

# AGIQUAD D1 MaxPro

## SDK Development Guide



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## Document Revision History

| Revision Date | Revision Details                                                                                                                                                            | Version |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 2025-10-22    | Add sceneNo(Map's name) field                                                                                                                                               | V2.0.0  |
| 2025-10-23    | Added message—send point cloud initial position to robot                                                                                                                    | V2.0.1  |
| 2025-10-27    | Added locationType and locationStatus fields, marked robot task initial positioning status, robot returns positioning status information                                    | V2.0.2  |
| 2025-11-12    | Added the positioning status of the robot returning to the initial position, pan-tilt control commands, charging pile control commands, and pan-tilt photo-taking commands. | V2.0.3  |
| 2025-11-17    | Added the command for sending pan-tilt preset points.                                                                                                                       | V2.0.4  |
| 2025-12-20    | Added the MQTT Cloud Platform Integration Guide.                                                                                                                            | V2.0.5  |

# I、Product Introduction

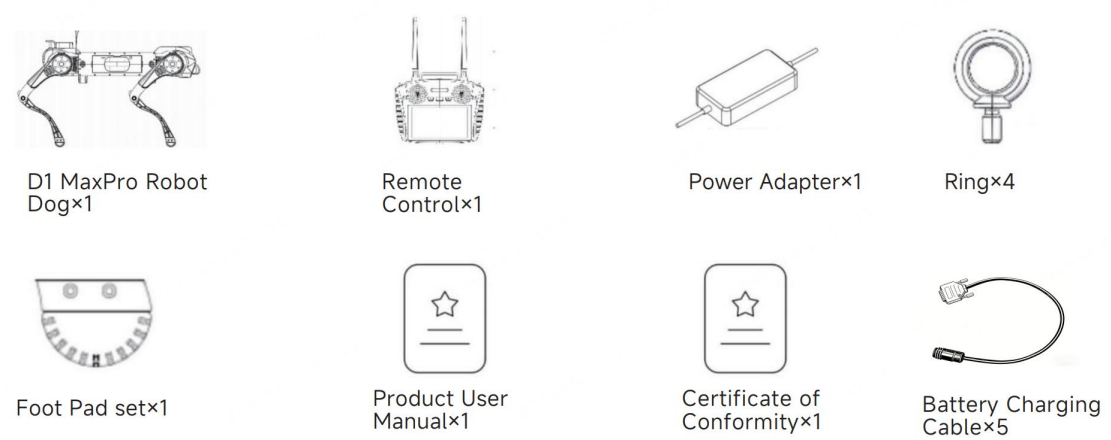
## 1.1 Product Overview

AGIBOT D1 MaxPro equipped with 3 motors on each leg, the AGIBOT Quadruped Robot D1 MaxPro features 12 degrees of freedom and boasts locomotion capabilities including walking, trotting, stair climbing, and trench crossing. The product's core strengths lie in its high load capacity, long battery life, and exceptional adaptability to complex terrains. Meanwhile, it opens up the SDK for motion control algorithm development and communication protocols, enabling users to conduct secondary development as needed. Remarkable progress has been achieved in the R&D of several key functions and applications, as detailed below:

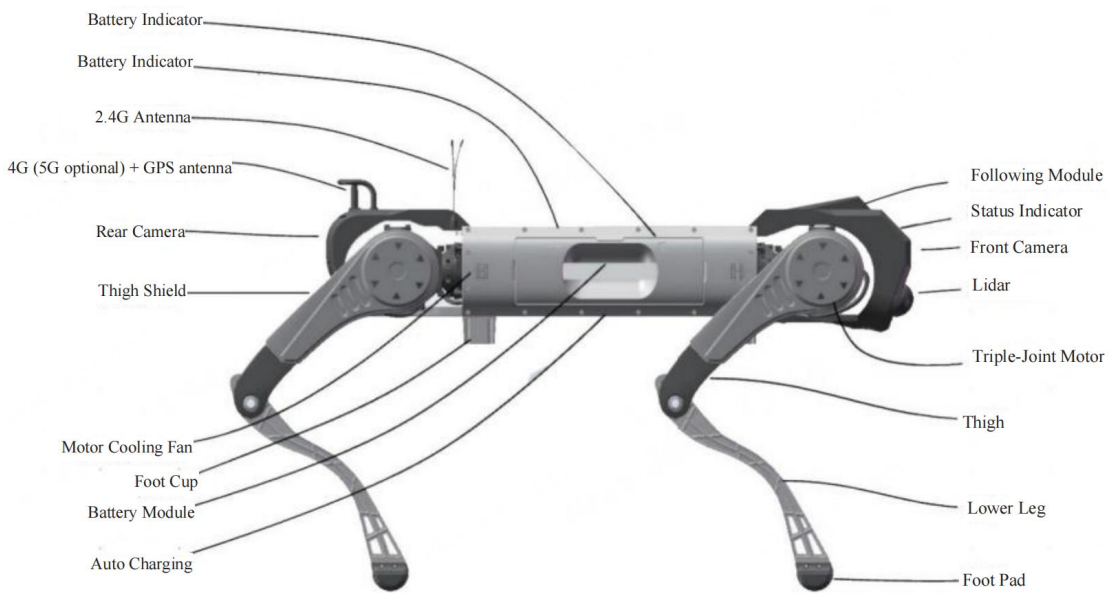
1. **Load Capacity:** High load capacity is the flagship feature of the D1 MaxPro. It can sustain a long-term load of up to 50 kg and an instantaneous load of as high as 100 kg, representing a 2.5-fold increase in load capacity compared to its predecessor. This performance meets the requirements of heavy-duty scenarios such as material transportation and industrial handling.
2. **Autonomous Patrol and Environmental Perception:** The robot can achieve autonomous patrol via LiDAR, and realize remote deployment and video feed transmission through 4G networks. It is also integrated with a rich suite of sensors including LiDAR, a head-mounted camera, an IMU (Inertial Measurement Unit), and GPS. These enable comprehensive environmental perception in complex settings, as well as map construction and path planning, making the robot suitable for applications in diverse scenarios such as public security patrols, water conservancy inspections, and petroleum pipeline inspections.
3. **Motion Performance:** Boasting outstanding locomotion flexibility, the D1 MaxPro can nimbly ascend and descend stairs with a 45° incline and stably climb hollow industrial stairs. It excels in obstacle surmounting, capable of crossing single steps up to 30 cm in height. Its mature fall recovery mechanism allows it to get back on its feet in less than 20 seconds, enabling rapid resumption of operations in complex terrains or unexpected situations. With a no-load speed of 3 m/s, it can respond quickly to emergency tasks and access complex scenarios and operational blind spots.
4. **Environmental Adaptability:** The robot holds an IP67 industrial-grade protection rating, enabling normal operation in a wide temperature range from -20°C to 55°C and in water up to 20 cm deep. It is resistant to extreme cold, intense heat, wind, and rain, ensuring stable performance under various harsh natural conditions.
5. **Battery Life Assurance:** Equipped with a 2160Wh battery, the D1 MaxPro sees a 28% improvement in load endurance time. Additionally, the battery supports quick on-site disassembly and replacement, providing robust power support for special tasks and emergency situations in industrial applications, reducing downtime

and enhancing work efficiency.

1.2 Product list



1.3 Hardware components



1.4 Product parameters

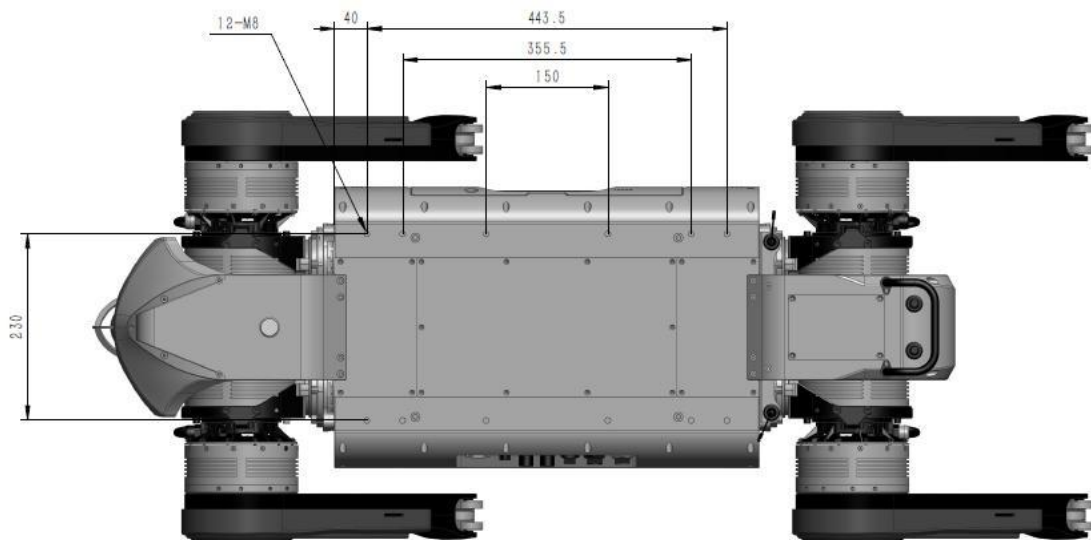
| Cat.             | Items                                       | Parameters             |
|------------------|---------------------------------------------|------------------------|
| Basic Parameters | Name                                        | D1 MaxPro              |
|                  | Standing dimensions (length, width, height) | 1270mm x 520mm x 730mm |

|                          |                                                  |                                                                                                                                                                                                                                   |
|--------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | Lying down dimensions<br>(length, width, height) | 1360mm x 570mm x 300mm                                                                                                                                                                                                            |
|                          | Weight                                           | 68±1kg                                                                                                                                                                                                                            |
| Electrical<br>Parameters | Battery Power                                    | 2081Wh                                                                                                                                                                                                                            |
|                          | Battery Voltage                                  | 48V                                                                                                                                                                                                                               |
|                          | Battery Capacity                                 | 45Ah                                                                                                                                                                                                                              |
|                          | Charging Time                                    | 4.5h (Optional 2h)                                                                                                                                                                                                                |
|                          | Battery Replacement                              | ✓                                                                                                                                                                                                                                 |
|                          | Autonomous Charging                              | Optional selection                                                                                                                                                                                                                |
| Motion<br>Parameters     | Continuous Walking Speed                         | 1.2m/s                                                                                                                                                                                                                            |
|                          | Sprint Speed                                     | 3m/s                                                                                                                                                                                                                              |
|                          | Continuous Walking Endurance (No-Load)           | 5.5h                                                                                                                                                                                                                              |
|                          | Continuous Walking Endurance (Loaded)            | 2.5h                                                                                                                                                                                                                              |
|                          | Continuous Load                                  | 50kg                                                                                                                                                                                                                              |
|                          | Instantaneous Load                               | 100kg                                                                                                                                                                                                                             |
|                          | Climbable Step Height                            | 30cm                                                                                                                                                                                                                              |
|                          | Climbable Incline Angle                          | 45°                                                                                                                                                                                                                               |
| Sensor<br>Parameters     | Wide-Angle Camera                                | <p>Front Camera: Resolution 1920x1080, Frame Rate 30fps, Horizontal Field of View (HFOV) 122°, Vertical Field of View (VFOV) 64.5°</p> <p>Rear Camera: Resolution 1080P, Frame Rate 30fps, Diagonal Field of View (DFOV) 120°</p> |

|                          |                                                                            |                                           |
|--------------------------|----------------------------------------------------------------------------|-------------------------------------------|
|                          | LiDAR                                                                      | 1 x Airy 96-channel LiDAR (front-mounted) |
| Optional Features        | Autonomous Navigation, Dual-Light Gimbal, Ad Hoc Network, Following Module | 1                                         |
| Environmental Parameters | Dust and Water Resistance                                                  | IP67                                      |
|                          | Operating Temperature                                                      | -20~55℃                                   |

## 1.5 Mounting Hole Layout for Upper Payload

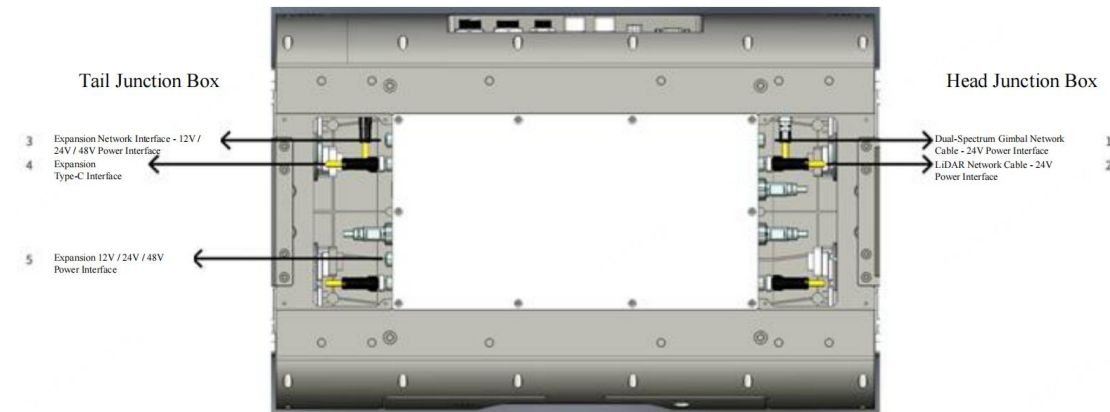
- The D1 MaxPro is equipped with an adaptive load function, supporting an additional payload range of 0 to 50 kg.
- Corresponding screw holes are provided on the D1 MaxPro's body. Users can fabricate their own fixtures based on these screw holes to secure upper payload devices. The dimension drawing is shown below.



When adding a payload, the D1MaxPro must be in a prone position. Mount the payload and secure it firmly. Then, switch the D1MaxPro to a standing position, and it will automatically detect the payload weight. After a 3-second wait, the payload weight detection will be completed, and other operations can be performed.

## 1.6 Electrical Expansion Interfaces

### 1.6.1 Definition of Rear Interfaces



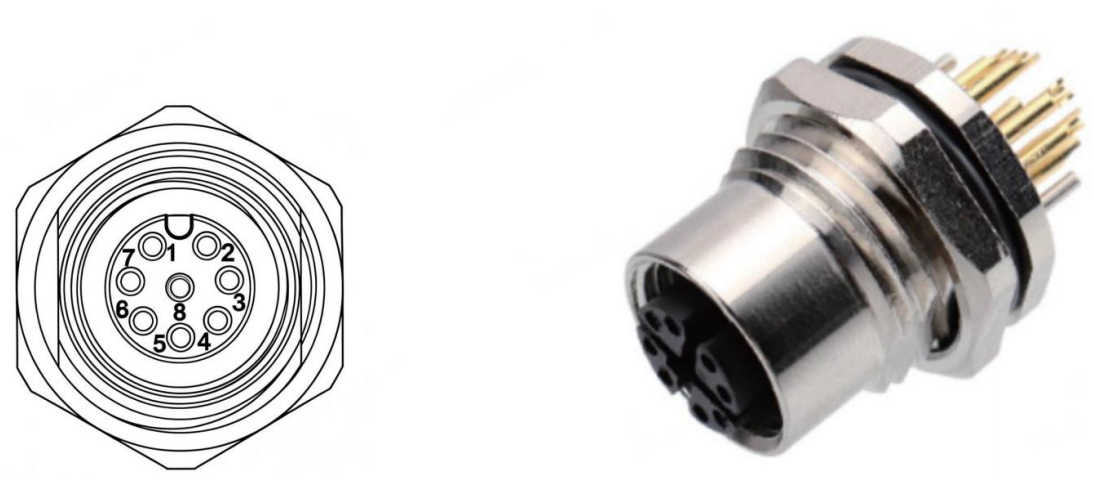
Note: The rear interfaces mainly consist of two modules: the head communication junction box and the tail power junction box.

| N O. | Interface                      | Interface Type              | Mating Connector Model | Quantity | Function                                                                            |
|------|--------------------------------|-----------------------------|------------------------|----------|-------------------------------------------------------------------------------------|
| 1    | Dual-Spectrum Gimbal Interface | M12A-8P Female              | M12A-8P Male           | 1        | Connects to head-mounted dual-spectrum gimbal communication; 12V and 24V/1.5A power |
| 2    | LiDAR Interface                | M12A-8P Female              | M12A-8P Male           | 1        | Connects to upper-mounted LiDAR communication; 24V/2A power supply                  |
| 3    | Expansion Network Interface    | M12A-17P Female             | M12A-17P Male          | 1        | Connects to expansion network cable; 12V, 24V, 48V/1.5A power                       |
| 4    | Expansion Type-C Interface     | Type-C Waterproof of Socket | USB Type-C             | 1        | Expands to USB 3.1 interface, 10Gbps                                                |

|   |                                   |             |           |   |                                                                     |
|---|-----------------------------------|-------------|-----------|---|---------------------------------------------------------------------|
| 5 | 12V, 24V, 48V/15A Power Interface | M12K Female | M12K Male | 1 | Provides power to upper-mounted equipment; 12V, 24V, 48V/10A output |
|---|-----------------------------------|-------------|-----------|---|---------------------------------------------------------------------|

1. Head Junction Box — M12A-8P Female Aviation Connector

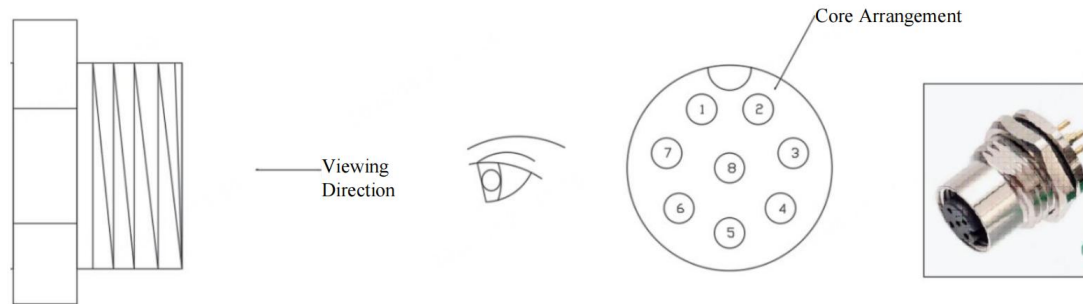
Dual-Spectrum Gimbal Network CablePin Definition



| M12A Female Pin No. | Definition | RJ45 Pin No. | Function               |
|---------------------|------------|--------------|------------------------|
| 1                   | 24V +      |              | 24V Power Positive     |
| 2                   | RX+        | 1            | Data Receive Positive  |
| 3                   | RX-        | 2            | Data Receive Negative  |
| 4                   | TX+        | 3            | Data Transmit Negative |
| 5                   | TX-        | 6            | Data Transmit Negative |
| 6                   | NC         |              |                        |
| 7                   | NC         |              |                        |
| 8                   | 24V -      |              | 24V Power Negative     |

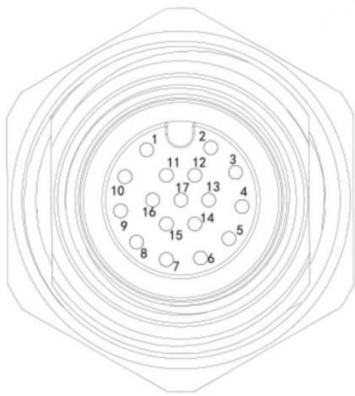
## 2. Head Junction Box - M12A-8P Female Aviation Connector

### LiDAR Network Cable Pin Definition



| M12A Female Pin No. | Definition | RJ45 Connector Pin No. | Function               |
|---------------------|------------|------------------------|------------------------|
| 1                   | 24V +      |                        | 24V Power Positive     |
| 2                   | RX+        | 1                      | Data Receive Positive  |
| 3                   | RX-        | 2                      | Data Receive Negative  |
| 4                   | TX+        | 3                      | Data Transmit Positive |
| 5                   | TX-        | 6                      | Data Transmit Negative |
| 6                   | NC         |                        |                        |
| 7                   | NC         |                        |                        |
| 8                   | 24V -      |                        | 24V Power Negative     |

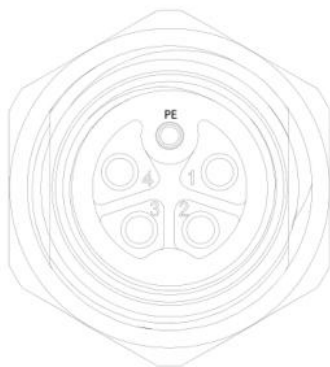
### 3. Tail Junction Box — M12A-17P Female Aviation Connector Pin Definition



| M12AFemale Pin No. | Definition | RJ45 Connector Pin No. | Function               |
|--------------------|------------|------------------------|------------------------|
| 1                  | 48V+       |                        | 48VPower Positive      |
| 2                  | RX+        | 1                      | Data Receive Positive  |
| 3                  | RX-        | 2                      | Data Receive Negative  |
| 4                  | TX+        | 3                      | Data Transmit Positive |
| 5                  | TX-        | 6                      | Data Transmit Negative |
| 6                  | 12V+       |                        | 12VPower Positive      |
| 7                  | 12V-       |                        | 12VPower Negative      |
| 8                  | 12V+       |                        | 12VPower Positive      |
| 9                  | 12V-       |                        | 12VPower Negative      |
| 10                 | 24V+       |                        | 24VPower Positive      |
| 11                 | 24V-       |                        | 24VPower Negative      |
| 12                 | 24V+       |                        | 24VPower Positive      |
| 13                 | 24V-       |                        | 24VPower Negative      |

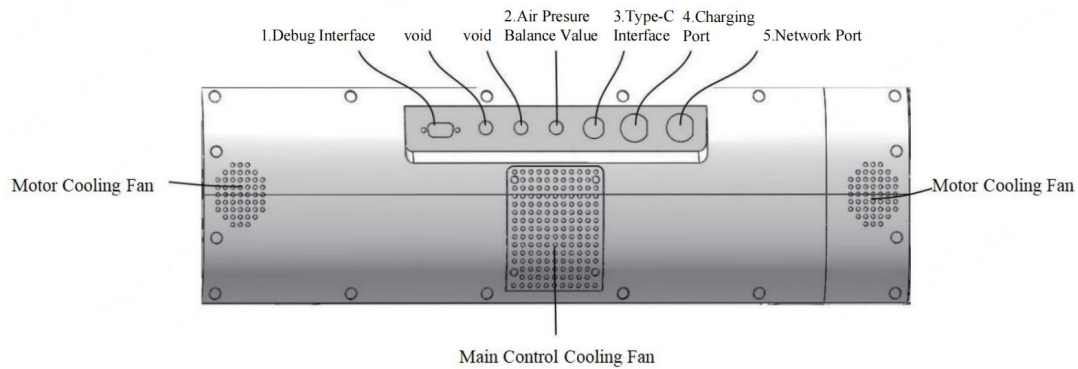
|    |      |  |                   |
|----|------|--|-------------------|
| 14 | 48V+ |  | 48VPower Positive |
| 15 | 48V- |  | 48VPower Negative |
| 16 | 48V+ |  | 48VPower Positive |
| 17 | 48V- |  | 48VPower Negative |

#### 4. Tail Power M12K Interface Definition



| M12AFe<br>male Pin<br>No. | Definiti<br>on | RJ45<br>Connector<br>Pin No. | Function             |
|---------------------------|----------------|------------------------------|----------------------|
| 1                         | 48V+           |                              | 48VPower Positive    |
| 2                         | 48V-           |                              | 48VPower Negative    |
| 3                         | 24V+           |                              | 24VPower Positive    |
| 4                         | 24\12V-        |                              | 24\12VPower Negative |
| 5                         | 12V+           |                              | 12VPower Positive    |

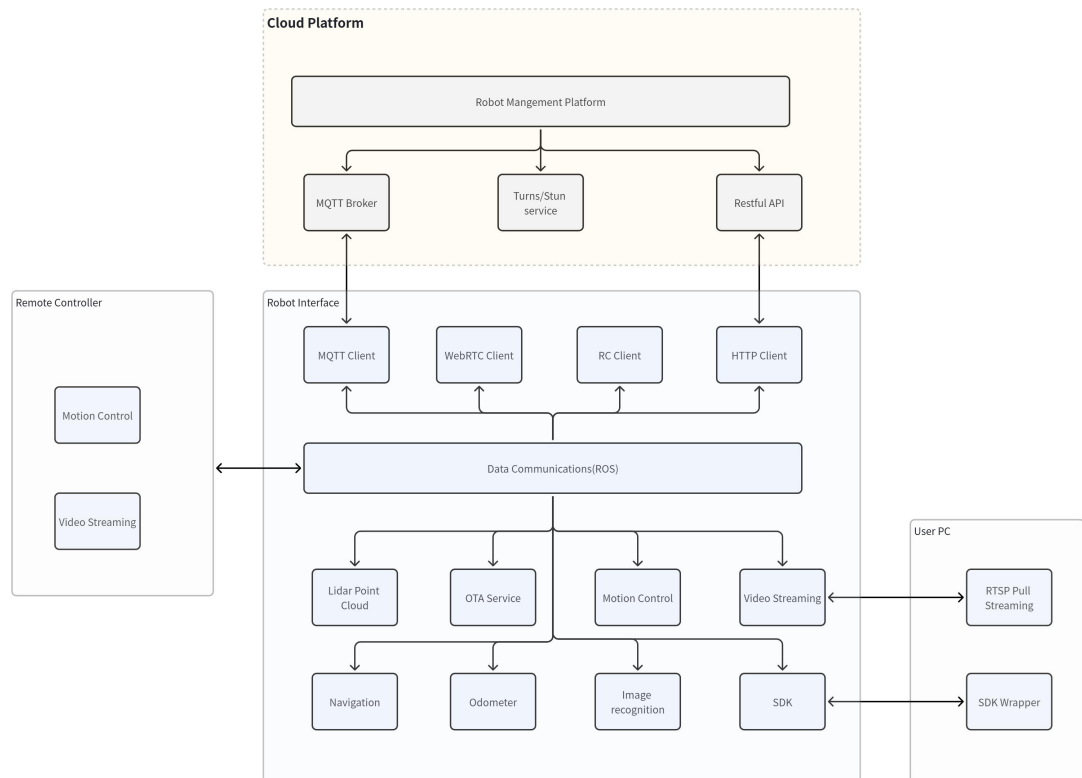
## 1.6.2 Pinout Definition for Left-Side Interfaces



| No. | Device Name                | Model                      | Function                                                         |
|-----|----------------------------|----------------------------|------------------------------------------------------------------|
| 1   | Debug Interface            | DB15 Female                | Motor CAN diagnosis, Battery CAN diagnosis, Debug emergency stop |
| 2   | Air Pressure Balance Valve | M12                        | Balances internal and external air pressure                      |
| 3   | Type-C Interface           | E10T-FT3-PWF/MT3-NWA-xxFPC | Type-C interface communication with main control board           |
| 4   | Charging Port              | E13T-P2B-PPF-01            | 48V charging port                                                |
| 5   | Network Port               | E13T-FR5-PRF-180           | 100M Ethernet port /Debug network port                           |

## II. System Architecture

### AGI MaxPro System Architecture



1. The **MQTT Client** is responsible for MQTT-based communication with the cloud platform, enabling functions including OTA updates, status reporting, and remote control.
2. The **WebRTC Client** communicates with the TURN/STUN services of the APP and cloud platform, and is in charge of video streaming and point cloud retrieval.
3. The **RC Client** communicates with the remote controller to implement wireless remote control.
4. The **HTTP Client** communicates with the platform side to realize upgrade package download, log upload, map upload, and other functions.
5. Video streaming is performed via **RTSP**.
6. **ROS Topic** is adopted for internal communication.

#### Cloud Platform

1. **MQTT** is used to establish a persistent connection after the D1 MaxPro is powered on, and is responsible for receiving reported statuses and heartbeats, as well as issuing commands (e.g., OTA, WebRTC).

2. **RESTful API** provides platform services to the outside, and also offers functions such as user and device management for the APP.
3. **TURN/STUN** services are used to establish WebRTC-based peer-to-peer (P2P) connections for P2P video streaming (falling back to server forwarding when a peer-to-peer connection cannot be established).
4. The **Command and Control System/Robot Management Platform** provides full lifecycle management of the robot, as well as functions including OTA, map editing, remote monitoring/control, and task management.

### Remote Controller

1. **Motion Control:** Communicates with the **RC Client** on the device side to provide wireless remote control functionality based on 2.4GHz.
2. **Video Streaming:** Implements video streaming based on **RTSP**.

## III. SDK Development Guide

### 3.1 SDK Overview

- This document describes the Software Development Kit (SDK) for D1 MaxPro, which encapsulates the capabilities of the D1 MaxPro (including high-level motion control, low-level motor/joint control, video transmission, point cloud, odometry, etc.), facilitating secondary development for users with certain development capabilities.
- Each chapter introduces the calling methods of different service interfaces, the standard format definitions of data input/output, and some functional development examples respectively.
- The interface definitions are subject to changes according to the mass production and development status, and shall prevail by the latest version of the interface definition document.
- A specific protocol is used for communication between the SDK program and the internal program of the D1 MaxPro. Therefore, there are differences in communication between different versions of the SDK program and the internal program of the D1 MaxPro. Please select the corresponding version of the SDK program according to the device version. If conditions permit, it is recommended to update the internal program of the D1 MaxPro to the latest version for better compatibility.
- When controlling via SDK interfaces, all states are designed and specified by the secondary developer, and the native motion control system will not perform additional intervention or state transition.
- When running the SDK, ensure that the system has sufficient resources;

otherwise, the motion control module may fail.

### 3.2 Environment Dependencies

Development is recommended to be carried out on Ubuntu 20.04; Mac and Windows systems are not supported for development temporarily.

- The **high-level development SDK** does not require the installation of the ROS1 system.
- The **low-level development SDK** requires the mandatory installation of the ROS1 system.

### 3.3 Network Configuration

- The user's development computer can connect to the robot dog via wireless, wired, and Type-C port.
- Note: Do not set the IP address of the user's development computer to be the same as that of the robot dog to avoid conflicts.
- After configuration, you can use the `ifconfig` command to check the IP address of the development computer, and use the `ping` command to confirm the network connectivity.

| Network Interface | D1 MaxPro IP Address | DHCP |
|-------------------|----------------------|------|
| Wireless Network  | 192.168.12.1         | ✓    |
| Wired Network     | 192.168.144.3        | ✗    |
| Type-C            | 192.168.55.1         | ✗    |

**Wi-Fi Name:** lxai (followed by the robot serial number, e.g., lxai2-3)

**Wi-Fi Password:** lxai2024

The device provides SSH login functionality. After establishing a connection with the device via wireless or wired network, you can log in to the device through SSH.

```
Plain Text
#Wireless connection method
ssh jetson@192.168.12.1      #pw:lxai2023
#Wired connection method
ssh jetson@192.168.144.3    #pw:lxai2023
#type-C connection method
```

```
ssh jetson@192.168.55.1    #pw:lxai2023
```

### 3.4 SDK Acquisition

The SDK currently supports TCP-based communication and offers SDK packages for both X86 and ARM architectures. The invocation methods for high-level and low-level interfaces differ. Depending on your specific requirements, please first check the version number, capture a screenshot, and forward it to our technical support team to receive the appropriate SDK package.

Note: As the SDK is continuously iterated and upgraded, please refer to the latest SDK received.

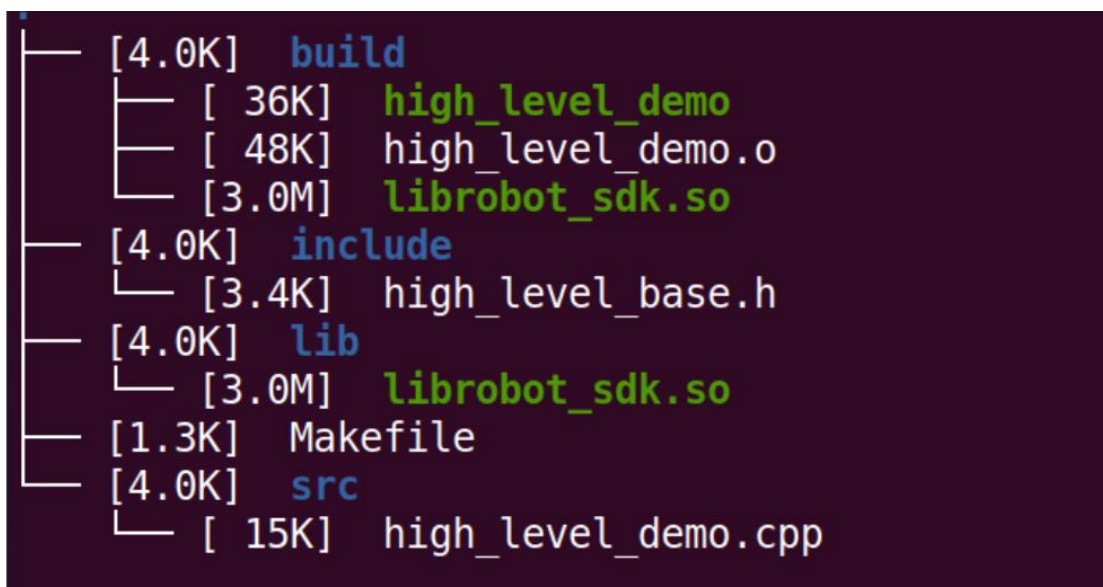
Obtain via the following GitHub repository

```
Plain Text  
git clone https://github.com/AgibotTech/Agibot_D1_MaxPro.git
```

### 3.5 SDK Installation and Compilation

#### Case 1: High-level SDK Installation

Different SDK files will be provided based on whether the ROS1 system is installed in the user's development environment. The ZIP file (for the environment with ROS1 installed) has the following directory structure after decompression:



Execute the following commands; after successful compilation, you can run the provided demo program `high_level_demo.cpp`.

Bash

```
make clean
make -j6
./high_level_demo
```

The ZIP file (for the environment without ROS1 installed) has the following directory structure after decompression:

```
├── [4.0K]  build
│   ├── [ 44K]  high_level_remote_tcp_client_test
│   └── [1.2M]  libhigh_level_remote_tcp_client.so
├── [ 415]  build.sh
├── [4.0K]  include
│   └── [3.4K]  high_level_base.h
├── [4.0K]  src
│   └── [ 15K]  high_level_remote_tcp_client_test.cpp
```

Execute the `build.sh` script, then you can run the provided demo program `high_level_remote_tcp_client_test.cpp`.

Bash

```
./build.sh
./high_level_remote_tcp_client_test
```

## Case 2: Low-level SDK Installation

Unlike the high-level SDK, the low-level SDK does not rely on dynamic library development. Users only need to write their own programs, subscribe to the `rt/lowstate` topic and publish to the `rt/lowcmd` topic to implement control.

## IV. API Function Introduction

### 4.1 HighLevel Function Introduction

The high-level motion control interface enables control of the robot dog's posture, speed, walking, specific movements, and other aspects, and can also retrieve the relevant status of the robot dog.

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | Standup                                                                                               |
| Function Prototype | int32_t Standup()                                                                                     |
| Function Overview  | standup                                                                                               |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | Getdown                                                                                               |
| Function Prototype | int32_t Getdown()                                                                                     |
| Function Overview  | get down                                                                                              |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                      |
|--------------------|----------------------|
| Function Name      | ZeroTorque           |
| Function Prototype | int32_t ZeroTorque() |
| Function Overview  | Zero Torque mode     |
| Function Overview  | none                 |

|              |                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------|
| Return Value | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks      |                                                                                                       |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | Damp                                                                                                  |
| Function Prototype | int32_t Damp()                                                                                        |
| Function Overview  | damping                                                                                               |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | Highknee                                                                                              |
| Function Prototype | int32_t Highknee(bool val)                                                                            |
| Function Overview  | Gait Reinforcement Learning Mode Switch                                                               |
| Function Overview  | val: Normal mode -0; Highknee-1                                                                       |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| Function Name      | Move                                                             |
| Function Prototype | int32_t Move(float lm, float vm, float lrm, bool continous_move) |
| Function Overview  | Move continuously forward, backward, left, and right             |
| Function Overview  | lm:Lateral movement<br>right:[0,0.4](m/s)                        |

|              |                                                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | left:[-0.4,0](m/s)<br>vm:Forward/Backward Movement<br>Forward:[0,1.5](m/s)<br>Backward:[-0.5,0](m/s)<br>lrm:Left/Right Turning<br>Right:[0,0.5](rad/s)<br>Left:[-0.5,0](rad/s)<br>continous_move:<br>Keep moving all the time : true<br>Move for one second: false |
| Return Value | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                                                                                                                                                              |
| Remarks      | When continous_move is false, the effect is the same as that of the int32_tMove(float lm, float vm, float lrm) interface.<br>When continous_move is true, modifying the speed parameters will take effect immediately.                                             |

|                    |                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | Rotate_up_and_down                                                                                                                                |
| Function Prototype | int32_t Rotate_up_and_down(float udm, float ang)                                                                                                  |
| Function Overview  | Pitch Control                                                                                                                                     |
| Function Overview  | udm:<br>Turning Speed[0.042,0.2](rad/s)<br>ang:<br>angle[-14,11]<br>-x indicates looking up by x degrees<br>x indicates looking down by x degrees |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                                             |
| Remarks            |                                                                                                                                                   |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | StopMove                                                                                              |
| Function Prototype | int32_t StopMove()                                                                                    |
| Function Overview  | stop moving                                                                                           |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            | Set the speed command to zero                                                                         |

|                    |                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | ContinuousGait                                                                                                                                                                 |
| Function Prototype | int32_t ContinuousGait(bool flag)                                                                                                                                              |
| Function Overview  | Continue moving                                                                                                                                                                |
| Function Overview  | flag: Set to true to enable, false to disable.                                                                                                                                 |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                                                                          |
| Remarks            | Calling the Move function will make the robot dog move for 1 second and then stop automatically. You can use this function to control whether continuous movement is required. |

|                    |                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetActionStatus                                                                                                                                                                           |
| Function Prototype | int32_t GetActionStatus()                                                                                                                                                                 |
| Function Overview  | Robot Motion Status                                                                                                                                                                       |
| Function Overview  | None                                                                                                                                                                                      |
| Return Value       | <p>Unloading state: 0 ;</p> <p>Recovering to Standing (automatically switches to Balanced Standing after completion): 2</p> <p>Balanced Standing State: 3 ;</p> <p>Damping State: 5 ;</p> |

|         |                                                                                                                                       |
|---------|---------------------------------------------------------------------------------------------------------------------------------------|
|         | Walking State: 6 ;<br><br>Lying Down Process (automatically switches to Damping State after completion): 7;<br><br>Unknown State: -1; |
| Remarks |                                                                                                                                       |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | MoveForward                                                                                           |
| Function Prototype | int32_t MoveForward(float distance)                                                                   |
| Function Overview  | Move by Specified Distance (Forward/Backward)                                                         |
| Function Overview  | distance:Distance of movement                                                                         |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            | To be implemented                                                                                     |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | MoveSideways                                                                                          |
| Function Prototype | int32_t MoveSideways(float distance)                                                                  |
| Function Overview  | Move by Specified Distance (right/left)                                                               |
| Function Overview  | distance:Distance of movement                                                                         |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            | To be implemented                                                                                     |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | FinishMovement                                                                                        |
| Function Prototype | int32_t FinishMovement()                                                                              |
| Function Overview  | End the movement action                                                                               |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            | To be implemented                                                                                     |

|                    |                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetAngle                                                                                                                                 |
| Function Prototype | float GetAngle()                                                                                                                         |
| Function Overview  | Get the tilt angle of the robot dog                                                                                                      |
| Function Overview  | none                                                                                                                                     |
| Return Value       | Returns the tilt angle of the robot dog if the call is successful<br>Maximum upward tilt angle : 14°<br>Maximum downward tilt angle: 11° |
| Remarks            | - Negative values: upward tilt<br>- Positive values: downward tilt<br>- Value range: [-14, 11]                                           |

|                    |                                          |
|--------------------|------------------------------------------|
| Function Name      | GetSideways                              |
| Function Prototype | float GetSideways()                      |
| Function Overview  | Get the left and right movement distance |
| Function Overview  | none                                     |

|              |                                                                             |
|--------------|-----------------------------------------------------------------------------|
| Return Value | A successful call returns the left and right movement distance of the robot |
| Remarks      | To be implemented                                                           |

|                    |                                                                              |
|--------------------|------------------------------------------------------------------------------|
| Function Name      | GetForward                                                                   |
| Function Prototype | float GetForward()                                                           |
| Function Overview  | Obtain the forward and backward movement distance                            |
| Function Overview  | none                                                                         |
| Return Value       | A successful call returns the distance the robot moves forward and backward. |
| Remarks            | To be implemented                                                            |

|                    |                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | ParameterAdjustmentMode                                                                                                                                                    |
| Function Prototype | int32_t ParameterAdjustmentMode(bool flag)                                                                                                                                 |
| Function Overview  | Parameter Adjustment Mode                                                                                                                                                  |
| Function Overview  | flag:<br>- true: Enable height/speed control<br>- false: Disable height/speed control                                                                                      |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                                                                      |
| Remarks            | Setting height and speed parameters must first set this interface to true to take effect.Setting to false will restore the robot dog's speed and height to default values. |

|                    |                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotStatus                                                                                                                                                                                                                                                                                                                        |
| Function Prototype | struct Robotstate GetRobotStatus()                                                                                                                                                                                                                                                                                                    |
| Function Overview  | Get the state of the robot                                                                                                                                                                                                                                                                                                            |
| Function Overview  | none                                                                                                                                                                                                                                                                                                                                  |
| Return Value       | <p>A successful call returns the motor temperature and power level</p> <pre> struct Robotstate {     double driver_temperature[12]; // Motor temperature Each of the four feet has 3 motors. 0-2 are for foot 1, 3-5 are for foot 2, 6-8 are for foot 3, and 9-11 are for foot 4.     u_char batterySoc; // battery level % }; </pre> |
| Remarks            |                                                                                                                                                                                                                                                                                                                                       |

|                    |                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotSpeed                                                                                                                                                                                                                                                                          |
| Function Prototype | struct Robotspeed GetRobotSpeed()                                                                                                                                                                                                                                                      |
| Function Overview  | Obtain the speed and angular speed of the robot along the x, y, and z axes                                                                                                                                                                                                             |
| Function Overview  | none                                                                                                                                                                                                                                                                                   |
| Return Value       | <p>A successful call returns the speed of the robot</p> <pre> struct Robotspeed {     float body_x; // robot x-axis speed (m/s)     float body_y; // robot y-axis speed (m/s)     float body_z; // robot z-axis speed (m/s)     float body_ang; // robot angular speed (m/s) }; </pre> |
| Remarks            |                                                                                                                                                                                                                                                                                        |

|                    |                                                  |
|--------------------|--------------------------------------------------|
| Function Name      | GetSdkVersion                                    |
| Function Prototype | float GetSdkVersion()                            |
| Function Overview  | Get Sdk Version                                  |
| Function Overview  | none                                             |
| Return Value       | A successful call returns the SDK version number |
| Remarks            |                                                  |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotCloudMapLocation                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Function Prototype | struct RobotCloudMapLocation GetRobotCloudMapLocation()                                                                                                                                                                                                                                                                                                                                                                                              |
| Function Overview  | Obtain positioning on the point cloud map                                                                                                                                                                                                                                                                                                                                                                                                            |
| Function Overview  | none                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Return Value       | <p>A successful call returns the position information in the coordinate system of the robot dog's point cloud map.</p> <pre> struct RobotCloudMapLocation{     float position_x;  //Coordinates in three-dimensional space     xyz(m)     float position_y;     float position_z;     float orientation_x; //Rotational attitude represented by     quaternions     float orientation_y;     float orientation_z;     float orientation_w; }; </pre> |
| Remarks            |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | StartRobotCharging                                                                                    |
| Function Prototype | int32_tStartRobotCharging()                                                                           |
| Function Overview  | start charging                                                                                        |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | StopRobotCharging                                                                                     |
| Function Prototype | int32_t StopRobotCharging()                                                                           |
| Function Overview  | stop charging                                                                                         |
| Function Overview  | none                                                                                                  |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            |                                                                                                       |

|                    |                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotBatteryStatus                                                                                                  |
| Function Prototype | struct RobotBatteryStatus GetRobotBatteryStatus()                                                                      |
| Function Overview  | Get battery level and charging status                                                                                  |
| Function Overview  | none                                                                                                                   |
| Return Value       | A successful call returns the battery level and charging status information of the robot<br>struct RobotBatteryStatus{ |

|         |                                                                                                          |
|---------|----------------------------------------------------------------------------------------------------------|
|         | <pre>int battery_percent; //Battery percentage: 0~100  bool is_charging; //whether is charging  };</pre> |
| Remarks |                                                                                                          |

|                    |                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotMapList                                                                                             |
| Function Prototype | std::vector<RobotMapInfo>GetRobotMapList()                                                                  |
| Function Overview  | Get the list of maps                                                                                        |
| Function Overview  | none                                                                                                        |
| Return Value       | <p>A successful call returns a list of maps</p> <pre>struct RobotMapInfo{     std::string map_name; }</pre> |
| Remarks            |                                                                                                             |

|                    |                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetRobotMapFiles                                                                                                                   |
| Function Prototype | int32_t GetRobotMapFiles(const std::string&map_name,const std::string&save_directory)                                              |
| Function Overview  | Get the map file                                                                                                                   |
| Function Overview  | <p>map_name: Map name (obtained via GetRobotMapList),</p> <p>save_directory: The local storage directory specified by the user</p> |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                              |
| Remarks            |                                                                                                                                    |

|                    |                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | SetNavigationChargingControl                                                                                                            |
| Function Prototype | int32_t SetNavigationChargingControl(bool flag)                                                                                         |
| Function Overview  | Set navigation and charging control switches                                                                                            |
| Function Overview  | flag:Set true to turn on, false to turn off                                                                                             |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                                   |
| Remarks            | Before using the start charging interface, you must set this interface to true; otherwise, the start charging interface cannot be used. |

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetSdkSwitch                                                                                                                                            |
| Function Prototype | int32_t GetSdkSwitch()                                                                                                                                  |
| Function Overview  | Get the state of the SDK switch control                                                                                                                 |
| Function Overview  | none                                                                                                                                                    |
| Return Value       | A successful call returns 0, indicating no control right;<br>returns 1, indicating having control right;<br>otherwise, returns the relevant error code; |
| Remarks            |                                                                                                                                                         |

|                    |                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------|
| Function Name      | JointLockMode                                                                                                        |
| Function Prototype | int32_t JointLockMode(bool val)                                                                                      |
| Function Overview  | Joint locking mode                                                                                                   |
| Function Overview  | val: Set true to turn on; set false to turn off                                                                      |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned.                |
| Remarks            | It is necessary to first call the int32_t Rotate_up_and_down() function to make the robot dog lean forward or pitch. |

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Function Name      | SwitchToRLMode                                                                                        |
| Function Prototype | int32_t SwitchRLMode(bool val)                                                                        |
| Function Overview  | Switch to reinforcement learning mode                                                                 |
| Function Overview  | val: Set true to turn on; set false to turn off                                                       |
| Return Value       | A return value of 0 indicates a successful call; otherwise, the corresponding error code is returned. |
| Remarks            | It has the same function as the Highknee() interface, and you can choose either one of them.          |

|                    |                                                                              |
|--------------------|------------------------------------------------------------------------------|
| Function Name      | GetRobotChargeResult                                                         |
| Function Prototype | int32_t GetRobotChargeResult()                                               |
| Function Overview  | Get the robot's charging status                                              |
| Function Overview  | none                                                                         |
| Return Value       | Returns the following values if the call is successful:<br>- 0: Not charging |

|         |                                                                                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | <ul style="list-style-type: none"> <li>- 1: Searching for charging pile</li> <li>- 2: Charging in progress</li> <li>- 3: Leaving charging pile</li> <li>- -1: Failed to search for charging pile</li> <li>- Other values: Corresponding exception codes</li> </ul> |
| Remarks |                                                                                                                                                                                                                                                                    |

|                    |                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Function Name      | GetNavigationChargingStatus                                                                                                                                                                                                          |
| Function Prototype | int32_t GetNavigationChargingStatus()                                                                                                                                                                                                |
| Function Overview  | Get the status of the navigation and charging control switches                                                                                                                                                                       |
| Function Overview  | none                                                                                                                                                                                                                                 |
| Return Value       | Returns the following values if the call is successful: <ul style="list-style-type: none"> <li>- 0: Control switch is enabled</li> <li>- 1: Control switch is disabled</li> <li>- Other values: Corresponding error codes</li> </ul> |
| Remarks            | If the query result indicates that the control switch is disabled, calling the start charging interface will fail to execute.                                                                                                        |

## 4.2 Low-level Service Interface

### 1. Low-level Control Commands

Users send motor control commands by subscribing to the topic `rt/lowcmd`. The specific data structure to be sent is as follows:

Go

```
std_msgs/Header header

float32[4] q_des_abad    //Desired Abduction joint angle (target
position)
float32[4] q_des_hip     //Desired hip joint angle
float32[4] q_des_knee    //Desired knee joint angle
float32[4] qd_des_abad   //Desired Abduction joint angular velocity
(target speed)
float32[4] qd_des_hip    //Desired hip joint angular velocity
float32[4] qd_des_knee   //Desired knee joint angular velocity
float32[4] kp_abad       //Abduction joint position control gain (P
in PD control)
float32[4] kp_hip        //Hip joint P gain
float32[4] kp_knee       //Knee joint P gain
float32[4] kd_abad       //Abduction joint velocity control gain
(D in PD control)
float32[4] kd_hip        //Hip joint D gain
float32[4] kd_knee       //Knee joint D gain
float32[4] tau_abad_ff   //Abduction joint feedforward torque
float32[4] tau_hip_ff    //Hip joint feedforward torque
float32[4] tau_knee_ff   //feedforward torque of knee joint
int32[4] flags           //Control mode flag for each leg
```

### 2. Low-level Data Reception

Users retrieve motor and IMU data by subscribing to the `rt/lowstate` topic. The data structure is as follows:

#### 1、IMU Status Information

Plain Text

```
float32[3] imu_angular_velocity    //roll rate(roll angular
velocity, around X-axis)
                                     // pitch rate(pitch angular
velocity, around Y-axis)
```

```

//yaw rate (yaw angular
velocity, around Z-axis)
float32[3] imu_linear_acceleration //Linear acceleration on X-axis
//Linear acceleration on Y-axis
//Linear acceleration on Z-axis
float32[4] imu_orientation // Attitude represented by
quaternion
bool imu_is_valid
uint16 imu_packet_id

```

## 2、Motor Status Information

```

Go

float32[4] q_abad //Abduction/Adduction joint angle (unit:
radian)
float32[4] q_hip //Hip joint angle (unit: radian)
float32[4] q_knee //Knee joint angle (unit: radian)
float32[4] qd_abad //Abduction joint angular velocity (unit:
rad/s)
float32[4] qd_hip //Hip joint angular velocity
float32[4] qd_knee //Knee joint angular velocity
float32[4] tau_abad //Abduction joint torque (Unit: N*m)
float32[4] tau_hip //Hip joint torque
float32[4] tau_knee //Knee joint torque
int32[4] flags //Joint status flag bit
int32 spi_driver_status //SPI driver status
int32 abnormal_warning_level_motor //Motor abnormal warning level
int32 abnormal_warning_level_soc //Battery SOC abnormal warning
level

```

## 4.3 Motion Control Diagnostic Exception Codes

At present, abnormal information occurring during the execution of motion control will be displayed in a pop-up window on the remote controller. The error codes are shown in the following table:

| k<br>e<br>y | Item<br>Meaning           | key_str | code Analysis | Prompt content |
|-------------|---------------------------|---------|---------------|----------------|
| 0           | Empty item,<br>no meaning | None    |               | No prompt      |

|   |                                                                                                           |                                |                                                                                                                                                                                                                              |                                                                          |
|---|-----------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1 | Recover standing diagnostic item:<br>Whether the robot fails to stand up due to incorrect joint positions | RecoverStand_JointPos          | <ul style="list-style-type: none"> <li>- 0: No error;</li> <li>- Other values: 12 joint numbers (0~11) correspond to bits 0~11 of the code. The bit is set to 1 if the corresponding joint position is incorrect.</li> </ul> | Abnormal joint position, unable to stand up. Error code: \$code          |
| 2 | Recover standing diagnostic item:<br>Whether the robot fails to stand up due to motor errors              | RecoverStand_MotorWarningLevel | <ul style="list-style-type: none"> <li>- 0: No error;</li> <li>- Other values: MotorWarningLevel 1~3, higher number = more severe issue</li> </ul>                                                                           | Abnormal joint hardware, unable to stand up. Error code: \$code          |
| 3 | Recover standing diagnostic item:<br>Whether the robot fails to stand up due to low battery               | RecoverStand_SocWarningLevel   | <ul style="list-style-type: none"> <li>- 0: No error;</li> <li>- Other values: SocWarningLevel 1~3, higher number = more severe issue</li> </ul>                                                                             | Low battery, unable to stand up. Error code: \$code                      |
| 4 | Recover standing diagnostic item:<br>Whether the robot fails to stand up due to IMU errors                | RecoverStand_ImuStatus         | <ul style="list-style-type: none"> <li>- 0: No error;</li> <li>- Other values: bit0: 0=OK, 1=IMU module unavailable; bit1: 0=OK, 1=IMU attitude unsuitable for standing recovery</li> </ul>                                  | Abnormal IMU sensor, unable to stand up. Error code: \$code              |
| 5 | Recover standing diagnostic item:<br>Whether the                                                          | RecoverStand_CommandError      | <ul style="list-style-type: none"> <li>- 0: No error;</li> <li>- 1: Damping command active, unable to respond to stand recovery command;</li> </ul>                                                                          | Damping/power-off command exists, unable to stand up. Error code: \$code |

|    |                                                                                    |                             |                                                                                                                                                 |                                                                       |
|----|------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|    | robot fails to stand up due to incorrect commands                                  |                             | - 2: Power-off command active, unable to respond to stand recovery command                                                                      |                                                                       |
| 6  | Visual mode error:<br>Whether elevation map node has errors                        | VisualMode_ElevationMapping | - 0: No error;<br>- -1: Elevation map node timeout;<br>- 1: Front depth camera error;<br>- 2: Front depth camera odometry error                 | Abnormal elevation map, visual mode unavailable. Error code: \$code   |
| 7  | Visual mode error:<br>Whether odometry node has errors                             | VisualMode_Odom             | - 0: No error;<br>- -1: Odometry timeout;<br>- 1: Odometry not in visual mode;<br>- 2: Odometry initializing;<br>- 3: Odometry data input error | Abnormal odometry, visual mode unavailable. Error code: \$code        |
| 8  | Visual mode error:<br>Whether motion control internal perception module has errors | VisualMode_Perception       | - 0: No error;<br>- 1: Error occurred                                                                                                           | Abnormal map acquisition, visual mode unavailable. Error code: \$code |
| 9  | Front right leg status                                                             | Leg_front Right             | - 0: No error;<br>- Other values (bit value = 1 means error, 0 means normal):<br><br>bit0: A joint communication lost;                          | Abnormal front right leg hardware. Error code: \$code                 |
| 10 | Front left leg status                                                              | Leg_front Left              | bit1: H joint communication lost;<br><br>bit2: K joint communication                                                                            | Abnormal front left leg hardware. Error code: \$code                  |

|        |                                |                  |                                                                                                                                                                                                                                                  |                                                      |
|--------|--------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 1<br>1 | Rear right leg status          | Leg_rear Right   | lost;<br>bit3: CAN bus off for this leg;<br>bit4: A joint error;                                                                                                                                                                                 | Abnormal rear right leg hardware. Error code: \$code |
| 1<br>2 | Rear left leg status           | Leg_rear Left    | bit5: H joint error;<br>bit6: K joint error;<br>bit8: A joint reported specific Errcode;<br>bit9: H joint reported specific Errcode;<br>bit10: K joint reported specific Errcode                                                                 | Abnormal rear left leg hardware. Error code: \$code  |
| 1<br>3 | Motor temperature status level | MotroTempWarning | - 0: OK;<br>- Other values: 1~3 higher number = more severe issue                                                                                                                                                                                | Motor high temperature warning. Error code: \$code   |
| 1<br>4 | Battery SOC status level       | SocWarning       | - 0: OK;<br>- Other values: 1~3 higher number = more severe issue                                                                                                                                                                                | Low battery warning. Error code: \$code              |
| 1<br>5 | IMU status                     | Imu              | 0:OK;<br>1: IMU unavailable                                                                                                                                                                                                                      | Abnormal IMU sensor module. Error code: \$code       |
| 1<br>6 | Runtime safety check item      | SafetyChecker    | - 0: OK;<br>- Other values (bit value = 1 means error, 0 means normal):<br>bit0: IMU error;<br>bit1: Body attitude angle exceeds limit;<br>bit2: Joint angle/speed exceeds limit;<br>bit3: Abnormal joint hardware;<br>bit4: Joint angle reaches | Runtime safety check abnormal. Error code: \$code    |

|        |                                                       |                    |                                                                                               |                                                                               |
|--------|-------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
|        |                                                       |                    | hard limit;<br>bit5: Foot end position exceeds limit                                          |                                                                               |
| 1<br>7 | UserMode<br>switch<br>(Normal/High-speed/Visual mode) | UserMod<br>eSwitch | - 0: OK;<br>- 1: Failed to switch to visual mode;<br>- 2: Failed to switch to high-speed mode | Failed to switch to XX mode, retry in stationary state.<br>Error code: \$code |

Users can retrieve the results of all the above diagnostic items by subscribing to the topic `report_all_item`. The data structure of the diagnostic items is as follows:

Plain Text

```
status_report_set #Outer message definition
Header header      #
uint16 total_count # Total number of diagnostic items
uint16 error_count  # Number of diagnostic items with errors
status_report[] report_set # Array containing detailed results of each diagnostic item
```

Plain Text

```
status_report #Nested Message Definition
string key_str # Key converted to string (to improve readability)
int16 key      # Unique identification ID of the diagnostic item (unique for each item)
int16 code     # Error code (see the table above for details)
string str     # String information (prompt for code meaning, to reduce code lookup time)
```

## 4.4 MQTT Cloud Platform Integration Guide

### Deployment Steps

In addition to communicating with the robot dog via the SDK, the robot dog also supports communication with third-party platforms through the MQTT communication protocol. The specific steps are as follows:

1. The platform side needs to deploy an **MQTT Broker** (MQTT server, used to manage connections with the robot dog and responsible for message distribution).
2. Configure the IP address and port of the MQTT Broker on the robot dog. After

the robot dog is powered on, it will automatically establish a connection with the MQTT Broker.

Note: For detailed MQTT deployment process, please see the relevant documentation. <https://www.emqx.com/zh/downloads-and-install/enterprise?os=Ubuntu>

3. Subsequent communication between the platform and the robot dog is conducted based on message subscription/publishing. For specific topics and payload settings, refer to the communication protocol definition below.

## Interface Definitions

### 1、 Robot Real-Time Position Report (Robot → Platform)

| Details                    |                                                                                                                                                                                                                                                                                    |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                |
| Brief Function Description | Send a message to the specified topic when the robot's position changes                                                                                                                                                                                                            |
| Message subject            | robot/v1/s/linxai-0001/location-report                                                                                                                                                                                                                                             |
| Content-Type               | application/json                                                                                                                                                                                                                                                                   |
| Message content            | <pre>{   "topic": "robot/v1/s/\${robotNo}/location-report",   "qos": 1,   "service": "robot",   "method": "locationReport",   "payload": {     "robotNo": "linxai-0001",     "positionId": "1",     "lng": 113.920868,     "lat": 22.456439,     "x": 22.45,     "y": 22.45,</pre> |

|                               |                                                                                                                                                           |                  |        |                                                                                                              |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|--------------------------------------------------------------------------------------------------------------|
|                               | <pre>"z":22.45, "robotStatus":1, "reportTime":"2024-11-18 12:01:30", "remark":""," "charge":0.5, "chargeTime":""," "time":"2024-12-11 15:23:56" } }</pre> |                  |        |                                                                                                              |
| Parameter Description         |                                                                                                                                                           |                  |        |                                                                                                              |
| Parameter Name                | Mandato<br>ry                                                                                                                                             | Default<br>Value | Type   | Description                                                                                                  |
| topic                         | Yes                                                                                                                                                       | None             | String | Message subject                                                                                              |
| qos                           | Yes                                                                                                                                                       | None             | int    | Message level (0: at<br>most once delivery;<br>1: at least once<br>delivery;<br>2: exactly once<br>delivery) |
| service                       | Yes                                                                                                                                                       | map              | String | Message service<br>provider                                                                                  |
| method                        | Yes                                                                                                                                                       | None             | String | Message method                                                                                               |
| Payload Parameter Description |                                                                                                                                                           |                  |        |                                                                                                              |
| Parameter Name                | Mandato<br>ry                                                                                                                                             | Default<br>Value | Type   | Description                                                                                                  |
| robotNo                       | Yes                                                                                                                                                       | None             | String | Robot serial number                                                                                          |
| positionId                    | No                                                                                                                                                        | None             | String | Position ID                                                                                                  |

|             |     |              |        |                                                                                                                                                                                                                                                                                                                                                                |
|-------------|-----|--------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             |     |              |        | (corresponds to the position ID returned by the 5.4 interface)                                                                                                                                                                                                                                                                                                 |
| lng         | Yes | None         | double | Current position (longitude) - 2000 coordinate system                                                                                                                                                                                                                                                                                                          |
| lat         | Yes | None         | double | Current position (latitude) - 2000 coordinate system                                                                                                                                                                                                                                                                                                           |
| x           | No  | None         | double | X coordinate                                                                                                                                                                                                                                                                                                                                                   |
| y           | No  | None         | double | Y coordinate                                                                                                                                                                                                                                                                                                                                                   |
| z           | No  | None         | double | Z coordinate                                                                                                                                                                                                                                                                                                                                                   |
| taskId      | No  | None         | String | Internal task ID of the robot platform                                                                                                                                                                                                                                                                                                                         |
| robotStatus | Yes | Robot status | Int    | <p>1: Standby - Robot is in standby and not executing any task;</p> <p>2: Task executing - Robot is currently executing a task;</p> <p>3: Charging - Robot is charging (switch to standby when fully charged);</p> <p>4: Abnormal - Robot is in an abnormal state, detailed cause required;</p> <p>5: Offline - Robot cannot communicate with the platform</p> |
| reportTime  | Yes | None         | String | Report time -<br>yyyy-MM-dd<br>HH:mm:ss                                                                                                                                                                                                                                                                                                                        |

|            |    |      |        |                                          |
|------------|----|------|--------|------------------------------------------|
| remark     | No | None | String | Remarks (e.g., fault information)        |
| charge     | No | None | float  | Remaining battery (0.50 = 50% remaining) |
| chargeTime | No | None | float  | Time required for full charge            |

## 2、Robot Event Report (Robot → Platform)

| Details                    |                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                                                             |
| Brief Function Description | Send a message to the backend topic when the robot-side event is updated                                                                                                                                                                                                                                                                                                                                        |
| Message subject            | robot/v1/s/linxai-0001/event-report                                                                                                                                                                                                                                                                                                                                                                             |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                |
| Message content            | <pre>{   "topic": "robot/v1/s/linxai-0001/event-report",   "qos": 1,   "service": "robot",   "method": "eventReport",   "payload": {     "eventType": "face",     "time": "2021-12-10 16:08:37",     "imageUrl": "http://43.139.143.59:9100/linxai-robot/event/2025/06/20250619_122946_963139f7-6c59-433a-affa-86734ce86bd9.jpg",     "lng": 113.315,     "lat": 22.395,     "robotBrandCode": "linxai", </pre> |

|                               |                                                                                                                                                          |                  |        |                                                                                                                         |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|-------------------------------------------------------------------------------------------------------------------------|
|                               | <pre>"camerald":10,  "workTime":10,  "workMileage":50,  "time": "2024-12-05 09:39:54",  "robotBrandCode": "linxai",  "robotNo":"linxai-0001"  }  }</pre> |                  |        |                                                                                                                         |
| Parameter Description         |                                                                                                                                                          |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                            | Default<br>Value | Type   | Description                                                                                                             |
| topic                         | Yes                                                                                                                                                      | None             | String | Message subject                                                                                                         |
| qos                           | Yes                                                                                                                                                      | None             | int    | Message level (0:<br>at most once<br>delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                       | Yes                                                                                                                                                      | robot            | String | Message service<br>provider (robot)                                                                                     |
| method                        | Yes                                                                                                                                                      | None             | String | Message<br>method:eventRep<br>ort                                                                                       |
| payLoad                       | Yes                                                                                                                                                      | None             | String | Detailed message<br>content                                                                                             |
| Payload Parameter Description |                                                                                                                                                          |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                            | Default<br>Value | Type   | Description                                                                                                             |

|           |     |      |        |                                                                                                                                                                                                                                                                 |
|-----------|-----|------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| robotNo   | Yes | None | String | Robot device ID                                                                                                                                                                                                                                                 |
| cameraId  | Yes | None | String | Capture device ID                                                                                                                                                                                                                                               |
| time      | Yes | None | String | Capture time                                                                                                                                                                                                                                                    |
| imageUrl  | Yes | None | String | Large image URL                                                                                                                                                                                                                                                 |
| lng       | No  | None | double | Current position (longitude) - 2000 coordinate system                                                                                                                                                                                                           |
| lat       | No  | None | double | Current position (latitude) - 2000 coordinate system<br>imageData<br>NoNoneString                                                                                                                                                                               |
| imageData | No  | None | String | Large image base64 (empty by default)                                                                                                                                                                                                                           |
| eventType | Yes | None | String | Event type:<br>1: Face;<br>2: Human body;<br>3: Motor vehicle;<br>4: Non-motor vehicle;<br>5: Failure to wear safety helmet and work clothes;<br>6: Fire hydrant event;<br>10000: Smoke and fire detection;<br>10001: Night human detection;<br>10002: Regional |

|                 |    |      |         |                                                                               |
|-----------------|----|------|---------|-------------------------------------------------------------------------------|
|                 |    |      |         | crowd gathering;<br>10003: Fighting;<br>10004: Banner                         |
| targetUrl       | No | None | String  | Target small image URL                                                        |
| targetData      | No | None | String  | Target small image base64 (default is empty)                                  |
| targetRect      | No | None | array   | Target frame pixel position (Note: Origin at top-left corner)                 |
| targetRectFloat | No | None | array   | corresponds to targetRect, Relative proportion of target frame to large image |
| cameraName      | No | None | String  | Device name                                                                   |
| cameraCode      | No | None | String  | Device national standard code                                                 |
| workTime        | No | None | Integer | Event execution duration (minutes)                                            |
| workMileage     | No | None | Integer | Event working mileage (meters)                                                |

### 3、Robot Heartbeat Information Report (Robot → Platform)

| Details        |     |
|----------------|-----|
| version number | 1.0 |

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                  |               |        |                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------------------------------------------------------------------|
| Brief Function Description | Send robot heartbeat information to the specified topic                                                                                                                                                                                                                                                                                                                                                          |               |        |                                                                            |
| Message subject            | robot/v1/s/sendRobotInfo                                                                                                                                                                                                                                                                                                                                                                                         |               |        |                                                                            |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                 |               |        |                                                                            |
| Message content            | <pre>{<br/>  "topic":"robot/v1/s/sendRobotInfo",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotInfo",<br/>  "payload":{<br/>    "robotNo":"linxai-0001",<br/>    "robotStatus":"1",<br/>    "soc":65,<br/>    "standOrDown":"stand",<br/>    "runningSpeed":11,<br/>    "hitchInfo":"Low battery level",<br/>    "temperature":"28",<br/>    "time":"2024-12-11 15:23:56"<br/>  }<br/>}</pre> |               |        |                                                                            |
| Parameter Description      |                                                                                                                                                                                                                                                                                                                                                                                                                  |               |        |                                                                            |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                                                                                                                                                       | Default Value | Type   | Description                                                                |
| topic                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                              | None          | String | Message subject                                                            |
| qos                        | Yes                                                                                                                                                                                                                                                                                                                                                                                                              | None          | int    | Message level (0: at most once delivery;<br><br>1: at least once delivery; |

|                                      |                       |                          |             |                                                                                                                                                                                                                                                                                  |
|--------------------------------------|-----------------------|--------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      |                       |                          |             | 2: exactly once delivery)                                                                                                                                                                                                                                                        |
| service                              | Yes                   | map                      | String      | Message service provider                                                                                                                                                                                                                                                         |
| method                               | Yes                   | None                     | String      | Message method                                                                                                                                                                                                                                                                   |
| <b>Payload Parameter Description</b> |                       |                          |             |                                                                                                                                                                                                                                                                                  |
| <b>Parameter Name</b>                | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                                                                                                                                                                                                               |
| robotNo                              | Yes                   | None                     | String      | Robot serial number                                                                                                                                                                                                                                                              |
| robotStatus                          | No                    | None                     | Integer     | Robot status (1: On; 2: Abnormal recovery; 3: Shutdown)                                                                                                                                                                                                                          |
| soc                                  | Yes                   | None                     | Integer     | Battery level [0,100]                                                                                                                                                                                                                                                            |
| standOrDown                          | No                    | None                     | String      | Robot standing state:Standing: stand;<br><br>Lying down: down;<br><br>Power-off state: passive;<br><br>Recovering to standing (automatically switches to balanced standing after completion): recoveryStand;<br><br>Balanced standing state: balanceStand;<br><br>Damping state: |

|              |     |      |        |                                                                                                                                                                           |
|--------------|-----|------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |     |      |        | impedanceControl<br>;Walking: motion;<br>Lying down<br>process<br>(automatically<br>switches to<br>damping state<br>after completion):<br>sitDown;<br>Unknown:<br>unknown |
| runningSpeed | No  | None | Float  | Normal running speed of the robot (m/s)                                                                                                                                   |
| hitchInfo    | No  | None | String | Alarm/fault information                                                                                                                                                   |
| temperature  | Yes | None | String | Temperature                                                                                                                                                               |
| reportTime   | Yes | None | String | Report time -<br>yyyy-MM-dd<br>HH:mm:ss                                                                                                                                   |

#### 4、 Robot Stand Control Command (Platform → Robot)

| Details                    |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| version number             | 1.0                                                                    |
| Brief Function Description | Send stand command to the robot                                        |
| Message subject            | robot/v1/c/sendRobotStandUpAction                                      |
| Content-Type               | application/json                                                       |
| Message content            | <pre>{   "topic":"robot/v1/c/sendRobotStandUpAction",   "qos":1,</pre> |

|                               |                                                                                                                                                                                                 |                  |        |                                                                                                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|-------------------------------------------------------------------------------------------------------------------------|
|                               | <pre>"service": "robot",<br/>"method": "sendRobotStandUpAction",<br/>"payload": {<br/>  "robotNo": "Ixaic2-7",<br/>  "action": "standUp",<br/>  "time": "2025-05-26 15:23:56"<br/>}<br/>}</pre> |                  |        |                                                                                                                         |
| Parameter Description         |                                                                                                                                                                                                 |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                                                                   | Default<br>Value | Type   | Description                                                                                                             |
| topic                         | Yes                                                                                                                                                                                             | None             | String | Message subject                                                                                                         |
| qos                           | Yes                                                                                                                                                                                             | None             | int    | Message level (0:<br>at most once<br>delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                       | Yes                                                                                                                                                                                             | map              | String | Message service<br>provider                                                                                             |
| method                        | Yes                                                                                                                                                                                             | None             | String | Message method                                                                                                          |
| Payload Parameter Description |                                                                                                                                                                                                 |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                                                                   | Default<br>Value | Type   | Description                                                                                                             |
| robotNo                       | Yes                                                                                                                                                                                             | None             | String | Robot serial<br>number                                                                                                  |

|            |       |      |        |                                           |
|------------|-------|------|--------|-------------------------------------------|
| action     | Yes   | None | String | Control command value (Stand: standUp)    |
| actionTime | Yeses | None | String | Command sending time: yyyy-MM-dd HH:mm:ss |

## 5、 Robot Lie Down Control Command (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                                  |               |      |             |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|-------------|
| version number             | 1.0                                                                                                                                                                                                                                                                              |               |      |             |
| Brief Function Description | Send lie down command to the robot                                                                                                                                                                                                                                               |               |      |             |
| Message subject            | robot/v1/c/sendRobotGetDownAction                                                                                                                                                                                                                                                |               |      |             |
| Content-Type               | application/json                                                                                                                                                                                                                                                                 |               |      |             |
| Message content            | <pre>{<br/>  "topic":"robot/v1/c/sendRobotGetDownAction",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotGetDownAction",<br/>  "payload":{<br/>    "robotNo":"Ixaic2-7",<br/>    "action":"getDown" ,<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |               |      |             |
| Parameter Description      |                                                                                                                                                                                                                                                                                  |               |      |             |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                       | Default Value | Type | Description |

|                                      |                       |                          |             |                                                                                                                         |
|--------------------------------------|-----------------------|--------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------|
|                                      |                       |                          |             |                                                                                                                         |
| topic                                | Yes                   | None                     | String      | Message subject                                                                                                         |
| qos                                  | Yes                   | None                     | int         | Message level (0:<br>at most once<br>delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                              | Yes                   | map                      | String      | Message service<br>provider                                                                                             |
| method                               | Yes                   | None                     | String      | Message method                                                                                                          |
| <b>Payload Parameter Description</b> |                       |                          |             |                                                                                                                         |
| <b>Parameter Name</b>                | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                                                      |
| robotNo                              | Yes                   | None                     | String      | Robot serial<br>number                                                                                                  |
| action                               | Yes                   | None                     | String      | Control command<br>value (Lie down:<br>getDown)                                                                         |
| actionTime                           | Yes                   | None                     | String      | Command<br>sending time :<br>yyyy-MM-dd<br>HH:mm:ss                                                                     |

## 6、 Robot zero torque mode control command (Platform --> Robot)

| Details               |     |
|-----------------------|-----|
| <b>version number</b> | 1.0 |

|                            |                                                                                                                                                                                                                                                                                         |               |        |                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|-------------------------------------------------------------------------------------------------------------|
| Brief Function Description | Send zero torque mode command to the robot                                                                                                                                                                                                                                              |               |        |                                                                                                             |
| Message subject            | robot/v1/c/sendRobotZeroTorqueAction                                                                                                                                                                                                                                                    |               |        |                                                                                                             |
| Content-Type               | application/json                                                                                                                                                                                                                                                                        |               |        |                                                                                                             |
| Message content            | {<br><br>"topic":"robot/v1/c/sendRobotZeroTorqueAction",<br><br>"qos":1,<br><br>"service":"robot",<br><br>"method":"sendRobotZeroTorqueAction",<br><br>"payload":{<br><br>"robotNo":"linxai-0001",<br><br>"action":"zeroTorque" ,<br><br>"time":"2025-05-26 15:23:56"<br><br>}<br><br>} |               |        |                                                                                                             |
| Parameter Description      |                                                                                                                                                                                                                                                                                         |               |        |                                                                                                             |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                              | Default Value | Type   | Description                                                                                                 |
| topic                      | Yes                                                                                                                                                                                                                                                                                     | None          | String | Message subject                                                                                             |
| qos                        | Yes                                                                                                                                                                                                                                                                                     | None          | int    | Message level (0: at most once delivery;<br><br>1: at least once delivery;<br><br>2: exactly once delivery) |
| service                    | Yes                                                                                                                                                                                                                                                                                     | map           | String | Message service provider                                                                                    |

| method                        | Yes       | None          | String | Message method                                       |
|-------------------------------|-----------|---------------|--------|------------------------------------------------------|
| Payload Parameter Description |           |               |        |                                                      |
| Parameter Name                | Mandatory | Default Value | Type   | Description                                          |
| robotNo                       | Yes       | None          | String | Robot serial number                                  |
| action                        | Yes       | None          | String | Control command value (Zero torque mode: zeroTorque) |
| actionTime                    | Yes       | None          | String | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss     |

## 7、Robot Stop Moving Control Command (Platform → Robot)

| Details                    |                                                                                                                                    |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                |
| Brief Function Description | Send stop moving command to the robot                                                                                              |
| Message subject            | robot/v1/c/sendRobotStopMoveAction                                                                                                 |
| Content-Type               | application/json                                                                                                                   |
| Message content            | <pre>{   "topic":"robot/v1/c/sendRobotStopMoveAction",   "qos":1,   "service":"robot",   "method":"sendRobotStopMoveAction",</pre> |

|                               |                                                                                                                                  |                  |        |                                                                                                                         |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------|--------|-------------------------------------------------------------------------------------------------------------------------|
|                               | <pre>"payload":{<br/>  "robotNo":"linxai-0001",<br/>  "action":"stopMove" ,<br/>  "time":"2025-05-26 15:23:56"<br/>}<br/>}</pre> |                  |        |                                                                                                                         |
| Parameter Description         |                                                                                                                                  |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                    | Default<br>Value | Type   | Description                                                                                                             |
| topic                         | Yes                                                                                                                              | None             | String | Message subject                                                                                                         |
| qos                           | Yes                                                                                                                              | None             | int    | Message level (0:<br>at most once<br>delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                       | Yes                                                                                                                              | map              | String | Message service<br>provider                                                                                             |
| method                        | Yes                                                                                                                              | None             | String | Message method                                                                                                          |
| Payload Parameter Description |                                                                                                                                  |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                    | Default<br>Value | Type   | Description                                                                                                             |
| robotNo                       | Yes                                                                                                                              | None             | String | Robot serial<br>number                                                                                                  |
| action                        | Yes                                                                                                                              | None             | String | Control command<br>value (Stop<br>moving:                                                                               |

|            |     |      |        |                                                     |
|------------|-----|------|--------|-----------------------------------------------------|
|            |     |      |        | stopMove; )                                         |
| actionTime | Yes | None | String | Command<br>sending time :<br>yyyy-MM-dd<br>HH:mm:ss |

## 8、 Robot switch to reinforcement learning gait control command (Platform --> Robot)

| Details                    |                                                                                                                                                                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                    |
| Brief Function Description | Send high knee lift command to the robot                                                                                                                                                                                                                                               |
| Message subject            | robot/v1/c/sendRobotHighKneeAction                                                                                                                                                                                                                                                     |
| Content-Type               | application/json                                                                                                                                                                                                                                                                       |
| Message content            | <pre>{   "topic":"robot/v1/c/sendRobotHighKneeAction",   "qos":1,   "service":"robot",   "method":"sendRobotHighKneeAction",   "payload":{     "robotNo":"linxai-0001",     "action":"highKnee",     "actionParam":{       "val":1     },     "time":"2025-05-26 15:23:56"   } }</pre> |
| Parameter Description      |                                                                                                                                                                                                                                                                                        |

| Parameter Name                           | Mandatory | Default Value | Type    | Description                                                                                         |
|------------------------------------------|-----------|---------------|---------|-----------------------------------------------------------------------------------------------------|
| topic                                    | Yes       | None          | String  | Message subject                                                                                     |
| qos                                      | Yes       | None          | int     | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service                                  | Yes       | map           | String  | Message service provider                                                                            |
| method                                   | Yes       | None          | String  | Message method                                                                                      |
| <b>Payload Parameter Description</b>     |           |               |         |                                                                                                     |
| Parameter Name                           | Mandatory | Default Value | Type    | Description                                                                                         |
| robotNo                                  | Yes       | None          | String  | Robot serial number                                                                                 |
| action                                   | Yes       | None          | String  | Control command                                                                                     |
| actionParm                               | Yes       | None          | Entity  | Control parameter object                                                                            |
| actionTime                               | Yes       | None          | String  | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss                                                    |
| <b>Action Parm Parameter Description</b> |           |               |         |                                                                                                     |
| val                                      | No        | None          | Integer | Normal: 0;                                                                                          |

|  |  |  |  |                   |
|--|--|--|--|-------------------|
|  |  |  |  | High knee lift: 1 |
|--|--|--|--|-------------------|

## 9、 Robot Forward/Backward/Left/Right Movement Control Command (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                         |
| Brief Function Description | Send forward/backward/left/right movement command to the robot                                                                                                                                                                                                                                                                              |
| Message subject            | robot/v1/c/sendRobotMoveAction                                                                                                                                                                                                                                                                                                              |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                            |
| Message content            | <pre>{   "topic":"robot/v1/c/sendRobotMoveAction",   "qos":1,   "service":"robot",   "method":"sendRobotMoveAction",   "payload":{     "robotNo":"linxai-0001",     "action":"move",     "actionParam":{       "lm":"0",       "vm":"0",       "lrm":"0.3",       "continousMove": true     },     "time":"2025-05-26 15:23:56"   } }</pre> |
| Parameter Description      |                                                                                                                                                                                                                                                                                                                                             |

| Parameter Name                           | Mandatory | Default Value | Type   | Description                                                                                         |
|------------------------------------------|-----------|---------------|--------|-----------------------------------------------------------------------------------------------------|
| topic                                    | Yes       | None          | String | Message subject                                                                                     |
| qos                                      | Yes       | None          | int    | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service                                  | Yes       | map           | String | Message service provider                                                                            |
| method                                   | Yes       | None          | String | Message method                                                                                      |
| <b>Payload Parameter Description</b>     |           |               |        |                                                                                                     |
| Parameter Name                           | Mandatory | Default Value | Type   | Description                                                                                         |
| robotNo                                  | Yes       | None          | String | Robot serial number                                                                                 |
| action                                   | Yes       | None          | String | Control command                                                                                     |
| actionParm                               | Yeses     | None          | Entity | Control parameter object                                                                            |
| actionTime                               | Yes       | None          | String | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss                                                    |
| <b>Action Parm Parameter Description</b> |           |               |        |                                                                                                     |
| Parameter Name                           | Mandatory | Default Value | Type   | Description                                                                                         |

|               |       |      |         |                                                                                                                      |
|---------------|-------|------|---------|----------------------------------------------------------------------------------------------------------------------|
|               |       |      |         |                                                                                                                      |
| lm            | Yes   | None | String  | Lateral movement value<br><br>Right lateral movement: (0 - 0.3) (m/s)<br><br>Left lateral movement: (-0.3 - 0) (m/s) |
| vm            | Yes   | None | String  | Forward/backward movement value<br><br>Forward movement: (0 - 1.5) (m/s)<br><br>Backward movement: (-0.5 - 0) (m/s)  |
| lrm           | Yeses | None | String  | Left/right steering value<br><br>Right steering: [0, 0.5] (rad/s)<br><br>Left steering: [-0.5, 0] (rad/s)            |
| vLimit        | No    | None | String  | Coefficient                                                                                                          |
| continousMove | Yes   | None | Boolean | Continuous movement: true;<br><br>Move for 1 second: false                                                           |

## 10、 Robot Up/Down Rotation Control Command (Platform → Robot)

|         |
|---------|
| Details |
|---------|

|                            |                                                                                                                                                                                                                                                                                                                                                                            |               |        |                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|--------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                        |               |        |                                                              |
| Brief Function Description | Send up/down rotation command to the robot                                                                                                                                                                                                                                                                                                                                 |               |        |                                                              |
| Message subject            | robot/v1/c/sendRobotRotateUpAndDownAction                                                                                                                                                                                                                                                                                                                                  |               |        |                                                              |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                           |               |        |                                                              |
| Message content            | <pre>{<br/><br/>"topic":"robot/v1/c/sendRobotRotateUpAndDownAction",<br/>  ,<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotRotateUpAndDownAction",<br/>  "payload":{<br/>    "robotNo":"linxai-0001",<br/>    "action":"rotateUpAndDown",<br/>    "actionParam":{<br/>      "udm":1<br/>    },<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |               |        |                                                              |
| Parameter Description      |                                                                                                                                                                                                                                                                                                                                                                            |               |        |                                                              |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                                                                                                                 | Default Value | Type   | Description                                                  |
| topic                      | Yes                                                                                                                                                                                                                                                                                                                                                                        | None          | String | Message subject                                              |
| qos                        | Yes                                                                                                                                                                                                                                                                                                                                                                        | None          | int    | Message level (0: at most once delivery;<br>1: at least once |

|                                          |                       |                          |             |                                                                      |
|------------------------------------------|-----------------------|--------------------------|-------------|----------------------------------------------------------------------|
|                                          |                       |                          |             | delivery;<br>2: exactly once<br>delivery)                            |
| service                                  | Yes                   | map                      | String      | Message service<br>provider                                          |
| method                                   | Yes                   | None                     | String      | Message method                                                       |
| <b>Payload Parameter Description</b>     |                       |                          |             |                                                                      |
| <b>Parameter Name</b>                    | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                   |
| robotNo                                  | Yes                   | None                     | String      | Robot serial<br>number                                               |
| action                                   | Yes                   | None                     | String      | Control command                                                      |
| actionParm                               | Yes                   | None                     | Entity      | Control parameter<br>object                                          |
| actionTime                               | Yes                   | None                     | String      | Command<br>sending time :<br>yyyy-MM-dd<br>HH:mm:ss                  |
| <b>Action Parm Parameter Description</b> |                       |                          |             |                                                                      |
| <b>Parameter Name</b>                    | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                   |
| udm                                      | Yes                   | None                     | String      | Rotation value<br>Up rotation: (0 - 1)<br>Down rotation: (-1<br>- 0) |
| vLimit                                   | No                    | None                     | String      | Coefficient                                                          |

## 11、 Robot Continuous Movement Control Command (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                                                                                                                       |               |        |                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|-----------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                   |               |        |                 |
| Brief Function Description | Send continuous movement command to the robot                                                                                                                                                                                                                                                                                                                         |               |        |                 |
| Message subject            | robot/v1/c/sendRobotContinuousGaitAction                                                                                                                                                                                                                                                                                                                              |               |        |                 |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                      |               |        |                 |
| Message content            | <pre>{<br/><br/>  "topic":"robot/v1/c/sendRobotContinuousGaitAction",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotContinuousGaitAction",<br/>  "payload":{<br/>    "robotNo":"linxai-0001",<br/>    "action":"continuousGait",<br/>    "actionParam":{<br/>      "flag":true<br/>    },<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |               |        |                 |
| Parameter Description      |                                                                                                                                                                                                                                                                                                                                                                       |               |        |                 |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                                                                                                            | Default Value | Type   | Description     |
| topic                      | Yes                                                                                                                                                                                                                                                                                                                                                                   | None          | String | Message subject |

|                                          |                       |                          |             |                                                                                                     |
|------------------------------------------|-----------------------|--------------------------|-------------|-----------------------------------------------------------------------------------------------------|
| qos                                      | Yes                   | None                     | int         | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service                                  | Yes                   | map                      | String      | Message service provider                                                                            |
| method                                   | Yes                   | None                     | String      | Message method                                                                                      |
| <b>Payload Parameter Description</b>     |                       |                          |             |                                                                                                     |
| <b>Parameter Name</b>                    | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                                  |
| robotNo                                  | Yes                   | None                     | String      | Robot serial number                                                                                 |
| action                                   | Yes                   | None                     | String      | Control command                                                                                     |
| actionParm                               | Yes                   | None                     | Entity      | Control parameter object                                                                            |
| actionTime                               | Yes                   | None                     | String      | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss                                                    |
| <b>Action parm Parameter Description</b> |                       |                          |             |                                                                                                     |
| <b>Parameter Name</b>                    | <b>Mandato<br/>ry</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                                  |
| flag                                     | Yes                   | None                     | Boolean     | flag: Set to true to enable, false to disable                                                       |

## 12、 Robot Damping Control Command (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                            |               |        |                                                                                           |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|-------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                        |               |        |                                                                                           |
| Brief Function Description | Send damping command to the robot                                                                                                                                                                                                                                          |               |        |                                                                                           |
| Message subject            | robot/v1/c/sendRobotDampAction                                                                                                                                                                                                                                             |               |        |                                                                                           |
| Content-Type               | application/json                                                                                                                                                                                                                                                           |               |        |                                                                                           |
| Message content            | <pre>{<br/>  "topic":"robot/v1/c/sendRobotDampAction",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotDampAction",<br/>  "payload":{<br/>    "robotNo":"linxai-0001",<br/>    "action":"damp" ,<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |               |        |                                                                                           |
| Parameter Description      |                                                                                                                                                                                                                                                                            |               |        |                                                                                           |
| Parameter Name             | Mandato ry                                                                                                                                                                                                                                                                 | Default Value | Type   | Description                                                                               |
| topic                      | Yes                                                                                                                                                                                                                                                                        | None          | String | Message subject                                                                           |
| qos                        | Yes                                                                                                                                                                                                                                                                        | None          | int    | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once |

|                                      |                  |                      |             |                                                  |
|--------------------------------------|------------------|----------------------|-------------|--------------------------------------------------|
|                                      |                  |                      |             | delivery)                                        |
| service                              | Yes              | map                  | String      | Message service provider                         |
| method                               | Yes              | None                 | String      | Message method                                   |
| <b>Payload Parameter Description</b> |                  |                      |             |                                                  |
| <b>Parameter Name</b>                | <b>Mandatory</b> | <b>Default Value</b> | <b>Type</b> | <b>Description</b>                               |
| robotNo                              | Yes              | None                 | String      | Robot serial number                              |
| action                               | Yes              | None                 | String      | Control command value (Damping: damp)            |
| actionTime                           | Yeses            | None                 | String      | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss |

### 13、Control Command Heartbeat Information Report (Platform → Robot)

| <b>Details</b>                    |                                                                                                                                                                                                                                                                    |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>version number</b>             | 1.0                                                                                                                                                                                                                                                                |
| <b>Brief Function Description</b> | After sending a robot motion command, send an action heartbeat to the robot every 2 seconds to guide continuous action. Stop sending the heartbeat after sending a stop command. The command action stops immediately if the robot does not receive the heartbeat. |
| <b>Message subject</b>            | robot/v1/c/sendRobotActionHeart                                                                                                                                                                                                                                    |
| <b>Content-Type</b>               | application/json                                                                                                                                                                                                                                                   |

|                               |                                                                                                                                                                                                                                                                         |                  |        |                                                                                                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|-------------------------------------------------------------------------------------------------------------------------|
| Message content               | {<br><br>"topic":"robot/v1/c/sendRobotActionHeart",<br><br>"qos":1,<br><br>"service":"robot",<br><br>"method":"sendRobotActionHeart",<br><br>"payload":{<br><br>"robotNo":"linxai-0001",<br><br>"action":"heart",<br><br>"time":"2024-12-11 15:23:56"<br><br>}<br><br>} |                  |        |                                                                                                                         |
| Parameter Description         |                                                                                                                                                                                                                                                                         |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                                                                                                                                           | Default<br>Value | Type   | Description                                                                                                             |
| topic                         | Yes                                                                                                                                                                                                                                                                     | None             | String | Message subject                                                                                                         |
| qos                           | Yes                                                                                                                                                                                                                                                                     | None             | int    | Message level (0:<br>at most once<br>delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                       | Yes                                                                                                                                                                                                                                                                     | map              | String | Message service<br>provider                                                                                             |
| method                        | Yes                                                                                                                                                                                                                                                                     | None             | String | Message method                                                                                                          |
| Payload Parameter Description |                                                                                                                                                                                                                                                                         |                  |        |                                                                                                                         |
| Parameter Name                | Mandato<br>ry                                                                                                                                                                                                                                                           | Default<br>Value | Type   | Description                                                                                                             |

|            |     |      |        |                                                  |
|------------|-----|------|--------|--------------------------------------------------|
| robotNo    | Yes | None | String | Robot serial number                              |
| action     | Yes | None | String | Heartbeat command identifier:heart               |
| actionTime | Yes | None | String | Command sending time :<br>yyyy-MM-dd<br>HH:mm:ss |

## 14、Platform Notifies Robot After Setting Working Time and Charging Threshold (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                          |
| Brief Function Description | Cloud notifies the robot after setting working time and charging threshold                                                                                                                                                                                                                   |
| Message subject            | robot/v1/c/sendInspectionPointTask                                                                                                                                                                                                                                                           |
| Content-Type               | application/json                                                                                                                                                                                                                                                                             |
| Message content            | <pre>{   "topic":"robot/v1/c/sendRobotTaskParam",   "qos":1,   "service":"robot",   "method":"sendRobotTaskParam",   "payload":{     "robotNo":"linxai-0001",     "taskStartTime":"11:00" ,     "taskEndTime":"11:50" ,     "socThreshold":"85"     "time":"2025-05-26 15:23:56"   } }</pre> |

|                               |               |                  |        |                                                                                                                      |
|-------------------------------|---------------|------------------|--------|----------------------------------------------------------------------------------------------------------------------|
|                               | }             |                  |        |                                                                                                                      |
| Parameter Description         |               |                  |        |                                                                                                                      |
| Parameter Name                | Manda<br>tory | Default<br>Value | Type   | Description                                                                                                          |
| topic                         | Yes           | None             | String | Message subject                                                                                                      |
| qos                           | Yes           | None             | int    | Message level (0: at<br>most once delivery;<br><br>1: at least once<br>delivery;<br><br>2: exactly once<br>delivery) |
| service                       | Yes           | map              | String | Message service<br>provider                                                                                          |
| method                        | Yes           | None             | String | Message method                                                                                                       |
| Payload Parameter Description |               |                  |        |                                                                                                                      |
| Parameter Name                | Manda<br>tory | Default<br>Value | Type   | Description                                                                                                          |
| robotNo                       | Yes           | None             | String | Robot serial number                                                                                                  |
| taskStartTime                 | Yes           | None             | String | Working start time                                                                                                   |
| taskName                      | No            | None             | String | Working end time                                                                                                     |
| socThreshold                  | No            | None             | String | Charging SOC<br>threshold                                                                                            |
| time                          | Yes           | None             | String | Report time (each<br>report time for multiple<br>reports)                                                            |

## 15、Platform Issues Inspection Task Command to Robot -

Based on RTK Navigation Mode (Platform → Robot)

| Details                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Brief Function Description | Cloud issues inspection task command to the robot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Message subject            | robot/v1/c/sendInspectionTask                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Message content            | <pre>{   "topic":"robot/v1/c/sendInspectionTask",   "qos":1,   "service":"robot",   "method":"sendInspectionTask",   "payload":{     "robotNo":"linxai-0001",     "action":"inspection" ,     "actionParam":{       "taskId":"1862433252233842690" ,       "taskName":"Inspection Task - Fixed Point Anomaly Inspection" ,       "routeId":"1864585156608434177" ,       "routeName":"Inspection route for the East Tower" ,       "startLng":"114.068284" ,       "startLat":"22.6104" ,       "endLng":"124.068284" ,       "endLat":"23.6104" ,       "pointList":[         {           "pointId":"1",           "pointTaskId":"1",</pre> |

```
2" ,
    "pointName": "East side of Building",
    "pointType": "2",
    "lng": "114.068284",
    "lat": "22.6104",
    "nextPointId": "2",
    "forfuter": ["", ""]
  },
  {
    "pointId": "2",
    "pointTaskId": "2",
    "pointName": "East side of Building",
    "pointType": "2",
    "lng": "114.068284",
    "lat": "22.6104",
    "nextPointId": "3",
    "forfuter": ["", ""]
  }
]
},
"time": "2025-05-26 15:23:56"
}
```

| Parameter Description |           |               |        |                                                              |
|-----------------------|-----------|---------------|--------|--------------------------------------------------------------|
| Parameter Name        | Mandatory | Default Value | Type   | Description                                                  |
| topic                 | Yes       | None          | String | Message subject                                              |
| qos                   | Yes       | None          | int    | Message level (0: at most once delivery;<br>1: at least once |

|                                          |                       |                          |             |                                                   |
|------------------------------------------|-----------------------|--------------------------|-------------|---------------------------------------------------|
|                                          |                       |                          |             | delivery;<br>2: exactly once<br>delivery)         |
| service                                  | Yes                   | map                      | String      | Message service<br>provider                       |
| method                                   | Yes                   | None                     | String      | Message method                                    |
| <b>Payload Parameter Description</b>     |                       |                          |             |                                                   |
| <b>Parameter Name</b>                    | <b>Mandat<br/>ory</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                |
| robotNo                                  | Yes                   | None                     | String      | Robot serial number                               |
| action                                   | Yes                   | None                     | String      | Control command<br>value (damping:<br>damp;)      |
| actionParam                              | Yeses                 | None                     | Object      | The instruction<br>contains a parameter<br>object |
| time                                     | Yes                   | None                     | String      | Command sending<br>time : yyyy-MM-dd<br>HH:mm:ss  |
| <b>action Parm Parameter Description</b> |                       |                          |             |                                                   |
| <b>Parameter Name</b>                    | <b>Mandat<br/>ory</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                |
| taskId                                   | Yes                   | None                     | String      | Task ID                                           |
| taskName                                 | No                    | None                     | String      | Name of the issued<br>task                        |
| routeId                                  | Yes                   | None                     | String      | Task specifies route<br>number                    |

|                                         |                       |                          |             |                                                                                          |
|-----------------------------------------|-----------------------|--------------------------|-------------|------------------------------------------------------------------------------------------|
| routeName                               | No                    | None                     | String      | Task Route Name                                                                          |
| pointId                                 | Yes                   | None                     | String      | Route point ID                                                                           |
| pointName                               | Yes                   | None                     | String      | Route point name                                                                         |
| startLng                                | Yes                   | None                     | String      | Starting longitude                                                                       |
| startLat                                | Yes                   | None                     | String      | Starting latitude                                                                        |
| endLng                                  | Yes                   | None                     | String      | Destination longitude                                                                    |
| endLat                                  | Yes                   | None                     | String      | Destination latitude                                                                     |
| pointList                               | Yes                   | None                     | String      | Array of route point information                                                         |
| <b>Point Task Parameter Description</b> |                       |                          |             |                                                                                          |
| <b>Parameter Name</b>                   | <b>Mandat<br/>ory</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                       |
| pointId                                 | Yes                   | None                     | String      | Point id                                                                                 |
| pointTaskId                             | Yes                   | None                     | String      | Point task ID                                                                            |
| pointName                               | Yes                   | None                     | String      | Point Name                                                                               |
| pointType                               | Yes                   | None                     | String      | Point type (1: Starting point; 2: Task point; 3: Inflection point; 4: Destination point) |
| lng                                     | Yes                   | None                     | String      | Point longitude                                                                          |
| lat                                     | Yes                   | None                     | String      | Point latitude                                                                           |
| nextPointId                             | Yes                   | None                     | String      | The next point id                                                                        |
| forfuter                                | No                    | None                     | Array       | Extended field, used as coordinate                                                       |

|  |  |  |  |                |
|--|--|--|--|----------------|
|  |  |  |  | identification |
|--|--|--|--|----------------|

## 16、The robot reports the execution results of patrol inspection tasks to the cloud platform (Robot → Platform)

| Details                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Brief Function Description | the robot returns its task status to the cloud server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Message subject            | robot/v1/s/sendInspectionTaskResult                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Message content            | <pre>{   "topic":"robot/v1/s/sendInspectionTaskResult",   "qos":1,   "service":"robot",   "method":"sendInspectionTaskResult",   "payload":{     "robotNo":"linxai-0001",     "taskId":"1862433252233842690",     "taskName":"Inspection Task - Fixed Point Anomaly Inspection",     "taskStatus":"1",     "routeId":"1864585156608434177",     "routeName":"Inspection route for the East Tower",     "workMileage":"650",     "workTime":"35",     "pointTask":[       {         "pointId":"1864585156608477314",         "pointTaskId":"2",</pre> |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <pre>"pointName":"East side of Building 2" , "pointType":"2", "arrivalTime":"2025-05-26 15:23:56" , "isAbnormal":1 , "abnormalType":2, "abnormalInfo":"Point anomaly information" , "capturePhotos":[     "http://43.139.143.59:9100/linxai- robot/event/2025/06/20250610_120255_8b3478da-f744- 43a5-ad79-d93538cd06ac.jpg",     "http://43.139.143.59:9100/linxai- robot/event/2025/06/20250610_120255_8b3478da-f744- 43a5-ad79-d93538cd06ac.jpg" ] } ], "time":"2025-05-26 15:23:56" } }</pre> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Parameter Description |               |                  |        |                                                                                                        |
|-----------------------|---------------|------------------|--------|--------------------------------------------------------------------------------------------------------|
| Parameter Name        | Manda<br>tory | Default<br>Value | Type   | Description                                                                                            |
| topic                 | Yes           | None             | String | Message subject                                                                                        |
| qos                   | Yes           | None             | int    | Message level (0: at most<br>once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service               | Yes           | map              | String | Message service provider                                                                               |
| method                | Yes           | None             | String | Message method                                                                                         |

| Payload Parameter Description    |           |               |        |                                                                                       |
|----------------------------------|-----------|---------------|--------|---------------------------------------------------------------------------------------|
| Parameter Name                   | Mandatory | Default Value | Type   | Description                                                                           |
| robotNo                          | Yes       | None          | String | Robot serial number                                                                   |
| taskId                           | Yes       | None          | String | Task ID                                                                               |
| taskName                         | No        | None          | String | Name of the issued task                                                               |
| taskStatus                       | Yes       | None          | String | Task execution status (2: In execution; 3: Execution successful; 4: Execution failed) |
| routeId                          | No        | None          | String | Task Route Name                                                                       |
| workMileage                      | Yeses     | None          | String | Inspection mileage (meters)                                                           |
| workTime                         | Yes       | None          | String | Working hours (minutes)                                                               |
| time                             | Yes       | None          | String | Reporting time (the reporting time each time when reporting multiple times)           |
| Point Task Parameter Description |           |               |        |                                                                                       |
| Parameter Name                   | Mandatory | Default Value | Type   | Description                                                                           |
| pointId                          | Yes       | None          | String | Waypoint ID                                                                           |
| pointTaskId                      | Yes       | None          | String | Current Waypoint Patrol Task ID                                                       |
| pointName                        | Yes       | None          | String | Point Name                                                                            |

|               |     |      |         |                                                                          |
|---------------|-----|------|---------|--------------------------------------------------------------------------|
| pointType     | Yes | None | String  | Waypoint Type (1: Origin; 2: Task Point; 3: Turning Point; 4: End Point) |
| arrivalTime   | Yes | None | String  | Arrival Time                                                             |
| isAbnormal    | Yes | 0    | Integer | Abnormality Exists (0: None; 1: Yes)                                     |
| abnormalType  | Yes | None | Integer | Abnormality Type (1: Crowding; 2: Fire Hydrant Leakage)                  |
| abnormalInfo  | Yes | None | String  | Abnormality Description (Text)                                           |
| capturePhotos | Yes | None | List    | Captured Photo URLs (Single/Multiple Images, String Array Format)        |

## 17、 After the robot reaches the mission point, it notifies the platform (robot --> platform)

| Details                    |                                                                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                              |
| Brief Function Description | After the robot reaches a certain task point, it stops and sends a notification to the cloud                                                     |
| Message subject            | robot/v1/s/sendInspectionPointTask                                                                                                               |
| Content-Type               | application/json                                                                                                                                 |
| Message content            | <pre>{   "topic":"robot/v1/s/sendInspectionPointTask",   "qos":1,   "service":"robot",   "method":"sendInspectionPointTask",   "payload":{</pre> |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <pre>"robotNo":"linxai-0001", "taskId":"1862433252233842690" , "taskName":"nspection Task - Fixed Point Anomaly Inspection" , "routeId":"1864585156608434177" , "routeName":"nspection route for the East Tower" , "pointTask":{   "pointId":"1864585156608477314" ,   "pointTaskId":"2" ,   "pointName":"East side of Building 2" ,   "arrivalTime":"2025-05-26 15:23:56" }, "time":"2025-05-26 15:23:56" } }</pre> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |
|-----------------------|
| Parameter Description |
|-----------------------|

| Parameter Name | Man<br>dator<br>y | Default<br>Value | Type   | Description                                                                                            |
|----------------|-------------------|------------------|--------|--------------------------------------------------------------------------------------------------------|
| topic          | Yes               | None             | String | Message subject                                                                                        |
| qos            | Yes               | None             | int    | Message level (0: at most<br>once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service        | Yes               | map              | String | Message service provider                                                                               |
| method         | Yes               | None             | String | Message method                                                                                         |

|                               |
|-------------------------------|
| Payload Parameter Description |
|-------------------------------|

| Parameter Name | Man | Default | Type | Description |
|----------------|-----|---------|------|-------------|
|----------------|-----|---------|------|-------------|

|                                         | <b>dator<br/>y</b>         | <b>Value</b>             |             |                                                                                        |
|-----------------------------------------|----------------------------|--------------------------|-------------|----------------------------------------------------------------------------------------|
| robotNo                                 | Yes                        | None                     | String      | Robot serial number                                                                    |
| taskId                                  | Yes                        | None                     | String      | Task ID                                                                                |
| taskName                                | No                         | None                     | String      | Send Task Name                                                                         |
| taskStatus                              | Yes                        | None                     | String      | Task execution status (2: In execution; 3: Execution successful; 4: Execution failed)  |
| routeId                                 | No                         | None                     | String      | Task Route Name                                                                        |
| time                                    | Yes                        | None                     | String      | Reporting time (the reporting time of each submission when there are multiple reports) |
| <b>Point Task Parameter Description</b> |                            |                          |             |                                                                                        |
| <b>Parameter Name</b>                   | <b>Man<br/>dator<br/>y</b> | <b>Default<br/>Value</b> | <b>Type</b> | <b>Description</b>                                                                     |
| pointId                                 | Yes                        | None                     | String      | Point Number                                                                           |
| pointTaskId                             | Yes                        | None                     | String      | Current Point task ID                                                                  |
| pointName                               | Yes                        | None                     | String      | Point Name                                                                             |
| pointType                               | Yes                        | None                     | String      | Point type (1: starting point; 2: task point; 3: inflection point; 4: end point)       |
| arrivalTime                             | Yes                        | None                     | String      | Arrival time                                                                           |

## 18、Send the point cloud map route point information to

## the robot (platform --> robot)

| Details                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Brief Function Description | The cloud sends map route point information to the machine end.                                                                                                                                                                                                                                                                                                                                                                                         |
| Message subject            | robot/v1/c/sendAgentRoutePoint                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Message content            | <pre>{   "topic":"robot/v1/c/sendAgentRoutePoint",   "qos":1,   "service":"robot",   "method":"sendAgentRoutePoint",   "payload":{     "robotNo":"linxai-0001",     "mapName":"Patrol route",     "pointList":[{       "pointId":"1001",       "x":11.5 ,       "y":85 ,       "z":123,       "roll":0,       "pitch":0,       "yaw":1.57,       "floor":"10",       "type":"1"     },{       "pointId":"1002" ,       "x":11:50 ,       "y":85 ,</pre> |

```
        "z":123,
        "roll":0,
        "pitch":0,
        "yaw":1.57,
        "floor":"10",
        "type":"1"
    }},
    "edgeList":[{"
        "srcId":"1001",
        "dstId":"1002",
        "cost":"1",
        "maxSpeed":"1"
    },{
        "srcId":"1002",
        "dstId":"1003",
        "cost":"1",
        "maxSpeed":"1"
    }],
    "time":"2025-07-26 15:23:56"
}
}
```

| Parameter Description |               |                   |         |                                                                                                     |
|-----------------------|---------------|-------------------|---------|-----------------------------------------------------------------------------------------------------|
| Parameter Name        | Mand<br>atory | Defaul<br>t Value | Type    | Description                                                                                         |
| topic                 | Yes           | None              | String  | Message subject                                                                                     |
| qos                   | Yes           | None              | Integer | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |

|                                         |                       |                           |             |                                                                           |
|-----------------------------------------|-----------------------|---------------------------|-------------|---------------------------------------------------------------------------|
| service                                 | Yes                   | map                       | String      | Message service provider                                                  |
| method                                  | Yes                   | None                      | String      | Message method                                                            |
| time                                    | Yes                   | None                      | String      | Sending time                                                              |
| <b>Payload Parameter Description</b>    |                       |                           |             |                                                                           |
| <b>Parameter Name</b>                   | <b>Mand<br/>atory</b> | <b>Defaul<br/>t Value</b> | <b>Type</b> | <b>Description</b>                                                        |
| robotNo                                 | Yes                   | None                      | String      | Robot serial number                                                       |
| mapName                                 | Yes                   | None                      | String      | Map name                                                                  |
| <b>Point Task Parameter Description</b> |                       |                           |             |                                                                           |
| <b>Parameter Name</b>                   | <b>Mand<br/>atory</b> | <b>Defaul<br/>t Value</b> | <b>Type</b> | <b>Description</b>                                                        |
| pointId                                 | Yes                   | None                      | String      | Unique identification ID of the point location                            |
| x                                       | Yes                   | None                      | Double      | X coordinate                                                              |
| y                                       | Yes                   | None                      | Double      | Y coordinate                                                              |
| z                                       | Yes                   | None                      | Double      | Z coordinate                                                              |
| roll                                    | Yes                   | None                      | Double      | Attitude parameter (radians) - flip degree: 0 is passed by default        |
| pitch                                   | Yes                   | None                      | Double      | Attitude parameter (radians) - orientation degree: 0 is passed by default |
| yaw                                     | Yes                   | None                      | Double      | Attitude parameter (radians) - Yaw angle: rotation degree number          |

|           |     |      |         |                                                                                                                                                                                                        |
|-----------|-----|------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pointName | No  | None | String  | Point Name                                                                                                                                                                                             |
| floor     | Yes | None | String  | Floor: For numbers with two or more digits, the tens place and above represent the floor number. A units digit of 0 indicates a floor, while a units digit greater than 0 indicates a staircase floor. |
| type      | Yes | None | Integer | Point types:<br>Origin: 0;<br>Charging point: 1;<br>Ordinary point: 2;<br>Visual point: 3;<br>Station: 4;<br>Non-ordinary point: 12;                                                                   |

#### edgeList Parameter Description of Edge Data Object

| Parameter Name | Mandatory | Default Value | Type   | Description                               |
|----------------|-----------|---------------|--------|-------------------------------------------|
| srcId          | Yes       | None          | String | The point ID corresponding to endpoint 1  |
| dstId          | Yes       | None          | String | The point ID corresponding to endpoint 2  |
| cost           | Yes       | None          | String | The cost value of the edge, default is -1 |
| maxSpeed       | Yes       | None          | String | Maximum speed, default 1.0                |

## 19、 Issue task instructions to the robot -- based on the point cloud map mode (platform --> robot)

### Details

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |             |
| Brief Function Description | Issue task instructions to the robot -- based on the point cloud map mode (platform --> robot)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |             |
| Message subject            | robot/v1/c/sendAgentTask                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |             |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |             |
| Message content            | <pre>{<br/>  "topic":"robot/v1/c/sendAgentTask",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendAgentTask",<br/>  "payload":{<br/>    "robotNo":"lxaic2-7",<br/>    "action":"dvtTask",<br/>    "actionParam":{<br/>      "taskId":"1" ,<br/>      "taskName":"Eco Building Patrol Mission",<br/>      "sceneNo":"ccc",<br/>      "pointList":[{<br/>        "pointId":"7",<br/>        "pointTaskId":"101",<br/>        "method":0,<br/>        "taskTime":0<br/>      }]<br/>    },<br/>    "time":"2025-07-26 15:23:56"<br/>  }<br/>}</pre> |        |      |             |
| Parameter Description      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |             |
| Parameter Name             | Mand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Defaul | Type | Description |

|                                          |                       |                           |             |                                                                                                     |
|------------------------------------------|-----------------------|---------------------------|-------------|-----------------------------------------------------------------------------------------------------|
|                                          | <b>andatory</b>       | <b>t Value</b>            |             |                                                                                                     |
| topic                                    | Yes                   | None                      | String      | Message subject                                                                                     |
| qos                                      | Yes                   | None                      | Integer     | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service                                  | Yes                   | map                       | String      | Message service provider                                                                            |
| method                                   | Yes                   | None                      | String      | Message method                                                                                      |
| <b>Payload Parameter Description</b>     |                       |                           |             |                                                                                                     |
| <b>Parameter Name</b>                    | <b>Mand<br/>atory</b> | <b>Defaul<br/>t Value</b> | <b>Type</b> | <b>Description</b>                                                                                  |
| robotNo                                  | Yes                   | None                      | String      | Robot serial number                                                                                 |
| action                                   | Yes                   | None                      | String      | Task instruction identifier                                                                         |
| actionParam                              | Yes                   | None                      | Object      | The instruction contains a parameter object                                                         |
| time                                     | Yes                   | None                      | String      | Sending time                                                                                        |
| <b>Action Parm Parameter Description</b> |                       |                           |             |                                                                                                     |
| <b>Parameter Name</b>                    | <b>Mand<br/>atory</b> | <b>Defaul<br/>t Value</b> | <b>Type</b> | <b>Description</b>                                                                                  |
| taskId                                   | Yes                   | None                      | String      | Task Unique identification ID                                                                       |
| taskName                                 | Yes                   | None                      | String      | Task Name                                                                                           |

|                                        |       |      |         |                                                                                                                                                                                                           |
|----------------------------------------|-------|------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| sceneNo                                | Yes   | None | String  | Map name                                                                                                                                                                                                  |
| <b>pointList Parameter Description</b> |       |      |         |                                                                                                                                                                                                           |
| pointId                                | Yes   | None | String  | Point id                                                                                                                                                                                                  |
| pointTaskId                            | Yes   | None | String  | Point task ID                                                                                                                                                                                             |
| method                                 | Yeses | None | Integer | Task type: 0: Trace and stop at obstacles 1: Obstacle avoidance                                                                                                                                           |
| taskTime                               | Yes   | None | String  | stop time: default 0 means no stop-1: After arrival, execute the waiting task and can only continue until a cancel waiting command is sent; > 0: Continue after waiting for the specified time (s/second) |

## 20、Sends task pause/resume/cancel commands to the robot (Platform → Robot)

| Details                           |                                                                                                                      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>version number</b>             | 1.0                                                                                                                  |
| <b>Brief Function Description</b> | Sends task pause/resume/cancel commands to the robot                                                                 |
| <b>Message subject</b>            | robot/v1/c/sendAgentTaskCmd                                                                                          |
| <b>Content-Type</b>               | application/json                                                                                                     |
| <b>Message content</b>            | <pre>{   "topic":"robot/v1/c/sendAgentTaskCmd",   "qos":1,   "service":"robot",   "method":"sendAgentTaskCmd",</pre> |

```
"payload":{
  "robotNo":"linxai-0001",
  "taskList":[{
    "taskId":"1" ,
    "taskName":"Eco Tower patrol mission",
    "taskCmd":0
  },{
    "taskId":"2" ,
    "taskName":"win Towers patrol mission",
    "taskCmd":1
  }],
  "time":"2025-07-26 15:23:56"
}
```

| Parameter Description         |           |               |         |                                                                                                     |
|-------------------------------|-----------|---------------|---------|-----------------------------------------------------------------------------------------------------|
| Parameter Name                | Mandatory | Default Value | Type    | Description                                                                                         |
| topic                         | Yes       | None          | String  | Message subject                                                                                     |
| qos                           | Yes       | None          | Integer | Message level (0: at most once delivery;<br>1: at least once delivery;<br>2: exactly once delivery) |
| service                       | Yes       | map           | String  | Message service provider                                                                            |
| method                        | Yes       | None          | String  | Message method                                                                                      |
| time                          | Yes       | None          | String  | Sending time                                                                                        |
| Payload Parameter Description |           |               |         |                                                                                                     |
| Parameter Name                | Mandatory | Default Value | Type    | Description                                                                                         |

|                                        |                  |                      |             |                                                                 |
|----------------------------------------|------------------|----------------------|-------------|-----------------------------------------------------------------|
|                                        |                  |                      |             |                                                                 |
| robotNo                                | Yes              | None                 | String      | Robot serial number                                             |
| <b>Task List Parameter Description</b> |                  |                      |             |                                                                 |
| <b>Parameter Name</b>                  | <b>Mandatory</b> | <b>Default Value</b> | <b>Type</b> | <b>Description</b>                                              |
| taskId                                 | Yes              | None                 | String      | Task Unique identification ID                                   |
| taskName                               | Yes              | None                 | String      | Task Name                                                       |
| taskCmd                                | Yes              | None                 | Integer     | Task instruction status:<br>0: Paused; 1: Resumed; 2: Cancelled |

## 21、Uploads map files to the cloud file server (Platform → Cloud)

|                                   |                                                                 |
|-----------------------------------|-----------------------------------------------------------------|
| <b>Interface content</b>          |                                                                 |
| <b>version number</b>             | 1.0                                                             |
| <b>Brief Function Description</b> | Uploads map files to the cloud file server                      |
| <b>Interface address</b>          | http://ip:48080/admin-api/robot/remoteCon/uploadRobotMapZipFile |
| <b>Content-Type</b>               | application/json                                                |
| <b>Request Method</b>             | Post                                                            |
| <b>Request Header Parameters</b>  | tenant-id ,Pass in 1                                            |
| <b>File Stream Parameters</b>     | MultipartFile file                                              |

|                                |                                                                                     |                           |             |                                                           |
|--------------------------------|-------------------------------------------------------------------------------------|---------------------------|-------------|-----------------------------------------------------------|
| <b>Request Content Example</b> | {<br>"robotNo":"linxai-0001",<br>"sceneNo":"maps2025072501",<br>"uploadType":1<br>} |                           |             |                                                           |
| <b>Parameter Description</b>   |                                                                                     |                           |             |                                                           |
| <b>Parameter Name</b>          | <b>Mand<br/>atory</b>                                                               | <b>Defaul<br/>t Value</b> | <b>Type</b> | <b>Description</b>                                        |
| robotNo                        | Yes                                                                                 | None                      | String      | Robot's unique number                                     |
| sceneNo                        | Yes                                                                                 | None                      | String      | map's unique number                                       |
| uploadType                     | No                                                                                  | None                      | Integer     | Upload type(0: OSS; 1: minIo,default value Not passed: 0) |

## 22、The cloud sends the initial position of the point cloud map to the robot (Cloud → Robot)

| Interface content                 |                                                                          |
|-----------------------------------|--------------------------------------------------------------------------|
| <b>version number</b>             | 1.0                                                                      |
| <b>Brief Function Description</b> | The cloud sends the initial position of the point cloud map to the robot |
| <b>Content-Type</b>               | application/json                                                         |
| <b>Message subject</b>            | robot/v1/c/sendAgLocationData                                            |

|                              |                                                                                                                                                                                                                                                                                                                                                                                       |      |         |                                        |  |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|----------------------------------------|--|
| Details Example              | <pre>{<br/>  "topic": "robot/v1/c/sendAgLocationData",<br/>  "qos": 1,<br/>  "service": "robot",<br/>  "method": "sendAgLocationData",<br/>  "payload": {<br/>    "robotNo": "lxaic2-7",<br/>    "sceneNo": "ccc",<br/>    "locationType": 2,<br/>    "x": "0",<br/>    "y": "0",<br/>    "z": "0",<br/>    "roll": "0",<br/>    "pitch": "0",<br/>    "yaw": "0"<br/>  }<br/>}</pre> |      |         |                                        |  |
|                              | Parameter Description                                                                                                                                                                                                                                                                                                                                                                 |      |         |                                        |  |
| topic                        | Yes                                                                                                                                                                                                                                                                                                                                                                                   | None | String  | Message subject                        |  |
| qos                          | Yes                                                                                                                                                                                                                                                                                                                                                                                   | None | Integer | 消息级别(0: 最多交付一次; 1: 至少交付一次; 2: 只交付一次; ) |  |
| service                      | Yes                                                                                                                                                                                                                                                                                                                                                                                   | map  | String  | Message service provider               |  |
| method                       | Yes                                                                                                                                                                                                                                                                                                                                                                                   | None | String  | Message method                         |  |
| time                         | Yes                                                                                                                                                                                                                                                                                                                                                                                   | None | String  | Sending time                           |  |
| payloadParameter Description |                                                                                                                                                                                                                                                                                                                                                                                       |      |         |                                        |  |
| robotNo                      | Yes                                                                                                                                                                                                                                                                                                                                                                                   | None | String  | Robot's unique                         |  |

|                  |     |      |         |                                                                                      |  |
|------------------|-----|------|---------|--------------------------------------------------------------------------------------|--|
|                  |     |      |         | number                                                                               |  |
| sceneNo          | Yes | None | String  | map's<br>unique<br>number                                                            |  |
| location<br>Type | Yes | None | Integer | Positioning<br>type (2:<br>point cloud<br>positioning;<br>3: RTK<br>positioning<br>) |  |
| x                | Yes | None | String  | X<br>coordinate                                                                      |  |
| y                | Yes | None | String  | Y<br>coordinate                                                                      |  |
| z                | Yes | None | String  | Z<br>coordinate                                                                      |  |
| roll             | Yes | None | String  | Attitude<br>parameters<br>(radians)-<br>Flip degree                                  |  |
| pitch            | Yes | None | String  | Attitude<br>parameters<br>(radians)-<br>Orientation<br>degree                        |  |
| yaw              | Yes | None | String  | Attitude<br>parameters<br>(radians)-<br>Yaw angle:<br>rotation<br>degree<br>number   |  |

|  |  |  |  |  |  |
|--|--|--|--|--|--|
|  |  |  |  |  |  |
|--|--|--|--|--|--|

## 23、The robot returns the initial position status of the point cloud map to the cloud (Robot → Cloud)

| Interface content                 |                                                                                                                                                                                                                                               |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>version number</b>             | 1.0                                                                                                                                                                                                                                           |
| <b>Brief Function Description</b> | The robot returns the initial position status of the point cloud map to the cloud                                                                                                                                                             |
| <b>Content-Type</b>               | application/json                                                                                                                                                                                                                              |
| <b>Message subject</b>            | robot/v1/s/sendAgLocationStatus                                                                                                                                                                                                               |
| <b>Details Example</b>            | <pre>{   "topic":"robot/v1/s/sendAgLocationStatus",   "qos":1,   "service":"robot",   "method":"sendAgLocationStatus",   "payload":{     "robotNo":"Ixaic2-7",     "sceneNo":"test",     "locationType":2,     "locationStatus":1   } }</pre> |
| Parameter Description             |                                                                                                                                                                                                                                               |

|                                     |     |      |         |                                                                        |
|-------------------------------------|-----|------|---------|------------------------------------------------------------------------|
| topic                               | Yes | None | String  | Message subject                                                        |
| qos                                 | Yes | None | Integer | Message QoS Level (0: At most once; 1: At least once; 2: Exactly once) |
| service                             | Yes | map  | String  | Message service provider                                               |
| method                              | Yes | None | String  | Message method                                                         |
| time                                | Yes | None | String  | Sending time                                                           |
| <b>payloadParameter Description</b> |     |      |         |                                                                        |
| robotNo                             | Yes | None | String  | Robot's unique number                                                  |
| sceneNo                             | Yes | None | String  | map's unique number                                                    |
| location Type                       | Yes | None | Integer | Positioning type (2: Point cloud positioning; 3: RTK positioning)      |
| location Status                     | Yes | None | Integer | Positioning status (0: positioning failed; 1: positioning successful;) |

## 24、Pan-tilt Control Commands: (Pan-tilt pan/tilt/zoom in/zoom out, Cloud → Robot)

| Details                           |                                                                       |
|-----------------------------------|-----------------------------------------------------------------------|
| <b>version number</b>             | 1.0                                                                   |
| <b>Brief Function Description</b> | Send up, down, left, and right movement commands to the pan-tilt head |
| <b>Message subject</b>            | robot/v1/c/sendRobotPtzPanAction                                      |

|                               |                                                                                                                                                                                                                                                                                                                                                                                     |         |        |                                                                        |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|------------------------------------------------------------------------|
| Content-Type                  | application/json                                                                                                                                                                                                                                                                                                                                                                    |         |        |                                                                        |
| Message content               | <pre>{<br/>  "topic":"robot/v1/c/sendRobotPtzPanAction",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotPtzPanAction",<br/>  "payload":{<br/>    "robotNo":"Ixaic2-7",<br/>    "action":"panLeft",<br/>    "actionParam":{<br/>      "index":"0",<br/>      "speed":"5",<br/>      "stop":"0"<br/>    },<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |         |        |                                                                        |
| Parameter                     |                                                                                                                                                                                                                                                                                                                                                                                     |         |        |                                                                        |
| Description                   |                                                                                                                                                                                                                                                                                                                                                                                     |         |        |                                                                        |
|                               |                                                                                                                                                                                                                                                                                                                                                                                     |         |        |                                                                        |
| topic                         | Yes                                                                                                                                                                                                                                                                                                                                                                                 | None    | String | Message subject                                                        |
| qos                           | Yes                                                                                                                                                                                                                                                                                                                                                                                 | None    | int    | Message QoS Level (0: At most once; 1: At least once; 2: Exactly once) |
| service                       | Yes                                                                                                                                                                                                                                                                                                                                                                                 | map     | String | Message service provider                                               |
| method                        | Yes                                                                                                                                                                                                                                                                                                                                                                                 | None    | String | Message method                                                         |
| Payload Parameter Description |                                                                                                                                                                                                                                                                                                                                                                                     |         |        |                                                                        |
| Parameter                     | Mand                                                                                                                                                                                                                                                                                                                                                                                | Default | Type   | Description                                                            |

| Name                                   | andatory | Value |        |                                                                                                                                                                                                                                                                                  |
|----------------------------------------|----------|-------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| robotNo                                | Yes      | None  | String | Robot serial number                                                                                                                                                                                                                                                              |
| action                                 | Yes      | None  | String | Control Command Identifier(<br>Enumerated values:<br>- Pan Left: panLeft<br>- Pan Right: panRight<br>- Tilt Up: panUp<br>- Tilt Down: panDown<br>- Zoom In: zoomIn<br>- Zoom Out: zoomOut<br>- Light Switch: lightOnOff<br>- Wiper Switch: wiperOnOff<br>- Fan Switch: fanOnOff) |
| actionParm                             | Yes      | None  | Entity | Control parameter object                                                                                                                                                                                                                                                         |
| time                                   | Yes      | None  | String | Command sending time :<br>yyyy-MM-dd HH:mm:ss                                                                                                                                                                                                                                    |
| <b>actionParmParameter Description</b> |          |       |        |                                                                                                                                                                                                                                                                                  |
| index                                  | Yes      | None  | String | Corresponding Sequence Number:-<br>Preset Point: 1-255- Cruise Path: 1-8-<br>Pattern Scan: 1- Linear Scan: 1-4-<br>Default: 0                                                                                                                                                    |
| speed                                  | Yes      | None  | String | Pan-tilt Movement Speed:- Basic<br>Movement: 1-7                                                                                                                                                                                                                                 |
| stop                                   | Yes      | None  | String | Pan-tilt Action Control: 0: Start; 1: Stop                                                                                                                                                                                                                                       |

**25、Charging Pile Control Commands: (Sends autonomous return-to-pile charging command, Cloud →**

Robot)

| Details                    |                                                                                                                                                                                                                                                                                                                                       |      |        |                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|-----------------|
| version number             | 1.0                                                                                                                                                                                                                                                                                                                                   |      |        |                 |
| Brief Function Description | Sends the autonomous return-to-pile charging command to the robot                                                                                                                                                                                                                                                                     |      |        |                 |
| Message subject            | robot/v1/c/sendRobotReturnToCharge                                                                                                                                                                                                                                                                                                    |      |        |                 |
| Content-Type               | application/json                                                                                                                                                                                                                                                                                                                      |      |        |                 |
| Message content            | <pre>{<br/>  "topic":"robot/v1/c/sendRobotReturnToCharge",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendRobotReturnToCharge",<br/>  "payload":{<br/>    "robotNo":"Ixaic2-7",<br/>    "action":"charge",<br/>    "actionParam":{<br/>      "cmd":1<br/>    },<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |      |        |                 |
| Parameter                  |                                                                                                                                                                                                                                                                                                                                       |      |        |                 |
| Description                |                                                                                                                                                                                                                                                                                                                                       |      |        |                 |
|                            |                                                                                                                                                                                                                                                                                                                                       |      |        |                 |
| topic                      | Yes                                                                                                                                                                                                                                                                                                                                   | None | String | Message subject |

|                                        |                  |                      |             |                                                                           |
|----------------------------------------|------------------|----------------------|-------------|---------------------------------------------------------------------------|
| qos                                    | Yes              | None                 | int         | Message QoS Level (0: At most once;<br>1: At least once; 2: Exactly once) |
| service                                | Yes              | map                  | String      | Message service provider                                                  |
| method                                 | Yes              | None                 | String      | Message method                                                            |
| <b>Payload Parameter Description</b>   |                  |                      |             |                                                                           |
| <b>Parameter Name</b>                  | <b>Mandatory</b> | <b>Default Value</b> | <b>Type</b> | <b>Description</b>                                                        |
| robotNo                                | Yes              | None                 | String      | Robot serial number                                                       |
| action                                 | Yes              | None                 | String      | Control instruction( <a href="#">charge</a> )                             |
| actionParm                             | Yes              | None                 | Entity      | Control parameter object                                                  |
| time                                   | Yes              | None                 | String      | Command sending time :<br>yyyy-MM-dd HH:mm:ss                             |
| <b>actionParmParameter Description</b> |                  |                      |             |                                                                           |
| cmd                                    | Yes              | None                 | Integer     | 0: Pile out<br>1: Pile in<br>2: End                                       |

## 26、The cloud sends pan-tilt photo-taking commands to the robot (Cloud → Robot)

|                                   |                                                        |
|-----------------------------------|--------------------------------------------------------|
| <b>Details</b>                    |                                                        |
| <b>version number</b>             | 1.0                                                    |
| <b>Brief Function Description</b> | Send the pan-tilt camera shooting command to the robot |

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |        |                 |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|-----------------|
| Message subject | robot/v1/c/sendNetDvrCaptureJpegPicture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |        |                 |
| Content-Type    | application/json                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |        |                 |
| Message content | <pre>{<br/>  "topic":"robot/v1/c/sendNetDvrCaptureJpegPicture",<br/>  "qos":1,<br/>  "service":"robot",<br/>  "method":"sendNetDvrCaptureJpegPicture",<br/>  "payload":{<br/>    "robotNo":"Ixaic2-7",<br/>    "action":"tkPicture",<br/>    "lChannel":"1",<br/>    "taskId":"1",<br/>    "recordCode":"001",<br/>    "actionParam":{<br/>      "wPicSize":"9",<br/>      "wPicQuality":"1",<br/>      "sName":"picture001.jpeg",<br/>      "sUrl":"43.139.143.59"<br/>    },<br/>    "time":"2025-05-26 15:23:56"<br/>  }<br/>}</pre> |      |        |                 |
| Parameter       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |        |                 |
| Description     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |        |                 |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |        |                 |
| topic           | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | None | String | Message subject |

|                                        |                  |                      |             |                                                                           |
|----------------------------------------|------------------|----------------------|-------------|---------------------------------------------------------------------------|
| qos                                    | Yes              | None                 | int         | Message QoS Level (0: At most once;<br>1: At least once; 2: Exactly once) |
| service                                | Yes              | map                  | String      | Message service provider                                                  |
| method                                 | Yes              | None                 | String      | Message method                                                            |
| <b>Payload Parameter Description</b>   |                  |                      |             |                                                                           |
| <b>Parameter Name</b>                  | <b>Mandatory</b> | <b>Default Value</b> | <b>Type</b> | <b>Description</b>                                                        |
| robotNo                                | Yes              | None                 | String      | Robot serial number                                                       |
| action                                 | Yes              | None                 | String      | Control instructions( <a href="#">tkPicture</a> )                         |
| IChannel                               | Yes              | None                 | String      | Channel Number                                                            |
| taskId                                 | No               | None                 | String      | Task id                                                                   |
| recordCode                             | No               | None                 | String      | Unique identifier code                                                    |
| actionParm                             | Yes              | None                 | Entity      | Control parameter object                                                  |
| time                                   | Yes              | None                 | String      | Command sending time :<br>yyyy-MM-dd HH:mm:ss                             |
| <b>actionParmParameter Description</b> |                  |                      |             |                                                                           |
| wPicSize                               | Yes              | None                 | String      | Photo size                                                                |
| wPicQuality                            | Yes              | None                 | String      | Photo quality coefficient: 0 - best, 1 - better, 2 - average              |
| sName                                  | Yes              | None                 | String      | Photo name                                                                |

|      |     |      |        |         |        |
|------|-----|------|--------|---------|--------|
| sURL | Yes | None | String | address | Upload |
|------|-----|------|--------|---------|--------|

## 27、The cloud sends pan-tilt preset point control commands to the robot (Cloud → Robot)

| Details                    |                                                                                                                                                                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| version number             | 1.0                                                                                                                                                                                                                                                                  |
| Brief Function Description | Send the pan-tilt camera shooting command to the robot                                                                                                                                                                                                               |
| Message subject            | robot/v1/c/sendNetDvrCaptureJpegPicture                                                                                                                                                                                                                              |
| Content-Type               | application/json                                                                                                                                                                                                                                                     |
| Message content            | <pre>{   "topic":"robot/v1/c/sendPTZPreset",   "qos":1,   "service":"robot",   "method":"sendPTZPreset",   "payload":{     "robotNo":"Ixaic2-7",     "action":"setPreset",     "actionParam":{       "index":"1"     },     "time":"2025-05-26 15:23:56"   } }</pre> |

|                               |           |               |        |                                                                                                                                                                                                                 |
|-------------------------------|-----------|---------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |           |               |        |                                                                                                                                                                                                                 |
| Description                   | Parameter |               |        |                                                                                                                                                                                                                 |
|                               |           |               |        |                                                                                                                                                                                                                 |
| topic                         | Yes       | None          | String | Message subject                                                                                                                                                                                                 |
| qos                           | Yes       | None          | int    | Message QoS Level (0: At most once; 1: At least once; 2: Exactly once)                                                                                                                                          |
| service                       | Yes       | map           | String | Message service provider                                                                                                                                                                                        |
| method                        | Yes       | None          | String | Message method                                                                                                                                                                                                  |
| Payload Parameter Description |           |               |        |                                                                                                                                                                                                                 |
| Parameter Name                | Mandatory | Default Value | Type   | Description                                                                                                                                                                                                     |
| robotNo                       | Yes       | None          | String | Robot serial number                                                                                                                                                                                             |
| action                        | Yes       | None          | String | Control instructions<br>(<br>Set the<br>Pan-Tilt preset position: setPreset<br><br>Remove the Pan-Tilt preset<br>positions: clePreset<br><br>Rotate<br>to the preset point of the pan-tilt :<br>gotoPreset<br>) |
| actionParm                    | Yes       | None          | Entity | Control parameter object                                                                                                                                                                                        |
| time                          | Yes       | None          | String | Command sending time :<br>yyyy-MM-dd HH:mm:ss                                                                                                                                                                   |

| actionParmParameter Description |     |      |        |                                                   |
|---------------------------------|-----|------|--------|---------------------------------------------------|
| index                           | Yes | None | String | The serial number of the Pan-Tilt preset position |

## V. Other Service Introductions

### 5.1 Video Streaming Service

The video feeds from the front and rear wide-angle cameras are pushed to the following URLs via **Gstreamer** respectively:

Plain Text

```
rtsp://192.168.144.3:8554/camb
rtsp://192.168.144.3:8554/camf
```

By default, the remote controller pulls the streams and displays real-time footage. The streams can also be previewed and called via VLC or OpenCV.

For detailed operation instructions, please contact the after-sales technical support team.