Makeblock
Construct Your Dreams

mBot Ranger
3-in-1 Educational Robot Kit
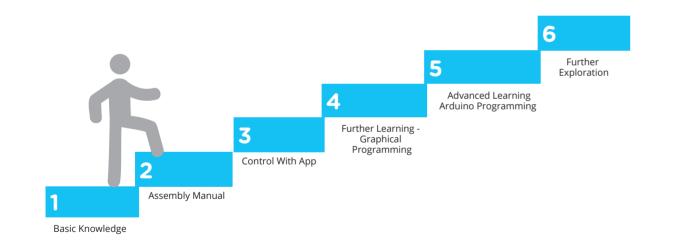
Makeblock
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Shenzhen Maker Works Technology Co., Ltd
Technical Support: tec-support@makeblock.cc
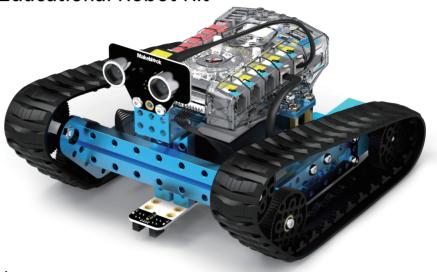www.makeblock.com

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Land Raider

Nervous Bird

Dashing Raptor

Index

Quick Guide

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.
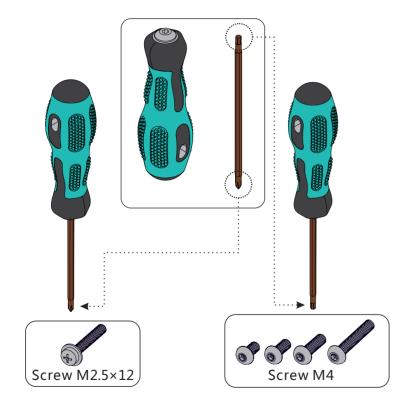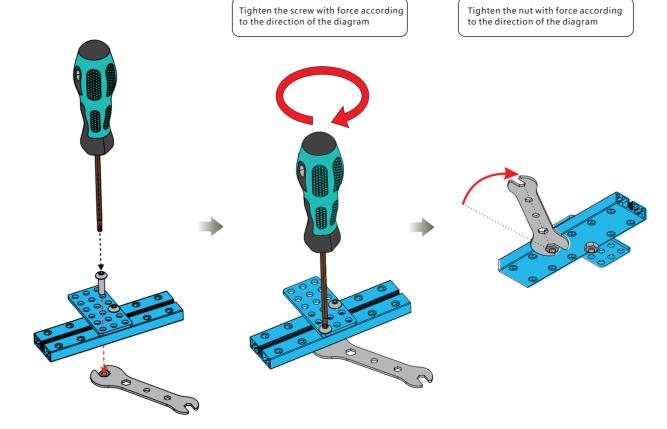
6 Further Exploration

5 Advanced Learning Arduino Programming

4 Further Learning - Graphical Programming

3 Control With App

2 Assembly Manual

1 Basic Knowledge

Part List

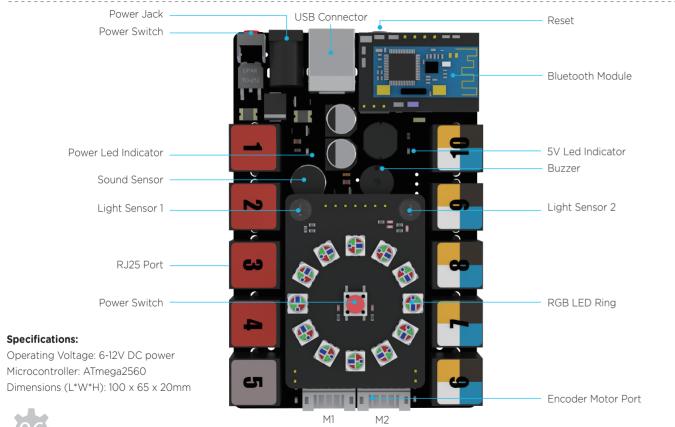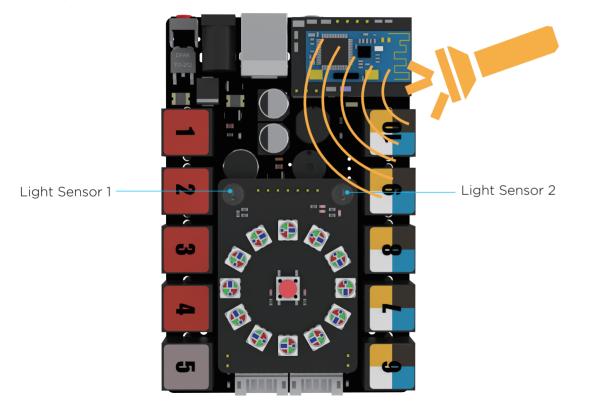|		
2 x Beam0824-112	2 x 90T Wheel	1 x USB Cable
1 x Beam0824-48	2 x 90T Tyre	2 x RJ25 Cable
2 x Plate 0324	2 x Track	1 x Wrench
2 x Plate 135°	4 x Plastic Spacer 4x7x10	1 x Hex & Cross Screwdriver
1 x Plate for Battery Holder	2 x 180 Encoder Motor	22 x Screw M4x8
1 x Plate T-type	8 x Copper Bush 4x8x4mm	4 x Screw M4x10
1 x Bracket 3x3	1 x Bruss Stud M4*30+6	6 x Screw M4x14
1 x Bracket U1	1 x Battery Holder	4 x Screw M4x25
1 x Universal Wheel	1 x Me Auriga	2 x Screw M2.5x12
4 x 62T Wheel Without Step	1 x Ultrasonic Sensor	10 x Nut M4
2 x 62T Wheel	1 x Line Follower Sensor	2 x Encoder Motor Wire

Introduction to Tools

Screw M2.5×12

Screw M4

Tighten the screw with force according to the direction of the diagram

Tighten the nut with force according to the direction of the diagram

Me Auriga

Power Jack
Power Switch
USB Connector
Reset
Bluetooth Module
Power Led Indicator
5V Led Indicator
Sound Sensor
Buzzer
Light Sensor 1
Light Sensor 2
RJ25 Port
RGB LED Ring
Power Switch
Encoder Motor Port

M1   M2

Specifications:

Operating Voltage: 6-12V DC power

Microcontroller: ATmega2560

Dimensions (L*W*H): 100 x 65 x 20mm

Introduction to Interfaces of Me Auriga

| Port NO.	Tag Color	Compatible Module Types	Typical Me Modules
1 & 2 & 3 & 4	1 2 3 4	(6-12V DC) Driven modules	Me Motor Driver Me Servo Driver Me Stepper Driver
5	5	Hardware serial port	Me Bluetooth Me Bluetooth Module (Dual-Mode)
6 & 7 & 8 & 9 & 10	6 7 8 9 10	One way digital interface Dual digital interface I²C 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 ...
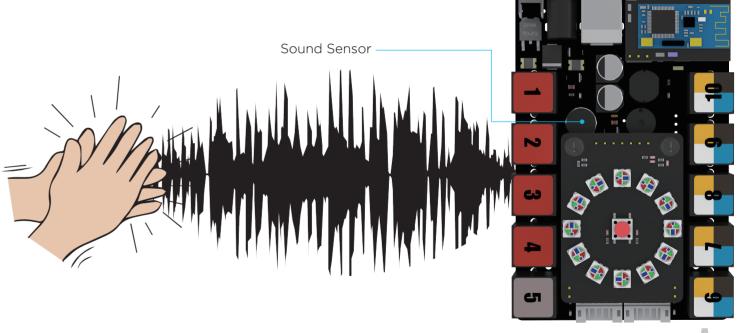
Light Sensor

Me Auriga has two on-board light sensors. Each of Ranger's light sensors can measure how much light is shinning 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.

Light Sensor 1

Light Sensor 2

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.
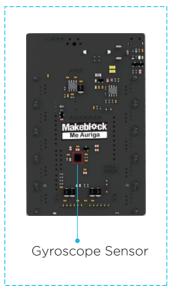
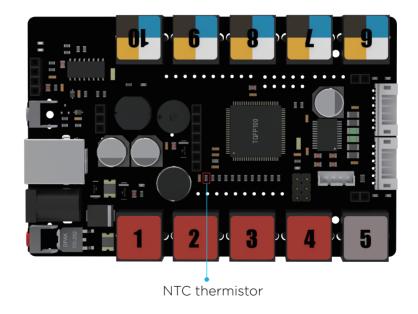Sound Sensor

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.
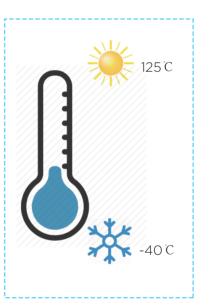

Gyroscope Sensor

Temperature Sensor

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

NTC thermistor

125 ℃
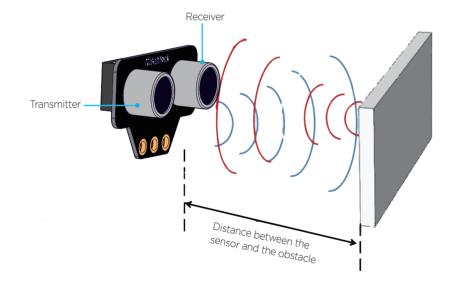
-40 ℃

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.

Receiver

Transmitter

Distance between the sensor and the obstacle

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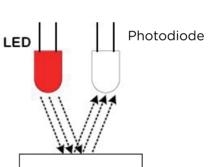Dimension (L*W*H): 56 x 36 x 31mm

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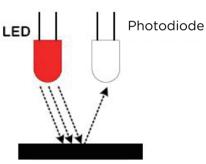
Specifications:
Operating Voltage: 5V DC
Detecting Range: 1-2cm
Dimension (L*W*H): 48 x 24 x 24mm

LED   Photodiode

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

LED   Photodiode

But not much light reflects from black surfaces to the sensor

Battery Information

Battery for Ranger: 1.5V (6) AA alkaline battery (Not included in this kit)

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.
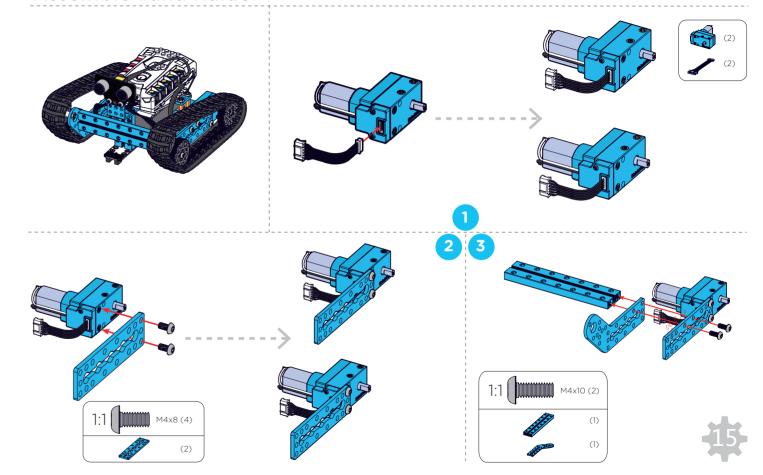
LOW BATTERY INDICATORS:

When the following phenomenon occurs, it means the Ranger batteries grow weak.
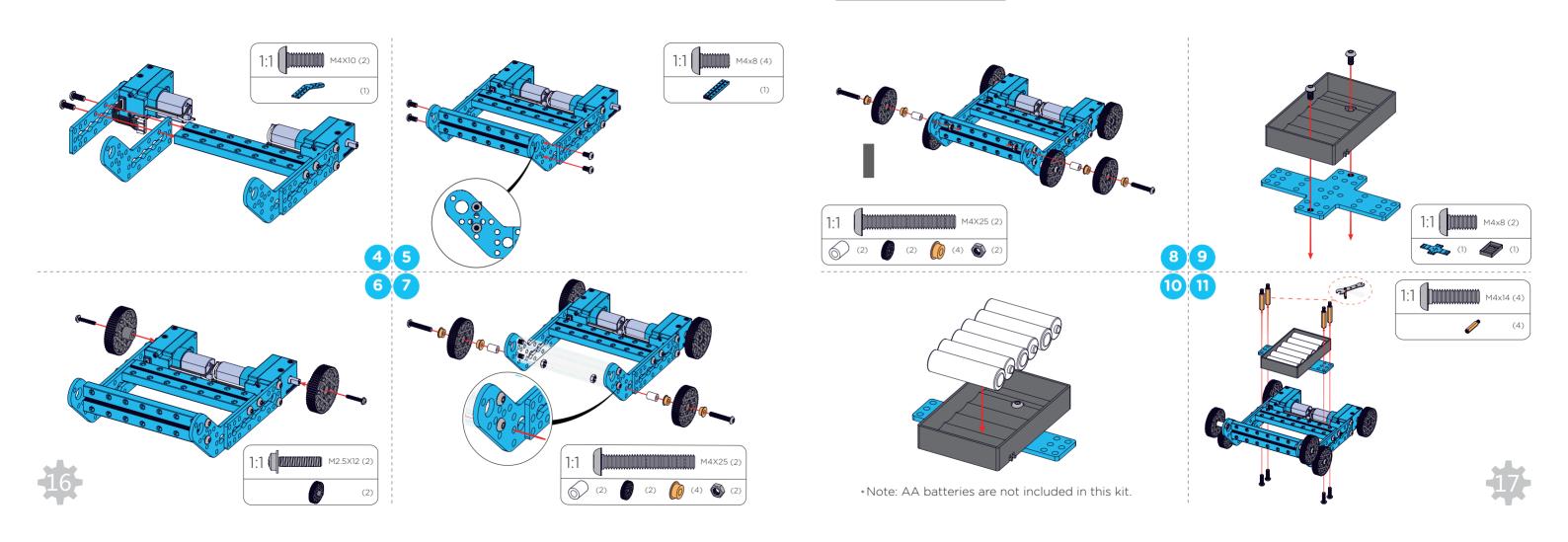
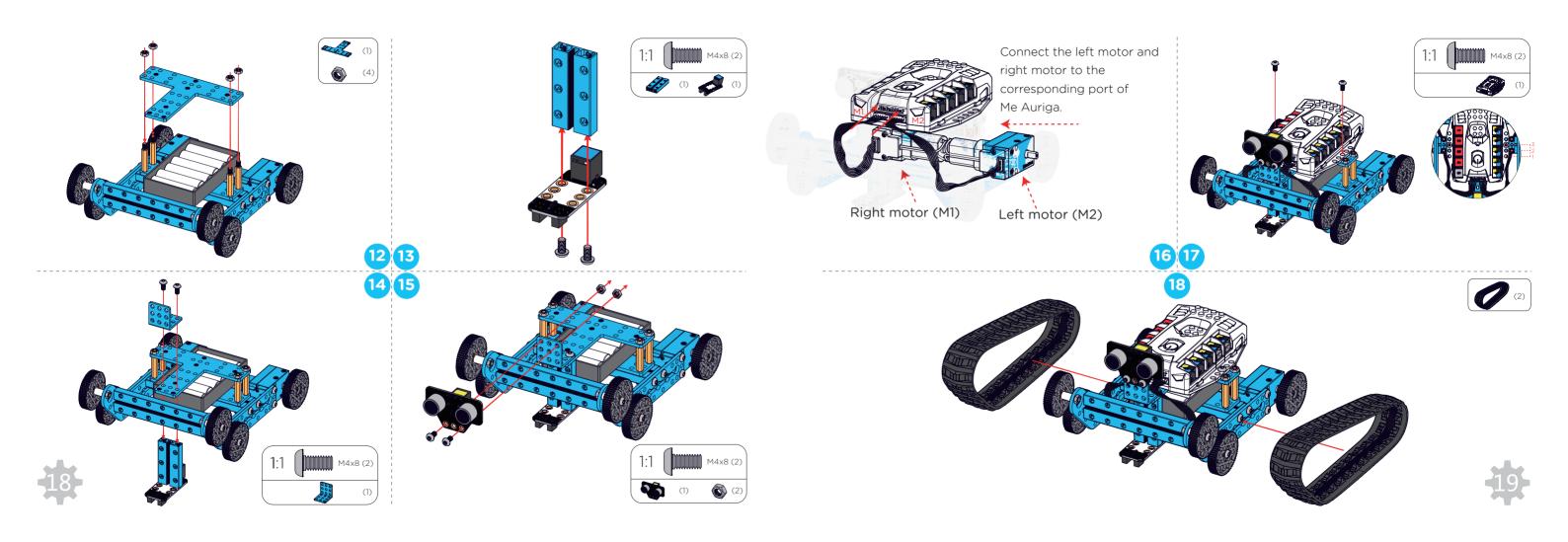|	
Land Raider & Dashing Raptor	1. Move very slowly and even automatically restart while turning or bumping into things. 2. Don't move when you set the motor speed to the largest
Nervous Bird	1. Cann't keep balance and fall down easily while moving or turning.

You need to power off and replace all batteries.

Assemble Land Raider

1:1 M4X10 (2)

(1)

1:1 M4x8 (4)

(1)

4 **5**
6 **7**

1:1 M2.5X12 (2)

(2)

1:1 M4X25 (2)

(2)   (2)   (4)   (2)

1:1 M4X25 (2)

(2)   (2)   (4)   (2)

*Note: AA batteries are not included in this kit.

8 **9**
10 **11**

1:1 M4x8 (2)

(1)   (1)

1:1 M4x14 (4)

(4)

(1)
(4)

1:1   M4x8 (2)

(1)   (1)

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

Right motor (M1)   Left motor (M2)

1:1   M4x8 (2)

(1)

12 **13**
14 **15**
16 **17**
18

1:1   M4x8 (2)

(1)

1:1   M4x8 (2)

(1)   (2)

(2)

18

19

Wiring of Land Raider

Me Auriga

Ultrasonic Sensor

Line Follower Sensor

180 Encoder Motor (M1)

180 Encoder Motor (M2)

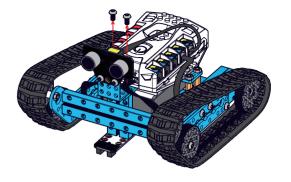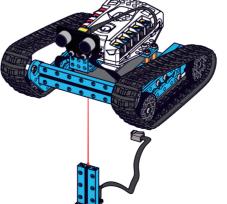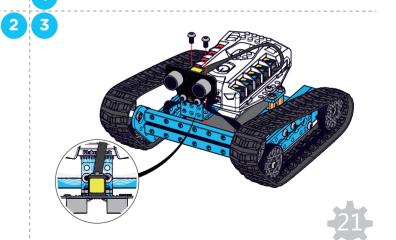Please follow page 33 for controlling with App
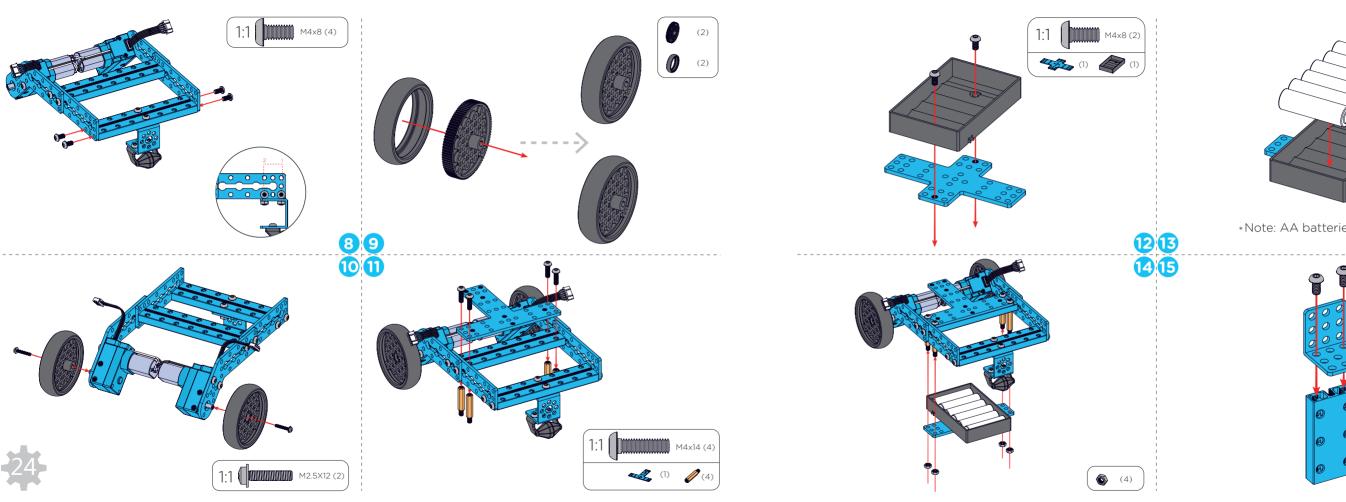
Playing Tips

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.
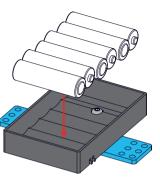

1

2 **3**
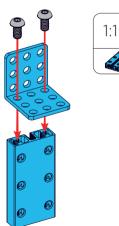
Assemble Dashing Raptor

(2)
(2)

1

2 3

1:1 M4x8 (2)
(1)

1:1 M4x10 (2)
(1) (1)

1:1 M4x8 (2)
(1)

1:1 M4x10 (2)
(1)

4 5
6 7

1:1 M4x8 (2)
(1) (1) (2)

1:1 M4x14 (2)
(1) (2)

1:1 M4x8 (4)

(2)

(2)

1:1 M4x8 (2)

(1) (1)

*Note: AA batteries are not included.

8 9
10 11

1:1 M2.5X12 (2)

1:1 M4x14 (4)

(1) (4)

(4)

1:1 M4x8 (2)

(1) (1)

12 13
14 15

1:1 M4x8 (2)

(1)

1:1 M4x8 (2)

1:1 M4x8 (2)

(1)

16 **17**
18 **19**

20

1:1 M4x8 (2)

(1) (2)

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

M1

M2

Right motor (M1)

Left motor (M2)
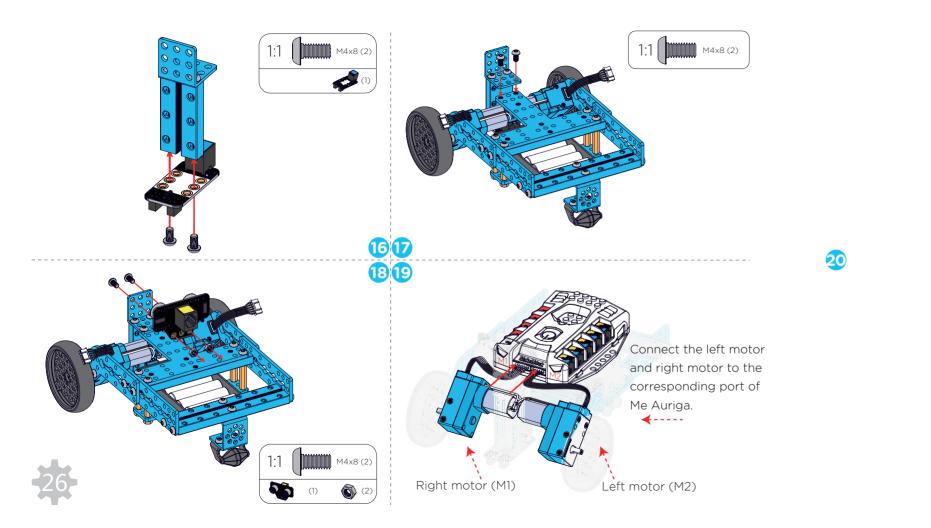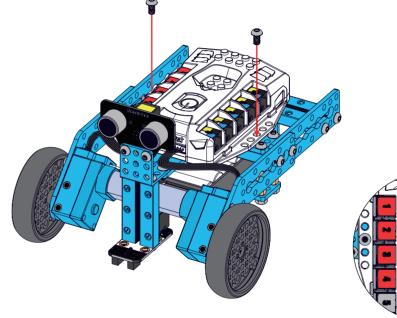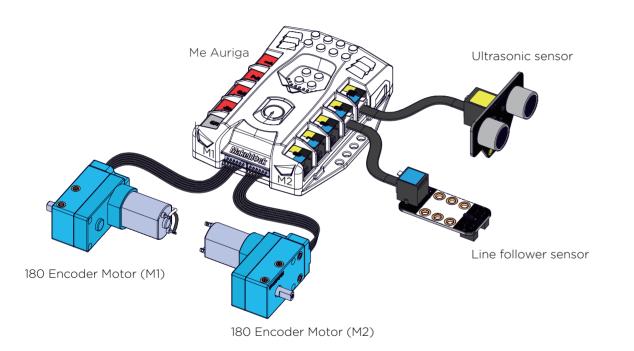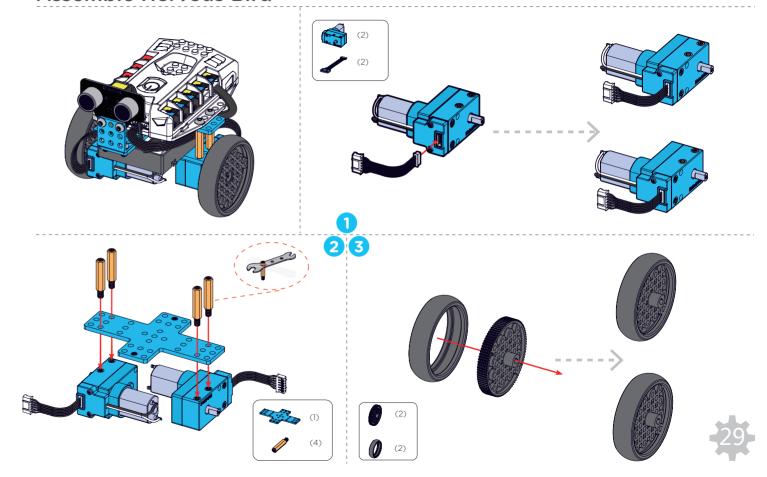
Wiring of Dashing Raptor
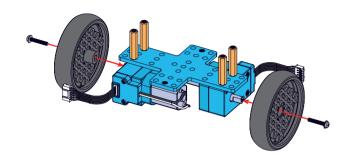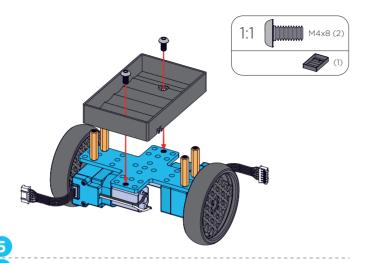
Me Auriga

Ultrasonic sensor

Line follower sensor

180 Encoder Motor (M1)

180 Encoder Motor (M2)

Please follow page 33 for controlling with App

Assemble Nervous Bird

1:1 M2.5X12 (2)

1:1 M4x8 (2)
(1)

1:1 M4x8 (2)
(1)

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

Right motor (M1)   Left motor (M2)

4 5
6 7

8 9
10

*Note: AA batteries are not included.

1:1 M4x8 (4)
(1)   (1)

1:1 M4x8 (2)
(1)   (2)

Wiring of Nervous Bird

Me Auriga

Me Ultrasonic Sensor

(1)

M1

M2

180 Encoder Motor (M1)

180 Encoder Motor (M2)

Please follow page 33 for controlling with App
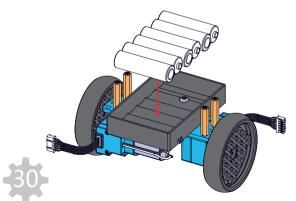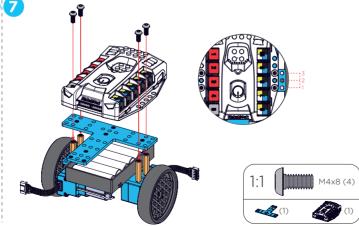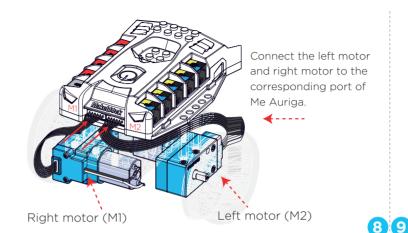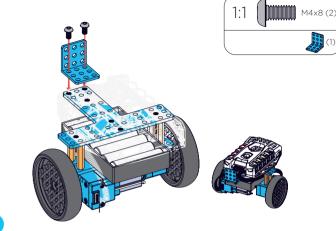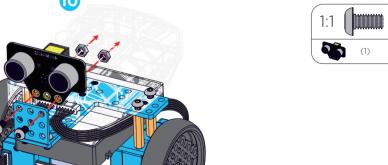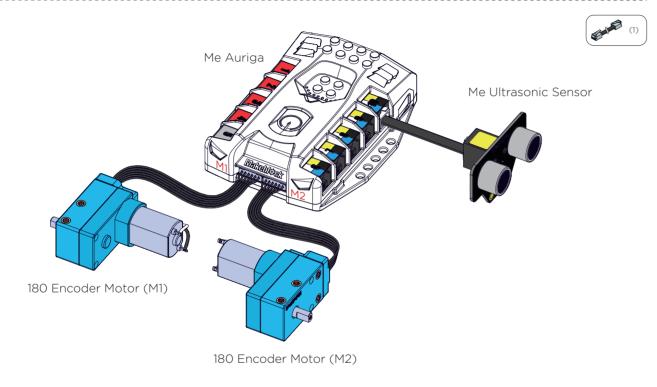
Control with App
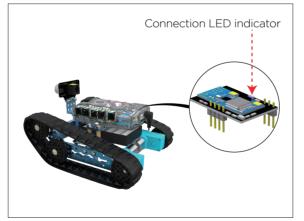
1. App Download. Not all devices are compatible now. Check learn.makeblock.com/c/ on your smart device's browser for confirmation, then download on App Store or Google play.

Available on the App Store

ANDROID APP ON Google play

2. Bluetooth Connection. Turn on your robot and open up your smart device's Bluetooth, choose the Robot ID in the list to connect Bluetooth. When the connection LED indicator stops to blink, it means that the robot is paired with smart devices successfully.

Connection LED indicator

Help

Connect it later

3. Get to know how to use the Makeblock App with mBot Ranger, please visit:

http://learn.makeblock.com/ranger/
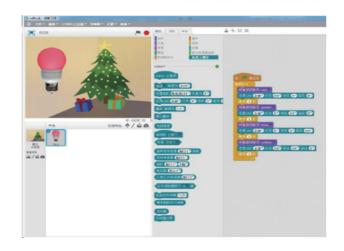
Further Learning - Graphical Programming

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 with 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/

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:
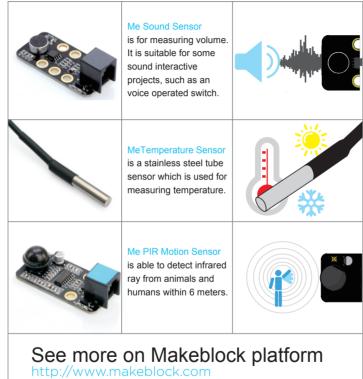
http://learn.makeblock.com/ranger-arduino-programming/
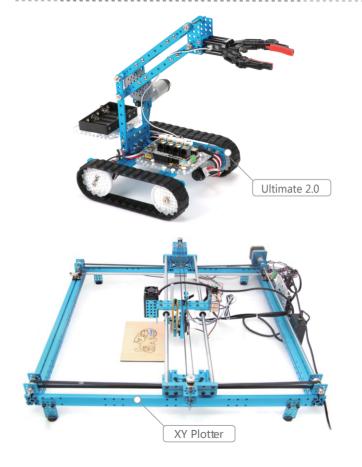
Further Exploration - Electronic Modules on Makeblock Platform

Ultrasonic Module is able to measure distance from 3cm to 400cm.

Me 7-Segment Display is a display module with four digit tubes that can show data like speed, time, score, and etc.

Me RGB LED Module contains four programmable RGB LEDs. The color of each LED can be set by editing components of red, green, and blue.

Me Joystick is normally used to control the moving direction.

Me Sound Sensor is for measuring volume. It is suitable for some sound interactive projects, such as an voice operated switch.

MeTemperature Sensor is a stainless steel tube sensor which is used for measuring temperature.

Me PIR Motion Sensor is able to detect infrared ray from animals and humans within 6 meters.

See more on Makeblock platform
http://www.makeblock.com

Further Exploration - More Kits on Makeblock Platform

Ultimate 2.0

XY Plotter

mGiraffe 3D Printer Kit

FAQs

Q1: How to turn the robot on?

A: Press the red button on the top of mainboard to turn the robot on. You will see some light effects and hear a piece of music in the start-up process.

Q2: How to turn the robot off?

A: Press and hold the red button on the top of main board for 3-5 seconds.

Q3: The robot doesn't work after I turned it on.

A: There may be one of two reasons:

1. The battery voltage may drop too low to continue running the robot. Please charge the batteries or use new batteries.
2. You may need to replace wires for the motor if they are broken.

Q4: I try to turn the robot to the left but it turn to the right.

A: You may need to switch the order of two wires (M1, M2) to correct rotation direction.

Q5: There are noises after I got the robot tank running.

1. Please check if the driven wheels are correctly installed.
2. Please grease the bearings of the driven wheel.

Q6: The self-balance car can't work correctly.

A: Check below reasons to solve this problem.

1. Please check if the battery still have power; if not, replace the batteries for the robot.
2. Please check if this self-balance car is correctly assembled. Make sure all the wheels are installed correctly and there is no obstacle affecting its movement.
3. Learn how to use the Makeblock App with self-balance car at http://learn.makeblock.com/ranger/

Q7: I can't connect the App with the robot via Bluetooth.

1. Check learn.makeblock.com/c/ on your smart device's browser for confirmation.
2. Please try to restart the App or reset the main control board.

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

A: There is a 5V LED indicator and 6-12V LED indicator on the mainboard, please refer to page 6 of this user manual.

Q9: Why the M4 nuts keep coming loose?

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

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

A: Please check if the ultrasonic sensor and line follower sensor are connected to the correct interfaces respectively.

Q11: Why the light sensor shows a high value when in a dark area?

A: Please check if the RGB LED has been switched on, which will affect the light sensor.

Q12: Why the line follower sensor cannot detect the black line?

A: Please check through the following reasons:

1. Do not keep the light follower sensor under the sun as it may be affected by the sunlight.

2. The detecting range of the line follower sensor is 1-2cm. Please adjust the distance between the sensor and the ground.

Q13: The RGB LEDs flashes randomly when I restart the robot.

A: The chip in the RGB LED has memory function, please restart your robot after 10 seconds.

Q14: How to use Ranger test pad?

A: Please refer to online tutorials at learn.makeblock.com/ranger

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

A: Check below signs:

1. Land Raider and Dashing Raptor move very slowly and even automatically restart while turning or bumping into things.

2. Land Raider and Dashing Raptor don't move when you set the motor speed to the largest.

3. Nervous Bird can't keep balance and fall down easily while moving or turning.