRatio+1 800
	r BalanceRatio+x	0-Red,1-Green,2-Blue	Eg: r BalanceRatio+1
AutoFunctionAOIWidth	w AutoAOIWidth x	x: 32-1024	Set the width of auto function AOI (in pixels). E.g., w AutoAOIWidth 1024.
	r AutoAOIWidth	/	Read the width of auto function AOI (in pixels).
AutoFunctionAOIHeight	w AutoAOIHeight x	x: 64-5000	Set the height of auto function AOI (in pixels). E.g., w AutoAOIHeight 240.
	r AutoAOIHeight	/	Read the height of auto function AOI (in pixels).
AutoFunctionAOIOffsetX	w AutoAOIOffsetX x	x: 0	Set the start columnof auto function AOI. E.g., w AutoAOIOffsetX 0.

Parameter	Command	Value	Description
	r AutoAOIOffsetX	/	/
AutoFunctionAOIOffsetY	w AutoAOIOffsetY x	x: 0-4760	Set the start row of auto function AOI. E.g., w AutoAOIOffsetY 100.
	r AutoAOIOffsetY	/	/
AutoFunctionAOIUsageIntensity	w AutoAOIUsage x	Off: 0 On: 0Xffffffff80000001	Read AOI 1. E.g. w AutoAOIUsage 0Xffffffff80000001.
	r AutoAOIUsage	/	Read parameter value.
CCMEnable	w CCMEnable x	0—Off 1—On	Enable/disable Color Correction Matrix. E.g., w CCMEnable 1.
	r CCMEnable	/	Read the status of Color Correction Matrix.
ColorTransformationEnable	w ColorTransformationEnable x	0—Off 1—On	Set the status of color transformation module. E.g., w ColorTransformationEnable 1.
	r ColorTransformationEnable	/	Read the selected status of color transformation module.
ColorTransformationValue	w ColorTransformationValue x	y: Desired value x=y*1024	Represents the value of the selected Gain factor or Offset inside the Transformation matrix. E.g., w ColorTransformationValue 855.
	r ColorTransformationValue	/	Read the value of the selected Gain factor or Offset inside the Transformation

Parameter	Command	Value	Description
			matrix.
HueAbsVal	w HueAbsVal x	0-255	Set hue. E.g., w HueAbsVal 128.
	r HueAbsVal	/	Read hue.
HueCtrl	w HueCtrl x	0—Off 1—0x1000000	Enable hue or not. E.g., w HueCtrl 0x1000000.
	r HueCtrl	/	Read enable status of hue.
SaturationAbsVal	w SaturationAbsVal x	0-255	Set saturation. E.g., w SaturationAbsVal 128.
	r SaturationAbsVal	/	Read saturation.
SaturationCtrl	w SaturationCtrl	0—Off 1—0x10000	Enable saturation or not. E.g., w SaturationCtrl 0x10000.
	r SaturationCtrl	/	Read enable status of saturation.
LUTEnable	w LUTEnable x	0—Off 1—On	Activate selected LUT. E.g., w LUTEnable 1
	r LUTEnable		/
LUTSelector	w LUTSelector x	0—Luminance1 1—Luminance2 2—Luminance3	Select LUT. E.g., w LUTSelector 0.
	r LUTSelector		/
LUTValue	w LUTValue x	y: desired value	Returns the Value at entry LUTIndex of

Parameter	Command	Value	Description
		x=262144+y	the LUT selected by LUTSelector. E.g., Set 100, w LUTValue 262244.
	r LUTValue		/
LUTSave	w LUT Save x	1—save	Save selected LUT. E.g., w LUT Save 1
Encoder Source A	w EncoderSourceA x	0—Line0 3—Line3	Set encoder source A. Eg: w EncoderSourceA 3.
	r EncoderSourceA	/	Read encoder source A.
Encoder Source B	w EncoderSourceB x	0—Line0 3—Line3	Set encoder source B. Eg: w EncoderSourceB 0.
	r EncoderSourceB	/	Read encoder source B.
EncoderOutputMode	w EncoderOutputMode x	0—AnyDirection 3—ForwardOnly	Set encoder's trigger mode. E.g., w EncoderOutputMode 1
	r EncoderOutputMode	/	Read encoder's trigger mode.
Encoder Counter Mode	w EncoderCounterMode x	0—IgnoreDirection 1—FollowDirection	Set encoder counter mode. Eg: w EncoderCounterMode 1.
	r EncoderCounterMode	/	Read encoder counter mode.
Encoder Counter	r EncoderCounter	/	Read encoder counter.
Encoder Counter Max	w EncoderCounterMax x	0-32767	Set encoder max. counter. Eg: w EncoderCounterMax 1.

Parameter	Command	Value	Description
	r EncoderCounterMax	/	Read encoder max counter.
Encoder Counter Reset	w EncoderCounterReset x	1	Reset encoder counter. Eg: w EncoderCounterReset 1.
Encoder Max Reverse Counter	w EncoderMaxReverseCounter x	0-32767	Set encoder max. reverse counter. Eg: w EncoderMaxReverseCounter 1.
	r EncoderMaxReverseCounter	/	Read encoder max. reverse counter.
Encoder Reverse Counter Reset	w EncoderReverseCounterReset x	1	Reset encoder reverse counter. Eg: w EncoderReverseCounterReset 1.
Input Source	w InputSource x	0—Line0 3—Line3 7—EncoderModuleOut	Set input source. Eg: w InputSource 7.
	r InputSource	/	Read input source.
Signal Alignment	w SignalAlignment x	0—RisingEdge 1—FallingEdge	Set signal alignment. Eg: w SignalAlignment 1.
	r SignalAlignment	/	Read signal alignment.
Trigger Line Rate (Hz)	r TriggerLineRate	/	It refers to the external trigger raw line rate after filtering.
PreDivider	w PreDivider x	1-128	Set PreDivider. Eg: w PreDivider 1.
	r PreDivider	/	Read PreDivider.

Parameter	Command	Value	Description
Multiplier	w Multiplier x	1-32	Set Multiplier. Eg: w Multiplier 1.
	r Multiplier	/	Read Multiplier.
PostDivider	w PostDivider x	1-128	Set PostDivider. Eg: w PostDivider 1.
	r PostDivider	/	Read PostDivider.
Resulting Trigger Line Rate (Hz)	r ResultingTriggerLin eRate	/	It refers to the external trigger frequency devices received after the external trigger raw line rate is calculated via frequency converter control. It only involves external trigger signals.
ShadingSelector	w ShadingSelector x	0—FPNCCorrection 1—PRNUCCorrection	Select shading correction type. E.g., w ShadingSelector 1.
	r ShadingSelector		Read shading correction type.
ActivateShading	w ActivateShading+x y	x: 0—FPNCCorrection 1—PRNUCCorrection y: 1—enable	E.g., activate PRNUC correction, w ActivateShading+1 1
PRNUCROIEnable	w PRNUCROIEnable x	0—disable 1—enable	Enable user PRNUC ROI. E.g. w PRNUCROIEnable 1.

Parameter	Command	Value	Description
	r PRNUCROIEnable	/	Read status of PRNUC ROI.
PRNUCROIExtensionEnable	w PRNUCROIExtensionEnable x	x: 0—disable 1—enable	Enable PRNUC ROI extension correction.
	r PRNUCROIExtensionEnable		Read PRNUC ROI extension correction status.
PRNUCWidth	w PRNUCWidth x	32-4096	Set image width used by PRNUC. E.g., w PRNUCWidth 4096.
	r PRNUCWidth	/	Read image width used by PRNUC.
PRNUCOffset X	w PRNUCOffsetX x	0-3896	Set image offset used by PRNUC. E.g., w PRNUCOffset 0.
	r PRNUCOffsetX	/	Read image offset used by PRNUC.
FPNCUserEnable	w FPNCUserEnable x	0—disable 1—enable	Enable FPNUC's user set. E.g., w FPNCUserEnable 1.
	r FPNCUserEnable	/	Read FPNUC's user set.
PRNUCUserEnable	w PRNUCUserEnable x	0—disable 1—enable	Enable PRNUC's user set. E.g., w PRNUCUserEnable 1.
	r PRNUCUserEnable	/	Read PRNUC's user set.
PRNUCUserSelector	w PRNUCUserSelector x	0—UserPRNUC1 1—UserPRNUC2	Select PRNUC's user set. E.g., w PRNUCUserSelector 0.

Parameter	Command	Value	Description
		2—UserPRNUC3	
	r PRNUCUserSelector	/	Read PRNUC's user set.
PRNUCTargetEnable	w PRNUCTargetEnable x	0—with correction standard 1—set correction manually	Enable correction manually. E.g., w PRNUCTargetEnable 1.
	r PRNUCTargetEnable	/	Read the status of correction.
PRNUCTarget	w PRNUCTarget x	0-4095	Set PRNUC's correction value. E.g., w PRNUCTarget 2048.
	r PRNUCTarget	/	Read PRNUC's correction value.
PRNUCSmoothEnable	w PRNUCSmoothEnable x	0—disable 1—enable	Enable PRNUC Smooth function or not. E.g, w PRNUCSmoothEnable 1.
	r PRNUCSmoothEnable	/	Read the status of PRNUC Smooth function.
LineRateRatio	w LineRateRatio x	y: configured value (0-1.99) x=y*1024	Set line rate ratio. E.g., w LineRateRatio 1024.
	r LineRateRatio	/	Read line rate ratio.
PixelShift	w PixelShift	y: configured value (0-63.99)	Set pixel shift. E.g., w PixelShift 1024.

Parameter	Command	Value	Description
		x=y*1024	
	r PixelShift	/	Read pixel shift.
ParallaxDirection	w ParallaxDirection x	0—Off 1—Red 2—Blue	Set the direction of parallax. E.g., w ParallaxDirection 0.
	r ParallaxDirection	/	Read the direction of parallax.
LineMode	w LineMode+x y	x: 0—Line0 1—Line1 3—Line3 4—Line4 5—CC1 y: 0—In 8—Strobe	Set I/O input and output mode. Eg: w LineMode+5 0 (Set CC1 as input).
	r LineMode+x	/	Read I/O input and output mode.
LineFormat	w LineFormat +x y	x: 0—Line0	Set line format of selected IO. E.g., w LineFormat +1 0.

Parameter	Command	Value	Description
		1—Line1 3—Line3 4—Line4 5—CC1 y: 0—SingleEnded 2—Differential	
	r LineFormat +x	/	Read line format of selected IO.
LineInverter	w LineInverter	0—disable all 2—enable Line1 only 8—enable Line4 only	Eg: w LineInverter 2 (enable Line1's inverter).
	r LineInverter	/	Read LineInverter status.
LineStatusAll	r LineStatusAll	Device input/output signal status: 1 level high, 0 level low. Input: bit[7:0] Bit[0/1/2/3]: Line0/3/6/9 input Bit[4/5/6/7]: Line0/3/6/9 output	Read the status of LineStatusAll

Parameter	Command	Value	Description
		Output: bit[15:8] Bit[8/9/10/11]: Line1/4/7/10 output Bit[12/13/14/15]: Line1/4/7/10 input Bidirectional input: bit[23:16] Bit[16/17/18/19]:line2/5/8/11 input Bidirectional output: bit[31:24] Bit[24/25/26/27]:line2/5/8/11 output	
LineSource	w LineSource+ x y	x: 1—Line1 3—Line3 4—Line4 y: 0—ExposureStartActive 5—SoftTriggerActive 6—HardTriggerActive	Selects which internal acquisition or I/O source signal to output on the selected Line.

Parameter	Command	Value	Description
	r LineSource+ x	/	Read internal acquisition or I/O source signal to output on the selected Line.
LineStrobe	w LineStrobe x	0—disable all 2—enable Line1 only 8—enable Line4 only	Enable Line1 or Line4. Eg: w LineInverter 2 (enable Line1's inverter).
	r LineStrobe	/	Read LineStrobe status.
StrobeSourceSelector	w StrobeSourceSelector+ x y	x: 1—Line1 3—Line3 4—Line4 y: 0—LineMode 2—FrameMode	Select strobe source according to the trigger method. E.g., w StrobeSourceSelector+1 0.
	r StrobeSourceSelector+ x		Read strobe source. E.g., r StrobeSourceSelector+1
StrobeLineDuration	w StrobeLineDuration+ x y	x: 3—Line3 y: 0—10000	Set the duration of strobe, and the unit is μs. E.g., w StrobeLineDuration +3 100.
	r StrobeLineDuration+ x		Read the duration of strobe. E.g., r StrobeLineDuration+3
StrobeLineDelay	w StrobeLineDelay+ x y	x: 3—Line3 y: 0—10000	Set the delay of strobe, and the unit is μs. E.g., w StrobeLineDuration +3 200.
	r StrobeLineDelay+ x		Read the delay of strobe. E.g., r

Parameter	Command	Value	Description
			StrobeLineDelay+3
StrobeLinePreDelay	w StrobeLinePreDelay+ x y	x: 3—Line3 y: 0—50000	Set the value of strobe line pre-delay, and the unit is μs. E.g., w StrobeLinePreDelay+ 3 300
	r StrobeLinePreDelay+ x		Read the value of strobe line pre-delay. E.g., r StrobeLinePreDelay+3
LineDebouncerTimeNs	w LineDebouncerTimeNs+x y	x: 0—Line0 3—Line3 5—CC1 y: value	Set trigger debouncer, input is available. Eg: w LineDebouncerTimeNs+5 100.
	r LineDebouncerTimeNs+x	/	Read trigger debouncer. E.g., r LineDebouncerTimeNs+3
CounterSelector	w CounterSelector x	0—Counter 0	E.g., w CounterSelector 0
CounterEventSource	w CounterEventSource x	0—Off	E.g., w CounterEventSource 0
Counter Event Activation	w CounterEventActivation x	0—Rising Edge 1—Falling Edge	E.g., w CounterEventActivation 0
	r CounterEventActivation	/	E.g., r CounterEventActivation
CounterResetSource	w CounterResetSource x	0—Off 3—Software	E.g., w CounterResetSource 0

Parameter	Command	Value	Description
CounterReset	w CounterReset x	Execute	It resets counter and it can be executed when selecting **Software** as **Counter Reset Source**.
CounterValue	w CounterValue x	1-4294967295	E.g., w CounterValue 500
CounterCurrentValue	r CounterCurrentValue	/	/
SuperPaletteEnable	w SuperPaletteEnable x	0—Off	/
SuperPaletteSelector	w SuperPaletteSelector x	0—Red 1—Green 2—Blue 3—Cyan 4—Magenta 5—Yellow	The associated node is controlled by XML, and you do not need to set the device.
SuperPaletteHue	w SuperPaletteHue+x y	x: SuperPaletteSelector y: 0-255	/
SuperPaletteSaturation	w SuperPaletteSaturation x	x: SuperPaletteSelector y: 0-255	/
CACEnable	w CACEnable x	0—Off	E.g., w CACEnable 0
CACEdgeThreshold	w CACEdgeThreshold x	0-2040	E.g., w CACEdgeThreshold 200
FileSelector	w FileSelector x	0/1/2—UserSet1/2/3	E.g., w FileSelector 1

Parameter	Command	Value	Description
		4/5/6—LUTLuminance1/2/3 7/8/9—UserPRNUC1/2/3 11—UserFPNC	
	r FileSelector	/	/
FileOperationExecute	w FileOperationExecute x	1—Enable	E.g., w FileOperationExecute 1
FileOpenMode	w FileOpenMode x	0—Read 1—Write	E.g., w FileOpenMode 0
	r FileOpenMode	/	/
PayloadSize	r PayloadSize	/	Provides the number of bytes transferred for each data buffer or chunk on the stream channel.
DeviceTapGeometry	w DeviceTapGeometry x	0x01020181:Geometry_1X2 0x02010181:Geometry_2X 0x04010181:Geometry_4X 0x08010181:Geometry_8X	Set the device’s transmission mode. Eg: w DeviceTapGeometry 0x02010181.

Parameter	Command	Value	Description
		0x0a010181:Geometry_10X	
	r DeviceTapGeometry	/	Read the device's transmission mode (the returned value is decimal system and it needs to be converted to hexadecimal).
CIConfiguration	r CIConfiguration	0—Base 1—Medium 2—Full 3—DualBase 4—EightyBit	The device's configuration.
Supported Baudrates	r SupportedBaudrates	/	Read supported Baudrates.
UserSetSelector	w UserSetSelector x	0—default 1—userset1 2—userset2 3—userset3	Set selected user parameter. Eg: w UserSetSelector 2.
	r UserSetSelector	/	Read selected user parameter.
UserSetLoad	w UserSetLoad 1	Execute	Load UserSetDefault parameter.
UserSetSave	w UserSetSave 1	Execute	Save parameters setting to UserSetSelector.
UserSetDefaultSelector	w UserSetDefaultSelector x	0—default	Select default loaded parameter.

Parameter	Command	Value	Description
		1—userset1 2—userset2 3—userset3	Eg: w UserSetSelector 2
	r UserSetDefaultSelector	/	Read default loaded parameter.

Appendix C Revision History

Table Appendix C-1 Revision History

Version	Document No.	Revision Date	Revision Details
V2.3.1	UD31919B	Feb. 4, 2023	Modify section Serial Communication Command List
V2.3.0	UD30839B	Nov. 4, 2022	● Modify section Appearance. ● Modify section First Type of Signal Wiring. ● Modify section Second Type of Signal Wiring. ● Modify section Serial Communication Command List
V2.2.0	UD29368B	July 14, 2022	● Modify section Appearance. ● Add section Set Scan Mode. ● Modify Enable Strobe Signal. ● Add section IO Test Tool.
V2.1.0	UD28268B	Apr. 25, 2022	● Modify section Appearance. ● Modify section First Type of Pin Definitions.
V2.0.10	UD26517B	Dec. 6,2021	● Modify section Appearance. ● Modify section First Type of Pin Definitions. ● Modify section Set Frame Timeout. ● Modify section Trigger Activation. ● Modify section Enable Strobe Signal. ● Modify section I/O Introduction. ● Modify section Input Wiring for Type I, Type III and Type IV Devices. ● Modify section Output Wiring for Type I, Type III and Type IV Devices. ● Modify section Device Control. ● Modify section Device Parameter Index.
V2.0.7	UD27296B	Feb. 21, 2022	● Add section Set Multiple Lights Control. ● Modify section Scan Direction.

Version	Document No.	Revision Date	Revision Details
			● Modify section Serial Communication Command List.
V2.0.6	UD25427B	Sep. 8, 2021	● Modify section Appearance. ● Modify section Interface and Indicator. ● Modify section Client Software Layout. ● Add section Set Scan Mode. ● Add section Set Line Discard Function. ● Modify section Select Output Signal. ● Modify section Enable Strobe Signal. ● Add section Set Super Palette Control. ● Add section Set Color Abnormal Correction. ● Modify section Serial Communication Command List.
V2.0.2	UD22950B	Feb. 3, 2021	● Add section Set Frame Timeout. ● Modify section Set Trigger Source. ● Add section Set Free Trigger. ● Modify section Trigger Related Parameters. ● Modify section Trigger Activation. ● Modify section Frame/Line Trigger Cache. ● Modify section Enable Strobe Signal. ● Add section I/O Introduction. ● Modify section I/O Electrical Feature. ● Modify section Input Wiring. ● Add section Set Binning. ● Add section Set Black Level. ● Modify section Set Gamma Correction. ● Modify section Set Color Transformation Control. ● Modify section Set Hue. ● Modify section Set Saturation. ● Modify section Set Shading Correction. ● Modify section File Access Control.

Version	Document No.	Revision Date	Revision Details
V2.0.1	UD17814B	Dec. 25,2019	● Modify section Quick Started with MVS ● Add section Set Color Transformation Control. ● Add section Set Hue. ● Add section TDI Function.
V1.0.0	UD14413B	April. 23, 2019	Original version.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