


# V2Pro Navigation Controller

## Product User Manual

**Version：** V2.0

**Date：** 2026-04-21

# Term explanation

| Terminology | Explanation |
|---|---|
| Depth | Depth video streams are similar to color or black-and-white video streams, where each pixel has a value representing the distance from the camera, that is, 'depth'. |
| FOV | Field of view, used to describe the range of angles from which a camera images a given scene, mainly includes horizontal field of view (HFOV), vertical field of view (VFOV), and diagonal field of view (DFOV). |
| IR | Infrared (IR) communication is a wireless communication technology for transmitting data, and this product mainly focuses on near-infrared band imaging |
| SoC | System-on-chip for processing image data, depth settlement, application algorithm operations, and other functions |
| dToF | By directly measuring the time interval from the emission to the reception of the light pulse, calculate the distance of the object using the flight time of the light. Light pulses are emitted and received at very short intervals (typically nanoseconds), and the distance is measured by measuring the time difference of the pulses |
| iToF | The depth information of the target object is obtained by indirectly calculating the light flight time by measuring the phase difference of the modulated light signal |
| IMU | Inertial measurement unit , a sensor device used to measure the three-axis attitude Angle (or angular rate) and linear acceleration of an object |
| SLAM | Simultaneous localization and mapping |

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# 1 Product Overview

## 1.1 Product Introduction

MRDVS V2Pro is a second-generation high-performance navigation controller specifically designed for complex scenarios. It has been upgraded from the first-generation controller and integrates top-view visual SLAM with 2D LiDAR, precisely meeting the navigation needs of robots in complex environments. The controller has built-in computing power and does not rely on external industrial control computers. When the robot runs completely within the designated area, the V2Pro can automatically scan the environmental information and quickly create a map through AI algorithms, providing a stable and reliable navigation solution for mobile robots.

## 1.2 Functional Features

### 1.2.1 Precise Navigation of Mobile Robots

- V2Pro integrates a wide-angle top-view camera (108° × 57°) and a high-precision 2D lidar (270°). Combined with an industrial-grade IMU module, it achieves a repeat positioning accuracy of ±1cm by fusing data from multiple sensors.
- The product is equipped with a 6TOPS processor, enabling the rapid creation of high-precision environmental maps. Combined with a visual operation interface, it allows for one-click mapping, significantly reducing the deployment threshold.

### 1.2.2 Enhanced Solution for Manual Forklifts

- Integrating the latest WiFi 6 technology, it has been specially optimized based on the positioning requirements of manual forklifts, ensuring the real-time and reliability of data transmission.
- The product is equipped with a 3-pin audio output, supporting voice prompts and alarm functions, significantly enhancing the safety of human-machine collaborative operations.

## 1.3 Application scenarios

**1.3.1 Factory logistics：** Supporting seamless indoor and outdoor shuttle of AGV - unmanned forklifts (from warehouse to platform to workshop).

**1.3.2 Upgrade of forklifts：** Alternative to UWB solution, with higher accuracy (＜ 3cm level positioning), lower deployment cost and shorter deployment time.

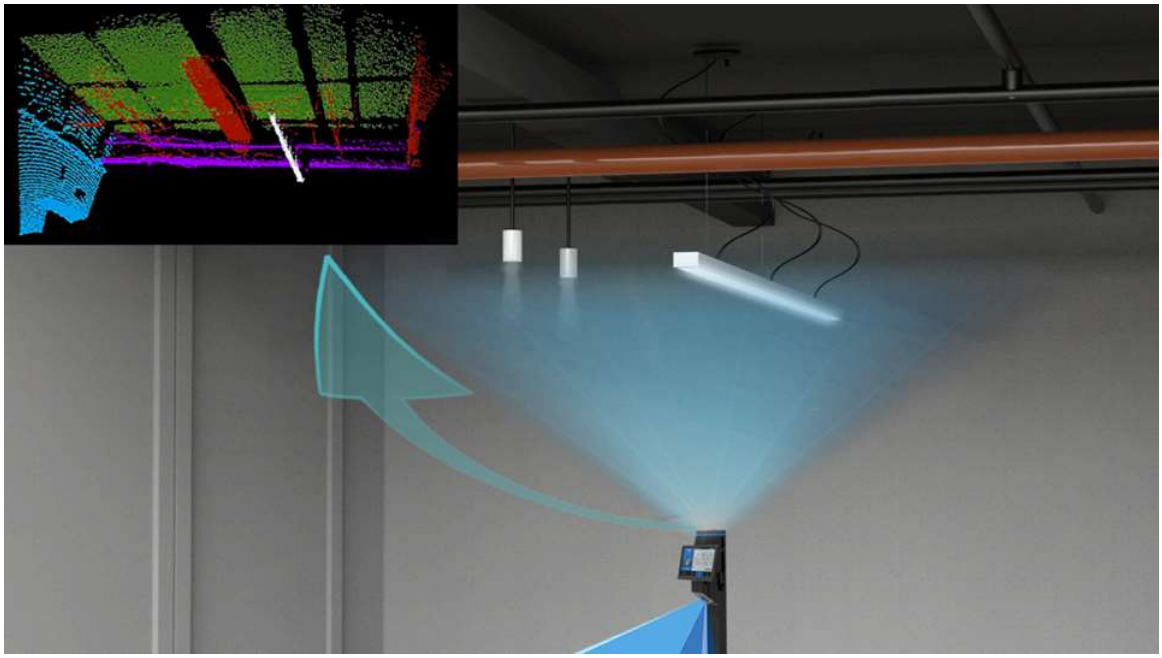


Figure 1 3D data collection of indoor space




Figure 2 Application Scenario of Manual Forklift Trucks

# 2 Specification Parameters

## 2.1 Basic Specifications

Table 1 Basic Specifications Table

| | Parameter items | V2Pro Navigation Controller |
|---|---|---|
| **Top-view camera** | Detection range | 1m-15m (ambient light 0-10 klux) |
| | Field of view (FOV) | 108°(H)×57°(V)±3° |
| | Frame rate | 20fps |
| | Antijamming capability | Anti-glare / Anti-environmental light |
| | Integrated module | IMU (inertial navigation module) |
| **2D LiDAR** | Scanning frequency | 15hz-25hz (switchable) |
| | Detect range | 15m @ 10% reflectivity/ 40m @ 90% reflectivity |
| | Ranging accuracy | ±30mm (typical) |
| | Angular resolution | 0.1° |
| | Horizontal field of view | 270° |
| **Master control system** | Processor | Rockchip 8-core ARM platform |
| | NPU computing power | 6TOPS |
| | Communication interface | 1× Ethernet / 1× CAN / 4× IO (2 IN 2 OUT) |
| | Power input | 24V(±4.8V) DC IN |
| | Power consumption | 6.6W (average), 15.3W (maximum) |
| | Wireless module | WiFi 6 |
| | Audio input | 1×3pin audio_out (L/R/GND) |
| | Size | 146.5mm×66.3mm×89.4mm |
| | Protection class | IP54 |
| | Operating temperature | -20°~60° |
| | Storage temperature | -40°~80° |

## 2.2 Interface definition

The navigation controller has three interfaces: a 24V DC power interface, and two 100Mbps network ports (one is connected to the AGV, and the other is reserved for the laser radar).

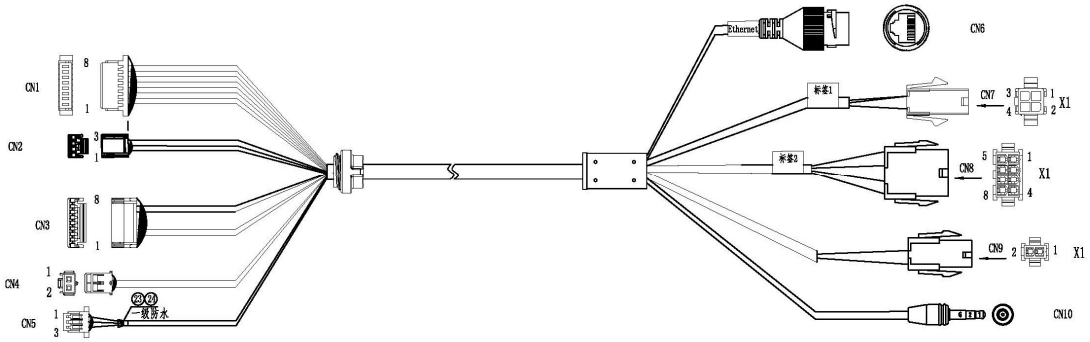



Figure 3 Diagram of Interface Wiring Connection

Table 2 Interface Definition Explanation

| Port | Definition | Description |
|---|---|---|
| CN6 | Ethernet | RJ45 female connector |
| CN7 | CAN interface | Pink：CAN_H；Purple：CAN_L；Black：GND |
| CN8 | IO interface | 1：IN1+ 2：IN1-<br>3：IN2+ 4：IN2-<br>5：OUT1+ 6：OUT1-<br>7：OUT2+ 8：OUT2-<br>IO IN：5-24V High voltage effective<br>IO OUT：Push-pull output, supporting 24V/100mA driving capability |
| CN9 | Power interface | DC 24V/3A；1：positive；G：negative |
| CN10 | Audio output | 3.5mm male connector |

# 3 Product information

## 3.1 product appearance



Figure 4 Product Appearance Picture

## 3.2 Structural drawings

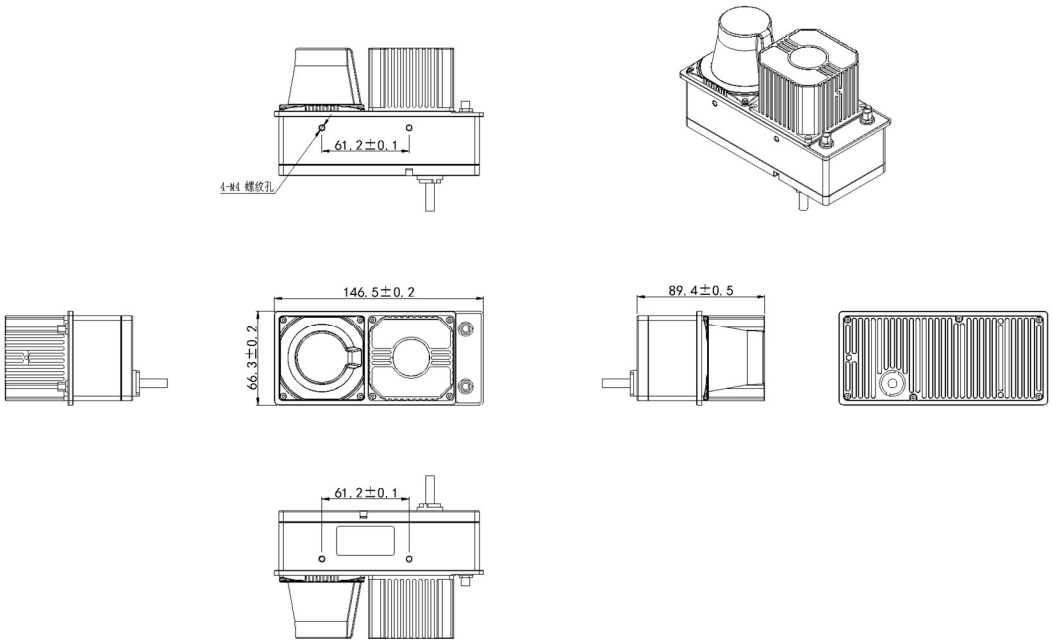



Figure 5 Product Structure Drawing

## 3.3 Product components

### 3.3.1 Component overview

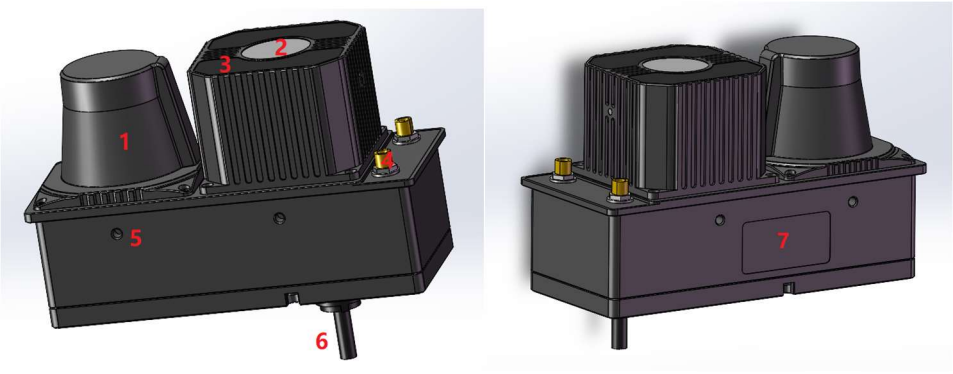



Figure 6 Introduction Diagram of Navigation Controller Components

Table 3 Introduction to Navigation Controller Components

| No. | Module |
|---|---|
| 1 | 2D Laser Light Emitting Window |
| 2 | The top-view camera lens window |
| 3 | Top-view camera lighting fixture |
| 4 | WiFi antenna interface |
| 5 | Installation screw holes: 4-M3 screw holes |
| 6 | Camera cables (Ethernet, power supply, CAN, IO, audio) |
| 7 | Label placement on the nameplate |

### 3.3.2 WiFi communication module

The V2Pro navigation controller is equipped with a wireless network card, which can provide stable and high-speed WiFi connections. This network card supports multi-user MIMO (MU-MIMO) technology, which can increase channel capacity when serving multiple devices simultaneously using the same frequency band, and can achieve a transmission speed of up to 1200 Mbps through dual-stream technology. This network card supports the ISM frequency bands of IEEE 802.11ax/ac/a/b/g/n standards, specifically ranging from 2.400 GHz to 2.4835 GHz. Detailed specifications are as follows.

Table 4 Technical Specifications of WiFi Communication Module

| Parameter category | Detailed information |
|---|---|

| | |
|---|---|
| Standard | IEEE 802.11ax/ac/a/b/g/n (2T2R)<br>Bluetooth version： V5.3 、 V5.0 、 V4.2 、 V4.1 、 V4.0 LE 、 V3.0+HS、V2.1+EDR |
| Data rate | **WiFi：**<br>• 802.11b: 11 Mbps<br>• 802.11a/g: 54 Mbps<br>• 802.11n: MCS0~15<br>• 802.11 AC: MCS0~9<br>• 802.11ax: HE0~11<br>Bluetooth**:** 1 Mbps, 2 Mbps, up to 3 Mbps |
| Operating frequency | IEEE 802.11ax/ac/a/b/g/n<br>ISM frequency band：2.400 GHz ~ 2.4835 GHz<br>(Restricted by local regulations, 5G frequency band is not currently supported.) |

# 4 Camera Integration Guide

## 4.1 Camera detection range and coordinate system

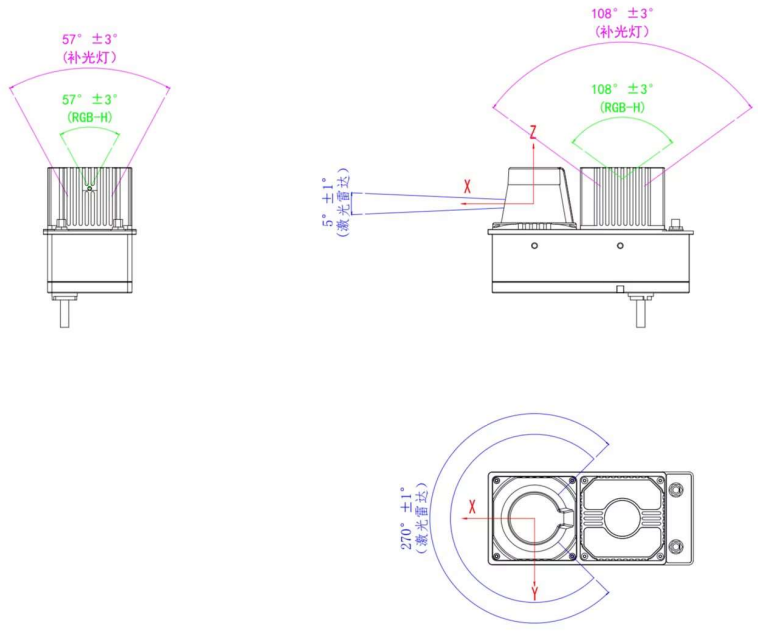



Figure 7 Navigation Controller Detection Range and Coordinate System Diagram

## 4.2 Installation methods




Figure 8 Installation Diagram of Navigation Controller

## 4.3 SDK

Please refer to the user manual of the MRDVS host computer and the SDK development guide.

## 4.4 Operating environment and reliability

Table 5 Product Integration Guide

| Item | | Specification |
|---|---|---|
| Working environment | Temperature | -20℃-- 60℃ |
| | Illumination | 0KLUX--100KLUX |
| Storage environment | Temperature | -40℃--85℃ |
| | Humidity | Relative humidity： Max 90% RH |
| Normal operating temperature rise | | Exterior temperature rise <25℃ |
| ESD grade | | Contact discharge ± 4KV， air discharge ±8KV |
| RE grade | | Compliant with GB 9254 CLASS A specifications |

| | |
|---|---|
| Working life | More than 3 years |
| Environmental certification | RoHs |

# 5 Quick Usage Guide

## 5.1 Packing list

| No. | Description |
|---|---|
| 1 | V2Pro Controller Body |
| 2 | 2PIN power cord |

## 5.2 Connection test

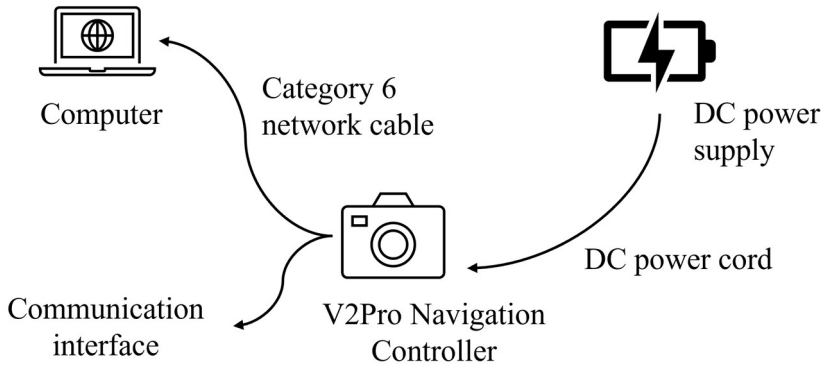



Figure 9 Diagram of Camera Connection Test

### 5.2.1 Camera power supply

- Insert one end of the DC power cable into the DC power interface of the camera, and connect the other end to a 24V/3A DC power adapter.
- Observe the power indicator light of the camera. When the indicator light flashes slowly in blue, it indicates that the power is turned on normally.
- If the indicator light is not on or shows abnormal (such as a constantly lit red light), please check whether the power interface is securely plugged in and whether the power adapter is powered on.

### 5.2.2 Network configuration

- Connect the communication interface of the camera directly to the network port of the computer using a Category 6 network cable.
- The default IP of the camera is 192.168.100.201.
- Set the IP of the computer to be in the same network segment as the camera and turn off the computer's firewall.
- The local area network computer can log in without a password by entering 192.168.100.201:9998 through the web browser.

### 5.2.3 Running the software

- Run the accompanying upper computer software, obtain the camera images, check whether the images are clear, without screen flickering or lagging, and confirm that the connection is normal.
- Refer to the interface instructions or the LxCameraViewer upper computer software user manual for usage.
- If you have any other questions, please contact Meyer Microvision sales or technical support for further assistance.

## 5.3 Interface Description




Figure 10 Interface Description

- Red menu bar: Clicking on it will lead to the detailed operation instructions for the corresponding functions, such as starting mapping, repositioning, map management, etc.

- Blue box: The 2D contour map loaded and the icon for the vehicle positioning display can be seen.
- Green box: The real-time RGB image of the top-view camera is displayed.
- Yellow box: The real-time signal strength of repositioning (green: excellent strength, blue: good strength, red: poor strength) is shown; the current position coordinates of the vehicle, the current movement speed of the vehicle, and the mouse position coordinates are also displayed in real time.

## 5.4 Mapping process

1、Starting mapping

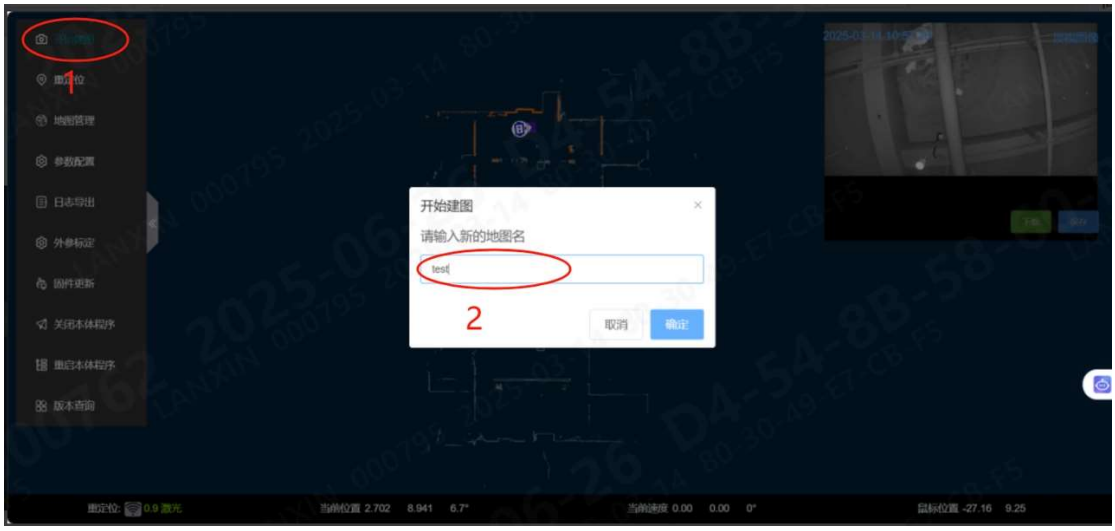



Figure 11 Start of Construction of map

2、Entering the name of the map

The name of the map should be composed of letters, numbers and underscores. It cannot start with a number.

3、Mapping interface




Figure 12 Map Construction Interface

- During the mapping process, the running speed of the vehicle should not exceed 0.5 m/s, and the angular velocity should not exceed 20 degrees/s.
- On the interface, the laser contour and the top-view camera image can be displayed.

4、Plan the general mapping path in advance, maintaining a low speed (<0.2m/s) of constant speed, straight line, right-angle turns. Avoid repetitive paths and random jittering. Keep approximately 1/3 of the common view area for the same direction path. Under normal circumstances, the parallel distance is maintained at about 2 meters. Maximize the coverage of the mapping area or the robot's travel path. The ideal situation is as shown in the following figure.



Figure 13 Ideal Recording Path

5、Ending mapping

The AGV scans the area within its operating range. After the scanning is completed, click the menu bar to end the mapping process. Please be patient while waiting (the waiting time is related to the size of the scanning area).

## 5.5 Map management

1、Map Management Interface

2、Backstage map




Figure 14 Map Management

After the map is completed, click the "Map Management" option in the menu bar. You can then see the name of the map you just created in the background map list. Click the "Deploy" button, and the map will be deployed to the host map. There are multiple maps, and all of them need to be deployed to the host map. The operations of modifying, exporting and deleting the map are supported.

3、Host map

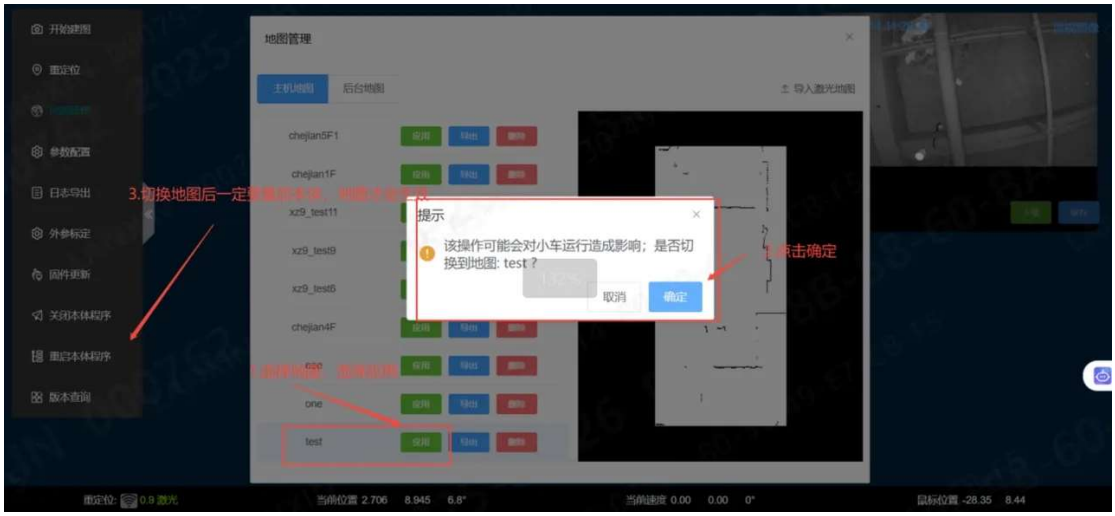



Figure 15 Host Map

Click "Apply" on the main map to make it effective. This map supports export and deletion. After clicking "Apply" and making sure to restart the device, the map will take effect. Otherwise, there may be issues such as failed re-location.

## 5.6 Relocation




Figure 16 Relocation

- After clicking the repositioning function, you can drag with the mouse to provide a matching prompt between the laser point cloud and the laser contour map, giving the approximate repositioning pose. Then, repositioning can be performed.
- After successful repositioning, the positioning timeout exception disappears.

## 5.7 Parameter configuration




Figure 17 Parameter Configuration

View and configure the chassis positioning parameters and sensor calibration values of the robot configuration, including the extrinsic parameters of the laser and the camera.

# 6 FAQ

| No. | Questions | Answers |
|---|---|---|
| 1 | Clicking to open the camera is not responding. | The firewall settings need to be checked and adjusted to ensure that the camera communication is not being intercepted. |
| 2 | The upper computer has detected multiple IP addresses. | Due to the existence of IP address conflicts within the local area network, it is necessary to manually select the correct IP address in order to turn on the camera. |
| 3 | After turning on the camera, the data flow became | It is recommended to connect the camera using a gigabit network cable. Using a hundred-megabit network cable may result in unstable initial data transmission. |

| | | |
|---|---|---|
| | unstable. | |
| 4 | Software installation location | The default installation to the C drive may cause abnormal operation due to system permission restrictions. It is recommended to choose an installation directory with appropriate read and write permissions. |

# 7 Notes

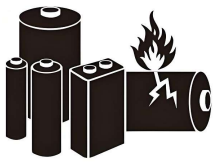
## 7.1 Laser safety



**激光安全**

- This product emits invisible laser during operation. During use, it is necessary to avoid damaging the eyes.
- The laser emitted by this product complies with Class 1 safety level. According to EN60825 requirements, it will not cause harm to the human body during normal use.

## 7.2 Lithium batteries



**Lithium batteries**

- This product contains lithium batteries, which comply with the transportation requirements for non-dangerous goods.
- The batteries must be handled in accordance with local and international transportation regulations.
- It is strictly prohibited to attempt to dismantle, squeeze, burn or short-circuit the batteries.