

Hikrobot Co., Ltd.

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

Available Model

This manual is applicable to the Binocular Structured Light Stereo Camera.

Contact Information

Hangzhou Hikrobot Co., Ltd.

E-mail: global.support@hikrobotics.com

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

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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 the specific power consumption of the device, please refer to the device's 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 installation structure.
- 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 IEC 60825-1:2014 and EN 60825-1:2014+A11:2021.



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.
- 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.

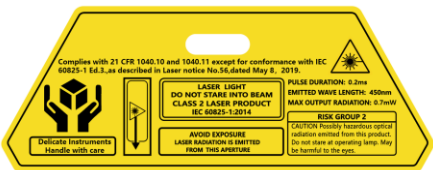
The laser-related parameters are shown below.

Table 1-1 Laser Parameters

Device Model	Laser Safety Class	Wavelength	Beam Divergence Angle	Pulse Width	Repetitive Frequency	Max. Power
MV-DLS300P-04	Class 2	450 ± 5 nm	Vertical: 0.96 rad	200 μs	17 Hz	0.7 mW
MV-DLS600P-12	Class 2	638 ± 5 nm	Vertical: 0.91 rad	400 μs	9 Hz	1.75 mW
MV-DLS1400M-15	Class 2	638 ± 5 nm	Vertical: 0.91 rad	400 μs	9 Hz	1.75 mW

The laser labels are shown below.

MV-DLS300P-04



MV-DLS600P-12
MV-DLS1400M-15

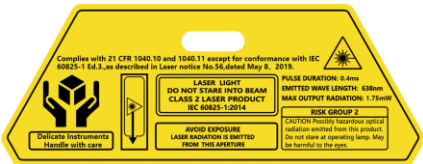


Figure 1-1 Laser Label

Chapter 2 Overview

2.1 Introduction

The binocular structured light stereo camera adopts binocular structured light imaging technology to obtain the RGB-D image with sub-millimeter measurement accuracy. The device has a customized optical system and a built-in algorithm of high-precision 3D image processing, applicable to scenarios of workpiece loading and unloading, bin picking, or alignment assembly.

2.2 Key Features

- Customized optical system provides high-quality image and a more detailed point cloud.
- Supports multi-core parallel processing with high precision and high image acquisition rate.
- Supports alignment between depth images and RGB images and has a built-in supplementary light, convenient for secondary development.
- Adopts light-weight design and small size with high stability for flexible installation and use.

Note

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

2.3 Terminology

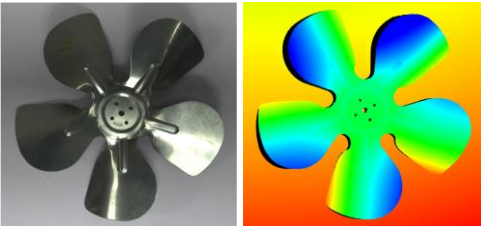
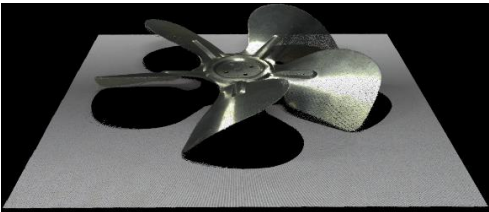
The terminologies in this user manual are shown in the table below.

Note

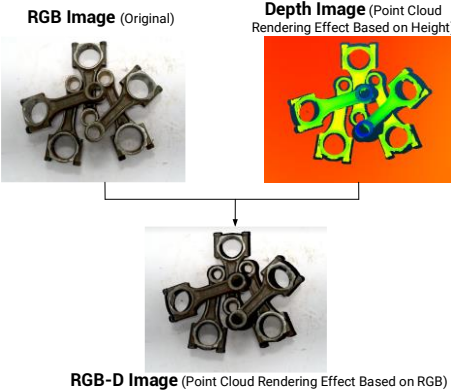
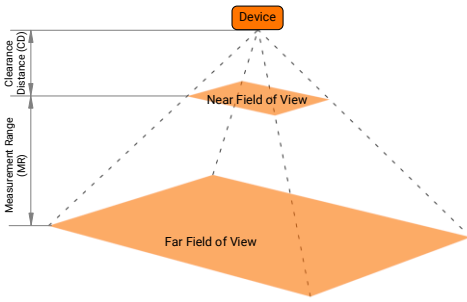
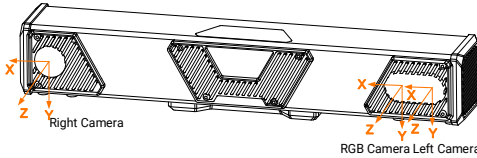
- The images below are for reference only.
 - The location of the mono image sensor or color image sensor may differ by device models.
-

Table 2-1 Terminologies

Terminology	Definition	Image
Galvanometer	It is a high-speed rotating mirror driven by motors, capable of rapid movement along the X-axis and Y-axis. By precisely controlling	--

	the motor's rotation angle, it accurately guides the laser line across the target surface, achieving full coverage of the entire working area.	
Micromirror Array	The micromirror array is a semiconductor chip composed of millions of aluminum micromirrors, each representing a single pixel. The tilt angle of each micromirror can be independently controlled by electrical signals to rapidly adjust the direction of incident light.	--
Depth Image	The depth map is a 2D image that samples the surface of a target object along the X-axis and Y-axis, and shows object information in gray or color in Z-axis. Taking the workpiece in the right figure as an example, the left side is a color image, and the right side displays a pseudocolor-rendered depth image. Different colors in the image represent the distance of each point from the camera.	
Point Cloud	The point cloud is a 3D image represented as a set of discrete points in 3D space. Each point contains its spatial coordinates (X/Y/Z). Taking the workpiece in the right figure as an example, the point cloud can reconstruct a 3D model of the object.	
IR Image	The IR image (infrared image) is generated by capturing the infrared radiation emitted from a target object via an IR camera. It obtains depth information in 3D reconstruction and enhances the	--

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	robustness of image processing.	
RGBD Alignment	Align pixel spatial positions of depth image and color image to generate an RGB-D image with the same resolution as the color image. After alignment, the depth value corresponding to each color pixel can be used for 3D coordinate calculation, achieving correspondence between color data and 3D information.	 The diagram illustrates the RGBD alignment process. It shows three images: an original RGB image of a mechanical part, a depth image rendered as a point cloud with colors representing height, and the resulting RGB-D image where the point cloud is overlaid on the original color image.
Measurement Range (MR)	It refers to the valid range for device measurement. Note If the object is out of the measurement range, no valid data will be obtained.	
Clearance Distance (CD)	It refers to the shortest distance between the device and the object in the measurement range. Note If the distance between the device and the object is less than the clearance distance, no valid data will be obtained.	 The diagram shows a top-down view of the camera's field of view. A 'Device' is at the top. Two horizontal lines indicate the 'Clearance Distance (CD)' (the minimum distance to the object) and the 'Measurement Range (MR)' (the total range of measurement). The field of view is divided into a 'Near Field of View' and a 'Far Field of View'.
Near Field of View	It refer to the viewable area close to the device.	
Far Field of View	It refer to the viewable area far from the device.	
X-Axis/Y-Axis/Z-Axis	They are coordinate axis on the three-dimensional coordinates. The origin of the coordinate system is the center of the lens.	 The diagram shows the physical camera unit with coordinate axes. The 'Right Camera' has X, Y, and Z axes. The 'Left Camera' also has X, Y, and Z axes. The origin of the coordinate system is the center of the lens.

2.4 Operating Principle

The binocular structured light stereo camera consists of structured light module, two 2D mono cameras, and one 2D color camera. The workflow is shown in the figure below.

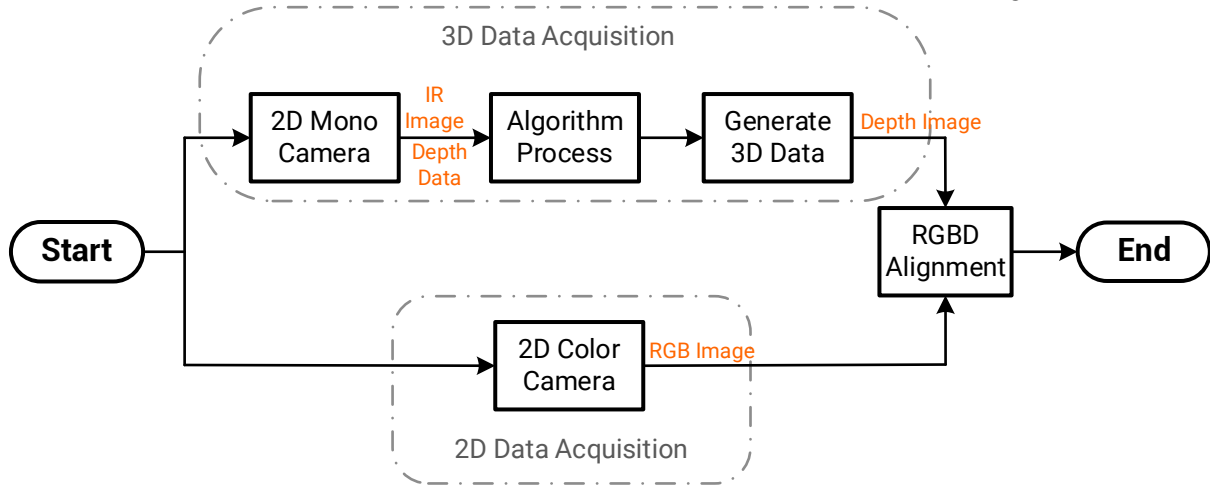


Figure 2-1 Workflow

Note

The binocular structured light stereo cameras here refer to two types: galvanometer laser 3D cameras and projected structured light 3D cameras. For galvanometer laser 3D camera, its structured light module includes laser and galvanometer, and for projected structured light 3D camera, the structured light module includes LED and micromirror array.

3D Data Acquisition

1. The structured light module projects stripe structured light on the surface of the object. Due to the height and shape of the object, the stripe patterns become distorted.
2. The two 2D mono cameras capture the distorted stripe patterns, calculate the depth data of the object surface through internal processing, and output an IR image.
3. The depth data is processed by internal algorithm to generate a depth image and point cloud.

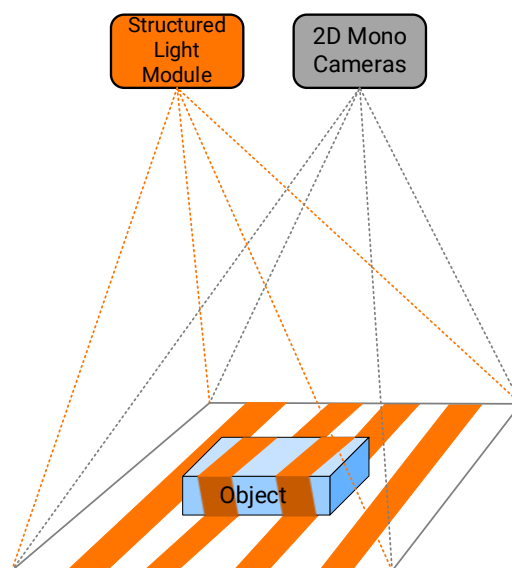


Figure 2-2 3D Data Acquisition

2D Data Acquisition

The 2D color camera captures a 2D image of the object when the galvanometer module does not project structured light, outputs an RGB image, and acquires the surface color and texture information of the object.

RGBD Alignment

The pixel alignment output of RGB image and depth image can be achieved via the client software, which fuses 3D structural information with visual features such as object surface colors and textures, showing a rich and complete scene.

2.5 Appearance

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

Note

- For specific appearance and dimension, please refer to the device's datasheet for details.
 - The appearance is subject to change, and the actual device you purchased shall prevail.
-

Table 2-2 Device Model and Appearance Type

Device Appearance Type	Device Model
Type I Device	MV-DLS600P-12
	MV-DLS1400M-15

Device Appearance Type	Device Model
Type II Device	MV-DLS300P-04
Type III Device	MV-DPS200P-02

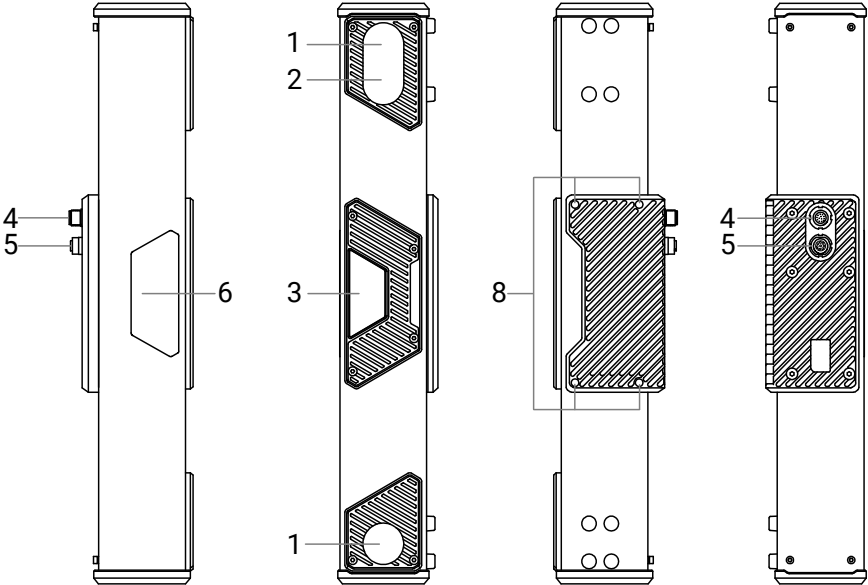


Figure 2-3 Appearance (Type I Device)

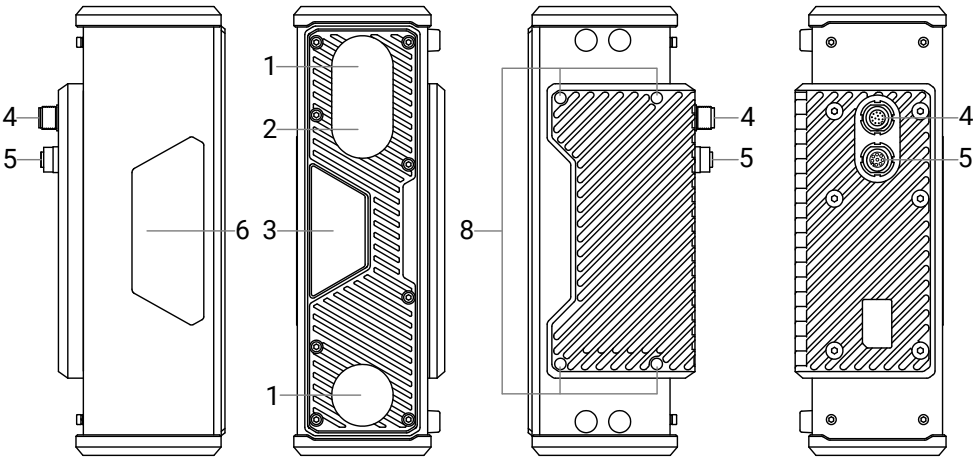


Figure 2-4 Appearance (Type II Device)

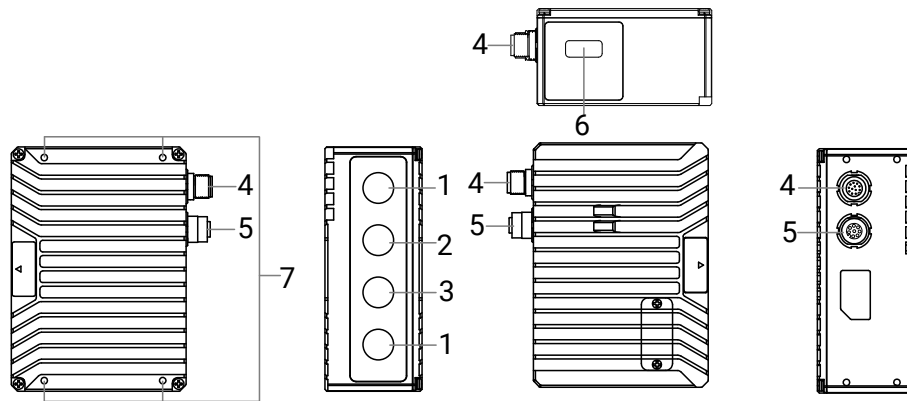


Figure 2-5 Appearance (Type III Device)

Table 2-3 Component Description

No.	Name	Description
1	Mono Image Sensor	It gets images of the measured object for calculating depth information.
2	Color Image Sensor	It gets RGB images of the measured object.
3	Structured Light Module	- For galvanometer laser 3D camera, the laser emits a laser line to the galvanometer mirror, and the galvanometer deflects to make the laser line scan the surface of the measured object. - For projected structured light 3D camera, it reflects LED light via rapid flipping of micromirror array, and projects encoded patterns onto the object surface for scanning.
4	Power and I/O Connector	It refers to the 12-pin M12 connector and provides power, I/O, and serial port. The connector is designed with threads. Before connection, you should tighten it. Refer to section Power and I/O Connector for details.
5	Gigabit Ethernet Interface	It is a gigabit Ethernet interface for transmitting data. The interface is designed with threads to tighten connection between the device and network cable.
6	LED Indicator	It displays the device's operation status. Refer to section Indicator for details.
7	Installation Hole	Some devices have two $\phi 5$ installation holes on the bottom of the device for auxiliary installation.
8	Threaded Hole	There are screw holes on the bottom/side of the device, used to fix the device to the bracket, and

then mount to other structures.

2.6 Power and I/O Connector

The device has a 12-pin M12 connector that provides power, I/O, and serial port. Refer to the figure and table below to get pin definitions.

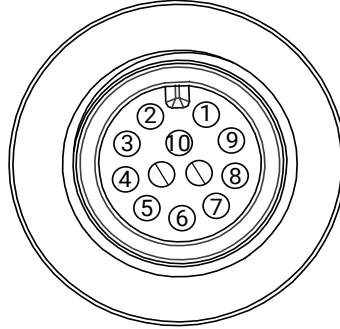


Figure 2-6 12-Pin M12 Connector

Table 2-4 Pin Definitions

Pin No.	Signal	I/O Signal Source	Description
1	POWER_IN	--	Power supply
2	GND	--	Power supply ground
3	I_OUT1	Line 1+	I/O isolated output 1
4	I_OUT4	Line 4+	I/O isolated output 4
5	I_OUT7	Line 7+	I/O isolated output 7
6	OUT_COM	Line 1/4/7-	Output signal ground
7	I_IN0	Line 0+	I/O isolated input 0
8	I_IN3	Line 3+	I/O isolated input 3
9	I_IN6	Line 6+	I/O isolated input 6
10	IN_COM	Line 0/3/6-	Input signal ground

Note

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

2.7 Indicator

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



Note

- The indicator status may differ by device models, and the actual device you purchased shall prevail.
- When the indicator is lit up, flashing rapidly, flashing slowly, or flashing very slowly, its unlit interval is 5 sec, 0.2 sec, 1 sec, and 2 sec respectively.

Table 2-5 Indicator Description

No.	Indicator Color	Status	Device Status
1	Blue	Rapid Flashing	The device is streaming in an internal triggering mode.
2	Blue	Slow Flashing	The device is streaming in an external triggering mode.
3	Blue	Solid	• The device operates normally. • The device's firmware is updated.
4	Red and Blue	Slow Flashing Alternately	The device's firmware is updating.
5	Red and Blue	Rapid Flashing Alternately	The device executes the command of Find Me.
6	Red	Very Slow Flashing	• The device's IP conflicts. • The device's network is not connected.
7	Red	Solid	• Loading uboot failed. • Updating firmware fails. • A fatal exception occurs. • Other errors occur.
8	Orange	Solid	Undervoltage fault is detected.

Chapter 3 Installation

3.1 Installation Preparation

You need to prepare following accessories before installation.

Table 3-1 Accessories

No.	Name	Quantity	Description
1	Power and I/O cable	1	It refers to the cable with 12-pin M12 connector and open end. You need to purchase separately.
2	Network Cable	1	It refers to the M12 to RJ45 network cable. You need to purchase separately.
3	Power Supply	1	It refers to the DC switch power supply. Refer to the values of power supply and power consumption in the datasheet. You need to purchase separately.
4	Bracket	1	It refers to the supplied bracket for fixing the device. Refer to section Install Device for installation details.
5	Screws	Several	They are the supplied M6T bolts for fixing the bracket.

Caution

- 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. Make sure ambient temperature around the device should be within the range of the temperature described in the datasheet.
- 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.
 - It is recommended to power the camera independently, which means that each electrical device should be equipped with a dedicated switching power supply and not share a power source with other electrical devices.
 - Select power modules with EMC certification (CCC or CE), and deploy them close to the camera. Make sure that the cable length from the power output to the camera is less than 3 meters.
 - A power filter should be installed at the input terminal of the power module.
-

3.2 Install Device

Before You Start

- Make sure that the device in the package is in good condition and all assembly parts are included.
- Make sure that all related equipment is powered off during the installation.
- Prepare the tools, such as wrench and screwdriver, for the device installation.
- Make sure that the device is fixed with the bracket.

Steps

1. (Optional) Fix the device to the bracket.

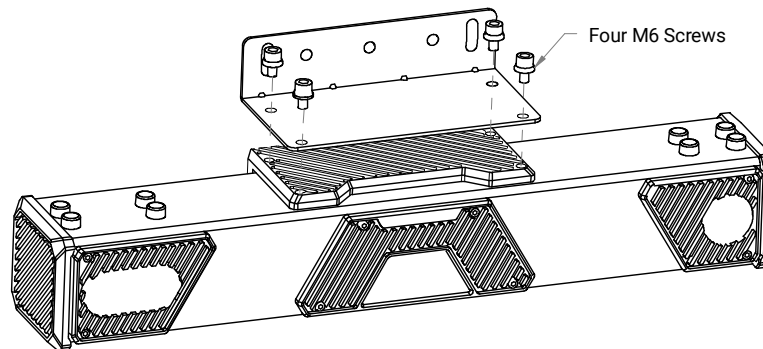


Figure 3-1 Bracket Fixing

2. Fix the bracket to the installation structure.

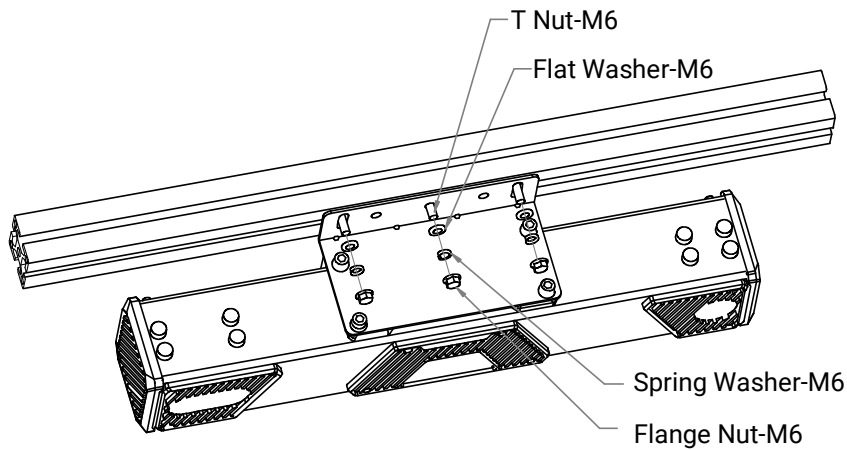


Figure 3-2 Fix to Installation Structure

Note

You can fix the bracket to the top or bottom of the installation structure. If the size of the installation structure is too large, it is recommended to fix the bracket to the bottom of the installation structure.

3. Use the network cable to connect the device to a switch or NIC.
4. Use the power and I/O cable to connect the device to a suitable switch power supply.
Refer to section [Power and I/O Connector](#) for details.



Figure 3-3 Power and I/O Connector

Chapter 4 Device Connection

4.1 Install Client Software

HiViewer (hereinafter referred to as the "client software") is a software application developed specifically for the device. The client software supports live view, parameter configuration, data saving, firmware upgrade and other functions, and you can choose among various rendering modes for viewing live images, such as RGB image, IR image, depth image, and point cloud image.

Steps

Note

- The client software is compatible with 32/64-bit Windows 7/10, and 64-bit Windows 11.
 - You can download the client software from 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 on the upper-left corner.



Figure 4-1 Installation Window

3. Click **Start Setup**.
4. Check **I accept** and click **Next**.
5. Select installation directory and select driver, and click **Next**.

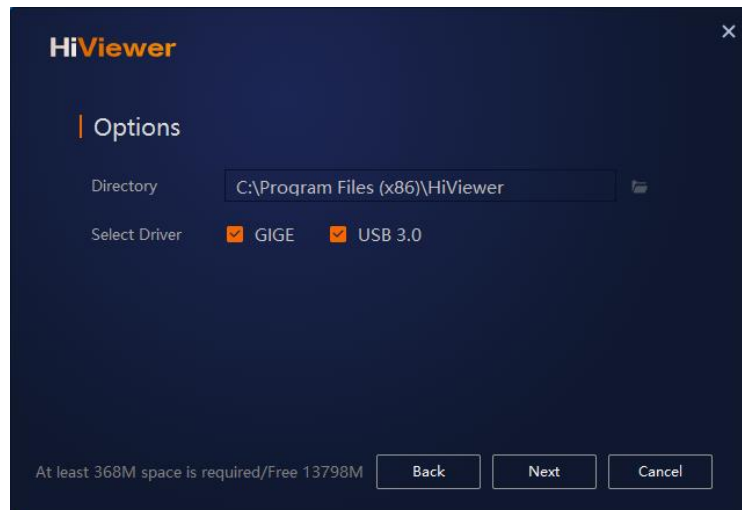


Figure 4-2 Select Directory and Driver

6. Finish the installation according to the interface prompts.

4.2 Set PC Environment

To ensure stable client running and data transmission, you are recommended to set PC environment.

4.2.1 Turn off Firewall

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**.
 - 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)**.

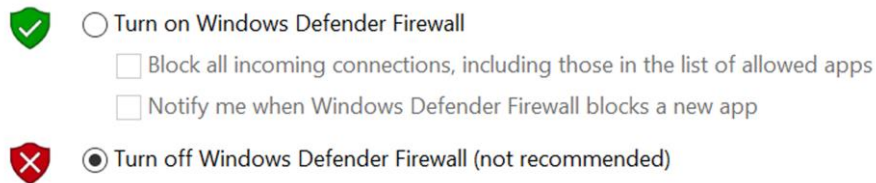


Figure 4-3 Windows Defender Firewall

4. Click **OK**.

4.2.2 Set PC Network

To ensure stable image transmission and normal communication between the PC and the device 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.

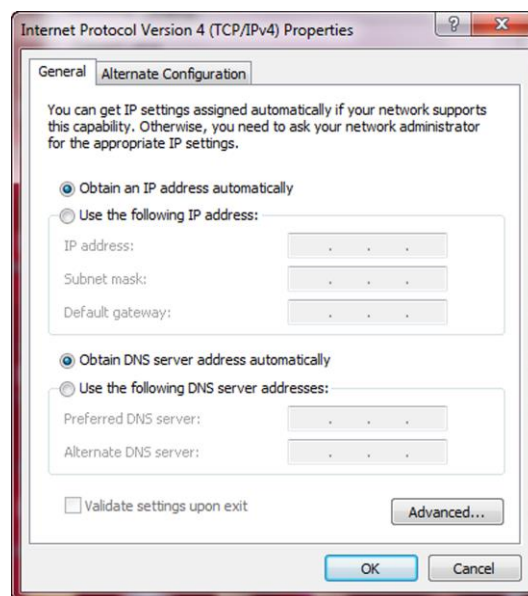


Figure 4-4 Set PC Network

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 **Receive Buffers** to its max. value.

4.3 Set Device Network

You can configure the IP address of the selected camera.

Steps

1. Double click the client software to run it, and the **Device List** window will pop up.
2. Select a device, and the basic information will be shown on the right.
3. Right-click the device and click **Modify IP** to open the **Modify IP Address** window, or click  to open the **Modify IP Address** window.
4. Set the IP address of the device in the same network segment with the PC.

Note

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



Figure 4-5 Modify Device's IP Address

4.4 Connect Device to Client Software

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

Double click the device name in device list, or click  to connect the device to the client.

Chapter 5 Quick Started with Client Software

5.1 Main Window Introduction

After connecting a camera to the Software, you will enter the main window.

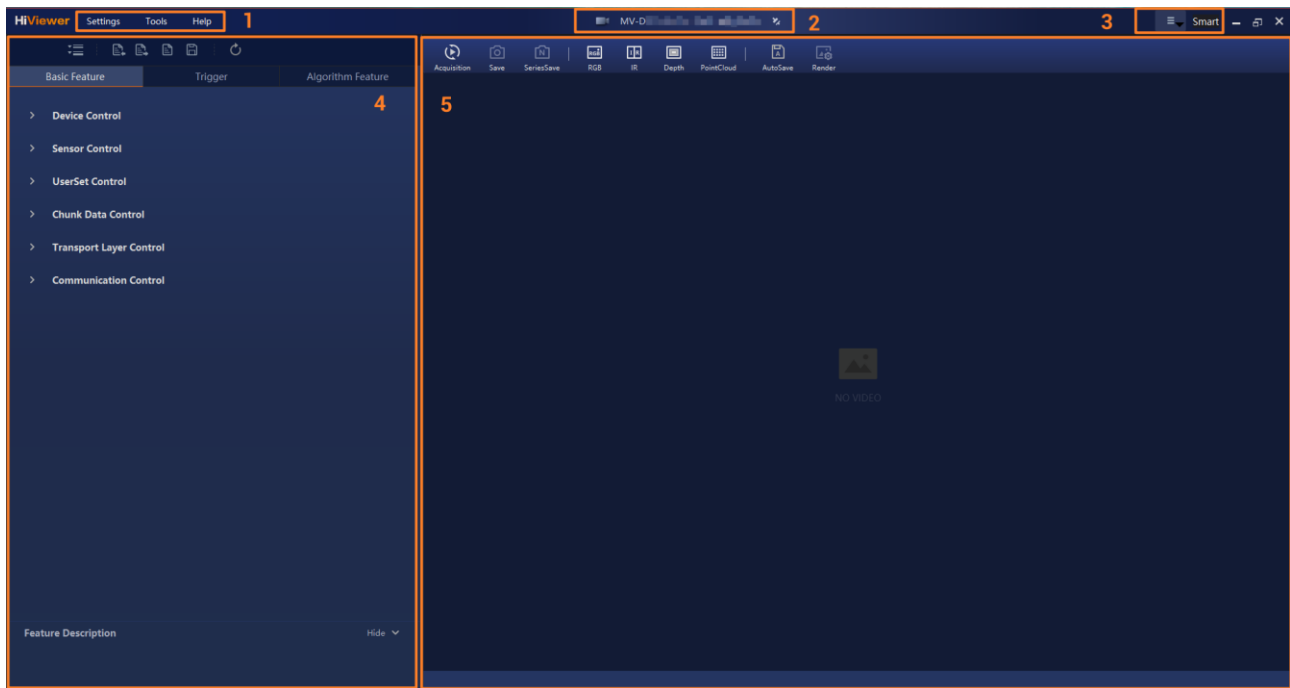


Figure 5-1 Main Window

Note

- For specific main window of the client software, refer to the actual one you got.
- Refer to the user manual of the client software for detailed operations.

The following table shows the description of each area of the main window.

Table 5-1 Main Window Introduction

No.	Area Name	Description
1	Menu Bar	Function modules including Settings , Tools , and Help .
2	Camera Management	Display camera model and serial No. You can click  to disconnect the camera and go back to the initial page. Then you can click Open Device List in the middle to manage cameras on the device list, or double click Quick Connect to quickly connect to the current camera.

No.	Area Name	Description
3	Management Mode	Switch management modes among Standard, Smart, and Developer. ● Standard: For standard camera to perform common acquisition. It is the default mode after launching the Software. ● Smart: For smart camera solution, with additional access to setting algorithm feature and Chunk. ● Developer: For high-end troubleshooting by developers, with access to high-end parameters and all the other parameters in Standard and Smart mode.  Note The functions introduced in this manual is under Smart mode.
4	Feature Panel	Configure and manage camera features, import/export features, and save/load features.
5	Display Window	View the images of the connected camera, switch image modes, and capture image, etc.

Note

If a prompt of network speed lowers than 1 Gbps is displayed when the camera is connected to the HiViewer, check whether the network environment is Gigabit Ethernet. To do this, go to **Network and Internet** → **Network and Sharing Center** → **Change Adapter Settings**, and double click the corresponding NIC to see if the network speed is 1 Gbps.

5.2 Device Debugging

The overall workflow of debugging device is shown below.

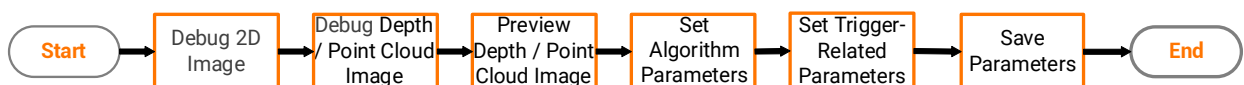


Figure 5-2 Overall Workflow

5.2.1 Switch Rendering Mode

The client software supports multiple rendering modes for viewing live images acquired by a camera, such as RGB image, IR image, depth image, and point cloud image. You can switch among different rendering modes via the top bar of the live view window.

RGB Image

Steps

1. Click  to start acquisition.
2. On the top bar of the live view window, click  to view live images in RGB image mode.



Figure 5-3 Live View in RGB Image Mode

3. Go to **Basic Feature** → **Sensor Control** to set related parameters to adjust brightness and contrast of color image, such as **Color Exposure Time**, **Color Gain**, and **Color Gamma**. Make sure color images have appropriate brightness for clear visibility of surface features.



Figure 5-4 Set RGB Image

- When the image is too dark, you can increase the values of exposure and gain. If the exposure is set to the maximum value allowed by the current frame rate, and the image requires more brightness, it is recommended to increase the gain first. As the exposure increases, the actual acquisition frame rate of the device decreases, which affects the efficiency of image acquisition.
- When the image is too bright, you can decrease the values of exposure and gain.

4. (Optional) When the same scene in a color image changes in light and dark at different times, you can select **DynamicMode** as **Color Exposure Mode**, and set auto exposure offset X/Y, auto exposure width/height, auto exposure time upper/lower limit, gain upper/lower limit, brightness, and Gamma correction. After you set the brightness value, the device will automatically adjust the exposure time and gain between the upper and lower limit.

Note

The **Color Exposure Mode** can be set only when the acquisition is stopped.

IR Image

Steps

1. On the top bar of the live view window, click  to view live images in IR image mode.

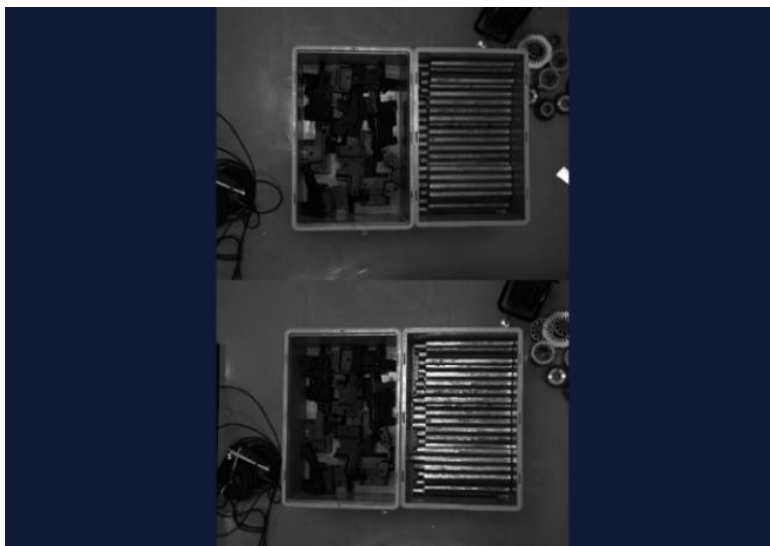


Figure 5-5 Live View in IR Image Mode

2. Go to **Basic Feature** → **Sensor Control** to set related parameters, such as **Exposure Time** and **Gain**.

Make sure IR images have appropriate exposure for good contrast.

- Low exposure: It may cause depth image missing or low reconstruction accuracy.
- Appropriate exposure: It ensures clear stripe pattern without adhesion, and achieves high-quality point cloud.
- High exposure: It may increase ambient light, resulting in image noise accumulation.

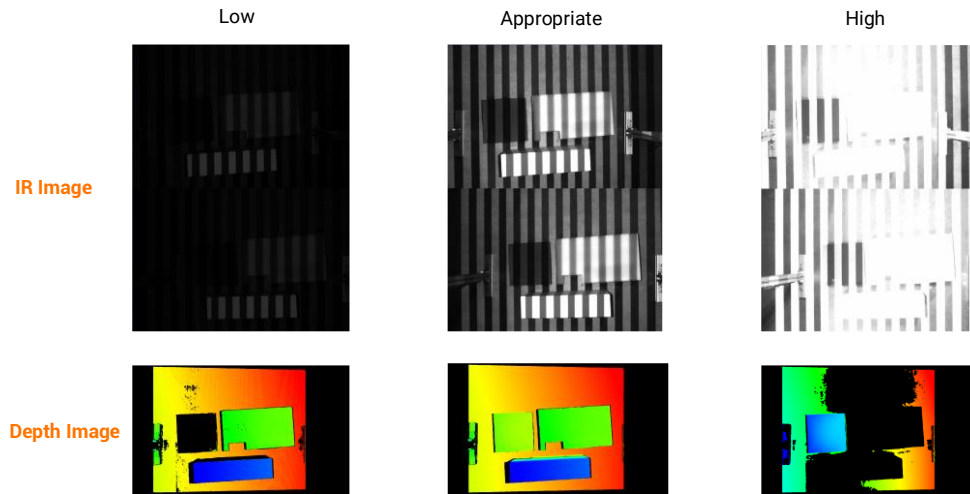


Figure 5-6 Set IR Image

3. (Optional) When the IR image is partially too bright and too dark, you can select **MultipleMode** as **Exposure Mode**, and set Gamma correction and the two sets of exposure time and gain. The device will automatically execute polling and get the images with the set parameters.

 Note

The **Exposure Mode** can be set only when the acquisition is stopped.

Depth Image / Point Cloud Image

On the top bar of the live view window, click  or  to view live images in depth image mode or point cloud mode.

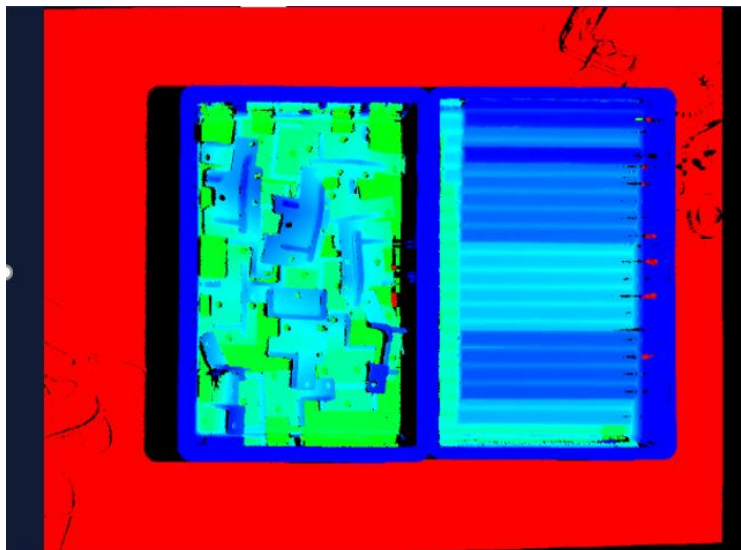


Figure 5-7 Live View in Depth Image Mode



Figure 5-8 Live View in Point Cloud Mode

In the depth image mode and point cloud mode, click  on the top bar of the live view window to set rendering mode: **Gray**, **Jet**, and **Texture**. The rendering-related parameters are introduced below.

- **Auto Mode:** After the function is enabled, the rendering range will be adjusted automatically. If the function is disabled, the rendering range will be between minimum value and maximum value, and you can adjust the value via the slider.
- **Fusion:** You can adjust the fusion value via the slider. The larger the value is, the greater the proportion of the RGB image will be, and the smaller the proportion of point cloud image will be. This parameter is valid when the rendering mode is **Texture**.
- **Display Mode:** You can select **Point** or **Plane** to display the rendering effect.
- **Side Wall:** After the function is enabled, the area where the height difference of the point cloud is within a specific range will be rendered in grids.
- **Palette Type:** You can select **RAINBOW**, **DARK_RAINBOW**, **DARK_GREEN**, **PINKISH_RED**, and **YELLOW**. This parameter is valid when the rendering mode is **Jet**.

Note

- In the depth image mode, only the **Gray** and **Jet** rendering mode can be set.
 - The rendering-related parameters may differ by the rendering mode.
-

5.2.2 Set Algorithm-Related Parameters

When previewing the depth image and point cloud image, you need to adjust algorithm-related parameters according to the actual scene. Please refer to the section of algorithm parameters settings in the user manual.

5.2.3 Set Trigger-Related Parameters

After debugging the image effect, you need to set trigger-related parameters. Please refer

to the trigger settings section in the user manual.

5.2.4 Save Parameters

After debugging the device parameters and images, you need to save the changes to prevent the device from restoring the default parameters after a power failure and restart. Please refer to the section of user set control in the user manual.

Chapter 6 I/O Electrical Features and Wiring

The device has three opto-isolated input signals (Line 0/3/6) and three opto-isolated output signals (Line 1/4/7).

6.1 Input Signal

The device's Line 0/3/6 are opto-isolated input signals, and their internal circuit is as follows.

Note

- The input voltage ranges from 5 VDC to 30 VDC.
- The breakdown voltage is 36 VDC. Keep voltage stable.

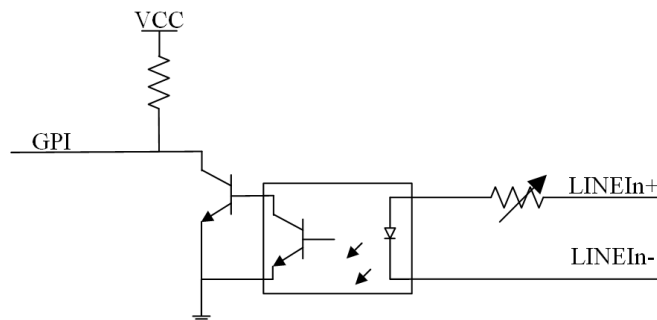


Figure 6-1 Internal Circuit of Input Signal

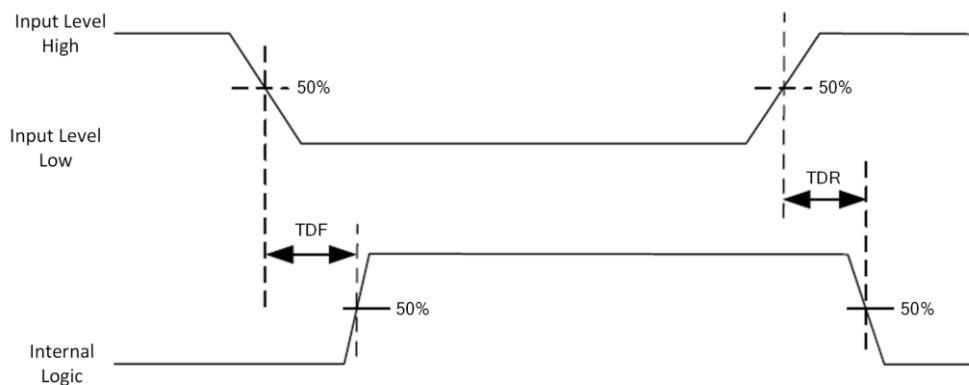


Figure 6-2 Input Logic Level

Table 6-1 Input Electrical Feature

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	1.5 VDC

Parameter Name	Parameter Symbol	Value
Input Logic Level High	VH	2 VDC
Input Falling Delay	TDF	81.6 μ s
Input Rising Delay	TDR	7 μ s

6.2 Output Signal

The device's Line 1/4/7 are opto-isolated output signals, and their internal circuit is as follows.

Note

- The output voltage ranges from 5 VDC to 30 VDC.
- The maximum output current is 25 mA.
- Do not directly connect with inductive load (e.g. DC motor, etc.) when outputting.

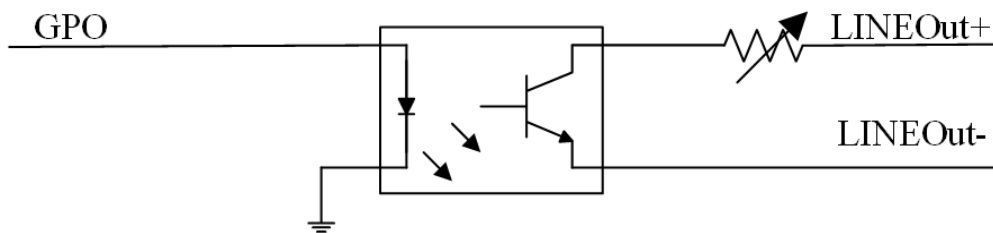


Figure 6-3 Internal Circuit of Output Signal

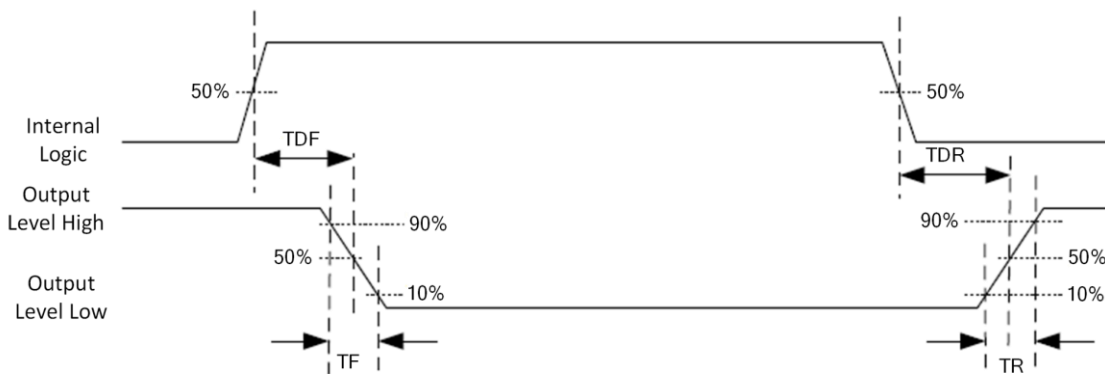


Figure 6-4 Output Logic Level

Note

If the external voltage and resistance change, the corresponding current of output signal and output logic level low may differ.

Table 6-2 Output Electrical Feature

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	730 mV
Output Logic Level High	VH	3.2 VDC
Output Falling Delay	TDF	6.3 μ s
Output Rising Delay	TDR	68 μ s
Output Falling Time	TF	3 μ s
Output Rising Time	TR	60 μ s

6.3 Input Signal Wiring

The device can receive external input signal via its I/O interface.

Note

Input signal wiring may differ with different types of external devices.

PNP Device

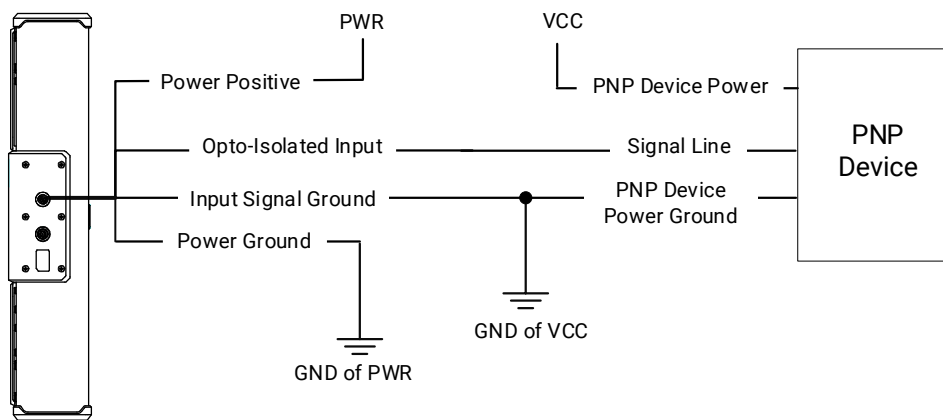


Figure 6-5 Input Signal Connecting to PNP Device

NPN Device

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

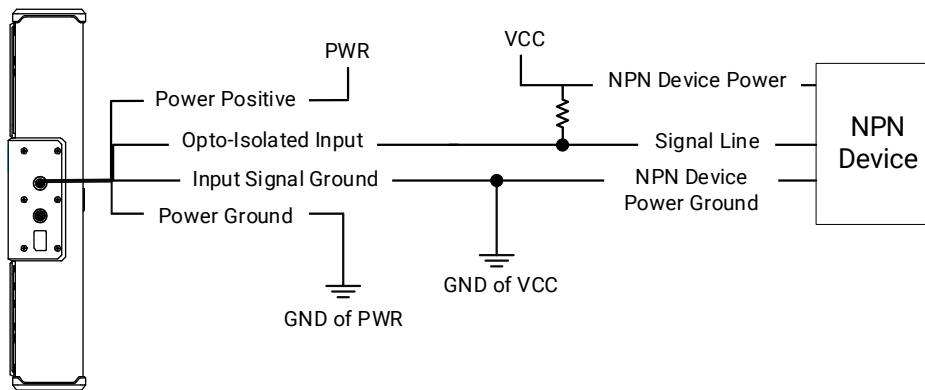


Figure 6-6 Input Signal Connecting to NPN Device

6.4 Output Signal Wiring

The device can output signal to external device via I/O interface.

Note

- Output signal wiring may differ with different types of external devices.
- The voltage of VCC should not be higher than that of PWR. Otherwise, the device's output may have exception.

PNP Device

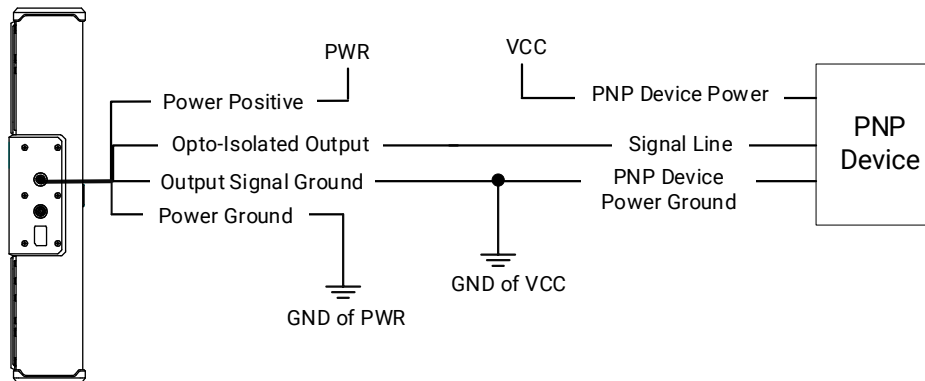


Figure 6-7 Output Signal Connecting to PNP Device

NPN Device

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

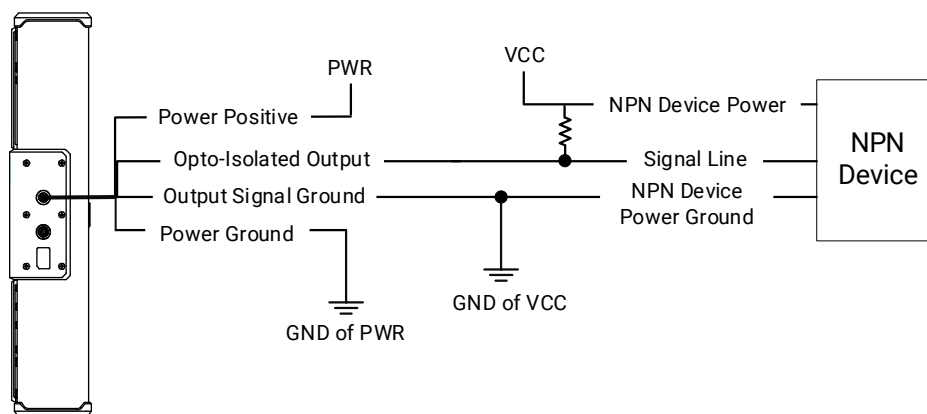


Figure 6-8 Output Signal Connecting to NPN Device

Chapter 7 Basic Features

7.1 Device Control

 Note

The specific device control parameters may differ by device models.

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

Table 7-1 Parameter Description

Parameter	Read/Write	Description
Device Model Name	Read Only	It is the model of the device.
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. • If User ID is empty, the client software displays the device model. • If you set it, the client software displays the User ID you set.
Device Uptime (s)	Read Only	It is the period of time when device is powered up.
Device Connection Speed (Mbps)	Read Only	It indicates the speed of transmission of the specified connection.
Device Link Speed (Mbps)	Read Only	It indicates the speed of transmission negotiated on the specified link.
Device Temperature	Read Only	It shows the temperature of the mainboard or the sensor. The sensor temperature is displayed by default.  Note • If you want to view the temperature of the mainboard, switch the management mode to Developer, and go to All Features → Device Control → Device Temperature Selector and select Mainboard.

Parameter	Read/Write	Description
		This function is supported by some device models.
Device Reset	Read & Write	Click Device Reset to reset the device.
Find Me	Read & Write	It is used to find the current device.

7.2 Set Working Mode

The device supports different working modes, and you can set it according to actual demands. Go to **Sensor Control** → **Camera Working Mode**, and set it.

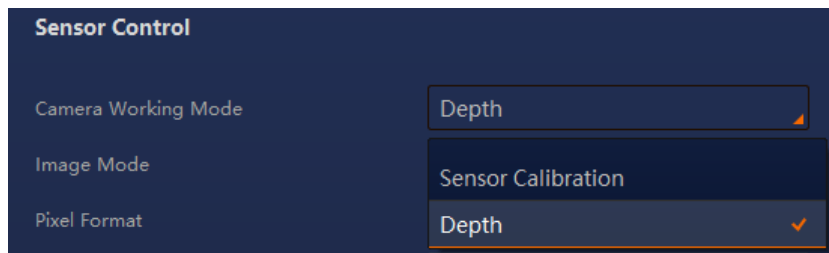


Figure 7-1 Set Working Mode

Table 7-2 Working Mode Description

Working Mode	Description
Sensor Calibration	The internal parameter calibration has been completed by default. If you need to re-calibrate, set the working mode to the sensor calibration.
Depth	It is used to output depth image of the measured object.

Note

The working mode may differ by device models.

7.3 Set Image Mode

The device supports outputting different images, including **Mono Image**, **Color Image**, and **Depth Image**. Go to **Sensor Control** → **Image Mode**, and select **Image Mode** according to actual demands.

Note

The image mode may differ by device models.

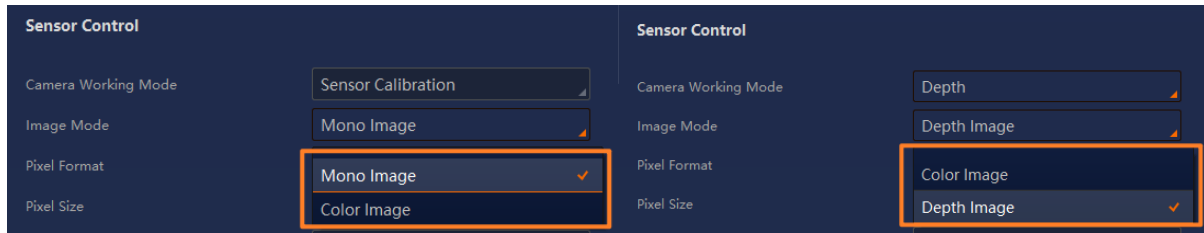


Figure 7-2 Set Image Mode

In different working modes, the device can output corresponding image modes as shown below.

Table 7-3 Relation between Working Mode and Image Mode

Working Mode	Supported Image Mode
Sensor Calibration	Mono Image, Color Image
Depth	Color Image, Depth Image

7.4 Set Pixel Format

This function allows you to set pixel format and view pixel size of the device. Go to **Sensor Control** → **Pixel Format**, set pixel format, and view pixel size. The relation among image mode, pixel format and pixel size is shown below.

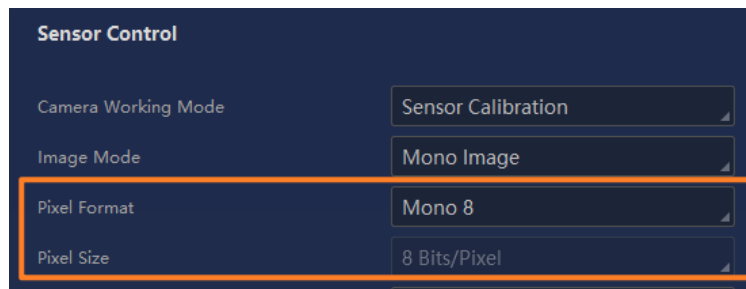


Figure 7-3 Set Pixel Format

Table 7-4 Relation Among Image Mode, Pixel Format and Pixel Size

Image Mode	Pixel Format	Pixel Size
Mono Image	Mono 8	8 Bits/Pixel
Depth Image	Coord3D_C16	16 Bits/Pixel
Color Image	RGB8 Planer	24 Bits/Pixel
	YUV420SP NV12	12 Bits/Pixel

Note

The pixel format of color image may differ by device models.

7.5 Set RGB JPEG

When working mode is **Depth**, and image mode is **Depth Image** or **Color Image**, you can enable **RGB Jpeg Enable** to convert the RGB8 Planer original image transmitted by device into a JPEG format, reducing transmission time.



Figure 7-4 Enable RGB JPEG

7.6 Set Exposure Mode

When image mode is **Depth Image** or **Mono Image**, the device supports two types of exposure mode, including **SingleMode** and **MultipleMode**, which can control exposure time and gain. Go to **Sensor Control** → **Exposure Mode** and set it according to actual demands.

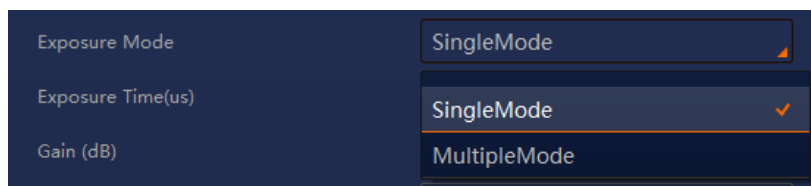


Figure 7-5 Set Exposure Mode

- Regarding the single exposure mode, you can set one set of exposure time, gain, and configure Gamma correction.



Figure 7-6 Single Exposure Mode

- Regarding the multiple exposure mode, you can set two sets of exposure time and gain, and configure Gamma correction. The device will execute polling according to the set parameters, and capture images with the exposure settings.



Figure 7-7 Multiple Exposure Mode

Note

- The unit of exposure time is μs and unit of gain is dB.
- The exposure mode may differ by device models.
- For some devices, the exposure time can only be set as an integer multiple of 256 μs . If the value is not the integer multiple, it will be adjusted automatically.
- The values of **Exposure Time 0** and **Gain 0** should be less than those of **Exposure Time 1** and **Gain 1** respectively.

7.7 Set Color Exposure Mode

When image mode is **Depth Image** or **Color Image**, the device supports two types of color exposure mode, including **SingleMode** and **DynamicMode**, which can control exposure time and gain. Go to **Sensor Control** → **Color Exposure Mode** and set it according to actual demands.

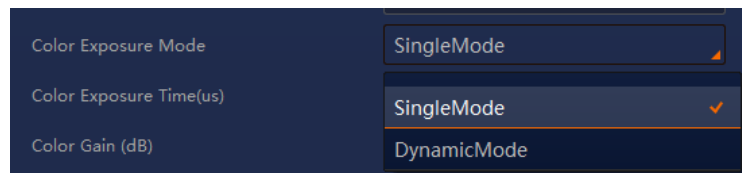


Figure 7-8 Set Exposure Mode

- Regarding the single exposure mode, you can set color exposure time, color gain, and configure color Gamma correction.

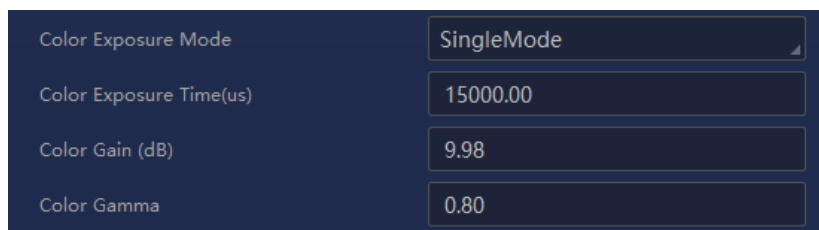


Figure 7-9 Single Exposure Mode

- Regarding the dynamic exposure mode, you can set auto exposure offset X/Y, auto

exposure width/height, auto exposure time upper/lower limit, gain upper/lower limit, brightness, and color Gamma correction. After you set the brightness value, the device will automatically adjust the exposure time and gain between the upper and lower limit.

Color Exposure Mode	DynamicMode
Auto Exposure OffsetX	384
Auto Exposure OffsetY	320
Auto Exposure Width	768
Auto Exposure Height	640
Auto Exposure Time Lower Limit	1000
Auto Exposure Time Upper Limit	15000
Gain Lower Limit(db)	0.00
Gain Upper Limit(db)	23.77
Brightness	100
Color Gamma	0.80

Figure 7-10 Dynamic Exposure Mode

Note

- The unit of exposure time is μs and unit of gain is dB.
 - The color exposure mode may differ by device models.
-

7.8 Set Frame Rate

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

- 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.
- Working mode: In different working modes, the corresponding algorithm mode and frame rate of original image are different. The frame rate of the original image in sensor calibration is less than that in depth mode.

Steps

1. Go to **Sensor 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.
-

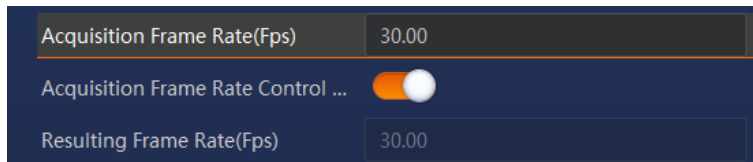


Figure 7-11 Set Frame Rate

7.9 Set Laser

Galvanometer Laser 3D Camera

For galvanometer laser 3D camera, the laser inside the device is used to emit laser speckle to the measured objects. Go to **Sensor Control** → **Laser Enable**, and enable **Laser Enable**.



Figure 7-12 Enable Laser for Galvanometer Laser 3D Camera

Note

- Avoid looking directly at the window of the laser module of the device to avoid irreversible damage to the eyes.
 - When the working mode is **Sensor Calibration**, the **Laser Enable** can be set, and the laser is disabled by default in non-trigger mode.
 - When the working mode is **Depth**, the laser is enabled by default.
-

Projected Structured Light 3D Camera

For projected structured light 3D Camera, the laser inside the device is used to project encoded structured light patterns onto the surface of the measured objects. Go to **Sensor Control** → **Laser Enable**, enable **Laser Enable**, and set **Laser Ratio** to adjust the input current of the optical device, thereby changing its output as a proportion of the maximum total output.

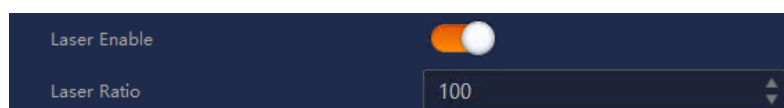


Figure 7-13 Enable Laser for Projected Structured Light 3D Camera

 Note

- When the working mode is **Sensor Calibration**, the **Laser Enable** can be set.
 - When the working mode is **Depth**, the laser is enabled by default.
-

7.10 Set Depth/RGB Align

The device supports Depth/RGB align function to render the depth image according to the coordinates of the RGB image for aligning the depth image with the RGB image and realizing accurate instance segmentation result.

Go to **Sensor Control** → **Depth/Rgb Align Enable**, and enable **Depth/Rgb Align Enable**.



Figure 7-14 Enable Depth/RGB Align

 Note

- The Depth/RGB align function may differ by device models.
 - The settings of this parameter will not be saved in the user parameter. When the device is reconnected, the parameter settings of the last disconnection will not change.
 - The Depth/RGB align function may reduce the max. frame rate of the device.
-

7.11 Set SDK Align

The device supports SDK align function for rendering the depth image based on the coordinates of the RGB image to align the depth image with the RGB image via SDK, increasing the accuracy of instance segmentation results. This function depends on the hardware environment in which the SDK runs. When the performance of the hardware environment is poor, it may cause a significant impact on the frame rate after this function is enabled.

Go to **Sensor Control** → **Sdk Align Enable**, and enable **Sdk Align Enable**.



Figure 7-15 Enable SDK Align

 Note

- The **SDK Align Enable** and **Depth/Rgb Align Enable** cannot be enabled at the same time.
 - The settings of this parameter will not be saved in the user parameter. When the device is reconnected, the parameter settings of the last disconnection will not change.
-

7.12 Set Chunk Data Control

The device supports embedding image information into image data via the Chunk function. The supported image information include **Time Stamp**, **RGB Image**, **Mono Image**, **Depth Image**, **Gray Image**, and **Trigger Identifier**.

Steps

1. Go to **Chunk Data Control** and enable the chunk function.

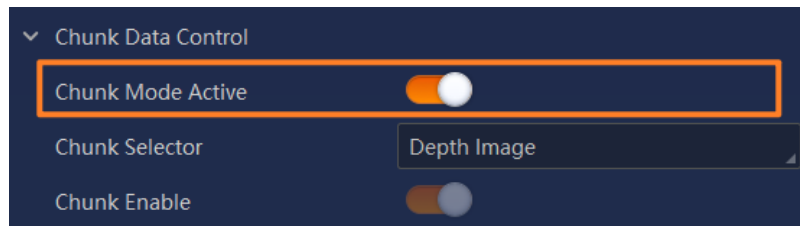


Figure 7-16 Enable Chunk

2. Select the image information, and enable the chunk.

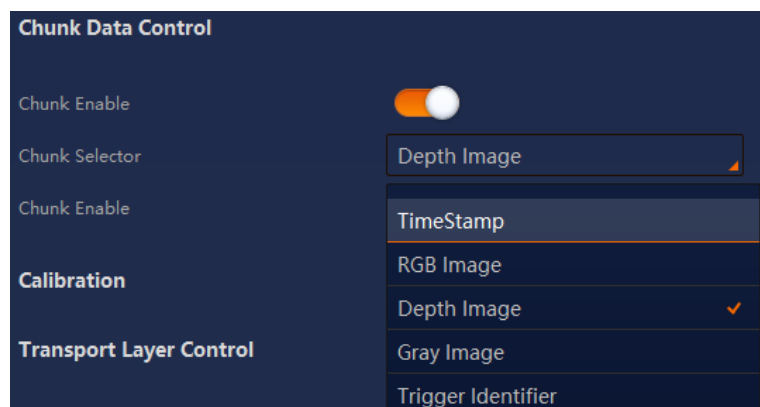


Figure 7-17 Select Information

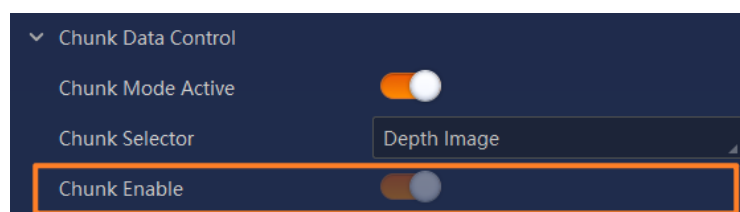


Figure 7-18 Enable Chunk

Note

- The supported image information may differ by device models.
- In some working modes, the **Chunk Mode Active** is enabled by default.
- For some device models, the **Chunk Enable** is enabled or disabled by default and cannot be changed.
- Repeat **Step 2** to add more information.

7.13 Set Transport Layer Control

You can go to **Transport Layer Control** to set the related parameters.

Note

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

Table 7-5 Parameter Description of Transport Layer Control

Parameter	Read/Write	Description
GEV Heartbeat Timeout (ms)	Read & Write	It indicates the current heartbeat timeout in milliseconds.
GEV SCPS Packet Size(B)	Read & Write	It is the device's packet size during transmission process.
Payload Size(B)	Read	It is the device's load size during transmission process.

7.14 User Set Customization

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

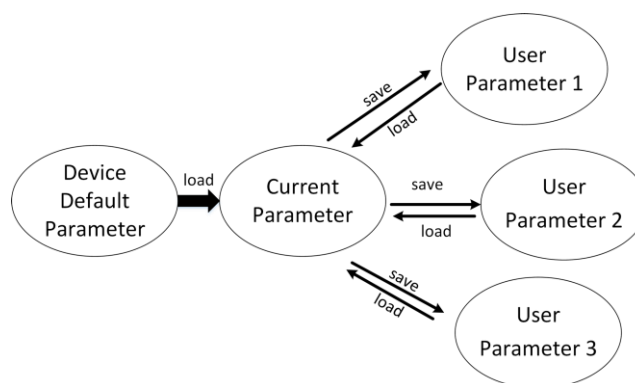


Figure 7-19 Parameter Relation

7.14.1 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 **User Set Save** to save parameter.

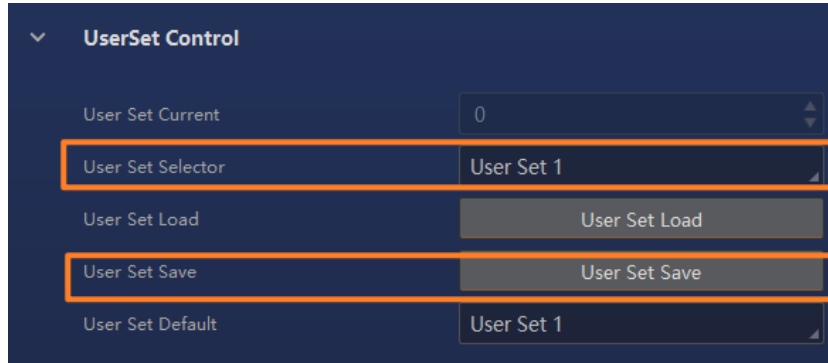


Figure 7-20 Save User Set

7.14.2 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 **User Set Load** to load parameter.

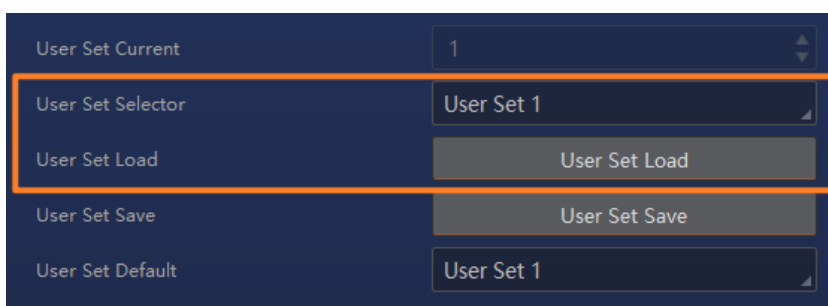


Figure 7-21 Load User Set

7.14.3 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.

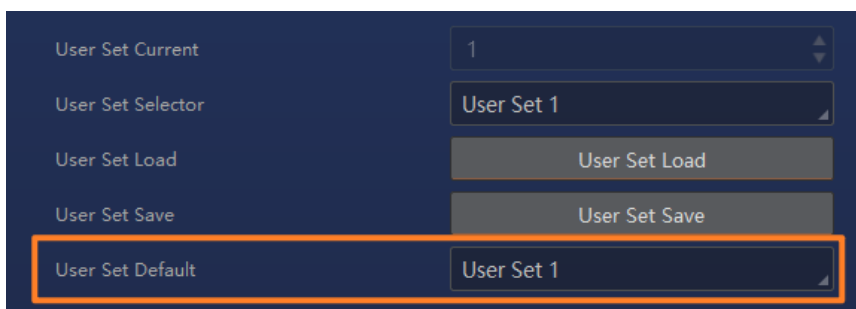


Figure 7-22 Set User Default

Chapter 8 Trigger Settings

This section introduces how to configure the device's trigger input function to acquire images.

8.1 Set Trigger Mode

The device supports two types of trigger mode, including internal trigger mode and external trigger mode. Go to **IO Input** → **Trigger Mode**, and set it.

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

8.1.1 Enable Internal Trigger Mode

Go to **Trigger** → **IO Input** → **Trigger Mode**, and select **Off** as **Trigger Mode**.

Note

Off refers to the internal trigger mode.

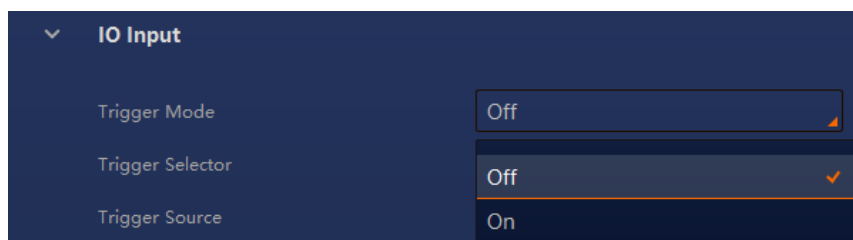


Figure 8-1 Enable Internal Trigger Mode

8.1.2 Enable External Trigger Mode

Go to **Trigger** → **IO Input** → **Trigger Mode**, and select **On** as **Trigger Mode**.

Note

On refers to the external trigger mode.

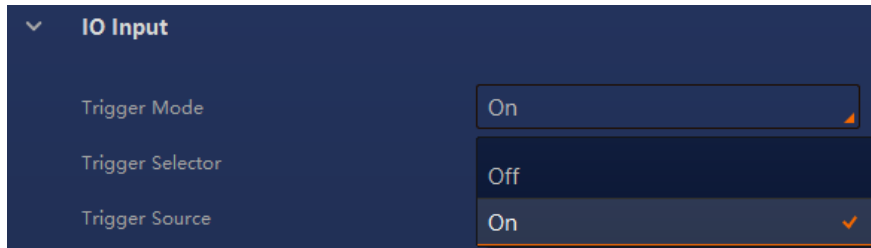


Figure 8-2 Enable External Trigger Mode

8.2 Set Trigger Source

The device's external trigger source includes software trigger and hardware trigger. Go to **Trigger** → **IO Input** → **Trigger Source**, and select **Trigger Source** according to actual demands.

Note

Make sure that the **Trigger Mode** is **On**.

Table 8-1 Trigger Source Description

External Trigger Source	Parameter	Description
Software Trigger	Software	The software sends trigger signal to the device to acquire images.
Hardware Trigger	Line *	External device connects to the device via device I/O interface. External device sends trigger signal to device to acquire images.

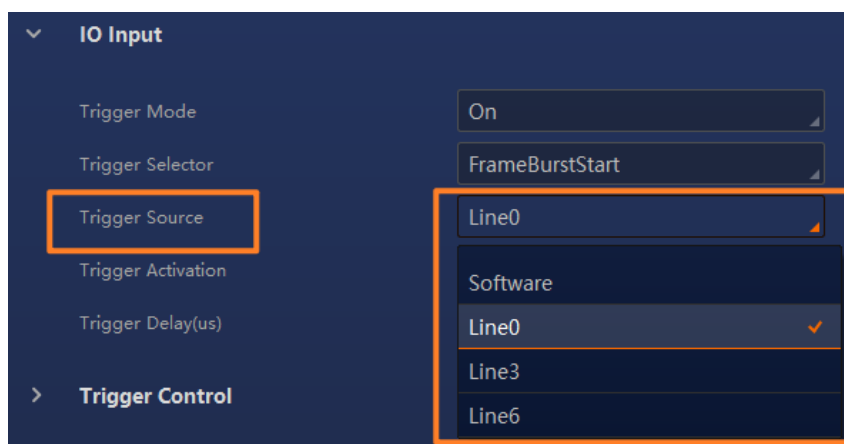


Figure 8-3 Set Trigger Source

8.2.1 Set and Execute Software Trigger Mode

Steps

1. Go to **Trigger** → **IO Input** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Software** as **Trigger Source**.
3. Click **Execute** in **Trigger Software**.
4. (Optional) Set **AutoTriggerTime** and enable **Enable Auto Trigger**. The device will automatically acquires images according to the set time.

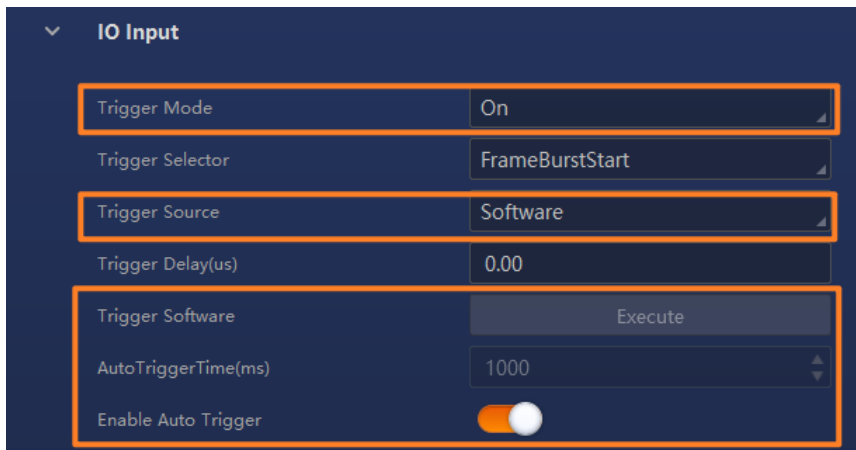


Figure 8-4 Set and Execute Software Trigger Mode

Note

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in the trigger source, including trigger delay.

8.2.2 Set and Execute Hardware Trigger Mode

Steps

1. Go to **Trigger** → **IO Input** → **Trigger Mode**, and select **On** as **Trigger Mode**.
2. Select **Line *** as **Trigger Source** according to actual demands.

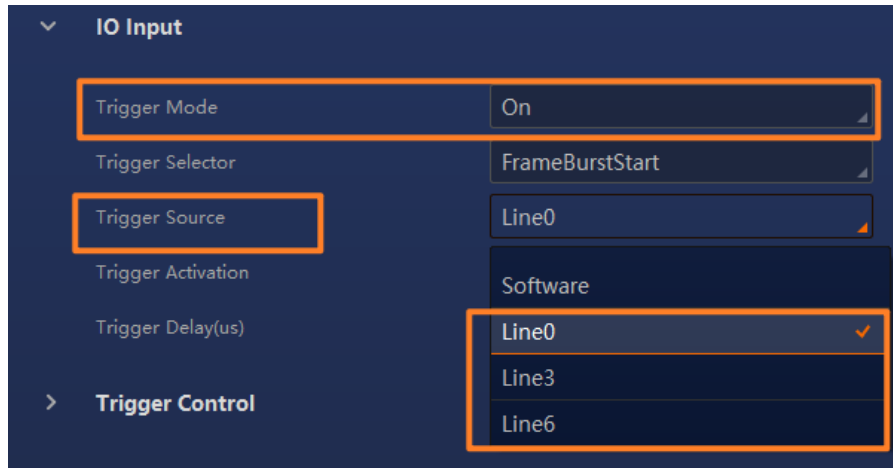


Figure 8-5 Set and Execute Hardware Trigger Mode

Note

Refer to section [Set Trigger Related Parameters](#) for parameters that can be configured in the trigger source, including trigger activation, trigger delay, and trigger debouncer.

8.3 Set Trigger Related Parameters

In external trigger mode, you can set related parameters, including trigger activation, trigger delay, and trigger debouncer.

Note

Different trigger sources can set various parameters in external trigger mode. Refer to the table below

Table 8-2 Trigger Source and Trigger Related Parameters

External Trigger Source Trigger Parameter	Software Trigger	Hardware Trigger
Trigger Activation	×	✓
Trigger Delay	✓	✓
Trigger Debouncer	×	✓

8.3.1 Set Trigger Activation

The device supports trigger acquisition in the rising edge or falling edge of the external signal. Go to **Trigger** → **IO Input** → **Trigger Activation**, and select **RisingEdge** or **FallingEdge** as **Trigger Activation**.

- **RisingEdge**: It means that when the level signal sent by external device is in rising edge,

the device receives trigger signal and starts to acquire images.

- **FallingEdge**: It means that when the level signal sent by external device is in falling edge, the device receives trigger signal and starts to acquire images.



Figure 8-6 Set Trigger Activation

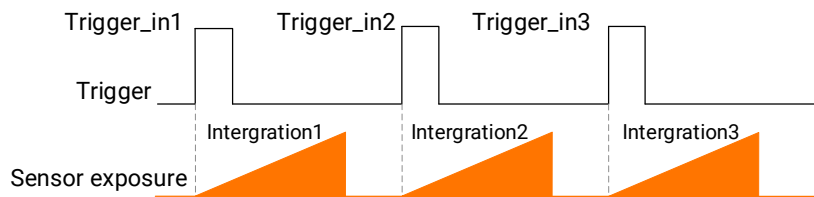


Figure 8-7 Rising Edge

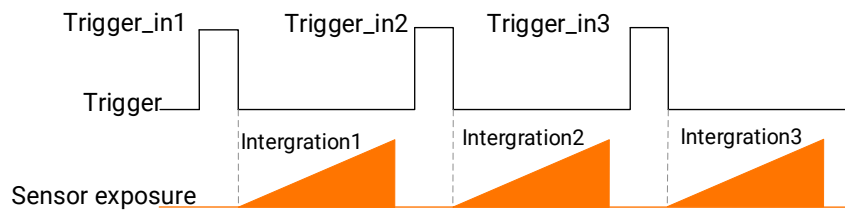


Figure 8-8 Falling Edge

8.3.2 Set Trigger Delay

The trigger delay function allows the device to add a delay between the receipt of trigger signal and the moment the trigger becomes active. Go to **Trigger** → **IO Input** → **Trigger Delay**, and enter **Trigger Delay**.

Note

- When the **RisingEdge** or **FallingEdge** is selected, the **Trigger Delay** can be set.
- The unit of trigger delay is μs .
- The sequence diagram below uses rising edge as trigger activation.

Trigger Mode	On
Trigger Selector	FrameBurstStart
Trigger Source	Line0
Trigger Activation	RisingEdge
Trigger Delay(us)	0.00

Figure 8-9 Set Trigger Delay

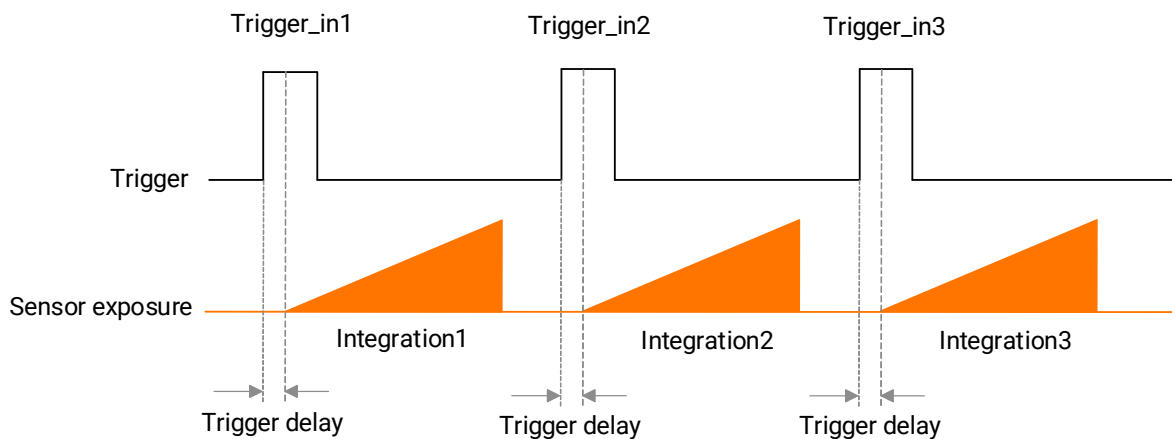


Figure 8-10 Sequence Diagram of Trigger Delay

8.3.3 Set Trigger Debouncer

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

Go to **Trigger Control**, select a Line in **Line Debouncer Selector**, and enter **Line Debouncer Time** according to actual demands.

Note

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

Line Debouncer Selector	Line 0
Line Debouncer Time(us)	1000

Figure 8-11 Set Trigger Debouncer

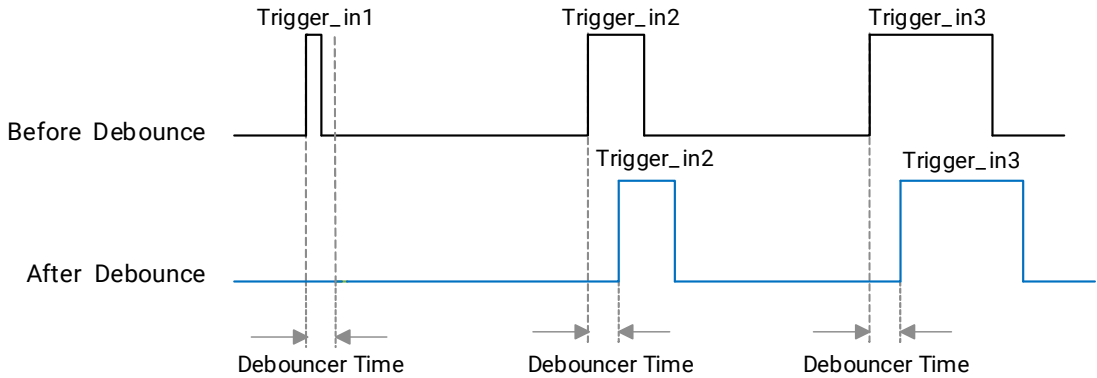


Figure 8-12 Sequence Diagram of Trigger Debouncer

 Note

The sequence diagram above uses rising edge as trigger activation.

Chapter 9 Algorithm Parameters Settings

The device supports built-in algorithms with high precision, and you can go to **Algorithm Control** and set the related parameters.

Note

The specific parameters may differ by device models.

9.1 View Algorithm Status Code

You can go to **Algorithm Control** → **Algorithm Status Code** to view the device's algorithm status code for troubleshooting.

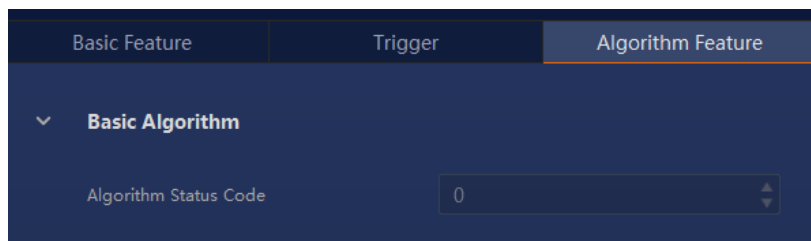


Figure 9-1 View Algorithm Status Code

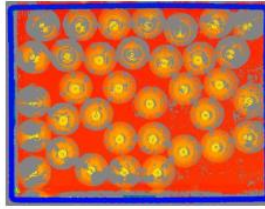
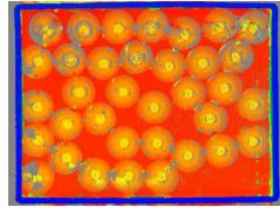
9.2 Set SSL Parameters

Go to **SSL Param Control** to set parameters related to depth image. The specific parameters are shown below.

Table 9-1 SSL Parameters

Parameters	Description
Min/Max Work Distance	It sets the nearest/farthest measurement distance of the sensor. A reconstruction error may occur if the value exceeds the set range.  Note For some devices, this parameter is invalid. You can edit configuration file of the client software to view the rendering effects of different distances. Please contact technical support for details.
Over Expo Threshold	Determine whether the overexposure occurs in the area based on grayscale values of the pixel.

	If the grayscale values of this area are greater than the threshold, the area will be confirmed as overexposed, and no reconstruction will be performed. Decreasing the threshold can eliminate the reconstruction errors caused by overexposure, but the reconstruction rate will decrease too. Increasing the threshold can increase the reconstruction rate, but there may be reconstruction errors or noise caused by overexposure.
Under Expo Threshold	Determine whether the underexposure occurs in the area based on grayscale values of the pixel. If the grayscale values of this area are less than the threshold, the area will be confirmed as underexposed, and no reconstruction will be performed. Increasing the threshold can eliminate the reconstruction errors caused by underexposure, but the reconstruction rate will decrease too. Decreasing the threshold can increase the reconstruction rate, but there may be reconstruction errors or noise caused by underexposure.
Complete Scene Flag	It can be set when the management mode is Developer. If this parameter is disabled, it is in robustness mode, and if the parameter is enabled, it is in completeness mode. Robustness: It can remove the majority of noise points, and improve the accuracy of the point cloud, but reduce the reconstruction rate. Completeness: It can improve the reconstruction rate, especially in scenes where reconstruction is incomplete due to local-reflective metal object or underexposed target. However, there are more noise points.  Note A lower reconstruction rate results in a higher proportion of no-data background in the depth image. In the images below (robustness and completeness), green points refer to noise, while the gray areas indicate the background. Comparing the two images, the depth image in robustness mode has fewer noise points but a larger background area.

	   High-Reflective Metal Object Robustness Completeness Figure 9-2 Depth Image Mode
Stereo Depth Binning	This function can increase the output frame rate and reduce the noise of the depth image. Meanwhile, the resolution of the depth image will also decrease. Therefore, it is not recommended to use this function when measuring small-sized objects.
SSL Depth Roi Offset X/Y	You can set the offset of the ROI of the depth image in X/Y direction.
SSL Depth Roi Width/Height	You can set the width and height of the ROI of the depth image. Only the ROI will output the point cloud. Meanwhile, the output frame rate of the depth image can be increased, and the surrounding abnormal points can be reduced.
Gauss Filter Mode	This function can execute filter preprocessing of the original image, enhancing the smoothness of the depth image. You can select NoFilter, LowFilter, or HighFilter. Compared to LowFilter, HighFilter achieves higher intensity and greater smoothness.
Relillum Compensation Enable	This parameter can execute compensation for illumination non-uniformity caused by the lens, and improve the reconstruction rate at the corners of the image.
Stereo Match Error Thrd	This parameter sets the search window size for binocular matching. Increasing the value can improve the reconstruction rate, but may also generate more noise points and increase processing time.

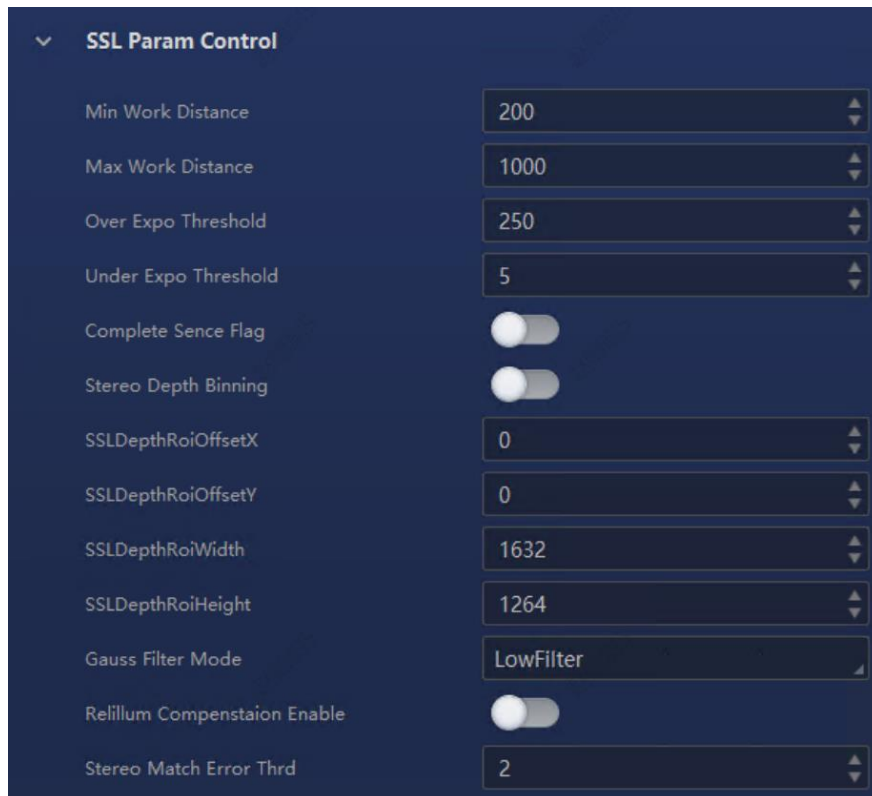


Figure 9-3 SSL Parameters

9.3 Set Post Processing Algorithm Parameters

You can set post processing parameters to improve the quality of the depth image.

Note

When multiple functions are enabled at the same time, they will be executed in the order in which the functions are displayed on the interface.

9.3.1 Set Noise Filter

When the device acquires the data, noise points generated by reflection appear in some small areas. The noise filter function can remove a small part of the isolated points whose length and width are less than the set threshold.

Table 9-2 Noise Filter Parameters

Parameters	Description
Noise Filter Enable	If it is enabled, the device will execute the noise filter function.
Noise Filter Type	You can select DomainFilter or SpeckleFilter .

	DomainFilter: The valid point areas are counted within the domain, without considering depth difference in the valid point areas. SpeckleFilter: The domain are constructed based on the depth difference. It is recommended to select this type when the surrounding non-empty domain should be removed.
Noise Filter Width	It refers to the continuous width of non-empty point in the X-direction. The isolated points greater than the value will not be filtered, and those less than the value set to empty points. The unit is pixels. This parameter is valid when DomainFilter is selected.
Noise Filter Height	It refers to the continuous height of non-empty point in the Y-direction. The isolated points greater than the value will not be filtered, and those less than the value set to empty points. The unit is pixels. This parameter is valid when DomainFilter is selected.
Noise Filter Speckle Depth Diff	It refers to the depth difference of adjacent points. The points whose depth difference less than the value belong to the same domain. This parameter is valid when SpeckleFilter is selected.
Noise Filter Speckle Area	It refers to the threshold of pixel area. The domain whose area less than the value will be removed. This parameter is valid when SpeckleFilter is selected.

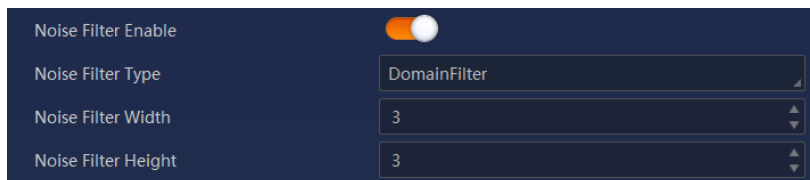


Figure 9-4 Noise Filter Parameters

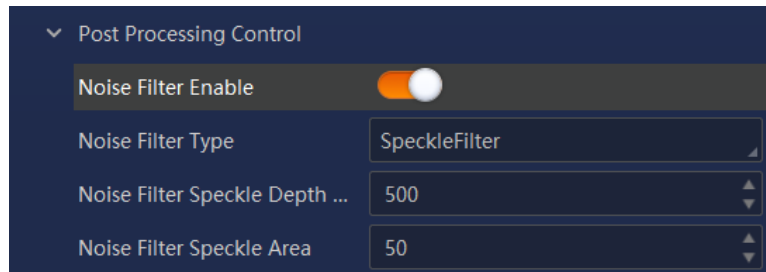


Figure 9-5 Noise Filter Parameters

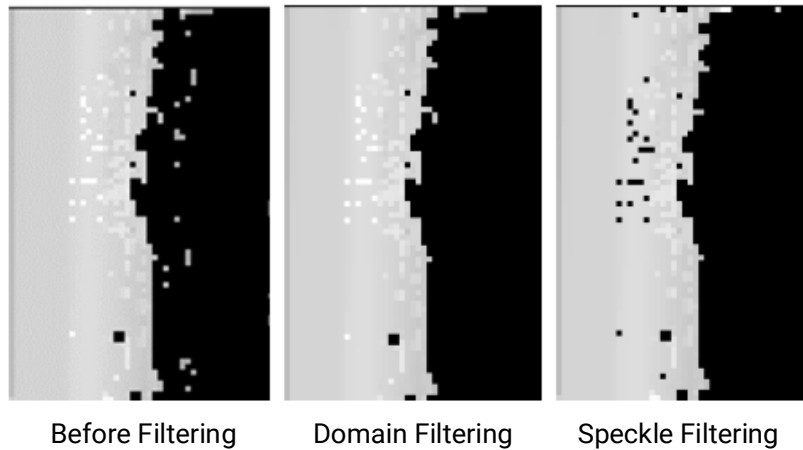


Figure 9-6 Noise Filter Effect

9.3.2 Set Normal Filter

The normal filter function can remove inclined planes that have too large angle with the Z-axis in the depth image, due to poor depth image quality or that is not needed in the application (affecting segmentation, etc.). This function calculates the angle between the normal vector and the Z-axis for each valid point in the depth image. If the angle is larger than the set value, the point is set as invalid.

Table 9-3 Normal Filter Parameters

Parameters	Description
Normal Filter Enable	If it is enabled, the device will execute the normal filter function.
Normal Filter Window Width	It refers to the size of the window used to calculate the normal vector of input depth image. - The smaller the window is, the better it can reflect the real shape around the point, and it is also more vulnerable to noise. - The larger the window is, the less it will be affected by noise, and it is also more likely to cause distortion.
Normal Filter Morph Size	It refers to the size of the window for normal vector filtering mask morphological processing, and 0 means off. During the process of normal vector filtering, this function can remove the holes in the depth image. The larger the window is, the larger the area of the holes that can be removed will be.
Normal Filter Zangle Type	You can select the method for calculating the angle between the normal vector and the Z-axis. X Direction: Use the angle in X-direction.

	• Y Direction: Use the angle in Y-direction. • XY Direction: Use the angle in X and Y directions (recommended).
Normal Filter Zangle Ther	It refers to the threshold to determine whether to filter the point's angle between the normal vector and the Z-axis. If the angle is greater than the threshold, the point will be removed.
Normal Filte Comp Type	It sets the type of normal filter. • Greater Than: Points where angle (between normal vector and the Z-axis) is greater than Normal Filter Zangle Ther will be filtered. • Range: Points where difference value between angle (normal vector and the Z-axis) and Normal Filter Zangle Ther is in the range of Normal Filte Angle ERR will be filtered.
Normal Filte Angle ERR	It refers to the error range between angle (normal vector and the Z-axis) and Normal Filter Zangle Ther. Points within this range will be filtered.  Note This parameter is valid only when Range is selected as Normal Filte Comp Type.

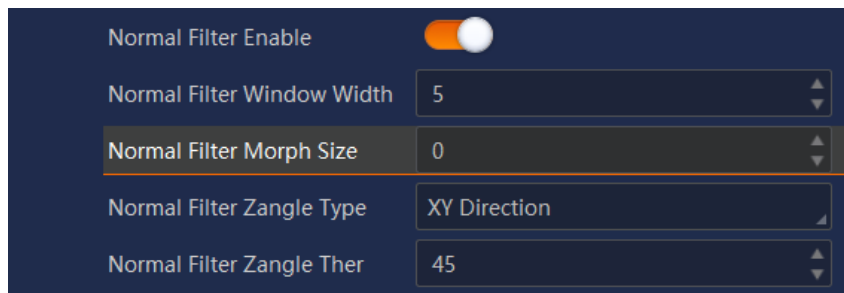


Figure 9-7 Normal Filter Parameters

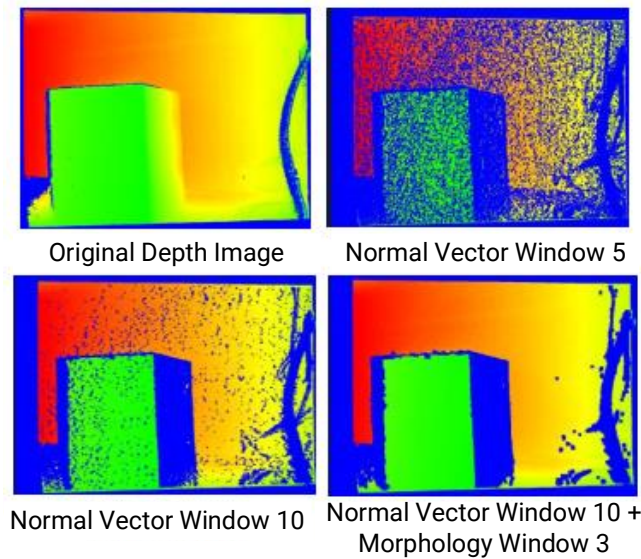


Figure 9-8 Normal Filter Effect

9.3.3 Set Extension

The extension function can expand data to fill invalid areas in depth image.

Table 9-4 Extension Parameters

Parameters	Description
Exten Enable	If it is enabled, the device will execute the extension function.
Exten Point Num	It refers to the maximum number of pixels to be filled during extension.
Exten Mode	It includes Smooth mode and Textured mode. • Smooth: This mode provides a smoother filling result with faster process speed, but at the cost of detail loss. It includes Smooth X, Smooth Y, and Smooth XY. • Textured: This mode achieves more details, but operates at lower speed. It includes Textured X only.

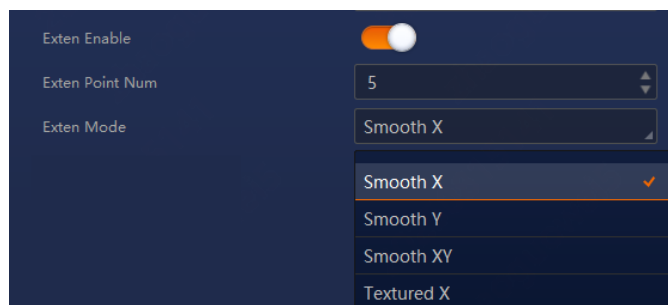


Figure 9-9 Extension Parameters

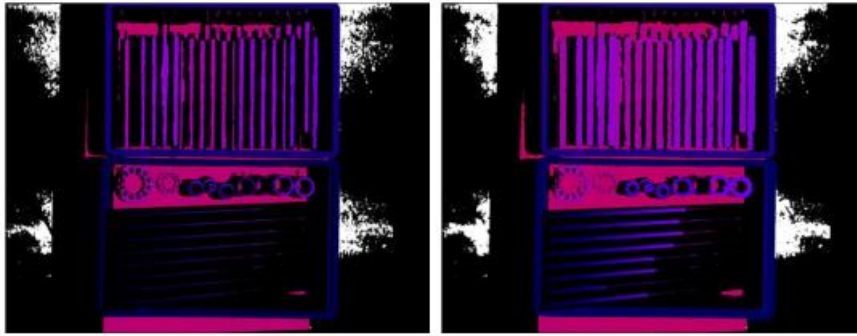


Figure 9-10 Extension Effect

9.3.4 Set Gap Filling

The gap filling function counts the holes in the X and Y directions on the depth image. It performs linear interpolation on the points whose continuous length is less than the set threshold and whose height difference between the non-empty points on both sides is smaller than the threshold, and fills the holes to obtain a more complete depth image.

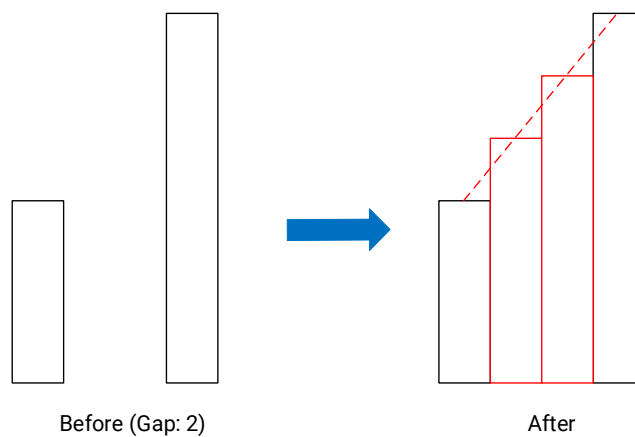


Figure 9-11 Gap Filling Principle

Table 9-5 Gap Filling Parameters

Parameters	Description
Gap Fill Enable	If it is enabled, the device will execute the gap filling function.
Gap Fill Mode	There are three options. • X Direction: Fill the invalid points in X-direction. • Y Direction: Fill the invalid points in Y-direction. • XY Direction: Fill the invalid points in X and Y directions (first X-direction, then Y-direction).
Gap Fill X Num	It sets the maximum gap width for filling in the X direction. If the gap width is greater than this value, no filling will be

	executed.
Gap Fill Y Num	It sets the maximum gap width for filling in the Y direction. If the gap width is greater than this value, no filling will be executed.
Gap Fill Height Th	It refers to the depth value height difference between the points on both sides of the gap. If it is greater than this value, no filling will be executed. The unit is depth value.

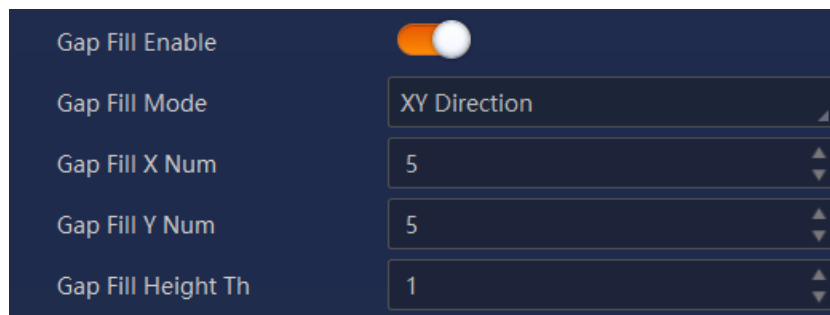


Figure 9-12 Gap Filling Parameters

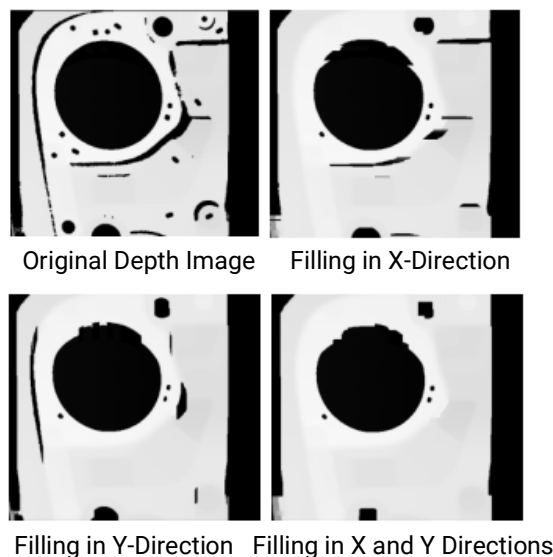


Figure 9-13 Gap Filling Effect

9.3.5 Set Range Filter

The range filter function can execute filtering for the depth image to remove noise light.

Table 9-6 Gap Filling Parameters

Parameters	Description
Range Filter Enable	If it is enabled, the device will execute the range filter

	function.
Range Filter Type	You can select Gaussian Filter, Median Filter, Mean Filter, Inverse Gaussian Filter, and Spatial Filter.  Note It is recommended to select Spatial Filter. Gaussian Filter and Mean Filter may cause distortion of depth edge, and Median Filter and Spatial Filter have a better effect on edge.
Range Filter Win Width	It refers to the window width of depth image filtering. The larger the value is, the smoother the image will be. This parameter is valid when Gaussian Filter, Median Filter, Mean Filter, or Inverse Gaussian Filter is selected.
Range Filter Win Height	It refers to the window height of depth image filtering. The larger the value is, the smoother the image will be. This parameter is valid when Gaussian Filter, Median Filter, Mean Filter, or Inverse Gaussian Filter is selected.
Range Filter Spatial Dir	You can select XY Direction, X Direction, or Y Direction. This parameter is valid when Spatial Filter is selected.
Range Filter Stddev	It refers to the standard deviation of spatial filter. The larger the value is, the smoother the image will be. This parameter is valid when Spatial Filter is selected.
Range Filter Decay	It refers to the spatial filter decay, which can affect the morphology of the filter kernel. This parameter is valid when Spatial Filter is selected.  Note It is recommended to keep the default value, because this parameter may cause offset of depth value.



Figure 9-14 Range Filter Parameters



Figure 9-15 Range Filter Parameters

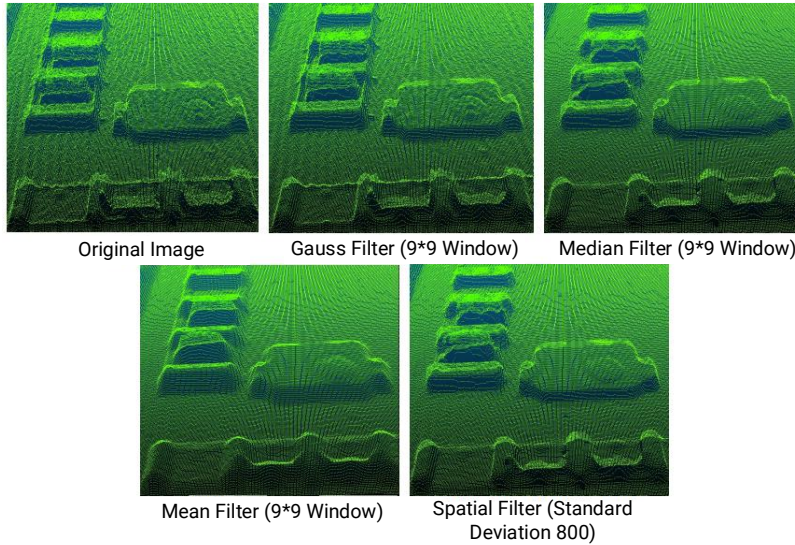


Figure 9-16 Range Filter Effect

9.3.6 Set Extraction

The extraction function can maintain the pixel points within the specified depth range, and set the points out of this range to invalid values (0).

Table 9-7 Gap Filling Parameters

Parameters	Description
Height Extract Enable	If it is enabled, the device will execute the extraction function.
Height Extract Min Depth	It refers to the minimum valid depth value.
Height Extract Max Depth	It refers to the maximum valid depth value.

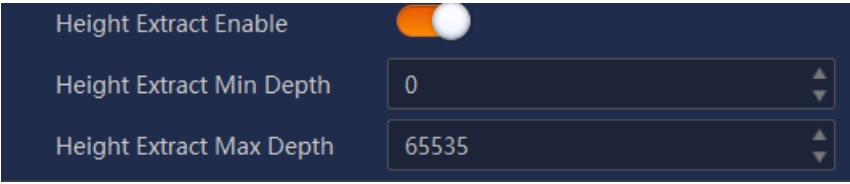


Figure 9-17 Extraction Parameters

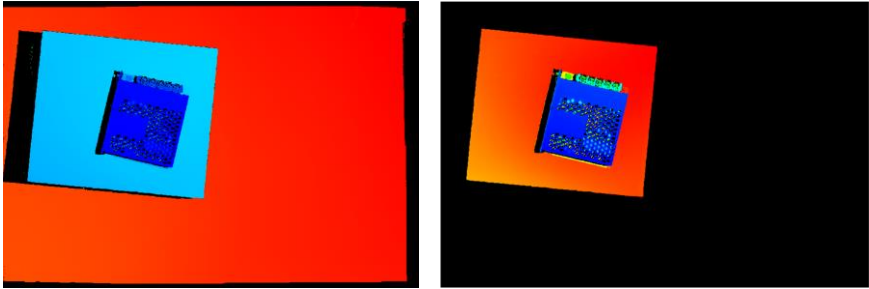


Figure 9-18 Extraction Effect

Chapter 10 Other Functions

10.1 Import/Export Feature

You can import or export device features in the client software.

Export

Click  to export the device feature.

Note

The Default parameters cannot be exported.

Import

Steps

1. Click  in the upper-left corner of the client software.
2. Select a file in MFS format to import.

Note

The device features with the same device model and the same firmware version can be imported only.

3. If there is a difference between the current device feature and feature in MFS file, you can click **Open** to view the details.
4. Click **Import** to import the feature, or click **Cancel** to cancel importing.

10.2 File Access Control

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

- User Set: The configuration file of the selected user set.
- RGBD Sensor Lut: The LUT used by the device sensor calibration for creating correction image.
- RGBD Sensor Calibrate: The sensor calibration file for saving internal parameter results.
- Device Log File: The system log files saved in the device.
- Device Enc File: The encrypted file.
- License Notice: The license notice file.
- Outer Code Pattern: The code pattern file for importing/exporting customized code file.
- Feature Language Map: The mapping file of the device's features.

Steps

1. Click  to open the file access dialogue box.
2. Select a device feature from the drop-down list of **Device Feature** and click **Import** or **Export**.

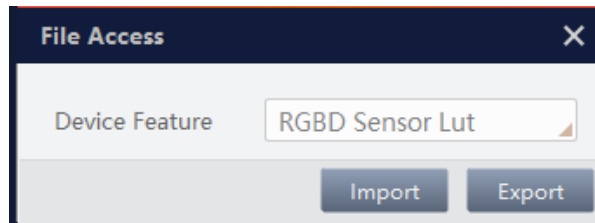


Figure 10-1 Import or Export

3. Select a file in MFA format from local PC to import, or select a saving path and enter file name to save and export.

Note

The License Notice file can be exported only.

10.3 Update Firmware

The device supports updating the firmware via the client software.

Note

- Use the firmware package of the corresponding device model for updating.
 - Do not disconnect the device with PC during updating.
 - The device will restart automatically after updating.
-

Steps

1. Run the client software, and click  on the control toolbar to open the device list window.
 2. Select the device that needs to be updated.
-

Note

Make sure that the device that needs to be updated is in available status.

3. Right click the selected device and click **Firmware Upgrade**, or click  in **Version** to open the updating window.

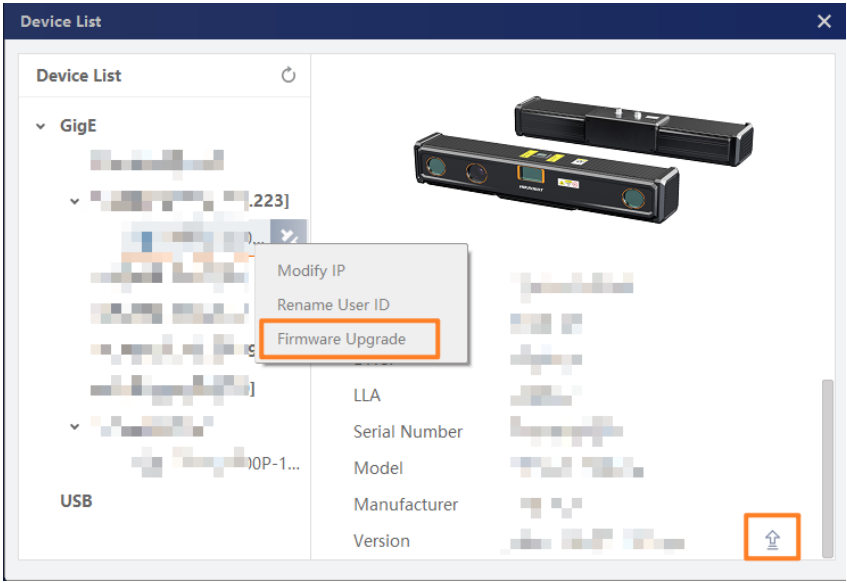


Figure 10-2 Device List Window

4. Click  to select the firmware file (in DAV format), and click **Upgrade** to update the firmware.

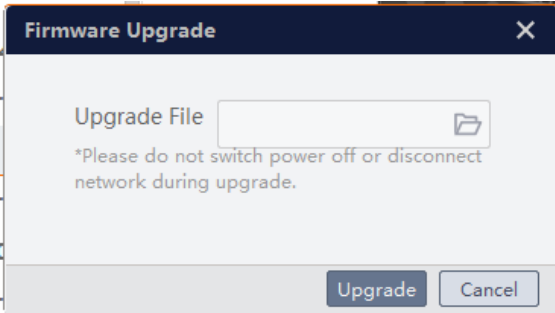


Figure 10-3 Update Firmware

Chapter 11 Device Application

Combined with RobotPilot, the binocular structured light stereo camera can be used for the positioning and recognition of the reflective objects, achieving object picking.



Figure 11-1 Application Scenario

The whole process of object picking is shown below, and you can refer to RobotPilot User Manual for details.

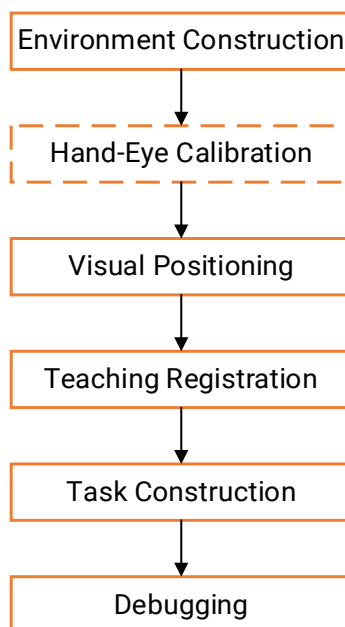
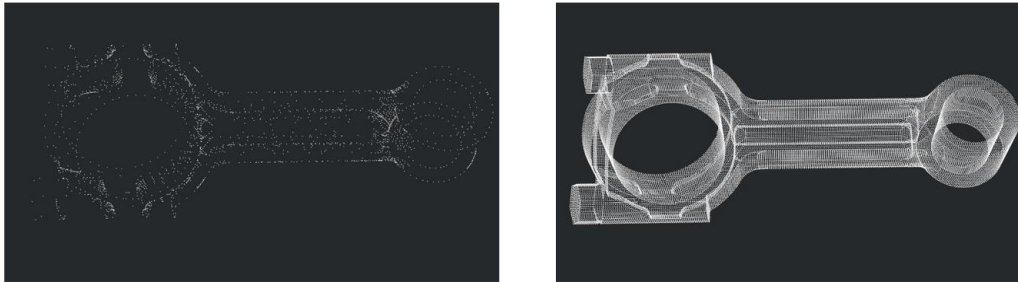


Figure 11-2 Object Picking Process

Chapter 12 Depth Image / Point Cloud Optimization

The quality of depth image or point cloud imaging is influenced by factors such as exposure settings, lighting conditions, object material, and reflectivity of the surrounding environment. If the effect of depth image or point cloud imaging is poor, for example, the point cloud appears sparse or incomplete, you can refer to the following optimization measures.



Sparse and Incomplete

Dense and Complete

Figure 12-1 Point Cloud Effect

12.1 Adjust Exposure/Gain

The quality of depth image or point cloud is highly dependent on the compatibility between exposure settings and the detection scene, especially in scenes involving black objects, reflective interference, or poor lighting. Therefore, make sure that the device is configured with appropriate exposure settings during image acquisition.

Steps

1. Change the working mode to **Depth**, and start image acquisition.
2. Adjust gain. You can configure different gain values, save the corresponding point cloud data, and select an appropriate value.

Note

The exposure settings not only influence the image quality, but also affect the time required for depth image acquisition. In scenarios with time limit, it is recommended to adjust the gain, and then change exposure parameters.

3. Execute auto exposure. You can change the management mode to **Developer**, go to **All Features** to search for **Auto Settings**, and click **Execute**.
4. If the effect of point cloud is still poor, you can adjust exposure manually. Configure different exposure values, save the corresponding point cloud data, and select an appropriate value. For more details, refer to section [Set Exposure Mode](#).

5. If there are many ROIs, and single exposure parameter settings cannot enhance the effect of depth image / point cloud across all ROIs, you can set multiple exposure parameters. For more details, refer to section [Set Exposure Mode](#).

Note

The multiple exposure settings may increase the image acquisition time.

12.2 Optimize Effect

This section introduces methods for optimizing effect of depth image or point cloud 3D reconstruction based on two scenes (highly-reflective object surface and inner surface reflection in material box).

12.2.1 Scene of Highly-Reflective Object Surface

Issue

When scanning highly-reflective metal objects, the position of the reflector significantly affects the quality of 3D reconstruction due to the high reflectivity. If the reflector is aligned with or deviates too far from the device's FoV, point cloud data on the workpiece surface may be missing.

Method

You can enable **Complete Scene Flag** to solve this issue. This function uses binocular-monocular fusion algorithm based on binocular structured light stereo camera to enhance the quality of 3D reconstruction.

Table 12-1 Complete Scene Flag Workflow

No.	Workflow	Description
1	Binocular Data Acquisition	Acquire reflected light information on the object's surface from two different perspectives.
2	Data Fusion	Fuse data of the two perspectives, and compensate for the limitations of monocular via binocular disparity information.
3	Point Cloud Completion	Generate a complete point cloud from fused data, reducing reconstruction missing.

Before You Start

Make sure that the device firmware meets the requirements in the table below.

Table 12-2 Firmware Requirements

Device Model	Minimum Firmware Version
MV-DLS300P-04, MV-DLS600P-12, MV-DLS1400M-15	Build20250304
MV-DPS200P-02	All supported

Steps

1. Change the management mode to **Developer**.
2. Go to **All Features** to search for **Complete Scene Flag**, and enable this function.

Note

The **Complete Scene Flag** function also has some limitations.

Table 12-3 Limitations of Complete Scene Flag

Limitation	Description
Accuracy Reducing	The compensated point cloud areas are reconstructed independently by a single camera, resulting in lower accuracy compared to normally-reconstructable areas.
Noise Point Adding	This function may add some noise points, affecting quality of point cloud.

Therefore, it is recommended to use noise point optimization and point cloud filtering functions in the client software or SDK when you enable **Complete Scene Flag** function. These functions can remove noise points during the compensation and improve the quality of point cloud.

12.2.2 Scene of Inner Surface Reflection in Material Box

Issue

When scanning workpieces that are placed in material boxes with highly-reflective inner surfaces (e.g., mirror surface or polished metal surface), reflections from the inner surfaces may cause partial missing of 3D point cloud data, especially the area near the edge of the box. The following issues may occur.

- Point cloud discontinuity: Discontinuous areas (breakpoint or edge breakage) appear on the workpiece surface.
- Ring-shaped spot artifact: Ring-shaped or spot areas (typically near the side of the material box) appear on the workpiece surface.
- Positioning accuracy reduction: The position of point cloud in contact areas between the workpiece and material box deviates from the actual geometric structure.

- Point cloud completeness loss: Point cloud data in partial areas on the workpiece surface are missing, particularly in highly-reflective areas.

Method

You can set **AntiReflection** as the code pattern inner mode to solve this issue.

Before You Start

Make sure that the device firmware meets the requirements in the table below.

Table 12-4 Firmware Requirements

Device Model	Minimum Firmware Version
MV-DLS300P-04, MV-DLS600P-12, MV-DLS1400M-15	Build20250304
MV-DPS200P-02	All supported

Steps

1. Change the management mode to **Developer**.
2. Go to **All Features** → **Scan Control** → **Sensor Control**, and set **AntiReflection** as the code pattern inner mode.

Note

After the **AntiReflection** is set, the additional scans result in increased processing time. The specific increase depends on the complexity of the scene. If the detection scenario has strict time requirements, please carefully evaluate the impact of the increased time consumption.

Chapter 13 FAQ (Frequently Asked Question)

13.1 Why there is no device listed after I run the client software?

Table 13-1 Question 1

Possible Cause	Solution
The device is powered off.	Check the device power connection to make sure that the device is powered up normally.
Network exception occurs.	Check the network connection to make sure that the device can be connected to the network normally. PC and the device are in the same network segment.
Undervoltage fault is detected, and the orange light is ON.	Check if the power supply meets the requirements in datasheet.

13.2 Why the image is very dark?

Table 13-2 Question 2

Possible Cause	Solution
The values of exposure and gain are too small.	Increase the values of exposure and gain properly.
No trigger signal exists when the trigger function is enabled.	Disable trigger function or output trigger signal.

13.3 Why the image quality is very poor during the live view?

Table 13-3 Question 3

Possible Cause	Solution
The network may not be 1 Gbps.	Check if the network transmission speed is 1 Gbps or not.
Packet loss occurs.	Go to Settings → Resend Packet in the menu bar of the client software, enable

Possible Cause	Solution
	Resend Packet , and increase Max. Packet Resending Percent and Timeout Period properly.

13.4 Why is the image capture process taking too long?

Table 13-4 Question 4

Issue Description	Solution
The Acquisition Frame Rate Control Enable is enabled, and the frame rate is too low.	Disable Acquisition Frame Rate Control Enable , or increase the frame rate.
The exposure mode is MultipleMode .	Set SingleMode as the exposure mode.
The exposure time is too large.	Appropriately reduce the exposure time and increase the gain to maintain the image brightness.
The code pattern inner mode is AntiReflection or HighPrecision .	Under Developer management mode, go to All Features → Scan Control → Sensor Control , and set Fast as the code pattern inner mode.
Many post processing algorithm parameters are enabled at the same time.	Disable some post processing algorithm parameters according to the actual demands.

Chapter 14 Revision History

Table 14-1 Revision History

Version	Revision Date	Revision Details
V2.0.0	Sep. 15, 2025	• Edit Section Introduction. • Add Section Terminology. • Add Section Operating Principle. • Edit Section Appearance. • Edit Section Install Device. • Edit Section Switch Rendering Mode. • Add Section Set RGB JPEG. • Edit Section Set Laser. • Add Section Set SDK Align. • Edit Section Set SSL Parameters. • Edit Section Set Normal Filter. • Add Section Set Extension. • Edit Section Set Range Filter. • Add Section Depth Image / Point Cloud Optimization. • Edit Section FAQ.
V1.0.0	Mar. 3, 2025	Original version.



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Hikrobot Co., Ltd.

Tel: 400-989-7998

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

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