User Manual

D Series RGBD Camera

Version NO: LW-RGBD Camera -Rev1.0.0

Contents

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Preface

- **About This Manual**

a) The photos, graphics, charts, illustrations, etc. provided in the manual are for explanation and illustration purposes only. There may be differences with the specific products. Please refer to the actual product.

b) Due to version upgrades or other needs, our company will update this manual. If you need the latest version of the manual, please log on to the company's official website (www.luminwave.com) to check it.

c) It is recommended that you use this manual under the guidance of professionals.

- **Instructions Before use**

a) Before using the product, please be sure to read this manual carefully and follow the instructions in the manual to operate the product to avoid product damage, property loss, personal injury, etc.

b) If this 3D camera product is used as part of your product, please make sure to provide this manual to the intended users of your product, or provide how to obtain the manual.

- **Heed Warning**

a) Warnings in the product and operating instructions to avoid accidents.

- **Product Maintenance and Technical Support**

a) Please do not attempt to open the device for repair in the absence of official guidance. If you need repair or encounter problems that cannot be solved by the instructions, please contact Luminwave Technology or Sales.

- **Disassembly prohibited**

a) It is prohibited to disassemble the product without the written consent of Luminwave.

Safety Notice

- **Power Supply**

a) It is recommended to use a 12V , 5A power supply to power the product.

b) If you design, configure or select the power supply system (including cables) of the product by yourself , please make sure to follow the power supply and voltage mentioned in the manual, or contact Luminwave technical support. Do not use cables / adapters that do not meet power supply requirements or are damaged .

- **Electrical Interface**

a) Before powering on the product, please ensure that the electrical interface is dry and free of dirt. Do not use power in a humid environment.

b) Please refer to the interface installation section of the manual and strictly follow the connector plug-in and pull-out instructions. If you have found any abnormalities in the interface (such as pin deflection, damaged cables, loose threads, etc.), please stop using it and contact Luminwave for technical support.

c) Please disconnect the power supply before plugging or unplugging the connector. Hot swapping may cause breakdown.

- **Radio Frequency（RF） Interference**

a) Please be sure to read this manual before use. Although the product is designed, tested, and manufactured to comply with regulations regarding radio frequency energy radiation, radiation from the product may still cause other electronic equipment to malfunction.

- **Vibration Conditions**

a) If there may be strong mechanical shock or vibration in the use environment, please contact Luminwave technical support team to obtain the shock and vibration performance parameters of specific product models. Mechanical shock or vibration exceeding the allowable range may cause damage to the product.

b) Products should be packaged in shockproof packaging materials to avoid damage during transportation.

Safety Notice

- **Explosiveness**

a) Do not use the product in any area where potentially explosive atmospheres are present, such as areas where the air contains high concentrations of flammable chemicals, vapors, or particulates (such as granules, dust, or metal powders).

b) Do not expose the product to high concentrations of industrial chemicals, including easily evaporated liquefied gases (such as helium), to avoid damaging or impairing product functionality.

- **Eye Safety**

a) This product is a Class 1 laser product. The laser safety level complies with the following standards. Please follow the corresponding laser safety instructions:

IEC/EN 60825-1:2014 21 CFR 1040.10 and 1040.11 standards, except for the deviations stated in Laser Notice No. 56 issued on May 8 , 2019 (IEC 60825-1 third edition)

NOTE: For maximum self-protection, it is strongly recommended not to look directly into the transmitted laser through a magnifying device such as a microscope, head-mounted loupe, or other form of magnifying glass, During the operation of the product, the entire light window can be regarded as the laser emission range of the product, and the direct-viewing light window can be regarded as direct-viewing the laser in transmission.

- **Enclosure**

a) The product is mainly composed of metal, glass and plastic, and contains sensitive electronic components inside. Avoid improper handling such as falling and burning. Once the product is dropped or burned, please stop using it immediately and contact Luminwave for technical support.

b) Avoid crushing or puncturing the product. Once the product shell is damaged, please stop using it immediately and contact Luminwave for technical support.

c) Do not operate the product with the shell loose to avoid damaging personal safety.

d) Before operating the product, please ensure that the product is firmly fixed to prevent external forces (such as impact, strong wind, flying rocks, etc.) from causing the product to detach from the fixed position.

e) If the product shell contains tooth-like structures and grooves, please wear gloves when operating to avoid cuts, crushes and other personal injuries caused by excessive force.

Safety Notice

- **Light Window**

a) Do not touch the light window with your hands to avoid getting fingerprints or dirt on the light window.

b) Please avoid touching the light window with hard or sharp objects to avoid scratches on the light window. If scratches have occurred, please stop using the product and contact Luminwave technical support; serious scratches on the light window may affect the quality of the point cloud data output by the product.

c) Be sure to remove the light window protective film before use.

- **Enclosure High Temperature**

a) When the product is running or for a period of time after operation, the product enclosure may be at a high temperature. In this case, please note:

Avoid direct contact with the product enclosure to avoid discomfort or even burns;

Avoid direct contact of flammable materials with the product enclosure to avoid fire.

b) If the product needs to be embedded into other devices, effective measures should be taken to alert third parties of high temperature risks.

- **Peripherals**

a) When purchasing peripherals for installation by yourself, be sure to refer to the installation steps in the manual, or contact Luminwave for technical support. Use of non-compliant or mismatched peripherals may damage the product or compromise personal safety.

- **Equipment Upgrade**

a) Please be sure to use the upgrade package provided by Luminwave and strictly follow the instructions included in the upgrade package.

Disclaimer

- To the maximum extent permitted by law, the products described in this manual (including their hardware, software, firmware, etc.) are provided "as is" and may contain defects, errors or malfunctions. The company does not provide any form of express or implied warranty Warranties, including but not limited to warranties of merchantability, quality satisfaction, fitness for a particular purpose, non-infringement of third party rights, etc.; nor shall we compensate you for any special, incidental, incidental or indirect damages caused by the use of this manual or the use of our products. Including but not limited to losses arising from loss of business profits, loss of data or documents.
- If you connect the product to the Internet, you are at your own risk, including but not limited to the possibility that the product may be subject to network attacks, hacker attacks, virus infections, etc. The company is not responsible for the resulting abnormal product operation, information leakage and other problems, but the company will Provide you with product-related technical support in a timely manner.
- When using this product, please strictly follow applicable laws. The company does not assume any responsibility if this product is used to infringe the rights of third parties or for other improper purposes.
- If the contents of this manual conflict with applicable laws, the legal provisions shall prevail.

1 Product Introduction

1.1 Product Name

Luminwave D series RGBD camera products .

1.2 Product Overview

The product is based on the 3D TOF camera and combined with the RGB module to form an RGB-D depth camera product. The product can achieve microsecond-level synchronous output of RGB images and TOF images, accurately capturing three-dimensional data of objects.

The product has millimeter-level measurement accuracy, supports RGB mode, and supports point cloud and RGB alignment. It can meet the application requirements of complex environments and is not interfered by ambient light. It can be widely used in application scenarios such as logistics automation, mobile robots, industrial safety protection, and passenger flow statistics.

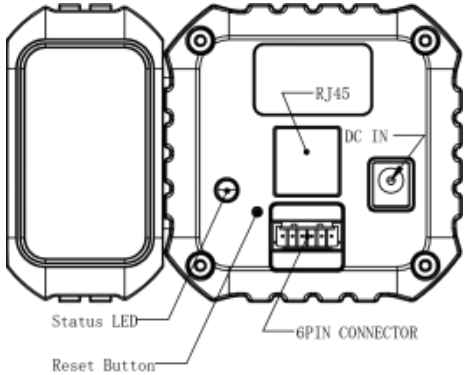
1.3 Specifications

Product number	LWP-D301C	LWP-D302C
Working principle	TOF	
Sensor	Sony DepthSense® TOF IMX570	
Laser	940nm VCSEL*2	
Working distance	0.4m~5m	
Ranging accuracy	＜1％（@2m≤5mm）	
TOF field of view (H x V)	70 ° x 50 ° , customizable up to 103 ° x 81 °	
RGB field of view (H x V)	70 ° x 50 °	
TOF resolution	640 x 480 pixels	
RGB resolution	1600 x 1200 pixel (global exposure)	
Frame rate	Max.30 fps	
Eye safety	Class 1	

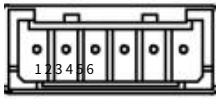
	Product number	LWP-D301C	LWP-D302C
Function	HDR function	support	
	Exposure time	support	
	Various filter settings	support	
	Output data format	RAW12 (depth map, IR map, point cloud) +RGB	
	RGB/TOF time synchronization	Microsecond synchronization	
Power Supply	Powered supply	12V DC	
	Power consumption	<10W	
	Network Interface	RJ45 1000M Ethernet	Aviation plug: 8 pin*M12 X-code
	Power interface	6.4mm DC	Aviation plug: 8 pin*M12 A-code
Physics	Dimensions (L x W x H)*	116mm x 76mm x 75mm	
	weight	693g	706g
	Operating temperature	-20 ~ 50 °C	
	Storage temperature	-30 ~70 °C	
	Protection level	IP42	IP67
Operating system		Windows 10 and above /Linux	

* The dimensions is excluding plug-ins. Please refer to Appendix 2 structural drawings for detailed dimensions.

1.4 Hardware Structure | Interface introduction LWP-D301C



- **Network interface:** RJ45 Gigabit Ethernet cable *
- **Power interface:** 12V DC , 5A power cord
- **6pin interface:** control line, the interface is defined as follows:



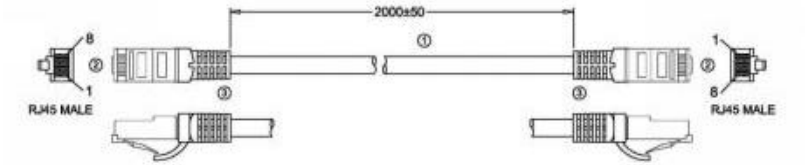
pin	1	2	3	4	5	6
Describe	NC	GND	NC	NC	485-B	485-A

6pin interface definition and specification diagram

* Using network cables with wrong bandwidth (such as 100M network cables) will affect the detection data results

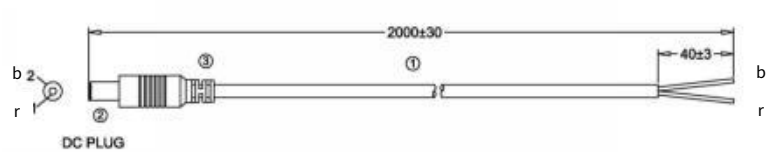
1.4 Hardware Structure | Cable introduction LWP-D301C

- **Network cable** : Standard 2m RJ45 Gigabit Ethernet cable, the specifications drawing is as follows



Dual RJ45 Gigabit Ethernet cable specifications diagram

- **Power cord:** Standard 2m DC 12V power cord, cable definition and specification drawings are as follows



DC 12V Power cord specifications diagram

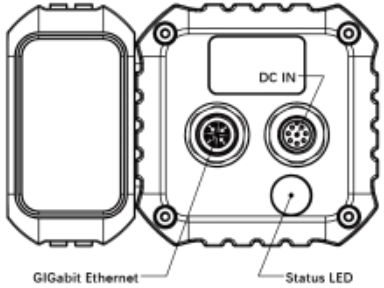
Cable Color	Black	Red	DC PLUG
Describe	GND	DC 12V input	5.5x2.1mm

- **Control line:** Standard 1m control line, cable definition and specification drawings are as follows

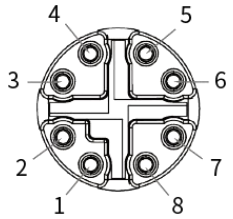
Schematic diagram of control line cable arrangement and specifications

Cable Color	Red	Black	Yellow	White	Green	Brown
Device Pin	1	2	3	4	5	6
Describe	NC	GND	NC	NC	485-B	485-A

1.4 Hardware Structure | Interface introduction LWP-D302C



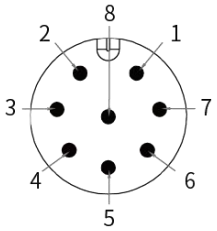
- **Network interface** : 8 pin*M12 X-code , the interface is defined as follows



PIN	Description
1	td0p
2	td0n
3	td1p
4	td1n
5	td3p
6	td3n
7	td2n
8	td2p

Network interface definition and specification diagram

- **Power interface:** 8 pin*M12 A-code , the interface definition is as follows

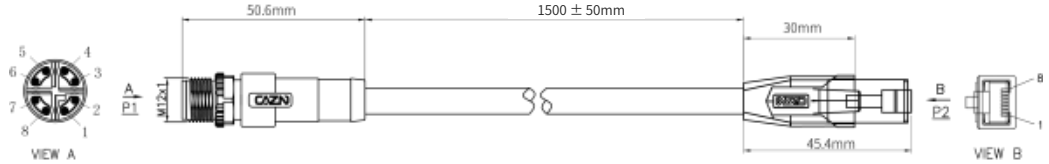


PIN	Description
1	P_GND Power ground wire
2	VIN DC 12V
3	485-A
4	485-B
5	EXT_TRIGGER external trigger input (3.3V-24V)
6	NC
7	S_GND signal ground wire
8	IP_RESET restore factory settings

Power interface definition and specification diagram

1.4 Hardware Structure | Cable introduction LWP-D302C

- **Network cable** : Standard 1.5m M12 8pin aviation plug-to- RJ45 Gigabit network cable. Specification drawings are as follows:



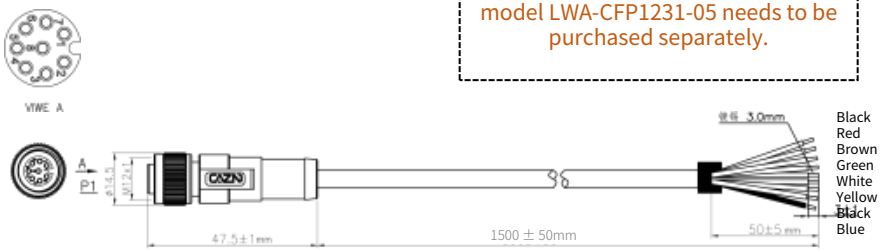
Air plug to RJ45 Gigabit network cable specifications diagram

5m cable is an independent accessory and needs to be purchased separately . The network cable model is LWA-CME1232-05.

- **Power cord** : Standard 1.5m M12 8pin aviation plug power cord . The cable definition and specification drawings are as follows

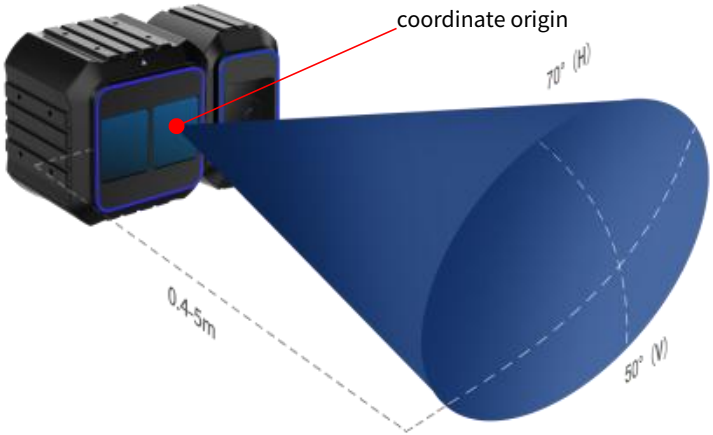
Device PIN	Cable Color	Describe
1	Black	P_GND Power ground wire
2	Red	VIN DC 12-24V
3	Brown	485-A
4	Green	485-B
5	White	EXT_TRIGGER external trigger input (3.3V-12V)
6	Yellow	NC
7	Black	S_GND signal ground wire
8	Blue	IP_RESET restore factory settings

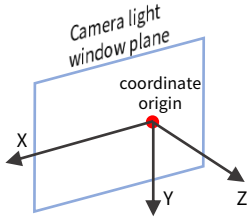
5m cable is an independent accessory and the power cord model LWA-CFP1231-05 needs to be purchased separately.



Schematic diagram of cable definitions and specifications for aviation plug-in multi-function cables

1.5 FOV and Measurement Range





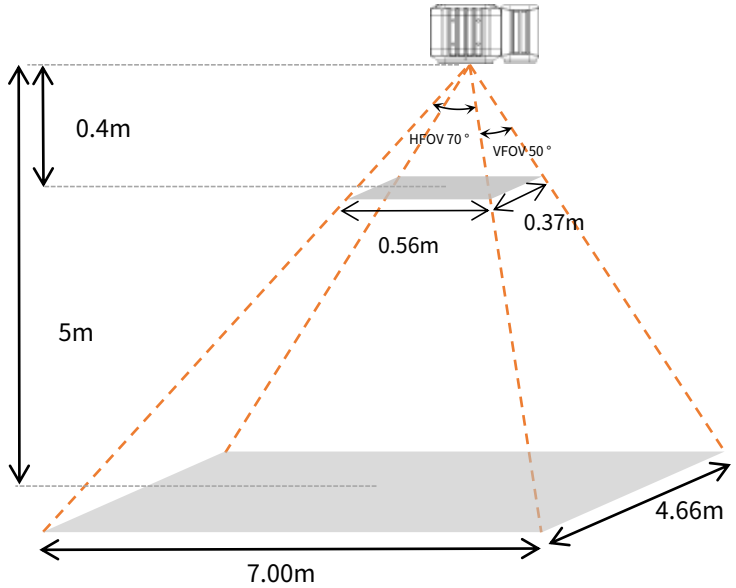
Field of view FOV and origin description

- **Camera origin description**

a) the X -axis coordinate is located at the center of the camera's left light window;

b) the Y -axis coordinate is located at the center of the camera's left light window;

c) Z coordinate origin is located on the camera light window plane.



Measuring range

1.6 Reset Button and Indicator Light

- **Reset button**

  LWP-D301C product can be restored to factory settings with the reset button on the back

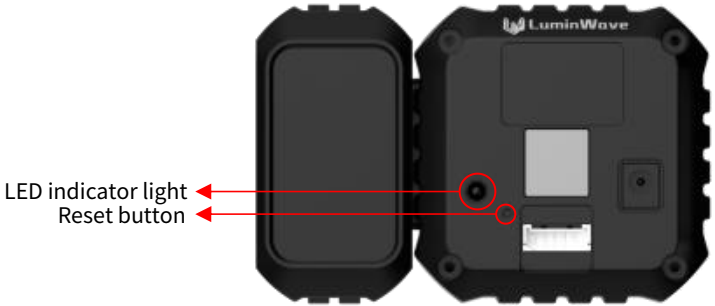
  When the camera is powered on, press and hold the button for more than 5 seconds. The LED light will flash red quickly and then turn green, indicating a successful reset.

- **LED indicator light**

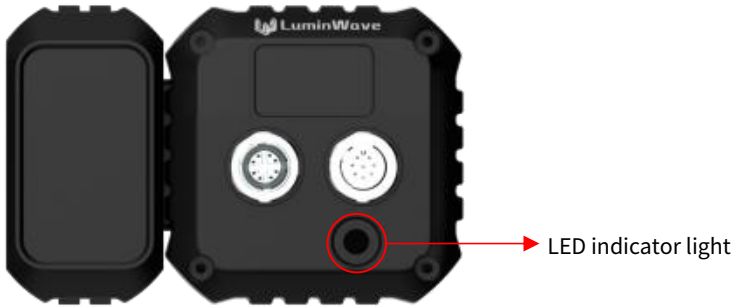
  Green light on: Power on successfully

  Yellow light on: Data collection

  Red light on: Fault occurs



LWP-D301C



LWP-D302C

2 Quick Operation

2.1 Product List | LWP-D301C

Factory Standard Checklist	 Front	 Back
Product Number	D series RGBD camera	
Specification Quantity	LWP-D301C*1	

Factory Standard Checklist				
Name	RJ45 Gigabit Ethernet cable	power cable	control line	Parts package (including screws, washers, etc.)
Specification Quantity	2m RJ45 *1	2m DC12V *1	1m*1	M3*8pcs

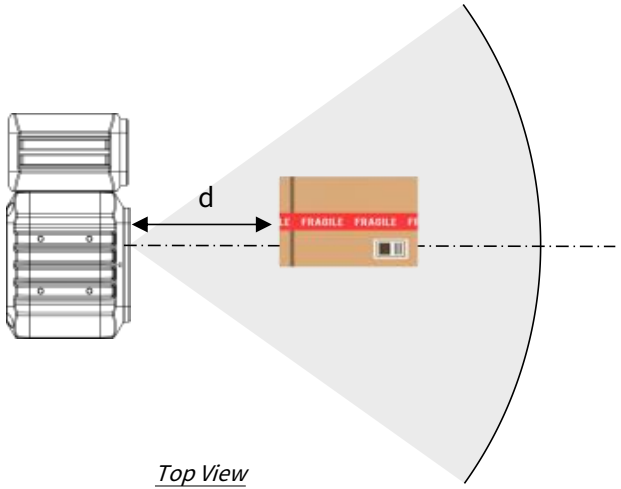
2.1 Product List | LWP-D302 C

Factory Standard Checklist	 Front Back			
Name	D Series RGBD Camera	RJ45 Gigabit Network Cable	Power Cable	Screw Package (including screw washers, etc.)
Specification Quantity	LWP-D302C*1	1.5m M12 8pin air plug to RJ45 Gigabit network cable * 1	1.5m M12 8pin aviation plug multi-function cable *1	M3*8pcs

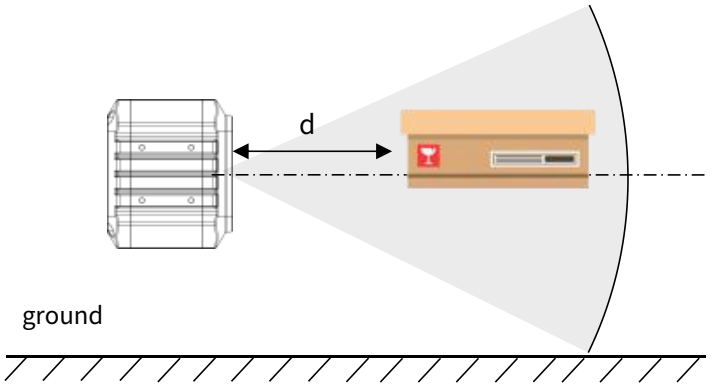
Individual Shopping		
Specification name	5m M12 8pin air plug to RJ45 Gigabit network cable	5m M12 8pin aviation plug multi-function cable
Model	LWA-CME1232-05	LWA-CFP1231-05

2.2 Installation | Precautions before Installation

- **Please be sure to remove the light window protective film before use;**
- Please check whether the equipment is completed and whether the model is suitable shown in the product list in 2.1;
- Check the installation environment. Do not install in humid, high temperature, vibration environments， etc. ;
- Fix the 3D camera as flat as possible to avoid unevenness;
- During the object detection process, in order to ensure the accuracy of the detection results, the minimum detection distance d_{min} Should be no less than 40cm , as shown in the figure below;



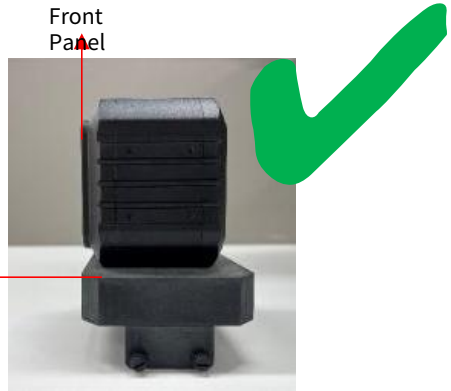
Top View



Side View

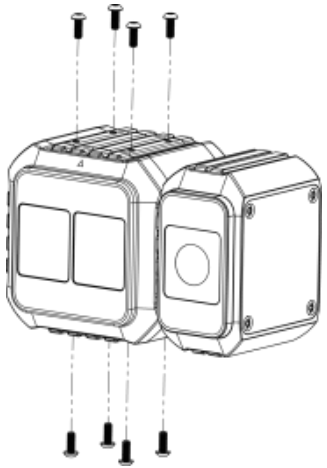
2.2 Installation | Precautions before Installation

- When detecting objects, please ensure that the 3D camera is facing the object being detected, and the deflection angle should not be too large. Prevent the camera from being unable to cover the entire detection range of the target, or causing an increase in the measurement error of the target;
- The screws on the mounting base should strictly follow the 3D camera fixing hole depth of 3.5mm , and the screw length can be selected according to the thickness of the base. The material of the mounting base is recommended to be aluminum alloy, which helps the camera dissipate heat;
- When installing the 3D camera , if there are contact mounting surfaces on the upper and lower sides, please ensure that the distance between the mounting surfaces is greater than the height of the 3D camera, avoid squeezing the 3D camera, and be careful not to exceed the reference plane contact with the 3D camera. The front panel of the camera is as shown in the right picture below.
- Before use, please be sure to remove the light window protective film, as shown in the left picture below



2.2 Installation | Recommended Installation

- **Screw Specifications :** M3*8pcs (can be adjusted by adding gaskets according to the thickness of the bottom plate. During actual installation, the final screws are 4pcs or 8pcs , which can be determined by your own evaluation)
- **Screw Torque :** Recommended torque 3.5~5.0kg-cm
- The following installation methods are recommended:



Base installation

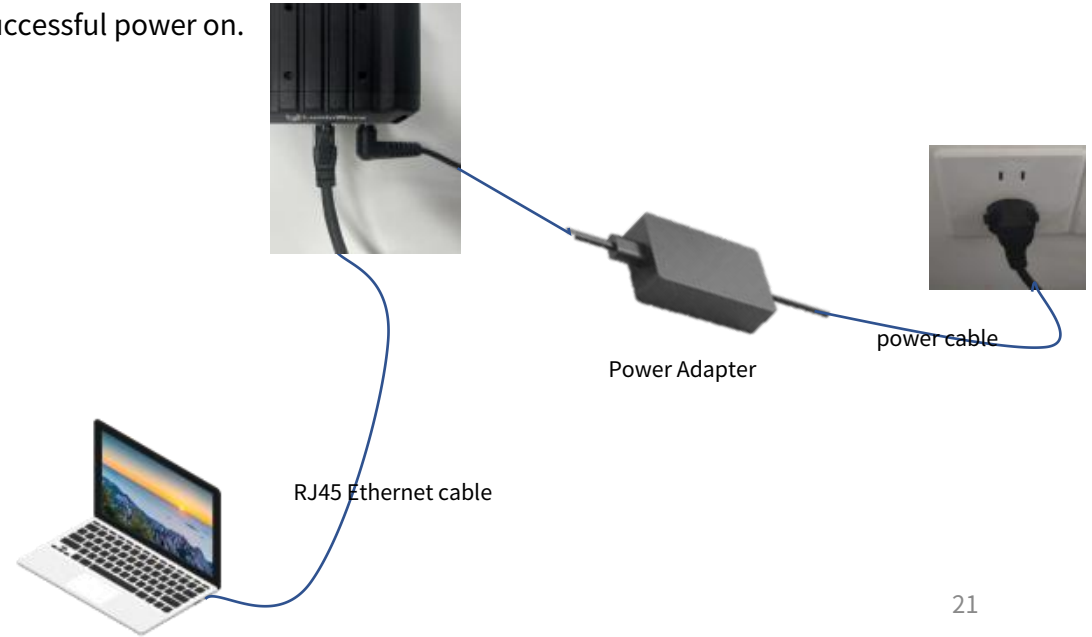
2.3 Wiring | Wiring Steps LWP-D301C

a) Please remove the light window protective film before use

b) Connect 3D camera to the computer via a Gigabit Ethernet cable

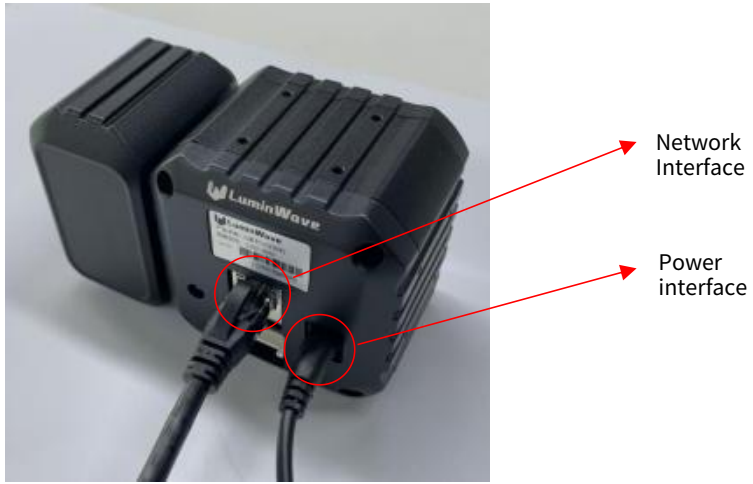
c) Use a 12V , 5A power cord and power adapter to the camera

d) The LED indicator lights up green, indicating successful power on.



2.3 Wiring | Interface Diagram LWP-D301C

- Make sure the device is powered off when connecting / disconnecting network cables or power cords . If you need to operate while the power is on, please discharge static electricity first and avoid touching the connector directly with your hands.



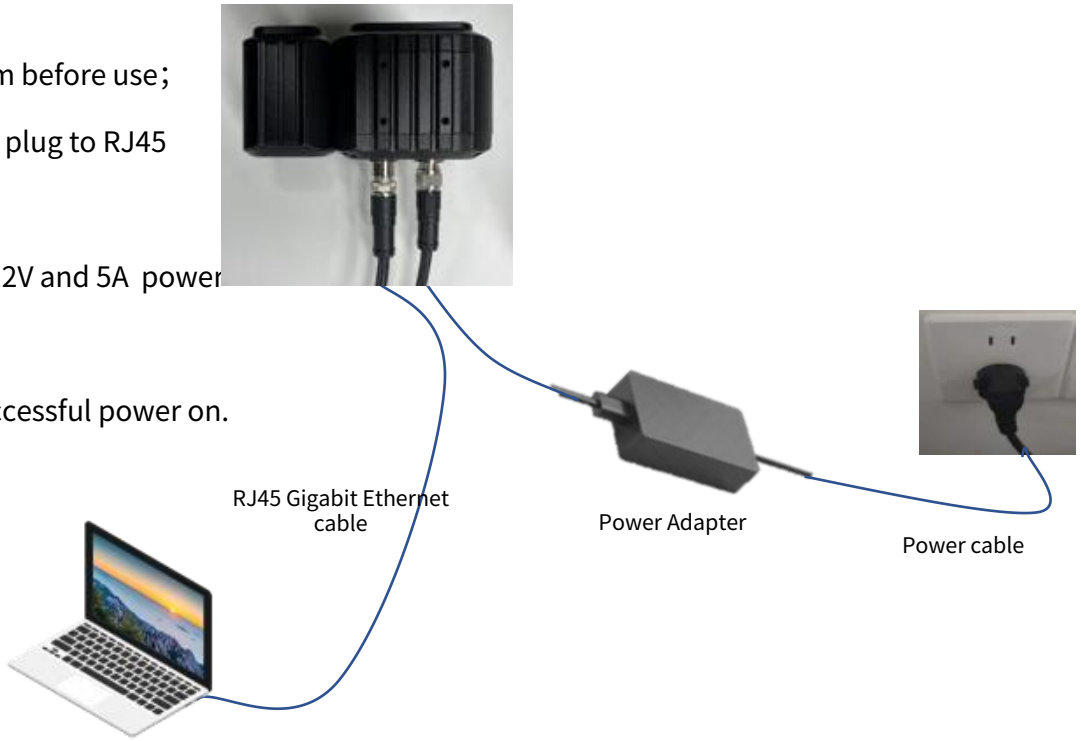
2.3 Wiring | Wiring Steps LWP-D302C

a) Please remove the light window protective film before use;

b) Connect 3D camera to the computer via an air plug to RJ45 Gigabit network cable;

c) Use multi-functional aviation plug cable and 12V and 5A power adapter;

d) The LED indicator light is green, indicating successful power on.



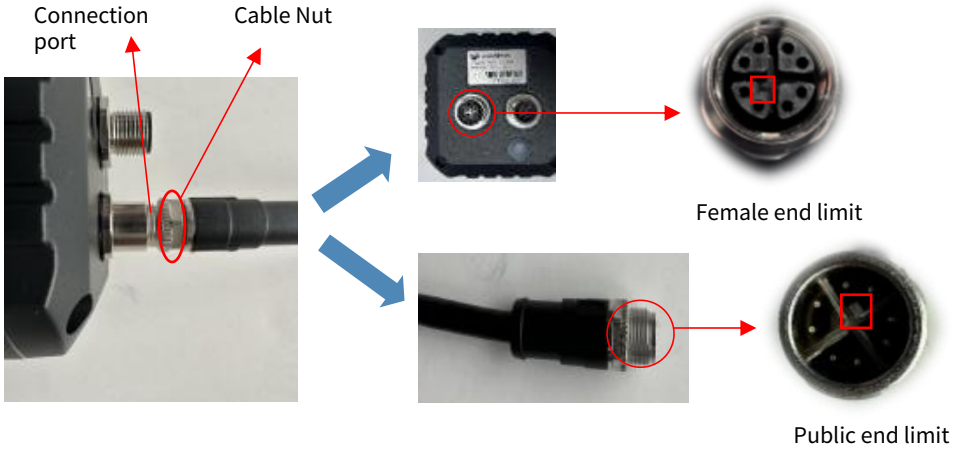
2.3 Wiring | Interface Diagram LWP-D302C

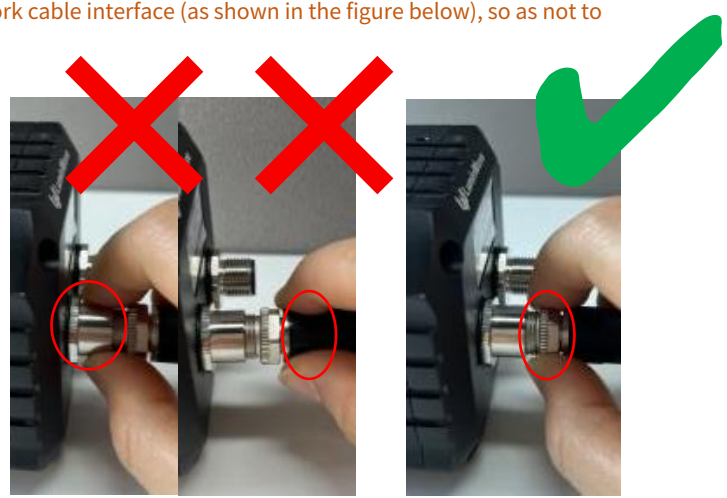
- **Network Cable Connection / Disconnection**

Connect network Cable	After powering off, align the female end with the male end, insert it into the device base, and tighten the nut.
Disconnect the Network Cable	After powering off, twist and loosen the fixing nut, hold the housing of the aviation interface tightly, and push it outward.

Note 1: When disconnecting or connecting, please ensure that the device is powered off. If you need to operate while the power is on, please discharge static electricity first and avoid touching the connector directly with your hands.

Note 2: When using the device, please do not adjust or pull the device aviation plug interface or network cable interface (as shown in the figure below), so as not to cause the device interface or cable to loosen and affect normal use.





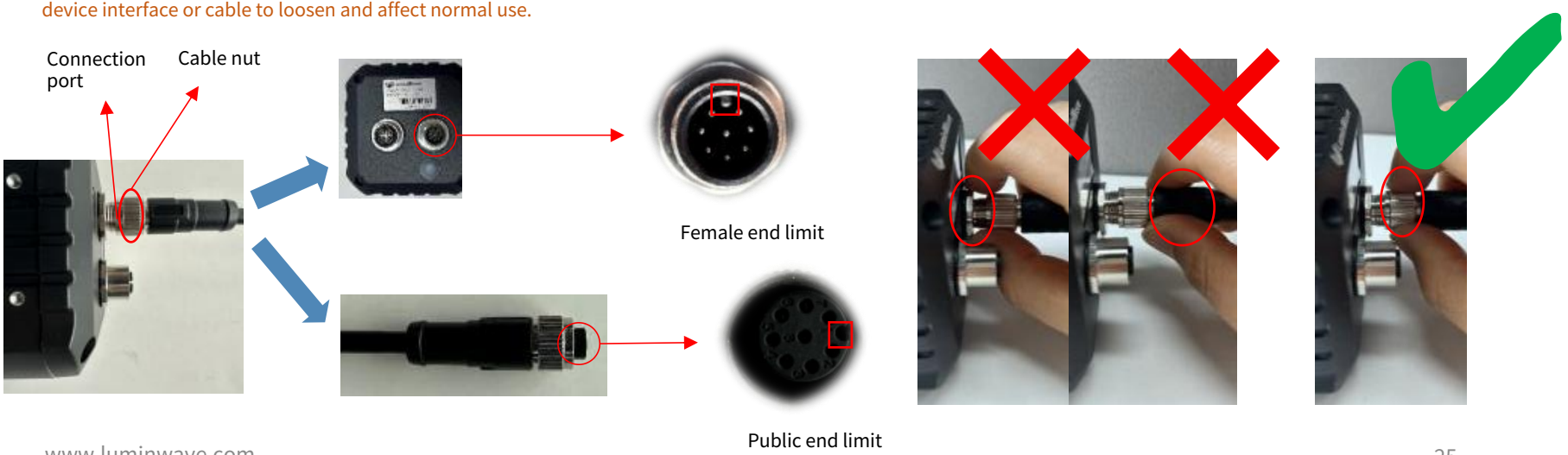
2.3 Wiring | Interface Diagram LWP-D302C

- **Power Cord Connection / Disconnection**

Connect the power cord	After powering off, align the female end with the male end, insert it into the device base, and tighten the nut.
Disconnect the power cord	After powering off, twist and loosen the fixing nut, hold the housing of the aviation interface tightly, and push it outward.

Note 1 : Please make sure the device is powered off when disconnecting or connecting. If you need to operate while the power is on, please discharge static electricity first and avoid touching the connector directly with your hands.

Note 2 : When using the device, do not adjust or pull the device's aviation plug interface or power cord interface (as shown in the figure below), so as not to cause the device interface or cable to loosen and affect normal use.



2.4 Network Configuration

- Default IP address of the 3D camera is **192.168.1.200** , which can be changed through the software LuminViewD .
- Before receiving data, please select Internet Protocol version 4 (TCP/IPv4), and set the computer IP address and the 3D camera IP address in the same network segment.

Network Configuration	a) Open "Network and Internet Settings"; b) Select "More Network Adapter Options", double-click Ethernet, and a dialog box will pop up; c) Select " Properties " and double-click " Internet Protocol Version 4 (TCP/IPv4)" to set the IP address; d) The computer IP address needs to be set in the same network segment as the 3D camera; e) The computer terminal network mask is set to 255.255.255.0 ;

Use of Host Computer Software

3.1 Introduction of Host Computer Software

3.1.1 Usage of Host Computer Software

This host computer software is used to display the images and data after the computer is connected to the 3D camera in real time. Users can obtain point clouds, depth maps, IRt images, RGB and data through the host computer software for later use.

3.1.2 Obtaining and Upgrading the Host Computer Software

Please visit the official website of Luminwave www.luminwave.com to download, or contact the sales staff to obtain it .

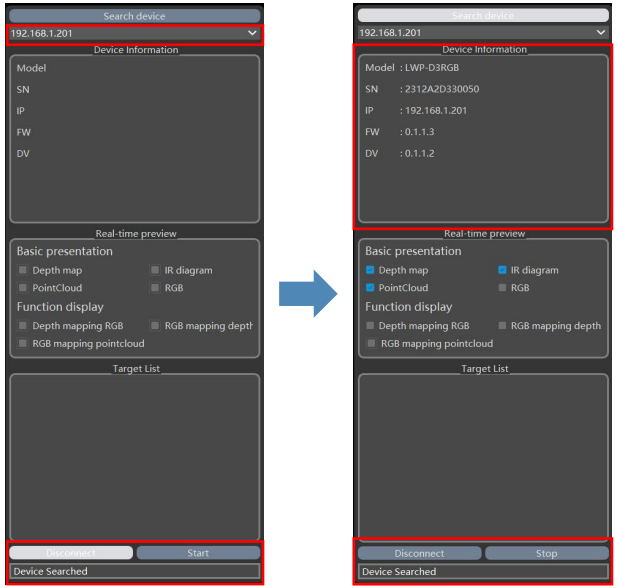
3.1.3 Operating Environment

The default version operates in Windows 10 (64 -bit) and above environments. If you need other versions, please contact Luminwave sales staff .

3.1.4 Instructions Before Use

a) Every time the host computer software runs, please click to search for the device first, click Connect and then connect the device.
b) the IP type of the local computer to static, and keep the network segment consistent with the device, otherwise network communication will not be possible.
c) If the device is connected through a router, the local computer also needs to be connected to the router for communication.
d) Don't click buttons too frequently, as the program will be delayed slightly when processing time-consuming tasks.
e) If automatic exposure is turned on in software trigger mode, you need to wait for a certain period of time before clicking the "Trigger" button.
f) The point cloud is not updated normally when switching scenes. You can click the point cloud view switching button at will to update the point cloud.
g) When finishing the operation, please disconnect the device first, close the host computer software, and then disconnect the power cord, network cable or aviation plug-in cable.

3.2 Device Usage | Connect/Disconnect



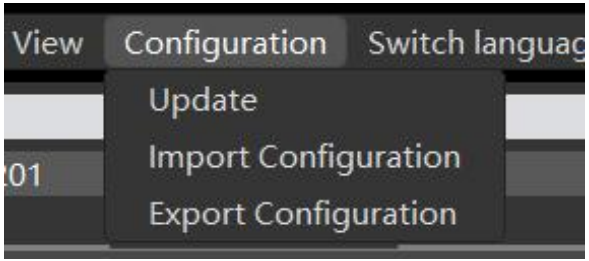
Display status before and after connection

- **Before connecting, please follow this instruction 2.4 Network Configuration to correctly configure the IP address.**
- **Default IP address of the 3D camera is 192.168.1.200 . You can change the default IP address through the host computer software LuminViewD.**

Network Configuration	1. Open "Network and Internet Settings"; 2. Select "More Network Adapter Options", double-click Ethernet, and a dialog box will pop up; 3. Select " Properties " and double-click " Internet Protocol Version 4 (TCP/IPv4)" to set the IP address; 4. The computer IP address needs to be set in the same network segment as the 3D camera; 5. The computer terminal network mask is set to 255.255.255.0 ;

① Unzip the host computer software package and find the executable file in the unzipped folder: LuminViewD , double-click to open the software;
② Click the "Search Device" button;
③ A device is found, "Device Searched" is displayed in the lower left corner, and the IP address is displayed under the "Search device" button (the default IP address of the device at this time is 192.268.1.200);
④ Click the "Start" button to connect the device;
⑤ After successful connection, the device information bar will display the device information of the current 3D camera. At this time, the LED indicator light will turn from green to yellow, indicating that the data is being obtained;
⑥ After successful connection, the corresponding depth map, IR map, RGB , and point cloud are displayed.
⑦ Click the "Stop" button to pause data acquisition. At this time, the LED indicator light turns from yellow to green.
⑧ Click the " Disconnect " button to disconnect the device. At this time, the LED indicator light turns from yellow to green.

3.2 Equipment use | Equipment upgrade



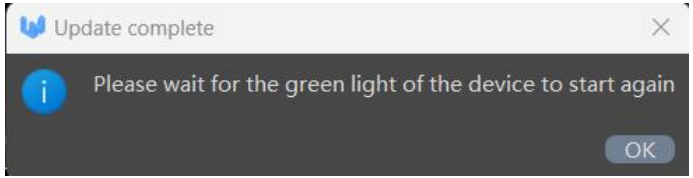
Firmware update operation path

a) Click " Search Devices "

b) After the device IP address is successfully displayed in the device information bar, click " Configuration " - " Update " in the menu bar to import the required firmware update package.

c) After the " Update Complete " dialog box pops up , wait for the green light of the device LED indicator to turn on again, indicating that the firmware update is complete.

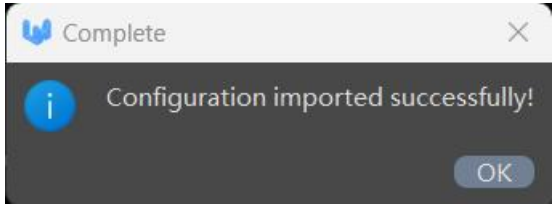
d) Click the " Start " button to start using the device normally



Complete firmware update

3.2 Device usage | Configuration Export/Import

Successfully exported configuration



Successfully imported configuration

- **Export configuration**

a) Operable when the equipment is running normally

b) Click " Configuration " - " Export Configuration " in the menu bar and select the path to be saved.

c) The "Successfully Exported Configuration" dialog box pops up, indicating that the configuration was exported successfully.

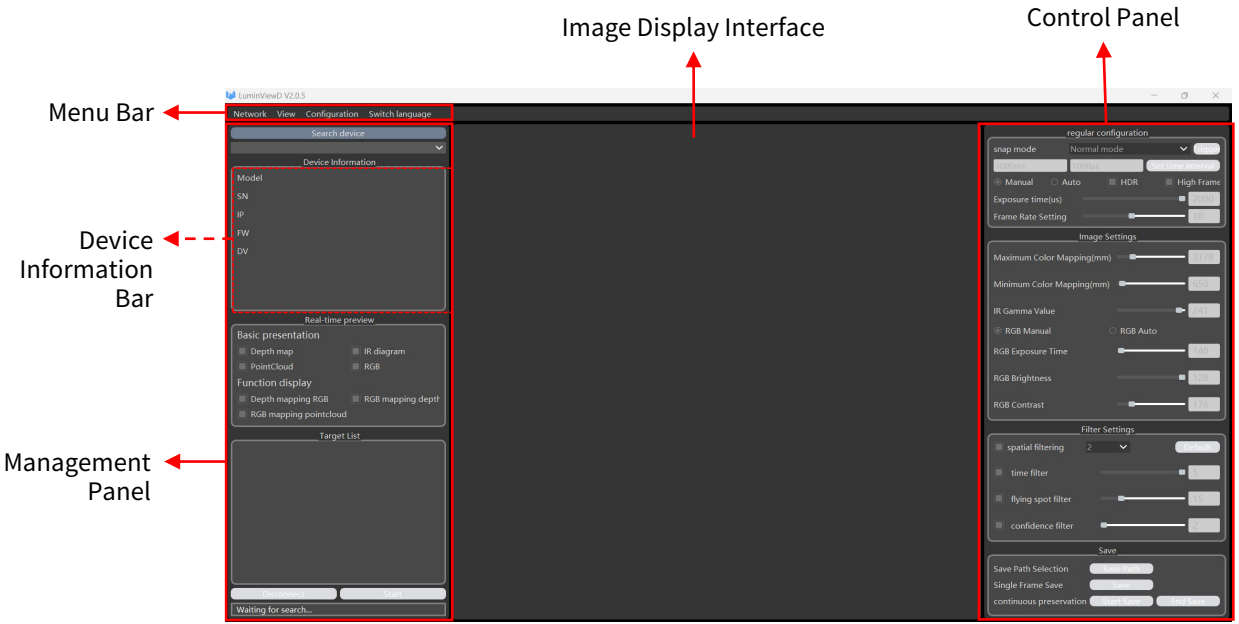
- **Import configuration**

a) Device "stops" runtime action

b) Click " Configuration " - " Import Configuration " in the menu bar and select the configuration file config in the previously saved path.

c) When the "Configuration imported successfully" dialog box pops up, it means that the configuration was imported successfully.

3.3 Main Interface Introduction



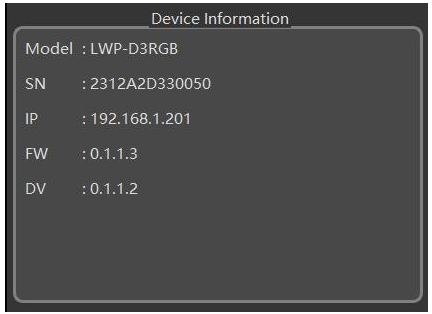
Main interface

Host computer software (LuminViewD) main interface consists of the following sections

- Menu Bar
- Management panel
- Image display interface
- control Panel

Among them, the management panel mainly consists of the device information bar.

3.3 Main Interface Introduction | Device Information



Device Information

- **Device Information**

Model : Display the current device model

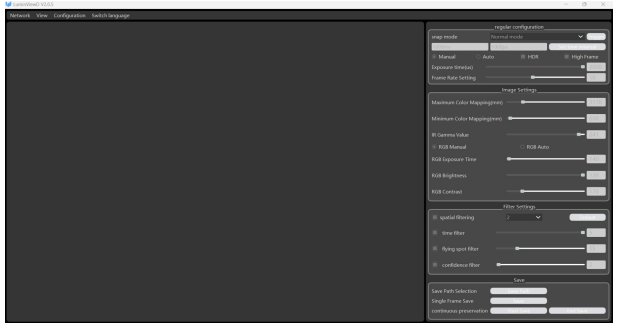
SN : Display the current device SN number

IP : Display the current device IP

FW : Displays the current device firmware version number

DV : Displays the current device driver version

3.3 Main Interface Introduction | Panel Operation



Hide admin panel

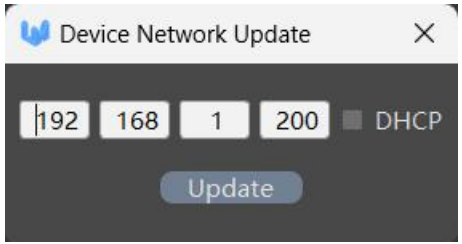
Hide control panel

- **Hide / Show Management panel, Control panel**

① Click "View" on the menu bar of the main interface

② Select Hide / Show Management Panel, Control Panel

3.4 Function Introduction | Change IP Address



Device network updates dialog box

- **Change Device Default IP Address**

a) When the device is running normally, click the "Stop" button and the device will pause data acquisition.

b) Select the "Network" button on the main interface menu bar

c) Select the "Device Network Settings" option

d) IP address you want to change in the pop-up " Device Network Update " dialog box

e) Click the " Update " button to update the default IP address

f) " Update Successful " dialog box pops up , indicating that the default IP update is successful.

g) Click the " Disconnect " button to disconnect the device

h) Waiting for the LED indicator to turn green again, click "Search Device" again. At this time, the default IP address will be changed to the changed IP address.

Note 1 : DHCP can automatically assign IP addresses to multiple 3D cameras and can only be checked when connecting to a switch.

Note 2 : Always keep the device IP address and the computer IP address in the same network segment

3.4 Function Introduction | View Images

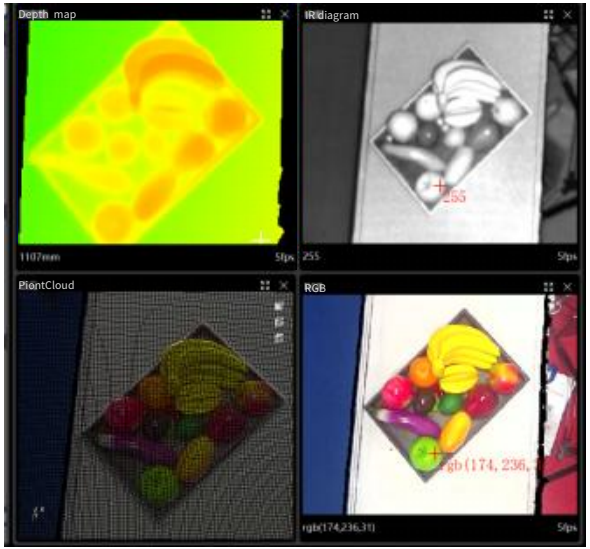


Image display interface

- **View Real-time Depth Map, IR Map,RGB**

a) You can double-click the screen or click to display / close full screen.

b) Click anywhere to view the numerical value. Symbols are displayed on the screen and numerical values are displayed in the lower left corner.

The value in the lower left corner of the depth map is the depth value of the real-time pixel at the click position, in mm;

IR image is the gray value, with a value of 0~255 ;

The value in the lower left corner of the rgb picture is the rgb(r,g,b) color value, with a value of 0~255 .

c) The values in the lower right corner are real-time frame rate information, and the unit is fps .

d) Slide the mouse wheel to zoom in / out the image, long press and drag the right mouse button to drag the image.

e) Click to close the depth map /IR map /rgb image display.

3.4 Function Introduction | View Images

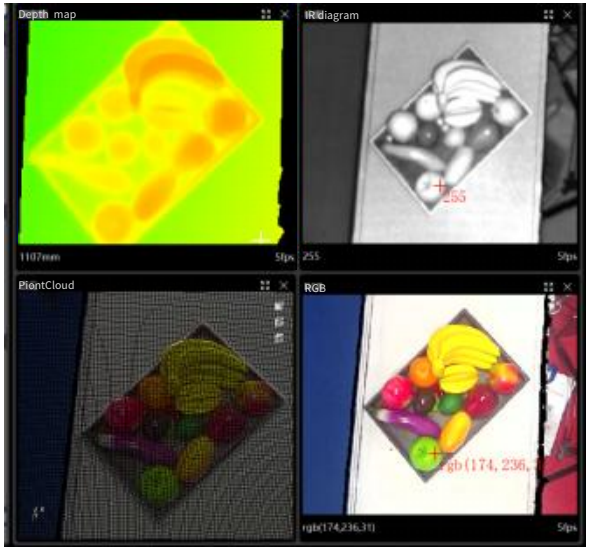


Image display interface

- **View real-time point cloud**

a) Double-click the screen or click to show / close full screen.

b) Drag the left mouse button or select the button to view the point cloud perspective.

: Select the point cloud perspective to be viewed, which are front view / side view / top view respectively.

: Three-dimensional coordinates, automatically changing with the point cloud perspective

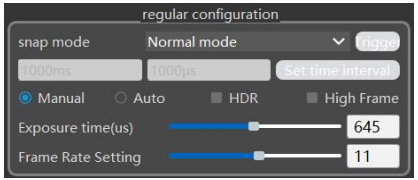
c) Slide the mouse wheel to zoom in / out the image.

d) Press the scroll wheel and drag to translate the point cloud.

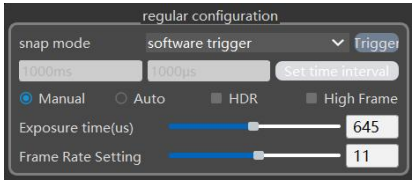
e) Left mouse button + Ctrl to rotate and adjust the point cloud.

f) Click to close the point cloud image display.

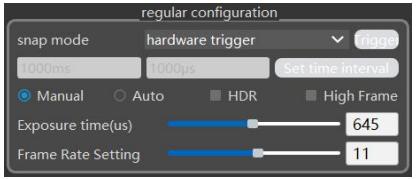
3.4 Function Introduction | "Regular Configuration" Module



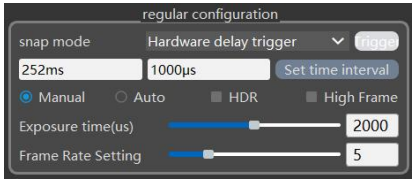
Nomrmal mode



Software trigger



Hardware trigger



Hardware delay trigger

- **Capture mode:** The following four trigger modes are available. The "trigger" button can only be clicked in software trigger mode.

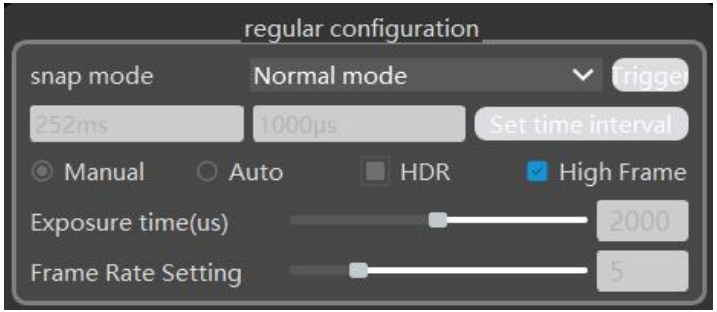
a) Normal mode: continuous acquisition of data in real time

b) Software trigger: Each time you click the "Trigger" button, one frame of data is obtained

c) Hardware trigger: Send a hardware trigger signal to obtain a frame of data

d) Hardware delay trigger: Send a fixed-period hardware trigger signal to obtain continuous frame data. Taking the picture on the left as an example, within 1000us , continuous frame data is obtained at an interval of 252ms . It will take effect after clicking the " Set Time Interval " button.

3.4 Function Introduction | "Regular Configuration" Module



Exposure settings

Frame rate (fps)	Maximum exposure time (us)
0~5	4000
5~10	2000
10~15	1300
15~20	1000
20~30	<1000

Maximum exposure time and frame rate relationship table

- **Manual exposure:** Manually adjust the exposure time.

In manual mode, you can enter a value in the box (press Enter to confirm) or drag the progress bar to change the following parameters:

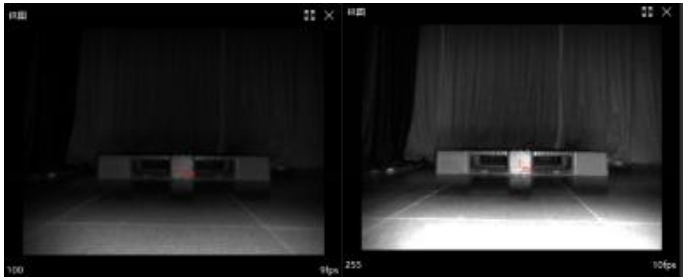
a) **Exposure time (us)** : It is the integration time, which represents the turn-on time of the laser. The maximum exposure time that can be set is related to the frame rate. For details, see the table on the left;

b) **Frame rate setting** : You can enter a value in the box (press Enter to confirm) or drag the progress bar to change this parameter. Changing the frame rate will change the maximum exposure time accordingly.

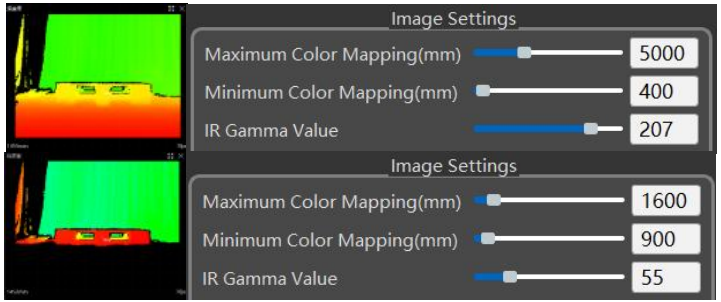
- **Automatic exposure: Adapt the optimal exposure** / integration time according to the distance of surrounding objects and the set frame rate value to avoid overexposure at close range. The more objects at close range, the lower the exposure time .
- **HDR mode: After turning on this function, you can automatically set** two exposure times, large and small, for overexposed areas under long exposure times , and combine the two values to obtain a more accurate depth image.
- **High frame mode:** up to 30fps

Note: Automatic exposure cannot be turned on in HDR mode and high frame mode.

3.4 Function Introduction | “Image Settings” Module



IR images under different IR gamma values



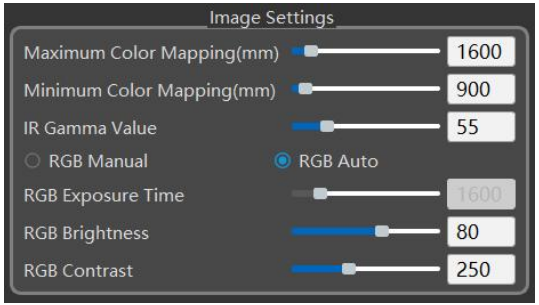
Depth map under different color mapping values at the same distance

You can enter a value in the box (press Enter to confirm) or drag the slider to change the following parameters:

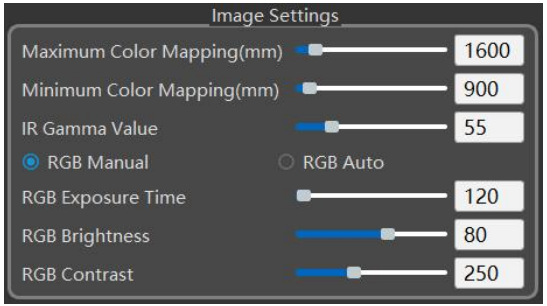
- **Minimum color mapping distance:** Minimum display distance. The color mapping range can be set for depth maps and point clouds. The value range is 200~15000mm . The minimum step size is 1mm . The value of the minimum color mapping distance must be smaller than the maximum color mapping distance.
- **Maximum color mapping distance:** the maximum display distance. The color mapping range can be set for depth maps and point clouds. The value range is 200~15000mm , and the minimum step is 1mm .
- **IR gamma value:** Set the IR image gain. The higher the value, the brighter the IR image. The value range is 0~255 .

Note: The response maximum color mapping distance needs to be selected based on the actual device working distance.

3.4 Function Introduction | “Image Settings” Module



RGB auto

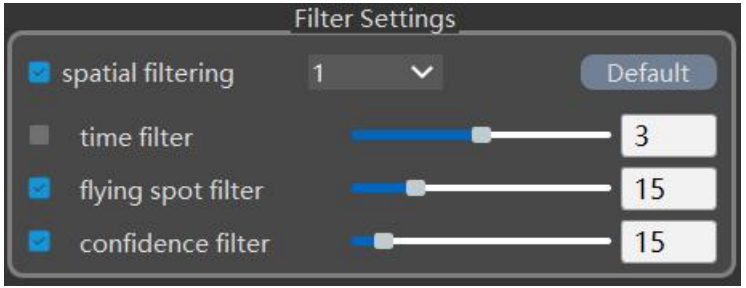


RGB manual

In manual mode, you can enter a value in the box (press Enter to confirm) or drag the progress bar to change the following parameters.

- **RGB Manual:** Manually adjust exposure time.
- **RGB exposure time** : used to adjust the amount of incident light hitting the RGB sensor , with a value of 0~50000 . The higher the value, the brighter the incident light.
- **RGB Auto:** Adapts the optimal exposure time according to the surrounding light intensity to avoid overexposure. The stronger the ambient light , the lower the exposure time .
- **RGB brightness** : You can enter a value in the box (press Enter to confirm) or drag the progress bar to change the brightness of the RGB screen, the value is 1~128 .
- **RGB contrast:** You can enter a value in the box (press Enter to confirm) or drag the progress bar to change the contrast of the RGB screen, the value is 100~500 .

3.4 Function Introduction | "Filter Settings" Module



Filter Settings

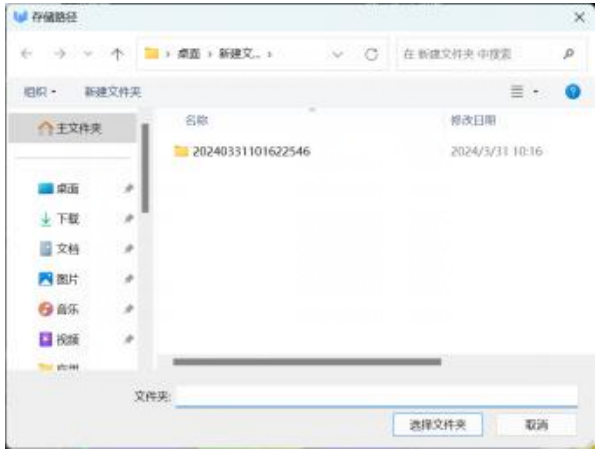
You can enter a value in the box (press Enter to confirm) or drag the progress bar to change the time filter, flying point filter, and confidence filter parameters.

You can select the following filtering processing methods by checking:

- **Spatial filtering:** point cloud smoothing processing, you can choose the value 1 or 2. The larger the value, the flatter the point cloud.
- **Time filtering:** used to adjust the stability of the detection distance. It is recommended to turn it off when detecting dynamic objects. Adjustable threshold, value range 1~5 , default value is 3 , the larger the value, the smaller the range of distance value change, the default is off
- **Flying point filter:** remove abnormal points on the edge of objects, adjustable threshold, value range 1~63 , default value is 15
- **Confidence filtering:** eliminate relatively inaccurate distance points, adjustable threshold, value range 1~150 , default value is 15
- **Default configuration:** Restore the device's default filter settings with one click . The time filter is not checked in the default configuration. If it is manual exposure mode at this time, restore the default exposure time and frame rate settings.

3.4 Function Introduction | "Save" Module

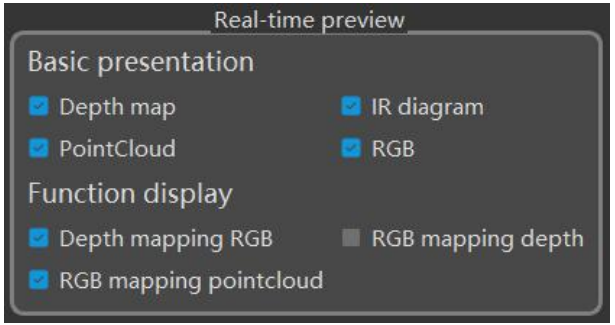
Image Settings



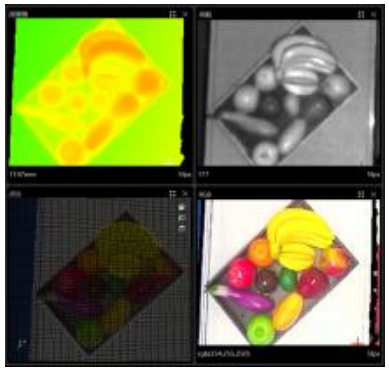
Save Route

- **Save path selection:** Click to customize the save path, as shown on the left **. The file name defaults to a timestamp, and depth maps,** IR maps, rgb , and point clouds can be selected to save.
- **Single frame save:** Click to save the current frame data, and save it as a folder named with the timestamp in the previously specified folder. Save image files (.png format), data files (.csv format, point clouds in .pcd format) , digital video file (.yuv format), the data file is saved as the data of the current frame.
- **Continuous preservation:** Click to select to save the data of each frame within a period of time, and save it to a folder named with the timestamp in the previously specified folder. Save image files (.png format), data files (.csv format, click The cloud is in .pcd format), digital video file (.yuv format), and the data file is saved as the data of the current frame.

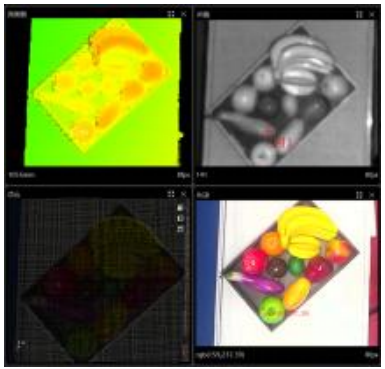
3.4 Function Introduction | “Real-time preview” Module



Live Browsing



RGB mapping depth + RGB mapping point cloud



Depth mapping RGB+RGB mapping point cloud

- **Basic Presentation**

a) **Depth map, IR map, pointCLoud, RGB : Select to display the depth map,** IR map, point cloud, and RGB in the image display interface by checking .

- **Function display**

Select to display the following effects on the image display interface by checking

a) **Depth mapping RGB :** After checking, the RGB map interface will have depth information.

b) **RGB mapping depth:** After checking, the depth map interface will include RGB information.

c) **RGB mapped pointcloud** : If checked, the point cloud interface will be accompanied by RGB information.

3.4 Function Introduction | Data Storage and Description

- **Data Saving**

a) " Continuous save " in the save settings , and select the file location you want to save.

b) Select IR , and point cloud data you want to save .

c) Click the corresponding save button to save the current frame data.

Note 1 : The checked data file is saved in the set path, and the file name defaults to the timestamp. The saving format is .png format (picture file), .csv format (data file) and .pcd format (point cloud data file).

- **Data Format Description**

a) **IR data:** The data transmission method is: from left to right, top to bottom, with a total of 480 rows and 640 columns of data. Corresponding to the true value amplitude of the horizontal and vertical positions, the data type is: unsigned short , so one pixel occupies 2 bytes.

b) **Depth data:** The data transmission method is: from left to right, top to bottom, with a total of 480 rows and 640 columns of data. Corresponding to the true value distance of the horizontal and vertical positions, the distance data unit is mm , and the data type is: unsigned short , so one pixel occupies 2 bytes.

The first pixel of the first row 0xff...	The second pixel in the first row 0xff...	Each line has width * pixelsize bytes ...	The last pixel of the first row 0xff...	The first pixel in the second row 0xff...	Each line has width * pixelsize bytes ...

4 SDK Support

Luminwave SDK software package supports Windows/Linux operating systems, the details are as follows.

If you need the corresponding SDK software package, please contact Luminwave sales staff.

- **Windows**

a) Windows SDK software package developed for x86_64 processor , using standard compiler VS2020 ;

b) Supports Windows 10 and above.

- **Ubuntu 18.04***

a) Ubuntu 18.04 SDK software package developed for x86_64 processor , using standard compiler x86_64-linux-gnu(v7.5.0) .

- **Ubuntu 20.04***

a) Ubuntu 20.04 SDK package developed for x86_64 processors .

* Ubuntu is one of the operating systems with Linux as the kernel

5 Storage and Transportation

- **Storage**

a) Please store the product in a ventilated, dry and dust-free environment. The recommended storage temperature is -30~70°C .

b) It is strictly prohibited to expose the product to toxic, harmful and corrosive environments to avoid damage or weakening of product functions.

c) Please handle it with care when storing and do not drop the product.

d) For those that have been stored for too long, please check the appearance and interface regularly to avoid abnormalities during use.

- **Transportation**

a) Before transportation, please carefully check whether the outer packaging of the product is intact.

b) Mechanical shock or vibration exceeding the allowable range may cause damage to the product. Products should be packaged in shockproof packaging materials to avoid damage during transportation.

c) Please handle it with care during transportation and do not bump, impact or drop the product.

d) Please ensure that the packaging box is dry, clean and free of moisture.

6 Q&A

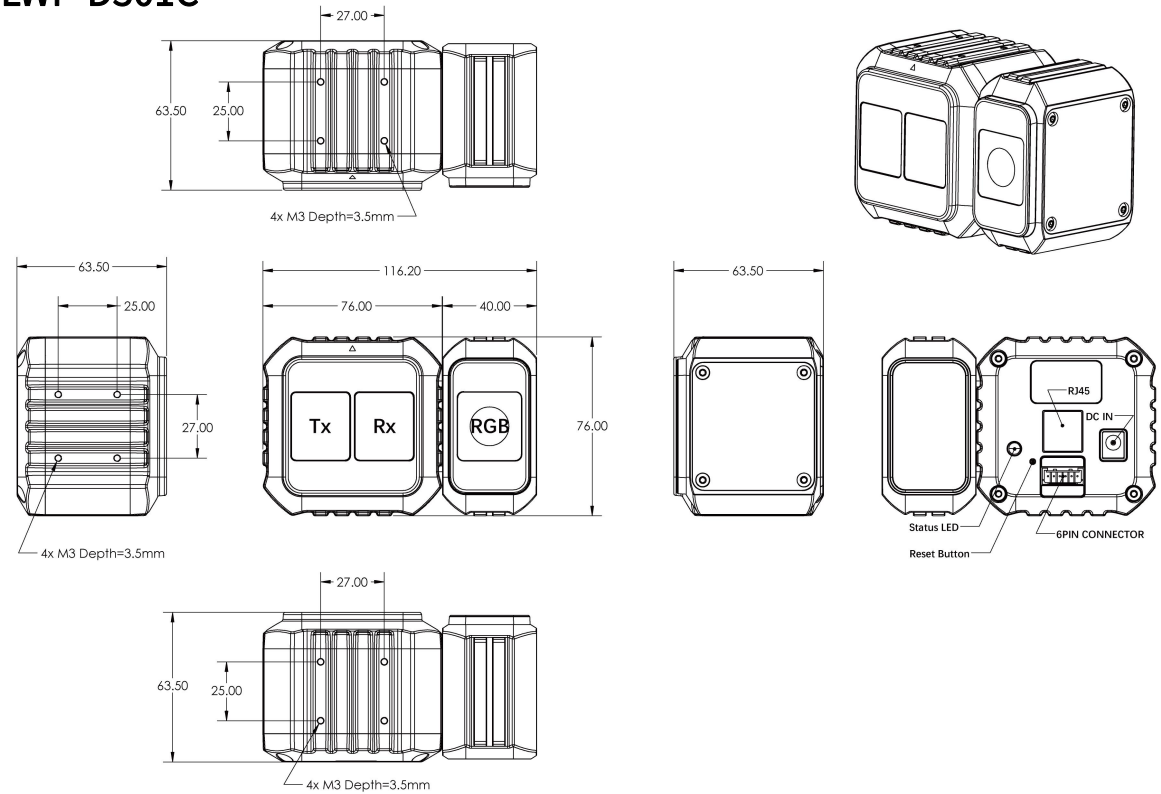
Fault phenomenon	Solution
Device cannot connect	1. Check whether the wiring is normal and the LED indicator light is normal and lights green. 2. IP addresses of the host computer software and test computer are correct and on the same network segment 3. IP settings of the machine are correct: enter "ipconfig" in the command prompt window and press Enter. If the device is directly connected, check whether the Ethernet is the "192.168.1.x" network segment. If it is through a LAN (such as wifi) connection), check whether the wireless LAN is the "192.168.1.x" network segment 4. If the network settings are normal and the device can be pinged , restart the device. 5. confirming the direct connection to the computer and needing to change the default IP address, whether the DHCP option is checked will cause the device to fail to connect.
Windows 10 (error code: 0xc000007b)	1. Download the onnxruntime.dll system library file, add it to the LuminViewD file, and restart the program
TCP connection timeout	1. After the switch is restarted, wait 30 seconds and then turn on the host computer software.
The work process is offline	1. After troubleshooting problems such as loose wiring, please contact Luowei staff.
Interface stuck	1. Check whether the collected data is abnormal. If the collected data is abnormal, it will cause an abnormality in the analysis module of the program, causing the visualization module to take a long time to calculate and cause the interface playback to freeze. Save the collected data and check whether its value is abnormal. 2. Confirm whether unnecessary services are turned on. If too many computer services are turned on, it will also cause lag. Please turn off unnecessary services before using this program. 3. Please confirm that the USB adapter network port is a 3.0 input port 4. Please confirm whether the network cable and network port are Gigabit network cables 5. If the problem still exists, please restart the host computer software
" Device not found " dialog box appears	1. Check whether the wiring is normal 2. It may be that the operation frequency is too fast. Wait for a while and click " Search Device " again to connect. 3. Please confirm that the USB adapter network port on the computer is a 3.0 input port
IR map, or point cloud appears.	1. Please confirm that the USB adapter network port on the computer is a 3.0 input port 2. Check whether the "capture mode" is set to "software trigger" mode

Appendix 1 Reflectance Reference Table

Material	Reflectivity
Black fabric	3%
Black rubber	4%
Opaque black plastic	14%
Clean rough plank	20%
Cork	35%
Transparent plastic cup	40%
Dry paper towels	47%
Newspaper	55%
Opaque plastic cup	60%
Packing box cardboard	68%
Beer foam	70%
Clean pine	70%
Human palm	75%
Opaque white plastic	87%
White drawing paper	90%

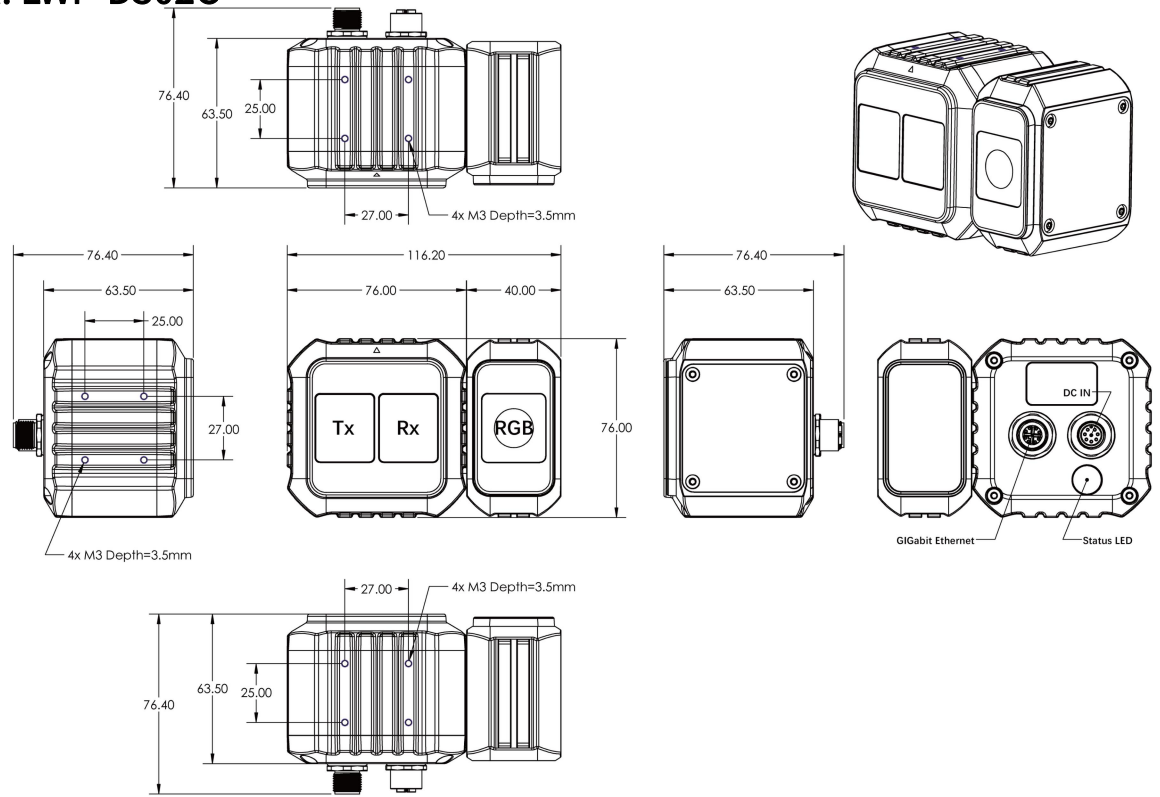
Appendix 2 Structural Drawings

Product model: LWP-D301C



Appendix 2 Structural Drawings

Product model: LWP-D302C



Appendix 3 Version Information

Serial Number	Version Number	Modify Content	Modification Date
1	Rev1.0.0	First Version Released	2024.4.10

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