Hikrobot Co., Ltd.

10 GigE Frame Grabber

User Manual

HIKROBOT

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

Available Model

This manual is applicable to the 10 GigE Frame Grabber.

Contact Information

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

Contents

Chapter 1 Safety Instruction

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

1.1 Safety Claim

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

1.2 Safety Instruction

Caution:

- Do not install the device if it is found that the device and accessories are damaged, rusted, water ingress, incorrect model, missing parts, etc. when unpacking.
- Avoid storing and transporting the device in places where have water splashing and rain, direct sunlight, strong electric fields, strong magnetic fields, strong vibrations, etc.
- Avoid dropping, smashing, or vigorously vibrating the device and components during handling.
- Do not touch the electronic components of the device with bare hands, which may cause damage to the device due to ESD.
- When installing the device, it needs to be installed by professionals under the condition of electrostatic protection. The PCB should not be exposed after the device is installed.
- 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.
- When the device is installed in a cabinet or terminal equipment, the cabinet or terminal equipment shall be provided with corresponding protective devices such as fireproof enclosures, electrical protective enclosures and mechanical protective enclosures, and

the protection level shall comply with IEC standards and local laws and regulations.
- In the use of the device, you must be in strict compliance with the electrical safety regulations of the nation and region.
- Make sure that the power consumption of ATX meets that of the device. For the specific power consumption of the device, please refer to the device's specifications.
- 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.
- If the device is not working properly, contact the store or the nearest service center. Do not disassemble or modify the device in any way. (The company does not bear any liability for any problem arising from unauthorized modification or maintenance).
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

Note:

- Check whether the device's package is in good condition, whether there is damage, intrusion, moisture, deformation, etc. before unpacking.
- Check the surface of the device and accessories for damage, rust, bumps, etc. when unpacking.
- Check whether the quantity and information of the device and accessories are complete after unpacking.
- Store and transport the device according to the storage and transport conditions of the device, and the storage temperature and humidity should meet the requirements.
- It is strictly prohibited to transport the device in combination with items that may affect or damage the device.
- Please read the manual and safety instructions carefully before installing the device.
- The device must not be exposed to water droplets or splashes, and it is strictly prohibited to place anything containing liquids (such as vases) on the device.
- The device should not be placed with exposed flame sources, such as lighted candles.
- Do not touch sharp edges of the device.
- Quality requirements for installation and maintenance personnel:
  - Qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills.
  - The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
  - The ability to comprehend the contents of this manual.

1.3 Electromagnetic Interference Prevention

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

- The control cable of the device and the power cable of the industrial light source must be wired separately to avoid bundled wiring.
- The power cable, data cable, signal cable, etc. of the device must be wired separately. Make sure to ground them if the wiring groove is used to separate the wiring and the wiring groove is metal.
- During the wiring process, evaluate the wiring space reasonably, and do not pull the cables hard, so as not to damage the electrical performance of the cables.
- The unused cables of the device must be insulated.
- 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.

Chapter 2 Overview

2.1 Introduction

The 10 GigE frame grabber provides up to 4 RJ45 ports and is applicable to 10 GigE industrial cameras. The host side adopts PCIe Gen2 × 8 or PCIe Gen3 × 8 bus connector, which can be directly mapped to the host memory through DMA to quickly read the collected image data.

2.2 Key Feature

- Supports GigE Vision V2.0 protocol with each channel accessing up to 10 Gbps data transfer speed.
- Various indicators indicate frame grabber status in real time.
- Adopts multiple I/O connectors for input and output.
- Provides SDK for secondary development.
- Complies with Genlcam standard.

Note

Refer to the specification of the frame grabber for detailed parameters.

Chapter 3 Appearance, Connector, and Indicator

3.1 Appearance

Note

- The appearance of MV-GT1002 is essentially identical to that of MV-GT1004, differing only in the number of RJ45 connectors.
- The appearance of MV-GT1102P is essentially identical to that of MV-GT1104P, differing only in the PCIe3.0 connector and the number of RJ45 connectors.
- Refer to the specification of the frame grabber for specific appearance and dimension.
- The appearance is subject to change, and the actual device you purchased shall prevail.

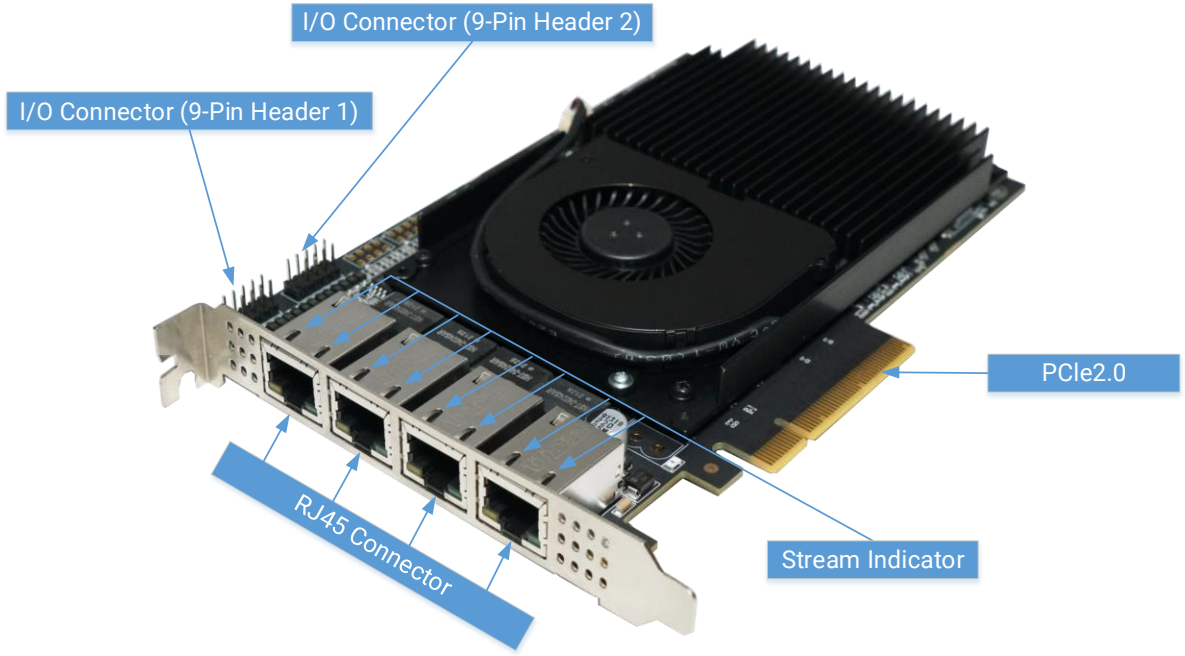

Figure 3-1 Appearance for MV-GT1004

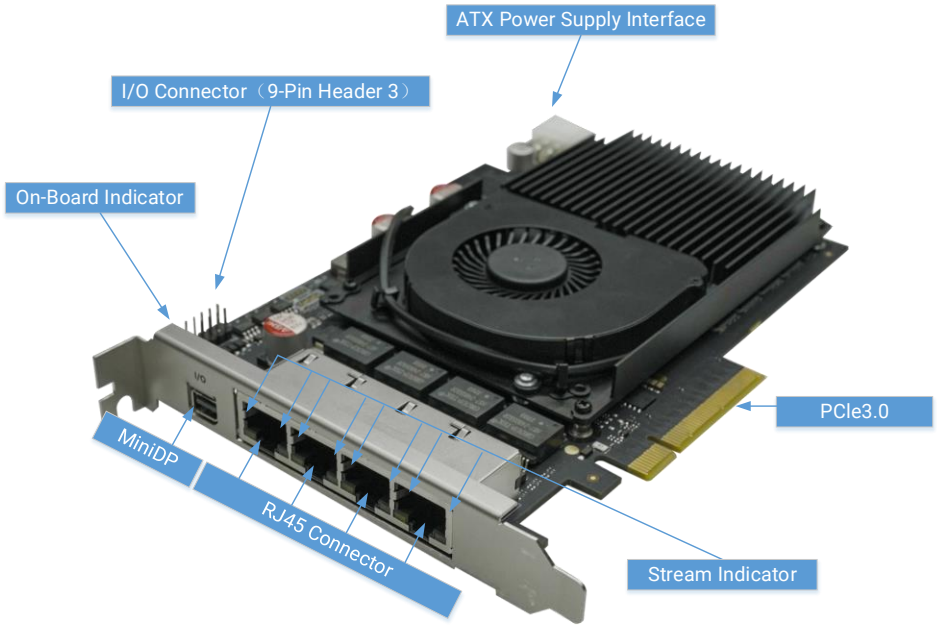

Figure 3-2 Appearance for MV-GT1104P

3.2 ATX Power Supply Interface

The MV-GT1100P series frame grabber supports two power supply methods: PCIe slot power supply and ATX interface power supply.
When the frame grabber is connected to 1 to 2 cameras, it can be powered solely through the PCIe slot. When the frame grabber is connected to 3 to 4 cameras, it is recommended to additionally connect the ATX power supply interface to the host 6-pin ATX 12V power cable to ensure the normal operation of the cameras.

Figure 3-3 ATX Power Supply Interface

3.3 I/O Connector

The frame grabber has multiple I/O connectors that provide input and output signals, with the configuration of these connectors varying across different models.

3.3.1 MV-GT1000 Series

MV-GT1000 series frame grabber adopts 9-pin header 1 and 9-pin header 2, and you can use I/O trigger cable 1 and I/O expansion bracket to wire the device.

9-Pin Header 1

Refer to the figure and table below for the definition of the 9-pin header 1.

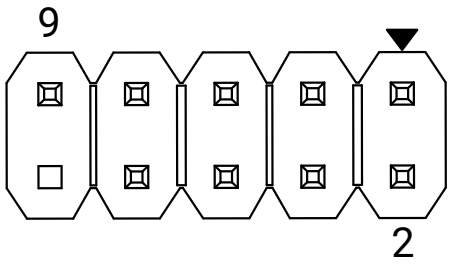

Figure 3-4 9-Pin Header 1

Table 3-1 9-Pin Header 1 Description

No.	Signal	Description	No.	Signal	Description
1	RS485_0P	Differential input/output IO0 positive.	6	RS485_2P	Differential input/output IO2 positive
2	RS485_0N	Differential input/output IO0 negative.	7	RS485_2N	Differential input/output IO2 negative.
3	RS485_1P	Differential input/output IO1 positive.	8	RS485_3P	Differential input/output IO3 positive
4	RS485_1N	Differential input/output IO1 negative.	9	RS485_3N	Differential input/output IO3 negative.
5	GND	Non-isolated I/O ground.	/	/	/

9-Pin Header 2

Refer to the figure and table below for the definition of the 9-pin header 1.

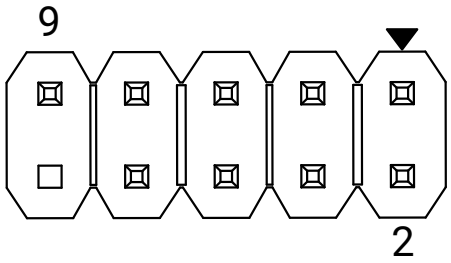

Figure 3-5 9-Pin Header 2

Table 3-2 9-Pin Header 2 Description

No.	Signal	Description	No.	Signal	Description
1	RS485_4P	Differential input/output IO4 positive.	6	RS485_6P	Differential input/output IO6 positive
2	RS485_4N	Differential input/output IO4 negative.	7	RS485_6N	Differential input/output IO6 negative.
3	RS485_5P	Differential input/output IO5 positive.	8	RS485_7P	Differential input/output IO7 positive
4	RS485_5N	Differential input/output IO5 negative.	9	RS485_7N	Differential input/output IO7 negative.
5	GND	Non-isolated I/O ground.	/	/	/

I/O Expansion Bracket

The I/O expansion bracket connects the 9-pin header of the frame grabber at one end, and is secured to the PC via a mounting bracket and connect the I/O trigger cable 1 below to have 4 input and output signals.

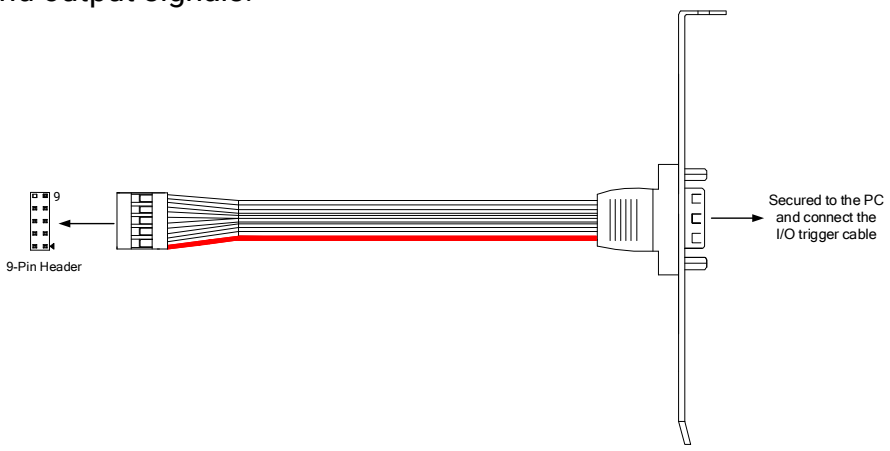

Figure 3-6 I/O Expansion Bracket

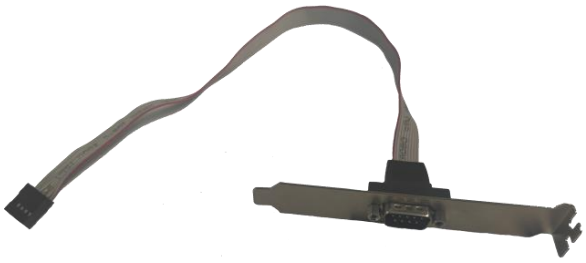

Figure 3-7 Appearance of I/O Expansion Bracket

Note

For the pin definition of I/O expansion bracket, see Frame Grabber Accessories.

I/O Trigger Cable 1

The two ends of the I/O trigger cable 1 are DB9F and open to have 4 input and output signals. The DB9F is connected to the I/O expansion bracket above.

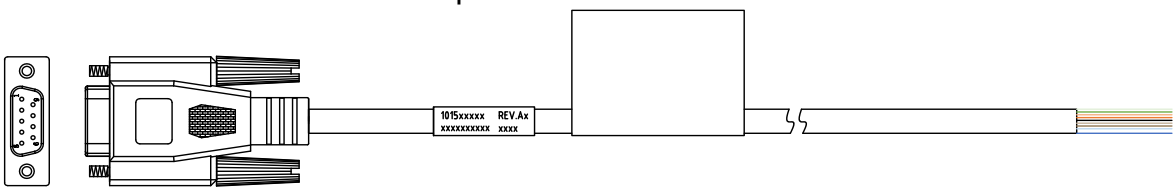

Figure 3-8 I/O Trigger Cable 1

Figure 3-9 Appearance of I/O Trigger Cable 1

Note

For the pin definition of I/O trigger cable 1, see Frame Grabber Accessories.

3.3.2 MV-GT1100P Series

MV-GT1100P series frame grabber adopts MiniDP and 9-pin header 3, and you can use I/O trigger cable and I/O extension bracket to wire the device.

MiniDP Interface

Refer to the figure and table below for the definition of the MiniDP interface.

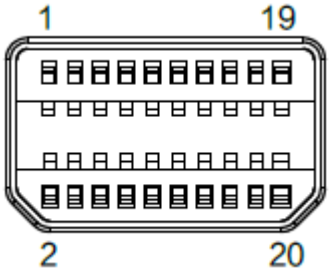

Figure 3-10 Appearance of MiniDP Interface

Table 3-3 MiniDP Interface Description

No.	Signal	Description	No.	Signal	Description
1	RS485_0P	Differential input/output IO0 positive.	10	/	/
2	RS485_0N	Differential input/output IO0 negative.	12	/	/
3	RS485_1P	Differential input/output IO1 positive.	13	GND	Non-isolated I/O ground.
5	RS485_1N	Differential input/output IO1 negative.	14	GND	Non-isolated I/O ground.
4	RS485_2N	Differential input/output IO2 positive.	15	/	/
6	RS485_2N	Differential input/output IO2 negative.	17	/	/
7	GND	Non-isolated I/O ground.	16	/	/
8	GND	Non-isolated I/O ground.	18	/	/
9	RS485_3P	Differential input/output IO3 positive.	19	/	/
11	RS485_3N	Differential input/output IO3 negative.	20	/	/

I/O Trigger Cable 2

The two ends of the I/O trigger cable 2 are MiniDP and open to have 4 input and output

signals. The MiniDP is connected to the MiniDP on the frame grabber.

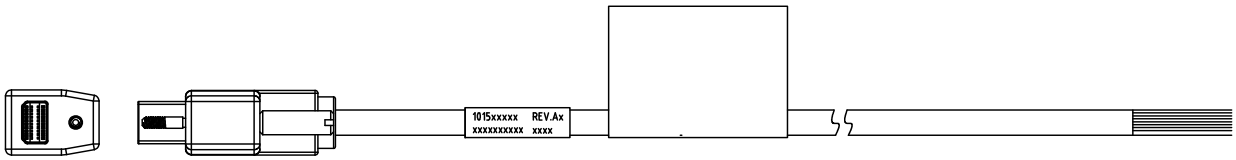

Figure 3-11 I/O Trigger Cable 2

Figure 3-12 Appearance of I/O Trigger Cable 2

Table 3-4 Pin Definition of Open End

No.	Cable Color	Signal	No.	Cable Color	Signal
1	White/Green	RS485_0P	15	White/Yellow	/
2	Green	RS485_0N	17	Yellow	/
3	White/Orange	RS485_1P	16	White/Purple	/
5	Orange	RS485_1N	18	Purple	/
4	White/Brown	RS485_2P	19	White/Light Blue	/
6	Brown	RS485_2N	20	Light Blue	/
9	White/Blue	RS485_3P	7	Black	GND
11	Blue	RS485_3N	8	Red	GND
10	White/Red	/	13	Brown	GND
12	Red	/	14	Orange	GND

9-Pin Header 3

Refer to the figure and table below for the definition of the 9-pin header 3.

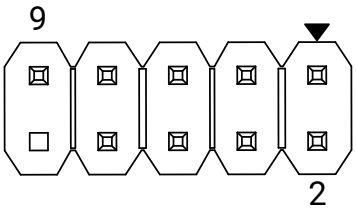

Figure 3-13 9-Pin Header 3

Table 3-5 9-Pin Header 3 Description

No.	Signal	Description	No.	Signal	Description
1	/	/	6	RS485_5P	Differential input/output IO5 positive
2	/	/	7	RS485_5N	Differential input/output IO5 negative.
3	RS485_4P	Differential input/output IO4 positive	8	/	/
4	RS485_4N	Differential input/output IO4 negative.	9	/	/
5	GND	Non-isolated I/O ground	/	/	/

I/O Expansion Bracket

The I/O expansion bracket connects the 9-pin header 3 of the frame grabber at one end, and is secured to the PC via a mounting bracket and connect the I/O trigger cable 1 below to have 2 input and output signals.

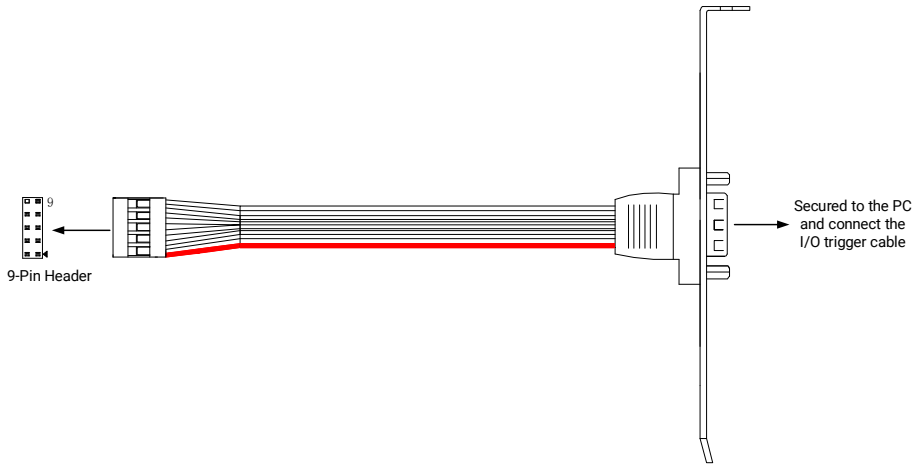

Figure 3-14 I/O Expansion Bracket

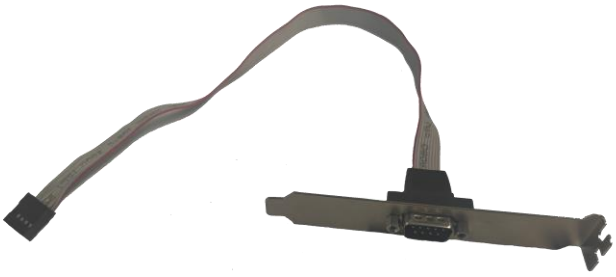

Figure 3-15 Appearance of I/O Expansion Bracket

Note

For the pin definition of I/O expansion bracket, see Frame Grabber Accessories.

I/O Trigger Cable 1

The two ends of the I/O trigger cable 1 are DB9F and open to have 2 input and output signals. The DB9F is connected to the I/O expansion bracket above.

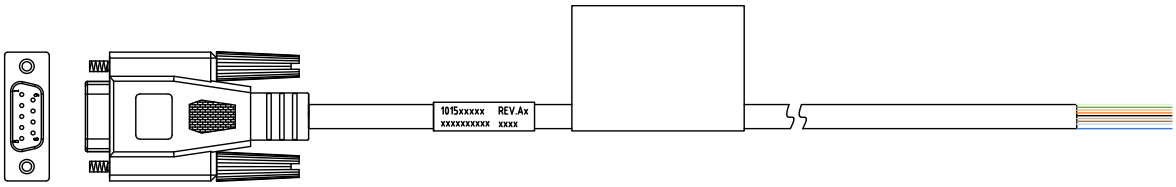

Figure 3-16 I/O Trigger Cable 1

Figure 3-17 Appearance of I/O Trigger Cable 1

Note

- For the pin definition of I/O trigger cable 1, see Frame Grabber Accessories.
- I/O trigger cable and I/O expansion bracket are sold separately, and you should purchase them according to actual demands.

3.4 PCIe Connector

The frame grabber has a PCIe2.0 or PCIe3.0 connector in x8 mode, which can be connected to the host. When in use, the PCIe2.0 or PCIe3.0 connector of the frame grabber can be inserted into the X8 or X16 slots of the host, as shown below.

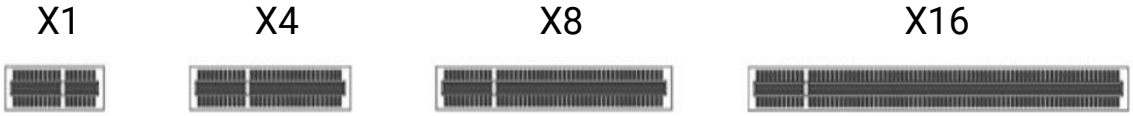

Figure 3-18 PCIe2.0 Interface

Note

Refer to the datasheet of the corresponding product for the supported PCIe connector.

3.5 RJ45 Connector

The frame grabber has 1 to 4 RJ45 connectors, marked as 0 to 3. The RJ45 connector closest to the PCIe slot is marked as 3, while the RJ45 connector farthest from the PCIe 2.0 slot is marked as 0. These connectors can be used for one to four 10 GigE cable link connections.

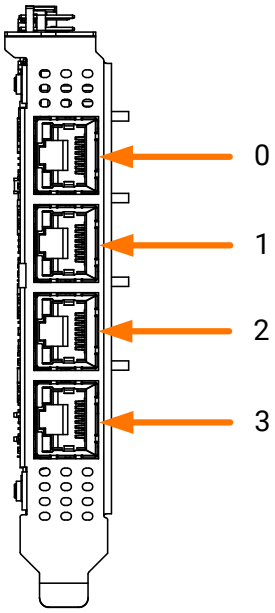

Figure 3-19 RJ45 Connector

3.6 Indicator

The frame grabber provides feedback on various information and status through indicators, and the indicators may vary depending on the model.

3.6.1 MV-GT1000 Series

The MV-GT1000 series frame grabber provides stream indicators to indicate status. Each RJ45 connector on the frame grabber has two stream indicators that are used to indicate the status of four 10 GigE ports respectively.

Table 3-6 Stream Indicator Description

Status	Description
Solid Green	The network connection is successful.
Flashing Yellow	The data is being transmitted.

3.6.2 MV-GT1100P Series

The MV-GT1100P series frame grabber has 2 types of indicators, including stream indictor and on-board indictor.

Stream Indicator

Each RJ45 connector on the frame grabber has 2 stream indicators that are used to indicate the status of four 10 GigE ports respectively.

Table 3-7 Stream Indicator Definition

Status	Description
Solid Green	The network connection is successful.
Flashing Yellow	The data is being transmitted.

On-Board Indicator

The on-board indicator includes loading indicator, power supply indicator, bus indicator, debug indicator, status indicator, and PoE indicator.

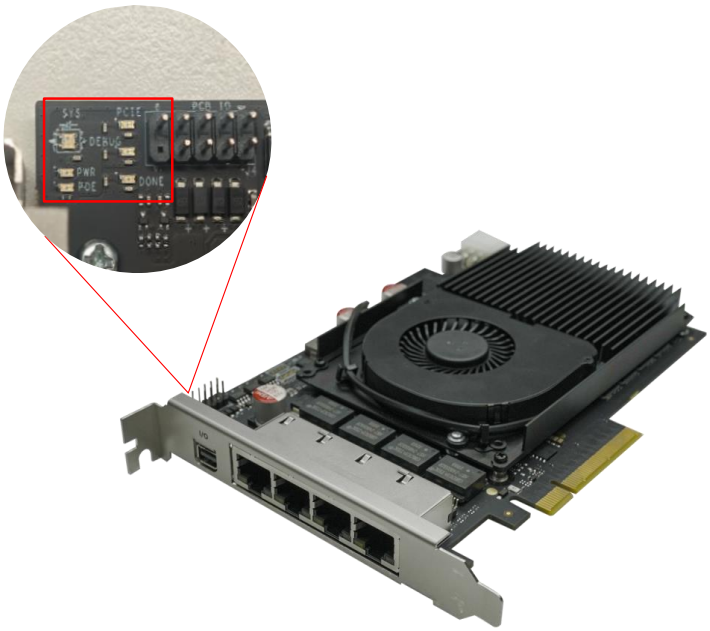

Figure 3-20 On-Board Indicator

- **Loading Indicator**

Loading indicator (DONE) is used to indicate whether the frame grabber is loaded normally.

Table 3-8 Loading Indicator Definition

Status	Description
Solid Green	The frame grabber is loaded.
Unlit	The frame grabber is not loaded.

- **Power Supply Indicator**

Power supply indicator (PWR) is used to indicate whether the frame grabber is powered on properly.

Table 3-9 Power Supply Indicator Definition

Status	Description
Solid Red	The frame grabber is powered on properly.
Unlit	The frame grabber is not powered on properly.

- **Bus Indicator**

Bus indicator (PCIE) is used to indicate whether the host PCIe identifies the frame grabber.

Table 3-10 Bus Indicator Definition

Status	Description
Solid Green	The PCIe identifies the frame grabber.
Unlit	The PCIe does not identify the frame grabber.

- **Debug Indicator**

Debug indicator (DEBUG) is used to indicate whether the frame grabber memory is initialized.

Table 3-11 Debug Indicator Definition

Status	Description
Solid Green	The frame grabber memory is initialized.
Unlit	The frame grabber memory is not initialized.

- **Status Indicator**

Status indicator (SYS) is used to indicate whether the frame grabber is working normally. The indicator is flashing blue, which means the frame grabber is working normally.

- **PoE Indicator**

PoE indicator (POE) is used to indicate whether the frame grabber is in an under-voltage condition during PoE operation.

Table 3-12 Debug Indicator Definition

Status	Description
Solid Red	The the frame grabber voltage is below 36 VDC, which may fail to meet power supply requirements. In this case, the ATX power supply interface can be used for PoE power supply.
Unlit	The voltage of the frame grabber is normal.

Chapter 4 Installation

4.1 Installation Preparation

Table 4-1 Installation Preparation

Category	Name	Description
Software	MVS Client Software	It is used to enumerate and set the frame grabber parameters.
	MVS Tool Kit	It is used to provide tool kit for you to finish the frame grabber function configuration.
Hardware	10 Gigabit Ethernet Cable	It is used to connect the frame grabber and cameras.
	I/O Trigger Cable	● For MV-GT1000 series frame grabbers, they are used with 9-pin header to connect the frame grabber via I/O connector to external devices. ● For MV-GT1100P series frame grabbers, they are used with MiniDP and 9-pin header to connect the frame grabber via I/O connector to external devices.
	I/O Expansion Bracket	
API Function Library	SDK	It is used for the secondary development.
Firmware Package	MV_GT1004_… .zip	It is used to update the frame grabber firmware.

4.2 Install Frame Grabber

Before You Start

- Before installing the frame grabber, make sure that the host is powered off.
- Before installing the frame grabber, please remove static electricity from your body via touching a grounded metal object.

Steps

1. Insert the frame grabber into the host PCIe2.0 × 8 slot or above.
2. Use screws to fix the frame grabber with the host.
3. Use 10 Gigabit Ethernet cable to connect the camera and the RJ45 connector of the frame grabber.

4.3 Install Client Software

MVS client software is used to connect and set frame grabber parameters, etc.

Steps

Note

- The MVS client software is compatible with 32/64-bit Windows 7/10/11 and 64-bit Linux operating system. Here we take Windows as an example.
- Make sure that the MVS is closed before installing or updating it.
- The graphic user interface may differ by versions of the client software you use.
- You can download the client software and SDK from ***en.hikrobotics.com***.
- The client integrates the required drivers for the frame grabber, so there is no need to download and install other drivers.

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

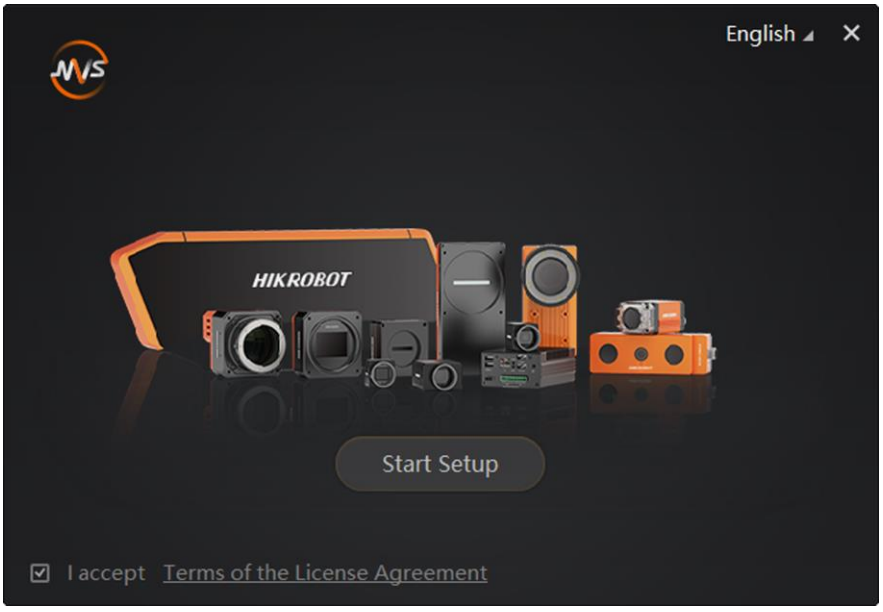

Figure 4-1 Installation Interface

4. Click **Start Setup**.

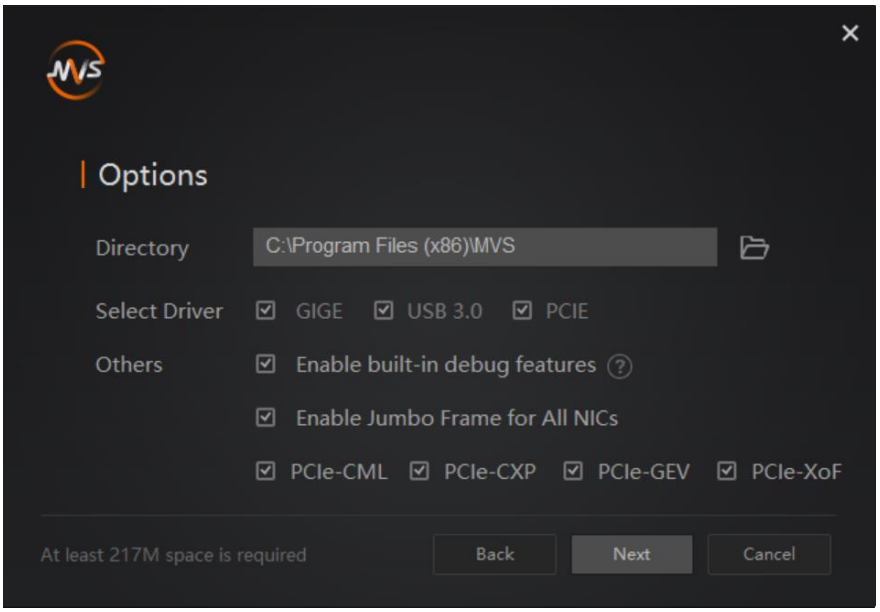

Figure 4-2 Default Settings

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

Chapter 5 Basic Operation of Client Software

5.1 Connect Frame Grabber to Client Software

Steps

Note

Refer to the user manual of the camera and client software for detailed camera operation.

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

Note

Refer to the camera user manual and MVS user manual for detailed camera operation.

5.2 Client Software Layout

The main window of the MVS client software is displayed after you connect a frame grabber to it.

Note

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

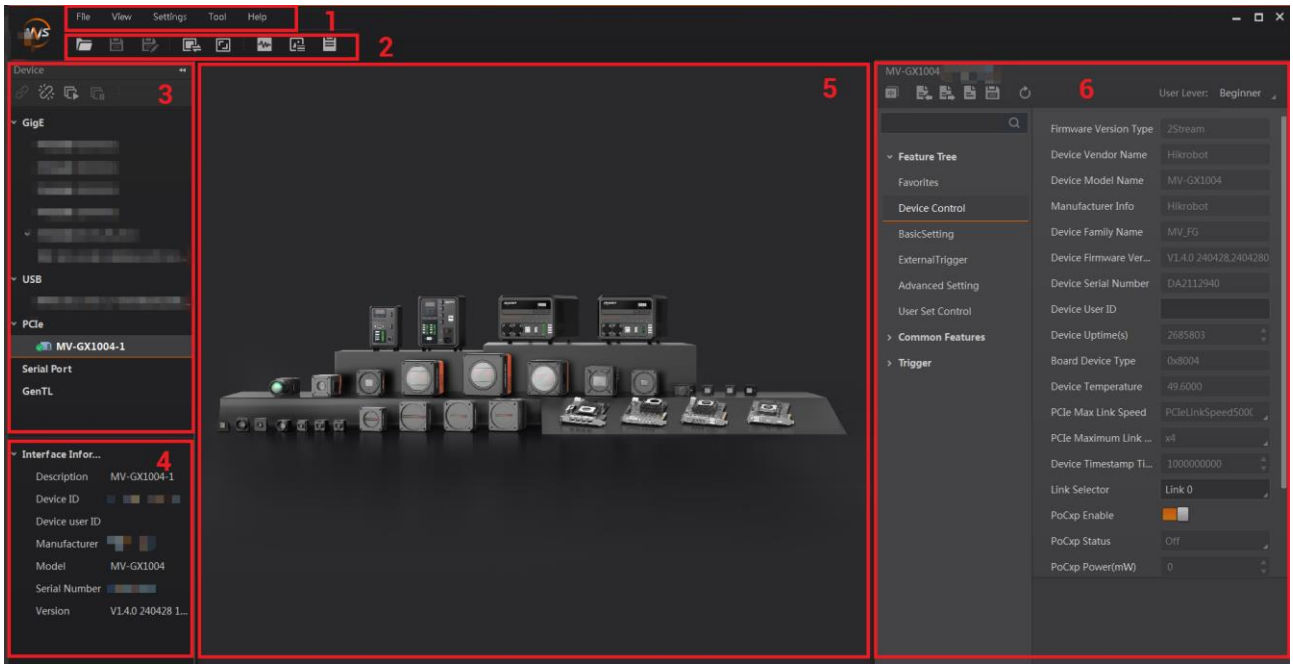

Figure 5-1 Main Window

Table 5-1 Main Window Description

No.	Area 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, etc.
4	Device Information Panel	This panel displays the detailed device information.
5	Display Window	This area displays the acquisition images in real time. You can click different icons to capture and save image, record, etc.
6	Feature Panel	You can view and set features of the selected device.

Table 5-2 Parameter Description

Parameter Name	Description
Device Control	It displays the basic information about the frame grabber.
Stream	It sets the frame signals.
GigE	It controls the trigger signals between the frame grabber and the camera.

Parameter Name	Description
Encoder Control	It sets signal sources and other parameters of the encoder.
Event Control	It sets parameters related to event log.
Digital IO Control	It sets the I/O signals.
Advance IO Control	It sets the advanced I/O signals.
Counter and Timer Control	It sets signal sources and other parameters of the counter.
File Access Control	It sets the framer grabber's file access control related parameters.
User Set Control	It allows loading or saving default or user-defined settings.

5.3 Secondary Development

Users can perform secondary development of the frame grabber. The SDK secondary development data path is located in C:\Program Files (x86)\MVS\Development, as shown below. Refer to the following table for the specific contents of each folder.

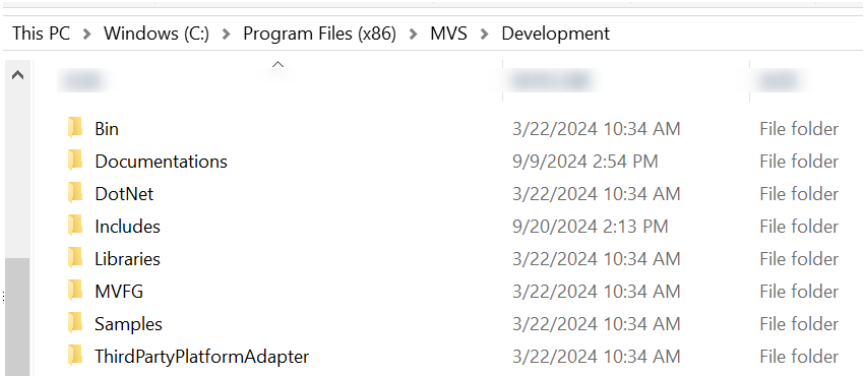

Figure 5-2 Secondary Development

Table 5-3 Folder Description

Folder Name	Content Description
Bin	It is the result of the compilation.
Documentations	It is secondary development documentation, including SDK developer guide and Demo instructions.
DotNet	.NET assembly.
Includes	Header files.
Libraries	Static library.

Folder Name	Content Description
MVFG	The SDK content of frame grabber, including secondary development documentation, some dynamic libraries developed in C#, header files, static library, sample code, and third-party platform plug-ins.
Samples	Sample code for various programming languages.
ThirdPartyPlatformAdapter	Third-party platform plug-ins.

Chapter 6 Operating Principle

The onboard diagram of the frame grabber is shown below. The working process of streaming from the designated camera via the frame grabber is as follows:
After the frame grabber establishes a connection with the camera, the PC side sends a streaming control instruction to the frame grabber through PCIe, and after the frame grabber GVCP data packet and MAC layer processing, the network packet is sent through the external PHY. The external PHY receives the camera network data packet, extracts the valid GVSP stream data packet after MAC layer parsing, sends it to the stream extraction module for image extraction and storage, and transmits the valid image data to the PC side through PCIe.
Besides, the frame grabber supports ToE trigger function. External I/O trigger sends action network packets to trigger the camera.

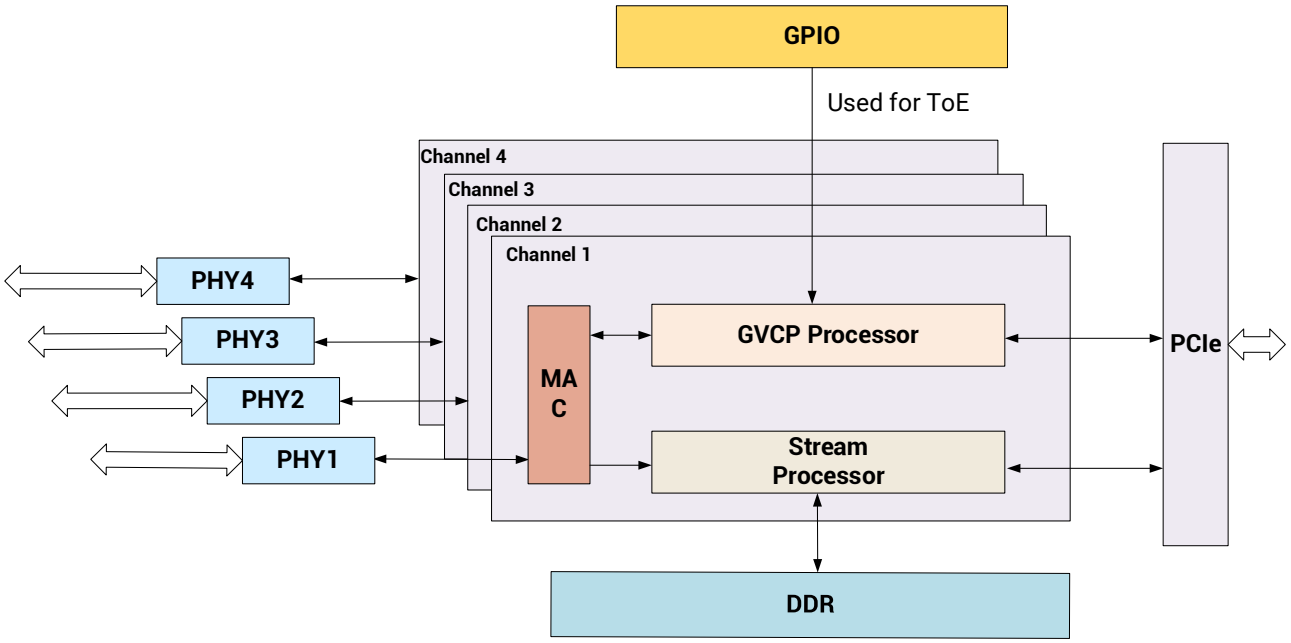

Figure 6-1 Operating Principle

Chapter 7 I/O Introduction

The frame grabber has 6 to 8 I/O connectors (D485 InOut 0 to D485 InOut 7) that can be configured as differential input or differential output.

7.1 I/O Electrical Feature

7.1.1 Differential Input Circuit

The differential input signals in I/O signals also support single-ended inputs, and the internal circuit is shown below.

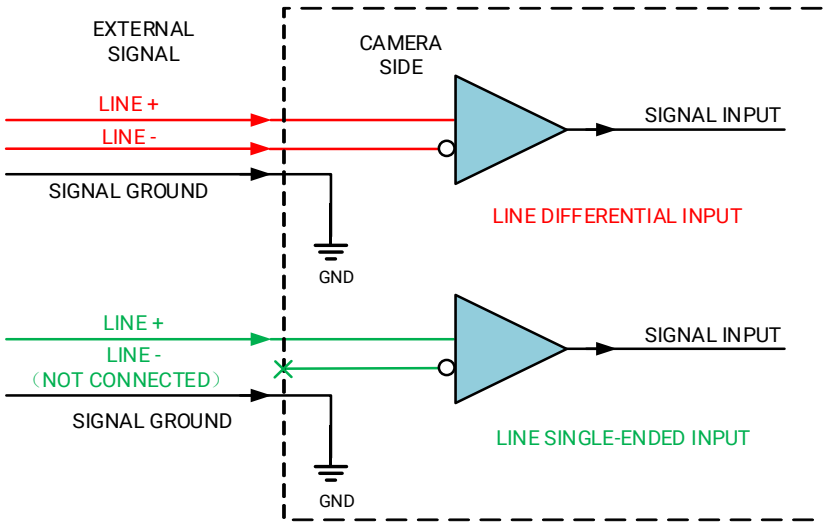

Figure 7-1 Internal Circuit of Differential Input

Differential input can receive RS-485, TTL, and LVTTL standard input signals.

- Using RS-485 standard input

If the differential input uses RS-485 standard signals, to ensure the normal operation of the device input circuit, the device ground signal should be connected to the external ground signals.

- Using TTL and LVTTL standard input

If the differential input uses TTL or LVTTL standard signals, see the table below for the electrical feature requirements.

Table 7-1 Electrical Feature Requirements of TTL and LVTTL Input

Voltage Range	Description
0 VDC to 1 VDC	Low level.
1 VDC to 3 VDC	Unstable voltage, and it is not recommended.

Voltage Range	Description
3.3 VDC to 12 VDC	Line 0/1/4/5/6/7 high level.
3.3 VDC to 24 VDC	Line 2/3 high level.

Note

The upper limit voltage of Line 0/1/4/5/6/7 is 13 VDC, and the upper limit voltage of Line 2/3 is 26.3 VDC.

7.1.2 Differential Output Circuit

The internal circuit of differential output signals is shown below.

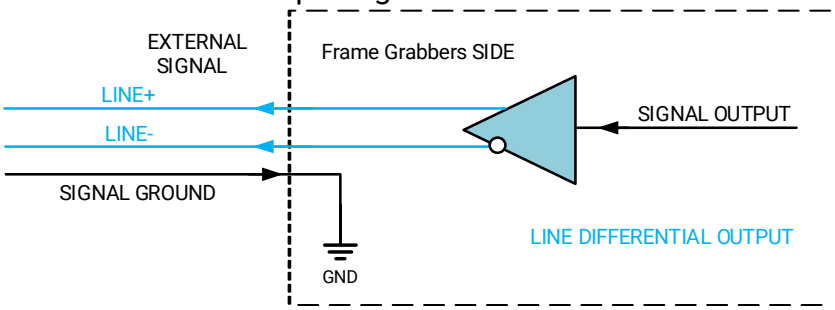

Figure 7-2 Internal Circuit of Differential Output

Differential output uses RS-485 standard signals.
To ensure the normal operation of the device output circuit, the device ground signal should be connected to the external ground signals. This connector can be configured as a main transmitter to connect the RS-485 bus.

7.2 I/O Wiring

7.2.1 Input Wiring

The frame grabber can directly receive differential signals or single-ended signals to trigger image capture through hardware triggering.

Note

Before using, make sure to set the hardware trigger signal source to input signal.

Refer to the figure below for the wiring when the trigger signal is provided by differential

signal source.

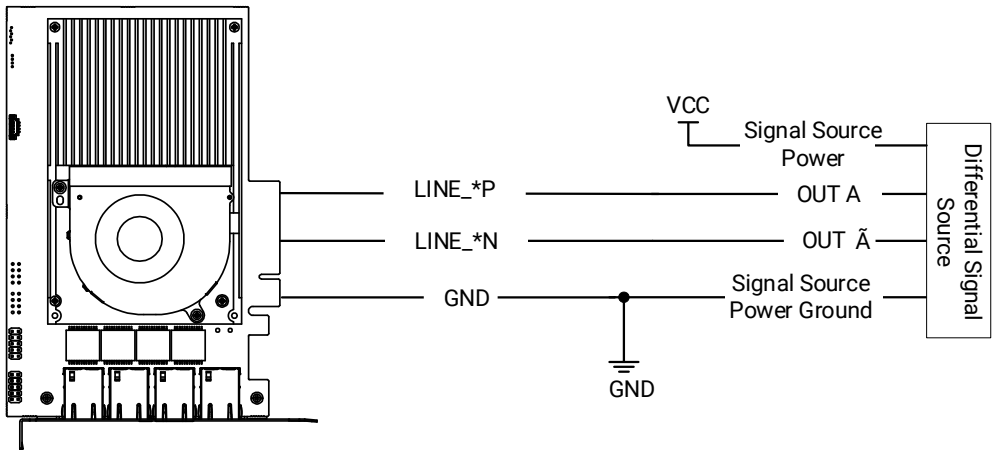

Figure 7-3 Differential Input Wiring

Refer to the two figures below for the wiring methods when the trigger signal is provided by PNP single-ended signal source.

Note

The range of pull-down resistor is 1 KΩ to 4.7 KΩ.

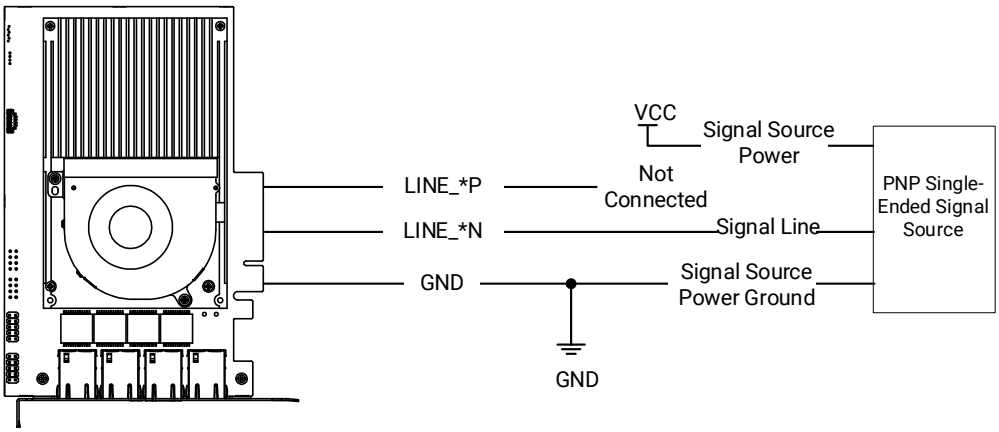

Figure 7-4 PNP Single-Ended Input Wiring (Without Pull-Down Resistor)

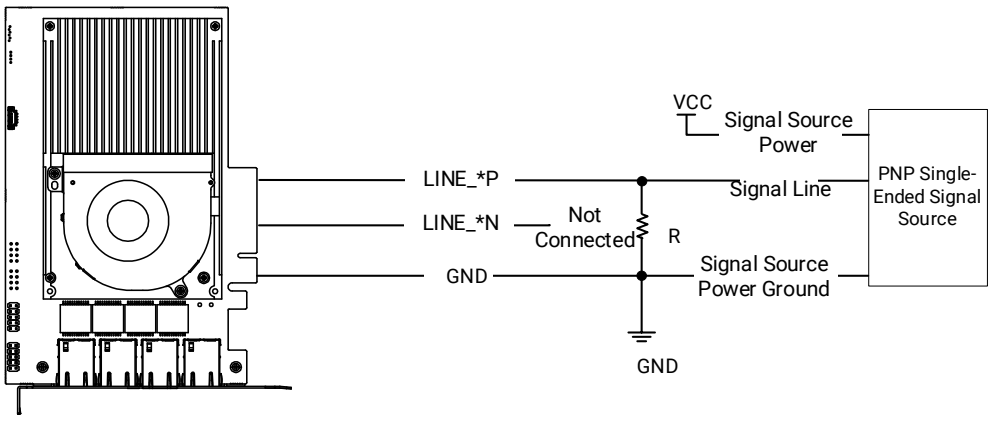

Figure 7-5 PNP Single-Ended Input Wiring (with Pull-Down Resistor)

Refer to the two figures below for the wiring methods when the trigger signal is provided by NPN single-ended signal source.

Note

The range of pull-up resistor is 1 KΩ to 10 KΩ.

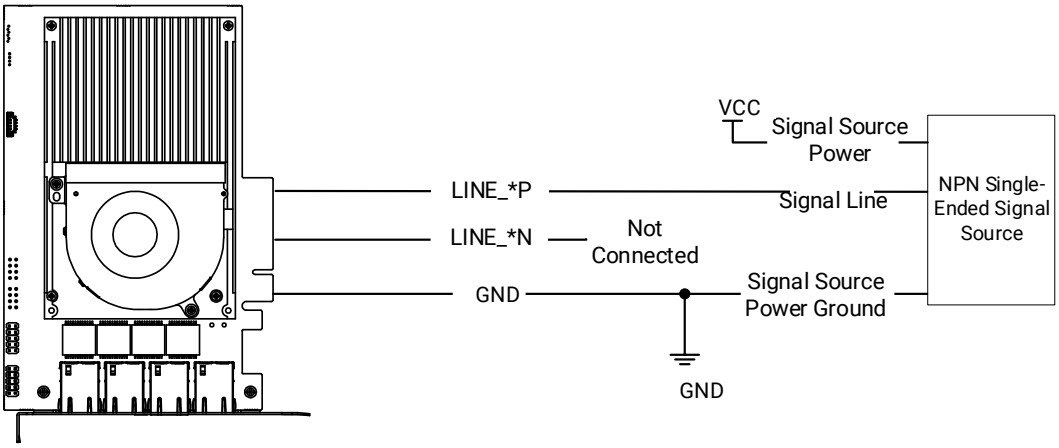

Figure 7-6 NPN Single-Ended Input Wiring (Without Pull-Up Resistor)

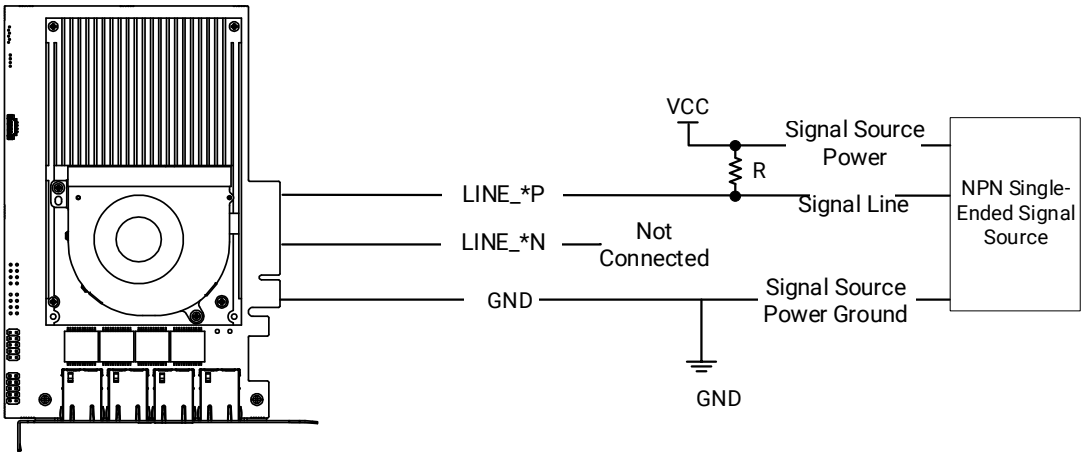

Figure 7-7 NPN Single-Ended Input Wiring (with Pull-Up Resistor)

7.2.2 Output Wiring

The 6 to 8 differential signals of the frame grabber can all be set as outputs to trigger other devices. When the I/O signals are used as differential outputs and single-ended outputs, the wiring methods are different.

- As differential outputs, the wiring method is shown below.

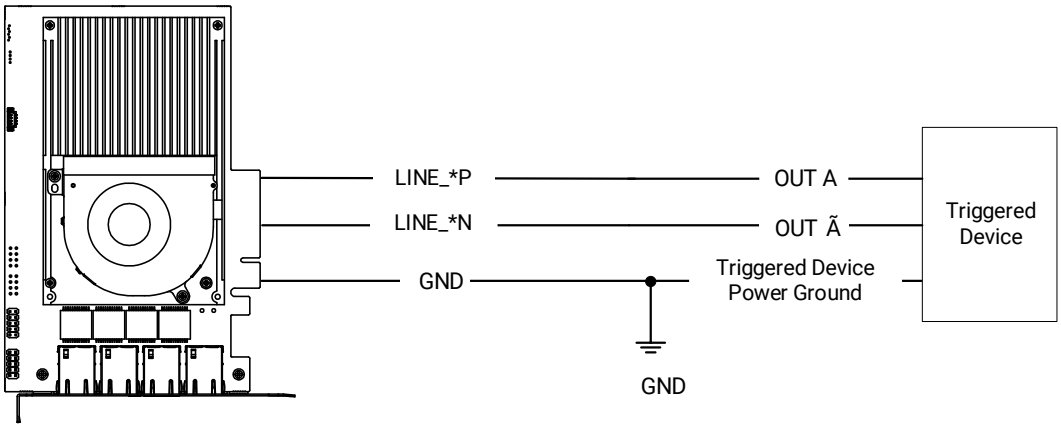

Figure 7-8 Differential Output Wiring

- When Line 0/1/4/5/6/7 are used as single-ended outputs, the output voltage is 3.3 V.

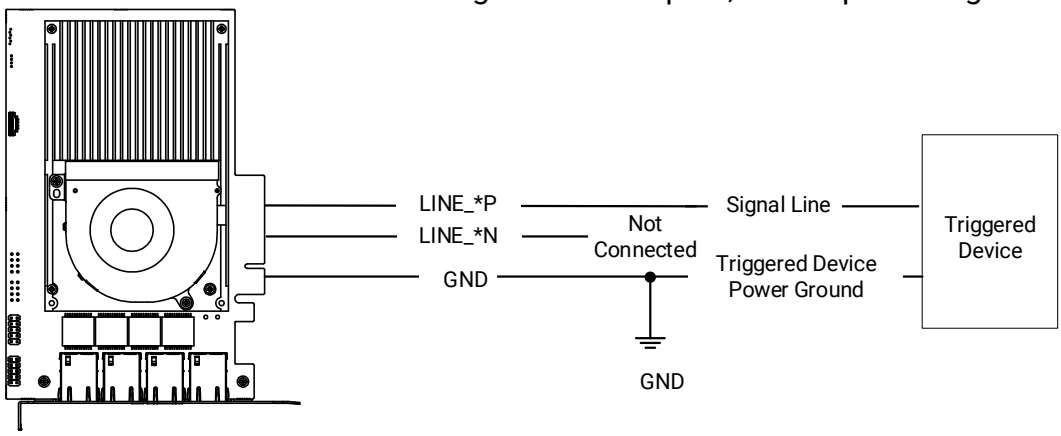

Figure 7-9 Single-Ended Output Wiring (Without Pull-Up Resistor)

- When Line 2 and Line 3 are used as single-ended outputs, a pull-up resistor is required, with a resistance range of 1 kΩ to 10 kΩ. The resistance R varies depending on the input voltage VCC of the single-ended signal.

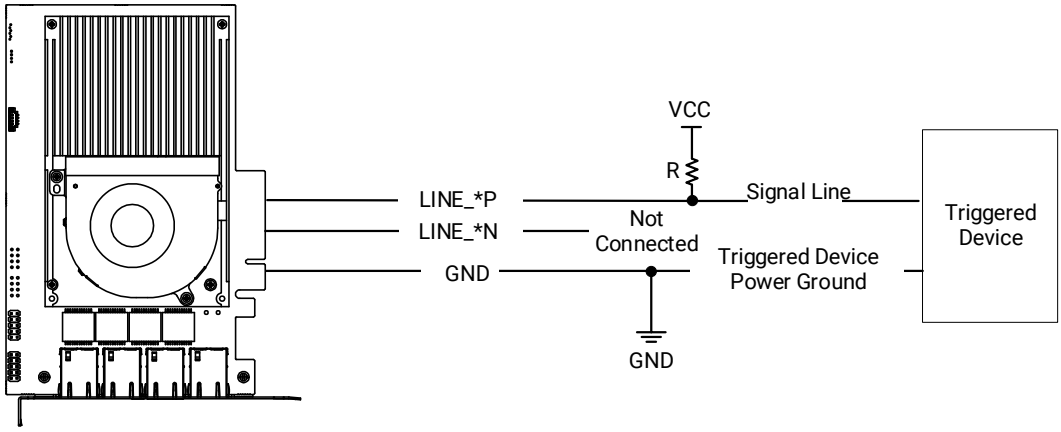

Figure 7-10 Single-Ended Output Wiring (with Pull-Up Resistor)

Table 7-2 Correspondence Between Voltage VCC and Resistance R

VCC	R
5 VDC	1 K
12 VDC	2 K to 4.7 K
24 VDC	4.7 K to 10 K

7.3 Input and Output Signals

The frame grabber has multiple configurable differential input/output signals, but different models feature varying interface types, resulting in different input/output signals.

- MV-GT1000 series frame grabber has 8 configurable differential input/output signals (D485 InOut 0 to D485 InOut 7).
- MV-GT1100P series frame grabber has 6 configurable differential input/output signals (D485 InOut 0 to D485 InOut 5).

You can go to **Digital IO Control** of the MVS client software to configure the input/output signals according to actual demands.

7.3.1 Input Signal

The frame grabber can receive multiple input signals that can be used as the signal source of output signal, encoder, and timer.

Steps

1. Go to **Digital IO Control**, and select **D485 InOut *** in the **Line Selector** according to actual demands.

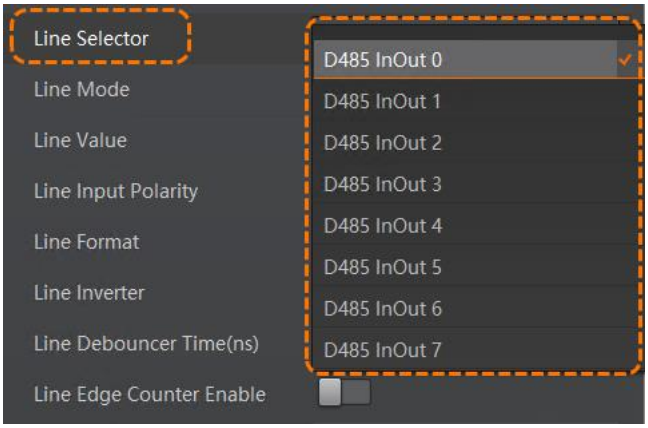

Figure 7-11 Line Selector

2. Select **Input** as **Line Mode**.
3. Set the type of input signals via **Line Input Polarity**.

Note

- **SingleEnded**: Receive single-ended input signals.
- **Differential**: Receive TTL and LVTTL standard input signals.

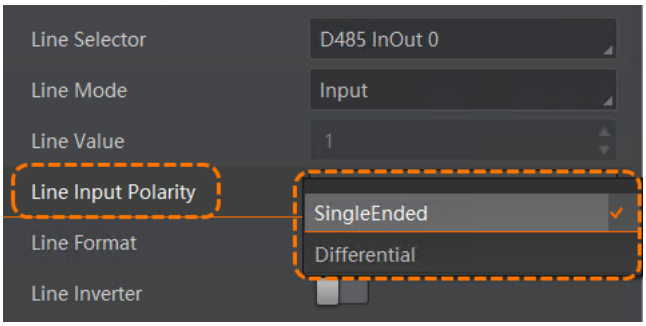

Figure 7-12 Input Signal Type

Caution

Select the signal type according to the type of the actual connected device. If the types mismatch, there is a risk of damaging the I/O.

4. Set the level threshold for input signals via **Line Level**.

Note

- This parameter is only available for MV-GT1100P series frame grabbers.
- This parameter can only be set when D485 InOut 0 to 3 is selected in the **Line Selector**.
- When the level threshold of one input signal is edited, the level thresholds of other input signals will be edited synchronously.
- Level thresholds should be set for corresponding external trigger levels.

5. (Optional) Enable **Line Inverter** if you want to invert the electrical level of selected lines.

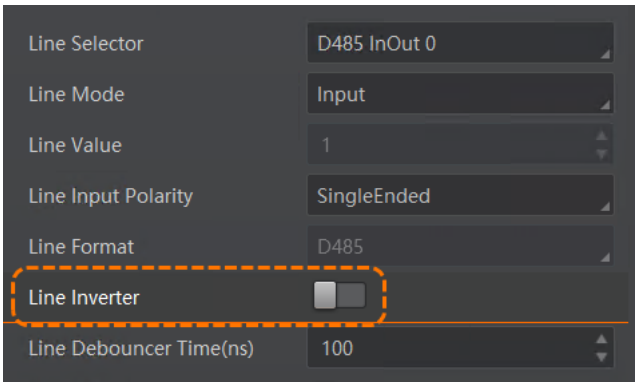

Figure 7-13 Line Inverter

Note

The line inverter is disabled by default.

6. Set **Line Debouncer Time(ns)** if the trigger signal sent by external devices to the frame grabber has signal bounce that may cause false trigger. Thus, it is necessary to debounce the trigger signal.

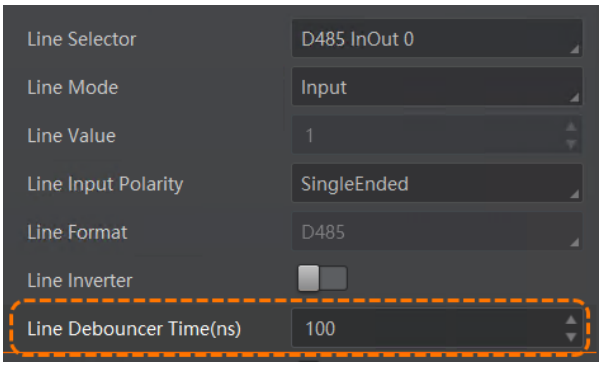

Figure 7-14 Line Debouncer Time

Note

The trigger signal will be ignored if the configured line debouncer time is larger than that of the trigger signal.

The sequence diagram is shown below.

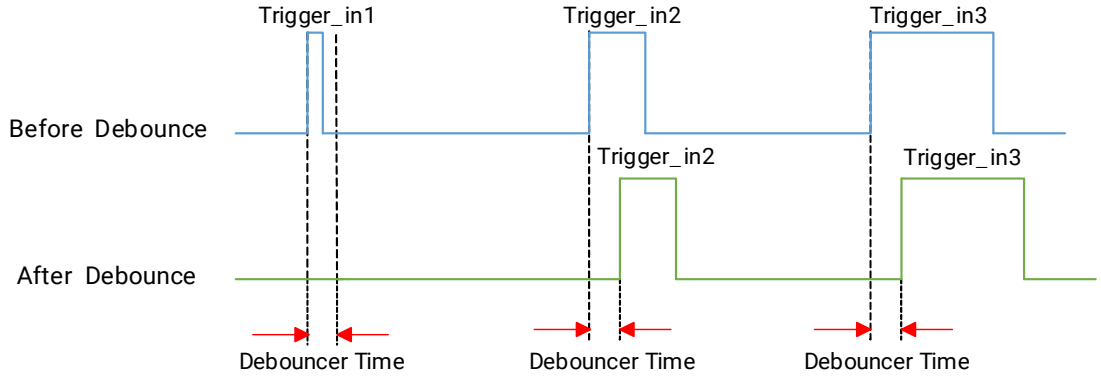

Figure 7-15 Sequence Diagram

Taking **D485 Input 0** as **Line Selector** as an example, the principle of trigger debouncer and line inverter is shown below.

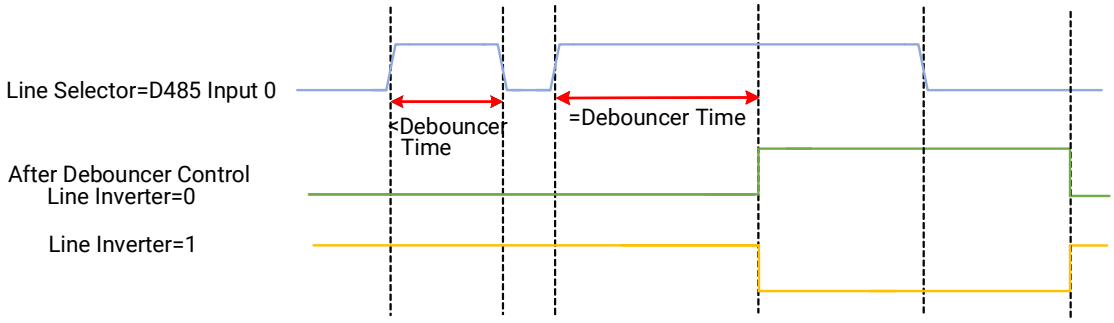

Figure 7-16 Principle

The code below shows the process of setting input signals.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};
MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);
unsigned int nInterfaceIndex = 0;
void* hInterface = NULL;
MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);
MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetEnumValueByString(hInterface, "LineSelector", "D485InOut0");
MV_CC_SetEnumValueByString(hInterface, "LineMode", "Input");
MV_CC_SetEnumValueByString(hInterface, "LineInputPolarity", "SingleEnded");
MV_CC_SetIntValueEx(hInterface, "LineDebouncerTimeNs", 100);


MV_CC_CloseInterface(hInterface);
MV_CC_DestroyInterface(hInterface);
```

7.3.2 Encoder Control

The encoder control is used to select encoder sources and set trigger signal mode sent by signal source A and B. It can also count the output signal quantity.

Steps

1. Go to **Encoder Control**, and select **Encoder 0** or **Encoder 1** as **Encoder Selector**.
2. Select corresponding signal sources or **Off** in **Encoder Source A** and **Encoder Source B**.

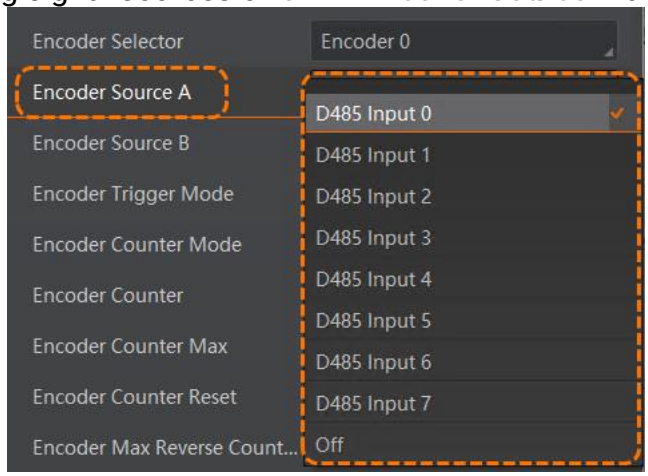

Figure 7-17 Input Signal

3. Set **Encoder Trigger Mode**.

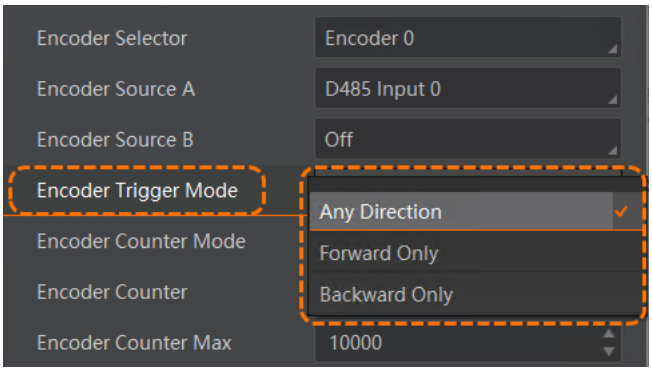

Figure 7-18 Encoder Trigger Mode

- **Any Direction** means that the frame grabber will output forward and backward signals.
- **Forward Only** means that the frame grabber will output forward signal only.
- **Backward Only** means that the frame grabber will output backward signal only.

The forward and backward signals of the encoder are judged according to the signals of Encoder A and Encoder B, and the principle is shown below.

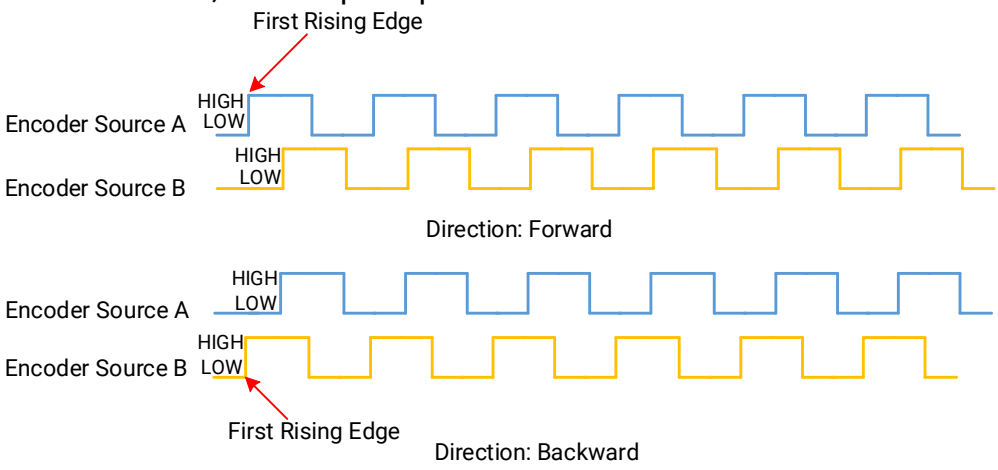

Figure 7-19 Principle

The output signal of the encoder is different if various trigger modes are selected, and the principle is shown below.

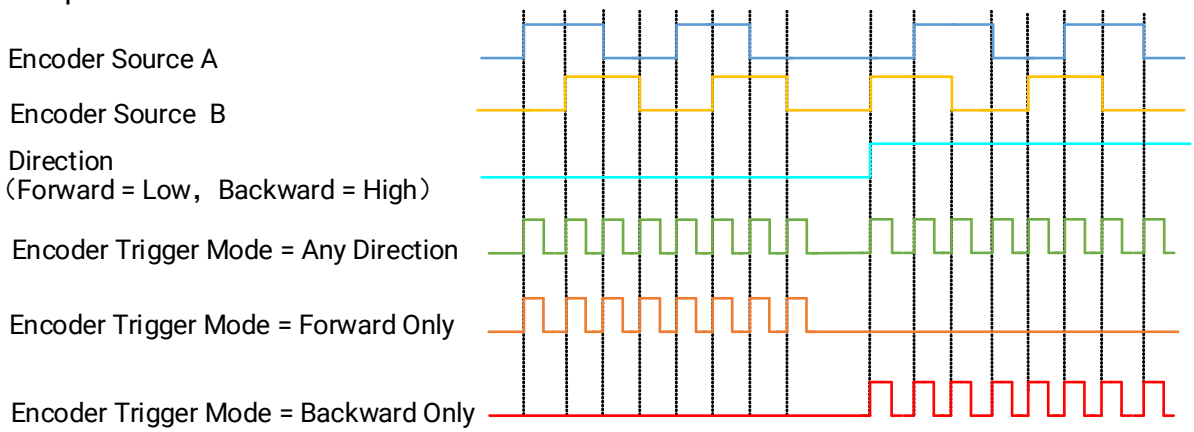

Figure 7-20 Encoder Trigger Signal Mode Principle

4. Set **Encoder Counter Mode**.

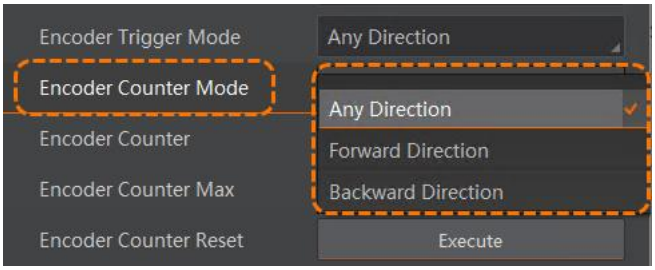

Figure 7-21 Encoder Counter Mode

- **Any Direction** means that both forward and backward signals will count.
- **Forward Direction** means that count increases with the forward signals and decreases with the backward signals.
- **Backward Direction** means that the count increases with the background signals and decreases with the forward signals. When the count decreases with the forward signals, it starts from the max. set counter value.

If the encoder selects different counter modes, and its principle is shown below.

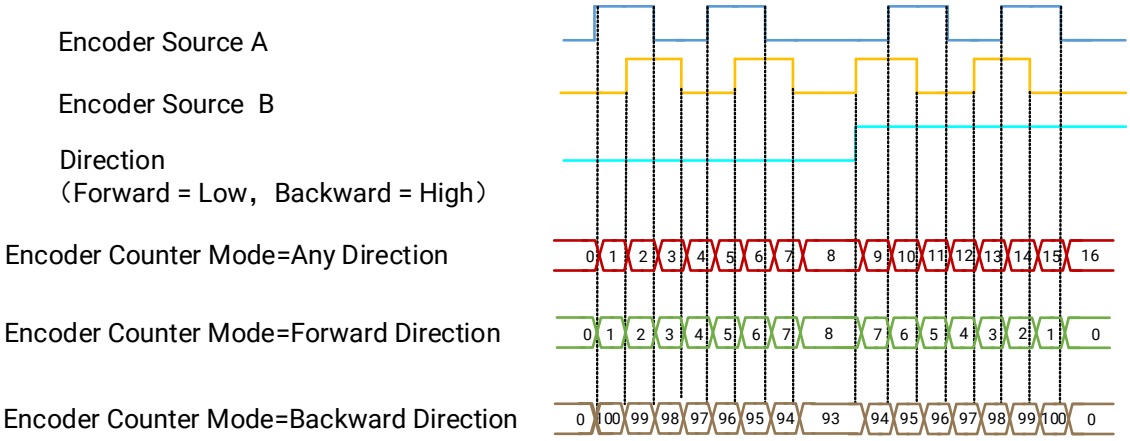

Figure 7-22 Encoder Counter Mode Principle

5. View counter value in **Encoder Counter**.

Note

- Set the max. counter value via **Encoder Counter Max**, and the counting will restart after the value exceeds the max. value.
- The **Encoder Counter Max** is only available to some models of frame grabber.

6. (Optional) Click **Execute** in **Encoder Counter Reset** to reset the counter.
7. (Optional) Set **Encoder Max Reverse Counter** to avoid outputting images if the object moves backward accidently, and click **Execute** in **Encoder Reverse Counter Reset** to let the camera output images again.

Note

The set value is the max. number of allowed reverse movements without generating images. The camera will only resume image output when the object being measured moves forward

and returns to the starting position.

Figure 7-23 Encoder Max Reverse Counter

The maximum value for handling encoder reverse can be determined by setting the **Encoder Max Reverse Counter**. By default, the reverse is not handled, that is **Encoder Max Reverse Counter = 0**. Taking the **Encoder Max Reverse Counter = 4** as an example, the output of the encoder under different trigger signal modes is introduced.

- If **Forward Only** is selected in **Encoder Trigger Mode**, the principle is shown below.

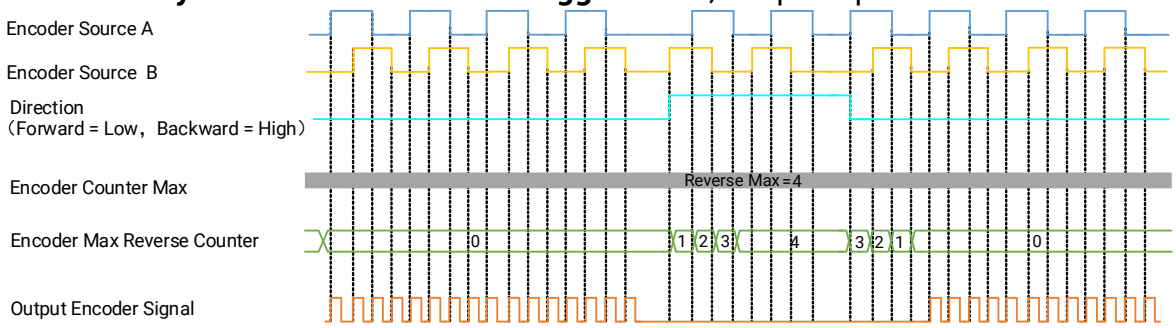

Figure 7-24 Forward Principle

- If **Backward Only** is selected in **Encoder Trigger Mode**, the principle is shown below.

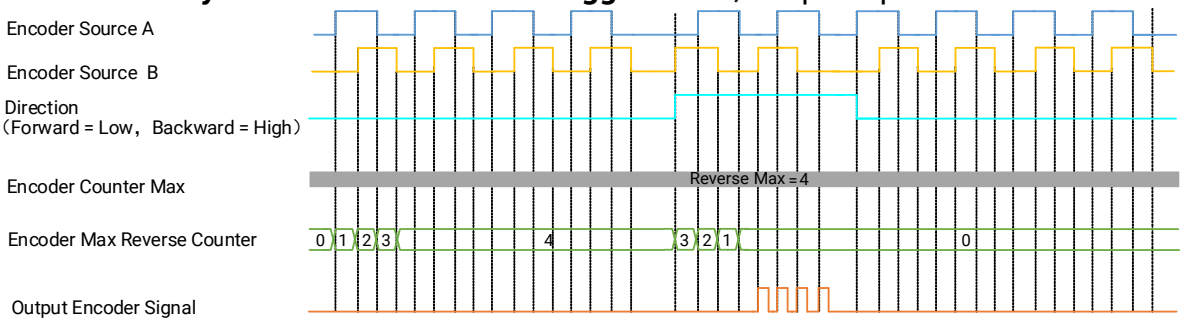

Figure 7-25 Backward Principle

- If **Any Direction** is selected in **Encoder Trigger Mode**, the principle is shown below.

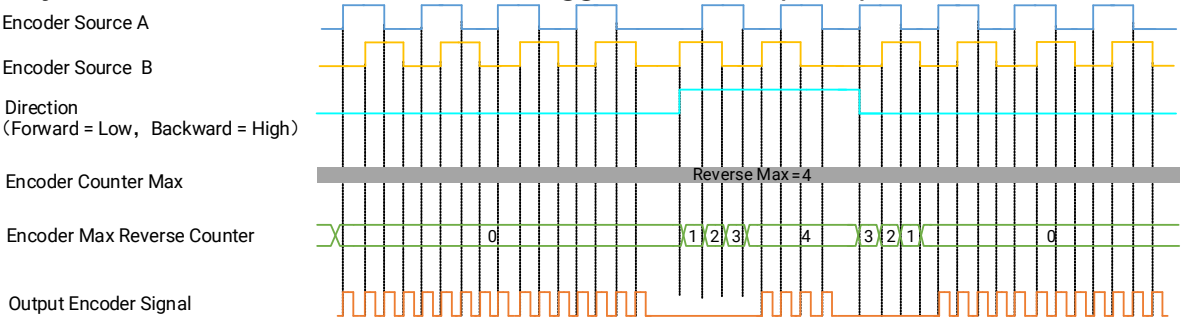

Figure 7-26 Any Direction Principle

8. **Encoder Trigger Line Rate (Hz)** displays the line rate of the encoder.
9. **Resulting Trigger Line Rate (Hz)** displays the actual line rate.
10. (Optional) If real-time counting of the number of edge triggers received by the encoder along is required, enable **Encoder Edge Counter Enable** to activate the encoder edge counter function, as shown below.

- **Encoder Rising Edge Counter** returns the rising edge counter value of selected encoder. When the trigger response mode is set to **Rising Edge** or **Any Edge**, it displays the number of rising edges. The value can be updated in real time based on the output situation.
- **Encoder Falling Edge Counter** returns the falling edge counter value of selected encoder. When the trigger response mode is set to **Falling Edge** or **Any Edge**, it displays the number of falling edges. The value can be updated in real time based on the output situation.
- **Encoder Edge Counter Reset**: Click **Execute** to reset edge counter of selected encoder.

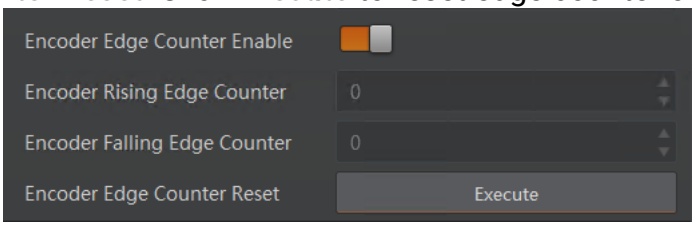

Figure 7-27 Encoder Edge Counter

The code below shows the process of setting encoder control.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);

MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetEnumValueByString(hInterface, "EncoderSelector", "Encoder0");

MV_CC_SetEnumValueByString(hInterface, "EncoderSourceA", "D485InOut0");

MV_CC_SetEnumValueByString(hInterface, "EncoderSourceB", "Off");

MV_CC_SetEnumValueByString(hInterface, "EncoderTriggerMode", "AnyDirection");

MV_CC_SetEnumValueByString(hInterface, "EncoderCounterMode", "IgnoreDirection");

MVCC_INTVALUE_EX stIntValue = {0};

MV_CC_GetIntValueEx(hInterface, "EncoderCounter", &stIntValue);

MV_CC_SetIntValueEx(hInterface, "EncoderCounterMax", 10000);

MV_CC_GetIntValueEx(hInterface, "EncoderTriggerLineRate", &stIntValue);

MV_CC_GetIntValueEx(hInterface, "ResultingTriggerLineRate", &stIntValue);
```

```
MV_CC_CloseInterface(hInterface);

MV_CC_DestroyInterface(hInterface);
```

7.3.3 Encoder Frequency Converter Control

The encoder frequency converter can convert the encoder's signal frequency into the frame trigger signal frequency that the camera needs through the frame grabber's frequency conversion module, thus triggering the camera. The frequency conversion module includes PreDivider, Multiplier and PostDivider.

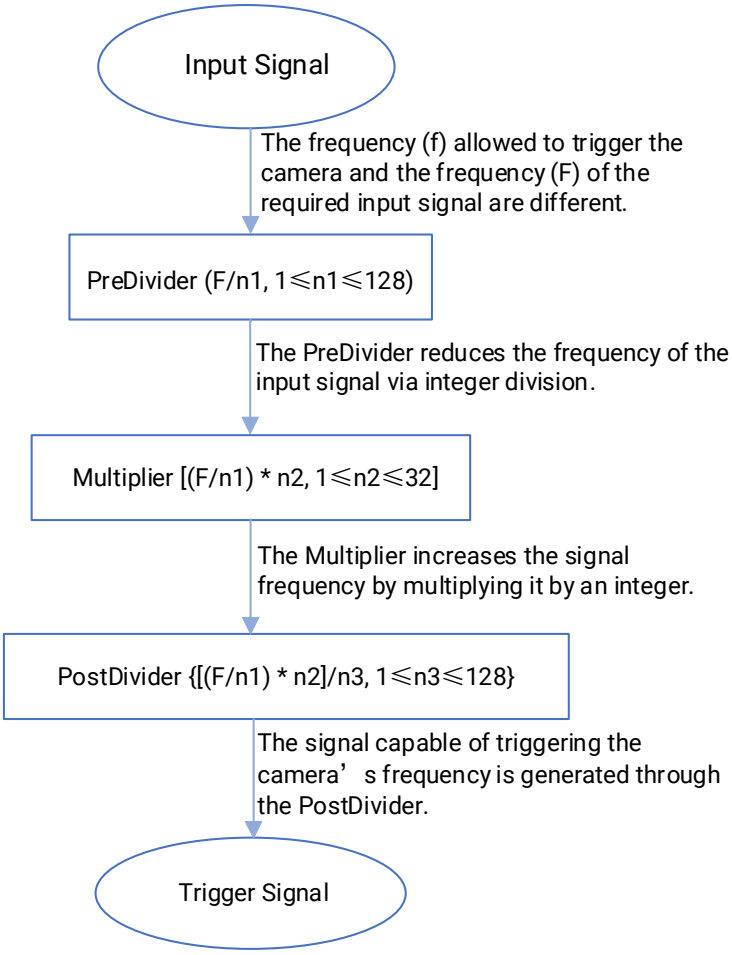

Figure 7-28 Encoder Frequency Converter Control

PreDivider

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

encoder signal is accepted.

Multiplier

After the signal is processed by the PreDivider, it is sent to the Multiplier. The Multiplier multiplies the signal by an integer to increase its signal frequency, and then the signal is sent to the PostDivider.

PostDivider

PostDivider reduces signal frequency via an integer factor, and uses the newly generated frequency signal as the device's trigger signal.
The principle of encoder frequency converter is shown below.

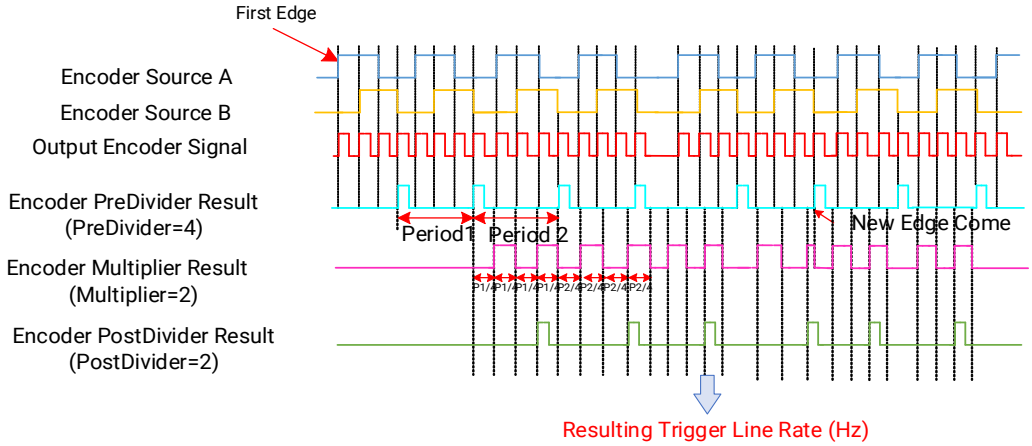

Figure 7-29 Principle of Encoder Frequency Converter

Steps

1. Go to **External Trigger**, and find encoder frequency converter related parameters.
2. Enter **Encoder PreDivider**, **Encoder Multiplier**, and **Encoder PostDivider** according to actual demands.

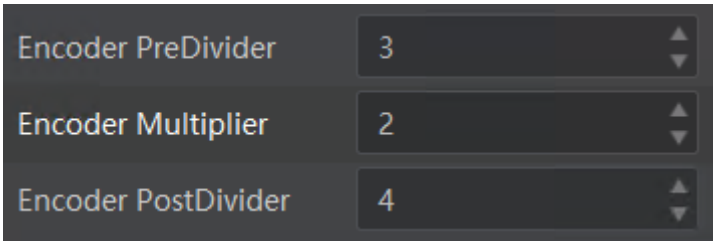

Figure 7-30 Encoder Frequency Converter Control (Before Reduction)

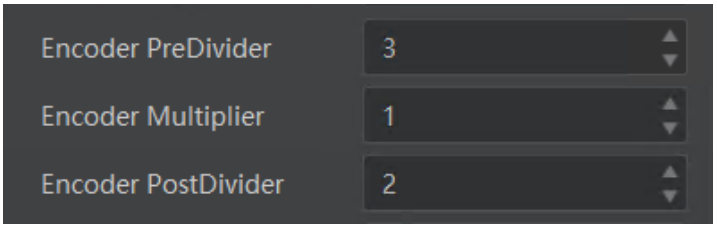

Figure 7-31 Encoder Frequency Converter Control (After Reduction)

The code below shows the process of setting encoder frequency converter.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);

MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetIntValueEx(hInterface, "EncoderPreDivider", 3);

MV_CC_SetIntValueEx(hInterface, "EncoderMultiplier", 1);

MV_CC_SetIntValueEx(hInterface, "EncoderPostDivider", 2);


MV_CC_CloseInterface(hInterface);

MV_CC_DestroyInterface(hInterface);
```

7.3.4 Timer Control

The timer control can output the corresponding signal by setting the high level and low level duration of the timer signal under the condition of setting corresponding trigger source and trigger activation.

Steps

1. Go to **Counter And Timer Control**, and select one timer from **Timer 0** to **Timer 3** in **Timer Selector**.
2. Set **Timer Duration(μs)** and **Timer Delay(μs)** according to actual demands. The principle of timer output is shown below.

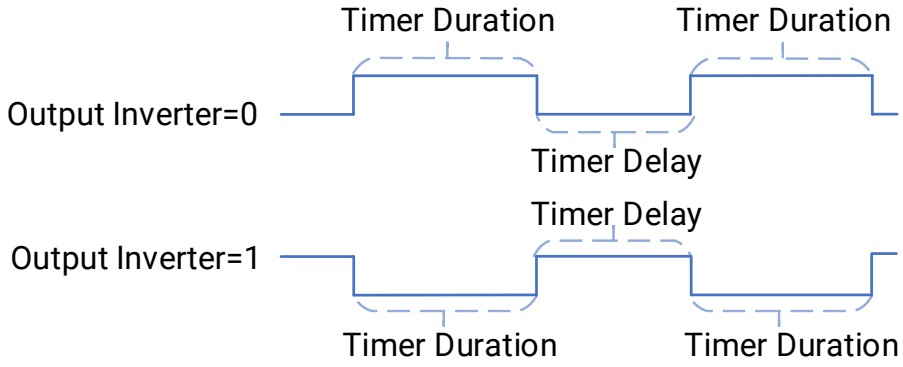

Figure 7-32 Principle of Timer Output

Note

The output signal of the timer is related to the settings of level inversion. Please set according to the demands.

3. Set **Timer Frequency(HZ)** according to actual demands. The timer signal will be outputted in cycles according to the frequency.
4. (Optional) Click **Execute** of **Timer Reset** to reset the output signals.

Note

The **Timer Reset** is only available to some models of frame grabber.

5. Select trigger source from **Timer Trigger Source**.

Note

- The supported timer trigger source may differ by different models of frame grabbers you use.

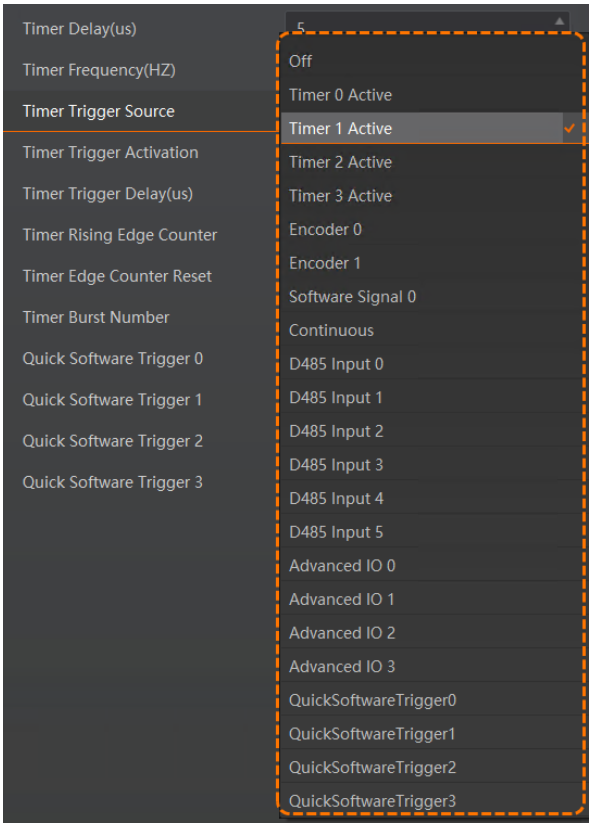

Figure 7-33 Timer Trigger Signal Source

- If **Continuous** is selected as **Timer Trigger Source**, the frame grabber will output signal continuously according to configured duration. The trigger activation will not impact this process.

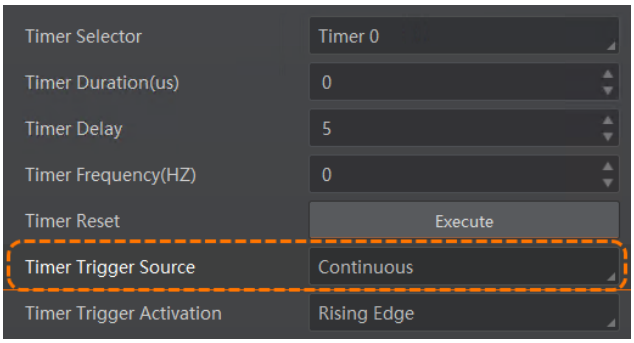

Figure 7-34 Continuous

- If **QuickSoftwareTrigger0/1/2/3** is selected as **Timer Trigger Source**, the frame grabber will receive the trigger signal after you click **Execute**.

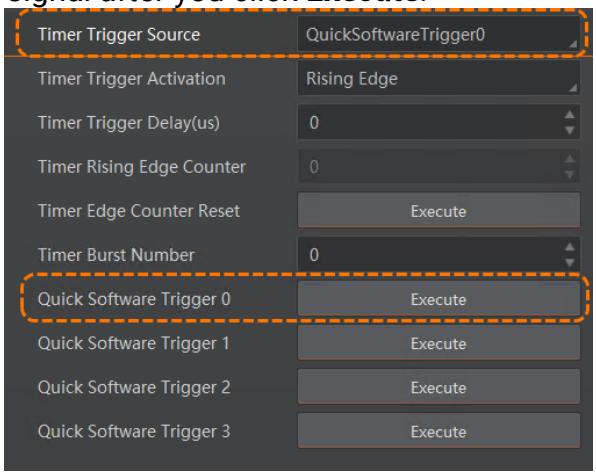

Figure 7-35 Quick Software Trigger

- If trigger sources other than **Continuous** are selected as **Timer Trigger Source**, the frame grabber will output signal when receiving the trigger signal.

6. Set the response modes to trigger signal via **Timer Trigger Activation** according to actual demands.

Table 7-3 Timer Trigger Activation Parameter

Timer Trigger Activation	Description
Rising Edge	When the electrical level signal given by external devices is in rising edge, the frame grabber receives the trigger source and starts to output configured timer signal.
Falling Edge	When the electrical level signal given by external devices is in falling edge, the frame grabber receives the trigger source and starts to output configured timer signal.
Any Edge	When the electrical level signal given by external devices is in rising or falling edge, the frame grabber receives the trigger source and starts

Timer Trigger Activation	Description
	to output configured timer signal.
High Level	When the electrical level signal given by external devices is in high level, the frame grabber receives the trigger source and starts to output configured timer signal.
Low Level	When the electrical level signal given by external devices is in low level, the frame grabber receives the trigger source and starts to output configured timer signal.

Taking **D485 Input** * as **Timer Trigger Source** and **Any Edge** as **Timer Trigger Activation** as an example, when the electrical level signal given by external devices is in rising edge or falling edge, the frame grabber receives the trigger source and starts to output corresponding timer signal.

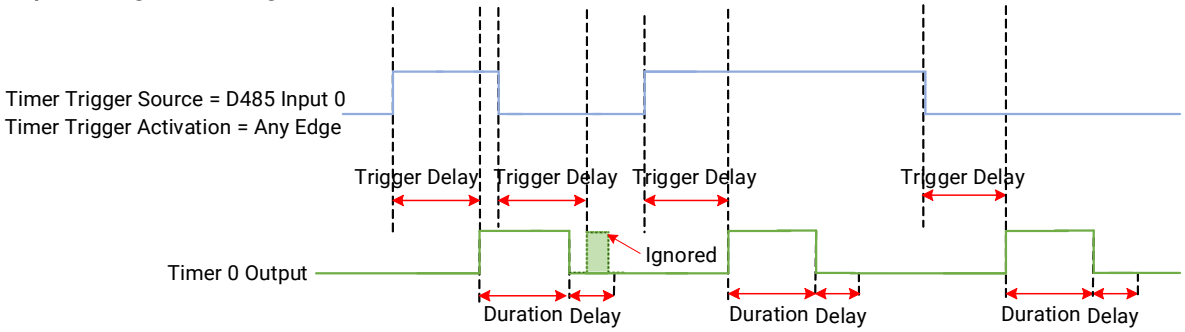

Figure 7-36 Principle

7. (Optional) If it is required to count the amount of edge trigger received by timer in real time, you need to enable **Timer Edge Counter Enable**, as shown below.

- **Timer Rising Edge Counter** returns the rising edge counter value of selected timer.
- **Timer Falling Edge Counter** returns the falling edge counter value of selected timer.
- **Timer Edge Counter Reset**: Click **Execute** to reset edge counter of selected timer.

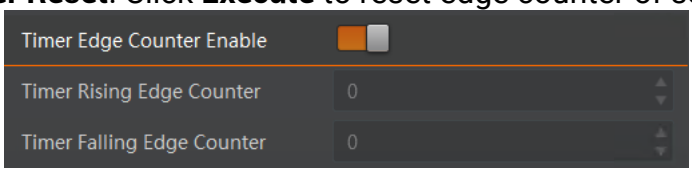

Figure 7-37 Timer Edge Counter

Note

Some models of frame grabber only support real-time counting and recounting the amount of rising edge triggers, namely only support **Timer Rising Edge Counter**, and there is no need to enable **Timer Edge Counter Enable**.

8. (Optional) If it is necessary to set the period of the output timer signal (one rising edge and one falling edge are one period), the number of timer periods can be set via the **Timer**

Period Number.

Note

The **Timer Period Number** is only available to some models of frame grabber.

The code below shows the process of setting the timer parameters.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};
MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);
unsigned int nInterfaceIndex = 0;
void* hInterface = NULL;
MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);
MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetEnumValueByString(hInterface, "TimerSelector", "Timer0");
MV_CC_SetIntValueEx(hInterface, "TimerDuration", 1000);
MV_CC_SetIntValueEx(hInterface, "TimerDelay", 1000);
MV_CC_SetIntValueEx(hInterface, "TimerFrequency", 100);
MV_CC_SetEnumValueByString(hInterface, "TimerTriggerSource", "D485InOut0");
MV_CC_SetEnumValueByString(hInterface, "TimerTriggerActivation", "RisingEdge");


MV_CC_CloseInterface(hInterface);
MV_CC_DestroyInterface(hInterface);
```

7.3.5 Signal Countering

The signal counting function is to count the rising edges and falling edges of selected lines (input or output signals).

Note

The function is only available to some models of frame grabber.

Steps

1. Go to **Digital IO Control**, and view the number of rising edges and falling edges in real time

via **Line Rising Edge Counter** and **Line Falling Edge Counter**.

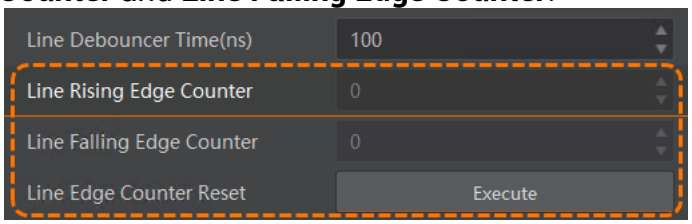

Figure 7-38 View Signal Amount

2. (Optional) Click **Execute** in **Line Edge Counter Reset** to reset counting.

7.3.6 Output Signal

The frame grabber supports setting multiple output signals that can be sent to external devices via the frame grabber.

Steps

1. Go to **Digital IO Control**, and select **D485 InOut *** in the **Line Selector**.
2. Select **Output** as **Line Mode**.

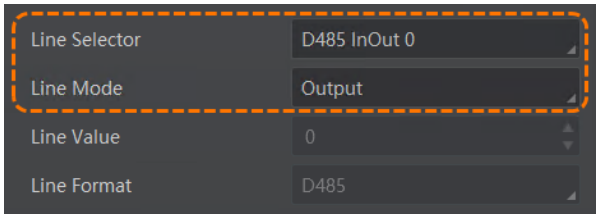

Figure 7-39 Set Output Signal

3. (Optional) Enable **Line Inverter** to invert the electrical level of selected lines.

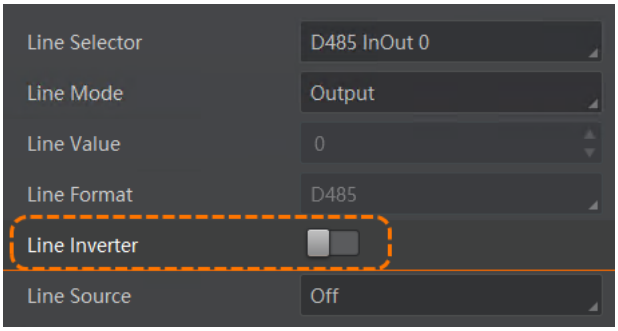

Figure 7-40 Enable Line Inverter

Note

The line inverter is disabled by default.

Take **Timer 0** as **Line Source** as an example and the principle of line inverter is shown below.

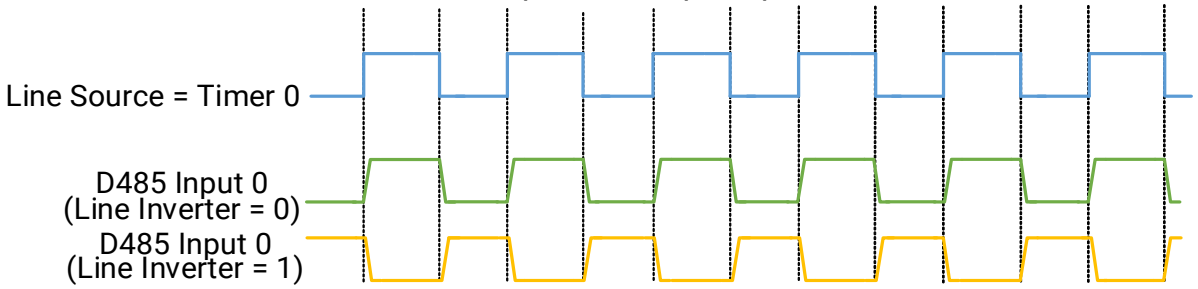

Figure 7-41 Principle

4. The frame grabber supports multiple output signal sources sent by external devices. When the frame grabber receives the trigger signal source sent by external device, it will output corresponding signal. You can select in **Line Source**.

Note

- After the I/O is set to output mode, it can no longer be configured as an output signal source. If D485 InOut 1 is set to output mode, D485 Input 1 will not be displayed as an output signal source.
- The supported output signal source may differ by different models of frame grabbers you use.

The code below shows the process of setting the output signal.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);

MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetEnumValueByString(hInterface, "LineSelector", "OptoCoupledOutput0");

MV_CC_SetEnumValueByString(hInterface, "LineMode", "Strobe");

MV_CC_SetEnumValueByString(hInterface, "LineSource", "Timer0Active");


MV_CC_CloseInterface(hInterface);

MV_CC_DestroyInterface(hInterface);
```

7.3.7 User Output

The frame grabber supports configuration of 8 user output signals, allowing enabling or

disabling each output signal individually.

Note

The function is only available to some models of frame grabber.

Steps

1. Go to **Digital IO Control**, and select **User Output 0** to **User Output 7** in **User Output Selector**.

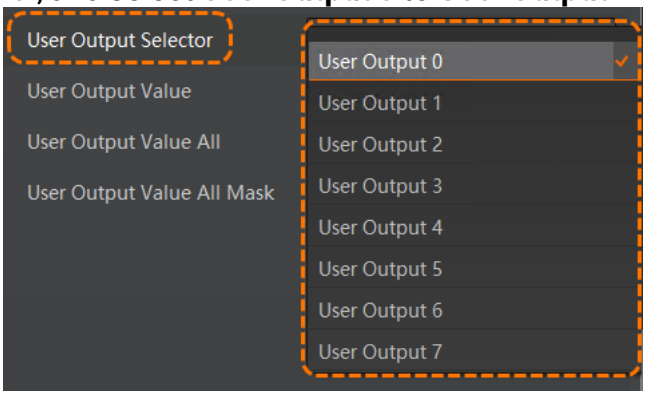

Figure 7-42 Set User Output Signal

2. Enable **User Output Value**.

Note

You can switch the user output signal in **User Output Selector**, and enable multiple user output signals at the same time.

3. View the enabled user output signals in **User Output Value All**, as shown below. There are 15 possible outcomes when different user output signals are enabled. The corresponding hexadecimal numbers and parameter values for each enabled user output signal are detailed in the table below.

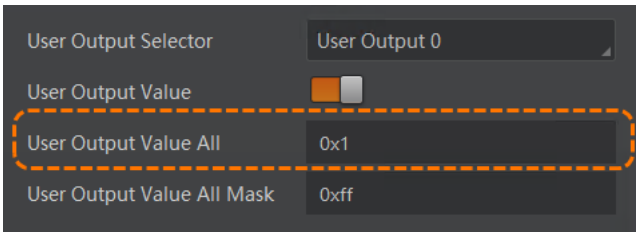

Figure 7-43 Enable User Output Signal

4. (Optional) Enable user output signal via **User Output Value All Mask**. If the signal is currently enabled or disabled, the corresponding parameter value can be configured according to the table below. The values of other signals cannot be reconfigured and are enabled by default.
For example, if you enter a in **User Output Value All Mask** and it displays as 0xa, then you can configure the output signals **User Output 1** and **User Output 3**, while **User Output 0**

and **User Output 2** cannot be configured.

Table 7-4 User Output Signals Corresponding to Parameter Values

User Output Signal	Hexadecimal Value	Parameter Value	Enabling Configuration
/	0	0x0	0
User Output 0	2^0	0x1	1
User Output 1	2^1	0x2	2
User Output 0, User Output 1	2^0+2^1	0x3	3
User Output 2	2^2	0x4	4
User Output 0, User Output 2	2^0+2^2	0x5	5
User Output 1, User Output 2	2^1+2^2	0x6	6
User Output 0, User Output 1, User Output 2	$2^0+2^1+2^2$	0x7	7
User Output 3	2^3	0x8	8
User Output 0, User Output 3	2^0+2^3	0x9	9
User Output 1, User Output 3	2^1+2^3	0xa	a
User Output 0, User Output 1, User Output 3	$2^0+2^1+2^3$	0xb	b
User Output 2, User Output 3	2^2+2^3	0xc	c
User Output 0, User Output 2, User Output 3	$2^0+2^2+2^3$	0xd	d
User Output 1, User Output 2, User Output 3	$2^1+2^2+2^3$	0xe	e
User Output 0, User Output 1, User Output 2、User Output 3	$2^1+2^2+2^3+2^4$	0xf	f

The code below shows the process of setting the user output signal.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);

MV_CC_OpenInterface(hInterface, NULL);
```

```
MV_CC_SetEnumValueByString(hInterface, "UserOutputSelector", "UserOutput0");

MV_CC_SetBoolValue(hInterface, "UserOutputValue", true);

MVCC_INTVALUE_EX stIntValue = {0};

MV_CC_GetIntValueEx(hInterface, "UserOutputValueAll", &stIntValue);


MV_CC_CloseInterface(hInterface);

MV_CC_DestroyInterface(hInterface);
```

7.3.8 Advanced I/O

The advanced I/O control function provides more flexible I/O logic operations based on timer control. It can control multiple advanced I/O signals by logical operations such as AND or NOT of different signal sources, and output the operation result. Advanced I/O control can provide free and flexible I/O configuration for frame grabbers by configuring the A and B signal sources of I/O signals, perform AND or NOT operations on them, and output corresponding I/O control signals according to operation logic.

Steps

1. Go to **Advanced Setting** > **Advanced IO Control**.
2. Select the advanced IO from **Advanced IO 0** to **Advanced IO 3** in **Advanced IO Selector** according to actual demands.

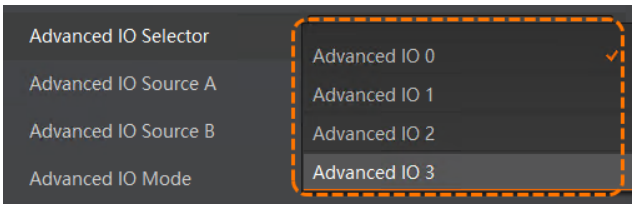

Figure 7-44 Advanced IO Selector

3. Set the signal sources of A and B via **Advanced IO Source A** and **Advanced IO Source B** according to actual demands.
4. Set the advanced IO control mode via **Advanced IO Mode** according to actual demands.

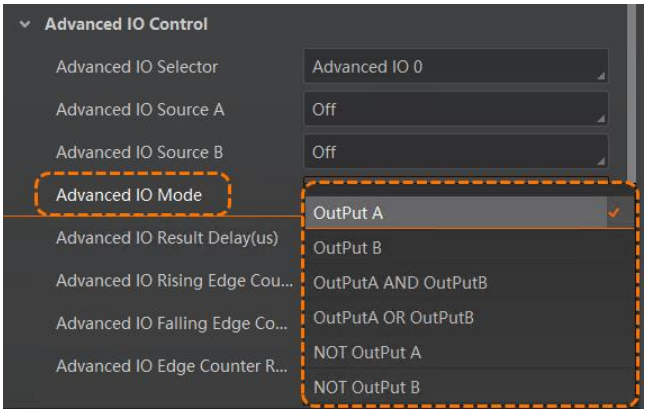

Figure 7-45 Advanced IO Mode

Table 7-5 Advanced IO Mode

Parameter Value	Description
OutPut A	Direct output of signals from **Advanced IO Source A**.
OutPut B	Direct output of signals from **Advanced IO Source B**.
OutPutA AND OutPutB	Perform AND operation to the signal sources selected by **Advanced IO Source A** and **Advanced IO Source B**, and then output the signal. For example, if both A and B are at high level, the output is high level.
OutPutA OR OutPutB	Perform OR operation to the signal source selected by **Advanced IO Source A** and **Advanced IO Source B**, and then output the signal. For example, if one of A and B is at high level, the output is high level.
NOT OutPut A	The signal selected by **Advanced IO Source A** is outputted after being inverted.
NOT OutPut B	The signal selected by **Advanced IO Source B** is outputted after being inverted.

The principle of advanced IO mode is shown below.

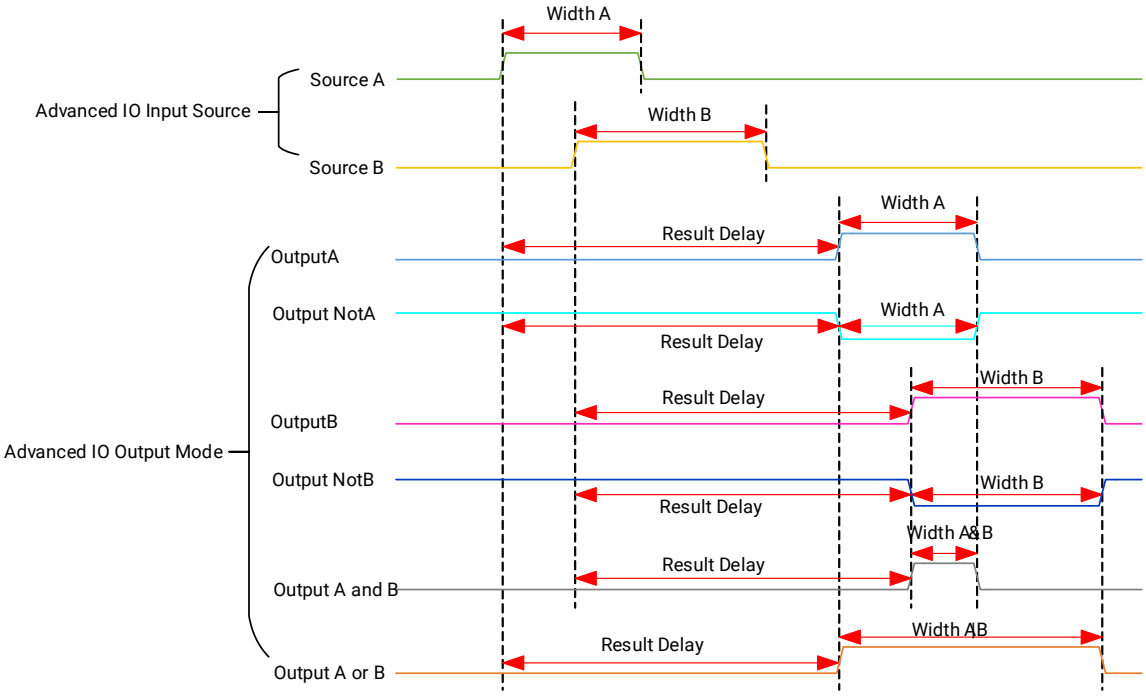

Figure 7-46 Principle of Advanced IO Mode

5. (Optional) Set **Advanced IO Result Delay(us)** if you want to delay for some time.

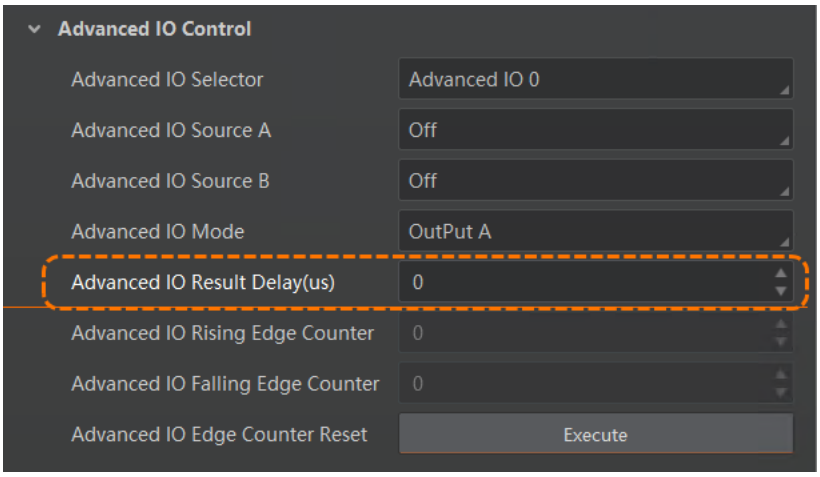

Figure 7-47 Set Advanced IO Result Delay

6. View the signal amount of rising edge and falling edge in real time via **Advanced IO Rising Edge Counter** and **Advanced IO Falling Edge Counter**.

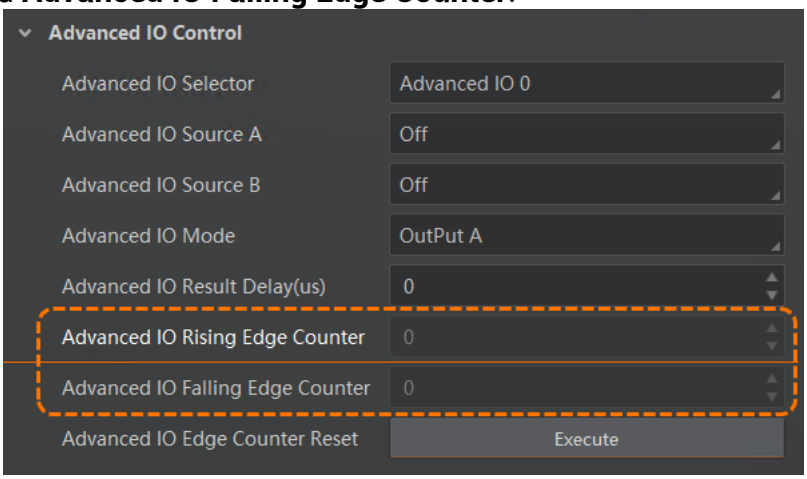

Figure 7-48 View Signal Amount

7. (Optional) Click **Execute** in **Advanced IO Edge Counter Reset** to reset counting.

Chapter 8 Other Functions

8.1 PoE

The PoE can control the power supply of cameras connected to the frame grabber, and display connection status, voltage, current, and power consumption of cameras in real time.

Steps

Note

- For the case of insufficient power, make sure that the cable of 6-pin ATX 12V is connected to the ATX power supply interface on the frame grabber with the host before using the PoE function.
- MV-GT1000 frame grabber does not support PoE function.

1. Go to **GigE**, and select one frame grabber connector in **Port Selector**.

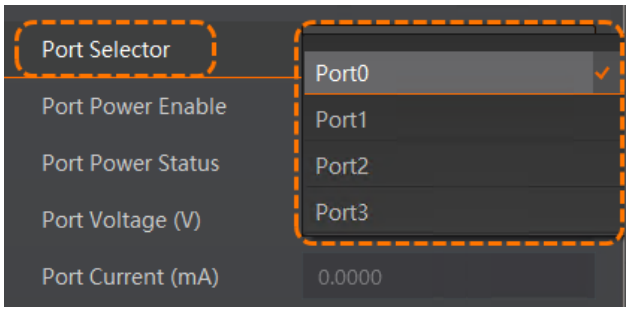

Figure 8-1 Port Selector

Note

Port 0 to **Port 3** correspond to 0 to 3 connector of the frame grabber.

2. Enable **Port Power Enable** to let the connector selected in **Port Selector** support PoE.
- The **Port Power Status** is **On** if the camera connection is detected.
- The **Port Power Status** is **Off** if the camera connection is not detected.

3. View the voltage, current, and power consumption of connected cameras in the corresponding connector.
- **Port Voltage (V)** displays the voltage of the camera.
- **Port Current (mA)** displays the current of the camera.
- **Port Power (mW)** displays the power consumption of the camera.

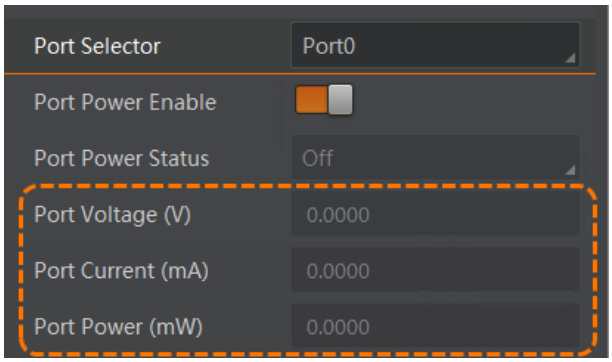

Figure 8-2 Voltage, Current and Power Consumption

8.2 Action Control

The action control is used to synchronize parameters of the frame grabber and cameras. The frame grabber sends trigger signals to the camera, and the camera starts to acquire images. You can go to **GigE** > **GigE TOE** to set related parameters.

Note

Make sure that **Action 1** is selected as **Trigger Source** before you use the GigE action control function.

Steps

1. Go to **GigE** and select one frame grabber connector in **Port Selector**.

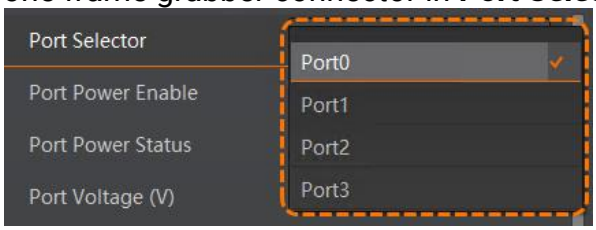

Figure 8-3 Port Selector

Note

Port 0 to **Port 3** correspond to 0 to 3 connector of the frame grabber.

2. Unfold **GigE TOE**, and enable **Action Enable**.

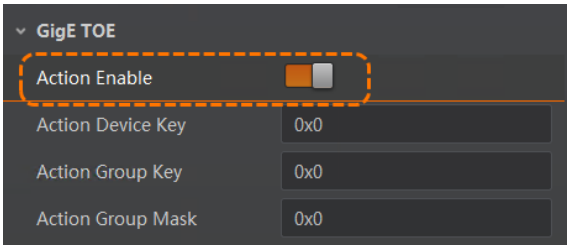

Figure 8-4 Action Enable

3. Set **Action Device Key**, **Action Group Key**, and **Action Group Mask**.

Note

The configured parameters here are displayed in hexadecimals.

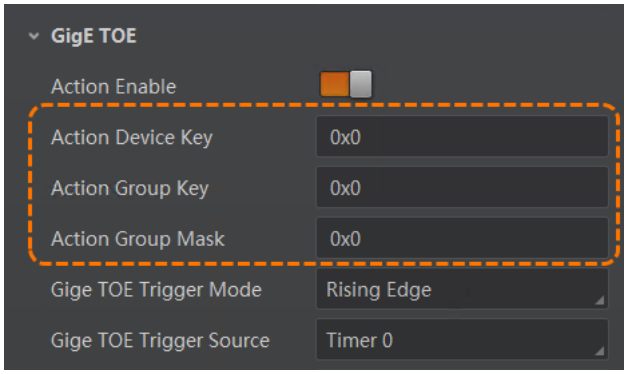

Figure 8-5 Action Control Parameters

Table 8-1 Advanced IO Mode

Frame Grabber Parameter Name	Camera Parameter Name	Requirement
GigE > GigE TOE > Action Device Key	Action Control > Action Device Key	Parameter values should be consistent.
GigE > GigE TOE > Action Group Key	Action Control > Action Group Key	Parameter values should be consistent.
GigE > GigE TOE > Action Group Mask	Action Control > Action Group Mask	Perform a bitwise AND operation, with the result being valid if it is non-zero.

4. Set the trigger response mode of frame grabber via **GigE TOE Trigger Mode** according to actual demands.

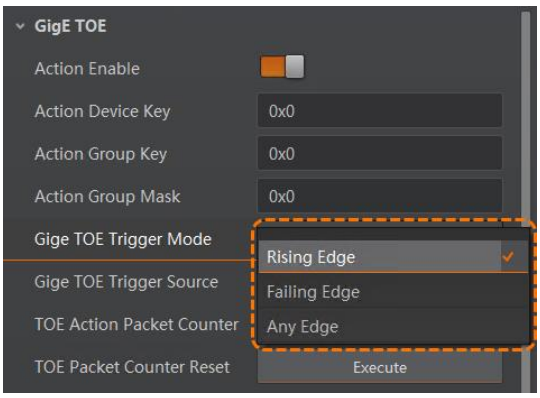

Figure 8-6 Action Control Trigger Response Mode

Table 8-2 Trigger Response Mode

Parameter	Description
Rising Edge	When the electrical level signal given by the frame grabber is in rising edge, the camera receives the trigger source and starts to output images.
Falling Edge	When the electrical level signal given by the frame grabber is in falling edge, the camera receives the trigger source and starts to output images.
Any Edge	When the electrical level signal given by the frame grabber is in rising edge or falling edge, the camera receives the trigger source and starts to output images.

5. Set the trigger source of the frame grabber via **GigE TOE Trigger Source**. When the action control related parameter value is the same as that of the camera, the trigger source can be set for sending action control signal.

Note

- The supported trigger source may differ by different models of frame grabbers you use.
- If **Software_in** is selected as **Gige TOE Trigger Source**, you can click **Execute** in **Action TriggerSoftware** to perform software trigger.
- If other trigger sources are selected as Gige TOE Trigger Source, when the frame grabber receives the set trigger source, it will send action control signals.

6. The frame grabber supports real-time counting of the number of transmitted action control packets.
- **TOE Action Packet Counter** shows the number of action control packets transmitted through the frame grabber. The value is updated in real time based on the output.
- Click **Execute** in **TOE Packet Counter Reset** to reset the action packet counting value.

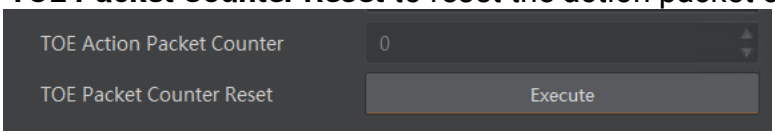

Figure 8-7 The Number of Action Control Packets

Note

The function is only available to some models of frame grabber.

8.3 Frame Processing

Frame processing is used to configure the image output method of the camera connected

to the frame grabber, including the caching mechanism and fast readout of image data.

Steps

1. Go to **Stream**, and select the channel according to the actual needs in **Stream Selector**.

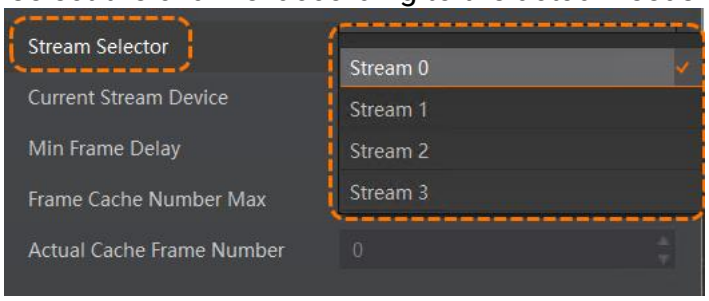

Figure 8-8 Stream Selector

Note

Stream 0 to **Stream 3** correspond to cameras connected to CH0 to CH3 connector of the frame grabber.

2. (Optional) Set the caching mechanism for images via **Min Frame Delay**.
- Enable **Min Frame Delay** to always cache the latest image data in the space for the image to be sent next, and any unsent image data is directly discarded.
- Disabled **Min Frame Delay** to cache the latest image data in the space for unsent images. If the cache space reaches its upper limit, the oldest unsent image data is discarded.

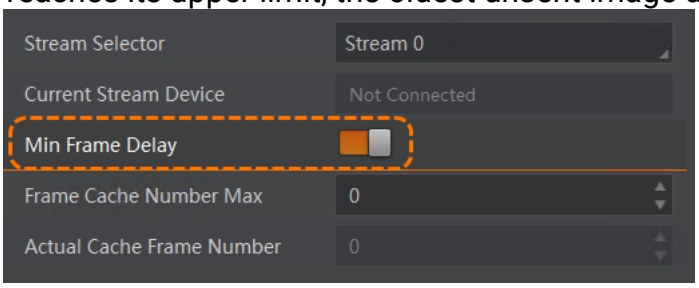

Figure 8-9 Min. Frame Delay

3. (Optional) Set the max. number of cached images via **Frame Cache Number Max**. You can view the actual number of cached images in **Actual Cache Frame Number**.

Note

Frame Cache Number Max and **Actual Cache Frame Number** are only supported by some models of frame grabber.

8.4 Device Control

In **Device Control**, you can view device information.

Table 8-3 Device Control Parameter Description

Parameter	Read/Write	Description
Device Vendor Name	Read Only	It is the name of device manufacturer.
Device Model Name	Read Only	It is the device model.
Manufacture Info.	Read Only	It is the manufacturer information.
Device Family Name	Read Only	It is the product name.
Device Version	Read Only	It is the device version.
Device Firmware Version	Read Only	It is the device firmware version.
Device Serial Number	Read Only	It is the device serial number.
Device User ID	Read & Write	It is the device name. It is empty by default. ● If it is empty, the device name is the device model (device serial number). ● If it is not empty, the device name is the set ID (device serial number).
Maximum Device Response Time	Read Only	It is the max. response time of the device. If the device has no response within this time, it is disconnected.
Device Manifest Table Address	Read Only	It is the ID of GenICam XML selected.
Device SBRM Address	Read Only	It is the SBRM address of the device.
Device Uptime (s)	Read Only	It is the period of time when device is powered up.
Board Device Type	Read Only	It is the device type.
Device Command Timeout	Read Only	It is the device timeout duration. If the device has no response within this time, it is disconnected.
Device Temperature Selector	Read & Write	It selects what the device components you want to display its temperature in n **Device Temperature**.
Device Temperature	Read Only	It displays the real-time temperature of the device components you selected in **Device Temperature Selector**.

Parameter	Read/Write	Description
PCIe Max Link Speed	Read Only	It is the max. link speed that PCIe supports.
PCIe Maximum Link Width	Read Only	It is the max. link width that PCIe supports.
Connection Port Number	Read Only	It is the device connection port No.
Connection Port Selector	Write	It selects the port for device connection.
Connection Port MAC Address	Read Only	It is the MAC address of device connection port.
Device Connection Speed (Mbps)	Read Only	It is the device connection speed.
Device Timestamp Tick Frequency (Hz)	Read Only	It is the device timestamp tick frequency.
Device Log Storage	Read & Write	It is used to enable or disable device log storage.

8.5 Firmware Update

You can use the MVS client software to update the frame grabber' s firmware.

Steps

1. Run MVS client software and right click in the PCIe connector.
2. Right-click the device to be updated, and click **Upgrade Firmware**.
3. Click to select the corresponding firmware package (.dav) from the local PC.

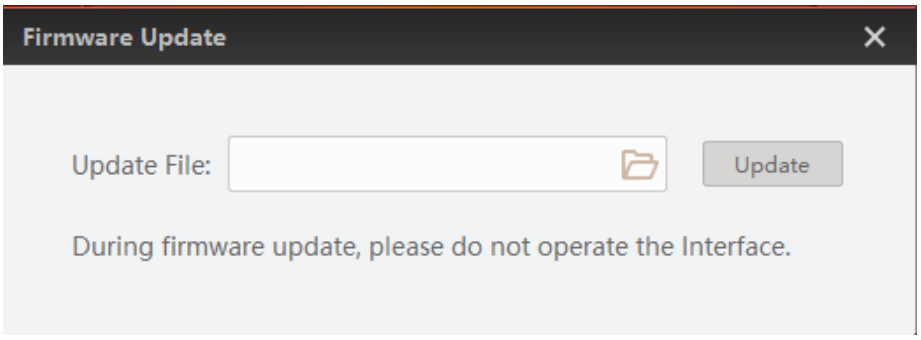

Figure 8-10 Select Update File

4. Click **Update** to start updating.

Note

- Disconnecting the frame grabber to the client software is required before updating firmware.

- Do not power off the frame grabber during updating.
- Restart the computer to check the frame grabber function after updating.

8.6 User Parameter Settings

This function allows loading or saving default or user-defined settings. The frame grabber supports four sets of parameters, including 1 default set and 3 user sets, and the relation among four sets of parameters is shown below.

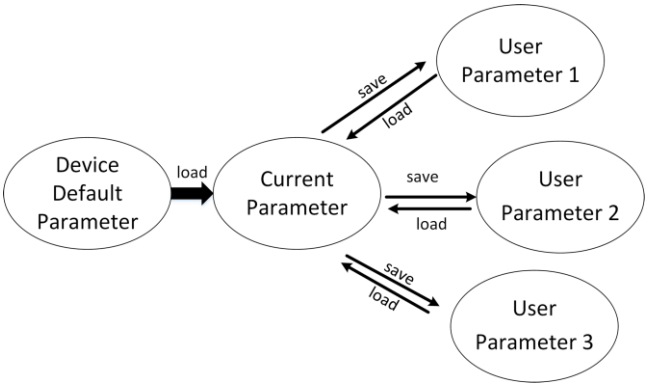

Figure 8-11 Parameter Relation

8.6.1 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 parameters.
3. View **User Set Save Status**:
- **Saving**: User parameters are being saved.
- **Ready**: User parameters have been saved.

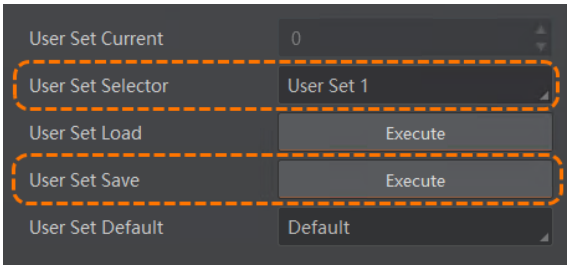

Figure 8-12 Save User Set

8.6.2 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.

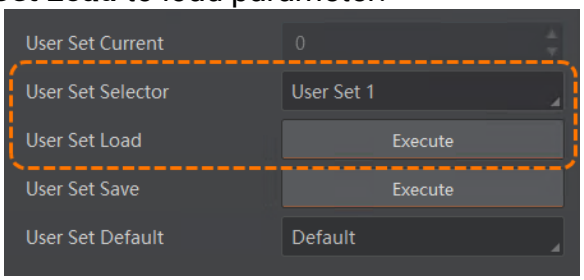

Figure 8-13 Load User Set

8.6.3 Set User Default

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

Note

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

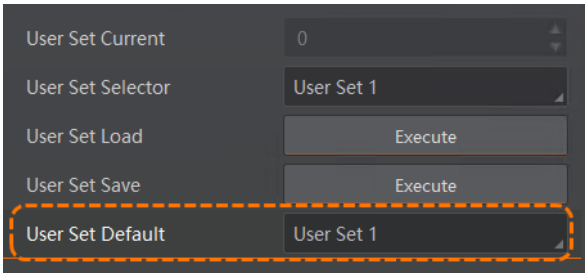

Figure 8-14 Set User Default

The code below shows the process of setting user parameters.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;
```

```
void* hInterface = NULL;
MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);
MV_CC_OpenInterface(hInterface, NULL);


MV_CC_SetEnumValueByString(hInterface, "UserSetSelector", "UserSet1");
MV_CC_SetCommandValue(hInterface, "UserSetSave");
MV_CC_SetCommandValue(hInterface, "UserSetLoad");
MV_CC_SetEnumValueByString(hInterface, "UserSetDefault", "UserSet1");


MV_CC_CloseInterface(hInterface);
MV_CC_DestroyInterface(hInterface);
```

8.7 File Access

The file access function can be used to import or export the feature files of the frame grabber and save them in MFA format. Currently, only **User Set 1/2/3**, **License Notice**, and **Log File** are supported.

Note

For **License Notice** and **Log File**, only exporting is supported.

Steps

1. Go to the feature tree, and click  to open the file access dialogue box.

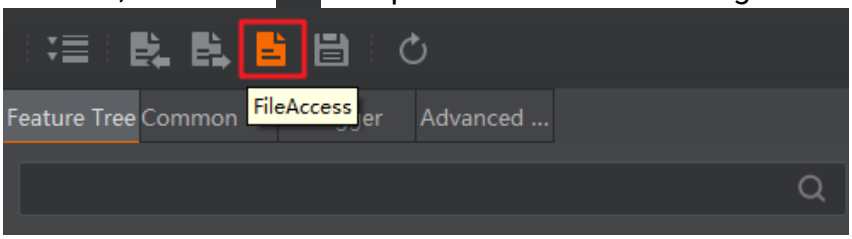

Figure 8-15 File Access

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

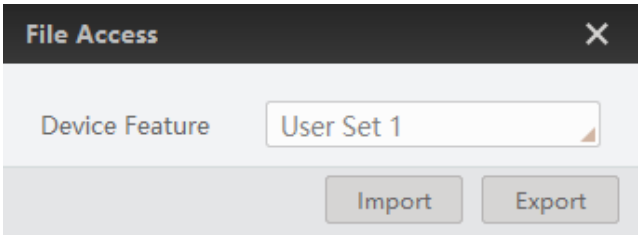

Figure 8-16 Import or Export

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. Refer to section ***User Set Control*** for details.
- Importing and exporting the device feature among the same model of the frame grabbers are supported.

The code below shows the process of importing or exporting the frame grabber feature settings.

```
MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);

MV_CC_OpenInterface(hInterface, NULL);


MV_CC_FILE_ACCESS stFileAccess = {0};

stFileAccess.pUserFileName = "UserSet1.mfa";

stFileAccess.pDevFileName = "UserSet1";

MV_CC_FileAccessRead(hInterface, &stFileAccess);

MV_CC_FileAccessWrite(hInterface, &stFileAccess);


MV_CC_CloseInterface(hInterface);

MV_CC_DestroyInterface(hInterface);
```

8.8 Event Control

You can view and set the frame grabber's event control related parameters to let the device generate an event and transmit a related event message to the computer.

Note

For abnormal events, you should view the device's SDK file.

Steps

1. Go to **Event Control**, and select corresponding channel in **Channel Selector** according to actual needs.

Note

Channel 0 to **Channel 3** correspond to cameras connected to frame grabber connectors 0 to 3.

2. Select corresponding event category in **Event Category**, and then you can select corresponding event source in **Event Selector**. The relation between event category and event source is detailed in the table below.

Note

If you select **IO Event** as **Event Category**, you need to first select the IO type in **Event IO Type**, then select event source, and the **Channel Selector** shows the signal sources of IO signal.

Table 8-4 Event Control

Event Category	Event Source	Description
Soft Event	Card Packet Received(From PCIE)_0	Receive data packet via PCIe connector.
	Card Packet Read Done(To Card)_0	The frame grabber completes reading.
	Card Ack Packet Received(From Card)_0	Receive data packet from frame grabber.
	Card Ack Packet Read Done(To PCIE)_0	PCIe completes reading.
Link Event	Trigger Rising Edge_0	Rising edge trigger.
	Trigger Falling Edge_0	Falling edge trigger.
	Locked Event_0	Link connection lock event.
	Unlocked Event	Unlock event.
	Control Ack Packet Received(From Camera)_0	Channel for receiving control response packets.
	Control Ack Packet Transmitted(To PCIE)_0	Channel for transmitting control response packets.
	Control Packet Received(From PCIE)_0	Channel for receiving control packets.
	Control Packet Transmitted(To Camera)_0	Channel for transmitting control packet.
	TOE Packet Transmitted_0	Channel for transmitting TOE packet.
Stream Event	Receive Image Frame Start(From Camera)_0	Receive the start image frame.

Event Category	Event Source		Description
	Receive Image Frame End(From Camera)_0		Receive the end image frame.
	Transmit Image Block Start(To PC) _0		Transmit the start image frame.
	Transmit Image Block End(To PC) _0		Transmit the end image frame.
PCIE Event	PCIe DMA Start		DMA starts.
	PCIe DMA End		DMA ends.
IO Event	Timer	Timer Rising/Falling Edge_0	Timer rising edge / falling edge.
	Encoder	Encoder Rising/Falling Edge_0	Encoder rising edge / falling edge.
	D485	D485 In Rising/Falling Edge_0	Differential input rising edge / falling edge.
		D485 Out Rising/Falling Edge_0	Differential output rising edge / falling edge.
	AdvancedIO	AdvancedIO Rising/Falling Edge_0	Advanced I/O rising edge / falling edge.

3. Enable corresponding event. When setting any event source, you need to set the **Event Notification** to **Notification On**, as shown below.

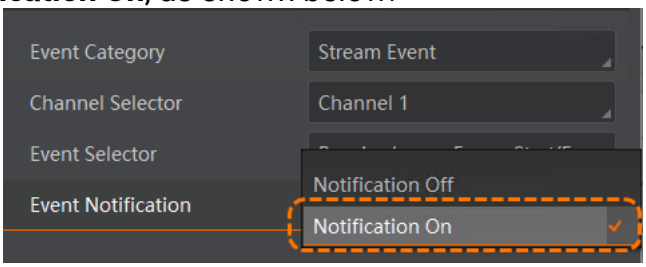

Figure 8-17 Event Notification

4. Right-click the connected frame grabber, and click **Event Monitor**.

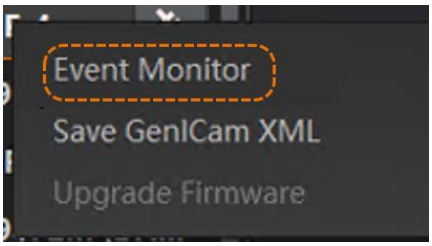

Figure 8-18 Enable Event Monitor

5. Select **Messaging Channel Event**, and view specific events after the device operates.

- **Save Path**: You can click to set the save path for event logs.
- **Auto Save**: If you select it, the event logs will be saved to the default path automatically.
- **Clear Log**: Click it to clear the displayed channel events.

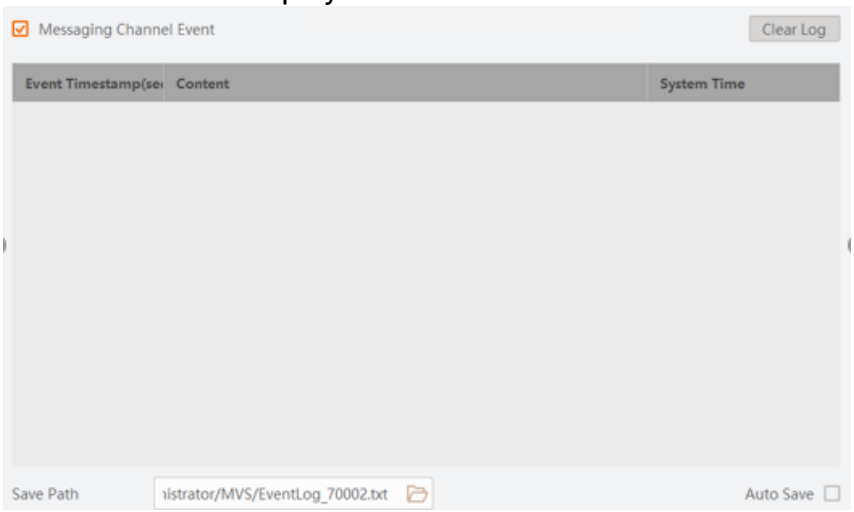

Figure 8-19 Event Monitor

Note

- The event monitor is only available when the frame grabber firmware supports the function.
- The event sources supported in event monitor may differ by different models of frame grabbers you use.

The code below shows the process of viewing and recording the event of connected frame grabber.

```
void __stdcall EventCallBack(MV_EVENT_OUT_INFO * pEventInfo, void* pUser);


MV_INTERFACE_INFO_LIST stInterfaceList = {0};

MV_CC_EnumInterfaces(MV_GIGE_INTERFACE, &stInterfaceList);

unsigned int nInterfaceIndex = 0;

void* hInterface = NULL;

MV_CC_CreateInterface(&hInterface, stInterfaceList.pInterfaceInfos[nInterfaceIndex]);
```

```
MV_CC_OpenInterface(hInterface, NULL);


MV_CC_EventNotificationOn(hInterface, "ReceiveImageFrameStart0");
MV_CC_RegisterEventCallBackEx(hInterface, "ReceiveImageFrameStart0", EventCallBack, NULL);


MV_CC_CloseInterface(hInterface);
MV_CC_DestroyInterface(hInterface);
```

Chapter 9 FAQ (Frequently Asked Questions)

There may be some problems when using the frame grabber. If the problems below occur, follow the guidance to solve by yourself. If you cannot solve them or have other problems, contact the technical support in time.

9.1 Why the frame grabber cannot be enumerated?

Table 9-1 Question 1

Possible Cause	Solution
Improper installation of the driver.	Make sure that MVS 3.4.1 or later is installed correctly. If the client is installed correctly, uninstall and reinstall it. **Note** For MV-GT1100P series frame grabbers, MVS 4.5.1 or later is required. Anti-virus software or firewall may intercept the driver. You can disable the firewall and uninstall the anti-virus software. If it is required to enable the firewall and anti-virus software, make sure that the MVS client software is on the allowlist before uninstalling and reinstalling it.
The MVS client software or other software is using the frame grabber.	Close the MVS client software or other software that is using the frame grabber. It should be noted that there may be processes after the MVS client software or the software using the frame grabber is closed, causing the frame grabber to be occupied and unsearchable. You can shut down the MVS process or the process of the software that uses the frame grabber in the task manager. If you cannot confirm whether there are processes occupying the frame grabber, you can try to restart the PC.
Insufficient power supply of the mainboard.	Power the frame grabber independently.

9.2 Why the camera connected to the frame grabber cannot be enumerated?

Table 9-2 Question 2

Possible Cause	Solution
The camera is not working normally.	Check whether the camera is working normally.
Improper wiring of the data cable.	Check the wiring of the data cable.

9.3 Why the camera's frame rate is not stable?

Table 9-3 Question 3

Possible Cause	Solution
Insufficient PCIe bandwidth.	Replace PCIe slot.
Low CPU performance.	Use high performance CPU.

9.4 Why is the camera not outputting images or outputting abnormal images?

Table 9-4 Question 4

Possible Cause	Solution
The parameter Payload Size(B) of the camera is misconfigured.	● If the parameter Gev GVSP Extended ID Mode is On, it is recommended to set Payload Size(B) to 8176. ● If the parameter Gev GVSP Extended ID Mode is Off, it is recommended to set Payload Size(B) to 8164.

Chapter 10 Revision History

Table 10-1 Revision History

Version	Document No.	Data	Revision Details
V2.1.0	UD43393B	June 14, 2025	● Edit Chapter 3 Appearance, Connector, and Indicator. ● Optimize Section 3.3 I/O Connector. ● Optimize Appendix A Frame Grabber Accessories. ● Add a question and corresponding solution to Chapter 9 FAQ (Frequently Asked Questions).
V2.0.0	UD42411B	Apr. 9, 2025	● Adjust document structure. ● Edit Chapter 2 Overview. ● Add appearance, I/O connector, and indicator of MV-GT1100P to Chapter 3 Appearance, Connector, and Indicator. ● Add Section 3.2 ATX Power Supply Interface. ● Edit Section 3.4 PCIe Connector. ● Edit Chapter 5 Basic Operation of MVS Client Software. ● Add sample codes for setting input signal, encoder parameters, encoder frequency converter, timer, output signal, user output, user parameters, file access, and event monitor. ● Delete introduction of GS series frame grabber. ● Edit Chapter 5 Basic Operation of Client Software ● Edit Chapter 7 I/O Introduction. ● Add Section 7.3.5 Signal Countering. ● Add Section 7.3.8 Advanced I/O. ● Add Section 8.1 PoE. ● Edit Section 8.2 Action Control ● Add Section 8.3 Frame Processing. ● Add Section 8.8 Event Control. ● Add Appendix A Frame Grabber Accessories. ● Add Appendix B Frame Grabber Fields.
V1.1.0	UD38951B	Aug 5, 2024	● Edit Chapter 3 Appearance. ● Add Section 6.2 GT Series Frame Grabber.
V1.0.0	UD29291B	July 8, 2022	Original version.

Appendix A Frame Grabber Accessories

When using the frame grabber, you need to prepare these cables: 10 GigE network cable, I/O trigger cable, and I/O expansion bracket. The appearance of accessories is shown below.

10 GigE Network Cable

The 10 GigE network cable is used to establish the data transmission between the frame grabber and the camera. It can provide three lengths of 3 m, 5 m, and 10 m, which can be selected as required.

Figure A-1 10 GigE Network Cable

Note

Refer to the datasheet of the corresponding product for the specific size and parameter of the 10 GigE network cable.

I/O Trigger Cable 1

The I/O trigger cable 1 (DB9F to open) is used for I/O trigger signal wiring of 9-pin header of MV-GT1000 frame grabbers, as shown below. Refer to the following table for pin definition. The cable has shielding protection, providing four lengths of 3 m, 5 m, and 7 m, which can be selected as required.

Figure A-2 I/O Trigger Cable 1

Note

Refer to the datasheet of the corresponding product for the specific size and parameter of the I/O trigger cable 1.

Table A-1 Pin Definition of Open End

Pin No.	Cable Color	Signal	Pin No.	Cable Color	Signal
1	White/Green	LINE_0P	6	White/Brown	LINE_2P
2	Green	LINE_0N	7	Brown	LINE_2N
3	White/Orange	LINE_1P	8	White/Blue	LINE_3P
4	Orange	LINE_1N	9	Blue	LINE_3N
5	Black	GND			

I/O Trigger Cable 2

The I/O trigger cable 2 (MiniDP to Open) is used for the I/O trigger signal wiring of the MiniDP connector of MV-GT1100P frame grabber. The pin definitions are detailed in the table below. The cable is shielded and is available in six lengths: 3 m, 5 m, 7 m, 10 m, 15 m, 20 m.

Figure A-3 I/O Trigger Cable 2

Table A-2 Pin Definition of Open End

Pin No.	Cable Color	Signal	Pin No.	Cable Color	Signal
1	White/Green	RS485_0P	15	White/Yellow	RS485_5P
2	Green	RS485_0N	17	Yellow	RS485_5N
3	White/Orange	RS485_1P	16	White/Purple	RS485_6P
5	Orange	RS485_1N	18	Purple	RS485_6N
4	White/Brown	RS485_2P	19	White/Gray	RS485_7P

Pin No.	Cable Color	Signal	Pin No.	Cable Color	Signal
6	Brown	RS485_2N	20	Gray	RS485_7N
9	White/Blue	RS485_3P	7	Black	GND
11	Blue	RS485_3N	8	White	GND
10	White/Red	RS485_4P	13	Pink	GND
12	Red	RS485_4N	14	Light green	GND

I/O Expansion Bracket

I/O expansion bracket is used for the I/O trigger signal wiring of the 9-pin header.

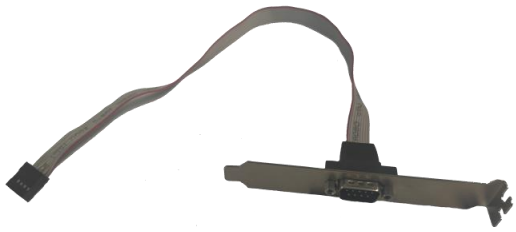

Figure A-4 I/O Expansion Bracket

Appendix B Frame Grabber Fields

B.1 Event Fields

The event-related nodes in the client have been deleted. Use the event configuration tool in the toolkit for event node configuration. This section introduces the configurable event fields and event sources for secondary development.

Table B-1 Event Fields

Field Name	Field Type	Enumerated Value	Value Name	Description
EventCategory	Enum	1	SoftEvent	Soft event
		2	LinkEvent	Link event
		3	StreamEvent	Stream event
		4	PCIEEvent	PCIE event
		5	IOEvent	I/O event
EventIOType	Enum	0	Timer	I/O type
		4	Encoder	
		5	D485	
		6	AdvancedIO	
ChannelSelector	Enum	0 to 3	/	Select channel
EventSelector	Enum	/	/	Select event
EventNotification	Enum	0	Off	Enable event
		1	On	

Table B-2 Event Source Fields

Event Type	Enumerated Value	Value Name
Soft Event	140	CardPacketReceived0
	141	CardPacketReadDone0
	142	CardAckPacketReceived0
	143	CardAckPacketReadDone0
Link Event	100	Trigger0RisingEdge0
	101	Trigger0RisingEdge1
	102	Trigger0RisingEdge2

Event Type	Enumerated Value	Value Name
	103	Trigger0RisingEdge3
	104	Trigger0FallingEdge0
	105	Trigger0FallingEdge1
Link Event	106	Trigger0FallingEdge2
	107	Trigger0FallingEdge3
	108	LockedEvent0
	109	LockedEvent1
	110	LockedEvent2
	111	LockedEvent3
	112	UnlockedEvent0
	113	UnlockedEvent1
	114	UnlockedEvent2
	115	UnlockedEvent3
	116	ControlAckPacketReceived0
	117	ControlAckPacketReceived1
	118	ControlAckPacketReceived2
	119	ControlAckPacketReceived3
	120	ControlAckPacketTransmitted0
	121	ControlAckPacketTransmitted1
	122	ControlAckPacketTransmitted2
	123	ControlAckPacketTransmitted3
	124	ControlPacketReceived0
	125	ControlPacketReceived1
	126	ControlPacketReceived2
	127	ControlPacketReceived3
	128	ControlPacketTransmitted0
	129	ControlPacketTransmitted1

Event Type	Enumerated Value	Value Name
	130	ControlPacketTransmitted2
	131	ControlPacketTransmitted3
	160	TOEPacketTransmitted0
Link Event	161	TOEPacketTransmitted1
	162	TOEPacketTransmitted2
	163	TOEPacketTransmitted3
Stream Event	84	ReceiveImageFrameStart0
	85	ReceiveImageFrameStart1
	86	ReceiveImageFrameStart2
	87	ReceiveImageFrameStart3
	88	ReceiveImageFrameEnd0
	89	ReceiveImageFrameEnd1
	90	ReceiveImageFrameEnd2
	91	ReceiveImageFrameEnd3
	92	TransmitImageBlockStart0
	93	TransmitImageBlockStart1
	94	TransmitImageBlockStart2
	95	TransmitImageBlockStart3
	96	TransmitImageBlockEnd0
	97	TransmitImageBlockEnd1
	98	TransmitImageBlockEnd2
	99	TransmitImageBlockEnd3
PCIE Event	76	PCIEDMAStart0
	77	PCIEDMAStart1
	78	PCIEDMAStart2
	79	PCIEDMAStart3
	80	PCIEDMAEnd0

Event Type	Enumerated Value	Value Name
	81	PCIEDMAEnd1
	82	PCIEDMAEnd2
	83	PCIEDMAEnd3
IO Event	0	TimerRisingEdge0
	1	TimerRisingEdge1
	2	TimerRisingEdge2
	3	TimerRisingEdge3
	4	TimerFallingEdge0
	5	TimerFallingEdge1
	6	TimerFallingEdge2
	7	TimerFallingEdge3
	8	EncoderRisingEdge0
	9	EncoderRisingEdge1
	10	EncoderFallingEdge0
	11	EncoderFallingEdge1
	60	D485InRisingEdge0
	61	D485InRisingEdge1
	62	D485InRisingEdge2
	63	D485InRisingEdge3
	64	D485InRisingEdge4
	65	D485InRisingEdge5
	66	D485InRisingEdge6
	67	D485InRisingEdge7
	68	D485InFallingEdge0
	69	D485InFallingEdge1
	70	D485InFallingEdge2
	71	D485InFallingEdge3

Event Type	Enumerated Value	Value Name
	72	D485InFallingEdge4
	73	D485InFallingEdge5
	74	D485InFallingEdge6
IO Event	75	D485InFallingEdge7
	144	D485OutRisingEdge0
	145	D485OutRisingEdge1
	146	D485OutRisingEdge2
	147	D485OutRisingEdge3
	148	D485OutRisingEdge4
	149	D485OutRisingEdge5
	150	D485OutRisingEdge6
	151	D485OutRisingEdge7
	152	D485OutFallingEdge0
	153	D485OutFallingEdge1
	154	D485OutFallingEdge2
	155	D485OutFallingEdge3
	156	D485OutFallingEdge4
	157	D485OutFallingEdge5
	158	D485OutFallingEdge6
	159	D485OutFallingEdge7
	244	AdvancedIORisingEdge0
	245	AdvancedIORisingEdge2
	246	AdvancedIORisingEdge1
	247	AdvancedIORisingEdge3
	248	AdvancedIOFallingEdge0
	249	AdvancedIOFallingEdge1
	250	AdvancedIOFallingEdge2

Event Type	Enumerated Value	Value Name
	251	AdvancedIOFallingEdge3

B.1 Other Fields

Field Name	Field Type	Enumerated Value	Description
Frame Grabber Trigger			
StreamSelector	Enum	● 0: Stream0 ● 1: Stream1 ● 2: Stream2 ● 3: Stream3	Stream selector.
CurrentStreamDevice	String	/	Image acquisition device corresponding to the current stream.
MinFrameDelay	Boolean	/	Min. frame delay time.
FrameCacheNumberMax	Integer	/	Max. number of cached image frames, range: [0, 255].
ActualCacheFrameNumber	Integer	/	Actual number of cached images, range: [0, 255].
Encoder Control			
EncoderSelector	Enum	● 0: Encoder0 ● 1: Encoder1	Encoder selector.
EncoderSourceA	Enum	● 48: D485Input0 ● 49: D485Input1 ● 50: D485Input2 ● 51: D485Input3 ● 52: D485Input4 ● 53: D485Input5 ● 54: D485Input6 ● 55: D485Input7 ● 127: Off	Input source of encoder PHASE_A.
EncoderSourceB	Enum	● 48: D485Input0 ● 49: D485Input1 ● 50: D485Input2 ● 51: D485Input3	Input source of encoder PHASE_B.

Field Name	Field Type	Enumerated Value	Description
EncoderSourceB	Enum	● 52: D485Input4 ● 53: D485Input5 ● 54: D485Input6 ● 55: D485Input7 ● 127: Off	Input source of encoder PHASE_B.
EncoderTriggerMode	Enum	● 0: AnyDirection ● 1: ForwardOnly ● 2: BackwardOnly	Encoder trigger mode.
EncoderCounterMode	Enum	● 0: AnyDirection ● 1: ForwardDirection ● 2: BackwardDirection	Encoder counter mode.
EncoderCounter	Integer	/	Encoder counter value display, range: [0, 4294967295].
EncoderCounterReset	Command	/	Reset encoder counter.
EncoderMaxReverseCounter	Integer	/	Encoder reverse counter, range: [0, 65535].
EncoderReverseCounterReset	Command	/	Reset encoder reverse counter.
EncoderTriggerLineRate	Integer	/	Encoder pre-trigger line rate, unit: Hz, range: [0, 4294967295].
EncoderPreDivider	Integer	/	Encoder predivide, range: [1, 128].
EncoderMultiplier	Integer	/	Encoder multiplier, range: [1, 32].
EncoderPostDivider	Integer	/	Encoder post-divider, range: [1, 128].
ResultingTriggerLineRate	Integer	/	Encoder post-trigger line rate, unit: HZ, range: [0, 4294967295].

Field Name	Field Type	Enumerated Value	Description
Input/Output Signal			
LineSelector	Enum	● 24: D485InOut0 ● 25: D485InOut1 ● 26: D485InOut2 ● 27: D485InOut3 ● 28: D485InOut4 ● 30: D485InOut6 ● 31: D485InOut7	Line selector.
LineMode	Enum	● 0: Input ● 1: Output	Set line mode.
LineInputPolarity	Enum	● 0: SingleEnded ● 1: Differential	Line input polarity.
LineInverter	Boolean	/	Line inverter.
LineDebouncerTimeNs	Integer	/	Debouncer time, unitL ns, range: [0, 400000000].
LineSource	Enum	● 255: Off ● 48: Timer0Active ● 49: Timer1Active ● 50: Timer2Active ● 51: Timer3Active ● 64: HighLevel ● 65: LowLevel ● 64: UserOutput0 ● 65: UserOutput1 ● 66: UserOutput2 ● 67: UserOutput3 ● 68: UserOutput4 ● 69: UserOutput5 ● 70: UserOutput6 ● 74: UserOutput7 ● 80: D485Input0 ● 81: D485Input1 ● 82: D485Input2 ● 83: D485Input3 ● 84: D485Input4 ● 85: D485Input5 ● 86: D485Input6 ● 87: D485Input7 ● 96: AdvancedIO0 ● 97: AdvancedIO1	Line input source.

Field Name	Field Type	Enumerated Value	Description
LineSource	Enum	• 98: AdvancedIO2 • 99: AdvancedIO3	Line input source.
Timer Control			
Timer Selector	Enum	• 0: Timer0 • 1: Timer1 • 2: Timer2 • 3: Timer3	Timer selector.
TimerDuration	Integer	/	Timer pulse duration, range: [0, 34000000].
TimerDelay	Integer	/	Timer start delay time, range: [0, 34000000].
TimerFrequency	Integer	/	Timer frequency, range: [0, 1000000].
TimerTriggerSource	Enum	• 255: Off • 48: Timer0Active • 49: Timer1Active • 50: Timer2Active • 51: Timer3Active • 64: Encoder0 • 65: Encoder1 • 80: SoftwareSignal0 • 81: Continuous • 96: D485Input0 • 97: D485Input1 • 98: D485Input2 • 99: D485Input3 • 100: D485Input4 • 101: D485Input5 • 102: D485Input6 • 103: D485Input7 • 112: AdvancedIO0 • 113: AdvancedIO1 • 114: AdvancedIO2 • 115: AdvancedIO3 • 192: QuickSoftwareTrigger0 • 193: QuickSoftwareTrigger1 • 194: QuickSoftwareTrigger2	Trigger source of timer.

Field Name	Field Type	Enumerated Value	Description
TimerTriggerSource	Enum	● 195: QuickSoftwareTrigger3	Trigger source of timer.
Timer Trigger Activation	Enum	● 0: RisingEdge ● 1: FallingEdge ● 2: AnyEdge ● 3: LevelHigh ● 4: LevelLow	Trigger mode of timer.
User Set Control			
UserSetCurrent	Integer	/	Display current user parameter set, range: [0, 4294967295].
UserSetSelector	Enum	● 0: Default ● 1: UserSet1 ● 2: UserSet2 ● 3: UserSet3	User parameter set selector.
UserSetLoad	Command	/	Load selected user parameter set.
UserSetSave	Command	/	Save selected user parameter set.
UserSetDefault	Enum	● 0: Default ● 1: UserSet1 ● 2: UserSet2 ● 3: UserSet3	Enable default loaded user parameter set.

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Hikrobot Co., Ltd.

Tel: 400-989-7998

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

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