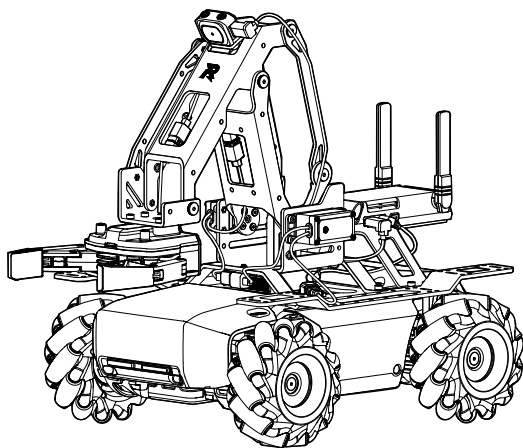


ROBOMASTER EP Core

User Manual v1.0

2020.08



Searching for Keywords

Search for keywords such as “battery” and “install” to find a topic. If you are using Adobe Acrobat Reader to read this document, press Ctrl+F on Windows or Command+F on Mac to begin a search.

Navigating to a Topic

View a complete list of topics in the table of contents. Click on a topic to navigate to that section.

Printing this Document

This document supports high resolution printing.

Using this User Manual

Legends

 Warning

 Important

 Hints and Tips

 Reference

Before Use

The following tutorials and manuals have been produced to ensure you make full use of your ROBOMASTER™ EP Core.

1. Safety Guidelines and Disclaimer
2. Quick Start Guide
3. User Manual

Check to make sure all parts are included and prepare for assembly by reading the RoboMaster EP Core Quick Start Guide. Refer to this user manual for more information. Watch all tutorial videos and read the RoboMaster EP Core Safety Guidelines and Disclaimer before using for the first time.

Watching the Video Tutorials

Visit the official DJI website <https://www.dji.com/robomaster-ep-core/video> or go to the app and enter the Videos page to watch the tutorial videos for assembly and use. You can also assemble the robot according to the assembly guide in the RoboMaster EP Core Quick Start Guide.

Referring to the RoboMaster EP Core Programming Manual

The RoboMaster EP Core Lab offers hundreds of programming blocks that allow you to access features such as PID control. The RoboMaster EP Core Programming Manual provides instructions and examples to help users quickly learn programming techniques for controlling the robot. Users can download the manual from the official DJI website <https://www.dji.com/robomaster-ep-core/downloads>.

Using an SDK

Open DJI SDK is available on the robot and includes multiple control interfaces for various embedded and extension modules as well as multiple output interfaces for video and audio streams. The robot supports USB, Wi-Fi, and UART connection and users are free to choose the method of connection based on the platform port.

Open DJI SDK greatly increases the expandability of the robot, offering the possibility to create customized functions. For more information, visit www.dji.com/robomaster-ep-core/downloads or robomaster-dev.rtfid.io.

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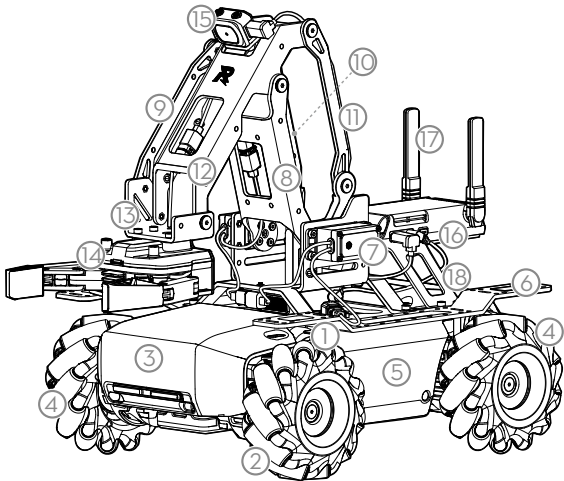
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Product Profile

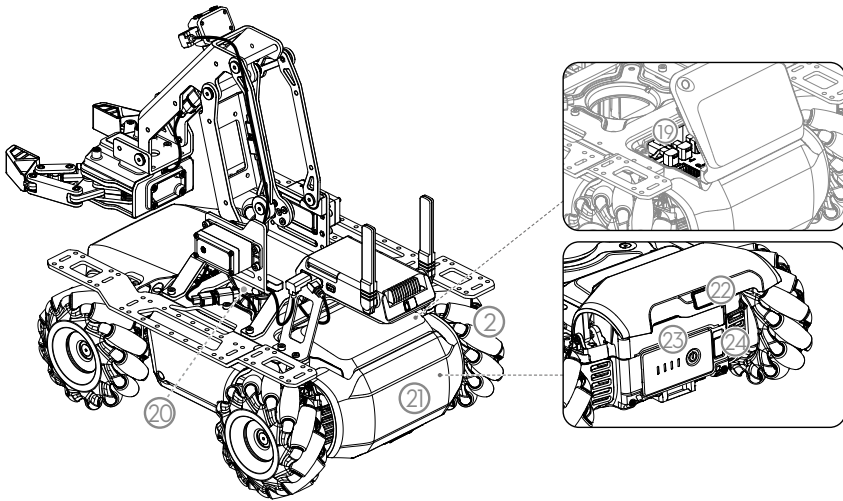
Introduction

The RoboMaster S1 Education Expansion Set Core (EP Core) is an all-in-one education solution for STEAM classrooms. It provides an official SDK that can be used with powerful mechanical accessories and interfaces to expand hardware possibilities. Together with rich teaching resources and a continually-updated competition database, the EP Core delivers a new classroom experience to make education easier for both teachers and students, expanding the boundaries of the future of education.

Robot Diagram



- | | |
|------------------------------------------------|------------------------------------|
| 1. Chassis | 10. Robotic Arm Connecting Rod #2 |
| 2. Right-Threaded Mecanum Wheel | 11. Robotic Arm Connecting Rod #3 |
| 3. Chassis Front Armor (built-in Hit Detector) | 12. Robotic Arm (2 of 2) |
| 4. Left-Threaded Mecanum Wheel | 13. Robotic Arm Endpoint Bracket |
| 5. Chassis Left Armor (built-in Hit Detector) | 14. Gripper |
| 6. Chassis Extension Platform | 15. Camera |
| 7. Servo | 16. Intelligent Controller |
| 8. Robotic Arm (1 of 2) | 17. Intelligent Controller Antenna |
| 9. Robotic Arm Connecting Rod #1 | 18. Rear Extension Platform |



- | | |
|------------------------------------------------|-------------------------------|
| 19. Motion Controller | 22. Rear Armor Release Button |
| 20. Speaker | 23. Intelligent Battery |
| 21. Chassis Rear Armor (built-in Hit Detector) | 24. Battery Eject Button |

Overview

RoboMaster EP Core uses an omnidirectional chassis and Mecanum wheels. The robot offers comprehensive control and an immersive driving experience thanks to the omnidirectional chassis, agile Mecanum wheels, and stable, low-latency image transmission in first-person view (FPV).

The robot uses a gripper and an agile robotic arm to grasp and move objects. The gripper and robotic arm are driven by two high-performance servos.

A customizable extension platform allows users to build and expand the robot any way they choose. The robot is also compatible with third-party building blocks, providing even more ways to learn and have fun.

Open DJI SDK is available on the robot and supports 39 programmable sensor ports. It is also compatible with third-party hardware, providing users with unlimited creative possibilities.

Preparing

Assembling the Robot

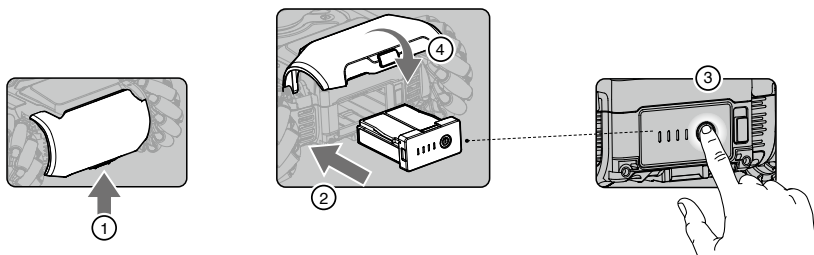
Refer to the RoboMaster EP Core Quick Start Guide.

Powering On the Robot

Follow the steps below to power on the robot:

1. Press the rear armor release button to open the chassis rear armor.

2. Install the intelligent battery into the battery compartment.
3. Press and hold the power button to turn on the battery.
4. Close the chassis rear armor.



Downloading the RoboMaster App

A. Search for the RoboMaster app in the App Store or on Google Play or scan the QR code to download the app on your mobile device.

B. Users can also download the RoboMaster software for Windows or Mac from the official DJI website to control the robot with a keyboard and mouse.

Windows: https://www.dji.com/robomaster_app

Mac: https://www.dji.com/robomaster_app



- Use your DJI account to log in to the RoboMaster app.
 - The RoboMaster app supports iOS 10.0.2 or later or Android 5.0 or later.
 - The RoboMaster app supports Windows 7 64Bit or later or MacOS 10.13 or later.
 - Before using the RoboMaster app with cellular mobile data, contact your mobile device data provider for the latest data information.
-

Connecting the Robot to the RoboMaster App

The robot must be connected to the RoboMaster app before use. Users can learn how to connect via Wi-Fi or via router on the Connection Mode page. Follow the prompts to connect to the app. Refer to the Connecting section for more information.

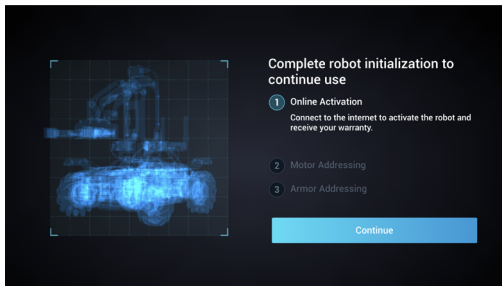


Initializing the Robot with the App

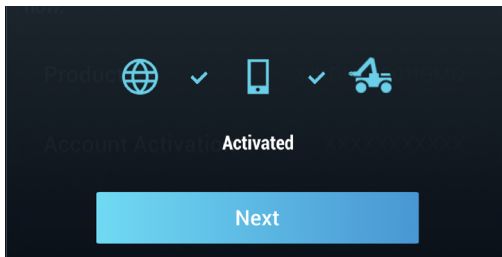
Activating the Robot

After connecting, use your DJI account to activate the robot in the RoboMaster app. Activation requires an internet connection.

1. Start activation.



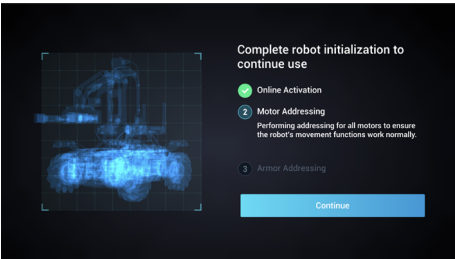
2. Follow the prompts to complete activation.



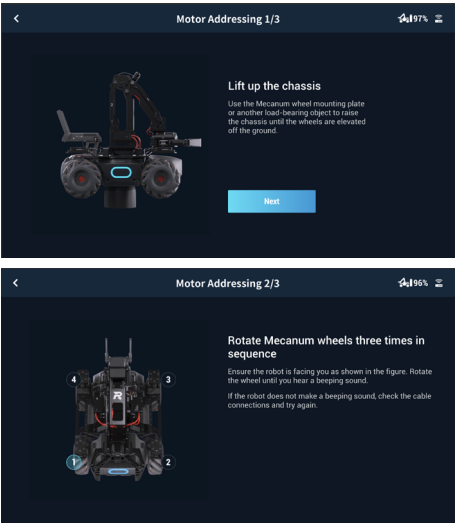
Motor Addressing

Motor addressing is required in the app before using for the first time. Follow the prompts to complete motor addressing.

- 1. Start Motor Addressing.



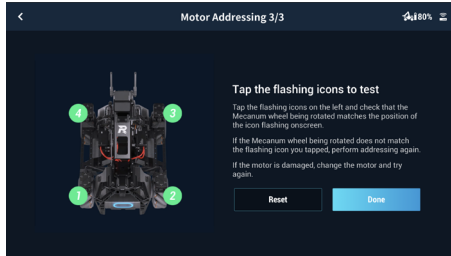
- 2. Lift the chassis and follow the prompts to rotate the Mecanum wheels in the order shown onscreen until all wheels have been rotated.




- 3. Tap  to test the Mecanum wheels one by one until all wheels have been tested.



4. Motor addressing completed.

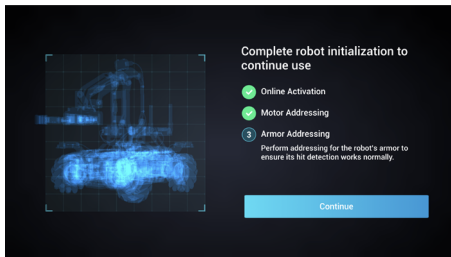


 Motor addressing is required when a motor is replaced. Open the RoboMaster app, click Settings then System, and select Motor Addressing.

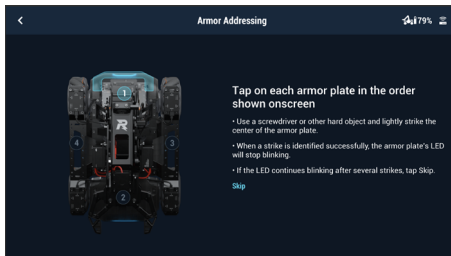
Armor Addressing

Armor addressing is required in the app when using the robot for the first time. Follow the prompts to complete armor addressing.

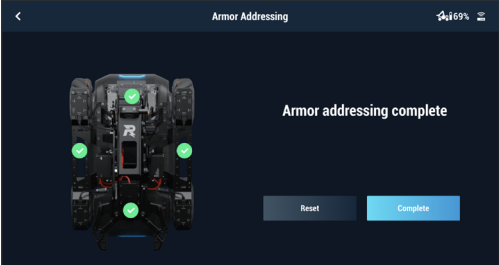
1. Start Armor Addressing.




2. Follow the prompts to tap on the armor plates in the order shown onscreen.



3. Armor addressing completed.

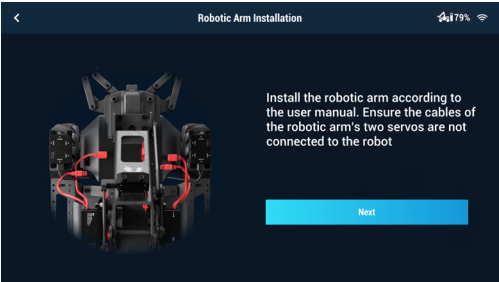


 Armor addressing is required when an armor module is replaced. Go to the RoboMaster app, click Settings, then System, and select Armor Addressing.

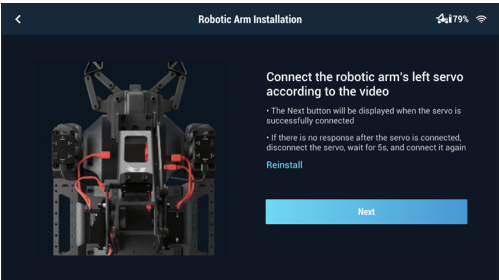
Robotic Arm Installation

The robotic arm must be installed in the app before using the robot for the first time.

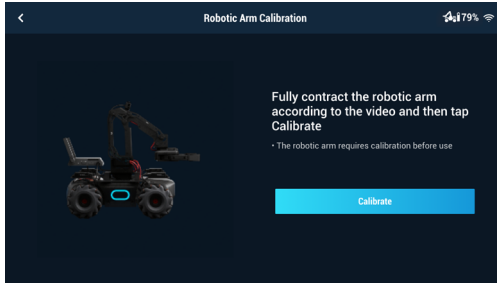
1. Start Robotic Arm Installation.



2. Follow the prompts to connect the left servo and right servo in turn.

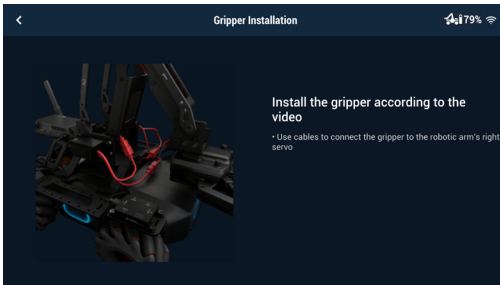


3. Calibrate the robotic arm.



Gripper Installation

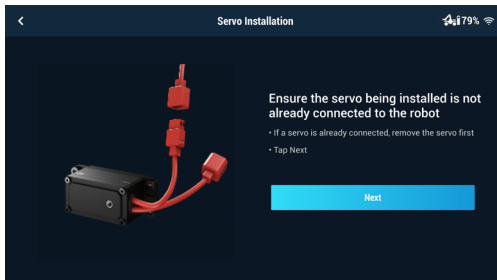
The gripper must be installed before using the robot for the first time.



Servo Installation

Make sure that the servos installed to the robot have different IDs and each ID ranges from 1 to 3. Otherwise, users must change the servo ID. Follow the prompts to complete servo installation.

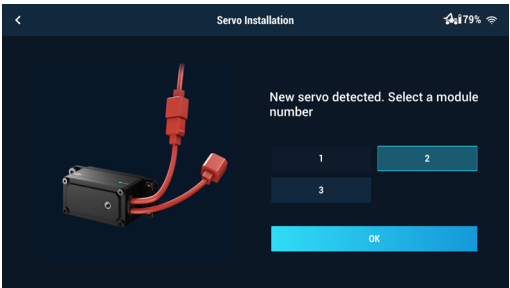
1. Start Servo Installation.



2. Follow the prompts to connect the servos in turn.



3. Follow the prompts to select module numbers for the servos until each servo has its unique number.

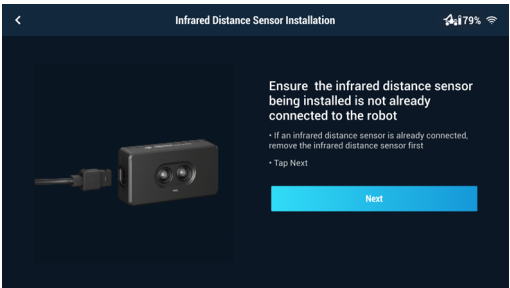


- Servos can be connected in series.
- After removing the robotic arm, the two servos on the robotic arm can be controlled separately.

Infrared Distance Sensor Installation

Follow the prompts to complete infrared distance sensor installation. If more than one infrared distance sensor is installed on the robot, each sensor must be set with a different ID.

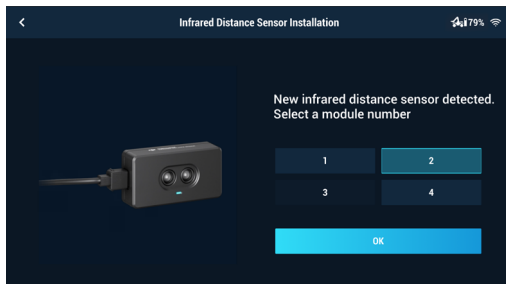
1. Start Infrared Distance Sensor Installation.



2. Follow the prompts to connect the infrared distance sensors in turn.



3. Follow the prompts to select module numbers for the infrared distance sensors until each sensor has its unique number. The robot supports the installation of multiple infrared distance sensors and users can select the ID accordingly.



Sensor Adapter Installation

The preset number for each sensor adapter is 1. Make sure that the sensor adapters installed on the robot have different IDs. Otherwise, users must change the sensor adapter ID. Follow the prompts to complete sensor adapter installation.



Modules and Functions

Using the RoboMaster App

With the dedicated RoboMaster app, users can access rich educational resources and several gameplay modes. The app can be used with a touchscreen or a gamepad and is available on iOS, Android, Windows, and Mac. Users on different platforms can even play together at the same time. Users can also write programs easily and apply them or share with friends instantly using the RoboMaster app. This section uses the RoboMaster app on iOS as an example. The specific interface may vary depending on the device used.

RoboMaster App Main Page



1. Account

Tap to log in and log out of your account, modify your avatar, name, and gender information. An internet connection is required in order to log in.

Check your total driving distance, total driving time, written code, coding time, the number of completed courses in "Road to Mastery", and the highest points in Target Practice.

Tap MasterBoard to view the top 100 users for total driving distance, total driving time, total code written, total coding time, and target practice score.

2. Media Library

Tap to view videos and photos.

3. Guide

- Product Support: Tap to enter the official DJI product support page.
- Maintenance Support: Tap to enter the official DJI Repair Center page.
- User Manuals: Tap to enter the official DJI user manual download page.
- Vision Markers: Tap to enter the official Vision Marker download page.
- Online Support: Tap to contact the official RoboMaster Series Online Assistance service.
- Feedback: Tap to fill out a feedback form.
- Videos: Tap to enter the official DJI tutorial video page.
- Forum: Tap to enter the official DJI forum page

4. Announcements

Announcements regarding topics such as RoboMaster products, competitions, and developer programs.

5. Connect

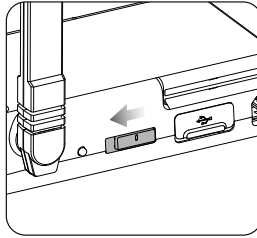
The robot must be connected with the app. Tap to see a guide on how to connect via Wi-Fi or router.

Connection via Wi-Fi

Users can enter both Solo and Battle mode when connecting via Wi-Fi.

Follow the steps below to connect:

- (1). Slide the mode switch on the intelligent controller to  and power on the robot.



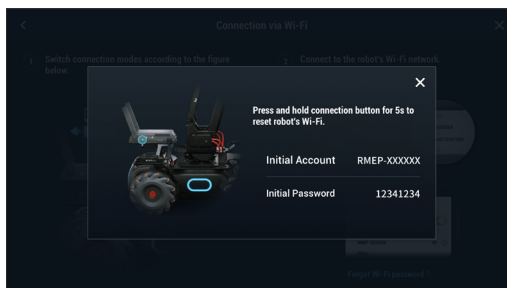
- (2). Run the RoboMaster app, go to Wi-Fi settings on the mobile device, select the Wi-Fi name (RMEP-XXXXXX) shown on the sticker on the body of the robot, and enter the password. The default password is 12341234.



- (3). Wait for the robot and the app to connect. The robot will emit a sound once connected.

Resetting the Password

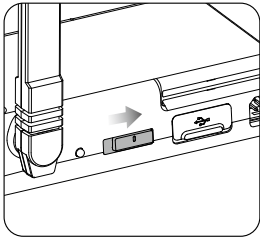
Make sure the mode switch on the intelligent controller is slid to the Connection via Wi-Fi position, and press and hold the connect button for five seconds to reset the password.



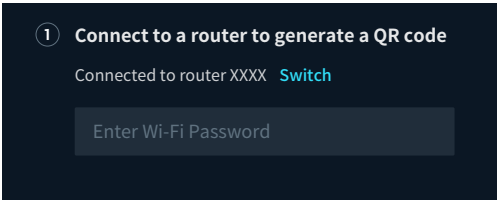
Resetting the Password

Users can enter both Solo and Battle mode when connecting via router.
Follow the steps below to connect:

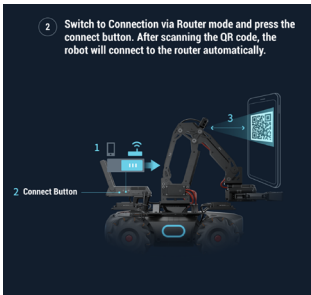
- (1). Slide the mode switch on the intelligent controller to  and power on the robot.



- (2). Open the RoboMaster app, go to Wi-Fi settings on the mobile device, connect to a router, and input the Wi-Fi password of the router to generate a QR code.



- (3). Press the connect button on the intelligent controller and use the camera of the robot to scan the QR code. The robot will connect to the router automatically.



6. Robot Model Selection

Select the robot model as RoboMaster S1 or RoboMaster EP.

7. Settings

Robot, Extension Module, Connect, Display, Control, and System can be found in the Settings page.

a. Robot

Users can check the status of each individual component of the robot. When a component is abnormal, the corresponding part will be displayed in red with more detailed information provided on the right side of the screen.

b. Extension Module

Users can install a robotic arm, gripper, servo, infrared distance sensor, or sensor adapter on the Extension Module screen. Users can also check the installation status of these modules.

c. Connect

Displays the connection status of the robot. When connected, users can also check the Channel Display, Wi-Fi Name, Wi-Fi Password, and also modify Wi-Fi information.

d. Display

Users can set the LED Display Color, FPV Hit Point Bar, FPV Screen Adaptation, Video Resolution, Anti-Flickering, and 3D Quality.

e. Control

Users can set the Speed, Control Mode, Control Sensitivity, Gyro Sensitivity, and Vibration.

f. System

The following actions can be performed under the system settings:

Power off the robot.

Enable programming sleep mode.

Check the app version and set the app language.

Set the voice language and the volume of the robot.

Perform a firmware update, check what firmware has been downloaded, and check the firmware version.

Perform armor addressing, motor addressing, and chassis calibration.

Replay the beginner guide.

Check the remaining space on the SD card and format the SD card.

Enable GPS information, check the device information, and read about the terms of use and the DJI Product Improvement program.

8. Solo

Tap to enter Solo mode. Users can connect either via Wi-Fi or router.

9. Battle

Tap to enter Battle mode. Users can connect either via Wi-Fi or router. When using multiple robots, users must connect via the same router.

10. Lab

Road to Mastery: Road to Mastery offers project-based courses that enhance users' understanding of programming languages, from robotics applications to AI technology, with different projects for both beginners and experts.

DIY Programming: Both Scratch and Python are available for programming.

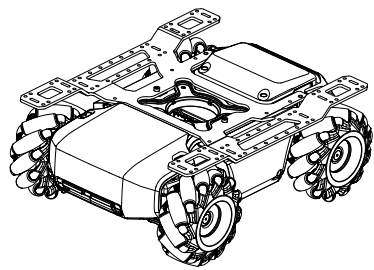
RoboAcademy: RoboAcademy offers a curriculum of videos and programming guides. In-depth videos introduce robotics in simple but fascinating ways, giving users insightful and relevant scientific knowledge. The RoboMaster EP Core Programming Manual offers detailed explanations of various blocks and modules, making it easier for users to understand the fundamentals of EP Core programming.

⚠ EP Core cannot use the blaster, gimbal, or their related functions in Solo, Battle, or Lab mode. It is recommended to connect the blaster or gimbal first.

Omnidirectional Chassis

Introduction

The chassis is an omnidirectional motion platform based on the Mecanum wheels, which can be used to move forward, traverse, skew, rotate, or a combination of movements at once.

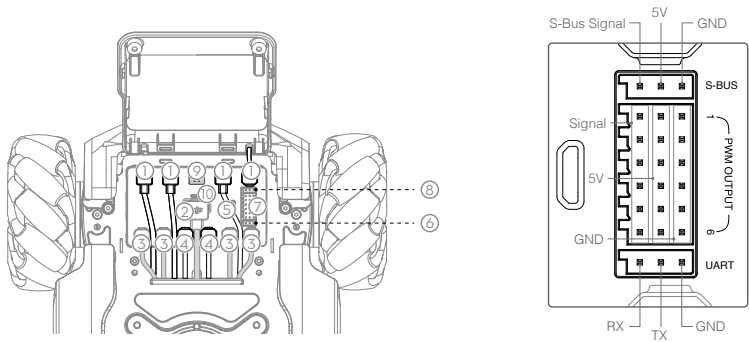


⚠ Avoid crashing into any objects at high speed.

Motion Controller

Overview

The motion controller is the core module for the chassis movement, providing a rich external module interface for video transmission and connecting the, battery, armor, and motors. It also integrates an omnidirectional wheel motion control algorithm, power management system, motor management system, and a chassis management system.



1. CAN Bus Port

CAN Bus port used for armor module connection.

2. Power Port

Power port used for intelligent battery connection. Note that this interface contains the battery management system. Avoid unplugging the power port unless necessary.

3. M BUS Port

Motor port used for motor connection.

4. CAN BUS Port

A reserved port used for armor module connection.

5. Micro USB Port

Supports connection and communication in SDK USB RNDIS.

6. UART Port

UART port is an extension port, used for programming and supports SDK connection.

7. PWM Output Port

The motion controller enables the duty cycle to be set through the Scratch or Python program using the PWM output port.

8. S-Bus Port











Controls signal reception and is used to connect a remote controller receiver that supports SBUS protocol.

9. M0 Port


Used for servo and gripper connection.

10. LED indicator

Used to indicate the status of the motion controller.

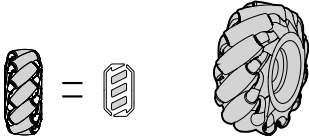
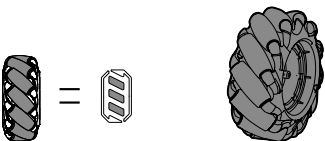
LED indicator		Motion controller status
Blinks blue slowly		Working normally
Blinks yellow slowly		Running autonomous program
Blinks green quickly		IMU calibration successful
Blinks red quickly		IMU calibration failed
Solid yellow	 —	IMU is calibrating
Solid white	 —	Firmware updating
Blinks red, green, and blue alternatively	  	No attitude information input
Blinks red slowly		<p>Stop Mode*</p> <p>Stop mode may occur in the following situations:</p> <ol style="list-style-type: none"> Motion controller is disconnected from or cannot communicate with motor. Robot cannot move due to the motor hardware abnormality. Motion controller cannot communicate with the remote controller. Abnormal motion controller attitude. Motion controller cannot communicate with the battery.

* Stop mode warning prompts will display in the app. Go to Settings then System to check the corresponding error.

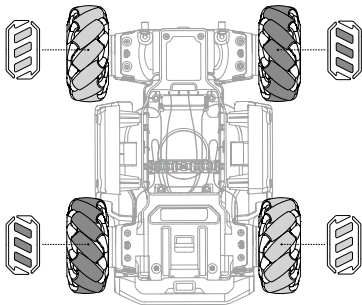
- 
- Connect the black, orange, and red cables to the ports of the corresponding color.
 - Make sure the motion controller is properly installed before use and the screws on the chassis rear cover are locked.
 - After each reinstallation of the motion controller, calibrate the robot if prompted to do so in the RoboMaster app. Refer to the Calibrating the Robot section for more information.
 - To avoid dislodging the motion controller when removing the rear chassis cover, lift the cover carefully before removing.

Mecanum Wheel

The Mecanum wheel is a commonly used robotic omnidirectional chassis moving solution, which is divided into two types: left-threaded and right-threaded. The four-wheeled chassis requires two pairs of Mecanum wheels.


			
Left-threaded Mark	Left-threaded Mecanum Wheel	Right-threaded Mark	Right-threaded Mecanum Wheel

When installing, you can check the left-threaded mark or right-threaded mark on the bottom of the chassis, and install the left-threaded or right-threaded Mecanum wheel accordingly.



Motors and ESCs

The robot features an M3508I brushless motor and ESC with a maximum speed of 1000 rpm for brushless motors.

- 
- Make sure the connections between all motors and motion controller are stable.
 - If the motor does not rotate freely, immediately power off the robot and check the motor.
 - DO NOT touch or let your hands or body come into contact with the motors, motors mounting plate, or inside of Mecanum wheel immediately after powering off the robot.

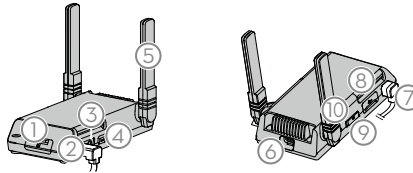
Armor Modules

A total of four armored modules are installed on the four sides of the chassis, which protect the internal structure of the robot.

Each hit detector module is represented by an LED light and is visible under the armor module.

Intelligent Controller

The intelligent controller is integrated with multiple systems including a video transmission system, game system, and Scratch programming system. It supports six smart modules, including line recognition, vision marker recognition, person recognition, clap recognition, gesture recognition, and robot recognition.



1. microSD Slot

Compatible with a microSD card that can read and write faster than 10 MB/s, supporting up to 64 GB.

2. Camera Port

Used to connect to the camera.

3. Speaker Port

Used to connect to the speaker.

4. Autonomous Program Button

Scratch programs written by the user can be set as autonomous programs, which can be loaded directly onto the robot. Press the Autonomous Program Button to run the program.

5. Antennas

For optimal Wi-Fi connection, set the intelligent controller antennas at 90°.

6. Secondary Camera Port

A reserved port used for switching to the second camera view.

7. CAN Bus Port

Used to connect to the motion controller.

8. Micro USB Port

Used to connect to the computer.

9. Connect Mode Switch

Used to switch between connecting via Wi-Fi or a router.

10. Connect Button

The connect button functions differently when connecting via Wi-Fi or router.

Connection to Wi-Fi: Once the Wi-Fi password is forgotten, press and hold this button for five seconds to reset the Wi-Fi password.

Connection to Router: When scanning the QR code with the robot to join a network, press this button first.

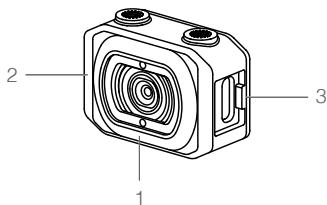


- DO NOT pull on the antenna.
- If the intelligent controller antenna is damaged, the performance of the robot will be affected. Contact DJI if the antenna is damaged.

Camera

The camera features a 1/4-inch sensor with 5 million pixels and a FOV of 120°, allowing users to control the robot from a first-person perspective.

Clean the lens regularly to avoid blurring or halos. Use a special lens cleaner to make sure that there is no foreign matter on the lens after cleaning and that it does not damage the lens.



1. Camera Lens

2. Microphone

3. Camera Port

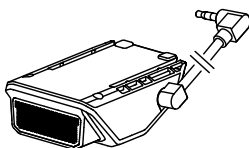
Used to connect the camera to the intelligent controller.



- DO NOT expose the camera to liquids or immerse in water.
- DO NOT store the camera in a humid place.
- DO NOT touch the lens.
- If the camera is wet, wipe it with a dry soft cloth.

Speaker

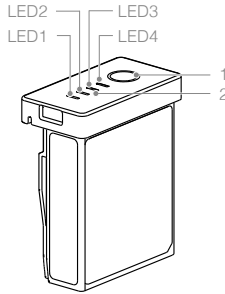
The speaker connects to the intelligent controller via a 2.5mm device with a power rating of 2 W.



- Make sure the speaker is properly installed and does not obstruct other components' movements.

Intelligent Battery

The intelligent battery has a capacity of 2400 mAh, a voltage of 10.8 V, and a variety of power management functions.



- 1. Power Button
- 2. Battery Level Indicator

Intelligent Battery Functions

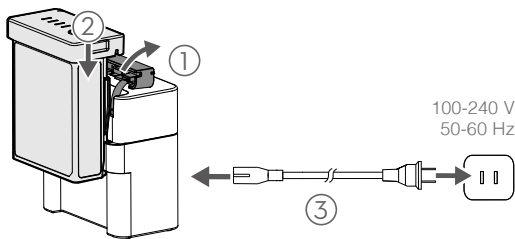
1. Battery Level Display: LEDs display the current battery level.
2. Auto-Discharging Function: The battery automatically discharges to below 70% of total power when it is idle for more than 10 days to prevent swelling. To exit the idle state, press the power level button to check the battery level. It takes approximately one day to discharge the battery to 60%. It is normal to feel moderate heat emitting from the battery during the discharge process.
3. Balancing Function: Automatically balances the voltage of each battery cell when charging.
4. Overcharge Protection: Charging stops automatically when the battery is fully charged.
5. Temperature Protection: The battery only charges when the temperature is 5 to 45° C (41 to 113° F).
6. Overcurrent Protection: Battery stops charging when high amperage is detected.
7. Over-Discharge Protection: To prevent serious damage to the battery, the current output will be cut off when the battery cell is discharged to 2.5 V and not in use. To extend operating times, overcharging protection is disabled as batteries discharge during usage. In this instance, a battery voltage below 1 V may cause a safety hazard such as a fire when charged. To prevent this, the battery will not be able to charge if the voltage of a single battery cell is below 1 V. Avoid using any batteries matching this description. Avoid over-discharging to prevent permanent battery damage.
8. Short Circuit Protection: Automatically cuts the power supply when a short circuit is detected.
9. Battery Cell Damage Protection: The RoboMaster app displays a warning message when a damaged battery cell is detected.
10. Sleep Mode: Sleep mode is entered to save power when the battery is not in use. If the battery is turned on without being connected to the robot, the battery will turn off after five minutes. When the battery power is less than 5%, it will automatically enter sleep mode after six hours to prevent over-discharging. If this occurs, press the battery power button once, and the battery can be charged to wake up.
11. Communication: Battery voltage, capacity, current, and other relevant information is provided to the robot.



Read the user manual, disclaimer, and descriptions on the battery before use. Users take full responsibility for all operations and usage.

Charging the Intelligent Battery

The battery charger is designed for charging batteries for the robot. Lift the battery charger cover and insert the intelligent battery. Connect the battery charger to a power outlet (100-240 V, 50/60 Hz).



Charging Time: Approx. 1 hour and 30 mins*

* The charging time was tested in a lab environment using a new intelligent battery, and should be taken as a reference only.

-
- Before using for the first time, charging is required to wake up the battery.
 - Make sure the battery is fully charged before each use.
 - When the charger is not in use, keep the battery charger covered in order to prevent the metal terminals from being exposed.

Status LED Descriptions

Battery Level Indicators while Charging (Battery)				
LED1	LED2	LED3	LED4	Battery Level
				0%~50%
				50%~75%
				75%~100%
				Fully Charged

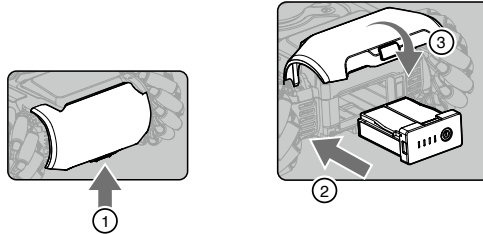
Battery Level Indicators for Battery Protection					
LED1	LED2	LED3	LED4	Blinking Pattern	Battery Protection Item
				LED2 blinks twice per second	Over current detected
				LED2 blinks three times per second	Short circuit detected
				LED3 blinks twice per second	Over charge detected
				LED3 blinks three times per second	Over-voltage charger detected
				LED4 blinks twice per second	Charging temperature is too low (<0°C)
				LED4 blinks three times per second	Charging temperature is too high (>40°C)

After any of the protection issues are resolved, the battery level indicator will power off. Unplug the intelligent battery from the charger and plug it back in to resume charging. Note that you do not need to unplug and re-plug the charger in the event of a charging temperature error. Charging will resume when the temperature falls within the normal range.

-
- DJI is not responsible for damage caused by third-party chargers.

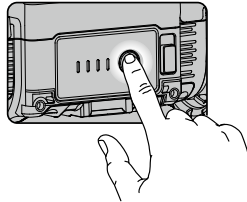
Mounting the Intelligent Battery

When in use, open the rear armor cover and insert the battery into the battery compartment.



- ⚠ • Make sure the battery is securely installed. Otherwise, the battery may fall out or have insufficient contact, which can lead to loss of battery information.
- Make sure to press the battery eject button before removing the battery.
- Make sure the external metal terminals of the battery compartment do not become deformed. Otherwise, it may not be possible to insert or remove the battery.

Using the Intelligent Battery



Checking the Battery Level

Press the battery level button once to check the battery level.

☑ The battery level indicators will also show the current battery level during discharging. The indicators are defined below.

- LED is on.
- ⚡ LED is flashing.
- LED is off.

Battery Level				
LED1	LED2	LED3	LED4	Battery Level
—	—	—	—	88%~100%
—	—	—	⚡	75%~88%
—	—	—	○	63%~75%
—	—	⚡	○	50%~62.5%
—	—	○	○	38%~50%
—	⚡	○	○	25%~38%
—	○	○	○	13%~25%
⚡	○	○	○	0%~13%

Powering On/Off

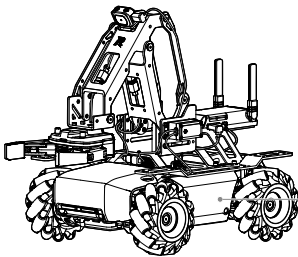
Press and hold the power button for more than two seconds to power on or off.

Low-Temperature Notice

- 1. The performance of the intelligent battery is significantly reduced at temperatures below 5° C (41° F). Make sure that the battery is fully charged and the cell voltage is at 4.2 V before use.
- 2. In extremely cold weather, the battery temperature may not be high enough even after warming up. In these cases, insulate the battery as required.
- 3. To ensure optimal performance, keep the core temperature of the Intelligent Battery above 20° C (68° F) when in use.

Robot LED Indicator Description

The robot features LED indicators on the four armor modules of the chassis body, which indicate the current status of the robot.



Chassis LED indicator, one for each armor.

LED Indicator Description

Robot Status	Chassis LED Indicator
Battery Power	
Power on Robot	Solid cyan
Power off Robot	Custom color powers off
Connect	
Robot operating normally, not connected to app	Pulses white
Robot and app connecting	Blinks cyan
Robot operating normally, connected to app	Solid custom color
Firmware update	
Updating firmware	Solid white
Firmware update failed	Solid red
Firmware update successful	Solid cyan

* The custom color is set under LED Display Color in the Display settings in the app.

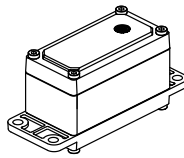
☀️ When changing the custom color, the LEDs on the chassis will change color.

Servo

Introduction

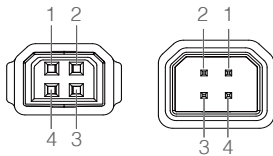
As a propulsion driver for the robot, the servo supports customized control abilities through the programming interfaces of the robot. The servo ensures minimal gear backlash, high control accuracy, and large output torque. Other uses include powering the robotic arm and supporting the DC gear motor mode, which allows users to build lifting structures.

The servo uses RS485 bus mode and is compatible with PWM mode. When the servo is used to drive the robotic arm, the system switches to RS485 bus mode automatically. When used independently, the servo can operate in either RS485 bus mode or PWM mode. The system automatically switches according to the input signal.



Servo PWM Port

The port pin is shown below:



1	2	3	4
485A/PWM	485B	VCC-12V	GND

The servo supports two control modes: angle mode and rate mode. The PWM signal has a frequency of 50 Hz and a duty cycle ranging from 2.5% to 12.5%.

Control Mode	Duty Cycle	Control Range
Angle Mode	2.5% to 12.5%	0° to 360°
Rate Mode	2.5% to 7.5%	49 to 0 rpm
	7.5% to 12.5%	0 to -49 rpm

LED Indicator Description for Servo


The LED indicator is used to indicate the status of the servo. Details are as follows:

LED Indicator	Servo Status
Solid green	Working normally
Blinks red rapidly	Self-test error*
Blinks green and yellow alternatively	Overload protection**
Blinks red and yellow alternatively	Stalled***
Blinks green rapidly	The servo is selected in the RoboMaster app

* The servo will perform a self-test when it is powered on. If a self-test error occurs, reconnect the servo with the power supply. Contact DJI Support if the servo still does not work normally after being powered on multiple times.

** The servo stops producing torque output after 200 milliseconds of overload, and automatically resumes output after three seconds.

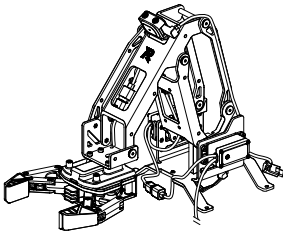
*** If the servo stalls, check the current operation and reconnect the servo with the power supply.

- 
- When in use, DO NOT touch the servo to avoid injury.
 - DO NOT hit the servo. Otherwise, it may reduce the service life of the servo or even lead to permanent damage.
 - When the servo overload warning prompts appear in the app multiple times, stop the operation immediately and check the operation and the structure of the robotic arm or servo.
 - When mounting the servo onto the robotic arm, use the programming interface with caution to avoid affecting the limit structure of the robotic arm.
 - When the servo is in PWM mode, its status cannot be displayed on a computer. The current status of the servo can be retrieved from the LED indicator.

Robotic Arm and Gripper

Introduction


The robotic arm of the robot supports precise FPV control and can be used with the gripper. Grab and move objects by controlling the robotic arm and gripper in first person view (FPV) in the RoboMaster app.



Use Instructions

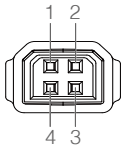
DO NOT apply external force to the robotic arm or gripper when they are in use.

The movement range of the robotic arm and the grip distance of the gripper can be controlled. The horizontal movement range of the robotic arm is 0-0.22 m while the vertical range is 0-0.15 m. The grip distance of the gripper is 10 cm.

- 
- To avoid injury, DO NOT touch the robotic arm or gripper when they are in use.
 - DO NOT hit or damage the robotic arm or gripper. Otherwise, the performance may be negatively affected or the servo may become abnormal.
 - Clean foreign objects like droplets in a timely manner. Otherwise, the surface of the structure may corrode.

Gripper PWM Port

The port pin is shown below:



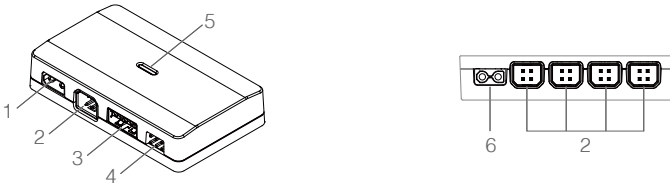
1	2	3	4
485A/PWM	485B	VCC-12V	GND

The gripper supports torque control mode. The PWM signal has a frequency of 50 Hz and a duty cycle ranging from 2.5%-12.5%. 2.5%-7.5% corresponds to the gripper's closing force (Max-0), and 7.5%-12.5% to its opening force (0-Max).

Power Connector Module

Introduction

A power connector module can connect and power third-party hardware, offering multiple ports to connect hardware and create custom programs and applications.



1. 12V Power Input Port

The input voltage is 9.6-12.6 V.

2. CAN Bus Port

Connect with CAN bus cable.

3. 5V/2A Power Output Port

The output voltage is 5 V and supports a current output of up to 2 A.

4. 5V/4A Power Output Port

The output voltage is 5 V and supports a current output of up to 4 A.

5. LED Indicator

Indicates the status of the power connector module.

6. 12V Conducting Power Output Port

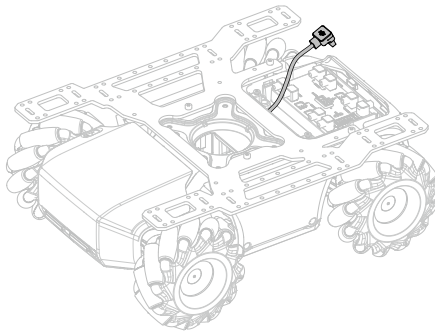
Conducts power along with the 12V power input port.



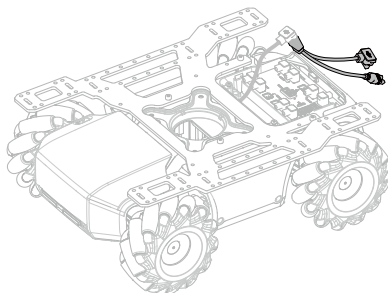
If both 5V power output ports are used, the module supports a current output of up to 4 A.

Mounting the Power Connector Module

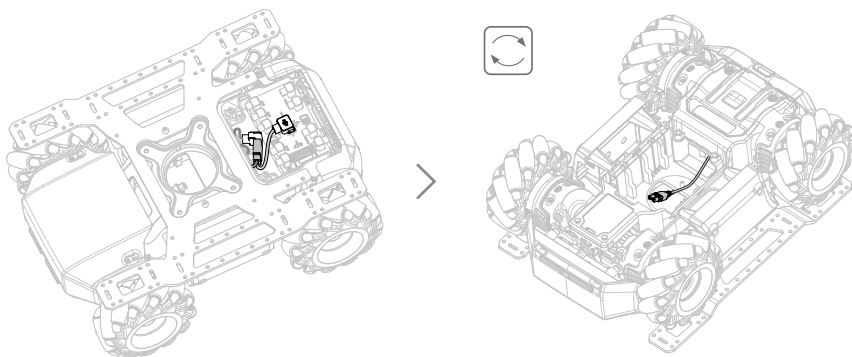
1. Unplug the power cable of the motion controller.



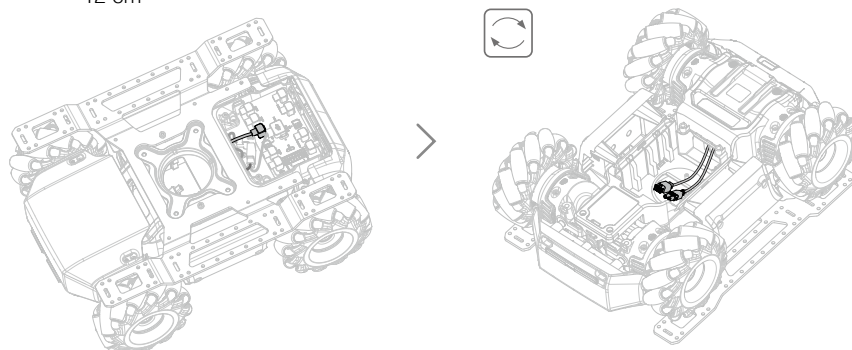
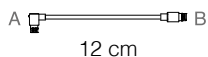
2. Connect the power cable and a Y-cable.



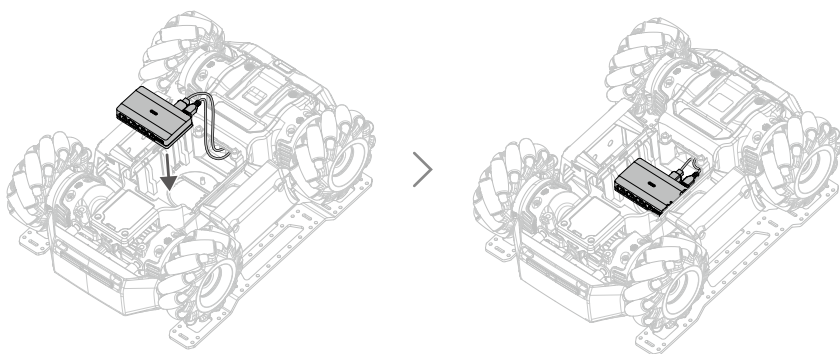
3. After connecting a Y-cable to the motion controller as shown below, place the power cable on the chassis and pull the XT30 power cable of a Y-cable through the chassis middle frame to the chassis cabin.



4. As shown below, connect the A end of a 12cm data cable to the motion controller and pull the B end through the chassis middle frame to the chassis cabin.






5. As shown below, connect the XT30 power cable in the chassis cabin to the 12V power input port and the B end of the 12cm data cable to the CAN bus port of the power connector module. Secure the module at the chassis cabin.



LED Indicator Description for Power Connector Module

The LED indicator is used to indicate the status of the power connector module. Details are as follows:

LED Indicator		Power Connector Module Status
Solid white		Normal power input and 5V output
Solid red		Normal power input, but 5V output has an overcurrent or is short-circuited
Off		Abnormal power input

Infrared Distance Sensor (TOF)

Introduction

The infrared distance sensor calculates the distance between a sensor and an object by measuring the time it takes an infrared light to reach the object and return to the sensor. The infrared distance sensor consists of an illumination unit, optical receiver, and signal processing system. The illumination unit emits a beam of modulated near-infrared light. When the beam of light is reflected by an object, the reflected beam will be directed through the optical receiver and converted into a current. The receiver transmits the generated electric signal to the signal processing system for demodulation and distance calculation.

The infrared distance sensor has a field-of view (FOV) of 20° and measures the distance of objects within the FOV. If there are multiple objects at different distances inside the FOV, the measured distance will be within the range of the nearest object and the farthest object. The actual measurement data is related to the size ratio and reflectivity of the object. Users can learn more about the infrared distance sensor through practice.

With a measurement range of 0.1-10 meters, the infrared distance sensor accurately measures within a margin of error of 5%. The addition of programmable modules in Scratch also provides reliable distance measurement information. This enables the robot to sense its environment and avoid obstacles, deepening users' understanding of advanced autonomous driving principles.



1. CAN Bus Port

Connect to the robot via a CAN bus cable.

2. Serial Port

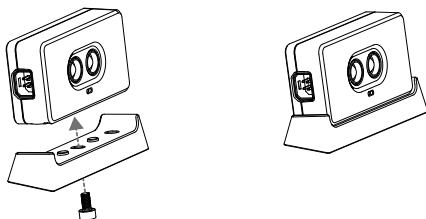
- a) The serial signal supports a level of 3.3 V.
- b) The input voltage is 5-12.6 V.

Mounting the Infrared Distance Sensor

The infrared distance sensor can be mounted on the chassis extension platform with the use of the TOF mounting bracket. If mounted on the front of the extension platform, the bracket must first be fixed to the straight connecting rod.

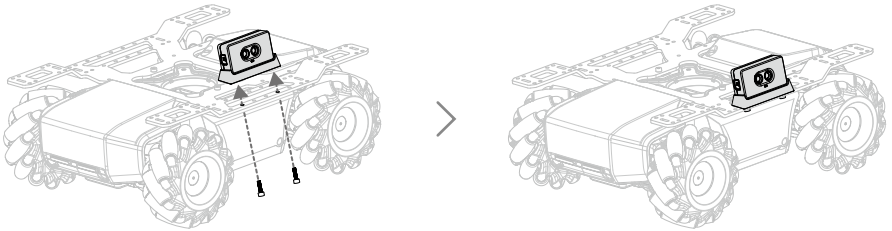
If the infrared distance sensor is required to be mounted on the rear of the robot, users must design their own parts and rearrange the position of the intelligent controller and infrared distance sensor without affecting the installation or connection of other parts.

1. To assemble a TOF module, use one M3-C screw to fix the infrared distance sensor to the TOF mounting bracket.



Left side:

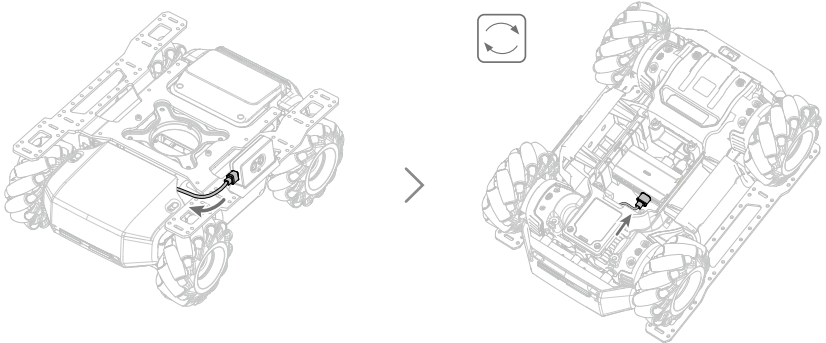
2. Use two M3-D screws to fix the TOF module to the left side of the extension platform, located above the chassis left armor.



3. As shown below, connect the TOF module with the power connector module with a 14cm data cable.

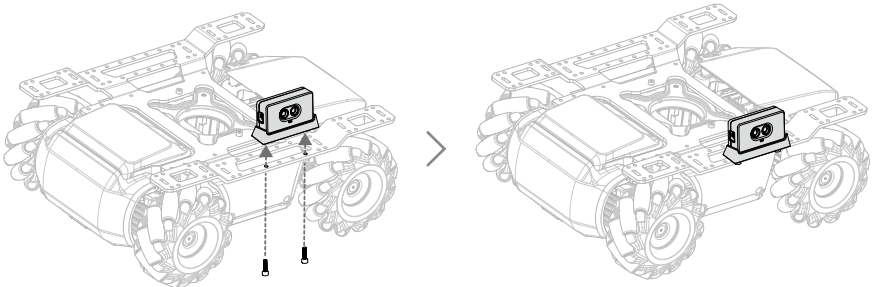


14 cm

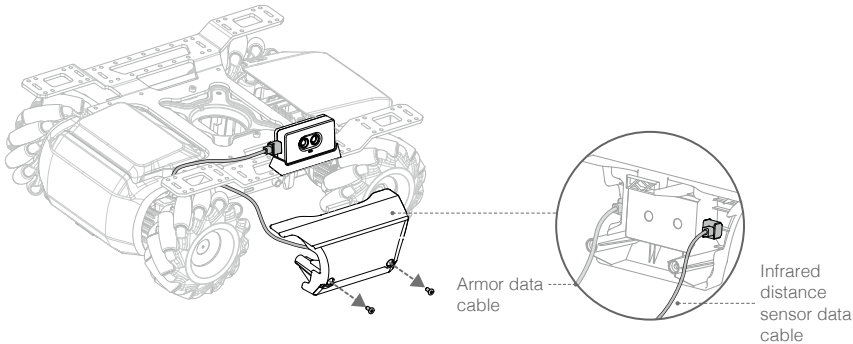
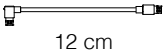


Right side:

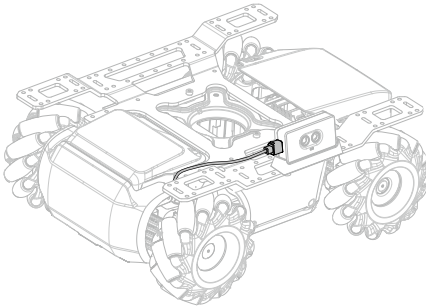
4. Use two M3-D screws to fix the TOF module to the right side of the extension platform, located above the chassis right armor.



5. After removing the screws of the right armor, connect the TOF module with the right armor with a 12cm data cable.

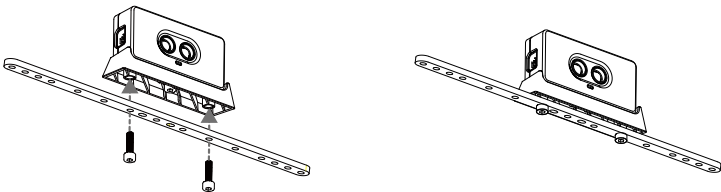


6. Arrange the data cable as shown below and remount the right armor.

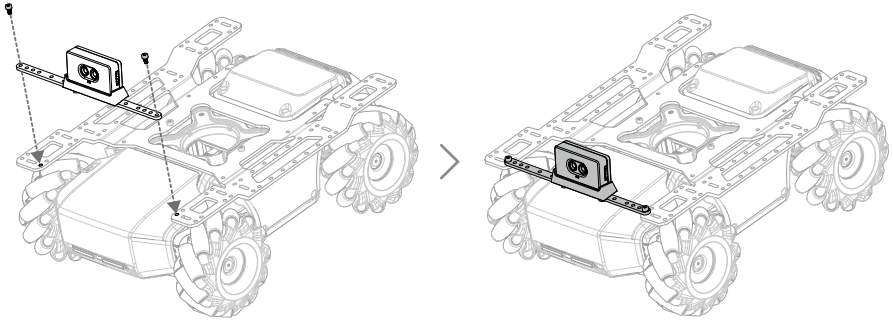


Front side:

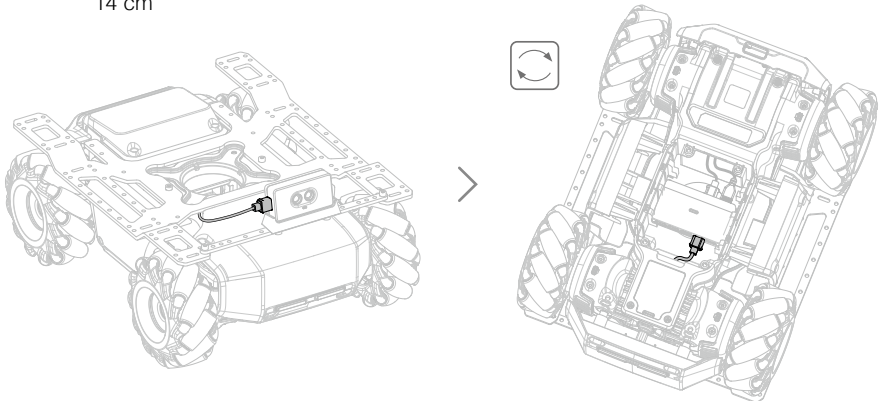
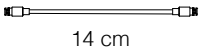
7. Use two M3-D screws to fix the TOF module to the straight connecting rod.



8. Use two M3-C screws to fix the straight connecting rod to the front of the extension platform.



9. As shown below, connect the TOF module with the power connector module with a 14cm data cable.



Serial Protocol Instruction

The infrared distance sensor supports CAN bus communication and plaintext serial protocol, enabling the sensor to be used on a third-party platform. Below shows the port configuration parameters:

Property	Parameter
Baud rate	115200
Data bits	8
Stop bit	1
Parity bit	/



Communicate with the infrared distance sensor by sending a plaintext string via the serial. Below shows the control commands that the infrared distance sensor supports:

Description	Control Command
Turn on the infrared distance sensor	"ir_distance_sensor measure on"
Turn off the infrared distance sensor	"ir_distance_sensor measure off"

After turning on the infrared distance sensor, the format of the returned data is shown below:
"ir distance: 100", 100 (unit: mm) is a sample of measurement data that is produced by the sensor.

LED Indicator Description for Infrared Distance Sensor

The LED indicator is used to indicate the status of the infrared distance sensor. Details are as follows:

LED Indicator	Infrared Distance Sensor Status
Solid cyan 	Working normally
Blinks cyan rapidly 	The infrared distance sensor is selected in the RoboMaster app

Using the Infrared Distance Sensor

The infrared distance sensor should not be interfered with or blocked and the lens should be clear and without stain when it is in use. It is not recommended to use the sensor in scenarios as shown below. Otherwise, the ranging precision may be reduced or the sensor may even be inoperable.

- a. When using the sensor on mirrors or transparent objects.
- b. When using the sensor on material of high absorbcency such as matte black.
- c. When using the sensor in rainy and foggy weather.
- d. When using the sensor on a strong reflector such as a traffic sign or reflective strip.
- e. When using the sensor in direct sunlight.
- f. When using the sensor on an obstacle that is small or low.

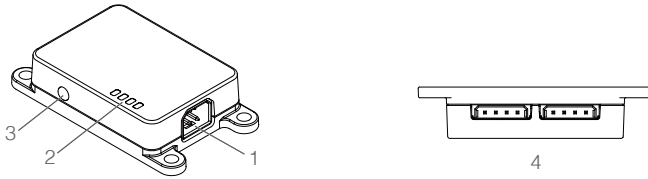


- When mounted on the chassis extension platform, the TOF module is tilted upwards by 10° and cannot detect the ground.

Sensor Adapter

Introduction

The robot is equipped with four sensor adapters, with IDs set to 1 by default. Each sensor adapter has two sensor ports and provides a power supply, making it convenient to connect and power third-party sensors that measure inputs such as temperature, pressure, and distance. Sensory data can even be used in Scratch, unlocking endless programming possibilities.



1. CAN Bus Port

Connect with CAN bus cable.

2. LED Indicator

Indicates the status of the sensor adapter.

3. Addressing Button

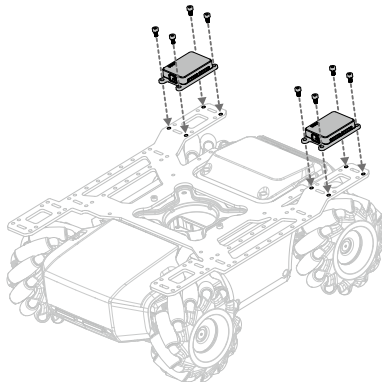
Set the ID of the sensor adapter.

4. Sensor Port

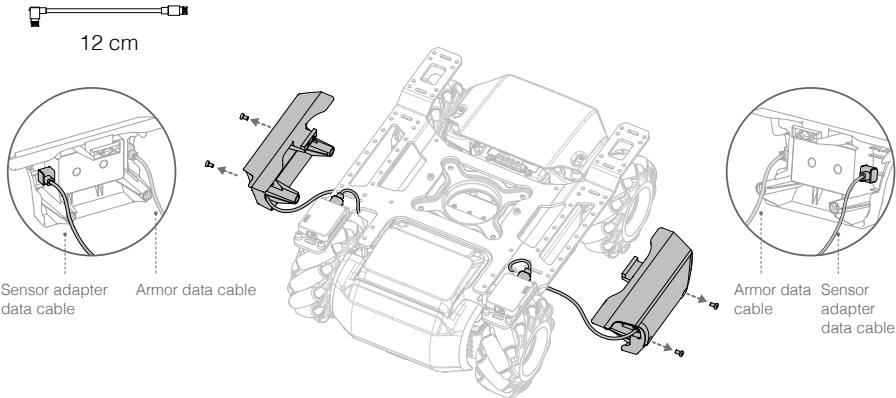
Supports the collection of switch and analog signals and has an input range of 0-3.3 V.

Mounting the Sensor Adapter

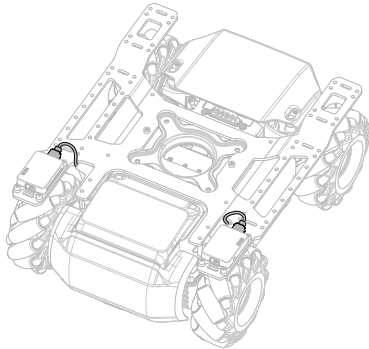
1. Use eight M3-C screws to fix two sensor adapters to the specific positions of the rear of the extension platform as shown below.



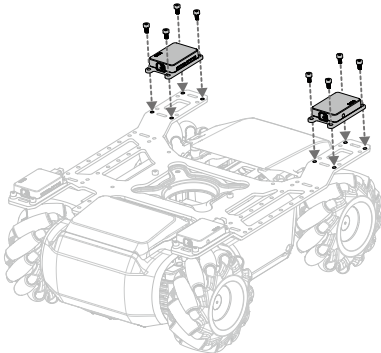
2. After removing the screws of the left armor and right armor, connect the respective sensor adapters with the armors using two 12cm data cables.



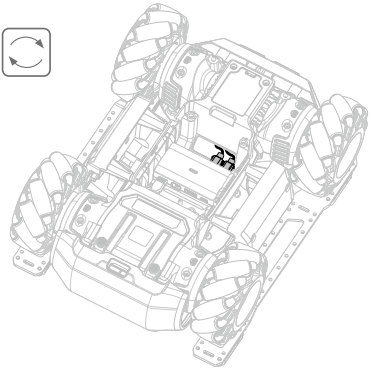
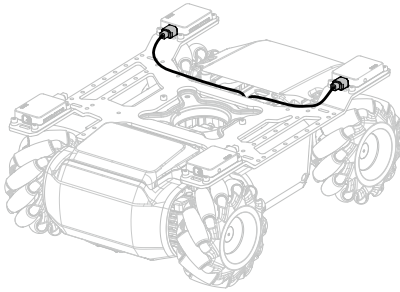
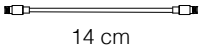
3. Arrange the data cables as shown below and remount the armor.



4. Use eight M3-C screws to fix two sensor adapters to the specific positions of the front side of the extension platform as shown below.





5. As shown below, connect the sensor adapter with the power connector module with two 14cm data cables.



LED Indicator for Sensor Adapter

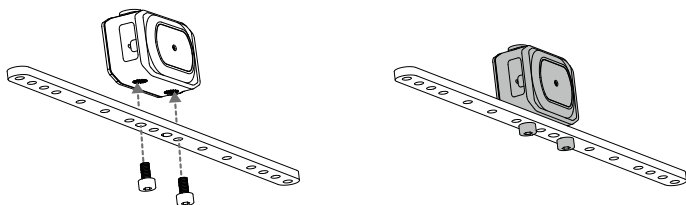
The LED indicator is used to indicate the status of the sensor adapter. Details are as follows:

LED Indicator		Sensor Adapter Status
Solid white	 —	Working normally
Blinks white rapidly		The sensor adapter is under addressing or selected in the RoboMaster app

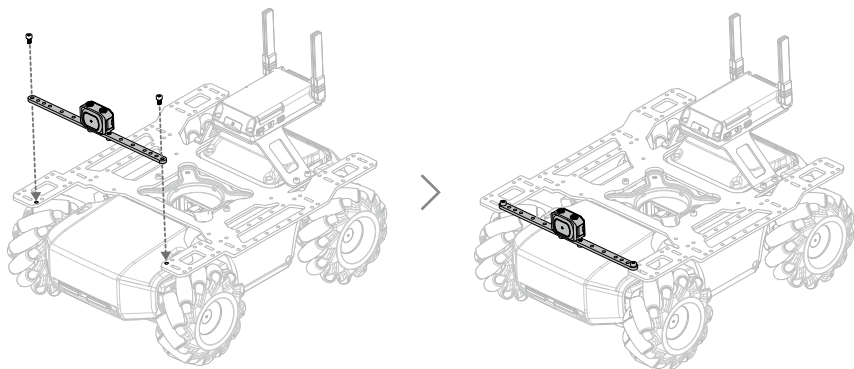
Straight Connecting Rod

The straight connecting rod can be fixed to the chassis extension platform so that an infrared distance sensor or camera can be installed. Below shows the installation procedure for the camera.

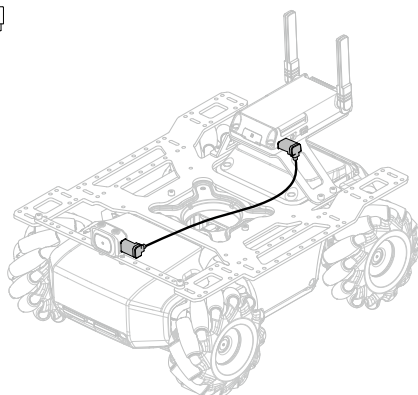
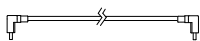
1. Use two M3-C screws to fix the camera to the specific position of the straight connecting rod as shown below.



2. Use two M3-C screws to fix the straight connecting rod to the front of the chassis as shown below.



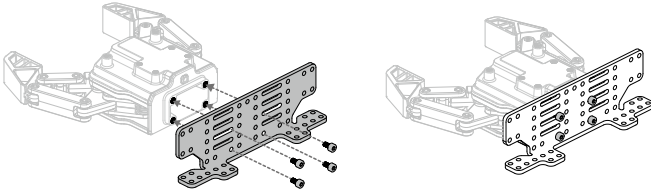
3. Connect the camera with the intelligent controller using a camera extension cable.



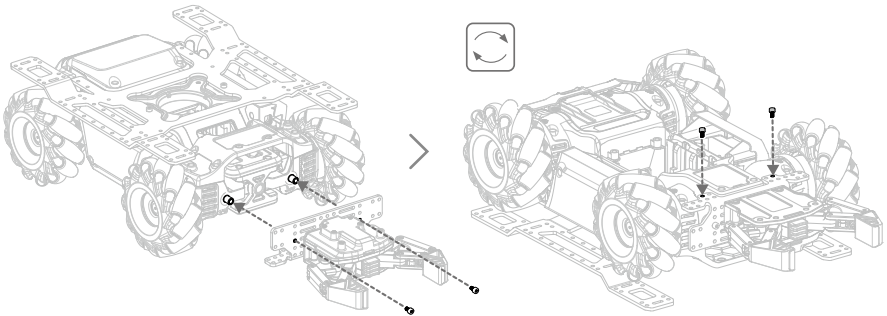
Front Axle Extension Platform

The front axle extension platform can be fixed to the front of the chassis so that a gripper or sensor can be installed. Below shows the installation procedure for the gripper.

1. Use four M3-C screws to fix the gripper to the specific position on the front axle extension platform as shown below.



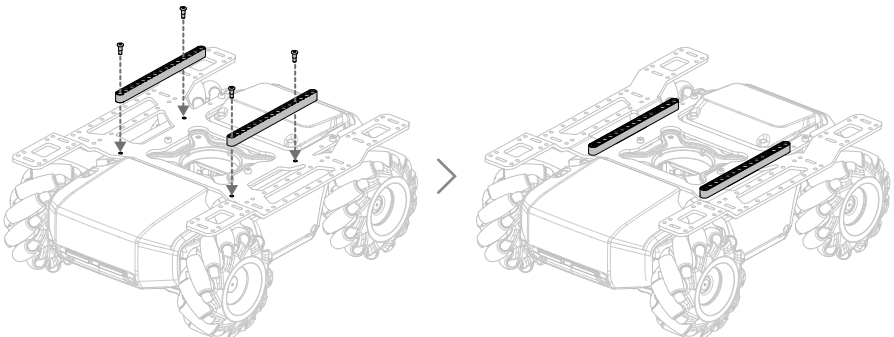
2. Use four M3-C screws to fix the front axle extension platform to the front of the chassis as shown below.



Extension Building Block

The robot is compatible with third-party building blocks. Below is an introduction on how to mount building rods to the robot.

As shown below, use four M3-B screws to fix the building rods to the chassis extension platform. More building blocks can then be added to the robot.



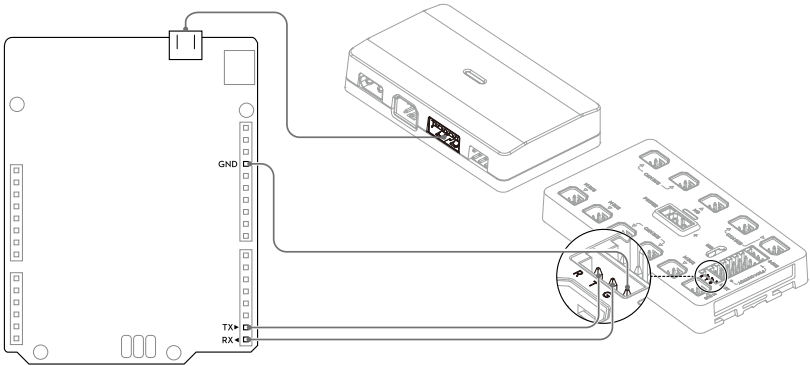
Robot and Third-Party Platforms

The robot is compatible with third-party platforms. Third-party platforms are powered by the power connector module and communicate with the robot using the SDK protocol. For more information, visit robomaster-dev.rtfid.io.

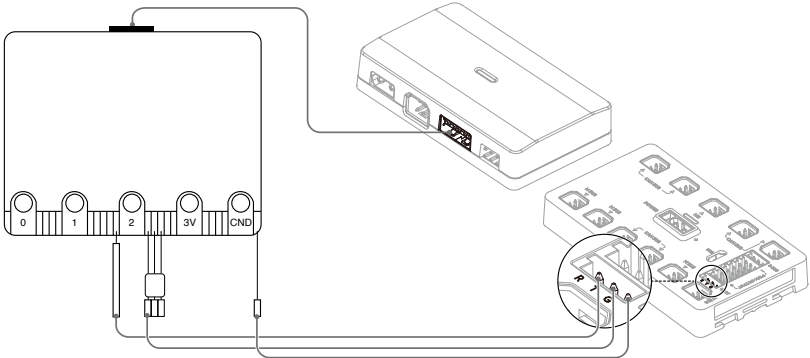
There are two ways to connect the robot with third-party platforms:

a) UART Connection

The third-party platform Arduino™ connects with the power connector module and communicates with the robot via the UART port of the motion controller as shown below:

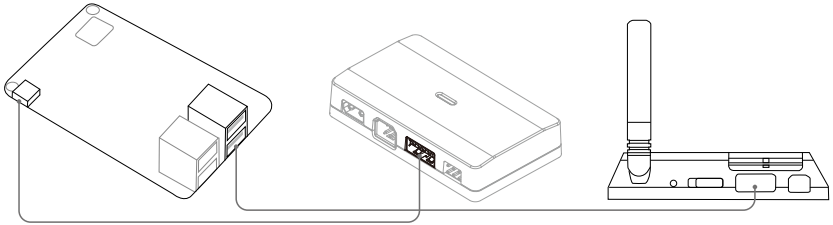


The third-party platform Micro:bit™ connects with the power connector module and communicates with the robot via the UART port of the motion controller as shown below:

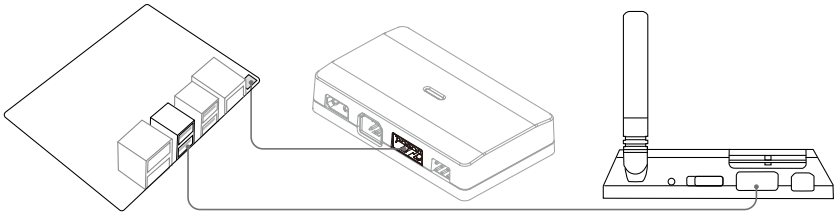



b) USB Connection

The third-party platform Raspberry Pi™ connects with the power connector module and communicates with the robot via the USB port of the intelligent controller as shown below:



The third-party platform Jetson Nano™ connects with the power connector module and communicates with the robot via the USB port of the intelligent controller as shown below:

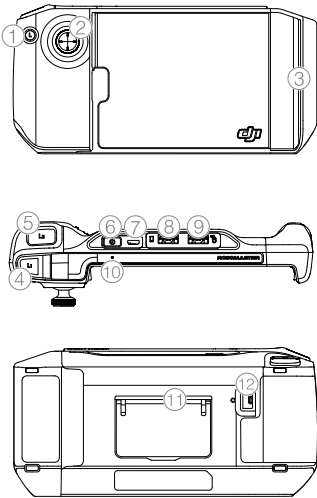


 This product is not authorized, sponsored, or otherwise approved by the above brands, and the connection between this product and the above brands should be taken as a reference only.

Gamepad (Not Included)

Introduction

By connecting to a mobile device running the RoboMaster app, users can control the robot and perform multiple tasks with the gamepad and app. Additionally, a mouse can be connected to the gamepad for more precision control of the robot.

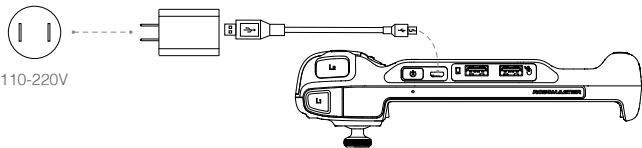


- 1. Custom Skills Button
- 2. Control Stick
- 3. Mobile Device Clamp
- 4. Cooldown Button
- 5. Launch Button
- 6. Power Button
- 7. Charging Port (Micro USB)
- 8. Mobile Device Port (USB)
- 9. Mouse Port (USB)
- 10. Status LED
- 11. Gamepad Stand
- 12. Mystery Bonus Button

⚠ Note that there are two USB ports available on the gamepad. The mobile device port cannot be used as the mouse port, and vice versa.

Charging the Gamepad

It is recommended to fully charge the gamepad before using for the first time.



It takes approximately two hours to fully charge a gamepad. The USB charger is not included in the package.

Firmware Update

The firmware of the gamepad can be updated using the RoboMaster app. When there is a firmware update available, the RoboMaster app will send a prompt after the gamepad is connected. Follow the prompts to update the firmware.



Make sure the mobile device is connected to the internet when downloading the firmware.

Status LED Description

The status LED indicates the working status and current battery level of the gamepad.

Status LED	Description
Blinks green slowly	The gamepad is charging
Blinks red quickly	The gamepad's battery level is 0%
Solid red	The gamepad's battery level is between 1% to 29%
Solid yellow	The gamepad's battery level is between 30% to 69%
Solid green	The gamepad's battery level is between 70% to 100%
Solid blue	The gamepad is initializing

Specifications

Model	GD0MA
Built-in Battery Type	3.6 V, 2600 mAh, 1S1P
Working Hours*	Approx. 2 hours
USB Port	500 mA / 5 V
Operation Temperature Range	-10° to 45° C (14° to 113° F)
Charging Temperature Range	0° to 45° C (32° to 113° F)
Charging Hours*	Approx. 2 hours

* The working hours were tested using an Android device, and the charging hours were tested using a 10 W USB charger at a temperature of 25° C (77° F). Both the working hours and the charging hours were tested in a lab environment, and should be taken as a reference only.

Operating Your Robot

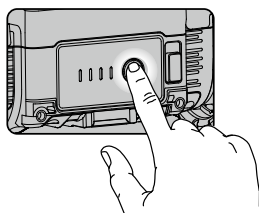
Checking Before Use

Check the following each time you use the robot:

1. Make sure the motion controller is properly installed, all cables are connected, and the screws on the chassis rear cover are tightened.
2. Make sure the intelligent controller, camera, and speaker are connected.
3. Make sure the microSD card is inserted.
4. Make sure the intelligent battery is fully charged and properly inserted.
5. For optimal Wi-Fi connection, set the intelligent controller antennas at 90°.

Powering on the Battery

Press and hold the power button for more than two seconds to power on or off.



Operating the Robot Using a Mobile Device

Connecting to the App

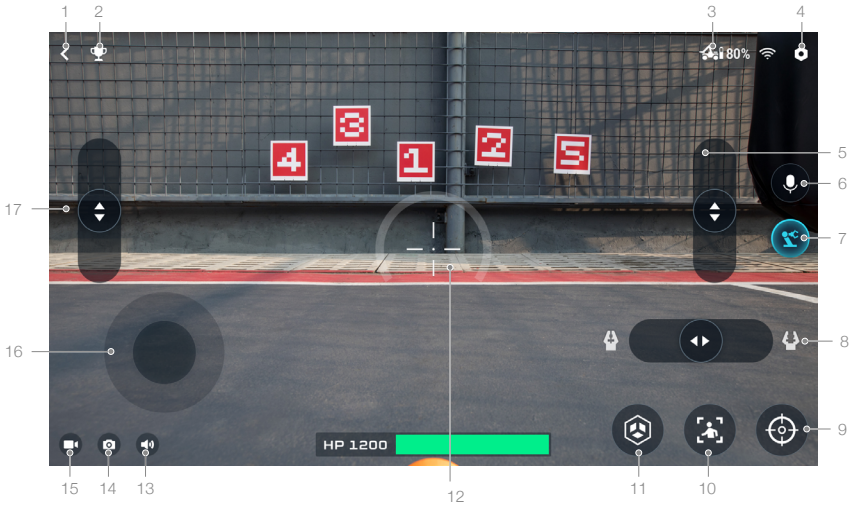
The robot must be connected to the RoboMaster app in order to use.

Selecting a Location

It is recommended to use the robot on flat surfaces such as wooden floors and carpets. Uneven surfaces such as sand or rocks may damage the wheels or motors.

Using Solo Mode

Enter Solo mode to see the page below.



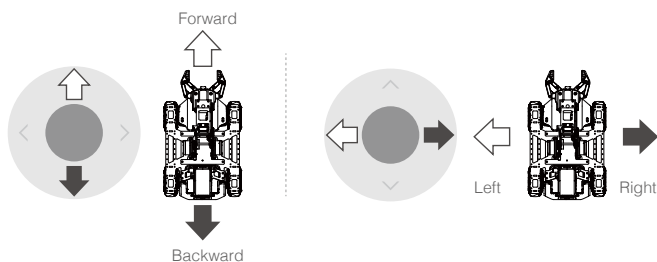
1. Back button: Tap to return to the home page.
2. Solo mode games button: Tap to enter Target Practice or Target Race.
3. Connection status button: Tap to see how to connect the Robot and the app.
4. Settings button: Tap to enter the Settings page.
5. Robotic arm control slider: Tap to lift or lower the robotic arm.
6. Intercom button: Tap to record and play an audio.
7. Robotic arm button: Tap to switch the FPV interface.
8. Gripper control slider: Tap to control the grip distance of gripper.
9. Zoom button: Tap to zoom in or out 4x.
10. Follow mode: Tap to enter Follow mode. Note: EP Core does not support this function.
 Note that the Follow mode will be affected in the following situations:
 - a. The person being followed is partly or completely obstructed.
 - b. The person being followed suddenly changes their movement dramatically.
 - c. The environment suddenly changes from light to dark, or vice versa.
 - d. The color or pattern of the person being followed is similar to the environment.
11. Custom skills button: Tap to perform preprogrammed custom skills.
12. Sight: Used to aim at targets.
13. Mute button: Tap to mute or unmute the sound on the mobile device.
14. Shutter button: Tap to capture a photo.
15. Record button: Tap to record a video.
16. Chassis control button: Tap to move the chassis.
17. Robotic arm control slider: Tap to fold or unfold the robotic arm.

Operating the Robot

The camera view is mainly used to control the chassis, robotic arm, gripper of the robot.

Controlling the Chassis

Tap the chassis control button to move the robot forward, backward, or sideward.



Controlling the Robotic Arm

Tap the robotic arm button to switch to the robot FPV interface. The robotic arm control sliders can be used to lift or lower and fold or unfold the robotic arm.

Controlling the Gripper

Tap the robotic arm button to switch to the robot FPV interface. Use the gripper control slider on the bottom right to control the grip distance of the gripper.

Gameplay

Operating the Robot Using a Gamepad

Introduction

Users can connect the Gamepad to a mobile device to control the robot in the following ways:

- 1. Using the gamepad connected to a mobile device.
- 2. Using the gamepad connected to a mobile device with a mouse attached.
- 3. Using the gamepad connected to a mobile device with a mouse and keyboard attached.

Connecting the Gamepad

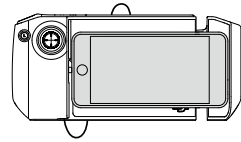




- Connect the mobile device to the mobile device port on the gamepad using a micro USB cable (not included).
- Adjust the mobile device clamp to secure it to the gamepad. Make sure the mobile device is connected with the cable facing toward the control stick as shown in the figure below.
- Press the power button to power on the gamepad. Press and hold the power button to power off the gamepad.

Gamepad Basic Operation

- When the gamepad is connected to a mobile device, the control stick on the gamepad is used to move the robot forward, backward, and sideward. The app cannot be used to control the chassis.
- The buttons on the gamepad can be used to perform actions on the robot. Users can also continue use the app to perform these actions.

Using the Gamepad

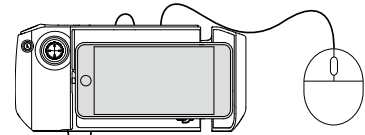
The control stick on the gamepad is used to control the chassis. The app is used to perform other actions. When the gamepad is connected, it is not possible to move the chassis using the app.

	Control Stick Movement 	Robot Movement Forward  Backward	Control Stick Movement 	Robot Movement  Left Right
-----------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------

The control stick on the gamepad is used to move the robot forward, backward, and sideward.

Using the Gamepad and Mouse

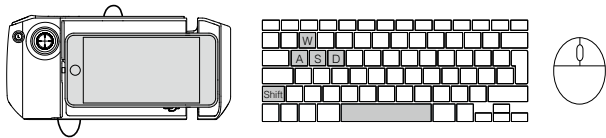
After the gamepad is connected to a mobile device, a computer mouse can also be connected to the gamepad. The control stick on the gamepad is used to control the chassis. The mouse actions are listed below, which can also be performed by the app, but the mouse is the primary controller.

	<table><tr><th>Mouse Action</th><th>Robot Action</th></tr><tr><td>Right click</td><td>Zooms in</td></tr><tr><td>Move mouse</td><td>Controls the chassis</td></tr></table>	Mouse Action	Robot Action	Right click	Zooms in	Move mouse	Controls the chassis
Mouse Action	Robot Action						
Right click	Zooms in						
Move mouse	Controls the chassis						

Using the Gamepad, Mouse, and Keyboard

A wireless mouse and keyboard is required. After the gamepad is connected to a mobile device, attach the wireless connector of mouse and keyboard to the gamepad. The control stick on the gamepad and the keyboard is used to control the chassis. The mouse actions are listed below, which can also be performed by the app, but the mouse is the primary controller.

The A, W, S, and D keys are used to control the chassis. The actions that can be performed with the mouse are listed below.



Keyboard Keys	Robot Action
W	Forward
A	Left
S	Backward
D	Right
Shift / Space	Accelerate

Mouse Action	Robot Action
Right click	Zooms in
Move mouse	Controls the chassis

⚠ Most Logitech and Rapoo keyboard and mouse devices are supported. It is recommended to use the following models:
Rapoo: 8200P, 9300P, 1800, 8100M
Logitech: M310t, MK850

Using a Computer and RoboMaster

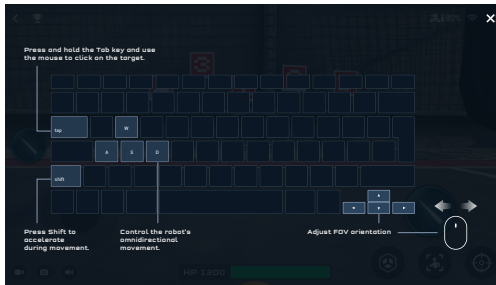
Install the Windows or Mac version of the RoboMaster app to a computer and control the robot directly via a mouse and keyboard.

Installing the Windows or Mac Version of RoboMaster

- Users can download the RoboMaster app for Windows or Mac from the official DJI website on a computer to control the robot with a keyboard and mouse.
Windows: https://www.dji.com/robomaster_app
Mac: https://www.dji.com/robomaster_app
- Run installation and follow the prompts to complete the RoboMaster app installation.
- Run the RoboMaster app to enter the homepage. The Windows or Mac version of the RoboMaster app is similar to the version for iOS and Android.

Using a Mouse and Keyboard to Control the Robot

When using RoboMaster for Windows or Mac, the robot is controlled with a mouse and keyboard. The corresponding actions are shown below.



Press and hold the space bar on the keyboard and use the A, W, S, and D keys to control the robotic arm and gripper.

Lab

The RoboMaster app Lab offers hundreds of programming blocks that allow you to access features such as PID control. The RoboMaster EP Core Programming Manual provides instructions and examples to help users quickly learn programming techniques for controlling the robot.

Users can study project-based courses in Road to Mastery to enhance their understanding of programming languages, from robotics applications to AI technology, with different projects for both beginners and experts.

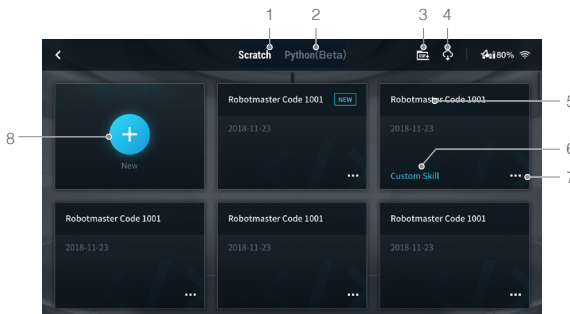
Scratch Programming

In Lab, go to the Scratch page and then DIY Programming to write programs.

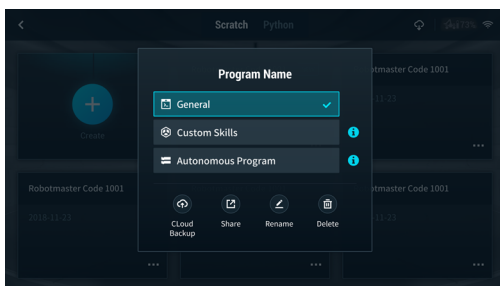
New Scratch programming blocks have been added to the Lab section of the RoboMaster app, which are designed to help users obtain and utilize sensory data. With these blocks, users can quickly access and control the sensor adapter, robotic arm, gripper, infrared distance sensor, and third-party open-source hardware.


In the Scratch page, users can write their own Python programs, which can be set as Autonomous Programs or Custom Skills and run on the robot.

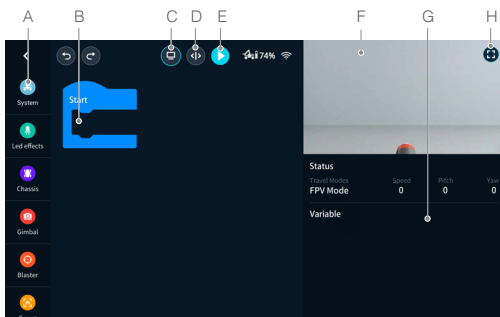
Refer to the RoboMaster EP Core Programming Manual for more information.



1. Scratch page: Tap to view Scratch programs.
2. Python page: Tap to view Python programs.
3. Import DSP file: This function is available on Android, Windows, and Mac devices. DSP files can be imported to iOS devices by using AirDrop.
4. Cloud space: Tap to view programs in the cloud space.
5. Program name: Displays the name of the program.
6. If the program is set as a general program, the program type is not displayed. The program type is only displayed if it is set as a custom skill or autonomous program.
7. Program settings: Tap to select the program type, set the program as a custom skill, set the program as an autonomous program, backup on the cloud space, share with other users, and rename or delete the program.



8. Tap  to create a new program.
 - A. Programming modules button: Tap the corresponding icon to program System, LED Effects, Chassis, Smart, Armor, Mobile Device, Media, Commands, Operators, and Data Objects.
 - B. Programming window button: Drag programming blocks into the window to create a program.
 - C. Display button: Tap to turn the FPV on or off.
 - D. Switch button: Tap to switch to view the programming block as Python code.
 - E. Run button: Tap to run the program.
 - F. FPV window: See the current FPV.
 - G. Status information: View the current status information of the robot.
 - H. FPV button: Tap to enter the FPV in full screen.



 EP Core cannot run programs related to the blaster or gimbal. It is recommended to connect the blaster or gimbal first.

AI Modules

There are six AI modules that can be programmed by entering Lab then DIY Programming then Scratch. Refer to the Smart section of the RoboMaster EP Core Programming Manual for more programming examples.

Note that the AI module will be affected in the following situations:

- The object is partly or completely obstructed.
- The environment is dark (less than 300 lux) or bright (greater than 10,000 lux).
- The environment suddenly changes from light to dark, or vice versa.
- The color or pattern of the object is similar to the environment.

Person Recognition

The robot is able to identify and track any individual selected in the FOV of the robot.

Line Recognition

When in Target Race, the user can program the robot to automatically follow a line on the ground. Line Recognition supports red, green, and blue lines. The robot cannot recognize lines of other colors.

Gesture Recognition

The user can program the robot to perform unique responses when identifying physical gestures.

Clapping Recognition

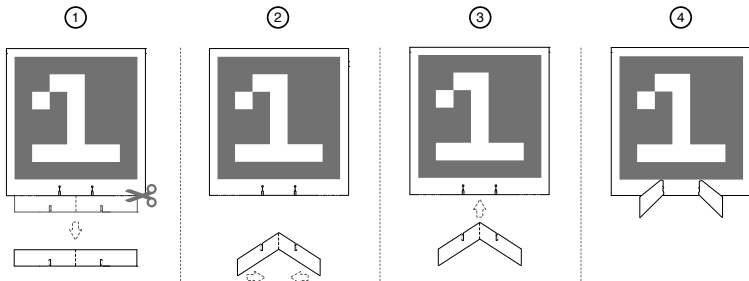
The user can program the robot to perform unique actions in response to clapping. Only claps within an effective distance of 2 meters can be identified. Identified clapping sequences include two consecutive claps and three consecutive claps.

Robot Recognition


The user can program the robot to perform unique responses when other robots are recognized.


Vision Marker Recognition

The user can program the robot to perform unique responses when identifying vision markers, which include numbers, letters, and special characters. Vision markers must be within an effective distance of three meters and only official vision markers can be identified. Refer to the instructions on the packaging of the vision markers for more information.



DO NOT block the color areas like red and blue. Otherwise, recognition will be affected.

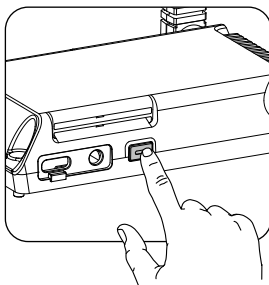
If you need to use more vision markers, tap  in the app to enter the guide page. Select the vision markers you wish to download and print.

 Vision Marker Recognition only supports red and blue markers. The robot cannot recognize vision markers of other colors.

Autonomous Program

A program can be set as an autonomous program and can be run independently on the robot.

1. If the robot is not connected to the app, the program can be launched by pressing the autonomous program button on the intelligent controller. Press the button again to stop the program.




2. If the robot is connected to the app, the autonomous program can only be launched in the following locations:

- (1) App homepage
- (2) Lab

The autonomous program cannot be launched in the following scenario:

- (1) When the Settings page opens

Custom Skills

A program can be set as a custom skill, which can be used in the FPV in both Solo and Battle mode. Tap  in the FPV to use a custom skill.

Python Programming

In Lab, go to the Python page then DIY Programming to write programs.

In the Python page, users can write their own Python program, which can be set as an Autonomous Program or a Custom Skill and run on the robot.

Users can also convert Scratch programs into Python code and use the source code display to help get started with programming with Python. Refer to the RoboMaster EP Core Programming Manual for more information.

With the addition of a multi-machine communication port, Python programming allows multiple robots to communicate and interact with each other in real time. The robot supports customizable UI. Users can code virtual widgets with Python to design their own user interfaces and more.

Appendix

Specifications			
RoboMaster EP Core			
Dimensions (L×W×H)	390×245×330 mm		
Weight	Approx. 3.3 kg		
Chassis Speed Range	0.8 m/s		
Max Chassis Rotational Speed	600°/s		
M3508I Brushless Motor			
Max Rotational Speed	1000 rpm		
Max Torque	0.25 N·m		
Max Output Power	19 W		
Operating Temperature Range	-10 to 40 °C (14 to 104 °F)		
Driver	Field-oriented control (FOC)		
Control Method	Closed-loop speed control		
Protection	Overvoltage protection		
	Overheating protection		
	Soft-starter		
	Short-circuit protection		
	Chip and sensor anomaly detection		
Intelligent Controller			
Latency ^[1]	Connection via Wi-Fi: 80-100 ms Connection via Router: 100-120 ms (unobstructed, free of interference)		
Live View Quality	720p/30fps		
Max Live View Bitrate	6 Mbps		
Operating Frequency ^[2]	2.4 GHz, 5.1 GHz, 5.8 GHz		
Transmission Power (EIRP)	2.400-2.4835 GHz	5.150-5.250 GHz	5.725-5.850 GHz
	FCC: ≤30 dBm	FCC: ≤30 dBm	FCC: ≤30 dBm
	SRRC: ≤20 dBm	SRRC: ≤23 dBm	SRRC: ≤30 dBm
	CE: ≤19 dBm	CE: ≤20 dBm	CE: ≤14 dBm
	MIC: ≤20 dBm	MIC: ≤23 dBm	
Operating Mode	Connection via Wi-Fi, Connection via Router		
Max Transmission Distance ^[3]	Connection via Wi-Fi:		
	FCC, 2.4 GHz 140 m, 5.8 GHz 90 m		
	CE, 2.4 GHz 130 m, 5.8 GHz 70 m		
	SRRC, 2.4 GHz 130 m, 5.8 GHz 130 m		
	MIC, 2.4 GHz 130 m		
	Connection via Router:		
	FCC, 2.4 GHz 190 m, 5.8 GHz 300 m		
	CE, 2.4 GHz 180 m, 5.1 GHz 70 m		
Transmission Standard	SRRC, 2.4 GHz 180 m, 5.8 GHz 300m		
	MIC, 2.4 GHz 180 m		
	IEEE802.11a/b/g/n		

Camera	
Sensor	CMOS 1/4"; Effective pixels: 5MP
FOV	120°
Max Still Photo Resolution	2560×1440 pixels
Max Video Resolution	FHD: 1080p/30fps HD: 720p/30fps
Max Video Bitrate	16 Mbps
Photo Format	JPEG
Video Format	MP4
Supported SD Cards	Supports microSD cards with a capacity of up to 64 GB
Operating Temperature Range	-10 to 40 °C (14 to 104 °F)
Intelligent Battery	
Capacity	2400 mAh
Maximum Charging Voltage	12.6 V
Nominal Charging Voltage	10.8 V
Battery Type	LiPo 3S
Energy	25.92 Wh
Battery Life (in use)	85 mins (measured at a constant speed of 0.8 m/s on a flat surface)
Battery Life (on standby)	Approx. 100 mins ^[5]
Weight	169 g
Operating Temperature Range	-10 to 40 °C (14 to 104 °F)
Charging Temperature Range	5 to 40 °C (41 to 104 °F)
Maximum Charging Power	29 W
Charger	
Input	100-240 V, 50-60 Hz, 1 A
Output	Port: 12.6 V=0.8 A or 12.6 V=2.2 A
Voltage	12.6 V
Rated Voltage	28 W
App	
iOS	iOS 10.0.2 or later
Android	Android 5.0 or later
Others	
Recommended Routers	TP-Link TL-WDR8600; TP-Link TL-WDR5640 (China) TP-Link Archer C7; NETGEAR X6S (International)
Recommended outdoor power supply solution for routers	Portable laptop charger (with the same input power of the router)

Robotic Arm	
Movement Range	0-0.22 m (horizontal); 0-0.15 m (vertical)
Axis Number	2
Gripper	
Grip Distance	Approx. 10 cm
Servo	
Weight	Approx. 70 g
Main Body Dimensions (L×W×H)	44.2×22.6×28.6 mm
Transmission Ratio	512
Rated Torque	1.2 N*m
Rated Rotational Speed	40±2 rpm
Operating Mode	Angle mode, rate mode
Infrared Distance Sensor	
Detection Range	0.1-10 m
Detection FOV	20°
Measurement Accuracy	5% ^[6]
Power Connector Module	
Communication Port	CAN bus × 5
Input	TX30 port: 12 V
Output	USB Type-C port: 5 V, 2 A Pin header port: 5 V, 4 A TX30 port: 12 V, 5 A
Sensor Adapter	
Port Type	IO input, AD output
Port Number	2

[1] Measured in an interference-free and unobstructed environment with a distance of approximately one meter between the mobile device, the router, and the robot. The iOS device used was an iPhone X. The results of testing with different Android device may be different.

[2] Outdoor use of the 5.1 GHz and 5.8 GHz frequency bands is prohibited in some areas. Follow all local laws and regulations in your country or region.

[3] Measured in an interference-free and unobstructed environment.

For Connection via Wi-Fi, the mobile device used for testing was a sixth-generation iPad (released in 2018). For Connection via Router, several router models were used for testing. FCC: TP-Link Archer C9; SRRC: TP-Link WDR8600; CE: TP-Link Archer C7; MIC: WSR-1160DHP3.

[4] Use of the infrared units will be affected in outdoor or infrared-intensive environment.

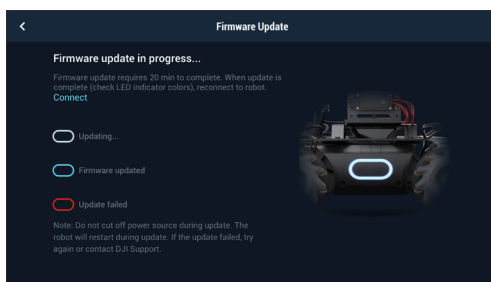
[5] Tested in a lab environment using a new intelligent battery, and should be taken as a reference only.

[6] Applied to an object surface whose reflectivity ranges from 10-90%.

Firmware Update

Check the robot firmware version in Settings, then System, and then Firmware Update. If there is a new firmware version, use the RoboMaster app to update the firmware of the robot.

1. Make sure that all parts are connected, power on the robot, and check to make sure the battery level is above 50%.
2. Tap App, then System, and then Firmware Update. Follow the onscreen instructions to update the firmware. Make sure the mobile device is connected to the internet when downloading the firmware.
3. The robot tracks the progress of the update using audio prompts. Wait until the update is complete.



- ⚠ • The battery firmware is included in the robot firmware. Make sure to update the firmware of all batteries if you have several.
- Only start a firmware update if the battery level is above 50%.
- Note that while updating the firmware, the status indicators may blink abnormally, and the robot may reboot.
- The robot and app may disconnect after updating. If this occurs, reconnect them.
- If you receive a prompt that newer firmware version is out of date, update and try again.
- When in Battle mode, make sure that all the robots are using the same firmware version.

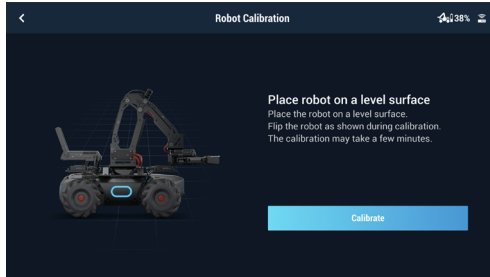
Calibrating the Robot

If any of the following scenarios occur, recalibrate the robot in the RoboMaster app:

- The robot moves involuntarily while rotating.
- The chassis cannot be controlled when warning prompts appear in the app.
- The motion controller has been installed or reinstalled.

The specific calibration steps are as below:

- Open the RoboMaster app, tap on Settings, then System, and select Calibration.
- Follow the steps in the app to calibrate.

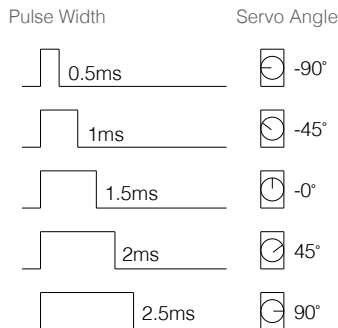


Setting the PWM Ports

PWM (pulse width modulation) controls the duration of a high level of output during a certain period, and is broadly used to control LEDs, navigation gears, and more. The PWM port has a default duty cycle of 7.5% and a fundamental frequency of 50 Hz.

For LEDs, the PWM output rate ranges from 0% to 100%, with 0% corresponding to an LED's lowest brightness and 100% to its highest brightness. For navigation gears, the PWM output rate ranges from 2.5% to 12.5%.

You can set the navigation gear PWM output percentage based on the rotation angles you wish to control.



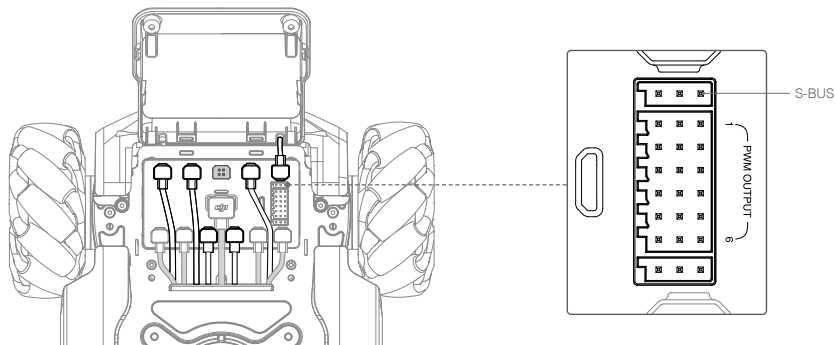
Each time the custom program or Python program finishes running, the PWM port output signal will be set to its default setting, which is 50 Hz and the duty cycle is 7.5%.

Using the S-Bus Port

A remote controller that supports the S-Bus protocol can be used to control the robot by connecting to the S-Bus port of the motion controller. Users must prepare their own receiver and remote controller. It is recommended to use a Futaba R6303SB receiver.

Connection

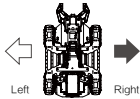

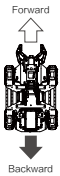

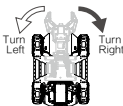
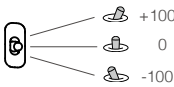

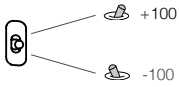
Connect the S-Bus port of the motion controller to the S-Bus port of the receiver by using the 3-pin servo cable.



Usage

Make sure the remote controller has been linked with the receiver before use. Refer to the manual documents of the receiver for more information on linking methods.

The correspondence of control channels of the S-Bus port of the motion controller are shown below. Refer to the manual documents of the remote controller to complete the channel mapping between the receiver and remote controller.

S-Bus Port Control Channels	Free Mode	Recommended Remote Controller Channel		
		Remote Controller Channel	Offset	Status
Channel 1	Move the chassis sideward	Control Stick Channel		
Channel 2	Move the chassis forward and backward			
Channel 4	Control the yaw of the chassis			
Channel 5	Control the movement speed of the chassis and there are three optional speeds: Fast Medium Slow	3-Position Switch Channel 		Fast
				Medium
				Slow
Channel 6	Free mode	Switch Channel 		Free mode
Channel 7	Control the release of the chassis and there are two statuses: Chassis is set when it produces output torque Chassis is released when it not producing output torque	2-Position Switch Channel 		Set
				Release

Programming Customizable UI

The customizable UI system expands the input and output modes of a program. Users can create UI widgets that are used to represent the input and output processing information of a program.

To code a Python program, call the related interfaces to generate a UI widget and bind the UI widget with an event callback. After coding and debugging in the Lab section of the RoboMaster app, users can save a program as a customizable skill and use it in Solo or Battle mode. For more information, visit www.dji.com/robomaster-ep-core/downloads or robomaster-dev.rtfd.io.

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