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# mBot Ranger

## 3-in-1 Educational Robot Kit



Makeblock Co., Ltd.  
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[www.makeblock.com](http://www.makeblock.com)



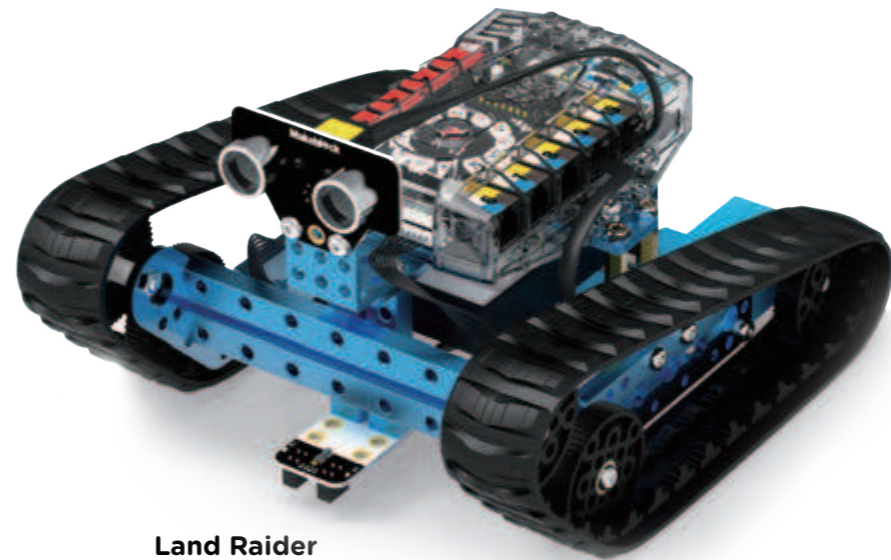
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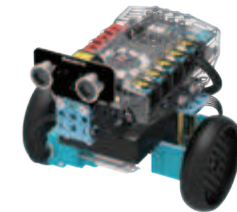
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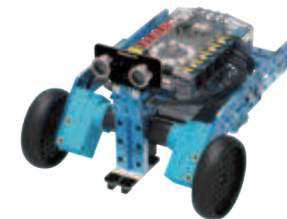
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Land Raider



Nervous Bird



Dashing Raptor

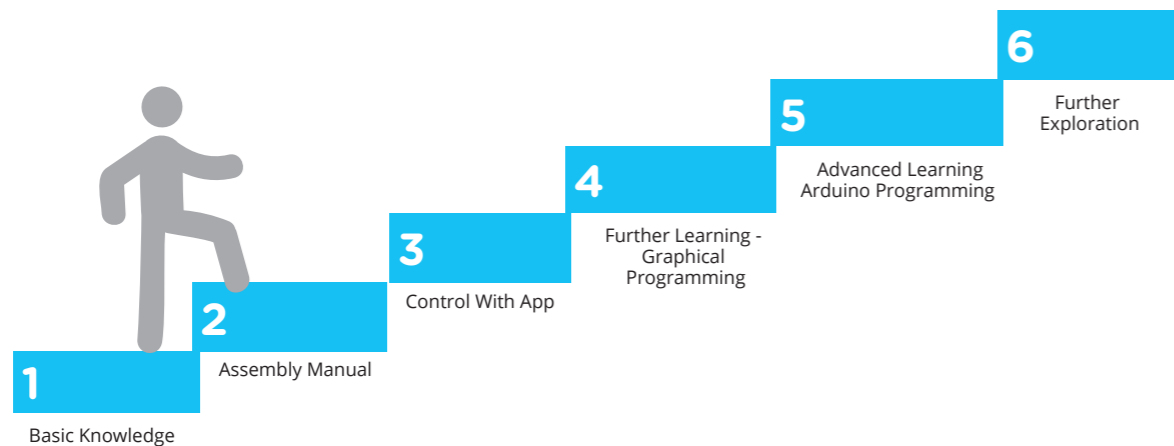
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## Quick Guide

WARNING:CHOKING HAZARD - Small parts. Children should be accompanied by adults.

mBot Ranger is a three-in-one STEM educational robot kit which supports three building forms: a robot tank, a three-wheeled racing car, and a self-balance car. Program and control mBot Ranger via smartphone, tablets, or computer to start your exploration in the world of robotics.



## Parts List

2 x Beam0824-112



1 x Beam0824-48



2 x Plate 0324-88



2 x Plate 135°



1 x Plate for Battery Holder



1 x Plate T-type



1 x Bracket 3x3



1 x Bracket U1



1 x Mini Caster Wheel



4 x 62T Wheel Without Step



2 x 62T Wheel



2 x 90T Wheel



2 x 90T Tyre



2 x Track



4 x Plastic Spacer 4x7x10mm



2 x 180 Encoder Motor



8 x Copper Bush 4x8x4mm



4 x Brass Stud M4\*30+6



1 x Battery Holder



1 x Me Auriga



1 x Ultrasonic Sensor



1 x Line Follower Sensor



1 x USB Cable



2 x RJ25 Cable-20cm



1 x Wrench



1 x Hex & Cross Screwdriver



22 x Screw M4\*8mm



4 x Screw M4\*10mm



6 x Screw M4\*14mm



4 x Screw M4\*25mm



2 x Screw M2.5\*12mm



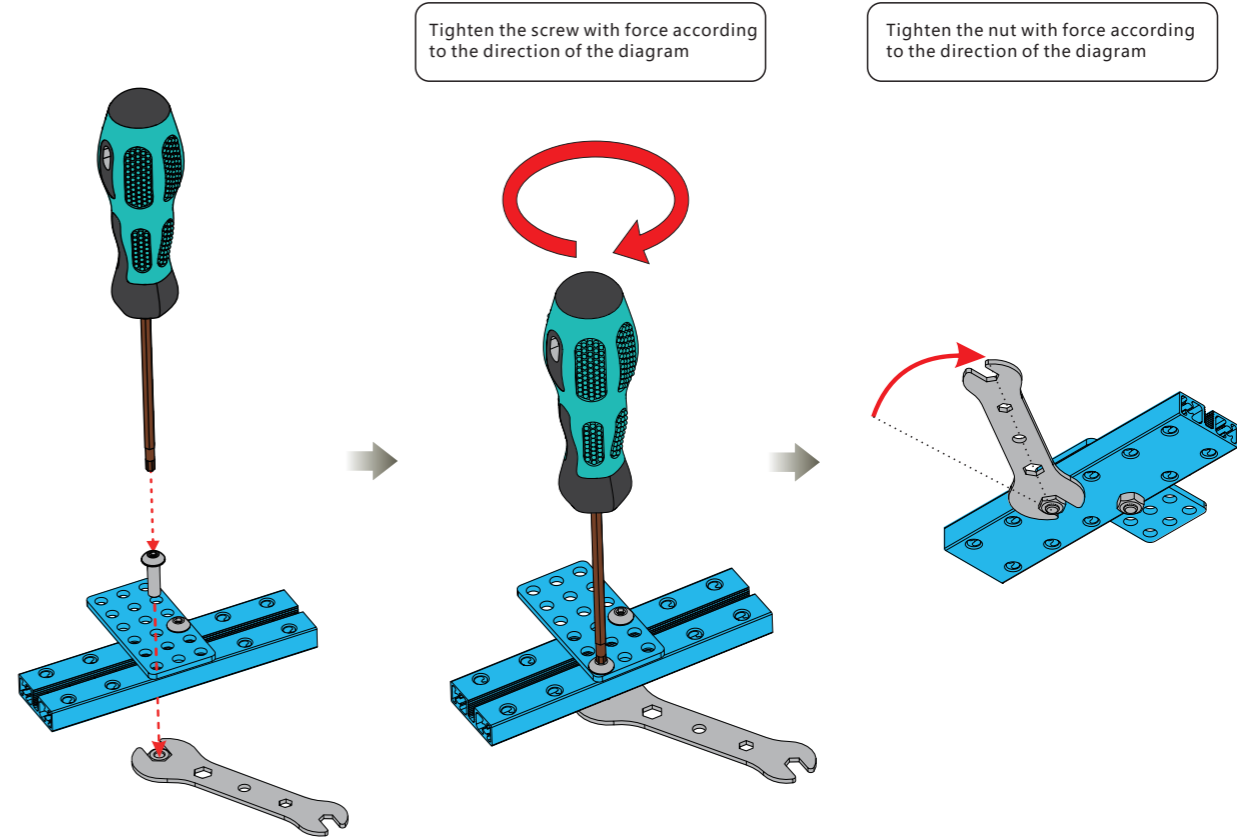
10 x Nut M4



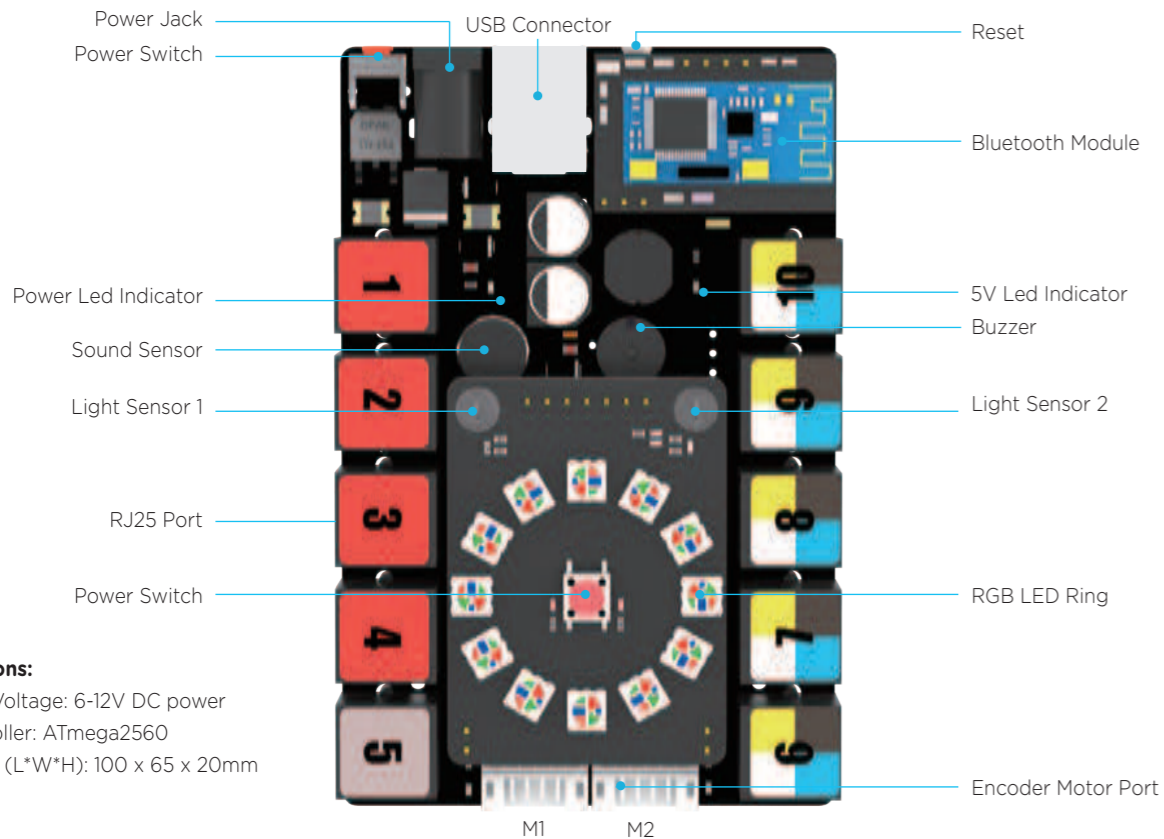
2 x Encoder Motor Wire



# Introduction to Tools



# Me Auriga



**Specifications:**

Operating Voltage: 6-12V DC power  
 Microcontroller: ATmega2560  
 Dimensions (L\*W\*H): 100 x 65 x 20mm



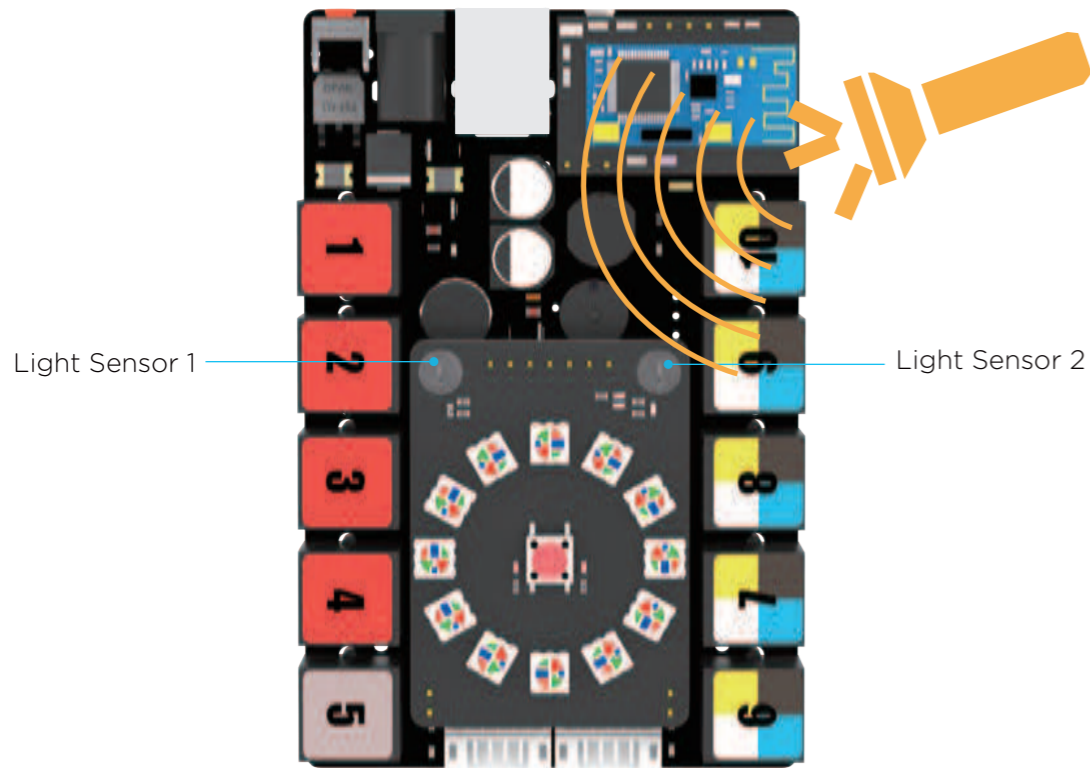
# Introduction to Interfaces of Me Auriga

Tag Color	Compatible Module Types	Typical Me Modules
	(6-12V DC) Driven modules	Me Motor Driver Me Servo Driver Me Stepper Driver
	Hardware serial port	Me Bluetooth Me Bluetooth Module (Dual-Mode)
	One way digital interface Dual digital interface I <sup>2</sup> C port Dual & one way analog interface	Me Ultrasonic Sensor Me RGB LED Me Limit Switch Me 7 Segment Serial Display Me PIR Motion Sensor Me Shutter Me Line Finder Me Infrared Receiver Decode Me 3 Axis Accelerometer and Gyro Sensor Me Potentiometer Me Joystick Me 4Button Me Sound Sensor ...



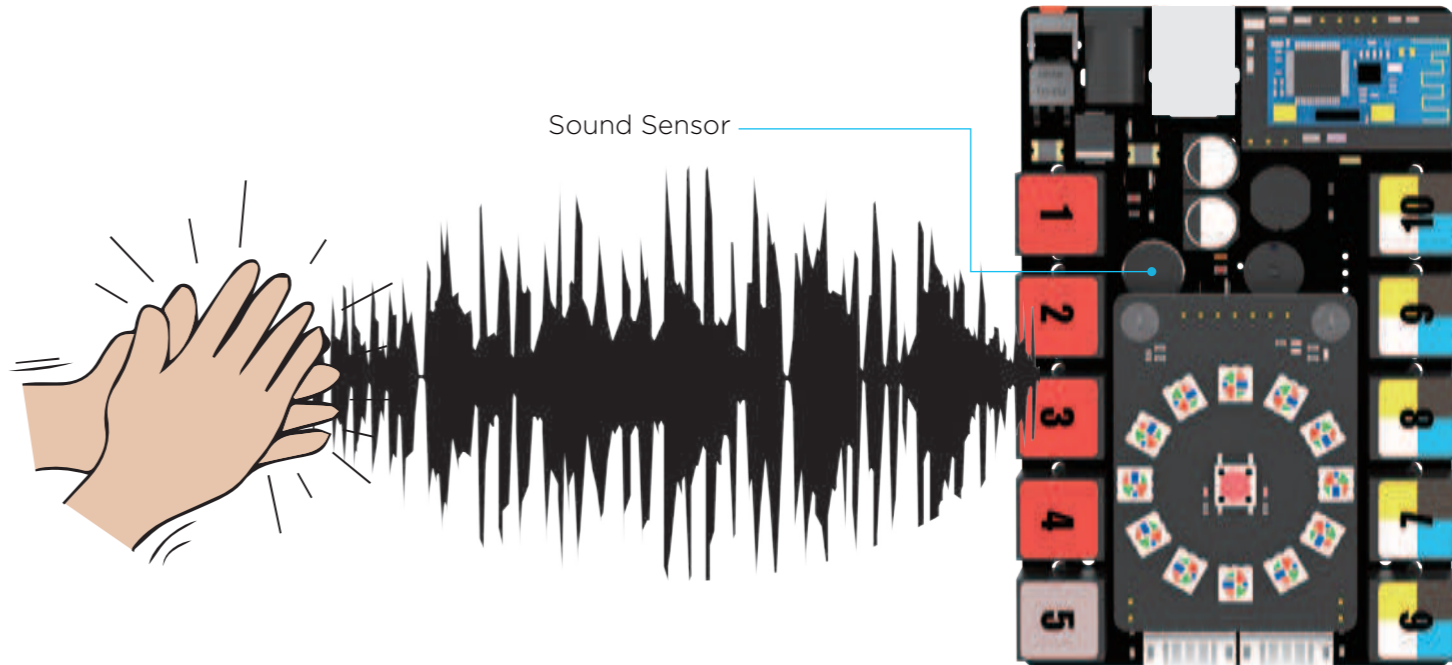
## Light Sensor

Me Auriga has two on-board light sensors. Each of Ranger's light sensors can measure how much light is shining on it. The more light shines on the sensors, the higher the signal it feeds back. Light sensors can be used to make an intelligent dimming lamp, a light-avoiding robot and a light-following robot.



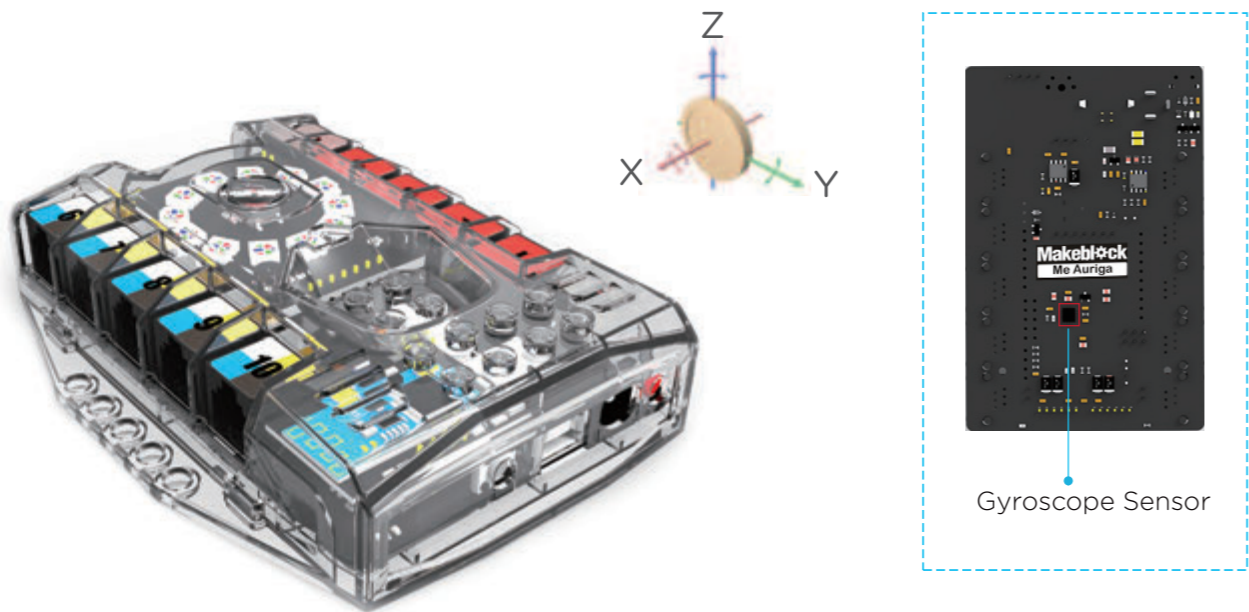
## Sound Sensor

The sound sensor on Me Auriga is designed to detect the intensity of sound in the surrounding environment. Based on the LM386 power amplifier and the electret microphone, the sound sensor can output analog values ranging from 0 to 1023. It can be used in sound interactive projects, such as a voice operated switch.



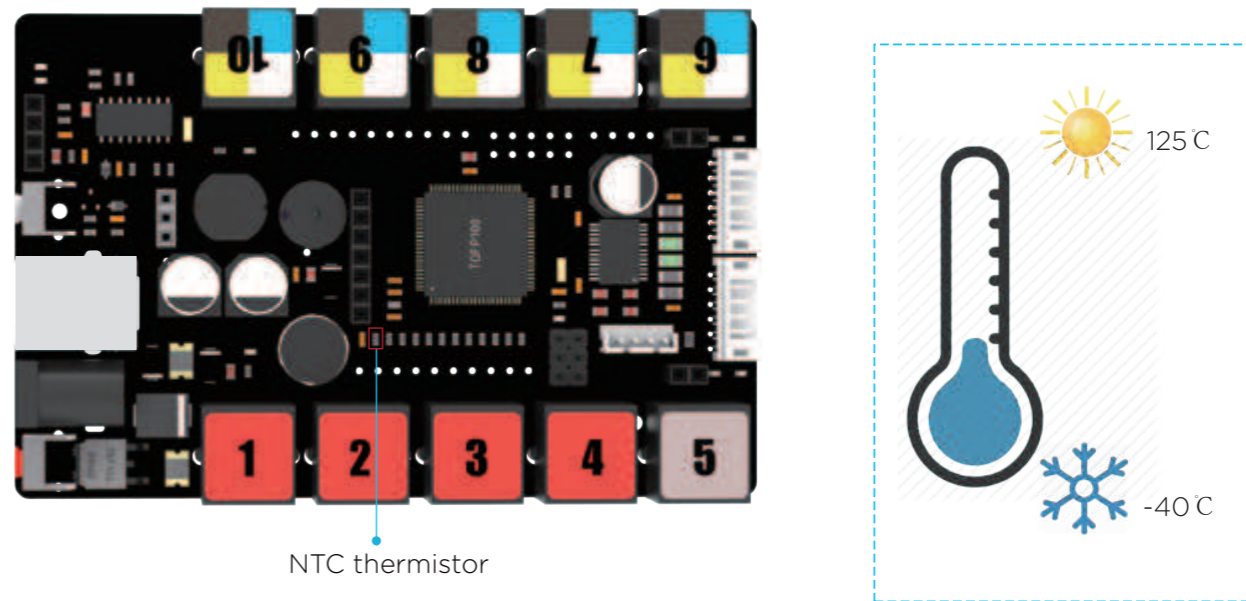
## Gyroscope Sensor

Ranger's on-board gyro sensor is a motion processing module. It measures the angular rate and the acceleration information of your robot. Based on MPU-6050, this gyro sensor combines a 3-axis gyroscope, 3-axis accelerometer, and a Digital Motion Processor™ (DMP) capable of processing complex 9-axis Motion Fusion algorithms. It can be used together with encoder motor to build a self-balance car.



## Temperature Sensor

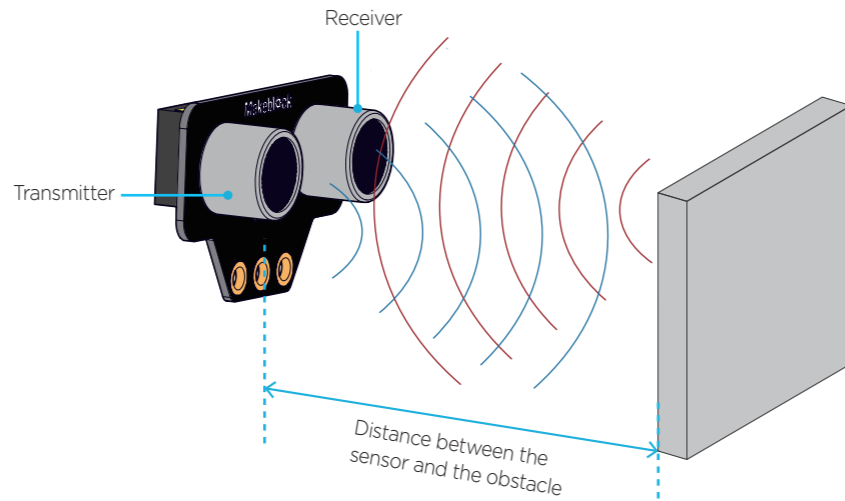
The Ranger's on-board temperature sensor contains a tiny thermometer (a NTC thermistor) that detects the temperature of the surroundings.





## Me Ultrasonic Sensor

Me Ultrasonic Sensor is an electronic module that emits an ultrasonic wave and determines the distance between the sensor and an object based on the time it takes to send the signal and receive the echo. Ultrasonic sensors have numerous applications, such as parking assistance sensors in cars and proximity alarms. This Me Ultrasonic Sensor can be attached to the port with yellow tags on Me Auriga.



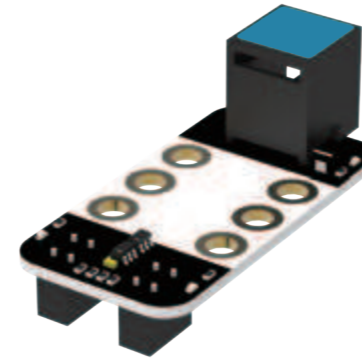
### Specifications:

Operating Voltage: 5V DC  
Detecting Range: 3cm-400cm  
Detecting Angle: Prefer at 30 degree angle  
Dimension (L\*W\*H): 56 x 36 x 31mm



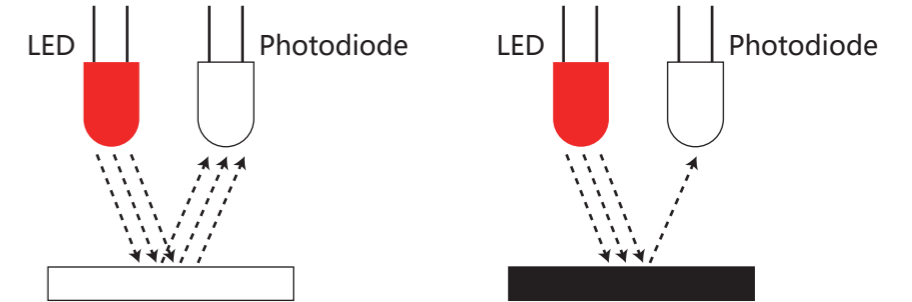
## Me Line Follower Sensor

Me Line Follower module is designed for giving the robot the ability to detect lines or nearby objects. It has two sensors on the module and each sensor contains two parts - an IR emitting LED and an IR sensitive phototransistor. By measuring the amount of reflected infrared light, it can detect transitions from light to dark (lines) or even objects directly in front of it. This module can be connected to the port with blue tags on Me Auriga.



### Specifications:

Operating Voltage: 5V DC  
Detecting Range: 1-2cm  
Dimension (L\*W\*H): 48 x 24 x 24mm



White surfaces reflect lots of infrared light back to the sensor.

But not much light reflects from black surfaces to the sensor



## Battery Information

Battery for Ranger:

Option 1. 1.2V (6) AA rechargeable batteries. (Not included in this kit).

Option 2. 1.5V (6) AA alkaline battery (Not included in this kit). Energizer and DURACELL are recommended.

We recommend that you'd better use rechargeable batteries.

### IMPORTANT BATTERY INFORMATION:

- Use only fresh batteries of the required size and recommended type.
- Do not mix old and new batteries, different types of batteries.
- Replace all batteries of the same type/brand at the same time.
- The supply terminals are not to be short-circuited.
- Remove exhausted batteries from the robot.
- Remove batteries if the robot is not going to be played with for some time.



### LOW BATTERY INDICATORS:

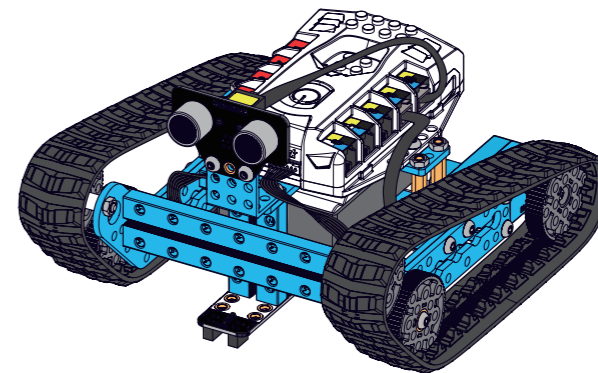
When the following phenomenon occurs, it means the Ranger batteries grow weak.

Land Raider & Dashing Raptor	If the robot moves very slowly, automatically restarts while turning, bumps into thing or doesn't move at all despite the motor speed being set to full power, the batteries are low.
Nervous Bird	If the robot easily loses its balance while moving or turning, the batteries are low.



Under these circumstances, you should power off the robot and replace or charge the batteries.

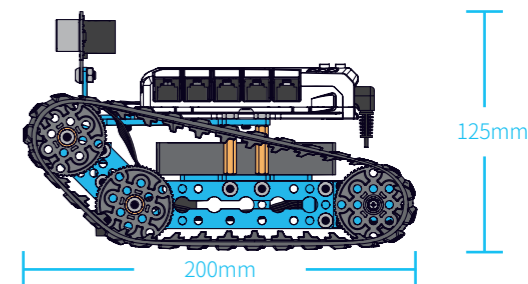
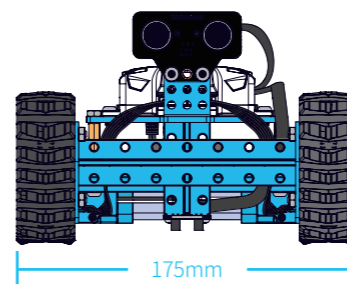
## Land Raider



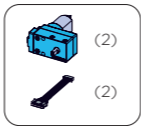
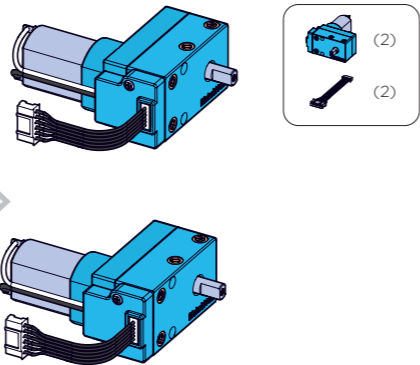
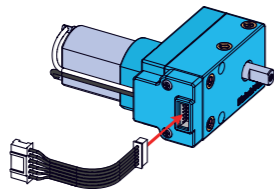
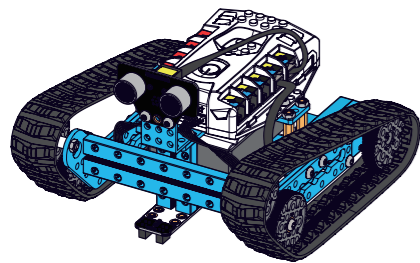
### Product description

Land Raider is an all-terrain off-road tank robot which may realize climbing obstacle, obstacle avoidance, intelligent tracking and colorful light and let you feel the excitement of controlling tank to surmount obstacle. What is praiseworthy is that the app can be used to customize the way of playing robot and by simple drag of the graphical programming block, then you can use the self-contained sound sensor, gyroscope, line-follower sensor, light sensor, ultrasonic sensor, LED light and encoder motor and create your own way to play Land Raider!

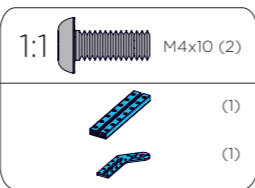
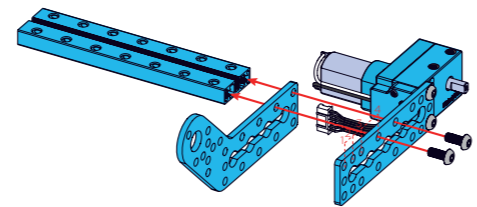
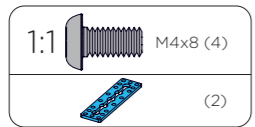
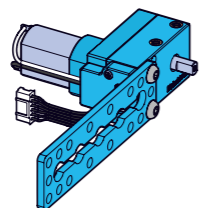
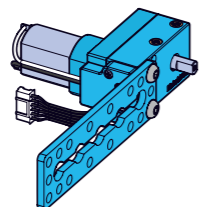
### Product size



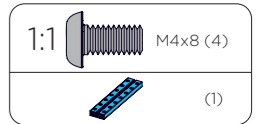
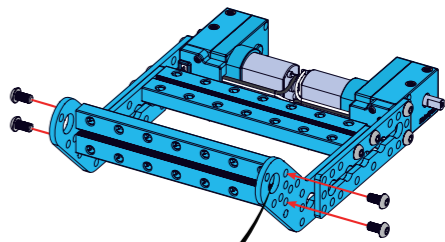
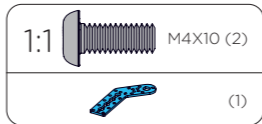
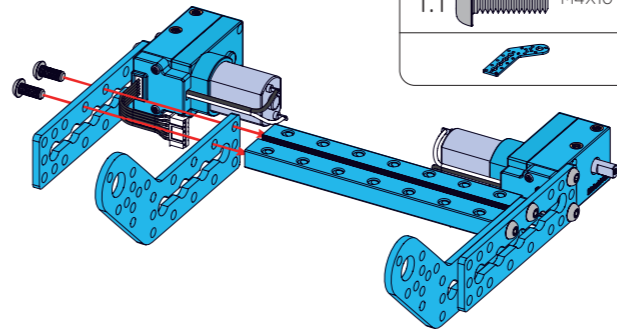
# Assemble Land Raider



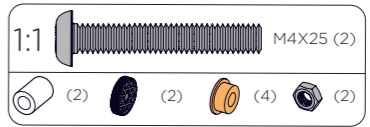
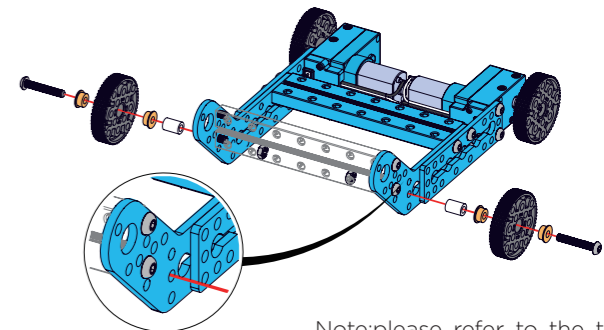
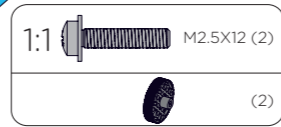
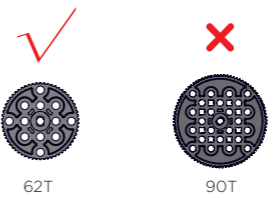
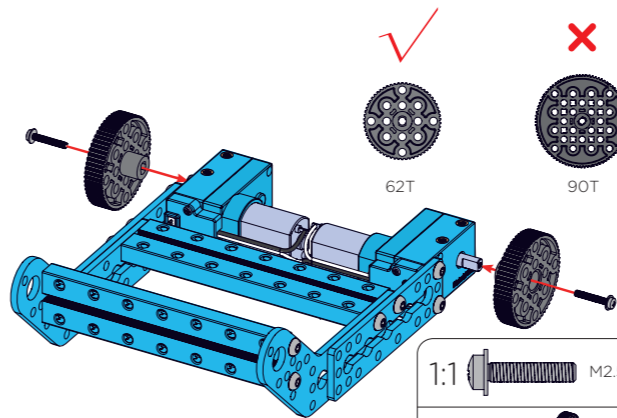
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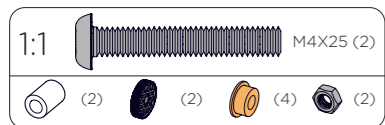
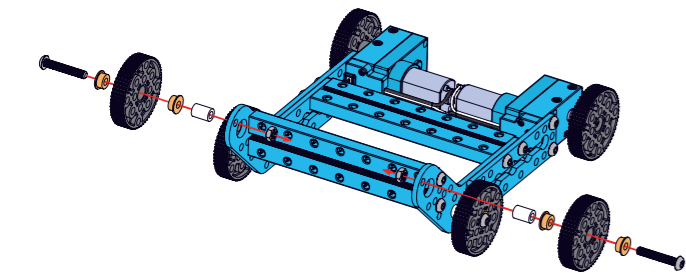


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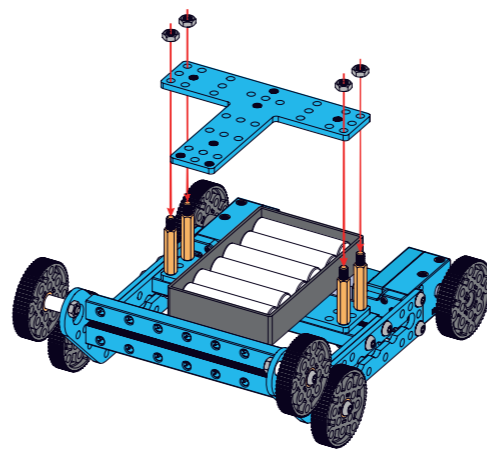
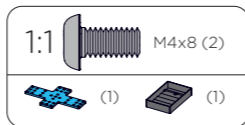
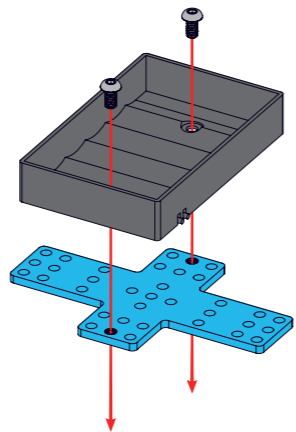
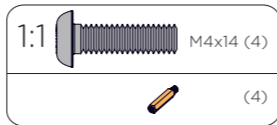
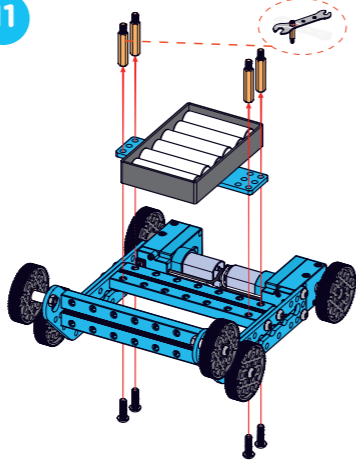


Note: please refer to the tool tips in page 5 and use wrench to tighten the nuts.

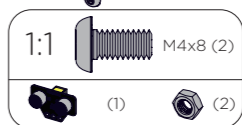
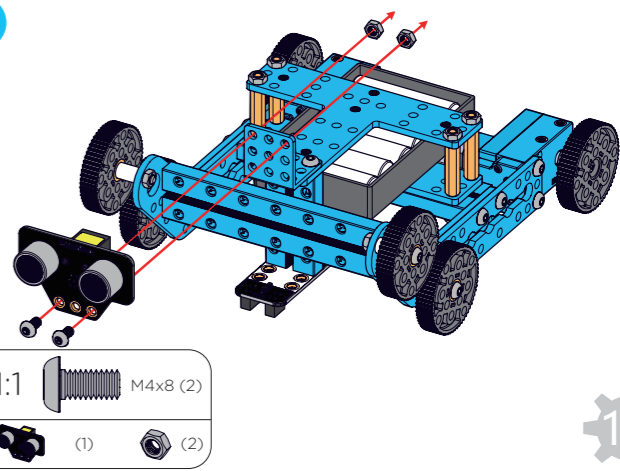
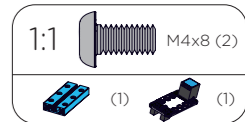
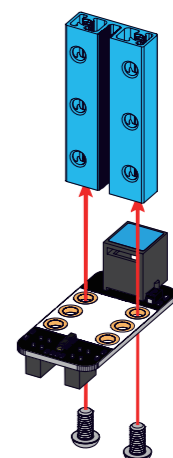
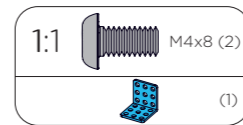
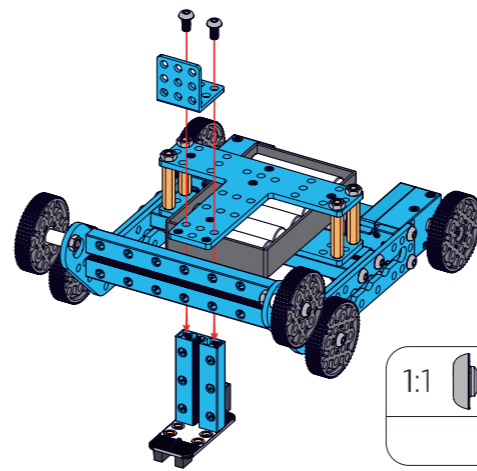
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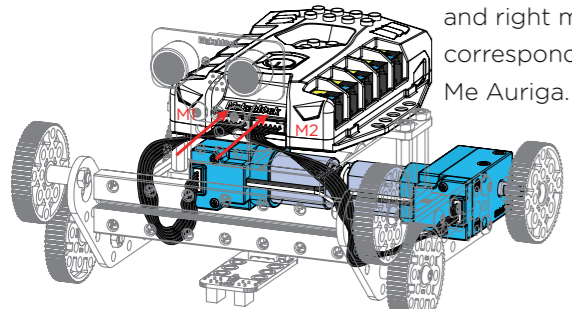


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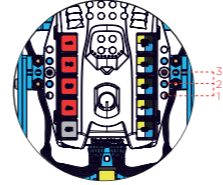
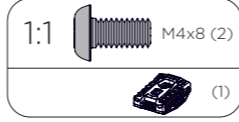
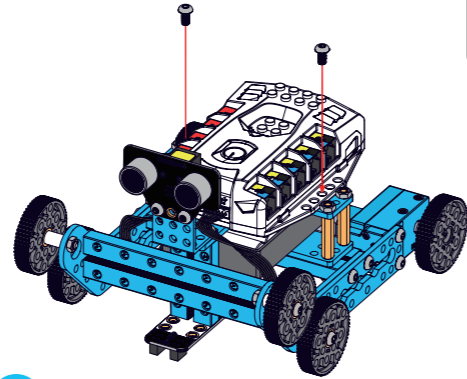
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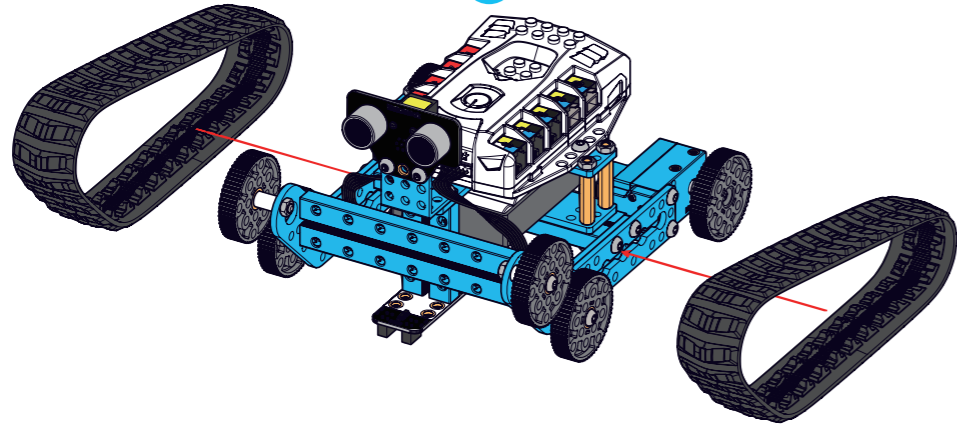


Right motor (M1) Left motor (M2)

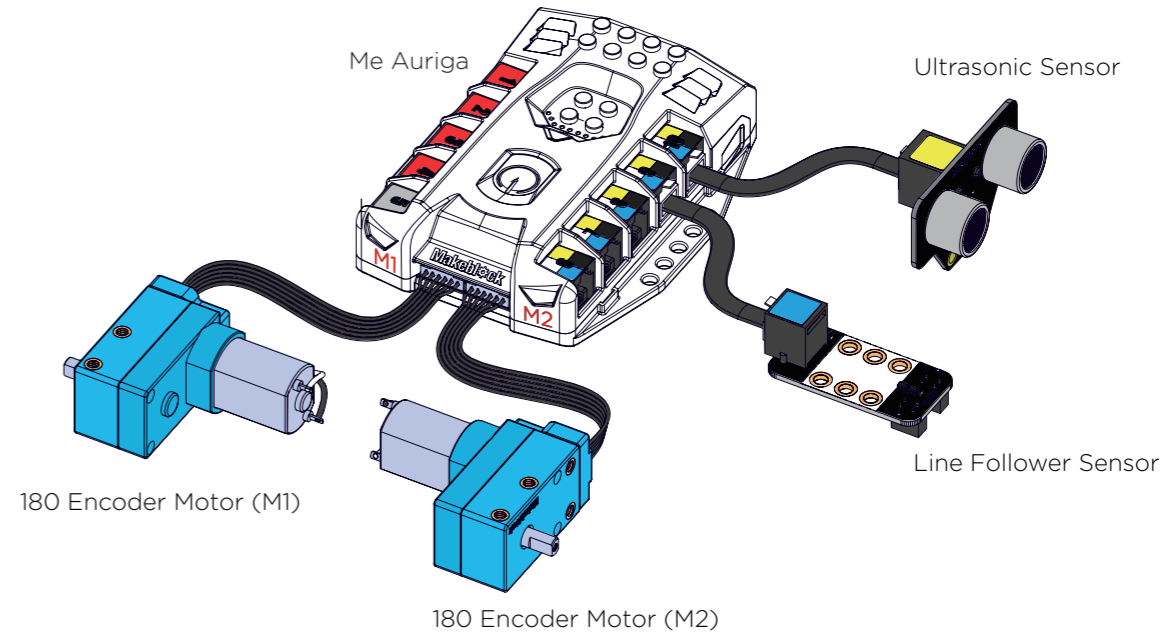
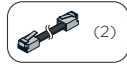
Connect the left motor and right motor to the corresponding port of Me Auriga.



16 17  
18



## Wiring of Land Raider



180 Encoder Motor (M1)

180 Encoder Motor (M2)

Line Follower Sensor

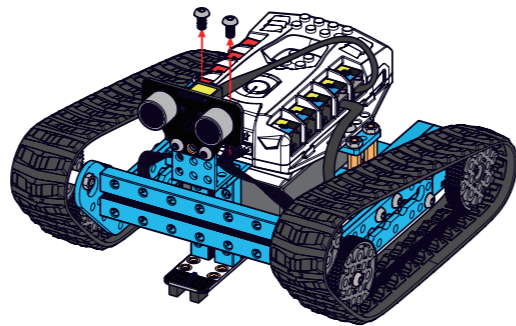
Ultrasonic Sensor

Me Auriga

Please follow page 36 for controlling with App

## Playing Tips

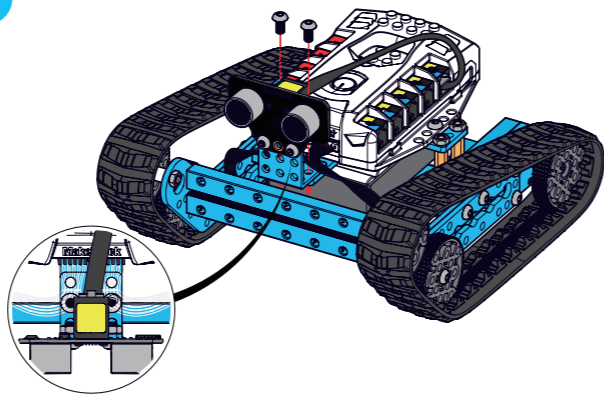
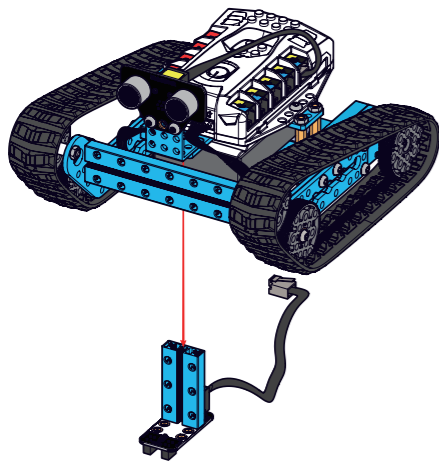
When you want to play Land Raider on rough terrain, please follow the instruction below to remove the line follower sensor. If not removed, may result in a malfunction or damage to the sensor.



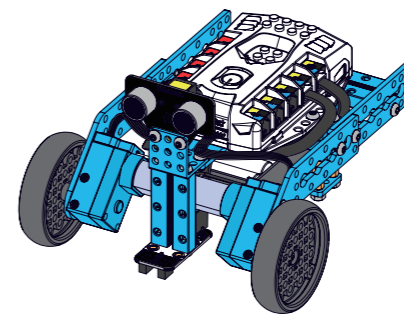
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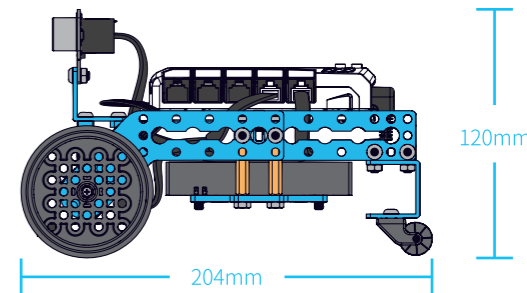
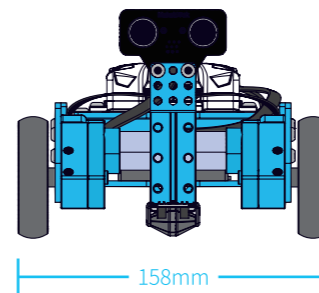
## Dashing Raptor



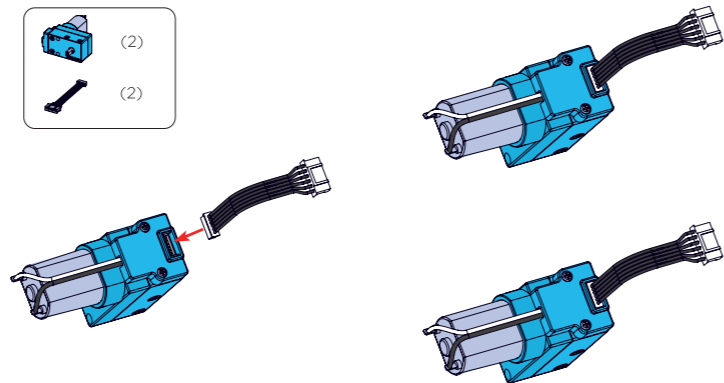
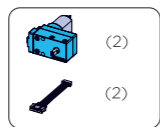
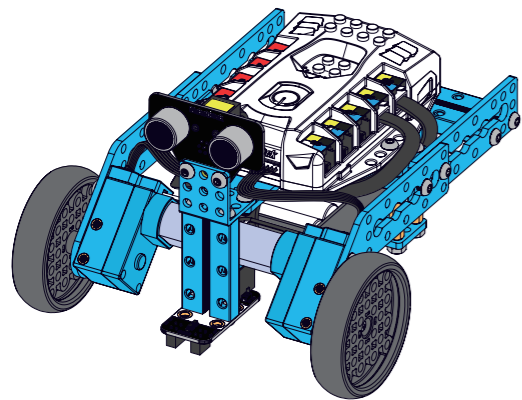
### Product description

Dashing Raptor is a three-wheeled racing robot and you can use Makeblock App to control it to rapidly realize running rapidly, obstacle avoidance, intelligent tracking and colorful light effects and let you feel the excitement of controlling racing speed. What is praiseworthy is that the app can be used to customize the way of playing robot and by simple drag of the graphical programming block, then you can use the self-contained sound sensor, gyroscope, line-follower sensor, light sensor, ultrasonic sensor, LED light and encoder motor and create your own way to play Dashing Raptor!

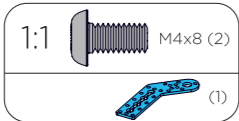
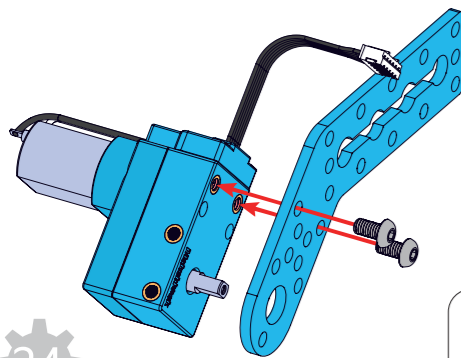
### Product size



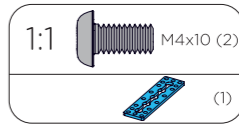
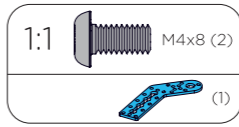
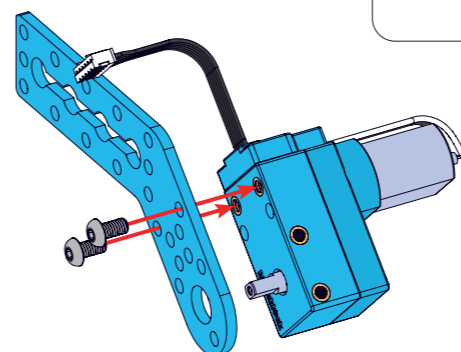
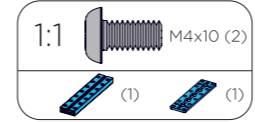
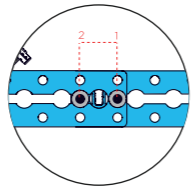
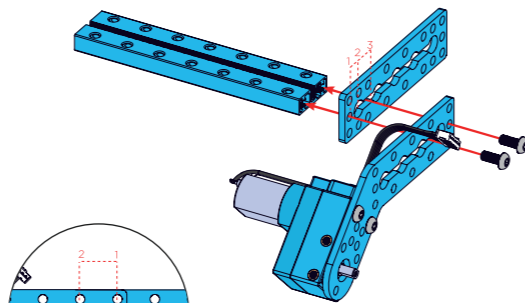
# Assemble Dashing Raptor



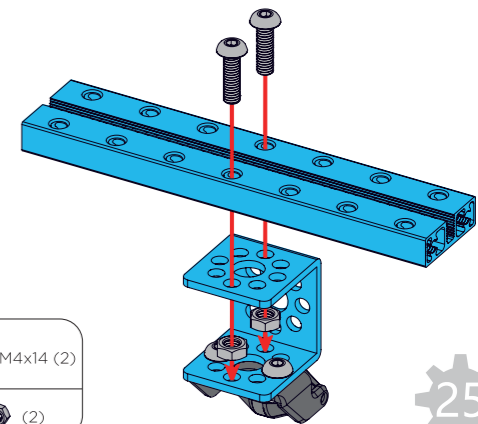
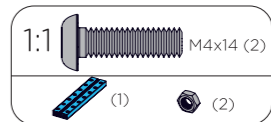
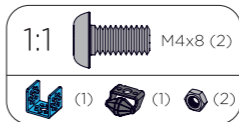
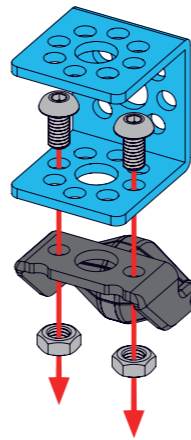
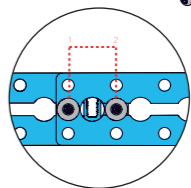
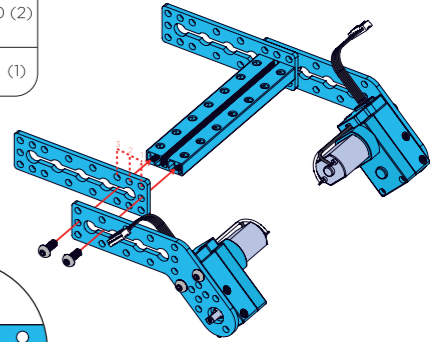
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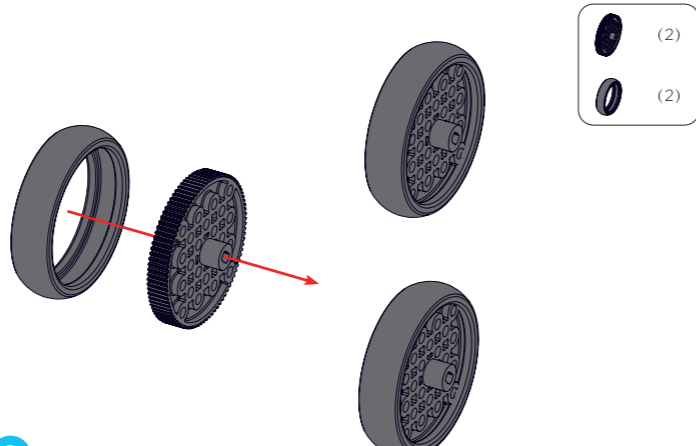
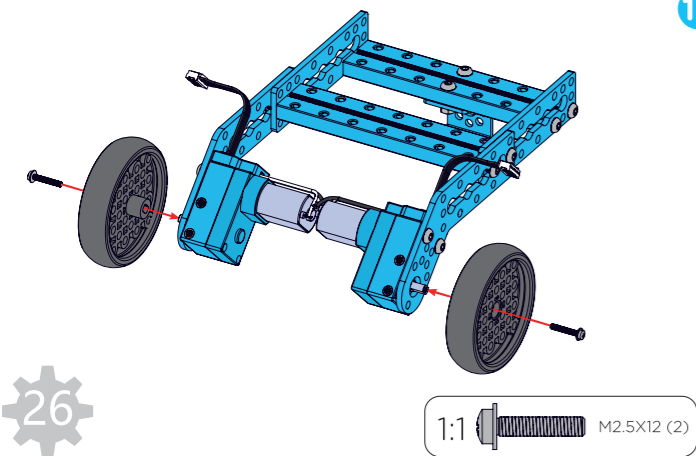
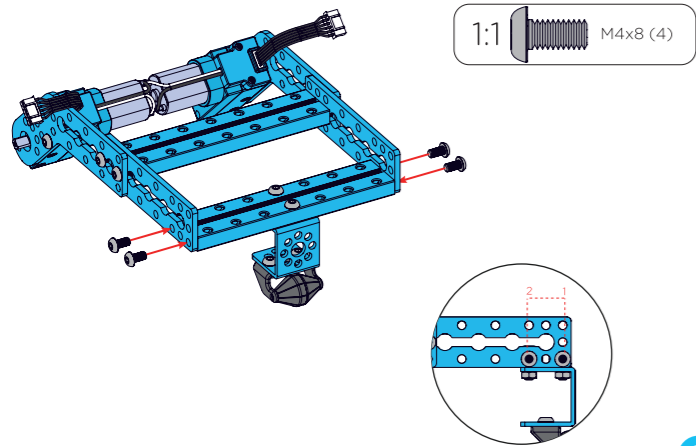
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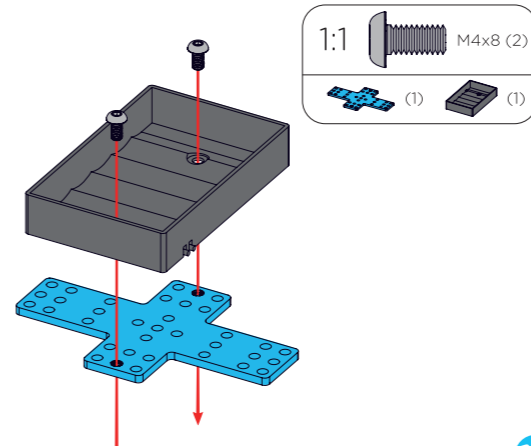
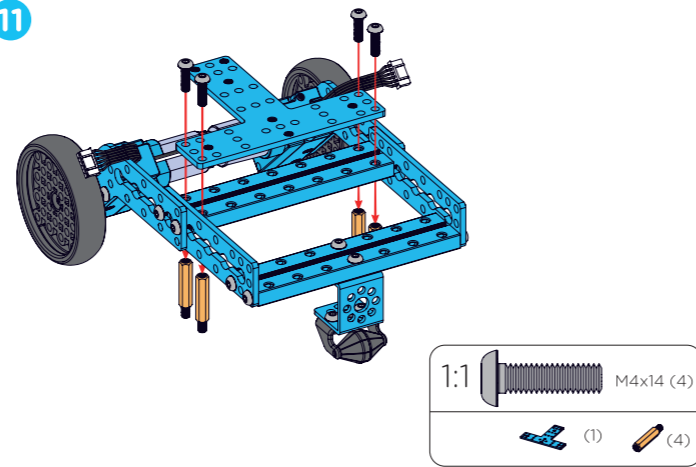
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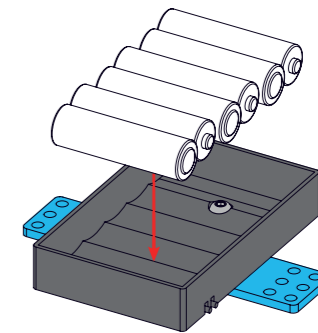
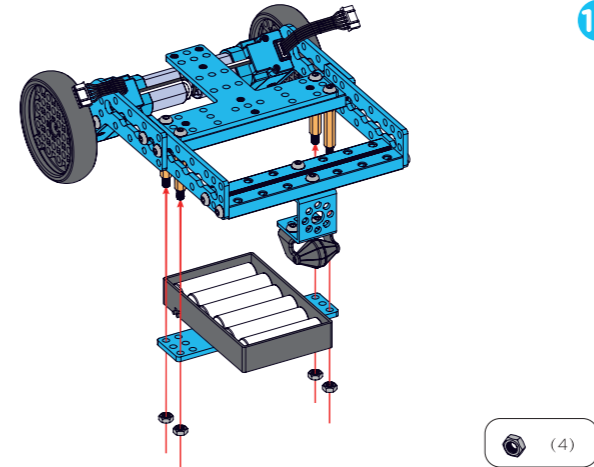
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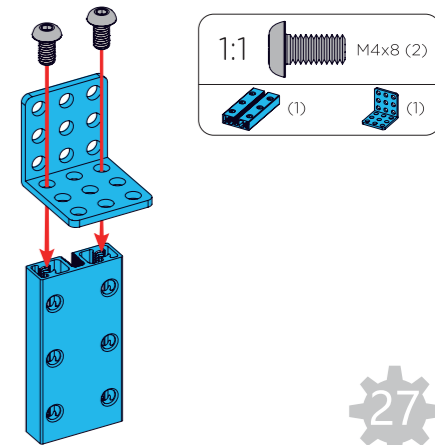
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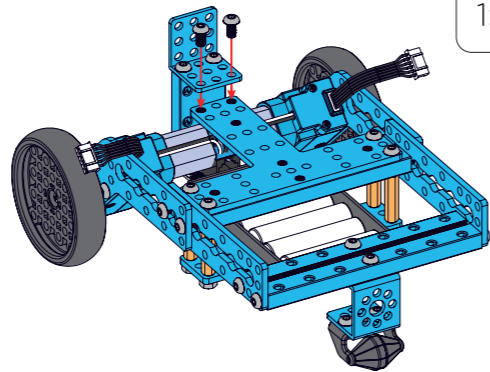
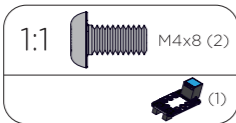
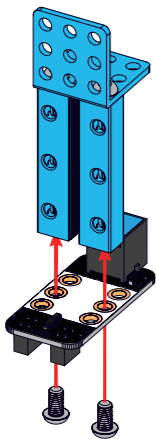
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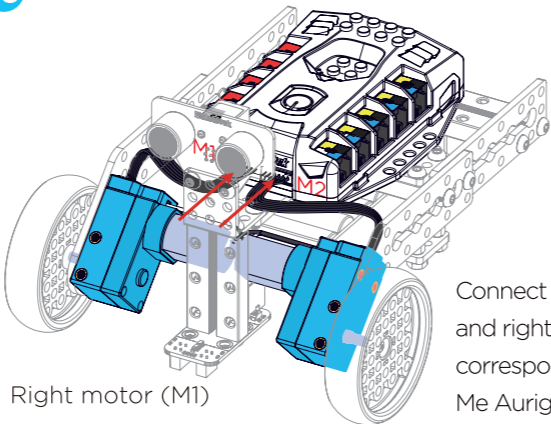
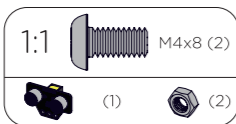
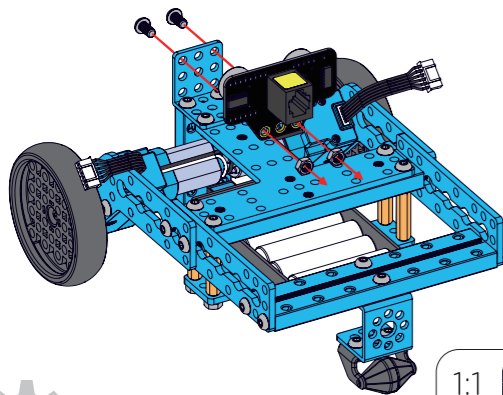
\*Note: AA batteries are not included.







16 17  
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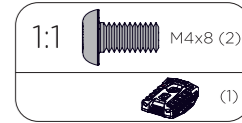
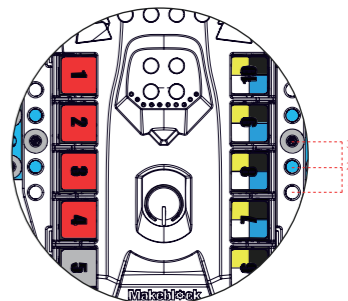
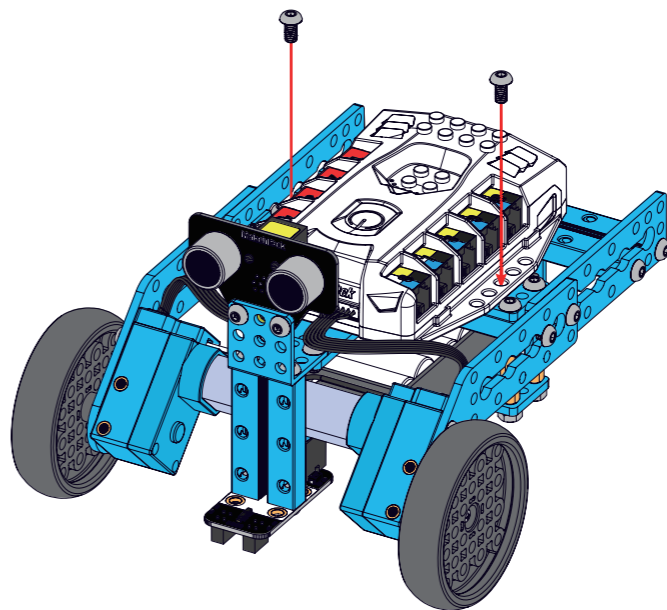


Right motor (M1)

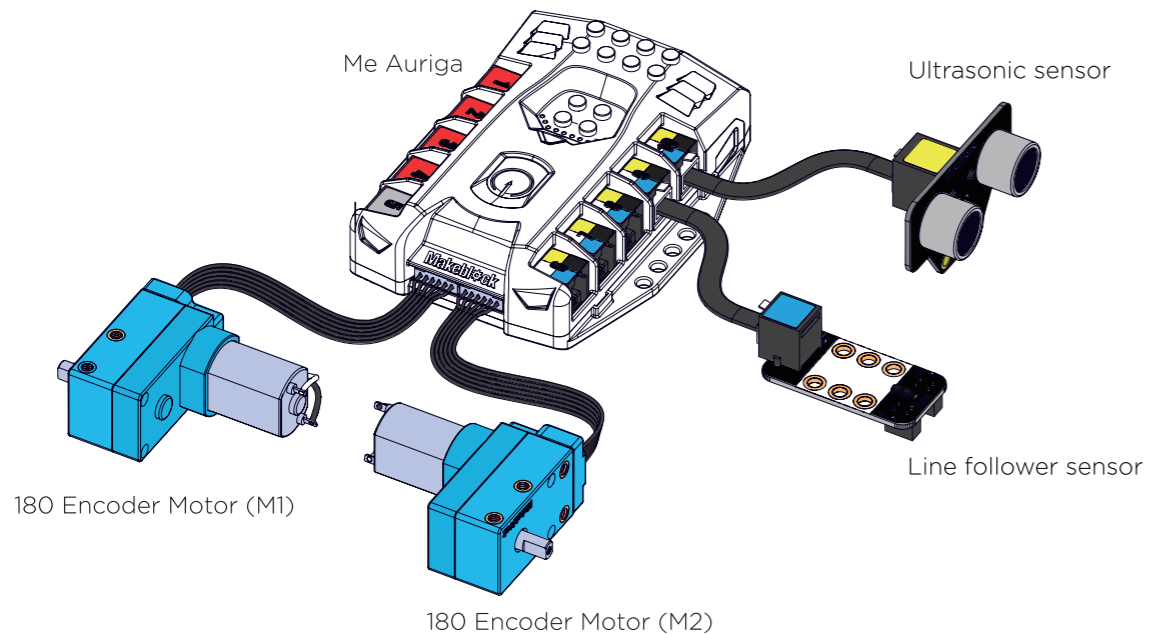
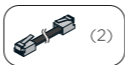
Left motor (M2)

Connect the left motor and right motor to the corresponding port of Me Auriga.

20



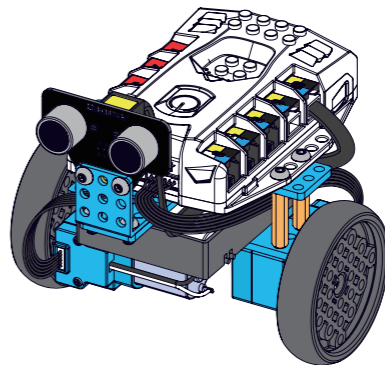
## Wiring of Dashing Raptor



Please follow page 36 for controlling with App



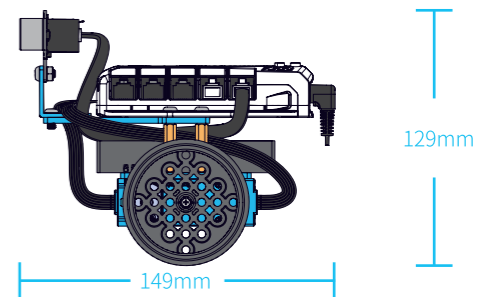
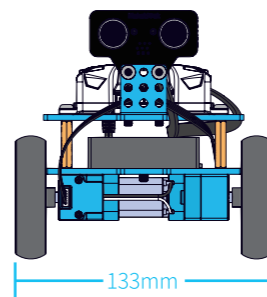
## Nervous Bird



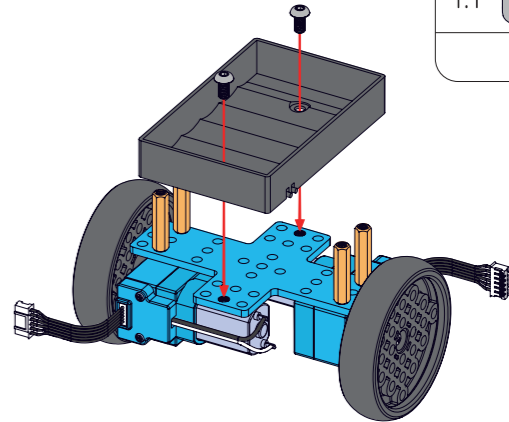
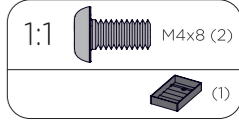
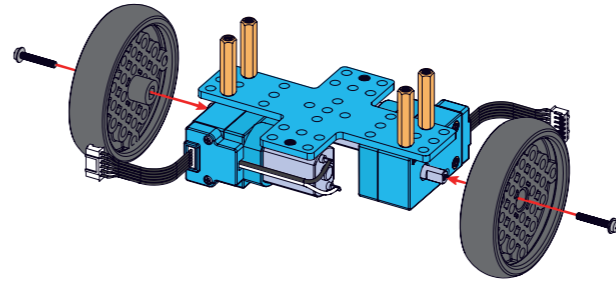
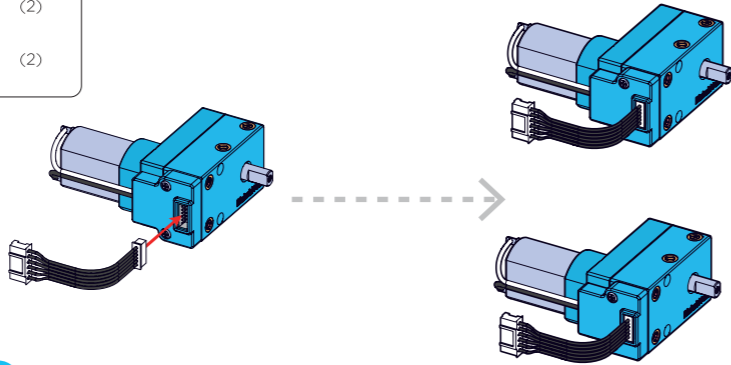
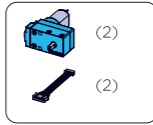
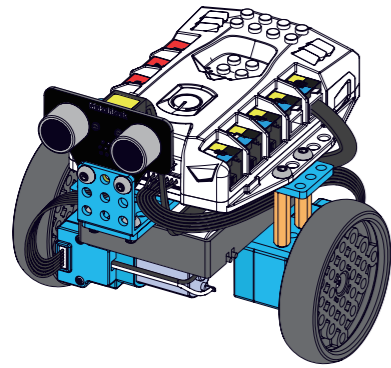
### Product description

Nervous Bird is a two-wheeled self-balancing robot that can keep balance while moving. You can use Makeblock App to control this robot and feel the mysterious "self-balancing" technology. What is praiseworthy is that the app can be used to customize the way of playing robot and by simple drag of the graphical programming block, then you can use the self-contained sound sensor, line follower sensor, light sensor, ultrasonic sensor and create your own way to play Nervous Bird! Note: this robot only supports partial graphical programming blocks.

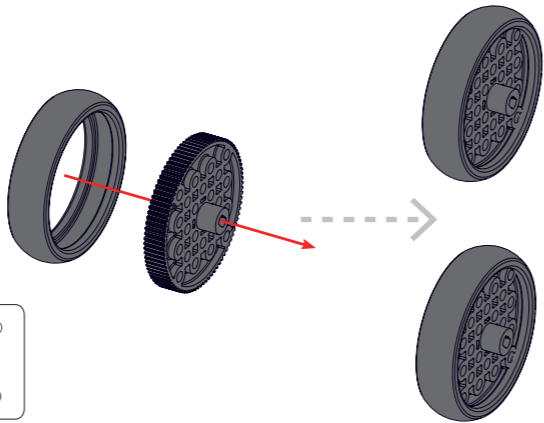
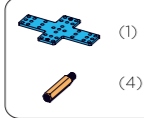
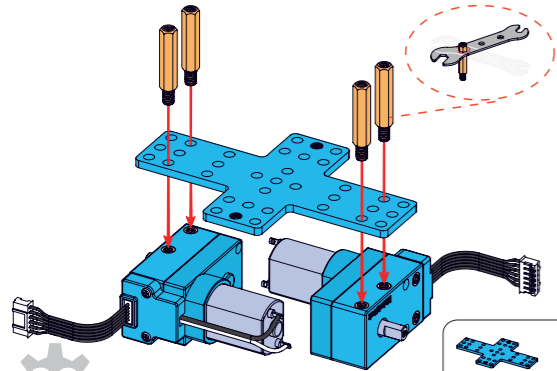
### Product size



# Assemble Nervous Bird

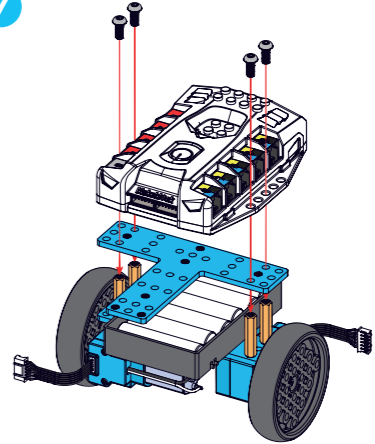
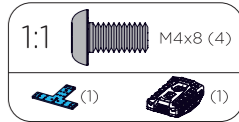
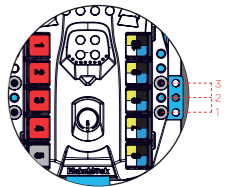
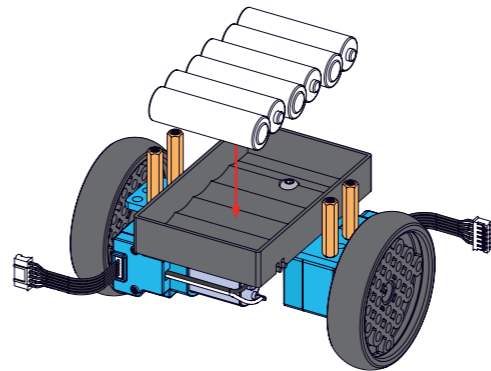


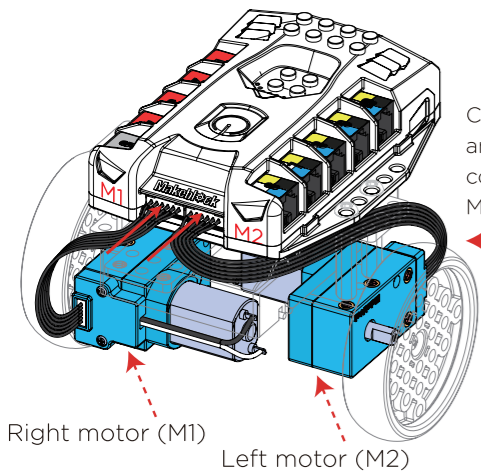
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\*Note: AA batteries are not included.

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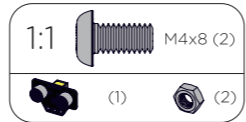
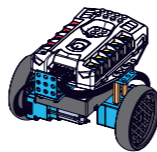
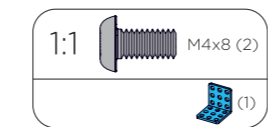
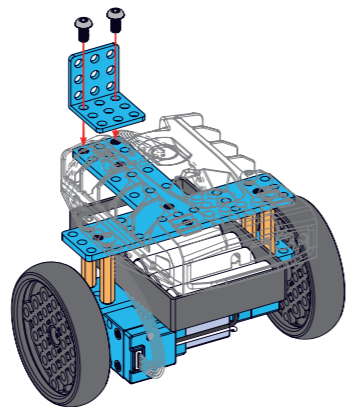
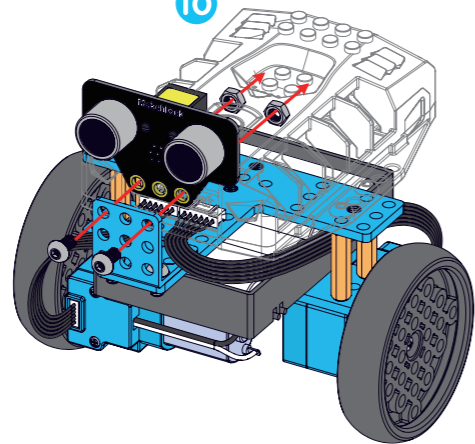


Connect the left motor and right motor to the corresponding port of Me Auriga.

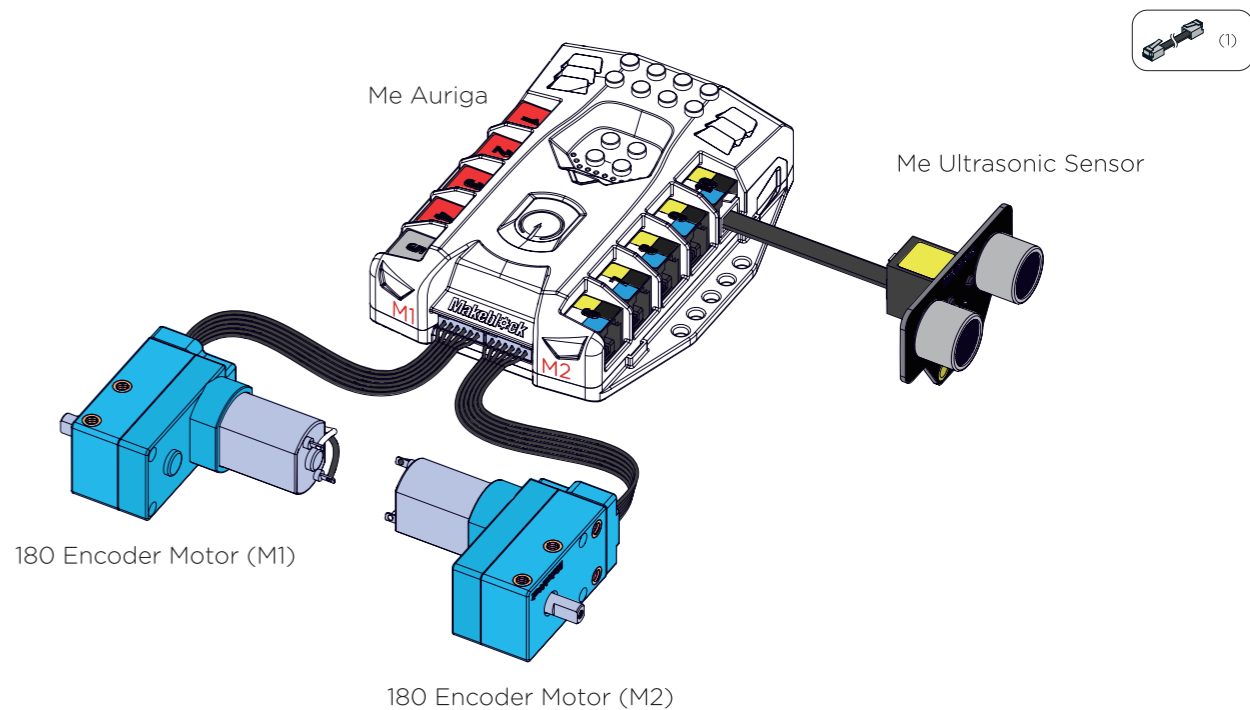
Right motor (M1)

Left motor (M2)

8 9  
10



## Wiring of Nervous Bird



Me Auriga

Me Ultrasonic Sensor

180 Encoder Motor (M1)

180 Encoder Motor (M2)

Please follow page 36 for controlling with App

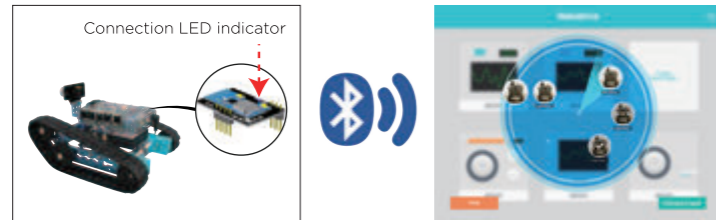
## Control with App

1.App Download. Method 1: visit <http://d.makeblock.com>; Method 2: search "Makeblock" on the App Store or Google play.



<http://d.makeblock.com>

2.Bluetooth Connection.Make sure your robot is turned on. Open up your device's Bluetooth menu and choose the Robot ID. When the connection LED indicator on the robot's Bluetooth chip stops flashing, it means the robot has successfully paired with your device.



3. Play and learn. To get to know how to use the Makeblock App with mBot Ranger, please visit: <http://learn.makeblock.com/en/ranger/>



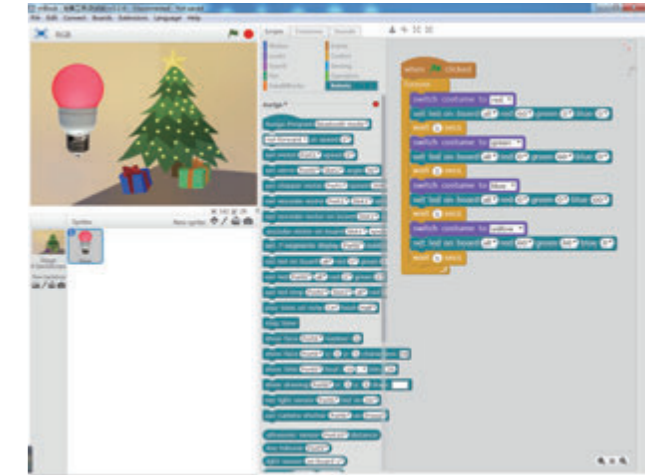
## Further Learning - Graphical Programming

### Introduction to mBlock

mBlock is an easy-to-use graphical programming environment based on Scratch 2.0 Open Source Code. It provides a quick way for you to program Arduino projects and create interesting interactions. mBlock is the ideal software to learn programming, control the robot, and realize multiple functions from the robot.

**Know More:** <http://www.mblock.cc/>

**Required System:** Windows/Mac



### mBlock Online Courses for Ranger Robot Kit

Thanks to the cooperation of Scratch teachers,we are developing sixteen chapters about learning graphical programming with Ranger. This course will guide you to program Ranger in lots of interesting scenes.

### Online Courses:

[http:// learn.makeblock.com/ranger-online-course/](http://learn.makeblock.com/ranger-online-course/)



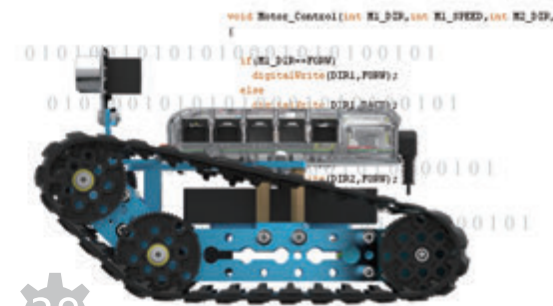
## Advanced Learning - Arduino Programming (C Language)

### Introduction to Arduino

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino software consists of a development environment (IDE) and the core libraries. The IDE is written in Java and based on the processing development environment.

**Know More:** <https://www.arduino.cc>

**Required System:** Windows/Mac/Linux




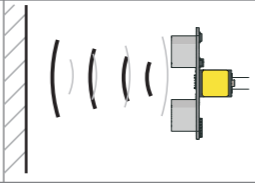





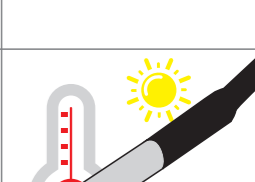


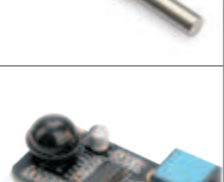


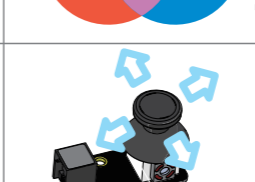
### Online Tutorials

This online tutorial is great for beginners who want to learn the basics of writing code while having fun playing with Ranger.

### Online Tutorials:

<http://learn.makeblock.com/ranger-arduino-programming/>

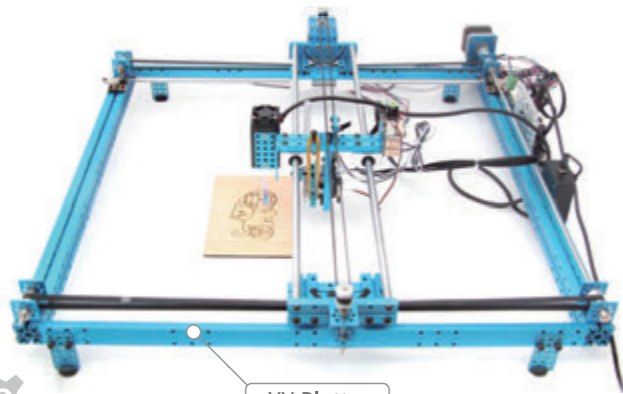
## Further Exploration - Electronic Modules on Makeblock Platform

	<p><b>Ultrasonic Sensor</b> measures distances from 3cm to 4m.</p>			<p><b>Me Sound Sensor</b> measures volume. It could be used in a project that uses a voice operated switch.</p>	
	<p><b>Me 7-segment Serial Display</b> allows information such as time, speed or scores to be displayed.</p>			<p><b>Me Temperature Sensor Module</b> measures temperature, ranging from -55C to 125C.</p>	
	<p><b>Me RGB LED</b> contains 4 programmable lights which can display lots of different colors.</p>			<p><b>Me Passive IR Detector Module</b> detects infrared signals from humans or animals within 6 meters.</p>	
	<p><b>Me Joystick</b> can control the movement of a robot or a part of a robot.</p>		<p><b>See more on Makeblock platform</b> <a href="http://www.makeblock.com">http://www.makeblock.com</a></p>		

## Further Exploration - More Kits on Makeblock Platform



Ultimate 2.0



XY Plotter



mGiraffe 3D Printer Kit

## Troubleshooting

### Q1: How do I turn the robot on?

Press the red button on the top of the mainboard to turn the robot on.

### Q2: How do I turn the robot off?

Press and hold the red button on the top of the main board for 3-8 seconds.

### Q3: I've turned the robot on but it still doesn't work. Why not?

- a) The batteries are dead. Try changing or charge them.
- b) The wires are faulty. Try replacing them.

### Q4: The robot turns left when I drive right and vice-versa.

Switch the motor wires over (from M1 to M2 and vice-versa).

### Q5: There are noises after I get the Land Raider running.

- a) Check if the driven wheels are correctly installed.
- b) Grease the bearings of the driven wheel.

### Q6: The self-balance car doesn't work

- a) Try changing or charge the batteries.
- b) Check that the robot has been correctly assembled, especially the wheels.
- c) Learn how to use the Makeblock App with the self-balance car at <http://learn.makeblock.com/en/ranger/>

### Q7: I can't connect the App to my robot via Bluetooth.

- a) Check <http://learn.makeblock.com> to find out compatibility for your device.
- b) Try restarting the App and the main control board.

### Q8: I want to know whether the mainboard is powered by USB 5V power or 6-12V power.

There is a 5V LED indicator and a 6-12V LED indicator on the main board. Please refer to page 6 of this manual.

**Q9: Why do the M4 nuts keep coming loose?**

The M4 nuts will come loose if you run the robot for a long time. Please use a wrench with a screwdriver to tighten the nuts.

**Q10: Why can't I read the values of the ultrasonic sensor and the line follower sensor?**

Check that the sensors are correctly connected to the appropriate ports.

**Q11: Why does the light sensor show a high value in a dark area?**

Check that the RGB LED is not interfering with the reading.

**Q12: Why is the line follower sensor unable to detect a black line?**

- a) Sunlight is affecting the readings of the sensor.
- b) The sensor is sensing outside of its optimum range of 1-2cm.

**Q13: Why do the RGB LEDs randomly flash when I restart the robot?**

The chip in the RGB LED has memory function. Please restart your robot after 10 seconds.

**Q14: How do I use the Ranger test pad?**

Please refer to online tutorials at <http://learn.makeblock.com/en/ranger/>

**Q15: How do I know when it's time to replace the batteries?**

Land Raider & Dashing Raptor – If the robot moves very slowly, automatically restarts while turning, bumps into thing or doesn't move at all despite the motor speed being set to full power, the batteries are low.

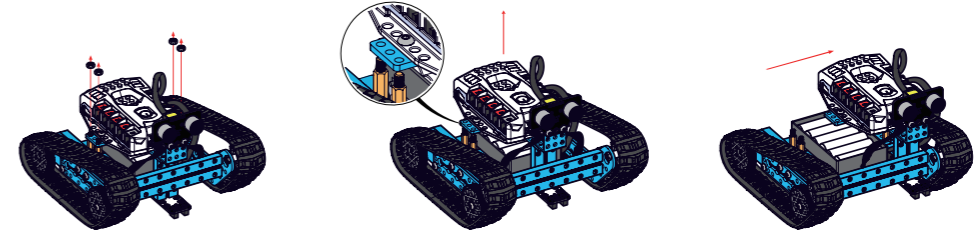
Nervous Bird – If the robot easily loses its balance while moving or turning, the batteries are low.

**Q16: How to replace all batteries?**

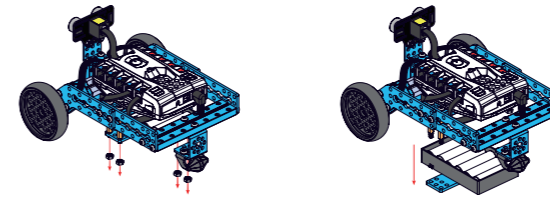
Method 1: use screw M3\*8 and M3 nuts to change conveniently. Video tutorials: <https://youtu.be/X8Sjz6PCh4I>.

Method 2: Remove the main board by following below illustrations.

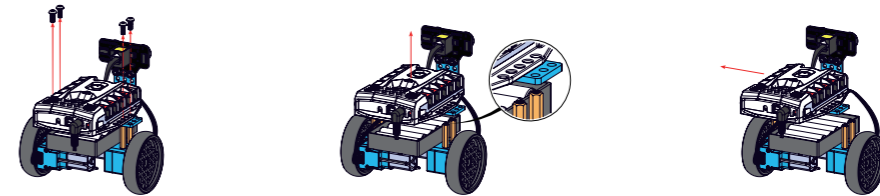
1. Land Raider.



2. Dashing Raptor.



3. Nervous Bird.





**Warning:**

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Note:**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help. "This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body."

**FCC ID: 2AH9Q-RANGER**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.