

3-Day Training on Unitree B2

Robot Operations

Weston Robot

2024.10

Contents

1. Main Components
2. Basic Operations
3. Maintenance

Objective

- Understand the main components of the robot.
- Gain familiarity with the robot's basic functions, including startup, shutdown, and movement control.
- Understand the robot's electrical architecture, including power distribution and communication interfaces.
- Identify common issues and troubleshoot hardware-related problems.

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Main Components

What's inside the box



B2



Remote Controller



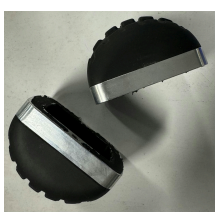
Battery



Charger



Cables



Foot Pads x2

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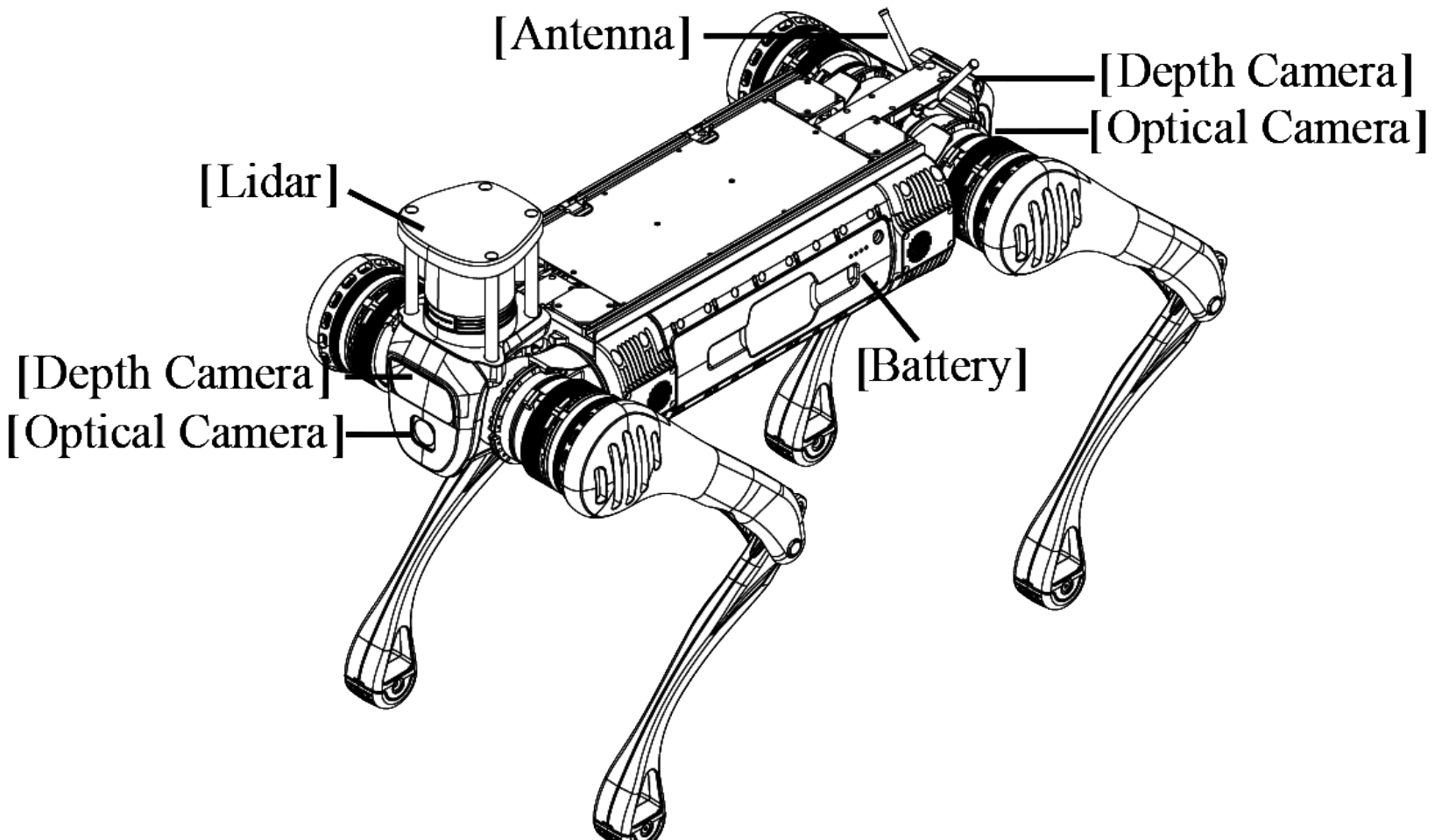
Compatible Accessories

- RoboSense LiDAR
- User Peripheral Board
- 5G Module
- Contact Charging Board



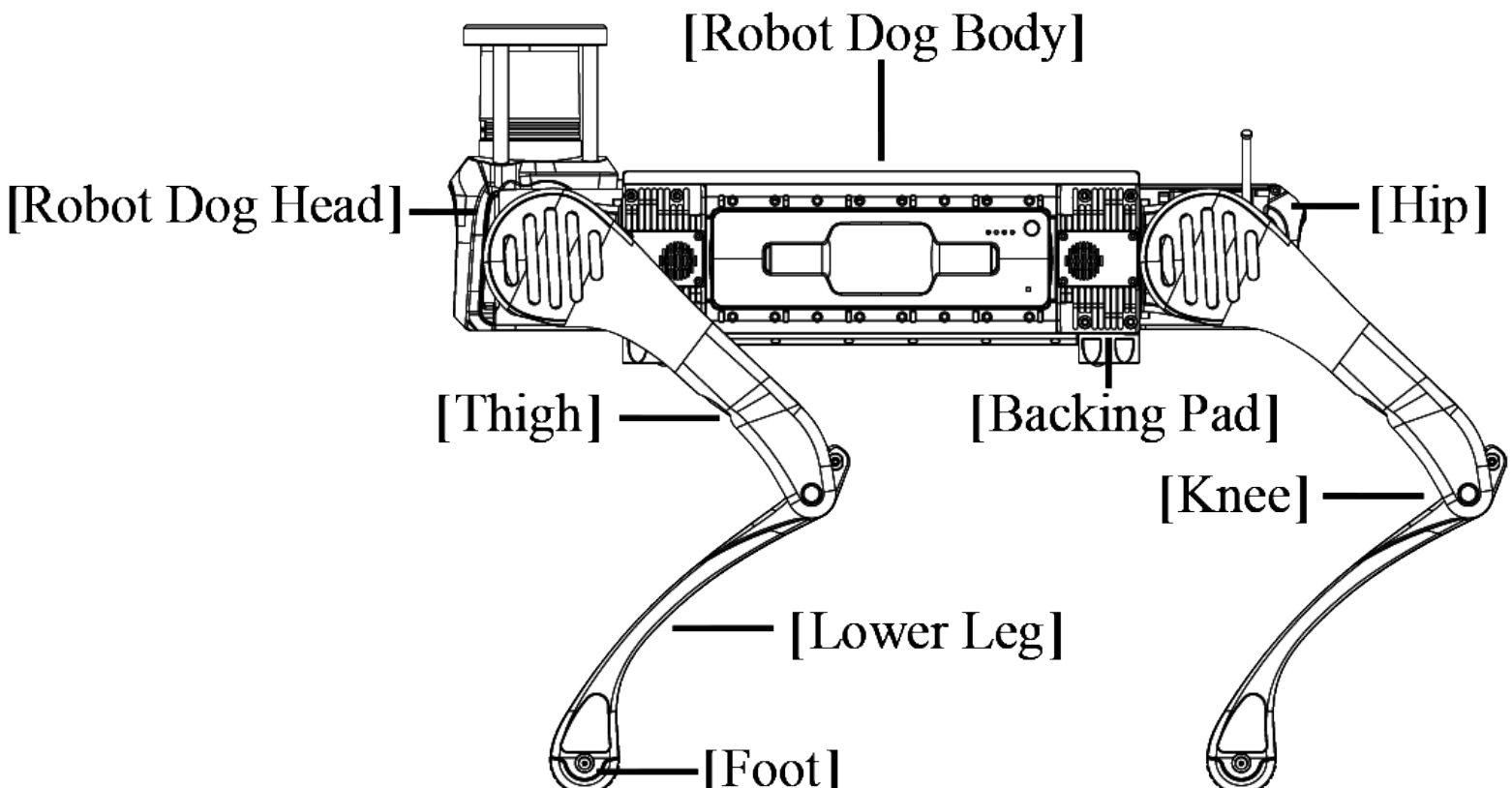
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B2



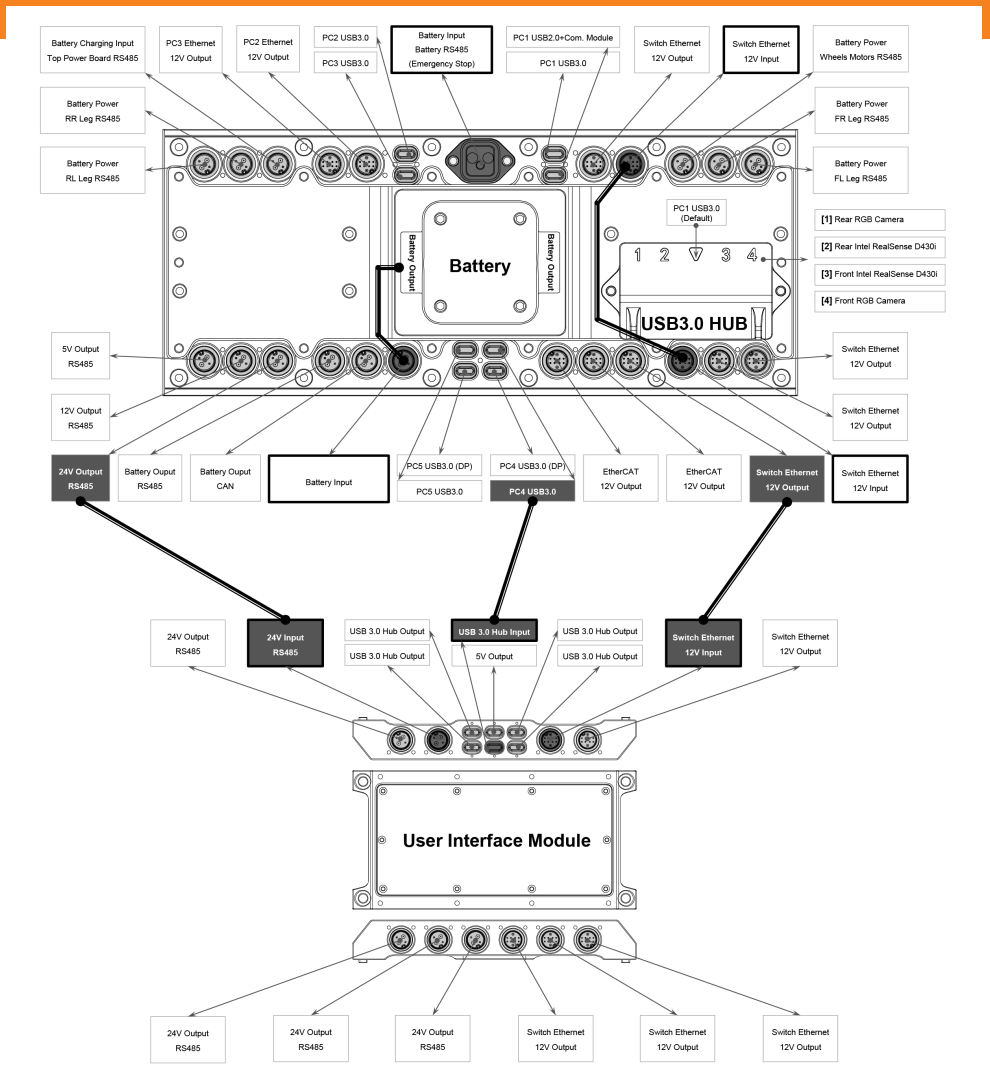
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B2



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Electrical Interface

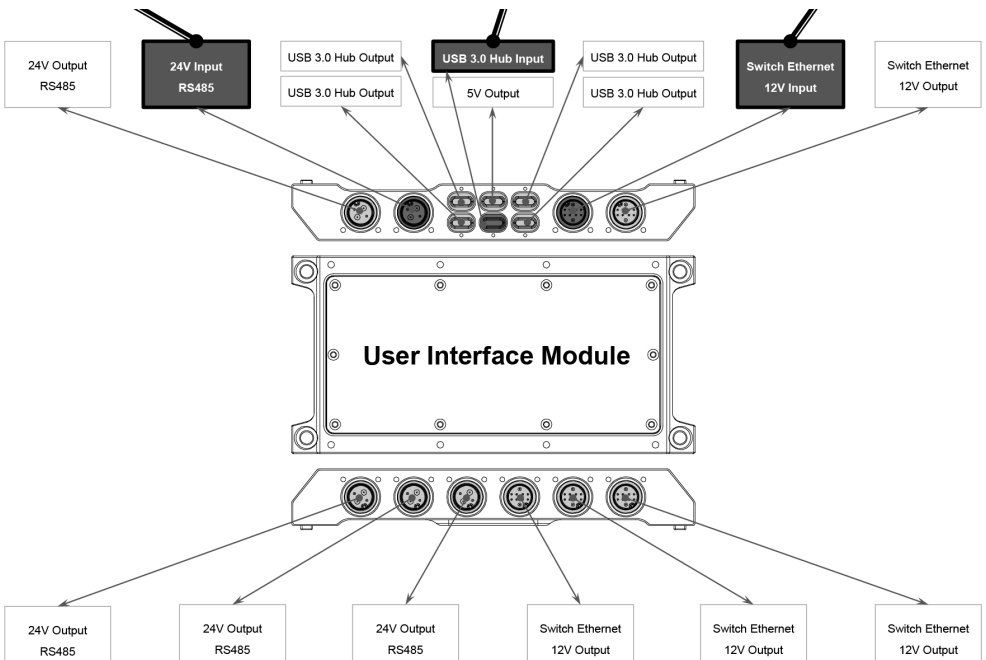


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Electrical Interface

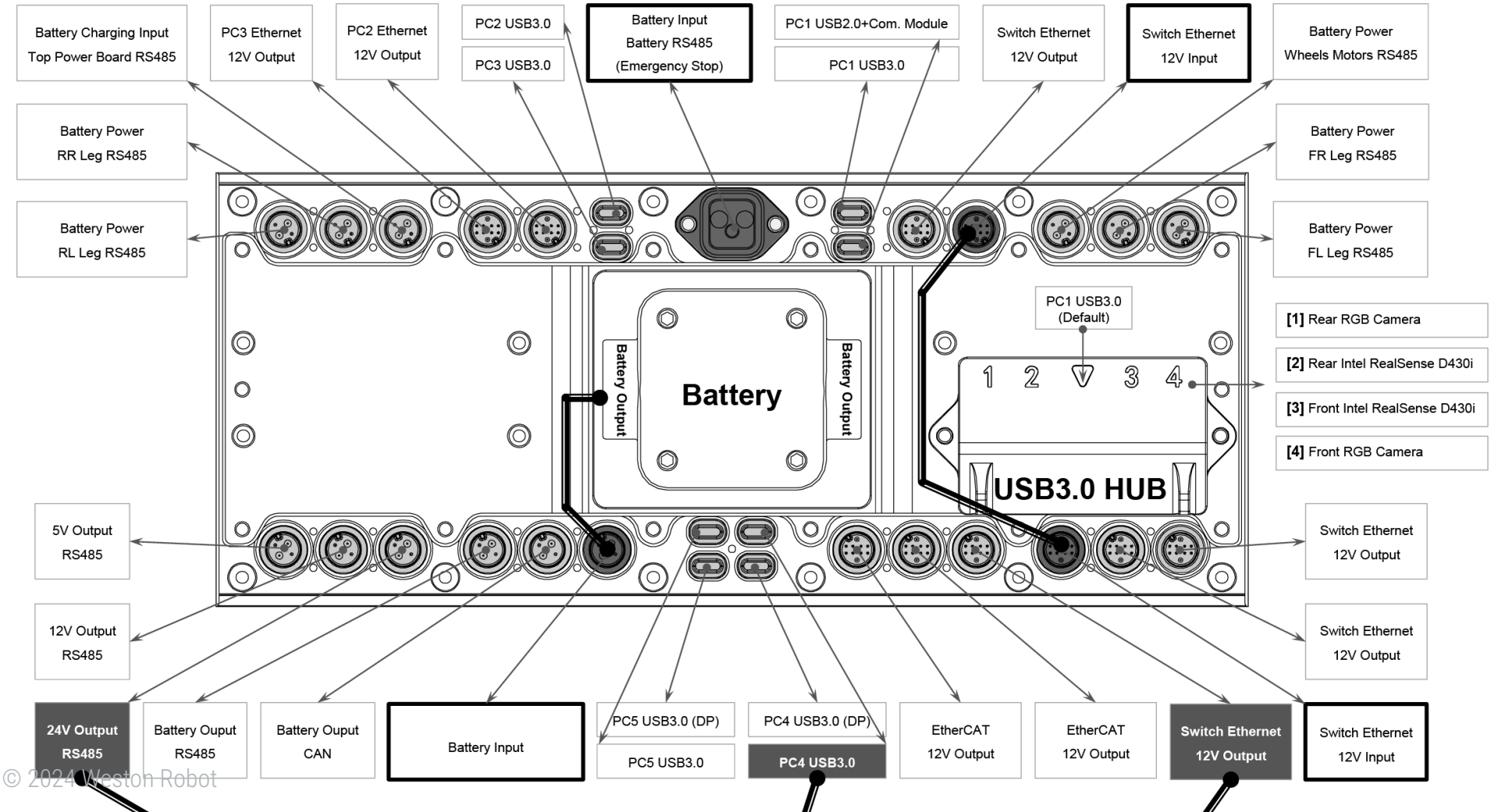
Interfaces

- 12V Output, Ethernet
  - Maximum load: 10A
  - Over current protection: 20A
- 24V Output, RS485
  - Maximum load: 10A
  - Over current protection: 20A
- 5V Output, USB 3.0
  - Maximum load: 2A



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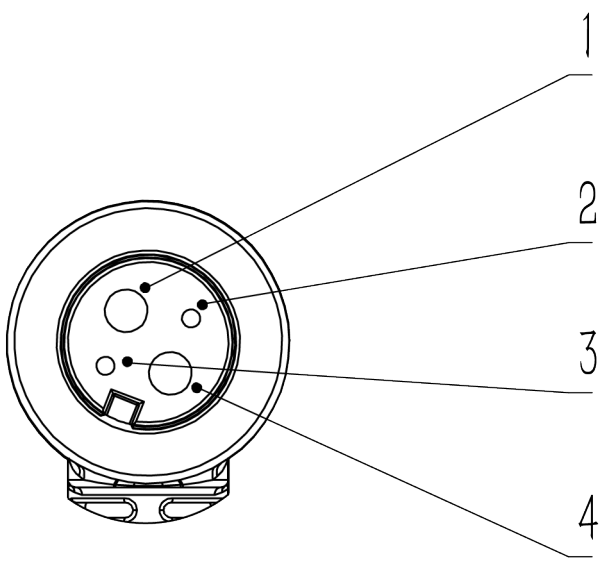
Electrical Interface



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Cable Interface

24V, RS485

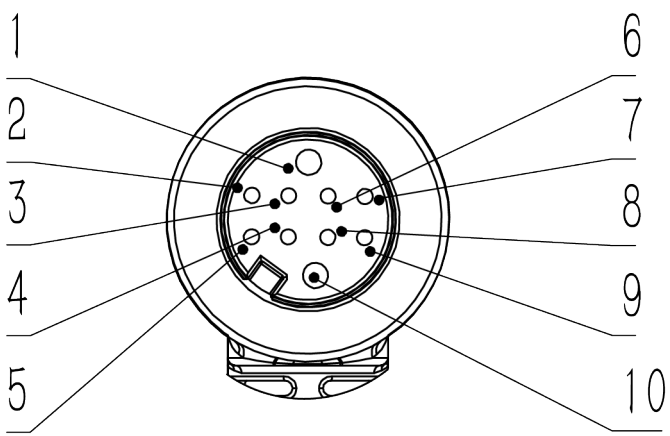


Pin	Colour	Description
1	Black (14AWG)	Ground
2	Red (24AWG)	485A
3	Black (24AWG)	485B
4	Black (24AWG)	Power

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Cable Interface

12V, Ethernet



Pin	Colour	Description
1	Black	Ground
2	Orange	4N
3	Purple	4P
4	Brown	1P
5	Blue	1N
6	White	3N
7	Green	3P
8	Pink	2N
9	Grey	2P
10	Red	Power

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Remote Controller (RC)

- Charging Voltage: 5.0V
- Charging Current: 2.0A
- Frequency: 2.4GHz
- Battery Capacity: 2500 mAh
- Communication: Data transmission module, Bluetooth
- Running Time: 4.5h
- RC Distance: 100m with direct line of sight



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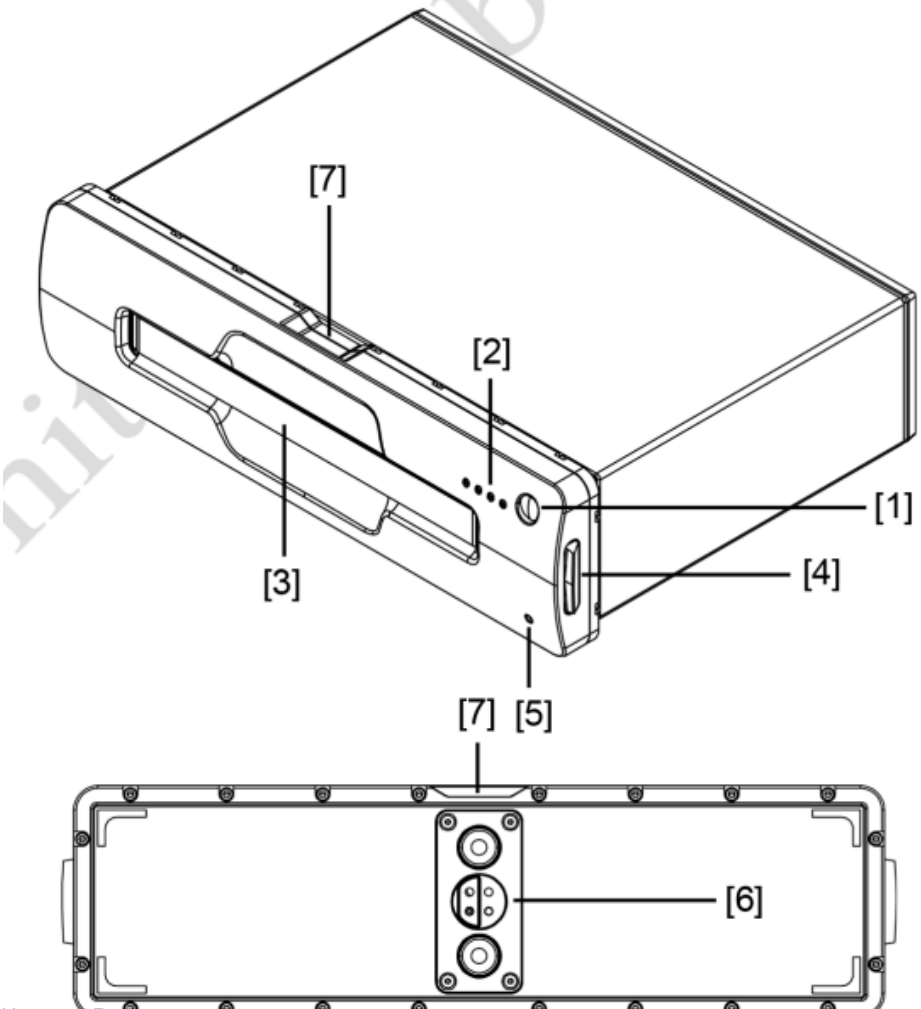
Battery

- Battery Model: BT2-10
- Battery Weight: 12.2kg
- Battery Capacity: 45Ah
- Standard Voltage: 50.4V
- Charging Voltage: 58.8V
- Charging Current: 10A
- Operating Time: 4.5h
- Charging Time: 3h 20m



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Battery Parts



[1] Power Switch

[2] LED Light

[3] carry handle

[4] Fastener

[5] pressure relief valve orifice

[6] Charger Interface

[7] Foolproof Interface

Unitree Robot

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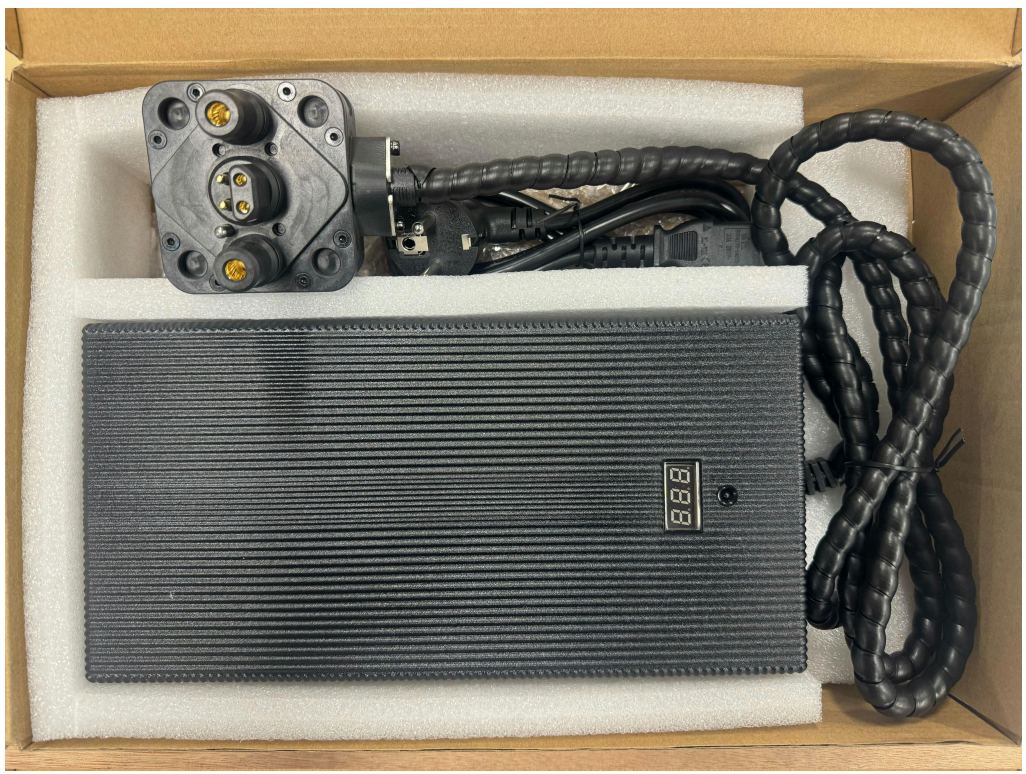
Battery Function

- **Overcharge Protection**: Stops charging when battery is fully charged.
- **Charging electric current protection**: When charging current is more than **20A**, battery will stop charging.
- **Over-discharge Protection**: When the battery discharges to 39V, the battery will cut off power.
- **Short circuit Protection**: In the event of a short circuit detected by the battery, the output will be cut off to protect the battery.
- **Battery load detection Protection**: Battery cannot be powered on without being properly installed in the robot.

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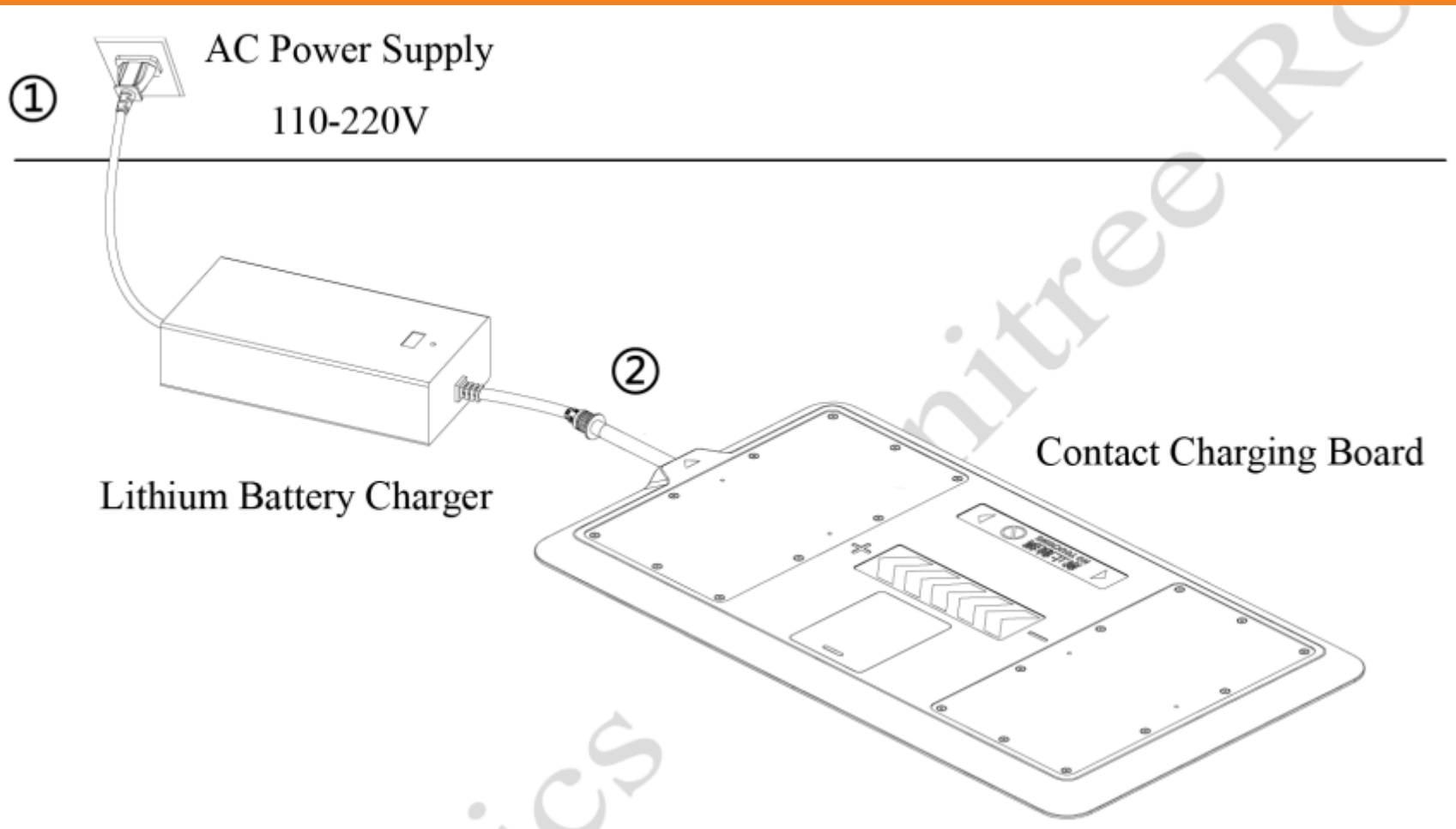
Charger

- Input: 100-240V ~ 50/60Hz 10A
- Output: 58.8V ⎓ 10A
- Charging Time: 3h 20m



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Charger

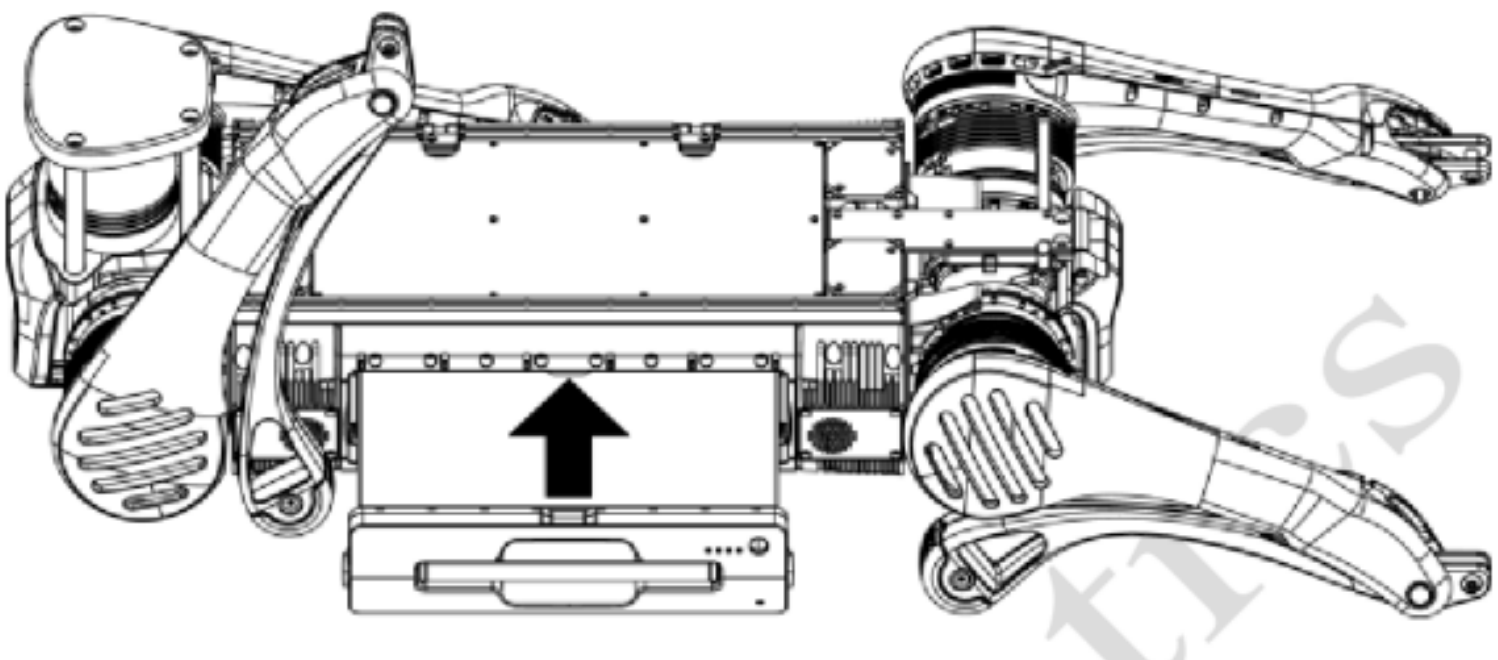


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Basic Operations

Switch On the Robot

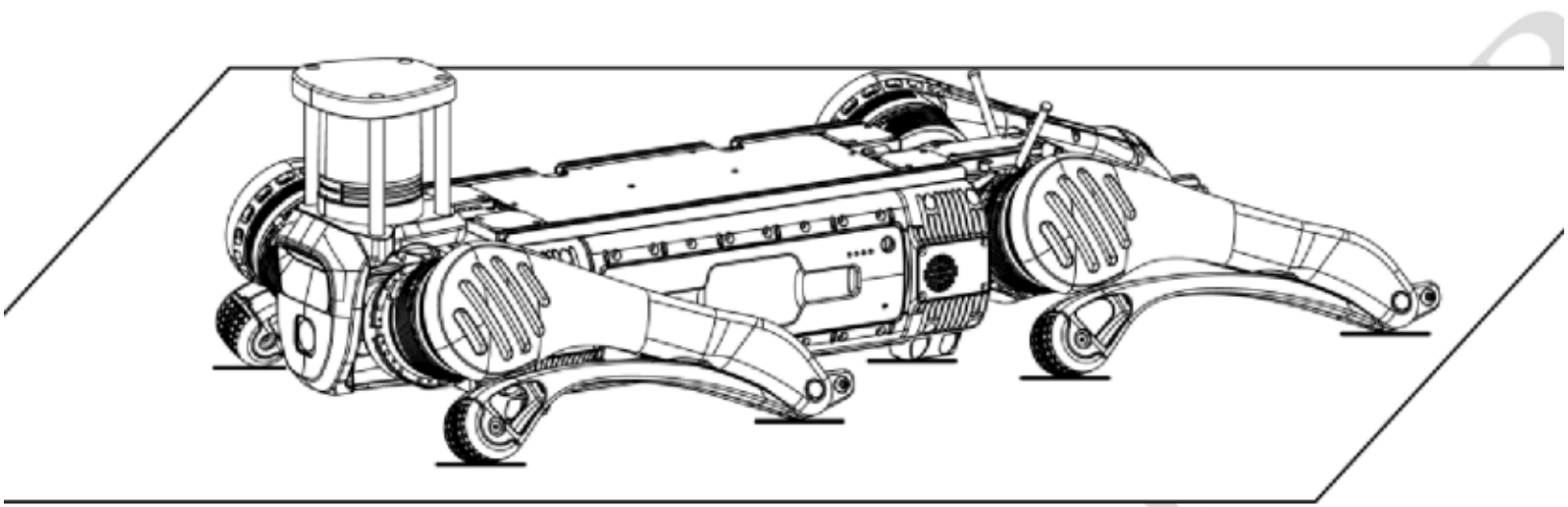
Installing Battery



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Switch On the Robot

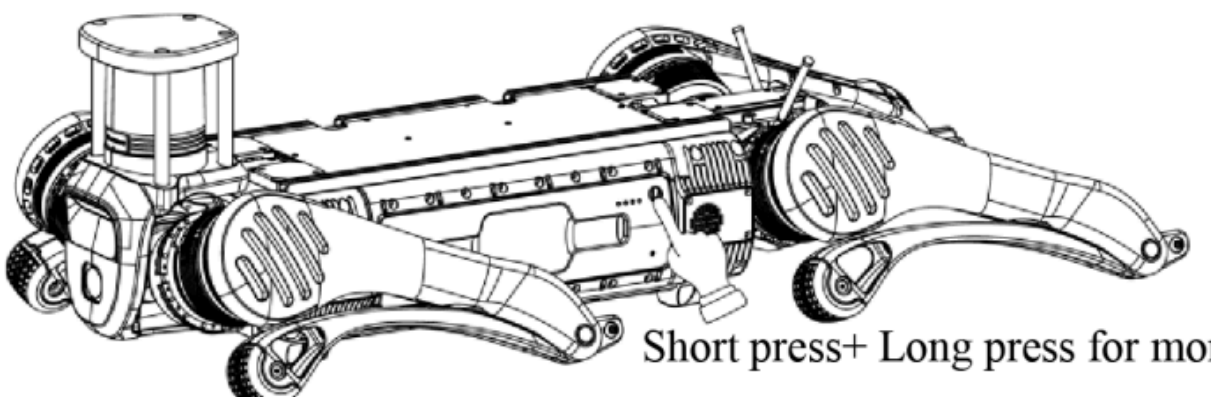
Body Placement



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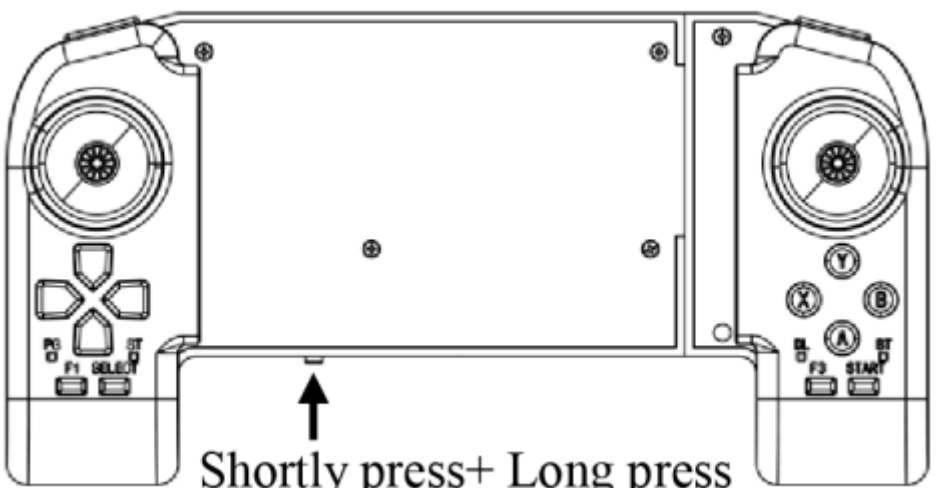
Switch On the Robot

Start up B2



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Switch On/ Off the RC



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RC Operations

Functions	Description
Damping Mode	All power to the motors of the robot are suspended, can be used as a soft e-stop
Locked Standing	The robot dog stands with leg joints locked. Robot does not respond to joystick commands.
Walking Mode	The robot leg joints are unlocked, allowing the robot to execute motion commands
Continuous Walking Mode	The robot is always in a stepping state and responds to motion commands.
Running Mode	The robot moves at a higher speed, 3.5m/s
Continuous Running Mode	The robot is always in a running state and responds to motion commands.
Stair Climbing Mode	The robot is able to climb stairs, no perception

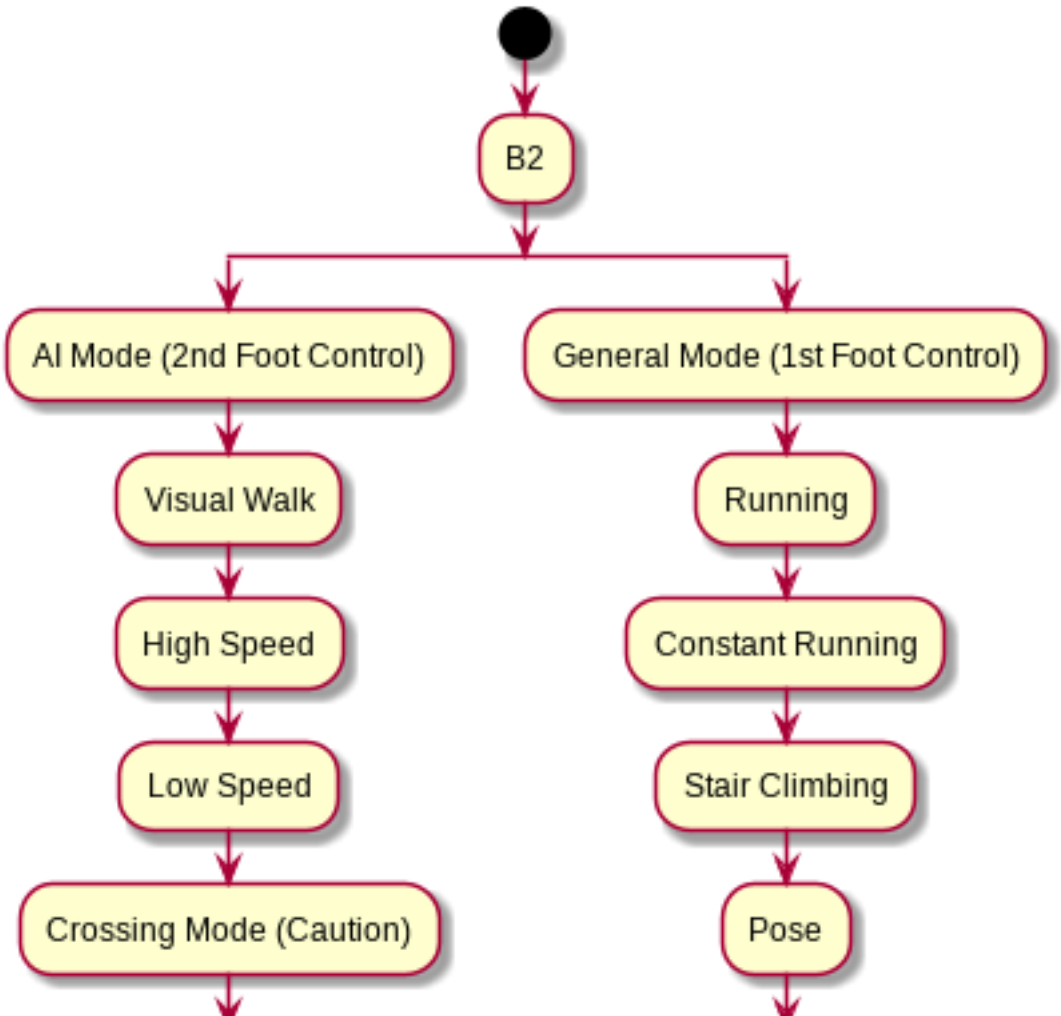
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RC Operations

Functions	Description
Visual Mode	The robot uses perception to perform visual walking, such as climbing stairs and walking on gravel roads.
Endurance Mode	Adjusts the robot motor joints' power draw appropriately to reduce power consumption
Pose	The robot is able to move its body in the z-axis, roll, pitch and yaw.

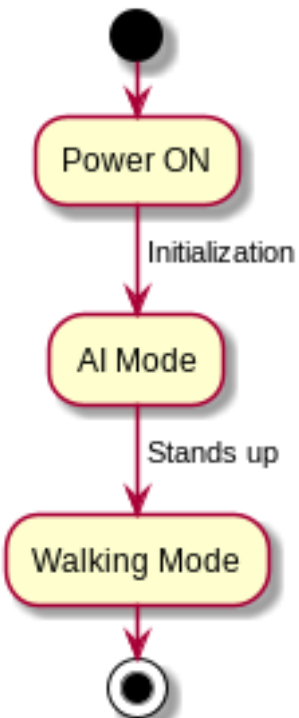
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RC Operations



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RC Operations



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RC Operations

Common Functions

Button	Action
Start	Unlocks Joints, transitions to **Walking Mode**
Start x2	Transitions to **Continuous Walking Mode**
Select	Transitions to **Locked Standing Mode**
L2 + A	Transitions to **Lock Standing** ⟷ **Prone position**
L2 + B	Transitions to **Damp Mode**
L2 + X	Recovery stand from fall
Hold (L1 + L2 + R1 + R2) + X	Switch to **General Mode**
Hold (L1 + L2 + R1 + R2) + B	Switch to **AI Mode**

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RC Operations

AI Mode Functions

Button	Action
X	Transitions to **Visual Walking**
L2 x2	Low Speed
L1 x2	High Speed

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RC Operations

General Mode Functions

Button	Action
L2 + Start	Transitions to **Running Mode**
L2 + (Start x2)	Transitions to **Continuous Running Mode**
+ Start	Transitions to **Stair Climbing**

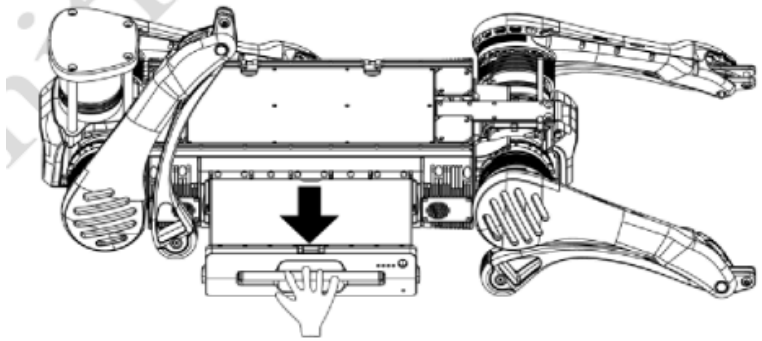
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Switch Off the Robot

- Set the Robot to prone position (L2 + A)
- Short press followed by long press till the robot switches off

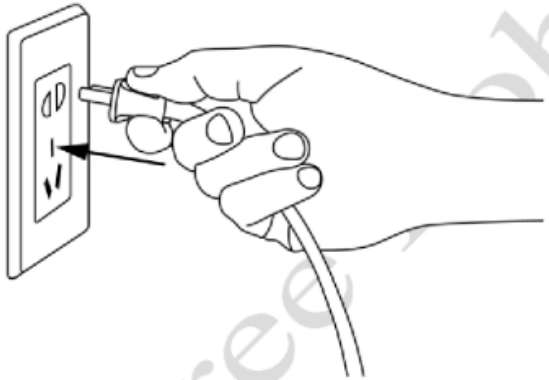
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Charging the Robot



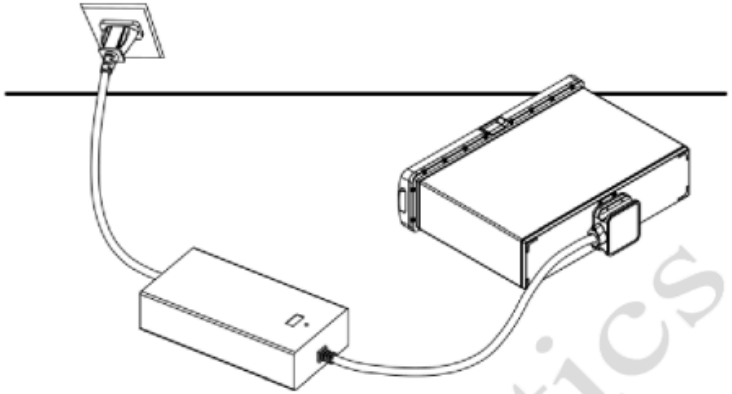
1) Remove the battery from the B2 body

(Pull out the battery pack strap)

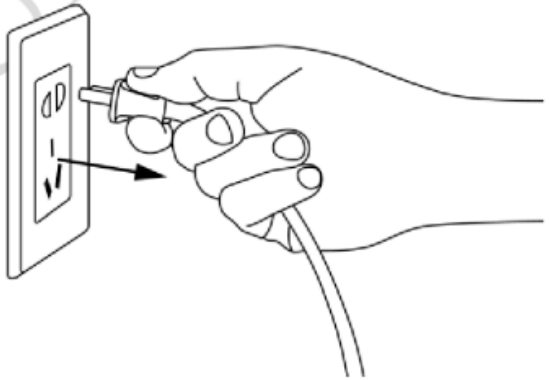


2) Charger input AC power

(100-240V, 50/60Hz)



3) Connect the B2 battery



4) Manually disconnect the power when fully charged

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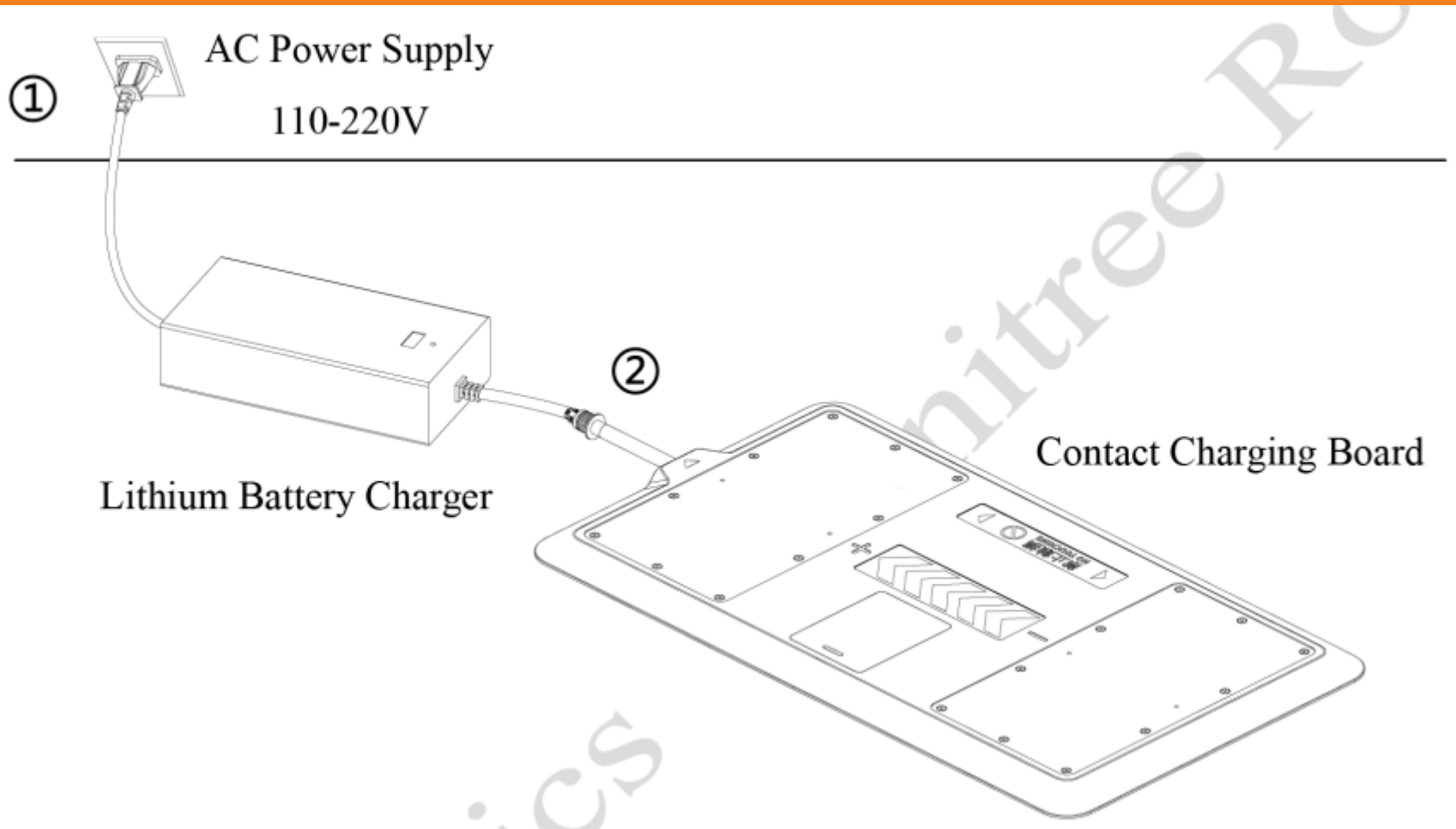
Charging the Robot (Contact Charger)

Pre-charging Inspection

- Ensure charging electrodes on the bottom of B2 body is clean and unobstructed.
- Ensure charging electrode surface is clean, use a dry towel to wipe if needed.
- Setup charging board as shown in the picture on the next slide.

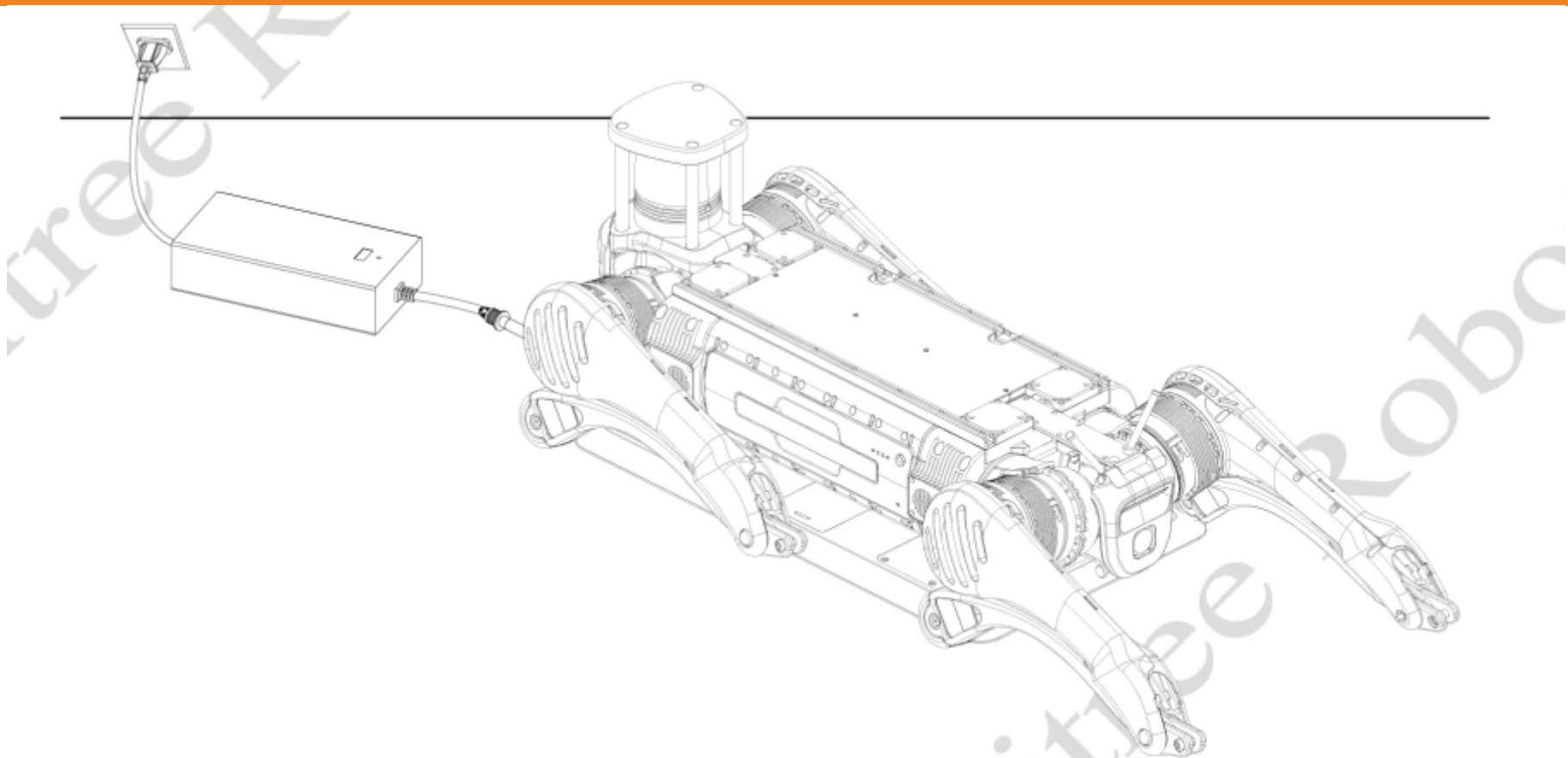
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Charging the Robot (Contact Charger)



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Charging the Robot (Contact Charger)



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Hands-on time

Mobile App

- The app can be downloaded from Unitree Explore



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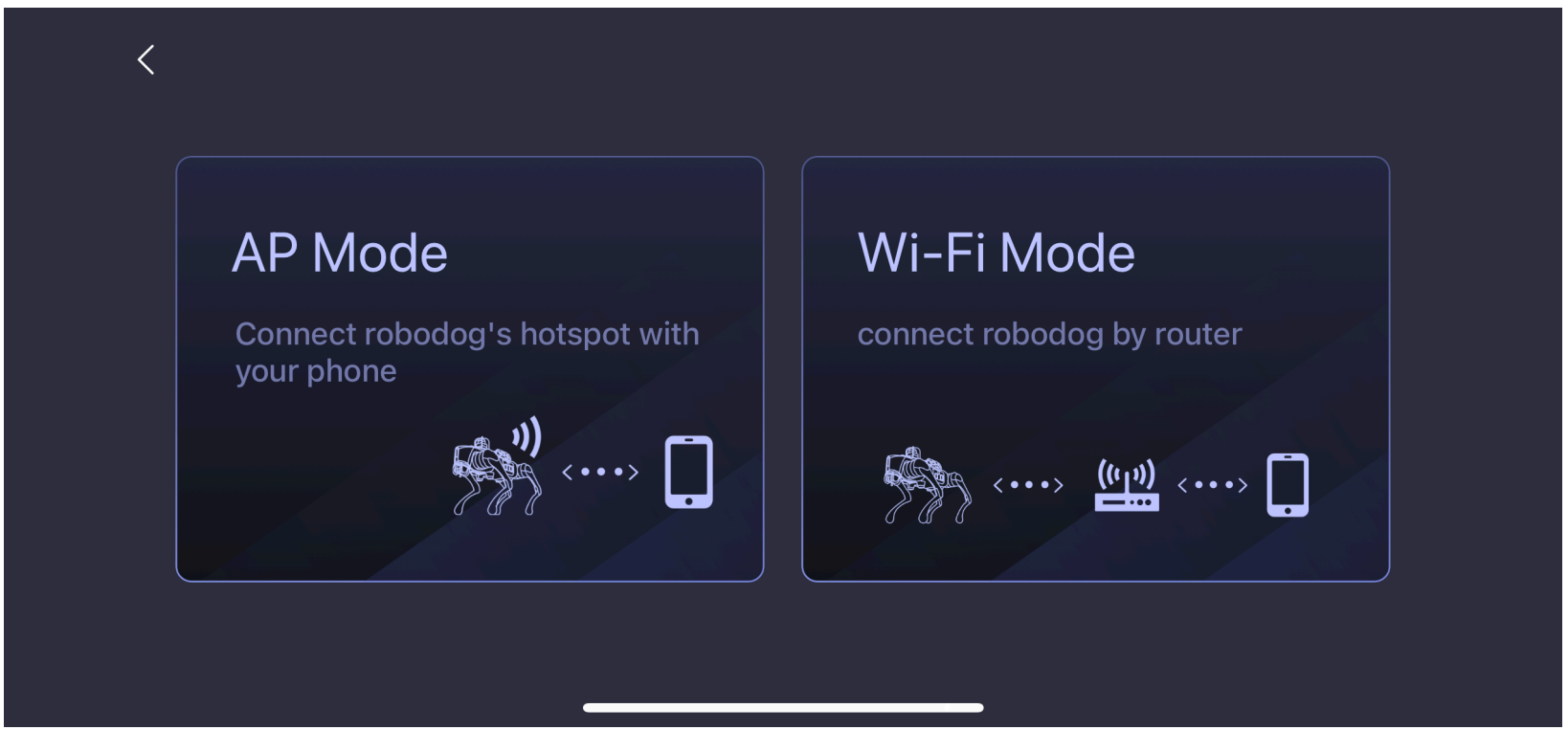
Basic App Usage

1. Login to the App with the credentials provided.
2. Add Robot
   - Turn on device Bluetooth
   - Click on **add robot** to select your B2 based on its unique ID.

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Basic App Usage

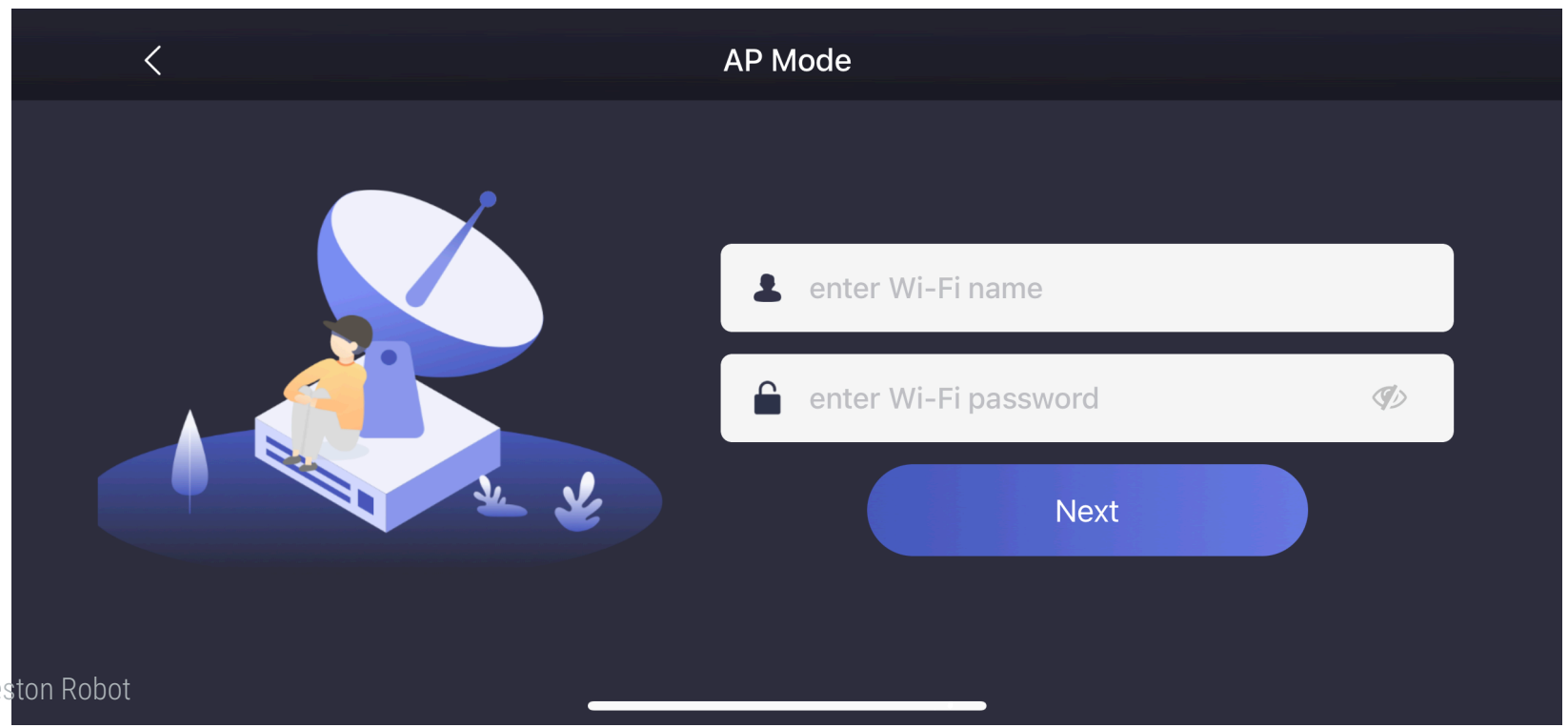
3. Connecting to Robot
   - B2 needs to establish a connection with the app (AP or WiFi mode)



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Basic App Usage

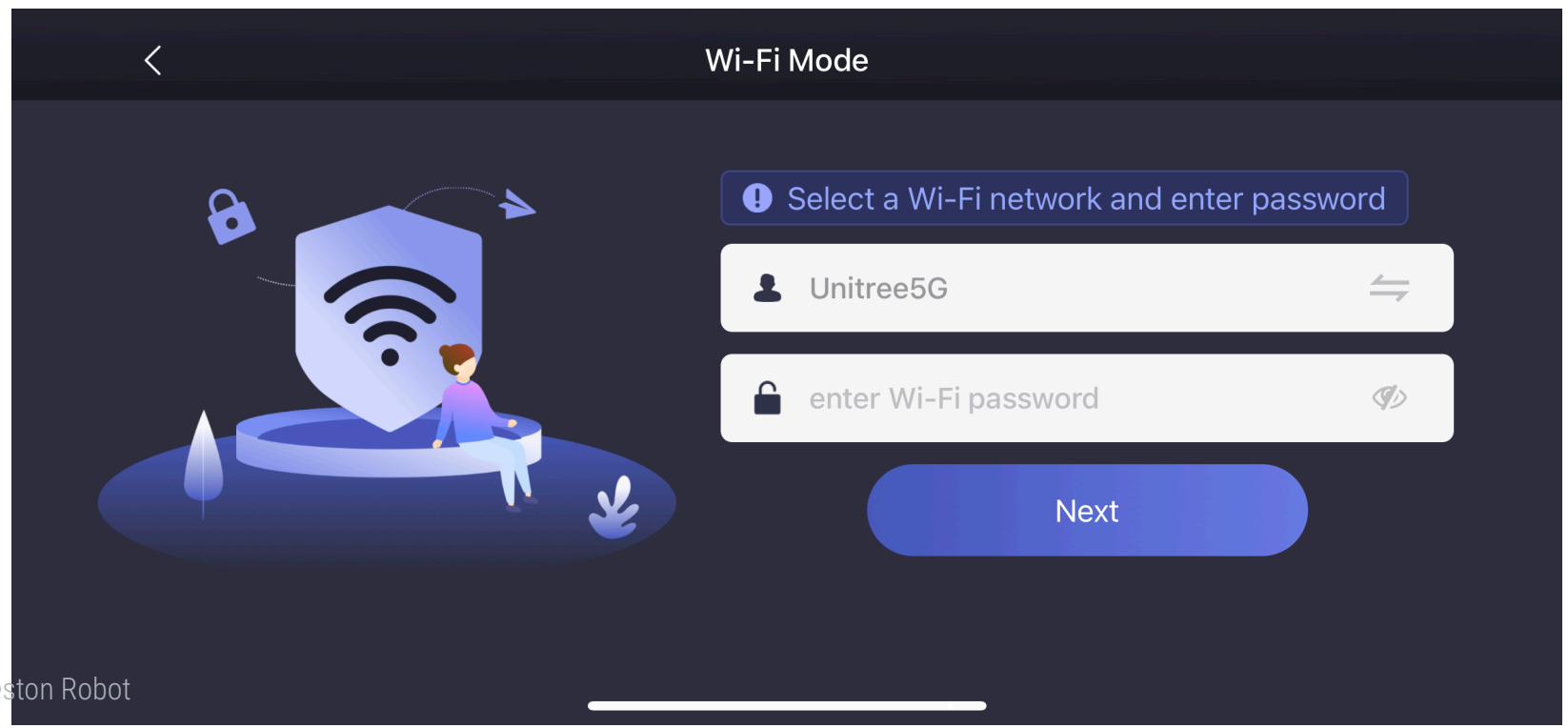
- AP mode
  - B2 provides a hotspot connection for the user's device to connect to
  - Follow the prompts to set the hotspot name (B2-XXXXXX) and 8-digit password



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Basic App Usage

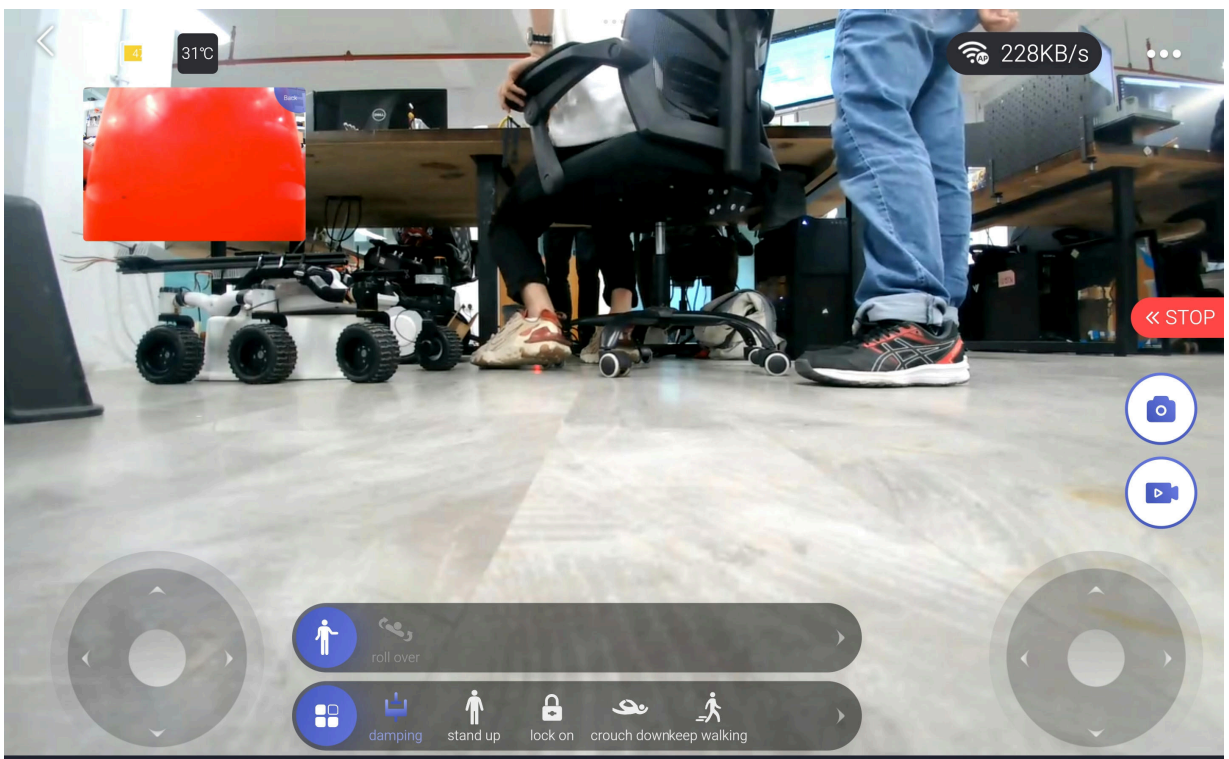
- WiFi mode
  - B2 and user's device connects to a common WiFi network
  - Select an existing WiFi network and enter the password



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Basic App Usage

4. Control
   - The app provides an UI for robot control and viewing of camera streams



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Maintenance

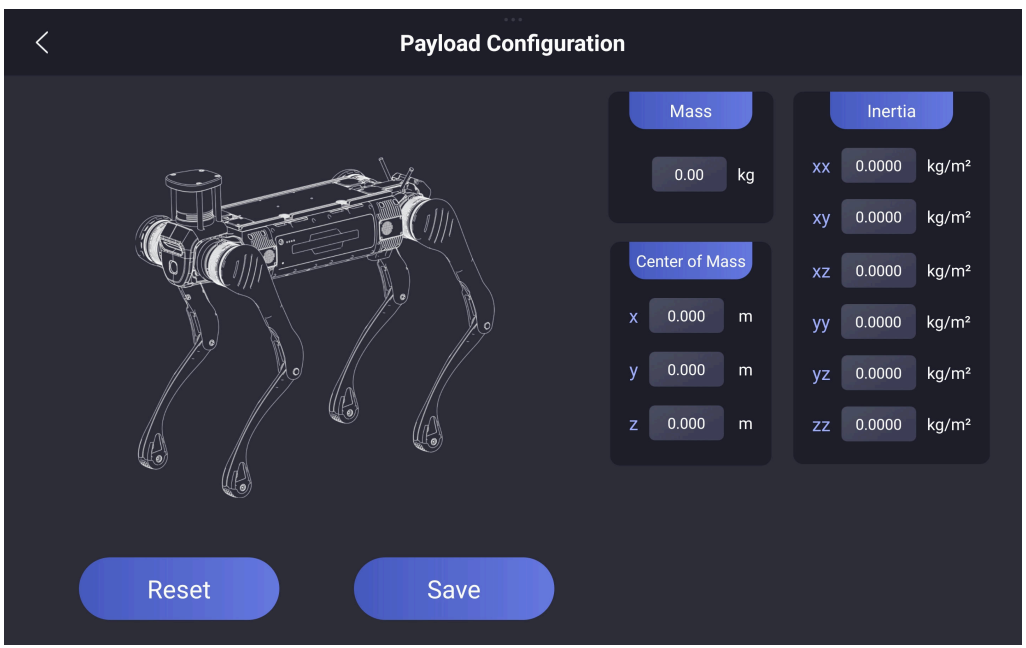
IMU & Legs Calibration

- The calibration of IMU and legs are done via the app.
- The option to calibrate can be found under Device ⟶ Data ⟶ Calibration
- Follow the prompts and images to calibrate the B2.
- **Do not calibrate the B2 unnecessarily. Only do so when there are visible drifts and imbalances in robot movement**

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Payload Configuration

- The payload configuration accounts for the weight added to the robot for movement and balancing.
- The configuration can be found under Device ⟶ Data ⟶ Payload Configuration



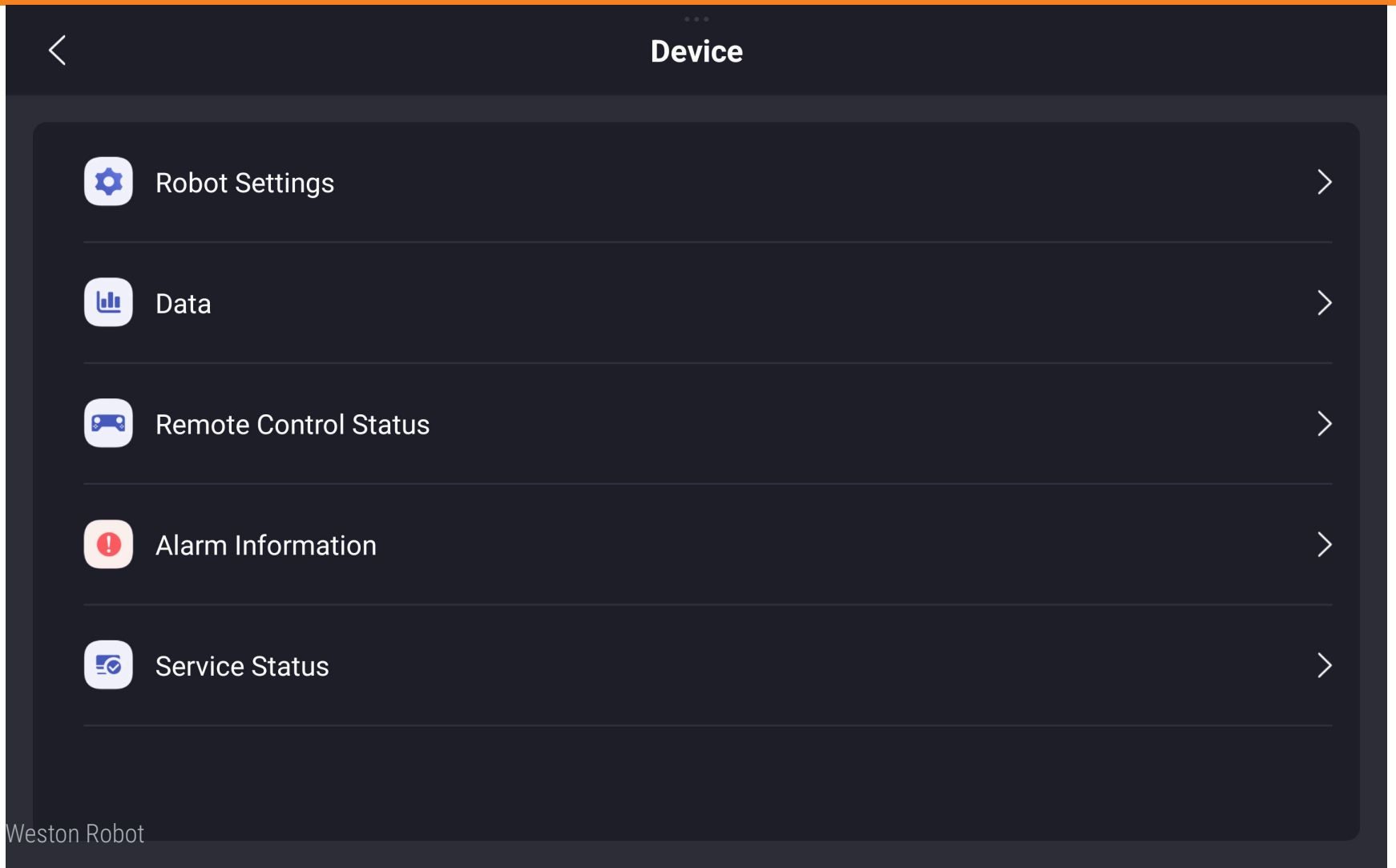
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Troubleshooting

- The app provides system alerts pertaining to the robot under **Alarm Information**
- Information regarding the motor can be found under **Data**
- Preliminary inspection of the robot's system can be done via **Automatic Machine Inspection**

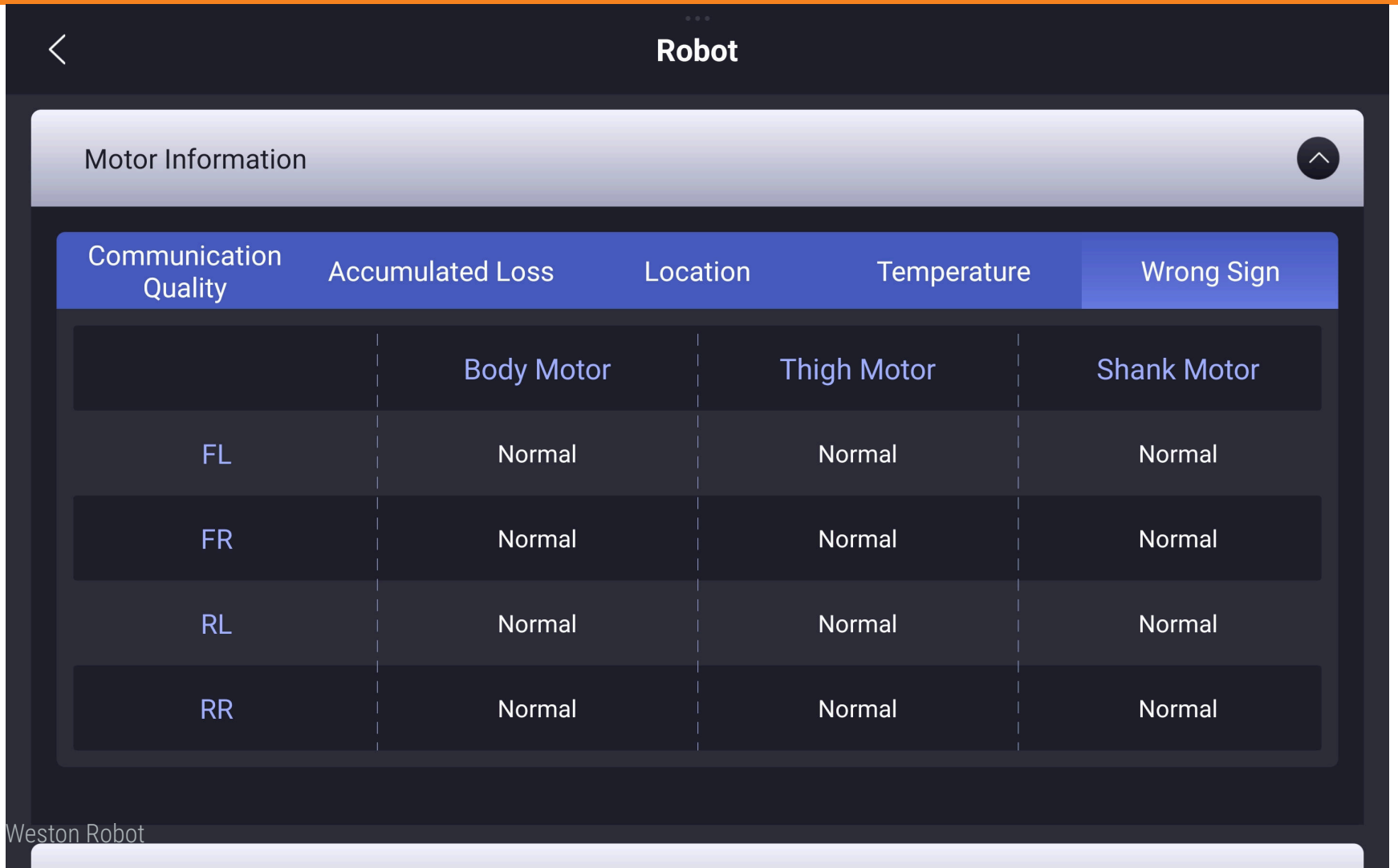
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Troubleshooting



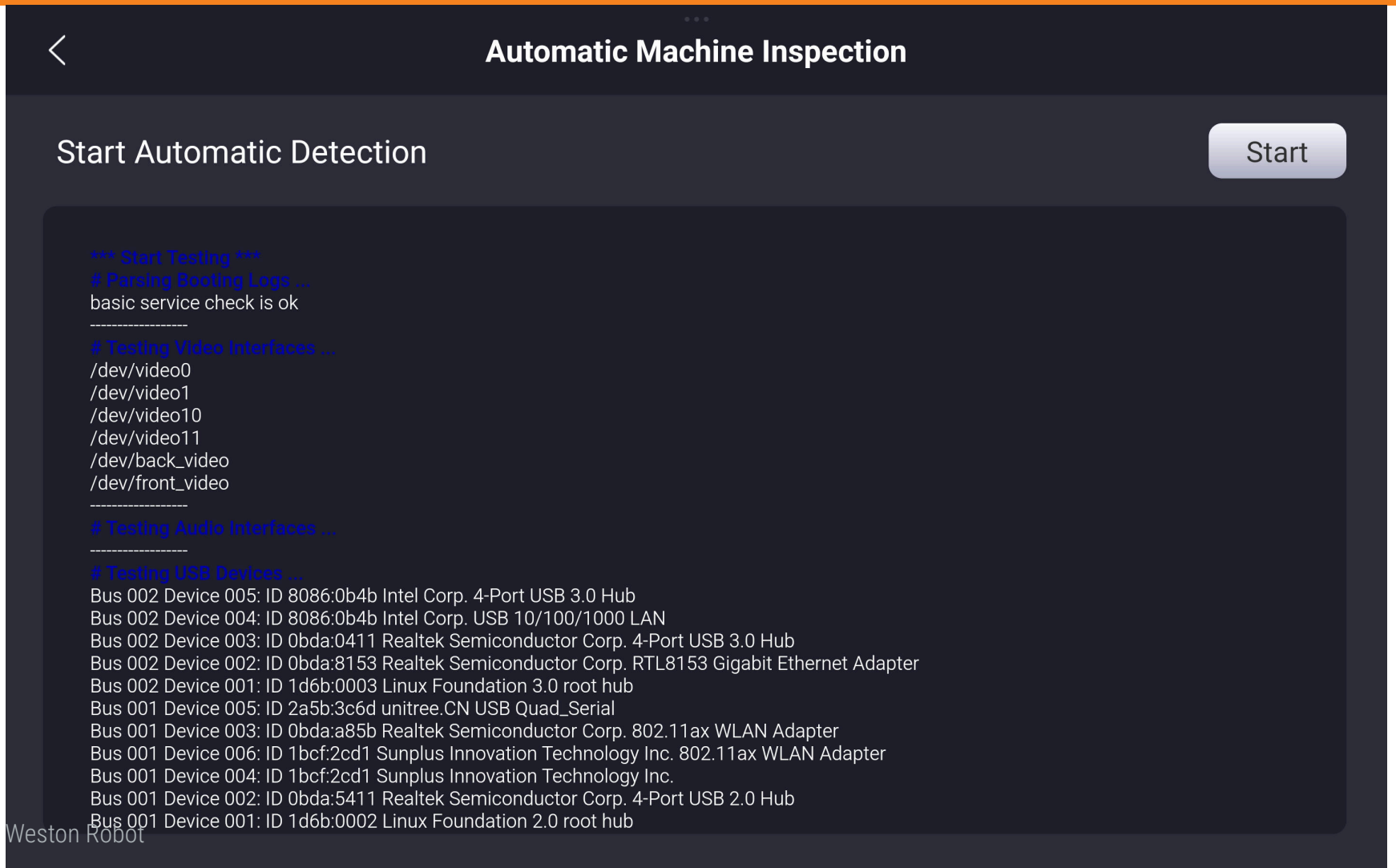
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Troubleshooting



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Troubleshooting



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The End