



USER MANUAL

Portable Intelligent Reconnaissance Robot



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1. Introduction

Content Description

This manual mainly introduces installation, configuration, use and maintenance methods for GTR5218 portable intelligent reconnaissance robot". As the reconnaissance robot is a complex and precision device, users should carefully read and fully understand this manual before operating the device, to avoid any danger or damage to the product.

Target Readers

This manual is suitable for users or operators who use "ZC-380 PRO portable intelligent reconnaissance robot" for the first time. It can also be used for training and later maintenance.

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Precautions

Operators must comply with the following operating norms to ensure the smooth progress of the mission and the safety of the equipment and personnel:

- If you need to pull or carry the chassis, please turn off the power first, and then hold the metal body. It is forbidden to hold the tracks or flippers by hand.
- Do not lift the equipment by pulling the wires, otherwise it may cause damage to the equipment connectors. During the transportation of the equipment, avoid collisions and strong vibrations. Fix the protective cotton to prevent displacement. After receiving the equipment during long - distance transportation, please check whether the screws are loose and tighten them.
- After the chassis is charged, please tighten the charging interface protection cover to ensure the protection performance of the equipment.
- When the chassis needs to be stopped urgently, please use the controller to operate. Do not use hands, feet to forcibly stop the robot's movement to avoid personal injury.
- The robot is not fireproof. Please stay away from fire and avoid operating in a high-temperature environment.

- Please use the charger that comes with the equipment and do not use unauthorized third - party charging equipment.
- If there is upper - mounted module installed, special attention should be paid that the overall equipment cannot be thrown or impacted. During operation, pay attention to the attitude of the chassis. Excessive speed and slope may cause the robot to tip over and may damage the equipment. Therefore, the damage to the upper - mounted module caused by this is not covered by the warranty.
- The controller should avoid falling and collision. Avoid scratching the screen with sharp objects.
- Do not modify the initial settings of the Android system of the controller, otherwise it may cause abnormalities in the control APP.
- After the system fails, please refer to "Chapter 4 Daily Maintenance and Problems & Solutions " for handling or contact the manufacturer for technical support. Do not disassemble the robot without permission. The equipment that has been disassembled without authorization is not covered by the warranty.
- The battery contains harmful substances. Do not disassemble the battery or battery pack.
- This product is not a toy. To ensure its reliability, its relevant components are made of metal devices, and some parts may have sharp components. Please keep children away from this product. Please be especially careful when operating in a scene with children.
- Please operate in a legal area and do not drive onto motor roads.
- Terminology Glossary
- Upper - mounted: That is, "load", referring to the accessories added on the chassis to achieve specific functions.
- LiDAR: Light Detection and Ranging, laser radar. DOF: Degree of Freedom, degree of freedom.

2. System Overview

2.1 System Introduction

Portable intelligent reconnaissance robot ZC-380 PRO is a rugged, lightweight ground robot that can be carried by a single person. It has the impact resistance of hard ground and can be quickly deployed in a narrow space. Equipped with cameras and MIC, it can collect live audio and video in order to detect dangerous objects or detect the scene environment. Its control mode is simple, and it moves quietly and quickly with strong concealing. Professionals can remotely control the robot to small or dangerous areas with a safe distance, and view or monitor the field environment and target situation in real time, so as to provide important basis for rapid task planning, decision-making and action.

2.2 Delivery List

Type	No.	Item	Amount
Standard Parts	1	GTR218 Portable intelligent reconnaissance robot chassis (including antenna and battery)	1
	2	Communication station (including antenna and battery)	1
	3	Controller	1
	4	The connection cable between the controller and the communication station	1
	5	Headset	1
	6	Charger for the chassis (output: DC 25.2V, 2.5A)	1
	7	Charger for the communication station (output DC 12.6V, 5A)	1
	8	Inner hexagon tool set	1
	9	Manuals in English and Chinese	1
	10	Transport case	1
Optional	1	Spare battery for chassis	/
Accessories	2	Communication station fixing buckle (compatible with belts)	/

Table 1 Delivery List

Note: The charging plug is suitable for use in mainland China (AC 220V). If you need to adapt it to sockets in other countries or regions, please bring your own converter.

2.3 System Composition

The robot system includes: the chassis, the communication station and the controller, the connecting cable between the controller and the communication station (an external headset can be connected), as shown in Figure 1. After the equipment is deployed and started up, the robot can be controlled in terms of movement through the controller and video surveillance of the on-site environment can be carried out.

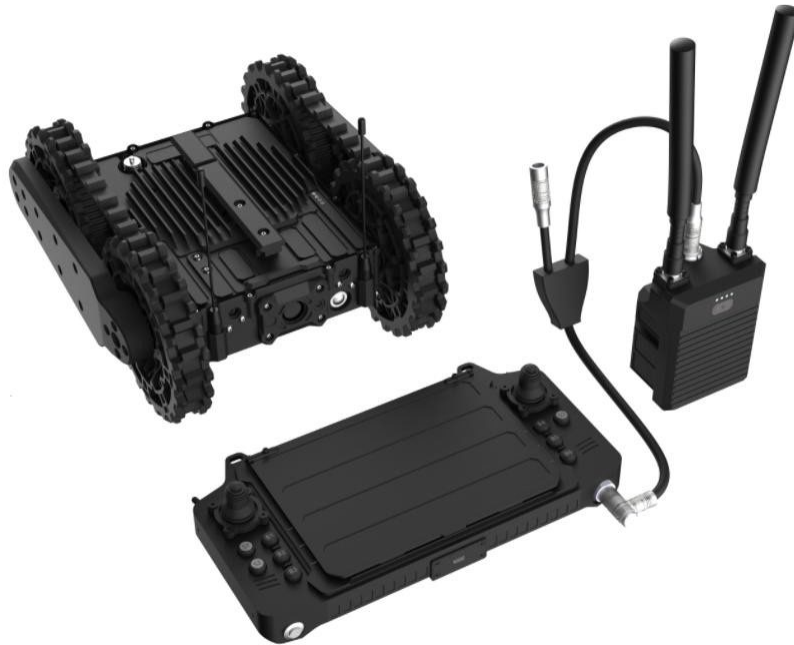


Figure 1 System Composition

2.4 Technical Features

1. **Remote Reconnaissance:** The stable point-to-multipoint or wireless AD hoc network assures remote reconnaissance.
2. **Light and Rugged:** The lightweight robot is not easy to be damaged, and it can be thrown and carried easily.
3. **Throwable:** The chassis can be thrown by one hand, it has passed the 3m high ground drop safety test, and it can self-right in-situ when flipped over.
4. **Low Noise:** The robot works with slight noise and strong concealment.
5. **Friendly interface interaction:** The controller adopts the graphic interface and the physical button, so the human-machine interaction is friendly and reliability.
6. **Modular functional accessories:** The batteries and tactical functional modules can be quickly replaced to meet the differentiated needs of multi-tasks.

2.5 Technical Specifications of the chassis.

The technical specifications of the chassis is shown in Table 2.

Technical Specifications	Robot Chassis
Size	298*254.5*140mm (antenna not included)
Weight	3.75kg
Mobility-Speed	up to 7-8km/h
Mobility-Slope	up to 35°
Mobility-Vertical Obstacles	up to 180mm
Dropping Height	≤3m
Mobility-Agility	zero radius turn
Payload	4kg
Network Type	point –to –multipoint or wireless AD hoc network
Communication Distance	1km
Communication Frequency	800MHz, 1.4GHz or 2.4GHz
RF Power	25dBm
IP Rating	IP67
Battery	2.5Ah, 24V
Power Dissipation	about 20W
Charging Time	about 1 hour
Continuous Working Hours	about 3.5 hours
Color Cameras	2 (one at the front and one at the back.), both support infrared night vision.
Camera Resolution	1080P
FOV	150°

Battery Life	cycle charge and discharge 500 times (23°C)
Operating Temp	-20°C-+50°C
Storage Temp	-25°C-+55°C
Interface	1 aviation plug
Autonomy	return over a long distance; automatically go up and down stair; self - right in - situ when flipped over.

Table 2 Technical Specifications of Chassis

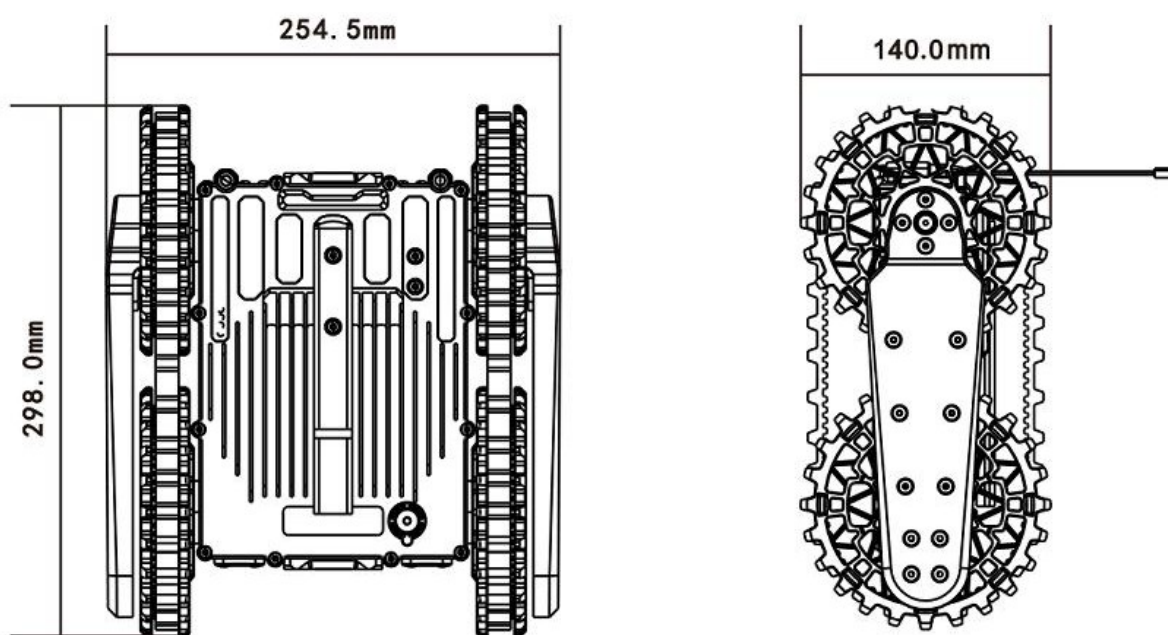


Figure 2 Dimensions of the Chassis

2.6 Technical Specifications of Communication Station

The technical specifications of the communication station are shown in Table 3.

Technical Specifications	Communication Station
Size	85*126*60.7mm (antenna not included); 85*410*60.7mm (includes standard 1.4G gooseneck antenna)
Weight	700g (antennas and accessories are not included)

Network Type	point –to –multipoint or wireless AD hoc network
Communication Frequency	800M, 1.4GHz OR 2.4G
Communication Distance	1km
Technical Specifications	Communication Station
RF Power	25dBm
Battery	6Ah, 12V
Continuous Working Hours	3-5hours (23°C)
Charging Time	about 2hours
Power Dissipation	4-12W (connecting the Controller)
IP Rating	IP67
Operating Temp	-20°C-+50°C
Storage Temp	-25°C-+55°C
Battery Life	cycle charge and discharge 500 times (23°C)
Interface	1 aviation plug

Table 3 Technical Specifications of Communication Station

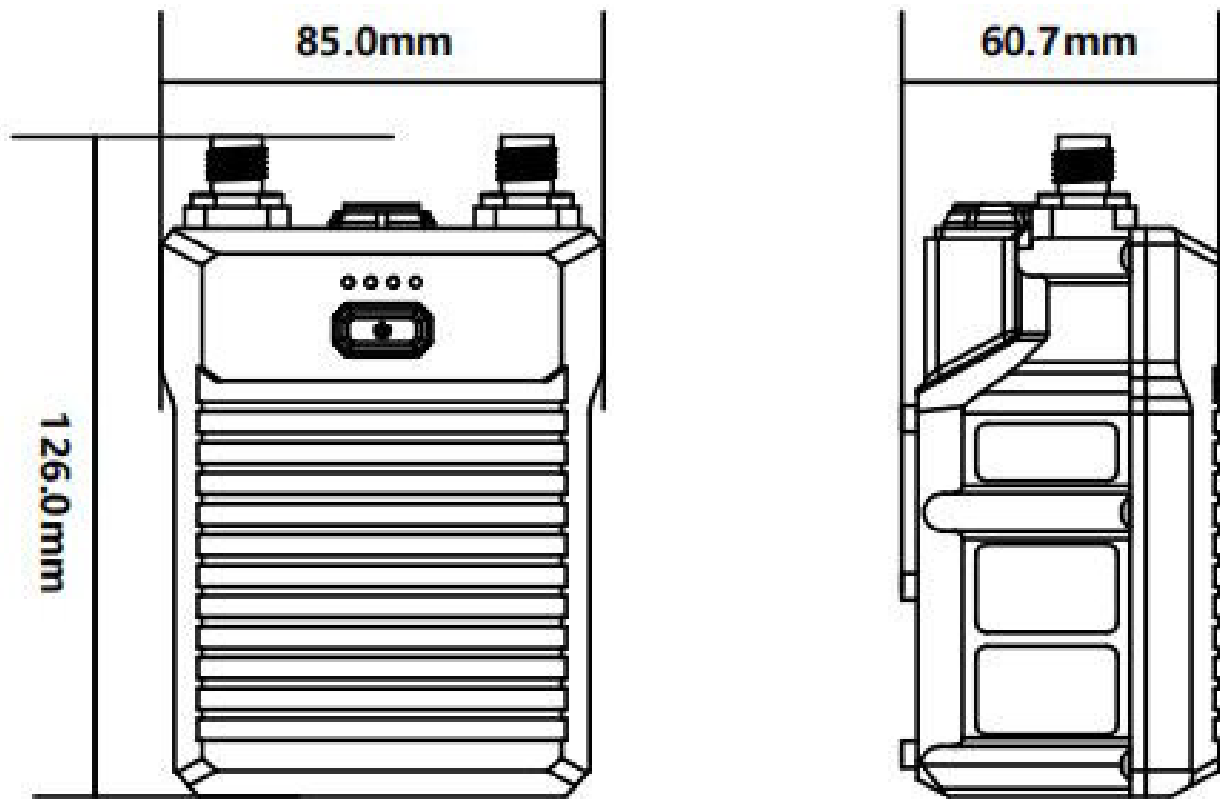


Figure 3 Dimensions of Communication Station

2.7 Technical Specifications of Controller

The technical specifications of the controller are shown in Table 4.

Technical Specifications	Controller
Size	275*147.5*65mm (closed condition, including joysticks)
Weight	1.2kg
Storage	RAM 4GB/ROM 32GB
OS	Android 12
Screen	7 inches, 10-point touch
Screen Luminance	≤1500nit
Resolution	1200*1920
Glove Mode	support
power Dissipation	3-11W
IP rating	IP67
Language	Chinese/English
Operating Temp	-20°C-+50°C
Storage Temp	-25°C-+55°C

Table 4 Technical Specifications of Controller

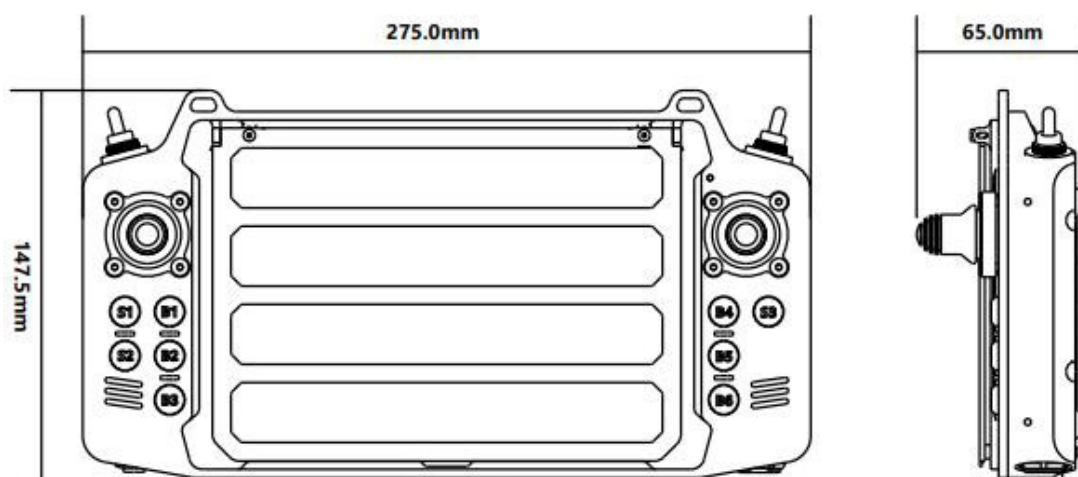


Figure 4 Size of Controller

3. Installation & Wiring

3.1 Antenna Installation

The communication frequency is set to 1.4G by default, and the standard antennas are suit for 1.4G. Later users can modify the communication frequency according to the actual needs (this function is still under development), but you need to consult the manufacturer to purchase the matching antennas or provide your own.

The antennas of the communication station are located in the transport case. Before use, install the antennas, screw them into the antenna interfaces above the communication station in the clockwise direction, and lock them with the fine-tuning nut.

3.2 Wiring Between Communication Station & Controller

The controller does not contain batteries. Before use, connect the controller to the communication interface of the communication station, and the communication station supplies power to the controller.

Note: The red mark on the interface of the connection cable should be aligned with the red mark on the device port before connecting. The description of the device interfaces and buttons are shown in Figure 5.

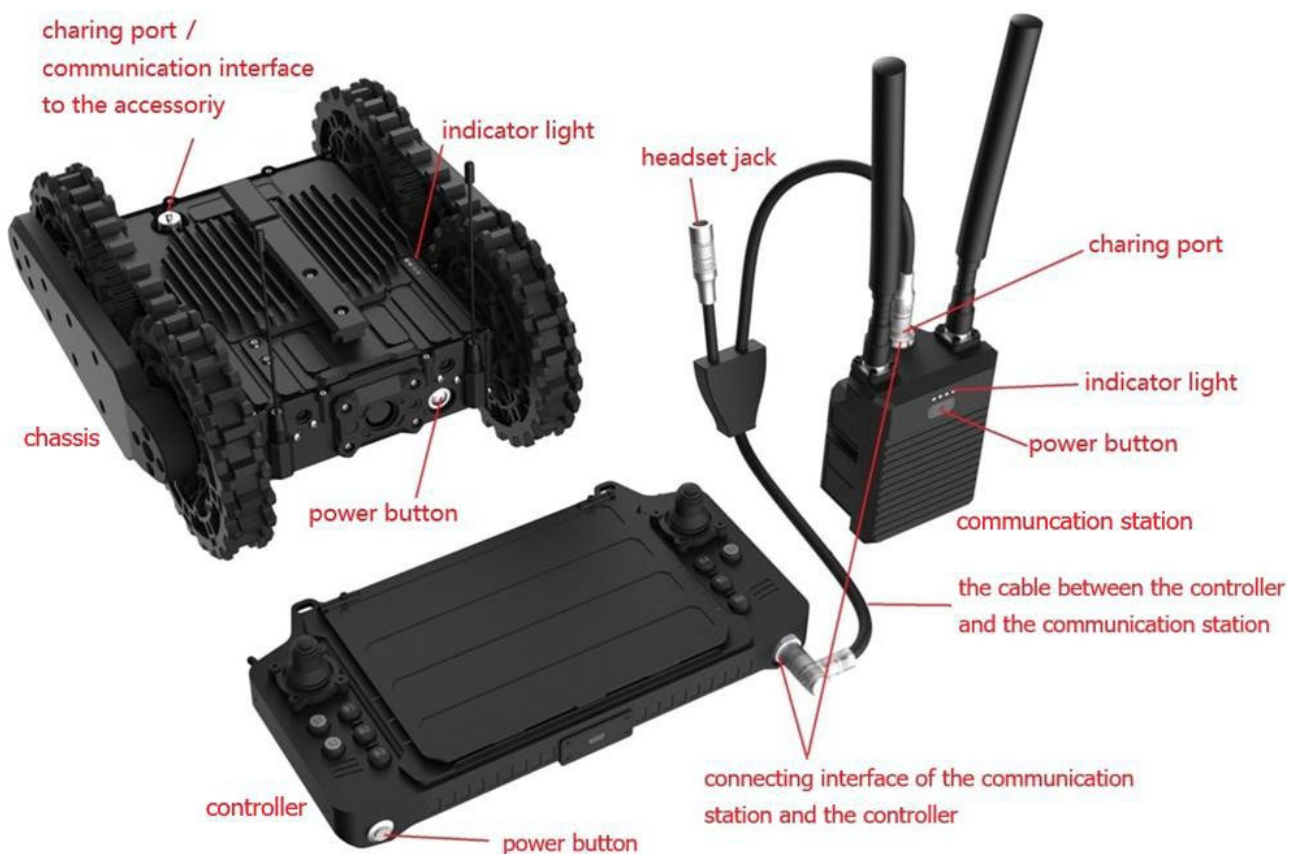


Figure 5 Functions of Interfaces & Buttons

Note: The cable connector between the communication station and the controller is a push-pull self-locking aviation plug. When pulling out, pull the release device first, as shown in Figure 6. Do not pull the cable.



1. Grasp the front part of the shell of the aviation plug;
2. Apply external force and pull the plug outwards.



1. Grasp the front part of the shell of the aviation plug;
2. Apply external force and pull the plug outwards.

Figure 6 Pull Out the Aviation Plug

3.3 Battery replacement

There are six quick-release hand screws in the battery box at the bottom of the chassis. After all of them are unscrewed, remove the battery protection cover, pull out the terminal, and tighten the screws after replacing the battery pack, as shown in Figure 7.

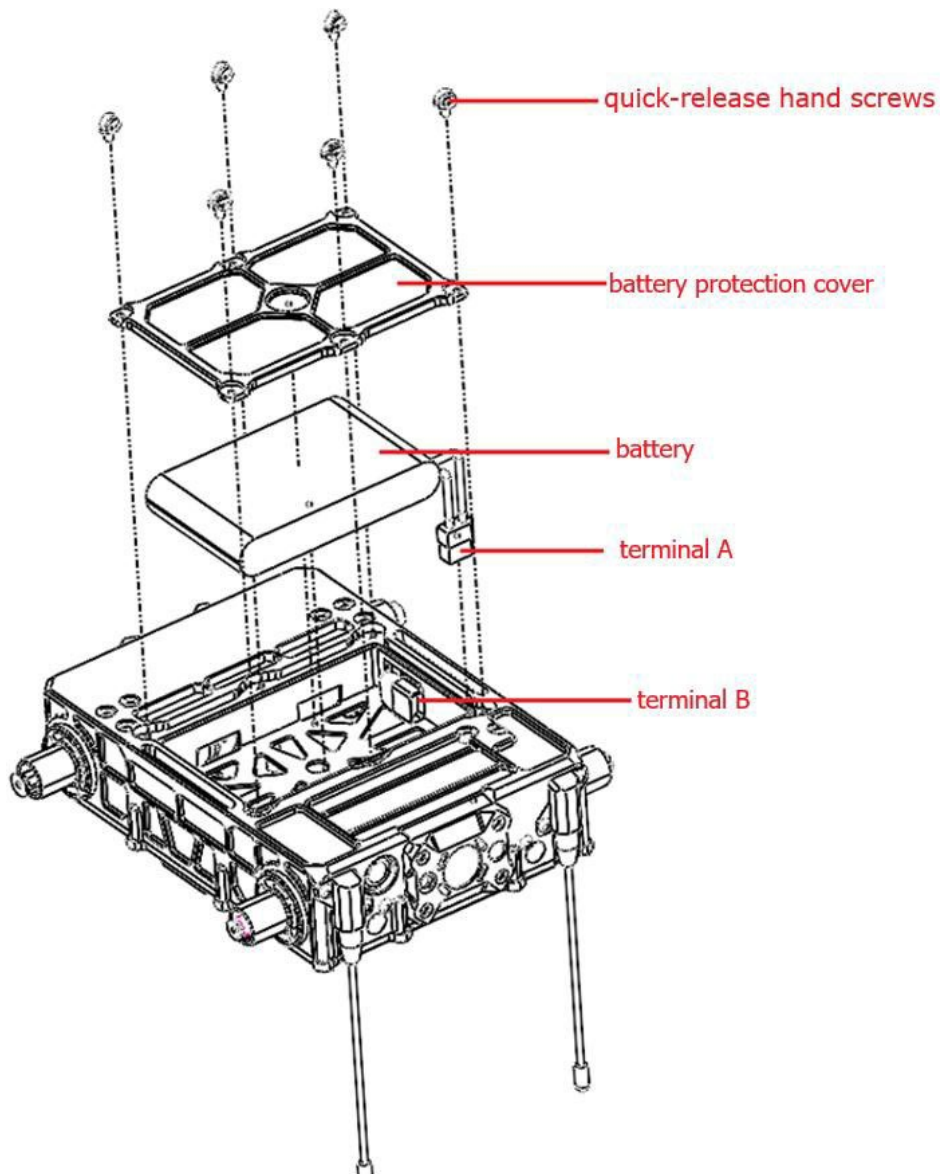


Figure 7 Chassis Battery Removal

3.4 Installation & Removal of Upper – mounted Accessories

Picatinny rail is reserved above the chassis, and the upper - mounted accessory with matching rail can be quickly matched and installed.

Push the bulge into the groove of the Picatinny rail, lock the buckle, and then access the communication interface of the install device on the chassis through the aviation plug on communication cable. When disassembling, you should remove the communication cable between the chassis and the optional accessory first, at the same time, reverse snap the buckle to loosen the installation slot, and the optional accessory can be taken out upward, as shown in Figure 8.

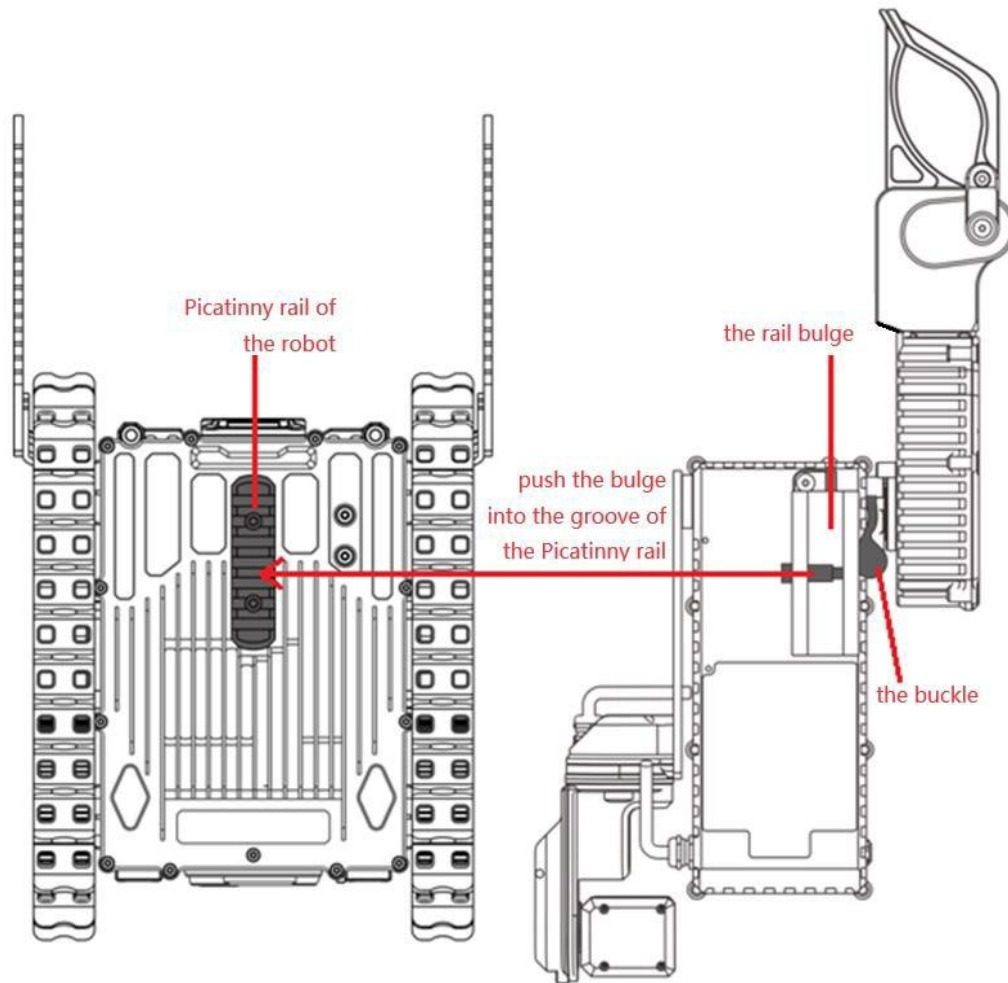


Figure 8 Installation and Disassembly (take the example of small lightweight manipulator)

NOTES:

- Some upper - mounted accessories cannot be thrown. For example, after the 3D laser scanning module or the small lightweight manipulator is installed, the device as a whole cannot be thrown.
- After such an upper - mounted accessory is installed, pay attention to the posture of the robot during operation. Too fast speed and too large slope may cause the robot to tip over, which may damage the accessory!

3.5 Fixing of the communication station

If the user has selected a communication station retaining buckle or back clip, the communication station can be secured to the user's belt through the retaining buckle or to the back clip with the M.O.L.L.E. system on a tactical vest or backpack.

Fixing fastener installation: First fix fastener A component to the back of the communication station with three screws and then fix fastener B component to component A through two hexagon screws, as shown in Figure 9. When disassembling, reverse operation is required.

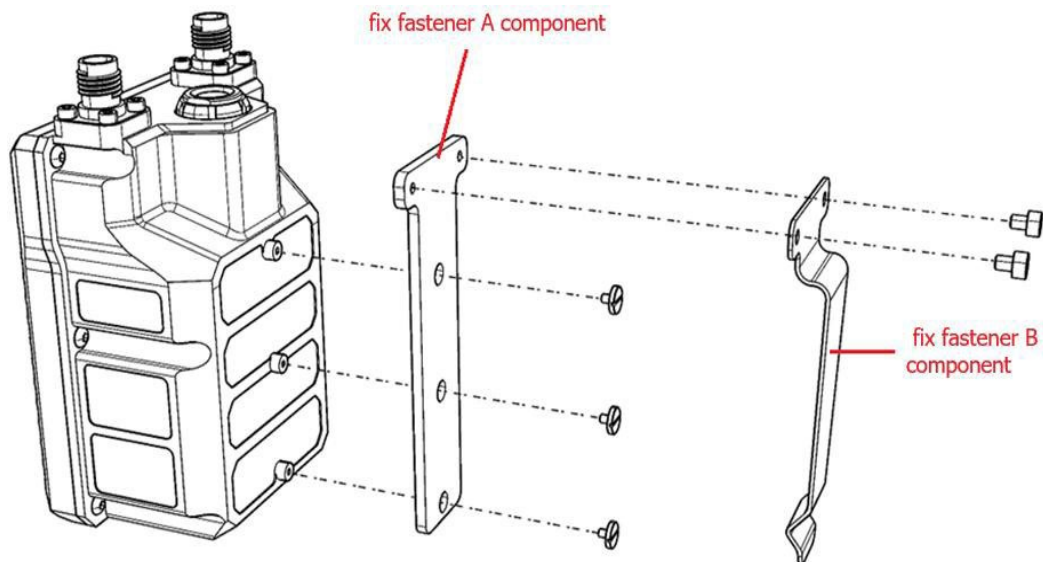


Figure 9 Communication Station Fastener

M.O.L.L.E. Installation of the back clip: Fix the back clip A component to the back of the communication platform using three screws, and then turn the upper part of the back clip B into the upper hole of the A component clockwise through the nut, as shown in Figure 10. When disassembling, reverse operation is required.

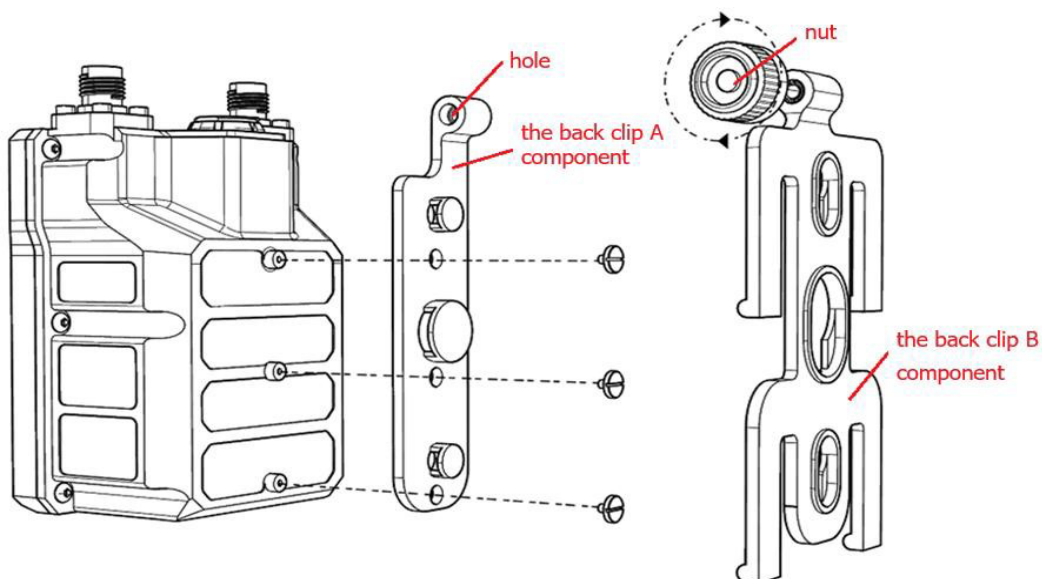


Figure 10 Communication Station Back Clamp Installation

4. Basic Operating

4.1 Charging

The chassis and communication station are charged with special chargers. The output of the robot chassis charger is DC25.2V, 2.5A, and the output of the communication station charger is DC12.6V, 5A. When the indicator light of the charger is red, it means that the battery is being charged, and if the indicator is green, it indicates that the charging device is fully charged, not connected, or virtually connected. See Figure 5 for the charging port. After charging, please cover the charging interface to ensure the protective performance of the product.

Note: The controller does not have a battery. After connecting to the communication station with a dedicated cable, the communication station supplies power to it.

4.2 Turn on & off

The power buttons of the chassis, communication station and controller are shown in Figure 5.

Routine method:

- **Turn on the chassis:** After short-pressing, press and hold the power button, and wait for the power indicator light to flash to indicate that the power-on is complete.
- **Turn off the chassis:** Press and hold the power button after a short-press and wait for the power indicator light to turn off to indicate that the shutdown is complete.
- **Turn on the communication station and the controller:** When the communication station and the controller are wired, first short-press and then press and hold any power button of the communication station or controller, the two will be powered on synchronously, the power indicator of the communication station will flash and light up, and the controller screen will light up;
- **Turn off the communication station and the controller:** When the controller screen is on, press and hold the power button, the controller screen will pop up the shutdown confirmation virtual button, click to confirm the shutdown, the communication station and the controller will shut down synchronously, the indicator light of the communication station will be off, and the controller screen will be off. When the controller is off, you should first light up the screen and then turn off the controller as described above.
- **Turn off the controller screen:** When the controller screen is on, short press the power button to turn off the controller screen;
- **Turn on the controller screen:** When the controller is powered on and the screen is off, short press the power button, and the controller screen lights up.

Special method:

- When the controller is wired with the communication station and powered on, you can also swipe down from the top of the screen to enter the system shutdown menu, click shut down, the controller and the communication station can be shut down, please do not modify other system settings in this process.
- When the controller is wired with the communication station and the controller is powered on, if there is an unexpected situation such as that the controller screen is out of control, you can press and hold (for greater than 12S) any power button of the two, and the communication station and the controller can

be forced to shut down. It is not recommended to use this method to shut down unless there are special circumstances.

- If the physical circuit between the controller and the communication station is disconnected and the communication station is already turned on, you need to connect the power cable to the communication station first and then short press the power button when you want to turn on the controller at this time.
- Unplugging the cable from the communication station will cause both the communication station and the controller to shut down. Please do not use this method to shut down under normal circumstances.

4.3 Check Battery Level

After starting the chassis, you can check the battery level on the page of the controller software.

The power level of the communication station can be checked by the power indicator. The power indicator of the communication station is a four-section indicator. The more lights that are on, the more battery charge there is. Once the controller is connected, you can also check its battery level through the software interface. When both the controller and the communication station are wired and turned off, you can short press either power button, and the power indicator of the communication station will light up to check the battery level.

Note: When the battery is not fully charged, the battery level display may be higher than the actual level (virtual charge), you can try again after fully charging the device.

4.4 Operating Instructions

4.4.1 Check Before Operation

1. Please ensure that the batteries of the chassis and the communication station are fully charged.
2. Confirm that there is no object such as small stones, twigs, or debris in the tracks or wheels.
3. Make sure that the screws of the equipment are not loose. If they are loose, tighten them with tools.
4. If there are any accessories installed, make sure that the installation is stable.
5. The controller and communication station need to be connected with a special connection cable, please ensure that the connection is firm.

4.4.2 Basic control instruction

Motion control and reconnaissance can be carried out by the controller. Controller operation includes software and physical buttons.

4.4.2.1 Controller Software Home Page

When only one chassis is powered on, after the controller is powered on, it enters the home page and connects to the corresponding chassis, as shown in Figure 11. Users can see the device power, communication link status and other information from the diagram, and can directly enter the corresponding page from the following "Media ", "Security" and "User Center". Click "Start" to enter the control page.

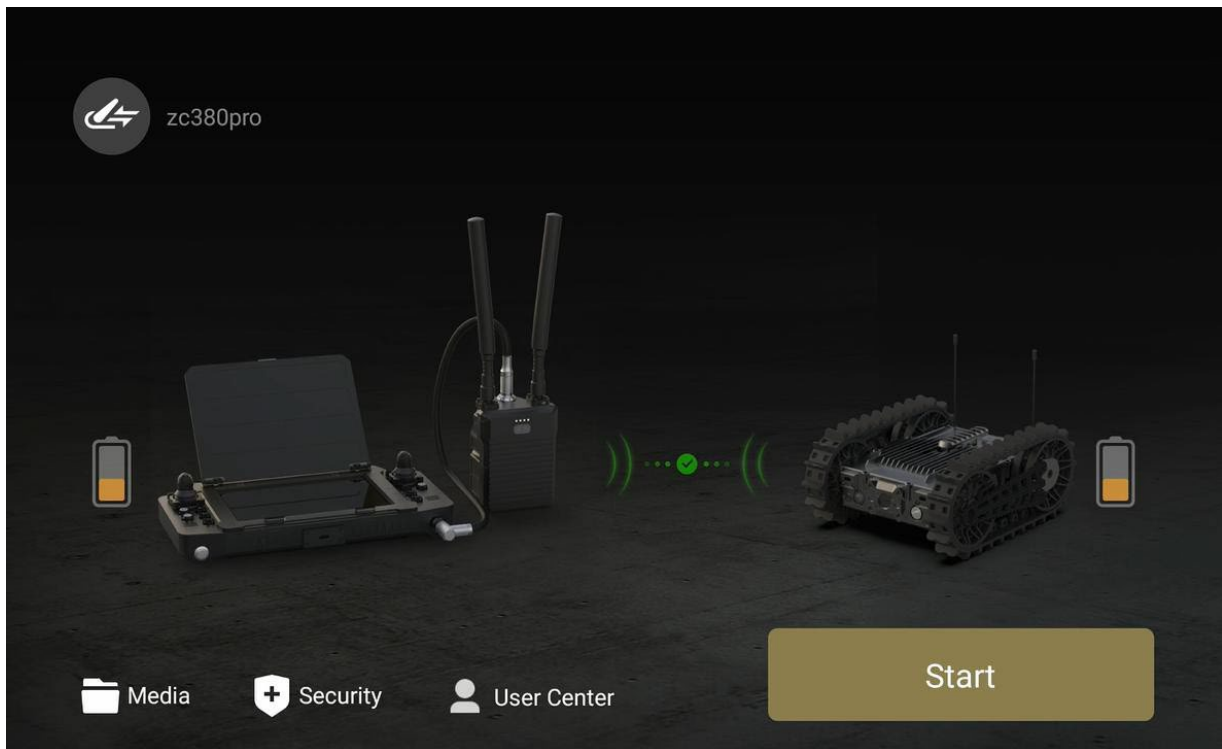


Figure 11 Home Page

When multiple chassis are powered on, the page shown in Figure 12 will be displayed upon startup. Users can click "Please select device" in the upper left corner according to their own needs to select the chassis to be controlled, and then click "Start" to enter the control interface. Users can also switch devices to be controlled on this screen.

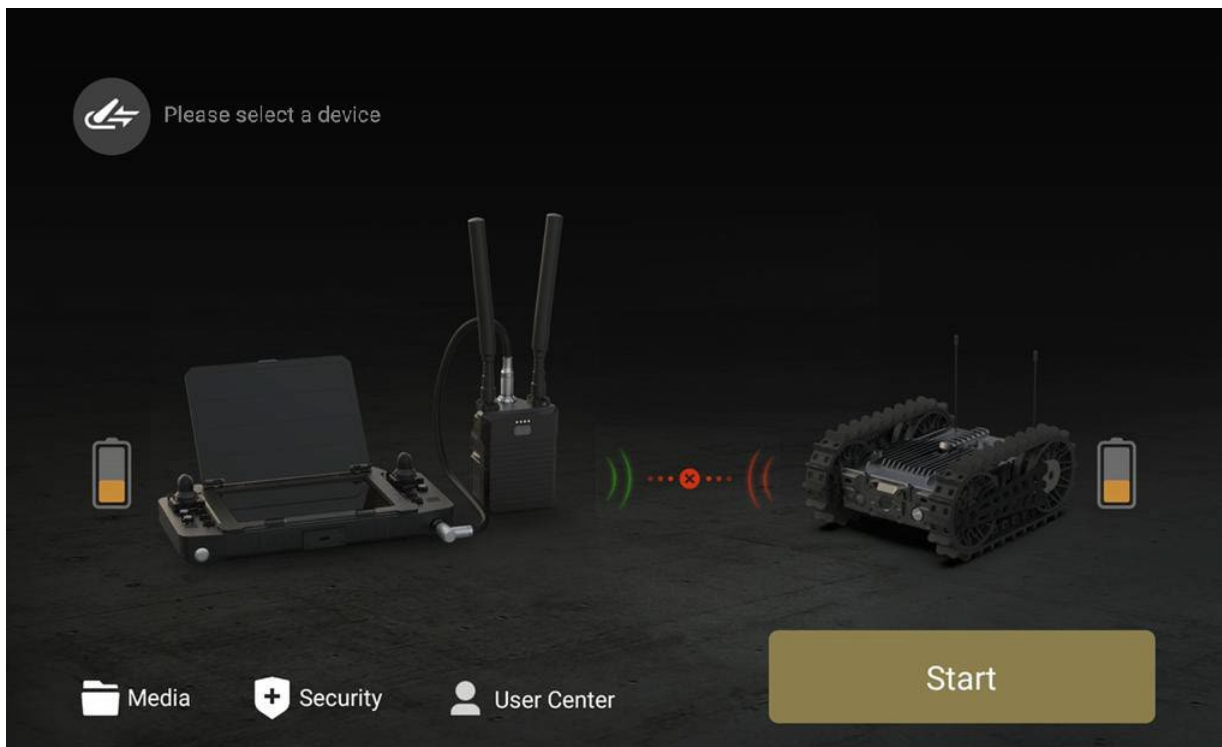


Figure 12 Home Page

Control Page

The control interface is shown in Figure 13. The user can control the chassis through the joysticks (as shown in 3.4.2.2). At the same time, the user can observe and monitor the situation of the reconnaissance site in real time, and can take photos and video files.

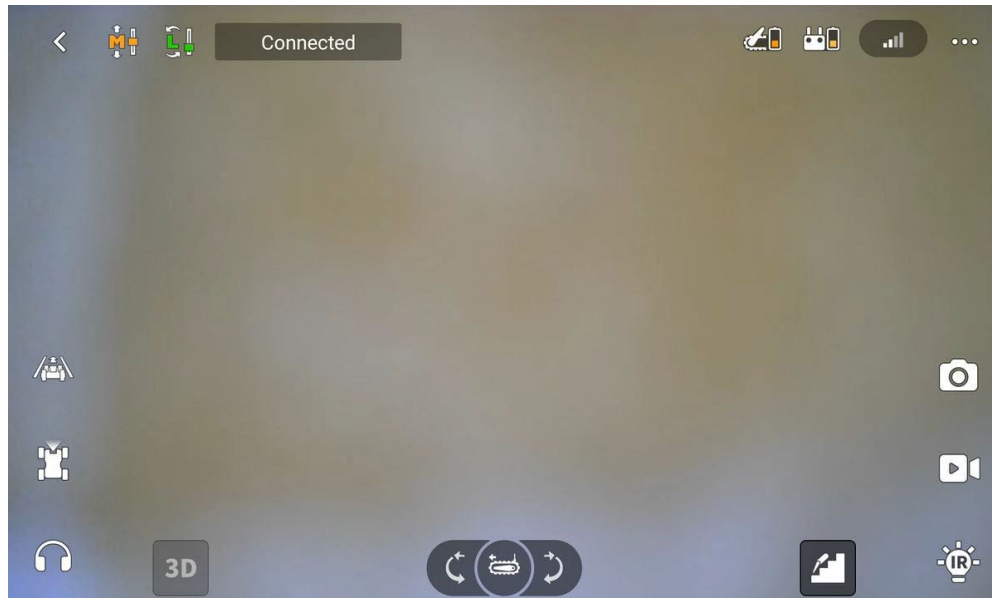


Figure 13 Control Page

Icons and operation instructions are shown in the Table5:

N o .	Icon	Instruction
1		The driving speed gear is divided into high, middle and low (H, M, L), and the upper limit of the driving speed is (: 2.2m/s, 1.1m/s, 0.55m/s).
2		The steering speed gear is divided into high, middle and low (H, M, L), and the upper limit of the steering speed is (10.88rad/s, 5.44rad/s, 2.72rad/s).
3		Status display bar. The content displayed here changes with the real-time status of the device. Click to enter the security center.
4		Robot chassis battery power display, when the power display is red or yellow, it indicates insufficient power, it is recommended to return to charge or replace the battery.

5		When the battery is displayed in red or yellow, it indicates that the battery is insufficient. You are advised to charge or replace the battery.
6		The strength of the network signal between the chassis and the controller. Click the icon to enter the network settings and select different frequency points (this function is still under development).
7		Tap this icon to enter the device settings screen. Note: After entering the setting screen, all physical keys cannot trigger response.
8		The orientation mode, after opening, can correct the deviation during the chassis driving to a certain extent. You can enable this mode if you want to keep driving in a straight line.
9		Chassis front and rear cameras switch. Click the icon to display different camera images on the screen.
10		Monitor, click to turn on/off the monitor function and save the monitored audio in the media library.
11		Capture: Take a picture of the camera displayed on the screen and save the photo file in the media library.
12		Recording: Click to open or close the recording mode and record the screen displaying. The recordings are saved in the media library. In recording mode, you can see the recording timing.
13		Camera infrared night vision switch, click to turn on or off the infrared fill light of the camera.
14		Click to enter the 3D point cloud model observation interface (refer to Appendix A for details).
15		Manipulator control: Click "Control" to open the manipulator control panel, and click "Action" to open the preset action panel of the manipulator (refer to Appendix B for details). This icon does not appear if the manipulator is not installed or connected.
16		Direction control of flippers.

1 7		Automatic climbing function, click to choose automatic up stairs or automatic down stairs function.
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Table 5 Icon Instructions

NOTES:

- The controller software is “”, if you exit the program by mistake, click the icon from the desktop to re-enter the control APP;
- Do not modify the initial system Settings of the controller. Otherwise, the control APP may fail.

Settings

The settings page includes Chassis, Control, Accessory, General and Comm settings.

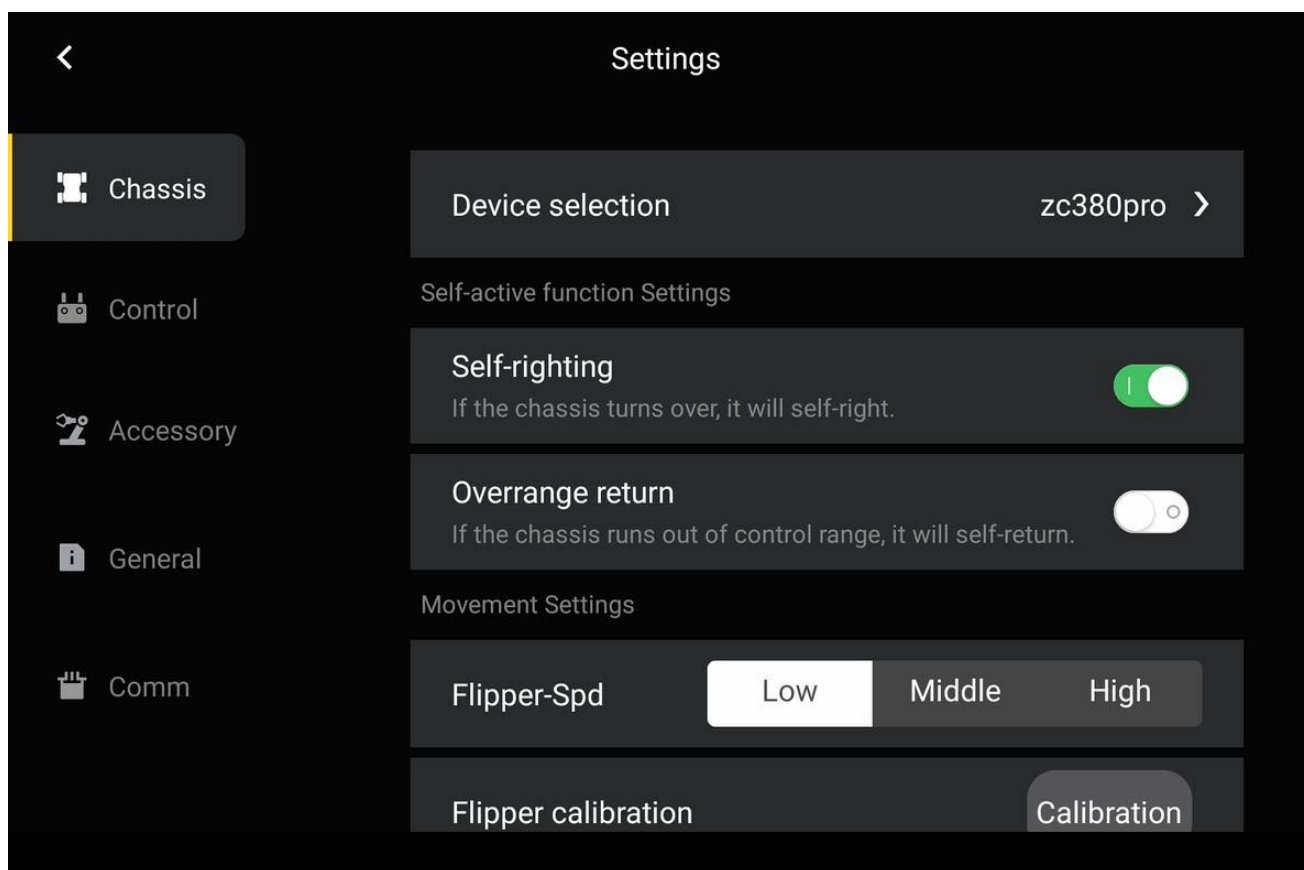


Figure 14 Chassis

Chassis Settings: The user can select the chassis to be operated, turn on or off the autonomous functions (automatic alignment, return over a long distance), set the flippers speed and manually calibrate the flipper attitude, and turn on or off the chassis power indicator.

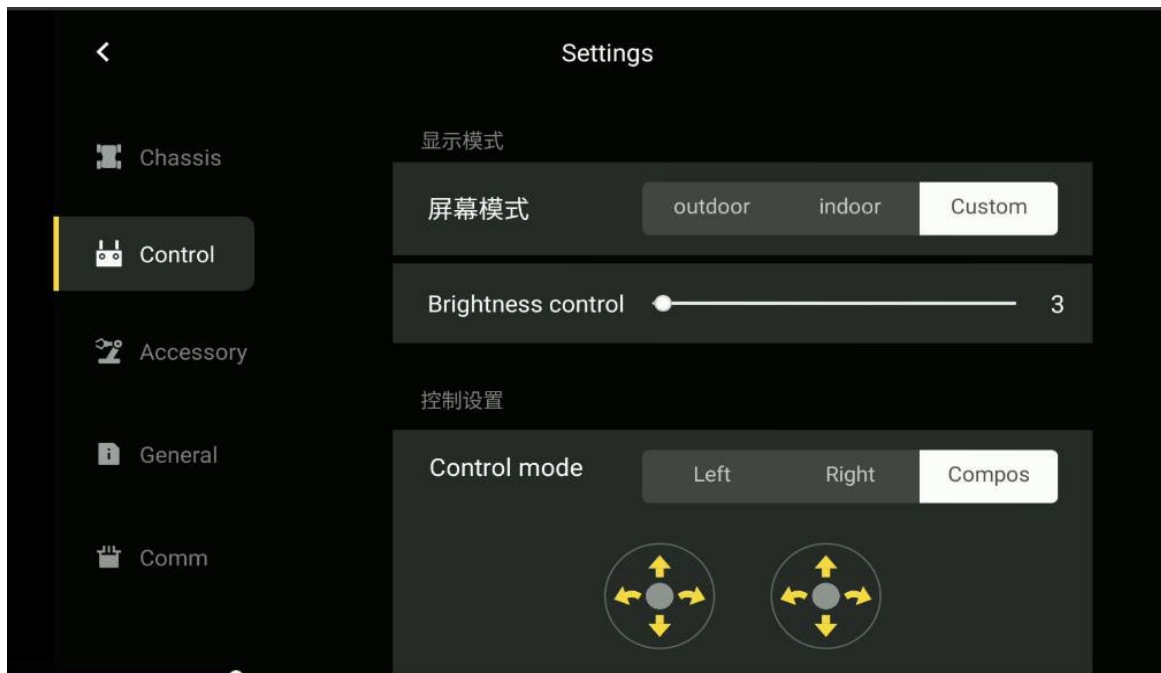


Figure 15 Control

Control Settings: mainly the settings of the controller, including **screen settings**, **control settings**, **auxiliary functions**. Users can set the screen brightness according to the use of the environment, outdoor mode screen brightness is relatively high, can achieve daylight visibility; Indoor mode screen brightness is lower, saving energy. Users can also customize the screen brightness. The control mode mainly depends on the user's habit, "Left" mode: the controller left rocker controls the chassis forward and backward, and the right rocker controls the chassis steering; "Right " mode: The controller's right rocker controls the chassis forward and backward, and the left rocker controls the chassis steering. "Compos" means that either of the two rockers can control the chassis forward and steering. **Auxiliary function** (under development) : The driver assistance line is opened, and the auxiliary line can be displayed on the screen for the reference of the operator; When the glove mode is turned on, the sensitivity will be increased and it is more suitable for the operator to use when wearing gloves.

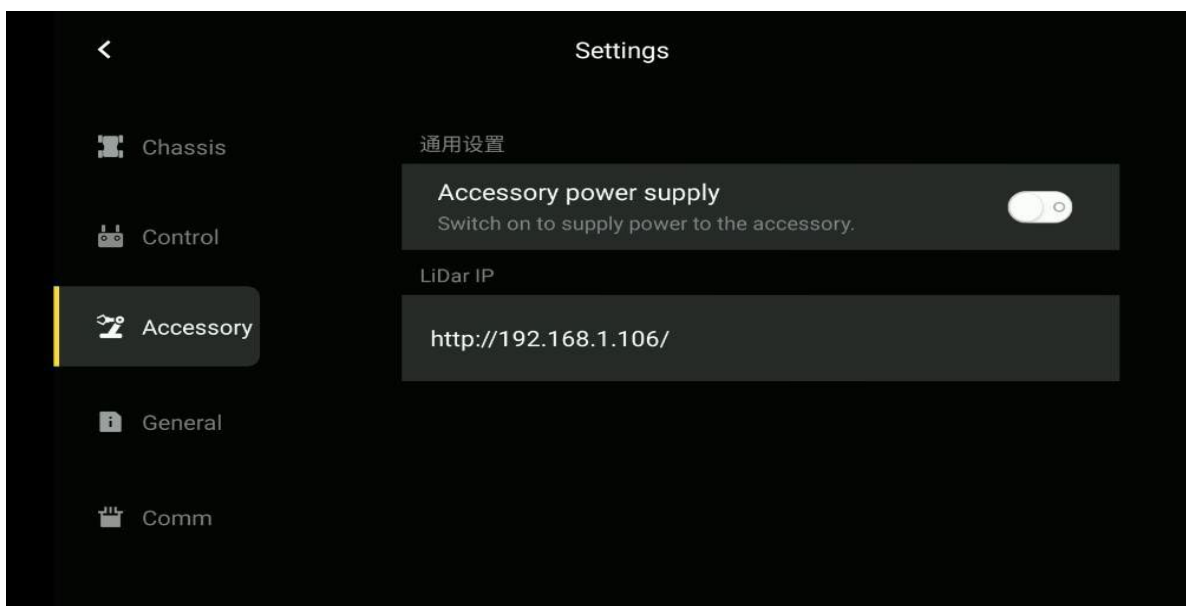


Figure 16 Accessory

Accessory Settings: General setting, currently only includes accessory power supply. If there is an accessory that needs chassis power supply (such as 3D Laser scanning module) ,you need to turn on this switch; LiDAR IP: the default IP address, if the LiDAR IP address is changed by misoperation, you can change it back to the default IP address.

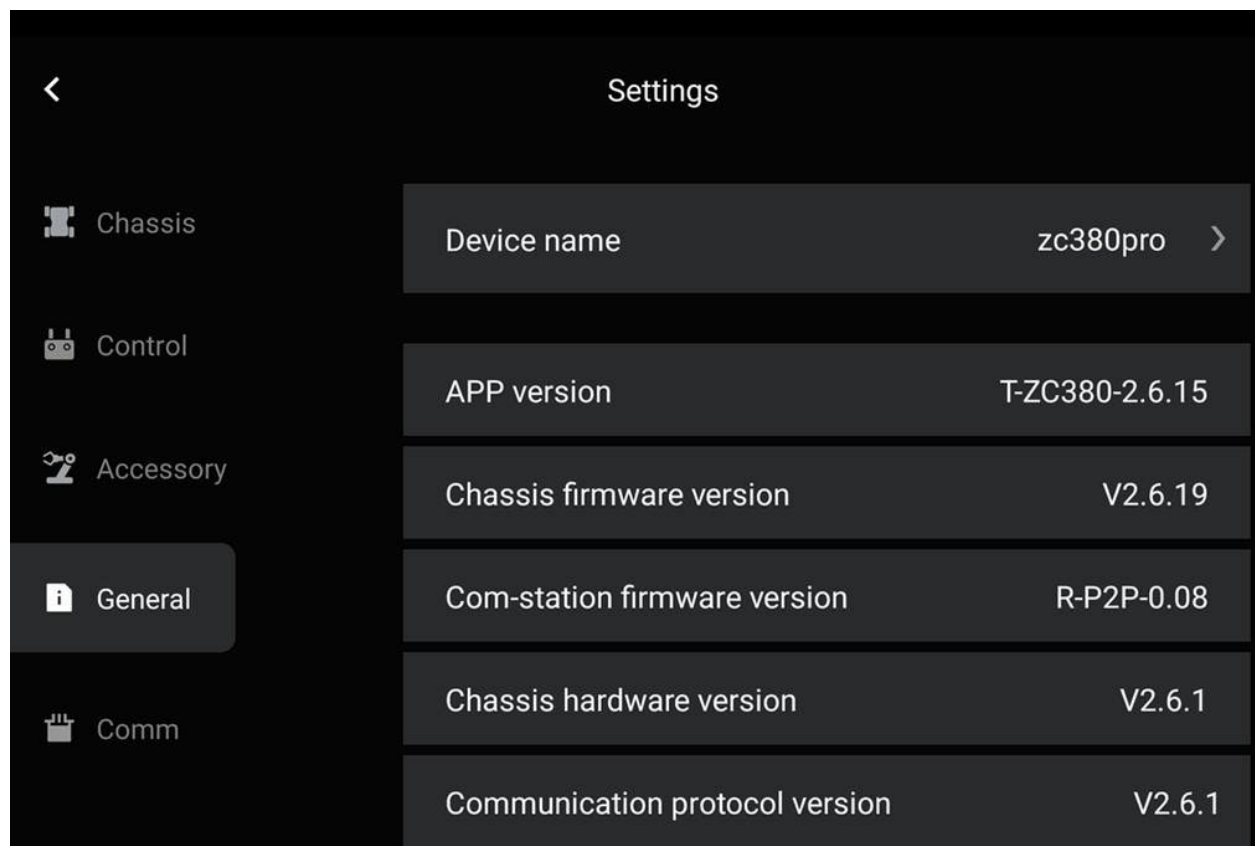


Figure 17 System Settings

General Settings: You can edit the name of the connected device and view the version of the device.

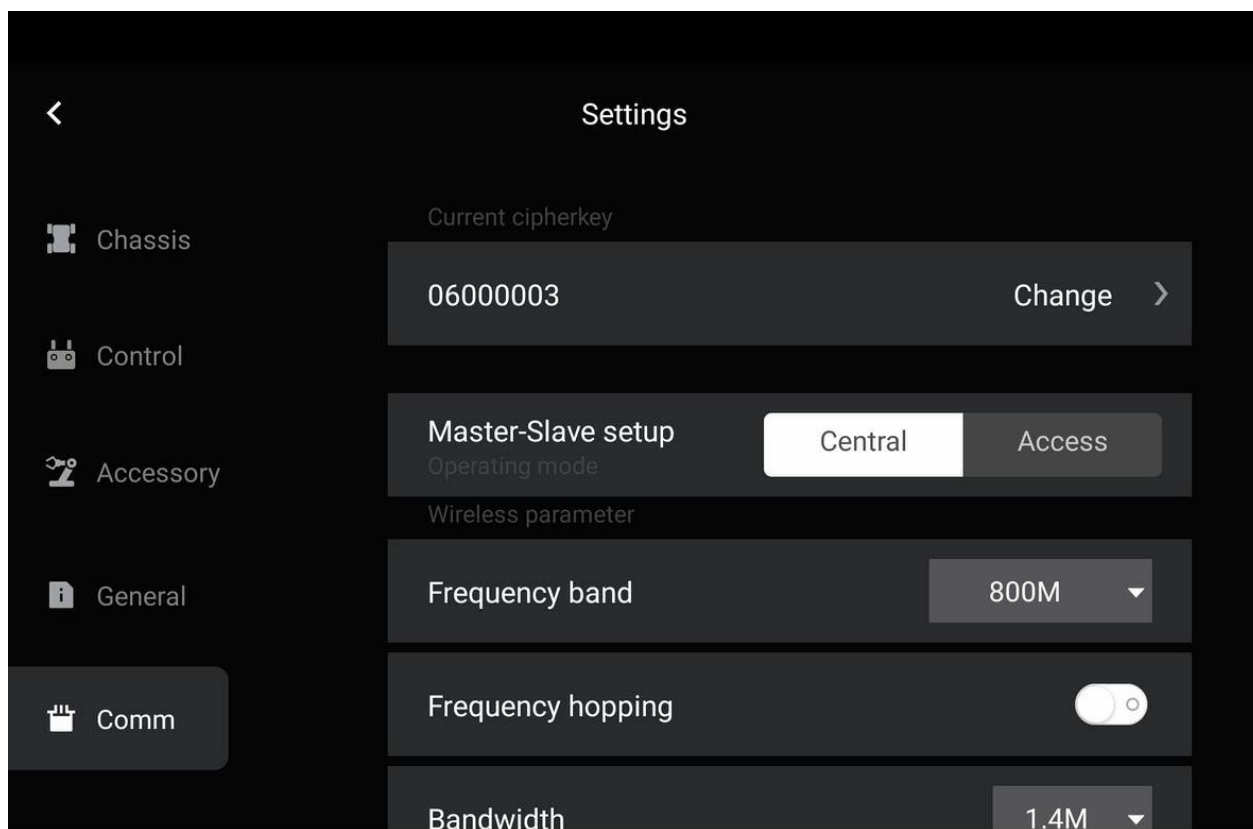


Figure 18 Communication

Comm Settings (under development): You can change the current cipherkey, node master-slave relationship and wireless parameters, current IP and other parameters. This feature is still under development.

Media

On this screen, you can view the photos, audio and video files you have taken, and label or batch the files.

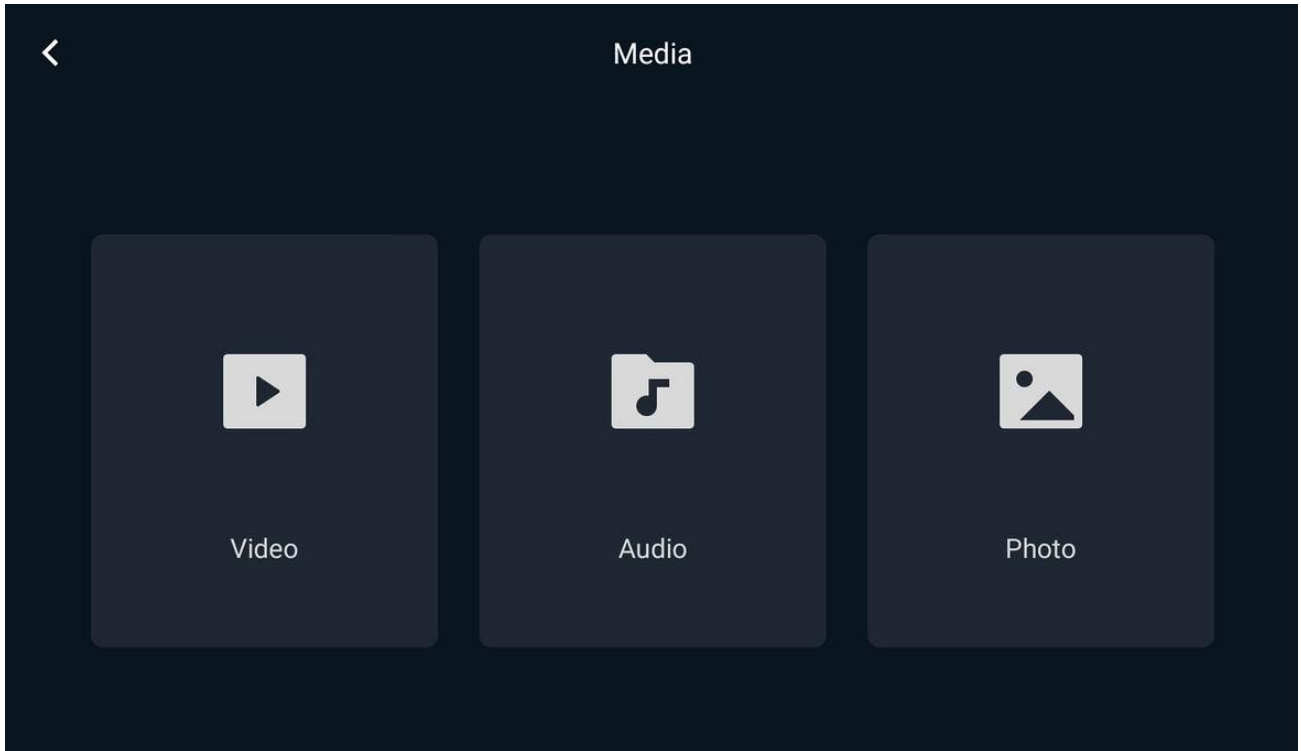


Figure 19 Media

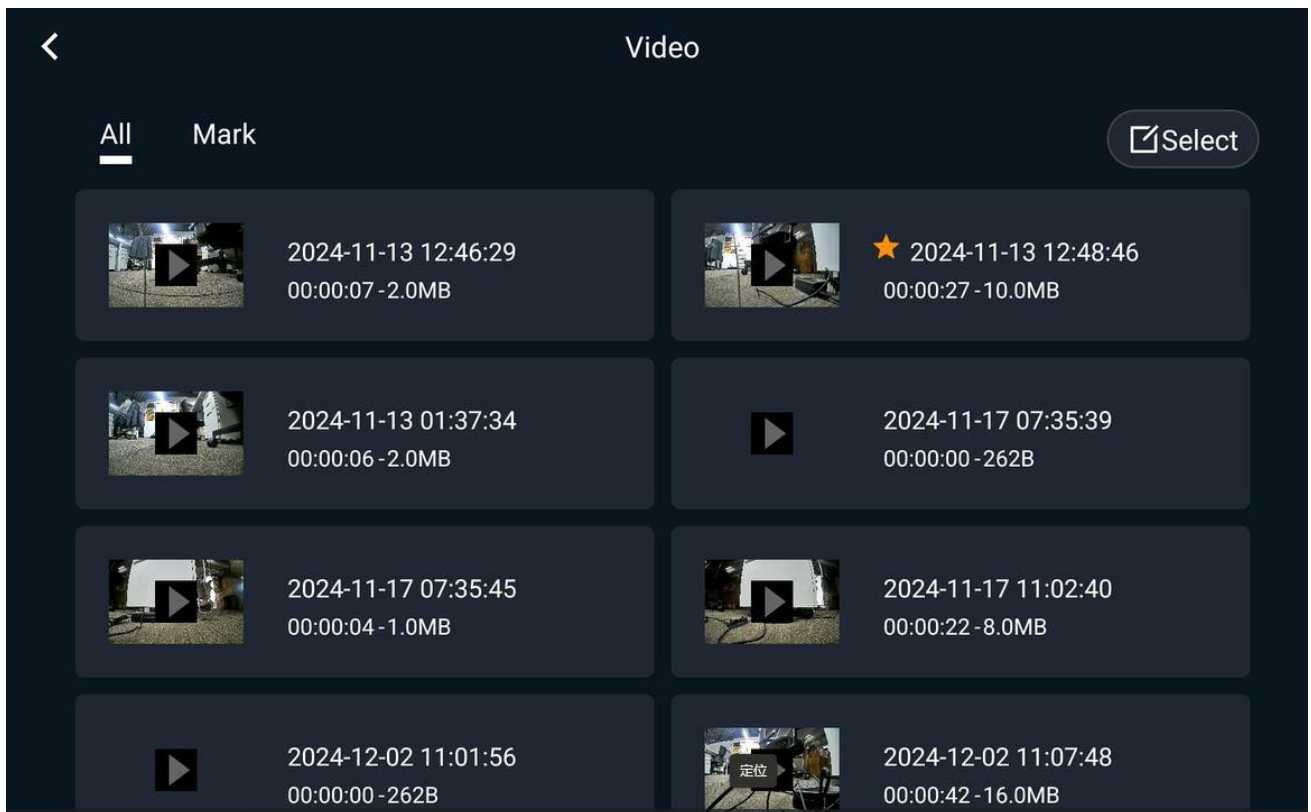


Figure 20 Video

Security

On this page, you can view the device connection status and the working status of the chassis battery, each sensor, memory and accessories. If there is an exception, the main page status display bar will also have a corresponding prompt, upper - mounted device status prompt will vary according to the connected device.

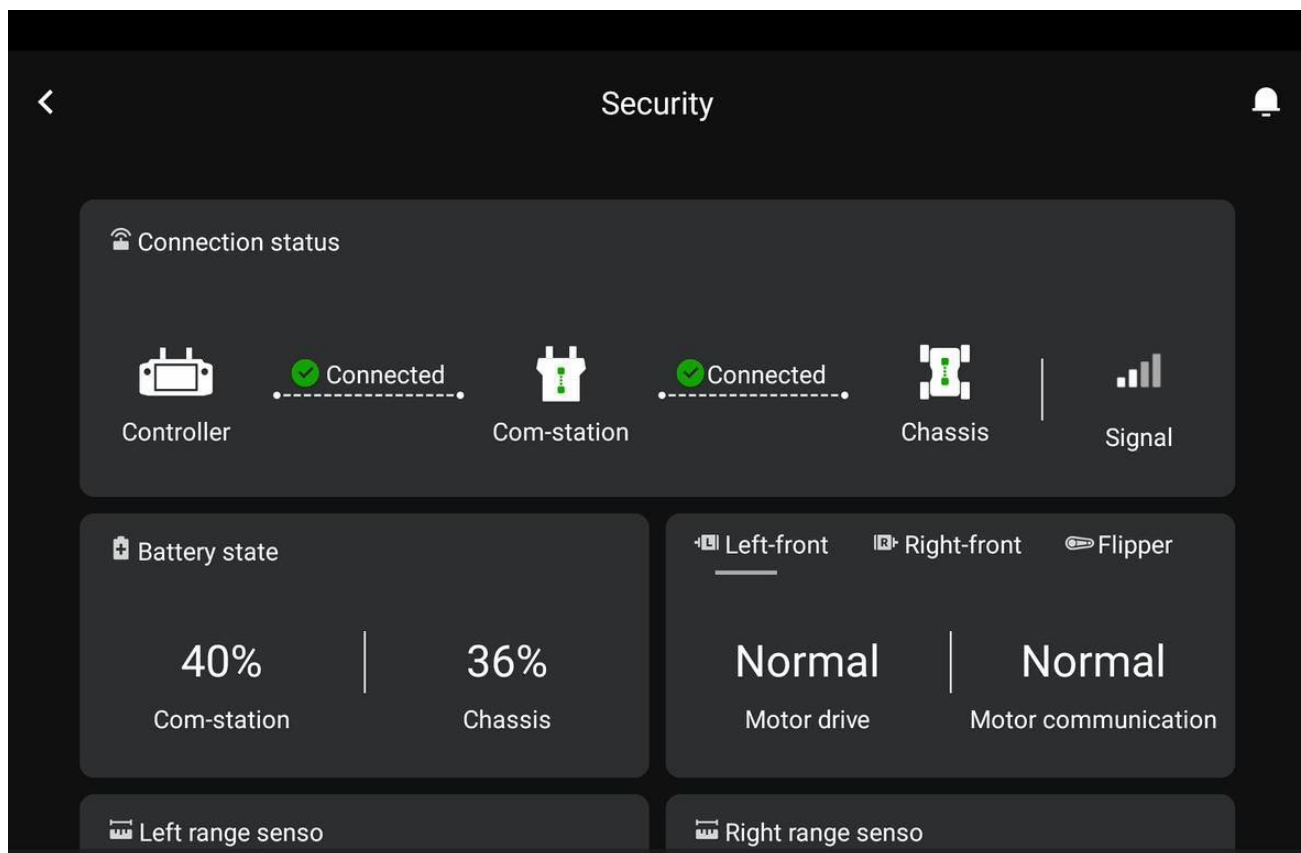


Figure 21 Security

User Center

Application Language: Currently only support English and Chinese switching.

Device network: you can view the IP addresses of all devices connected to the controller in the same network.

Instructions/ Accessory function guidance: It is convenient for first-time users to understand how to use the device.

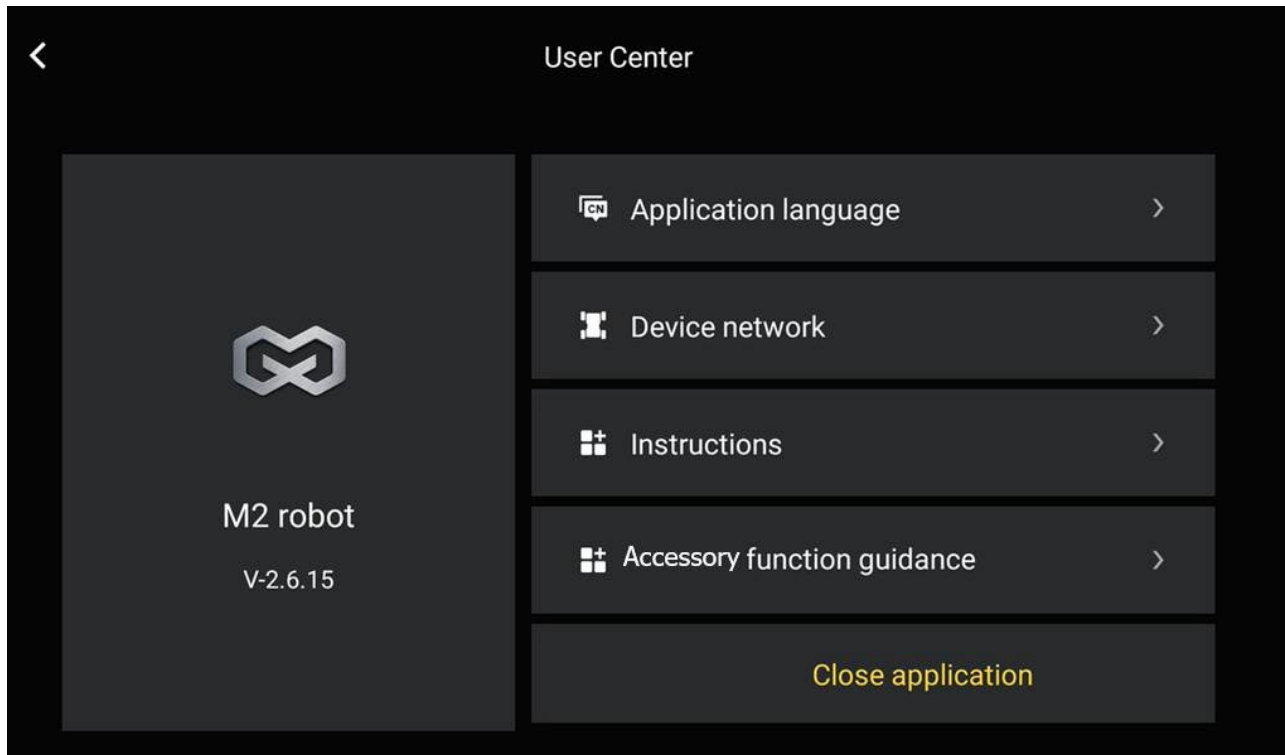


Figure 22 User Center

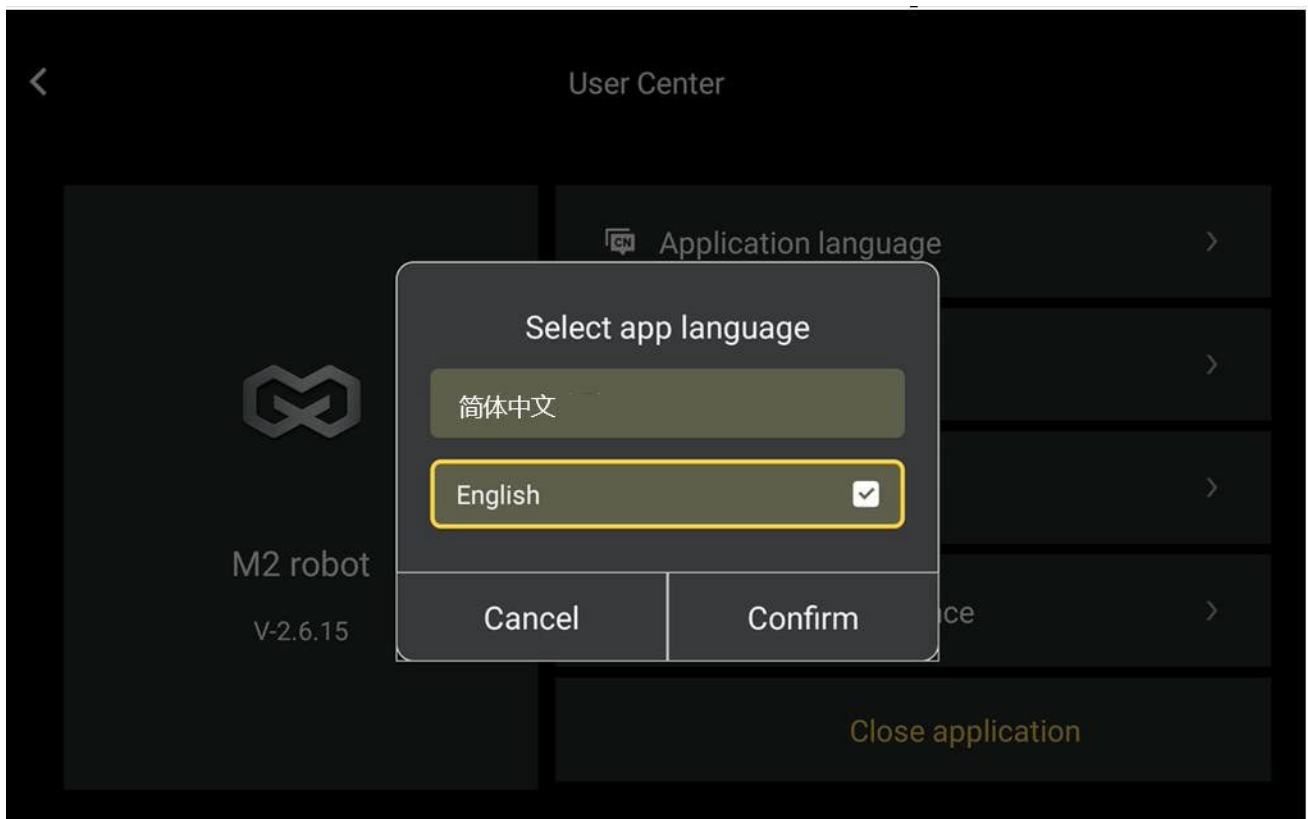


Figure 23 Language Settings

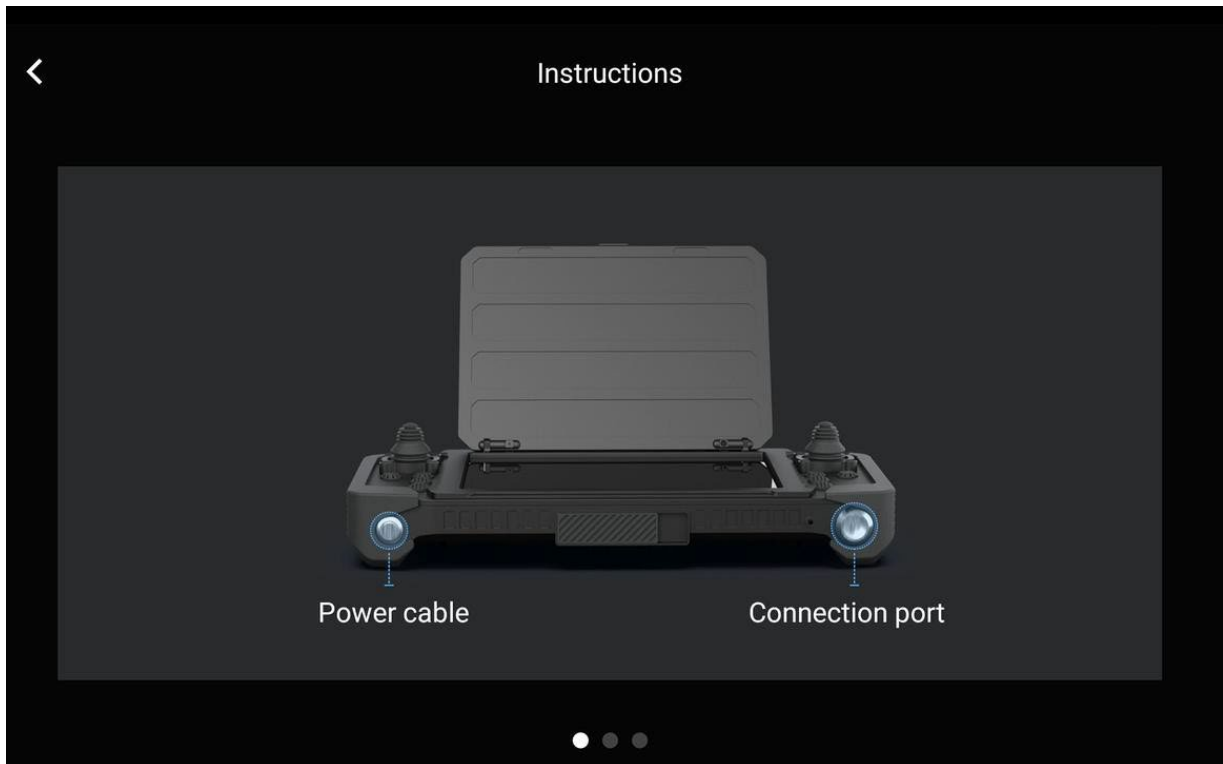


Figure 24 Instructions

4.4.2.1 Physical Buttons

Physical buttons of the controller are shown in Figure 25:



Figure 25 Physical Buttons of the Controller

T1/T2 lever: can quickly adjust the chassis driving speed and steering speed, its status can be fed back in the APP control interface.

J1/J2 joystick: Different control modes can be set through the APP Settings - control Settings interface.

Other buttons are physical shortcut keys, and corresponding virtual keys are displayed on the APP control interface.

5. Daily Maintenance and Problems & Solutions

5.1 Routine Maintenance

1. After use, please turn off the chassis, controller, communication station power supply, it is recommended to turn off the controller or communication station power supply and then unplug the connection cable.
2. After the equipment is recovered, clean the soil, weeds and sewage residues on the surface of the chassis in time to keep the chassis clean and dry; Please check whether the wire or interface is intact, avoid winding, and replace it in time if it is worn; Check the screws of the device. If they are loose, tighten them using tools.
3. After each use, please charge the device in time for the next use; If you do not use the device for a long time, please use the matching charger to charge the device regularly. It is recommended to charge and maintain the battery every month to prevent battery damage caused by over-discharge or passivation.
4. When the robot is out of service for a long time, please put the device into matching protective cotton in the box for storage; You can use leather lubricant to keep the tracks in good appearance.

5.2 Common Problems & Solutions

Symptom	Possible Reason	Solution
Unable to turn on.	The battery has run out of power.	Charging immediately.
	Battery life is end.	Contact the manufacturer to replace the battery.
After being fully charged, the robot has a short range of movement.	The power of battery is low.	When the battery is not fully charged, the battery quantity displayed may be higher than the actual quantity (virtual charge). You can fully charge the device and try again.
	Battery life is end.	Contact the manufacturer to replace the battery.
The battery is not charged or undercharged.	No output from charger.	Replace the Charger.
	The charger is in poor contact with the socket.	Replace the socket.
	Battery life is end.	Contact the manufacturer to replace the battery.

The controller or communication station suddenly shuts down.	The cable connecting the communication console and controller is loose and disconnected	Reconnect the controller to the communication station and turn it on.
The robot cannot walk or turn properly.	Motor or motor connection failure.	Stop to confirm and contact the manufacturer.
The controller is not connected to the chassis, no video image return, or cannot be controlled.	The distance between the controller and the chassis exceeds the maximum communication distance.	Adjust the distance between the controller and the chassis.
	Device antenna loose	Secure the chassis and communications station antenna.
	The battery has run out of power.	Charging immediately.
	The communication line between the communication station and the controller is virtual connected.	Insert or re-insert the cable between the communication station and the controller.
The controller screen fails or freezes.	It may be related to many factors such as running program delay and too many processes running on the device.	Press and hold (longer than 12 seconds) the power button of the controller or communication station to forcibly shut down the communication station and controller. Do not use this method to shut down the communication station and controller under normal circumstances.

Table 6 Common Problems and Solutions

Note: When checking faults, please shut down the robot before checking. If other faults are not listed in the table, please contact the manufacturer.



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ABOUT NORSAT

Norsat International Inc., founded in 1977, is a leading provider of innovative communication solutions that enable the transmission of data, audio and video for remote and challenging applications. Norsat's products and services include customizable satellite components, portable satellite terminals, maritime solutions and satellite networks. The company's products and services are used extensively by telecommunications services providers, emergency services and homeland security agencies, military organizations, health care providers

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