

Safety SEER Slim Stack 1500

SSS-1500EU

SFL-CDD15-CE

User Guide



Version History

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This is the original version of the User Guide.



Before operating the robot, please fully understand this User Guide.



Thank you for your purchase.

Only those who have received training and are qualified can use this product.

This document includes precautions that shall be followed to ensure personal safety and protect this product.

Disclaimer

All content in this document has been verified and confirmed to be as accurate, reliable, and complete as possible. However, it cannot be guaranteed that all content is consistent with the product.

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1. Foreword

1.1 Reading Tips

The robot, forklift, vehicle, etc. that appears in this document are all abbreviations for this product.

Before using the robot, please read the User Guide carefully.

Do not disassemble or assemble the robot without authorization.

Please pay attention to the safety warnings involved in the user guide.

If there is any abnormal issues with the robot, please contact the manufacturer promptly.

If you smell any unusual odors while using the robot, immediately stop, power off, and remove the battery.


The User Guide is not a substitute for the Technical Agreement.

1.2 Prohibition of Use

- It is prohibited to use in outdoor environments.
- It is prohibited to use in environments with strong interference to the navigation devices.
- It is prohibited to use in environments full of dust, powder, or other explosive hazards.
- It is prohibited to use in environments with high salt content (marine climate).
- It is prohibited to use in extremely poor environments (extreme climates, freezer warehouses, and strong magnetic fields, etc.).
- It is prohibited to transport flammable or explosive materials.
- It is prohibited to transport liquid materials.
- It is prohibited to run on uneven, obstructed, or ladder.
- It is prohibited to rotate in place on the ramp.
- It is prohibited to carry personnel.
- It is prohibited to operate with load on the shell.
- It is prohibited to run on surfaces with oil or water.
- It is prohibited to operate at places at an altitude of above 1,000 meters.




2. Safety

Please read this section carefully before starting and running the robot.

| | |
|---|--|
|  | <p>Notice</p> <ul style="list-style-type: none"> • We will not be responsible for any problems caused by damage, replacement, or modification of robot or its accessories in any way. • We will not be responsible for any damage to the robot, accessories or any other equipment caused by customer programming errors or faults. |
|---|--|


2.1 Safety Message Types



This document contains the following safety message types.

| | |
|---|---|
|  | <p>Warning</p> <ul style="list-style-type: none"> • Indicates a potentially dangerous situation that may result in death or serious injury. • Appropriate preventive measures should be taken to avoid damage or injuries. |
|  | <p>Caution</p> <ul style="list-style-type: none"> • Indicates a potential dangerous situation that may cause minor or moderate injuries to personnel. Remind to avoid unsafe behaviors. • Appropriate preventive measures should be taken to avoid damage or injuries. |
|  | <p>Notice</p> <ul style="list-style-type: none"> • Indicates important information, including situations that may result in equipment or property damage. |

2.2 General Safety Precautions

This chapter contains general safety precautions.

| | |
|---|---|
|  | <p>Precautions for Robot Rolling Over</p> <ul style="list-style-type: none"> • If the load is not placed or secured correctly, it may result in the load dropping out or the robot rolling over. • Ensure that the load is placed and secured properly according to the specifications. Please refer to chapter 3.4.3 Effective Load Specifications. |
|---|---|

| | |
|---|---|
|  | <p>Precautions for Personal Injury by Machine</p> <ul style="list-style-type: none">● The high-speed slewing part of the vehicle body, such as universal wheels and driving wheels, may cause personal injuries.● Do not overly rely on the vehicle's autonomous avoidance function. Please take the initiative to avoid the vehicle. |
|  | <p>Running Precautions</p> <ul style="list-style-type: none">● The robot can't detect descending stairs and holes on the floor.● Please mark stairs and holes as restricted areas on the map.● Please update the map in time. |

2.3 Safety Instructions

2.3.1 Qualification Requirements for Personnel

The installation, commissioning, operation and maintenance of the robot is only allowed to be carried out by qualified professionals.

In addition to the basic mechanical, electrical, commissioning, operation, and maintenance knowledge discussed in this document, the handling and transporting of this product requires knowledge of using lifting devices and corresponding hoisting devices. To assure safety, these tasks should only be carried out by professionals or by trained individuals under the guidance of professionals.

A professional refers to an individual who is capable of diagnosing tasks based on their professional education, knowledge and experience, understanding of relevant regulations, to identify potential hazards and implement appropriate safety measures. Professionals must adhere to relevant professional guidelines and possess the necessary professional knowledge.

Mechanical Installation and Commissioning Requirements

The personnel responsible for the mechanical installation and commissioning should possess professional knowledge and experience in related fields, and have sufficient experience to assess whether the machine is in a safe running state after using protective equipment.

Electrical Installation and Commissioning Requirements

The personnel responsible for the electrical installation and commissioning should possess professional knowledge and experience in related fields, and have sufficient experience to assess whether the machine is in a safe running state after using protective equipment.

Operation and Maintenance Requirements

The personnel responsible for the operation and maintenance should possess professional knowledge and experience in related fields, be familiar with the application of protective equipment on the machine and be guided by the machine user.

Personal Protective Equipment Requirements

When using this product, operators should wear appropriate personal protective equipment (such as safety shoes, do not let long hair hanging loose, etc.).

As an operator, it is your responsibility to have appropriate protective equipment when using this product.

All components of personal protective equipment must be intact.

2.3.2 Operation Safety

2.3.2.1 Operation Environment Safety

- The ground should be flat, and free from grooves, damages, hollow bumps, oil, adhesives or other contaminants.
- The ground should be free of screws, tack cloth, gloves, thread ends, cables, and other foreign materials that may get caught and tangled in the wheels.
- Do not operate in excessively open areas (beyond the laser sensing distance), such as long corridors.
- A robot at full load and low speed can only cross steps no higher than 0.5 cm.
- When navigating through narrow aisles, a 20 cm clearance should be maintained between the outer edge of the robot and the aisle.
- The sections of the working area shall be protected or marked with warning signs to alert other personnel that robots are operating.

2.3.2.2 Inspection before Operation

Before activation, the operator should inspect the condition of the robot to ensure safe use. The inspection items include, but are not limited to:

- Whether the wheel fasteners are tightened.
- Whether the power system is normal.
- Whether the emergency stop function is normal.
- Whether the payload handling device is damaged (such as bent, cracked or worn).
- Whether the warning device is normal.
- Whether the tricolor light is normal.
- Whether the function of the laser sensor is normal.
- Whether the battery level is normal.
- Whether the charging function is normal.
- Whether the HMI display screen is normal.

2.3.2.3 Operating on Ramp

- It is only allowed to run on ramps that meet the performance parameters; please refer to chapter [3.4 Technical Parameters](#).
- The upper and lower ends of the ramp should be flat to prevent the load or robot from touching the ground.
- It is prohibited to turn around, run diagonally or stop on the ramp.

2.3.2.4 Operating in Elevator or Lifter

- Ensure that the elevator or lifter can bear the total weight of the robot and its load.
- Ensure that no part of the robot is in contact with the walls of the elevator or lifter.
- Ensure that the robot does not have any accidental movement.
- Ensure that the elevator complies with relevant national standards.

2.3.3 Load Safety

- The robot and its load should not exceed the range permitted by the road surface.

- The load carried must be reliably secured.
- The load carried must be placed within the load center with certain anti-slip measures. Please refer to the chapter [3.4.3 Effective Load Specifications](#).
- The weight of the load carried by the upper mechanism must be evenly distributed, and unbalanced loading is not permitted.

2.3.4 Parking Safety

- When the robot stops running, shut down and cut off the power supply.
- Do not park on the ramp.
- Do not park near heat sources or fire sources.
- Do not park in open pits, underground passages, elevator shafts or other similar areas.
- Do not park in the fire escape lanes, stair exits and areas obstructing the passage of firefighting equipment.
- Under special circumstances, take safety measures for the robot, such as using wedges.

2.3.5 Safe Avoidance Range

The minimum turning diameter of the robot is 1295mm. Please be cautious to avoid.

- The use of batteries with damaged cables or contacts is strictly prohibited.
- Do not place the battery in water or get it wet.
- It is strictly prohibited to change the lithium battery in a liquid environment.
- Do not allow the positive and negative terminals of the battery to contact the metal shell at the same time.
- Do not short circuit, overcharge or over-discharge the battery.
- Do not use or store the battery near heat sources (such as fire or heaters).
- Do not reverse the positive and negative terminals of the battery.
- Do not use a nail or other sharp object to pierce the battery case, and do not hammer or step on the battery.
- Do not dismantle or modify the battery in any unauthorized way.
- Do not hit, throw or subject the battery to mechanical vibrations and natural falling.
- Do not mix batteries of different types and brands.
- If the battery emits peculiar smell, heat, deformation, discoloration or any other abnormal phenomenon, it shall not be used, and the battery should be removed from the operating environment.
- If the battery catches fire, extinguish it with dry powder, foam fire extinguisher, sand, etc., and the battery should be removed from the operating environment.
- When storing the battery, please pay attention to the laws and regulations of the relevant country.

2.4.2 How to Handle Damaged Lithium Batteries



- Damaged batteries should be handled and transported only after wearing personal protective equipment that is resistant to alkalis and solubles.
- If a battery shows signs of overheating, emitting smoke, releasing odors, producing noise, or deformation, please separate the battery from the housing.
- Store the battery in a fire-proof container or maintain a safe distance from combustible materials.
- Do not inhale any smoke that may occur.

2.4.3 Disposal of Lithium Batteries

- Please conduct professional disposal for the batteries.
- Remove the connecting points for proper disposal.
- Store the damaged batteries in a fire-proof container.
- Strictly follow the transportation requirements related to batteries during the transportation.

2.4.4 Safety Requirements of Charging Station

If the operator has purchased our charging stations, the following precautions should be noted:

| | |
|---|---|
|  | <p>Bridging the charging contacts of the charging station can pose a risk of injury!</p> <p>Bridging the charging contacts can cause damage, electric arcs, overheating, and pose a fire risk.</p> <ul style="list-style-type: none"> ● Items, especially conductive or flammable ones, must not be placed in the area in front of the charging contacts at the charging station. |
|  | <p>Incorrect placement of the charging station can pose a risk of injury!</p> <p>There is a risk of personnel tripping when charging stations are placed on travel routes and passages.</p> <ul style="list-style-type: none"> ● Please do not place the charging station on travel routes and passages. <p>Incorrect installation of a charging station can pose a risk of injury!</p> <ul style="list-style-type: none"> ● Anchor the charging station to the workshop ground to avoid functional failures and associated risks. ● Lay connecting cables according to the risk prevention regulations of the relevant countries. <p>Incorrect usage can pose a risk of injury and possible product damage!</p> <p>There is a risk of falling and injury, as well as damage to the charging station casing when stepping or climbing on the charging station.</p> <ul style="list-style-type: none"> ● Do not step on the charging pile or use it for climbing. |

2.5 Risk Assessment

Risk assessment is one of the important steps for the integrator to achieve safe installation. It is usually carried out by on-site commissioners.

Risk assessment not only involves the robot, and also consider peripheral modules, path planning, working environment, etc.

It is recommended to carry out the risk assessment with reference to the guidelines in ISO 12100, including but not limited to:

- Teaching during the installation, development, and use of the robot.
- The robot device works normally.

In article 4 of ISO 3691-4: 2020, the major hazards, dangerous situations and events that need to be paid attention to shall be listed.

The risk assessment items should be listed in the technical agreement.

2.6 Residual Risks

The following lists the potential major dangers. Please operate the robot with caution.

- The robot can be set to reverse, but if there are no sensors at the rear of the robot, there is a risk of collision when entering the running route of the robots.
- If users accidentally touch the moving parts of the robot, there is a risk of getting their hands caught, feet pressed, or being hit.
- There is a risk of collision or jamming during load transport.
- When the fork is lifting or lowering, no person is allowed to enter the robot's working area.
- In open areas, reversing is prohibited except when loading or unloading.

2.7 Environmental Safety

2.7.1 Noise

The noise produced during the operation of the robot is ≤ 75 dB.

2.7.2 Disposal

The robot contains the following materials that affect environment:

- Plastic

- Batteries
- Hydraulic oil

Disposal requirements: The user of this product and the final disposer should handle it in accordance with relevant national regulations.

2.7.3 Altitude

Electrical equipment should be able to operate normally in environments at an altitude of below 1000 meters.

For equipment used at high-altitude places, please reduce the effect of following factors:

- Dielectric strength;
- Switching capability of the equipment;
- Cooling effect of air.

If the correction factor is not specified in the product data, it is recommended to consult the manufacturer for the applicable correction factor.

3. Product Introduction

3.1 Brief Introduction

This robot is laser SLAM autonomous forklift, equipped with SEER Robotics core AMR controller, providing mapping and localization functions. It also reserves abundant I/O, CAN, RS485 and other interfaces, thus helping users to quickly realize different applications of autonomous forklift.

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Note: The dimension parameters provided in this document are the most up-to-date data available at the time of document creation. However, slight differences may arise in the subsequent design optimization process, we ask for your understanding and take the actual object as the standard.

3.4 Technical Parameters

| | |
|--|--|
| Product model | SSS-1500EU SFL-CDD15-CE |
| Product name | Safety SEER SlimStack 1500 |
| Basic Parameters | |
| Powering method | Electric |
| Operation type | Automatic navigation, by manual control device |
| Navigation type | Laser SLAM |
| Pallet type | Open pallet / closed pallet |
| Rated load capacity (kg) | 1500 |
| Load center distance (mm) | 600 |
| Weight (with battery) (kg) | 835 |
| Standard lifting height (mm) | 2944 mm |
| Extended mast height (mm) | 3564 mm |
| Fork surface ground clearance (mm) | ≤90 mm |
| Navigation laser scanning height (mm) | 1964±10 mm |
| Forklift dimensions: L x W x H (without fork tip) (mm) | 1712×1104×1994.5mm |
| Right-angle stacking aisle width, pallet 1000×1200 (1200 placed along the fork) (mm) | 1988+200 mm |
| Right-angle stacking aisle width, pallet 800×1200 (1200 placed along the fork) (mm) | 1920+200 mm |
| Right-angle stacking aisle width, pallet 1000×1000 (1000 placed along the fork) (mm) | 1869+200 mm |
| Minimum turning radius (mm) | 1295 |

| | |
|---|-----------------------|
| Braking method | Electromagnetic brake |
| Drive control mode | Servo control |
| Performance parameters | |
| Driving speed: full load / no load (m/s) | 1.0/1.5 |
| Lifting speed: full load / no load (mm/s) | 115/170mm/s |
| Lowering speed: full load / no load (mm/s) | 160/125mm/s |
| Mast movement speed: full load/no load (mm/s) | - |
| Passability (slope / step / gap) ^[1] (% / mm / mm) | < 5 / 20 / 30 |
| Navigation position accuracy ^[2] (mm) | ±10 |
| Navigation angle accuracy ^[2] (°) | ±0.5 |
| Fork in-position accuracy ^[2] | ±5 |
| Drive motor power (S2, 60 min) (kW) | 1.5 |
| Lifting motor power (S3, 15%) (kW) | 3.2 |
| Steering motor power (S2, 10 min) (kW) | 0.4 |
| Map area (single frame) (m ²) | ≤400000 |
| Wheel parameters | |
| Tire type: driving wheel / bearing wheel | Polyurethane |
| Tire dimensions: driving wheel (mm) | 230 x 90 |
| Tire dimensions: bearing wheel (mm) | 100 x 50 |
| Tire dimensions: balance wheel (mm) | 86 x 60 |
| Wheel number: driving wheel / balance wheel / bearing wheel | 1 / 2 / 4 |
| Wheel track: bearing side (mm) | 498 |
| Wheel track: driving side (mm) | 540 |

| Battery parameters | |
|--|-----------------------------------|
| Battery specifications (V / Ah) | 24 / 210 (lithium iron phosphate) |
| Battery weight (kg) | 55 |
| Comprehensive battery life (h) | 10 |
| Charging parameters (V / A) | 29.2 / 100 |
| Charging time (10% to 80%) (h) | 2 |
| Charging method | Manual / Automatic |
| Battery cycle life (times) | >2000 |
| Function configurations | |
| Lidar number | 1 (P+F R2000) +3 (SICK HV) |
| Wi-Fi roaming (● / - / ○) | ● |
| 3D obstacle avoidance ^[3] (● / - / ○) | ● |
| Pallet recognition ^[3] (● / - / ○) | ● |
| Cage stack ^[3] (● / - / ○) | ○ |
| High shelf pallet recognition ^[3] (● / - / ○) | ○ |
| Pallet abrasion detection ^[3] (● / - / ○) | - |
| Remote emergency stop ^[4] (● / - / ○) | - |
| Pallet stack ^[5] (● / - / ○) | ○ |
| HMI display (● / - / ○) | ● |
| Fork distance sensor (● / - / ○) | ● |
| Cargo overload detection (● / - / ○) | - |
| Safety configurations | |
| E-stop button (● / - / ○) | ● |
| Sound and light indicator (● / - / ○) | ● |

| | |
|---|---|
| Braking distance: 1 m/s / 1.5 m/s (cm) | ≤30 / ≤50 |
| Vehicle hardware fault detection (● / - / ○) | ● |
| 360° laser protection (● / - / ○) | ● |
| Bumper strip (● / - / ○) | - |
| Fork height protection (● / - / ○) | ● |
| Others | |
| Network | 4G / 5G / Wi-Fi 802.11 a/b/g/n/ac |
| Ground flatness (mm/m ²) | ±5 |
| Ambient temperature and humidity range (°C / %) | TEMP: 0°C to 50°C / RH: 10% to 90%, no compression, no condensation |
| Scenario requirements | Only suitable for indoor, light intensity ≤ 40 klx (IEC 61496-3), ground without water and oil and other scenes |
| IP rating | IP21 |
| Noise near the driver's ear according to EN12053 (dB(A)) | ≤75 |
| Certifications | |
| ISO 3691-4 | ● |
| EMC / ESD | ● |
| UN38.3 | ● |
| RED | ● |

| | |
|---|----------|
| ● | Standard |
| - | None |
| ○ | Optional |

Fork configuration and robot dimensions:

| Fork dimension (mm) | Fork outer width (mm) | Robot dimension (mm) |
|---------------------|-----------------------|--|
| 1200×185×55 | 555 | 1712×1104×1994.5 1712×1104×1994.5 |
| 1200×185×55 | 600 | |

[1]. The ground surface should be even, clean and without obvious ups and downs. The ramp slope is not more than $5\% = \arctan(0.05) \approx 2.8^\circ$. The robot cannot stop or turn at the ramps, steps, or gaps, it can only pass quickly perpendicular to them.

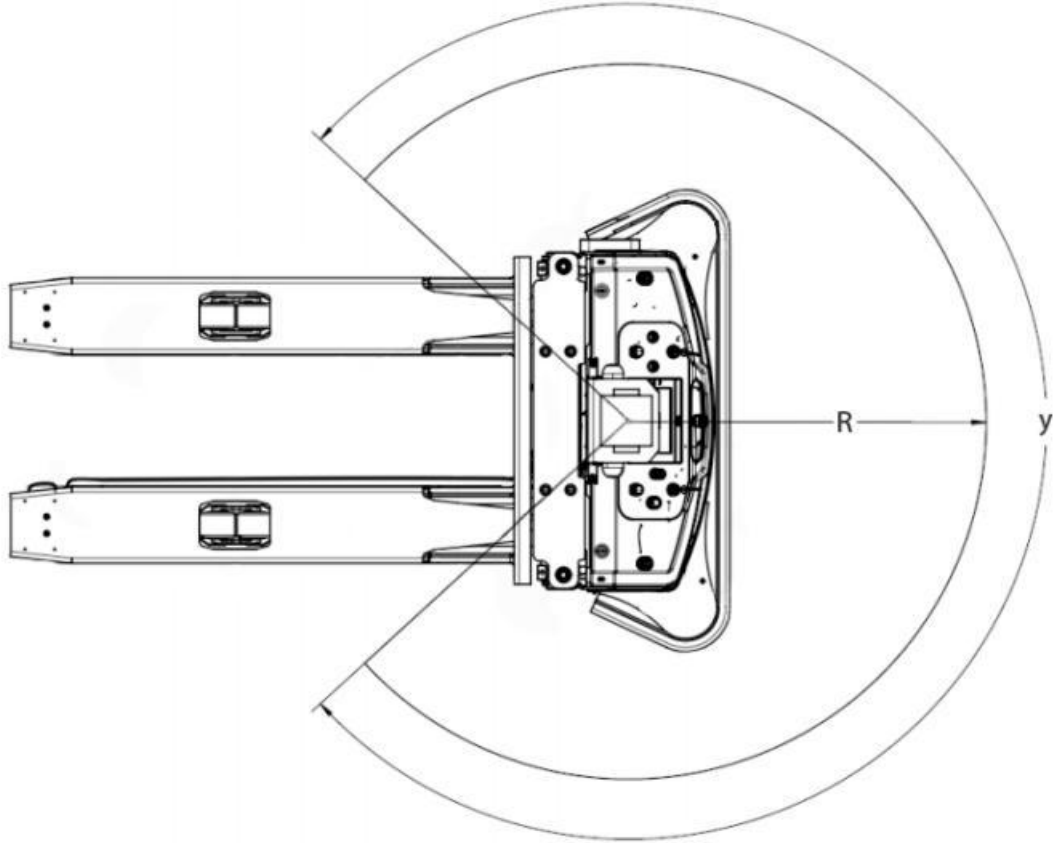
[2]. Positioning accuracy usually refers to the repeated accuracy of the robot navigating to the target site. Under the condition that the environment scanned by the robot laser radar is relatively stable, the repeated positioning accuracy of the robot navigating from a fixed direction to the target site can reach the expected value. When the robot runs along the planned path, it will try to fit the path as much as possible, but repeatability is not guaranteed. That is, the robot can guarantee the accuracy of the point position, but not the fitting accuracy of the path. The minimum site spacing supported by robot is 1 cm. Therefore, the robot should not be used as a linear guide.

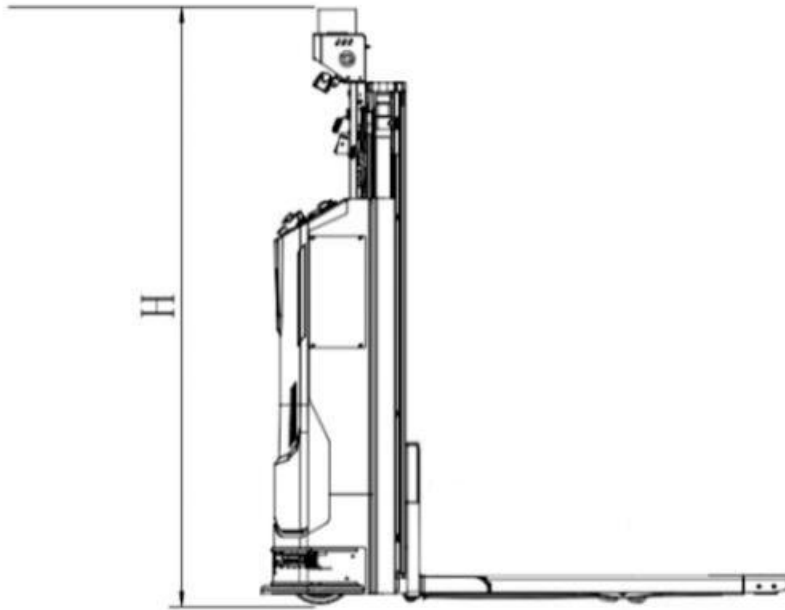
[3]. It needs to assemble the SEER Robotics recognition camera and get the algorithm authorization.

[4]. It needs to be used with SEER Robotics fleet management system.

[5]. It needs to be used with SEER Robotics fleet management system.

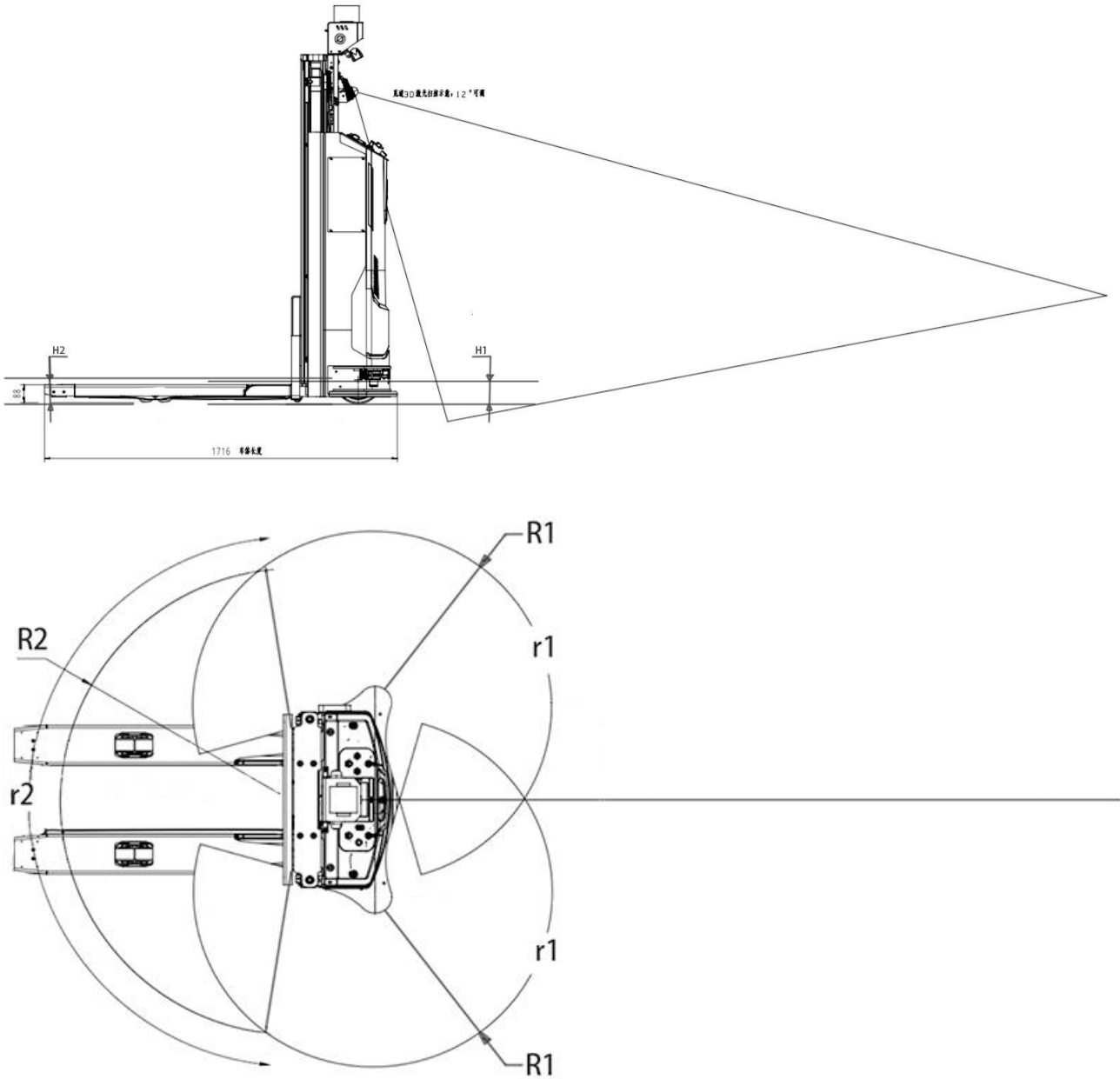
3.4.1 Navigation Laser Detection Range





| Model | No. | Definition | Value |
|------------|-----|------------------------|------------|
| SSS-1500EU | R | Detection distance (m) | R2000 25M |
| | Y | Scanning angle (°) | R2000 360° |
| | H | Detection height (mm) | 1994.5 mm |

3.4.2 Obstacle Avoidance Laser Detection Range

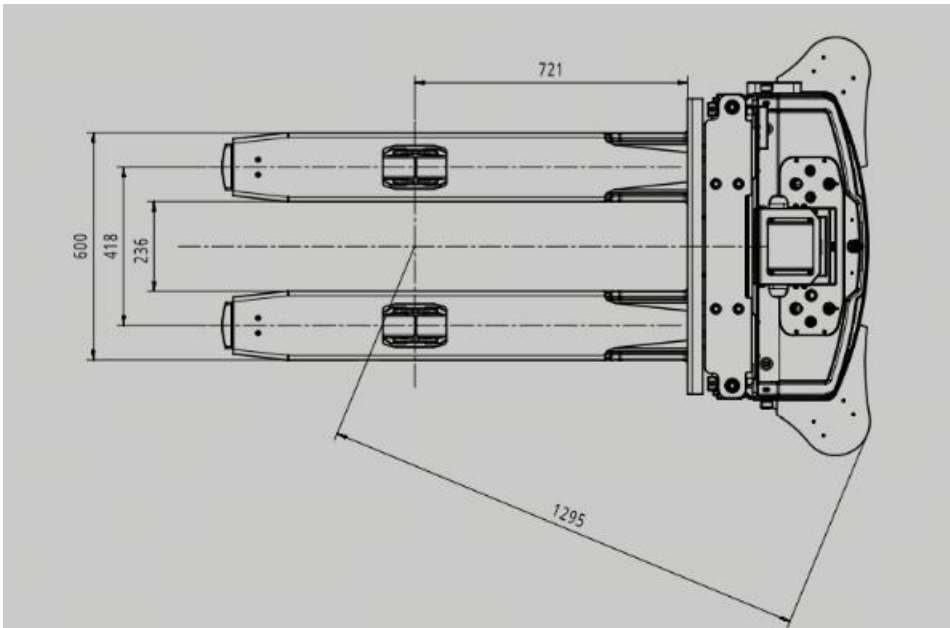


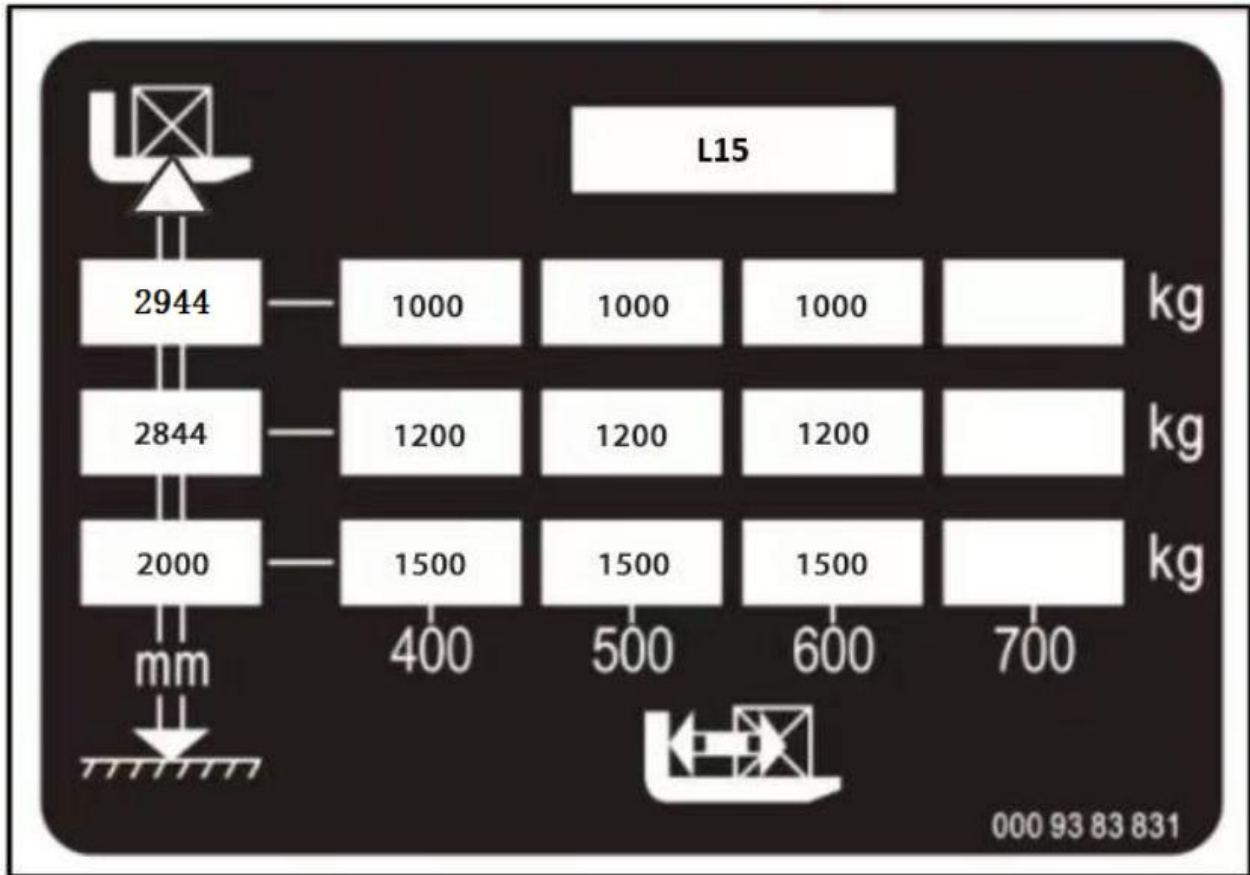
| Model | No. | Definition | Value |
|------------|-------|------------------------|-------|
| SCB-3000EU | R1、R2 | Detection distance (m) | 25m |
| | r1 | Scanning angle (°) | 235° |
| | r2 | | 130° |

| | | | |
|--|----|-----------------------|---------|
| | H1 | Detection height (mm) | 65±5mm |
| | H2 | | 150±5mm |

3.4.3 Effective Load Specifications

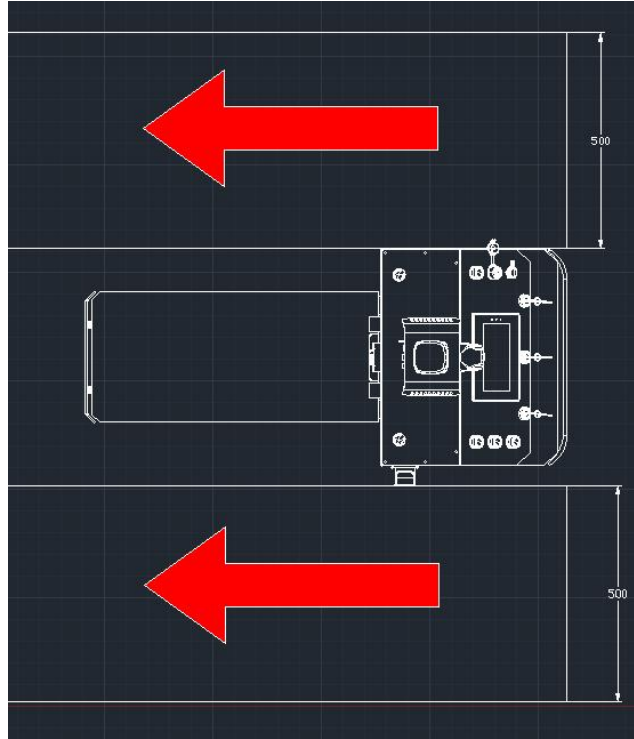
The diagram below illustrates the centroid specifications for safe operation under full load (1500KG).





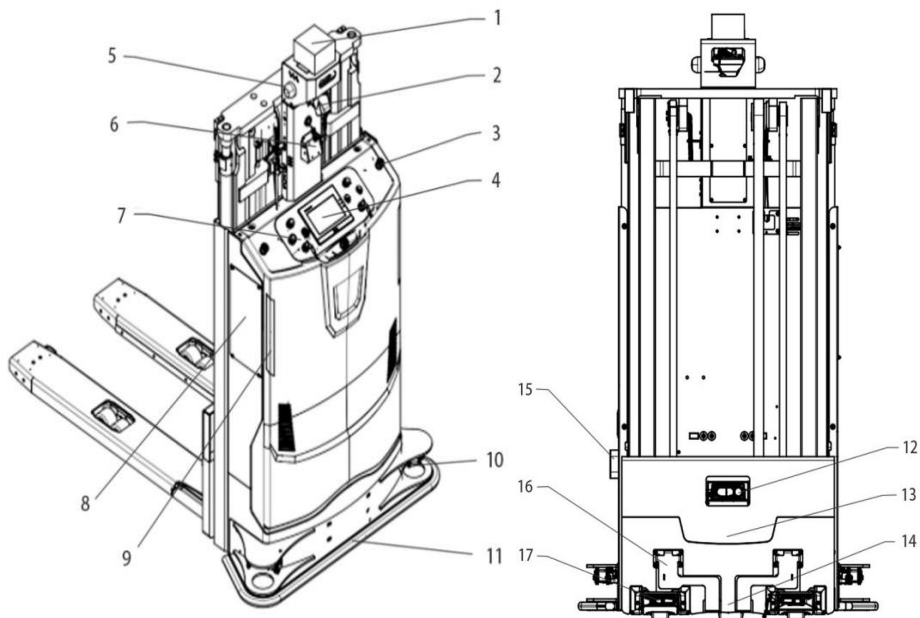
3.5 Escape Route

When charging, in order to avoid hindering the escape of people and rescue work, an escape passage with a width of 500mm should be reserved on both sides of the vehicle body to ensure that people can pass through quickly and orderly. At the same time, obvious safety evacuation signs and emergency lighting facilities should be installed in the passage so that people can clearly identify the escape direction in case of an emergency.



Under normal conditions, a space of 500mm shall also be reserved on both sides of the robot.

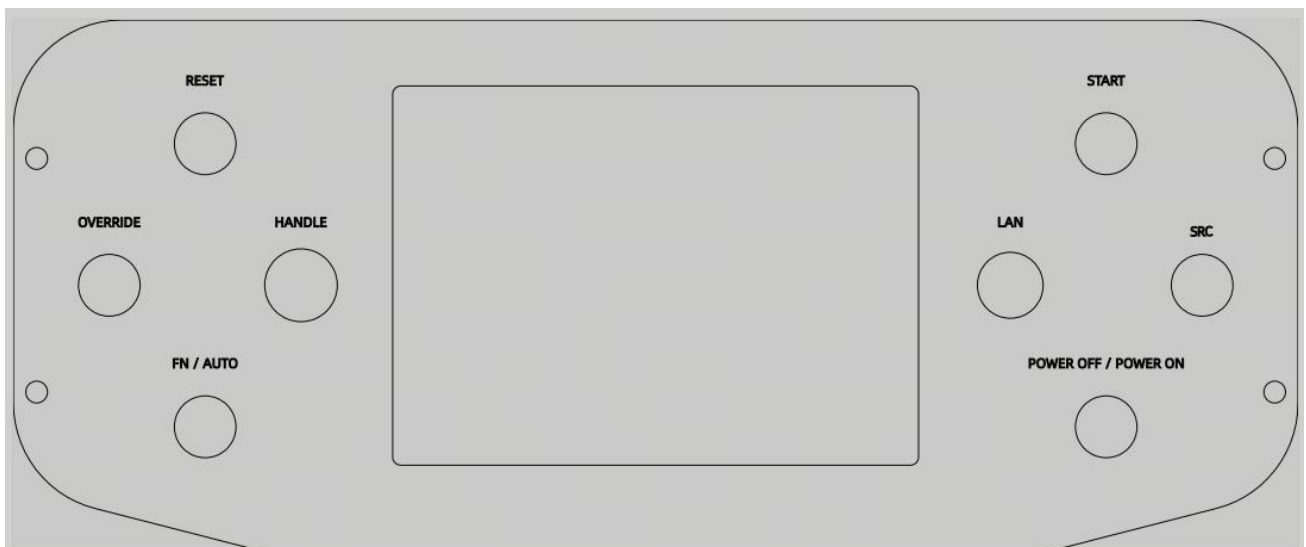
3.6 Main Configuration of Vehicle



| S.N. | Name | S.N. | Name |
|------|------------------|------|--------------------------------|
| 1 | Navigation laser | 10 | Front obstacle avoidance laser |

| | | | |
|---|---------------------------------|----|--------------------------------|
| 2 | Searchlight | 11 | Bumper strips |
| 3 | E-Stop Button | 12 | Carrier recognition camera |
| 4 | HMI display | 13 | Draw wire encoder |
| 5 | Tricolor light | 14 | Rear obstacle avoidance laser |
| 6 | 3D Obstacle avoidance | 15 | Automatic charging brush plate |
| 7 | Operation panel | 16 | Goods in-place switch |
| 8 | Manual charging port | 17 | Collision sensor |
| 9 | Ambient light and turning light | | |

3.7 Operation panel




| Identification | Indication | Identification | Indication |
|----------------|-------------------------|----------------|--------------|
| POWER OFF/ON | Battery on/off knob | FN/AUTO | Model switch |
| SRC | SRC power on/off button | RESET | Reset button |

| | | | |
|----------|--|-----|---------------------------------------|
| OVERRIDE | Manually turn off the laser during maintenance | LAN | Controller commissioning network port |
| START | Start after reset | | |

3.7.1 Emergency Stop Button

- The emergency stop button is strictly for use in emergency circumstances, and should not be used to terminate the robot operation.
- After the emergency stop button is pressed, the robot will immediately stop all motion.
- The emergency stop can be disengaged only when the cause of the fault is determined and the fault is eliminated.
- After the emergency stop is pressed, the robot can clear driver errors.
- After the emergency stop is pressed, the robot can be manually pushed.



Precautions for Emergency Stop of Robot

- When using our fleet management system, it is strictly prohibited to move the robot by pushing after pressing the emergency stop button; otherwise, it will cause the robot mission to go wrong.

3.7.2 Driver shutdown button

Pressing it will power off the driver, and pulling it up will power on the driver. This can clear driver errors.

3.7.3 Manual-Auto Switch

- Manual: Refers to the situation where the robot is controlled by external devices such as manual control devices (commonly seen in large robots such as forklifts). The criterion for judgment is whether the SRC enters the external control mode.
- Auto: When the SRC is not under external control mode, it is considered as automatic mode.

- a. Auto Navigation: Any situation where navigation commands are sent through API (including Roboshop, fleet management system, or other upper computers).
- b. Remote Control by Upper Computer: Any situation where control is performed through API 2010 (including Roboshop WASD, open-loop commands issued by customers, etc., which is originally called manual control).

3.7.4 HMI Display

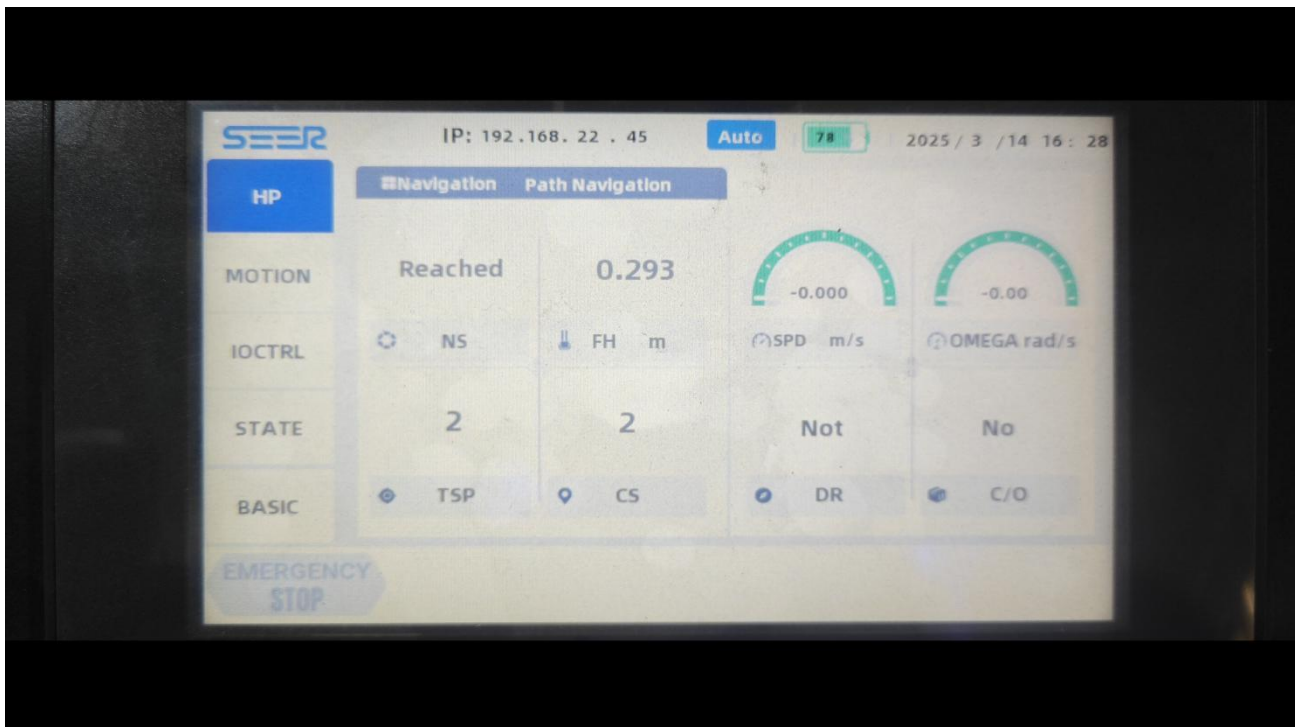
Username and password:

Username: Usr

Password: 111111

Username: Admin

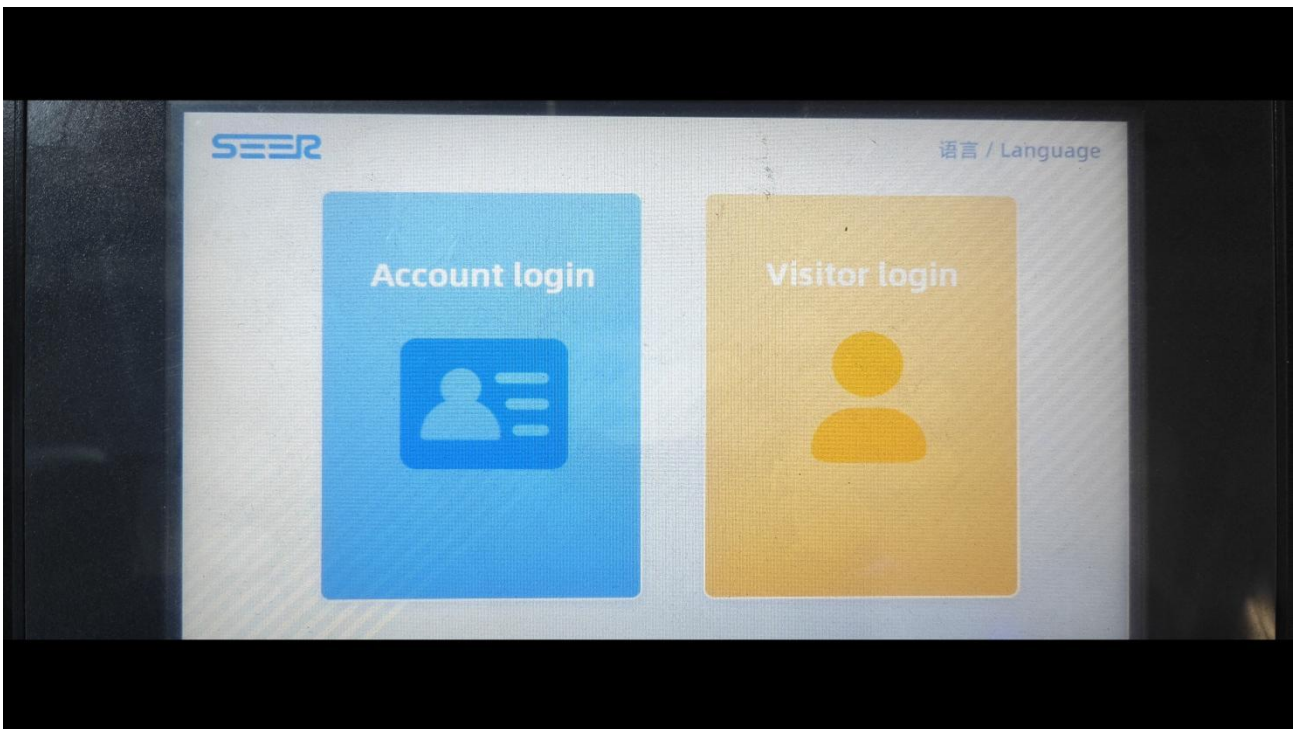
Password: 222222



3.7.4.1 Main Interface


After the display screen is turned on and connected to communication, the main interface can be displayed. It is mainly composed of five parts: [Home], [Motion Control], [Interface Control], [Status Parameters], and [System Settings].

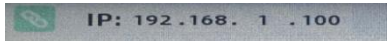
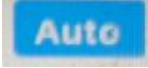
If the communication is not connected, "PLC communication no response" will be displayed.


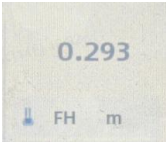
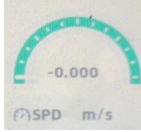





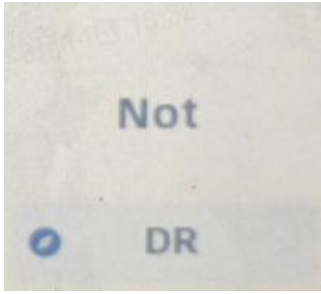
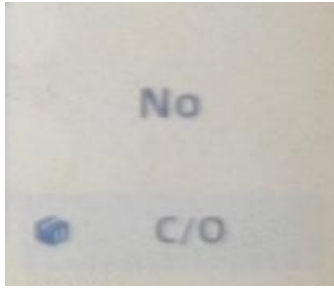

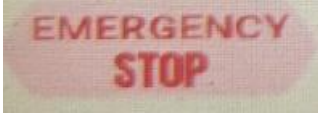
3.7.4.2 Homepage Information Display

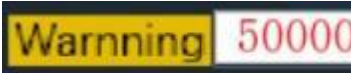

Homepage Information Introduction:

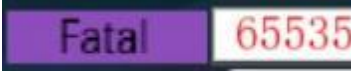
| Type | Icon | Definition |
|----------|---|---|
| Homepage |  | Clicking it can switch to the home page interface to display the operating status of the robot. |

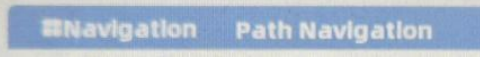



| | | |
|-------------|---|--|
| IP |  | It can display the current IP value in real time (the currently configured TP - Link). |
| Auto/manual |  | Auto/manual switch |

| | | |
|------------------|---|--|
| Navigation type |  | Real-time navigation type currently in use |
| Fork height |  | Indicates the current fork height of the robot is 0.293 meters; tapping allows setting the fork height |
| Running speed |  | Represents the current driving speed of the robot |
| Angular velocity |  | Represents the current angular velocity of the robot |
| Station display |  | Displays the real-time target station being traveled to |

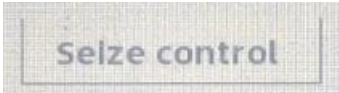
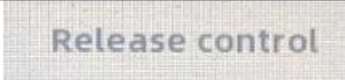
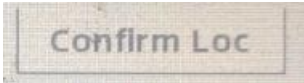
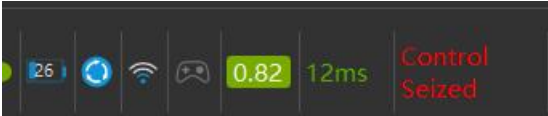
| | | |
|-------------------|---|---|
| |  | Indicates the robot's current station is 2 |
| Driving direction |  | The robot is currently in a stationary state |
| Loading |  | Displays the real-time loading and unloading status of the robot |
| In E-stop |  | Displays the real-time emergency stop status: emergency stop disabled |
| |  | Emergency stop enabled |

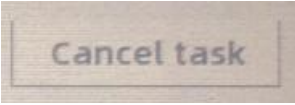

| | | |
|------------|---|--|
| Error code |  | Warning exists, and the corresponding alarm code is displayed on the right (based on the actual alarm code). |
| |  | Error occurred, and the corresponding alarm code is displayed on the right (based on the actual alarm code). |

| | | |
|--|---|---|
| |  | <p>Fatal exists, and the corresponding alarm code is displayed on the right (based on the actual alarm code).</p> |
|--|---|---|

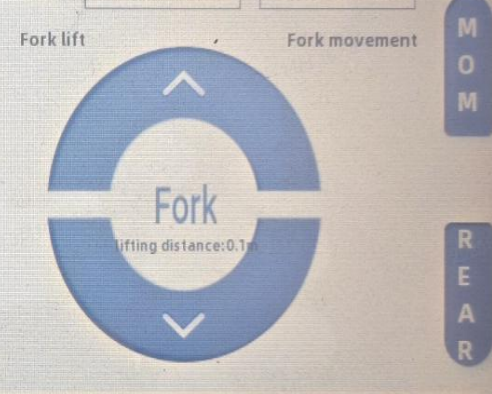
| Type | Icon | Definition |
|-----------------|--|---|
| Navigation type |  | <p>Indicates that the robot currently has no tasks.</p> |
| |  | <p>Indicates that the robot is navigating freely to a coordinate point.</p> |
| |  | <p>Indicates that the robot is navigating freely to a station.</p> |
| |  | <p>Indicates that the robot is navigating along a path to a station.</p> |

3.7.4.3 Control Interface

| Type | Icon | Definition |
|------------------|---|---|
| Control |  | Seize control of the robot. Without control, commands cannot be issued from the screen. |
| |  | Release control of robot |
| Confirm location |  |  <p>It is suitable for situations where the confidence level is appropriate and positioning confirmation is required.</p> |

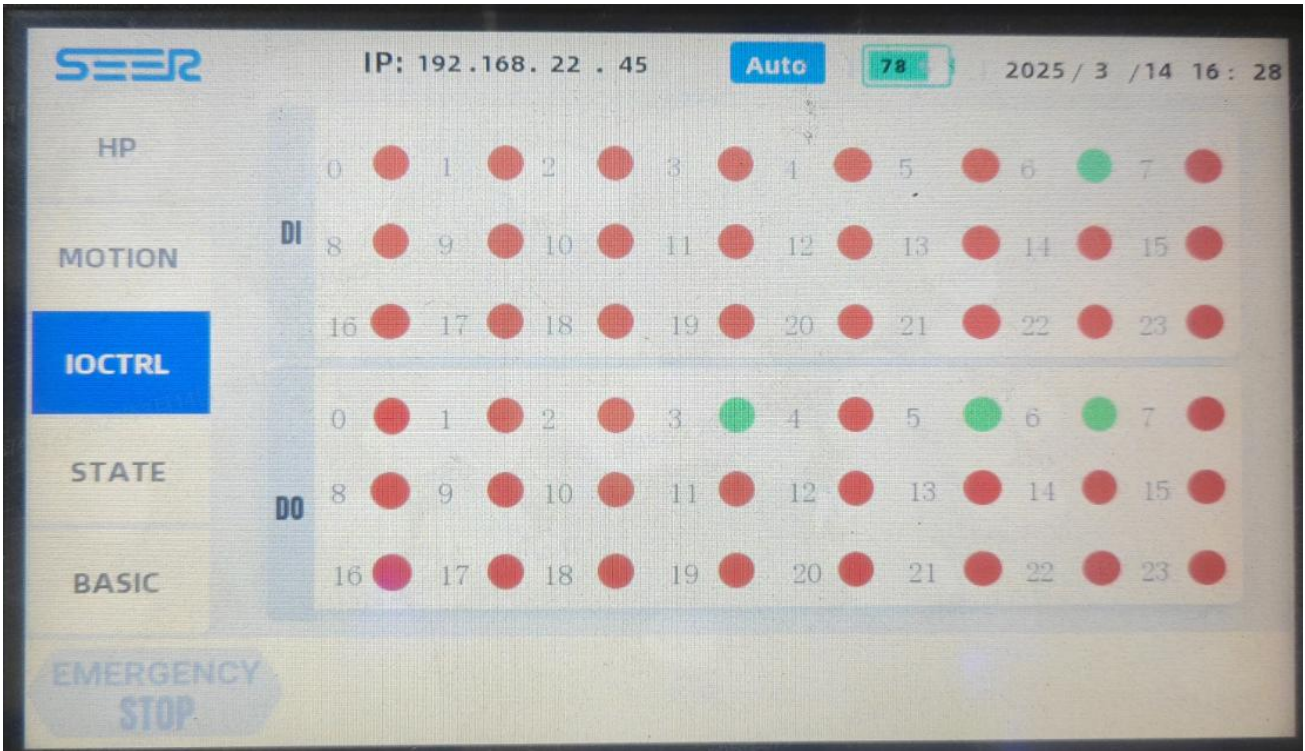
| | | |
|--------------------------|---|---|
| <p>Cancel navigation</p> |  | <p>Cancel the task</p> |
| <p>Moving</p> |  | <p>Control the steering wheel to move the robot</p> |



| | | |
|---------------------|---|------------------------------|
| <p>Fork control</p> |  | <p>Control fork movement</p> |
|---------------------|---|------------------------------|

| | | |
|----------------|--|--|
| Steering wheel | | Displays real-time parameter status of steering wheels |
|----------------|--|--|

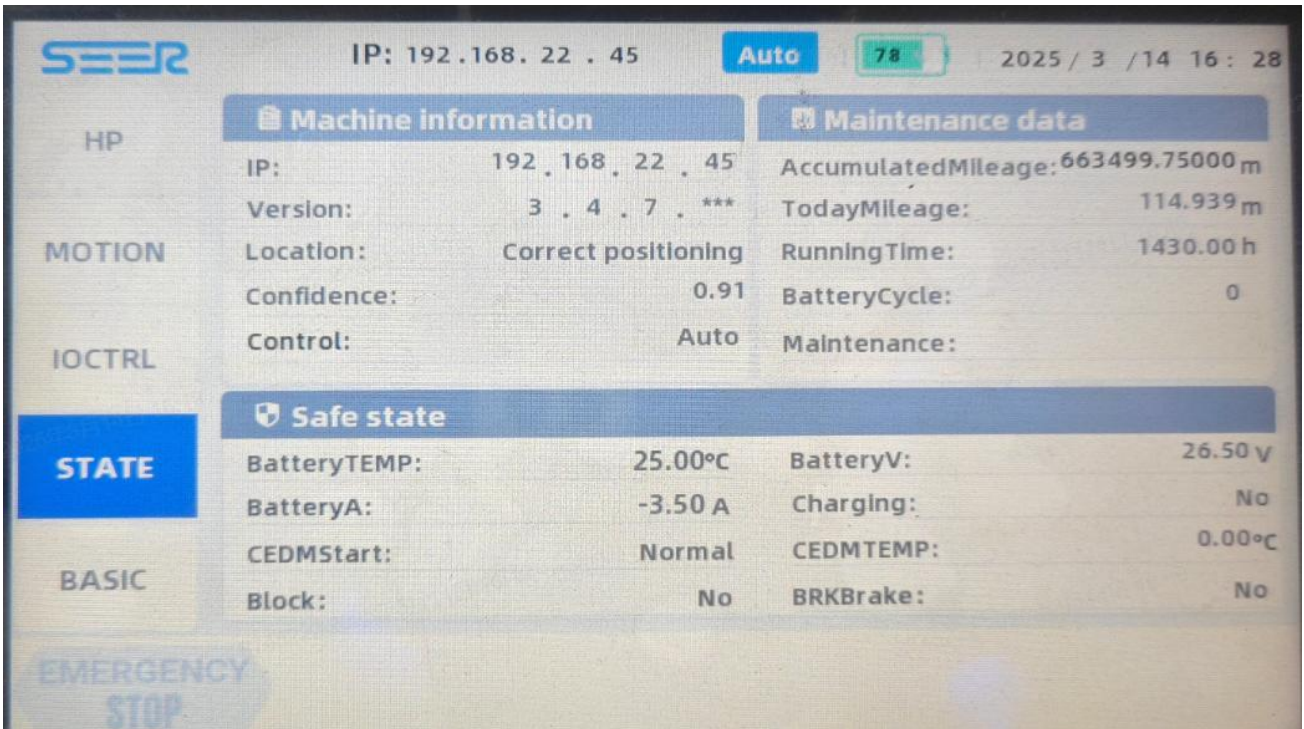
3.7.4.4 Control interface



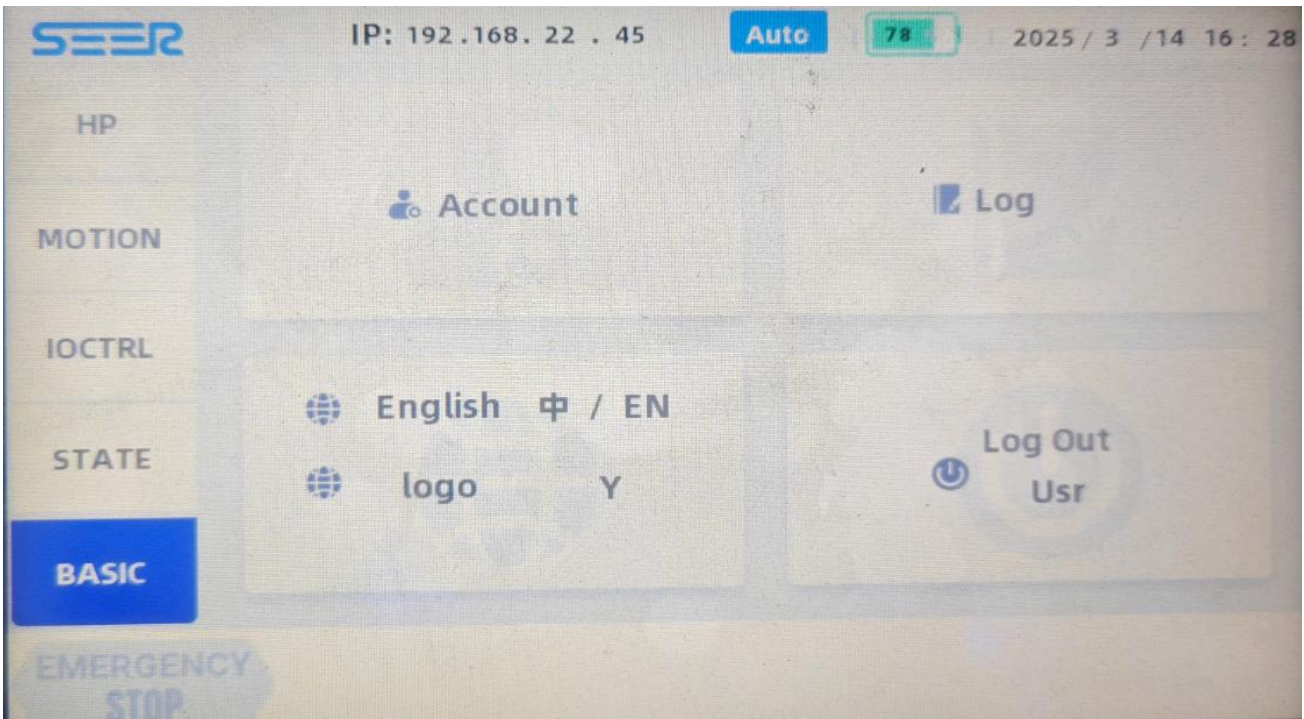
| Type | Icon | Definition |
|------|------|--|
| DI | | Not triggered. |
| | | Triggered |
| DO | | Disabled. Click the button to enable it. |
| | | Enabled. Click the button to disable it. |

3.7.4.5 Status parameter page

The status parameter interface will real-time detect the current robot's information, operation data, and battery status.



3.7.4.6 System setting page introduction



3.8 Acousto-optic System

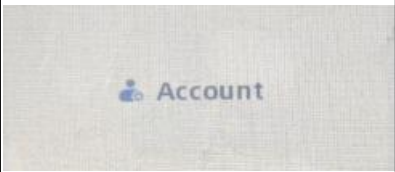
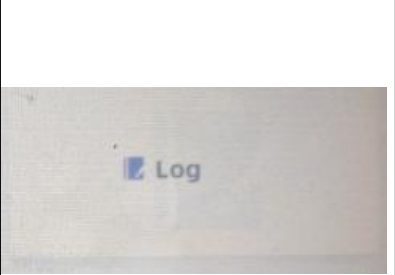
3.8.1 Tricolor Light

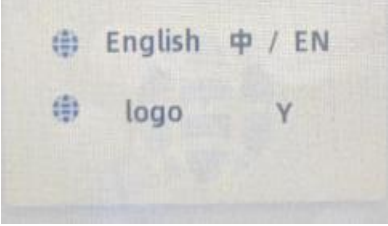
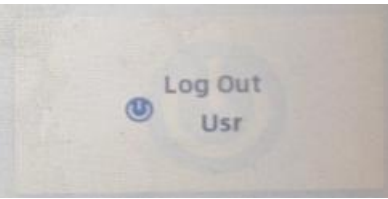
In automatic mode:

- When the forklift is in standby, tricolor light will display yellow.
- When the forklift is executing tasks, tricolor light will display green.
- When the forklift encountering an error, tricolor light will display red.
- When the personnel detection means are not active, tricolor light will display a red light and flash at intervals of one second.

In maintenance mode:

- When the Maintenance mode and override occurred, tricolor light will display a yellow light and flash at intervals of one second.

| Type | Icon | Definition |
|--------------------|---|---|
| Account management |  | Click to change username and password |
| Log |  | Click to view the robot's operation log and the screen's operation log. |

| | | |
|-----------------------|---|--|
| <p>Display effect</p> |  | <p>Switch between Chinese and English, and switch between with and without logo.</p> |
| <p>Log out</p> |  | <p>Log out the current account</p> |

3.8.
2
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aut
om
atic

mode:


- When the forklift turns left while performing the task, the left turn signal will be on.
- When the forklift turns right while performing the task, the right turn signal will be on.
- When the forklift reverses while performing the task, both turn signals on the sides will be on simultaneously.






3.8.3 Searchlight

This product is equipped with a searchlight. When the forklift is in automatic mode, the searchlight will always be on.

3.8 Main Labels

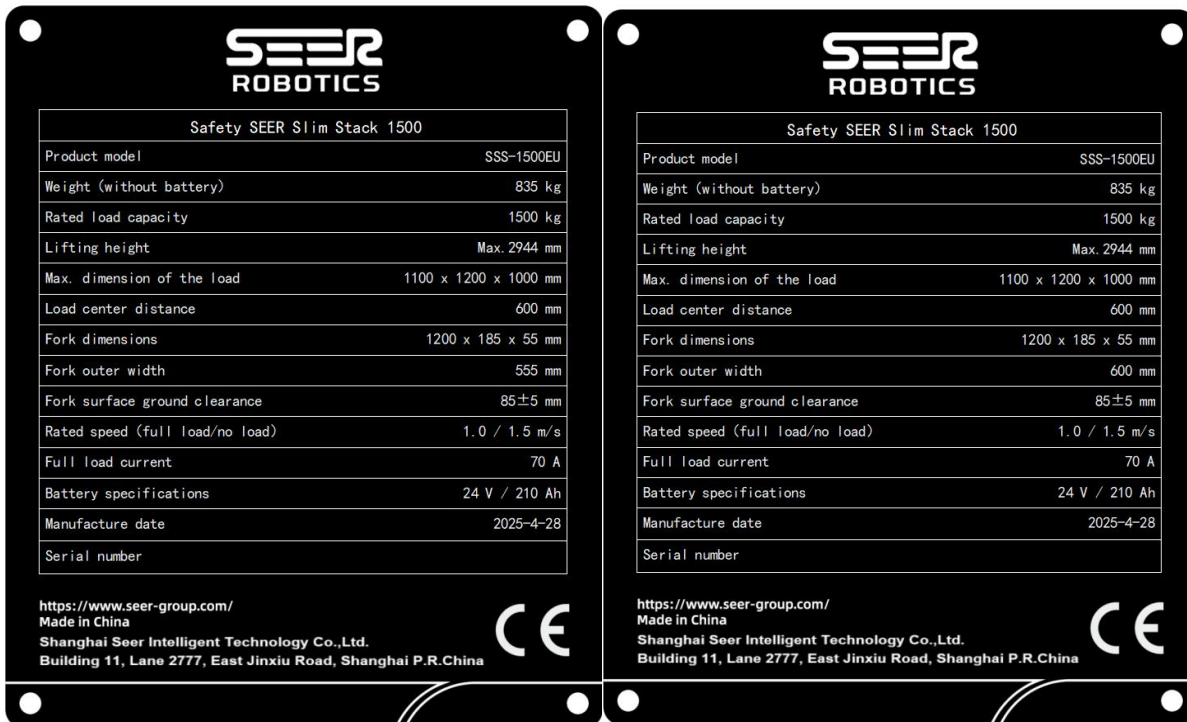
3.8.1 Warning Labels

| Definition | Label Sticker |
|---------------------------------|--|
| <p>Position of lifting eye.</p> |  |

| | |
|---|--|
| <p>Do not step on it.</p> |  |
| <p>Do not stand on the forks.</p> |  |
| <p>Laser product</p> |  |
| <p>Riding on this truck is prohibited</p> |  |
| <p>Beware of electric shock</p> |  |
| <p>Beware of collision</p> |  |
| <p>Beware of electric shock</p> |  |
| <p>Beware of hand pinching</p> |  |

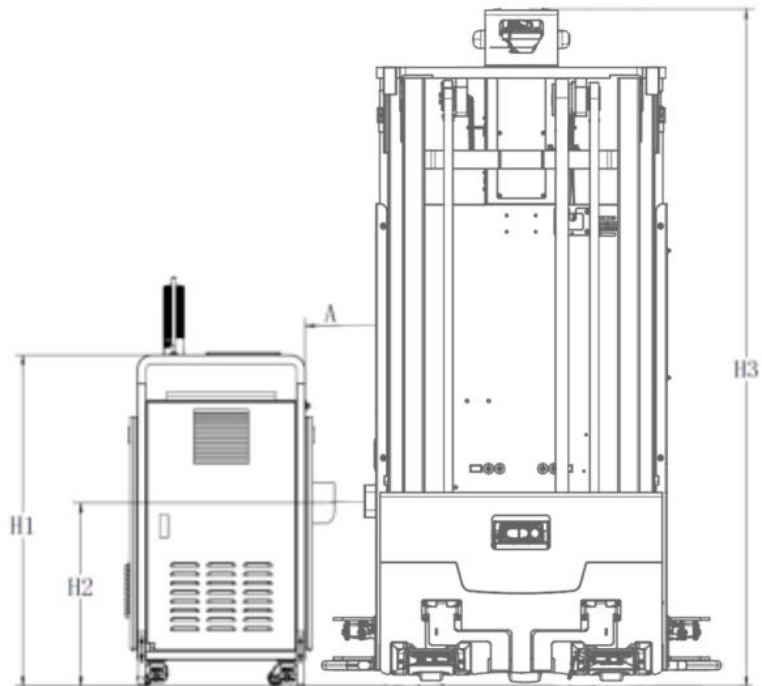
| | | | | | |
|--|--|----------------|--|--------------------------------------|--|
| <p>Please read the instruction manual when using it.</p> |  <table border="1"> <tr> <td colspan="2" style="background-color: yellow;">CAUTION</td> </tr> <tr> <td colspan="2" style="text-align: center;">Read operator's manual</td> </tr> </table> | CAUTION | | Read operator's manual | |
| CAUTION | | | | | |
| Read operator's manual | | | | | |
| <p>Do not step on it.</p> |  <table border="1"> <tr> <td colspan="2" style="background-color: orange;">WARNING</td> </tr> <tr> <td colspan="2" style="text-align: center;">No step</td> </tr> </table> | WARNING | | No step | |
| WARNING | | | | | |
| No step | | | | | |
| <p>Beware of collision</p> |  <table border="1"> <tr> <td colspan="2" style="background-color: red;">DANGER</td> </tr> <tr> <td colspan="2" style="text-align: center;">Crush! Hazardous zone no entry</td> </tr> </table> | DANGER | | Crush! Hazardous zone no entry | |
| DANGER | | | | | |
| Crush! Hazardous zone no entry | | | | | |

3.8.2 Product Nameplate



3.9 Battery and Charging

3.9.1 Automatic Charging of Robot



Note: Please refer to the *User Guide of SFL Charging Station* for the usage and configuration of the charging station.

3.9.2 Battery Basic Parameters

| No. | Items | Value |
|-----|----------------------------|------------------------|
| 1 | Material | Lithium iron phosphate |
| 2 | Rated voltage (V) | 25.6 |
| 3 | Rated capacity (Ah) | 210 |
| 4 | Battery cycle life (times) | 2000 |
| 5 | Weight (kg) | 70±5 |
| 6 | Voltage range (V) | 20 V - 29.2 V |

| | | |
|---|------------------------------|-------------|
| 7 | Maximum charging current (A) | 105 A |
| 8 | Storage temperature (°C) | -20 - 55 C° |
| 9 | IP rating | ≥IP20 |

3.10.3 Battery Interface Diagram

充电接口

型号: MS175
品名: 充电
规格: 充电

通信接口定义

| 型号 | pin | 定义 |
|--------|-----|----------|
| GX16-F | 1 | SD01 |
| | 2 | SD02 |
| | 3 | CHL_M |
| | 4 | CHL_L |
| | 5 | RESERVED |

手动充电口定义

型号: DR110A
品名: 充电

铭牌

技术说明:

1. 电池组额定电压: 25.6V, 额定容量: 210Ah, 工作电压范围: 20V-29.2V;
2. 电池组串并联: 8串2并;
3. 最大持续充电电流: 105A (0.5C), 最大持续放电电流: 200A, 峰值电流: 300A (≤20S);
4. 充电温度范围: 0°C-50°C, 放电温度范围: -20°C-60°C;
5. 电芯型号: 图轩3.2V105Ah (1FP21775200A-105Ah);
6. IP等级: IP5X, 箱体颜色: RAL7035, 小标纹;
7. 重量: 约52kg;

| 650mmx185mmx312mm | | | | | | 仙工24V210Ah电池组尺寸图 | | | |
|-------------------|----|----|------------|-----|-----|------------------|-----|-----|--|
| 标记 | 页数 | 分区 | 更改文件号 | 签名 | 年月日 | 阶段标记 | 重量 | 比例 | |
| 设计 | 1 | | 2025-02-08 | 标准化 | / | / | / | 1:1 | |
| 校核 | / | / | / | 工艺 | / | / | | | |
| 主管设计 | / | / | / | 审核 | / | / | 共1页 | 第1页 | |
| 视角 | | | | | | | | | |

| Definition of manual charging interface (battery box terminal) | | | |
|--|---|--|----------------------------|
| Plug-in type | Jacket: REMA 160A (male) contains two 25 mm ² wire terminals and 4 small terminals | | |
| Pin | Function | Description | Remark |
| 1 | C+ | Charging power line + | See the above illustration |
| 2 | C- | Charging power line - | |
| 3 | 24Vin+ | 24V battery normal + (small wire terminal) | |

| | | | |
|---|----|---|--|
| 4 | A+ | Charge wake-up signal (small wire terminal) | |
|---|----|---|--|

3.9.4 Battery Storage

- For long-term storage, the battery assembly should be kept in a shaded and well-ventilated area, away from flammable and explosive materials, and protected from direct sunlight to prevent overheating due to prolonged exposure.
- If the storage period exceeds 1 month, it is recommended to charge the battery to 50% of its capacity and store it in a dry warehouse at room temperature. The contact areas of the battery assembly should be protected from moisture, water, and dust to prevent corrosion and short circuits.

3.11 Quick to Use

3.11.1 In the Box

- The robot
- Manual charger / Automatic charging station (optional single or two pieces)



3.11.2 Startup of Robot

1. Use the key to turn the battery switch (POWER OFF/ON) to the right to power on.
2. Press the SRC button (ON/OFF) until the indicator light is always on, and release the button to complete the boot process. At this time, the tricolor light, searchlight and laser light are on.

3.11.4 Shutdown of Robot

1. Make sure that the robot has no tasks and is in the stopped status.
2. Press and hold the **SRC** button (ON/OFF) for 3-4 seconds, then release it and wait for a few seconds until the SRC button's green light goes off.
3. Use the key to turn the battery switch to the left to power off.
4. Press and turn off the driver power-off switch.

Note: If the robot is being shut down for transportation, maintenance, or repair purposes, the robot battery switch must be turned off.

3.10.4 Maintenance mode

Direction control:

- During operation, the Maintenance-auto switch should be adjusted to the Maintenance position on the vehicle panel;
- Then, the driver should stand on one side of the vehicle, turn off the SRC, turn on the power switch, press the **BRAKE** button with one hand, and then push the vehicle with both hands.
- Release the emergency stop switch, Press the **SRC** button, powered off the vehicle, hold down the **BRAKE** button, and push the vehicle, then the robot will move.



3.12 Product Maintenance

3.12.1 Maintenance Instructions

Before performing any maintenance or troubleshooting activities, please read the content of this chapter, this manual and other related manual carefully to fully understand the safe maintenance and troubleshooting procedures.

Only authorized personnel who have passed safety training and other related training can maintain the robot. Other related training includes training on robot system and training on maintenance organized by the manufacturers, distributors, and local importers.

Operators shall participate in safety training in accordance with national regulations.

| | |
|---|---|
|  | <p>Usage Precautions for Robot Parts</p> <ul style="list-style-type: none"> ● Only approved parts can be used. ● If unapproved parts are used without authorization, we will not bear any responsibility. We will not responsible for any damage to the robot, accessories or any other equipment caused by the use of unapproved parts. |
|  | <p>Precautions for Robot Maintenance</p> <ul style="list-style-type: none"> ● Perform maintenance in strict accordance with the description in this manual. Do not dismantle or change any parts not described in this manual without authorization. Wrong dismantling, changing parts, or wrong maintenance may cause the robot system to work abnormally and cause serious safety problems.. ● When you need to enter the working area of the robot under emergency, stop the robot system. ● Please carry out maintenance and repair activities in the designated maintenance area. Before performing any maintenance, always remove the robot from the system and turn off the power supply for the robot to prevent the robot from moving suddenly when it receives the system instructions. |

3.11.2 Maintenance Suggestions

3.11.2.1 Maintenance Suggestions for Main Parts of Vehicle

| Maintenance Parts | Maintenance Items | 1 day | 1 week | 1 month | 3 months | 6 months | 1 year | 3 years |
|-------------------|---------------------------------------|-------|--------|---------|----------|----------|--------|---------|
| Body System | Check the cover plates (left, right). | | | | √ | | | |
| | Inspect battery box fasteners. | | | | √ | | | |
| | Check the frame for cracks. | | | | √ | | | |
| | Check whether | | | | √ | | | |

| | | | | | | | | |
|--------------|--|---|--|---|--|---|---|---|
| | the vehicle body is securely installed. | | | | | | | |
| Motor | Check for any loose connections. | | | √ | | | | |
| | Clean the motor. | | | √ | | | | |
| | Check the installation bolts for tightness. | | | √ | | | | |
| | Check for abnormal bearing noise. | | | √ | | | | |
| | Check insulation resistance. | | | | | √ | | |
| | Check the commutator and carbon brushes. | | | | | √ | | |
| Drive System | Check for leaks. | | | | | | √ | |
| | Check the oil level. | | | | | √ | | |
| | Check for noise. | | | | | | √ | |
| | Change the oil. | | | | | | | √ |
| Wheel Part | Remove any cords and debris from the wheels. | √ | | | | | | |

| | | | | | | | | |
|--------------|---|--|--|--|---|---|--|--|
| | Check the wear condition of driving wheel and bolt. | | | | √ | | | |
| | Check the flexibility and fastening of the universal wheel and axle. | | | | √ | | | |
| | Check the wear condition of universal wheel. | | | | √ | | | |
| | Check whether the bearing wheel can rotate and whether the connecting parts are fastened. | | | | | √ | | |
| | Check the wear condition of the bearing wheel. | | | | √ | | | |
| | Remove and lubricate the wheel bearings. | | | | | √ | | |
| Braking Part | Clean the braking parts. | | | | √ | | | |
| | Check the wear condition of brake friction pads. | | | | √ | | | |

| | | | | | | | | |
|------------------------|---|--|--|--|---|---|---|---|
| | Check the braking performance in the released brake status. | | | | √ | | | |
| Electric Control Board | Cleaning and installation inspection. | | | | | √ | | |
| | Securely fasten the cable plug. | | | | | √ | | |
| | Check the contact points. | | | | | | √ | |
| | Check the action of the contactors. | | | | | | √ | |
| Oil Cylinder | Check the tank for oil leaks. | | | | | | √ | |
| | Check the oil level. | | | | | | √ | |
| | Change the oil. | | | | | | | √ |
| | Check for leaks. | | | | | | √ | |
| | Check the installation condition. | | | | | | √ | |
| Mast | Check for damage and cracks. | | | | | | √ | |
| | Check the movement of the rollers. | | | | | | √ | |

| | | | | | | | | |
|--|--|--|--|--|---|--|--|--|
| Check the lifting chain and pins for damages, and the sprocket for wear condition. | | | | | √ | | | |
| Check for signs of breakage on the forks. | | | | | √ | | | |

3.12.2.2 Maintenance Suggestions for Basic Parts

| Part | Maintenance Method | Maintenance Period |
|-----------------------|---|---|
| Shell | Check for cracks. Check the installation conditions. | Once every month, replace as needed. |
| Universal wheel | Check the surface wear condition. | Once every month, replace as needed. |
| Laser | Check the surface for scratches and cracks. | Once every week, replace as needed. |
| Emergency stop button | Check whether it can be pressed normally, and rotated to rebound. | Once every three months, replace as needed. |
| Safety label sticker | Check the wear condition or clear visibility. | Once every six months, replace as needed. |

3.12.2.3 Lubrication Parts Table

| Lubrication Part | Interval (h) | | | Category of lubricating oil and grease |
|-------------------------------------|--------------|------|------|--|
| | 500 | 1000 | 3000 | |
| Wheel bearings (including steering) | | L | | A |
| Hydraulic system | H | 0 | | B |
| Drive gear box | H | | 0 | C |

| | | | | |
|-------------------------|---|--|--|---|
| Lifting chain | L | | | D |
| Lifting system bearings | L | | | G |

L = Lubrication, H = Inspection, O = Change Oil

3.12.2.4 Lubricating Oil and Grease Requirements

| Category | | Specifications | | Corresponding Parts |
|----------|------------------|---|--------------------------------------|-------------------------|
| | | > -15°C | < -15°C | |
| A | Grease | 3# lithium grease dropping point 170 | | Bearings and bushings |
| B | Hydraulic oil | China: YB-32 International: ISO-LHM46 | YC-32 International: ISOVG46 | Hydraulic system |
| C | Transmission oil | 85 W / 90 (Room temperature SAE20W) | 75 W / 75 International: SAE75W | Gear box |
| D | Lubricating oil | CC30 (Room temperature SAE20W) | CC15W (Low temperature SAE10W) | Chains and pipelines |
| G | Grease | 3# lithium grease dropping point 170 | | Lifting system bearings |

3.12.3 Cleaning Requirements

3.12.3.1 Floor Cleaning Requirements

The driving wheel, bearing wheel and balance wheel of the robot are all made of PU (polyurethane) material, which will inevitably leave marks on the floor after long-term running.

Floor cleaning requirements:

- Check the condition of the floor daily and promptly clean up dust, foreign objects, and liquid contamination to prevent the robot from slipping.

- Clean up the traces left by the universal wheels on the floor in a timely manner to avoid severe marks.
- Do not wax the floor on the path of the robot; otherwise, it may cause the wheels of the robot to slip or become dirty.

3.12.3.2 Robot Cleaning Requirements

Weekly routine cleaning is important to ensure the reliability of the robot operation. Before cleaning, please make sure to unplug the power supply to avoid short circuits that may damage the electrical system.

1. External Cleaning

- Remove any debris from the wheels daily to keep them rotating smoothly.
- After cleaning, lubricate the forklift parts specified in the Lubrication Parts Table with lubricating oil.

2. Cleaning Electrical Components

- Use compressed air to blow away dust from the motor, but do not use a wet cloth to wipe the dust off the circuit.
- Do not wash the electrical components with a high-pressure washing device.
- Do not damage the electrical components on the circuit board. Maintain the position of these components to avoid short circuits.

3. Before assembling the vehicle body, use an air gun to clean the dust and debris in the vehicle body. Inspect the vehicle body after cleaning, there should be no defects such as residues and dirt.


4. No residues are allowed in the vehicle body: After the vehicle body is assembled (without shell), check for any screws, cut copper wires, or wire insulation that may have fallen in the vehicle body. If found, it must be cleaned up.

5. Check whether the wiring inside the vehicle body is neat and free from dust or dirt. If any is found, wipe it with alcohol.

6. Install the shell and wipe it clean with a dry rag.

7. If there is still dirt after cleaning with a dry cloth, dip a little alcohol to clean the surface until it is completely clean.

3.12.3.3 Laser Cleaning Requirements

| | |
|---|---|
|  | <p>Precautions for Laser Cleaning</p> <p>If the laser is not cleaned or is cleaned improperly, it may cause the following problems:</p> <ul style="list-style-type: none">● The robot can't detect the sign/pallet rack.● The robot enters the emergency stop status without clear reasons. |
|---|---|

Please clean the laser according to the following instructions, otherwise it may cause damage to the laser lens or function failure:

- Keep the laser lens surface clean, and clean up the dust regularly.
- Please use special cleaning cloth.
- Do not dry wipe the laser lens surface. Please use a damp, soft cloth to clean, and add a little detergent if necessary.
- Do not use corrosive solvent-based detergent, such as acetone.
- Do not use alcohol to clean the laser.

3.12.4 Storage Requirements

3.12.4.1 Requirements for Robot Storage

If the robot needs to be stored for a long time, please take the following measures for different parts:

Battery:

- Recharge the battery, and then maintain it according to the daily maintenance method of the battery.
- Charge the battery and check the electrolyte level every 3 months.

Hydraulic System:

- If the forklift is stored for more than a year, replace the hydraulic oil in the hydraulic system. Please refer to the maintenance section and lubrication parts table.

Drive System:

- If the forklift is stored for more than a week, secure the driving wheels firmly or suspend them to prevent movement. Also, unload the cargo.

Precautions for Reusing Forklift after Storage:

- Before reusing after a period of storage, function and safety checks should be carried out as daily maintenance and safety checks.
- If the storage time exceeds 3 months, perform preventive maintenance according to the maintenance requirements of this manual (at interval of 500 hours).

3.12.4.2 Requirements for Charger Storage

- When the charger is not in use, it should be placed in the packing box.
- The warehouse temperature should be within -20°C to 70°C, with a normal temperature range of -20°C to 50°C. The relative humidity should be between 5% to 90%. The warehouse should not contain harmful gases, flammable substances, explosives, corrosive chemicals, strong mechanical vibrations, impacts, or magnetic field influences.
- The packing box should be placed at least 20 cm above the ground and at least 50 cm away from the wall, heat sources, and ventilation openings. The charger can be stored under these conditions for two years. If the storage period exceeds two years, it must be re-inspected.
- The charger must be powered on every three months, and the power-on time should be no less than 0.5 hours.

3.12.5 Other requirements

- For the maintenance information of SCB-1500EU not mentioned above, please refer to Maintenance manual of SSS-1500EU and SFL-CDD15-CE Maintenance Manual.

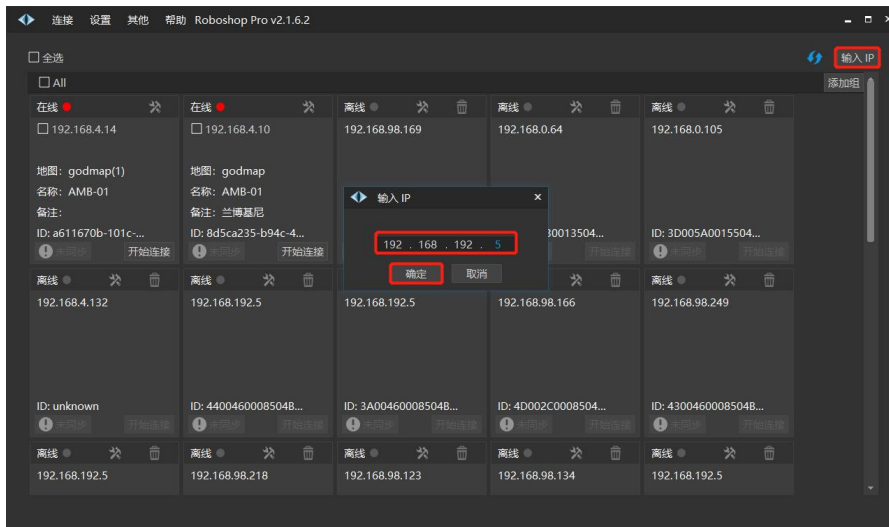
4. Software Debugging

4.1 Connect Robot

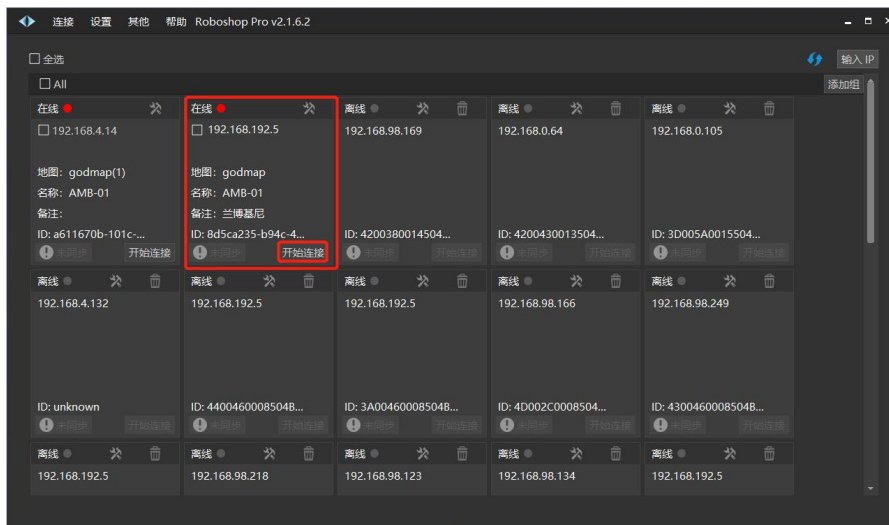
To operate the robot, you need to use the latest version of Roboshop:

1. Connect the computer to the network port of the robot via a network cable.
2. Set the computer's Ethernet IP to the network segment 192.168.192.xxx (xxx must be more than 200), and the subnet mask as 255.255.255.0, the gateway can be omitted.

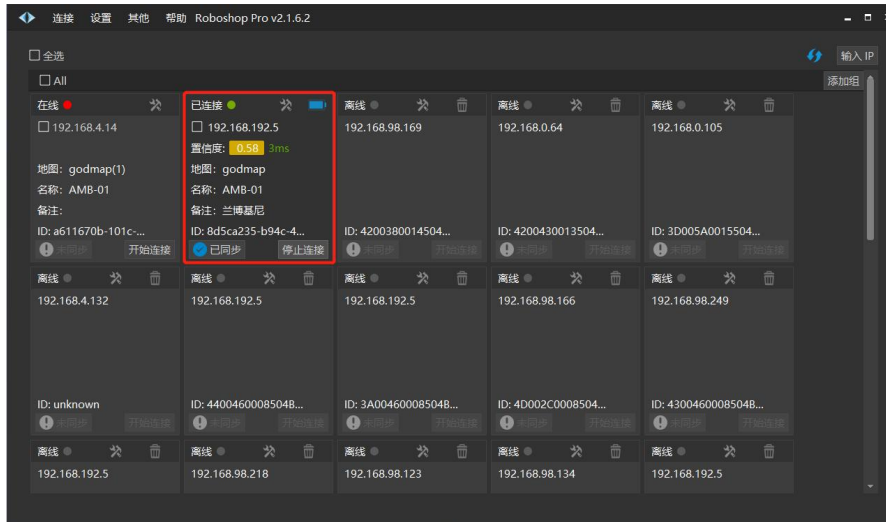
3. Open Roboshop and click the Refresh button on the [Homepage] or manually click Add Group, set address as [192.168.192.5] to add the robot.



4. Find the robot with the IP address [192.168.192.5] in the robot list on the [Homepage] and click the button **Connect**.



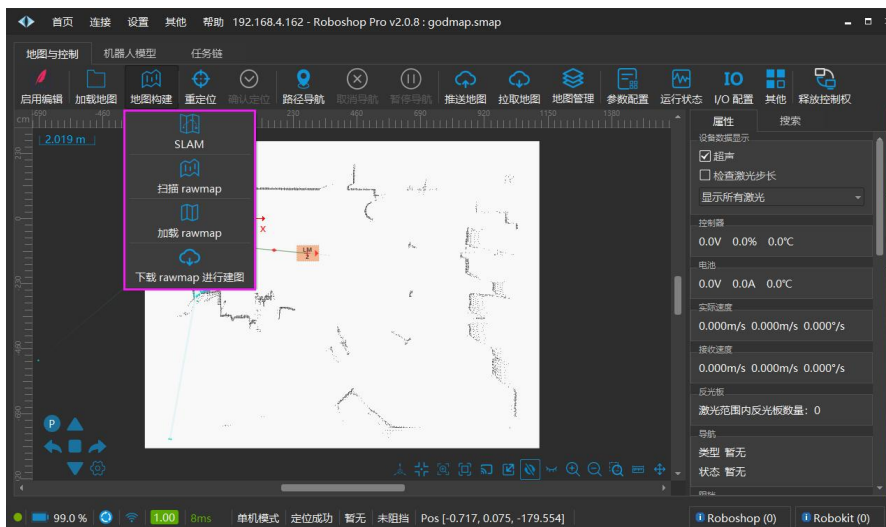
5. It indicates that the robot has been connected successfully when “Confidence” , “Map” , “Name” , “Note” , “ID” and other information , of the robot are displayed on the card.



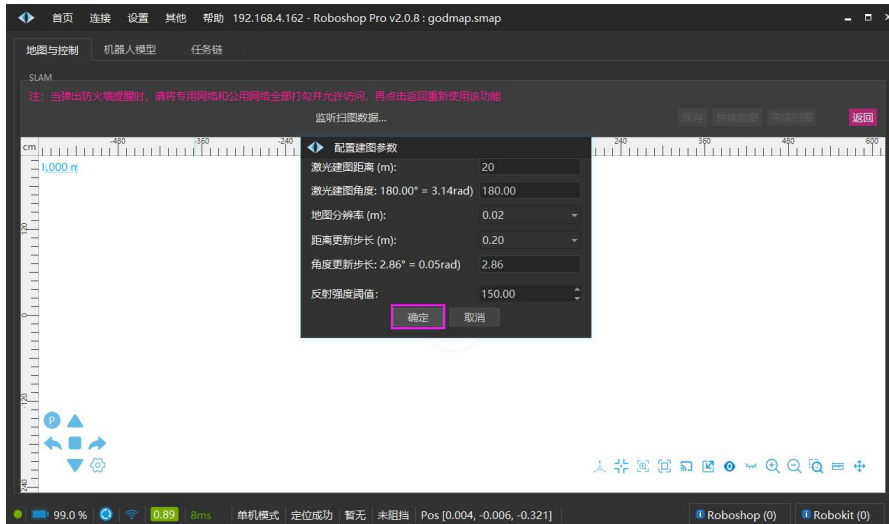
4.2 Mapping and Editing

Precondition: The robot is connected, and the robot model has been successfully configured and synchronized.

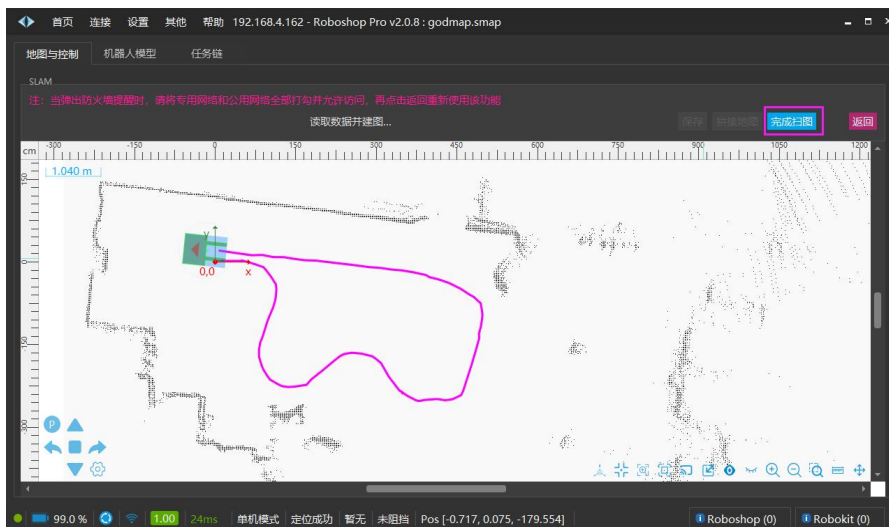
a. Open the Roboshop, after the robot connected successfully, double-click the robot to enter the Map/Control interface. Click **Mapping** in the toolbar, and all methods for [Mapping] will pop up.



b. Click **Mapping** --> **SLAM**, do not modify any parameters in the pop-up interface (generally, there is no need to modify the parameters of this interface), and click the **OK** button.



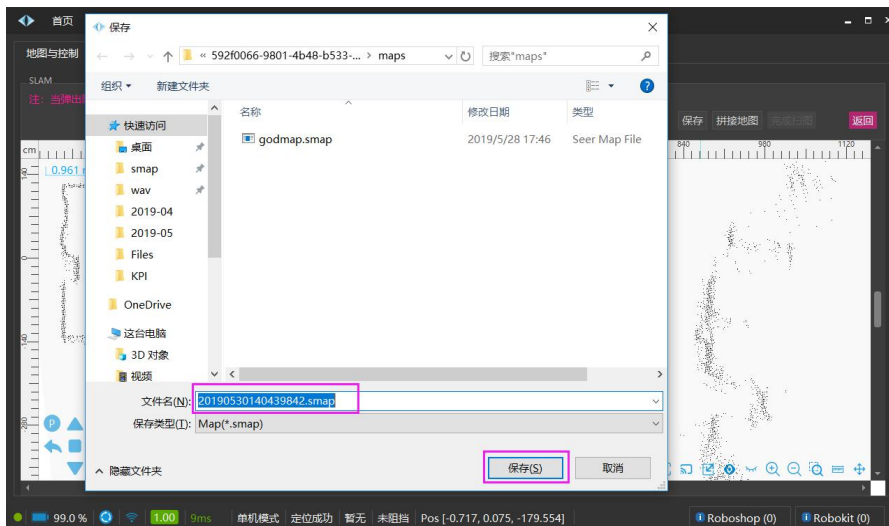
c. Use the keys W (Forward), A (Left turn), S (Reverse), D (Right turn) on the keyboard for robot control to make the robot move in the scene, and click the button **Complete scan** in the upper right corner when you finish scanning the map.



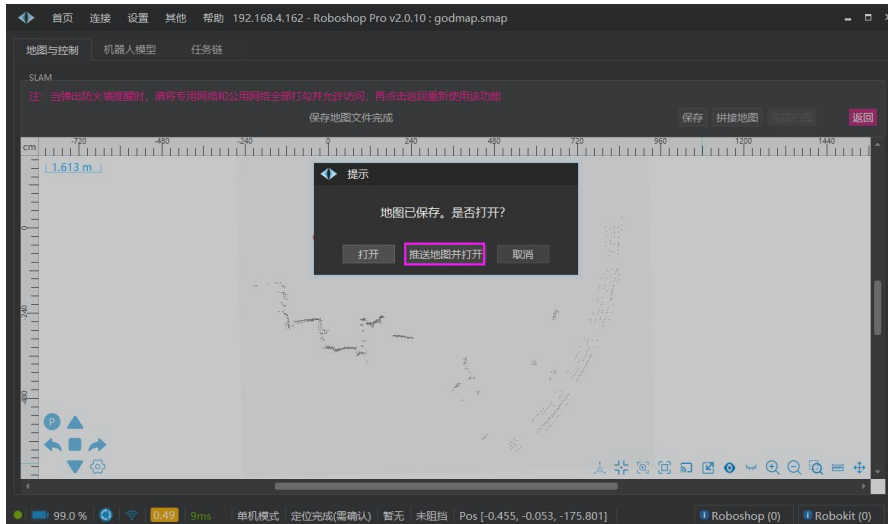
d. Wait for the completion of the map construction, and then click the button **Save** in the upper right corner.



e. Select the desired path and enter the desired name in the pop-up interface to save the map.



f. After it is saved successfully, a dialog box will pop up to ask whether to open it. Then click **Push** to open the map just constructed and synchronize the map, and then used it directly. At this moment, the mapping has been completed.

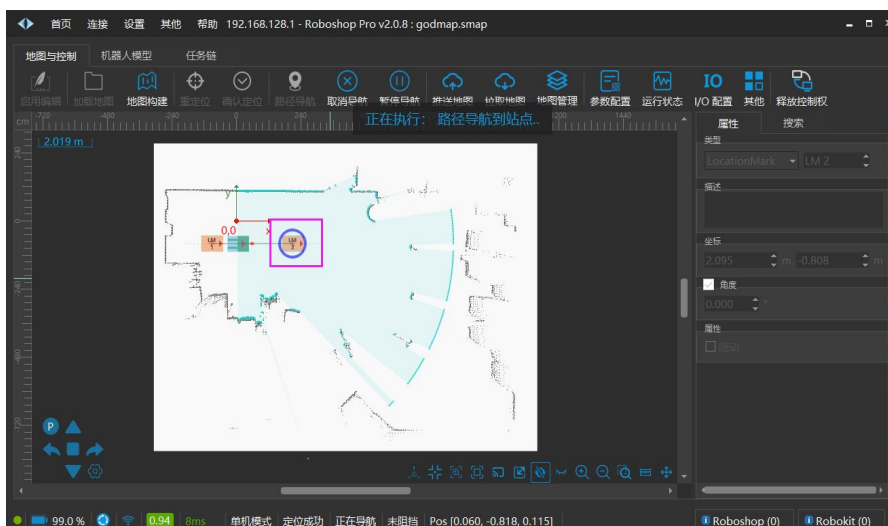


Note: If you click **Open**, the map just constructed will be opened, and a dialog box with "Inconsistent map data" will pop up. Choose **Push, Open** or **Cancel** according to your needs.

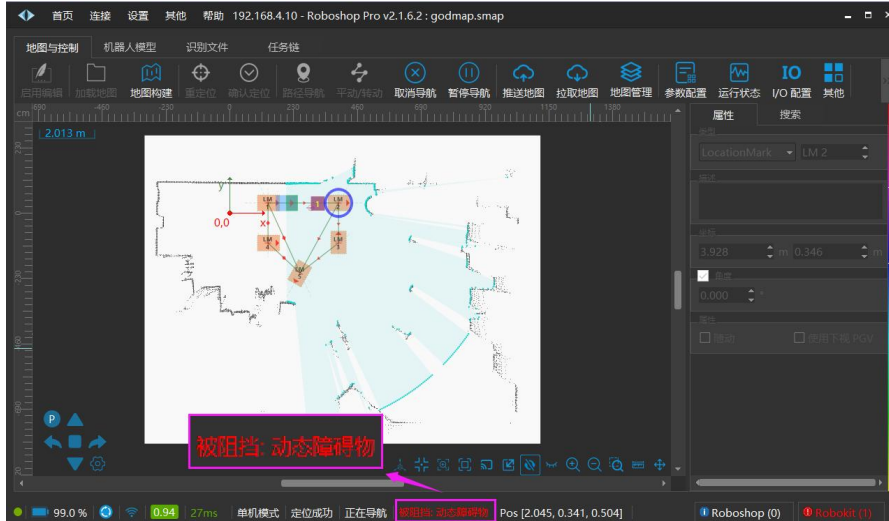
4.3 Path Navigation and Obstacle Stop Verification

Precondition: There are at least two sites on the map which are connected by a Bezier curve.

Robot conducts path navigation on the path: Click **Path Nav** in the toolbar, and then click a site, such as clicking the point LM2, then the robot will perform path navigation along the path to the destination point (point LM2), and the direction of the robot to the point is consistent with the direction of the site, as shown in the figure below.



Note: If there is an obstacle on the path, the robot will stop in front of the obstacle in the navigation process, and will not run further until the obstacle disappears. The blocking reason will be displayed in the status bar.

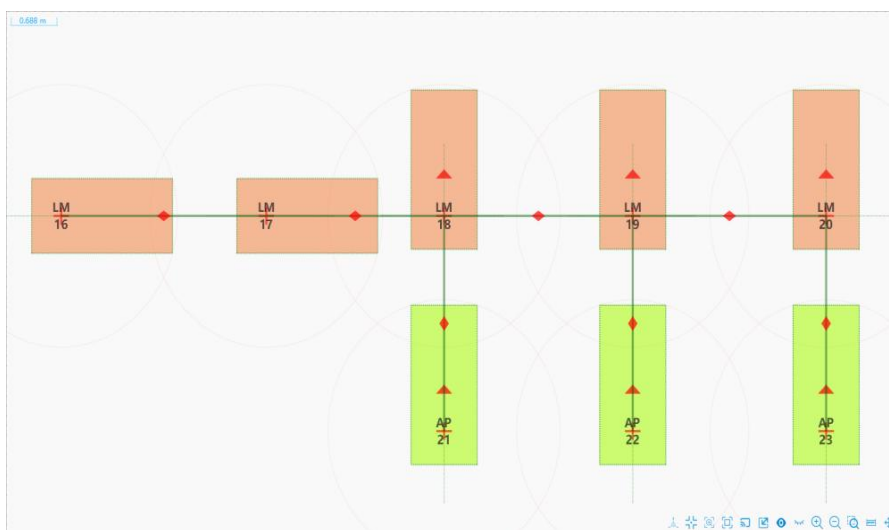


4.4 Establishment and Configuration of AP Workstation for Forking Action

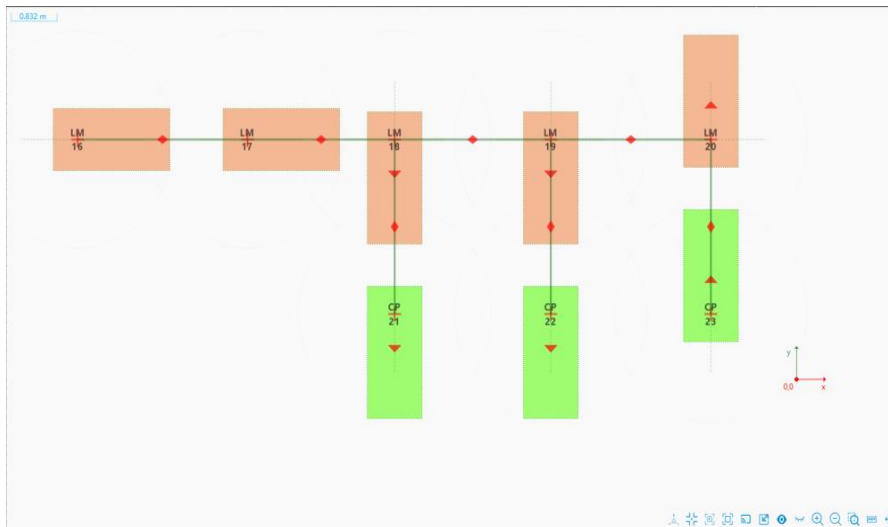
- a. Operate the robot to build a map in the area where it needs to work.
- B. Establish the AP point in the position where the shelves are placed daily.
- c. Configure the workstation.

4.4.1 Workstation (AP)

AP point is the working station where the forklift performs actions such as picking up and dropping off goods, recognizing pallets. Since the forklift's forks are at the rear, the route direction for the forklift to go to the AP point for picking up and dropping off goods is: LM-->AP in reverse, AP-->LM forward.



4.4.2 Special Workstation (CP, namely charging point)



CP point stands for charging point, which is the location where the forklift is charged. It is controlled to come here for charging through Roboshop or fleet management system. The route direction is either forward entry and reverse exit or reverse entry and forward exit to prevent the forklift from rotating in place to adjust its direction.

Note: The point on the main route should not have direction, but when the storage bin location (referring to the AP point where recognition action needs to be performed) or charging point is near the main route and needs to directly enter the storage bin location from the main route, if the distance from the main route to the storage bin location is far, the pre point can be placed between the AP point and the main route; otherwise, the pre point can only be placed on the main route.

4.4.3 Work Route

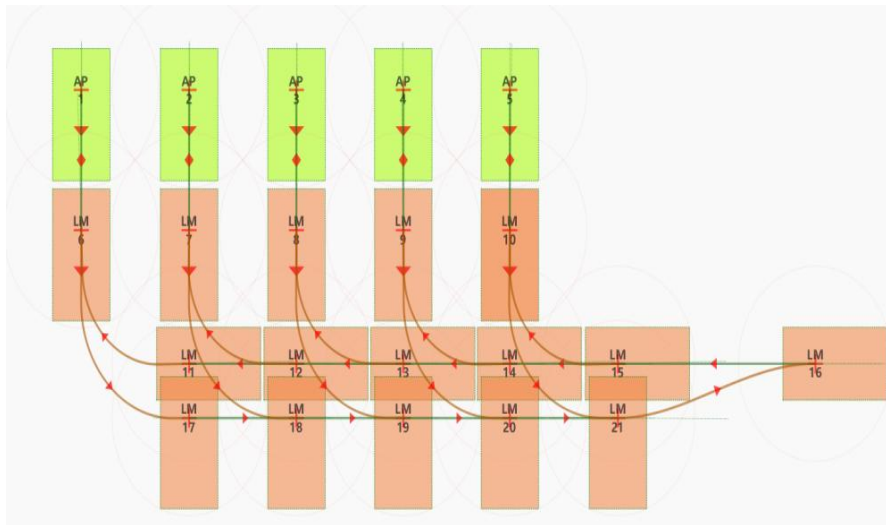
Caution: The attributes on the route when entering and exiting the AP point should be set as LM->AP in reverse, AP->LM forward. After completing the drawing, carefully inspect it to prevent accidents during use.

The forklift has two working modes: recognition mode and non-recognition mode. Depending on the forklift's working mode and the size of the site space, the corresponding routes will also differ. The following examples will illustrate this.

4.4.3.1 Recognition Mode with Ample Space

When the forklift operates in recognition mode and there is ample space on the site, the forklift's route is drawn as a "dead-end road", which means the forklift enters and exits using two separate and fixed one-way routes (pay attention to the gap between the goods and the shelves when taking curved paths to prevent collisions).

The following figure shows the operation:

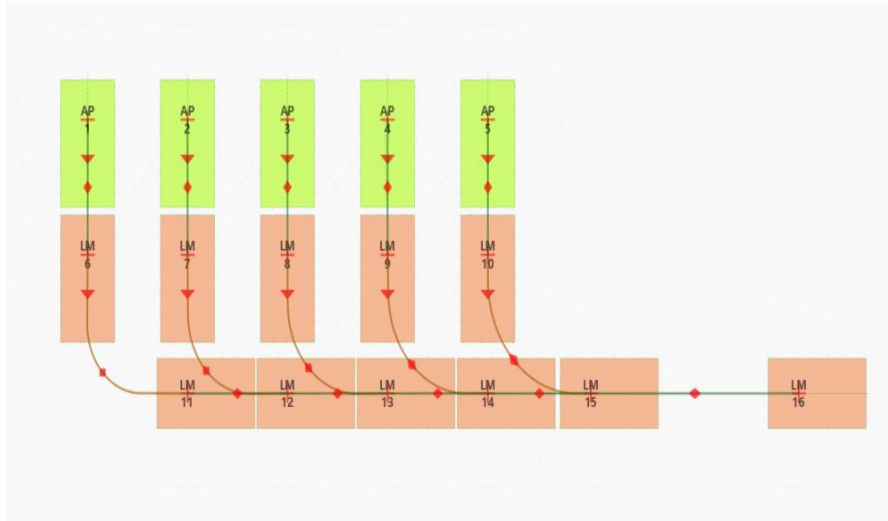


The forklift's route for entering the storage bin location is set to be one-way only. After completing the picking and placing of goods, it should exit the storage bin location using a different route. The positioning of points needs to be adjusted according to the actual location. It is important to note that station positions and routes can overlap, but the lines between points should be clearly distinguished to prevent any potential accidents. Special attention should be paid when drawing the routes to avoid any hazardous incidents.

4.4.3.2 Non-recognition Mode with Ample Space

When the forklift operates in non-recognition mode and there is ample space on the site, the forklift can enter and exit the storage bin location in an arc-shaped path.

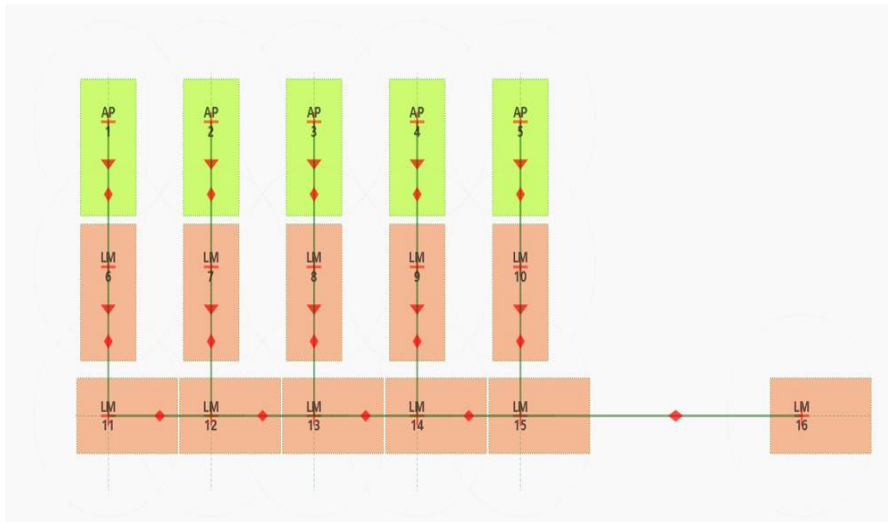
The following figure shows the operation:



4.4.3.3 Small Space (it is the same with or without recognition)

When the space is small and the distance between storage bin locations does not allow the forklift to travel in an arc, the route planning can only be done in a right-angle manner.

The following figure shows the operation:



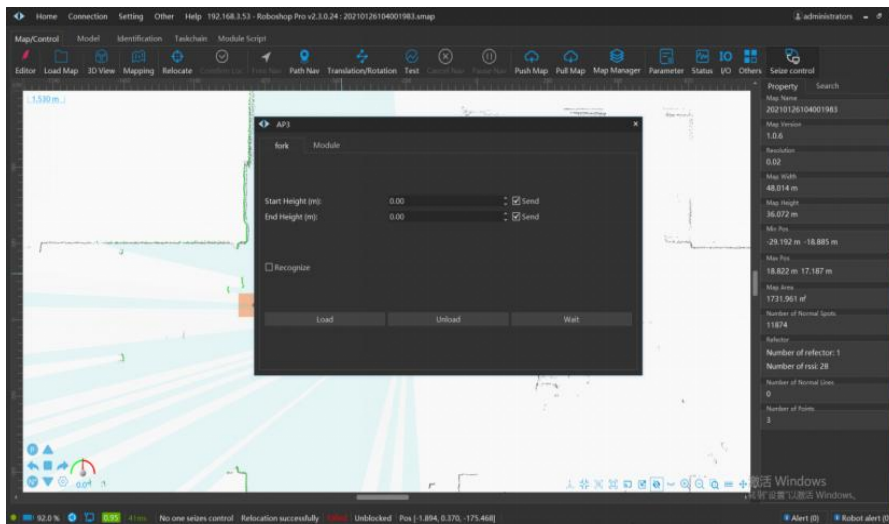
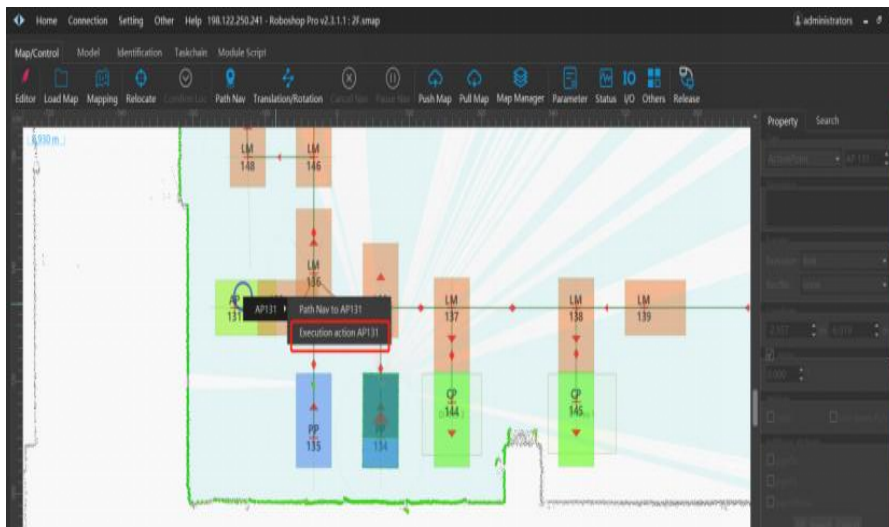
4.5 Path Navigation to the Specified Point and Execute the Corresponding Action

Forklift pickup has two modes: recognition mode and non-recognition mode.

- Recognition mode: This mode uses 3D recognition camera to recognize the position and height of the shelves in the environment for picking; A pre point in front of the shelf

needs to be set on the map, and the AP points do not need to be set accurately. Note: For more details, refer to chapter [6.7 Recognition Function](#).

- **Non-recognition mode:** This mode enables the robot to pick based on a preset path on the map. The AP points on the map represent the picking positions for the robot, and a pre point is required to set the entry height accurately for picking. Preset condition: Confirm that the robot positioning status is normal, and the path between the target point and the current point of the robot is unobstructed.

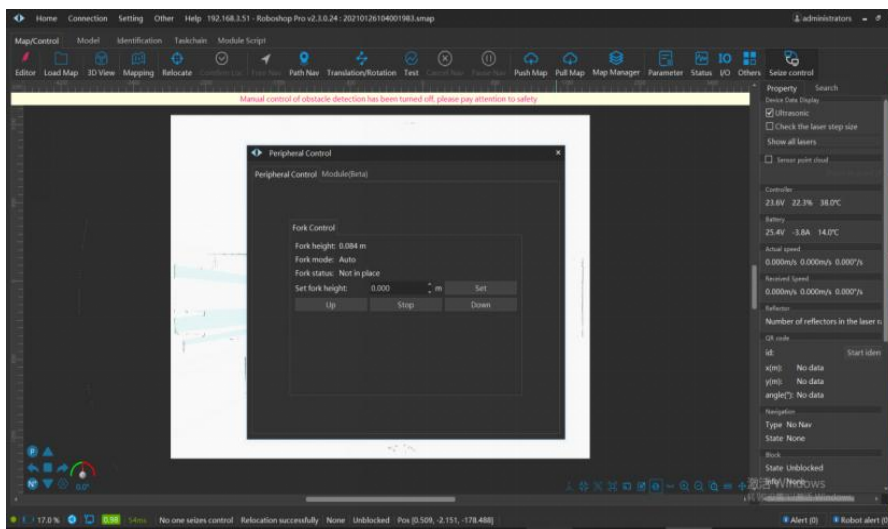


a. **Load/Unload in Non-Recognition Mode:** Click **Path Nav** in the toolbar, left-click on the target point. In the popped-up dialog box, select **Execute Action AP35**. In the next dialog box, uncheck the option **Recognize**. Enter the [Start Height] and [End Height] in the dialog box and select the **Load/Unload** option. The robot will then go to the pre point of AP35 to perform the

Start Height action, then enter AP35 to perform the End Height action and the corresponding Load/Unload action.

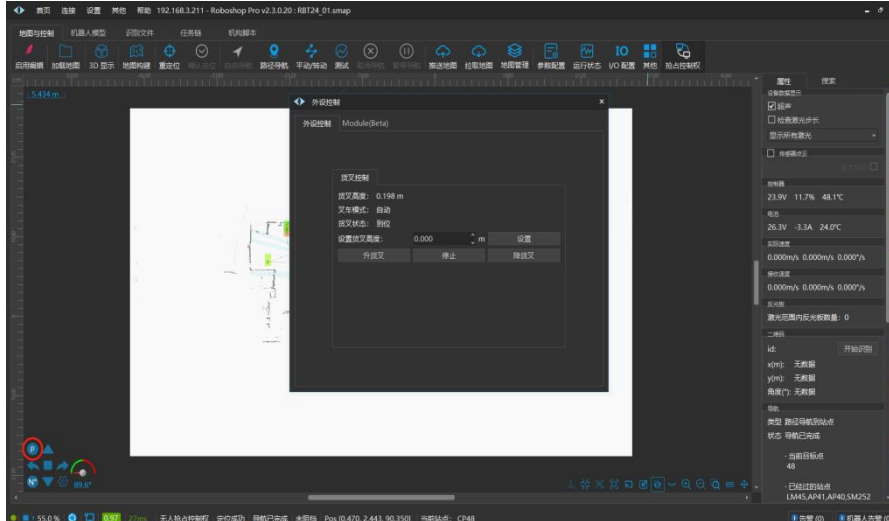
b. Load/Unload in Recognition Mode: Click **Path Nav** in the module toolbar, left-click on the target point. In the popped-up dialog box, select **Execute Action AP35**. In the next dialog box, check the option **Recognize**. The robot will automatically go to the pre point of AP35, recognize the object, lift the forks to the height of the shelf, and then enter and perform the lifting action.

4.6 Upper Computer Controls the Up/Down of Fork



Upper computer controls the up/down of the fork: Confirm that the robot position status is normal, click the **P** button at the bottom right corner of Roboshop.

- Click **Up** to lift the robot fork from its current position to its highest height;
- Click **Down** to lower the robot fork from its current position to the lowest height;
- Click **Stop**, the robot will stop the movement (up or down) of the fork mechanism;
- In **Set fork height**, enter a specified height such as 1m, and the fork mechanism will rise to 1m.



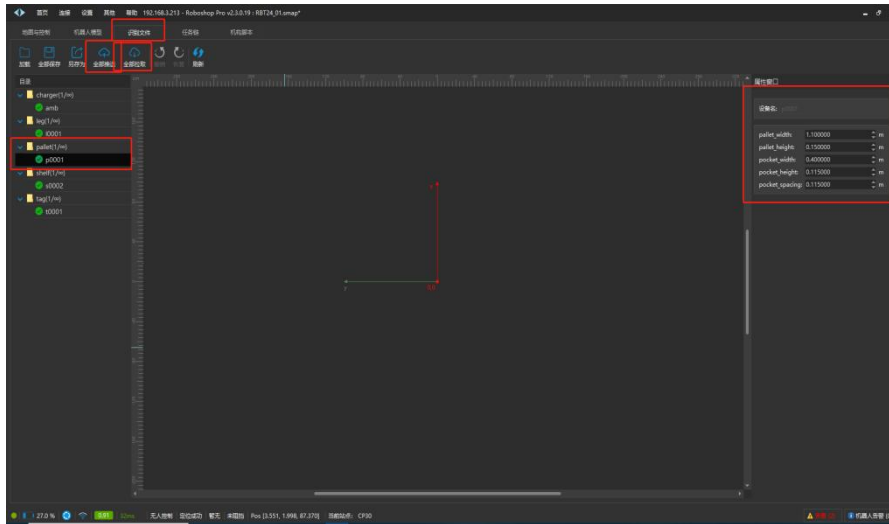
4.7 Recognition Function

After installing the optional 3D camera, the forklift can perform recognition before picking up the goods, thereby adjusting the position between the forks and the goods for more precise operations. Now introduce two recognition modes: pallet recognition and cage recognition. The following examples will use the Percipio camera.

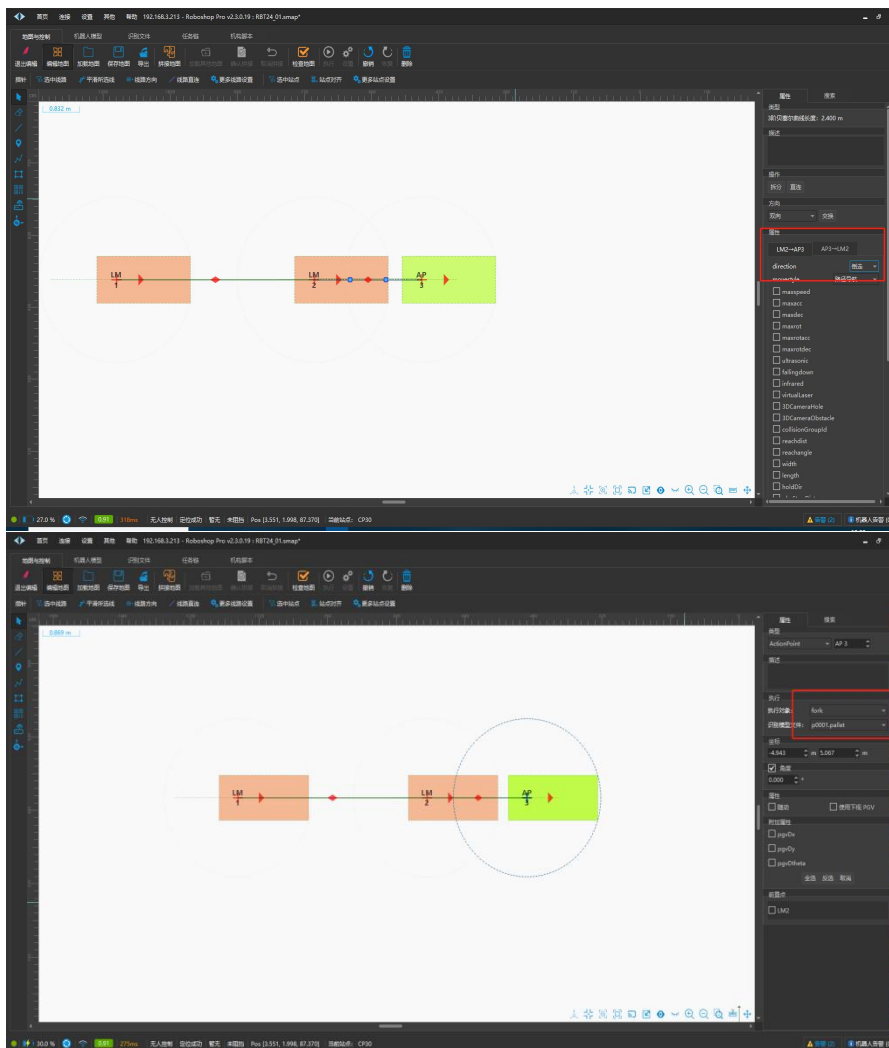
4.7.1 Pallet Recognition

For specific operations and parameter settings, refer to the document Instruction Manual for Percipio Camera Obstacle Avoidance and Pallet Recognition (<https://shimo.im/docs/ZzkLVrp0o8fBKN3Q/>).

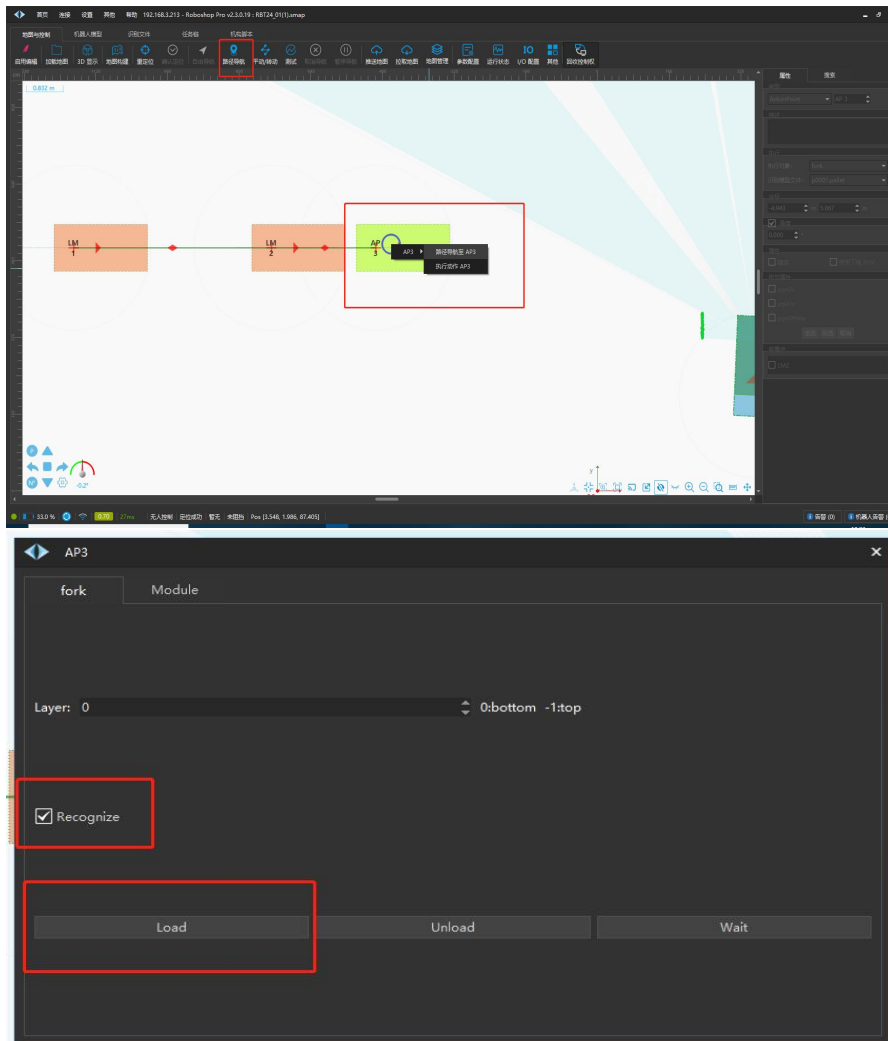
1. To recognize pallets, you need to set up the pallet data in advance. The steps are as follows: Go to **Recognition > Download > Select [p001]** in the left panel under [pallet] and modify it, or right-click **Copy and Add** to create a new pallet, then modify the pallet parameters. Finally, click **Push All** to push the modified pallet recognition file to the robot.



- Set three sites in the map: LM1, LM2, and AP3. Connect them in sequence. Set LM2-->AP3 as reverse. Click AP3, change [Executor] to "fork", [Recfile] to "p001.pallet" (the specific file is selected according to the actual request), then save and push the map.



3. Click **Path Nav**, move to AP3, left-click to select **Execution action AP3**, check **Recognize** in the pop-up action box, and click **Load** to send the command.

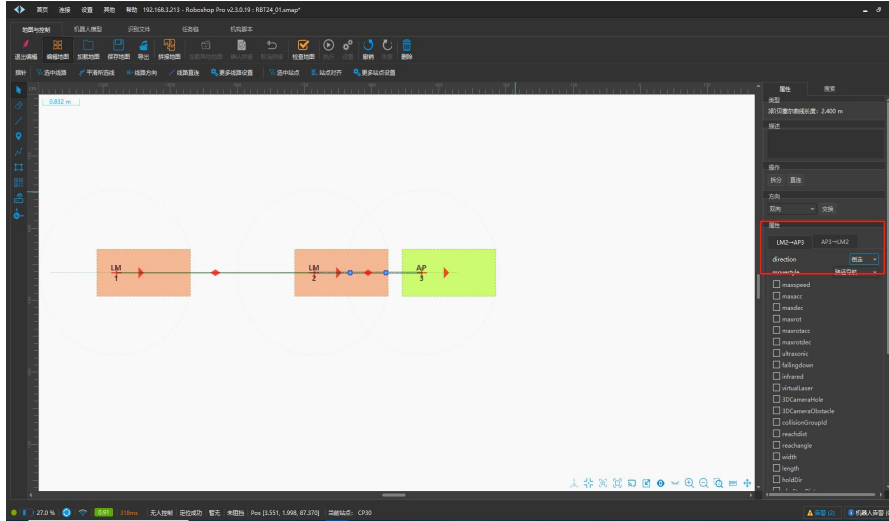


4.7.2 Cage Recognition

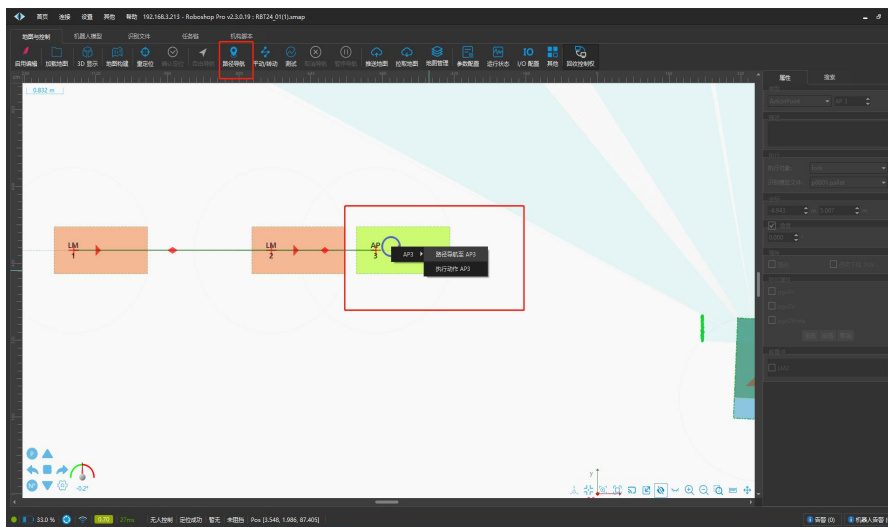
For specific operations and parameter settings, refer to the document Instructions for AprilTag QR code recognition and use. (<https://shimo.im/docs/jjLOpLRfnYguimmA/>)

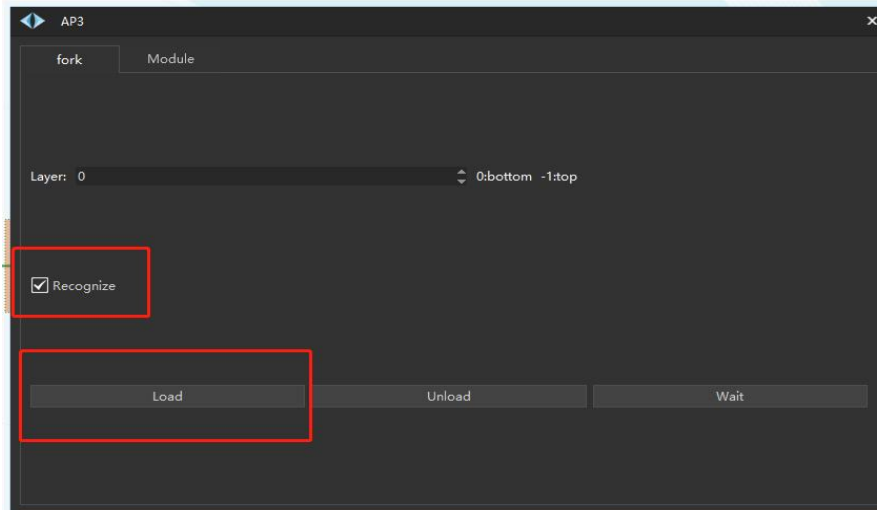
1. To recognize cages, you need to set up the cage data in advance. The steps are as follows: Go to **Recognition > Download > Select [t001]** in the left panel under [tag] and modify it, or right-click **Copy and Add** to create a new cage, then modify the cage parameters. Finally, click **Push All** to push the modified cage recognition file to the robot.

2. Set three sites in the map: LM1, LM2, and AP3. Connect them in sequence. Set LM2-->AP3 as reverse. Click AP3, change [Executor] to "fork", [Recfile] to "t001.cage" (the specific file is selected according to the actual request), then save and push the map.



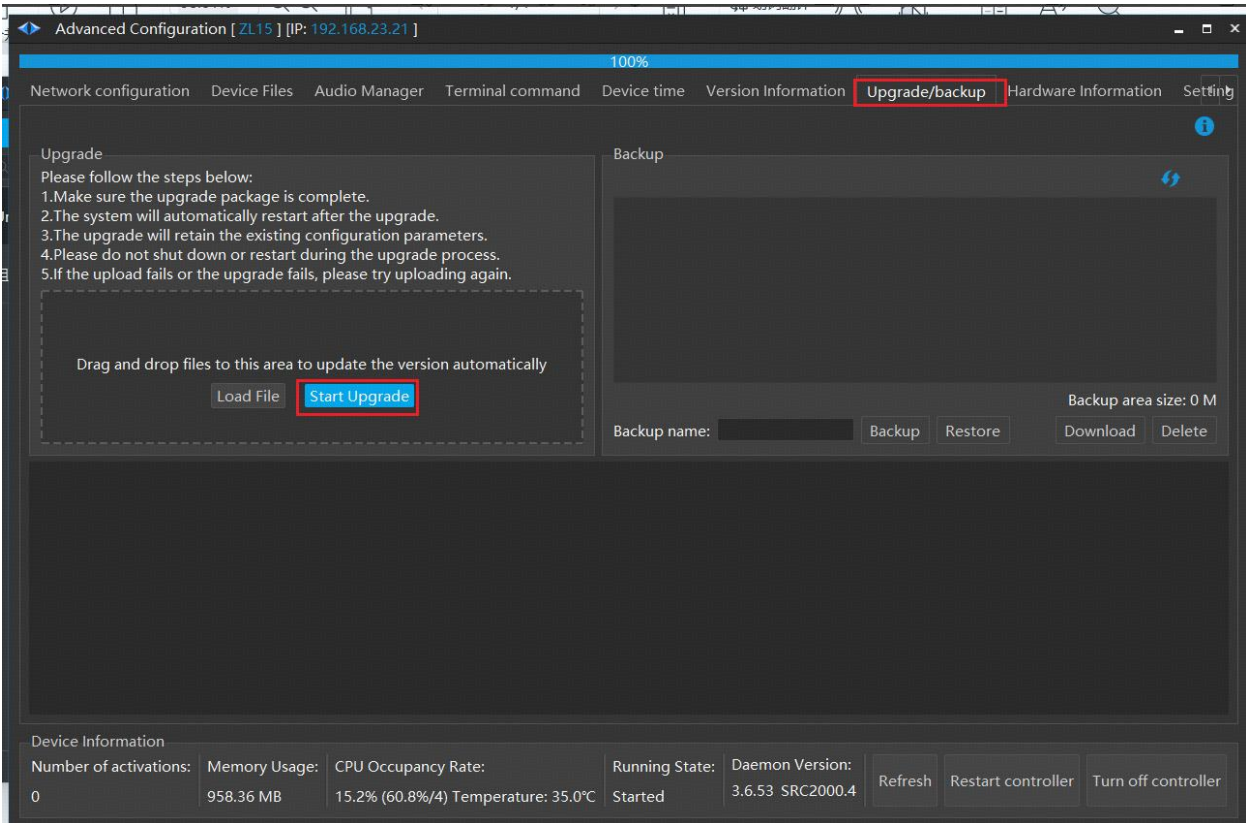
3. Click **Path Nav**, move to AP3, left-click to select **Execution action AP3**, check **Recognize** in the pop-up action box, and click **Load** to send the command.





4.8 Software Update

1. Open the Roboshop software, and select the vehicle to be upgraded, then click on **Advanced Configuration**.
2. Click on the **Upgrade/Backup** interface, and select the files that need to be loaded.
3. Click **Start Upgrade** to begin. After the upgrade is completed, the selected vehicle will automatically power off and restart.



Notice: If it prompts that the upgrade fails, please try to upload again or contact our after-sales service for processing. For other relevant software usage materials, please visit the Help Center of SEER's official website (seer-robotics.ai) for searching or contact our after-sales service to obtain them.

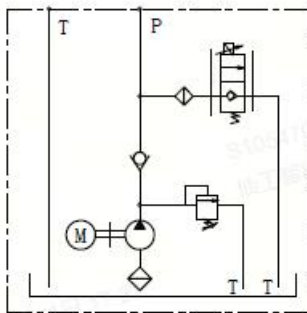
Appendix I Electrical Schematic Diagram

See attached.



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_40_Seer_ForkLif

Appendix II Hydraulic schematic diagram



液压原理图