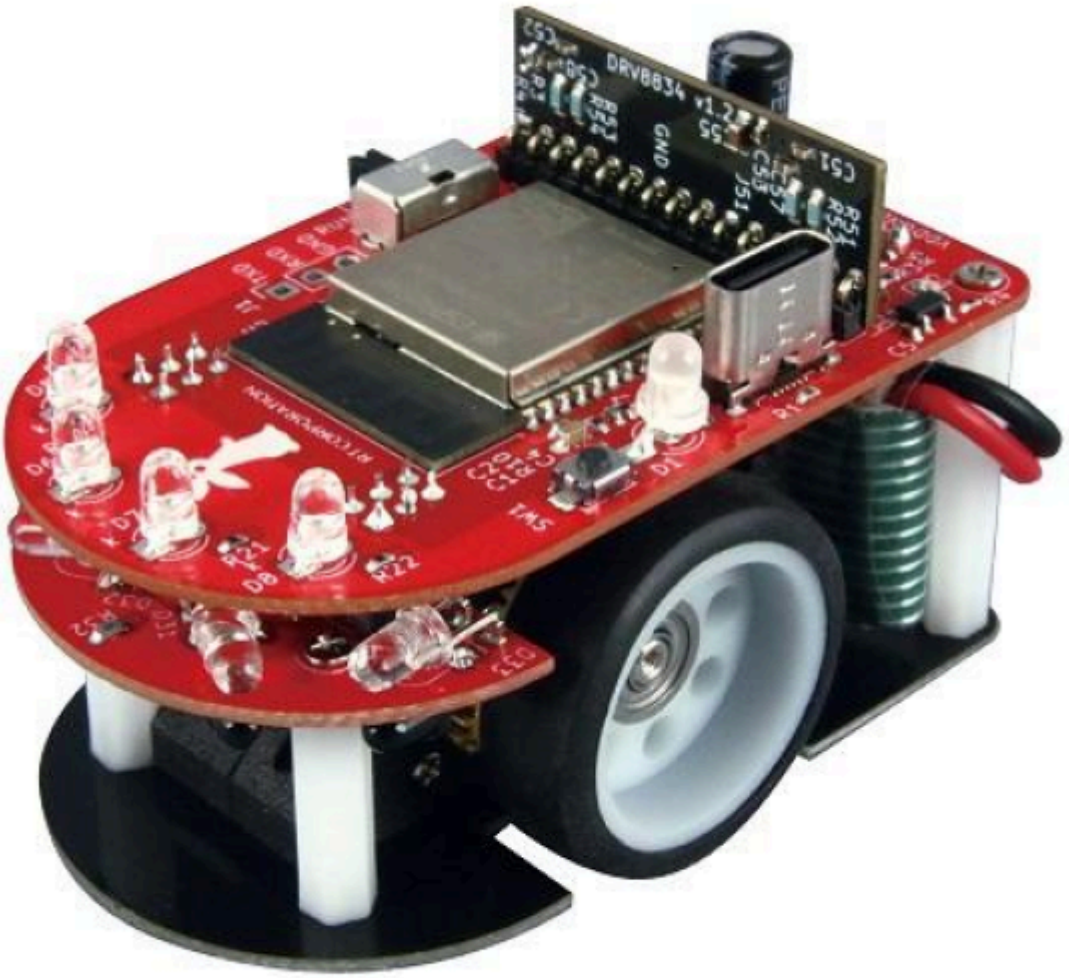
Pi:Co V2
Introductory guide



Ver. 1.0
RT CORPORATION

RT CORPORATION

INDEX

INDEX **1**
Before we begin **2**
Precautions 2
Safety Precautions 3
Manuals description **4**
Pi:Co V2 Introductory guide 4
Building an Arduino development environment manual 4
Pi:Co V2 software instruction manual (Arduino ver.) 4
Product Specifications **5**
Content list **6**
Parts name and their uses **7**
Parts name 7
Power switch 8
Battery 9
Battery charging 9
Mode change switch 10
Power supply indicator LEDs 11
Power supply check LED 11
Wall sensor LEDs 11
Wall sensor phototransistors 11
Wheels 11
Tires 11
Buzzer 11
Writing Sample Programs **12**
Sample & running modes selection buttons **13**
Running mode 13
Adjustment mode 16
Product Warranty **20**
Warranty content 20
Warrantor’s information 20
Warranty period 20
Coverage 20
Warranty exclusions 21
Terms and conditions 21
Cost covered by the Customer 22
Procedure for warranty 22
Contact information **23**
Revision hisotry **23**
Intellectual property rights and Copyright **23**

Before we begin

Thank you for purchasing our RT Micromouse V2 (‘the Product’). Please read this manual carefully before using this product.

Precautions

- We advise First-time users to work with an experienced person.
- In the unlikely event that the delivered product is faulty, damaged (including damage to the product during transportation) or missing accessories, please contact our sales support (sales@rt-net.jp) within 7 days of receipt of the product. Depending on the situation, we will replace partially or the entire product, and/or send the missing item(s) free of charge. Please note that we will not be able to provide a free of charge service if it has been 8 days or more since the delivery.
- Product specifications and appearance, as well as data and information published on the web, may change for improvement without notice. Please note that the improved version may differ from the product, data, and information at the time of purchase, and that no exchanges, refunds, returns, or modifications will be made for any differences.
- Due to the nature of the manufacturing process, the frame and parts of this product may be scratched. These scratches do not interfere with the operation of the unit and are not covered by the warranty.
- This manual is intended for users who already have knowledge and are familiar with the procedure of compile and software operating techniques in Linux, MacOS and Windows environments. As such, this manual does not contain instructions on basic use for those OS.
- The information in this publication is subject to change without notice. Please refer to our website for the most up-to-date information.
- Company names, product names and other proper nouns mentioned in this publication are registered trademarks or trademarks of the respective companies. The TM and (R) marks are omitted in the text.

Safety Precautions

Warning Signs

Mark	Definition
⚠ Danger	Indicates "Danger" Mishandling may result in death or serious injury. This term indicates matters that are of an urgent nature and cause serious damage to property, such as the occurrence of fire.
⚠ Caution	Indicates "Caution" Indicates an item that, if mishandled, could result in minor injury or physical damage.

Hazard content and response methods

	Hazard content (action, phenomenon)	Mark	Response action
Working stage	Metal material contacts with the product during manipulation or operation of the product.	⚠ Danger	Ensure that there are no metal objects around when operating the product. Remove all metallic materials such as rings, necklaces, etc., during operation.
	Operating the product with wet hands.	⚠ Danger	Operating the product with wet hands may cause a short circuit. If your hands are wet, wipe them dry with a towel before operating.
	Manipulate the product with static electricity.	⚠ Caution	This product uses semiconductors that are sensitive to static electricity. Before operating the product, please release static electricity by touching a metal surface.
	Connecting the battery when the power switch is turned on.	⚠ Caution	Turn the power switch OFF before connecting the battery.
	Continued use without recharging the battery.	⚠ Caution	When using 1-cell Li Po batteries, charge them before the battery voltage drops below 3.5 V.
	Injuries due to hands, fingers, etc. caught in moving parts.	⚠ Caution	Keep hands/fingers away from the product when power on and moving.
Assembly	Removing the main board when the battery is connected.	⚠ Caution	Turn power off and remove battery from the product, before disconnecting the main board.

Manuals description

This section presents the manual for this product. The manual is divided into three files.

Pi:Co V2 Introductory guide

The present manual. This manual serves as a quick reference and describes the precautions to be taken, the components and how to use the Product. Please read it first before using.

Building an Arduino development environment manual

This manual explains how to build an environment for developing software for this product, including how to install the Arduino IDE and how to write programs. Please refer to this manual when building the environment for developing this product.

Pi:Co V2 software instruction manual (Arduino ver.)

This manual explains the sample programs included with this product, such as how to make the LEDs light up, how to operate the motor and how to actually run the maze. Please refer to this manual when running the sample program.

Product Specifications

Technical specifications for the Product are as follows:

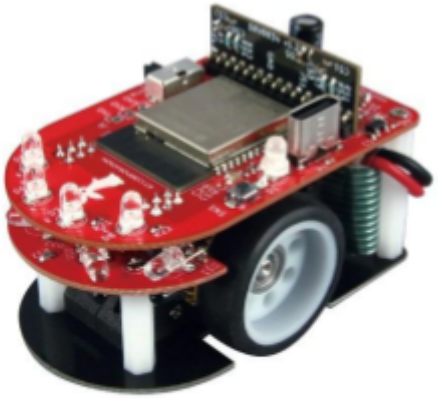
SPECIFICATIONS

ITEM	SPECS
Product Name	Pi:Co V2
Model Number	RT-PH002
Size	60x39x39 (mm)
Weight	60g (including battery)
Input power (rated voltage)	Supply from battery: 3.7 USB power supply: 5V
Battery	3.7V 260mAh
Battery charging function	Yes
CPU Modules	Espressif Systems ESP32-S3-WROOM-1-N16R8 ● Operating frequency : 240MHz ● ROM : 384kB ● SRAM : 512kB ● SPI Flash : 16MB ● PSRAM : 8MB ● Wi-Fi : 802.11 b/g/n ● Bluetooth LE : Buletooth 5
Program writing mode	USB communication ● Interface: USB Type-C
Programmable input interface	● Buttons x2 ● Wall sensors (Infrared LED and phototransistors) x4
Programmable output interface	● LEDs (red) x4 ● 2 color LEDs (red & green) x1 ● Buzzer x1 ● Stepping motors x2
Input interface	● Sketch execution mode switch x1 ● Reset button x1
Output interface	● Power supply check LED x1 ● Charging indicator LED x1

Content list

Items included in this product are as follows.

Num.	Prodcut	Qty.
1	RT Micromouse V2 (Battery included)	1
2	Download card for manuals	1



① Product

② Download card

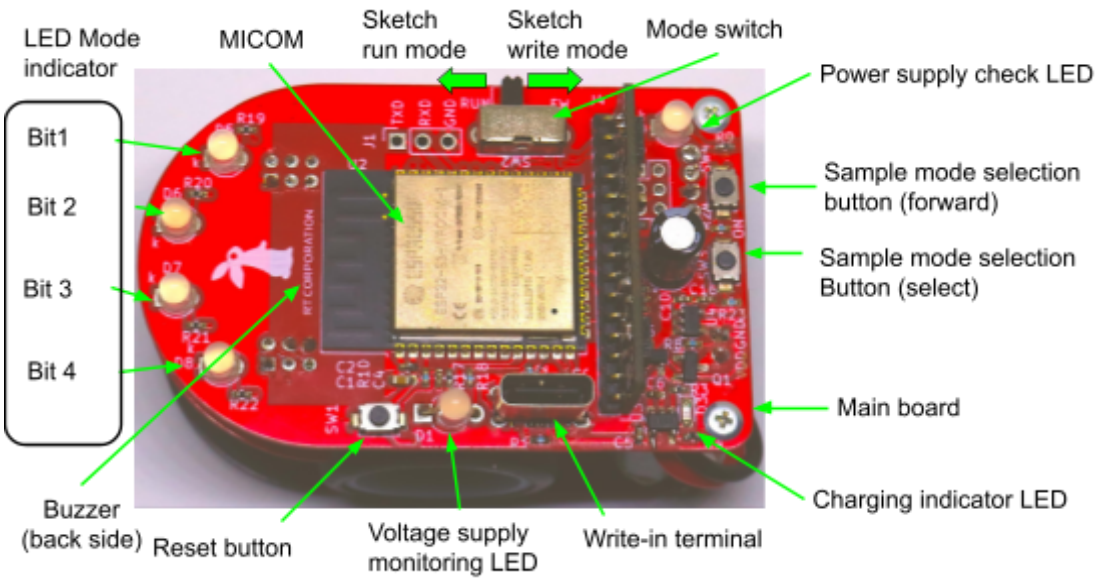
USB data cable is not included and must be prepared by the customer; USB connector for Pi:Co V2 is Type-C.

Parts name and their uses

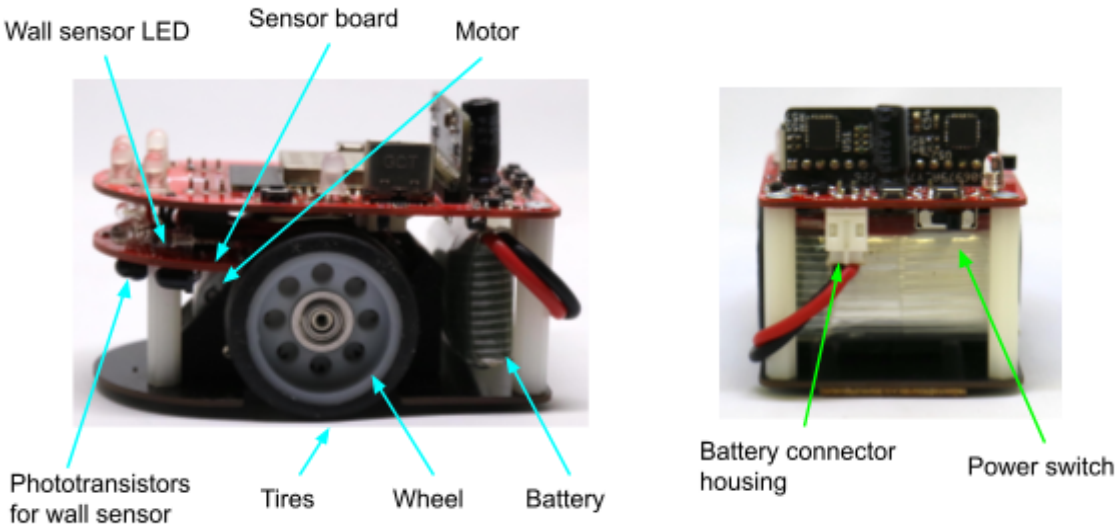
This section describes the names of the various parts of the product and how they are used.

Parts name

The names of the parts of the product are shown in the diagram below.



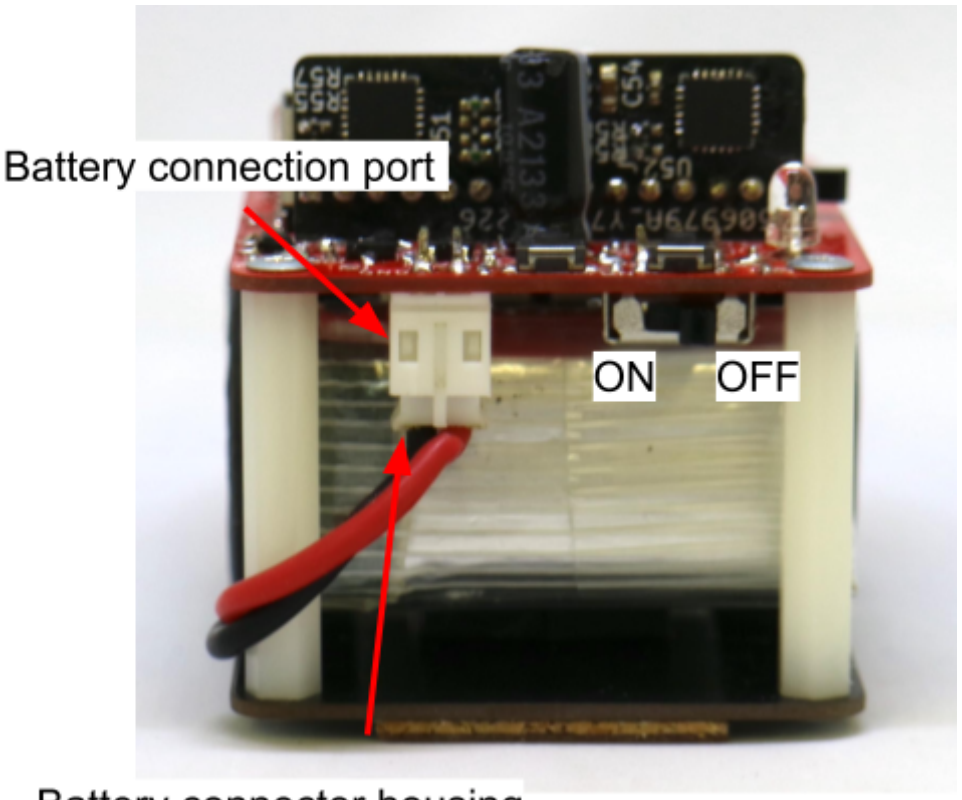
Product top view



Product side view and rear view

Power switch

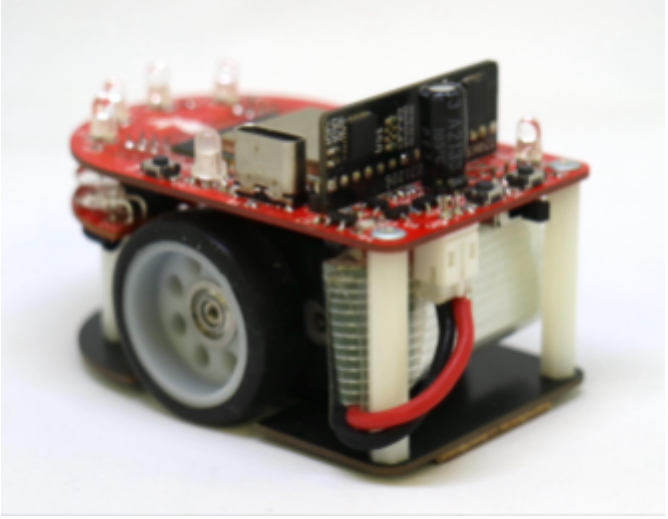
This switch turns the power supply of the product ON and OFF. As shown in the diagram below, slide it to the right to turn OFF and to the left to turn ON. The power switch should only be operated after the battery is connected. Also, turn the power OFF when connecting the battery to prevent unexpected power surges.



Battery

The battery should be placed between the rear post and the tire. When connecting the battery connector to the battery connection post, ensure that the power switch is in OFF position.

If the product is not to be used for a long period of time, remove the battery from the product and store it. At that time, it is recommended that the battery voltage is around 3.8 V.



Battery correctly installed in the product

Battery charging

Charge the battery using a USB cable. The charging voltage is 5 V. If using a PD (Power Delivery) USB, prepare a PD with an output of 5 V. The maximum output current is 300 mA.

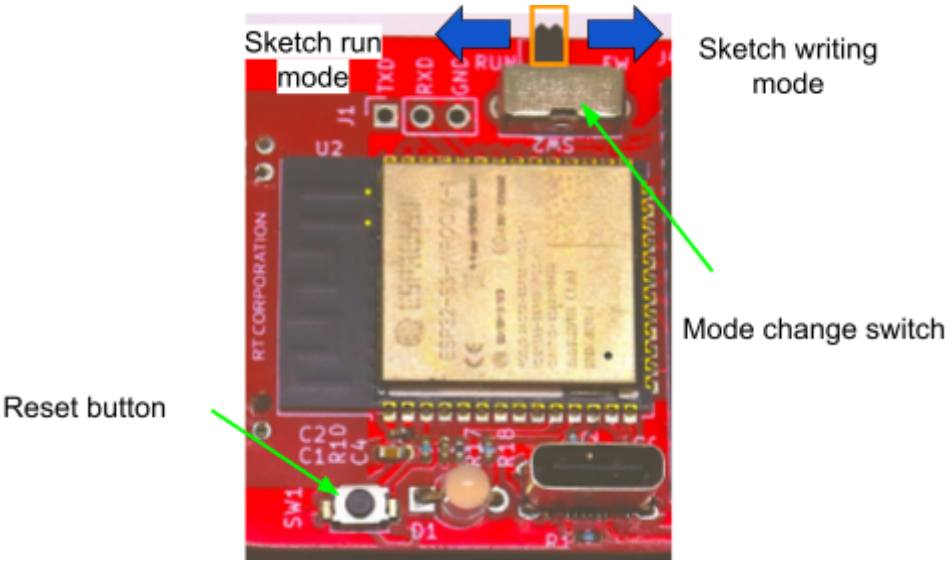
The orange LED lights up during charging and turns off when charging is complete.

Charging the Product

Mode change switch

It switches between the writing mode and executing mode, for the built program to be written in the microcontroller. Basically, switching to sketch execution mode allows you to write and execute programs using the Arduino IDE or Eclipse.

However, if writing cannot be performed due to a problem in the program, it is necessary to switch to sketch writing mode. After switching the mode switch to sketch writing mode, the mode can be switched by turning the power OFF and then ON or by pressing the reset button.



Power supply indicator LEDs

The Product comes with a two-colour LED for checking the power supply voltage. It can emit a combination of red and green colours.

In the sample program, the colour changes according to the battery voltage. When the battery is fully charged the colour is green, and shifts to red as the voltage decreases.

Power supply check LED

This LED is for checking if the Product is switched on. It lights up when the power switch is ON and power is supplied to the microcontroller. The LED will only turn off when the power switch is in OFF position.

Wall sensor LEDs

LEDs for measuring the presence and distance of walls. They emit an infrared beam towards the wall in front of and to the left and right.

Wall sensor phototransistors

Phototransistor for measuring the presence and distance of walls. After the LED for the wall sensor emits light, the light reflected off the wall is received by these transistors. The light intensity is then converted to A/D to measure the presence and distance of the wall.

Wheels

Transmits the motor's power to the tires.

Tires

Rubber tires mounted on wheels.

Buzzer

The buzzer can be programmed to change the pitch (frequency) of the sound. The volume cannot be adjusted.

Writing Sample Programs

This section briefly describes how to write programs to the microcontroller using the Arduino IDE. For detailed environment building procedures and how to write programs, please refer to the **Arduino Development Environment Building Manual**.

1. Open the sketch of the sample program “pico_V2_STEP8_micromouse” in the Arduino IDE.
2. Connect the Product to a PC via USB cable.
3. Turn Product’s power ON.
4. Check that the port, board and other settings are correct before writing the sketch.

5. Click the icon  to write the sketch.

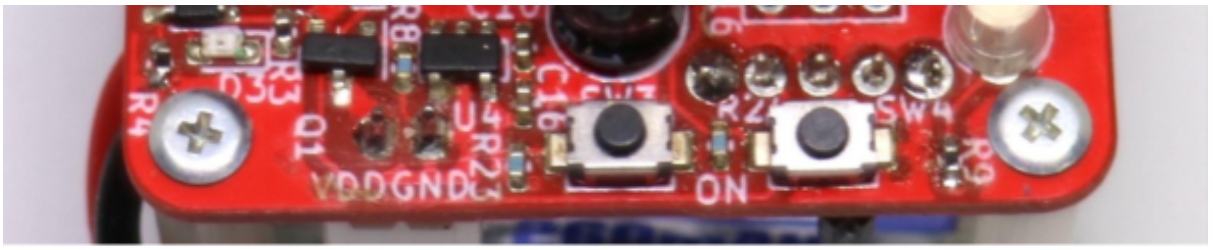
This completes the writing of the program to the microcontroller.

Sample & running modes selection buttons

In the sample program pico_v2_STEP8_micormouse, the running mode is switched by operating the sample mode selection button.

Each mode has its own number, and the mode can be selected by pressing the left or right button in the image below. Pressing the right button advances the mode number by one. Once the mode has been selected, press the left button to execute it.

The modes include running mode and adjustment mode. The running mode is set from 1 to 15 and the adjustment mode from 1 to 7.



Select Forward

Sample mode selection buttons

Running mode

Running mode 1 : Performs the left-hand method, for maze search. It does not recognise the goal and therefore continues to move until the power is switched off or is stopped by resetting the operation.

Running mode 2 : Perform the adachi method, one of the maze search methods. After reaching the goal point, return to the start point while continuing the search.

Running mode 3 : Performs the shortest route run. Runs from the start point to the finish point in the shortest number of sections, using the maze information already explored.

There are no programs or content set from Running mode 4 to 14, the customer is free to add their own content. Only the lighting of the LEDs is shown in the picture below.

Running mode 4

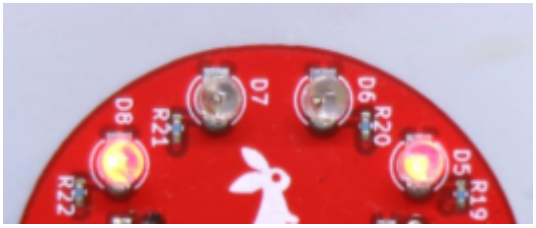
Running mode 5

Running mode 6

Running mode 7

Running mode 8

Running mode 9



Running mode 10

Running mode 11

Running mode 12

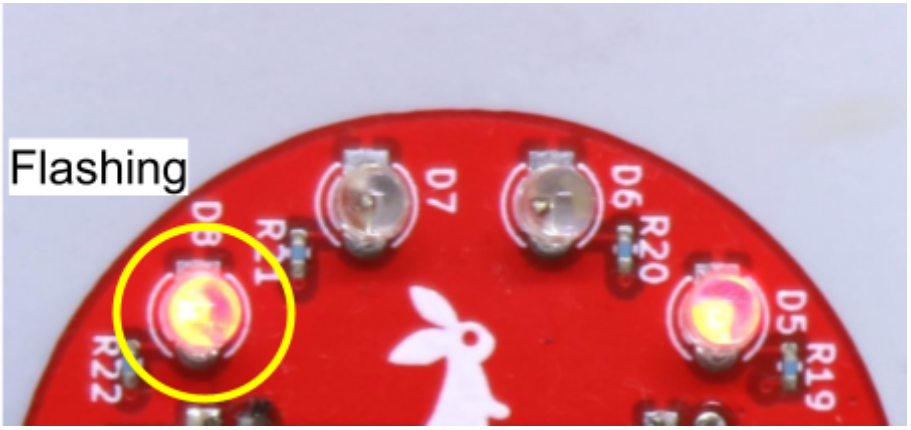
Running mode 13

Running mode 14

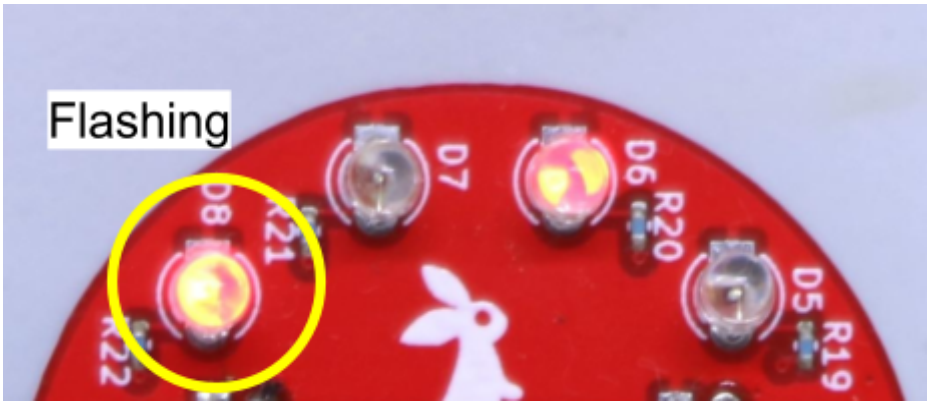
Running mode 15 : When selected, the system switches to the adjustment mode.

Adjustment mode

Adjustment mode 1 : Wall sensor values are displayed on the serial monitor of the Arduino IDE.

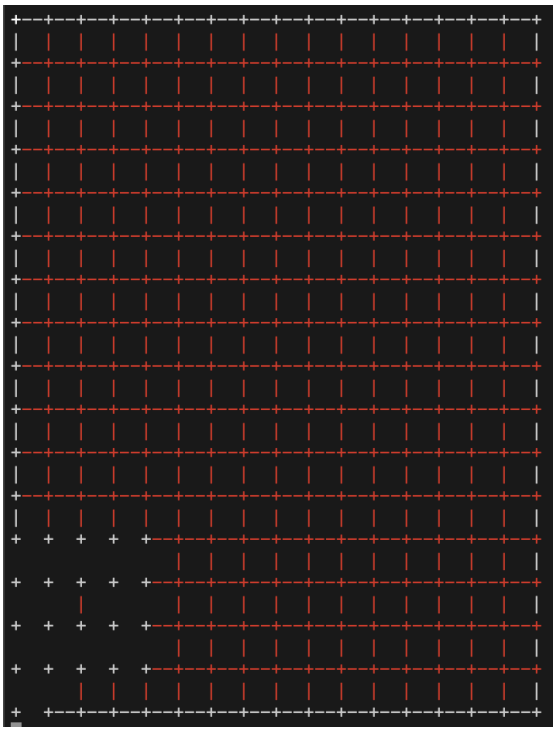


Adjustment mode 2 : Run straight for nine sections of the maze.

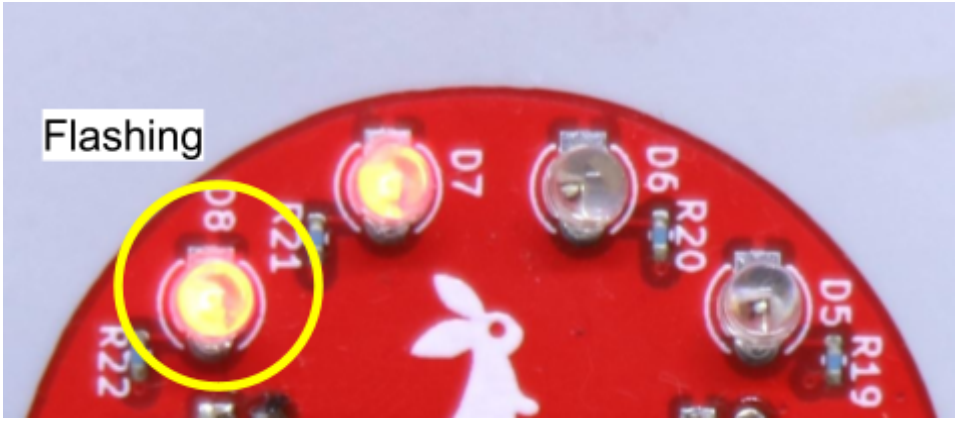


Adjustment mode 3 : Turn 8 times to the right.

Adjustment mode 4 :Displays the map of the explored maze. Given that it uses escape sequences, it must be displayed on a terminal screen such as TeraTerm.

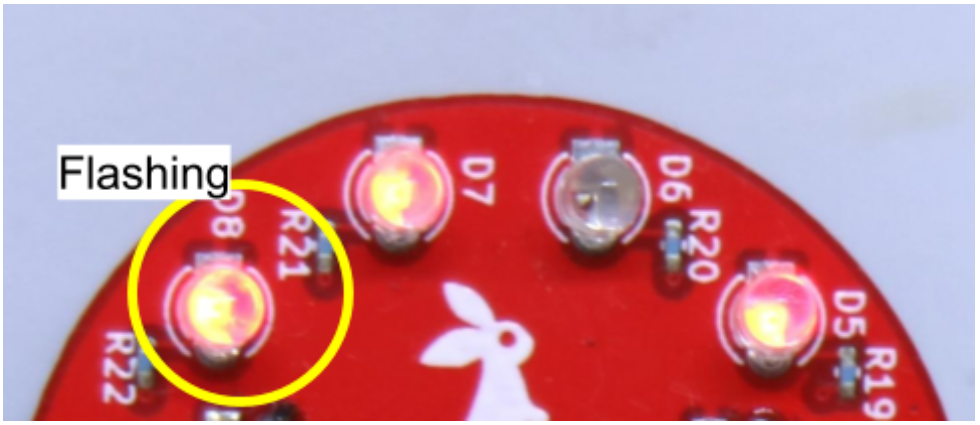


Display maze map.



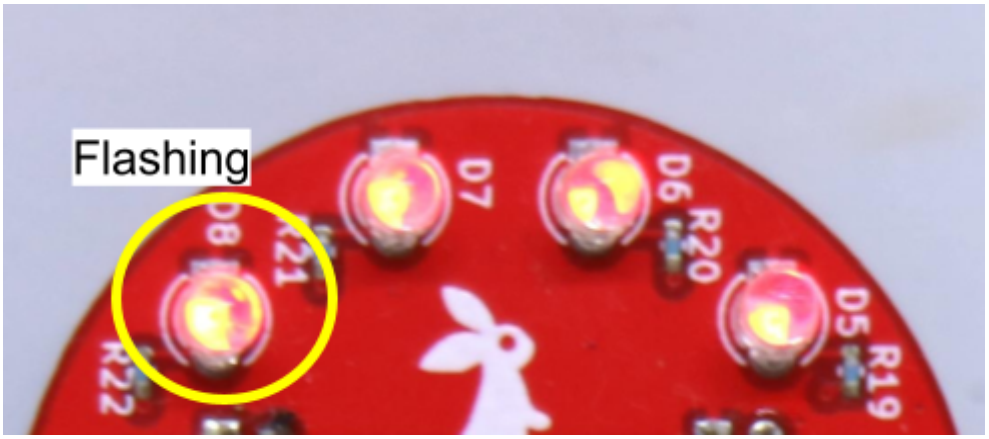
Adjustment mode 5 and adjustment mode 6 does not have any executable content, the customer is free to add their own content. For these two modes the default setting only consists in LEDs flashing as shown in images.

Adjustment mode 5



Adjunstment mode 6

Adjustment mode 7 : When selected, the system returns to running mode 15.



Product Warranty

Warranty content

In the event that the Product purchased by the client has any failures or defects due to the design or production; RT Corporation (hereinafter referred to as “we” or “us”), will repair the Product free of charge in accordance with the warranty period and conditions set out below.

Warrantor’s information

The warrantor is as stated in the ‘Contact Us’ section of this document. The reception hours for repairs, etc. shall be as stated in the ‘Contact Us’ section.

Warranty period

The warranty period is 12 months starting from the date of delivery of the product. After the 12 months have passed the warranty shall expire.

Coverage

1. This warranty applies to the Product sold and used within the Japanese territory. It does not cover the Product taken abroad.

2. This warranty only applies to the main body of the Product. The warranty does not cover those accessories included in the set for this Product.

3. This warranty does not cover any malfunction, defects, damages, loss or injuries (personal or property damages, indirect damages, special damages, lost earnings, etc.) other than to the main body of the product caused by the malfunction or failure

4. This warranty applies to products with standard specifications. The warranty does not cover special specifications and the contents of custom specifications including special notes.

Warranty exclusions

The warranty will not apply for the following cases:

1. Malfunctions or defects caused by failure to comply with the procedures, precautions, safety matters, checks and operating methods specified in the manuals, also on the labels attached to the equipment and instruction manuals group of the Product (hereinafter referred to as 'manuals, etc.').

2. Failure or malfunction resulting from operation under conditions other than those described in the operating environment conditions in the manual.

3. Malfunctions or defects resulting from use (including modification of the program, modification of the unit, etc., by the customer) that exceeds the limits or scope of the specifications (payload, operating speed, etc.) stated in the manuals, etc.

4. Deterioration, failure and defects over time

5. Failure or malfunction due to natural disasters

6. Failure or malfunction due to condensation, abnormal voltage, collisions, falls, drops, pollution or other accidents.

7. Malfunctions or defects caused by repairs or maintenance carried out by anyone other than Us or appointed service providers.

8. Malfunctions or defects caused by reasons not attributable to Us in addition to the preceding items.

Terms and conditions

If, during the warranty period, the product fails or malfunctions under normal usage in accordance with the manual, etc., and the customer informs Us of this. We will, at our discretion, take any of the following measures.

(A) Free repair

We will repair or replace parts of the original product sent to Us by the customer; and restore it to its normal condition. Repairs shall be carried out by Us or by a contractor commissioned by Us. The costs for parts, etc. shall be borne by Us. Please note that damaged partial sections of the Product or pieces that have been replaced for repair may not be returned.

(B) Free replacement of the product

If we consider the original Product sent by the customer to be unrepairable, We will replace it with an equivalent one. Please note that in this case, we may not be able to return

all or part of the original product. We will bear the shipping costs for sending the replacement Product..

(C) Ferunds

If we determine that the Product cannot be repaired for free as stipulated in clause (A) and the free replacement as stipulated in clause (B) is not possible; We will refund the purchase value of the Product. Any bank transfer or other handling charges for the refund shall be borne by Us.

Cost covered by the Customer

The following costs shall be borne by the customer

1. Packaging and shipping costs when the Customer sends the Product to Us for repairs for free of charge, as stipulated in the item (A) of the preceding Article. The customer shall pack the product in a way that it can withstand transportation.

2. The Customer should cover the cost for packaging and shipping to send the Product to Us, for the purpose of Product replacement free of charge as stipulated in paragraph (B) of the preceding Article. The customer shall pack the product in a way that it can withstand transportation.

3. Repair/replacement service charges and return shipping costs apply if the product falls within the warranty exclusions or is not faulty or defective. If our inspection reveals that a warranty exclusion applies, we will inform the customer and confirm whether repairs are required. If the customer requests the product to be repaired, repair/replacement services will be provided and charged separately upon agreement with the customer. The customer shall bear the shipping costs for the return of the product.

Procedure for warranty

In order for us to quickly investigate the cause of the malfunction/failure and consider what and how to repair the Product, We will request the customer to follow these procedures. Please note that the average repair time is approximately two weeks from the date of arrival of the Product, but may take longer depending on the situation.

1. Submit a written statement specifying the conditions of use in as much detail as possible.
2. Submit a written statement specifying the fault conditions in as much detail as possible.

Contact information

For enquiries about this product, please send your communication to:

RT Corporation
Suehiro Bldg. 3F
3-9-2 Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN

URL	https://rt-net.jp/
TEL	03-6666-2566
E-mail	support@rt-net.jp (Technical support)
	sales@rt-net.jp (sales support)
Reception hours	weekdays from 11:00 hours to 18:00 hours (Closed on Saturdays, Sundays, holidays, summer and New Year holidays)

For the latest product and company information, please visit our website.

Revision hisotry

Date of publication (YY/MM/DD)	Edition number	Revisted content
24/06/12	1.0	Newly created

Intellectual property rights and Copyright