User manual

TRACER 200

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1 About the documentation

Thank you for using all AgileX Robotics products.

This document provides relevant information on the Tracer200 robot from four aspects: safety specifications, product information, configuration and usage, and maintenance. Before using Tracer200, please carefully read this document and related manuals, and operate the robot strictly according to the specifications. After reading, please keep the document properly for easy reference at any time.

1.1 Getting help

If you want to inquire about basic information about other robot products of AgileX Robotics, please visit the official website: www.agilex.ai.

If you have questions or comments about this document, please send an email to: sales@agilex.ai .

1.1.1 Related manuals

This document only describes the Tracer200 product and does not include its deployment components or software. For other information, you can consult the corresponding documents:

Manual	Description
Software User Guide	This document describes how to operate and set up the robot's standard software products.
Deployment Deployment Guide	This document describes how to install the deploymentware for deployment robots.

1.2 Release Notes

Version number	Date	Illustration
V1.0	24/1/2024	Create a new document.

2 Safety instructions

This chapter introduces the dangers and related precautions that may be encountered by personnel and equipment working with or near the Tracer200 . Please fully read and understand the contents of this chapter and pay special attention to the warning instructions.

⚠ Notice

- AgileX robotics assumes no responsibility for any damages resulting from the damage or modification of Tracer200 or its accessories in any way.
- AgileX robotics also disclaims any responsibility for any damages caused by programming errors or malfunctions affecting Tracer200 or its accessories.

2.1 Warning instructions

2.1.1 Document warning symbols

Three levels of warning symbols are used in the document. The following figure is arranged in descending order of importance:

⚠ Warning

- An extremely imminent hazardous situation which, if not avoided, could result in death or serious injury;
- Take appropriate precautions to avoid loss or injury.

⚠ careful

- Potentially hazardous situations which, if not avoided, may result in minor or moderate injury;
- Take appropriate precautions to avoid loss or injury.

⚠ Notice

- Instructions requiring special attention, including situations that may result in equipment damage or property damage.

2.1.2 Equipment warning signs

Warning icons indicating different types of hazards are posted on the inside and outside of the robot and its accessories

Icon	Illustration	Icon	Illustration
	Pay attention to safety signs;		Watch out for electrical signs;
	Beware of high temperature signs Caution - Hot parts may cause burns;		Beware of laser markings;

Icon	Illustration
	No sitting or lying sign
	Emergency stop button pointing sign

2.2 User Responsibilities

⚠ WARNING: USER RESPONSIBILITY

• It is the end user's responsibility to conduct a risk assessment and take relevant safety measures for the tasks performed by the robot in accordance with local regulations;

• It is the end user's responsibility to ensure that the robot is designed to comply with local standards and regulations.

Safe operation of the Tracer200 is the user's responsibility and includes:

- Before running the robot, you must carefully read the " Tracer200 User Guide" and follow the operating instructions;

- Ensure that the working environment meets the safe operating environmental conditions of the robot;

- Ensure that all personnel working with the robot have received adequate training and are able to abide by operating specifications and operate the robot safely;

- Ensure that the goods carried by the robot and the loading and unloading operations comply with local safety standards;

- Personnel working with robots must wear personal protective equipment, such as safety shoes;

- When there is more than one robot running in the same workspace, the scheduling management system （RCS）must be connected through the LAN to share dynamic information between the robots to prevent conflicts;

- Regularly maintain the robot to ensure that all control functions and safety functions can work properly.

⚠ Notice

Tracer200's risk assessment report shows that the various risks arising from contact with robots are relatively small, depending on the surroundings of the robot.

Safety awareness and standard training for personnel. Please read the contents of this document carefully, participate in the training seriously, and abide by the robot operating specifications.

2.2.1 Precautions

⚠ WARNING: ELECTRICAL HAZARD

If electronic components on the robot are not used safely in accordance with specifications, equipment damage or personal injury may result.

- Please do not use any charger provided by no AgileX Robotics to charge the robot;
- Do not perform any operations on the internal parts of the robot while it is charging;
- If liquid is spilled on the robot, power off the robot, remove all liquid, and allow the robot to air dry thoroughly.

⚠ WARNING: Scald Hazard

While the robot is operating, drivetrain components dissipate heat and direct contact may result in a risk of burns.

- Wait for the robot to cool down completely before performing maintenance operations.

Warning: pinch hazard

The robot door has a certain weight, which may cause a risk of entrapment when opening or closing.

WARNING: Capsizing Hazard

If the goods on the robot are not correctly placed and fixed, or the environment does not meet the operating conditions of the robot, the goods may fall during transportation, causing equipment damage or personal injury.

- Properly secure cargo in accordance with local safety regulations and robot payload specifications;
- Ensure that the robot's working environment meets safe environmental conditions.

CAUTION: FALL HAZARD

The robot cannot detect descending stairs or depressions in the ground, which may cause a risk of falling when passing through this area.

- Refer to the analysis environment, physically block this area at the height of the robot lidar, and it is set as a restricted area on the map .

2.2.2 User roles

All personnel working with Tracer200 are required to attend training courses to gain expertise in autonomous mobile robots. Among them, different procedures can only be performed by personnel who have received corresponding guidance. The functions of the staff operating Tracer200 are distributed as follows:

● **Operators**

Personnel who directly operate and cooperate with the robot. It is necessary to have sufficient technical knowledge and equipment operation experience to be able to operate the robot safely.

● **Operations Administrator**

A person who monitors the robot but does not work directly with it. It is necessary to have sufficient technical knowledge and equipment application management experience to be able to supervise the overall operation process of the robot.

● **Equipment operation and maintenance personnel**

People who configure and maintain robots. Developers with professional technical knowledge and equipment maintenance experience are required to be able to regularly maintain and repair robots.

2.3 Safety environment

 WARNING: Equipment damage/personal injury

Using the robot in an unsafe environment may cause equipment damage or personal injury.

• Please choose an environment that meets the conditions for safe driving of the robot and isolate unsafe areas.

2.3.1 General environment

The following conditions are for general environments:

- Venue: Indoor environment (no direct sunlight);

- Ground: hard flat ground (no water/oil/dust), flatness error ±10mm, ground friction coefficient ≥0.4;

- Clearance and slope: 10 mm can be climbed over steps, 20 mm can be climbed over gaps , and the climbing angle is < 5 %;

- Temperature and humidity: temperature 5~40℃ (average ambient temperature 25℃), relative humidity 10~95 RH% , no condensation, no corrosive or explosive gas.

・ **Quarantine measures**

for unsafe areas of your environment (see Analyzing your environment) :

① **Add physical occlusion:**

Physically block the unsafe area at the height of the robot's lidar so that the robot will not try to approach this area;

② **Set map restricted areas:**

Set unsafe areas as "forbidden areas" on the map so that the robot always works in the designated area;

 Notice

You can isolate unsafe areas by either or both adding physical barriers or setting up map exclusion zones. AgileX recommends that you always add physical shielding as a necessary isolation method.

2.3.2 Safety clearance

・ **Side clearance**

Tracer200 can operate in doors, passages or other restricted spaces. On the basis of the width of the space that allows the robot to pass, sufficient clearance must be left on both sides:

The width of the navigation or docking channel that the robot can pass depends on the robot's rotation range or docking distance.

・ **Rotation clearance**

Tracer200 are forward, backward and turning. The robot's free rotation area depends on the robot's rotation range.

・ **Docking gap**

When docking, Tracer200 needs to leave a distance of 0. 6 m with the automatic charging pile to correct its docking posture.

2.3.3 Obstacles

・ **Mobility impairment**

Before robots enter high-traffic areas, appropriate precautions need to be taken to alert people in the area. If the traffic consists of other mobile devices, the parameters of the robot and other devices need to be adjusted to reduce the risk of collision between the two parties.

・ **Blocking obstacles**

If an obstacle suddenly enters the robot's driving range, it will trigger the robot's pause:

- When the obstacle leaves the robot's driving path, the robot will recover on its own and continue to perform the task;

- When the obstacle does not leave the robot's driving path, but there is enough space around it, the robot will re-plan the path after a few seconds and continue to perform the task;

- When the obstacle does not leave the robot's driving path and there is not enough space around it, the robot will switch to the "warning" state and the status light will flash yellow , waiting for manual intervention.

2.4 Operating area

It is the user's responsibility to divide all working areas of the robot based on the risk analysis report. Special areas require additional safety precautions:

- Fence;

- Ground warning signs;

- Equipment warning signs;

- Security protection area;

- Indicating signals (lights or sounds, etc.)

- Residual Risk List.

⚠️ **Notice**

Pay special attention to special obstacles in the channel (see Analysis Environment).

2.4.1 Operation danger zone

Aisle clearance may be insufficient and here are three examples of precautions that should be taken when operating in hazardous areas:

● **Charging area**

Charging hazard areas include charging piles installed against the wall and robot docking areas.
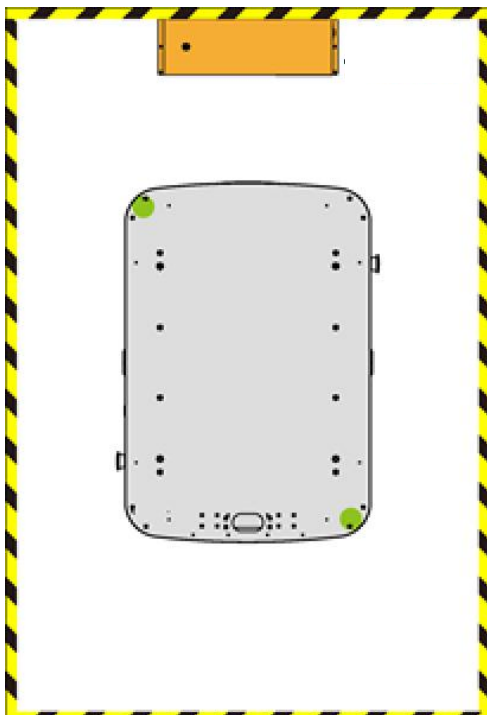
Potential risks:

- When the robot is docked, there may be a risk of crushing injuries to people standing next to the charging pile and the robot;

- When the robot is docked, there may be a risk of crushing injuries to people standing between the charging pile and the robot.

Precaution:

- Paste warning signs on the ground in this operational danger zone;
- When the robot is docked, an audible and visual warning will be issued;
- Provide safety training to all personnel working in this area;
- Set the speed limit of the robot in this area;
- Set the surrounding traffic-intensive areas as restricted areas on the map;

Residual risk: low

· **Narrow passage**

Narrow passage danger zones include narrow passages restricted by continuous or intermittent obstacles (passage cannot be turned around).
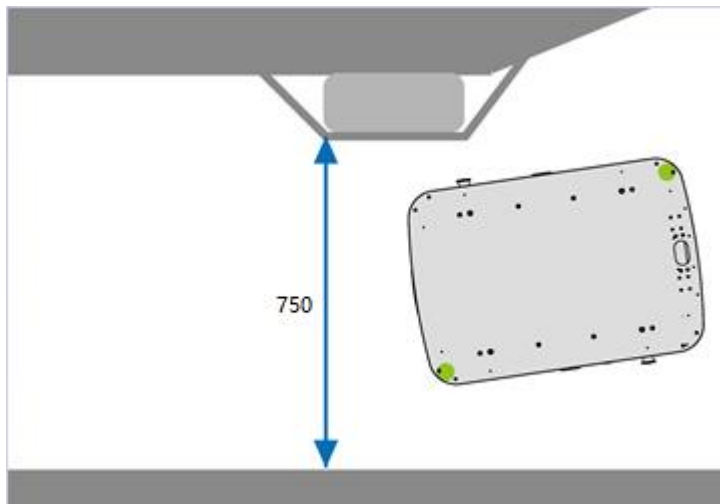
Potential risks:

- There may be a risk of crushing injuries when a person enters the passage laterally from the middle.

Precaution:

- When the robot is driving, it emits audible and visual warnings;
- Provide safety training to all personnel working in this area;
- Set the speed limit of the robot in this area;
- It is prohibited to place obstacles in traffic-intensive areas to restrict access;
- Set the surrounding traffic-intensive areas as restricted areas on the map;

Residual risk: low

2.4.2 Restricted area

Areas with insufficient aisle clearance and which cannot be protected by personnel detection devices are "no-go zones". Please refer to the "Software User Guide" and please set this area as a restricted area in the map so that the robot always works in the designated safe area.

2.5 Stopping method

When an abnormality occurs, please stop the robot quickly and safely and handle the robot in accordance with local safety procedures.

2.5.1 Emergency stop

Tracer200 is equipped with two emergency stop buttons. In an emergency, press the button hard and the robot will stop under control, the status light will flash red, and the emergency stop icon in the robot status bar on the software interface will light up.

After the emergency situation is resolved, turn the button clockwise to release the emergency stop.
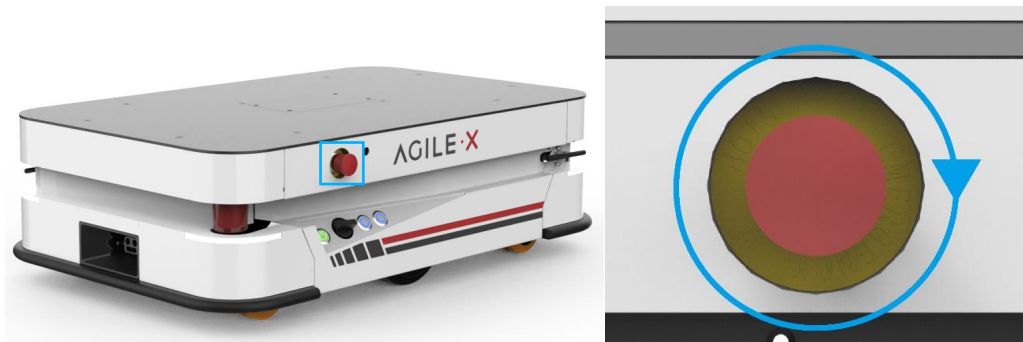
2.5.2 Temporary suspension

There is a pause/resume button on the left side of the Tracer200 chassis and a pause task button. When an abnormal situation occurs, press the pause/continue button, and the robot will pause the current task. The status light will appear like white trailing water, and the indicator light in the robot status bar on the software interface will display "task paused."

After the abnormal condition is solved, press the pause/resume button on the robot or the start task button on the software again, and the robot will continue to perform the current task.

2.6 Intended and unintended uses

2.6.1 Intended use

Tracer200 is designed for use in indoor environments, see Safe Environment on page 5 for safe environmental conditions for robot operation . Before the robot operates, it needs to be debugged and deployed under the technical guidance of AgileX.

Tracer200 has passed safety certification and can work in an unobstructed mixed human-machine environment.

2.6.2 Unintended uses

Deploying Tracer200 , the potential risks to the people and equipment working with it must be considered. Deploy robots in strictly controlled and managed environments, and only allow access to professionally trained personnel.

Any use that deviates from the intended purpose is considered misuse, including but not limited to:

● **Sitting/leaning on the robot**

There is a risk of equipment damage or personal injury;

● **Driving on steep slopes**

Slopes exceeding the robot's driving range may cause wheels to slip, causing equipment damage or personal injury;

● **Robot overload**

The cargo exceeds the robot's maximum payload, which may cause overturning, causing equipment damage or personal injury;

● **Permissible operating parameters exceeded**

Configuring operating parameters that exceed the robot's allowed driving speed, acceleration, deceleration or rotation limits may cause the robot to be unable to operate stably, leading to risks such as collision and overturning;

- **User guide not followed**

There is a risk of equipment damage or personal injury;

- **No risk assessment of the installation of the integrated mechanism**

Failure to conduct a risk assessment on the complete machine after the integrated mechanism is installed may lead to risks of equipment damage or personal injury;

- **Use in outdoor environment**

Tracer200 cannot be used outdoors because there is a risk of equipment damage or personal injury;

- **Use in hazardous (explosive or corrosive) environments;**

- **Use in environments with ionizing or non-ionizing radiation;**

- **Use in extremely hot or humid environments;**

- **Use in life-critical medical applications;**

- **For use on ships, trains, airplanes or other mobile environments**

There is a risk of equipment damage or personal injury;

- **Used for traction.**

⚠️ **WARNING: Equipment damage/personal injury**

Unintended use of the robot will cause equipment damage, equipment performance degradation, personal injury and other hazards. If you have any questions about the application of robots, please contact AgileX.

2.7 Risk assessment

Risk assessment is one of the most important tasks for an integrator to achieve a safe installation. It is recommended that integrators use ISO 12100 , EN 1525 , EN ISO 3691-4 , ISO/TS 3691-8 , ANSI B 56.5 or other relevant standards for risk assessment.

The risk assessment should consider all work procedures during the entire life of the robot, including but not limited to:

- Teaching the robot when installing and developing it;

- Troubleshooting and maintenance;

- Robot installation operation.

List major hazardous conditions and events that require attention, prepare a risk assessment report and save it in technical files.

2.7.1 Other risks

AgileX Robotics has classified the potentially significant hazards listed below as risks that the integrator must consider:

- A person stands on the road where Tracer200 is traveling or walks toward a moving robot, he or she may be pulled, collided, or the risk of crushing or entrapment;

- If a person stands in the path of the robot or walks toward the robot when the Tracer200 is reversing, he may be pulled or pulled by the robot.

- Risk of collision, crushing or entrapment. Tracer200 may reverse when docking;

- When a person touches the Tracer200, there may be a risk of being run over or trapped by the robot.;

- Personnel may be at risk of being collided, run over or trapped by the robot in the cargo transfer area, docking point, charging area and material platform area of Tracer200.

⚠️ **Notice**

Special models may have other significant risks.

2.7.2 Modify the platform

If there is a need to modify Tracer200 to adapt to specific scenarios, please ensure that:

- After the change, there are no sharp edges around the robot that may cause danger, and the extended range does not exceed the footprint of the robot;

- Navigation functionality is unaffected;

- All safety features work properly and comply with local safety standards;

- The modified machine must pass the AgileX safety assessment.

2.8 Battery safety

⚠️ **Warning: Equipment damaged**

Please do not use any battery not provided by AgileX Robotics for the main power supply of the robot.

⚠️ **Warning: Battery damaged**

After receiving the product, please fully charge the battery first to avoid the battery being discharged in a usable state, and the battery needs to be replaced.

● **Working temperature and humidity range**

Charging: 0~45℃, 45~85%RH

Discharge: -20~60℃, 45~85%RH

● **Storage temperature and humidity range**

Short term (more than one month): -20~+55℃, 45~85%RH

Mid-term (more than three months): -20~+45℃, 45~85%RH

Long term (more than one year): -5~+30℃, 45~85%RH

2.9 Security restriction function

Tracer200 has several built-in security features to ensure safe operation in the intended environment .

Relevant control software has ensured that the robot's movements are within safe limits to avoid triggering safety functions. The safety monitoring function adjusts the monitoring range according to the current working mode of the robot.

2.9.1 Anti - collision function

Collision avoidance is a safety feature that ensures the robot stops before colliding with a person or object.

This function ensures that the robot avoids people or objects in time when it detects people or objects in the active protection area .

2.9.2 Speed limit function

The safety system can monitor the speed of each motor. When the speed reaches the highest value of the limit range, the robot will automatically adjust the speed to a safe range through the software.

2.9.3 Emergency stop

There are two emergency stop buttons on the Tracer200, and other emergency stop buttons can be connected through the electrical interface.

The emergency stop button should only be pressed in an emergency.

2.10 Safe electrical interface

The robot is equipped with several safety-related electrical inputs and outputs. All safety-relevant electrical inputs and outputs are dual-channel.

2.10.1 Electrical input

External emergency stop button input

This input is used to connect the emergency stop button. When activated, the safety system will issue a Category 0 stop and apply the brakes to bring the Tracer200 to a stop.

2.11 Scrap disposal

Dispose in accordance with country-specific waste disposal regulations.

To conserve resources and protect the environment, all Tracer200 electrical and electronic products should be disposed of through designated collection facilities.

Please refer to local safety regulations for disposal of scrapped machines

3. Unpacking preparation

This chapter introduces the unboxing inspection and software installation steps after receiving the Tracer200 robot product. Please read this chapter carefully, check the received robot and its related items, unpack and install Tracer200 correctly.

3.1 Transportation and storage

⚠️ **Caution: Damage to electronic components**

Failure to follow safe transportation and storage conditions for the robot may cause damage to the safety electronic components inside the robot.

• Store the Tracer200 under the safe conditions described in this section .

・ **Robot**

- Venue: Indoor environment (no direct sunlight);
- Ground: hard flat ground (no water/oil/dust), flatness error ±10mm, ground friction coefficient ≥0.4;
- Clearance and slope: 10 mm can be climbed over steps, 20 mm can be climbed over gaps , and the climbing angle is < 5 %;
- Temperature and humidity: temperature 5~40℃ (average ambient temperature 25℃), relative humidity 10~95 RH% , no condensation, no corrosiveness, no explosiveness gas.
- Use original or Jingshi Technology-certified transport boxes for transportation to prevent impact and vibration from damaging the robot during transportation;
- Always store or transport the robot upright to avoid damaging internal components.

・ **Battery**

- Storage temperature and humidity range:
- Short term (more than one month): -20~+55℃, 45~85%RH
- Mid-term (more than three months): -20~+45℃, 45~85%RH
- Long term (more than one year): -5~+30℃, 45~85%RH
- Please store the battery in a cool, dry, ventilated environment with small temperature changes.

3.2 Unpacking and inspection

After receiving the robot items, please carefully check whether the shipping box is damaged. If any damage

is discovered, request that the shipping agent be present during unpacking.

Please check the robot delivery list carefully before signing the delivery order. Confirm that all items have been received and shipped correctly with no obvious damage.

- If the items received do not match the delivery order or the items are damaged, please do not sign on the delivery order and contact AgileX immediately.

⚠️ **Notice**

Please keep the shipping materials of the robot product as they will be needed in case of a claim or re-installation in the future.

3.2.1 List of items

The following table lists standard accessories for the Tracer200, excluding additional options for special needs:

Items	Quantity	Unit	Description
Autonomous Mobile Robot (AMR)	1	PCS	Tracer200 robot
Power Adapter	1	PCS	Robot wired charger
Document	1	PCS	Tracer200 User Guide

3.2.2 Unpacking operation

① Place and secure the transport box in a clean area with a width of 2.5m around it;

② Remove the wooden frames around the robot and the top, leaving the wooden pallets at the bottom;

③ The two people work together to lift the equipment through the safe stress points of the lidar slots on both sides of the robot chassis;

④ Remove the wooden frame at the bottom of the robot;

⑤ Place the robot slowly on the ground.

3.2.3 Check equipment

- Remove the transparent packaging film around the robot;

- Check whether there are scratches or dents on the four sides of the robot's shell, and whether the cover plate is loose or damaged;

- Check whether the function buttons and two emergency stop switches on the robot are loose or damaged;

- Check whether the two laser radars on the opposite corners of the robot and the depth camera mirrors on the front are complete;

- Check whether the anti-collision edge is loose or damaged;

- Check whether the two antennas at opposite corners of the robot are loose or damaged.

⚠ **Notice**

If damage is found, please take a photo, save it, and contact AgileX.
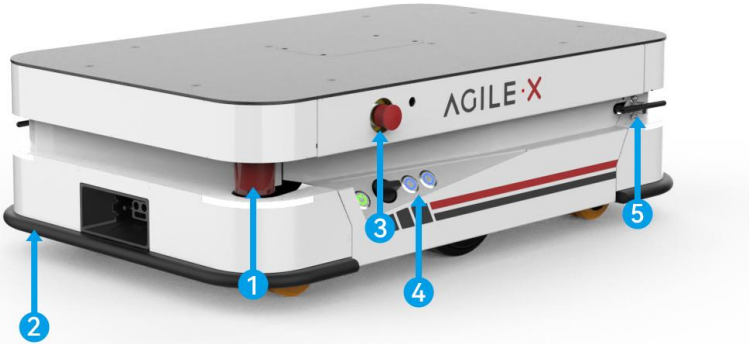
① Lidar	② Anti-collision edge	③ Emergency button
④ Function buttons	⑤ Antenna	

4 Product introduction

4.1 Product information

The Tracer200 is a general-purpose autonomous mobile robot (AMR) platform chassis designed for indoor scenarios where humans and machines are mixed and capable of transporting up to 200kg of goods.

Each robot supports network communication. Users can control the robot through web-based software on a computer, tablet or vehicle. When using the robot for the first time, it is necessary to create or import a map, in which the robot can locate, independently plan its driving path and effectively avoid obstacles. When charging piles are deployed in the environment and charging tasks are set, the robot can autonomously navigate to the charging area for charging when the power level is below a certain value.

Tracer200

4.1.1 Specifications

Tracer200 specifications			
Product number	Tracer200	Power supply	Manual/automatic /battery replacement
Size	800x500x250mm (subject to design)	Lithium battery	Rated voltage: DC24V
			Capacity: 40Ah
Weight	90kg (subject to design)		Charging time: 2.5h
Payload	200kg (platform load)		Running time: 8h (continuous at full load)
Max speed	Rated speed: 1.5m/s	Charging voltage	29.4V
	Maximum angular velocity: 120 ° /s	Power	500W

	Navigation maximum speed: 1.2m/s	Navigation	Lidar-based autonomous navigation
Radius of rotation	470mm (around the center of the robot)	Drive mode	Two wheel differential
Straight navigation channel width	750mm	Braking method	Slow down/emergency stop
U-turn navigation channel width	1340mm	Ambient temperature	5~40°C
Positioning accuracy	Highest global positioning accuracy: ±100mm/±3°	Environment humidity	10~95RH%
	Maximum accuracy of VL mark: ±5m/±1°	Protection level	IP21
Traversable gap	Gap that can be crossed: 20mm	Ground requirements	Hard flat floor (no water/oil/dust)
	Height that can be crossed over the step: 10mm	Communication	Wi-Fi:802.11a/b/g/n/ac
	Maximum climbing angle: 5% (chassis only)		I/O: USB and RJ45
Standard accessories	Power Adapter		
deploymentware	Charging pile , UWB base station		
Security	It is equipped with lidar on the front and rear ends, a depth camera on the front end, emergency stop buttons on the left and right sides, TOF sensors on all sides, and warning lights and speakers.		

4.2 Button description

There is a set of buttons on the right side of the mobile platform Tracer200 and a button next to the top display:
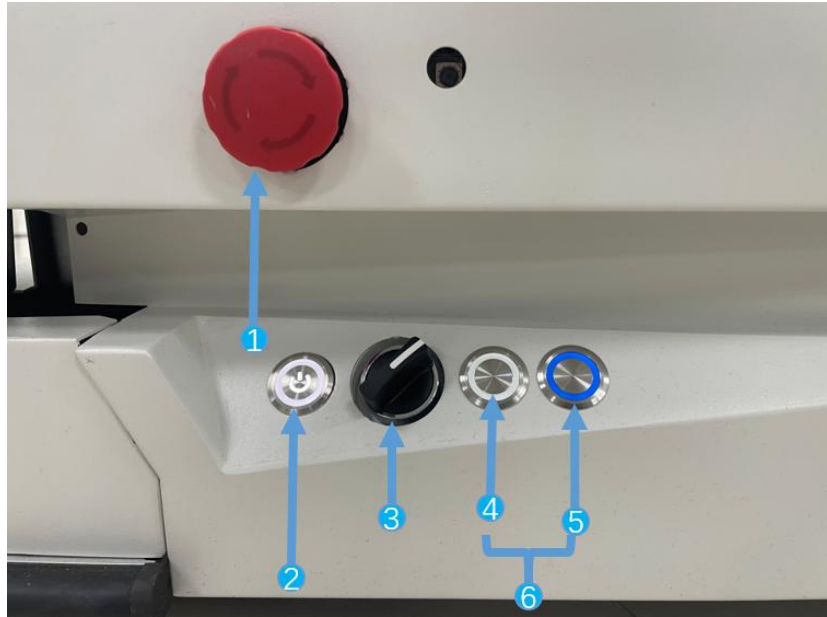
① Emergency button	② Power button	③ Mode switch	④ Pause/Continue button
⑤ Reset button	⑥ Combination of hotspot buttons		

① **Emergency button**

When an emergency occurs on the robot, press this button to perform an emergency stop; rotate this button clockwise to release the emergency stop.

② **Power button**

Short press this button to turn on the robot's power, and long press this button for 1.5 seconds to turn off the robot's power.

③ **Mode switch button**

Switch the robot working mode through the switch gear.

S / M / A

Left: Stop mode (S).

Center: Manual mode (M).

Right: Automatic mode (A).

④ **Pause/continue button:**

Press this button to pause/resume the robot's task execution status;

When connected to LAN WiFi, press and hold this button and the robot will announce the current IP address .

⑤ **Reset button:**

Short press this button and the robot will reset the coordinate point recorded at the last moment; long press this button and the robot will reset to the reset point.

⚠ **Notice**

To reset by short pressing this button, you need to ensure that the reset posture of the robot at this moment is accurate and consistent with the position recorded at the last moment. Shutting down the mobile robot or turning on the "kidnapped" robot will not reset successfully by short pressing this button.

⑥ **Combination hot button:**

Press the "Pause/Continue" and "Reset" buttons at the same time for 5 seconds, the robot hotspot will be turned on, accompanied by a voice broadcast, and can be connected to the tablet software.

4.3 Working mode

Tracer200 has the following three working modes:

・ **Stop mode (Stop):**

The working mode used for operation and maintenance personnel to repair and maintain robots. In this mode, the power of the motion module is cut off, and the movement of the robot and integrated mechanism cannot be controlled.

・ **Manual mode (Manual):**

Working mode for manually controlling robot movement. In this mode, press the unlock button on the robot to push the robot. When the unlock button is not pressed, connect a handheld wired controller to the signal aviation plug, and you can use the handheld controller to remotely control the movement of the robot.

・ **Automatic mode (Automatic):**

Working mode for autonomous movement of robots. In this mode, tasks or task groups can be sent to the robot through tools such as the Robot Control System(RCS) or APP , and the robot will automatically complete the edited combination instructions.

4.4 External components

Tracer200 external components

external parts	
1. Back end LiDAR	2. Anti-collision edge
3. Emergency button	4. Function buttons
5. Front antenna	6. Automatic charging port
7. Depth camera	8. Manual charging port
9. Front-end LiDAR	

4.5 Sensor system

The cooperation between the robot's built-in sensors can ensure the safe operation of the robot in the work environment to adapt to mixed human-machine scenarios.

Tracer200 is equipped with the following sensor systems:

- Lidar

- Depth camera

- Anti-collision edge

- Internal sensor

4.5.1 Lidar

The Tracer200 is an optical sensor installed at the front and back diagonally of the robot; it uses infrared laser rays to accurately measure the distance to the target point.

- Each lidar has a 270° overlapping field of view, ensuring a safe 360° scanning range for the robot.

- LiDAR detects objects on a plane approximately 180 mm above the ground, and objects above or below this plane will not be detected;

- While in motion, the lidar continuously scans the surrounding environment using a scanning distance of up to 50m .
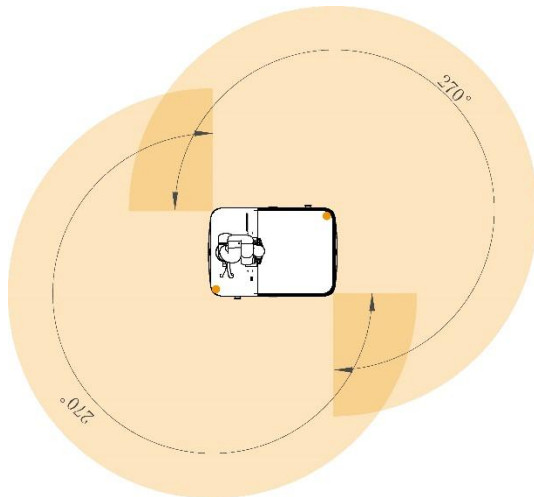
LiDAR scanning area   Full lidar installation height
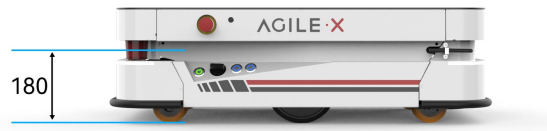
· **LiDAR functions:**

- Build a map;

- Locate the robot in the environment and plan its driving path;

- The robot continuously scans the surrounding environment while driving and effectively avoids static or dynamic obstacles;

- When the robot docks with the material platform, the feature plate is identified and the docking posture is corrected.
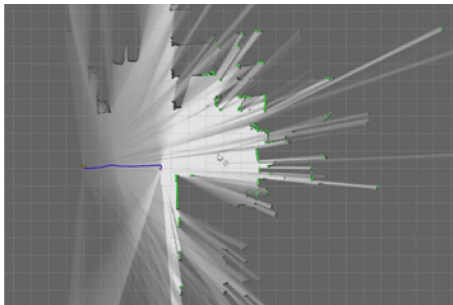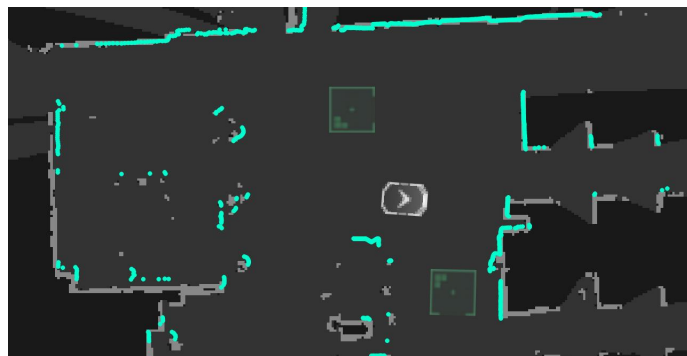
Build a map   real-time positioning

The robot system will fuse the data detected by sensors such as lidar and depth cameras to determine whether there are obstacles in the robot's path. If so, the robot will slow down and re-plan its route; when it cannot avoid obstacles, the robot will stop and wait for the road to clear.

4.5.2 Depth camera

Tracer200 is installed on the front of the robot and uses the detected depth image and RGB ordinary image to perceive the three-dimensional objects in front of the robot to adjust the driving route.

Depth camera detection range:

- Objects up to 10 45 mm vertically at 1 214 mm in front of the robot;
- Objects within 91.2 ° horizontal field of view outside the 410 mm ground blind zone

⚠️ **Notice**

Depth camera readings will be used as 3D point cloud data; they will not record video information of identifiable objects or human features.

4.5.3 Internal sensors

The robot's internal sensor system consists of the following components:

・ **IMU**

Measure the robot's direction and angular velocity;

・ **Motor encoder**

Provides a closed-loop feedback signal by tracking the speed and/or position of the motor shaft;

・ **Safety encoder**

Detect wheel movement.

4.6 Light strip status

LED light strips on Tracer200 are used to inform people working together about the current operating status of the robot. The light strip version V 1.0.5 .

Robot status		Light strip position	Light strip color	Light strip status
Initialization	(Status/positioning/hardware) initialization	Four side light strips	yellow	Flash (same as warning)
Spare	Spare	Four side light strips	White	Breathe
	Following & Identification	Four side light strips	yellow	Flash mob
	Following	Four side light strips	White	Always on
On task	Perform tasks	Four side light strips	White	Always on
	Pause task	Four side light strips	yellow	Slow flash
	Waiting state	Four side light strips	White	Always on

	Starting tips (speed starts from 0)	Four side light strips	▭ White	Flash mob
	Navigation - Forward/Back	Four side light strips	▭ White	Always on
	Navigation - Turn left (> 30 °)	left light	▭ White	Flash mob
	Navigation - Turn right (> 30 °)	Right light	▭ White	Flash mob
	Docking-Enter/Exit	Four side light strips	▭ White	Slow flash
	Docking - loading/unloading	Four side light strips	▭ White	Slow flash
	Traffic control	Four side light strips	▭ White	Slow flash
Mode	Automatic mode-remote control mode	Four side light strips	▭ White	Always on
	Manual mode	Four side light strips	🟧 yellow	Always on
	Stop mode	Four side light strips	🟥 red	Always on
Warn	Warn	Four side light strips	🟧 yellow	Flash mob
Fault	Fault	Four side light strips	🟥 red	Flash mob
Offline	Offline	Four side light strips	🟧 yellow	Flash (same as warning)
Charge	Charging	Four side light strips	🟩 green	Not fully charged: flash slowly Fully charged: always on
	Low battery (low battery when idle and waiting)	Four side light strips	🟩 green	Flash mob

4.7 Basic accessories

4.7.1 Power adapter

【Power Adapter】

Lithium battery charger for robots. It can be used independently or installed inside a charging pile to achieve autonomous recharging function.

Interface Description:

Charging aviation plug: Connect to the charging aviation interface;

Power plug: Connect to the power socket.

Specifications:

Power adapter specifications			
Body size	235× 1 20×70mm	self-respect	3.5kg
Input cable length	1500mm	Output cable length	100 0mm
Input	200-240V , 50-60 HZ	output	29.4 ±0.2 V , 20A ±3% , 700 W

Indicator status:

LED light	Color	State
LED1	🔴Red	Start up
LED2	🔴Red	Charging
	🟢Green	Be filled

4.7.2 Automatic charging pile

Autonomous charging pile

Size	213×580×380mm
Input format	Single-phase three-wire(L/N/PE)
Input voltage	220V
Frequency	45Hz-65Hz
Max input current	≤ 18A (According to actual power)
Output power	≥ 0.99(fully load)

factor				
Output voltage	24V	48V	72V	120V
Output current	0-50A	0-50A	0-50A	0-50A
Voltage stabilization accuracy	≤ ± 0.6%			
Counterweight noise voltage	<2mV			
Peak-peak noise voltage	≤150mV(20MHz Bandwidth)			
Efficiency	≥90%(Rated input full load condition)			
broadband noise voltage	≤50mV(3.4kHz~150kHz)			
discrete frequency noise voltage (phase voltage)	≤≤250mmVV((3.04.1k5HzM~H1z5~03kOHMz H)z)			
Ac overvoltage warning recovery point	Default (286±5)VAC			
AC undervoltage value	Default (164±5)VAC			
Ac undervoltage warning recovery point	Default (175±5)VAC			
Operating temperature	-20℃ ~65℃, recommended 15℃ ~25℃			
Storage temperature	-40℃ ~70℃			
Relative humidity	10%～90%,recommended40%～60%			
Atmospheric pressure	70 kPa~106 kPa			
Field requirement	There is no serious dust, explosive dangerous medium, corrosion of metal and damage to the insulation of harmful gas, conductive particles and serious mold, and no strong electromagnetic field interference.			

4.8 Standard software

4.8.1 AgileX Fleet
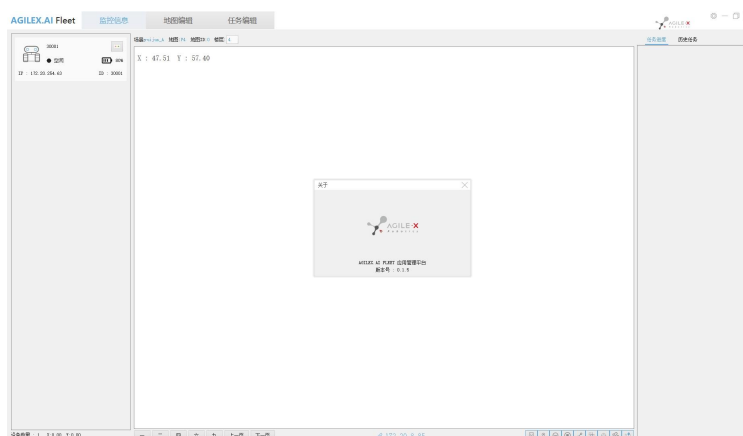
AgileX Fleet is a PC-based robot management software that has three major functions: map editing, task editing, and monitoring information, making it easy for operators and operations administrators to flexibly monitor and manage robots in scenarios where multiple robots are working.

4.8.2 AgileX Pro

AgileX Pro is a tablet-based robot management software that integrates real-time monitoring and control, task planning, equipment configuration, map construction and other functions to facilitate operators and operation and maintenance personnel to better monitor and manage robots in mobile scenarios.

4.9 Optional accessories (part)

4.9.1 RCS scheduling management system

・ **Features**

- **Operation monitoring:**

Supports multi-area monitoring and provides visual monitoring of real-time status of robots, auxiliary

positioning base stations, elevators and other equipment.

- Scheduling management:

Docking orders issued by external systems (WMS, ERP, MES, etc.), automatically generating task lists and transmitting them to robots. During multi-machine operation, robot cluster control is performed to prevent traffic congestion and improve operating efficiency.

- Resource configuration:

Compatible with multiple types and numbers of robots and external devices; the system supports map management functions such as building maps, modifying maps, map splicing, and online map updates, enabling flexible environment configuration, and supports cross-floor environmental operations and online adjustments in multi-map scenarios in buildings Scheduling strategies to match the special scheduling needs of different work scenarios.

- Interactive terminal:

It can be equipped with an independently developed handheld mobile APP, vehicle-mounted terminal, and PC client. The system supports external remote control boxes, PDAs and other terminal devices to meet the operational needs of different user roles in different scenarios.

- System interface:

The system provides a complete SDK interface for external systems (such as WMS, ERP, MES, etc.) to access RCS, supports data interaction with various external I/O devices, and realizes full-process automation of the business.

5 Debugging

This chapter introduces the basic operations of Tracer200 in formal operation, such as power switching, charging, position calibration and initialization, etc. Please ensure that you have carefully read the safety instructions in Chapter 2 and the product introduction in Chapter 4 to understand and be familiar with the basic information of Tracer200 to provide a basis for safely operating the robot.

5.1 Preparation for starting up

Please read and complete the following inspections carefully before starting the robot for operation, and make strict preparations before starting the robot for use, so that the robot can operate more safely and stably autonomously.

5.1.1 Safety check

1. Unlock the emergency stop button

Check: Check whether the four emergency stop buttons on the Tracer200 are all unlocked;

Action: If the emergency stop is pressed, turn the button clockwise to unlock.
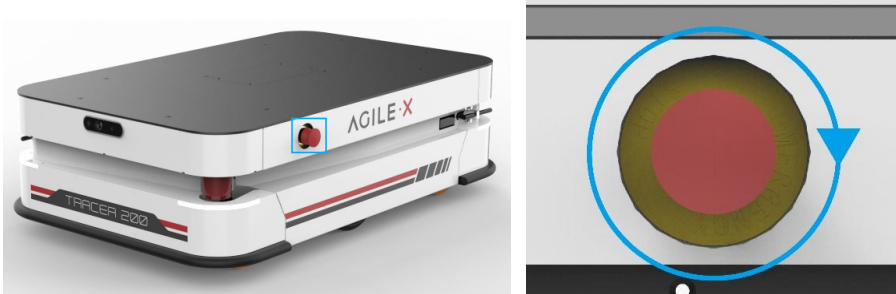
2. Clean the robot surface

Inspection: Check whether there are foreign objects, stickers, etc. on the surface of the Tracer200 ;

Measures: If there are any, use a damp cloth to wipe the surface of the robot to remove foreign matter.

3. Wipe the depth camera lens

Inspection: Check the depth camera on the front of the Tracer200 at close range to see if there are foreign objects visible to the naked eye;

Measures: If there is oil or dust, please use glasses cloth and lens cleaning fluid to gently wipe away the foreign matter.
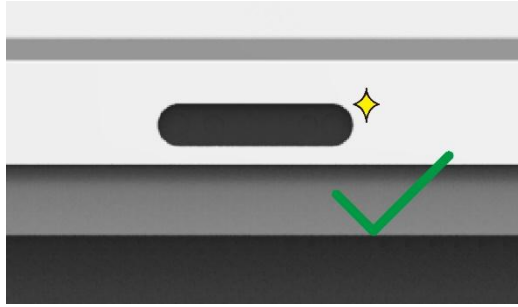
4. Wipe lidar mirror surface

Inspection: Check the two diagonal lidars at the front and rear of the Tracer200 at close range to see if there are foreign objects;

Measures: If there is oil or dust, please use glasses cloth and lens cleaning fluid to gently wipe away the foreign matter.
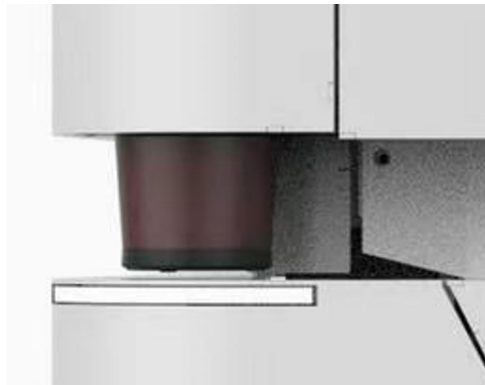
5. Clean the wheels

Inspection: Check whether the six wheels on the Tracer200 are entangled with foreign objects;

Measures: If there are foreign objects such as wires, use a small shovel to remove them.
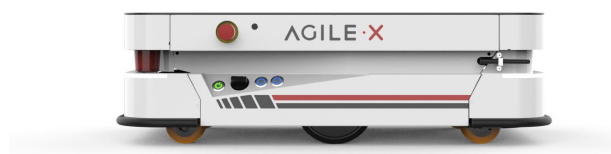
6. Wipe the charging port

Inspection: Check whether there are foreign objects, stickers, etc. on the surface of the charging port on the Tracer200 charging pile;

Action: If foreign matter is present, wipe it off with a dry cloth

7. Clean the charging area

Check: Confirm that the charging pile is connected to the AC power supply and the power is turned on, and there are no other objects or water stains in the charging area;

Measures: Please connect the power supply and turn on the charging pile, and clean objects or water stains in the charging area.
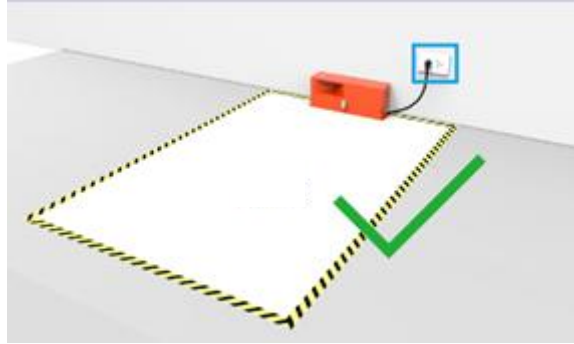
8. Clean aisles and storage areas

Inspection: Check whether there are any obstacles blocking the passage in the working channel of Tracer200 ;

Measures: If there are obstacles, please clean them up in time to avoid affecting the work of the robot. If there are new fixed obstacles in the environment,

Please update the map now.

5.2 Turn on the power

① Set the robot mode switch to manual mode (M);

① Press the power button of the robot, the button will display a white light, the robot will start, and the status light will be always yellow. After the robot emits the voice "IP address is x xx.xxx.xxx.xxx ", the startup will be successful.

> ⚠️ **CAUTION: Equipment damaged**
>
> Do not move the robot before it sends out a voice broadcast, otherwise it will affect the robot's initialization process and cause damage to the equipment.

5.3 Software connection

Establish a connection with the robot through the tablet Tracer200 software, control and configure the robot.

In non-scheduling mode, establish a connection with the robot by connecting to the robot hotspot and configuring the robot WiFi;

In scheduling mode, establish a connection with the robot under the server by connecting to the scheduling server WiFi .

5.3.1 Connect to robot hotspot

① Set the robot mode switch to manual mode (M)/ StopMode(S);

② Press and hold the combination button "Pause/Continue" and "Reset" on the left side of the robot for 5 seconds. The button's white light will flash, and the robot's voice will broadcast "The IP address is x xx.xxx.xxx.xxx ;

③ Enter the WiFi connection interface of the tablet system, connect to the robot hotspot Woosh200-000000Z , and enter the default password:woosh888.
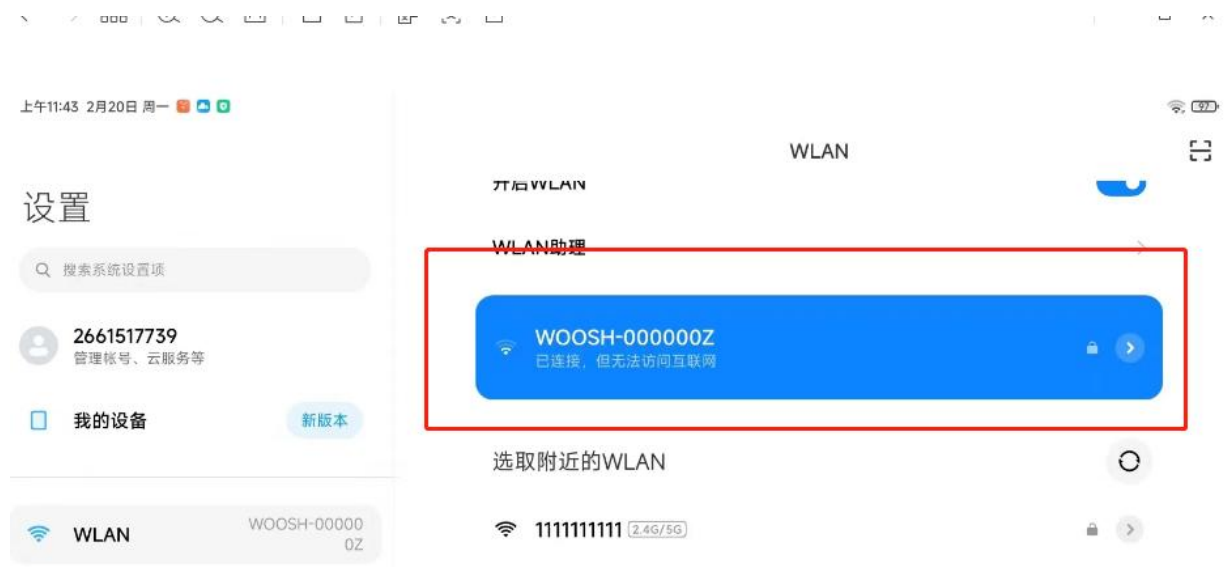
④ Please refer to the "Software User Guide" for connecting the robot IP, configuring the robot WiFi and connecting to the scheduling server .

5.4 Building a map

5.4.1 Analysis environment

⚠ **Notice**

Please ensure that the working environment meets the robot safety environment conditions (see Safety Environment on page 5) .

Before working with the Tracer200, you need to create a map of the robot's work area. Maps are the basis of robotic navigation, recording the shape and position of objects in the environment that have permanent physical characteristics, such as walls, doors, pillars, large fixtures, etc.

Tracer200 is an autonomous navigation robot based on lidar. It builds a map through lidar and determines its own position on the map. It combines sensing technologies such as lidar and depth vision to autonomously avoid obstacles in the environment..

・ **Special disorder**

Tracer200 's lidar scans a horizontal plane parallel to the ground. The installation height is about 180mm from the ground . It cannot detect objects above, below or beyond this plane.

Please pay special attention to whether there are any special obstacles in the environment that cannot be detected by the robot:

- Descending stairs: The robot cannot recognize descending stairs and ground depressions;

- Suspension facilities: The robot cannot identify obstacles above the detection range, and the suspension facilities may cause damage to the robot's integrated mechanism;

- Large active areas: Large active areas are areas where people or equipment move frequently. If the robot encounters obstacles during driving, it will re-plan its path. Frequent resetting of the path in this area will greatly reduce the robot's working efficiency;

- Shelf: The robot will recognize a shelf with four columns as four points on the ground and think there is enough space under the shelf to pass. The path is re-planned only when the bottom baffle is detected close to the shelf, which will affect the robot's working efficiency;

・ **Solution**

- Add physical occlusion: Physically block this area at the height of the robot's lidar so that the robot will not try to approach these areas;

- Set map mark: Set this area as a restricted area on the map to keep the robot in the designated safety area.

- Work within the area; or divide the area to stagger the robot and obstacles.

⚠ **Notice**

You can isolate unsafe areas by either or both adding physical barriers or setting up map exclusion zones. Even so, AgileX still recommends that you always add physical shielding as a necessary isolation method.

・ **Warning area**

When Tracer200 performs tasks at the site, people or equipment will cause interference to the robot, which may even cause equipment damage or personal injury. Please paste warning signs on the ground of the robot's working docking area to remind people around you, and set the parameters of other mobile devices so that they will not enter the robot's docking area. The types of docking areas are:

- Storage area

- Charging area

- Parking area/origin area

- Elevator access area

5.4.2 Building a map

Use AgileX Pro to control the robot to build an accurate and complete map.

> ⚠️ **Notice**
>
> The map is the basis for the safe operation and efficient operation of the robot. Please take your time to create a high-quality map.

> ⚠️ **CAUTION: Equipment damage/personal injury**
>
> Please ensure that the robot is not carrying cargo when building the map to avoid equipment damage or personal injury.

① Establish a connection with the robot via AgileX Pro;

② Choose a suitable location (open and without obstacles) as the map origin. Please remember this point pose, the robot will need to use the origin point to reset in the future;

③ Set the robot mode switch to manual mode (M), push the robot to the set origin, press the button again after completion, and switch the mode to automatic mode (A);

④ Enter AgileX Pro to build and upload the scene map, please refer to the "Software User Guide" .

> ⚠️ **CAUTION: Equipment damage/personal injury**
>
> •When building a map, the operator needs to be in the same space as the robot and must not compose the map remotely;
>
> • When building a map, the operator must keep his eyes on the robot and control the robot through the tablet handle. Do not stare at the screen to control the robot.
>
> To avoid causing equipment damage or personal injury .

5.5 Edit map

Use AgileX Fleet to patch and constrain the map built by the robot, and create the task actions that the robot needs to perform in the edited map.

Notice

The robot will always follow the safety loop established by internal controllers and sensors. Regardless of how the map is edited, the robot will autonomously avoid obstacles while driving.

CAUTION: Equipment damage/personal injury

When temporary additions or uncontrollable obstacles appear, please update the map immediately to ensure that the working environment is always safe for the robot, otherwise equipment damage/personal injury may result.

5.6 Real - time monitoring

① Enter the AgileX Fleet monitoring information module to view the tasks and robot execution status issued by the scheduling server or stand-alone machine;
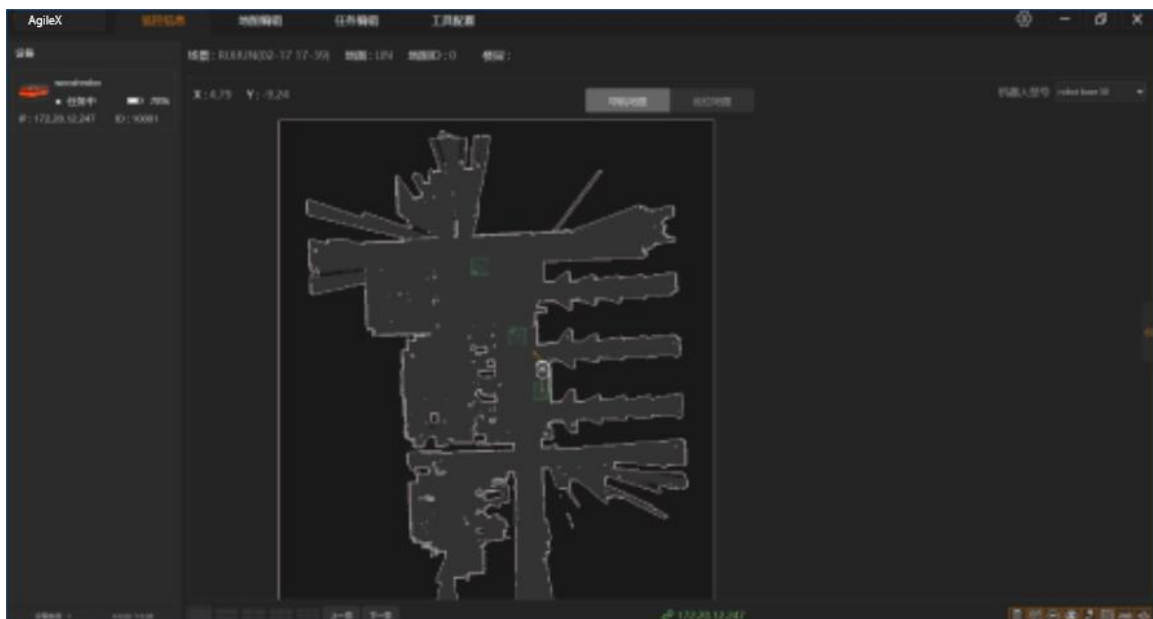
② Enter the AgileX Pro console module to view the tasks issued by the scheduling server or a single machine and the execution status of the connected robots.

5.7 Mobile robots

Move the robot by push or remote control.

5.7.1 Pushing the robot

① Set the robot mode switch to manual mode (M), push the robot, and switch back to automatic mode (A) after the robot reaches the target point.

5.7.2 Remote control robot

· **Tablet remote control**

① Use AgileX Pro software to establish a connection with the robot, turn on the remote control mode, and control the movement of the robot through the virtual handle in the interface. See the Software User Guide .

⚠️ **CAUTION: Equipment damage/personal injury**

When remote controlling the robot, please keep your eyes on the robot and control the robot through the tablet handle. Do not stare at the screen to control the robot to avoid equipment damage or personal injury.

5.8 Charging method

Tracer200 is installed in the battery compartment at the rear, and the user can check the current battery percentage of the robot through the software interface;

The battery charging time is 2.5 hours . After being fully charged, it can run continuously for 8 hours at full load. When the battery is low, the robot status light flashes green.

The lithium battery pack in the robot can be charged through manual charging or automatic charging .

5.8.1 Manual charging

① Set the robot mode switch to manual mode (M) and push the robot to the power socket;

② Connect the standard power adapter socket that is connected to the AC power supply to the manual charging aviation interface on the robot. If the adapter indicator light turns green, charging is successful.

5.8.2 Autonomous recharging

The robot charging pile is deployed next to the power socket, and the robot charging task is set to achieve the autonomous recharge function.

⚠️ **CAUTION: Equipment damage/personal injury**

Personnel or equipment in the robot charging area will cause interference to the docking robot. Please take appropriate precautions:

•Paste warning signs on the ground in the charging area to remind surrounding staff;
•Set other mobile device parameters so that they do not enter the robot charging area.

① Set charging task:

‑ In the scheduling state, enter AgileX Pro to set the robot's low battery value and charging time period. The robot will go to the charging area to charge independently in this state. Please refer to the "Software User Guide" ;

‑ In the non-scheduling state, enter AgileX Pro to manually issue a charging task to the connected robot. After receiving the task, the robot will automatically go to the charging area to charge. Please refer to the "Software User Guide" .

⚠️ **Notice**

② The robot receives the charging task and autonomously navigates to the charging area to dock with the charging pile;

③ The robot enters the charging state, and the status light turns blue and circulates like water.

5.9 Position calibration

The position of the robot can be re-calibrated in the following four ways: reset-point reset, manual reset, QR code reset and UWB quick reset.

⚠️ **Notice**

When resetting, please pay attention to the position and orientation of the robot and ensure that there is no load on the robot.

• **Reset-point reset**

Restore robot map position points.

① Set the robot mode switch to manual mode (M), push the robot to the reset point, and switch back to automatic mode (A);

② Press and hold the reset button on the robot;

③ The robot's voice prompts "Initialization successful" and the reset is successful.

• **Manual reset**

Manually calibrate robot position.

① Enter the AgileX Pro calibration page and manually adjust the robot map pose to reset;

• **Record coordinate point reset**

Robot position recorded automatically by the system

① The robot remains unchanged from the previous moment;

② Short press the reset button on the robot;

③ The robot's voice prompts "Initialization successful" and the reset is successful.

5.9.1 Perform tasks

After the robot is initialized, the status will switch to spare, and tasks need to be manually issued to the robot again. Please refer to the "Software User Guide".

5.10 Unloading cargo

- The loading and unloading operations of personnel or equipment must comply with local safe operating regulations;
- Do not perform any operations on the upper cargo while the robot is moving;
- Do not step on the robot or protect the cargo.

5.11 Turn off the power

① Make sure the robot is idle and in a suitable location for parking;
② Press and hold the power button on the robot for 1.5 seconds. The button light goes out and the robot status light goes out. Release the button and the power turns off.

5.12 Exception handling

5.12.1 Exception handling

Q1: The robot is blocked

Fault: If the transportation is interrupted due to unblocked roads and no space for avoidance while the robot is driving, the robot will enter a warning state and the status light will flash yellow;

Solution: Clear the obstacles around the robot, leaving a sufficient path for the robot to pass. After waiting for a few seconds, the robot will automatically resume work.

Q2: Robot positioning is lost

Failure: If the robot's positioning is lost due to environmental changes or other factors, the robot will enter a warning state, the status light will flash yellow, and a voice will be broadcast at the same time "The positioning is seriously lost and cannot be automatically repaired. Please re-calibrate";

Solution: Move the robot to the reset point to reset.

Q3: Robot emergency stop

Fault: Due to an emergency in the mission, the emergency stop button of the robot was pressed;

Solution: Move the robot to the reset point to reset.

Q4 : The tablet and robot task status do not match

Solution: Restart the AgileX Pro software or reconnect the robot IP, please refer to the "Software User Guide".

Q5 : The tablet cannot connect to the scheduling server

Solution: Restart the scheduling server.

5.12.2 Emergency Solution

When an emergency occurs, press the emergency stop button on the robot to stop the robot, and handle the robot in accordance with local safety procedures. If a fire occurs, use plenty of water to cool down and carbon dioxide to extinguish the fire.

The robot can be moved to a safe area in the following two ways:

① Switch the robot to manual mode (M), press the unlock button to push the robot or connect a wired controller to the robot to remotely control the robot ;

② After moving the robot to a safe site, please contact AgileX, we will contact you in the shortest possible time, according to the specific situation of the remote technical guidance operation and maintenance personnel to repair the robot, while developing an emergency plan to minimize the impact on your factory.

6 Maintenance

This chapter introduces the steps for daily maintenance and periodic inspection of Tracer200 .

⚠️ **WARNING**

Use the maintenance tools specified by AgileX to perform maintenance operations. Unsuitable tools can cause equipment damage or personal injury.

6.1 Safety instructions

⚠️ **WARNING : ELECTRICAL HAZARD**

If electronic components on the robot are not used safely in accordance with specifications, equipment damage or personal injury may result.

- Please do not use any charger provided by AgileX to charge the robot;
- Do not perform any operations on the internal parts of the robot while it is charging;
- If liquid is spilled on the robot, power off the robot, remove all liquid, and allow the robot to dry completely before restoring power.

⚠️ **WARNING : Scald Hazard**

While the robot is operating, drive components dissipate heat and direct contact may result in a risk of burns.

- Wait for the robot to cool down completely before performing maintenance operations.

6.2   Daily maintenance

Please perform maintenance on Tracer200 and its working environment on time according to the maintenance cycle.

Workspace maintenance:

part	Maintenance tasks	Period
Ground	Clear the work area floor of any foreign objects (such as dust, ice, standing water, etc.) that will interfere with the robot's navigation. Pay special attention to the robot's storage location and frequently traveled roads.	Daily

Map	Update the map immediately when obstacles or special obstacles are added to the workspace (see Analyzing the Environment)	Daily
Ground markings	Check that the floor markings are complete and reimburse them if they are severely worn.	Per month

robot:

Depth Camera — Front LiDAR — LED — Maually Charging Port — WIFI Antenna — Reset Camera — Back LiDAR — Collison Detection — Automatic charging port

 Notice

Do not use organic solvents to clean any part of the robot. The solution may damage electronic equipment and cause damage to the robot.

Part	Maintenance tasks	Period
Robot shell	Use compressed air or a damp cloth to wipe the outside of the robot to make sure the outer shell is clean and free of foreign matter. ⚠ **Warning: Equipment damaged** While the robot is operating, drivetrain components dissipate heat and direct contact may result in a risk of burns.	weekly
LiDAR	Dust particles may be attracted to the optical lens cover due to static electricity. Clean the optical lens cover regularly and if it is dirty. Dampen a soft, clean cloth with anti-static plastic cleaner and wipe the optics cover.	3 months/occasionally
Driven wheel	Wipe away dust with a damp cloth and use a small shovel to clean debris if necessary. Make sure there are no foreign objects or threads wrapped around the wheel.	weekly
Driving wheel	Wipe away dust with a damp cloth and use a small shovel to clean debris if necessary. Make sure there are no foreign objects or threads wrapped around the wheel.	weekly

LED light strip	LED strip on the robot lights up normally.	weekly

Software:

Keep the running environment system version unchanged after installing the robot application software.

6.3 Regular maintenance

Please check Tracer200 on time according to the maintenance cycle to avoid equipment damage caused by aging of components.

⚠️ **Notice**

Before performing maintenance operations, please move the robot to a spacious ground to ensure there is enough space for maintenance.

⚠️ **WARNING: Equipment damage/personal injury**

Before performing certain maintenance operations, you need to turn off the power of the robot to avoid danger during the maintenance process.

part	Maintenance tasks	Period
Top cover	Check whether the top cover plate is installed smoothly and the connection is intact.	Check monthly and replace as needed.
driven wheel	Check the wheel surface for wear.	Inspect every six months and replace as needed.
driving wheel	Check the wheel surface for wear.	Inspect every six months and replace as needed.
lidar	Check the optical lens cover for damage such as cracks or scratches.	Replace as needed .
emergency button	Check whether the emergency stop button is working properly. Press the emergency stop button and check whether the robot has implemented an emergency stop and the status light flashes red.	Inspect every three to four months according to EN /ISO 13850 Machinery Safety - Emergency Stop Function.
depth camera	Inspect the mirror for visible damage, such as cracks or scratches.	Check monthly and replace as needed.
LED light _	Check whether the robot LED strip status display is normal.	Check every three to four months and obtain technical support as needed.

Voice broadcast	Check whether the robot's voice warning broadcast is normal.	Check every three to four months and obtain technical support as needed.
Unlock button	Check if the unlock button is working properly. Switch the robot to manual mode (M), press the unlock button and push, press the button again after the test is completed.	Check monthly and replace as needed.
Warning signs	Check whether the warning signs on the robot are clear and legible.	Inspect every six months and replace as needed.
Work area safety markings	Check that robot-related safety markings in the work area are clearly legible.	Inspect every six months and replace as needed.

⚠ Notice

Users cannot repair damaged parts by themselves. If you need to replace them, please contact AgileX.

6.4 Battery maintenance

part	Maintenance tasks	cycle
Battery	Check whether the battery in storage or in use is damaged or leaking; if the battery has been stored for a long time, please fully charge the battery every three months;	every half year

⚠ Notice

•The battery is expected to last for 300 cycles. If it needs to be replaced, please contact AgileX;

•Once the battery has been decommissioned, dispose of it in accordance with all local environmental laws governing electronic components.

Storage temperature and humidity range

- Short term (more than one month): -20~+55℃, 45~85%RH

- Mid-term (more than three months): -20~+45℃, 45~85%RH

- Long term (more than one year): -5~+30℃, 45~85%RH

Please store the battery in a cool, dry, ventilated environment with small temperature changes.

6.5 Packaging and transportation

Please use the original robot or the transport box confirmed by AgileX to transport the robot to prevent impact and vibration from damaging the robot during transportation.

Please ensure that the robot power supply and DC circuit breaker power supply are turned off before transportation.

⚠ **Notice**

Make sure the robot is always stored upright when transporting to avoid damage to internal components.

7 Appendix

7.1 Hardware interface

content	describe	quantity
USB Type - A	For peripheral connection (one each for USB 2.0 and USB 3.0)	2
USBType - B	Used for lower computer debugging connection	1
Debug interface	For debugging (network port)	1

⚠ **Notice**

Before using the electrical interface, please read the safety instructions in Chapter 2 .

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