SKCON2 User Manual

Version: 20190422

Abilix

WER World Education Robot Contest

table of Contents

1 Introduction

SKCON2 It is a new generation of educational robot building block series controller launched by Ability Storm! Its appearance is quite technological At the same time, it has many functions and stable and reliable performance required for educational robot teaching and competition!

SKCON2 In terms of hardware, while continuing the design style of the building block series, the shell provides more structural holes to support Six-sided overlapping, fully realize space expansion; software, support flowchart programming, bar graph programming, C Language programming, Provide you with rich learning and application methods!

This book introduces SKCON2 And the functions of the supporting software and how to use it, the examples provided in the book can help You learn better to improve the efficiency of the product.

Note: The supporting software of the product depends on the product model, and the actual product shall prevail.

2 Introduction to SKCON2

2.1 Core functions and parameters

SKCON2 Equipped 128*64 Dot matrix screen, backlight can be

You can complete the program, port, electrical

The function interface operation of the machine and settings can be programmed

Display characters or sensor return value.

SKCON2 Equipped with rich interfaces, USB stand by

Wired connection to the computer; RJ11 Support multiple external sensors

Actuator, support closed loop motor!

SKCON2 Support removable dedicated lithium battery power supply,

The system has built-in power monitoring to meet the needs of teaching and competition.

SKCON2 Have a long time (approx 10 Minutes) none

Operate the automatic shutdown function unless the user program is running

Row.

SKCON2 Supports six-sided lap joints, only need to use some bolts, it can be assembled with blocks (Krypton series) into abundance

Rich project.

SKCON2 The hardware core parameters are as follows:

a) 32 Bit Cortex-M3 (STM32F103VET6) CPU , 72MHz , 512K FLASH , 64K SRAM .

b) I/O Interface: Total 12 Way, adopt RJ11 Socket, used in conjunction RJ11 The plug cable is firm and convenient

For plugging. Port has analog input (AI), digital input (DI), digital output (DO), UART

Serial universal asynchronous communication interface (10 Way) and reusable I ² C Bus synchronous serial communication interface (2 road).

c) Motor interface: total 4 road(RJ11). The port has a closed-loop control function, supports controlling the steering of the motor, and

The output voltage is the battery voltage, and the maximum current supported by a single channel is 1.5A . The port also supports reading the return value of the motor encoder.

d) Wired connection interface: total 1 Road, adopt standard USB-C Interface, with the use of universal data cable, convenient operation

And reliable. Support wired download of user programs and wired upgrade firmware.

e) Built-in sound intensity detection, support for obtaining sound intensity return value (analog).

f) Built-in speakers, support for playing built-in audio.

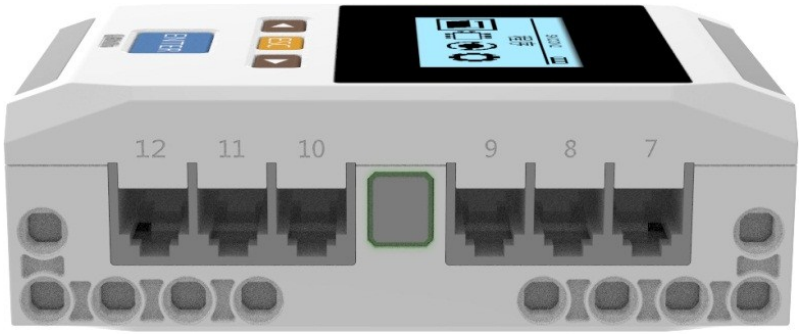
2.2 Battery use and switch operation

SKCON2 Operating Voltage 7-8.4V , Use a dedicated battery for power supply.

Dedicated lithium battery: 7.4V , 1500mAh , 11.1Wh , Support independent charging.

The battery needs to use a dedicated 8.4V1A The charger is charging. When the indicator light on the charger is red, it means charging

When the battery is fully charged, it turns green.



After installing the battery, long press (about 1 Sec) power button to turn on. After the controller is turned on, no matter in any interface,

Long press the power button (about 1 Seconds) to shut down.

Note: In the power-on state, short press the power button, the operation interface returns to the previous level.

* Instructions for battery and charger

1. Regularly check whether the charging plug, wire and other parts are damaged. If damage is found, stop using it until

Repaired intact;

2. Do not use other types of batteries and chargers that are not specified by the company;

3. The battery should be removed from the product before charging, and can only be charged under adult supervision;

4. Press the lithium battery into the back of the controller according to the front facing out and the back facing in to complete the installation. Push the battery card

Button to take out the battery;

5. Used batteries should be taken out of the product;

6. Avoid liquid flowing into the controller and the lithium battery, so as not to cause battery power supply and short circuit of power terminals;

7. When the battery is not energized or cannot be charged, it can only be replaced by the service provider authorized by Ability Storm or Ability Storm.

change;

8. Batteries must be recycled or disposed of separately from household garbage;

9. It is strictly prohibited to use the product while charging.

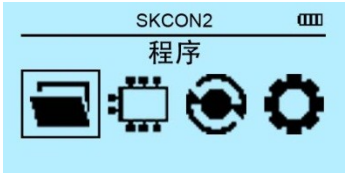
3 SKCON2 operation interface

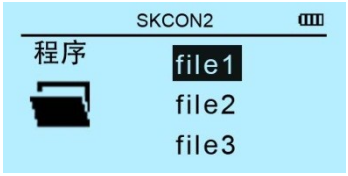
3.1 Main interface

SKCON2 After power on, the operation interface presented to you is as shown in the figure above. Press the right button to select it.

Other function modules, click ENTER Key to enter the next level interface, short press ESC Key to return.

3.2 program





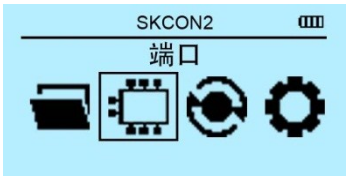
Program: Store the downloaded program (programming software is required, see " SKCON2 Programming software").

Each line in the list is a program, click one of them, the program starts to run; while the program is running, press ESC

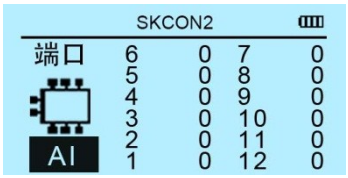
Stop and exit the program; the program does not support deletion, supports overwriting; the program name does not support modification, a total of provided 6 Program bars.

Note: When the program is running, if there is a "display" code in the program, the corresponding information will be displayed on the screen.

3.3 port

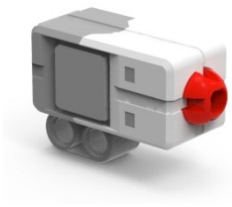
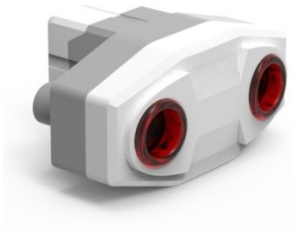


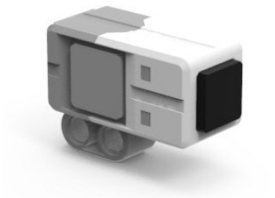
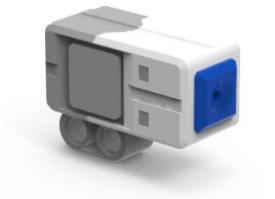
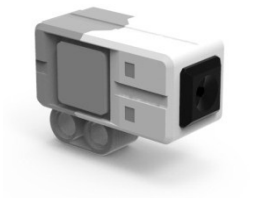
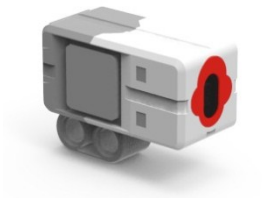
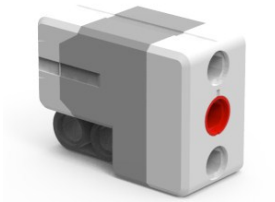
3.3.1 Port-AI



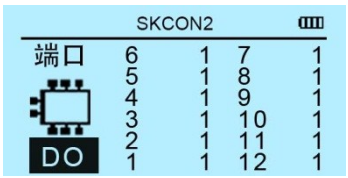
Read port 1~12 The return value of supports reading the value of the digital input type (DI), the value of the analog input type (AI).

The return value range of each sensor is different, please refer to the following table:

sequence number	name	Schematic diagram	Return value range
1	Grayscale		0~4095
2	collision		0 , 1
3	Ultrasound		50~1500

4	flame		0~4095
5	temperature		0~40
6	Magnetic sensitivity		0 , 1
7	humidity		0~100%
8	Infrared		0~1200mm
9	angle		0~359

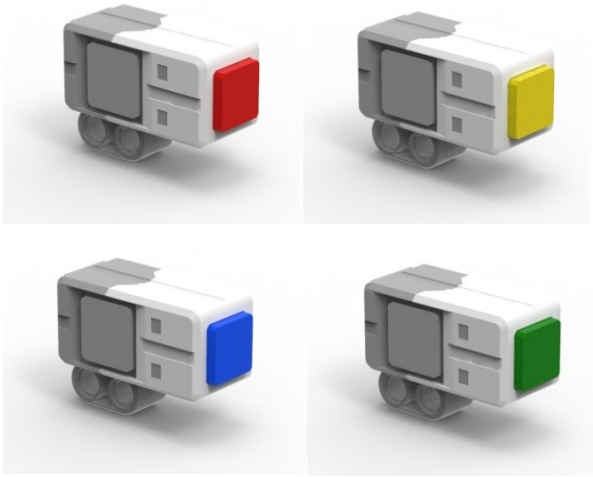
3.3.2 Port-DO



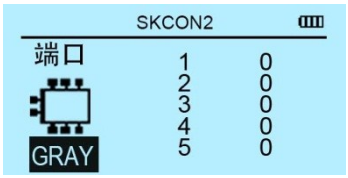
Control port 1~12 The output signal supports controlling the value of the digital output type (DO). The controller will automatically

Substitute output 0 , 1 When the signal is externally installed, such as a lantern module, the phenomenon is alternately on and off.

For the supported actuators, please refer to the following table:

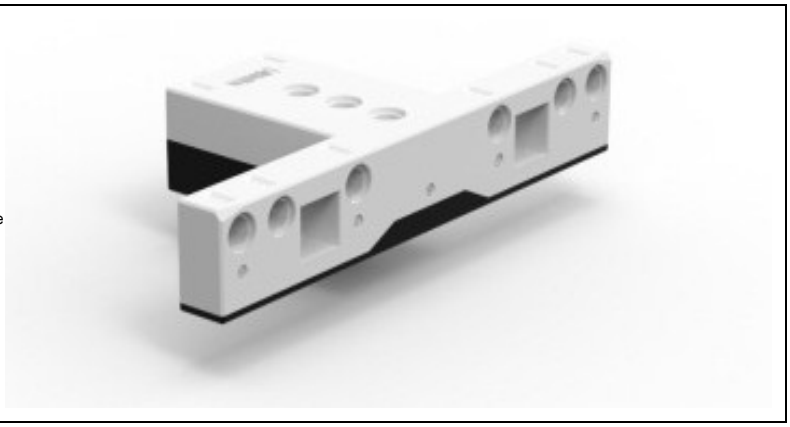
sequence number	name	Schematic diagram
1	Electromagnet	
2	Lantern	

3.3.3 Port-GRAY

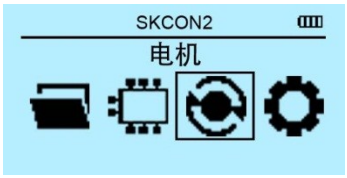


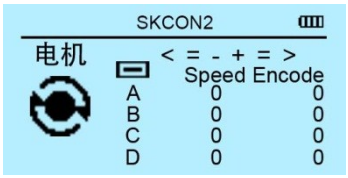
Read external integrated gray scale return value, port 1~12 .

sequence number	name	Schematic diagram

1	Integrated grayscale	

3.4 Motor





Through port A~D , Debug the speed of closed-loop large motor and closed-loop small motor, and read the return value of the motor encoder.

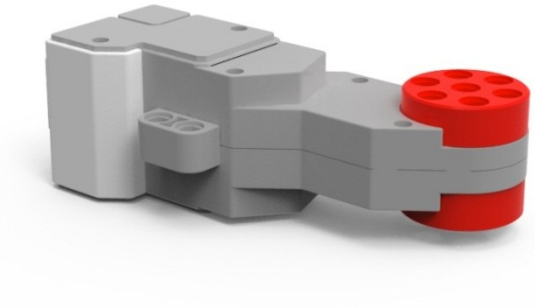
The port can be selected by the left and right buttons, ENTER Key to enter the debugging speed (Speed a row), ESC return;

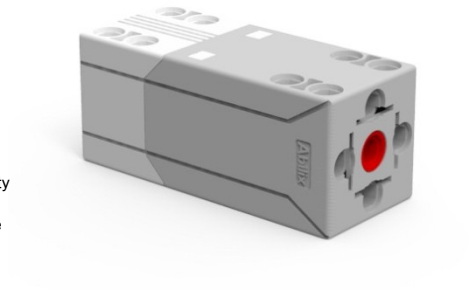
Support select all 4 All ports are selected for synchronous control.

When an external motor is installed on the port, Encode One column can read the return value of the motor encoder.

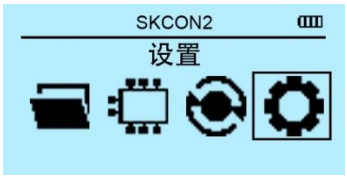
Note: When operating the motor interface, pay attention to avoid the output end of the motor, otherwise there may be friction or extrusion.

risk.

Ordinal name Known as	Schematic diagram	Speed range	Encoder return value range
1 close ring Big Electricity machine		-100~100	-99999~99999

2	close ring small Electricty machine		-100~100 -99999~99999	

3.5 Set up



3.5.1 Read and write data

The plastic data can be stored, and the data will not be lost when the machine is turned on and off.

All data can be modified and saved in the interface, and can also be read and written through programming software.

3.5.2 Key tone

Set the key tone switch.

3.5.3 Backlight

Set the controller screen backlight switch.

3.5.4 Language

Set the operation interface language, support simplified Chinese, English.

3.5.5 Contrast

Set the contrast of the controller screen.

3.5.6 About

Display the controller software version.

4 SKCON2 programming software

SKCON2 Support flowchart programming, C Language programming and bar graph programming, interactive friendly, powerful, initial

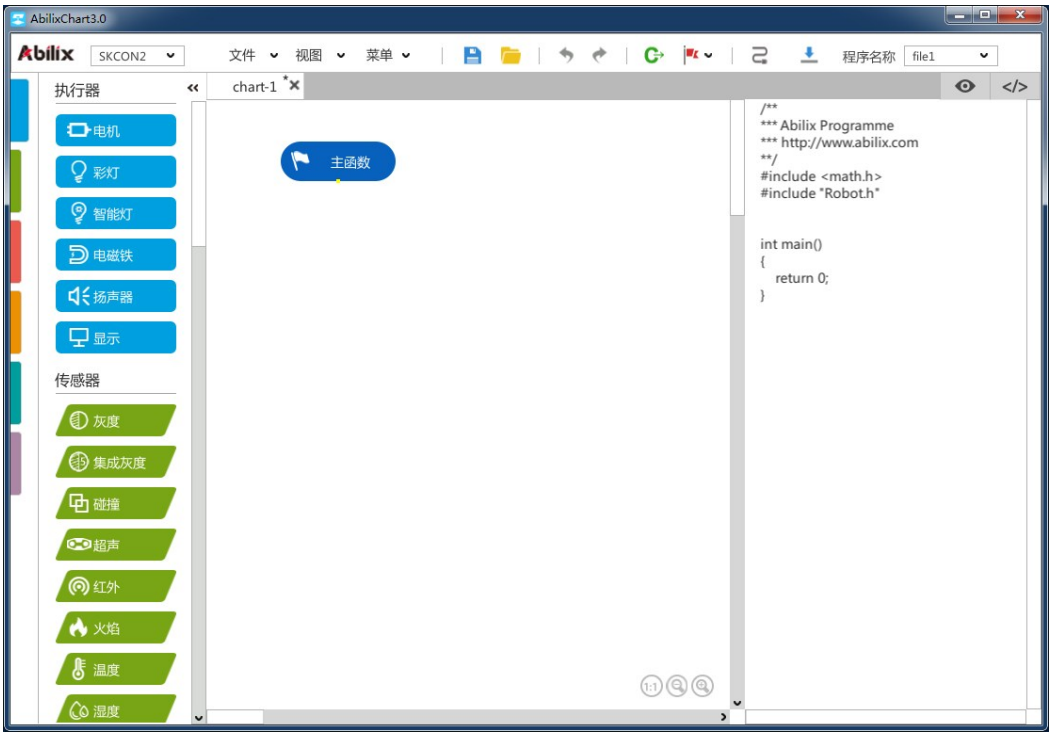
The threshold for scholars is low, the advancement is fast, and the high-level expansion space is wide!

Serial number	name of software	Programmatically	homescreen icon
1	Abilix Chart 3.0	Flowchart programming C Language programming	
2	Abilix Scratch 3.0	Bar graph programming	

You can obtain the matching software installation files in the product CD, or by visiting the official website of Ability Storm

www.abilix.com , Obtained from the "Technical Services/Data Download" page.

4.1 Abilix Chart 3.0



Using standard flowchart programming method, support C Code control display, support one-key turn of graphic programming C Code

Cheng. Support wired download.

4.1.1 Toolbar

1) Select model: Support Abilix More products under the brand

note:

a) It will take effect immediately after selection, and it will be retained until another selection

b) Before selecting again, pay attention to save the current program file

2) File, view, menu;

3) Save, open;

4) Go back to the previous step and redo the next step;

5) redirect to C Language programming environment, selection function;

6) Download the program.

Wired connection and download		
first step	Use standard USBC Cable connection SKCON2 "port PC "With computer	
Second step	Select program name	file1~6
third step	click to download"	
the fourth step	carry out	

4.1.2 Programming area

By using the mouse, drag the required program module to the programming area to design the flow chart program;

To set a certain program module in detail (when it can be set), in the programming area, double-click this module, in the second window

Just set it in the mouth, and it will take effect after confirming that it is closed.

4.1.3 Code preview area

```
//CExplainFile
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <pthread.h>
#include "Robot.h"

int Main()
{
    SetMotor(0,100);
    return 0;
}
```

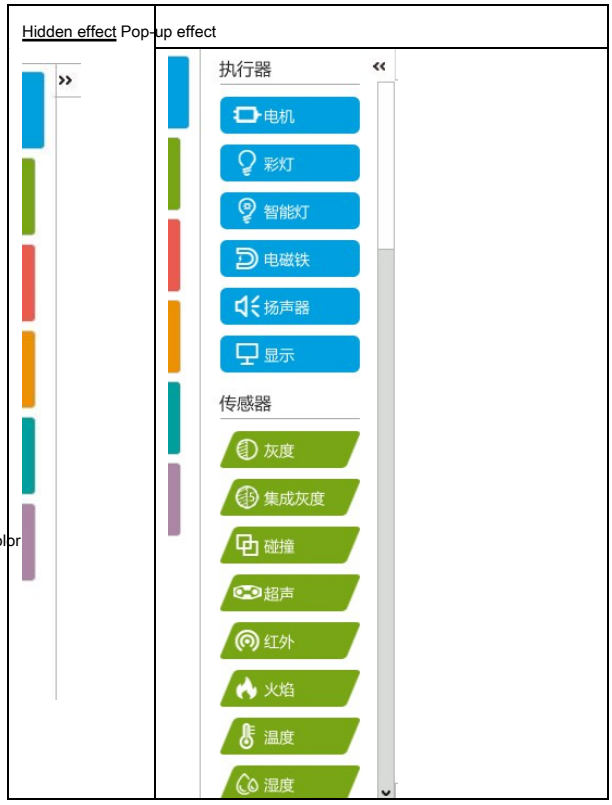
When you are programming in the "programming area", once the module is connected to the "main function" (or the newly created function

Number), the code of the current graphics program can be displayed synchronously in the area on the right.

Note: This area can be customized to show or hide,  The button is visible at the bottom right of the toolbar.

4.1.4 Program module library

By clicking « Hide or pop module library



4.1.4.1 **Actuator module**

contain:

External actuators: motors, colored lights, smart lights,

Electromagnet

Built-in actuator: speaker, display

4.1.4.2 **Sensor module**

contain:

External sensor: grayscale, integrated grayscale, touch

Collision, ultrasound, flame, temperature, magnetic sensitivity, color

Color, humidity, infrared, angle, motor code

(Built-in motor)

Built-in sensors: sound intensity, timer, reading and writing

Data and key detection.

4.1.4.3 **Control module library**

Including: condition judgment, infinite loop, multiple loop, condition loop, exit loop, delay.

4.1.4.4 **Computing module library**

Contains: calculation, advanced calculation, logic, comparison, random number, data classification.

4.1.4.5 **Line Inspection Module Library**

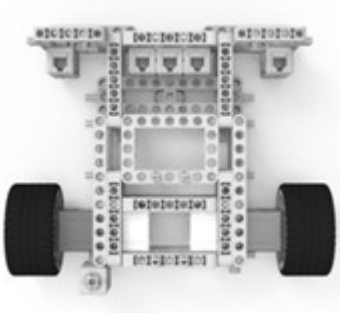
This is a module library specially made for the building block series of line patrol robots with line patrol function as the main function. WER (world

Educational Robot Competition) and its related building blocks are widely used in applications (mainly involving WER Professional Building Block Series

Match, CARC China Association for Science and Technology Education Robot Engineering Challenge, NOC China Audio-visual Education Ability Challenge and other competitions).

The line inspection module library is suitable for rear drive, 5 Grayscale or set

To grayscale and differentially drive the robot, except for motion



These modules can also be combined with

Other module library program modules are mixed.

5.1.2.6.1 **initialization**

Set motor attributes and grayscale attributes. Patrol only

Other modules in the line module library work. When designing a competition solution, you usually need to place this module in the program

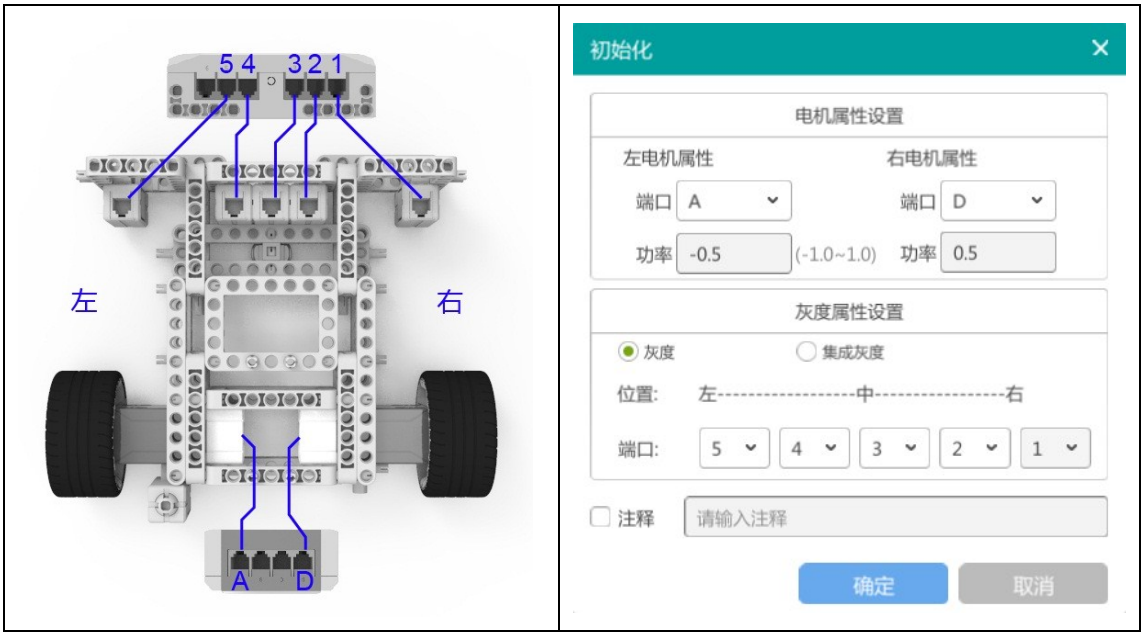
Start position.

Motor attribute setting: port A~D Single choice, power range- 1.0~1.0 Floating point data.

Gray property setting: Gray indicates that the robot is equipped with a single-channel gray, and the number of sensors is 5 One; integrated gray scale Indicates that the robot is equipped with multi-channel integrated gray scale, and the number of sensors is 1 But integrated 5 Channels.

Position refers to the position of the gray-scale sensor installed in the forward direction of the robot; port refers to the connection of these sensors Connected to SKCON2 On the port.

Reference example:



Note: Left motor properties "- 0.5 ", means "setting reverse, power 50% ". Set to reverse to solve the

When the machine is turned over and installed, the output ends of the left and right motors rotate clockwise at the same time, causing the robot to rotate counterclockwise on the ground.

Like; in the early debugging, the closer the power value 0 , The higher the fault tolerance rate, the value will be close to 1 or

- 1 To speed up the overall situation.

5.1.2.6.2 **Environmental collection**

It is used to calibrate the gray sensor value of the robot. Usually when the competition map is used for the first time, or the drawing is generated due to use

It is recommended to use this module when the color changes.

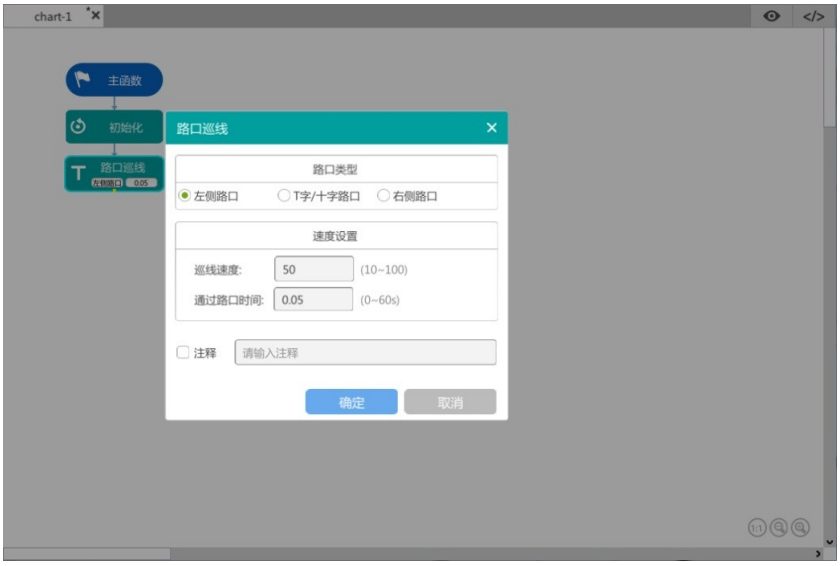
Note: When downloading and running this module program, follow the instructions on the robot screen. The collected values will be stored sequentially

in SKCON2 Data location 11-20 , Where data 11-15 Store the value of the trajectory, 16-20 Store the value of the background.

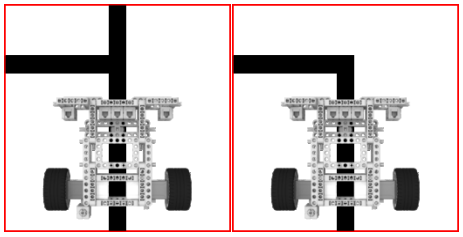
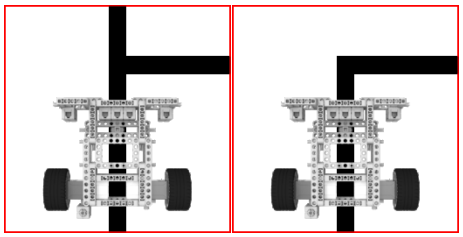
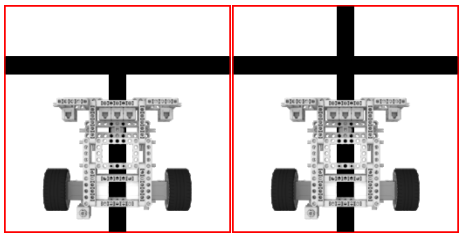
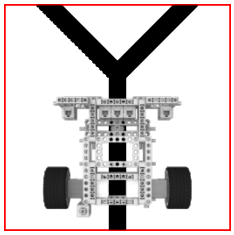
These values can be modified, and modification should be done with caution.

5.1.2.6.3 **Intersection patrol**

Find the module of the intersection by patrolling the line, the intersection type includes: left intersection, T Word/crossroads, intersection on the right.



Examples of intersection types:

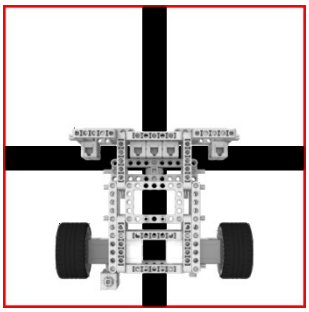
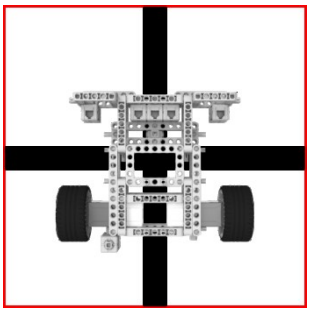
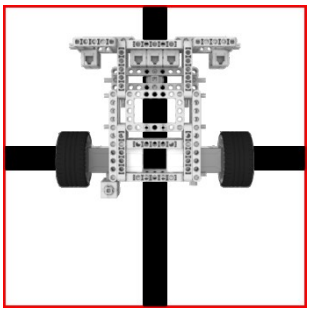
	Type of intersection: Intersection on the left
	Type of intersection: Intersection on the right
	Type of intersection: The left intersection (when turning left in the next step), Or the intersection on the right (when turning right in the next step), or T Word intersection, Or intersection (when going straight ahead)
	Type of intersection: The left intersection (when turning left in the next step), Or the intersection on the right (when turning right next step). Note: Do not select T Word intersection or crossroads.

Intersection time: the time used to find and pass the intersection, usually 0.0-1.0 Floating point

Data, and the actual operation effect varies with the "line patrol speed". Remarks: the quality of the same robot,

The difference in tire friction is negligible, but try to keep the ground and tires clean.

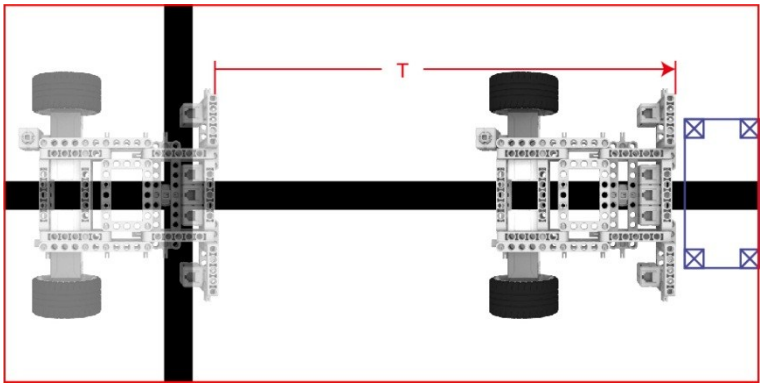
Examples of crossing time:

		
Crossing time (S): 0	Crossing time (S): 0.1	Crossing time (S): 0.2

5.1.2.6.4 **Advanced line inspection**

Follow specific conditions to track the line, the conditions include: time value, motor encoder value and sensor value.

Examples of time value conditions:

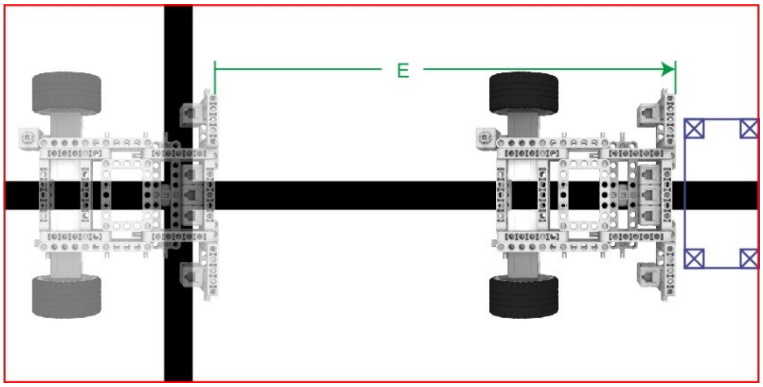


Time value (s) : 2

Remarks: The robot patrols the line until 2 Stop in seconds. Generally used for short-distance rough displacement, widely used, but the accuracy is not

High, the debugging process needs constant correction.

Examples of motor encoder values:

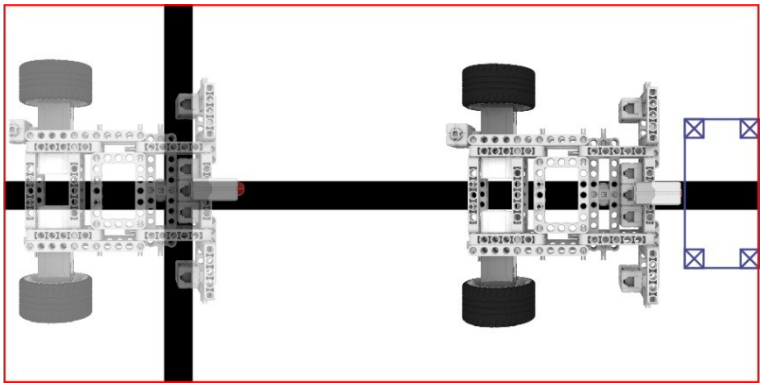


Motor encoder value: left motor, 6400

Remarks: The robot patrols the line until the left motor encoder reading is greater than 6400 Stop when. Mostly used for short-distance precise displacement,

The higher the consistency of the starting position and attitude, the higher the consistency of the stopping position and attitude.

Examples of sensor values:



Sensor value: port 7 (Reading value)= 1

Remarks: Robot patrols the line until the port 7 equal 1 (That is, the collision is pressed) to stop. When the sensor type is grayscale,

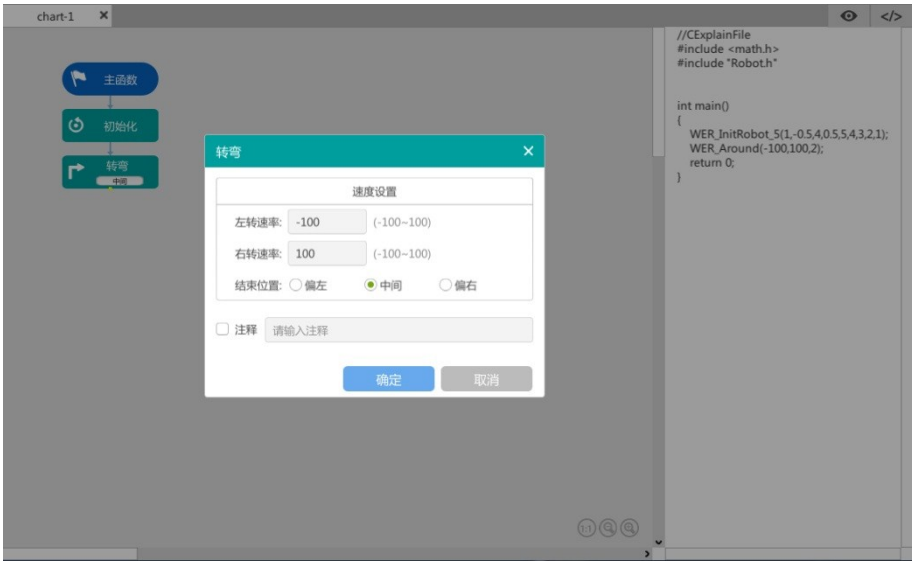
It is also applicable to analog input data such as infrared. Used in specific scenarios. In the example, the target position is simulated

A project model fixed on the field, the collision of the robot in the forward direction, the robot will encounter the project model

Type so that the corresponding port (7) The reading is determined by 0 Becomes 1 , Which triggers the condition and finally achieves the purpose of displacement.

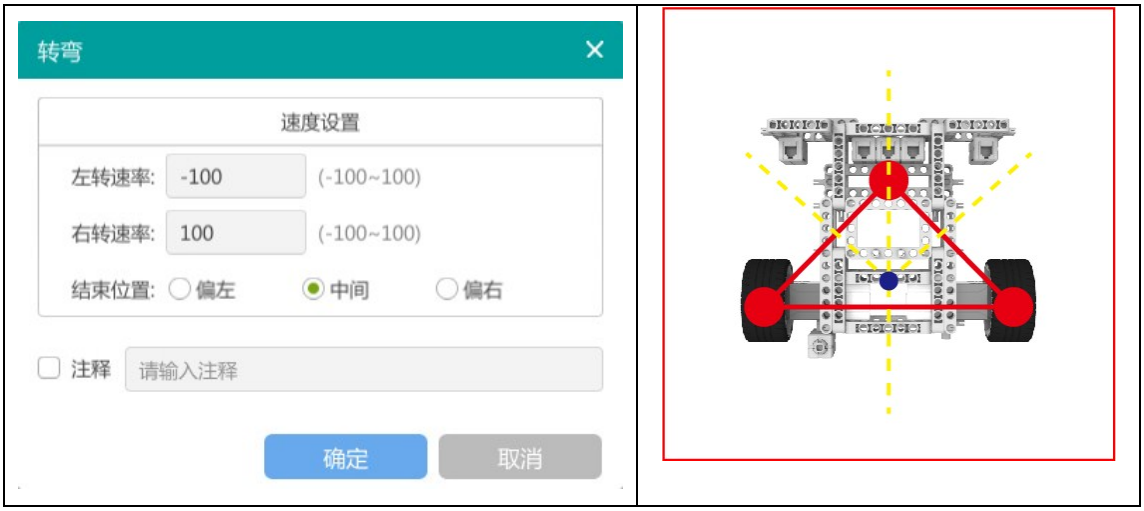
5.1.2.6.5 **Turn**

Through the different steering of the left and right motors, and determine the gray return value in turn, the robot turning action is completed.

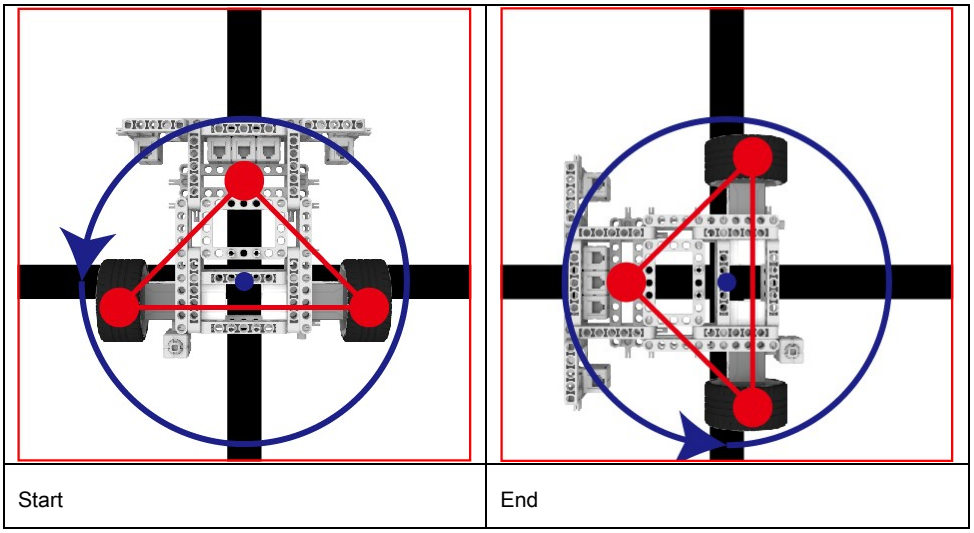


Robot turning mode, there are 3 This can be achieved by controlling the speed of the left and right motors. Take a left turn as an example:

Turn examples a) : Turn left (the left wheel moves backward, the right wheel moves forward)

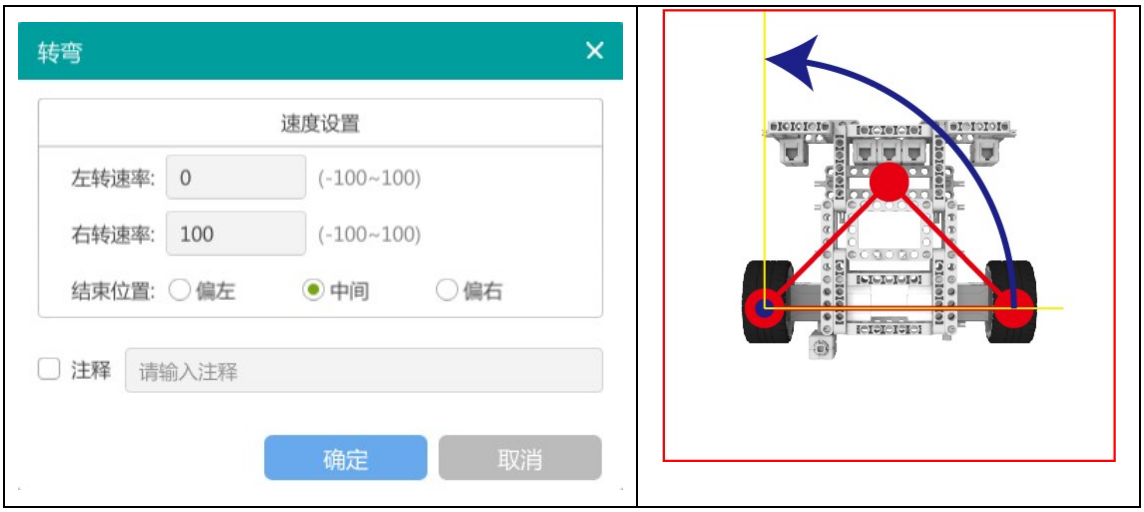


This method is widely used and easy to understand. Features, small turning radius.

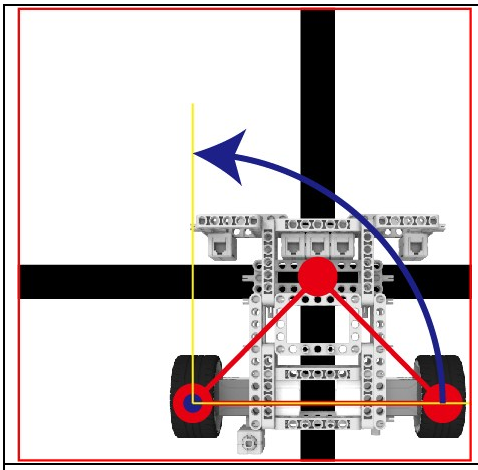
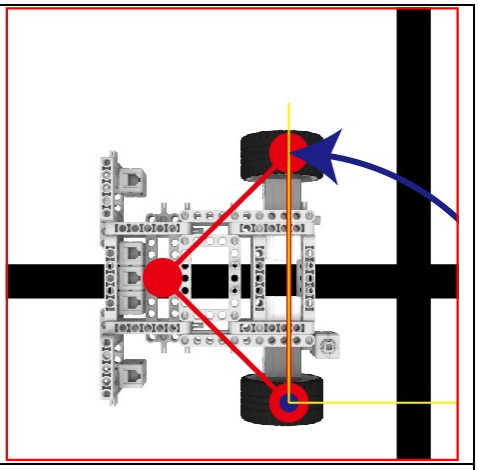


Start	End

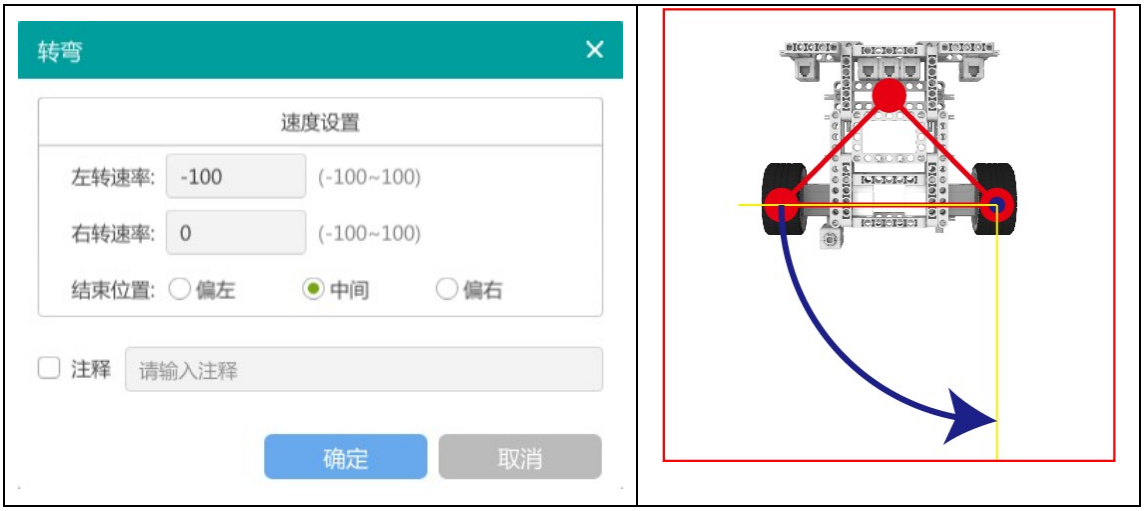
Turn examples b) : Turn left (the left wheel stops, the right wheel moves forward)



This method is special and has fewer applications. Features, large turning radius.

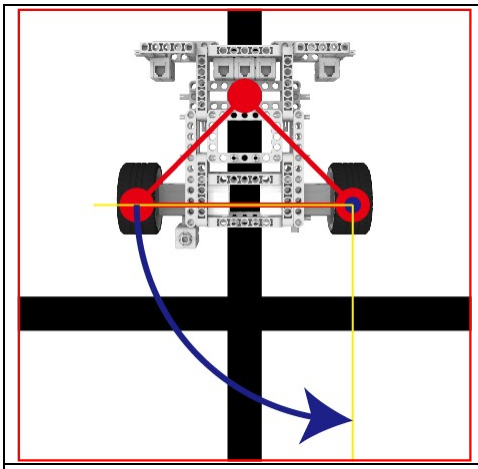
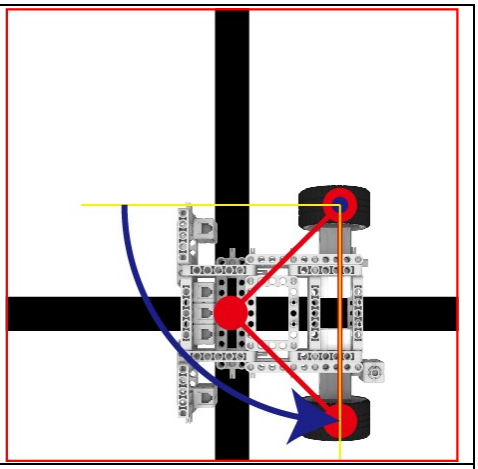
	
Start	End

Turn examples c) : Turn left (the left wheel moves back, the right wheel stops)

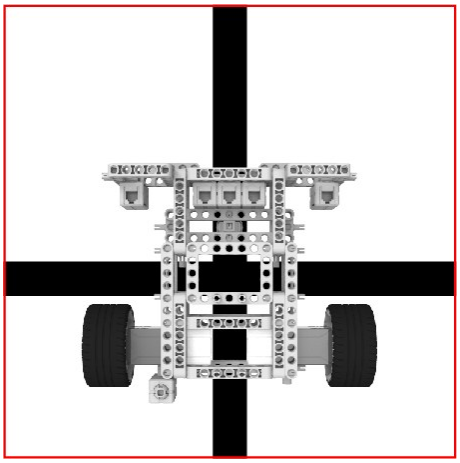
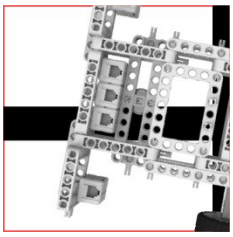
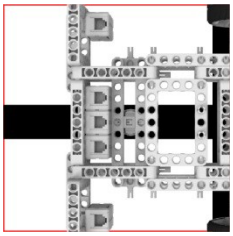
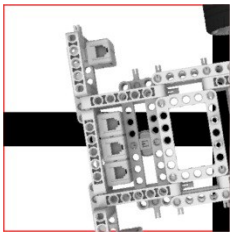


This method is also quite special, and it is characterized by a large turning radius, but the advantage is that it leaves a longer distance track after turning.

Traces are used for posture correction.

	
Start	End

At the end of the turn 3 Kind, take a left turn as an example:

<table>
<tr><td rowspan="3">  </td><td>  </td><td>Left</td></tr>
<tr><td>  </td><td>intermediate</td></tr>
<tr><td>  </td><td>Right</td></tr>
<tr><td>Start</td><td>End</td><td>End position</td></tr>
</table>

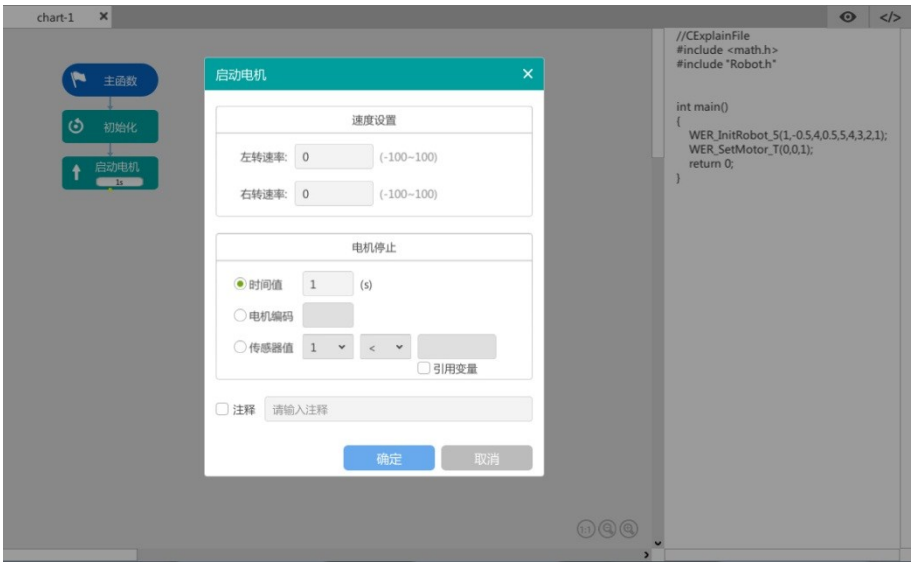
Note: When the mass is constant, the greater the speed, the greater the inertia. The actual stop position of the "end position" must be affected by inertia

The sound is different, so you need to use this function flexibly.

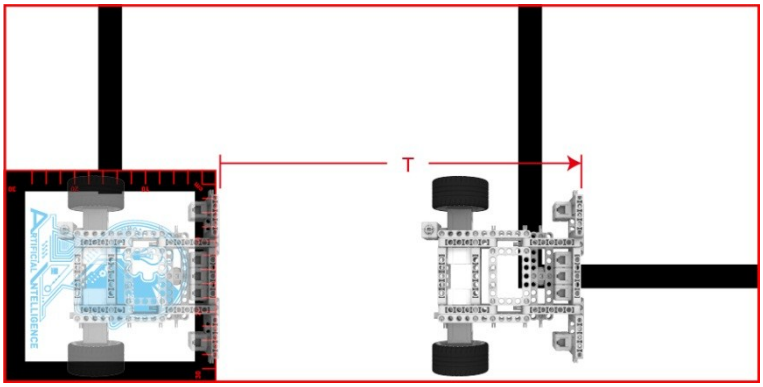
5.1.2.6.6 **Start the motor**

Start the motor through specific conditions, including: time value, motor encoder value and sensor value.

The applicable displacement method can be straight line, curved line, forward and backward.



Examples of time value conditions:

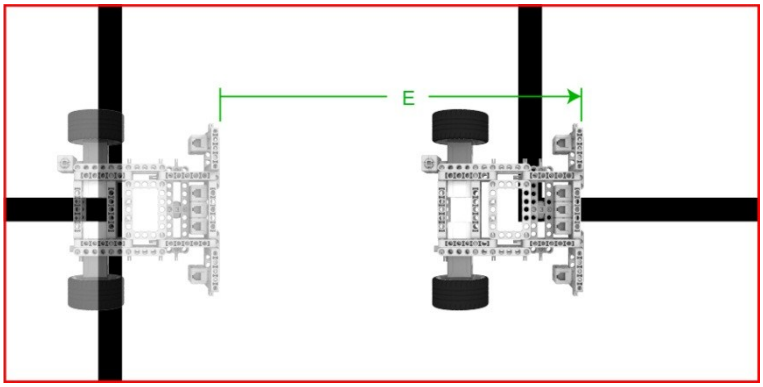


Revolver speed: 20 , Right wheel speed: 20 , Time value (s) : 2

Note: The robot starts until 2 Stop in seconds. Generally used for short-distance rough displacement, widely used, but the accuracy is not

High, the debugging process needs constant correction, usually slow speed.

Examples of motor encoder values:

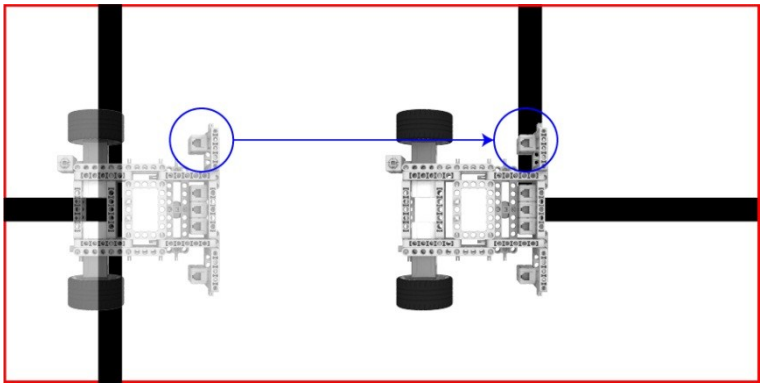


Revolver speed: 100 , Right wheel speed: 100 , Motor encoder value: left motor, 6400

Remark: The robot starts until the left motor encoder reading is greater than 6400 Stop when. Mostly used for short-distance precise displacement,

The higher the consistency of the starting position and attitude, the higher the consistency of the stopping position and attitude.

Examples of sensor values:



Sensor value: port 5 (Reading value)> 2500

Note: The robot will patrol the line until the port return value is greater than 2500 (That is, when the grayscale detects the track), it stops. When sensing

It is also applicable when the device type is analog input such as infrared or digital input data such as magnetic sensitivity and collision. Used for specific

Scenes. In the example, the start position port is simulated 5 Light-colored ground is detected, after the robot moves forward, the port 5 detected

Trace so that the corresponding port (5) The return value is determined by **<** 2500 Becomes**>** 2500 , Which triggers the condition and finally reaches the displacement

the goal of.

4.1.4.6 **Function module**

Create new functions, tasks, returns, and customize.

4.1.4.7 **Other modules**

It is added as the software version iterates.

4.2 Abilix Scratch 3.0

Stay tuned!

5 Summary

Now you have mastered SKCON2 Operation method, open the programming software, design your robot program

Right! You can also combine the building blocks provided by Ability Storm to create your own robot project! More chance to participate WER

World Educational Robot Competition (Visit wergame.org Online Registration)!

(WER WeChat public account)

(WER FACEBOOK)

5.1 Technical support and service

You can visit the official website of Ability Storm www.abilix.com , Get the latest in "Technical Service/Data Download"

Please pay attention to the product instructions.

If you encounter problems during use, or have suggestions for product improvement, you are welcome to contact us. Contact information:

service line: 400 8080 199

Email : services@abilix.com

I wish you a happy use!