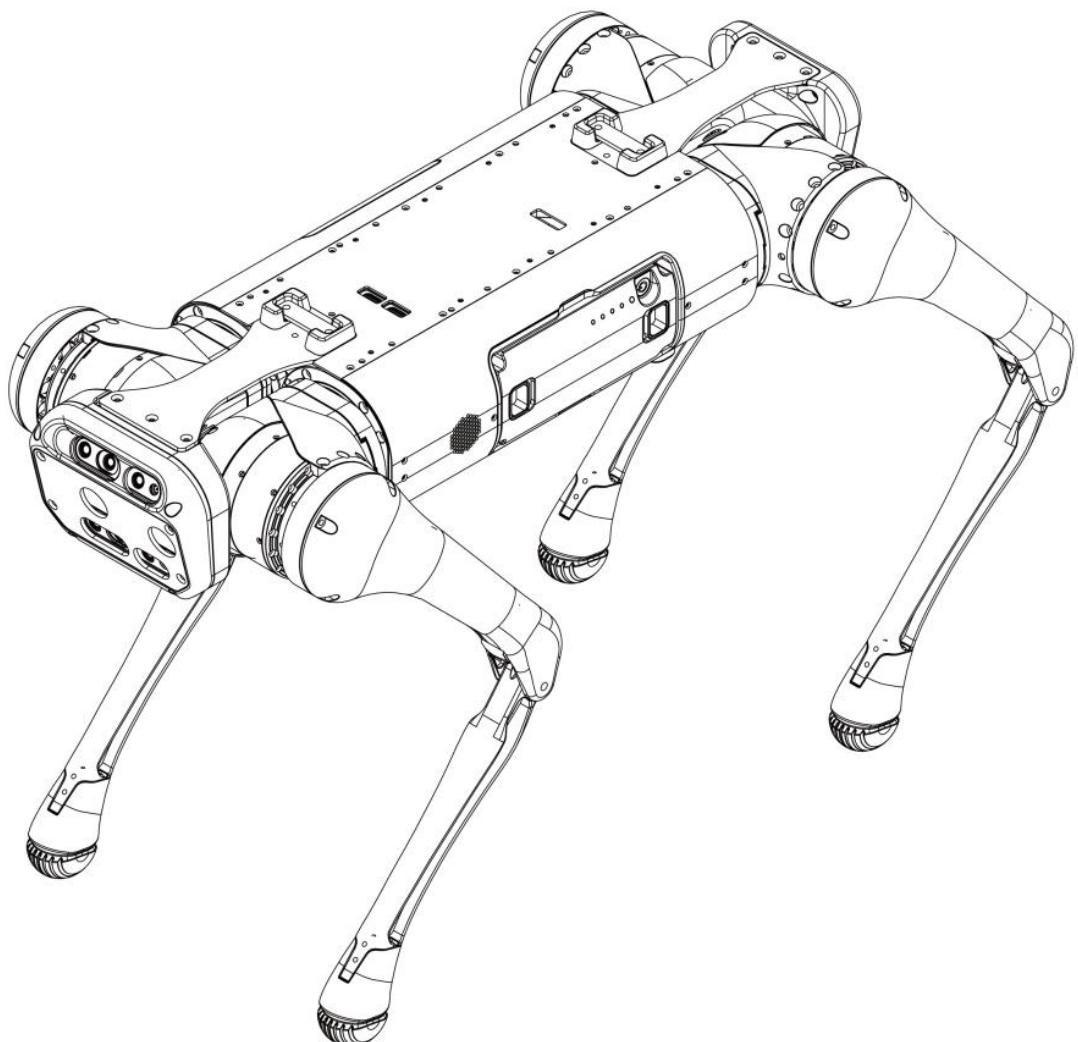


ALIENGO

User Manual V1.1

2020.03



Unitree

www.unitree.cc/cn

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Statements and Warnings

- 1.This product is not a toy and is not suitable for people under the age of 18. Do not allow children to come into contact with this product.
- 2.Please read this document carefully before using the product to understand how to use this product correctly and understand your legal rights, responsibilities and safety instructions; otherwise, it may bring property damage, safety accidents and personal safety hazards. By using this product, you are deemed to have understood, endorsed and accepted all and part of the terms and conditions of this document. The user is committed to being responsible for his or her actions and all consequences arising therefrom. The user undertakes to use the product solely for legitimate purposes and agrees to these terms and any relevant policies or guidelines that may be established by Unitree.
- 3.To the fullest extent permitted by law, Unitree does not make any warranties, express or implied, with respect to this product, including but not limited to warranties of merchantability, fitness for a particular purpose, or non-infringement. To the fullest extent permitted by law, Unitree shall not be liable for any damages resulting from the user's failure to use the product in accordance with this document. Not liable for any indirect, consequential, punitive, incidental, special or penalties, including damages incurred as a result of your purchase, use or inability to use the product (even if Unitree has been advised of such loss) The possibility is also). To the fullest extent permitted by law, in no event will Unitree's general liability (whether in contract or otherwise) to you for all damages, losses and litigation will exceed your purchase (if any). And the amount paid to Unitree.
- 4.The laws of some countries may prohibit exemption from the terms of the guarantee, so your rights may vary in different countries.
- 5.Unitree has the final right to interpret the above terms in compliance with laws and regulations. Unitree reserves the right to update, change or terminate these Terms without prior notice.
- 6.Do not use the emergency braking function when the robot is not protected by the protective frame and protective rope provided by Unitree in the software manual. Otherwise, it will cause the robot to fall to the ground and cause serious damage !!!
- 7.When the robot is not protected by the protective frame and protective rope provided by Unitree (or there is no artificial support for the robot), please do not cut off the power of the robot by pressing the battery power button, otherwise the robot will fall to the ground!!! For details, please refer to "How to Turn Off the Robot When the Remote Control Module Fails" in "Robot Abnormal Situation Response" P38.

- 8.AlienGO is a purely electric quadruped robot with certain anti-jamming, but the energy density of the motor is much lower than the hydraulic pressure. Do not push the robot suddenly and vigorously, nor to kick the robot, so if the robot falls and is damaged due to a sudden and strong push or kick, it will not be covered by the warranty.
- 9.Please control the robot to a prone position before standby for a long time (hold down the L2 button and click the A button three times) to avoid the robot automatically shutting down and falling down damaged due to low power!
- 10.When there is only one battery level remaining, please stop and turn off the robot in time, take out the battery and charge it, to prevent the robot from falling to the ground and damaged when power is low.

Product Profile

This section introduces the Aliengo and the name and function of the parts of Aliengo and remote control.

Product Description

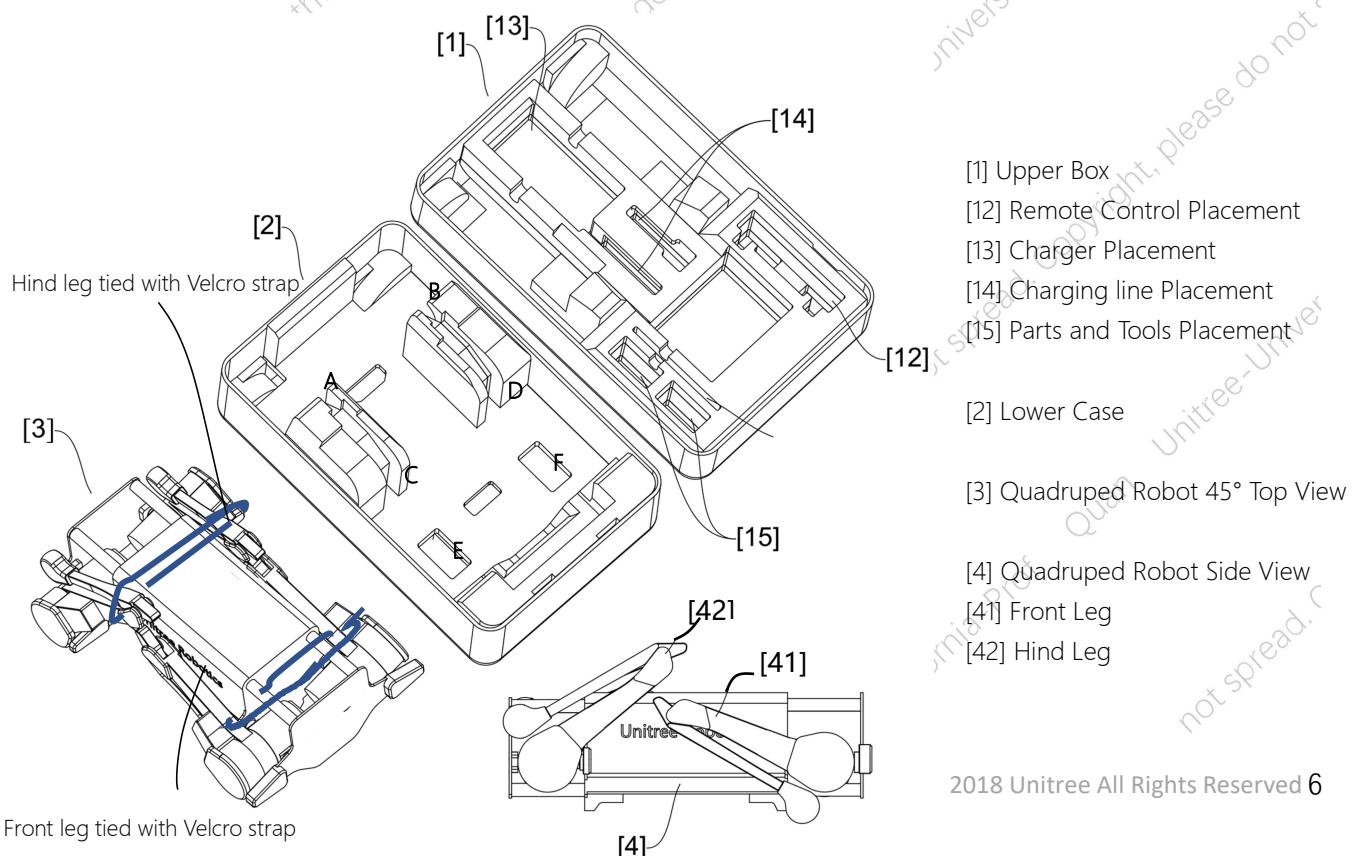
Introduction

The ALIENGO quadruped robot consists of a quadruped robot, a remote control and a remote control software. The whole machine has 12 DOF (composed of 12 high-performance servo motors), uses force control technology to perform compound control of force and position for each joint. The ALIENGO can achieve full 3-axis attitude and 3-axis position stabilization while standing, can also move forward and backward, left and right sideways, turn in place, and follow certain rules on a level ground (Straight lines, circles, arcs, rectangles), crawl forward, up and down slopes/steps, large-scale Push Recovery, trotting, etc., and also have superior adaptability to irregular terrain.

Feature Highlights

The ALIENGO performs function expansion and performance optimization on the basis of conventional motion. The optimal design of joint parts makes the quadruped robot not only reduce the cost, but also greatly improve the motion performance and service life, and make the appearance more beautiful. The addition of binocular vision sensor enables the quadruped robot platform to have real-time image transmission (quality 720P/30fps), human body following and other intelligent applications; And support for secondary development. After the optional lidar, it can complete the expansion functions of automatic obstacle avoidance, navigation planning, automatic positioning and 3D map construction. NVIDIA TX2 is optional for secondary visual development. At the same time, Aliengo supports APP control for Android and IOS.

Unpacking and Packing



Unpacking

Place the box on the flat ground according to the placement requirements (Face up), then open the upper box and lift the whole robot out, as shown in the figure above. Remove the robot and remote control, charger, etc. from the box, place the robot on the flat ground, untie the velcro strap of the robot's leg, and then prepare for the boot.

Before Packing

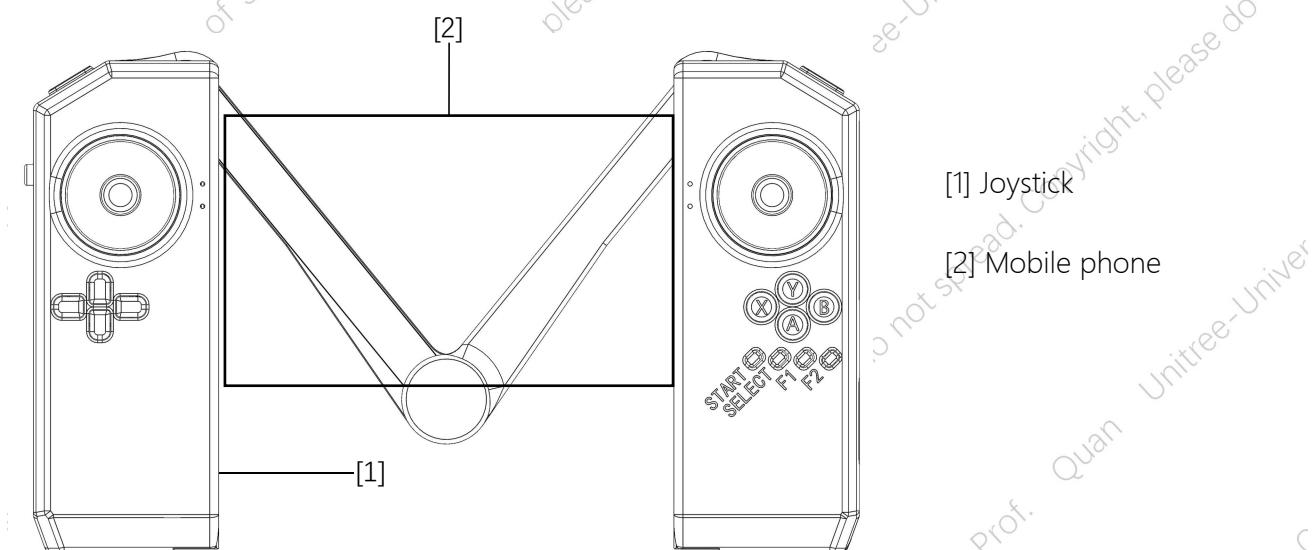
First rotate the legs of the robot to the position shown in Figure [4] above(the rear leg is folded up: rotate the rear leg hip motor so that the rear thigh is placed in the position shown in the above figure [4] above, and the lower leg is closed. Place it in the position shown in Figure [4] above, and tie the left rear leg and the right rear leg together with a Velcro strap, as shown in Figure [3] above. The front leg is folded up: similar to the hind leg, as shown above Figure [3], [4] above placed and bundled).

Packing

After completing the preparation work before packing, load the robot into the lower case [2] in the direction shown in the figure (note that the two rear thighs of the robot are respectively engaged in the A and B slots of the figure [2] during the loading process. The two front calves are respectively inserted into the C and D slots of the figure [2], and the forefoot foot ends are placed in the E, F lower trap holes of the figure [2]). After the robot is loaded into the lower case, place the remote control, charger, etc. that came with the product into the corresponding positions in the upper case and fix them with elastic straps, make sure the above parts do not fall when the upper case is closed.

- ! •If not using the robot for a long time, take out the battery pack and put it into battery box.

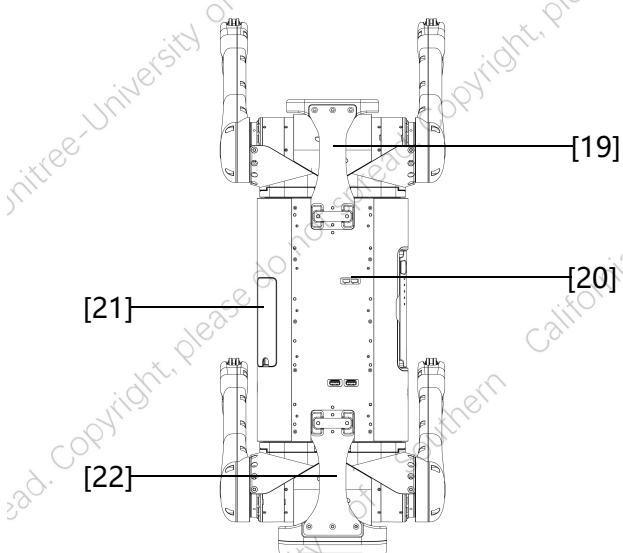
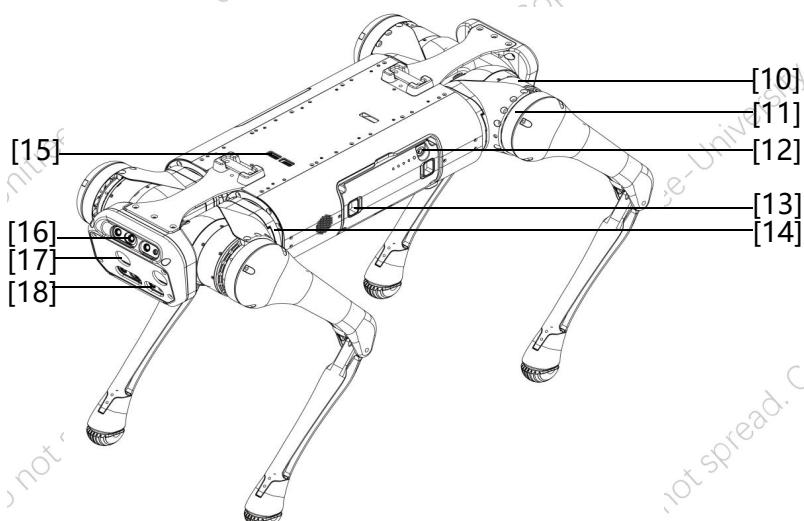
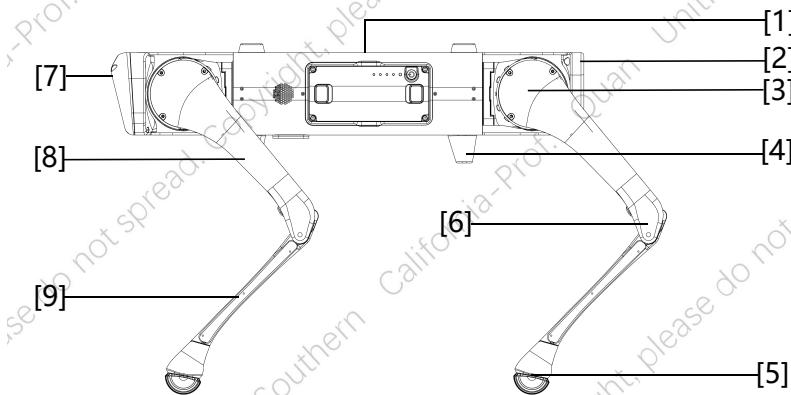
Part Name of the Remote Control



[1] Joystick

[2] Mobile phone

Robot Part Name



Prepare Before Starting Up

Install the Battery Pack

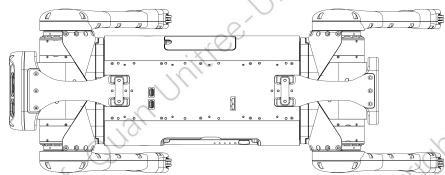
Insert the battery pack into the battery slot from the side of the robot, and pay attention to the installation direction. If the battery cannot be completely inserted, please adjust the battery direction and do not press it forcibly to avoid damaging the battery interface and Clasp.



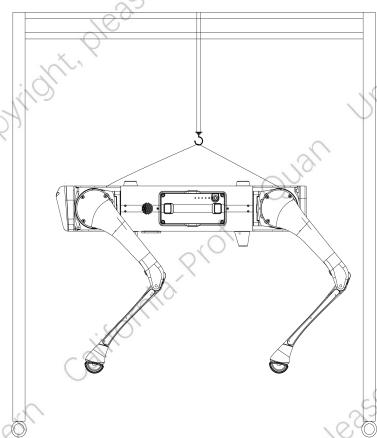
- Recommended that the battery be fully charged.

Body Placement

Horizontal boot: please make sure that the robot is placed on the leveling ground before starting the machine. The robot's abdominal support pad should be flat on the ground. The body level is not tilted on the ground. The robot calf is fully stowed (As shown below) , make sure that the robot's thighs and calves are not pressed by the body, otherwise the robot may fail to boot. Please carefully observe the following figure, it is necessary to understand the placement requirements of the four legs of the robot.



Suspension boot: use the tool rope to suspend the robot through the front and rear suspension plates (as shown below), keeping the robot body in a balanced state, with the four feet off the ground and hanging down naturally.



Connect the remote control module

The remote control module includes a joystick and mobile phone. First press the power button for a short time, and then press and hold the power button for more than 2 seconds to turn on the joystick. Open the mobile phone to search for the joystick Bluetooth. After successful pairing, open the robot APP software (see P29 for details) and connect the robot to control the robot.

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ALIENGO

This section introduces the operation mode of ALIENGO, the functional characteristics of battery and the replacement method of foot assembly.

ALIENGO Quadruped Robot

Overview

The ALIENGO consists mainly of control systems, communication systems, power systems, and battery packs. This chapter will detail the functions of the various components of the robot.

Robot Operating Mode

ALIENGO uses a new hardware architecture and control system that supports the following operating states and operating modes:

Static Standing State:

The static standing state refers to the initial height of the robot body position after the start-up, the body level, and the joystick has no operation state. In this state, the power consumption of the whole machine is the smallest, and the longest battery life can be achieved.

"A" Mode (3-Axis Attitude And 3-Axis Position Control While Standing) :

When the robot is standing, the joystick can be used to control the robot in 3-axis attitude and 3-axis position. Including the body pitch, body roll, body yaw, continuous squat, jog-type squat, continuous standing, jog-up, and various combinations.

"W" Mode (Walking) :

When the robot is in W mode, the robot can realize the step by step without manipulating the joystick; the joystick can realize the forward and backward movement, the left and right side shift, the in-situ turning, and the walking according to certain rules on the flat ground (straight line, circle, arc , Rectangular), crawl forward, up and down slope/step, large-scale Push Recovery, etc., also has super adaptability to irregular terrain, the maximum walking speed is 1.5 m / s.

"L2+START" Mode (Trotting) :

Hold down the key L2 , then press START to enter the trotting mode, when the robot is in place for trotting; By controlling the handle, the robot can run forward and backward on the flat ground, move left and right, and turn in place.



- Since the actual control personnel have different levels of control proficiency, in order to be reliable and stable, please use it in an open and flat environment. When operating the robot, be careful to avoid steps above 5cm, slopes greater than 25°, and obstacles that may cause the robot to fall. When the robot is walking on a terrain with a certain undulation or slope, the controller should reduce the walking speed of the robot.
- The robot have certain requirements for the ground to walk. Do not use robot on the ground with very low friction, such as ice. Do not use robot on soft ground, such as thicker sponge floors. For use on smoother floors, such as glass, tiles, etc., carefully and compliantly control the robot to exercise, avoid strenuous exercise, and reduce the walking speed of the robot to prevent the robot's foot from slipping and falling.



- Through the START key on the joystick, the robot can switch between static standing mode and W mode. The L2 + START key enables the robot to switch between static standing mode and trotting mode.

Startup and Shutdown

Startup

After placing the robot according to the requirements in the "Preparing Before Booting" section, start the following steps: short press the power switch once, then press and hold the power switch for more than 2 seconds to turn on the battery (when the battery is turned on, the indicator light is the green light is always on and the indicator shows the current battery level). Then the robot will perform the power-on self-test. If the self-test is successful, the robot will sound the music and then stand up to the initial height of the body, and the boot is successful. If the music is not heard during the above process, the robot fails the self-test. If the boot fails, the robot can't stand up. At this time, you need to re-start the body according to the two steps of "body placement" and "check cable" in the "Preparing for Boot" section.

Shutdown

Before shutting down, please make sure that the robot stands on the level of the ground, make sure that the robot is in Static Standing State (the height of the robot body is at the initial height after starting up, the body level, the joystick has no operation, the state when standing statically). Slow rhythm Press the button of the left button, the robot will squat to the horizontal level without tilting on the ground. After the abdominal support pad is flat on the ground, press the power switch once, then press the power switch for more than 2 seconds to turn off battery. When the battery is turned off, the indicators are off. After shutting down, please adjust the size of the robot's size legs and hips according to the requirements in the "Preparation before starting" section, and prepare for the next boot.



- The squat button on the left button will be described in the "Joystick Operation" section.
- Please pay attention to Unitree's official website - service and support - technical support - firmware update or contact Unitree staff. We will develop a one-button shutdown function as soon as possible, and upload the firmware. At that time, the customer can update the firmware to make the robot have a one-button shutdown function.

Battery Pack

Introduction

The battery pack is designed for the ALIENGO with a capacity of 12600 mAh and a voltage of 25.2 V with charge and discharge management. The battery pack features a high-performance battery and uses the advanced battery management system developed by Unitree to provide sufficient power for the ALIENGO. The battery pack must be recharged using a dedicated charger from Unitree.

-  •Be sure to fully charge the battery before using it for the first time.

Battery Pack Function

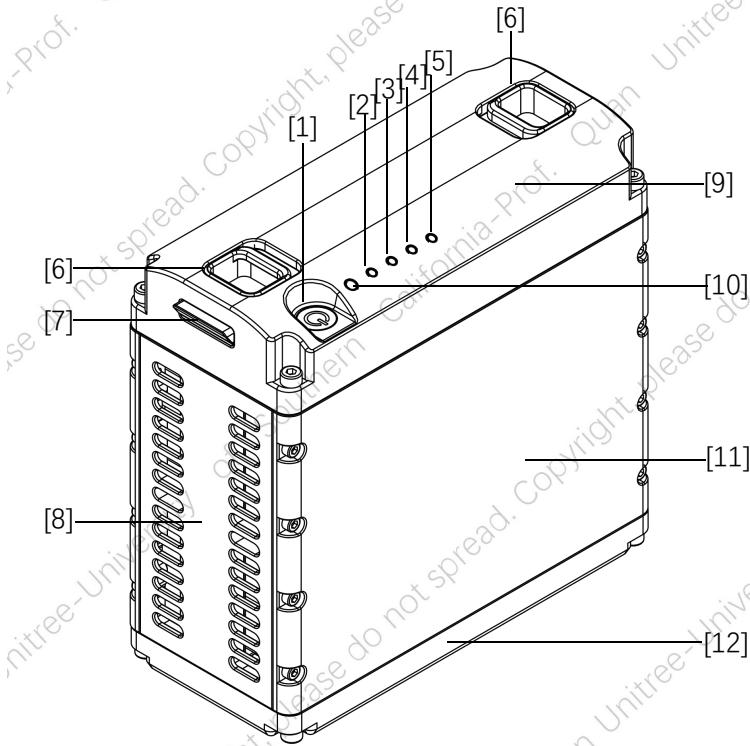
The battery pack has the following features:

1. **Battery Display:** The battery has its own battery indicator, which can display the current battery level.
2. **Battery Storage Self-discharge Protection:** When the power of battery is higher than 65% After 10 days without any operation, the battery can start self-discharge to 65% to protect the battery. Each self-discharge process lasts for about 1 hour. There is no LED light indication during discharge, and there may be slight heat, which is normal.
3. **Balanced Charge Protection:** Automatically balance the internal battery voltage of the battery to protect the battery.
4. **Overcharge Protection:** Overcharging can seriously damage the battery, our battery can automatically stop charging when it is fully charged.
5. **Charging Temperature Protection:** Charging will damage the battery when the battery temperature is below 5 °C or above 55 °C. At this temperature, the battery will trigger charging abnormality.
6. **Charging Current Protection:** High current charging will seriously damage the battery. When the charging current is greater than 14A, the battery will stop charging.
7. **Over-discharge Protection:** Over-discharge will seriously damage the battery. When the battery is discharged to 21V, the battery will cut off the output.
8. **Short Circuit Protection:** When the battery detects a short circuit, the output will be cut off to protect the battery.
9. **Battery Load Detection Protection:** When the battery is turned on, if no powered device is connected, the battery will automatically shut down after 3 seconds.



- Please read and strictly follow requirements of Unitree in this manual, disclaimer, the sticker on battery pack surface and dedicated charger surface before using the battery pack. The consequences of failure to use as required are borne by the user.

Battery Pack Part Name



[1] Power switch

[2] LED1

[3] LED2

[4] LED3

[5] LED4

[6] Buckle

[7] Clip

[8] Battery pack

[9] Battery pack panel

[10] Light sensor

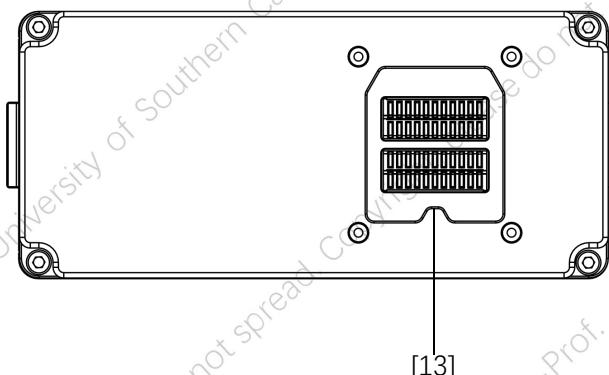
Perceive the intensity of the external light to adjust the brightness of the battery pack status indicator to avoid glare.

[11] Battery pack shell

[12] Battery pack base plate

[13] Battery interface

Battery pack charger interface.



Turn the Battery On/Off

Turn on the Battery Pack: In the off state, first press the power switch once, then press and hold the power switch for more than 2 seconds to turn on the battery. When the battery is turned on, the power indicator is steady green and the battery indicator shows the current battery level.

Turn off the Battery Pack: In the on state, short press the power switch once, then press and hold the power switch for more than 2 seconds to turn off the battery. When the battery is turned off, the indicators are off.

Precautions For Use:

- The battery pack should be used between 5 °C and 40 °C, and the temperature is too high (above 45 °C), which may cause the battery pack to catch fire or even explode. If the temperature is too low (below 0 °C), the battery pack life will be seriously damaged.
- Do not use the battery pack in strong magnetic or static environments. Otherwise, the battery pack protection board will malfunction, causing the battery pack and the robot to malfunction.
- When the battery pack charge is less than two compartments, stop using the robot as soon as possible, replace the new battery pack or charge the battery pack.
- Before inserting or removing the battery pack into the robot battery compartment, make sure that the battery pack is closed, otherwise the battery pack or the robot may be damaged.

View Battery

When the battery pack is off, press the battery switch once to view the current battery level.

	The battery indicator can be used to display the battery level during charging and discharging of the battery pack. The indicators are defined as follows.
	Indicates that the LED light is always on
	Indicates that the LED light is off

Battery Level LEDs				
LED1	LED2	LED3	LED4	Remaining Battery
				87.5%-100%
				75%-87.5%
				62.5%-75%
				50%-62.5%
				37.5%-50%
				25%-37.5%
				12.5%-25%
				0%-12.5%
				=0%

Charging

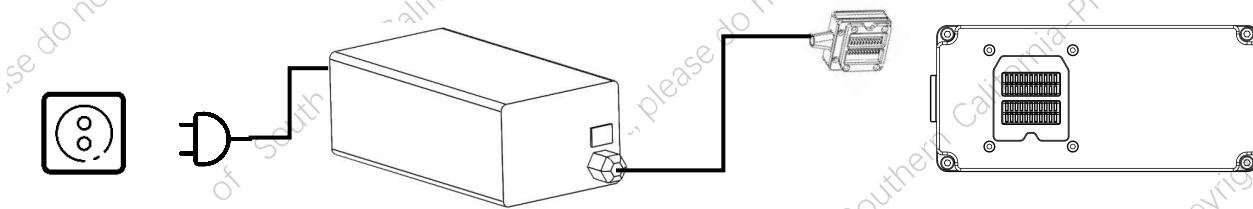
- Connect the charger to an AC power source (100-240V, 50/60Hz). Before connecting, you must ensure that the external power supply voltage matches the rated input voltage of the charger, otherwise the charger will be damaged(the rated input voltage of the charger is indicated on the charger nameplate).
- Before charging the battery, the charger is connected to the AC power supply before the battery is connected.

3. Before charging the battery, please make sure the battery pack is off, otherwise it will damage the battery and charger.

4. Under the charging state, battery indicator will flash in a cycle and indicate the current battery level.

5. When the battery indicator is off, the battery pack is full. Please remove the battery pack and charger to complete the charge.

6. After the robot is running, the battery pack temperature may be high. The battery pack must be charged after the battery pack temperature drops to room temperature.



Charging Indicator

LED1	LED2	LED3	LED4	Current Battery
●	○	○	○	0%-25%
●	●	○	○	25%-50%
●	●	●	○	50%-75%
●	●	●	●	75%-100%
				Full

Charging Protection Indication

The LED can display information about battery protection triggered by abnormal charging.

Charging Indicator

LED1	LED2	LED3	LED4	Display Rule	Protection Project
○	●	○	○	LED2: 2 times/sec	Excessive charging current
○	●	○	○	LED2: 3 times/sec	Short circuit
○	○	●	○	LED3: 2 times/sec	Overcharge causes battery voltage be too high
○	○	●	○	LED3: 3 times/sec	Charger voltage is too high
○	○	○	●	LED4: 2 times/sec	Charging temperature is too low
○	○	○	●	LED4: 3 times/sec	Charging temperature is too high

Troubleshoot (charge current is too large, charge short circuit, charge overcharge causes battery voltage is too high, charging voltage is too high), please re-plug the charger to resume charging. If the charging temperature is abnormal, please unplug the charger first. After the charging temperature returns to normal, plug in the charger and recharge.



- For safety reasons, the battery needs to be discharged during transportation. The discharge mode is divided into active discharge and passive discharge:
 1. Active discharge: Run the robot until the battery is at a low battery (eg 50% or less).
 2. Passive Discharge: The battery is stored in self-discharge protection. For details, please refer to the chapter "Battery Pack" - "Battery Pack Function".

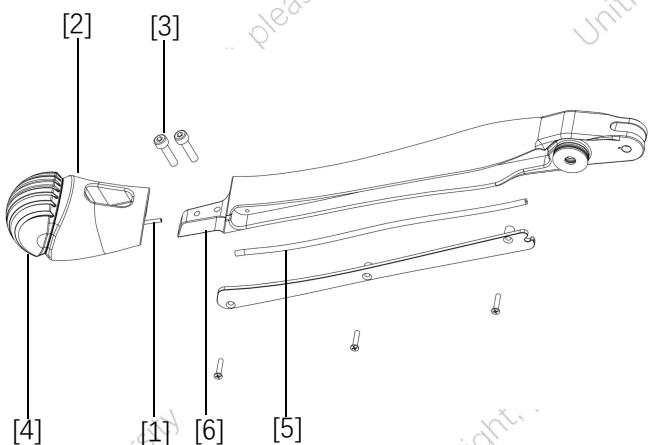
Foot Assembly

Introduction

The foot assembly adopts a new design. The movement of the robot will compress the air in the foot pad and send the pressure signal through the air pipe to the pressure sensor in the shoulder, so as to judge the environment the robot is in and adjust the movement of the robot accordingly.

Foot end components include foot end base, bottom curved rubber pad, air needle and other components. It can increase the friction of the foot, avoid the damage of the foot, and reduce the impact on mechanical parts.

The foot end components are consumables, and the service life is generally 2-6 months (depending on the use frequency, duration and working condition). We will send you several spare foot parts as a gift. Especially in the rough ground running wear will be more serious, such as obvious foot pad wear, damage, or found that the robot walking on the ground significantly increased impact noise, please replace the foot components in time, so as not to damage the foot, resulting in the robot movement disorder.



- [1] Air Needle
- [2] Foot Protection Cover
- [3] Foot Cap Screws
- [4] Rubber Foot Pad
- [5] Rubber Trachea
- [6] Air Needle and Trachea Connection Slots

Foot Assembly Replacement Method

Remove the [3] foot cap screws, and gently rotate the [1] air needle and [5] rubber trachea connected in the [6] connection slots; Attach the new foot assembly air needle to the rubber trachea (make sure the connection does not loosen easily), and then install the foot end component in the corresponding position of the lower leg (note that the foot end component is divided into left and right parts, the directions are different), and then tighten the screws.

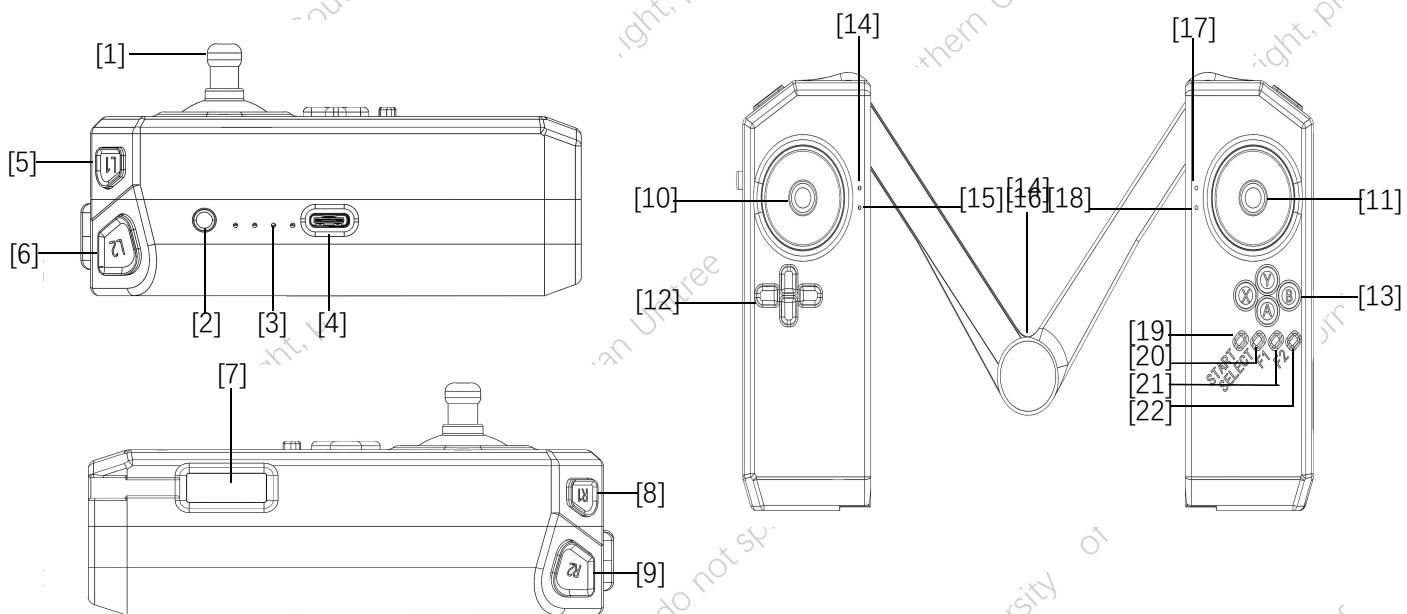
Remote Control Module

This section describes the features of the remote controller and includes instructions for controlling the quadruped robot.

Remote Control Module

Joystick Introduction

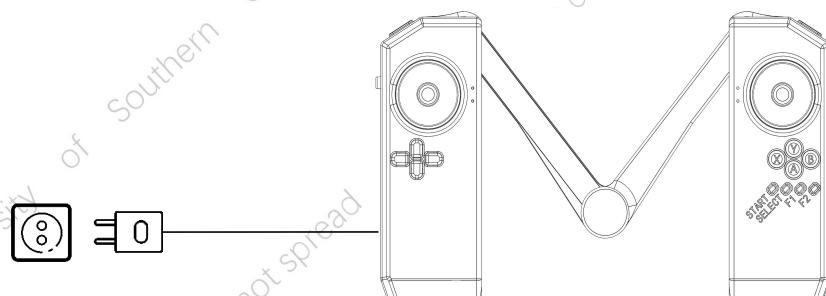
The joystick belongs to a part of the remote control module, which can control the robot to realize the 3-axis attitude and the 3-axis position control when standing. It can also control the robot to realize the forward and backward, the left and right side shift, the in-situ turn and the certain rule walking on the leveling ground. (straight line, circle, arc, rectangle), crawl forward, up and down slope / step, etc. The joystick adopts a new folding design, which is more convenient to carry; Through bluetooth connection to mobile phones, the signal transmission is more convenient and stable; Ergonomic structure for a more comfortable feel.



- [1] Stick [2] Power Button [3] Battery Indicator [4] Charging Interface Type C [5]/[6] L1/L2 Button
- [7] Stick Slot / Data Cable Slot [8]/[9] R1/R2 Button [10]/[11] Left Stick/ Right Stick
- [12]/[13] Left Button/ Right Button [14] Power Connection Indicator [15] Charging Status Indicator
- [16] Folding Connecting Rod [17] WIFI Signal Light [18] Bluetooth Signal Light [19] START Button
- [20] SELECT Button [21]/[22] Left Stick Calibration Button/Right Calibration Button

Charge the Joystick

When the battery indicator of the joystick shows low battery (the same status as the battery low battery indicator), the joystick should be connected to the charger, as shown in the figure below:



Joystick Operation

Installing the Remote Control Module

The joystick is part of the remote control module. The joystick has a built-in Bluetooth module and Data transmission module. The mobile phone communicates with it through Bluetooth connection.

Press the power button for a short time, and then press and hold the power button for more than two seconds, and you hear a "drip~ ", that is, the remote control is turned on.

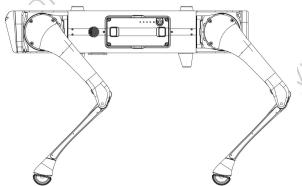
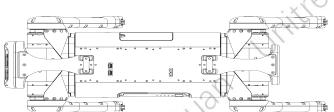
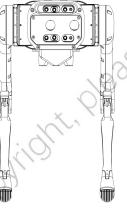
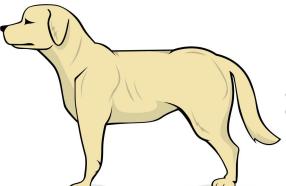
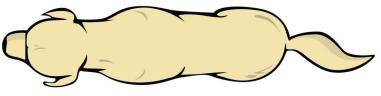
Press the power button for a short time, and then press and hold the power button for more than two seconds, and you hear three "drip~ drip~ drip~ ", that is, the remote control is turned off.

Joystick calibration

Hold the remote control but do not touch the joystick. Press the remote control buttons F1 and F3 and release them at the same time. At this time, the remote control will emit a continuous "drip ~drip ~" sound (1 time / second) to indicate that it has entered the calibration mode. After entering the calibration mode, move the left and right joysticks to full rudder and rotate it several times until the "drip ~ drip ~" sound stops, and the calibration is ready. Press F3 once to make the calibration take effect and complete the calibration.

Note : Please do not touch the joystick before calibrating, only enter the calibration mode to move the joystick. After calibration, you can view the status of the joystick after calibration through APP.

Robot and Robot Schematic

	Side View	Top View	Front View
Robot			
Robot Schematic			

Control the Robot (Use the Joystick to Manipulate the Robot)



- Stick back to center/center: The Stick of the joystick is in the middle position.
- Stick lever amount: The offset of the remote control joystick from the center of the joystick.
- Walls, doors and other obstructions can greatly weaken the signal between the robot and the remote control module. Please be sure to operate the robot in an open space.

Before Reading

When using the control program that comes with Unitree, the operation instructions and robot actions in this section correspond to each other. When users use the own programs in developer mode: the joystick command is still valid during high-level (application layer) development. If the high-level API command and the joystick command are sent to the robot together, the two command robots will execute, which may lead to the robot. Instability, please be sure to determine whether you need to use the joystick control according to the robot running status. The joystick command fails during the underlying development.

This chapter is an introduction to the new player's manipulation of the robot. New players can quickly learn how to use the joystick to control the robot by reading this section, so that the robot can show excellent sports performance.

This chapter is also a chapter that old players need to check frequently , Old players can grasp the essentials of operating robots by repeatedly checking the contents of the table, And know which actions are not recommended.

The content of the form is mainly divided into 5 parts:

- 1.Joystick control method for basic operation in A mode.
- 2.Joystick control method for combined action and special action in A mode.
- 3.Joystick control method for basic action in W mode (walking).
- 4.Joystick control method for combined action and special action in W mode.
- 5.Joystick control method for basic operation in L2+START mode.
- 6.Joystick control method for combined action and special action in L2+START mode.
- 7.Actions not recommended in W and L2+START mode.

Parts 1 to 6 are actions that allow the operator to use them, which are sufficient to express the superior athletic performance of the robot. When using the actions involved in sections 1 through 4, be sure to follow the instructions in the "Disclaimer and Safe Use Guidelines" section.

Part 7 is an action that is not recommended, it is very likely that the robot will fall and the robot's battery

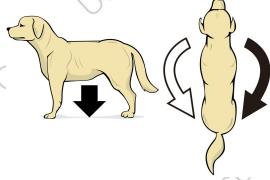
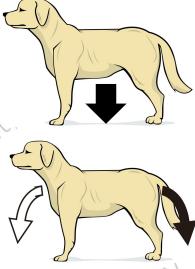
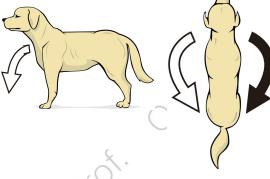
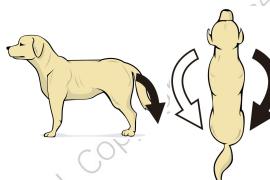
life may be greatly reduced.

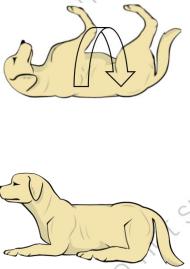
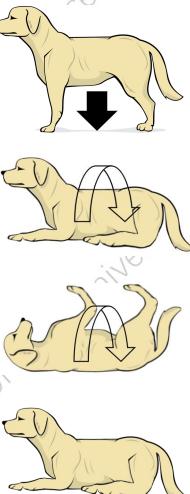
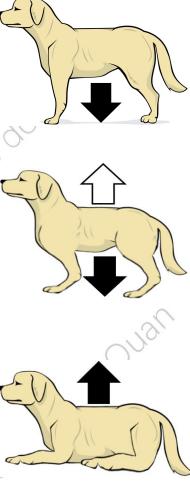
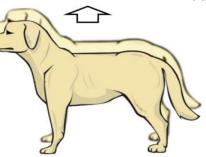


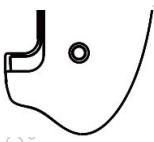
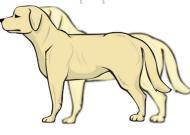
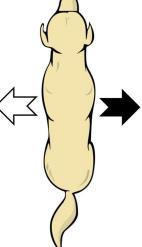
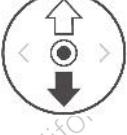
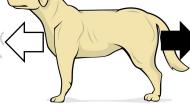
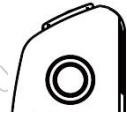
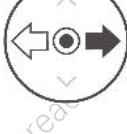
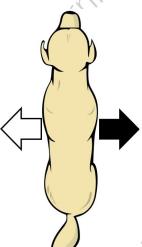
- Since the robot does not have a visual perception system at present, and the actual control personnel have different levels of control proficiency, in order to be reliable and stable, please use it in an open and flat environment. When operating the robot, be careful to avoid steps above 5cm, slopes greater than 25°, and obstacles that may cause the robot to fall. When the robot is walking on a terrain with a certain undulation or slope, the controller should reduce the walking speed of the robot and carefully control it so that the robot is tripped by obstacles.
- Foot robots have certain requirements for the ground to walk. Do not use robots on the ground with insufficient friction, such as ice. Do not use robots on soft ground, such as thicker sponge/turf floors. For use on smoother floors, such as glass, tiles, etc., carefully and compliantly control the robot to exercise, avoid strenuous exercise, and reduce the walking speed of the robot to prevent the robot's foot from slipping and falling.

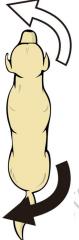
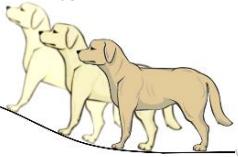
1. Basic Action under "A Mode" (3-Axis Attitude and 3-Axis Position Control when Standing)

NO	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
1	Left Stick	Left Stick		The left stick is used to control the robot body to lift or squat. Push the stick up, robot body lifts up. Push the stick down, the robot squats. When the stick is in the middle position, the robot is in a static standing state (the body position is in the initial state after power on).
2	Left Stick	Left Stick		The left Stick is used to control the yaw of the robot. Push the stick to the left, the robot is twisted to the left. Push the stick to the right, the robot is twisted to the right. In the middle position, the yaw angular of body is zero. The more the stick is pushed away from the center position, the greater the yaw angular.
3	Right Stick	Right Stick		The right Stick is used to control the pitch of robot. (lean forward and backward) Push the stick up, robot body leans forward. Push the stick down, robot body leans backward. When the stick is in the middle position, robot body is in a horizontal position. The more the stick is pushed away from the center position, the greater the yaw angle.
4	Right Stick	Right Stick		The right Stick is used to control the robot body roll. (When the robot faces the operator) Push the stick to the left, robot body rolls to the right. Push the stick to the right, robot body rolls to the left. The robot body does not roll when the Stick is in the middle position. The more the stick is pushed away from the center position, the larger the roll angle.
5	Left Button	Left Button		The left button is used to control the robotic body's jog lift and jog squat. Press the up button and the robot body is lifted up. Press the down button and the robot body will be clicked. Note: Please keep in mind the number of key presses. After the end of the action, please adjust back to the static standing state of the robot, otherwise the robot's battery life may be greatly reduced.
6	SELECT Key	SELECT Key		The SELECT button is used to turn on/off the body following function (zero force control). Press Select button to open the body to follow, 6 degrees of freedom under control, then according to the current output torque of 12 motors of the robot, calculate the external force, so as to achieve the robot's external force. Press the select button again, the fuselage is back and the body follower function is turned off.

2. Combined Action and Special Action under "A Mode"				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
7	Left Stick	Left Stick		The left Stick is used to control the robot's jaw and the body is twisted. Push stick down and to left, the robot squats while twisting to left. Push stick down and to right, the robot squats while twisting to left. The robot is in a static standing state when it is in the middle position. The more the stick is pushed away from the center position, the larger the amplitude.
8	Left Stick Right Stick	Left Stick Right		The linkage of the left and right Sticks is used to control the lower jaw of the robot and the front and back of the body. Push left stick down and push right stick up, the robot squats and the body leans forward. Push left stick down and push right stick down, the robot squats and the body leans backward. The robot is in a static standing state when it is in the middle position. The more the stick is pushed away from the center position, the larger the amplitude.
9	Right Stick	Right Stick		The right Stick is used to control the robot body to make a clockwise rotation. Shake the right Stick clockwise to rotate the robot body clockwise. When in the middle position, the robot is in a stationary standing state. The more the stick is pushed away from the center position, the larger the amplitude.
10	Right Stick	Right Stick		The right stick is used to control the robot body to rotate counter-clockwise. Shake the right Stick counter-clockwise to rotate the robot body counter-clockwise. When in the middle position, the robot is in a stationary standing state. The more the stick is pushed away from the center position, the larger the amplitude.
11	Right Stick Left Stick	Right Stick Left Stick		The combination of the left and right Sticks can control the robot to lean forward and the body to twist. Push right stick up and push left stick to left, the robot leans forward and the body twists to the left. Push right stick up and push left stick to right, the robot leans forward and the body twists to the right. The robot is in a stationary standing position in the middle position. The more the stick is pushed away from the center position, the larger the amplitude.
12	Right Stick Left Stick	Right Stick Left Stick		The combination of the left and right Sticks can control the robot to lean backward and the body to twist. Push right stick down and push left stick left, the robot leans backward and the body twists to the left. Push right stick down and push stick to right, the robot leans backward and the body twists to the right. The robot is in a stationary standing position in the middle position. The more the stick is pushed away from the center position, the larger the amplitude.

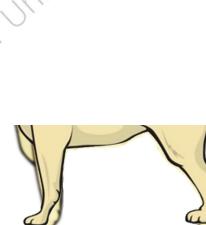
Combined Action and Special Action under "A Mode"				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
13	L2 Button Right Button-"X"Button	L2 Button Right Button-"X"Button		When the robot is lying on its back, hold down the L2 key and press the X key to roll the robot 180° to the right. After rolling, the robot is in the supine state and the joints are in the high-damping state. Hold down the L2 key and press the single right button-a button to perform semi-squat and standing movements successively. Press START to release the joint locking state and enter the normal operation mode.
14	L2 Button Right Button-"Y"Button	L2 Button Right Button-"Y"Button		Press L2 and then Y and the robot rolls 360° to the right. After rolling, the robot is in the supine state and the joints are in the high-damping state. Hold down the L2 key and press the single right button-a button to perform semi-squat and standing movements successively. Press START to release the joint locking state and enter the normal operation mode.
15	L2 Button Right Button-"A"Button	L2 Button Right Button-"A"Button		After holding down the L2 key and repeatedly clicking the right button-A button, the robot will cycle in turn according to the following states: standing - half squatting - prone - half squatting - standing. When the robot is in half squatting state, the joint will be locked, and the robot can manually raise from S to W. Note: Press the L2+A button only when the robot is in a static standing position. Do not press the L2+A button while walking, otherwise the robot will fall and be damaged.
16	L1 Button R1 Button	L1 Button R1 Button		After holding down the L1 button and single-clicking the R1 button, the robot will jump vertically once in place.

3. Basic Action under "W mode" (walking)				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
17	START Key 	START Key 		The START button is used to switch between the two states of the robot in step and stationary. Press the START button to turn on the step function and the robot enters the W mode. Press the START button again and the robot switches to the static standing state. After the robot enters W mode, if the joystick has no operation, the robot automatically switches to the static standing state after 4 seconds.
18	Left Button 	Left Button 		The left button is used to correct the phenomenon that the robot IMU drifts heavily. In the W mode (turning on the local step function), there is no joystick operation, and if there is a left or right drift when the robot is stepping on the ground, the IMU needs to be corrected. If the robot drifts to the right (left), press the left (right) button once, and observe the IMU correction after 3 seconds. If it is still drifting, continue to repeat until the drift is not obvious (the reaction time of the button takes 3 seconds)
19	Left Stick 	Left Stick 		The left Stick is used to control the forward and backward movement of the robot. In W mode, Push stick up, the robot moves forward. Push stick down, the robot moves backward. When in the middle position, the robot walks at zero speed and steps on the ground. The more the stick is pushed away from the center position, the faster the robot will move. (please push the Stick slowly to prevent the robot from suddenly moving forward or backward).
20	Left Stick 	Left Stick 		The left Stick is used to control the robot to circle in the in-situ state. In W mode, push stick to left, the robot steps back and turns counterclockwise. Push stick to right and the robot steps back and turns clockwise. When in the middle position, the rotational angular velocity of the robot is zero and the robot is stepping on the ground. The more the stick is pushed away from the center position, the faster the robot will rotate..
21	Right Stick 	Right Stick 		The right Stick is used to control the robot's lateral movement. In W mode, push stick to left, the robot moves to the left. Push stick to the right, the robot moves to the right. When in the middle position, the speed is zero and the robot is in place. The more the stick is pushed away from the center position, the faster the robot will move.

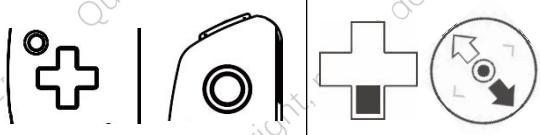
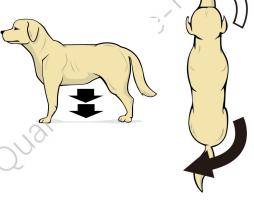
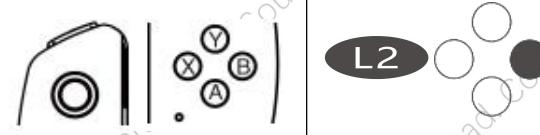
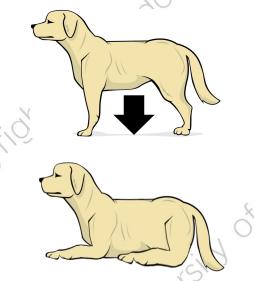
4. Combined Action and Special Action under "W Mode" (walking)				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
22	Left Stick	Left Stick		<p>The left Stick is used to control the arc (circle) of the robot.</p> <p>In W mode, push stick in the upper right direction, the robot will go to the right front arc. If you hold on the direction of stick, the robot will go forward and circle clockwise. Push stick to the lower left, the robot will take the arc to the right. If hold on, the robot will retreat and move counterclockwise. The angle between the Stick and the horizontal line corresponds to the walking radius of the robot. The larger the angle, the larger the radius.</p>
23	Left Stick	Left Stick		<p>The left Stick is used to control the arc (circle) of the robot.</p> <p>In W mode, push stick to the upper left direction, robot will take the arc to the left front. If hold on, the robot will go forward and rotate counterclockwise. Push Stick to the lower right, the robot will take the arc to the left. If hold on, the robot will retreat and move clockwise. The angle between the Stick and the horizontal line corresponds to the walking radius of the robot. The larger the angle, the larger the radius.</p>
24	Right Button – "A" Button	Right Button- "A"Button		<p>A button is used to turn on/off the climbing mode (terrain following mode)</p> <p>Press the A button to turn on the climbing mode. In the W mode, you can manipulate the robot to climb.</p> <p>Note: rated forward climbing angle is less than or equal to 2°.</p>
25	L1 Key Left Button	L 1Key Left Button		<p>The L1 button is used in conjunction with the left button to change the height of the robot's leg.</p> <p>In the W mode, after pressing the L1 button, the up button of the left button is clicked, and the robot raises the leg height. After holding down the L key, jog the left button down button, the height of the robot lift leg is lowered. Each change in height changes by 1 cm. The robot's initial leg height is 5cm, and the leg height can be changed to 4-8cm.</p> <p>Note: Increasing the height of the leg raises the landing speed of the foot end, the contact force between the foot end and the ground increases, and the step sound becomes larger, increasing the impact on the reducer and reducing the life of the reducer. No special circumstances, please set the height of the leg to 4-5cm.</p>

5. Basic Action Under “L2+START Mode” (trotting)				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
26	L2 Button START Button	L2 Button START Button		Press and hold the L2 button, and then press the start button, the robot will perform trotting in place. After that, press the start button, the robot will enter the walking mode, and then press the start key to enter the standing mode.
27	Left Button	Left Button		In the L2 + START mode (turn on the trotting function), without any joystick operation, if the robot drifts left and right while trotting in place, the IMU needs to be corrected. If the robot drifts to the right (left), press the left (right) button once and observe the IMU correction after 3 seconds. If the robot still drifts, continue to repeat the operation until the drift is not obvious (the response time of the button needs 3 seconds)
28	Left Stick	Left Stick		The left Stick is used to control the forward and backward movement of the robot. In L2+START mode, Push stick up, the robot trotting forward. Push stick down, the robot trotting backward. When in the middle position, the robot is trotting on the ground. The more the stick is pushed away from the center position, the faster the robot will move. (please push the Stick slowly to prevent the robot from suddenly moving forward or backward).
29	Left Stick	Left Stick		The left Stick is used to control the robot to circle in the in-situ state. In L2+START mode, push stick to left, the robot steps back and turns counterclockwise. Push stick to right and the robot steps back and turns clockwise. When in the middle position, the rotational angular velocity of the robot is zero and the robot is trotting on the ground. The more the stick is pushed away from the center position, the faster the robot will rotate.
30	Right Stick	Right Stick		The right Stick is used to control the robot's lateral movement. In L2+START mode, push stick to left, the robot moves to the left. push stick to the right, the robot moves to the right. When in the middle position, the speed is zero and the robot is trotting on the ground. The more the stick is pushed away from the center position, the faster the robot will move.

6. Combined Action and Special Action under “L2+START Mode” (trotting)

No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
31	Left Stick	Left Stick		<p>The left Stick is used to control the arc (circle) of the robot.</p> <p>In L2+START mode, push stick in the upper right direction, the robot will go to the right front arc. If you hold on the direction of stick, the robot will go forward and circle clockwise. Push stick to the lower left, the robot will take the arc to the right. If hold on, the robot will retreat and move counterclockwise. The angle between the Stick and the horizontal line corresponds to the walking radius of the robot. The larger the angle, the larger the radius.</p>
32	Left Stick	Left Stick		<p>The left Stick is used to control the arc (circle) of the robot.</p> <p>In L2+START mode, push stick to the upper left direction, robot will take the arc to the left front. If hold on, the robot will go forward and rotate counterclockwise. Push Stick to the lower right, the robot will take the arc to the left. If hold on, the robot will retreat and move clockwise. The angle between the Stick and the horizontal line corresponds to the walking radius of the robot. The larger the angle, the larger the radius.</p>
33	L1Key Left Button	L1 Key Left Button		<p>The L1 button is used in conjunction with the left button to change the height of the robot's leg.</p> <p>In the L2+START mode, after pressing the L1 button, the up button of the left button is clicked, and the robot raises the leg height. After holding down the L key, jog the left button down button, the height of the robot lift leg is lowered. Each change in height changes by 1 cm. The robot's initial leg height is 5cm, and the leg height can be changed to 4-8cm.</p> <p>Note: Increasing the height of the leg raises the landing speed of the foot end, the contact force between the foot end and the ground increases, and the step sound becomes larger, increasing the impact on the reducer and reducing the life of the reducer. No special circumstances, please set the height of the leg to 4-5cm.</p>

Actions that are not recommended under "W" and "L2+START" mode				
No	The Position of Stick or Button on Joystick	Operation Diagram	Robot Schematic	Remarks
34	Left Button	Left Button		<p>The left button is used to control the body lift and squat when stepping.</p> <p>In W and L2+START mode, press the up button, the robot body will lift up. Press the down button, the robot body will squat.</p> <p><u>Note 1: This action is not recommended. Note 2: Please refer to Table 5 for other precautions.</u></p>
35	Left Button Left Stick	Left Button Left Stick		<p>Left button and left Stick linkage is used to control the robot crept forward and backward.</p> <p>In W and L2+START mode, press the down button, the robot body will squat. Push stick up, the robot crept forward. Push stick down, the robot crept backward. <u>Note 1: This action is not recommended. Note 2: Please refer to Table 5 for other precautions.</u></p>
36	Left button Right Stick	Left Button Right Stick		<p>Left button and right Stick linkage is used to control the robot crept to the left and right.</p> <p>In W and L2+START mode, press the down button, the robot will squat. Push stick to left, the robot crept and moves to the left. Push stick to right, the robot crept and moves to the right. <u>Note 1: This action is not recommended. Note 2: Please refer to Table 5 for other precautions.</u></p>
37	Left Button Left Stick	Left Button Left Stick		<p>Left button and Left Stick linkage is used to control the robot crept to turn counterclockwise and clockwise.</p> <p>In W and L2+START mode, press the down button, the robot will squat. Push stick to left, the robot crept and turns counterclockwise. Push stick to right, the robot crept and turns clockwise. <u>Note 1: This action is not recommended. Note 2: Please refer to Table 5 for other precautions.</u></p>
38	Left Button Left Stick	Left Button Left Stick		<p>Left button and left Stick linkage is used to control the robot crept to walk arc (circle)</p> <p>In W and L2+START mode, press the down button, the robot will squat. Push stick in the upper right direction, and the robot will squat down to the right front. If the Stick is kept, the robot will kneel forward and circle clockwise. Push stick in the lower left direction, and the robot will squat down to the right rear. If the Stick is kept, the robot will squat back and move counterclockwise.</p> <p><u>Note 1: This action is not recommended. Note 2: Please refer to Table 5 for other precautions.</u></p>

	Left Button Left Stick	Left Button Left Stick			Left button and left Stick linkage is used to control the robot crept to walk arc (circle). In W and L2+START mode, press the down button, robot will squat. Push stick in the upper left direction, and the robot will squat down the arc in front of the left front. If the Stick is kept, the robot will kneel forward and move counterclockwise. Push stick in the lower right direction, and the robot will squat down the right rear. If the Stick is kept, the robot will squat back and move clockwise. <u>Note 1: This action is not recommended.</u> <u>Note 2: Please refer to Table 5 for other precautions.</u>
40	L2 Button Right Button-"B"Button	L2 Button Right Button-"B"Button			Hold down the L2 key, click the right button -B, the robot will be high damping down, click the right button -B again, the robot will enter the zero force mode (four joints are completely free of force).

APP

This section introduces the main functions of the Unitree Robotics app.

APP

APP Interface Introduction

UnitreeRobotics is an application tailored for quadruped robots of Unitree. Use of Android and IOS system platforms; It supports touch screen and special joysticks, this section takes UnitreeRobotics APP as an example to explain, the specific interface is subject to the corresponding platform display.

UnitreeRobotics APP home page

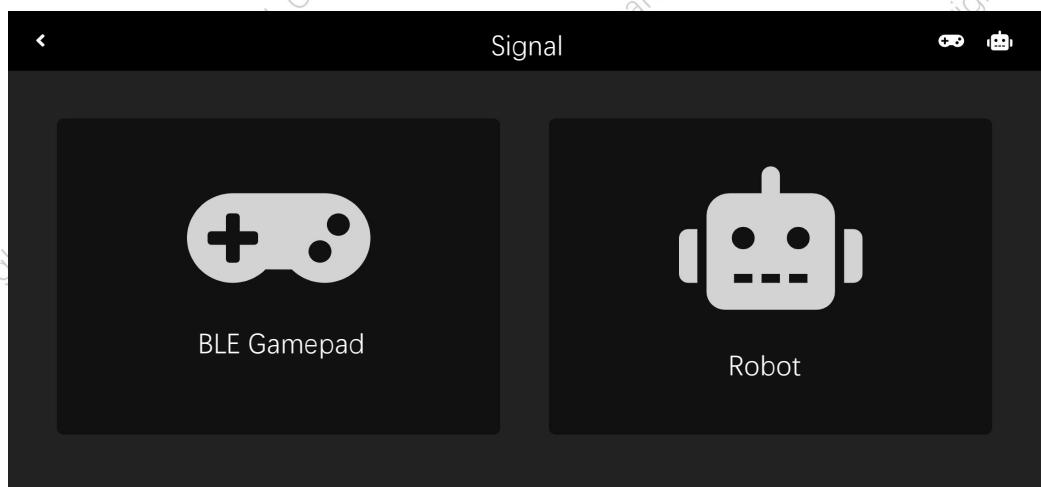


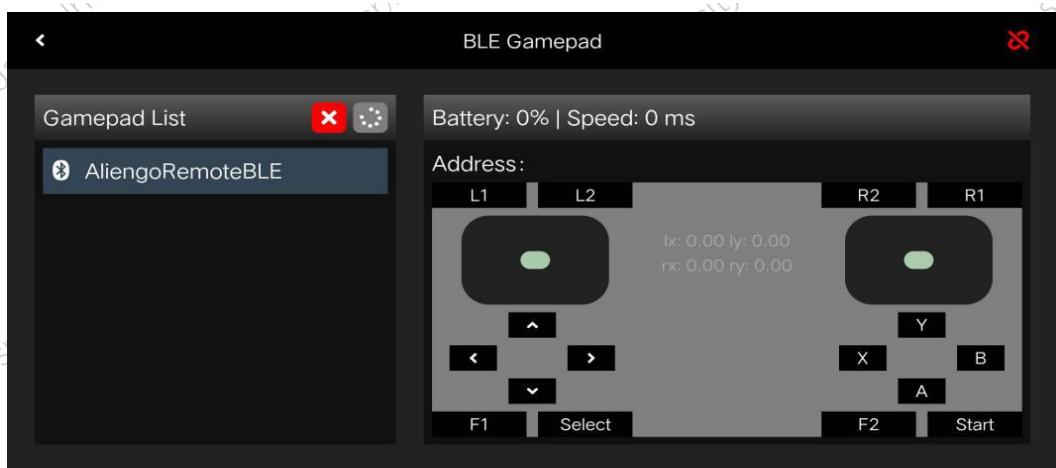
Documentation

Click to view the robot user manual and other documents.

Connect

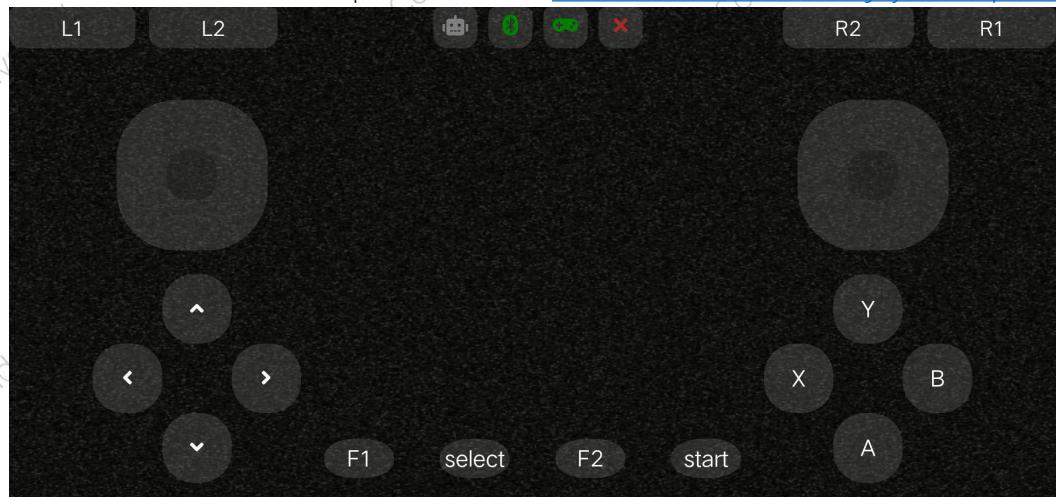
Check the connection status of the phone with the Bluetooth controller or robot. Operate the joystick when the connection is successful, The keys and joystick on the Bluetooth controller interface will be synchronized.





Remote controller

Click to enter the robot control interface, please refer to "["Remote Control Module-joystick Operation"](#)".



Simulator

Click to enter the simulation operation interface. When the robot is not connected, you can understand the buttons and functions of the joystick through simulation control.



Robot Special Case Handling

Unitree uses a streamlined mechanical structure to reduce manufacturing difficulty and improve machine reliability. Our robots have achieved good levels in terms of structure, dynamic performance, kinematics and cost. The quadruped robots we develop are reliable and cost-effective. They are very suitable for the exploration of scientific and field-level applications as a new four-legged mobile platform, but when the external environment does not meet the requirements of robot operation or improper use by users, The robot will have some abnormalities. In addition, in the developer mode, the user will use the program developed by himself on the robot. This has great uncertainties and may cause damage to the robot. Therefore, in the developer mode, please use the protective frame and rope attached to the Unitree official.

Robot Black Box

The robot black box is mainly used to record the state information of the robot operation. After the robot fails, it can help the maintenance personnel to determine the cause of the machine fault more quickly, and judge whether the cause of the machine fault belongs to the user's improper operation or the robot hardware problem according to the black box data. After the robot is turned on, the robot black box will record the machine's IMU, joint angle, joint speed, force sensor and other robot attitude data, as well as internal historical data such as customer control commands and robot running time.



- Improper user operation causes the machine to malfunction and is not covered by the warranty. Please use it in strict accordance with the operating instructions.

Robot Abnormal Situation Response

Post-test failed

Short press the power switch once, then press and hold the power switch for more than 2 seconds to turn on the battery. When the battery is turned on, the indicator light is steady green and the indicator light shows the current battery level. Then the robot will perform the power-on self-test. If the music is not heard, the robot fails the self-test, the boot fails, and the robot can't stand up. In this case, you need to follow the "body placement" and "check line" in the "Preparation before boot" section. Cable "two steps to re-boot the body before starting the work.

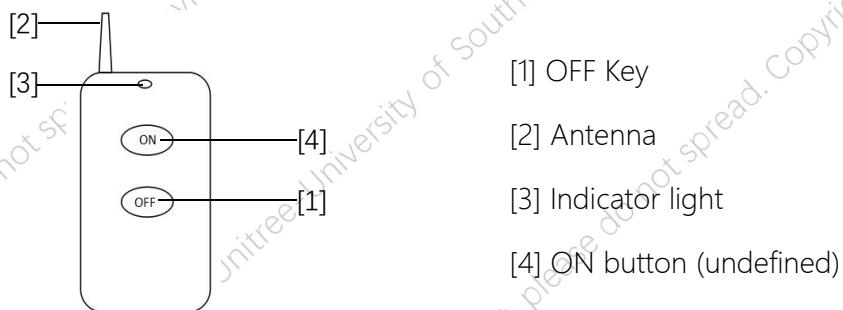
Robot Fall Self-protection

When using Unitree's official motion control program, if the robot is unstable and falls due to external

environment reasons (not enough ground friction, etc.) or improper operation by the user, the robot will switch to the self-protection state and the robot's motor will automatically switch, Go to the brakes to protect the parts.

Emergency Braking (Before Using this Function, Make Sure that the Unitree Official Protection Frame and Rope are Used to Protect the Robot)

Under the developer mode, if the robot is out of control, you can cut off the power of the built-in power distribution board of the robot by pressing and holding the OFF button for 1 second. The robot will lose power. If there is no protection frame protection, the robot will directly drop. The electric fell to the ground. If you need to restart the robot, you need to turn off the battery pack, adjust the robot to the power-on state, and then start the machine according to the normal process.



- In the case of emergency braking, if the robot does not have a protective frame protection, it will cause the robot to break. Therefore, in the developer mode, the user must ensure that the robot protects the robot by the protection frame and the protection rope.
- When users use their own programs, there is a lot of uncertainty, the robot may do some unexpected actions (Uncontrolled to the crowd, rushing to the water, high places Fall, leg movements, tumbling, The motor large torque instantaneous output). Can cause damage to the robot. Therefore, when the customer is in secondary development, please be sure to use protection frame and protection rope protection.
- One robot corresponds to a dedicated emergency brake remote control (the robot and the emergency brake remote control are bound to each other), and the mixing is invalid.
- Please use the emergency brake remote control within 10m from the robot in an environment with no obstruction and no electromagnetic interference. Otherwise, the remote control distance may be shortened or the remote control may be invalid.

Drift and Self-calibration Method of Foot Force Sensor

In the course of using, the robot foot force sensor may drift, which is shown as follows:

• Start robot when suspend in midair

Start robot when suspend in midair, the battery can be turned on by pressing the power switch once and pressing the power switch for more than 2 seconds, the battery can be turned on. After hearing the

music, there are two different situations:

- 1.If the foot end force sensor does not drift, the four legs of the robot will reach the initial position set by the program (the plane of the four legs will be perpendicular to the fuselage, and the joint stiffness of the thigh and the calf is very large), as shown in Figure 1 below.
- 2.If the foot end force sensor drifts, the four legs of the robot cannot reach the initial position set by the program, and each joint is in a zero torque state (undamped state), as shown in Figure 2 below.

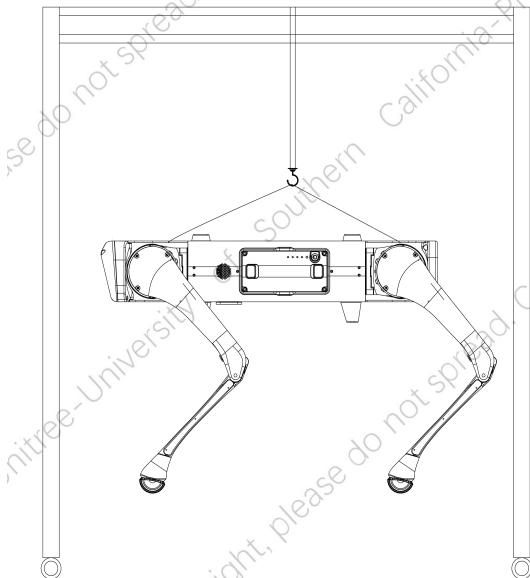


Figure 1: When the boot is successful, the four legs will reach the initial position set by the program. At this time, each joint is in a high damping state (the joint stiffness is large).

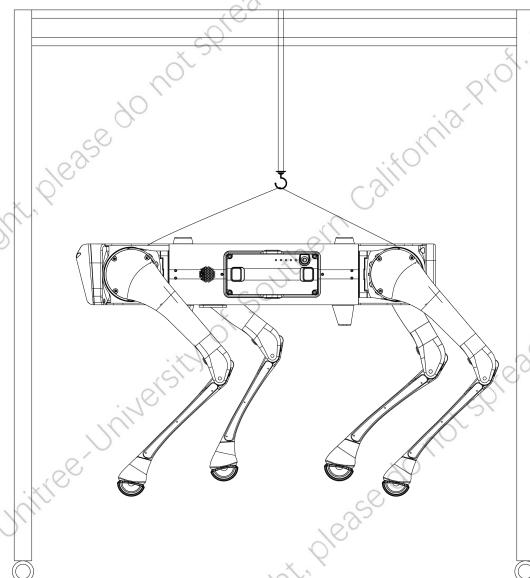


Figure 2: The four legs **cannot** reach the initial position set by the program. At this time, each joint is in a zero torque state (undamped state).

Foot force sensor drift solution: straighten the thigh joint and knee joint (as shown in Figure 3 below), and then restart, the foot end force sensor can be self-recalibrated, the robot four legs can reach the programmed initial position .

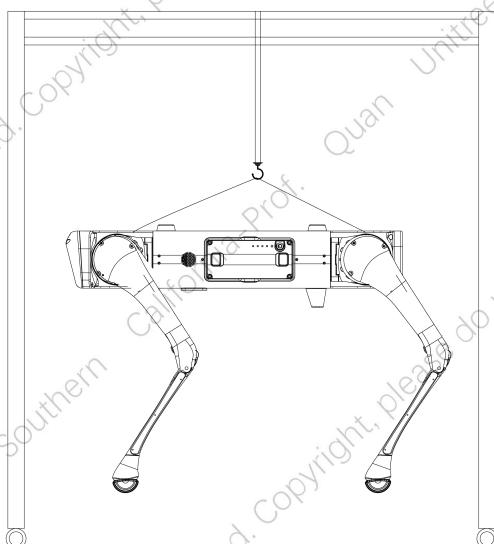


Figure 3: After the thigh joint and knee joint are straightened, the foot end force sensor is self-calibrated and then turned on.

When the robot starts on the ground

When the robot starts on the ground, you can hear the sound of the boot music, but the robot can't stand up.

Solution: Perform the foot end force sensor drift solution when starting (suspended).

Note: Please distinguish it from the chapter "Power on self test is unsuccessful". The reason for the unsuccessful self-test in the chapter " Power on self test is unsuccessful is that the position of the leg is not correct (such as the fuselage is pressed against the lower leg) or the communication cable interface is loose. In these cases, the sound of the boot music cannot be heard. .

How to turn off the robot when the remote control module fails

When the remote control module fails (such as the power of the joystick exhausted), the robot can not be used to make the robot dog down until it is flat on the ground. You can only use the battery power button to force the shutdown (note! If you are not ready before the shutdown, it will easily cause the robot to power down and shoot the ground, causing serious damage to the robot).

Preparations before forced shutdown: After passing the nylon belt through the robot suspension board, hold the nylon belt by hand to make it in a tight state (as shown in the figure below). Press the power switch for a short time, and then press and hold the power switch for 2 seconds Turn off the power, and slowly place the robot on the ground after power off.

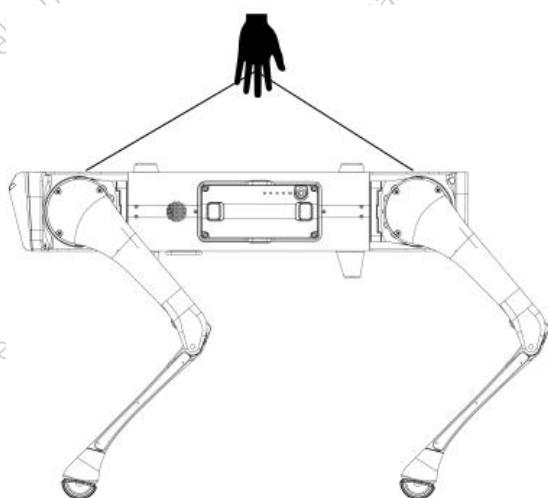


Illustration of preparations before forced shutdown

Disclaimer and Safe Use Guidelines

Environmental Requirements

1. Please do not operate the robot in an electromagnetic interference environment. Sources of electromagnetic interference include, but are not limited to, high voltage power lines, high voltage power stations, mobile telephone base stations, and television broadcast signal towers.
2. Please do not run the robot in the environment of WiFi signal interference. WiFi signal interference is usually caused by co-channel interference. When you are disturbed, be sure to turn off some or all of the other wireless device WiFi sources, and then use the remote control to operate the robot.
3. Operate in a good weather environment at 5 ° C -35 ° C. Do not operate in bad weather, such as fog, snow, rain, lightning, sandstorms, storms, tornadoes, etc.
4. When using, please keep the robot within the line of sight to keep the robot at a safe distance of at least 3 meters from obstacles, complex ground, crowds, water surface and other objects.
5. Since the robot does not have a visual perception system at present, and the actual control personnel have different levels of control proficiency, in order to be reliable and stable, please use it in an open and flat environment. When operating the robot, be careful to avoid steps above 10cm, slopes greater than 25°, and obstacles that may cause the robot to fall. When the robot is walking on a terrain with a certain undulation or slope, the controller should reduce the walking speed of the robot and carefully control it so that the robot is tripped by obstacles.
6. The robot is not waterproof, please do not run on the ground with water, rain or snow or humid environment.
7. The robot is not dustproof. Do not run on gravel or dusty environment.
8. Foot robots have certain requirements for the ground to walk. Do not use robots on the ground with very low friction, such as ice. Do not use robots on soft ground, such as thicker sponge floors and grassland. For use on smoother floors, such as glass, tiles, etc., carefully and compliantly control the robot to exercise, avoid strenuous exercise, and reduce the walking speed of the robot to prevent the robot's foot from slipping and falling.

Check Before Starting

1. Use only genuine Unity parts and ensure that all parts are in good working order.
2. Make sure the remote control and battery pack are fully charged.
3. Make sure the firmware and app have been updated to the latest version (early versions may only

- support manual firmware updates).
4. Please make sure that the robot is placed on the leveling ground before starting the machine. The robot's abdominal support pad should be flat on the ground. The body level is not tilted on the ground. The robot calf is fully stowed and the robot hip joint is adjusted to open the four legs. Refer to "Body Display" in the "Preparing Before Boot" section.
 5. Users ensure that they are not manipulating the robot without drunkenness, drug effects, or inability to concentrate.
 6. Be familiar with the characteristics of each gait mode. Familiar with emergency braking method in case of robot instability/uncontrolled.
 7. Ensure that there are no foreign objects inside the robot and each component (e.g. water, oil, sand, earth, etc.)
 8. Check the condition of the robot cable: whether the cable is damaged, whether the interface is disconnected, and whether the cable is caught in the gap between the hip motor and the front and rear baffles. If the cable is caught in the above gap, the cable should be removed. To prevent damage to the cable.

Operational Considerations

1. Standing Status:

When standing, if the local friction is insufficient or the robot's foot does not have reliable support, do not violently control the robot for posture adjustment (including pitch, roll, yaw, body height adjustment, etc.), otherwise the side may cause the robot to lose stability, inverted.

2. Walking Status:

Please walk under the stable terrain control. If you are walking on a ground with less friction, do not violently control the robot to complete the movement. Otherwise, the side may cause the robot's foot to slip and become unstable.

3. Battery Life:

The rated life of the robot with no-load static standing and upright running alternately is about 2.5 -4.5 hours. It depends on the actual operating conditions of the robot, such as long-time faster walking, long-term adjustment of the body posture when the robot is standing, robotic leg bending standing, running with load, lower body height walking, appropriate Conditions such as undulations and slope topography will reduce battery life. (The height of the body is low, and when the knee joint is relatively large, the burden on the motor is large, so the power consumption is significantly increased early, and the motor is heated).

4. About Steps and Undulating Pavement:

Since the robot does not have a visual perception system, and the actual controller has different levels of proficiency in control, the current version does not recommend the customer to walk more than 10 cm for the sake of reliability and stability, otherwise it is likely to be caught due to improper operation. The control personnel should also be cautious when encountering undulating ground and reduce the speed of the robot.

5. About Climbing:

The rated forward climbing angle is less than or equal to 25°. Since the robot does not have a visual perception system at present, when using a large climbing angle (about equal to or greater than 25°), the robot body is likely to have a more lateral drift, especially when using the Trot gait; The visual perception system, which makes a direct turn on a slope with a large slope, is likely to destabilize the robot; when climbing the slope, please reduce the walking speed; it needs to be controlled by the controller.

6. About Speed:

The maximum speed can reach 1.5m/s under the stable control of flat terrain.

7. About the Robot Walking by the Track:

The official delivery version may support the robot on a flat or square track with pre-set conditions.

8. About the Robot Body Posture Adjustment Combined Action

(including pitch, roll, yaw, body height adjustment, etc.)

The official delivery version may support the standing state, level the ground, under the premise of pre-setting, the robot performs a series of body posture adjustment combined actions according to certain rules.

9. About Footpad:

The robot footpad is a consumable item, and we will give you an alternate footpad. Especially when running on rough ground, the wear will be more serious. If the obvious foot pad is found to be worn or damaged, or the impact noise on the ground is obviously increased when the robot is walking, please replace the foot pad in time to avoid damage to the foot. Foot sensor (such as force sensor).

10. It is forbidden to be complicated on the ground, the ground is slippery, there are debris on the ground, the terrain is undulating (step is higher than 10cm, etc.), the slope is larger (greater than 25°), and the robot is used when there is a sharp object on the ground or the periphery.

11. Carefully grip the joints at the joints, such as the knee joint.

Battery Pack Safety Guidelines

Improper use, charging or storing the battery pack may result in fire or property and personal injury. Be

sure to use the battery pack with reference to the safety instructions below.

Use

1. Make sure the battery pack is fully charged before each use.
2. When using, moving or charging, please be careful of the battery and charging plug to avoid being damaged by external force.
3. When the battery pack is lower than two grids, stop using the robot as soon as possible, replace the new battery pack or charge the battery pack.
4. A battery that has just been used or a battery that has just been charged will have a certain amount of heat. This is normal, but be sure to let it sit for a while in a well-ventilated and empty place, wait for the battery to cool naturally before using it.
5. Do not allow the battery pack to come into contact with any liquid. Do not immerse the battery pack in liquid or get it wet. Do not use the battery pack in rain or in a damp environment. Decomposition reaction may occur after the inside of the battery pack contacts water, causing the battery pack to ignite spontaneously and may even cause an explosion.
6. It is strictly forbidden to use the battery pack that is not officially provided by Unitree. For replacement, please check the Unitree website for relevant purchase information. Unitree is not responsible for battery pack accidents caused by the use of battery packs not supplied by Unitree.
7. It is strictly forbidden to use a damaged, bulged, leaky battery pack.
8. Keep the battery pack powered off before installing or unplugging the battery pack. Do not plug or unplug the battery pack while the battery pack is powered on, otherwise the power supply or robot may be damaged.
9. The battery pack should be used between 5 °C and 35 °C. If the temperature is too high (above 40 °C), the battery pack may catch fire or even explode. If the temperature is too low (below 0 °C), the battery pack life will be seriously damaged.
10. Do not use the battery pack in strong magnetic or static environments. Otherwise, the battery pack protection board will malfunction, causing the battery pack and the robot to malfunction.
11. Do not disassemble or puncture the battery pack in any way.
12. The liquid inside the battery pack is highly corrosive. If there is leakage, please keep away. If the internal liquid is spattered onto human skin or eyes, rinse immediately with water for at least 15 minutes and seek medical attention immediately.
13. If the battery pack is severely impacted by external force, it must not be used again until the official inspection of Unitree is delivered.
14. If the battery pack is on fire, use solid-state fire-fighting equipment. It is recommended to use

fire-fighting equipment in the following order: water or water mist, sand, fire blanket, dry powder, carbon dioxide fire extinguisher.

15. Do not place the battery pack in a pressure cooker or microwave oven.
16. Do not place the battery pack on the conductor plane.
17. Do not short circuit the positive and negative poles of the battery pack with wires or other metal objects.
18. Do not hit the battery pack. Do not place heavy objects on the battery pack or charger.
19. If there is dirt on the battery pack connector, wipe it off with a dry cloth. Failure to do so may result in poor contact, resulting in energy loss or failure to charge.

Charging

1. The battery pack will automatically stop charging when it is fully charged. It is recommended to disconnect the charger after the battery pack is full.
2. Please be sure to plug in the charger when the battery is off.
3. When charging the battery, please ensure that the battery is charged in the line of sight to prevent unpredictable accidents.
4. Recommended 5A charging, such as 10A charging, please put the battery in ventilation.
5. When charging, please pay attention to ensure that the environment around the battery is well cooled, and there are no flammable and explosive materials such as sundries.
6. Keep the smart battery pack off when charging.
7. Smart battery packs must be recharged using a dedicated charger from Unitree. Unitree will not be responsible for any consequences of charging with a charger not supplied by Unitree.
8. When charging, please put the battery pack and charger on the ground without any flammable or combustible materials around the concrete floor. Please pay attention to the charging process to prevent accidents.
9. It is forbidden to charge the battery pack immediately after the robot has finished running. At this time, the battery pack is in a high temperature state, and forced charging may cause serious damage to the life of the battery pack. It is recommended to charge the battery pack to room temperature before charging. The ideal charging environment temperature (5°C - 40°C) can greatly extend the life of the battery pack.
10. Disconnect the charger from the battery pack after charging is complete. Check and maintain the charger regularly, and check the appearance of the battery pack and other components. Never use alcohol or other flammable agents to clean the charger. Never use a damaged charger.

Storage and Transportation

1. When not using the battery pack, remove the battery pack from the robot and store it in a dedicated battery case provided by Unitree.
2. Do not place the battery pack near a heat source, such as in a car that is exposed to direct sunlight or hot weather, a fire source, or a heating furnace. The ideal storage temperature of the battery pack is 22 °C - 28 °C.
3. When storing, please pay attention to ensure that the environment around the battery is well cooled, and there are no flammable and explosive materials such as sundries.
4. The environment in which the battery pack is stored should be kept dry. Do not place the battery pack in water or where it may leak.
5. It is forbidden to mechanically impact, crush, puncture the battery pack, and it is forbidden to drop or short-circuit the battery pack.
6. Do not store or transport the battery pack with glasses, watches, metal necklaces, hair clips or other metal objects.
7. Do not transport damaged battery packs. Once you need to transport the battery pack, be sure to discharge the battery pack to about 65% charge.
8. Do not store the battery pack for a long time after it has been completely discharged, to prevent the battery pack from entering the over-discharge state, causing the battery to be damaged and cannot be used again.

Discard

1. Always leave the battery pack completely discharged before placing the battery pack in the designated battery pack recycling bin. The battery pack is a dangerous chemical and is strictly prohibited from being disposed of in a common waste bin. For details, please follow the local battery pack recycling and disposal laws and regulations.

Maintenance

1. Do not use the charger to charge the battery pack in an environment where the temperature is too high or the temperature is too low.
2. Do not store the battery pack in an environment where the room temperature exceeds 40 °C.
3. Do not overcharge the battery pack, otherwise it will cause damage to the battery core.
4. If you do not use the battery for a long time, please check the remaining battery power regularly. If the battery is lower than 30%, please charge the battery to 70% before saving. In order to avoid battery over-discharge and damage the battery.

After-sales Policy

Warranty Period

Main Component Warranty Schedule		
Product	The Main Components	Warranty Period
ALIENGO	Mainboard	6 months
	Motor	3 months (No more than 360 hours) [1]
	Reducer	3 months (No more than 360 hours) [1]
	Servo Controller	6 months
	Battery Pack	6 months (Less than 200 cycles)
	Leg and Foot Parts	No Warranty Period
	Cable and Frame	No Warranty Period
Motor (single product)	Motor	3 months [1]
	Reducer	3 months [1]
Battery Pack (single product)	Battery Pack	6 months (Less than 200 cycles)
Servo Controller (Single Product)	Motor Driver	6 months

[1]: Under the premise of operating the user manual, the warranty period is 3 months and the usage time is no more than 360 hours (average 4 hours per day).

[2]: Gifts such as remote control, charger, etc., are not covered by the warranty.

Warranty Period

1. After you purchase the ALIENGO and other related products, the warranty period starts from the day you receive the goods.
2. If the product of Unitree you purchased has exceeded the warranty period, you can also get our help by purchasing another service.
3. During the warranty period, without the permission of Unitree, if the clients do transformation, disassembly, and shell opening privately, the warranty period will be directly invalid..

Maintenance Method

In accordance with specific circumstances, we will repair or replace the parts of Unitree products purchased by you correspondingly. However, the following circumstances will not be free warranty:

- 1.Damages caused by factitious factors rather than manufacturing factors;
- 2.Damage caused by transformation, disassembly, and shell opening privately, etc.;
- 3.Damages caused by improper installation, incorrect use, or operation not in accordance with official instructions or manuals;
- 4.Damage caused by the repairing and exchanging followed by a non-authorized service instructions or manuals;
- 5.Damages caused by unauthorized modification of circuits and misuse of the battery and the charger;
- 6.Damages caused by the operations in severe environment, such as strong magnetic disturbances, rain, dust storms, wetlands and other complex conditions;
- 7.Damage caused by operation in sharp terrain, undulating conditions, etc.;
- 8.Damage caused by operation on ground with very low friction (eg ice ground, glass ground);
- 9.Damage caused by falling damage (except for falls on flat terrain)
- 10.Damages caused by colliding with people or objects in the complex environments.
- 11.Damages caused by operating the product in an environment suffering from interference with other wireless devices , such as Wi-Fi signals, etc.;
- 12.Damages caused by overloading in excess of safe load conditions;
- 13.Damages caused by violence or non-violence in excess of the robot's anti-interference limits;
- 14.Damages caused by powering the robot with non-original battery;
- 15.Damages caused by compatibility and reliability issues when using the products of the third party;
- 16.Damages caused by forced operation in case of aging or damaging parts;
- 17.Damages caused by operating the unit with a low-charged or defective battery;
- 18.The relevant items are not sent within the specified time after contacting Unitree to confirm the warranty service;
- 19.Due to operational errors, the robot hits hard objects or falls down, there are obvious signs of collisions on the surface of the robot, and obvious traces of scratches.
- 20.There are obvious signs of dust, sand, water and metal powder intrusion inside the robot.
- 21.Due to the use of water in the humid environment, there are obvious water spots on the surface and inside of the robot, the components and boards have corrosion marks.
- 22.Under the developer mode, users use their own programs to develop high-level or low-level robots, resulting in damage to the robot without the protection of protective frame and protection rope. Including: When the high-level development, the robot carries users' own vision system to control

the robot to move, the damage caused by the robot hitting a sharp object or falling down from the height; When the bottom-level development, the damage caused by the user-controlled motor hits the joint limit or other impacts, high-speed vibration of the motor; etc.

Other Rules

1. When you send the product(s) to Unitree for return, repair or replacement, you are responsible for shipping costs.
2. Unitree will examine the returned product(s) to identify the problem. If the problem qualifies for service under this policy, Unitree will bear the cost for refund, replacement, or repair and return the product(s) at our cost to you.
3. If the product does not conform to the condition of free maintenance, you will have to pay the service. Unitree will not start repair until you agree to the cost for repair. If you disagree with the cost for repair, Unitree will return the product(s) with you burdening the cost of return shipping.
4. If the product exceeds the warranty scope, we will collect the corresponding inspection fees, replacement parts fees, test fees, labor fees and express fees in accordance to the specific issues.
5. Product maintenance may cause user-generated data loss. Therefore, please backup your data first.
6. Please do not send the seriously damaged battery back. If you have sent it back, Unitree will reject the battery and will not return it.

Appendix

Specifications

Visit Unitree official website.

Chinese: <http://www.unitree.cc/cn/>

English: <http://www.unitree.cc/>

Firmware Upgrade

Use the Unitree Assistant firmware upgrade software to upgrade the robot's main firmware and motor drive firmware. (The actual function of the robot will differ from this manual due to the firmware version) The operation interface of Unitree Assistant is shown in Figure 1. The various parts of the interface are defined as follows:

- 1.The serial port configuration part includes the port number of the serial port, the serial port baud rate, the serial port open button, the serial port open indicator, the total number of received bytes of the serial port and the total number of bytes sent.
- 2.Node selection, including master, motor drive, and coordination;
- 3.Reset button, click once, the corresponding node will perform software reset.
- 4.The firmware version number shows the serial port, including the loader version number and the firmware version number.
- 5.Get the version number button, click once, you will get the firmware version number of the corresponding node, and the indicator light next to it will light up. If the corresponding node does not return data, the indicator will go out.
- 6.Firmware erase button, click once, the firmware program of the corresponding node will be erased, when the next reset, the corresponding node will enter the loader program.
- 7.The firmware loads the window and also shows the firmware size in bytes.
- 8.In the upgrade section, click on the node and the node will enter the upgrade process. When the upgrade progress bar is filled, the upgrade is successful and the upgrade indicator next to it will light up.

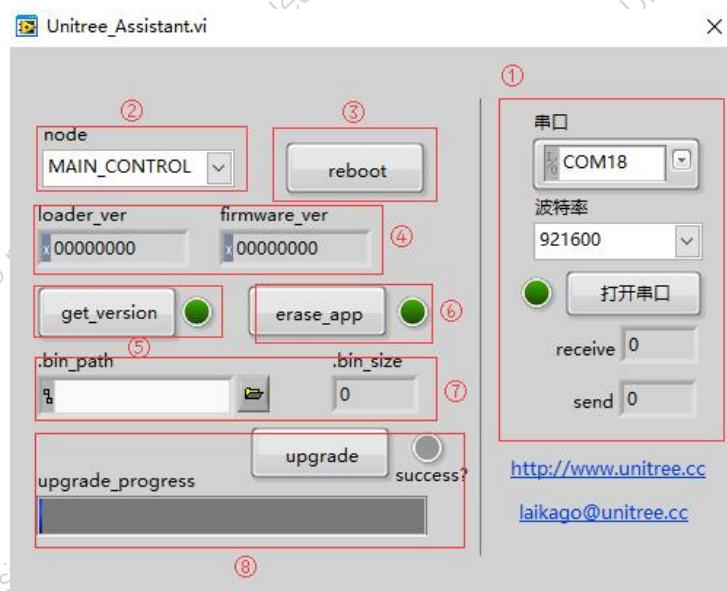


Figure 1 Unitree Assistant operation interface

Upgrade Process:

1. First connect one end of the serial cable to the USB port of the computer, the other end to the robot, and then turn on the power of the robot (Currently the connector port does not support hot plugging, so you need to connect the serial port first and then power it on). If you need to upgrade the "master or joint motor", you need to connect the serial cable to the connector shown in Figure 2 of "Mainboard debug interface", 24V is the input interface, 5V, 12V and 19V are the output interfaces.

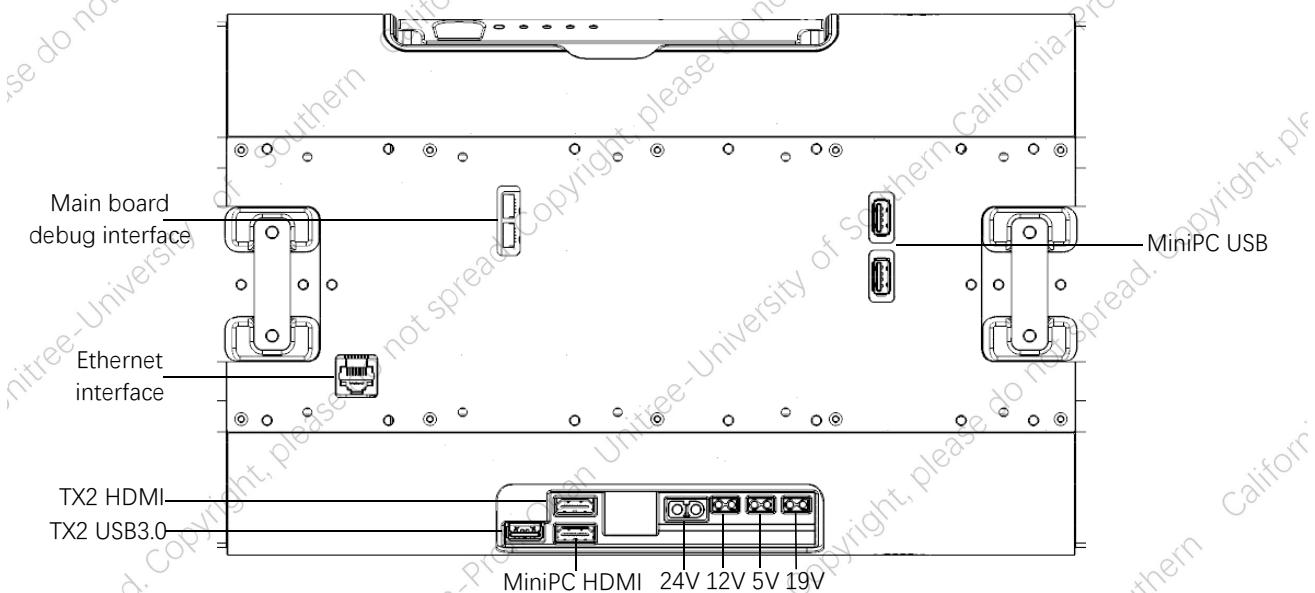


Figure 2 Introduce "Master or Joint Motor" Upgrade Connector and other Connector

2. After connecting the serial cable, return to the "Unitree_Assistant.vi" interface, select the corresponding serial port number in the "Serial Port" option on the right side, select the 921600 baud rate, and then click the "Open Serial Port" button. If the serial port is normally open, Then the indicator light next to the button will light up, as shown in Figure 4.

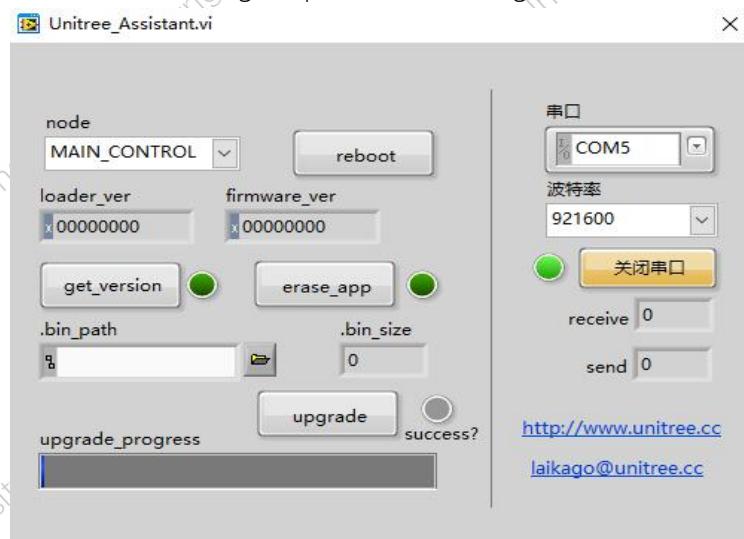


Figure 4 Interface after successfully opening the serial port

3. Select the node to be upgraded in the "node" drop-down menu, as shown in Figure 5, then load the .bin file to be upgraded, and finally click the "upgrade" button. The upgrade success "success" light will light up, the interface is shown in Figure 6.



Figure 5 node selection drop-down menu

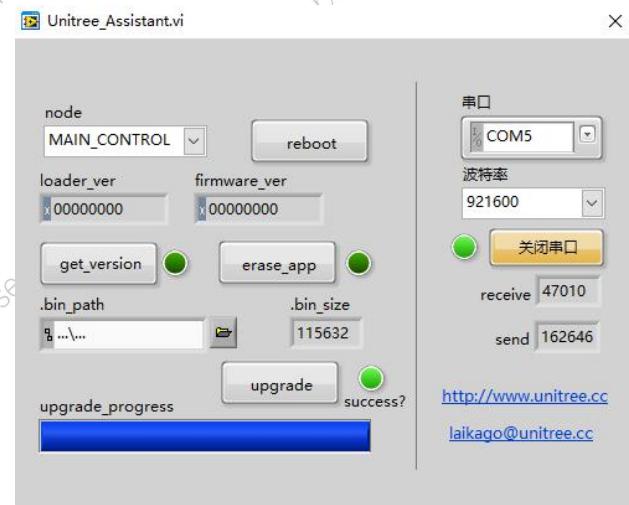


Figure 6 Interface after successful node upgrade

Node and Update Firmware Correspondence Table			
MAIN_CONTROL	Master Firmware	USER_CONTROL	Control firmware
FR_JOINT0	Right front leg hip firmware	RR_JOINT0	Right hind leg hip joint firmware
FR_JOINT1	Right front leg thigh motor firmware	RR_JOINT1	Right hind leg thigh motor firmware
FR_JOINT2	Right front leg calf motor firmware	RR_JOINT2	Right hind leg calf motor firmware
FL_JOINT0	Left front leg hip firmware	RL_JOINT0	Left hind leg hip joint firmware
FL_JOINT1	Left front leg thigh motor firmware	RL_JOINT1	Left hind leg thigh motor firmware
FL_JOINT2	Left front leg calf motor firmware	RL_JOINT2	Left hind leg calf motor firmware

4. After the upgrade is successful, you can click the "get_version" button to confirm whether the firmware version number of the node is the firmware version number to be upgraded, as shown in Figure 7.



Figure 7 Querying the firmware version number of the node

5. After the ALIENGO updates the firmware successfully, please restart the machine.



- Ensure that the ALIENGO is at least 50% charged during firmware upgrades.
- Ensure that the ALIENGO hangs on the protective frame when upgrading the firmware.
- During the firmware download process, do not change the node option, wait for the firmware download to complete, then switch the node option.
- Do not plug or unplug the download line during the upgrade process.
- It takes about 1-2 minutes to upgrade a single firmware, and it takes about 20 minutes to upgrade all the firmware. During the upgrade process, the quadruped robot may have the following conditions: leg weakness, no motor return data, robot restart and so on, the above is normal, please wait for the firmware upgrade to complete.
- After the upgrade is complete, please restart the machine.