



2-Day Training on Unitree G1

Robot Operations

Weston Robot

2025.08

Contents

1. Main Components
2. Basic Operations (**Remove waist lock before using 3 DoF commands**)
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.

Main Components

What's Inside the Box



G1



Remote Controller



Battery



Charger

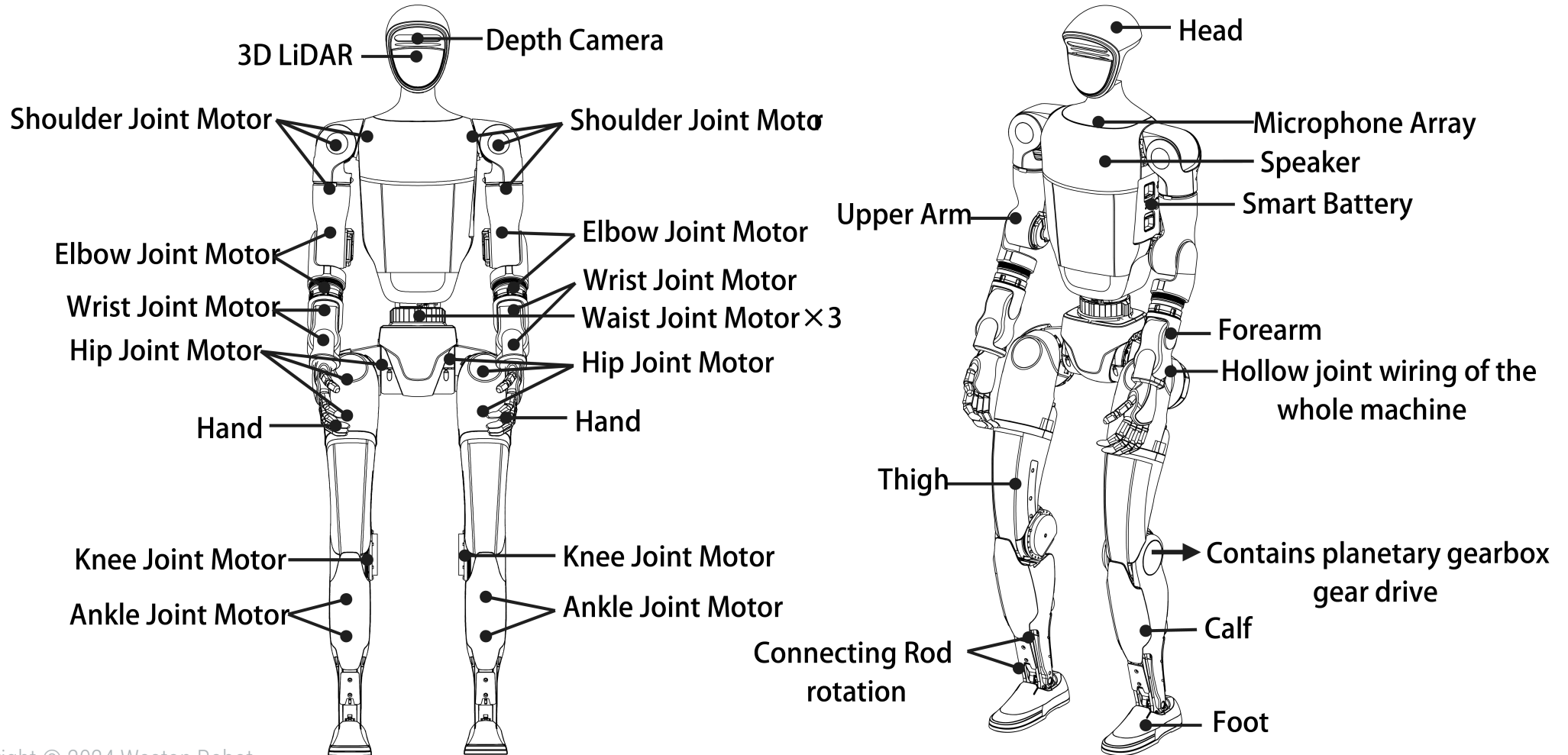


Rack Handle

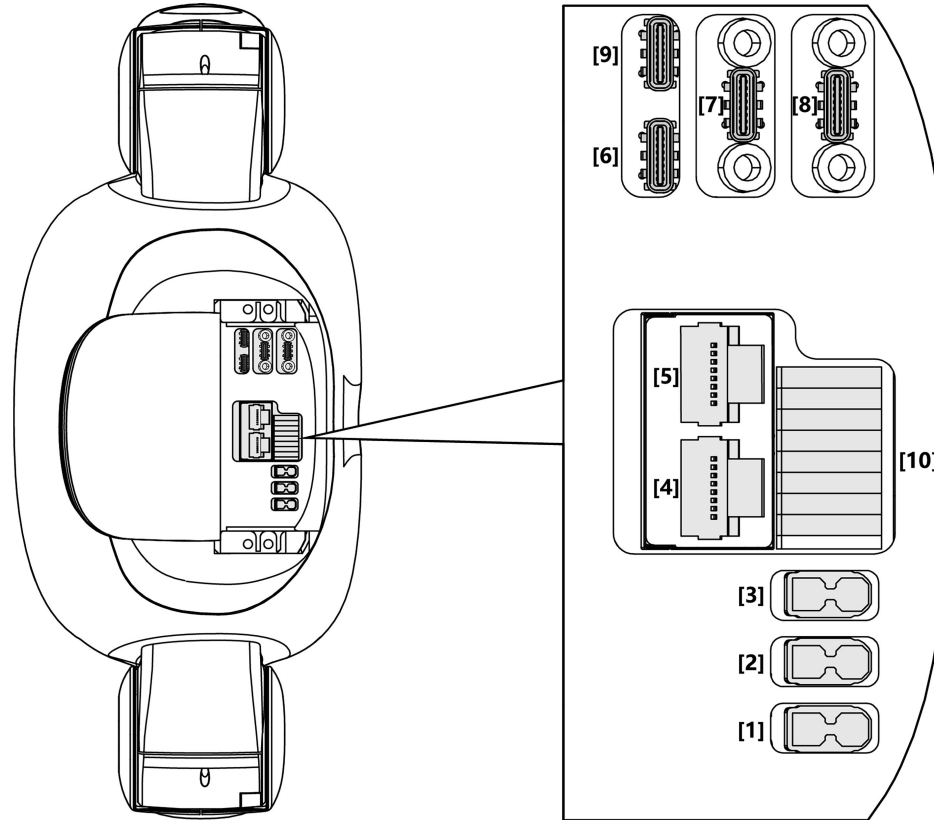
Compatible Accessories

- Dex3-1 hand (3-finger)
- Inspire DFX hand (5-finger)





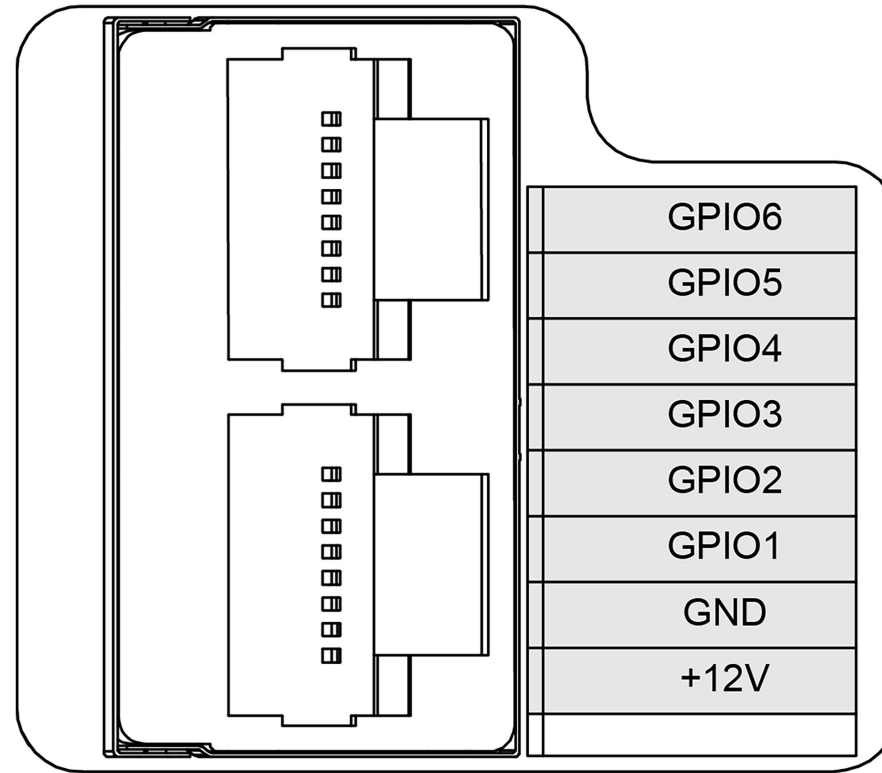
Electrical Interface



Electrical Interface

Number	Connector	Description
1	XT30	58V/5A Battery power output (directly connected to battery output)
2	XT30	24V/5A power output
3	XT30	12V/5A power output
4	RJ45	Ethernet
5	RJ45	Ethernet
6	Type-C	USB3.0, 5V/1.5A power output
7	Type-C	USB3.0, 5V/1.5A power output
8	Type-C	USB3.0, 5V/1.5A power output
9	Type-C	USB3.0, 5V/1.5A power output
10	5577	12V/3A power output & IO pins

Electrical Interface

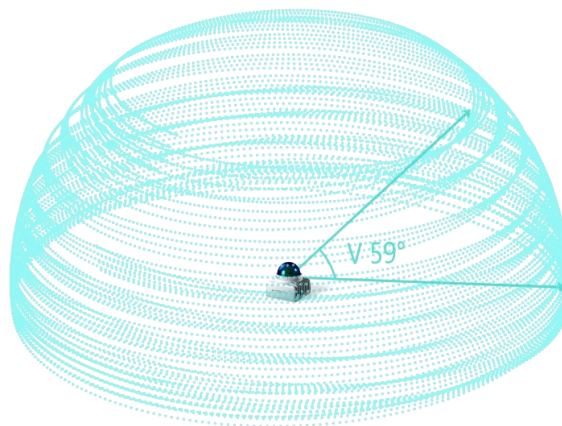


Electrical Interface

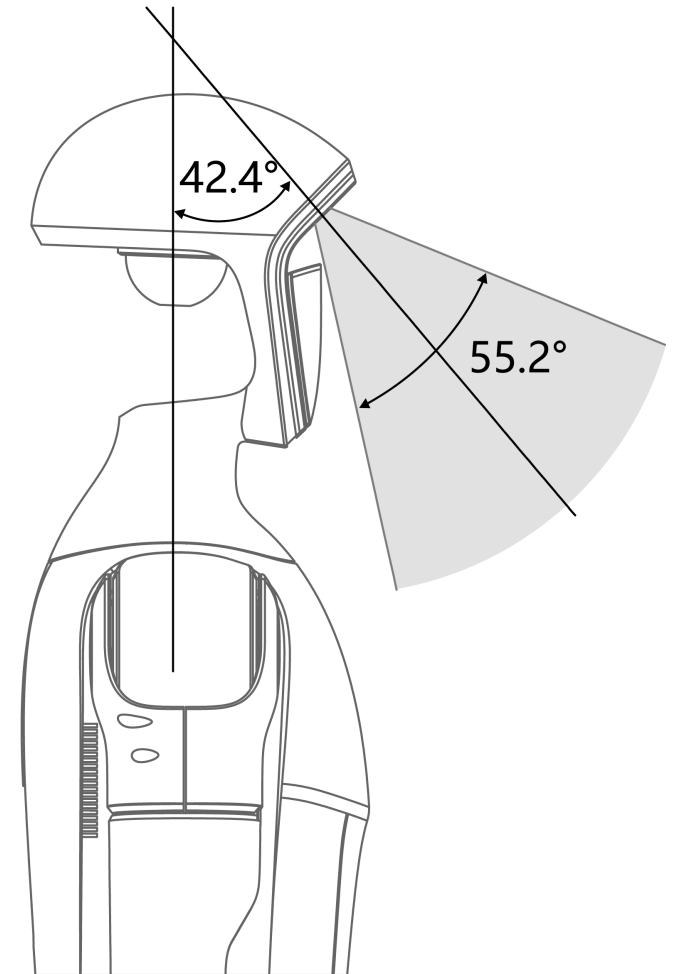
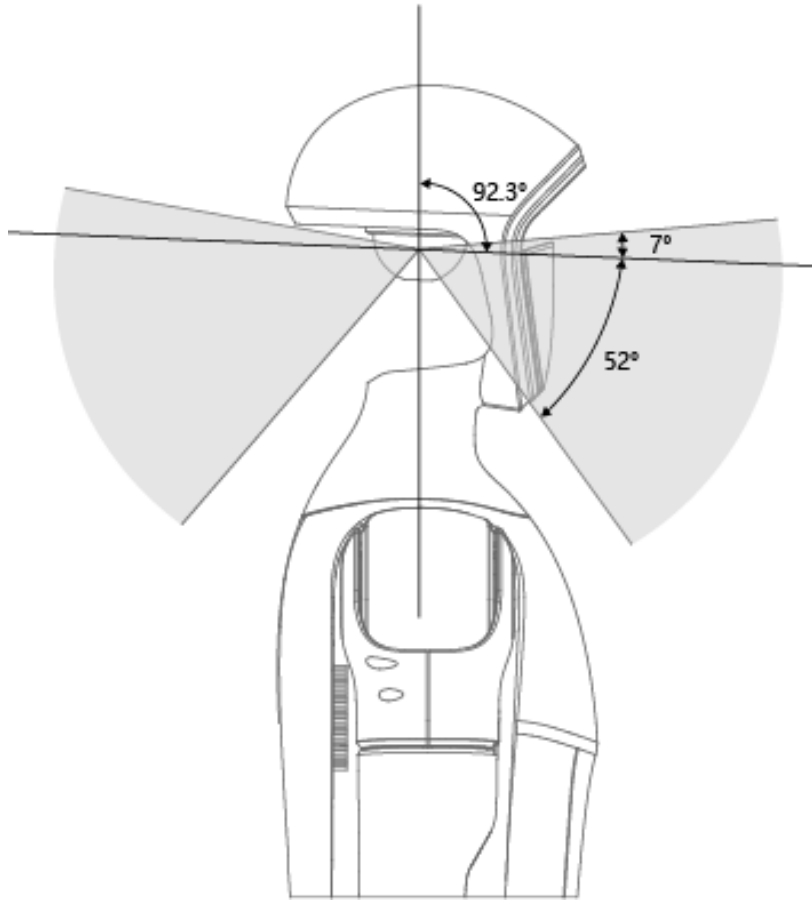
I/O Number	NX Pin Number	Description
GPI01	203	UART1_TX
GPI02	205	UART1_RX
GPI03	232	I2C2_SCL
GPI04	234	I2C2_SDA
GPI05	128	GPIO
GPI06	130	GPIO

Sensors

- Livox MID-360 lidar
 - ▶ Horizontal FOV: 360°
 - ▶ Vertical FOV: 59°
- Intel Realsense D435i
 - ▶ Depth:
 - FOV: $87^\circ \times 55^\circ$
 - Resolution: Up to 1280×720
 - ▶ RGB:
 - FOV: $69^\circ \times 42^\circ$
 - Resolution: Up to 1920×1080 (2MP)



Sensor FoV



Remote Controller (RC) Specifications

- Charging Voltage: 5.0V
- Charging Current: 700mA
- Frequency: 2.4GHz
- Lithium Battery Capacity: 780mAh
- Communication: Data transmission module, Bluetooth
- Running Time: 5h
- RC Distance: 100m with direct line of sight



Remote Controller (RC) Specifications



Battery

- Battery Capacity: 9000mAh
- Standard Voltage: 46.8V
- Charging Voltage: 54.6V
- Charging Current: 5.5A
- Operating Time: 2h
- Charging Time: 1h 40m



Battery Function

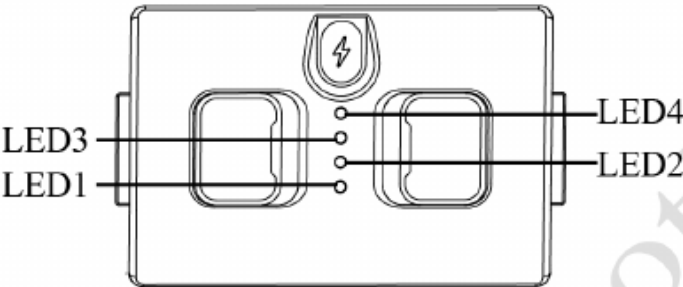
- **Balance charging protection:** Automatically balances the voltage of the internal cells.
- **Overcharge protection:** Stops charging when battery is fully charged.
- **Charging electric current protection:** When charging current is more than **10A**, battery will stop charging.
- **Over-discharge 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.

Battery LED Indicator

Power on discharge LED status				
LED1	LED2	LED3	LED4	Current Battery
				88%~100%
				76%~88%
				64%~76%
				52%~64%
				40%~52%
				28%~40%
				16%~28%
				4%~16%
				0%~4%

Battery Fault LED Indicator

Protection Indicator Light					
LED1	LED2	LED3	LED4	Indication	Proction Item
				2.5Hz flashing	Excessively Hight/Low Temperature
				2.5Hz flashing	Excessively High/Low Voltage
				2.5Hz flashing	Over Current/Short Circuit
				2.5Hz flashing	Need to use the upper computer to view detailed faults/errors
				5Hz flashing	Firmware Update Mode



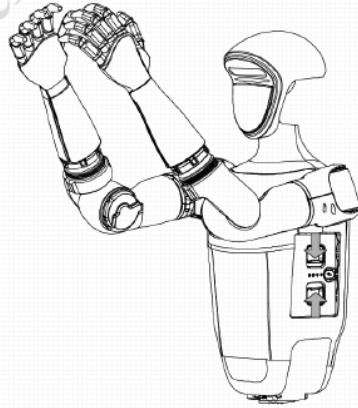
Charger

- Input: 100-240V ~ 50/60Hz 4A
- Output: 54.6V $\approx$ 5.5A
- Charging Time: 1h 40m

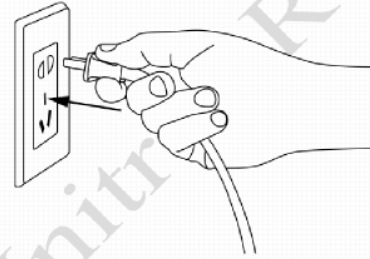


Charging the Battery

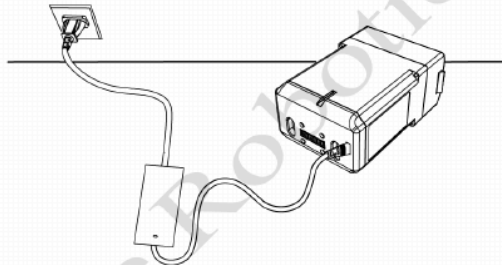
Charge the battery



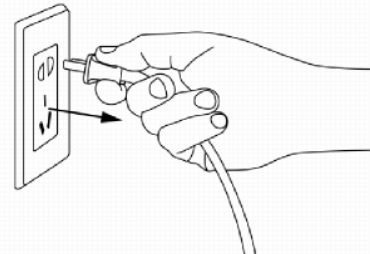
- 1) Remove the battery from the G1 body
(Pull out the battery pack strap)



- 2) Charger input AC power
(100-240V, 50/60Hz)



- 3) Connect the G1 battery

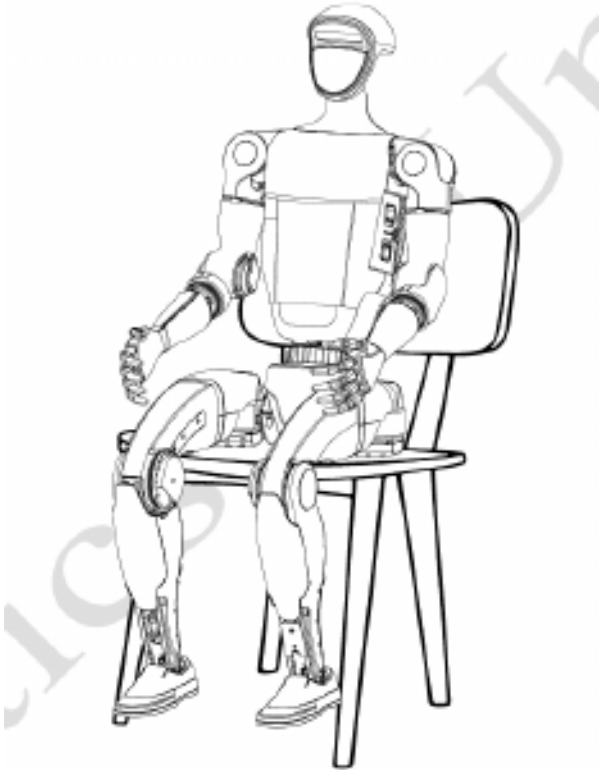


- 4) Manually disconnect the power when fully charged

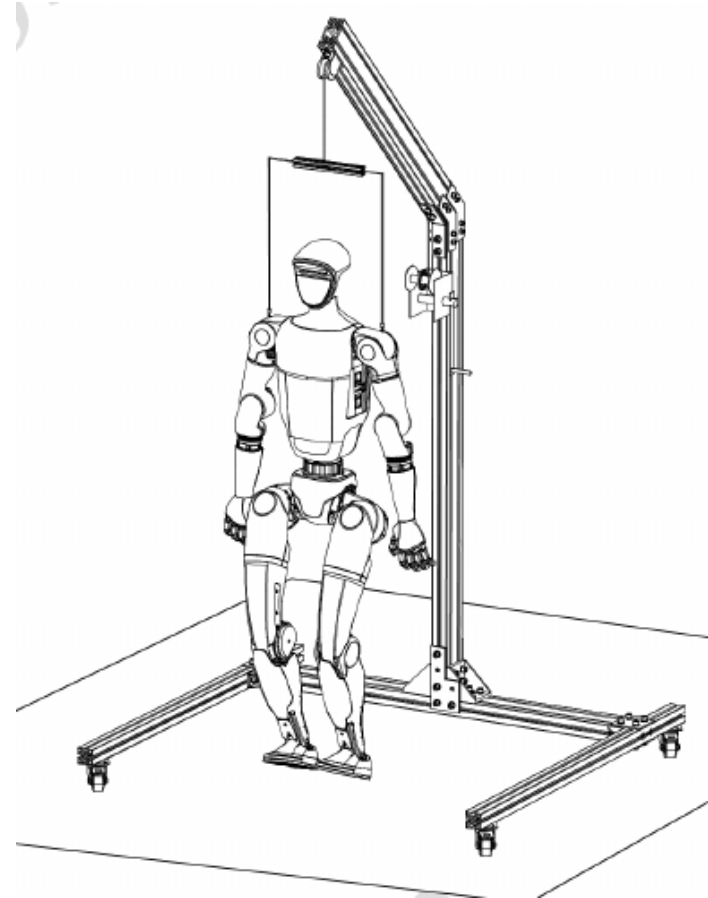
Basic Operations (Remove waist
lock before using 3 DoF commands)

Switch On the Robot

Sitting upright

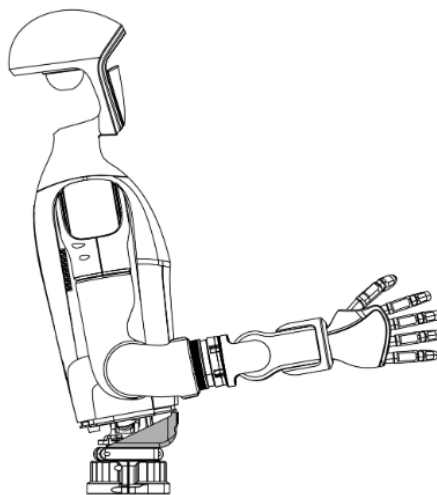
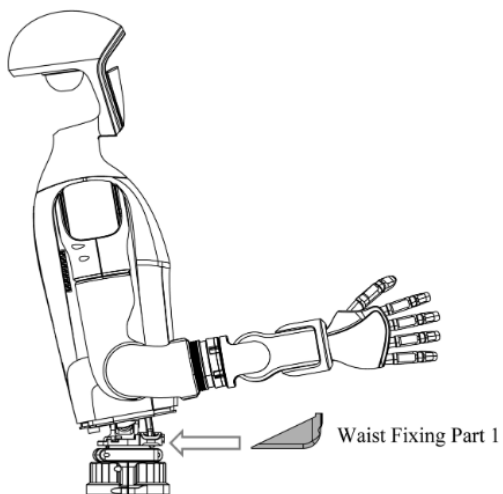


Suspended

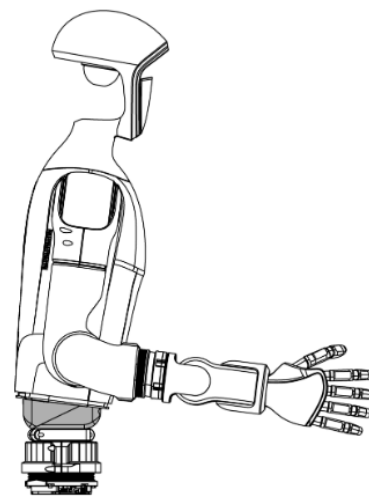
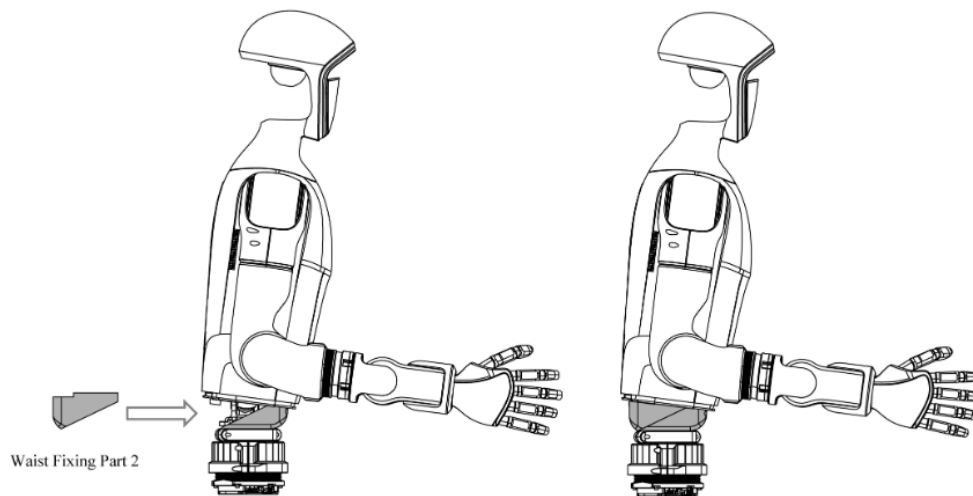


Waist Fastener

Waist Fastener Part 1

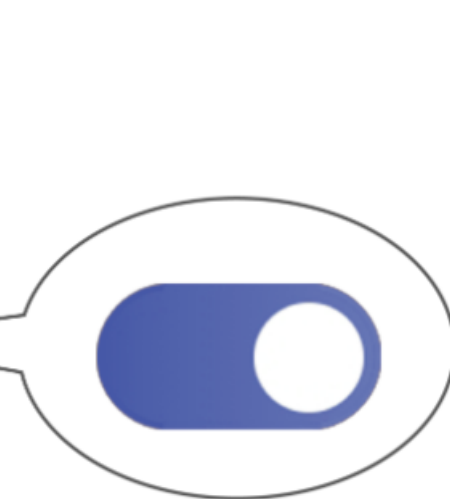
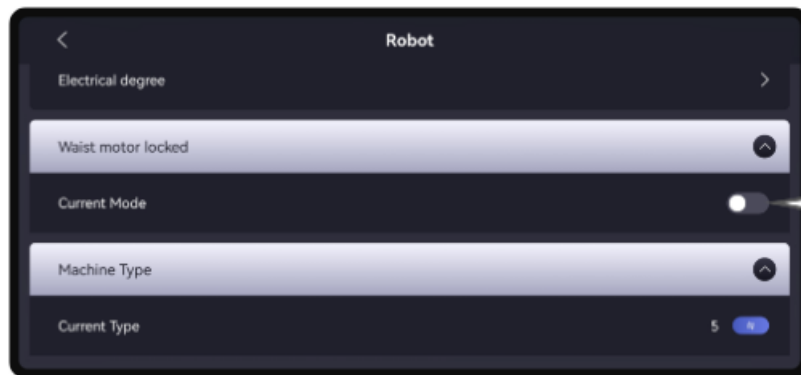


Waist Fastener Part 2



Waist Configuration in APP

Waist Configuration



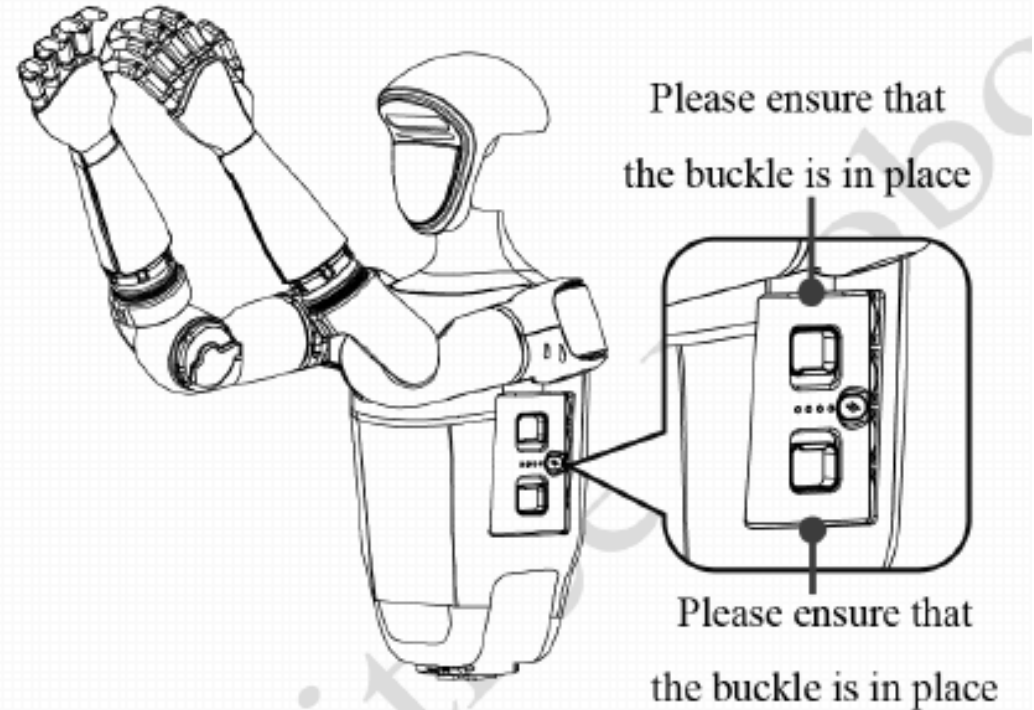
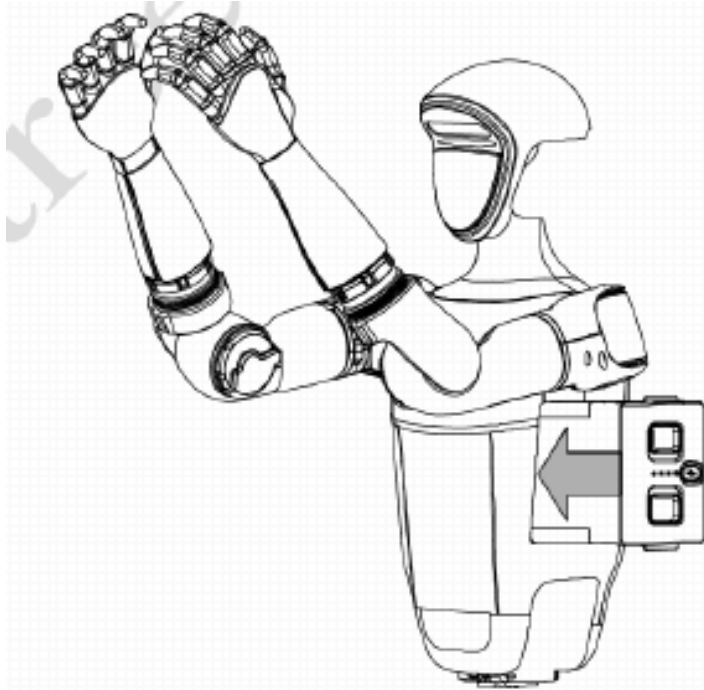
Switching On/Off the RC

- To Switch On/Off: Short press followed by a long press.



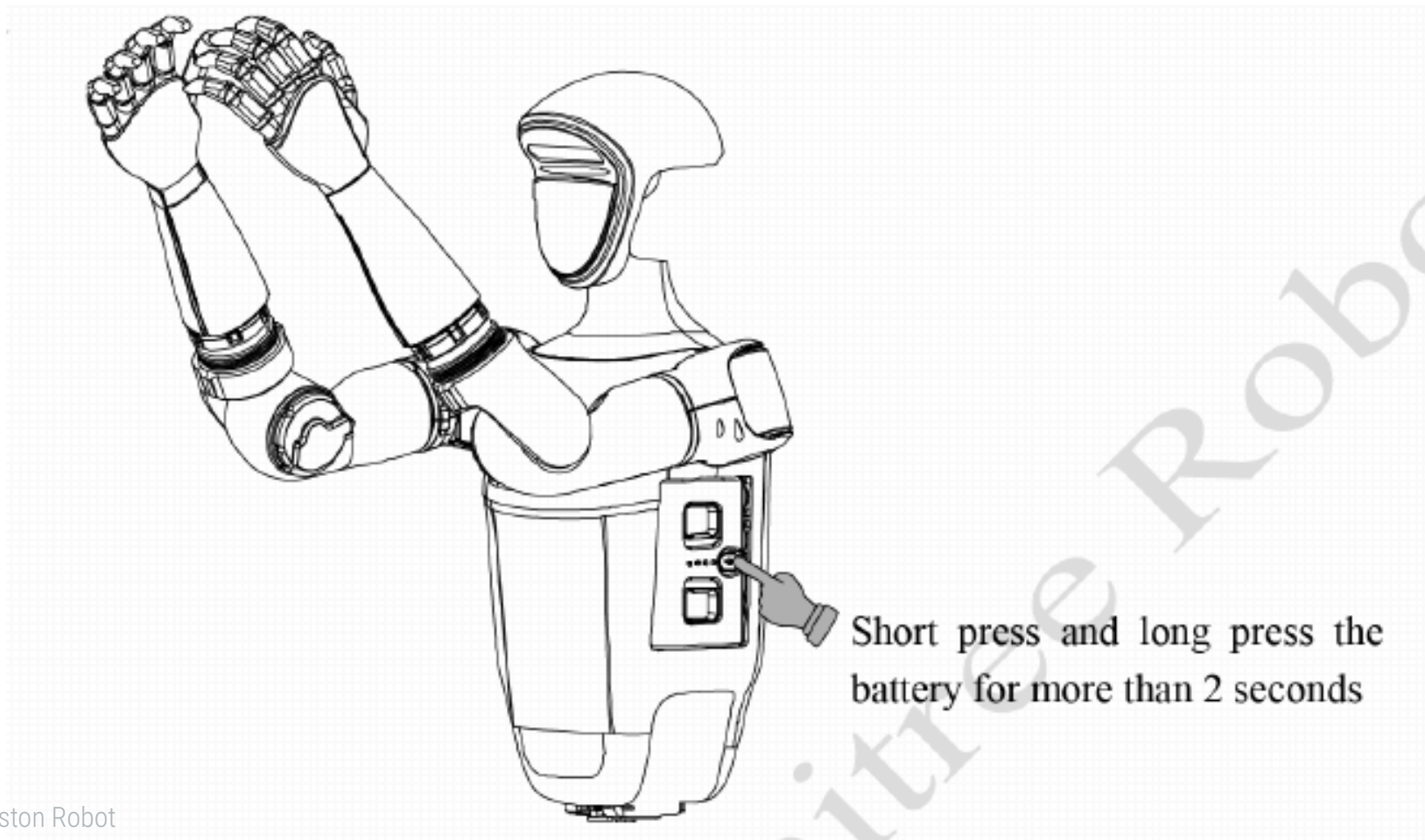
Switch On the Robot (Sitting)

Installing Battery



Switch On the Robot (Sitting)

Start up



Switch On the Robot (Sitting)

Boot up sequence (*Motion Control Version < 8.2.0.0*)

- Wait for about 1 minute until the blinking LED on G1's face turns solid and G1 enters zero torque mode (Joints have no resistance).
- Press **L1 + A** to enter damping state (Joints have resistance).
- Press **L1 + UP button** and assist the G1 into standing position (Joints are locked in this state and robot may have difficulty balancing).
- Press **R1 + X** (1 DoF waist) or **R1 + Y** (3 DoF Waist) to enter walking mode.

Switch Off the Robot (Sitting)

Boot down sequence (*Motion Control Version < 8.2.0.0*)

- Place the chair behind the G1.
- Press **L1 + LEFT button** and assist the robot to sit on the chair.
- Press **L1 + A** to enter damping state.
- Switch off the G1.

Switch On the Robot (Sitting)

Boot up sequence (***Motion Control Version $\geq$ 8.2.0.0***)

- Wait for about 1 minute until the blinking LED on G1's face turns solid and G1 enters zero torque mode (Joints have no resistance).
- Press **L2 + B** to enter damping state (Joints have resistance).
- Press **L2 + UP button** and assist the G1 into standing position (Joints are locked in this state and robot may have difficulty balancing).
- Regular (Walking) Mode: Press **R1 + X** (1 DoF waist) or **R1 + Y** (3 DoF Waist).
- Running Mode: Press **R2 + A**.

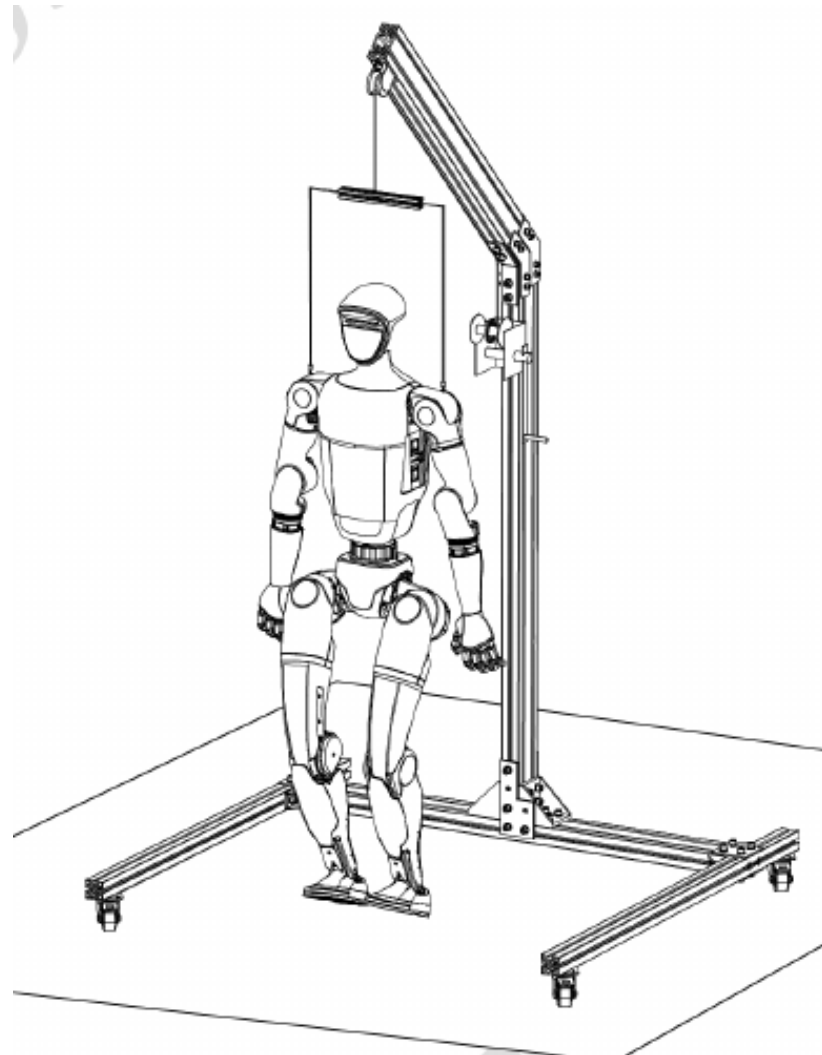
Switch Off the Robot (Sitting)

Boot down sequence (*Motion Control Version $\geq$ 8.2.0.0*)

- Place the chair behind the G1.
- Press **L2 + LEFT button** and assist the robot to sit on the chair.
- Press **L2 + B** to enter damping state.
- Switch off the G1.

Switch On the Robot (Suspended)

- Gradually raise the G1 and ensure the robot's completely suspended and its feet are off the ground.



Switch On the Robot (Suspended)

Boot up sequence (*Motion Control Version < 8.2.0.0*)

- Wait for about 1 minute until the blinking LED on G1's face turns solid and G1 enters zero torque mode (Joints have no resistance).
- Press **L1 + A** to enter damping state (Joints have resistance).
- Press **L1 + UP button** and wait for the G1 to enter standing position (Joints are locked in this state).
- **Lower the G1 till the feet touches the ground.**
- Press **R1 + X** (1 DoF waist) or **R1 + Y** (3 DoF Waist) to enter walking mode.

Switch Off the Robot (Suspended)

Boot down sequence (*Motion Control Version < 8.2.0.0*)

- Move the robot back to the rack and secure it (The feet is still in contact with the ground and rack handle strap is taut).
- Press **L1 + A** to enter damping state.
- Gradually raise the G1 and ensure the robot's completely suspended and its feet are off the ground.
- Switch off the G1.

Switch On the Robot (Suspended)

Boot up sequence (*Motion Control Version* $\geq$ 8.2.0.0)

- Wait for about 1 minute until the blinking LED on G1's face turns solid and G1 enters zero torque mode (Joints have no resistance).
- Press **L2 + B** to enter damping state (Joints have resistance).
- Press **L2 + UP button** and wait for the G1 to enter standing position (Joints are locked in this state).
- **Lower the G1 till the feet touches the ground.**
- Regular (Walking) Mode: Press **R1 + X** (1 DoF waist) or **R1 + Y** (3 DoF Waist).
- Running Mode: Press **R2 + A**.

Switch Off the Robot (Suspended)

Boot down sequence (*Motion Control Version $\geq 8.2.0.0$*)

- Move the robot back to the rack and secure it (The feet is still in contact with the ground and rack handle strap is taut).
- Press **L2 + B** to enter damping state.
- Gradually raise the G1 and ensure the robot's completely suspended and its feet are off the ground.
- Switch off the G1.

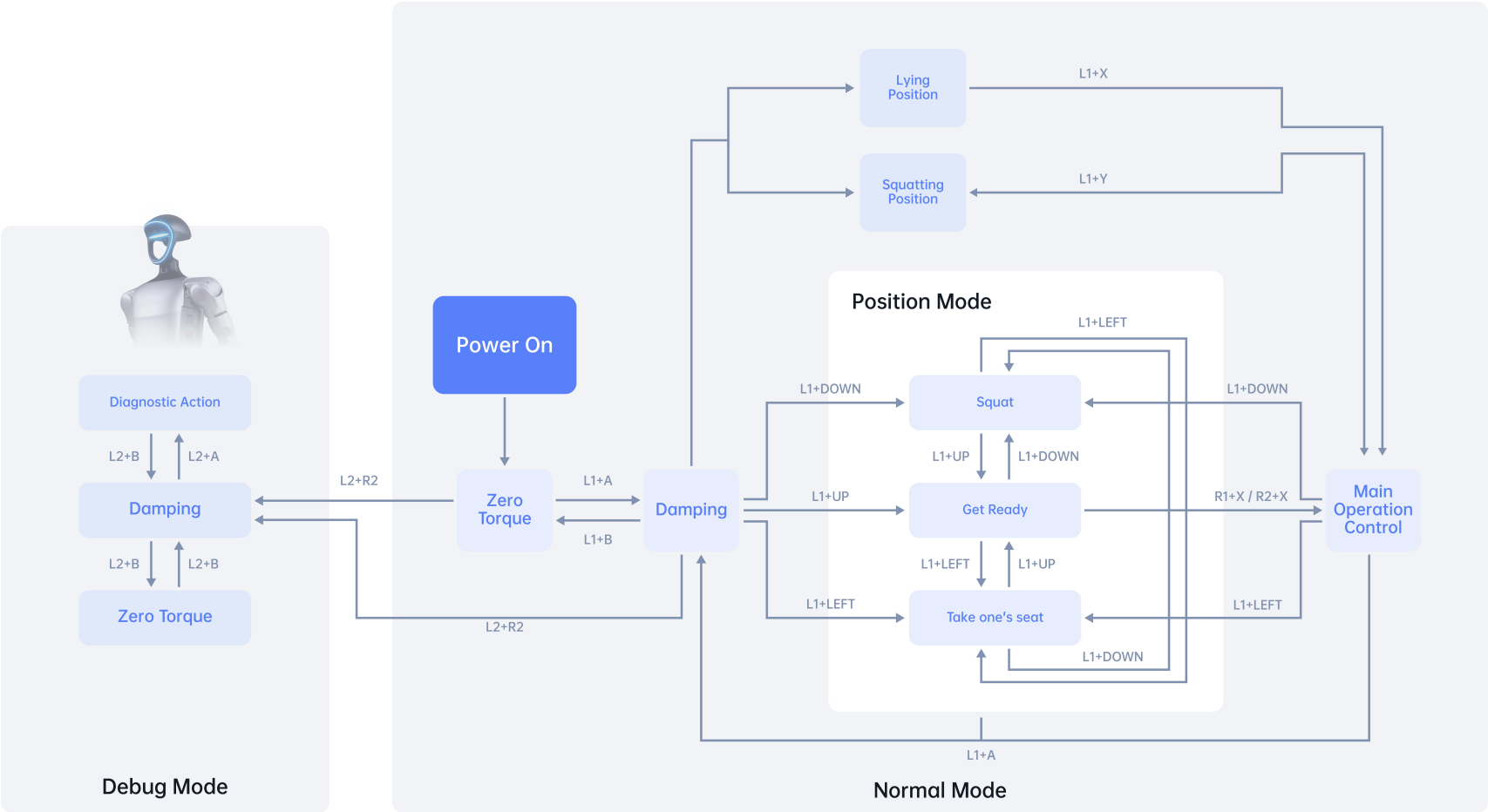
RC Modes Overview

Mode	Description
Zero Torque Mode	All motors stop active motion, no damping when swinging.
Damping Mode	All motors stop active motion, clear damping when swinging, ready for other modes.
Ready Mode	Robot assumes a preparatory posture within 5 seconds.
Squat Mode	Robot enters a squat position within 5 seconds (No balance control).
Seating Mode	Robot assumes a seated position within 5 seconds (No balance control).
Motion Mode	Robot can be controlled to move using the remote control.
Continuous Walking Mode	Robot continuously steps and responds to motion commands.
Standing Mode	Robot stops stepping when joystick input is zero; steps to maintain balance if disturbed.
Debug Mode	Used for SDK development and debugging; stops motion control commands to avoid conflicts.

Switching Modes (*Motion Control Version < 8.2.0.0*)

Mode	Button Combination
Zero Torque Mode	Hold L1 + Click B
Damping Mode	Hold L1 + Click A
Lock Stand	Hold L1 + Click UP
Seated Mode	Hold L1 + Click LEFT
Lying and Standing	Hold L1 + Click X
Squat Switch	Hold L1 + Click Y
Debug Mode	Hold L2 + Click R2

Operational Flow (Motion Control Version < 8.2.0.0)



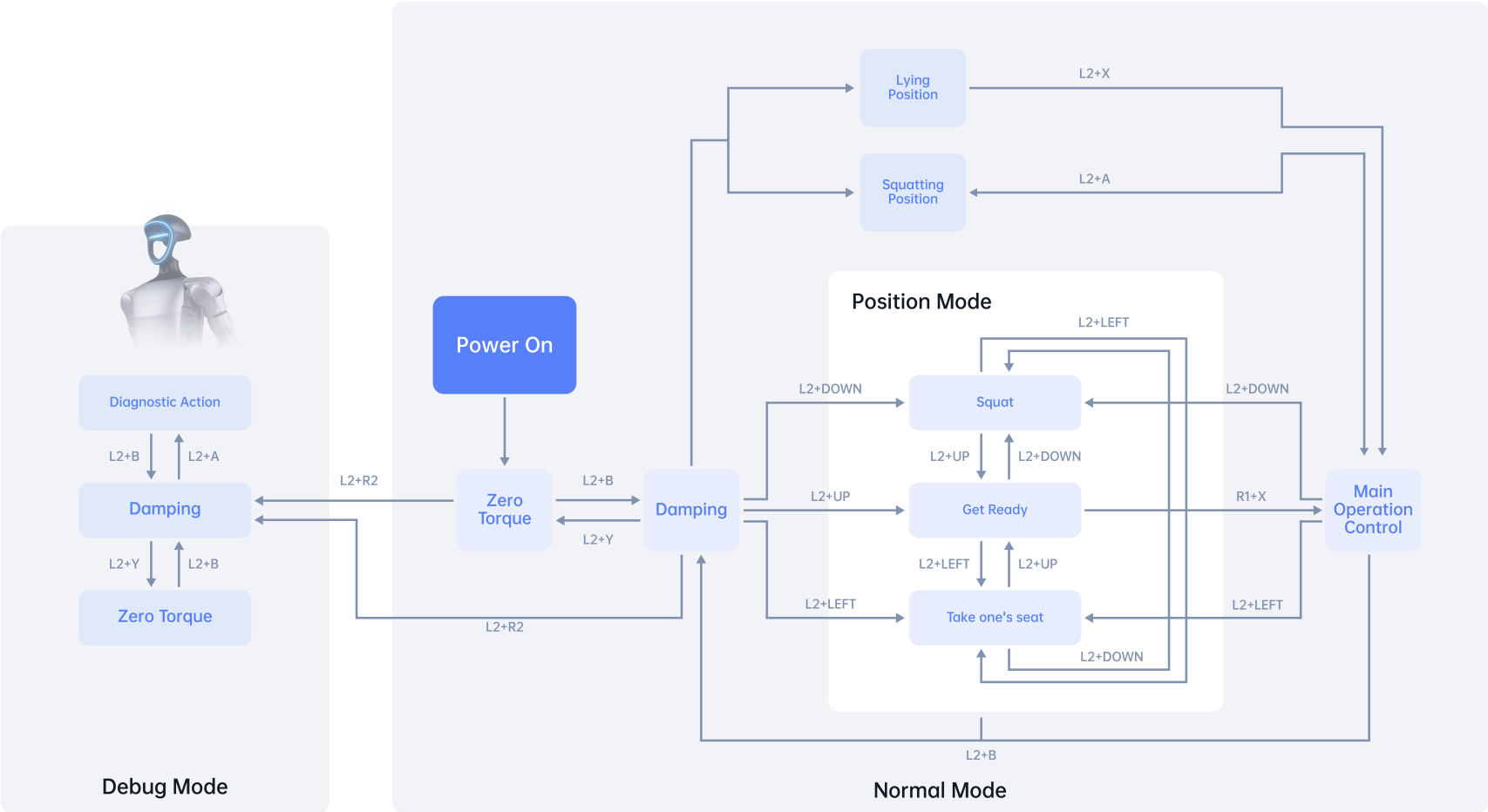
Switching Modes (*Motion Control Version >= 8.2.0.0*)

Mode	Button Combination
Zero Torque Mode	Hold L2 + Click Y
Damping Mode	Hold L2 + Click B
Lock Stand	Hold L2 + Click UP
Seated Mode	Hold L2 + Click LEFT
Lying and Standing	Hold L2 + Click X
Squat Switch	Hold L2 + Click A
Debug Mode	Hold L2 + Click R2

LED Strip Color (*Motion Control Version >= 8.2.0.0*)

Mode	LED Strip Color
Zero Torque Mode	Solid Purple
Damping Mode	Solid Orange
Seated Mode	Solid Green
Debug Mode	Solid Yellow
Normal Operation	Solid Blue
Standby Mode	Solid Dark Blue
Error State	Solid Red

Operational Flow (Motion Control Version >= 8.2.0.0)



Operation Control

Action	Button Combination
Lock Stand → Operation Control	Hold R1 + Click X
Continuous Walk (Not recommended)	Double Click START
Stationary Stand	Click START
Low Speed	Double Click L2
High Speed	Double Click L1

Operation Control (Only Used for 3 DoF Waist)

Action	Button Combination
Lock Stand → Operation Control	Hold R1 + Click Y
Continuous Walk (Not recommended)	Double Click START
Stationary Stand	Click START
Low Speed	Double Click L2
High Speed	Double Click L1

Operation Control (Running Mode)

Action	Button Combination
Lock Stand → Operation Control	Hold R2 + Click A
Continuous Walk (Not recommended)	Double Click START
Stationary Stand	Click START
Low Speed	Hold R2 + Click Down
High Speed	Hold R2 + Click Up

Interactive Functions

Function	Button Combination
Wave Hand	Hold SELECT + Click Y
Handshake	Hold SELECT + Click A
Turn Around and Wave Hand	Hold SELECT + Click X

Offset Compensation

Action	Button Combination
Left Offset	Hold R1 + Click RIGHT
Right Offset	Hold R1 + Click LEFT
Forward Offset	Hold R1 + Click DOWN
Backward Offset	Hold R1 + Click UP

Hands-on time

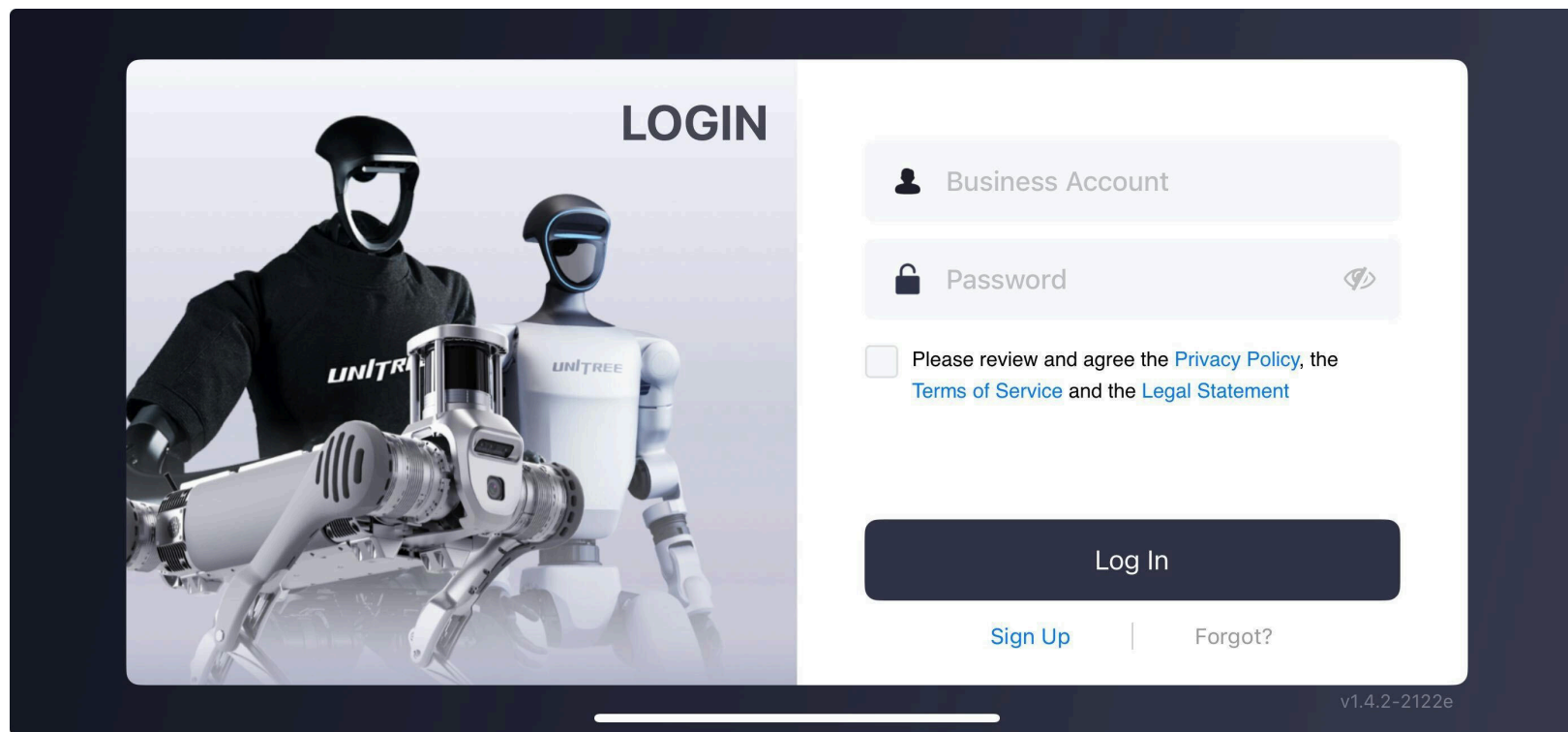
Mobile App

- The app can be downloaded from Unitree Explore



Basic App Usage

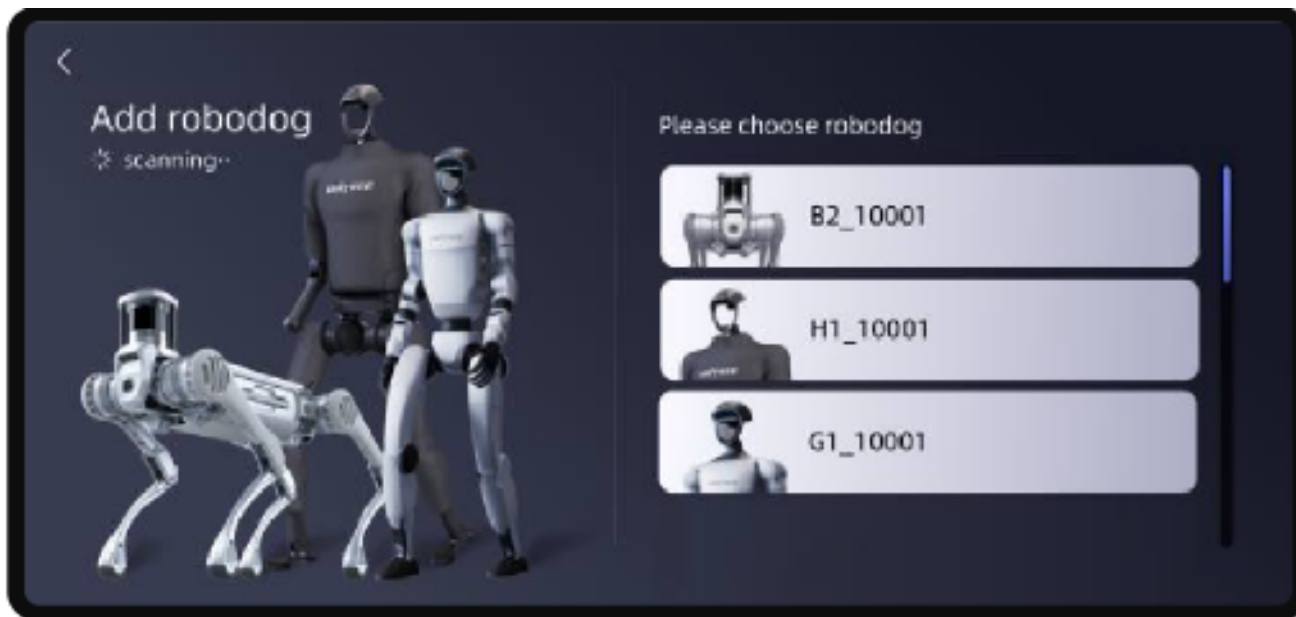
1. Create a new account and login to the app.



Basic App Usage

2. Bind robot to account

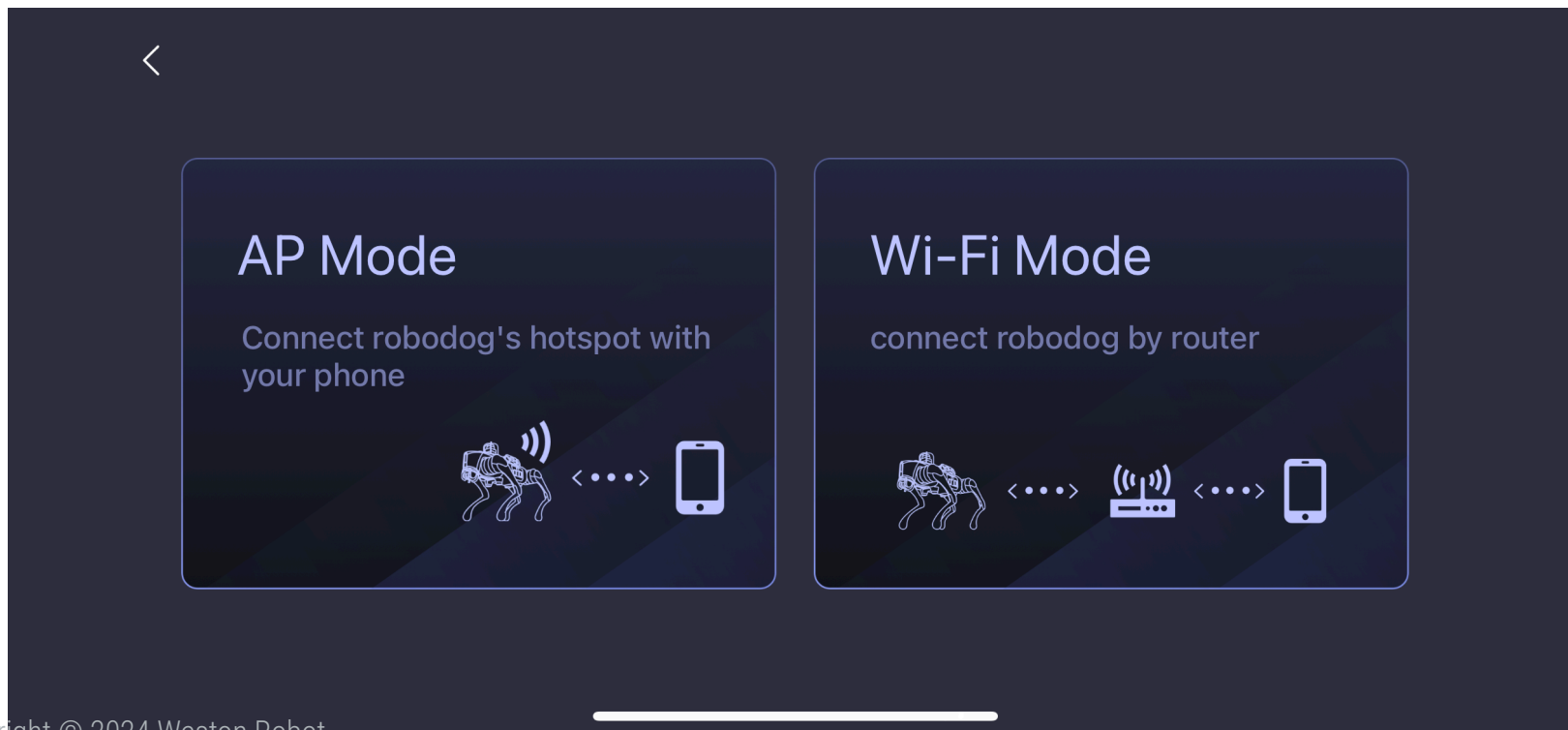
- Turn on device Bluetooth
- Click on **add robot** to select your G1 based on its unique ID.
- *Note: One robot can only be bound to one account.*



Basic App Usage

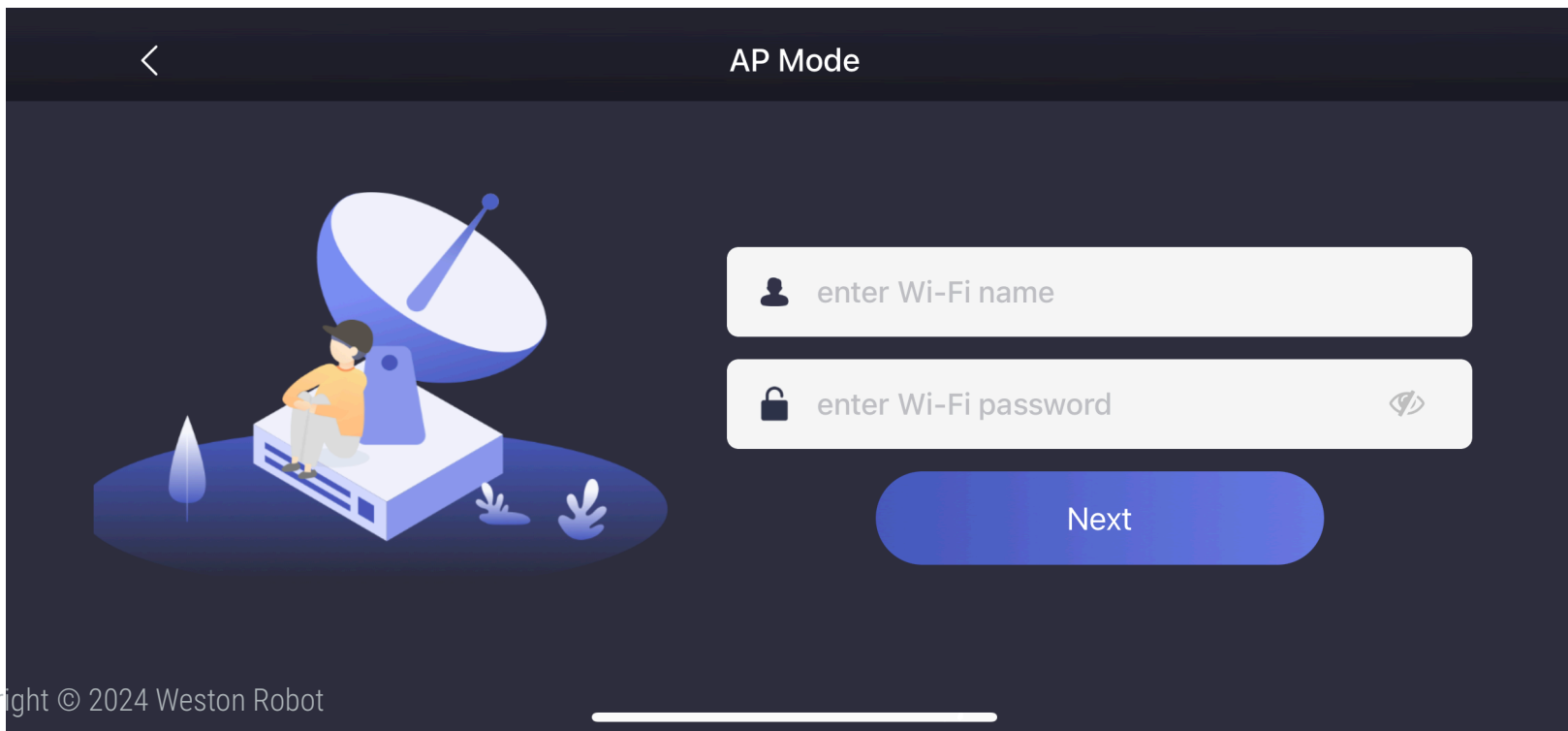
3. Connecting to Robot

- G1 needs to establish a connection with the app (AP or WiFi mode)



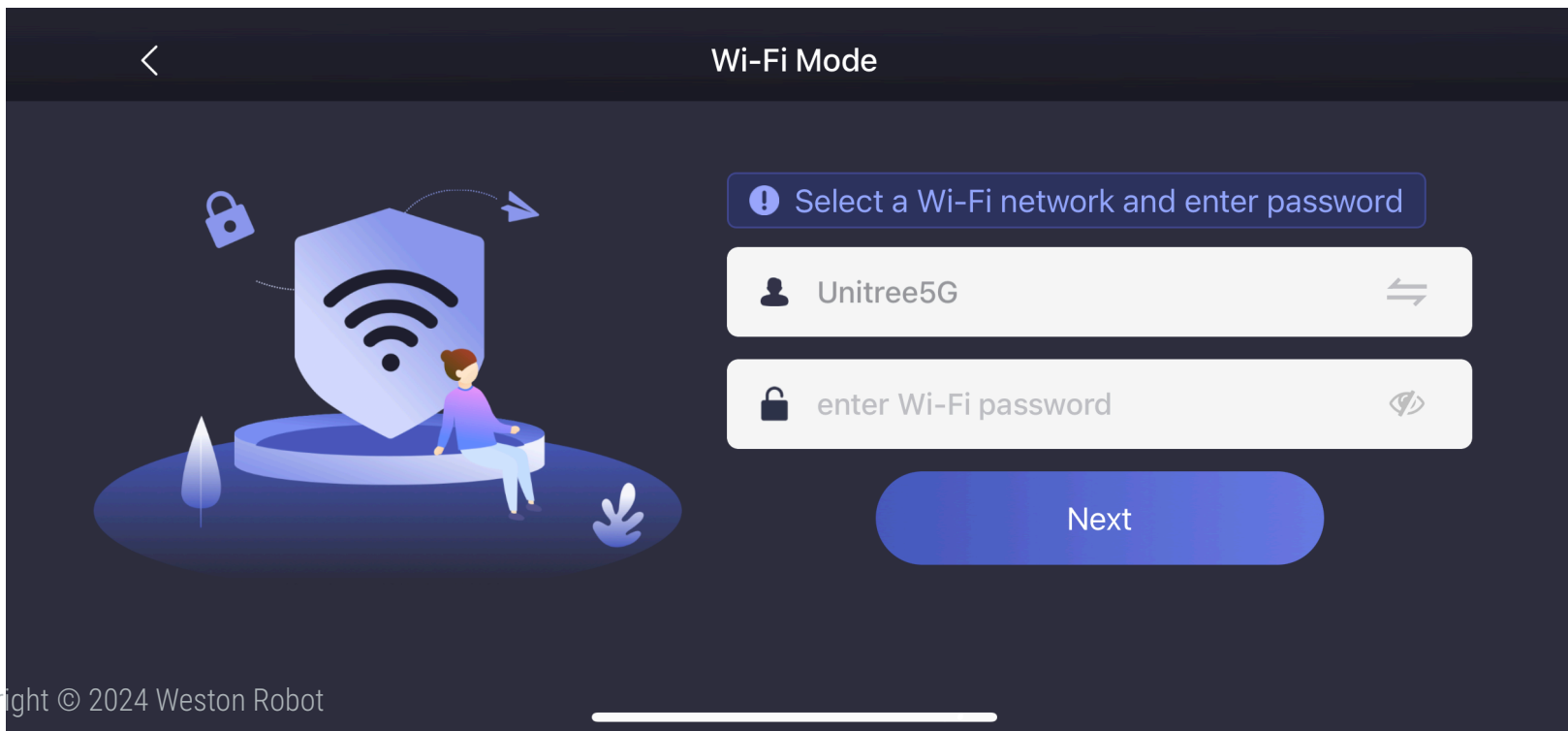
Basic App Usage

- AP mode
 - ▶ G1 provides a endpoint connection for the user's device to connect to
 - ▶ Follow the prompts to set the AP name (G1-XXXXXX) and 8-digit password



Basic App Usage

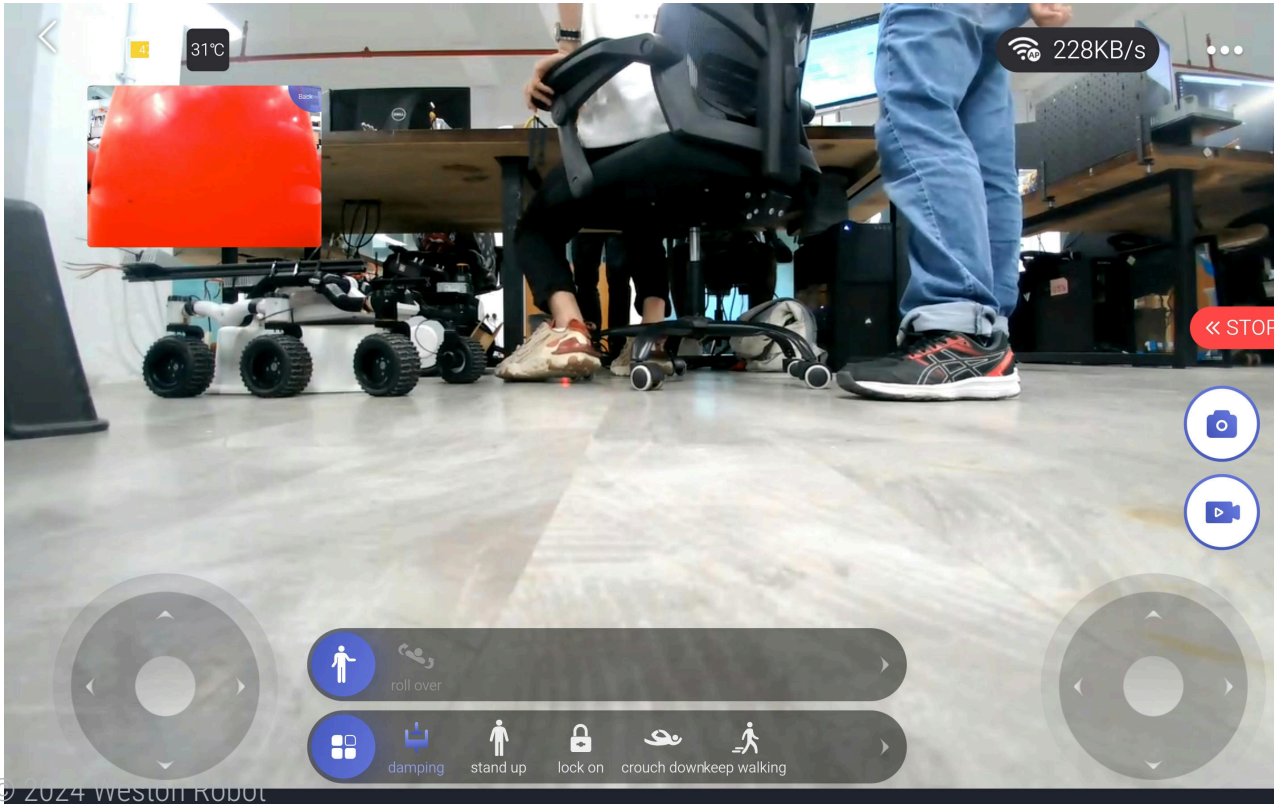
- WiFi mode
 - ▶ G1 and user's device connect to a common WiFi network
 - ▶ Select an existing WiFi network and enter the password



Basic App Usage

4. Control (*Still in developement*)

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



Maintenance

IMU & Motor Calibration

- The calibration of IMU and motors are done via the app.
- Watch the motor calibration video on the [Unitree Developer Docs](#) before calibrating the G1.
- The option to calibrate can be found under Device → Data → Robot → Calibration
- Follow the prompts and images to calibrate the G1.
- **DO NOT** calibrate the G1 unnecessarily. Only do so when there are visible drifts and imbalances in robot movement

Troubleshooting

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

Troubleshooting

<

Alarm Information

Warning

2025.03.25

!

Communication firmware error

Command Timeout

16:03:06

!

Communication firmware error

Joint Limit Transient Over Voltage

15:54:21

!

Communication firmware error

Joint Limit Transient Over Voltage

15:47:59

!

Communication firmware error

Joint Limit Transient Over Voltage

15:45:13

!

Communication firmware error

Command Timeout

15:21:24



Troubleshooting



Automatic Machine Inspection

Start Automatic Detection

Testing Network Connection ...

Inner Network: eth0

inet 192.168.123.161 netmask 255.255.255.0 broadcast 192.168.123.255

inet6 fe80::7c1d:75ff:fe60:f589 prefixlen 64 scopeid 0x20<link>

STA Network: wlan0

inet 192.168.29.126 netmask 255.255.255.0 broadcast 192.168.29.255

inet6 fe80::547c:ec15:69ff:487f prefixlen 64 scopeid 0x20<link>

Internet Connected

AP Network: wlan1

The End