DOBOT User Guide 

# **Dobot Scratch User Guide**

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Shenzhen Yuejiang Technology Co., Ltd



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The user has the responsibility to make sure following the relevant practical laws and regulations of the country, in order that there is no significant danger in the use of the robotic arm.

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# Preface

#### Purpose

This manual introduces the use of Scratch, including equipment connection, building blocks, etc., for the convenience of users to understand and use Scratch.

### **Intended Audience**

This document is intended for:

- Customer Engineer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

### **Change History**

Date	Change Description
2020/01/11	The first release

# Symbol Conventions

The symbols that may be founded in this document are defined as follows.

Symbol	Description
	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury
	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robotic arm damage
	Indicates a potentially hazardous situation which, if not avoided, can result in robotic arm damage, data loss, or unanticipated result
	Provides additional information to emphasize or supplement important points in the main text



# Contents

1. Intro	duction	11	
2. Devid	ces and	Extension Center	2
3. Quic	k Start	3	;
3.1	Device	Connection	;
3.2	Program	n Upload	ŀ
4. Prog	ram Ins	structions	j
4.1	Maigcia	an/Magician Lite	5
	4.1.1	Setting	5
	4.1.2	Motion	3
	4.1.3	Detection	
	4.1.4	I/O (Only Magician supported)12	)
	4.1.5	Calibration (Only Magician Lite supported)14	ŀ
4.2	Extensi	on Device	7
	4.2.1	Sliding rail	7
	4.2.2	AI19	)
	4.2.3	Photoelectric and Color Sensor	
4.3	Magic	Box	)
4.4	Mobile	Platform	5
	4.4.1	Mobile Platform	5
	4.4.2	Sensor	7
4.5	Arduin	o	)
	4.5.1	Serial Port42	)
	4.5.2	IO Operation	ŀ
	4.5.3	Vision Recognition	5
	4.5.4	Speech Recognition	)
	4.5.5	JoyStick	
4.6	AIStart	er53	;
	4.6.1	AIStarter	;
	4.6.2	Motion	ŀ
	4.6.3	Sensor	5
	4.6.4	Xbee61	

Issue V1.3.1 (2020-01-15)



# 1. Introduction

DobotScratch is a building block programming and code programming software based on the offline version of Scratch 3.0, which not only allows users to create story, game, and animation, etc, but also provide programming instruction for Dobot hardware devices. The devices that DobotScratch supported are Dobot Magician, Dobot Magician Lite, Magic Box, AI-Starter, Mobile Platform, and Arduino. The homepage is shown below.

🖉 вовот		Scratch作品			1
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	2			设置 3	
			12 III	🗛 RENAIN FISRA ·	
	Sec.		<b>9</b> 92	🔥 difficiene ing 💿 n saing 💿	
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			- #it	A SEXYZ RE 0 2449 108E 0	
			🔵 (20		
			<b>0</b> 230		
设备	角色		<ul> <li>•</li> </ul>	A STABAR O	
12	- \$3	0	● 日制形木	A NGORED	
Magician	5			运动	
-2 <u>-</u> 0	-			A ===	
Magici	Tak [5] C TRIK ()			🔨 (1233) R 0 Y 0 Z 0 R	
۲				🔨 HANR X 💿 Y 💿 Z 💿 R 💽	
Magic	x 0	Y+		A 8050 x 0 2× v 0 2×	
*	Y 0 X.	Z+			
Mobile	z O	2.		20 842X152 X11 0 X12 0	
9	R 0	Y.		A FREEMER O HERE MERCER	
AlStarter	R- 2	R+ 🧷		- 10 mile -	
<u>.</u> 0				- 100 m -	
Arduin	○ 滑轨 ○ レ	L+		检测	
				A REFORM	
				A grantes x -	a a se a
Ø	○ 吸取 ○ 释放	展査		▲ 東東出産火石丸度 火石1・	

Figure 1.1 Homepage

No.	Function	Description
1	Menu bar	Change system language, save and upload your works, etc
2	Dance area	Show your work, connect device, set role and background, etc
3	Block area	Provide all blocks
4	Code area	Drag block to this page and edit it.
5	Jogging control area	connection control, motion direction control, end control and slide rail control



# 2. Devices and Extension Center

We will introduce the device lib and extension center in this chapter, you can click it view device lib. As shown below.



Figure 2.1 device selection

The block area will shown the corresponding instruction after selecting device. You can also

click

to add extension device in extension center. As shown below.



Figure 2.2 extension center

# 

One DobotScratch can control multiple devices at the same time.



# 3. Quick Start

# 3.1 **Device Connection**

DobotScratch supports multiple Dobot devices. This section uses Dobot Magician Lite as an example to describe how to connect devices.

#### Prerequisites

Magician Lite has been connected to PC via USB

#### Procedure

- **Step 1** Power on Magician Lite.
- Step 2 Click On DobotScratch into Choose a Device interface, where you should select Magician Lite.



		MagicianLite	×
Por CC	rt Name DM5		Connect
	Select your dev	vice in the list above.	



Figure 3.1 Connect Magician Lite and Scratch

**Step 4** After connecting Dobot Magciain Lite and DobotScratch successfully, you can drag the blocks in the block area to start programming. As shown in the figure

below, click **r** to home Maigcian Lite.





# 3.2 Program Upload

DobotScratch supports multiple Dobot devices. This section uses AI-Starter as an example to describe how to upload program to devices.

#### Prerequisites

AI-Starter has been connected to PC via USB.

#### Procedure

Step 1 Click on DobotScratch into Choose a Device interface, where you should select AI-Starter.

Step 2 Drag the blocks to the block area, as shown below.



	<b>;;;</b> (	Code									
Control	Motion										
Operators	Car Front - Speed 1										
Variables	Car Front - Speed 1 Motion Tim 1										
Arduino	Car Right - Motor Speed 1 RPM	$\mathbf{X}$									
AlStarter											
Motion				1	Smarti	oot Init					
Sensor	Set Servo SERVO1 - Angle 1			2	repeat	10	- Space	 Mot	ion Tim	Sacor	
Xbee	Detach Servo SERVO1 -				Cal	TION	J Speer	-			
My Blocks	Sensor										
•	Star RightFront - Sonar										
	RightFront  Barriers Detected										
	Return RightFront - Sonar Data										
	Return IR IR1 👻 Data										
	Return geomagnetic Angle										
	Set Calibration										
	Set Right - Color Senor White Balance										
	Set Right - Color Senor ON -										
	Detected Right - Color Senor Red - I										
	retrun Right - Color Senor Red - Data										
	Return Button Switch1 + Data										
	Get Motor Pose Port Right 👻										
	Set Sonar Threshold Distance 1										

Figure 3.2 Drag blocks to the block area

Click

to select the corresponding serial port and click **upload** to

upload code. As shown below.

Step 3

Upload Code	×
Port Name COM5: USB Serial Device	Choose
Waiting for upload	
Refresh 🕤 Upload	Î.

Figure 3.3 select the corresponding serial port to upload code

Power on AI-Starter to perform it after uploading code.

```
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```



# 4. Program Instructions

# 4.1 Maigcian/Magician Lite

# 4.1.1 Setting

Instruction	Select End Effector Gripper -
Description	Select end-tool
Parameters	end-tool: <ul> <li>Gripper</li> <li>Suction cup</li> </ul>
	Pen
Return	None

#### Table 4.1 Select end-tool

### Table 4.2 Set PTP motion ratio

Instruction	Set Motion Ratio Velocity 0 % Acceleration 0 %
Description	Set motion ratio
Parameter	Speed ratio: Set the speed ratio. Set the speed multiplied by the ratio to the actual speed Acceleration ratio: Set the acceleration ratio. Set the acceleration multiplied by the ratio as the actual acceleration
Return	None

#### Table 4.3 Set the speed and acceleration of the joint axis

Instruction	Set Joint Velocity 0 °/s Acceleration 0 °/s^2
Description	Set the speed and acceleration of the joint axis
Parameter	Speed: Set the speed of each joint coordinate axis Acceleration: Set the acceleration of each joint coordinate axis
Return	None

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Instruction	Set XYZ Velocity 0 mm/s Acceleration 0 mm/s*2 \n Set End Effector Velocity 0 */s Acceleration 0 */s*2	
Description	Set the speed and acceleration of the Cartesian axis	
Parameter	Speed: Set the Cartesian axis speed	
	Acceleration: Set acceleration of Cartesian axis	
Return	None	

#### Table 4.4Set the speed and acceleration of the Cartesian axis

#### Table 4.5Set the stepper motor speed

Instruction	Set Stepper Motor STEPPER1 - Speed 0 pulses/s	
Description	Set the stepper motor speed. (This block is only supported by Magician)	
Parameter	Motor: Select the motor first	
	Speed: motor speed (puls/s)	
Return	None	

# Table 4.6 Set the height of the lift in Jump mode and the height limit of the Z axis

Instruction	Set Jump Height 0 mm zLimit 0 mm	
Description	Set the height of the lift in Jump mode and the height limit of the Z axis	
Parameter	Height: set the door height	
	Z-axis height limit: Set the Z-axis height limit	
Return	None	

#### Table 4.7 Set lost step threshold

Instruction	Set Lost Step Threshold 0 °
Description	Set a lost step detection threshold to detect whether the positioning error exceeds the threshold. If the threshold is exceeded, the motor lost steps
Parameter	Parameter setting: set cutting value
Return	None

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Instruction	Set Stepper Motor STEPPER1 - Speed 0 pulses/s , Number of Pulses 0
Descriptio n	Set the number of stepper motor speed pulses. (This block is only supported by Magician)
Parameter	Motor: Select motor Speed: Set the motor speed (puls/s) Pulse number: set the number of motor pulses
Return	None



Instruction	Set Lost Step
Description	Perform motor loss detection
Parameter	None
Return	None

#### Table 4.10 Set the convert motor speed

Instruction	Set Conveyor Motor STEPPER1 - Speed 0 mm/s	
Description	Set the conveyor motor speed (this block is only supported by Magician)	
Parameter	Motor: Select motor	
	Speed: Set the motor speed	
Return	None	

# 4.1.2 Motion

#### Table 4.11 Home robot

Instruction	Home		
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Description	Home robot
Parameter	None
Return	None

#### Table 4.12 Robot moves to a set target point in jump mode

Instruction	
Description	Robot moves to a set target point in jump mode
Parameter	X: Set the X coordinate value
	Y: set the Y coordinate value
	Z: Set the Z coordinate value
	R: Set the R coordinate value
Return	None

#### Table 4.13 The robot moves to the set target position with a certain type of motion

Instruction	Goto X 0 Y 0 Z 0 R 0 Move Type Straight Line -
Description	The robot moves to the set target position with a certain type of motion
Parameter	<ul> <li>X: Click the edit box to set the X coordinate value</li> <li>Y: Set Y coordinate value</li> <li>Z: Set the Z coordinate value</li> <li>R: Set the R coordinate value</li> <li>Movement type:</li> <li>Joint</li> <li>Straight Line</li> </ul>
Return	None

#### Table 4.14 Robot moves a relative Cartesian coordinate increment

$\begin{array}{c} \textcircled{\begin{tabular}{ c c c c c } \hline \hline$
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Description	Robot moves a relative Cartesian coordinate increment
Parameter	$\triangle$ X: set x increment value
	$\triangle$ Y: set y increment value
	$\triangle$ Z: set z increment value
	$\triangle$ R: set r increment value
Return	None

#### Table 4.15 Robot moves to the set joint target position

Instruction	Move Joints to Joint1 0 ° Joint2 0 ° Joint3 0 ° Joint4 0 °
Description	Robot moves to the set joint target position
Parameter	Joint 1: Set the angle of Joint 1
	Joint 2: Set the angle of Joint 2
	Joint 3: Set the angle of joint 3
	Joint 4: Set the angle of joint 4
Return	None

#### Table 4.16 Set R axis rotation angle

Instruction	Set R 0 ° Mode Relative -
Description	Set R axis rotation angle
Parameter	R-axis angle: set rotation angle
	Mode:
	Relative: Relative coordinate
	Absolute: Absolute coordinate
Return	None

#### Table 4.17 Set suction cup switch

Instruction	Suction Cup ON -
Description	Set suction cup switch

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Parameter	Suction cup status:
	• ON
	• OFF
Return	None

#### Table 4.18 Set gripper status

Instruction	Gripper Grip -
Description	Set gripper status
Parameter	Gripper status:
	• Grip
	• Release
	• Off
Return	None

# 4.1.3 **Detection**

Table 4.19	Get real-time	robot	coordinates
------------	---------------	-------	-------------

Instruction	Get Current Coordinate X -
Description	Get real-time robot coordinates
Parameter	Axis:
	• X
	• Y
	• Z
	• R
Return	Coordinate value

#### Table 4.20 Get real-time joint angle of robotic arm

Instruction	Get Current Joint Angle Joint1 -
Description	Get real-time joint angle of robotic arm

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Parameter	Joint:
	• Joint 1: Set the angle of Joint 1
	• Joint 2: Set the angle of Joint 2
	• Joint 3: Set the angle of joint 3
	• Joint 4: Set the angle of joint 4
Return	Return joint angle

#### Table 4.21 Detect Robot lost step results

Instruction	Check Lost Step
Description	Detect Robot lost step results
Parameter	None
Return	True: step lost
	False: no step lost

#### Table 4.22 clearthe robot alarm

Instruction	Clear Alarm
Description	Clear robot alarm
Parameter	None
Return	None

# 4.1.4 I/O (Only Magician supported)

Table 4.23 Set EIO state

Instruction	Set Pin EIO1 - Mode IOFunctionDummy -
Description	Set EIO state

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Parameter	EIO: Select IO address according to function type
	Function type:
	• IOFunctionDummy
	IOFunctionDO
	• IOFunctionDI
	• IOFunctionPWM
	• IOFunctionADC
	• IOFunctionDIPU
	IOFunctionDIPD
Return	None



Instruction	Set PWM Output Port EIO1 - Frequency 0 Duty 0 %
Description	Set PWM output
Parameter	EIO: Select IO address
	Frequency: Set the frequency. Value range: 10HZ ~ 1MHZ
	Duty Cycle: Set the duty cycle. Value range: 0 ~ 100
Return	None

#### Table 4.25 Set digital output to high or low

Set digital Output Port EIO1  Value HIGH
Set digital output to high or low
EIO: Select EIO address Value: high or low
None

#### Table 4.26Read the value of a digital signal

Instruction	Get Digital Input Reading EIO1 -

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Description	Read the value of a digital signal
Parameter	EIO: Select EIO
Return	0: low level; 1: high level

#### Table 4.27 Read the value of an analog signal

Instruction	Get Analog Input Reading EIO1 -
Description	Read the value of an analog signal
Parameter	EIO: Select EIO
Return	0: low level; 1: high level

# 4.1.5 Calibration (Only Magician Lite supported)

If Magician Lite is required for precise positioning and grasping, coordinate calibration is required in advance. The calibration steps are as follows.

**Step 1** Click "Coordinate Calibration" to pop up the calibration interface, follow the prompts to install the suction cup, and click **Next**.



Figure 4.1 Install suction cup

Step 2 Follow the prompts to place the device. Click Next.

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Figure 4.2 Place Magician Lite

Step 3 After placing the calibration plate in the box under the camera according to the prompts, the four calibration points A, B, C, and D will be displayed in the figure. Click Next.

· Coordinate calibration	• • • • • • •	Close 🗙
③ Please place the calibration card	in the middle of the camera's view.	
	Note: Please place the calibration card according to the frame as shown in the screen. I the four calibration points A, B, and D appear on the screen, fix position of the calibration card.	e blue When C, c the
Prev	Next	

Figure 4.3 Place calibration plate

**Step 4** Follow the prompts to jog the robot arm to move the end suction cup to the calibration point A, and click **Next**.

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Figure 4.4 Move the end suction cup to the calibration point A



Figure 4.5 Calibration point A

#### 

Do not move the calibration plate during the calibration process, otherwise the calibration will be invalid.

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```



**Step 5** Follow step 4 to calibrate point B, point C and point D.

# 4.2 Extension Device

# 4.2.1 Sliding rail



Instruction	SetLinearRail IsEnable on  Version V1
Description	Set Sliding rail status
Parameter	Status: Click the drop-down box to set the status
	Version: Click the drop-down box to select the corresponding version of the sliding rail
Return	None

#### Table 4.29 Get sliding rail state

Instruction	Get Linear Rail State
Description	Get Sliding rail state
Parameter	None
Return	None

#### Table 4.30 Move the sliding rail for a certain distance

Instruction	MoveLinearRailTo 0 mm
Description	Move the sliding rail for a certain distance
Parameter	Distance: Set the moving distance of the sliding rail
Return	None

#### Table 4.31 Set the speed and acceleration in PTP mode





Description	Set the speed and acceleration in PTP mode
Parameter	Speed: Set the speed of the sliding rail Acceleration: Set the acceleration of the sliding rail
Return	None

### Table 4.32 Set the speed and acceleration in jogging mode

Instruction	Set Linear Rail Jogging Mode Velocity 0 Acceleration 0
Description	Set the speed and acceleration in jogging mode
Parameter	Speed: Set the speed of the sliding rail Acceleration: Set the acceleration of the sliding rail
Return	None

# Table 4.33 Get the speed and acceleration in PTP mode

Instruction	Get Linear Rail Point to Point Mode Speed -
Description	Get the speed and acceleration in PTP mode
Parameter	Select the parameter speed (mm / s) or acceleration (mm / $s^2$ )
Return	Speed or acceleration

## Table 4.34 Get the speed and acceleration in jogging mode

Instruction	Get Linear Rail Jogging Mode Speed -
Description	Get the speed and acceleration in jogging mode
Parameter	Select the parameter speed (mm/s) or acceleration (mm/s <sup>2</sup> )
Return	Speed or acceleration

#### Table 4.35Get sliding rail postion

Instruction	Get Linear Rail Position		
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Description	Get sliding rail position
Parameter	None
Return	Sliding rail position (mm)

# 4.2.2 AI

# **Speech Recognition**

Speech Recognition

**Step 1** Click **Open speech recognition** popup the voice recognition interface.

voice recognition	
open speech recognition	
start Chinese_putonghua 🕶	voice recognition,
start Chinese_putonghua 🔻	voice recognition,
speech recognition results	
speech broadcasting hello	

Figure 4.6 Open speech recognition

Step 2 Please select a language, Click Start to recognize your voice.





**Step 3** Click **Stop** to finish speech recognition.

DOBOT	Dobot Scratch User Guide	4 Program Instructions
	Speech recognition	Close 🗙
	Please select a language: English ▼	Stop
	Figure 4.8 Stop recognition	
Step 4	Close this interface, and the recognition result will results module	be saved to Speech recognition

Instruction Description

Table 4.36	Recognize speech autom	natically

Instruction	start Chinese_putonghua  voice recognition, continued for 1 second
Description	Recognize speech automatically
Parameter	Select language: select language to Chinese_putonghua or English
	Time: set speech recognition time
return	None
Example	Click to execute program. Say something for 5s, wait for 3s to broadcast speed result.

Table 4.37Recognize speech manually

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Instruction	start Chinese_putonghua  voice recognition, Manual
Description	Recognize speech manually
Parameter	Select language: select language to Chinese_putonghua or English
return	Nome
Example	Click to xexcute program. Click <b>Start</b> to say something, when you finish speaking, click <b>Stop</b> , wait for 3s to broadcast speed result.

#### Table 4.38 Speech recognition result

Instruction	speech recognition results
Description	speech recognition will be saved in this module
Parameter	None
return	Speech recognition
Example	Please refer to Table 4.36

#### Table 4.39 broadcast speech

Instruction	speech broadcasting hello
Description	Broadcast speech
Parameter	Set speech that need to broadcast
return	None
Example	Please refer to Table 4.36

# **Image Getting**

Table 4.40 Get image automatically

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```



Instruction	Timeout 3 s to take picture
Description	Get image automatically
Parameter	Set time to get image
return	None
Example	Click and the camera will take a picture after 3s, if the picture's tag contains Home, the Robot will execute home function.

Table 4.41 Get image manually

Instruction	Take pictual manually
Description	Get image manually
Parameter	None
return	None
Example	Click and click take a picture, if the picture's tag contains Home, the Robot will execute home function

Table 4.42 Save image

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Instruction	Picuture
Description	An image will be saved in this module
Parameter	None
return	Image
Example	Please refer to Table 4.41

# **Image Recognition**

Create Image Date

Step 5 Click Edit classification data to popup create image date interface.

Image Identification	
Edit classification data	
Picture recognize 1 's tag	
Use picture 1 cut and recognise	
Things count in picture	
Picture 1 thing's tag	
Picture 1 cordinate x  thing's value	Je

Figure 4.9 Edit classification data

÷ to get image and name it. (please colse your computer camera before Step 6 Click using camera)

	1 cube
5M USB CAM (0ed: 2050)	Cut 2 button 3 bag
	+



Figure 4.10 Get image and name it

Step 7 If you need to cut the object in the picture, you can check **Cut** and click the object in the box to get the picture.





**Step 8** Click **Training model** to test image, put object below the camera, and the system will match it via feature.





Step 9 Click Finish to finish creating image after finish image testing.

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\_

5M USB CAN	M (0edc:2050) ▼		
		cube	0.38%
		button	96.48%
1.		bag	0.98%

Figure 4.13 Finish model

#### Instruction Description

Table 4.43Image name recognition

Instruction	Picture recognize 1 's tag
Description	Recognize image name
Parameter	Put an image into the module
return	Image name
Example	Please refer to Table 4.40

#### Table 4.44 Cut and recognize image

Instruction	Use picture 1 cut and recognise
Description	Cut and recognize image
Parameter	Put an image into the module
return	None
Example	Click <b>space</b> key to execute program. If picture's tag is <b>home</b> , get coordinate value and to make robot execute home function

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	<u> </u>				
when space +	key pressed				
Timeout 3 s to	take picture				
Use picture Picut	ure cut and recognise				
set i_count -	to Things count in picto	Jre A			
repeat i count		<b>-</b>			
if Does stri	ng Picture i_count	thing's tag con	tain home	then	
speech broadc	asting Picture i_coun	cordinate x	thing's value		
speech broadc	asting Picture i_coun	cordinate y	<ul> <li>thing's value</li> </ul>	5	
Allows					
change i cou	nt 🔹 by 🖃				
If <u>L_co</u>	unt = 0 then				
stop all <del>-</del>					
و					

#### Table 4.45 Get the number of image which is cut

Instruction	Things count in picture
Description	Get the number of image which is cut
Parameter	None
return	Image number
Example	Please refer to Table 4.44

#### Table 4.46 Get number of picture which is cut

Instruction	Picture 1 thing's tag
Description	Get number of picture which is cut
Parameter	Picture number: set cut picture number
return	name
Example	Please refer to Table 4.44

#### Table 4.47 Get coordinate of picture

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Instruction	Picture 1 cordinate x  thing's value
Description	Get coordinate of picture which is cut
Parameter	Picture number: set cut picture number
return	Coordinate value
Example	Please refer to Table 4.44

# **Face Recognition**

Create Face Date

**Step 1** Click **New face data** topopup the create face date interface.



Figure 4.14 Create face data







# Step 3 Click Training model to test face date

1 Adding features and data —	(2) T	est classification model
	1 Name1	+
5M USB CAM (0edc:2050) 🔻		
		+
① <u>Delete categorical data</u>		
		Training model >

Figure 4.16 Training model

Step 4 Put your face below the camera, and click Test to match it via feature.

🔆 Edit face data	• •	Close 🗙
1 Adding features and data	2 Test classi	fication model
5M USB CAM (0ed::2050) V	Name1 Name4 Test	0.15%
< Return		Finish

Figure 4.17 Train model

**Step 5** Click **Finish** to finish creating face data.



∯: Edit face data	• •		Close 🗙
1 Adding features and data -	2	Test classification model	
5M USB CAM (0edc:2050) ▼			
	Name1	0.15%	
	Name4	0.29%	
	l	Test	
< Return		Finish	

Figure 4.18 finish training model

Instruction Description

Table 4.48 sexual recognition

Instruction	The gender of picture 1 facial recognization is male -
Description	Recognize sexual via face data
Parameter	Face data: put face data into the module Sexual: male, female
return	True: Recognize successfully False: Recognize failed
Example	Click key space to execute and recognize a man' sexual and expression.

#### Table 4.49 Expression recognition

Instruction	The expression of picture 1 facial recognization is normal -
Description	Recognize expression via face data

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Parameter	Expression:	
	• Normal	
	• Smile	
	• Laugh	
return	True: Recognize successfully	
	False: Recognize failed	
Example	Please refer to Table 4.48	

#### Table 4.50 Get name

Instruction	The class name of picture 1
Description	Get name via face data
Parameter	Put face date into the module
return	Name
Example	Click is to execute program. If the picture match is greater than 0, broadcast picture's name

#### Table 4.51 Face match

Instruction	The class name of picture 1 facial recognization is Class1
Description	Get face match results
Parameter	face: put a face data into the module name: select match name
return	Match range: 0%~100%
Example	Please refer to Table 4.50



# **OCR Recognition**



Instruction	OCR recognize picture 1 words
Derscription	Recognize the text of image
Parameter	Put an image into this module
Return	Text
Example	Press <b>space</b> key to execute program, the camera will take a picture after 3s, if the picture contains text <b>Laugh</b> , program will broadcast <b>hahahahahaha</b> when space • key pressed         Timeout 3 s to take picture         if       Does string         OCR recognize picture         Picuture         words         contain         Laugh         the picture         if         Does string         OCR recognize picture         Picuture         words         speech broadcasting         hahahahahaha

# 4.2.3 Photoelectric and Color Sensor

Table 4.53	Set infrared sensor state

Instruction	Set Infra-Red Sensor State on  Version V1 Port GP1
Description	Set infrared sensor state
Parameter	Status: set status on, off Version: Select the appropriate sensor version Port: Select the port where the sensor is connected to the robot
Return	None



Instruction	Get GP1 - Infra-Red Sensor
Description	Get Infrared Sensor value
Parameter	port: Select the port where the sensor is connected to the robot
Return	Value

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#### Table 4.55 Get color sensor state

Instruction	Set Color Sensor State on  Version V1 Port GP1
Description	Set color sensor status
Parameter	Status: set status         • On         • Off         Version: Select the corresponding color sensor version         Port: Select the port where the sensor is connected to the robot arm
Return	None



Instruction	Get red - Color Sensor
Description	Get color sensor value
Parameter	Select color:
	• Red
	• Green
	• Blue
Return	Color value

# 4.3 Magic Box

Table 4.57Output analog signal pin value

Instruction	Analog Output Pin 0 Value 1
Description	Output analog signal pin value
Parameter	Pin: Set pin number
	Value: Set value, value range: 0~255
Return	None

#### Table 4.58Output digital signal pin value

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Instruction	Digital Output Pin 0 Level 1
Description	Output digital signal pin value
Parameter	Pin: Set pin number
	Level: 1: high level, 0: low level
Return	None

#### Table 4.59 Set pin state

Instruction	Set Pin 0 Mode IOFunctionDummy -
Description	Set pin state
Parameter	<ul> <li>Pin: Select the pin according to the function type</li> <li>Function type:</li> <li>IOFunctionDummy</li> </ul>
	<ul> <li>IOFunctionDI</li> <li>IOFunctionPWM</li> <li>IOFunctionADC</li> <li>IOFunctionDIPU</li> <li>IOFunctionDIPD</li> </ul>
Return	None

#### Table 4.60 Set PWM output

Instruction	Set PWM Output Pin 0 frequency 1 Duty Cycle 1
Description	Set PWM output
Parameter	Pin: input pin
	Frequency: Set the frequency. Value range: 10HZ ~ 1MHZ
	Duty Cycle: Set the duty cycle. Value range: 0 ~ 100
Return	None

Table 4.61Read the value of a digital signal

```
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```



Instruction	Digital Read Pin 0
Description	Read the value of a digital signal
Parameter	Pin: Enter the pin number
Return	1: high level, 0: low level

# Table 4.62Read the value of a digital signal

Instruction	Digital Read Pin 0
Description	Read the value of a digital signal
Parameter	Pin: Enter the pin number
Return	True: read successfully
	false: read failed

#### Table 4.63 Read the value of an analog signal

Instruction	Analog Read Pin 0
Description	Read the value of an analog signal
Parameter	Pin: Enter the pin number
Return	1: high level
	0: low level

### Table 4.64Set stepper motor speed

Instruction	Set Stepper Motor STEPPER1 - Speed 0 pulses/s
Description	Set stepper motor speed
Parameter	Motor: Select motor
	Speed: Motor speed (puls / s)
Return	None

# Table 4.65 Set the number of stepping motor speed pulses

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Instruction	Set Stepper Motor STEPPER1 - Speed 0 pulses/s , Number of Pulses 0
Description	Set the number of stepping motor speed pulses
Parameter	Motor: Select motor
	Speed: Set motor speed (puls/s)
	Pulse number: set the number of motor pulses
Return	None

# Table 4.66Set the conveyor motor speed

Instruction	Set Conveyor Motor STEPPER1 - Speed 0 mm/s
Description	Set the conveyor motor speed
Parameter	Motor: Select motor
	Speed: Set the motor speed
Return	None

# 4.4 Mobile Platform

# 4.4.1 **Mobile Platform**



Instruction	Mobile Platfrom Init
Description	Initialize the mobile platform
Parameter	None
Return	None

# Table 4.68Initialize the mobile platform key

Instruction	Set Key Init	
Description	Initialize the mobile platform key	
Parameter	None	
Return	None	
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### Table 4.69 Set LED state

Instruction	Set LED LED1 - State ON -
Description	Set LED state
Parameter	Sselect LED: • LED1 • LED2 • LED3 • LED4 Set state: • ON • OFF • BLINK
Return	None

#### Table 4.70 Set the movement direction and speed of the car

Instruction	Car Ahead  Speed 1
Description	Set the movement direction and speed of the car
Parameter	Direction: Ahead Back Turn Left Turn Right Speed: set the duty cycle, range (0 ~ 255)
Return	None

#### Table 4.71 Set the movement direction, speed and time of the car

|--|

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Description	Set the movement direction, speed and time of the car
Parameter	Direction:
	• Ahead
	• Back
	• Turn Left
	Turn Right
	Speed: set the duty cycle, range $(0 \sim 255)$
	Time: Set time (seconds)
Return	无



Instruction	Car Right V Motor Speed 1 RPM
Description	Set the motor speed
Parameter	Select motor:
	• Right
	• Left
	speed: Set the motor speed, the setting range ( $0 \sim 160$ rpm)
Return	None

#### Table 4.73 Set the motor parameters

Instruction	Set Motor KP 1 KI 1
Description	Set the motor parameters
Parameter	KP: scale factor. Value range: 0.5 ~ 2.5
	KI: integration factor. Value range: $0.05 \sim 0.5$
Return	None

# 4.4.2 Sensor



#### Table 4.74 Start sonar

Instruction	Star Right Front - Sonar
Description	Start sonar
Parameter	Select sonar:
	Right Front
	• Front
	Left Front
Return	None

Table 4.75 Detect barrier

Instruction	Right Front  Barriers Detected
Description	Detect barrier
Parameter	Select sonar: <ul> <li>Right Front</li> <li>Front</li> <li>Left Front</li> </ul>
Return	true: Obstacle detected false: No obstacle detected

#### Table 4.76 Get detection distance

Instruction	Return Right Front - Sonar Data
Description	Obtain ultrasound data of a certain position, that is, the distance between the car and the obstacle
Parameter	Select sonar:
	Right Front
	• Front
	Left Front
Return	Distance



Table 4.77	Get the infrared	sensor data
------------	------------------	-------------

Instruction	Return IR IR1 - Data
Description	Get the infrared sensor data
Parameter	Select IR:         •       IR1         •       IR2         •       IR3         •       IR4         •       IR5
	• IR6
Return	IR data

#### Table 4.78 Set the color sensor white balance

Instruction	Set Right  Color Senor white balance
Description	Set the color sensor white balance
Parameter	Select color sensor: • Right • Left
Return	None

#### Table 4.79 Set color sensor state

Instruction	Set Right - Color Senor ON -
Description	Set color sensor state
Parameter	Select color sensor: • Right • Left state: • ON • OFF

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Return

None

Table 4.80 Get RGB value

Instruction	retrun Right - Color Senor Red - Data
Description	This block is used to obtain the color value by the color sensor
Parameter	Select color sensor:
	• Right
	• Left
	Color:
	• Red
	• Green
	• Blue
Return	Infrared sensor color value. Value range: 0 ~ 255

#### Table 4.81 Detect color

Instruction	Detected Right - Color Senor Red - Data
Description	This block is used to detect whether the color sensor detects a color
Parameter	Select color sensor:
	• Right
	• Left
	Color:
	• Red
	• Green
	• Blue
Return	True: Color detected
	False: No color detected

#### Table 4.82 Get the switch state

Instruction	Return Button 1 - State

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Description	Get the switch state
Parameter	Select button:
	• 1
	• 2
Return	1: press
	0: release

#### Table 4.83Get the motor angle

Instruction	Get Right - Motor Angle
Description	Get the motor angle
Parameter	Select motor: • Right • Left
Return	Angle

Table 4.84	Set the ultrasonic sensor detection threshold
------------	---

Instruction	Set Sonar Threshold 1
Description	Set the ultrasonic sensor detection threshold
Parameter	Set threshold: set the detection threshold, value range: 0 ~ 51.2cm
Return	None



Instruct ion	Set Deviation IR1× 0 +IR2× 0 +IR3× 0 +IR4× 0 +IR5× 0 +IR6× 0
Descri ption	Set the position offset corresponding to the sensor
Param eter	IR: • IR1 • IR2

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	•	IR3
	•	IR4
	•	IR5
	•	IR6
	Set offset	: Set the offset of each infrared pair. When setting the offset, you need to set the 6 infrared pair
	offsets to symmetric data centered on 0, for example: -3, -2, -1, 1, 2, 3 This will not cause the car to deviate	
	from the b	black line during the line inspection process.
Return	None	

#### Table 4.86 Get the infrared sensor offset

Instruction	Get Deciation
Description	Get the infrared sensor offset
Parameter	None
Return	Return deviation

### Table 4.87 Get the infrared sensor offset after PID processing

Instruction	Get PID-Processed Deviation
Description	Get the infrared sensor offset after PID processing
Parameter	None
Return	Return deviation

# 4.5 Arduino

# 4.5.1 Serial Port

#### Table 4.88 Set pin mode

Instruction	Set Pin 13 Mode OUTPUT -
Description	Set pin mode
Parameter	Pin: input pin index
	Select mode:
	• OUTPUT
	• INPUT

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	• INPUI_PULLUP
Return	None

#### Table 4.89 Set baud rate for serial data transmission

Instruction	Set Baud Rate 115200
Description	Set baud rate for serial data transmission
Parameter	Baud rate: Set the baud rate for data transmission
Return	None

#### Table 4.90 Set Xbee data transmission baud rate

Instruction	Set Xbee2 Serial 115200
Description	Set Xbee data transmission baud rate
Parameter	Baud rate: Set the baud rate for data transmission
Return	None

#### Table 4.91 Serial print

Instruction	Serial Printin "hello world"
Description	Serial print
Parameter	Set data
Return	None

#### Table 4.92 Serial line feed

Instruction	Serial Print "hello world"		
Description	Serial line feed		
Parameter	Set data		
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Return None

Table 4.93 Get serial value length

	Get Serial value
Description	Get serial value
Parameter	None
Return	Serial data byte

#### Table 4.94 Get serial string

Instruction	Get Serial string
Description	Get serial string
Parameter	None
Return	String

# 4.5.2 **IO Operation**



Instruction	Arduino Digital Write 13 Pin Level HIGH -
Description	Set Arduino digital level
Parameter	• pin
	• level: high or low
Return	None



Instructio n	Analog Write Pin 5 Value 5
Descripti	Write analog value to the specified analog pin, used to control the brightness of the LED indicator or
on	control the speed of the motor

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Paramet	• pin: pin number
er	• value: value range 0~255
Return	None



Instruction	Digital Read Pin 5
Description	Read digital signal pin value
Parameter	Pin: Pin number
Return	True: read successfully
	False: read failed

 Table 4.98
 Read digital signal pin value

Instruction	Digital Read Pin 5
Description	Read digital signal pin value
Parameter	Pin: Pin number
Return	Pin value

Table 4.99Read analog signal pins

Instruction	Analog Read Pin A 5
Description	Read analog signal pins
Parameter	Pin: Pin number
Return	Pin value

Table 4.100 Set the output frequency and output duration of the ultrasonic pin

Instruction	Play Tone on Pin 5 Output Frequency 5 Output Time 5
Description	Set the output frequency and output duration of the ultrasonic pin
Parameter	• Pin number
	• Output frequency, value range: 31~65535HZ

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	• Output duration, value range: 0~4294967295 us
Return	None



Instruction	Set Servo Pin 5 Angle 5
Description	Set angle of the servo motor
Parameter	• Pin: Pin number
	• Angle: Motor angle, value range: $0^{\circ} \sim 180^{\circ}$
Return	None

# 4.5.3 Vision Recognition

You need to initialize it before using the vision kit. If you have previously saved the initialization data, you can click **Import Initialization Data** to import to initialize it. Otherwise, click

Init Visual Sort

to complete the initialization according to the wizard. The initialization steps are

as follows

1. Follow the prompts to complete the initialization preparations.

🔆 Init Visual Sorting	• • • • • • • •	Close 🗙
	Visual Sorting Initialization	
The Initialization Calibration.Befor	includes Coordinate Calibration and Color e the Initialization please make sure.	(
1. The Arduin 2. Magician h	o Skill Kit has already been installed on Magici as already been connected to local computer;[	an properly; COM5 ▼
3. PixyMon h	as already been installed on local computer 🧃	Download

Figure 4.19 Vision sorting initialization



Need to download and install PixyMo n according to different PC systems



Ø Downloads – Pixy2 – PixyCam	-	□ ×
PIXY		≡
Pixy2 Downloads		
This page contains links to the most recent software/firmware releases for Pixy2. These dow work with the original Pixy!	wnloads v	vill not
PixyMon v2		
PixyMon v2 is the configuration utility for Pixy2 that runs on Windows, MacOS and Linux.		
<ul> <li>Pixymon v2 Windows version 3.0.24 (exe)         <ul> <li>installation docs for Windows Vista, 7, 8, 10</li> <li>installation docs for XP</li> </ul> </li> <li>PixyMon v2 Max version 3.0.24 (dmg, High Sierra)</li> </ul>		
<ul> <li>installation docs</li> <li>Linux Pixymon v2 is available through github         <ul> <li>installation docs</li> </ul> </li> </ul>		

Figure 4.20 Download PixyMon

2. Move the robot arm to the suction cup close to the plane and click the "Record" button to record the plane height.

🔆 Init Visual Sorting	• • • • • • •	Close 🗙
	Visual Sorting Initialization	
Step 1: Record 1	The Base Level	
Please level the bas till the suction cup is button to record the	e where the blocks will be placed, move tightly in contact with the base and click base level	the robort arm the "Record"
	Robot Arm Position	
	Record	

Figure 4.21 Record base level

3. According to the actual situation, write in the height of the different colored squares, and then click "Record".

🔆 Init Visual Sorting		Close 🗙
	Visual Sorting Initialization	1
Step 2: Set Diffe	erent Color Blocks' Height	
Please Input differe recognition.Blocks during each Visual	nt color blocks' height.The program vith the same color should be with t Sorting operation.	supports four colors' he same height
Red	mm Yellow	mm
Blue	mm Green	mm
	Record	

Figure 4.22 Record block height

4. Move the camera to the wooden block recognition position, click "Record" to obtain

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```



the position of the robot arm or manually enter the position of the robot arm and click "Record".

🔆 Init Visual Sorting	g • •	• • • • • •	Close 🗙
	Visual Sorting	Initialization	
Step 3: Rec	ord Visual Rocogniti	on Location	
The current Vis one specific lo the two method offset between location.After r Please don't r	sual Sorting Program can cation every time after the ds below to record the vi- the Tool Center Point of recording the location. move the robotic arm b	n only perform visual record e initialization. Please ch sual recognition location. the Magician and the ca efore the initialization i	ognition at noose one of . There is an imera <b>s finished!!</b>
	Method1	Method2	
Record Magic	cian's Current Location	X Y Z	
X	Y Z	Input Magician's Lo	
		input Magician 5 EC	ocation

Figure 4.23 Record recognition position

5. Record the PixyMon calibration point reading. Follow the prompts to place the three calibration blocks into the camera's field of view. Click "Action" in the PixyMon window and repeatedly use the Signature1 box to select three wooden blocks, and write in the coordinates and height and width of the wooden blocks according to the box selection results, and click "Record".

	(/)Arduine
Cottor Control Cottor C	Balland Series Cone F
Norman Andre Van Hep P 20 P	Fund and provide the set of th
ring response 0.0x03	

Figure 4.24 Record calibration position

# 

Before using Signature1 to select wooden blocks, you need to open the Console. Click on "View-> Console"





Figure 4.25 open console

6. Record the robot coordinates of the calibration block. Hold the robot arm close to the center of the three wooden blocks and click "Record" to record separately.



Figure 4.26 Hold the robot arm close to the center of the three wooden blocks

🔆 Init Visual Sorting	1		•••	Close	• <b>x</b>
	Visua	I Sorting Ini	tialization		
Step 5: Rec	ord Marked	Blocks's Ro	botic Arm C	oordinates	
Move the robot marked blocks XYZ coordinate sequence of the step 4.	tic arm till the separately.C es of the three e points you	suction cup is lick the 'Record e marked block record is the sa	tigntiyin conta l' buttons belo s.Please mak ame as the blo	ct with each of the w to record the e sure the cks'sequence in	(
Block1	Х	Y	Z	Record	
Block2	X	Y	Z	Record	
Block3	X	Y	Z	Record	

Figure 4.27 Record position

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```



7. Color calibration. Put the wooden block that needs to identify the color in the field of vision, click "Action" according to the prompt and use Signature1, 2, 3, 4 to select the wooden block of the corresponding color, and match the color with the mark in the option box.



Figure 4.28 Select block



Figure 4.29 Color matching

# 4.5.4 **Speech Recognition**



Instruction	Speech Recognition Init
Description	Initialize speech recognition module
Parameter	None
Return	None

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#### Table 4.103 Add speech

Instruction	Add Speech Recognition " hello " to Phrase 1 •
Description	Add speech to speech recognition module
Parameter	Voice content: Edit voice content
	Speech recognition phrase: Select the speech recognition phrase serial number to be
	added
Return	None

Instruction	Detect Phrases 1 -
Description	Detect voice module
Parameter	Select speech recognition column number
Return	True: Voice detected
	False: No speech detected

# 4.5.5 JoyStick

|--|

Instruction	Check Red - Button State
Description	Get button status
Parameter	Select button: • Red • Green • Blue
Return	State: • true: Up • false: Down

Table 4.106 Set LED state

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Instruction	Tum Red - LED ON -
Description	Set LED state
Parameter	Select LED:
	• Red
	• Green
	• Blue
	State:
	• ON
	• OFF
Return	None

Table 4.107 Get LED state

Instruction	Check Red - LED State
Description	Get LED state
Parameter	Select LED
	• Red
	• Green
	• Blue
Return	LED state
	• True: ON
	• False: OFF

Table 4.108 Read Joystick value

Instruction	Read Joystick x - Value
Description	Read Joystick value
Parameter	Joystick coordinate
	• x
	• y
Return	Joystick value



#### Table 4.109 Check Joystick state

Instruction	Check Joystick Press State
Description	Check Joystick state
Parameter	None
Return	Press state: • true: Up • false: Down

# 4.6 AlStarter

# 4.6.1 AlStarter



Instruction	Smartbot Init
Description	Initialize AI-Starter
Parameter	None
Return	None

#### Table 4.111Initialize switch

Instruction	Set Key Init
Description	Initialize switch
Parameter	None
Return	None

Table 4.112 Set LED status

Instruction	Set LED LED1 - State ON -
Description	Set LED state
Parameter	Select LED:
	• LED1

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	• LED2
	Set state:
	• ON
	• OFF
	• BLINK
Return	无

#### Table 4.113 Set PID

Instruction	Set Motor PID KP 1 KI 1
Description	This program block is used to set the motor parameters
Parameter	KP: scale factor. Value range: 0.5 ~ 2.5
	KI: integration factor. Value range: $0.05 \sim 0.5$
Return	None

# 4.6.2 Motion



Instruction	Car Front - Speed 1
Description	Set direction and speed of AI-Starter
Parameter	Direction: Ahead Back Turn left Turn right Speed: Set Duty ratio. Value range: 0-255
Return	None

#### Table 4.115 Set the movement direction, speed and time of AI-Starter

Car Front - Speed 1 Motion Time 1 Second

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Description	Set the movement direction, speed and time of AI-Starter
Parameter	Direction:
	• Ahead
	• Back
	• Turn left
	• Turn right
	Speed: Set Duty ratio. Value range: 0-255
Return	None

Table 4.116 Set motor speed

Instruction	Car Right - Motor Speed 1 RPM
Description	Set motor speed
Parameter	Select the motor
	• LEFT
	• RIGHT
	Speed: Set the motor speed. Value range: $0r/m - 100r/m$
Return	None

Table 4.117 Attach sever

Instruction	Attach Servo SERVO1 -
Description	Make servo attach to make AIStarter unload
Parameter	Select servo
Return	None

#### Table 4.118 Detach servo

Instruction	Detach Servo SERVO1 -
Description	Make servo detach to make AIStarter restore

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Parameter	Select servo
Return	None

#### Table 4.119 Set servo angle

Instruction	Set Servo SERVO1 - Angle 1
Description	Set servo angle
Parameter	Servo: select motor
	Angle: set angle
Return	None

# 4.6.3 Sensor



Instruction	Star RightFront - Sonar
Description	Start sonar
Parameter	Sonar position: <ul> <li>Right Front</li> <li>Front</li> <li>Left Front</li> </ul>
Return	None

#### Table 4.121 Detect barrier

Instruction	RightFront  Barriers Detected
Description	Detect whether a barrier is exist in front of AI-Starter, before calling this module, please start the corresponding sonar
Parameter	Obstacle position:         • Right Front         • Front         Left Front
Return	true: There is a barrier false: There is no barrier

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#### Table 4.122 Get sonar data

Instruction	Return RightFront - Sonar Data
Description	Get the detection distance of sonar, which is the distance between AI-Starter and barrier.
Parameter	Sonar position: • Right Front • Front Left Front
Return	Detection distance



Instruction	Retum IR IR1 - Data
Description	Get infrared sensor data
Parameter	IR:
	• IR1
	• IR2
	• IR3
	• IR4
	• IR5
	• IR6
Return	false: Black line
	true: White line

#### Table 4.124 Get geomagnetic angle

Instruction	Return geomagnetic Angle
Description	Get geomagnetic angle
Parameter	None
Return	Geomagnetic angle

# Table 4.125 Set calibration

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Instruction	Set Calibration
Description	Calibration method: Press down the left-most key after starting up, make AI-Starter rotate $360^{\circ}$ around space axes X, Y, Z respectively, press down the left-most key once again to finish calibration
Parameter	None
Return	None

#### Table 4.126 Set color sensor white balance

Instruction	Set Right  Color Senor White Balance
Description	Set color sensor white balance
Parameter	Color sensor: • Right • Left
Return	None



Instruction	Set Right  Color Senor ON	
Description	Set color sensor state	
Parameter	Color sensor:	
	• Right	
	• Left	
	state:	
	• ON	
	• OFF	
Return	None	

Table 4.128 Detect RGB

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Instruction	Detected Right - Color Senor Red - Data	
Description	Get color sensor value	
Parameter	Color sensor:	
	• Right	
	• Left	
	Color:	
	• Red	
	• Green	
	• Blue	
Return	True: Detect successfully	
	False: Detect failed	

#### Table 4.129 Get RGB

Instruction	retrun Right - Color Senor Red - Data	
Description	Get color sensor value	
Parameter	Color sensor: • Right • Left Color: • Red • Green	
	• Blue	
Return	Color sensor value. Value range: 0~255	

### Table 4.130 Get Switch state

Instruction	Return Button Switch1 - Data
Description	Get switch state
Parameter	Switch:
	• Switch 1
	• Switch 2
	• Switch 3
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Return	true: Press
	false: Release

#### Table 4.131 get photosensitive value

Instruction	Get Photoresistance Value
Description	get photosensitive value
Parameter	None
Return	Photosensitive value. Value range: 0 – 4096

### Table 4.132 Set sonar threshold

Instruction	Set Sonar Threshold Distance 1
Description	Set sonar threshold
Parameter	Set threshold. Value range: 0~51.2cm
Return	None

#### Table 4.133 Set the position offset

Instruct ion	Set Deviation IR1× 0 +IR2× 0 +IR3× 0 +IR4× 0 +IR5× 0 +IR6× 0	
Descri ption	Set the position offset corresponding to the sensor	
Param	IR:	
eter	• IR1	
	• IR2	
	• IR3:	
	• IR4:	
	• IR5:	
	• IR6:	
	Set offset: Set the offset of each infrared pair. When setting the offset, you need to set the 6 infrared	
	pair offsets to symmetric data centered on 0, for example: -3, -2, -1, 1, 2, 3 This will not cause the	
	car to deviate from the black line during the line inspection process.	

Issue V1.3.1 (2020-01-15)



Return None

#### Table 4.134 Get the infrared sensor offset

Instruction	Get Deciation
Description	Get the infrared sensor offset
Parameter	None
Return	Return deviation

#### Table 4.135 Get the infrared sensor offset after PID processing

Instruction	Get PID-Processed Deviation
Description	Get the infrared sensor offset after PID processing
Parameter	None
Return	Return deviation

#### Table 4.136 Get motor pose

Instruction	Get Motor Pose Port Right -	
Description	Get motor pose	
Parameter	Select motor:	
	• Right	
	• Left	
Return	Motor pose (Number of pulses obtained by the encoder)	

# 4.6.4 Xbee

Table 4.137	Get Xbee value
10010 11101	000,70000,0000

Instruction	Xbee read data	
Description	该Instruction用于读取Xbee数值	
Parameter	无	
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Return Xbee数值

#### Table 4.138 Send Xbee value

Instruction	Xbee Send "hello world"
Description	Send Xbee values
Parameter	Value: Set the value to be sent
Return	None

#### Table 4.139 Compare two Xbee value

Instruction	Xbee "a" compare Xbee "b"
Description	Compare two Xbee values
Parameter	Value: Set the value to be compared
Return	Ture: same
	False: different

#### Table 4.140 Clear Xbee cache

Instruction	Xbee Clear
Description	Clear the Xbee cache
Parameter	None
Return	None





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