

Hikrobot Co., Ltd.

Line Laser 3D Camera

User Manual

HIKROBOT

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

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

Available Model

This manual is applicable to the line laser 3D camera.

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Chapter 1 Safety Instruction

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

1.1 Safety Claim

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

1.2 Safety Instruction



Caution

- Do not install the device if it is found that the device and accessories are damaged, rusted, water ingress, model mismatch, missing parts, etc., when unpacking.
- Avoid storage and transportation in places such as water splashing and rain, direct sunlight, strong electric fields, strong magnetic fields, and strong vibrations.
- Avoid dropping, smashing or vigorously vibrating the device and its components.
- It is forbidden to install the indoor device in an environment where it may be exposed to water or other liquids. If the device is damp, it may cause fire and electric shock hazard.
- Place the device in a place out of direct sunlight and ventilation, away from heat sources such as heaters and radiators.
- The supplied bracket in the package is only applicable for this device, and using with other equipment may cause instability and injury.
- This is a Class A device. In the living environment, this device may cause radio interference. In this case, the user may be required to take practical measures against the interference.
- In the use of the device, you must be in strict compliance with the electrical safety regulations of the nation and region.
- Do not connect multiple devices to the same power adapter. Exceeding the adapter load may cause a fire due to excessive heat generation.

- Use the power adapter provided by the official manufacturer. The power adapter must meet the Limited Power Source (LPS) requirements. For specific requirements, please refer to the device's technical specifications.
- Do not cover the device's plug or outlet for disconnecting power supply.
- It is strictly forbidden to wire, maintain, and disassemble the device that is powered on. Otherwise there is a danger of electric shock and a damage to device.
- Make sure that the device is installed in good condition, the wiring is firm, and the power supply meets the requirements before powering on the device.
- For a device with a power switch, please use the switch to power on and off. It is strictly forbidden to plug and unplug the power cord.
- If the device emits smoke, odor or noise, please turn off the power and unplug the power cord immediately, and contact the dealer or service center in time.
- It is strictly forbidden to touch any terminal of the device when operating it. Otherwise there is a danger of electric shock.
- It is strictly forbidden for non-professional technicians to detect signals during device operation, otherwise it may cause personal injury or device damage.
- It is strictly forbidden to maintain the device is powered on, otherwise there is a danger of electric shock.
- In order to ensure the stability of the depth data, avoid enabling the depth data measurement function of the device immediately after the installation. It is recommended to start the measurement at least one hour after the electric current is taken on the device to ensure the uniform heat diffusion of the internal device.
- Avoid aiming the image sensor at strong light in direct mode or reflection mode, such as laser beams, otherwise the image sensor will be damaged.
- Please keep the image acquisition window clean. It is recommended to wipe it with a clean cloth that is moistened with alcohol (75% or less). When the product is not in use, dust protection is required. Damage caused by improper maintenance will not be liable for warranty.
- If the device does not work properly, please contact your dealer or the nearest service center. Never attempt to disassemble the device yourself. We shall not assume any responsibility for problems caused by unauthorized repair or maintenance.
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

Note

- Check whether the device's package is in good condition, whether there is damage, intrusion, moisture, deformation, etc. before unpacking.
- Check the surface of the device and accessories for damage, rust, bumps, etc. when unpacking.
- Check whether the quantity and information of the device and accessories are complete after unpacking.
- Store and transport the device according to the storage and transport conditions of the device, and the storage temperature and humidity should meet the requirements.
- It is strictly prohibited to transport the device in combination with items that may affect or damage the device.

- Quality requirements for installation and maintenance personnel:
 - Qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills.
 - The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
 - The ability to comprehend the contents of this manual.
- Please read the manual and safety instructions carefully before installing the device.
- Please install the device strictly according to the installation method in this manual.
- Do not contact the device with strong acids, alkalis, oils, greases or organic solutions such as thinners.
- To prevent injury, the device must be securely fastened to the profile.
- Do not expose the device directly to flashlights, high-frequency switch lighting devices, or to sunlight, which may affect the performance.

1.3 Electromagnetic Interference Prevention

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

maintain good conductivity.

- Use a shielded network cable to connect to the device. If you use a self-made network cable, make sure that the shielding shell at the aviation head is well connected to the aluminum foil or metal braid of the shielding cable.

1.4 Laser Precaution

The device complies with IEC60825.1:2014 and GB7247.1:2012, and belongs to Laser 3B.

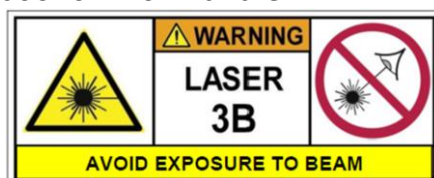


Figure 1-1 Laser Label

! Caution

- Do not look directly at the laser beam, and if necessary, adjust the direction of direct eye gaze or close your eyes for protection.
- Do not use optical instruments (such as telescopes, magnifier) to observe the laser beam.
- Do not place optical instruments (such as mirrors) within the irradiation range of the laser beam.
- The laser radiation emitted from the device can cause eye injuries, burning of skin or inflammable substances.
- Wear the laser safety goggles within the operation range of the device. Do not look directly at the laser beam, even if wearing the laser safety goggles.
- Avoid shining the laser on highly reflective materials. If it is unavoidable, the angle of the reflective material should be adjusted to prevent damage caused by laser reflection.
- Turn off the laser when the device is not in use.
- Please use this device correctly and safely in accordance with the contents of this manual and the local standards and laws and regulations. Otherwise the operator may be exposed to the risk of injury, electric shock, or radiation from the laser.

The laser-related parameters are shown below.

Table 1-1 Laser Parameters

Device Model		MV-DL2125-04H-R	MV-DL2125-04P-R	MV-DL2126-04H-R	MV-DL2126-04P-R
Parameter					
Laser Safety Class		Class 3B	Class 3B	Class 3B	Class 3B
Wavelength		808 ± 10 nm	808 ± 10 nm	808 ± 10 nm	808 ± 10 nm
Beam Divergence Angle		1.308 rad	1.308 rad	1.745 rad	1.745 rad
Pulse Width	Short Period	1 μs	1 μs	1 μs	1 μs
	Long Period	10 μs to 1000000 μs	10 μs to 1000000 μs	10 μs to 1000000 μs	10 μs to 1000000 μs

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Repetitive Frequency	Short Period	500 kHz	500 kHz	500 kHz	500 kHz
	Long Period	1 Hz to 100 kHz	1 Hz to 100 kHz	1 Hz to 100 kHz	1 Hz to 100 kHz
Max. Power		650 mW	1500 mW	650 mW	1500 mW
Nominal Ocular Hazard Distance (NOHD)		5000 mm	5000 mm	5000 mm	5000 mm

Chapter 2 Overview

2.1 Introduction

With built-in image process algorithm of wide dynamic range and high-accuracy measurement algorithm, the line laser 3D camera can output accurate results of volume measurement in real-time without occupying PC resources. It adopts high-power laser module and image process technology to achieve accurate measurement and high efficiency. It is applicable to volume measurement and positioning applications in logistics and warehouse.

2.2 Key Feature

- Adopts wide dynamic range algorithm to accurately measure materials of high-absorbance or high-reflection.
- Adopts image process algorithm with strong scenario adaptability.
- Detection speed up to 3 m/s and accuracy of 5 mm.
- Adopts high-power laser module with wide dynamic range.
- Adopts narrow band pass filter to suppress the interference.
- Stable performance with simultaneous exposure and laser.
- Supports outputting data type of length/width/height, integral volume, point cloud data, and location coordinates.

Note

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

Chapter 3 Appearance

Note

Appearance here is for reference only. Refer to the device's specification for detailed dimension information.

There are three kinds of device appearance currently:

- The type I device is applicable to MV-DL1617-04L and MV-DL2040-04B-H.
- The type II device is applicable to MV-DL2025-04H-H, MV-DL2125-04H-H, and MV-DL2125-04H-R, and MV-DL2125-04P-R.
- The type III device is applicable to MV-DL2126-04H-R and MV-DL2126-04P-R.

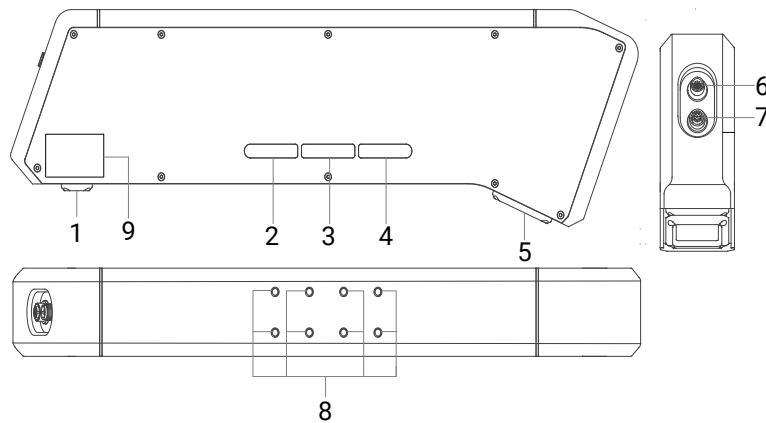


Figure 3-1 Appearance (Type I)

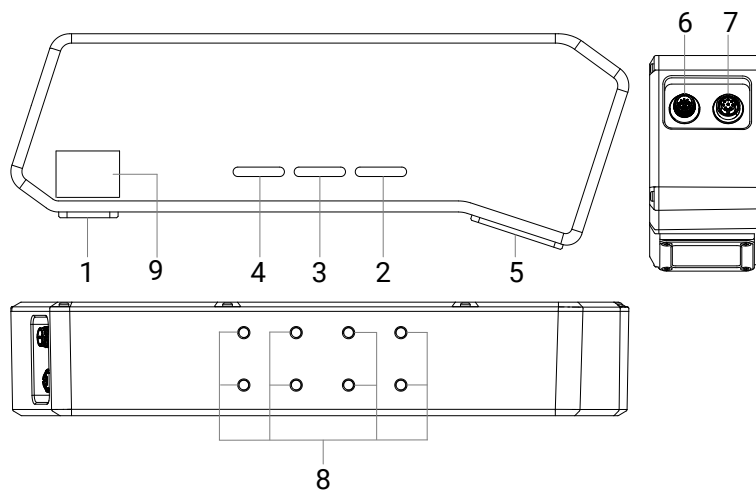


Figure 3-2 Appearance (Type II)

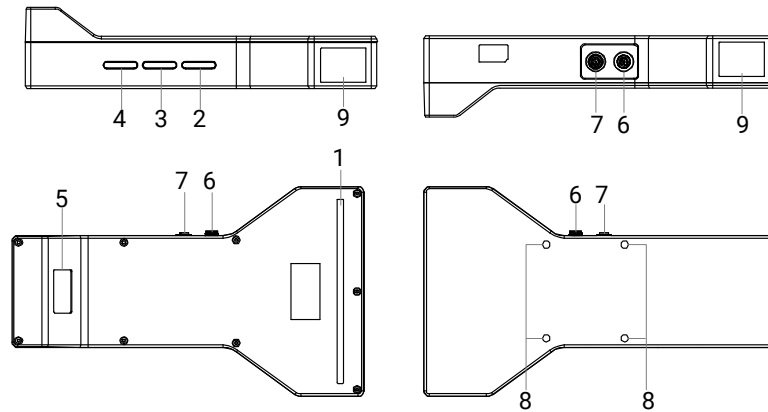


Figure 3-3 Appearance (Type III)

Table 3-1 Component Description

No.	Name	Description
1	Laser	It sends out laser to object surface.
2	Laser Indicator	It shows laser status. When the indicator works normally, the indicator is solid green.
3	Device Status Indicator	It shows device status. When the device system works normally, the indicator is solid yellow.
4	Power Indicator	It shows power supply status. When the power supply is normal, the indicator is solid blue.
5	Camera Lens	It acquires laser contour lines of the surface of the measured object.
6	Power and I/O Interface	It provides power, I/O and serial port function. For different models of device, it has 5-pin M12 interface, or 12-pin M12 interface. The interface is designed with threads to tighten connection between the device and cable.
7	Gigabit Ethernet Interface	It is a RJ45 gigabit Ethernet interface with aviation connector. The interface is designed with threads to tighten connection between the device and cable.
8	Screw Hole	There are several screw holes on top of the device that are used to fix the device to the mounting plate. It is recommended to use the supplied hex socket screws during installation. If other screws are used, the flat head screws are recommended, and the length of screws should be shorter than the total length of mounting plate thickness and screw hole depth.
9	Laser Label	It shows laser information. The black triangle on the label

		indicates the position of the laser emission window.
--	--	--

Note

When you install the device, it is recommended to use a mounting plate for installation, which can fix the device and avoid loosening during the use of the device. The mounting plate is already included in the package.

Chapter 4 Interface Description

Two types of power and I/O interface are available: 5-pin M12 interface and 12-pin M12 interface. Among them, the 12-pin M12 interface has two types of definitions. Relation between different power and I/O interfaces and device models is shown below.

Table 4-1 Device Interface

Power and I/O Interface	Device Model
5-Pin Interface	MV-DL1617-04L
First Type of 12-Pin Interface	MV-DL2040-04B-H
Second Type of 12-Pin Interface	MV-DL2025-04H-H, MV-DL2125-04H-H, MV-DL2125-04H-R, MV-DL2125-04P-R, MV-DL2126-04H-R, MV-DL2126-04P-R

4.1 5-Pin Interface

Read the following section to get definitions of 5-pin M12 interface.

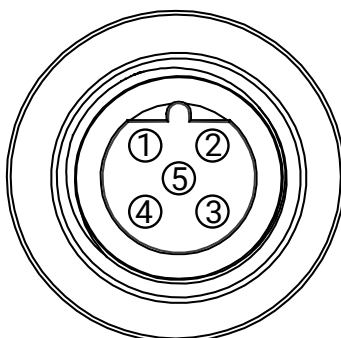


Figure 4-1 5-Pin M12 Interface

Table 4-2 Pin Definitions

No.	Signal	I/O Signal Source	Description
1	--	--	--
2	OPTO_GND	Line 0-	Opto-isolated signal ground
3	OPTO_IN0	Line 0+	Opto-isolated input
4	GND	--	Device power supply ground
5	Power	--	Device power supply

Note

You should refer to the table above and the label attached to the power and I/O cable to wire the device.

4.2 12-Pin Interface

There are 2 types of 12-pin interface. They have the same M12 interface, but their specific pin definitions are different. Read the following section to get definitions.

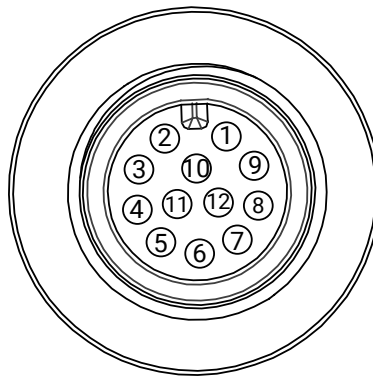


Figure 4-2 12-Pin M12 Interface

First Type of 12-Pin Interface

The definition of first type of 12-pin interface is shown below.

Table 4-3 Pin Definitions (First Type of 12-Pin Interface)

No.	Signal	I/O Signal Source	Description
1	Power	--	Device power supply
2	GND	--	Device power supply ground
3	OPTO_OUT0	Line 1+	Opto-isolated output
4	OUT_COM	Line 1-	Opto-isolated output ground
5	OPTO_IN0	Line 0+	Opto-isolated input
6	IN_COM	Line 0-	Opto-isolated input ground
7	--	--	--
8	--	--	--
9	--	--	--
10	--	--	--

No.	Signal	I/O Signal Source	Description
11	RS232_RXD	--	RS-232 receive
12	RS232_TXD	--	RS-232 transmit

Note

You should refer to the table above and the label attached to the power and I/O cable to wire the device.

Second Type of 12-Pin Interface

The definition of second type of 12-pin interface is shown below.

Table 4-4 Pin Definitions (Second Type of 12-Pin Interface)

No.	Signal	I/O Signal Source	Description
1	DC-PWR	--	Direct current power supply positive
2	GND	--	Device power supply ground
3	OPTO_OUT0	Line 1 Signal Line	I/O isolated output 1
4	OPTO_OUT1	Line 4 Signal Line	I/O isolated output 4
5	OPTO_OUT2	Line 7 Signal Line	I/O isolated output 7
6	OUT_COM	Line 1/4/7 Signal Ground	Output common port
7	OPTO_IN0	Line 0 Signal Line	I/O isolated input 0
8	OPTO_IN1	Line 3 Signal Line	I/O isolated input 3
9	OPTO_IN2	Line 6 Signal Line	I/O isolated input 6
10	IN_COM	Line 0/3/6 Signal Ground	Input common port
11	RS232_R	--	RS-232 serial port input
12	RS232_T	--	RS-232 serial port output

Note

You should refer to the table above and the label attached to the power and I/O cable to wire the device.

Chapter 5 Installation

5.1 Installation Preparation

You need to prepare following accessories before installation.

Table 5-1 Accessories

No.	Name	Quantity	Description
1	Power Supply	1	It refers to the supplied switch power supply and its cables, which are included in the package.
2	Power and I/O cable	1	It refers to the supplied 7 m 5-pin or 12-pin power and I/O cable. The interface type is M12 to open. It is included in the package.
3	Network Cable	1	It refers to the supplied 7 m network cable, and its interface is M12 to RJ connector. It is included in the package.
4	Incremental Encoder	1	It is recommended to use incremental encoder of Kubler, and the model is 8.KIS40.1342.1024. You need to purchase separately.
5	Calibration Board	1	It is used to calibrate the device.
6	Mounting Plate	1	It is used to fix the device to an installation position. It is included in the package.
7	Screws	Several	It refers to the M6 × L8 or M6 × L9 screws. They are included in the package.  Note The specific screws and quantity may differ by device models.
8	Infrared Supplement Light	1	It is used to provide light during device calibration. It is recommended to use 808 nm / 850 nm infrared supplement light, and the model is MV-LB-102-102-00IRL. You need to purchase separately.

Note

- Before any installation or maintenance work, please disconnect the power supply from the utility, and ensure that it will not be reconnected inadvertently.

- Do not install the power supply in places with high moisture or near the water.
 - Do not install the power supply in places with high ambient temperature or near fire source.
 - Please install the exposed high-voltage terminals on the power supply in a closed chassis or cabinet to prevent accidental contact.
 - Keep enough insulation distance between mounting screws and internal components of power supply.
 - Fans and ventilation holes must be kept free from any obstructions. Also a 10 cm to 15 cm clearance should be kept when the adjacent device is a heat source.
 - The power supply must be grounded as required.
 - Output current and output power must not exceed the rated values on specifications.
 - Non-standard mounting or operating under high ambient temperature may increase the internal component temperature and will decrease the output power.
 - All failure should be examined by a qualified technician. Do not remove the case of the power supply by yourself.
 - Do not touch the power terminal for 5 minutes after the power is turned off, that may cause electric shock.
-

5.2 Install Device

Before You Start

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

Note

The images below are for reference only. Refer to the actual device you purchased.

Steps

1. Use countersunk screws to fix the mounting plate to the rear of the device, and use the T-head bolts to fix the mounting plate to a gantry.

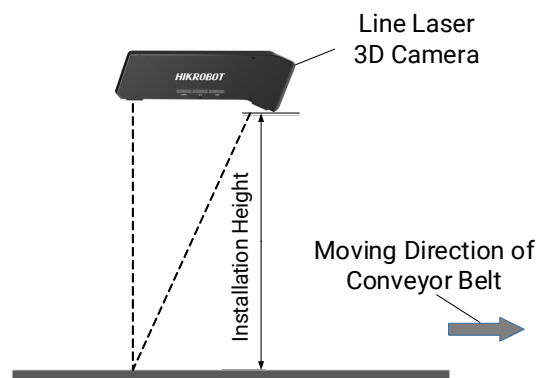


Figure 5-1 Installation Direction

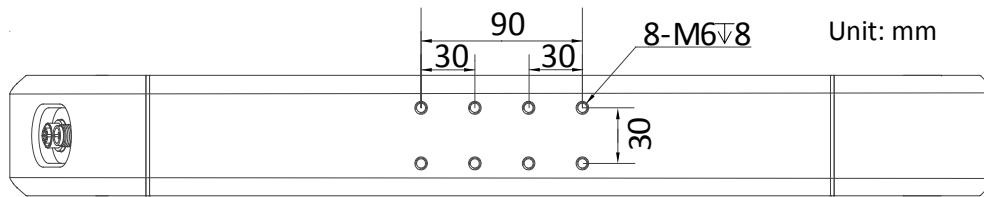


Figure 5-2 Screw Holes (Type I and Type II Devices)

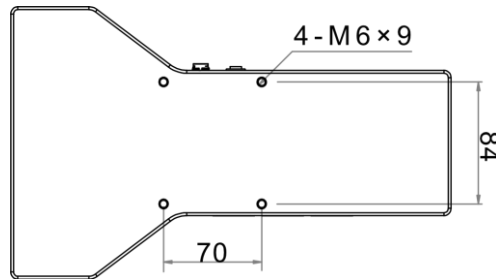


Figure 5-3 Screw Holes (Type III Device)

Note

- The screw holes may differ by device models. Refer to the images above for reference.
- The installation height of the device should be equal to the device's clearance distance plus measurement range.
- The installation height may differ by device models. Refer to the device's specification for details.

2. Make sure that the camera is installed in a right direction. The laser should face front and camera lens face back. When the conveyor belt moves from left to right, the laser should be in the left, and the camera should be in the right.

Note

- The device should be installed at the middle of the conveyor belt.
 - The installation should be firm and avoid vibration. Otherwise, the measurement accuracy will be affected.
-



Figure 5-4 Installation Diagram

Chapter 6 Device Connection

Camera connection to the client software is required for camera's configuration and remote operations. This section introduces how to install the client software, set PC and camera network, connect the camera to the client software, etc.

6.1 Install Client Software

3DMVS is a client software for camera configuration and remote operations.

Steps

Note

- The client software is compatible with 32/64-bit Windows 7/10 and 64-bit Windows 11.
 - You can get the client software installation package from <https://en.hikrobotics.com/>.
 - The graphic user interface may differ by different versions of client software you use.
-

1. Double click the installation package to start installing the client software.
2. Select the language.
3. Read and check **Terms of the License Agreement**.
4. Click **Start Setup**.
5. Select installation directory and click **Next**.

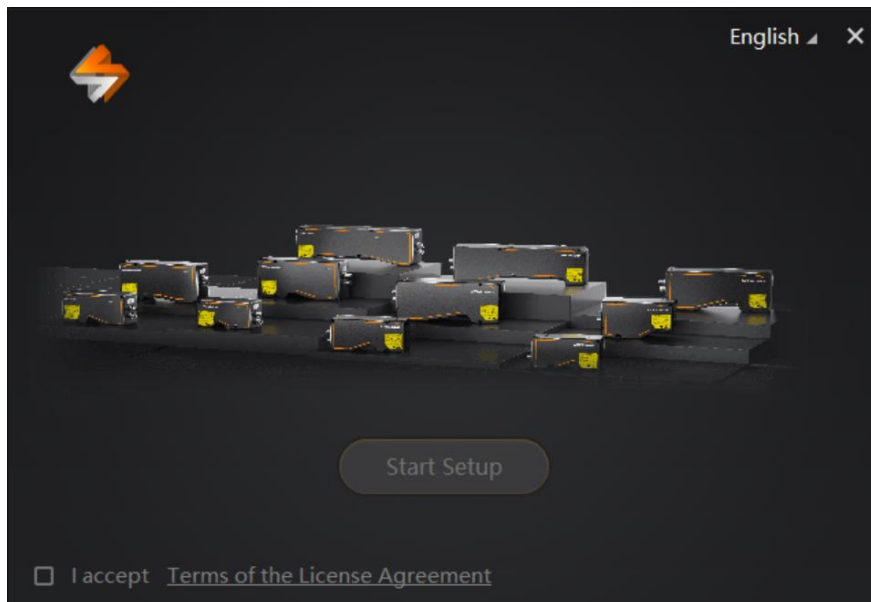


Figure 6-1 Installation Interface

6. Finish the installation according to the interface prompts.

6.2 Turn off Firewall

To ensure stable client running and image transmission, you are recommended turning off Windows firewall before using the client software.

Steps

Note

For different Windows versions, the path name or interface may differ. Please refer to the actual condition.

1. Go to Windows Firewall.

Windows 7 system: Click **Start** → **Control Panel** → **Windows Firewall**.

Windows 10 system: Click **Start** → **Control Panel** → **System and Security** → **Windows Defender Firewall** → **Firewall & network protection**.

Windows 11 system: Click **Start** → **Settings** → **Privacy & security** → **Windows Security** → **Firewall & network protection**.

2. For Windows 7 and 10 system, click **Turn Windows Defender Firewall on or off** on the left. For Windows 11, select the network and turn off in **Microsoft Defender Firewall**.

3. Select **Turn off Windows Defender Firewall (not recommended)**.

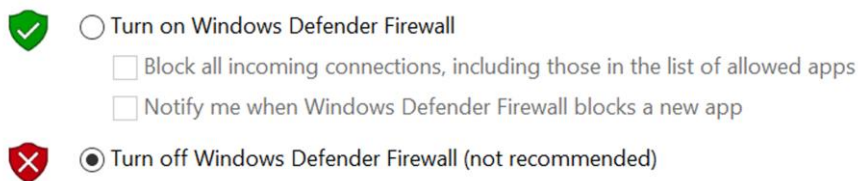


Figure 6-2 Windows Defender Firewall

4. Click **OK**.

6.3 Set PC Network

To ensure stable image transmission and normal communication between the PC and the camera via client software, you need to set the PC network before using the client software.

Steps

Note

For different Windows versions, the path name or interface may differ. Please refer to the actual condition.

1. Go to PC network settings page: **Start** → **Control Panel** → **Network and Internet** → **Network and Sharing Center** → **Change adapter settings**.

2. Select NIC and set the IP obtainment mode.

- Select **Obtain an IP address automatically** to get an IP address of the PC automatically.
- Select **Use the following IP address** to set an IP address for the PC manually.

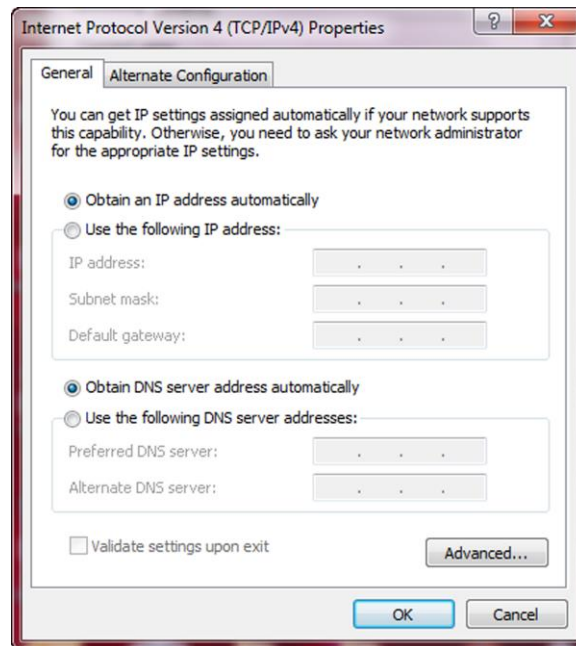


Figure 6-3 Set PC Network

3. Set NIC property.

- 1) Go to NIC settings page: **Control Panel** → **Hardware and Sound** → **Device Manager** → **Network Adapter**.
- 2) Select corresponding network interface card, and click **Advanced**.
- 3) Set **Jumbo Packet** value to 9014 Bytes.

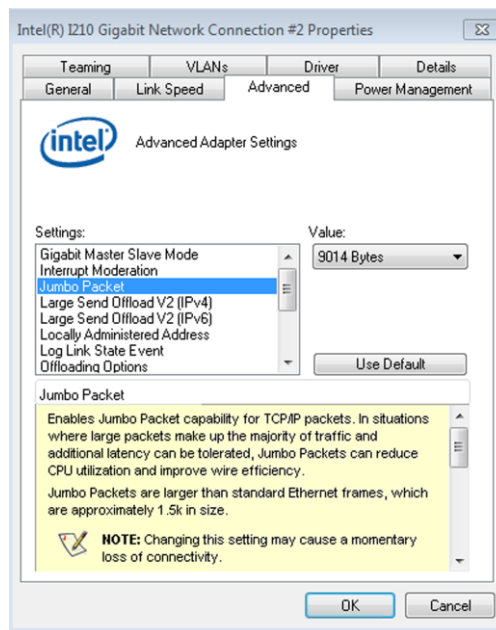


Figure 6-4 NIC Properties Advanced Settings

6.4 Set Device Network

You can set and operate the camera in the client software only when the camera is in the same network segment with the PC where the client software is installed.

Steps

1. Double click the client software to run it, and the **Device List** window will pop up.
2. Click **Edit** to open the **Edit IP Address** window.

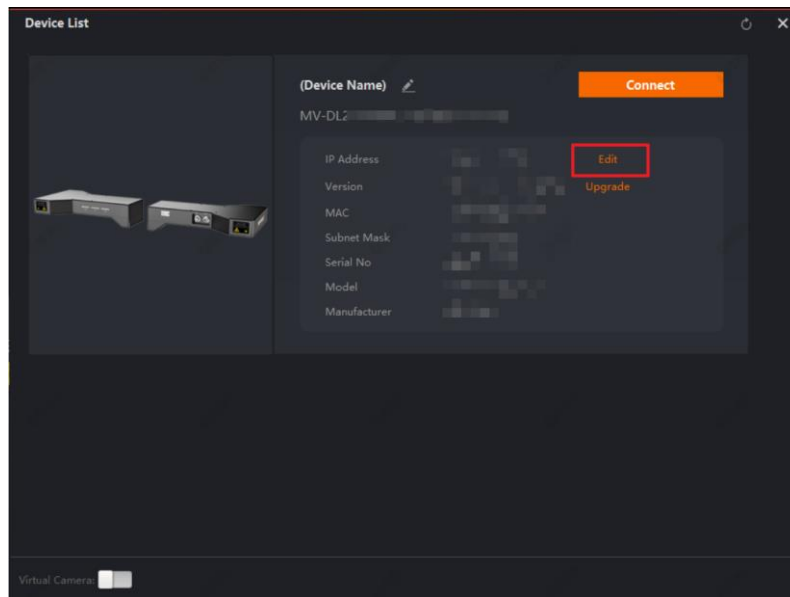


Figure 6-5 Device List

3. Set the IP address of the camera in the same network segment with the PC.

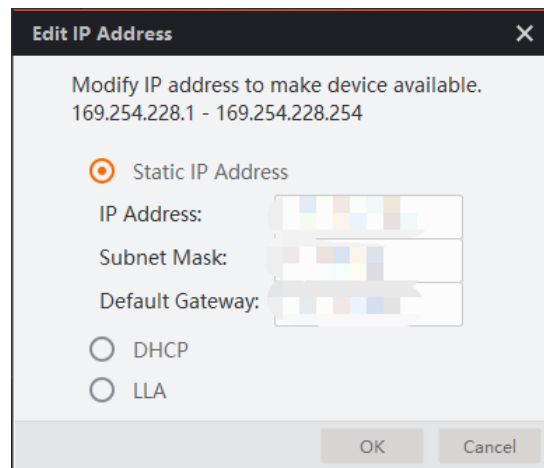


Figure 6-6 Edit IP Address

Note

It is recommended to set the IP address as the static IP for device's stable operating.

6.5 Connect Device to Client Software

Make sure your device IP address is in the same network segment with the PC where you installed the client software before connecting the device to it.

Open the **Device List** window, and click **Connect** to connect the device to the client.

Chapter 7 Quick Started with 3DMVS

This section introduces the layout of the client software, and basic operations about camera in the client software.

7.1 Client Software Layout

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

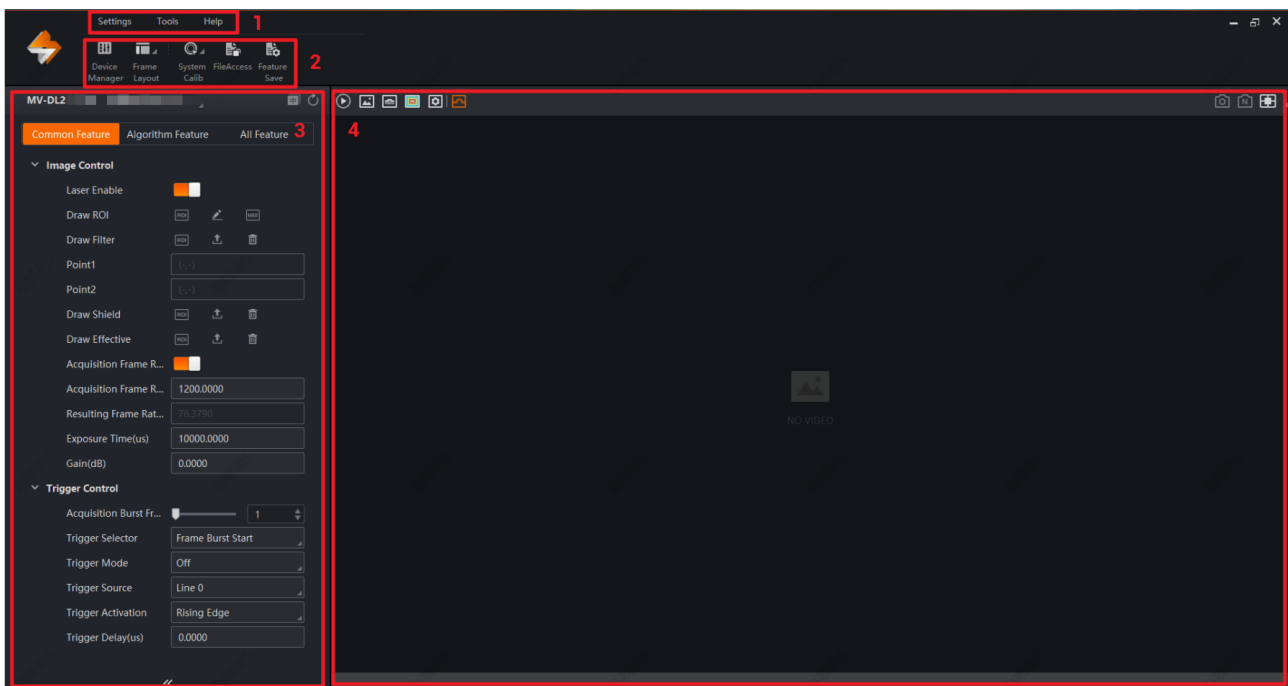


Figure 7-1 Main Window

Note

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

Table 7-1 Main Window Description

No.	Name	Description
1	Menu Bar	The menu bar displays function modules, including Settings , Tools , and Help .
2	Control Toolbar	The control toolbar provides quick operations for the device.
3	Settings Area	You can view and set device-related parameters.
4	Live View Area	This area displays device's images, and you can switch image

No.	Name	Description
		mode, capture images, etc.

Note

For specific attributes, please refer to the actual device you got.

Table 7-2 Device Attribute Description

Attribute	Description
Device Control	You can view device information, edit its name, and reset the device.
Image Format Control	You can view and set device's resolution, pixel format, test pattern, etc.
Acquisition Control	You can view and set the device's acquisition mode, frame rate, exposure time, etc.
Analog Control	You can view and set device's gain, etc.
Digital IO Control	You can set the different input and output signals.
Counter And Timer Control	You can set frequency division of the external trigger signal.
Debug	You can enable the debug port of the device.
Device Log Control	You can save device logs to local or transmit them remotely.
Event Control	You can set event control related parameters to let the device generate an event and transmit the event message to the computer.
Chunk Data Control	You can enable Chunk data function and set its content.
Laser Stripe Control	You can set laser-related parameters.
LSL Range Image Control	You can set depth image related parameters.
3D Volume Control	You can set volume measurement related parameters.
TCP Transport Control	You can transmit detected object information such as length, width, height, volume via TCP.
Transport Layer Control	You can set the parameters of transport layer.
User Set Control	You can save or load the device's parameters, and set the default parameter when running the client.

7.2 Basic Operation with Client Software

After installing the client software, you need to calibrate system first, draw filter region and Region of Interest (ROI). After that, if volume measurement results can be obtained, you need to calibrate the volume, and copy the measure file to the installation directory of the client software. Otherwise, you need to analyze reasons, and redo internal parameter calibration and laser plane calibration.

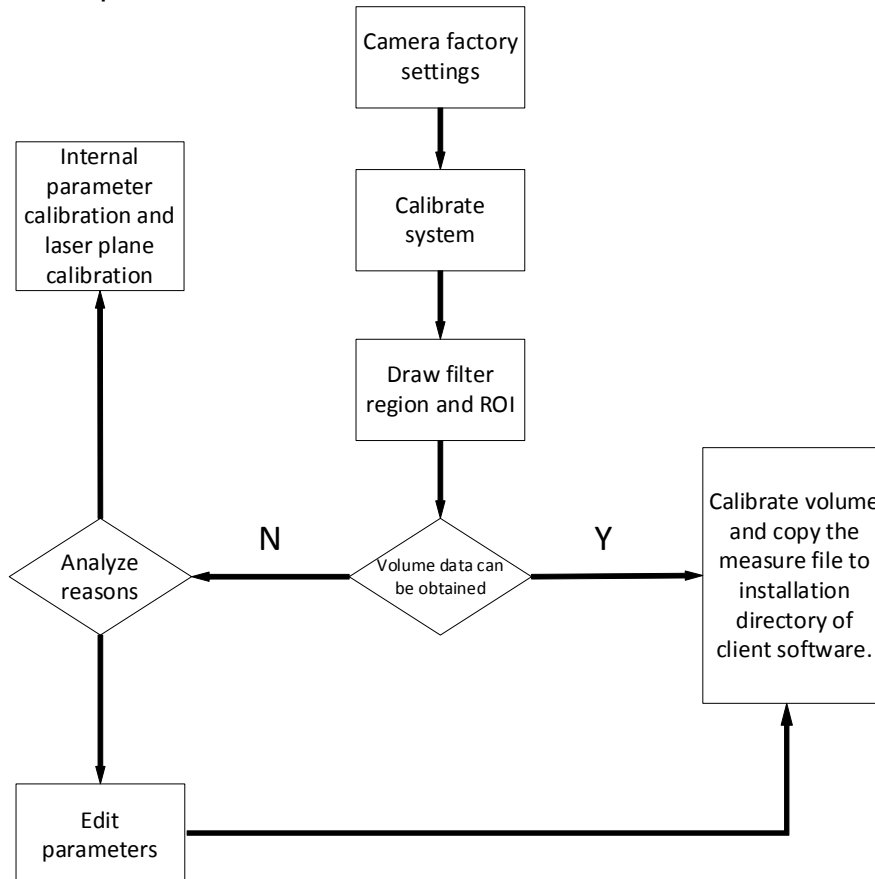


Figure 7-2 Process Flow

7.2.1 Calibrate System

Before using the device to measure volume, you should execute system calibration first. The purpose of system calibration is to transform 3D coordinates from sensor coordinates to system coordinates, and increase measurement accuracy of the device.

There are 2 types of system calibration with same effect, including calibration by calibration board and by calibration box.

Note

- Make sure you have turned off PC firewall, set PC network and device network. Otherwise, client operation and image transmission may be affected.

- Make sure the image is clear during calibration, and you can use infrared supplement light to do that. Otherwise, the calibration may be inaccurate.
 - It is recommended to calibrate and measure object after the device is powered on for about one hour due to even heat dissipation.
 - Apart from system calibration, the device also supports internal parameter calibration and laser plane calibration. These two calibrations have been done by default. You can contact the technical support to help you redo these two calibrations if necessary.
 - Recalibration is required after the device installation position is changed.
-

Calibration by Calibration Board

Steps

1. Go to **All Feature** → **Digital IO Control** → **Laser Enable**, and disable **Laser Enable**.

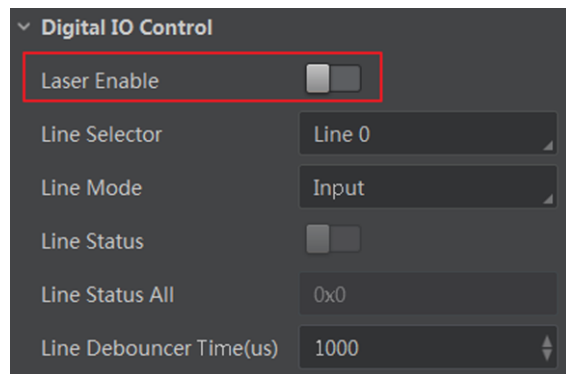


Figure 7-3 Disable Laser Enable

2. Go to **Image Format Control** → **Image Mode**, and select **Origin Image** as **Image Mode**.
3. Go to **Acquisition Control**, disable **HDR Enable**, and increase **Exposure Time** to the range between 5000 μ s and 10000 μ s
4. Click **Camera Calibration** on the navigation panel to enter the calibration page, and then select **System Calib by Calib Board**.

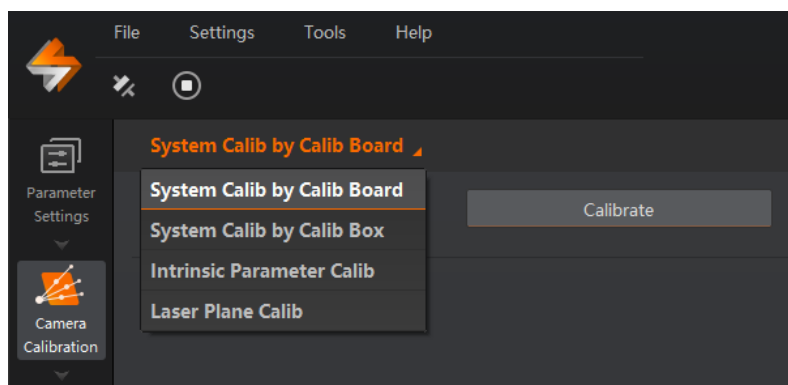


Figure 7-4 Calibration Board

5. Click **Calibrate** to open the system calibration window.

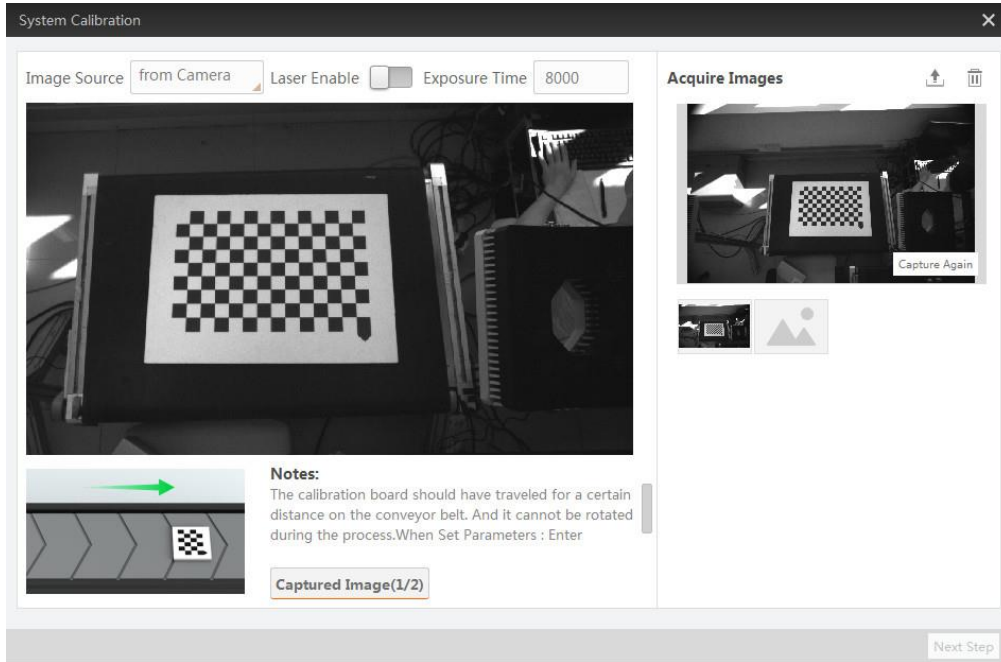


Figure 7-5 System Calibration Window

6. Select **Image Source** and then click **Capture Image** to acquire 2 images for calibration in turn.

Note

- Make sure 2 captured images are clear. Otherwise, the calibration may be inaccurate.
 - You should capture 2 images of the calibration board on different positions of the conveyor belt, and move the calibration board along the conveyor belt operation direction.
-

7. Click **Next Step** after obtaining 2 images.

8. Enter **Pattern Width**, **Pattern Height**, **Square Size** and **Mounting Height** according to the specification of the calibration board and the camera's mounting height.

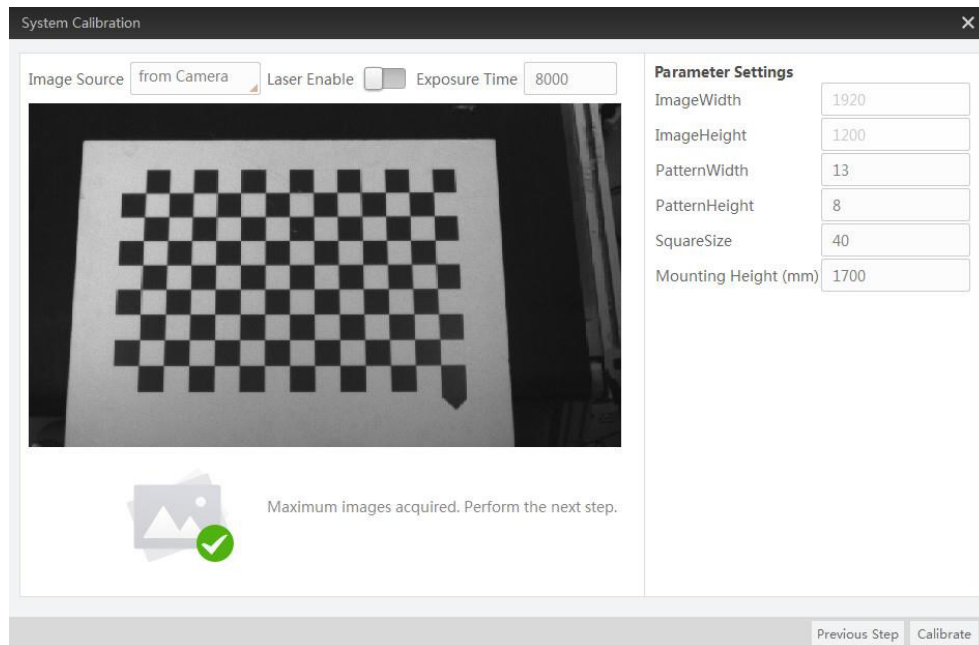


Figure 7-6 Parameter Settings

9. Click **Calibrate**. The calibration results will be written into the camera and take effect. If calibration fails, please calibrate again

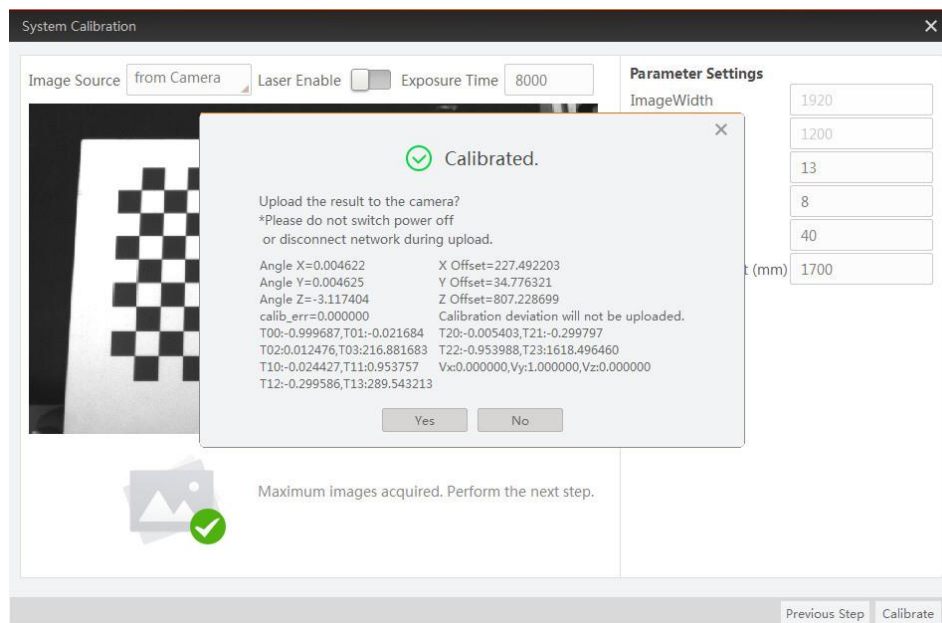


Figure 7-7 Calibration Completion

10. Click **Yes** to upload calibration result to the device.

Calibration by Calibration Box

Before You Start

- Make sure you have prepared at least 3 different boxes with known dimensions, and you cannot use the box with same length and width.
- Make sure the box's long side is paralleled with the travel direction of the conveyor belt when putting boxes on the conveyor belt.
- You should put boxes on the conveyor belt in turn, and boxes cannot be placed too close with each other.
- Make sure you have drawn the filter region and set ROI before calibration. For details, refer to section **Draw Filter Region** and section **Draw ROI**.

Steps

1. Go to **Digital IO Control** → **Laser Enable**, and enable **Laser Enable**.
2. Go to **Image Format Control** → **Image Mode**, and select **3D Point Cloud** as **Image Mode**.
3. Click **Camera Calibration** on the navigation panel to enter the calibration page, and then select **System Calib by Calib Box**.

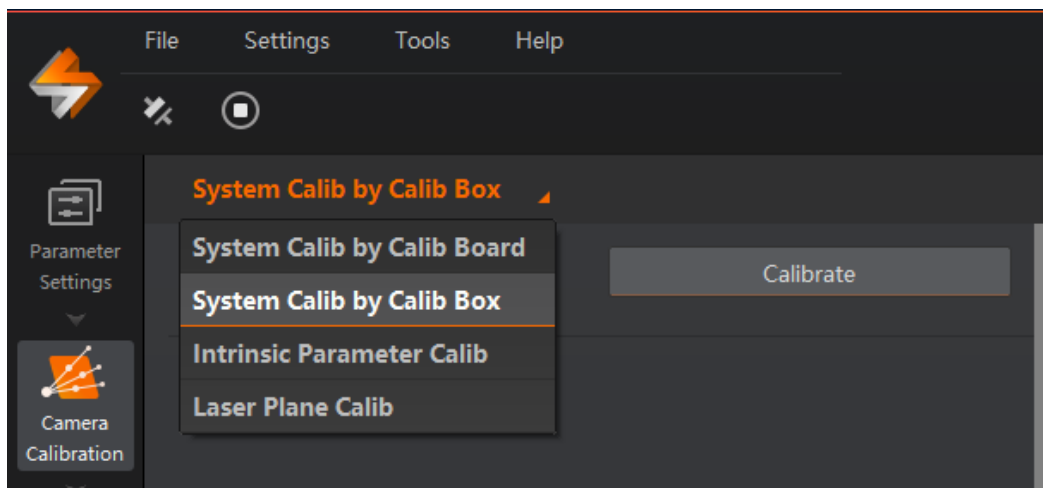


Figure 7-8 Calibration Box

4. Click **Calibrate** to enter the calibration window.
5. Enter **Mounting Height** and **Measure Error** according to actual demands.
6. Enter the length, width, height of three boxes you use.

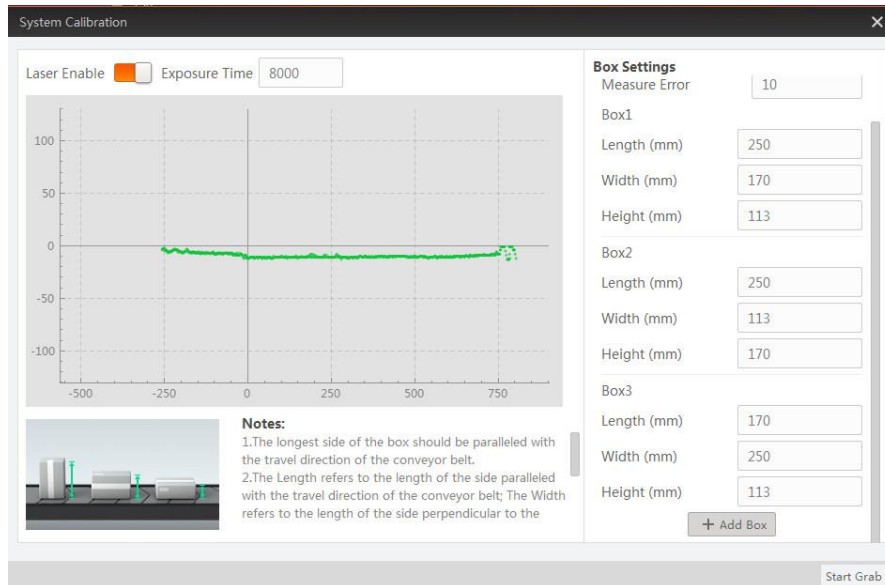


Figure 7-9 Parameter Settings

Note

- Length refers to the side paralleled with the travel direction of the conveyor belt. Width refers to the side perpendicular to the travel direction.
- The function of calibration by calibration box may differ by device models.

7. Click **Start Grab**, and put 3 boxes onto the conveyor belt in turn.

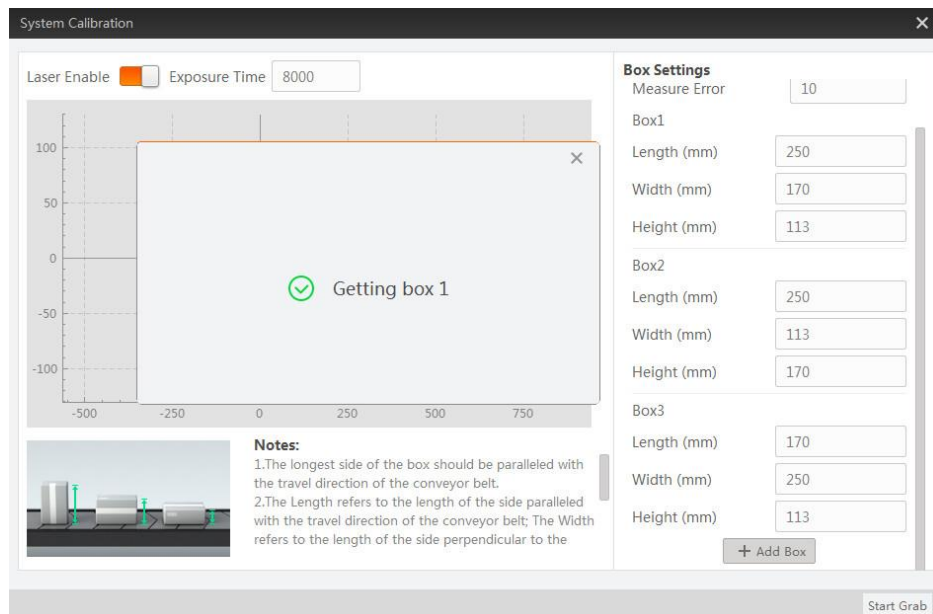


Figure 7-10 Getting Box 1

8. Box calibration will start automatically when all boxes pass through the field of view of the device. When calibration completes, the results will be displayed.

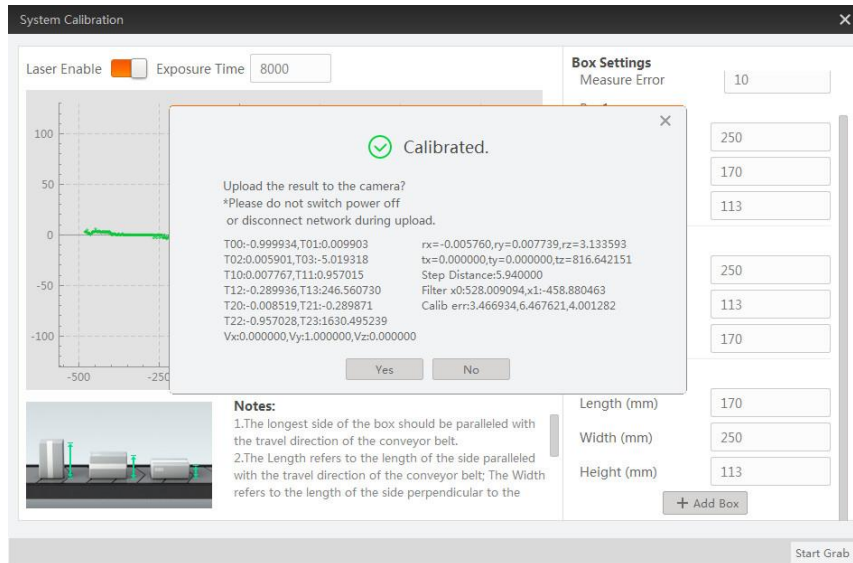


Figure 7-11 Calibration Completion

9. Click **Yes** to upload calibration result to the device.

Restore Calibration Parameters

The device has a set of default calibration parameters. When calibrations fail due to maloperation, you can click **Reset Calib Files** to restore it.

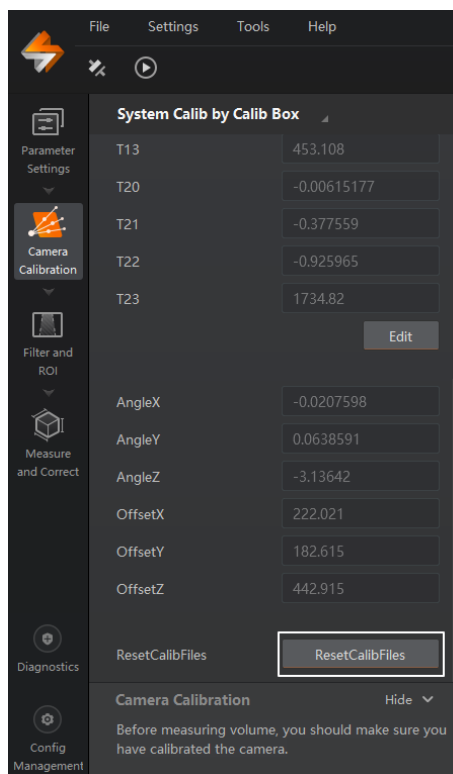


Figure 7-12 Click Reset Calib Files

7.2.2 Draw Filter Region

If there're unwanted objects which are irremovable in the measurement area, you can set a filter region to filter them.

Before You Start

System calibration should have been done for the device.

Steps

1. Go to **Digital IO Control** → **Laser Enable**, and enable **Laser Enable**.
2. Click **Filter and ROI** on the navigation panel.
3. Click  in **Draw Filter Region** to draw the filter region on images.
4. Click  to complete.

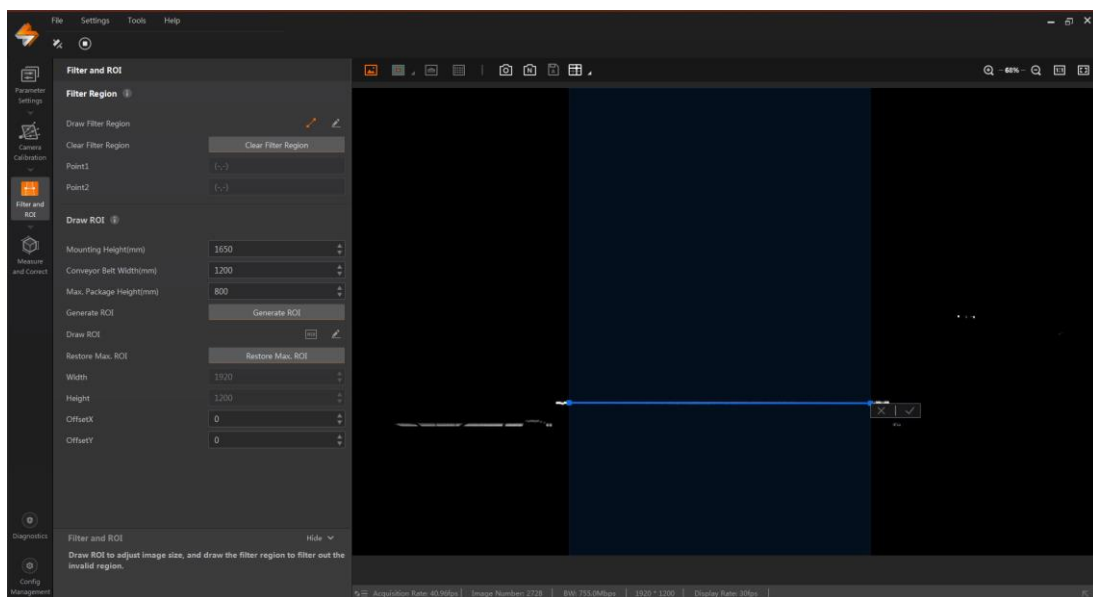


Figure 7-13 Draw Filter Region

7.2.3 Draw Shield Region

When there is light in the ROI, it may affect the measurement accuracy. You can avoid interference by setting the shielding region to eliminate the measurement error caused by the light.

Note

- If the light appears in the range of the measured object, the use of shield region function may also cause effective data to be filtered. It is recommended to use this function with caution.
 - The shield region function may differ by device models.
 - Up to 10 shield regions can be drawn, and one shield region can draw 10 sides at most.
-

Steps

1. Go to **Image Format Control** → **Image Mode**, select **Origin Image** as **Image Mode**, and start acquisition.
2. Click **Filter and ROI** on the navigation panel, and find **Shield Region**.
3. Click **Add Shield Region** to draw the shield region according to actual demands.

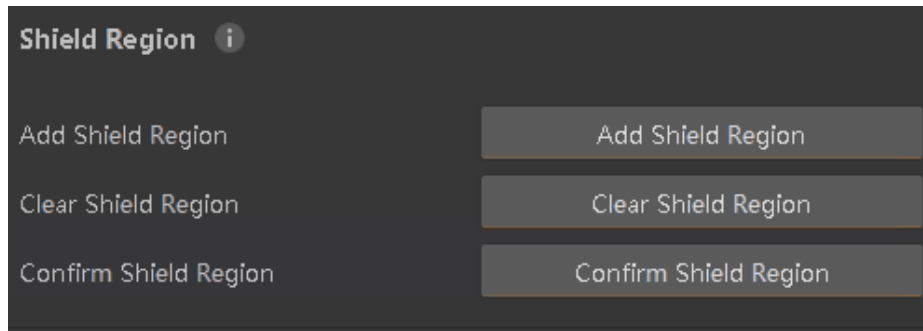


Figure 7-14 Add Shield Region

4. Click in the image to decide the starting location, drag the cursor to draw line, and double click to create closed polygon area.

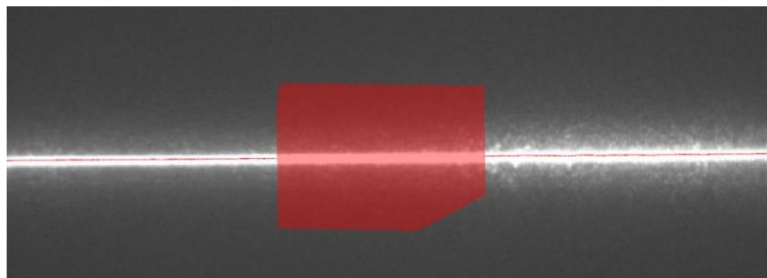


Figure 7-15 Draw Shield Area

5. Click **Confirm Shield Region** after drawing.
6. (Optional) Click **Clear Shield Region** to cancel drawing.

7.2.4 Draw Effective Region

You can draw an effective region if there is interference of light in measurement area to ensure effective data is not filtered.

Note

- The effective region function may differ by device models.
 - Up to 3 effective regions can be drawn, and one region can draw 10 sides at most.
-

Steps

1. Go to **Image Format Control** → **Image Mode**, select **Origin Image** as **Image Mode**, and start acquisition.
2. Click **Filter and ROI** on the navigation panel, and find **Effective Region**.
3. Click **Add Effective Region** to draw the effective region according to actual demands.

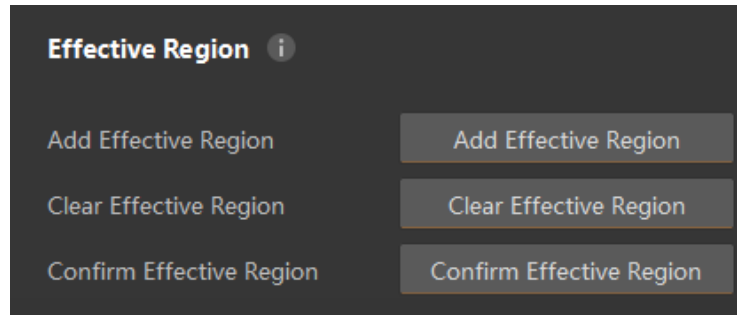


Figure 7-16 Add Effective Region

4. Click in the image to decide the starting location, drag the cursor to draw line, and double click to create closed polygon area.
5. Click **Confirm Effective Region** after drawing.
6. (Optional) Click **Clear Effective Region** to cancel drawing.

7.2.5 Draw ROI

If you are only interested in certain area of the image, you can draw ROI (Region of Interest) to do that. After ROI being drawn, the client software only acquires the image data within the ROI. This improves the acquisition efficiency, and enhances acquisition frame rate.

Before You Start

Make sure that the image mode is **Origin Image** and acquisition is started.

Steps

1. Click **Filter and ROI** on the navigation panel, and find **Draw ROI**.
2. Enter **Mounting Height**, **Conveyor Belt Width** and **Max. Package Height**, and click **Generate ROI** to generate ROI automatically. Or, click  in **Draw ROI**, and drag the cursor to draw the ROI manually.
3. Click  to complete.
4. (Optional) Click **Restore Max. ROI** to restore the ROI to the maximum size.

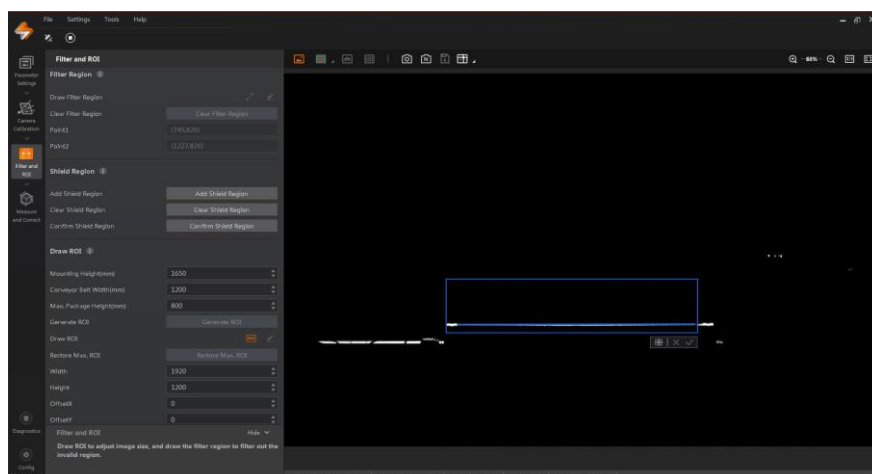


Figure 7-17 Draw ROI

7.2.6 Measure and Correct Calibration

Steps

1. Click **Measure and Correct** on the navigation panel.
2. Click **OK** to close the pop-up window, and volume measurement results will be displayed in the **Measurement Result** area.

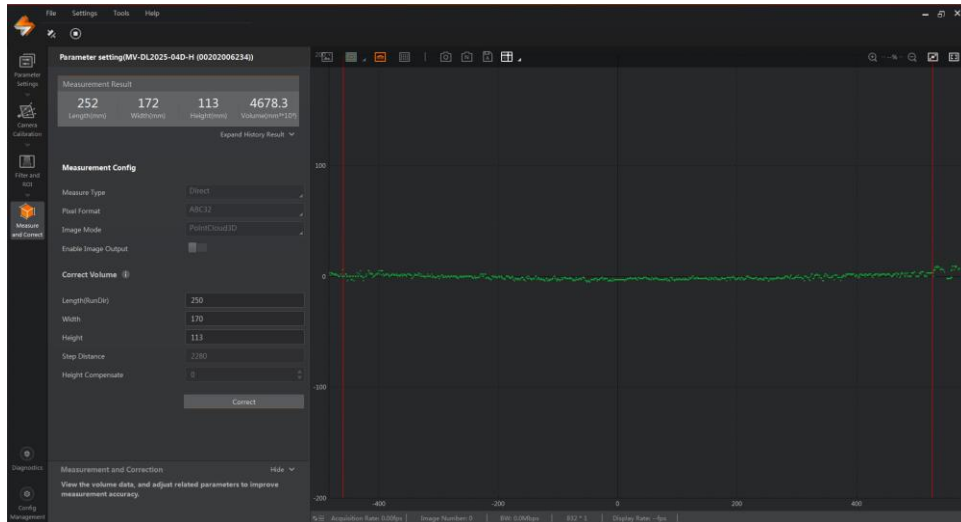


Figure 7-18 Measurement Result

3. Click **Correct**. The correct step distance and height compensate will be displayed.

Note

You need to repeat calibration until the difference between length and width is within 10 mm.

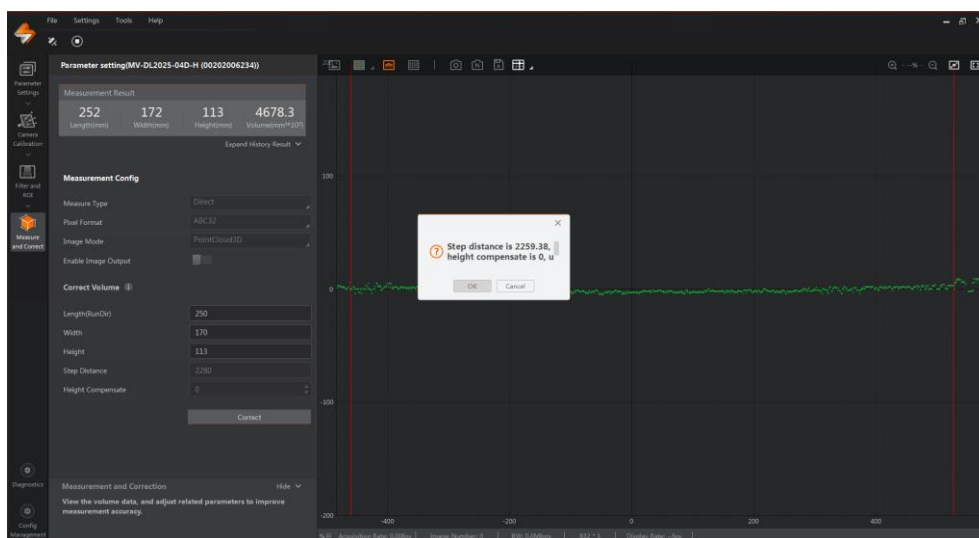


Figure 7-19 Step Distance and Height Compensate Value

4. Click **OK** to upload the calibrated step distance and height compensate value to the device.

Note

Executing measurement and calibration above is required if you use the calibration board to calibrate. If you use the calibration box, then this step can be ignored.

Chapter 8 Image Acquisition Settings

This section introduces how to set image acquisition related parameters, such as acquisition mode, trigger mode, trigger source, etc.

8.1 Set Frame Rate

Frame rate refers to the image number that is acquired by the camera per second. The higher frame rate, and shorter time used for image acquisition will be. The following 4 factors determine the camera's frame rate in real-time.

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

Steps

1. Click **Acquisition Control** → **Acquisition Frame Rate**.
2. Enter **Acquisition Frame Rate**.
3. Enable **Acquisition Frame Rate Control Enable**.
4. View the camera's final frame rate in **Resulting Frame Rate**.

Note

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

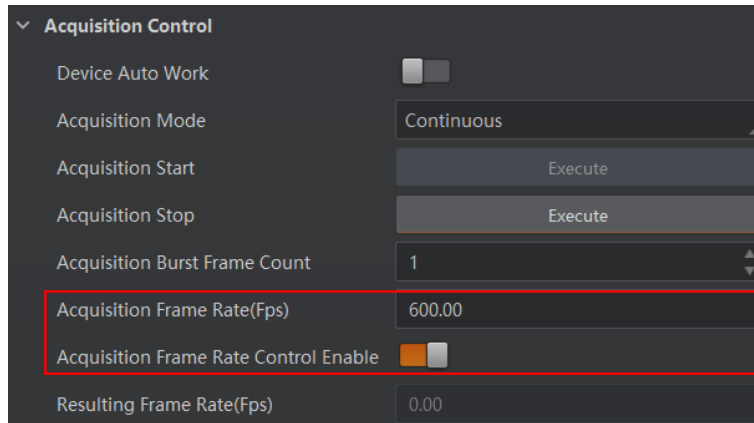


Figure 8-1 Set Frame Rate

8.2 Set Acquisition Mode

The camera supports continuous acquisition mode which means that the camera acquires images continuously, and it will not stop until you stop it manually. In this mode, the real-time frame rate decides the acquisition frame number per second.

You can click **Acquisition Control** → **Acquisition Mode**, and select **Continuous** as **Acquisition Mode**.

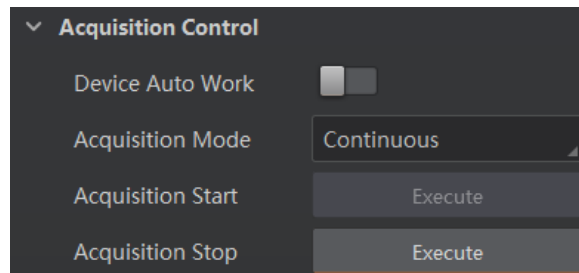


Figure 8-2 Set Acquisition Mode

8.3 Set Trigger Mode

The camera has 2 types of trigger mode, including internal trigger mode and external trigger mode.

Internal Trigger Mode

In this mode, the camera acquires images via its internal signals.

External Trigger Mode

In this mode, the camera acquires images via external signals like software signal and hardware signal. The trigger source of external trigger mode includes software trigger, hardware trigger, and counter trigger.

8.3.1 Enable Internal Trigger Mode

You can click **Acquisition Control** → **Trigger Mode**, and select **Off** as **Trigger Mode**.

Note

Off refers to the internal trigger mode.

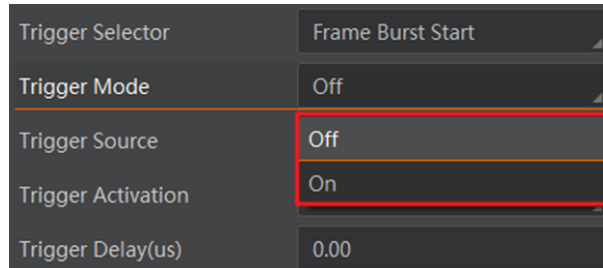


Figure 8-3 Enable Internal Trigger Mode

8.3.2 Enable External Trigger Mode

You can click **Acquisition Control** → **Trigger Mode**, and select **On** as **Trigger Mode**.

Note

On refers to the external trigger mode.

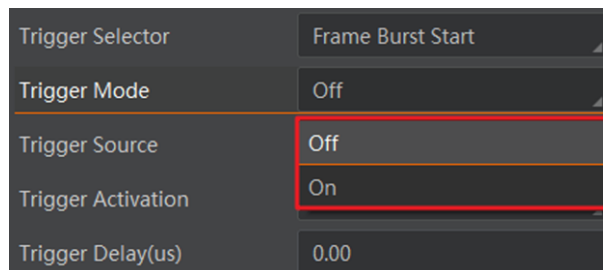


Figure 8-4 Enable External Trigger Mode

Set and Execute Software Trigger Mode

In software trigger, the software sends trigger signal to the camera via GigE interface to acquire images.

Steps

1. Click **Acquisition Control** → **Trigger Mode**.
2. Select **On** as **Trigger Mode**.
3. Select **Software** as **Trigger Source**.
4. Click **Execute** in **Trigger Source** to send trigger commands.

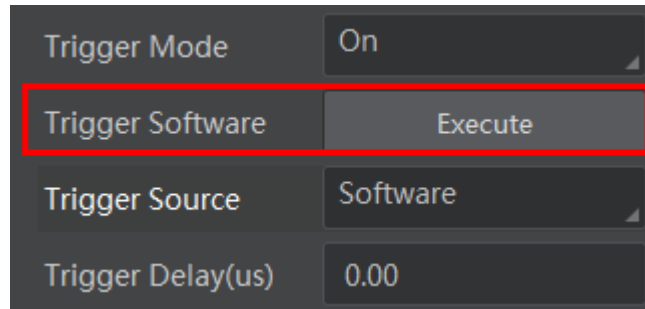


Figure 8-5 Set Software Trigger

Set and Execute Hardware Trigger Mode

In hardware trigger, external device connects with the camera via I/O interface, and sends trigger signal to the camera to acquire images.

Steps

1. Click **Acquisition Control** → **Trigger Mode**.
2. Select **On** as **Trigger Mode**.
3. Select specific lines (Line 0) as **Trigger Source** according to actual demands.
4. Set **Trigger Activation** according to actual demands.

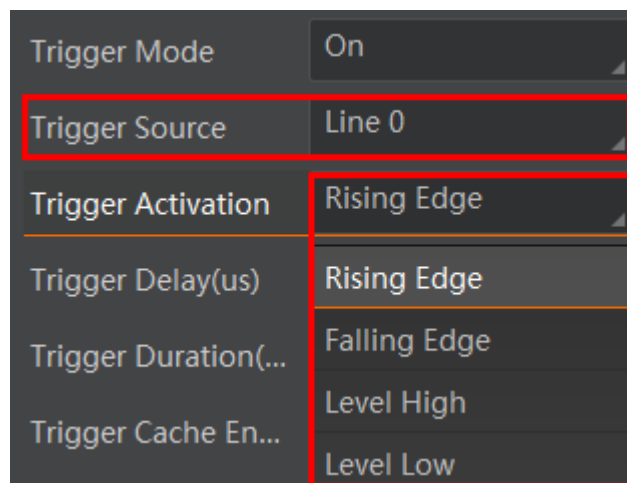


Figure 8-6 Set Hardware Trigger

Set and Execute Counter Trigger Mode

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

Steps

1. Click **Acquisition Control** → **Trigger Mode**.
2. Select **On** as **Trigger Mode**.
3. Select **Counter 0** as **Trigger Source**.

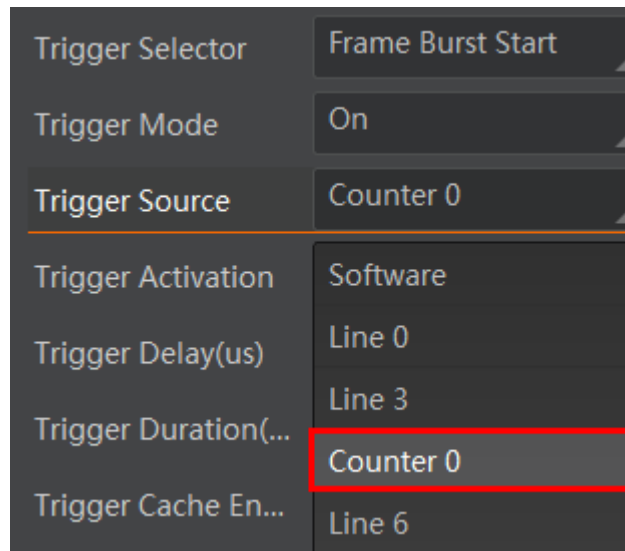


Figure 8-7 Set Counter Trigger

4. Go to **Counter and Timer Control**, and set following parameters according to actual demands.

Table 8-1 Counter and Timer Control Description

Parameter	Description
Counter Selector	It selects counter source. Counter 0 is available only at present.
Counter Event Source	It selects the signal source of counter trigger. Line 0 is available. This parameter is disabled by default.
Counter Reset Source	It selects the signal source of resetting counter. Software is available only. This parameter is disabled by default.
Counter Reset	It resets counter and it can be executed when you select Software as Counter Reset Source .
Counter Value	It is the counter value with the range of 1 to 1023.
Counter Current Value	It displays the number of executed external trigger.

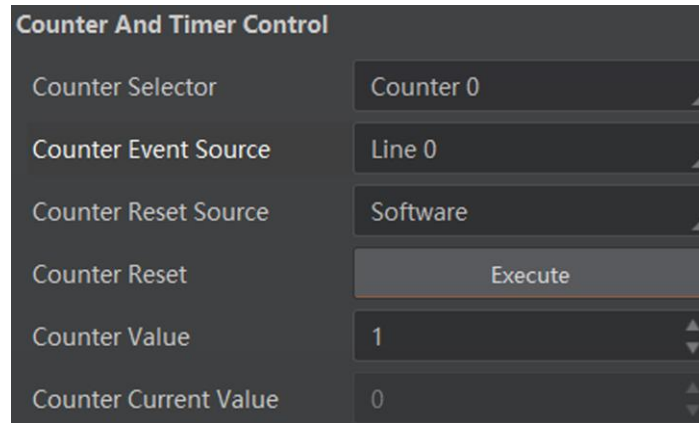


Figure 8-8 Counter and Timer Control Parameters

8.3.3 Set Related Parameters about External Trigger Mode

In external trigger mode, you can set 6 related parameters, including trigger activation, acquisition burst frame count, trigger delay, trigger duration, trigger cache enable, and trigger debouncer.

Note

Different trigger sources can set various parameters in external trigger mode. When hardware trigger or counter trigger is trigger source, you can set all 6 parameters mentioned above. When software trigger is trigger source, you can set acquisition burst frame count, trigger delay, trigger duration, and trigger cache enable.

Set Trigger Activation

The camera supports trigger acquisition in the rising edge, falling edge, level high, or level low of the external signal. Click **Acquisition Control** → **Trigger Activation**, and select **Rising Edge**, **Falling Edge**, **Level High** or **Level Low** as **Trigger Activation**.

Table 8-2 Trigger Activation Description

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

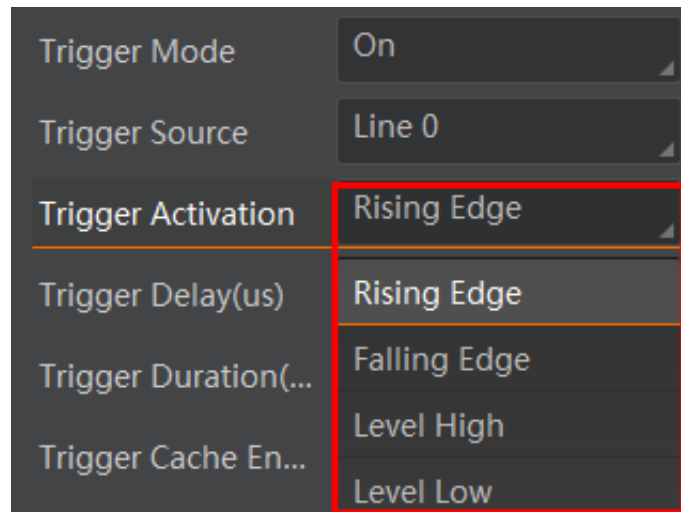


Figure 8-9 Set Trigger Activation

Set Acquisition Burst Frame Count

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

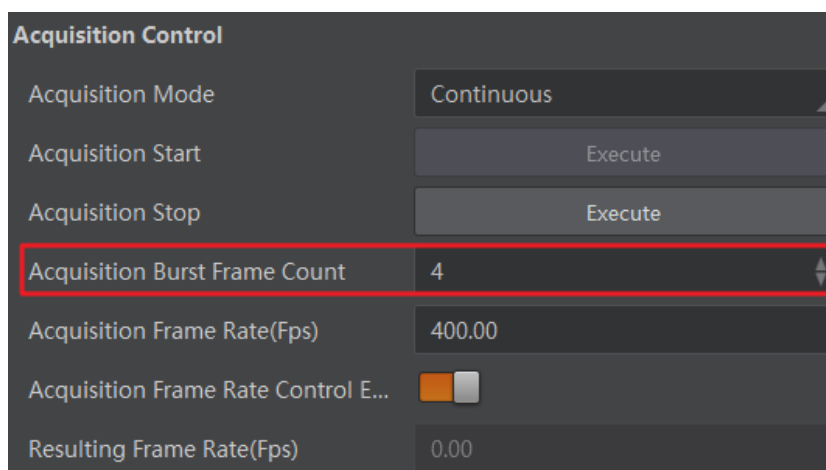


Figure 8-10 Set Acquisition Burst Frame Count

Note

- The range of **Acquisition Burst Frame Count** is from 1 to 1023.
 - When **Acquisition Burst Frame Count** is 1, the camera is in single frame trigger mode. When **Acquisition Burst Frame Count** is larger than 1, the camera is in multi-frame trigger mode.
 - If **Acquisition Burst Frame Count** is n, when input 1 trigger signal to the camera, the camera stops acquiring images after exposing n times and outputting n frame images.
-

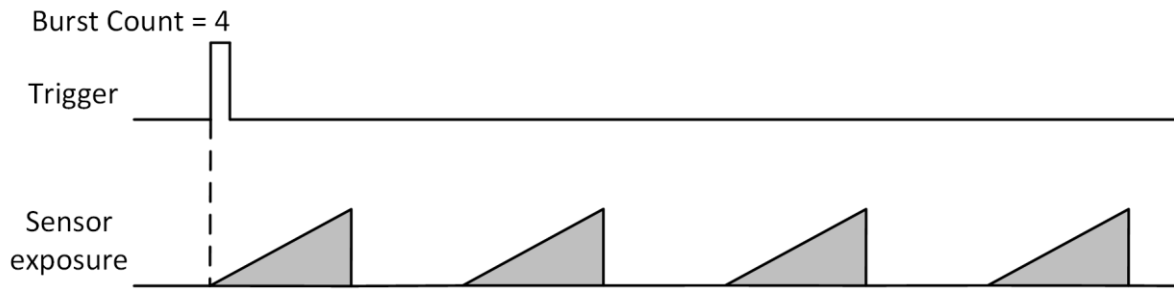


Figure 8-11 Sequence Diagram of Acquisition Burst Frame Count

Set Trigger Delay

The trigger delay function allows the camera to add a delay between the receipt of trigger signal and the moment the trigger becomes active. Click **Acquisition Control** → **Trigger Delay**, and enter **Trigger Delay**.

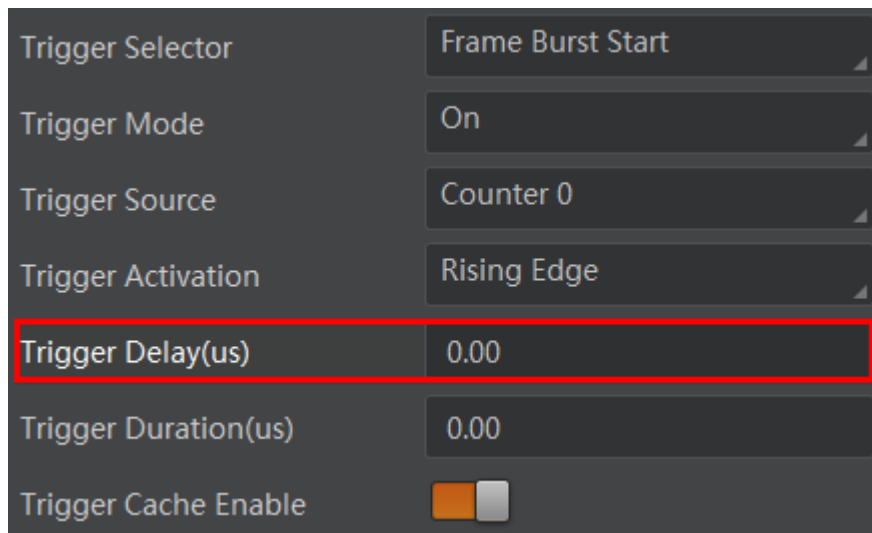


Figure 8-12 Set Trigger Delay

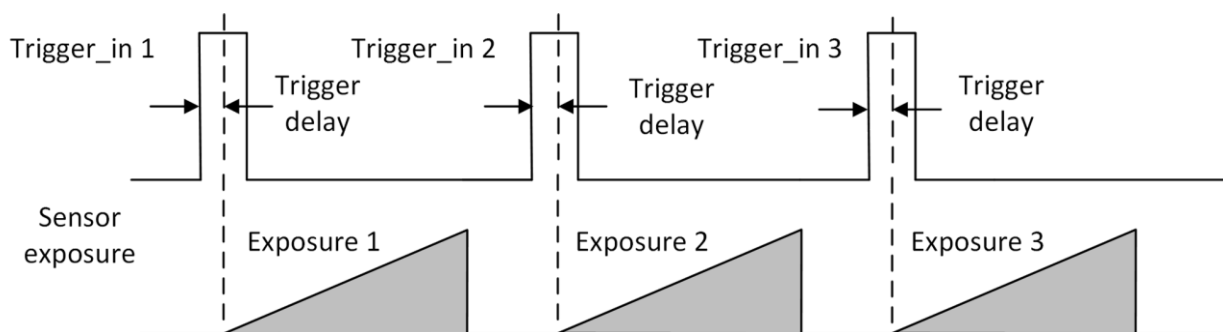


Figure 8-13 Sequence Diagram of Trigger Delay

Set Trigger Duration

Note

The trigger duration function may differ by device models.

Trigger duration allows you to set how long the trigger signal lasts. Go to **Acquisition Control** → **Trigger Duration**, and set **Trigger Duration**.

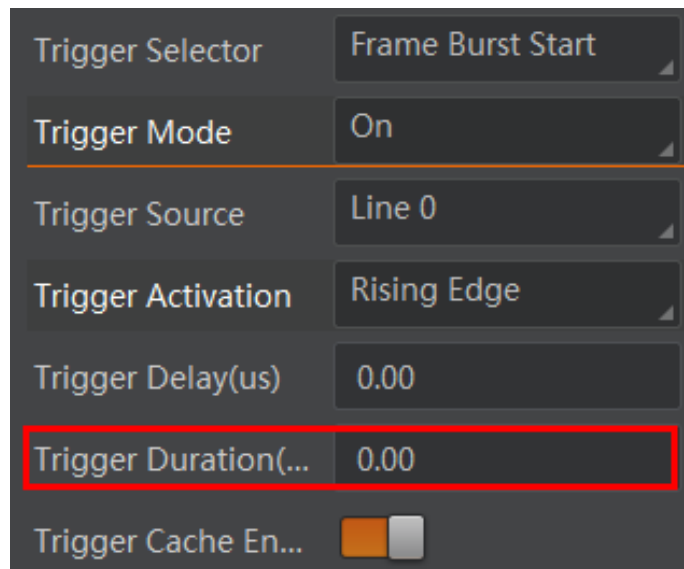


Figure 8-14 Sequence Diagram of Trigger Delay

When selecting **Rising Edge** or **Falling Edge** as **Trigger Activation**, the device will acquire images continuously within the configured time of **Trigger Duration** after receiving a trigger signal.

When selecting **Level Low** or **Level High** as **Trigger Activation**, the device will acquire images continuously within the configured time of **Trigger Duration** after the end of electrical level duration time.

Set Trigger Cache

The trigger cache function allows the camera to save and process new signal during trigger stage, and the camera can save and process 2 trigger signals at most. Go to **Acquisition Control** → **Trigger Cache Enable**, and enable **Trigger Cache Enable**.

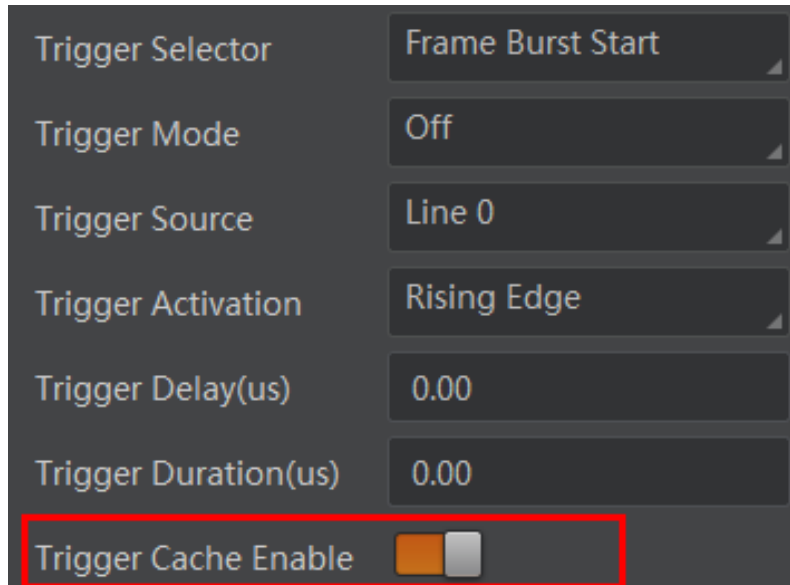


Figure 8-15 Set Trigger Cache

For example, if the camera receives the 2nd trigger signal when it is processing the 1st trigger signal, and the result will be different if you enable **Trigger Cache Enable**.

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

Set Line Debouncer Time

The trigger debouncer function allows the camera to filter out unwanted short external trigger signal that is input to the camera. Go to **Digital IO Control** → **Line Debouncer Time**, and enter **Line Debouncer Time**.

Note

When the **Line Debouncer Time** you set is greater than the pulse width of trigger signal, and this trigger signal will be ignored. Otherwise, the trigger signal will be output after delay.

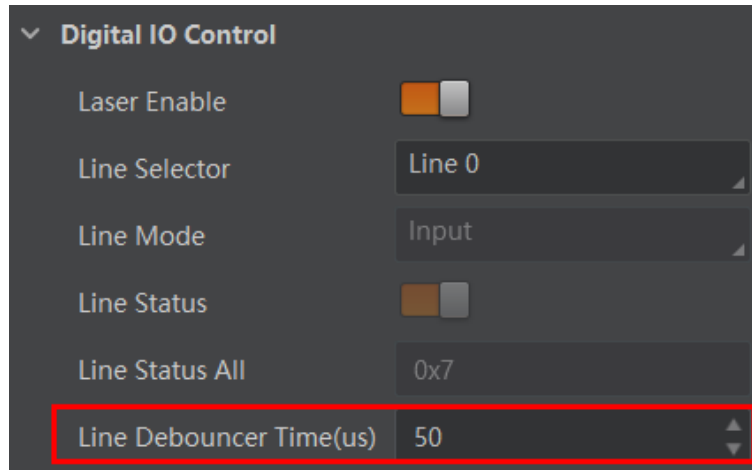


Figure 8-16 Set Line Debouncer Time

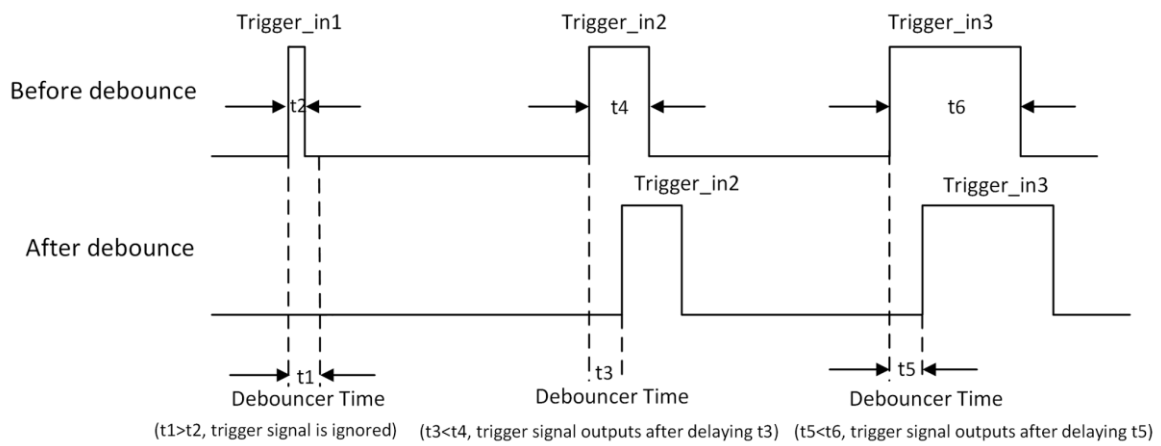


Figure 8-17 Sequence Diagram of Trigger Debouncer

Chapter 9 Image Quality Settings

This section introduces how to set image related parameters of the camera via client software.

Note

For different models of the camera, the specific parameters may differ, and the actual device you purchased shall prevail.

9.1 View Resolution

Note

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

Click **Image Format Control**, and you can view resolution by reading **Width Max** and **Height Max**.

Width Max stands for the max. pixels per inch in width direction, and **Height Max** stands for the max. pixels per inch in height direction.

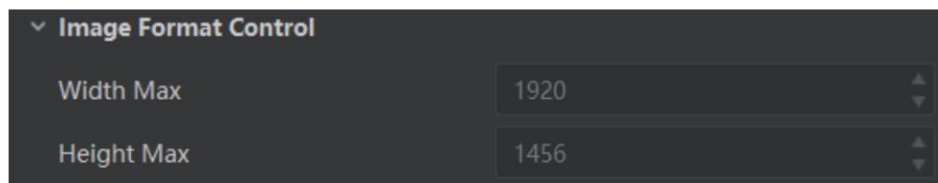


Figure 9-1 View Resolution

9.2 Set ROI

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

Note

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

Click **Image Format Control** → **Region Selector**, and enter **Width**, **Height**, **Offset X**, and **Offset Y**.

 Note

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

Width

It stands for horizontal resolution in ROI area.

Height

It stands for vertical resolution in ROI area.

Offset X

It refers to the horizontal coordinate of the upper left corner of the ROI.

Offset Y

It refers to the vertical coordinate of the upper left corner of the ROI.

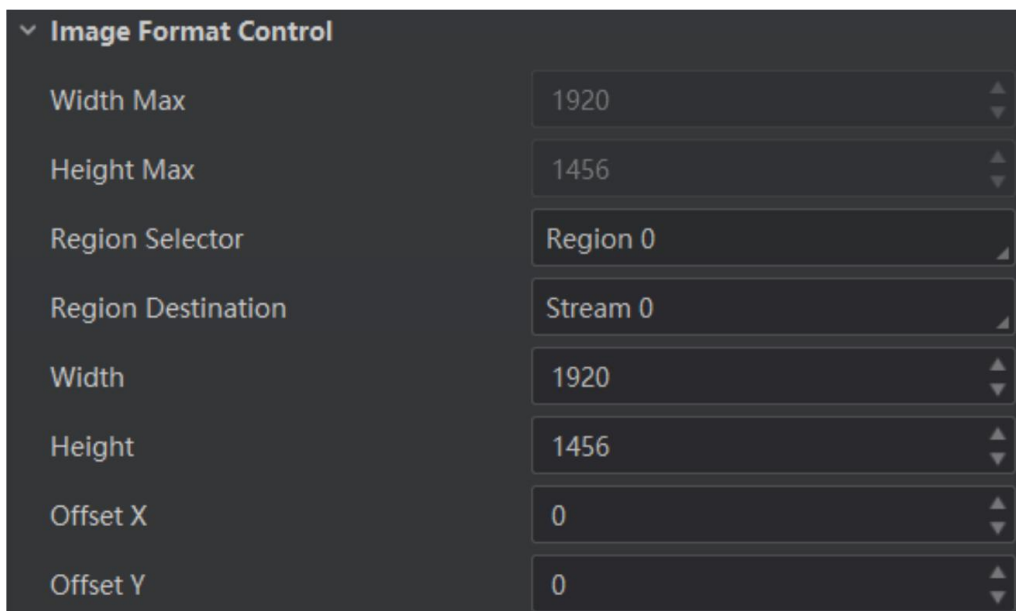


Figure 9-2 Set ROI

9.3 View Pixel Format

This function allows you to view the format and size of the image data transmitted by the camera.

 Note

The pixel format is related with the image mode.

Click **Image Format Control**, and view **Pixel Format** and **Pixel Size**.

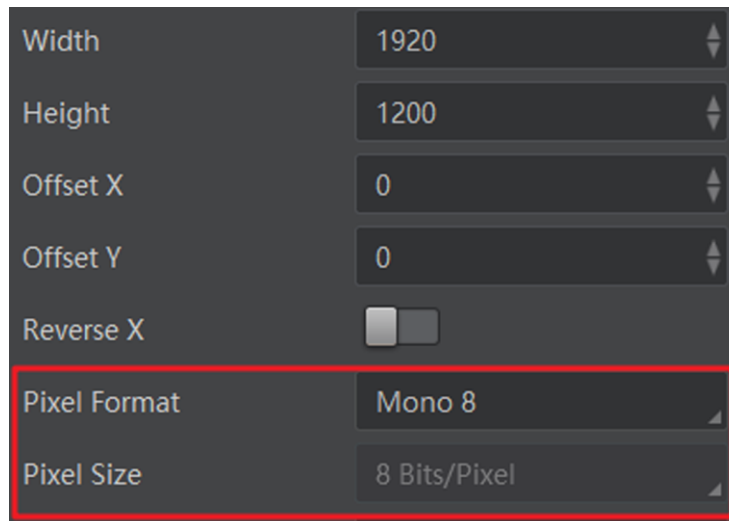


Figure 9-3 View Pixel Format

9.4 Set Image Mode

The camera supports 3 image modes, including origin image, 3D point cloud, and 3D Range Image.

- Origin image refers to the original image acquired by the camera.
- 3D point cloud refers to the image that contains three-dimensional coordinates. Different colors stand for various height information, namely, the red color refers to the lowest location, and the blue refers to the highest location.
- 3D range image refers to depth image.

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

Note

- When selecting **3D Point Cloud** as **Image Mode**, make sure you have completed calibration. Otherwise, point cloud data cannot be displayed.
 - The color of cloud in 3D point cloud is rendered in the client software.
-

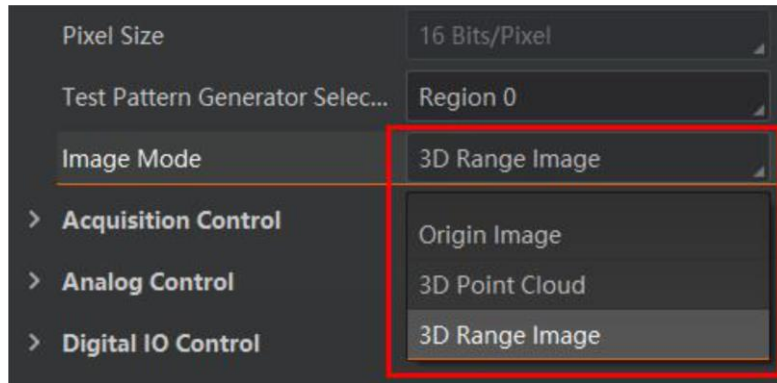


Figure 9-4 Set Image Mode

9.5 Set Exposure Time

The camera supports adjusting exposure time. Go to **Acquisition Control**, and enter **Exposure Time** according to actual demands.

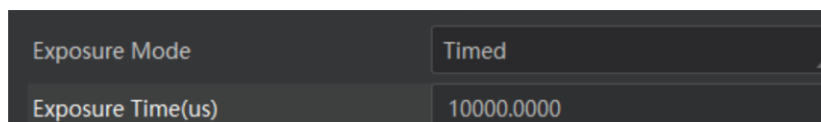


Figure 9-5 Set Exposure Time

9.6 Set Gain

The camera supports adjusting gain. Go to **Analog Control**, and enter **Gain (dB)** according to actual demands.

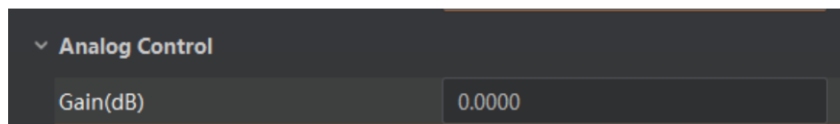


Figure 9-6 Set Gain

Note

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

9.7 Set HDR

Note

The HDR function may differ by camera models.

The camera supports HDR (High Dynamic Range) function that the camera acquires images based on 2 sets of settings, and each with its own exposure time and gain.

Steps

1. Click **Acquisition Control**, and enable **HDR Enable**.
2. Select 0 or 1 as **HDR Selector**, and set corresponding **HDR Shutter** and **HDR Gain**.
3. (Optional) Click **Execute** in **Reset HDR Config** to reset HDR parameters.

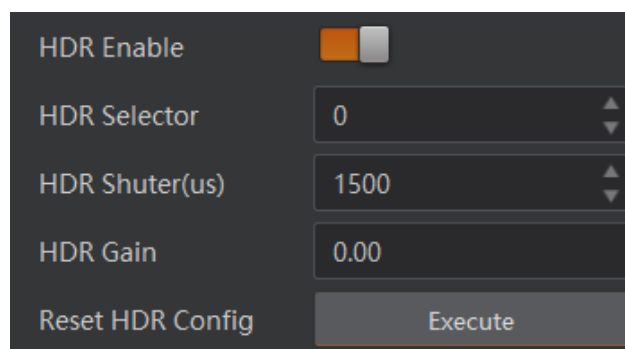


Figure 9-7 Set HDR

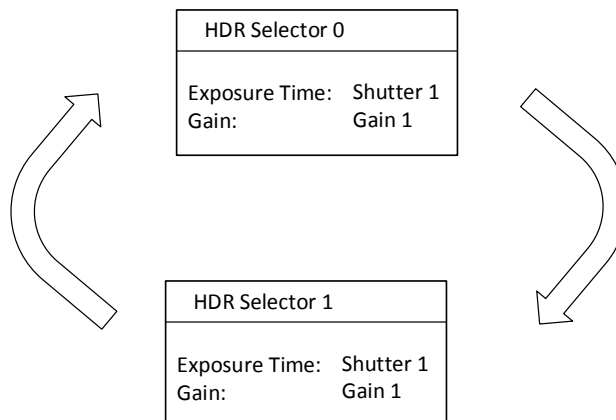


Figure 9-8 HDR Polling

9.8 Set Chunk Data Control

Note

The chunk data control function may differ by device models.

The device can embed image information into image data via the chunk function. The supported embedded information includes image, frame counter, line point number, line number, intensity, etc. Refer to the table below for details.

Table 9-1 Chunk Data Description

Chunk Selector	Status
Image	Enabled always
Frame Counter	Enabled in point cloud data
Line Point Num	Enabled in point cloud data and depth data
Line Num	Enabled in point cloud data and depth data
Intensity	Enabled always
First Frame ID	Enabled in depth data
Scan 3D Coordinate Scale	Enabled in depth data
Scan 3D Coordinate Offset	Enabled in depth data
Laser Point	Enabled in origin image

Steps

1. Go to **Chunk Data Control**, and set **Chunk Selector** according to actual demands.
2. Enable **Chunk Enable**.

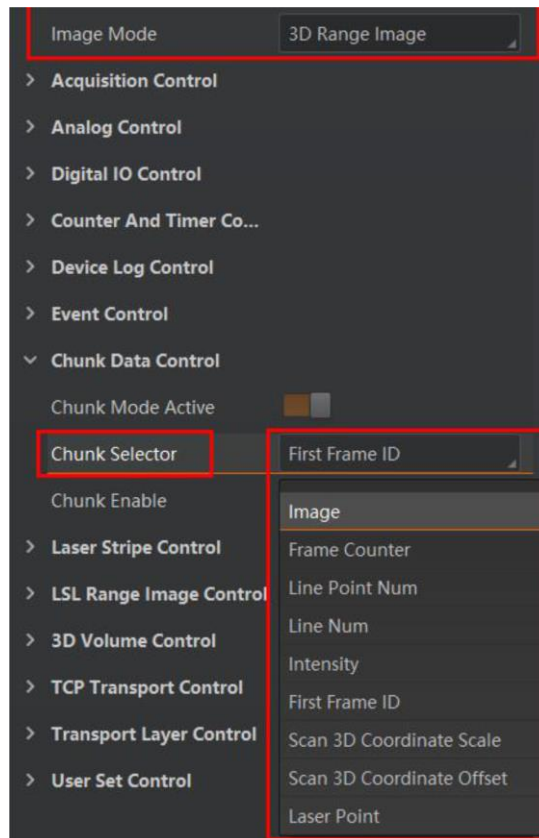


Figure 9-9 Set Chunk Data Control

Chapter 10 I/O Output

The signal output settings allow you to set output related parameters. The output signal of the camera is level signal, and it can be used to control external device like light source.

Note

For specific output signal lines, refer to section **Interface Description** for details.

10.1 Enable Line Inverter

The level inverter function allows the camera to invert the electrical signal level of an I/O line, and meets requirements of different devices for high or low electrical signal level.

Steps

1. Click **Digital IO Control** → **Line Selector**.
2. Select specific lines as **Line Selector** according to actual demands.
3. Enable **Line Inverter**.

Note

The **Line Inverter** function is disabled by default.

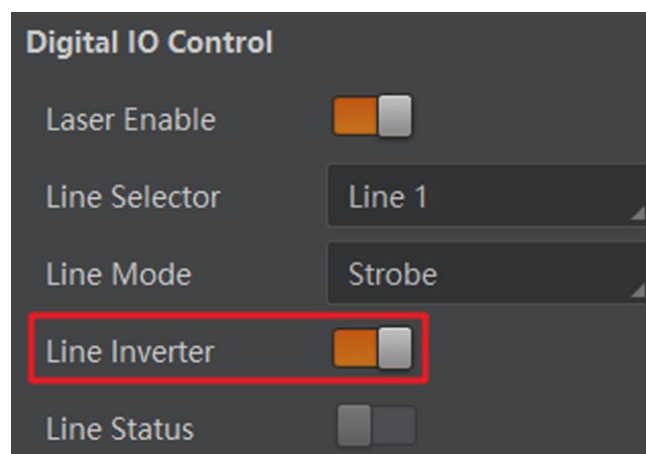


Figure 10-1 Enable Line Inverter

10.2 Enable Strobe Signal

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

Steps

1. Click **Digital IO Control**.
2. Set **ExposureActive** as **Line Source**.

Note

The camera currently supports setting **ExposureActive** as **Line Source** only.

3. Enable **Strobe Enable**.

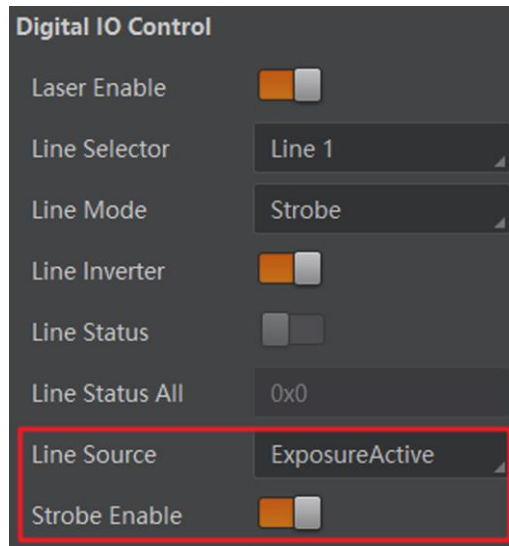


Figure 10-2 Enable Strobe Signal

10.2.1 Set Strobe Line Duration

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

Note

- When the **Strobe Line Duration** value is 0, the strobe duration is equal to the exposure time. Otherwise, the strobe duration is the value you set.
 - Regarding device model of MV-DL2025-04H-H, the duration of level high is always equal to the **Strobe Line Duration** you configured here.
-

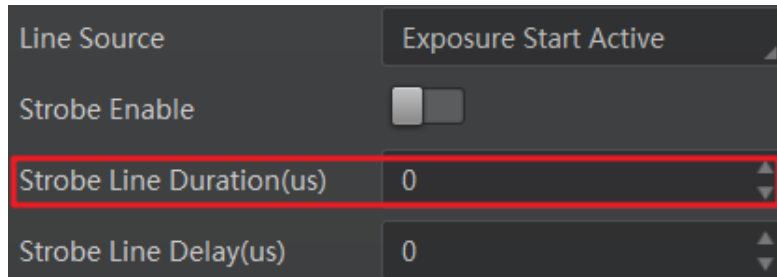


Figure 10-3 Set Strobe Line Duration

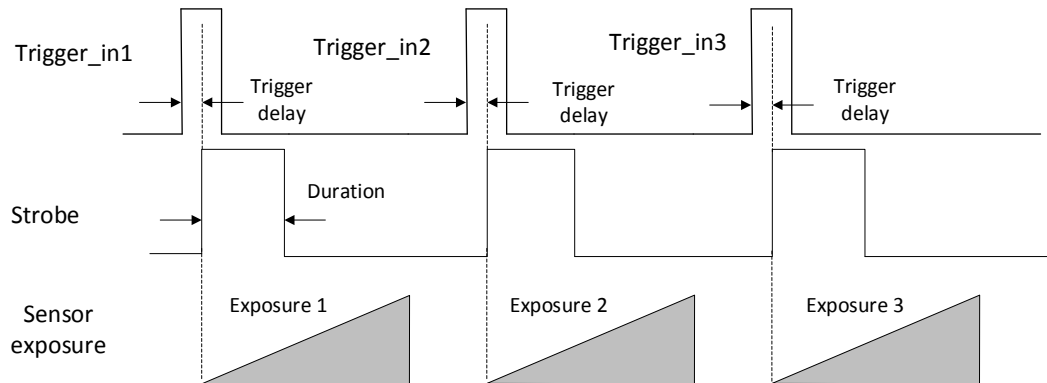


Figure 10-4 Sequence Diagram of Strobe Line Duration

10.2.2 Set Line Delay

The strobe line delay function allows the camera to output signal in a delay time. When camera exposure starts, the strobe output does not take effect immediately. Instead, the strobe output will delay according to the value you set.

Click **Digital IO Control** → **Strobe Line Delay**, and enter **Strobe Line Delay**.

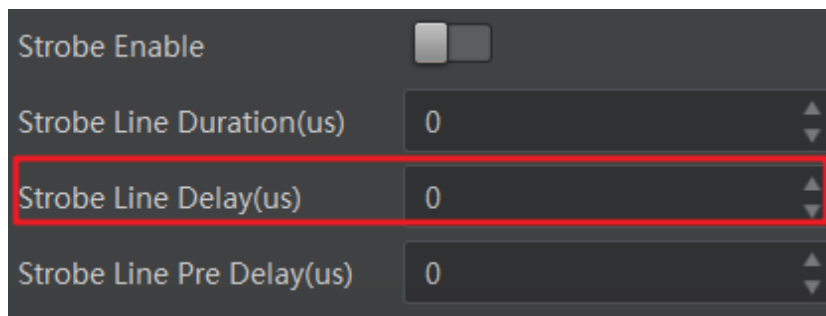


Figure 10-5 Set Strobe Line Delay

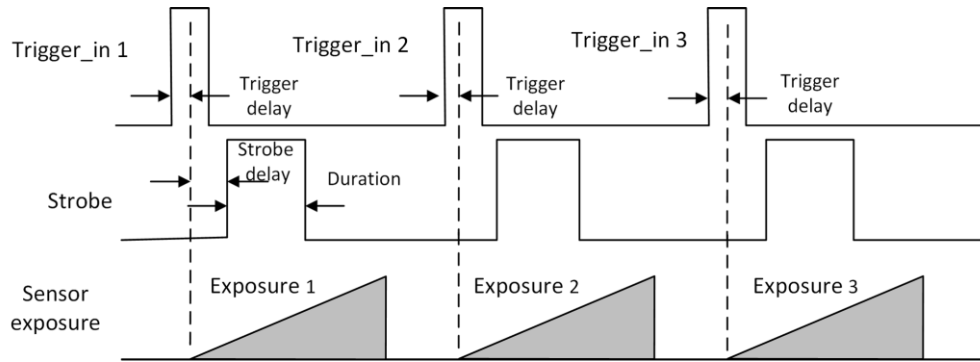


Figure 10-6 Sequence Diagram of Strobe Line Delay

10.2.3 Set Line Pre Delay

The camera supports the function of strobe line pre delay, which means that the strobe signal takes effect early than exposure. This function is applicable to the external devices that have slow response speed. Click **Digital IO Control** → **Strobe Line Pre Delay**, and enter **Strobe Line Pre Delay**.

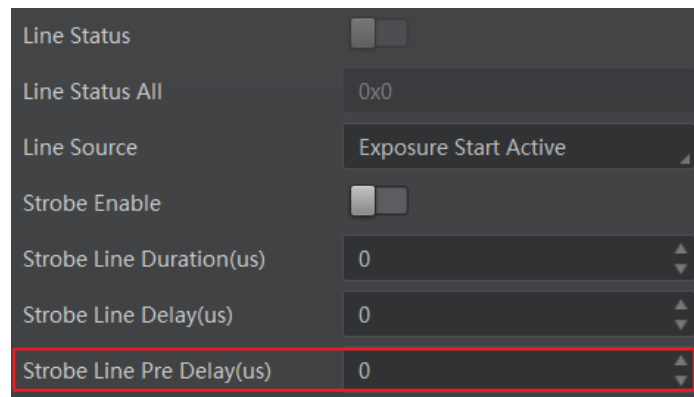


Figure 10-7 Set Strobe Line Pre Delay

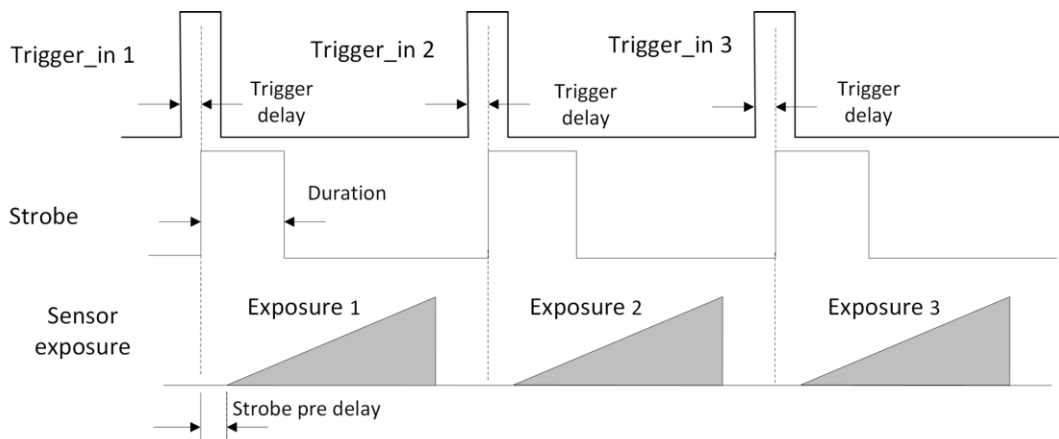


Figure 10-8 Sequence Diagram of Strobe Line Pre Delay

Chapter 11 I/O Wiring

The device can receive or output signals via its I/O interface. This section introduces how to wire the device.

11.1 Input Wiring

The device can receive input signals from encoders and photoelectric trigger switches. For the device that has 3-pair input and output, it is recommended to use Line 3 and Line 6 to connect with encoders, and use Line 0 to connect with photoelectric trigger switches.

11.1.1 Wiring with Encoder

In order to make sure the accuracy of operation direction of the conveyor, it is recommended to use encoder to wire the device.

Kubler Encoder

You are recommended using Kubler encoder (Model: KIS40.1342.1024), which has the same power requirement with the device (12 VDC).

No matter your device is equipped with 5-pin M12 interface or 12-pin M12 interface, you also can finish the wiring with encoder based on the following demonstration.

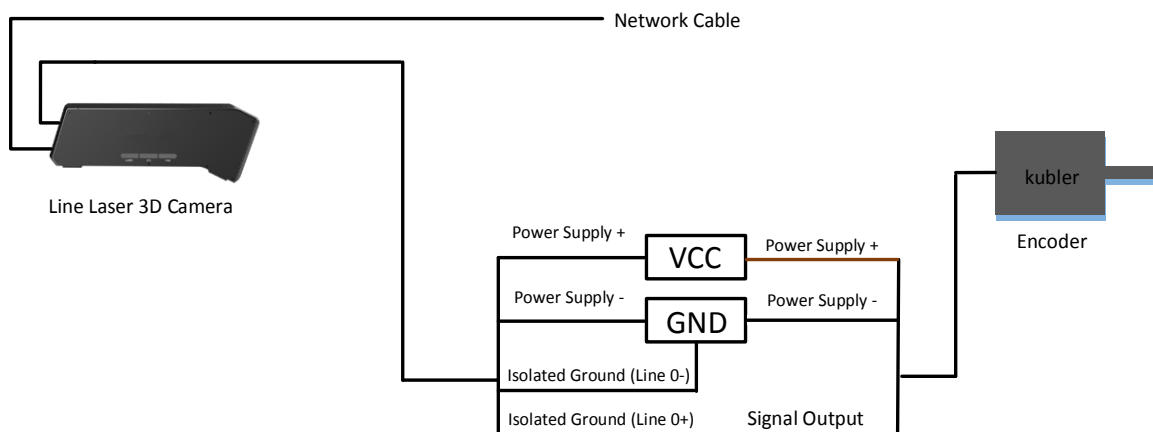


Figure 11-1 Wiring with Encoder

Other Encoders

If you adopt encoders that do not have the power supply of 12 VDC, you should power the encoder separately when using the encoder with the device. For wiring, please refer to corresponding user manual of encoder you used.

Note

- The device supports trigger of level high (3 VDC to 12 VDC), level low (-3 VDC to -12 VDC), rising edge (> 3VDC), and falling edge (< 3 VDC) as opto-isolated input.
- MV-DL2040-04H/D-H model's Line 3 and Line 6 support wiring with high-speed encoder.

11.1.2 Wiring with Photoelectric Trigger

5-Pin Interface and 12-Pin Interface (Type I)

Note

The 12-pin interface supports 3 wiring methods below, and the 5-pin interface supports wiring with pull-up resistor only.

PNP Device

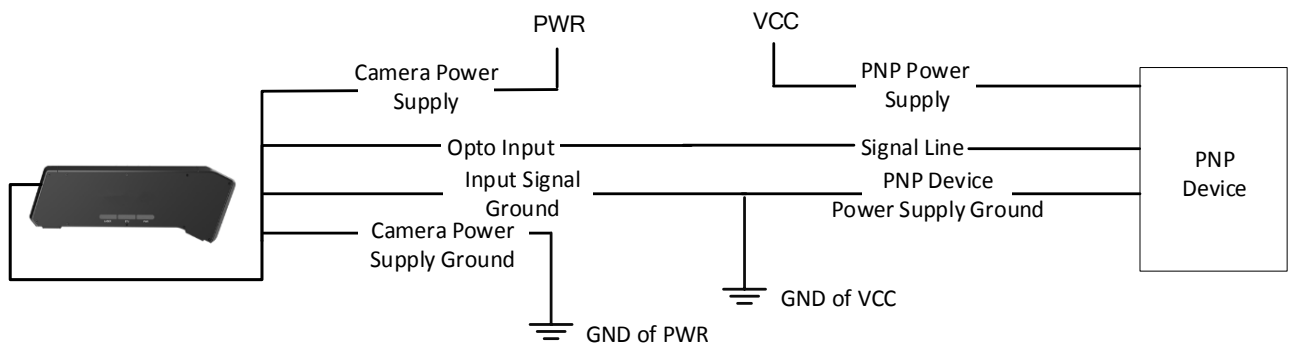


Figure 11-2 Input Signal Connecting PNP Device

NPN Device

If the VCC of NPN device is 12 VDC or 24 VDC and pull-up resistor is not used, its wiring is shown below.

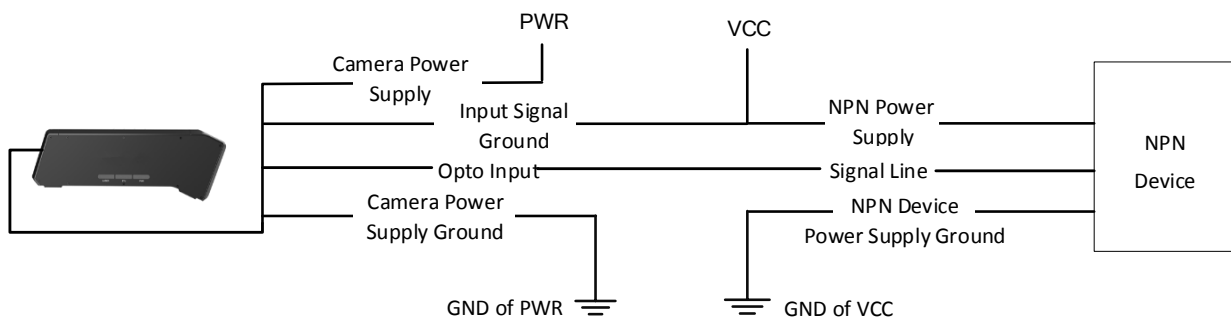


Figure 11-3 Input Signal Connecting NPN Device Without Pull-up Resistor

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

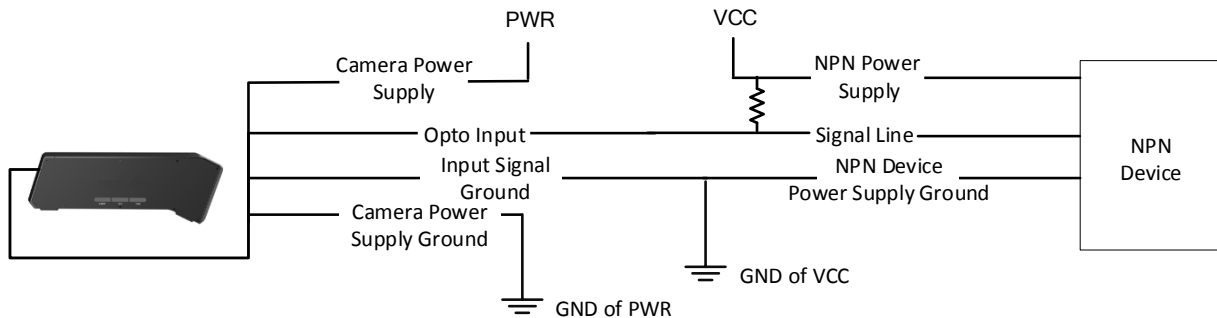


Figure 11-4 Input Signal Connecting NPN Device with Pull-up Resistor

12-Pin Interface (Type II)

PNP Device

Here we take Line 0 as an example to introduce wiring.

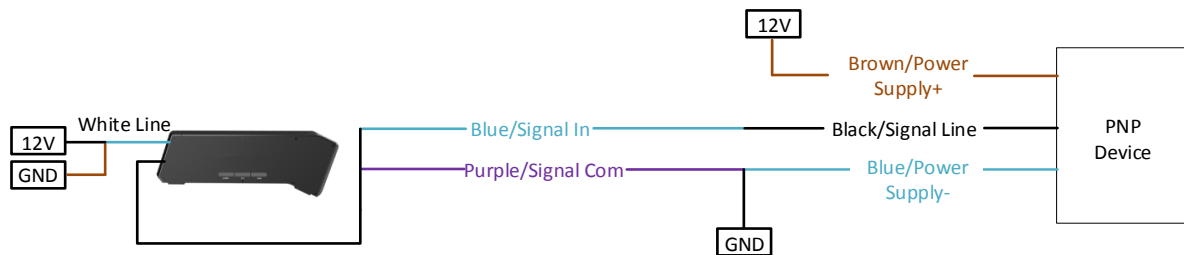


Figure 11-5 Input Signal Connecting PNP Device

NPN Device

For wiring with NPN device, 2 wiring methods are available. Here we take Line 0 as an example to introduce wiring.

You can connect com with signal line, signal in with 12 V power supply positive. This wiring method supports one input only, and cannot support encoder input at the same time.

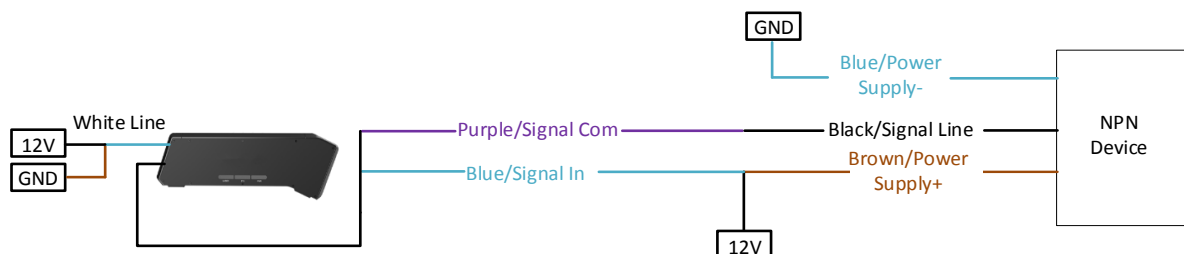


Figure 11-6 Input Signal Connecting NPN Device without Pull-up Resistor

Another wiring method is to use multiple inputs, and this method requires pull-up resistor.

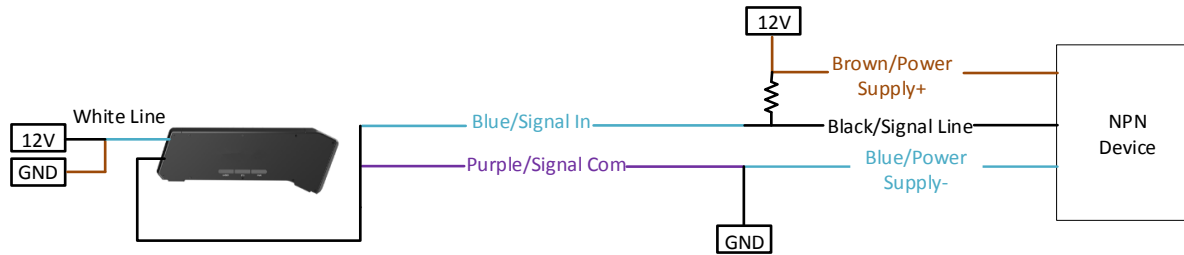


Figure 11-7 Input Signal Connecting NPN Device with Pull-up Resistor

11.2 Output Wiring

Note

- The 12-pin interface supports 3 wiring methods below, and the 5-pin interface supports wiring with pull-up resistor only.
- The voltage of VCC should not higher than that of PWR. Otherwise, the device's output signal may have exception.

PNP Device

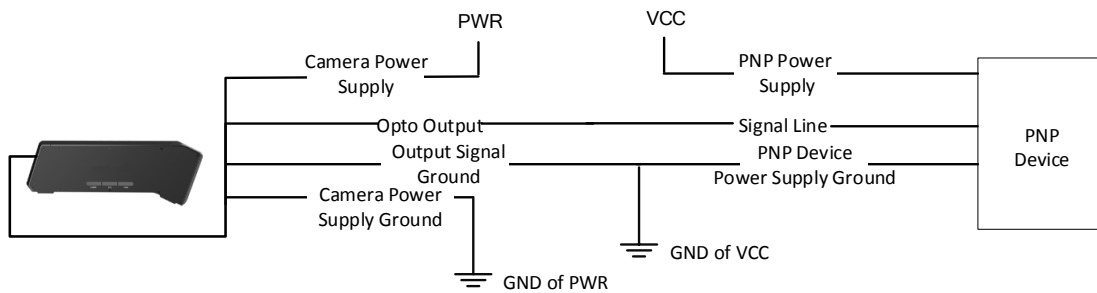


Figure 11-8 Output Signal Connecting PNP Device

NPN Device

If the VCC of NPN device is 12 VDC or 24 VDC and pull-up resistor is not used, its wiring is shown below.

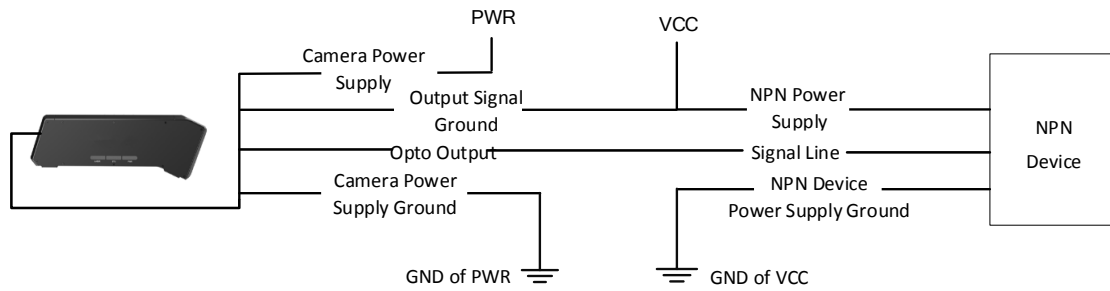


Figure 11-9 Output Signal Connecting NPN Device Without Pull-up Resistor

If the VCC of NPN device is 12 VDC or 24 VDC and the external pull-up resistor is used, it is recommended to use 1 K Ω pull-up resistor.

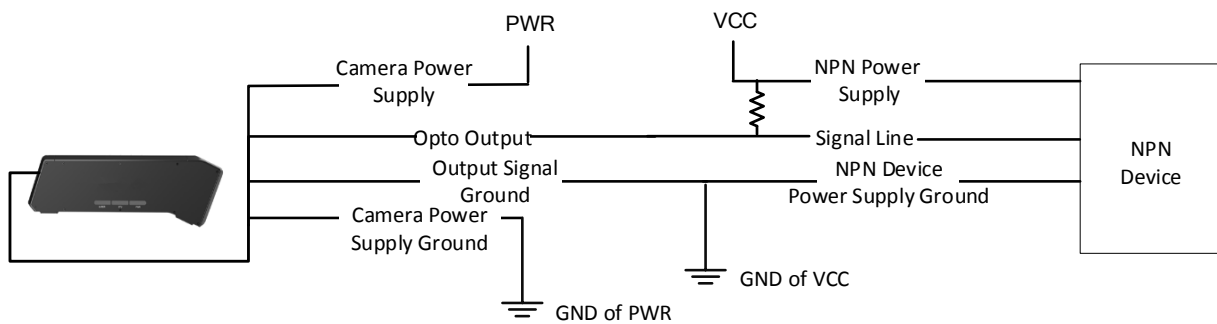


Figure 11-10 Output Signal Connecting NPN Device with Pull-up Resistor

Chapter 12 Other Functions

12.1 Device Control

 Note

The specific device control parameters may differ by device models.

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

Table 12-1 Parameter Description

Parameter	Read/Write	Description
Device Type	Read Only	It is the device type.
Device Scan Type	Read Only	It is the scan type of the device's sensor.
Device Vendor Name	Read Only	It is the name of the manufacturer of the device.
Device Model Name	Read Only	It is the model of the device.
Device Manufacturer Info.	Read Only	It is the manufacturer information about the device.
Device Version	Read Only	It is the version of the device.
Device Firmware Version	Read Only	It is the version of the firmware in the device.
Device Algorithm LSL Version	Read Only	It is the version of device's LSL algorithm.
Device Algorithm VM Version	Read Only	It is the version of device's VM algorithm.
Device Serial Number	Read Only	It is device's serial number. This string is a unique identifier of the device.
Device User ID	Read & Write	Device name and it is empty by default. You can set according to your preference.
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 Connection Selector	Read & Write	It selects which Connection of the device to control.
Device Connection	Read Only	It indicates the speed of transmission of the

Parameter	Read/Write	Description
Speed (Mbps)		specified connection.
Device Link Selector	Read & Write	It selects which Link of the device to control
Device Link Speed (Mbps)	Read Only	It indicates the speed of transmission negotiated on the specified link.
Device Link Connection Count	Read Only	It returns the number of physical connection of the device used by a particular link.
Device Link Heartbeat Mode	Read & Write	It activates or deactivates the link's heartbeat.
Device Stream Channel Count	Read Only	It indicates the number of streaming channels supported by the device.
Device Stream Channel Selector	Read & Write	It selects the stream channel to control.
Device Stream Channel Type	Read Only	It reports the type of the stream channel.
Device Stream Channel Link	Read Only	It is the index of device's Link to use for streaming the specified stream channel.
Device Stream Channel Endianness	Read Only	It is the endianness of multi-byte pixel data for this stream.
Device Stream Channel Packet Size (B)	Read & Write	It specifies the stream packet size, in bytes, to send on the selected channel for a transmitter or specifies the maximum packet size supported by a receiver.
Device Event Channel Count	Read Only	It indicates the number of event channels supported by the device.
Device Character Set	Read Only	It is character set used by the strings of the device's bootstrap registers.
Device Reset	Read & Write	Click Execute to reset the device.
Device Temperature Selector	Read & Write	It selects the location within the device, where the temperature will be measured
Device Temperature	Read Only	It is device temperature in degrees Celsius (C). It is measured at the location selected by Device Temperature Selector.
Find Me	Read & Write	It is used to find the current device.
Device Max Throughput (bps)	Read Only	It is max. bandwidth of the data that can be streamed out of the device.

12.2 Enable Device Auto Work

Note

The function of device auto work may differ by device models.

The function of device auto work allows the device to load saved parameters automatically when it starts. Click **Acquisition Control** → **Device Auto Work**, and enable **Device Auto Work**.

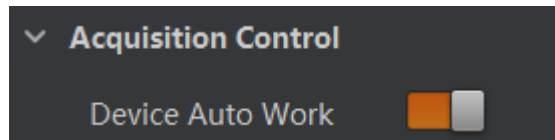


Figure 12-1 Enable Device Auto Work

12.3 Enable Laser

The laser is used to send laser stripe to the measured objects. Click **Digital IO Control** → **Laser Enable**, and enable **Laser Enable**.

Note

Make sure that the laser is enabled when the device operates and executes system calibration.

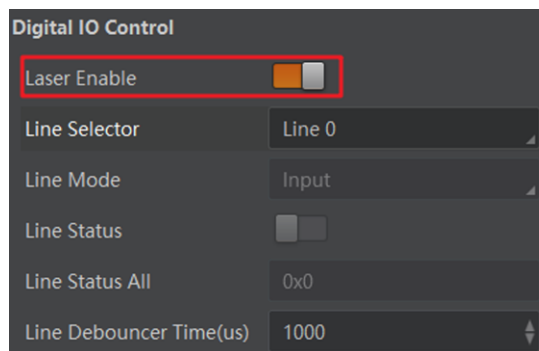


Figure 12-2 Enable Laser

12.4 Set Device Log Control

Note

- The function of device log control may differ by device models.
 - Logs saved in the device support exporting and importing via file access control function.
-

The function of device log control can save the device's logs to local or transmit them remotely via UDP.

Steps

1. Find **Device Log Control** in the feature tree.
 2. Set **Log Output Mode** as **Local File** or **Remote** according to actual demands.
- **Local File**: Logs will be saved in the device.

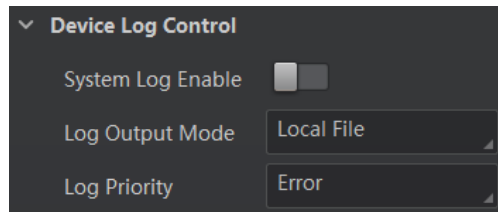


Figure 12-3 Local File

- **Remote**: Logs will be transmitted remotely, and you need to enter **Log Remote IP** and **Log Remote Port** according to actual demands.

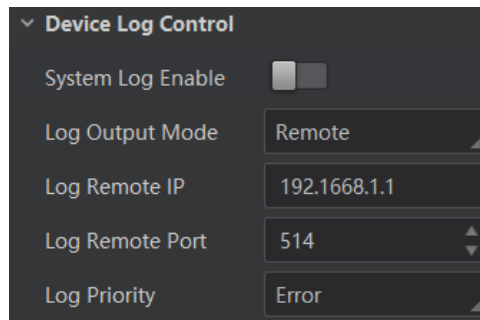


Figure 12-4 Remote

3. Set **Log Priority**, including **Fatal**, **Error**, **Warning**, **Info**, and **Debug**.

Note

- The log priority from high to low is **Fatal**, **Error**, **Warning**, **Info**, and **Debug**.
 - Logs whose priority level above or equal to the **Log Priority** you selected will be saved.
-

12.5 Set File Access Control

The file access function can import and export the device's calibration files, and save them in mfa format. The device's calibration files include:

- LSL Sensor Calibrate LUT: The LUT used by the device sensor calibration.
- LSL Sensor Calibrate: The sensor calibration file.
- LSL System Calibrate: The system calibration file.
- LSL Algorithm Param: The algorithm parameter file.
- Device Extend Config: ROI information file.
- Feature Language Map: The mapping file of the device' feature tree node name.

- Device Log File: The system log files saved in the device.

Steps

1. Click **Parameter Settings**, and click  to open the file access dialogue box.

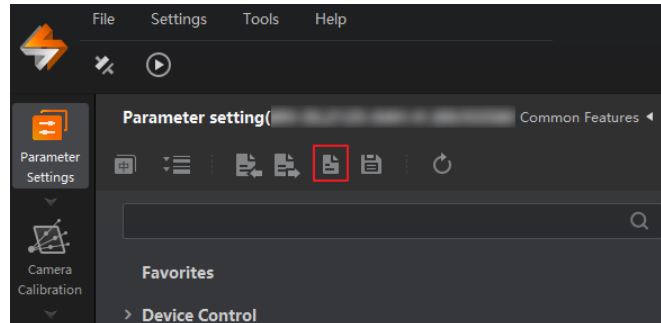


Figure 12-5 File Access

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

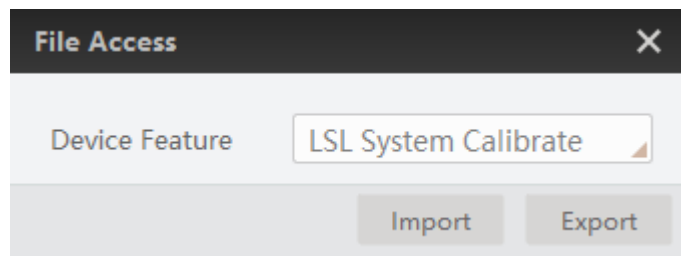


Figure 12-6 Import or Export

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

Note

The supported calibration files may differ by device models.

12.6 Set Event Control

This function allows the camera to output event messages.

Note

The camera supports outputting volume measurement result only, and you can select **Dws Volume** as **Event Selector**.

Steps

1. Click **Event Control** → **Event Selector**.
2. Select **Dws Volume** as **Event Selector**.
3. Select **Notification On** or **Notification Off** as **Event Notification** to output measurement result or not.

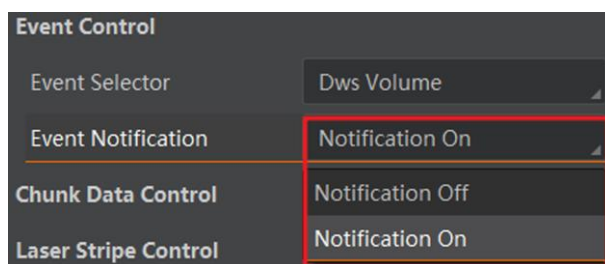


Figure 12-7 Set Event Control

12.7 Set 3D Volume Control

In the **3D Volume Control** attribute, you can set volume measurement related parameters.

Table 12-2 Parameter Description of 3D Volume Control

Parameter	Description
Algorithm Status Code	It displays error information when operating the algorithm.
Min Packet Height	It refers to the min. package height that the device can measure, and the unit is mm. The data that is smaller than this parameter will be filtered.
Height Ratio	It sets height ratio ranging from 0 to 100.
Min Contour Point Num	It sets the min. quantity of contour points of measured objects. Its range is from 0 to 999.
Horizontal Revise Number	It sets the revise quantity of contour points in the horizontal direction.
Vertical Revise Number	It sets the revise quantity of contour points in the vertical direction.
Compensate Height	This parameter value should be adjusted according to standard object's height. After calibration, Compensate Height plus average height on conveyor belt should be close to 0. The unit of this parameter is mm.
Step Distance	It refers to the step distance of the conveyor belt, and the unit is um.
Max Profile Width	It sets the max. measured contour width. After settings, you need to initialize algorithm again. Its range is from 1000 to 2500.
Max Profile Number	It sets the max. measured contour line quantity. After settings, you need to initialize algorithm again. Its range is from 400 to 1200.
Pixel Unit	It sets the corresponding physical size of single pixel in depth images. After settings, you need to initialize algorithm again.
Filter Area Enable	If it is enabled, the client software can transfer the plane correction of the conveyor belt to zero plane after drawing the filter region. This parameter is enabled by default.

Measure Mode	It sets the algorithm measurement mode, including Continue , Trigger , Multi and Trigger Multi .
Engine Mode	It selects mode of creating point cloud, including traditional and deep learning.

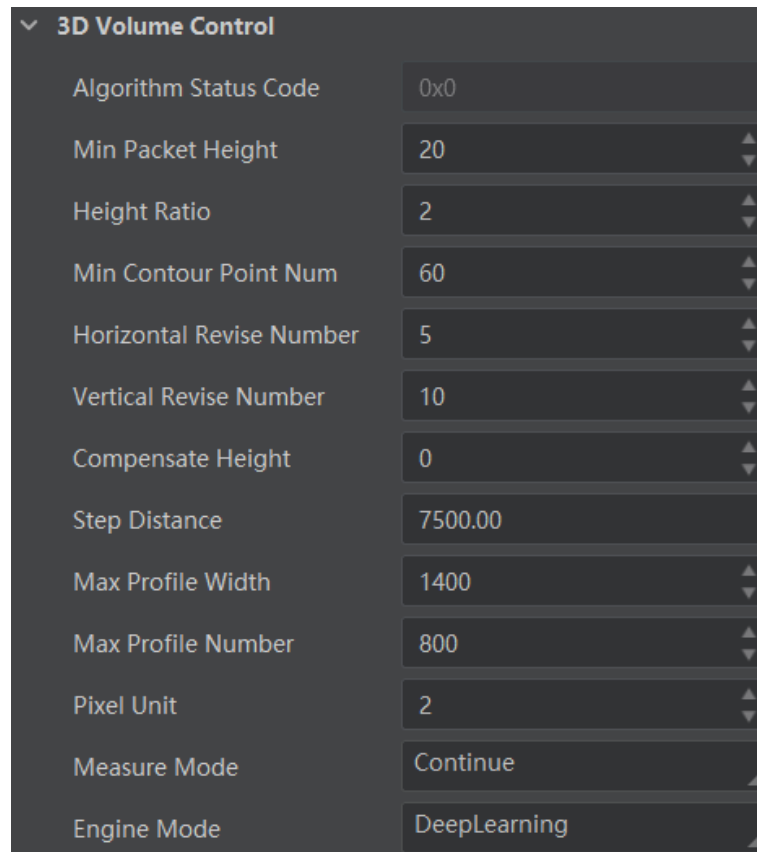


Figure 12-8 Set 3D Volume Control

Note

- After selecting different **Engine Mode**, you need to reset the camera.
- Deep learning mode should be supported by corresponding firmware. You can contact the technical support for details.

12.8 Set Laser Stripe

The device supports configuring parameters of the laser stripe. You can Go to **Laser Stripe Control** → **Center Point Control**, and set specific parameters accordingly.

- Profile type: It is the laser stripe type, including center point, upper edge point, and lower edge point.
- Point select mode: Use this parameter to select different modes to filter effective laser points when multiple laser points are extracted from the same column of the image. It has five modes, including best, top, bottom, widest and brightest.

- Best: When multiple laser points are extracted from the same column, select the laser point with the largest average gray scale. If the average gray scale is the same, select the point with the largest line width. If the average grayscale and line width are the same, select the point with the highest pixel brightness value. If the average gray level and line width and the brightest value are equal, the top point is selected.
- Top: The top laser point is selected when multiple laser points are extracted from the same column,
- Bottom: The lowest laser point is selected when multiple laser points are extracted from the same column.
- Widest: The point with the largest line width is selected when multiple laser points are extracted from the same column. If the linewidth is the same, the brightest point in the same linewidth is preferentially selected. If the linewidth is the same and the brightest value of the laser line is the same, the laser line center point with the highest average brightness is selected.
- Brightness: The point with the highest pixel brightness value is selected when multiple laser points are extracted from the same column. If all contain overexposed points (brightness value 255), the point with the largest line width among the brightest points is selected. If the line width among the brightest points is the same, the laser line center point with the highest average brightness is selected.
- Min/Max line width: It is the minimum/maximum line width, when the number of pixels occupied by the continuous laser line in the vertical direction is greater than or equal to the minimum line width and less than or equal to the maximum line width, the laser line is determined to be valid. Otherwise, it is invalid. This parameter can only be configured when custom is selected for laser sensitivity.
- Binary threshold: The device only filters the gray value that is greater than or equal to the value of the parameter laser line pixels as a valid point.

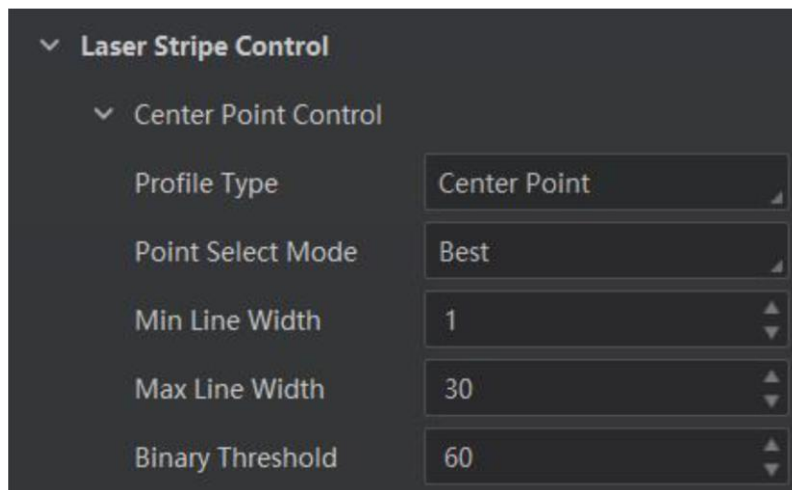


Figure 12-9 Set Laser Stripe

12.8.1 Set Profile Filter

The device supports configuring different filter window sizes for the profile, and filter the profile points in the window. You can go to **Laser Stripe Control** → **Center Point Control** → **Profile Filter**, and set specific parameters accordingly.

- Mean filter window size: It sets mean filter window size, 3/5/7/9 points or off are available.
- Median filter window size: It sets median filter window size, 3/5/7/9 points or off are available.
- Outliers filter window size: It sets outliers filter window size, 1/3/5/7/9 points or off are available.

12.9 Set Range Image Control

The device supports configuring parameters of rang images. You can go to **LSL Range Image Control**, and set specific parameters accordingly.

- LSL data unit: It is the unit of outputted point cloud data and range image data.
- Y scale: It is the sampling interval of range image in vertical direction, and the unit is $\mu\text{m}/\text{pixel}$.
- Range image height: It is used to set the number of profile of range image in pixels. This parameter is only available when image mode is 3D range image.
- Step distance: It sets the distance between two adjacent frames of profile data.
- Output image height type: It includes real type and setting type. This parameter is only available when image mode is 3D range image.
 - Real type: The range image is outputted based on the actual number of profiles after the trigger. If the actual number of profiles is higher than the range image height, data is outputted based on range image height, and the excess part is outputted directly.
 - Setting type: The range image is outputted based on the range image height after the trigger. If the actual number of profiles is higher than the range image height, data is outputted based on range image height, and the excess part is filled with black and outputted.
- Frame Timeout (ms): It is the timeout period. You can set the trigger end time of the device. This parameter is only available when image mode is 3D range image.
 - When the parameter is 0, the device waits for the next trigger signal until the image height is up to range image height and the device outputs the image.
 - When the parameter is not 0, if the device does not receive the next trigger signal within the configured time, the trigger is considered to be over. At this time, the image filled with black and outputted, and the image height is range image height.

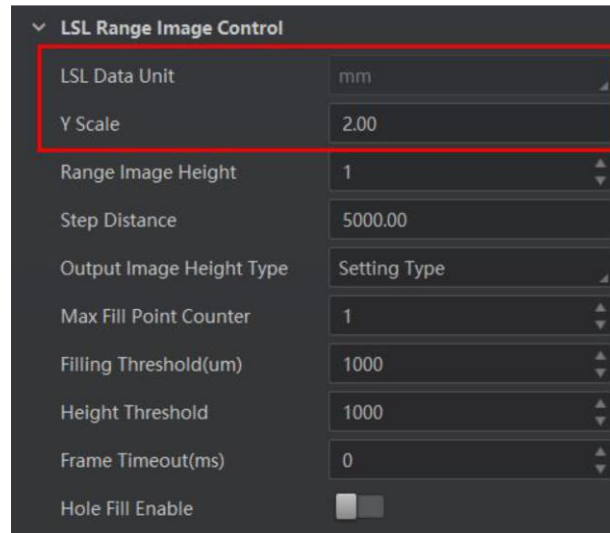


Figure 12-10 Set Range Image Control

12.10 Set TCP Transport Control

Note

- The function of TCP transport control may differ by device models.
- Before using this function, set **Notification Off** as **Event Notification** in **Event Control**.

The function of TCP transport control can transmit detected object information via TCP.

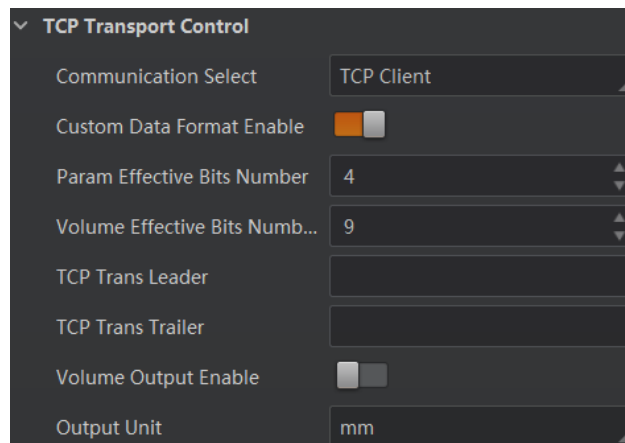


Figure 12-11 Set TCP Transport Control

Steps

1. Find **TCP Transport Control** in the feature tree.
2. Set **Communication Select** as **TCP Server** or **TCP Client** according to actual demands.
 - **TCP Server**: Enter **TCP Server Port**, and enable **TCP Server Enable**.

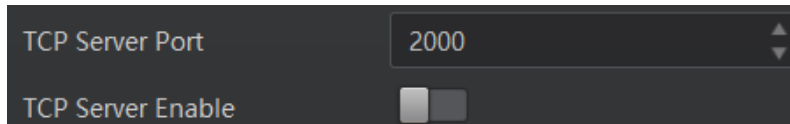


Figure 12-12 TCP Server

- **TCP Client:** Enter **TCP Host IP** and **TCP Host Port**, and enable **TCP Client Enable**.

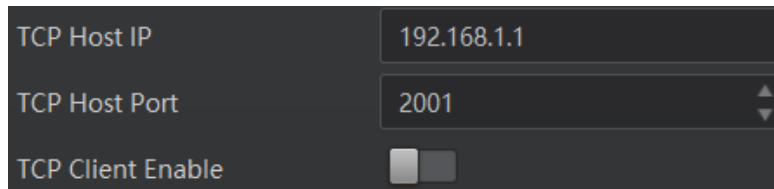


Figure 12-13 TCP Client

3. Enter following parameters according to actual demands.

Table 12-3 Parameter Description

Parameter	Description
Custom Data Format Enable	If it is enabled, you can set the data digits of the volume output information.
Param Effective Bits Number	It sets output data's digits of parameters (length, width, height). If configured digit is greater than the actual one, zero is added before the actual digit. Otherwise, it is output according to the actual number one.
Volume Effective Bits Number	It sets output data's digits of volume. If configured digit is greater than the actual one, zero is added before the actual digit. Otherwise, it is output according to the actual number one.
TCP Trans Leader/Trailer	It sets the frame header and frame end of the TCP output data, that is, add a customized string before and after the output data.
Volume Output Enable	It is used to control whether volume information is included in the output information.
Output Unit	It set data unit of output information, including mm or cm.

12.11 Set Transport Layer Control

Note

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

You can go to **Transport Layer Control** to view the device's load size, GEV version, etc.

Table 12-4 Parameter Description of Transport Layer Control

Parameter	Read/Write	Description
Payload Size (B)	Read Only	It is the device's load size.
GEV Version Major	Read Only	It is the major version in GEV version.
GEV Version Minor	Read Only	It is the minor version in GEV version.
GEV Device Mode Is Big Endian	Read Only	It is the endianness in device's register.
GEV Device Mode Character Set	Read Only	It is the character set in device's register.
GEV Interface Selector	Read Only	It sets which physical network interface to be controlled.
GEV MAC Address	Read Only	It is the MAC address of the network interface.
GEV Supported Option Selector	Read & Write	It selects the GEV option to interrogate for existing support.
GEV Supported Option	Read Only	It indicates whether the selected GEV option is supported or not.
GEV Current IP Configuration LLA	Read Only	It indicates whether the Link Local Address IP configuration scheme is activated on the given network interface.
GEV Current IP Configuration DHCP	Read & Write	It indicates whether the DHCP IP configuration scheme is activated on the given network interface.
GEV Current IP Configuration Persistent IP	Read & Write	It indicates whether persistent IP configuration scheme is activated on the given network interface.
DEV PAUSE Frame Reception	Read & Write	It controls whether incoming pause frames are handled on the given logical link.
GEV Current IP Address	Read Only	It is the current IP address for the given network interface.
GEV Current Subnet Mask	Read Only	It is the current subnet mask of the given interface.
GEV Current Default Gateway	Read Only	It is the default gateway IP address to be used on the given network interface.
GEV First URL	Read Only	It is the first choice of URL for the XML device

Parameter	Read/Write	Description
		description file.
GEV Second URL	Read Only	It is the second choice of URL to the XML device description file.
GEV Number Of Interfaces	Read Only	It indicates the number of physical network interfaces supported by this device.
GEV Persistent IP Address	Read & Write	It indicates the persistent IP address for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Subnet Mask	Read & Write	It indicates the persistent subnet mask associated with the persistent IP address on this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Default Gateway	Read & Write	It indicates the persistent default gateway for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Link Speed	Read Only	It indicates the speed of transmission negotiated by the given network interface in Mbps.
GEV Message Channel Count	Read Only	It indicates the number of message channels supported by this device.
GEV Stream Channel Count	Read Only	It indicates the number of stream channels supported by this device.
GEV Heartbeat Timeout (ms)	Read & Write	It indicates the current heartbeat timeout in milliseconds.
GEV Heartbeat Disable	Read & Write	It disables the GEV Heartbeat.
GEV Timestamp Tick Frequency(Hz)	Read Only	It indicates the number of timestamp ticks in 1 second (frequency in Hz).
Timestamp Control Latch	Read & Write	It latches the current timestamp value of the device.
Timestamp Control Reset	Read & Write	It resets the timestamp value for the device.
Timestamp Control Latch Reset	Read & Write	It resets the timestamp control latch.
Timestamp Value	Read Only	It is a read only element. It indicates the

Parameter	Read/Write	Description
		latched value of the timestamp.
GEV CCP	Read & Write	It controls the device access privilege of an application.
GEV MCP Host Port	Read & Write	It controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GEV MCDA	Read & Write	It controls the destination IP address for the message channel.
GEV MCTT (ms)	Read & Write	It provides the transmission timeout value in milliseconds.
GEV MCRC	Read & Write	It controls the number of retransmissions allowed when a message channel message times out.
GEV MCSP	Read Only	It indicates the source port for the message channel.
GEV Stream Channel Selector	Read Only	It selects the stream channel to control.
GEV SCP Interface Index	Read Only	It is the Index of network interface to be used.
GEV SCP Host Port	Read & Write	It is the host port of the channel
GEV SCP Direction	Read Only	It transmits or receives the channel.
GEV SCPS Big Endian	Read Only	It is the Endianness of multi-byte pixel data for this stream.
GEV SCDA	Read & Write	It indicates the destination IP address for this stream channel.
GEV SCSP	Read Only	It indicates the source UDP port address for this stream channel.

12.11.1 Check Heartbeat

The heartbeat detection function allows you to check if the camera's transmission channel is working properly or not. Click **Transport Layer Control** → **GEV Heartbeat Timeout**, and enter **GEV Heartbeat Timeout**.

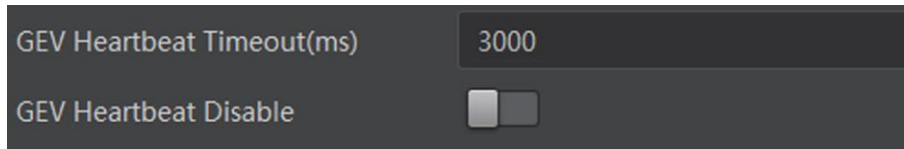


Figure 12-14 Check Heartbeat

 Note

The heartbeat detection function is enabled by default, and you can go to **GEV Heartbeat Disable** to disable it.

12.11.2 Set Device Connection Mode

The device supports connecting with PC via DHCP or persistent IP. The device will obtain IP according to the following order.

1. If the device's Persistent IP function is enabled and the configured persistent IP is available, and the device will load the persistent IP. Otherwise execute 2.
2. If DHCP function is enabled and the obtained IP address is available, and the device will load the IP address obtained by DHCP. Otherwise execute 3.
3. LLA obtains IP address.

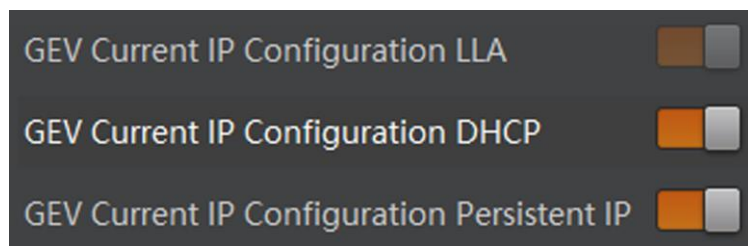


Figure 12-15 Set Device Connection Mode

12.12 User Set Customization

This function allows you to save or load camera settings. The camera supports 4 sets of parameters, including 1 default set and 3 user sets, and the relation among 4 sets of parameters is shown below.

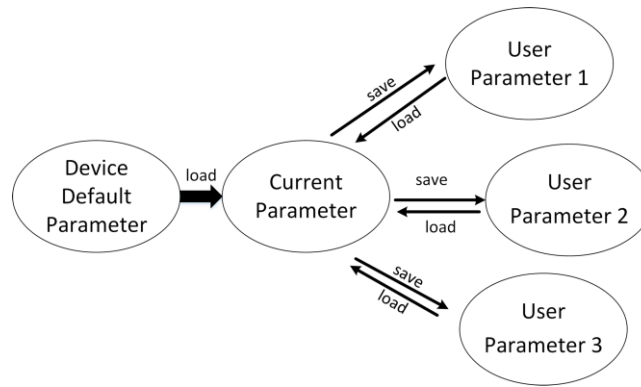


Figure 12-16 Parameter Relation

12.12.1 Save User Set

Steps

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

Note

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

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

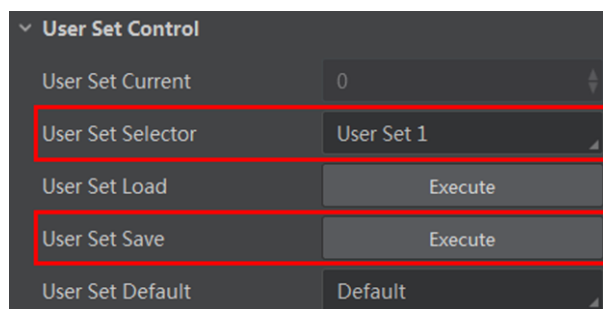


Figure 12-17 Save User Set

12.12.2 Load User Set

Steps

Note

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

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

Note

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

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

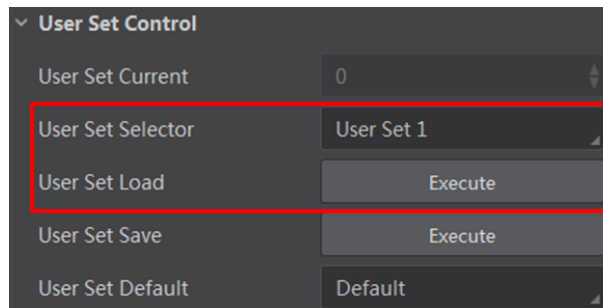


Figure 12-18 Load User Set

12.12.3 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.

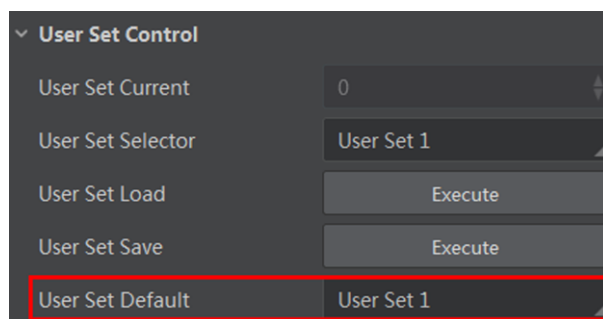


Figure 12-19 Set User Default

12.13 Export Main Parameters

The device supports exporting main parameters, including but not limited to the client software version, SDK version, algorithm library version, exposure, gain, etc. Go to **Config Management** → **Export Main Parameters**, and click **Export** in **Export Parameters** to export main parameters.

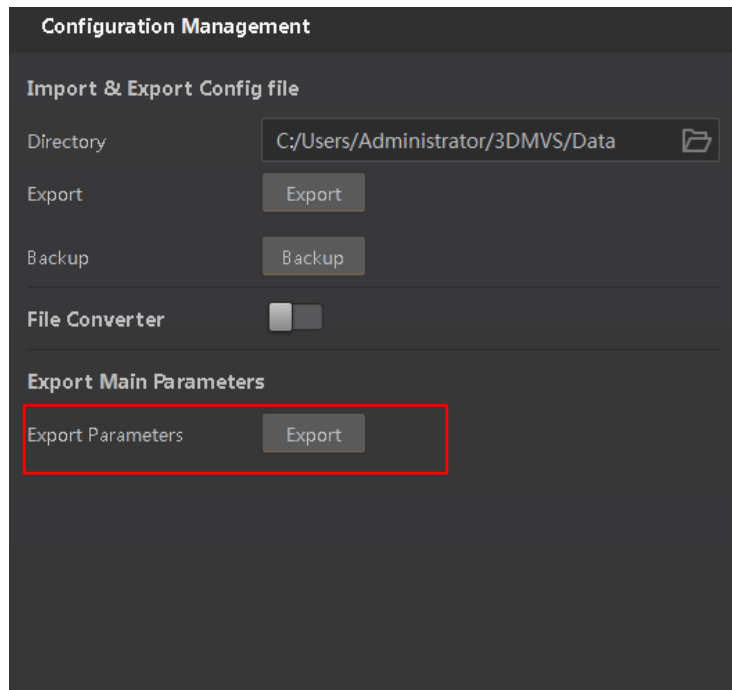


Figure 12-20 Export Main Parameters

Note

The exported file is in txt format.

Chapter 13 FAQ (Frequently Asked Question)

13.1 What can I do if the algorithm, the camera, and the client software do not match?

Problem

There are 2 versions for both algorithm library and camera, and many versions for client software. The exception occurs when outputting volume data due to mismatch among algorithm library, camera and client software.

Solution

Use the latest version of camera firmware, 3DMVS, calibration tool, and software.

13.2 What can I do if the system outputs the volume information very slow?

Problem

The system outputting volume information is timed out.

Solution

It is recommended to overlap the first line of the calibration plate with the laser line. After the end of the package leaves the reference point and moves through volume measurement trigger distance within 1 ms (10 ms at most), the algorithm library outputs the volume value.

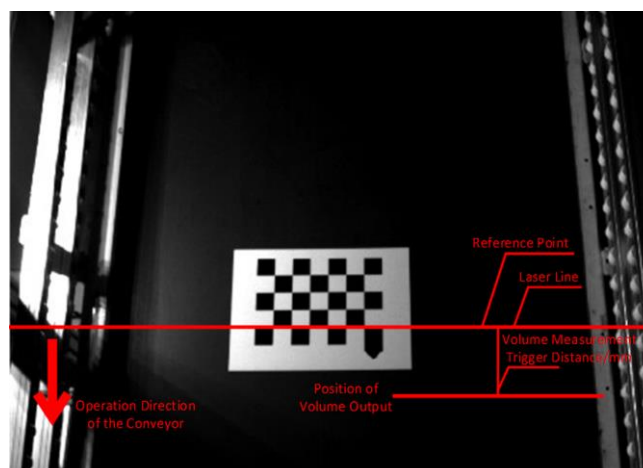


Figure 13-1 Capture Image 1

Most of scenarios are like the figure shown below. After the end of the package leaves the reference point and moves through volume measurement trigger distance within 1 ms (10 ms at most), the algorithm library outputs the volume value.

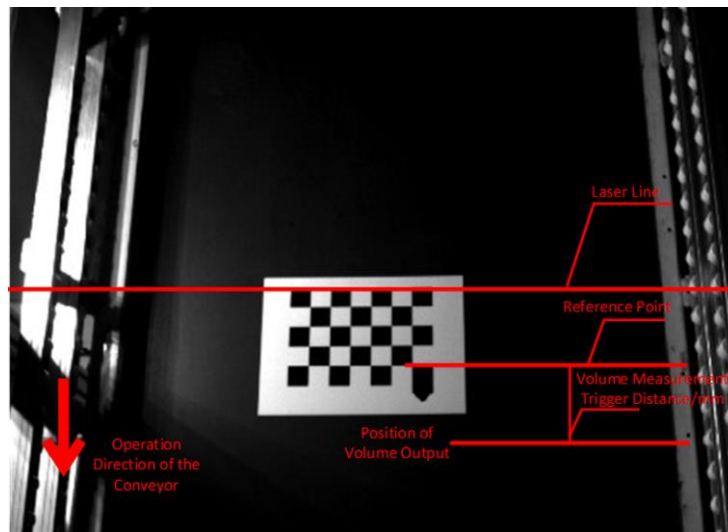


Figure 13-2 Capture Image 2

Note

Only when the end of the package leaves the laser line, the algorithm library outputs the volume value.

13.3 Why the image quality is not good?

Problem

The exposure time is larger than 8000 μ s, or the image quality is influenced by the environment lighting.

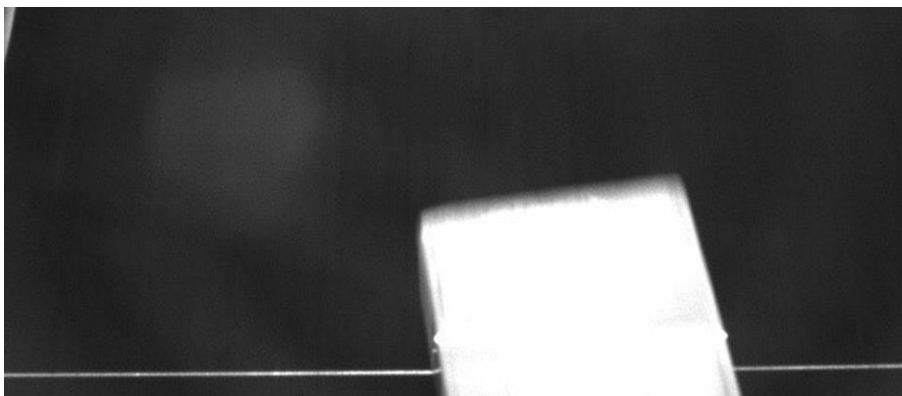


Figure 13-3 Overexposure



Figure 13-4 Environment Lighting

Solution

- Set the exposure time smaller than 4,000 μ s.
- Set binary threshold larger than 40.
- Adjust the gain if the black package cannot be detected.
- Avoid the direct sunlight in the scene.



Figure 13-5 High Quality Image Example

13.4 Why the volume information is not correct?

Problem

- The camera is out of focus.
- The camera is not calibrated.
- Related parameters have not been adjusted after system calibration.
- The width and the length of the camera are not accurate.

Solution

- Make sure the camera is not out of focus.

- Make sure you have finished system calibration.
- If the height is not accurate after calibration, you can adjust height compensate as ± 10 mm according to actual demands.
- If the length is not accurate after calibration, you can adjust step distance according to actual demands. If the measured object length is longer than the actual value, it is recommended to reduce step distance value.
- Make sure the object to be measured is placed parallel to the laser line first, and then start the conveyor belt to test whether the output width is accurate or not. If the length is not accurate, you should adjust the step distance. If the width is not accurate, you should calibrate again.
- If the problem still exists after trying above solutions, please contact technical support.



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