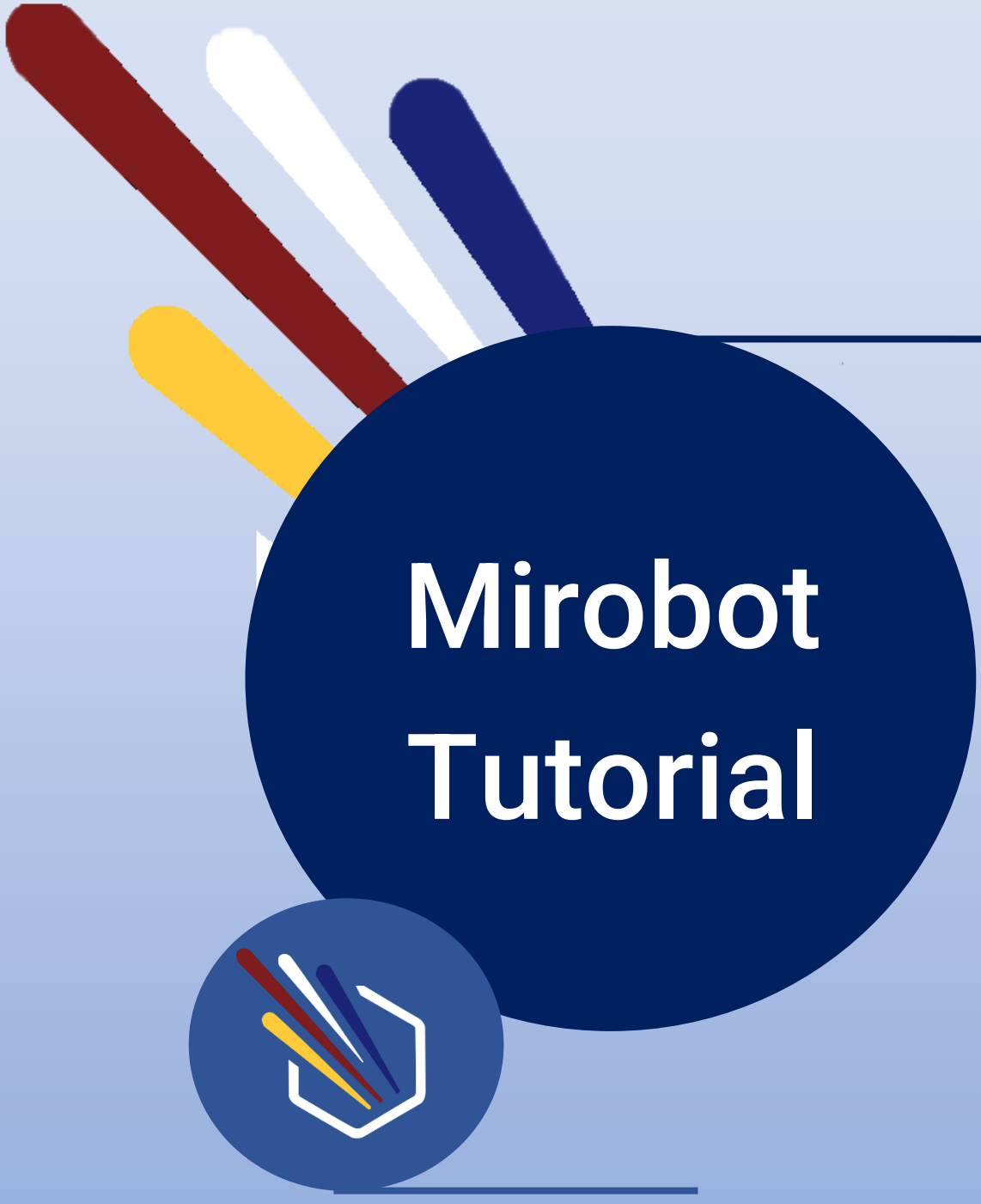
Training Center



Mirobot Tutorial

ECAM LYON_THAMMASAT UNIVERSITY

Table of contents

Disclaimer

Part of this tutorial come from the official tutorial from the website of WLKATA (https://www.wlkata.com/support/download-center).

For more information you can go on the official website.

The tutorial below takes parts of the official tutorial and others parts are added to have a better understanding of the functioning of the WLKATA Mirobot.

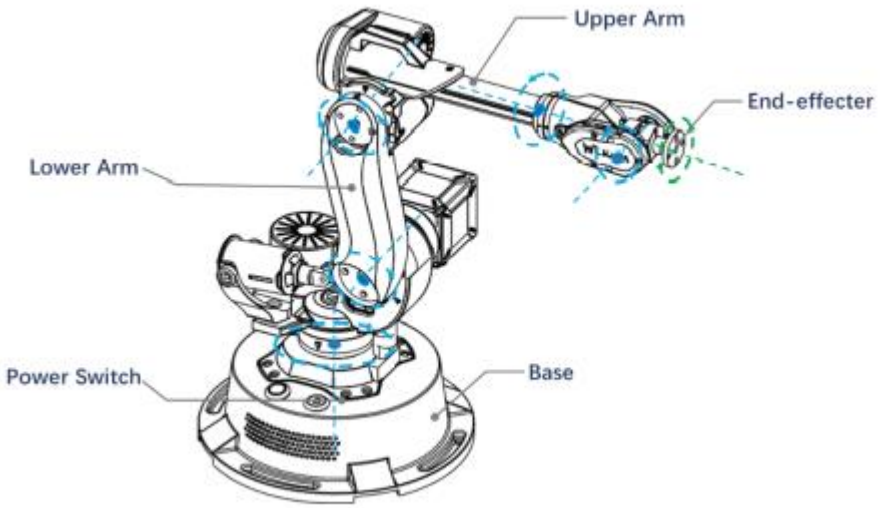
1. Introduction of WLKATA Mirobot

WLKATA Mirobot is a six-axis mini-industrial robot arm manipulator and is independently developed and launched by Beijing Tsinew Technologies Co., Ltd. The WLKATA Mirobot manipulator is primarily developed for STEAM makers, and adolescent education and higher education purpose.

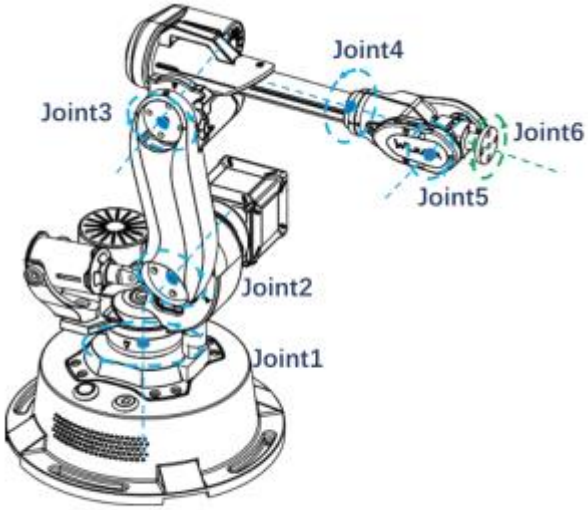
It represents a new generation of lightweight six-axis desktop robot arm model, which integrates a variety of practical functions, such as drawing, handling, stacking, painting, writing and machine vision. Users can easily control Mirobot by remote controller, graphical programming, teaching and play. It has a rich I / O extension interface, which allowed it to connect to diverse end-effectors. For advanced operation, users could adopt Python, C++ and more for subsequent development.

1.1 Structure of WLKATA Mirobot

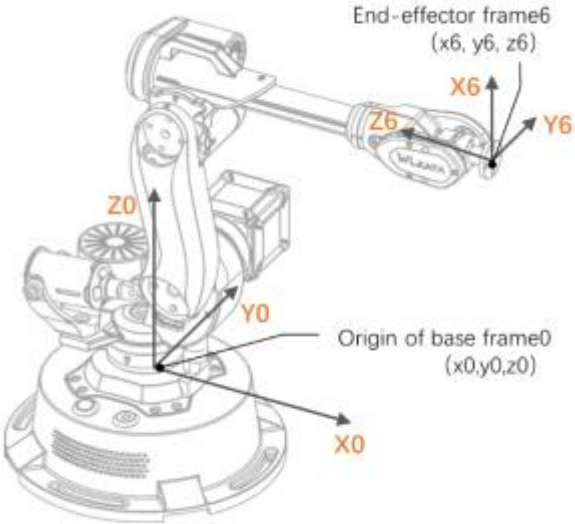
WLKATA Mirobot is mainly composed by a base, six rotating joints, a lower arm, an upper arm and an end-effector connection plate. There are a total of six robot joints in Mirobot. The reference frame is shown in Figure below.



The Structure of WLKATA Mirobot



The Six Joint Frame Of WLKATA Mirobot



Reference Frame of WLKATA Mirobot

1.2 Items

WLKATA Mirobot
Robot Arm

Mirobot User
manual

Hex Screwdriver

Sub Control Box

IDC Cable

Calibration Panel

Power Supply

Robot Arm
USB Cable

Micro Servo
Gripper Module

Pen Holding

1.3 Add-ons accessories

Pneumatic Unit

Suction Cup

2-Finger Gripper

3 Finger soft-claw

Teach pendant (Bluetooth)

Sliding Rail

Conveyor

Vision Set

2. Safety Precautions

This chapter introduces the safety precautions when using this device. **Please read this manual carefully before using the manipulator for the first time.**

This device should be used in an environment that meets the below requirements. Do not modify the device without authorization. Otherwise, it may cause device failure, even personal injury, electric shock, fire, etc.

The operator must first read the manual carefully and use the manipulator in strict accordance with the specifications of the manual.

2.1 Symbolic conventions

The following symbols may appear in this manual and their meanings are as follows.

Symbol	Explain
	Indicates a high potential hazard which, if not avoided, could result in personnel death or severe injury.
	Indicates a moderate or low potential hazard, if not avoided, may cause slight personal injury, manipulator damage.
	This indicates that there is a potential risk, which may lead to arm damage, data loss ,or unpredictable results.

2.2 General Safety

DO NOT Change or Modify the Circuit or Wire.

The manipulator is an electrical equipment. Non-professionals are not allowed to change or modify the circuit or wire. Otherwise, it is easy to cause injury to the equipment or person.

When using the manipulator, the subsequent safety rules shall be followed:

- The “DANGER,” “WARNING,” and “NOTICE” described in the manual are used as additional instructions for all security precautions.

- Please use the manipulator within the detailed environment. If the manipulator is used ahead of the stipulation and load requirements, the device lifetime will be reduced and even produce damages to the equipment.

- The personnel responsible for the installation, operation and maintenance of the WLKATA Mirobot manipulator must firstly receive training, and understand various safety precautions, and master the correct operation and maintenance methods before operating and maintaining the manipulator.

- It is not suggested to repair the damaged parts or disassemble the manipulator without professional training. If the devices crash, please contact the WLKATA Mirobot technical support engineer for advice.

- The high corrosive cleaning is not suitable for the cleaning of the manipulator, and the anodized parts are not suitable for immersion cleaning.

- If needs to discard the device, please rightly dispose of it as industrial waste by relevant laws to protect the environment.

- There are small parts in the packing box. DO NOT let children play with the packing or parts in the box to prevent swallowing or hurts.

- If the manipulator is used by a child, at least one adult must be on the side to monitor the child's operation.

- The equipment shall be shut down when the operation is completed.

- In the process of manipulator movement, please do not extend your hand into the movement range of the manipulator to avoid bumping or pinching.

- It is strictly prohibited to change or remove and modify the nameplate, description, icon, and mark of the manipulator and related equipment.

- During the handling and installation, please pay attention to handle with care according to the instructions. Otherwise, it is easy to damage the manipulator.

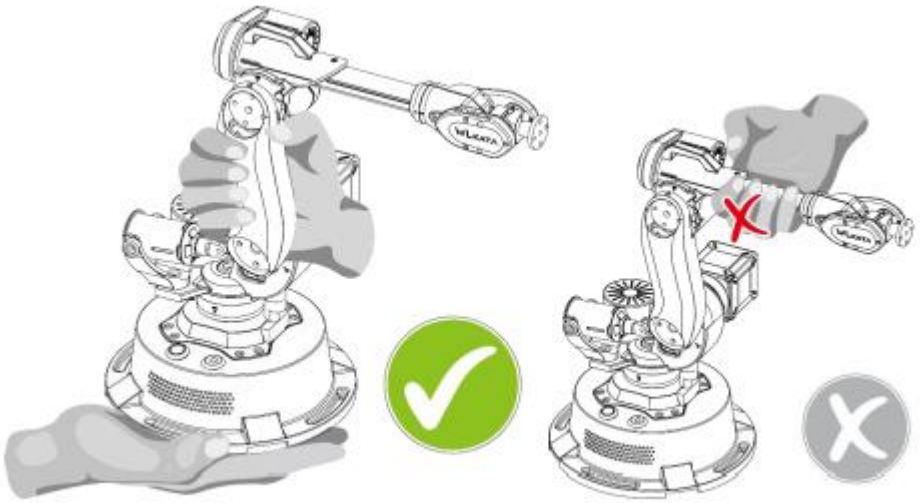
- When operating the manipulator, the local laws and regulations shall be strictly observed. The safety precautions described in the manual are only a supplement to local safety regulations.

- Before operating the manipulator, please refer to this WLKATA Mirobot User Manual.

2.3 Precautions

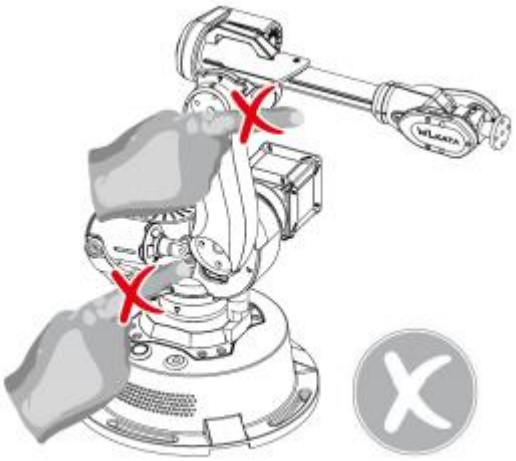
I. Lifting and Handling Mirobot Correctly

Always remember to lift and handling Mirobot by holding the Lower Arm with one hand and holding the Base with the other hand. One should not lift or handle Mirobot by holding the Upper Arm, or it would cause damage to the motor gears of the major joints.



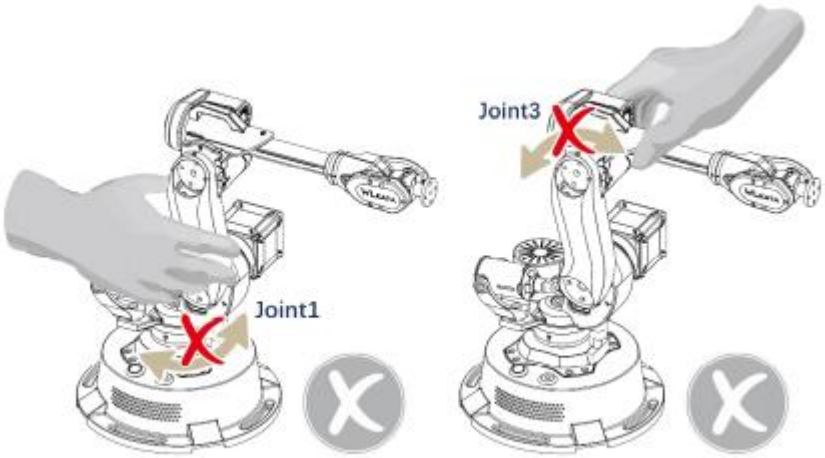
II. Be Careful of Your Finger and Preventing Pinching

When the manipulator is during operation, do not place your fingers in the gap between the upper and lower arms, or the cap between the lower arm and base to prevent pinching.



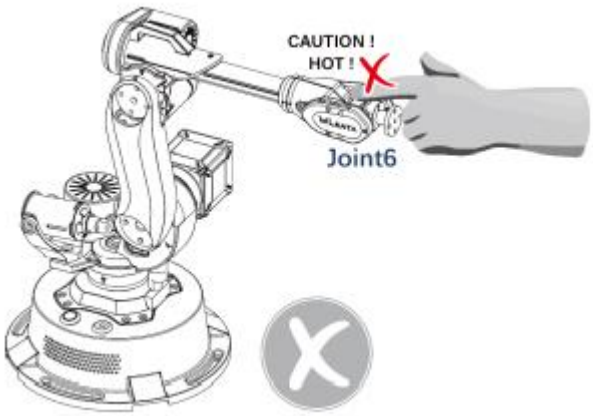
III. DO NOT Twisting the Joints by Hands!

DO NOT (!) twist the Joint 1 or Joint 3 by hand in any case, since this would lead to fatal damage to these joints (due to the high reduction gear ratio of these motors). It is only allowed to adjust the joints by using WLKATA studio or proper operation software.



IV. Caution the Hot Surface of Motor & Chip

When Mirobot is powered on, DO NOT (!) touch the surface of joint 6 motor or the chip by hand, as those parts could be very hot during working.

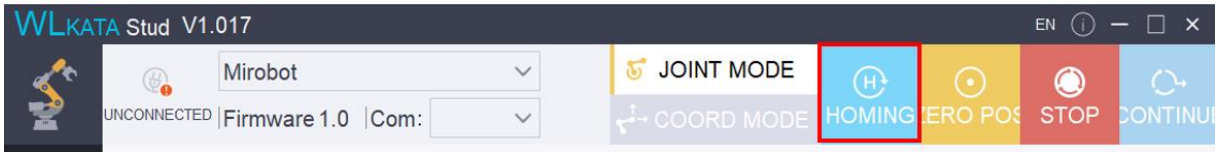


V. Press the RESET button for a Hardware Emergency Stop

In any case of illegal or abnormal operation of the Mirobot, one should press the RESET button immediately on the top of the Mirobot base for an emergency stop. Then before any further operation, remember to execute the HOMING action.

VI. Execute HOMING action on Each Time Powering on or re-connect the Mirobot manipulator

Each Time the manipulator is powered on, RESET from an emergency stop, or reopen the WLKATA studio, the user must execute the HOMING action by clicking the HOMING button in WLKATA Studio to homing the joints position. One should wait for the HOMING action to be completed before any further operation.



VII. Unplugging All Extent Components When Powered Off

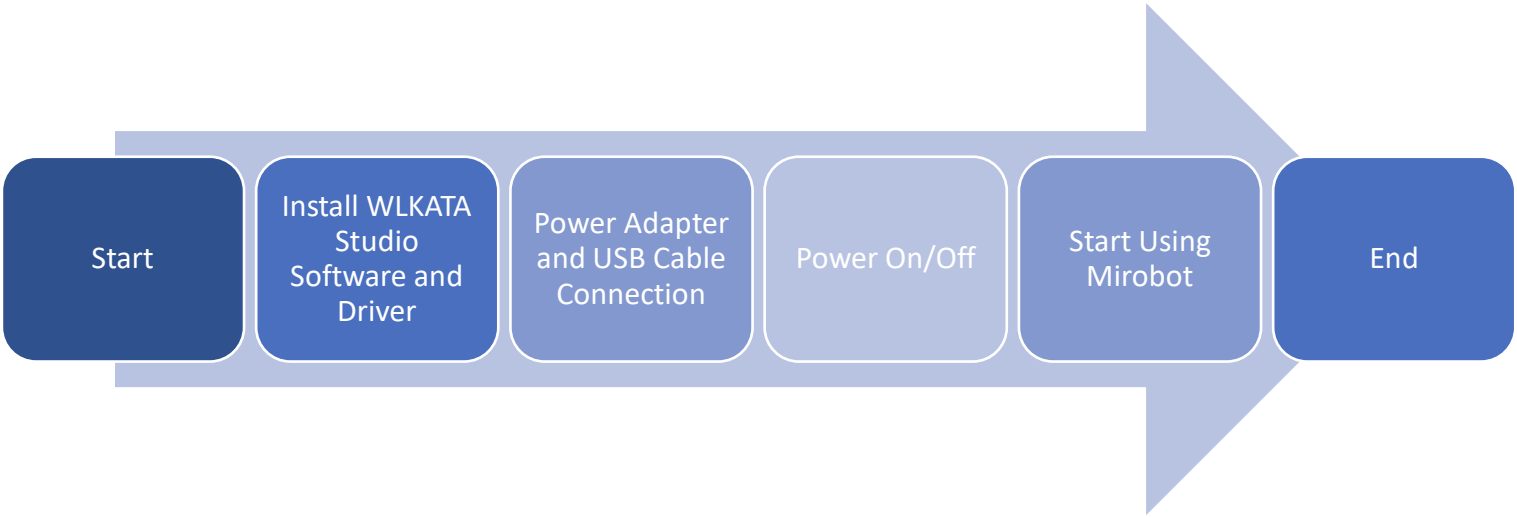
When powering off the manipulator, please disconnect and unplug all external components from the manipulator, such as Bluetooth box, extender box, colour sensor, sliding rail, conveyor belt etc. Otherwise, the manipulator and the external components may be damaged.

VIII. Avoid Using This Device for Laser Engraving

This manipulator is not designed for executing laser engraving. For users who use this device in potentially hazardous conditions, one should wear full personnel protection equipment, including glass, glove and use proper protection cover unit, etc.

3. Quick start guides of Mirobot

In this chapter, you will learn how to control the manipulator by using WLKATA Studio. The overall process of operation is shown in the Figure below.



3.1 Install WLKATA Studio Software and Driver

You can control the Mirobot by using WLKATA Studio software to realize functions such as Joint Mode control, Coordinate Mode control, TEACHING & Play, BLOCKY control and DRAWING etc.

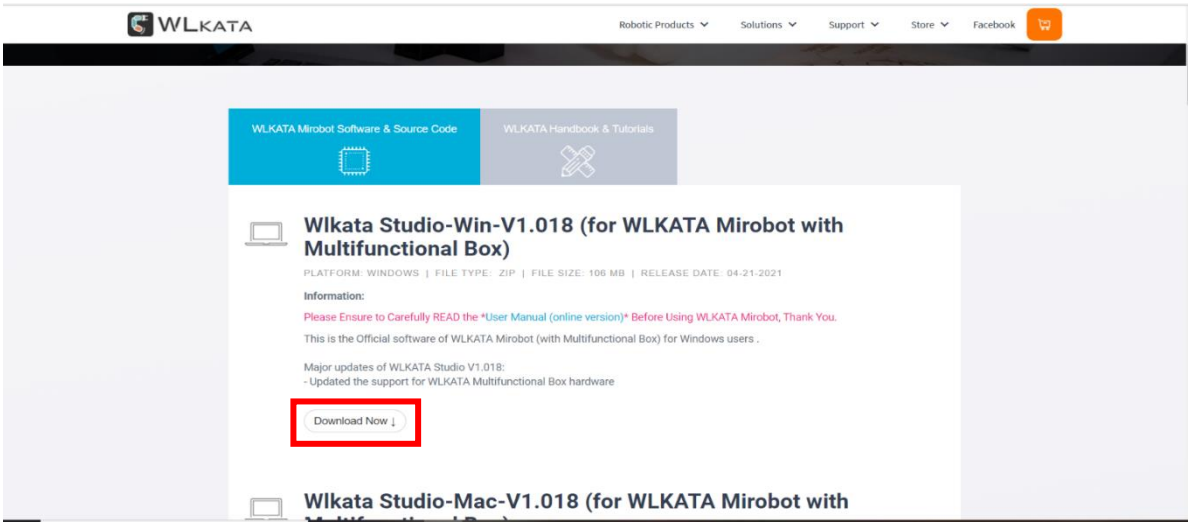
3.1.1 System environment requirements

WLKATA Studio control software supports the following operating systems:

- Windows 7 (64 bit)
- Windows 8 (64 bit)
- Windows 10 (64 bit)

3.1.2 Downloading WLKATA Studio and the driver packages

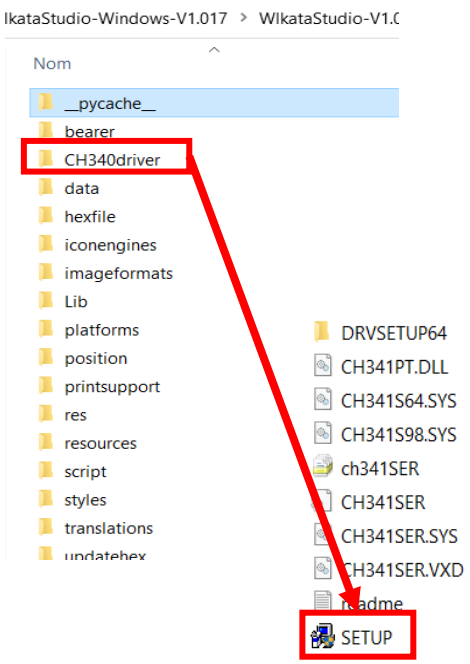
Download WLKATA Studio software package and the CH340 driver package from WLKATA Download Center.(https://www.wlkata.com/support/download-center)



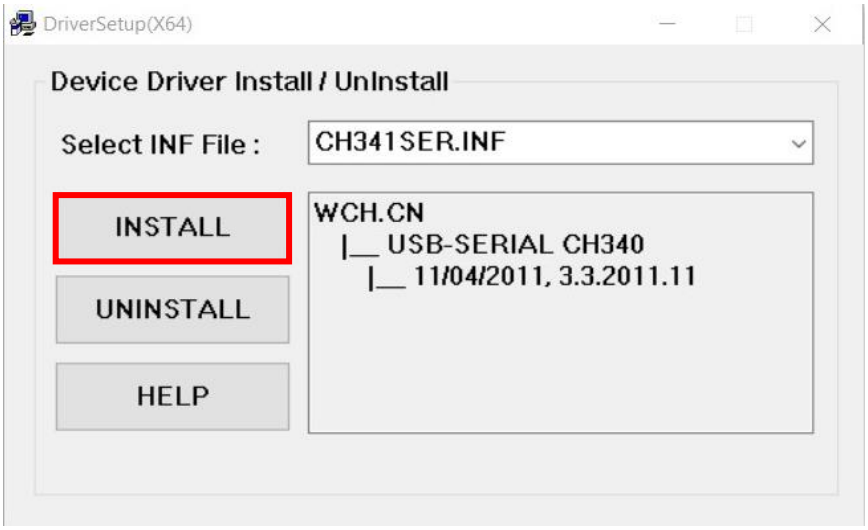
3.1.3 Installing and verification of the driver

1. Installing the driver

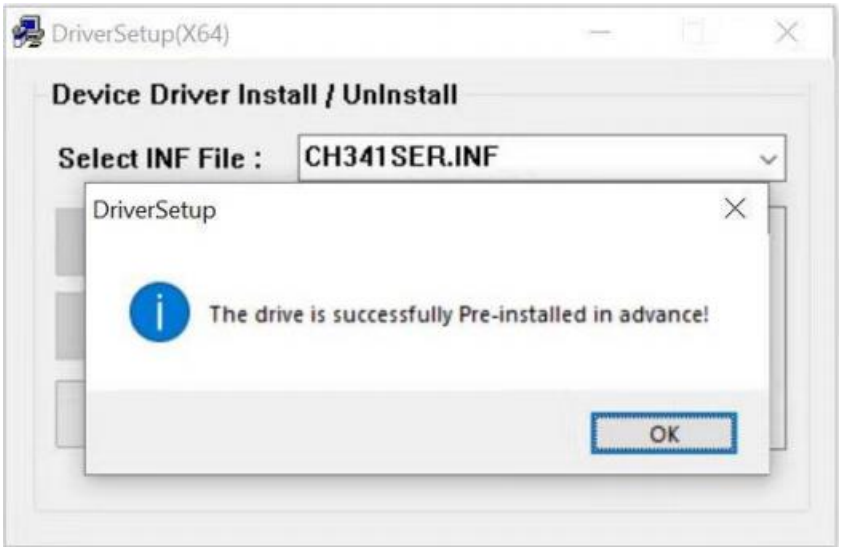
Decompress the driver package to a local root directory such as D:\ or E:\ to avoid potential foreign language character disturbance. Click **SETUP.exe** in the directory to install the **CH340 driver.**



Then in the pop-up window, click **INSTALL** and the interface will pop up after successful installation. Click **OK.**



CH340 driver installation wizard interface



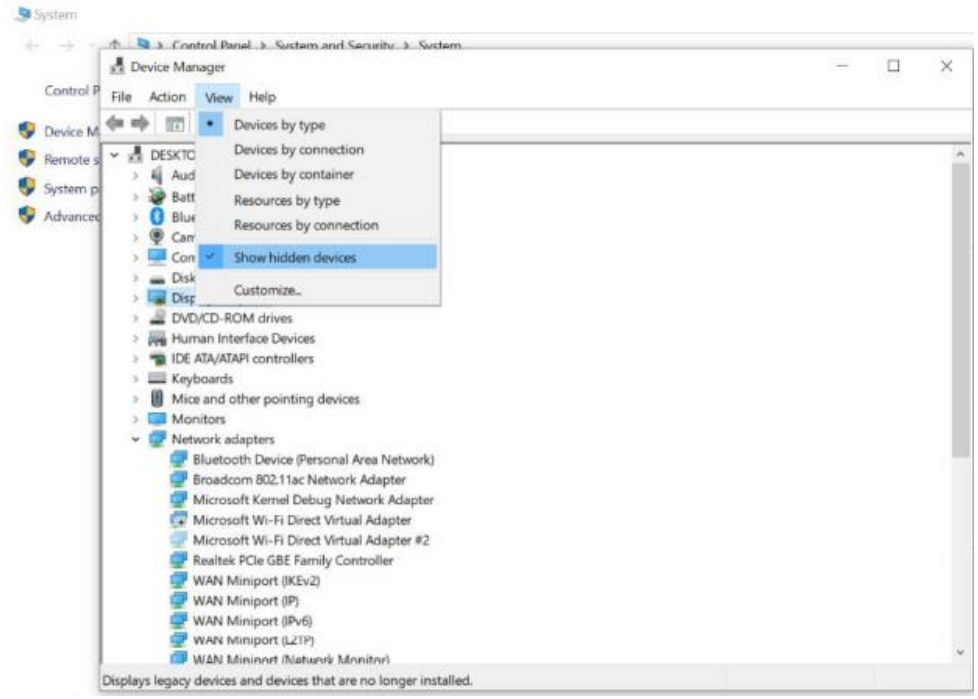
Driver installed successfully

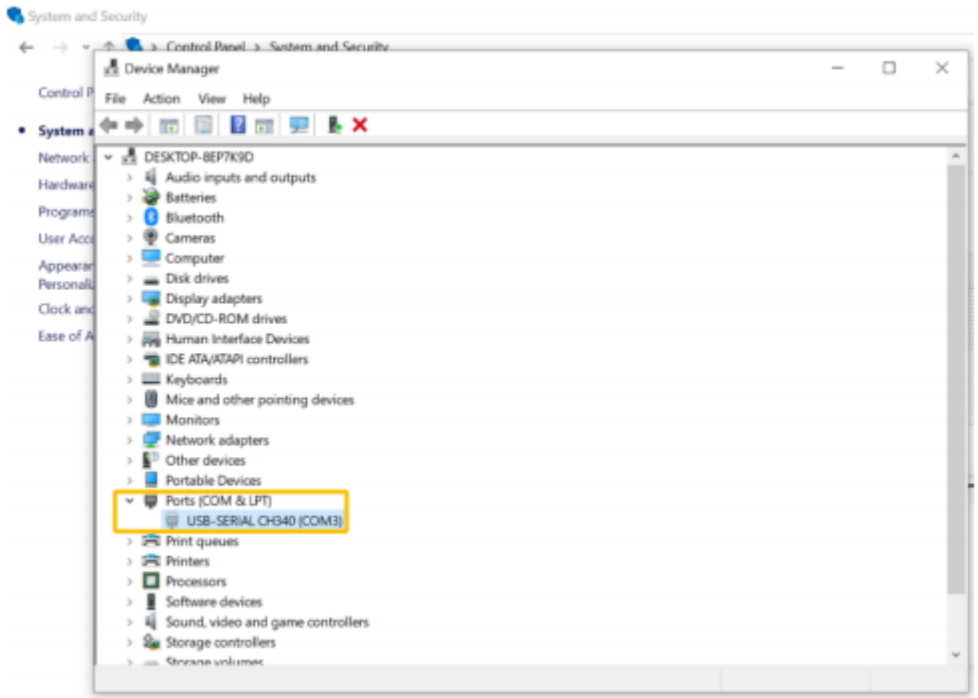
2. Verifying the driver

(1) Ensure to connect the manipulator to the computer by using the supplied USB data cable.

(2) Open the **Device Manager** in your PC windows system. Ensure to tick the **Show hidden devices** option in the **View menu**. If the "**USB-serial ch340 (COM4**)" can be found in the port (**COM and LPT),** it means the driver is installed successfully. **The port number**

following the COM **may be different** depends on the default driver installation of your system



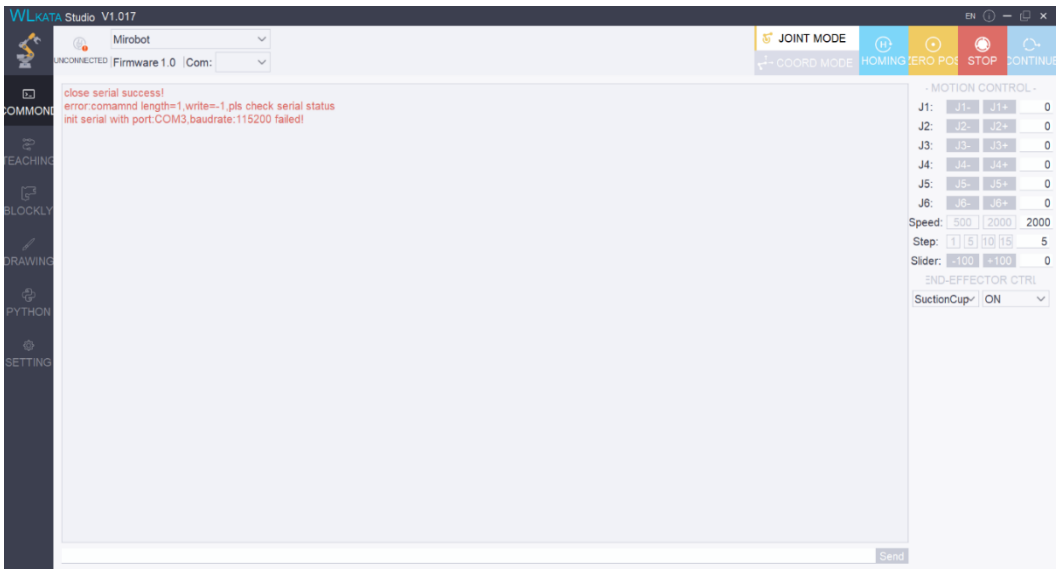


3.1.4 Installing WLKATA Studio

Double-click **Wlkata Studio.exe** in the directory to open the software user interface.

Qt5Svg.dll	18/03/2021 08:48	Extension de l'app...	321 Ko
Qt5WebChannel.dll	18/03/2021 08:48	Extension de l'app...	108 Ko
Qt5WebEngineCore.dll	18/03/2021 08:48	Extension de l'app...	69 068 Ko
Qt5WebEngineWidgets.dll	18/03/2021 08:48	Extension de l'app...	227 Ko
Qt5Widgets.dll	18/03/2021 08:48	Extension de l'app...	5 346 Ko
QtWebEngineProcess	18/03/2021 08:48	Application	17 Ko
table	20/05/2021 09:37	Document texte	1 Ko
tmp_save_svg_qncz	07/05/2021 16:54	GCode File	18 Ko
tmp_save_svg_qncz	07/05/2021 16:54	Scalable Vector Gr...	1 Ko
tmpmxf.py	20/05/2021 10:45	Fichier PY	1 Ko
vcruntime140.dll	18/03/2021 08:48	Extension de l'app...	86 Ko
WlkataStudio	18/03/2021 08:48	Application	2 697 Ko

WLKATA Studio interface (the robot is not connected yet)



3.2 Installing the WLKATA Mirobot

3.2.1 Power adapter and USB cable connection

(1) Use the USB cable to connect the WLKATA Mirobot and your computer.

Connecting the manipulator to the computer

(2) Connect the power adapter to the manipulator

Connecting the manipulator to the power adapter

3.2.2 Powering on and off WLKATA Mirobot

DO NOT Twist the Joint 1 or Joint 3 by Hand No Matter the Manipulator Is Powered On or Off! Since this would lead to fatal damage to the gears of these joints.

Power on:

Connect the manipulator with supplied power adapter. Press **the On/Off power button** on the top of the manipulator base to power on the device. The green power indicator on the **On/Off** button will light up.

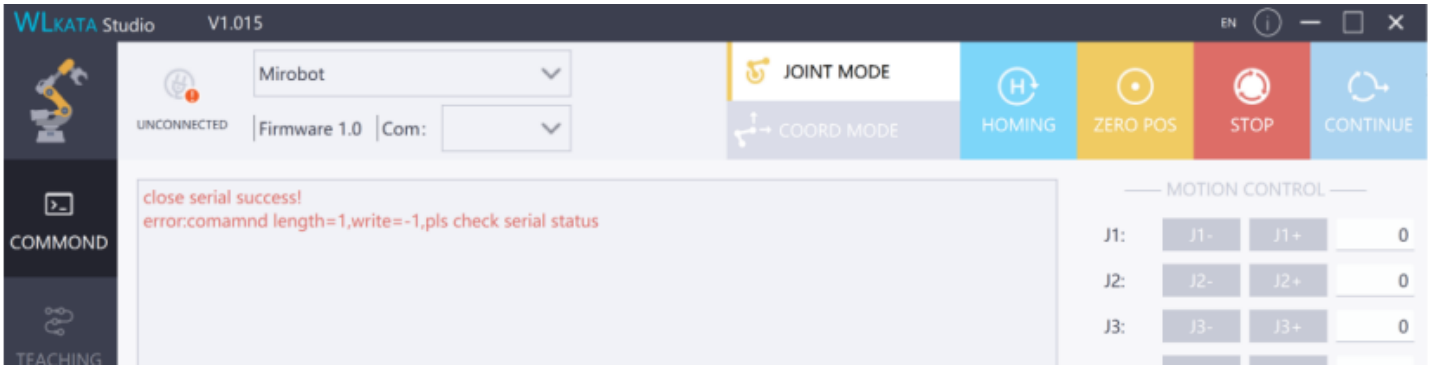
Switching on the manipulator

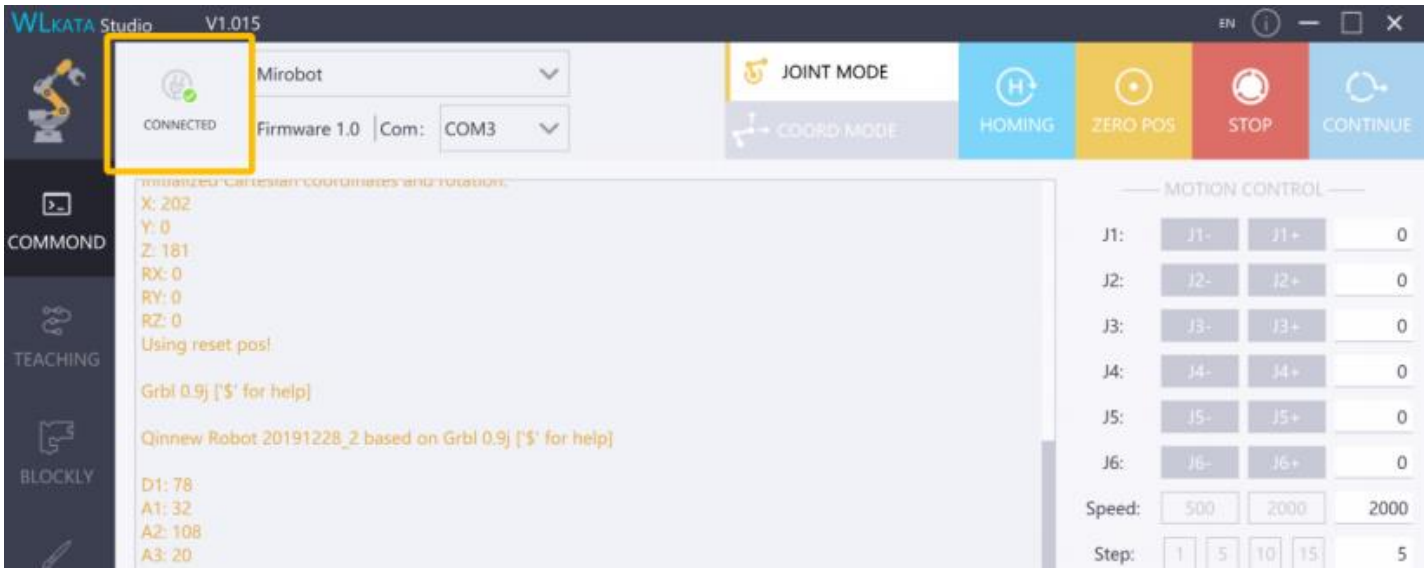
Power off:

Press the power button on the top of the base of the manipulator again to turn off the power. The power indicator light on the button will turn off.

3.3 Verifying the device connection

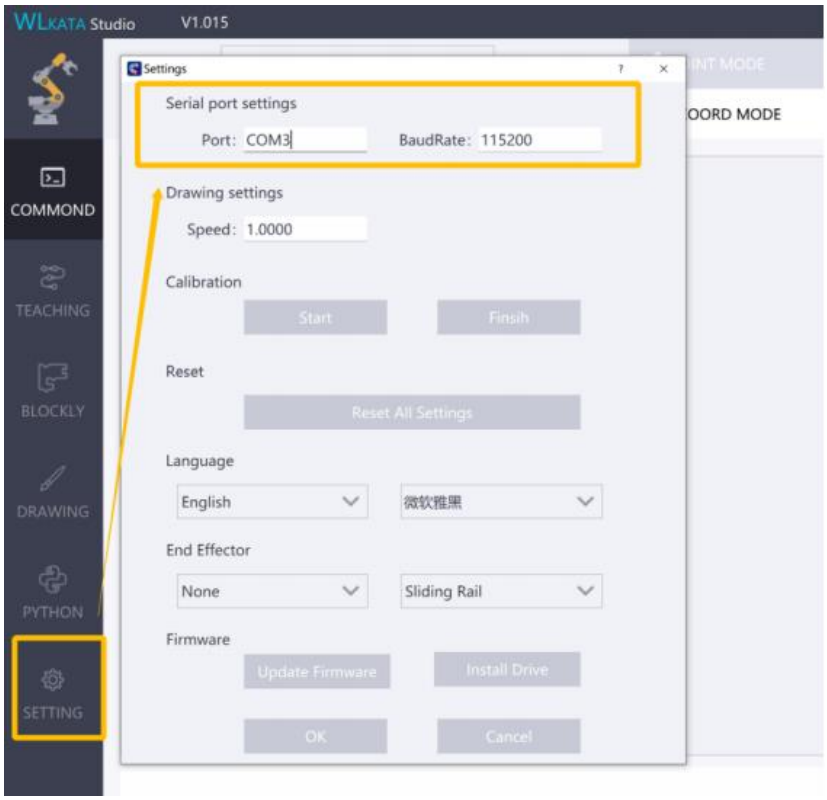
(1) Open the WLKATA Studio.exe. The software should automatically search and connect to the manipulator after a few seconds if the power is on. When successfully connects to the manipulator, the upper left corner of the WLKATA interface should display the **CONNECTED** green icon.





WLKATA Studio can search and connect to the manipulator automatically

(2) If the software did not connect to the manipulator automatically, please manually connect the manipulator by click SETTING to set "Port" and "Baud Rate". Enter the correct serial port COM_ number (as found in step (2) in the content of 2. Verifying the driver). After clicking "OK", there will be "Connected" displayed in the upper left corner.



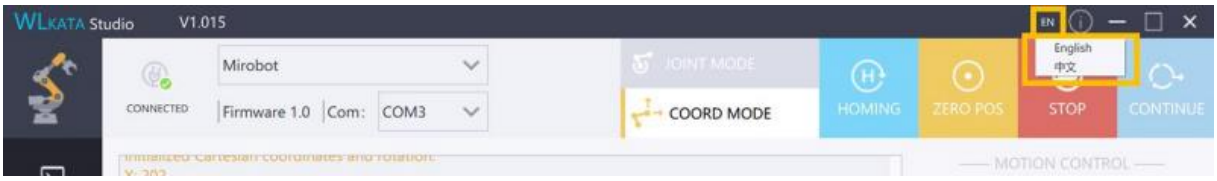
Manually setting a serial port number in the SETTING if the manipulator is not connected automatically.

3.4 Introduction of WLKATA Studio Control Interface Software

WLKATA Studio is a control software for Mirobot. It includes command control, joint/coord control, teaching, graphical programming, python programming, writing and drawing, firmware upgrade and other functions.

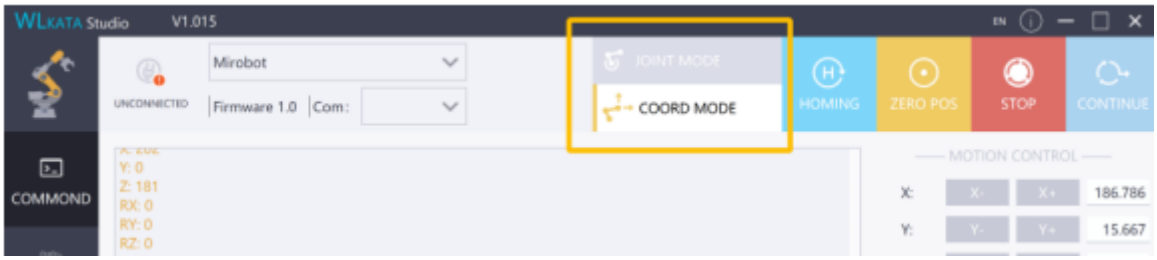
3.4.1 Chinese and English switch

After opening the software, click SETTING to set the language, select English or Chinese, confirm and restart. (It can also be set by clicking "EN" in the upper right corner of the interface).

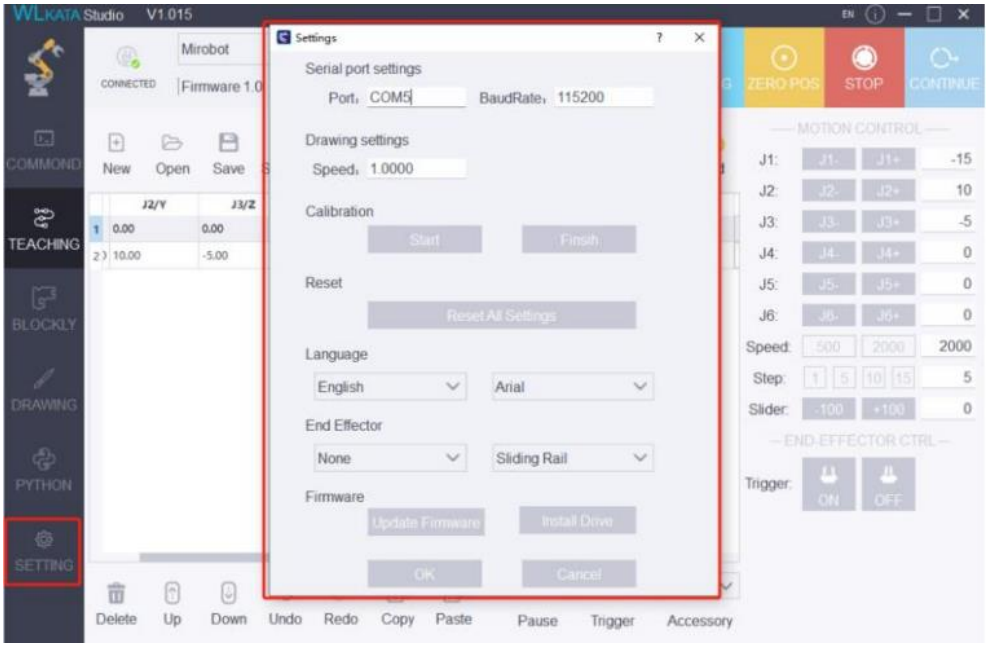


3.4.2 Joint/Coord Mode switch

In the **Command mode**, select "**JOINT MODE**" or "**COORD MODE**" at the top of the user interface, and the selected mode will be displayed as a white background status. The difference will be explained later in this tutorial.



3.4.3 Introduction to SETTING interface



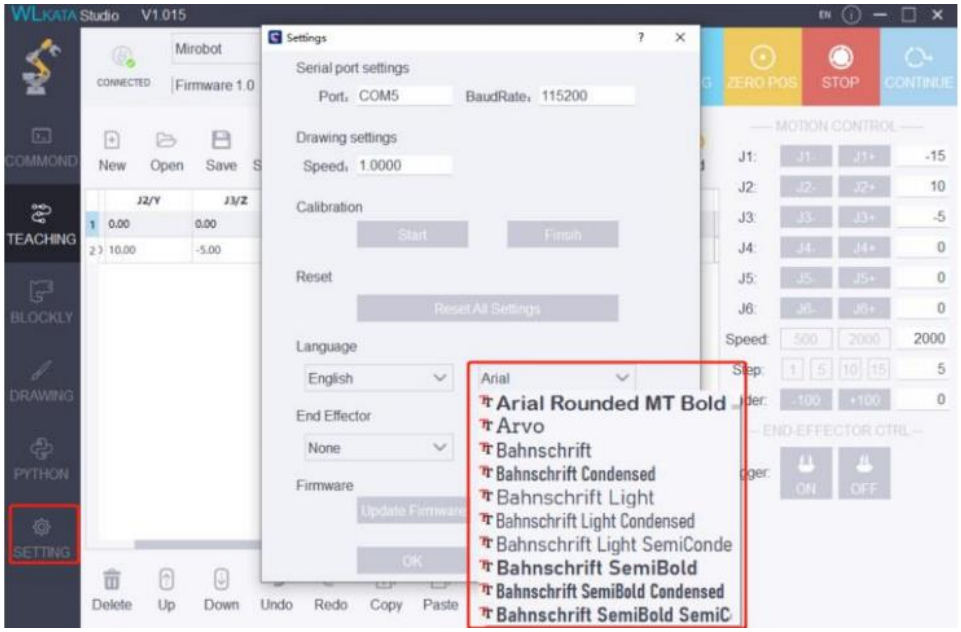
(1) **Serial port settings:** set the serial port and baud rate (115200) of the robotic arm connected to Mirobot Studio.

(2) **Drawing settings:** set drawing speed (recommending the default value)

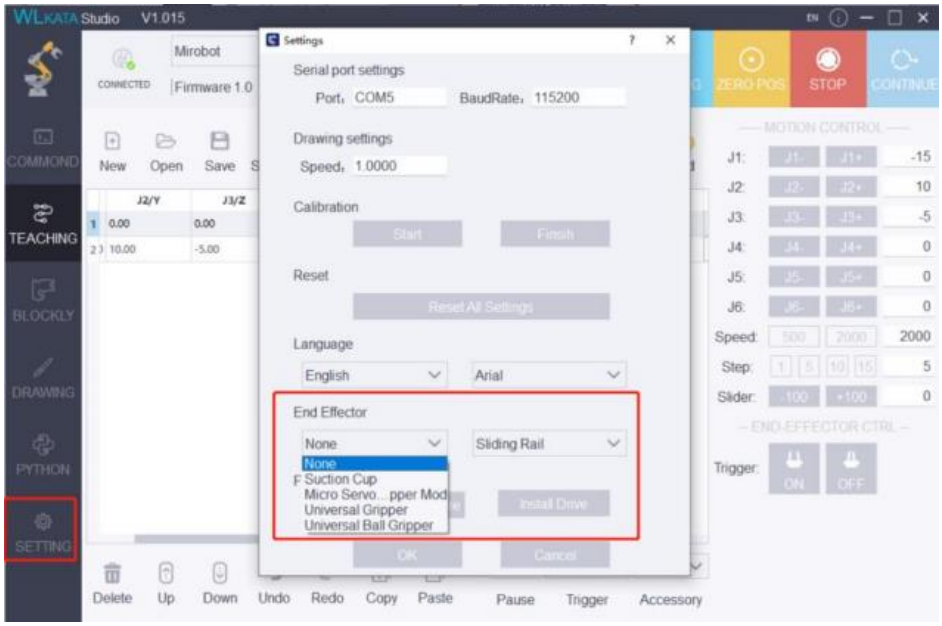
(3) **Calibration:** used to calibrate the robotic arm.

(4) **Reset:** reset all data of the robotic arm (recalibration is required after reset)

(5) **Language**: Set language and font (After language setting, click OK to automatically restart the software to take effect.
After font setting, click OK to manually restart the software to take effect) Or click the "EN" button in the upper right corner of the interface to switch between Chinese and English.



(6) **End Effector:** select the end tool and rail/belt mode used by the robotic arm.



(7) **Firmware**: update the firmware, refer to "Mirobot Firmware Upgrade Tutorial" for detailed operation.

4. Star using the manipulator

This chapter describes the essential control operation of this manipulator by using the WLKATA Studio software

4.1 Prerequisite

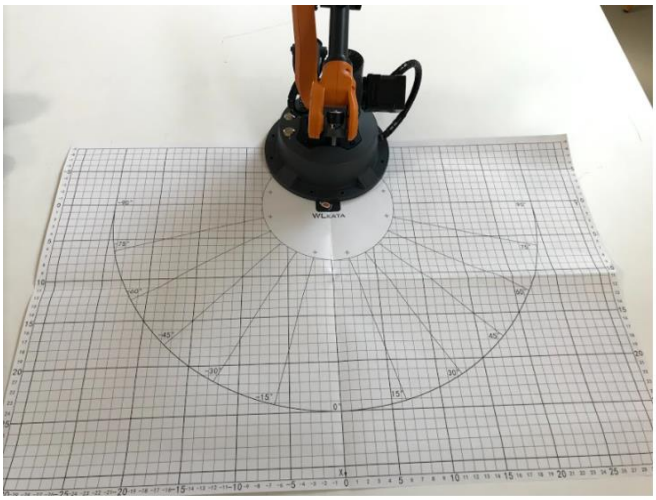
- The driver and WLKATA Studio software have been installed successfully. For details, please refer to the 3.1 Installing WLKATA Studio software and Driver.

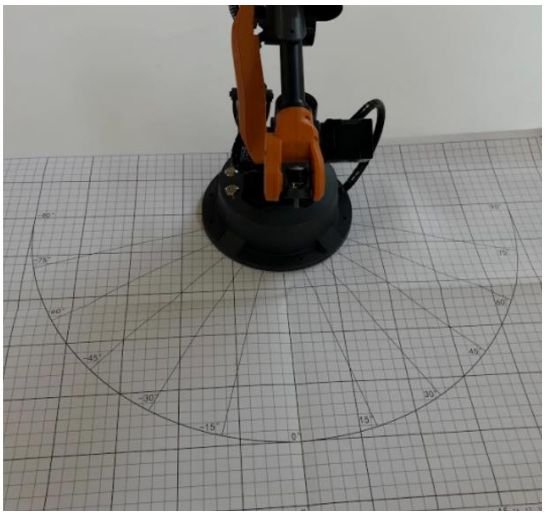
- The manipulator has been correctly connected to the computer, and the power supply of the manipulator has been turned on. Please refer to 3.3 Powering on and off WLKATA Mirobot for detailed operation.

4.2 Preparing operation steps

1. Power on and connecting the robot

Place the robot in the centre of the calibration panel.





Please follow the steps of the 3.2.1 Power adapter and USB cable connection.

2. Connecting WLKATA Studio with the manipulator

Double click **the Wlkata Studio.exe** in the directory, and the Mirobot Studio interface should pop up. Then please follow the steps of 3.1.3 to verify the driver and connection. When the connection is successful, the CONNECTED green icon should be displayed in the upper left corner of the WLKATA Studio interface.

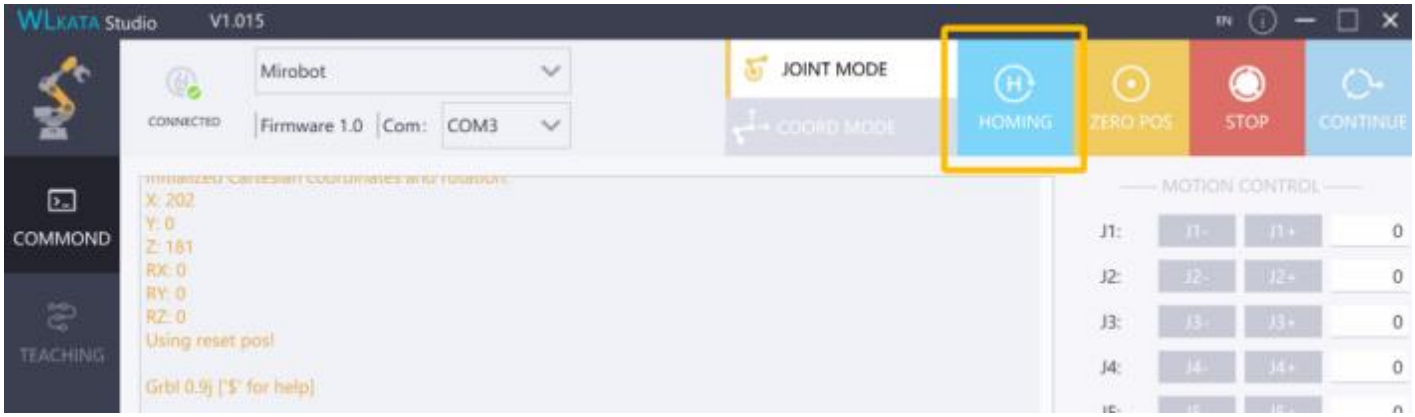
3. HOMING the manipulator before any operation

Before any operation, the manipulator must be homed to the pre-designed homing position. Click the **HOMING button** in the WLKATA Studio.

Wait for the manipulator to be homed. The figures below show the manipulator during the homing process and the correct position of the manipulator after a successful HOMING action.

* Note: If the HOMING action is failed or interrupted, please reapply the power of the manipulator and repeat the HOMING action.

The manipulator must be HOMING again each time reapplying power from a power failure or an emergency stop or re-opened the WLKATA Studio. One should wait for the HOMING action to be fully completed before any further operation.



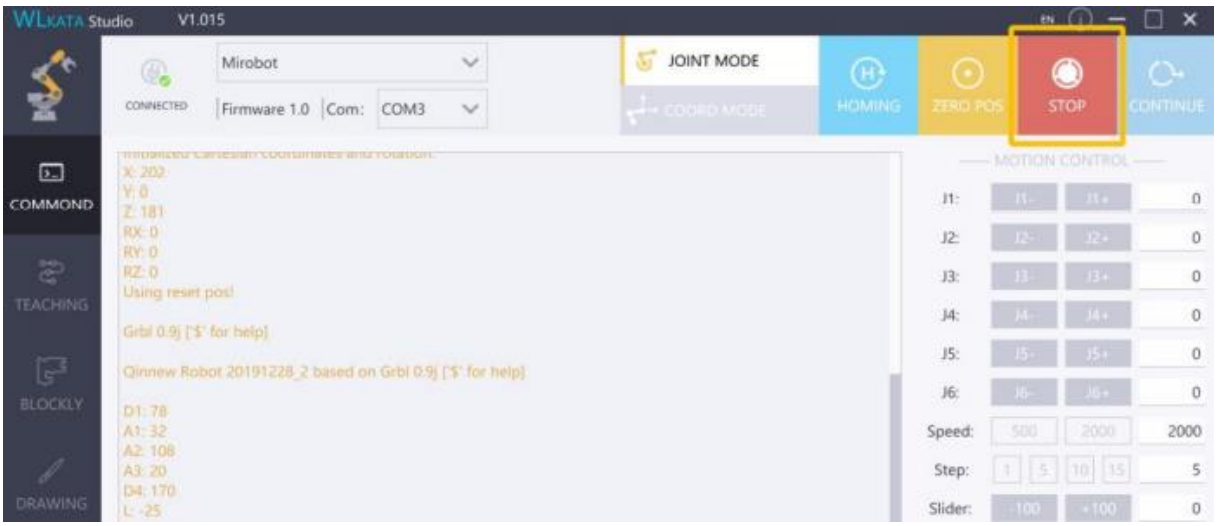
Doing the HOMING action each time powering on the manipulator

In the progress of HOMING the manipulator

The correct manipulator position after a successful HOMING action

4. Software emergency stop and reset

In case of any illegal operation of the manipulator, click the **STOP** button immediately in the Mirobot Studio to trigger a software emergency stop operation.



Emergency stop button in the WLKATA Studio

After the emergency stop operation, press the **RESET** button on the top of the manipulator base to recover the device from the emergency status.

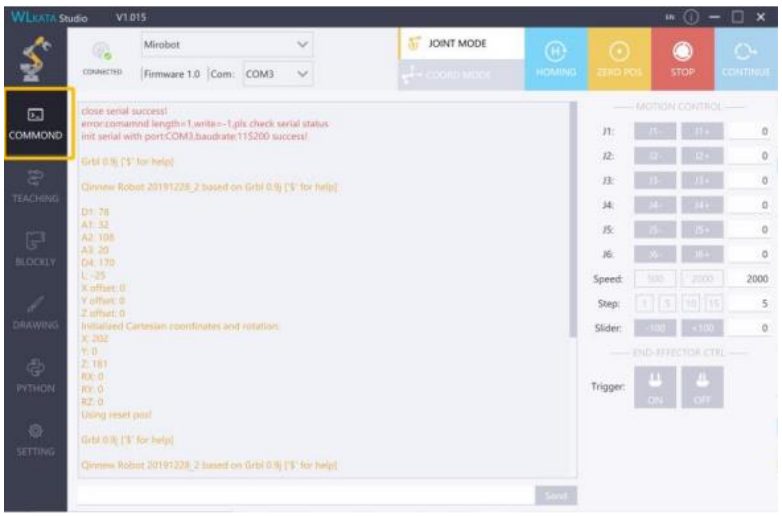
Pressing RESET button on the base of the manipulator after a software emergency stop

After press the RESET button, please **HOMING** the manipulator in the software again before continuing using the manipulator.

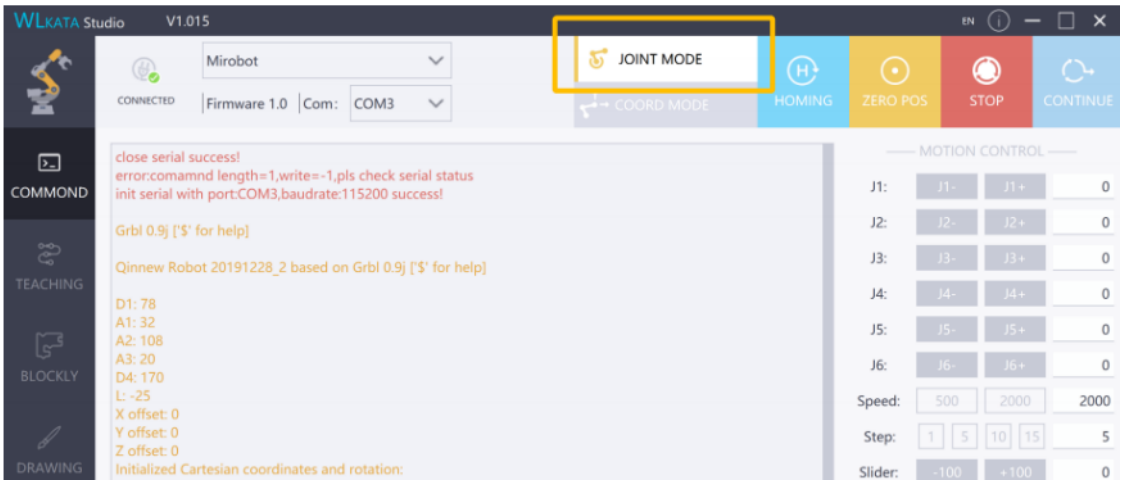
After a software emergency stop, press RESET on top of the base, and do the HOMING again before continuing using the manipulator.

4.3 Using the ROBOT JOINT MODE control function

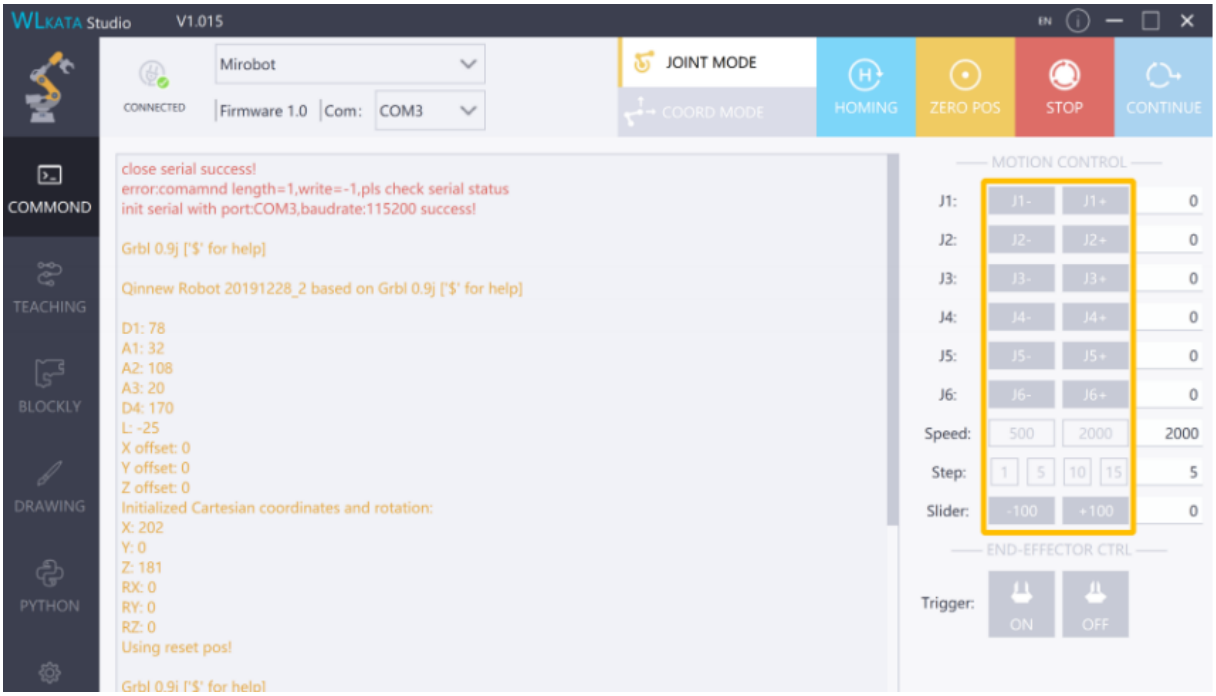
(1) Click the **COMMAND** tab in the software interface.



(2) Switch to the **ROBOT JOINT MODE** in the upper control modes selection panel.



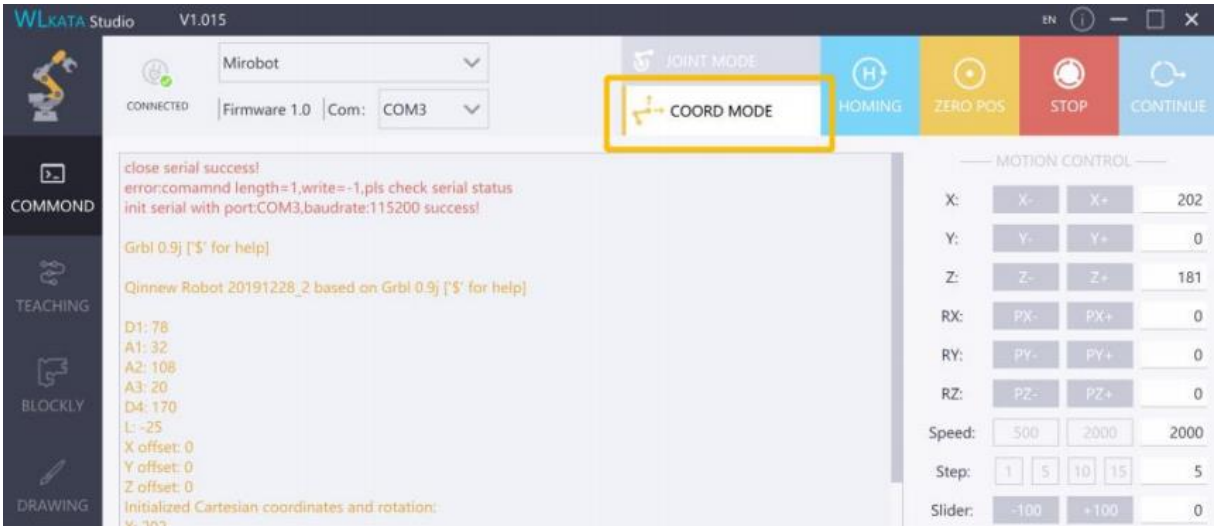
(3) Click each of the **J+ and J- control buttons** on the right panel to control the motion of each of the six joints of the manipulator separately. The speed can be adjusted by input **Speed** value and the step can be adjusted by input **Step** value.



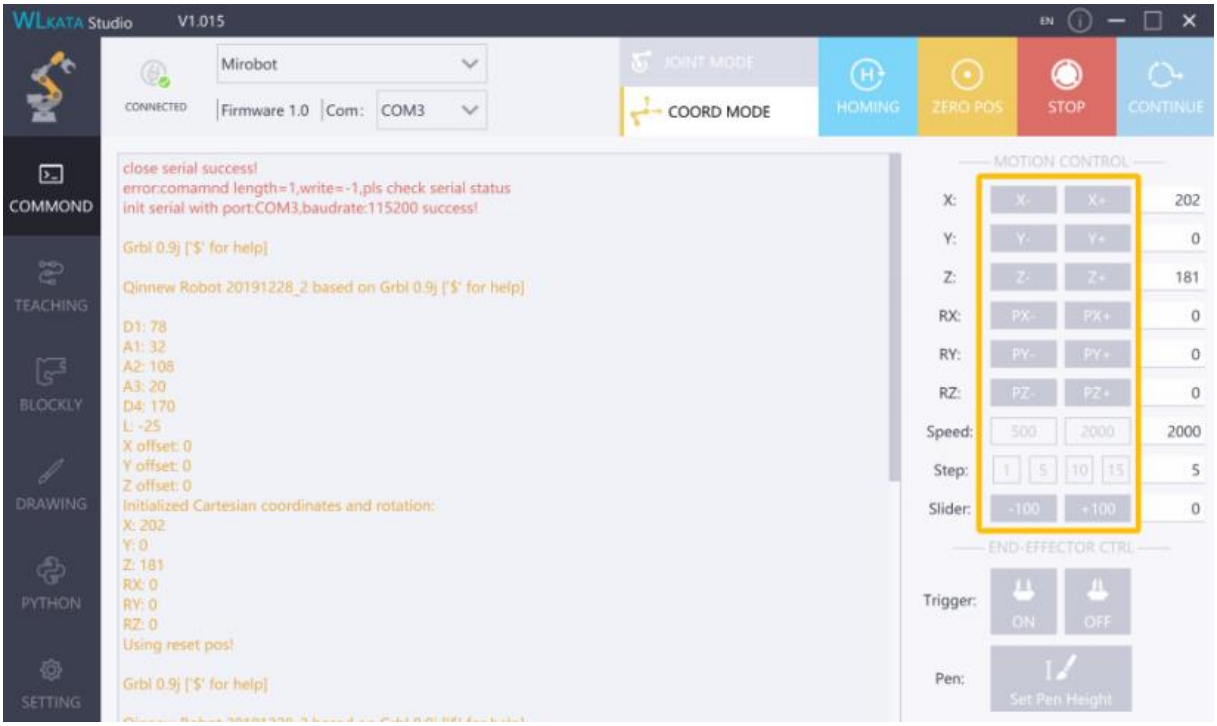
4.4 Using the COORDINATE MODE control function

(1) Click the **COMMAND** tab.

(2) Switch to **COORDINATE MODE** in the control modes selection panel.

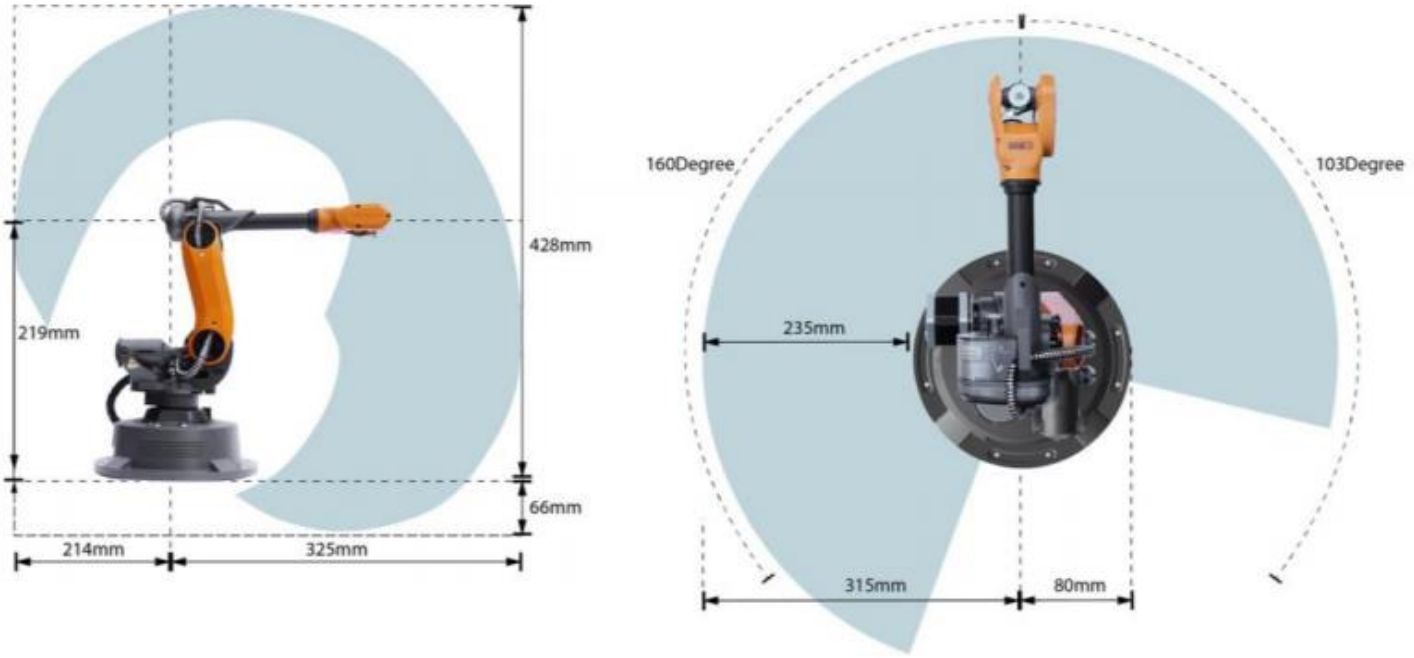


(3) Click each of the control buttons on the right panel of the WLKATA Studio to control the spatial position and attitude (**XYZ coordinate and RX RY RZ angle**) of the End-effector of the manipulator. The speed can be adjusted by input **Speed** value, and the step can be adjusted by input **Step** value. You can also enter the value on the right and then Enter.



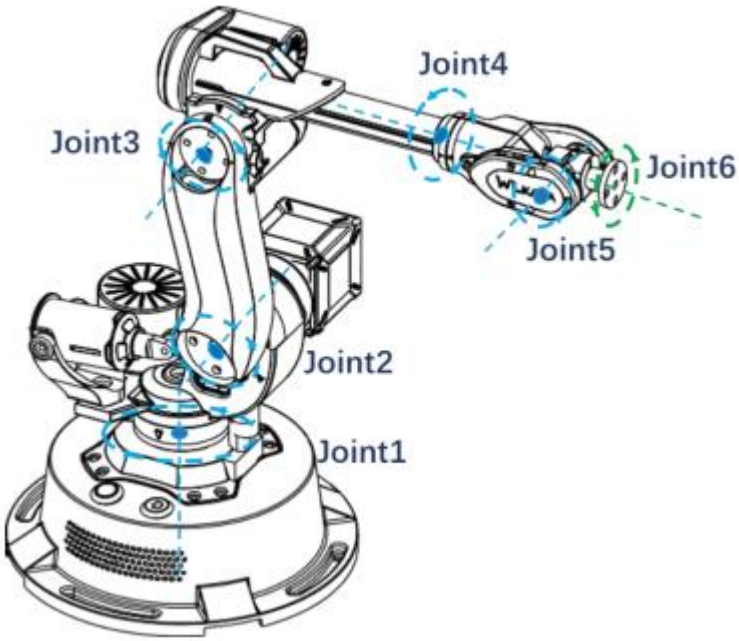
4.5 Working space

The workspace of WLKATA Mirobot.

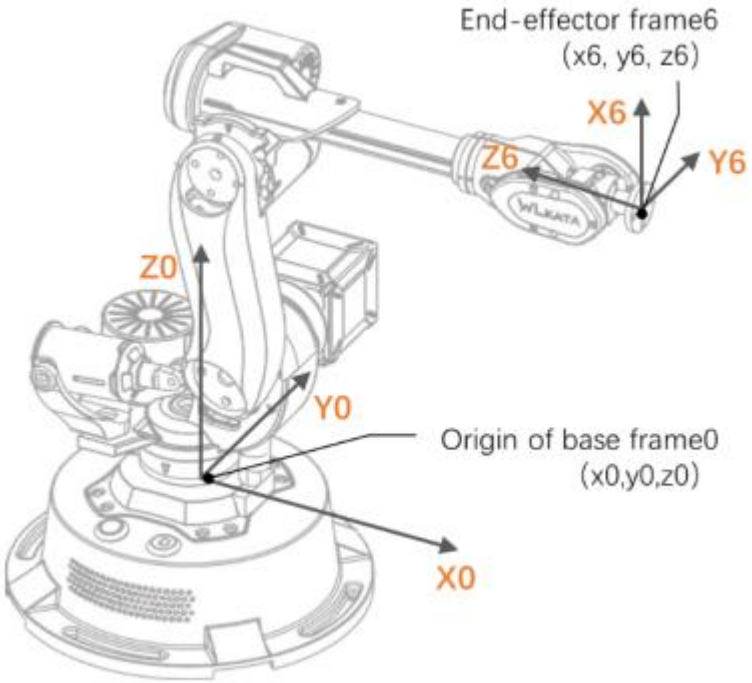


4.5.1 Coordinate system

WLKATA Mirobot has a six-joint coordinate system and a Cartesian space coordinate system.



Six-joint coordinate system of WLKATA Mitobot



Reference frame (Cartesian space coordinate system) of WLKATA Mirobot

1. **Joint coordinate system**: the coordinate system determined by reference to each moving joint.

This manipulator has six joints: J1, J2, J3, J4, J5 and J6. All of them are rotary joints. The positive rotation direction of each joint follows the right-hand rule and the thumb points to the opposite direction of the output shaft of each shaft motor.

2. **Cartesian coordinate system:** the coordinate system is determined by reference to the base of the manipulator.

- The origin of the coordinate system is the centre of the base platform.
- The x-axis direction is perpendicular to the fixed base forward.
- The y-axis direction is perpendicular to the fixed base to the left.

4.5.2 Sports function

The motion modes of the Mirobot manipulator include Joint Motion mode and Coordinate mode.

1. **Joint motion mode**

The Joint motion mode means that each joint of the manipulator is controlled separately. You can click the joint motion button to move a single joint.

- Click "J1 +" and "J1 -" to control the positive and negative rotation of the base motor.
- Click "J2 +" and "J2 -" to control the positive and negative rotation of the boom motor.
- Click "J3 +" and "J3 -" to control the positive and negative movement of the jib motor.
- Click "J4 +" and "J4 -" to control the positive and negative rotation of the fourth axis at the end.
- Click "J5 +" and "J5 -" to control the positive and negative rotation of the fifth axis at the end.
- Click "J6 +" and "J6 -" to control the positive and negative rotation of the sixth axis at the end.

2. **Cartesian motion mode**

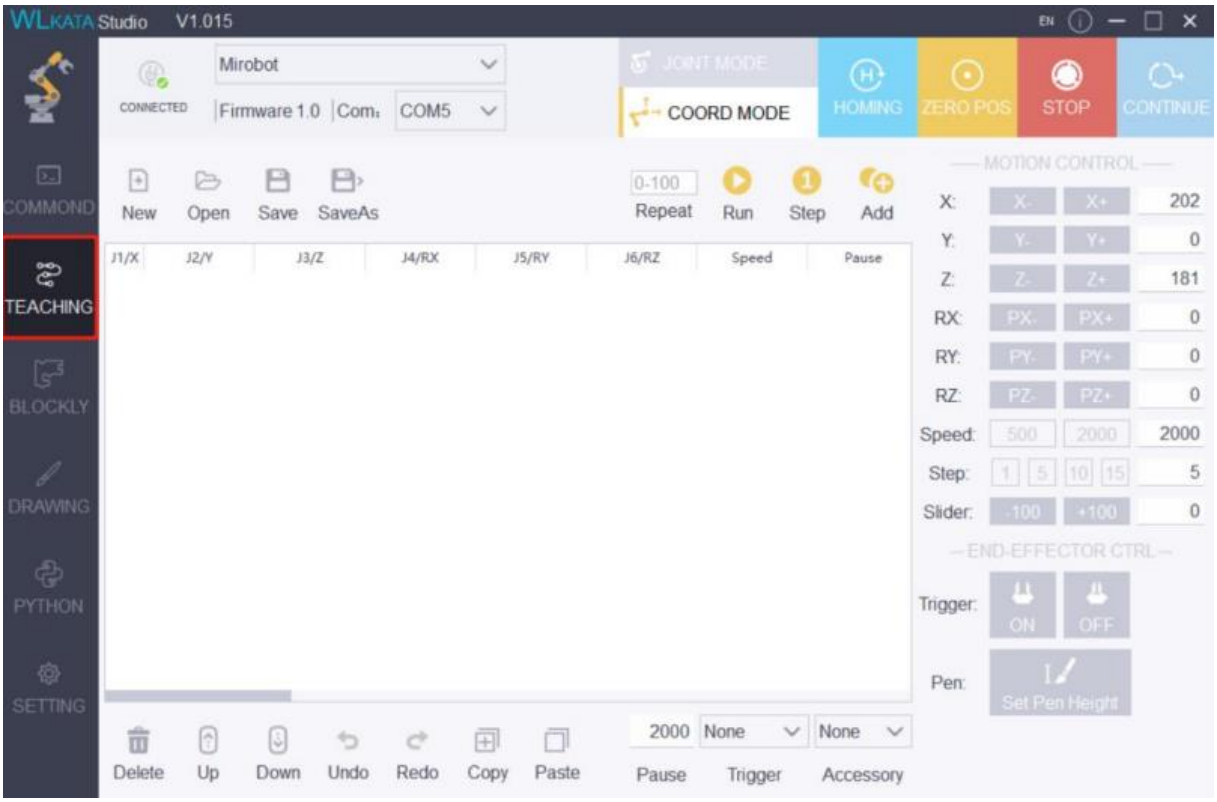
The Cartesian motion mode of the manipulator controls the position and attitude of the end-effector. You can click the coordinate and RPY angle motion buttons to change the position and attitude of the end actuator.

- Click "x +" and "X -" to control the manipulator to move along the positive and negative direction of the X-axis.
- Click "Y +" and "Y -" to control the manipulator to move along the positive and negative direction of the Y-axis.
- Click "Z +" and "Z -" to control the manipulator to move along the positive and negative direction of the Z-axis.
- • Click "PX +" and "PX -" and the end posture of the manipulator rotates along the X-axis.
- Click "PY +" and "PY -" to rotate the end posture of the manipulator along the Y-axis.
- Click "PZ +" and "PZ -" and the end posture of the manipulator rotates along the Z-axis.

5. The TEACHING function

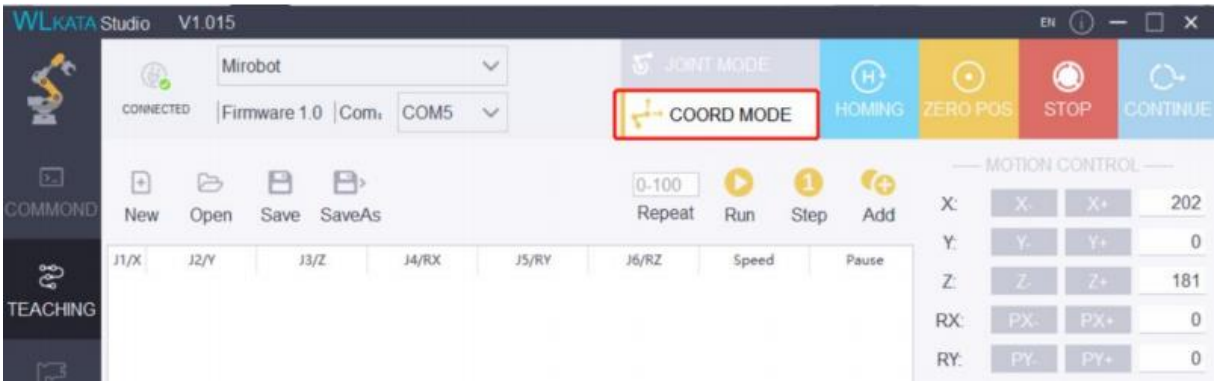
5.1 Using the TEACHING function

(1) Click “TEACHING” to enter the interface.



(2) Choose control mode

In the Angle Mode, the position parameters of each axis are recorded: in the Joint Mode, the position and posture parameters of the robot arm end are recorded. Choose the “Joint More” here.

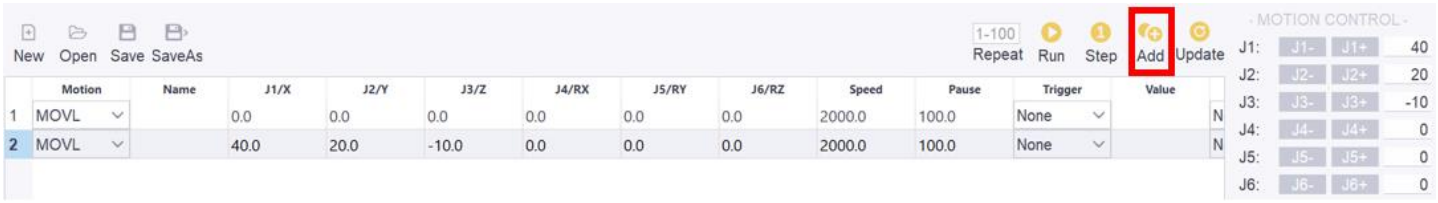


DO NOT Change the control mode during the same TEACHING & PLAY file/task, or the point data after switching the mode would be discordant and cause illegal motion.

(3) Add teaching point

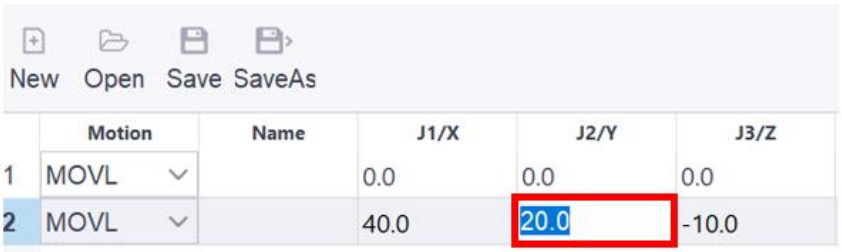
Click the -/+ control buttons on the right panel of WLKATA Studio to move the joints (under the ROBOT JOINT MODE) / or the position and attitude of the End-effector (under the COORDINATE MODE) to the wanted position. When adjusted to a satisfactory position point, click the **Add Point** button to add a teaching point.

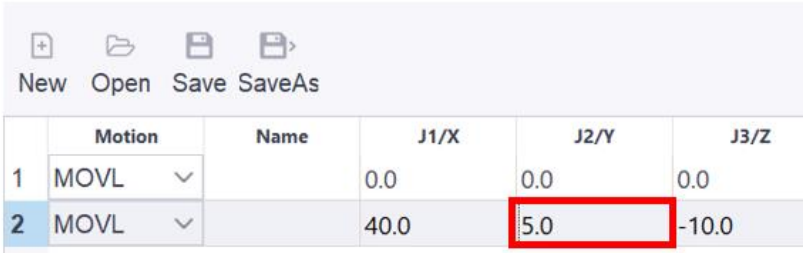
After adding the first teaching point, one could continue to adjust the position and posture of the manipulator, and then click the Add Point button to add the second and the third teaching point... until all teaching points are added.



(4) Edit the property of teaching points:

- Editing the teaching point in-line: double left-click on the top of the cell you want to edit --> input the desired value --> single left-click in blank area / or press Enter to confirm your edit.



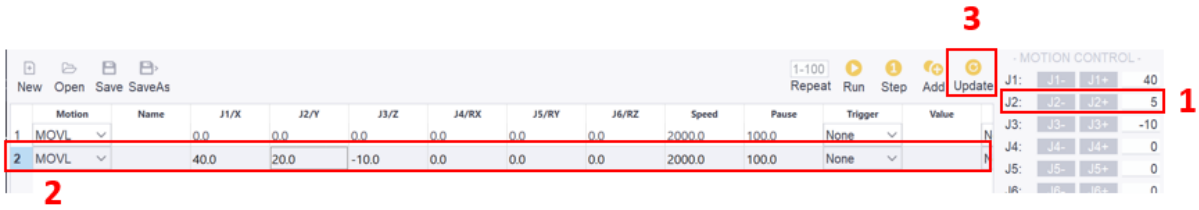


- Editing the teaching point by the right panel:

--> adjust the value in the right panel.

-> move the mouse arrow back to the teaching point line you want to edit and single left-click on the top of the line again.

--> choose **Update** in the pop-up menu to apply the value on the right panel to the selected teaching point line.



(5) Using the basic functions

New: clear the current task and start again.

Open: lookup and open a Teaching & Play file created by WLKATA Studio earlier.

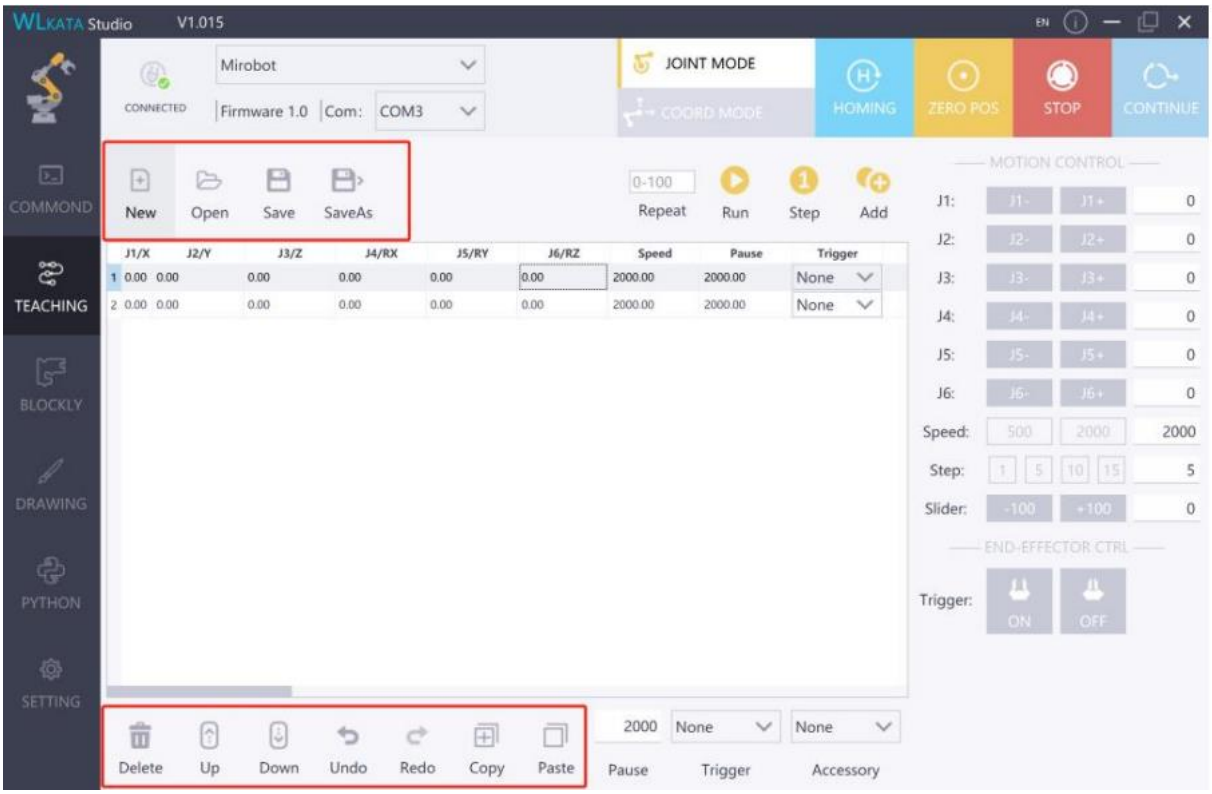
Save: save the task in the chosen directory.

Delete: delete a teaching point line.

Down and Up: change the order of a teaching point line.

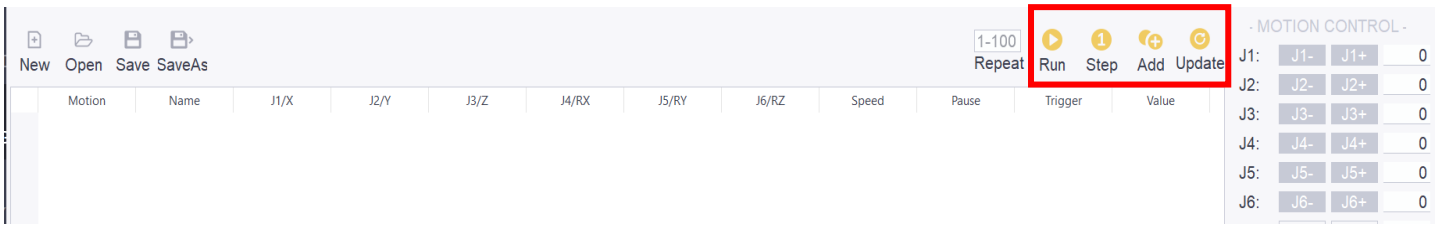
Undo and Redo: undo or redo the previous operation.

Copy and Paste: copy the line and paste to the selected teaching point.



(6) Run and step run of the record

Click the **Run** button in the panel to realize the whole recurrence of the recorded teaching points in the list. Click the **Step** button in the panel to realize the single-step movement of the recorded teaching point one by one in the list.



*Note: There is a difference when you choose Joint or Coord Mode. When you choose Coord Mode, the value appears in italic.

5.2 Example

Try to move the robot using this function. You may try to move it within a different axis, with the JOINT MODE and the COORDINATE MODE.

In the example below, the robot moves in the joint mode.

	Motion	Name	J1/X	J2/Y	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value
1	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
2	MOVL		30.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
3	MOVL		-20.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
4	MOVL		-20.0	15.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
5	MOVL		-20.0	-15.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
6	MOVL		-20.0	-15.0	20.0	0.0	0.0	0.0	2000.0	100.0	None	
7	MOVL		-20.0	-15.0	-20.0	0.0	0.0	0.0	2000.0	100.0	None	
8	MOVL		-20.0	-15.0	-20.0	50.0	0.0	0.0	2000.0	100.0	None	
9	MOVL		-20.0	-15.0	-20.0	-50.0	0.0	0.0	2000.0	100.0	None	
10	MOVL		-20.0	-15.0	-20.0	0.0	20.0	0.0	2000.0	100.0	None	
11	MOVL		-20.0	-15.0	-20.0	0.0	-20.0	0.0	2000.0	100.0	None	
12	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	

Line 1: It's the zero position of the robot.

Line 2: The robot moves on Joint 1 at a value of 30.

Line 3: The robot moves on Joint 1 at a value of -20.

Line 4: The robot moves on Joint 2 at a value of 15.

Line 5: The robot moves on Joint 2 at a value of -15.

Line 6: The robot moves on Joint 3 at a value of 20.

Line 7: The robot moves on Joint 3 at a value of 50.

Line 8: The robot moves on Joint 4 at a value of -50.

Line 9: The robot moves on Joint 4 at a value of -20.

Line 10: The robot moves on Join 5 at a value of 20.

Line 11: The robot moves on Joint 5 at a value of -20.

Line 12: The robot returns at the zero position.

(*Note: Joint 6 has no value here because we have not connected something on the arm like a Suction Cup. It's easier to see the Joint 6 move with something on it.)

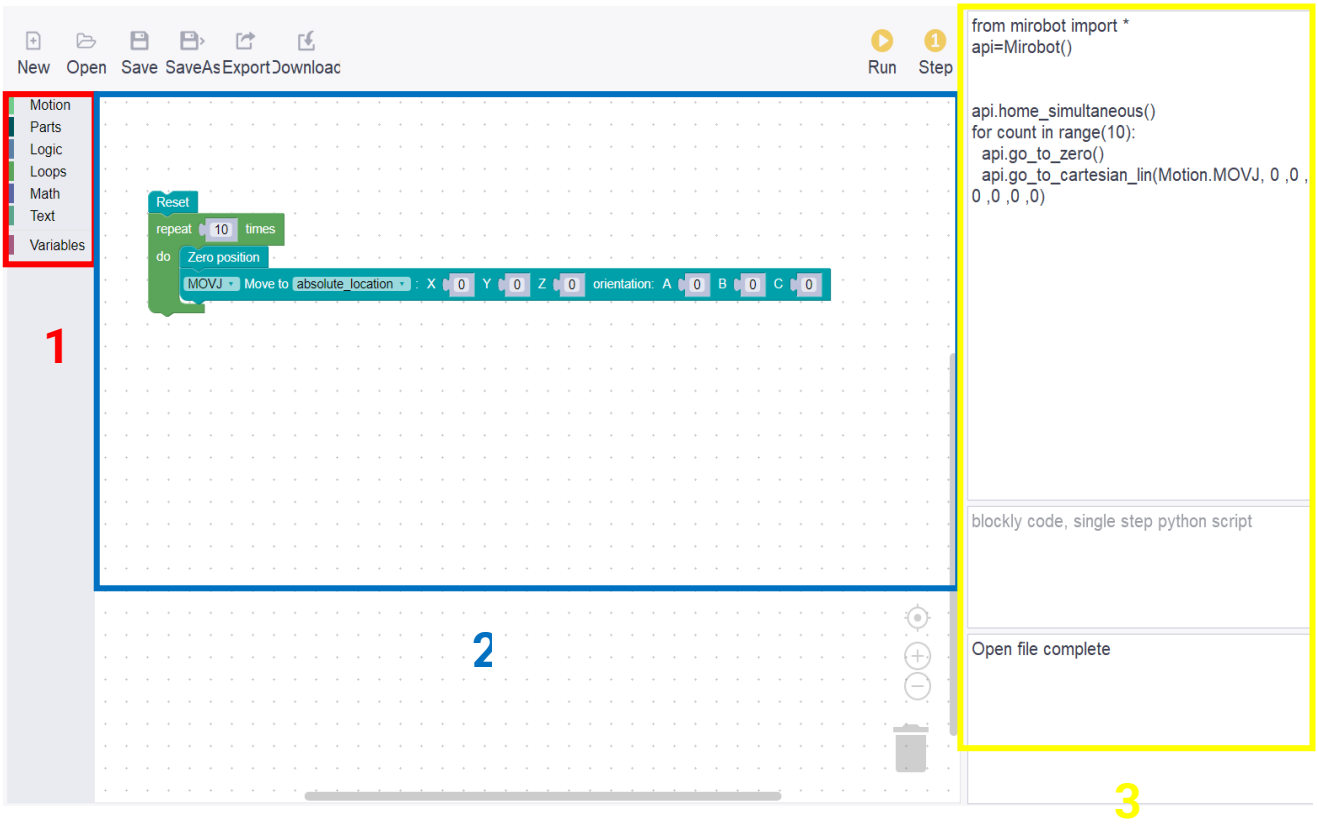
6. The BLOCKY function

6.1 Using the BLOCKY function

BLOCKY is an open-source graphical programming platform created by Google, which is easy to be learnt and applied by starters.

(1) Click the **BLOCKLY** tab in the software interface to switch to the BLOCKY page.

(2) Drag and drop the BLOCKY module from the **Selection Panel** (1) to **the Programming Panel** (2) to program. **The Code Panel** (3) would show the python codes of the BLOCKY module on the Programming Panel. Drag the dividing axis to adjust the size of the work area or hide the code area.



Basic functions

New: create a new folder

Open: open a local file

Save: save the file, which is saved to the “data” directory by default

Save As: save the modified file

Export: export Gcode to a local folder

Download: download Gcode to the robotic arm sub-control board

Run: run the code in the work area

Step: choose a code block in the work area, and run the code in separate steps

BLOCKY programming module

There are 14 commonly used programming code blocks in the action options:

Reset: homing the Mirobot

Zero position: the Mirobot moves from the current position to the full zero position under the angle mode.

Pause send() seconds: the next instruction is issued after the program delays the specified time. Delay time () seconds: execute the next instruction after the specified time.

Position move(): Mirobot moves from the current position to the specified position in the coordinate mode.

Move (forward/backward/up/down) number () speed (): move the specified coordinate number from the current position in the specified direction.

Suction cup (on / off): control the opening or closing of a suction cup.

Gripper (open/close): control the opening or closing of the end tools.

Slider move to () speed (): control the slide rail to move to the specified position.

Conveyor move (relative position/absolute position) speed (): control the conveyor belt to move to the specified position.

Rotation Angle: the Mirobot robot arm moves from the current position to the specified position in the angle mode.

Turn (joint X) (counter/clockwise): let the Mirobot Specify joint move clockwise or counter clockwise to the designated coordinates.

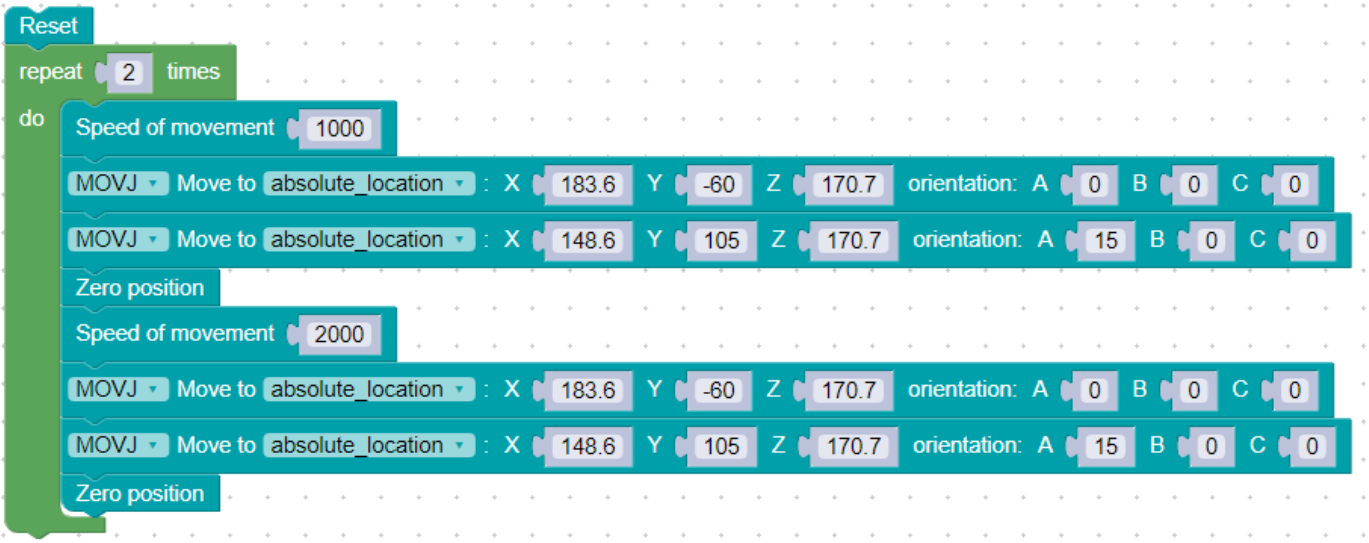
Door track movement: move to the specified relative or absolute position with the gate trajectory

Arc trajectory movement: draw the arc according to the requirements of arc trajectory movement.

6.2 Example: making the robotic arm move

Training Center

Select the Coord Mode. You can move the different axis of the robot to reach the wanted position and then enter them in the block.



Reset: HOMING the robot

Repeat: repeat all the block under it. Here repeat 2 times.

Speed movement 1000: change the speed the robot move at the wanted value, here 1000.

MOVJ: Move the robot to the wanted coordinates.

Zero position: the robot goes to the zero position (the position it takes at the end of the HOMING).

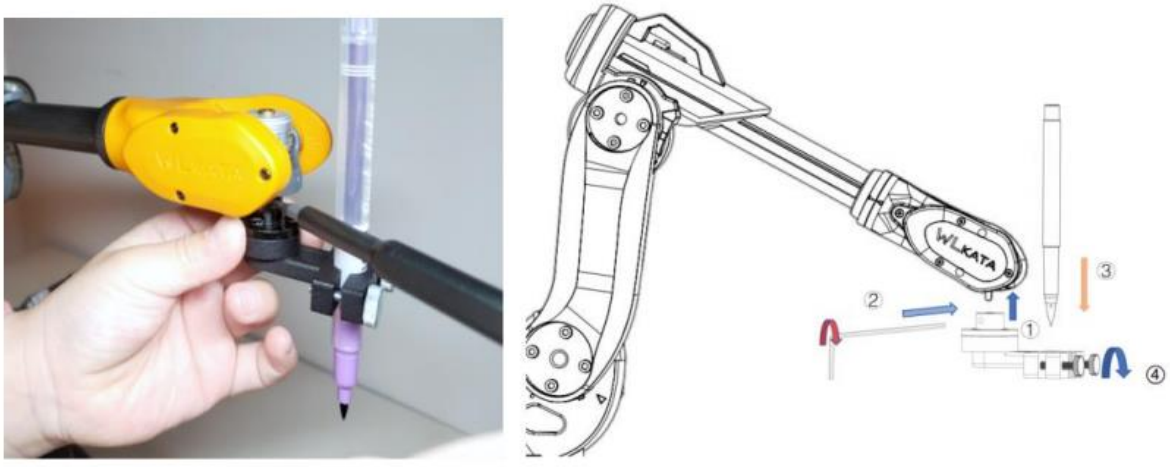
7. The DRAWING function

POWER OFF the manipulator before installing the pen holding.

7.1 Installing the pen

(1) Install the pen-holder module and the pen.

- Fix the pen holder to the end of the robotic arm.
- Tighten the jackscrew with the M1.5 hex key and fix the pen holder on the end motor shaft of the robotic arm.
- Insert the pen into the holder from the top.
- Tighten the nut of the holder.



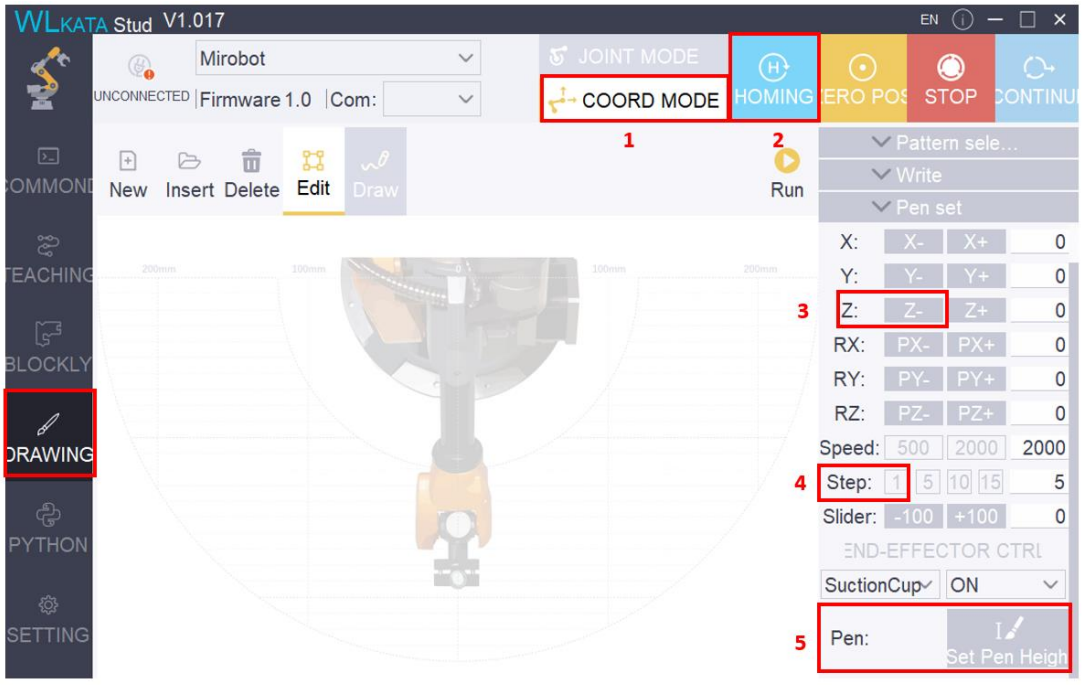
Installing the pen-holder module and the pen

(2) Drawing **on a smooth Whiteboard** to **minimize the surface force of friction** or prepare a thin soft cushion and place it under the paper to provide additional buffering during a drawing.

7.2 Set the pen height

We need to set the height of the pen first before drawing. Please follow the below instruction:

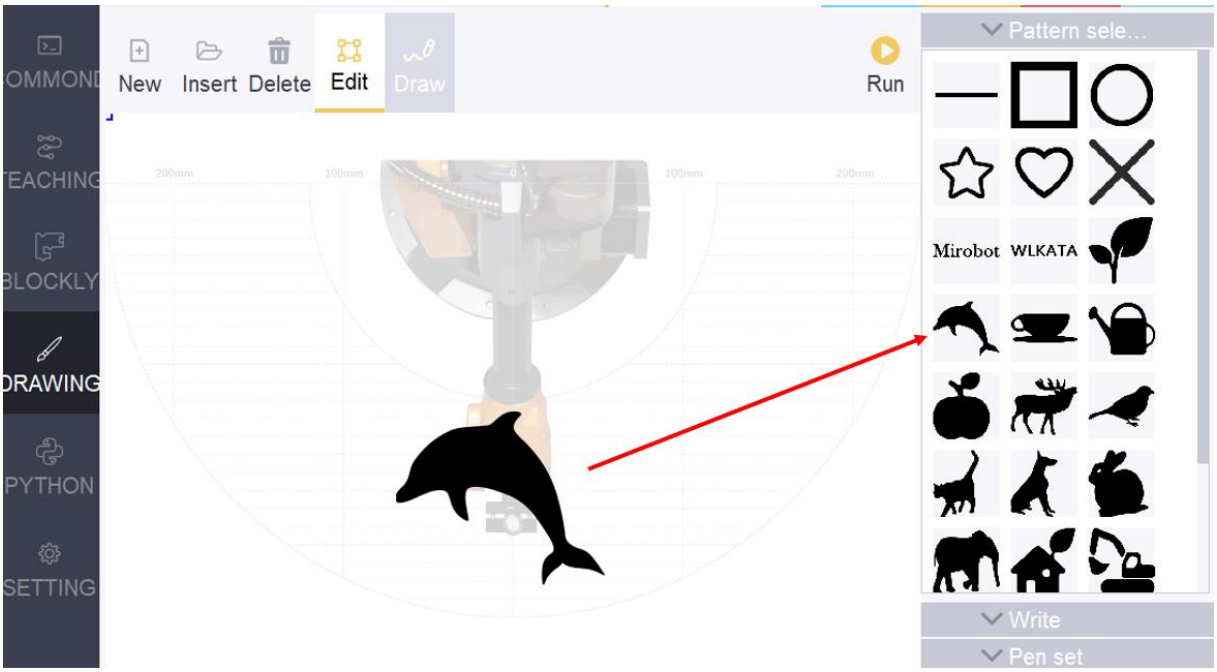
- Connect the power supply and USB cable of Mirobot and press the On/Off button on the base to power ON the manipulator.
- Open the Mirobot Studio software. Confirm there is “CONNECTED” in the upper left corner, switch to the **DRAWING** panel, then click “**HOMING**” to reset the robotic arm.
- After the manipulator back to the homing position, click the **Z- button** to adjust the height of the pen until it just touches the paper.
- When the paper is closer to the paper, you can set the **Step to “1”.**
- **Be careful not to over-adjust the Z-axis position lower than it need to be**, or the pen tip would hit the desktop too hard, interrupt the pen from moving and even cause damages to the joints.
- When the pen tip is just touching the paper, click the **Set Pen Height** button to set this pen height for the DRAWING function.



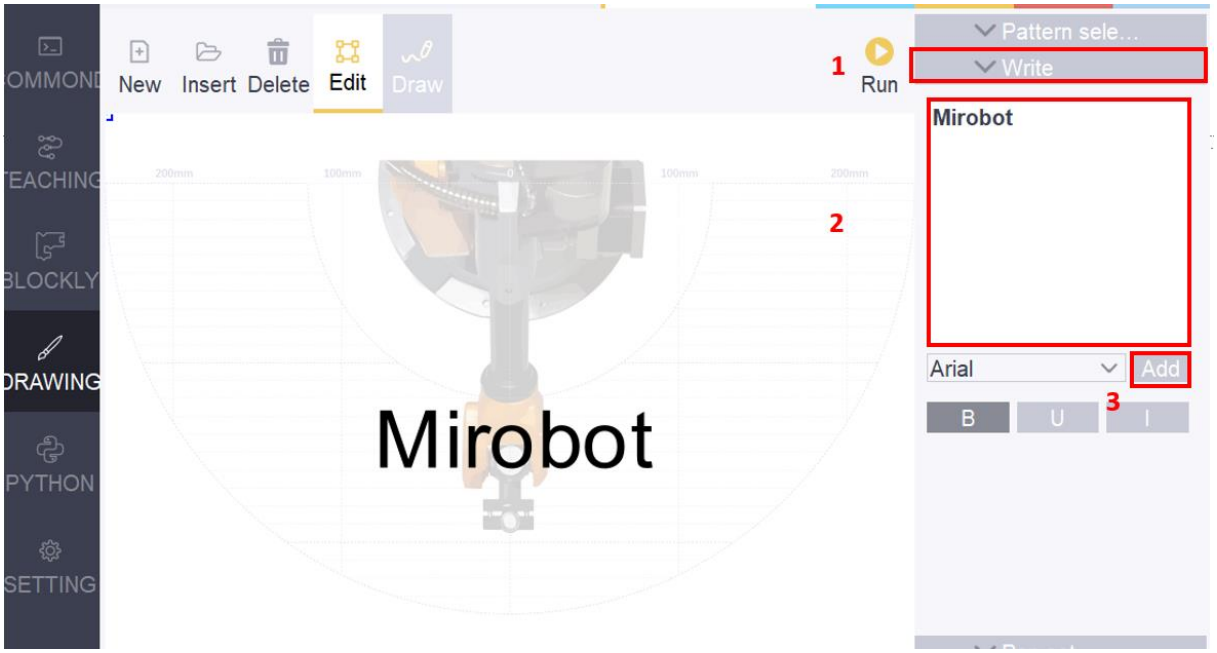
7.3 Letting the manipulator draw

After setting the pen height, the right panel will be automatically switched from “Pen Set” to the “Pattern Selection" panel sector.

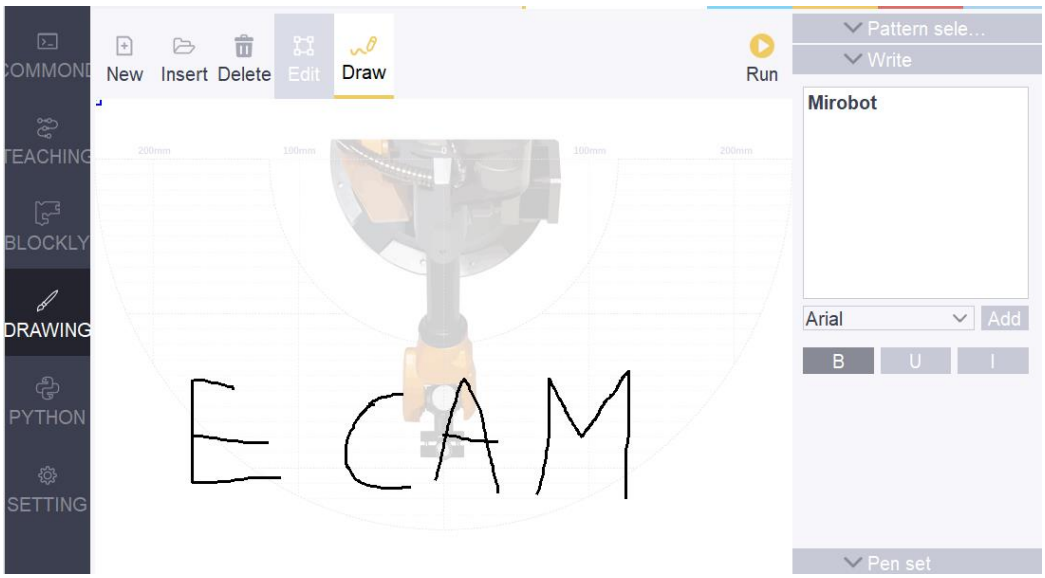
- To add a graph from existing files, you can either choose an example from the **Examples** in the upper right “Pattern Selection" panel sector or insert a graph by clicking the **Insert** button. The graph you have chosen should be shown in the centre of the canvas.



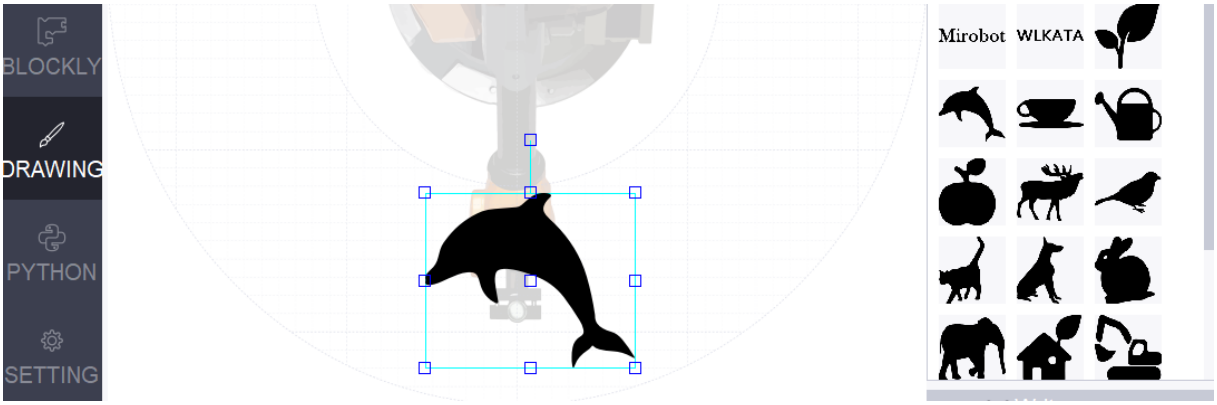
- To add a text graph, typing in the lower right panel **Write** and click **Add** button and the text you have typed should be placed in the centre of the canvas.



- To add a mouse drawing graph, click the **Edit | Draw** button to switch from the **Edit** mode to the **Draw** mode. And then you can use your mouse as a pen to draw on the canvas.



- To adjust the size and position of the graph, ensure **the Edit | Draw** button is in the Edit mode → click the graph in the canvas and a resize frame would appear around the graph. Adjust the corners to resize the graph and drag the inner frame to change the position of the graph.



- To delete the unwanted graph on the canvas, ensure the Edit | Draw button is in the Edit mode → choose the unwanted graph on the canvas → click the **Delete** button.
- To start over from a blank canvas, click the **New** button to clear the canvas.
- To start the drawing, click the **Run** button, and the manipulator will draw the graph(s) on the canvas. (Don't forget to HOMING before).

8. Using the Pneumatic Set

The pneumatic set includes a Pneumatic Unit, three pneumatic tools (a Suction Cup, a 2-Finger Gripper and free finger soft-claw) and the wire connector. Please follow the instruction below to install and use the Pneumatic Unit correctly.

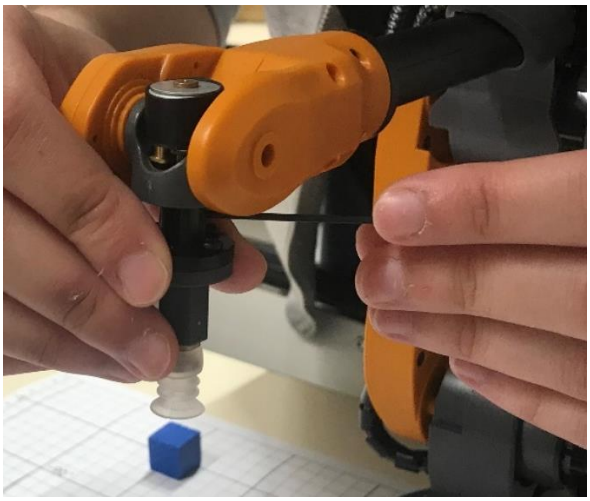
Power off the manipulator before installing the Pneumatic Set, or it could cause damage to the circuits of the Pneumatic Unit or Extender Box.

8.1 General installation

(1) **Power off** the manipulator

(2) Install the manipulator on the calibration panel as shown before.

(3) Install the wanted pneumatic tool by screwing it on the tip of the end-effector with supplied hex screwdriver. You have two sides to screwing.

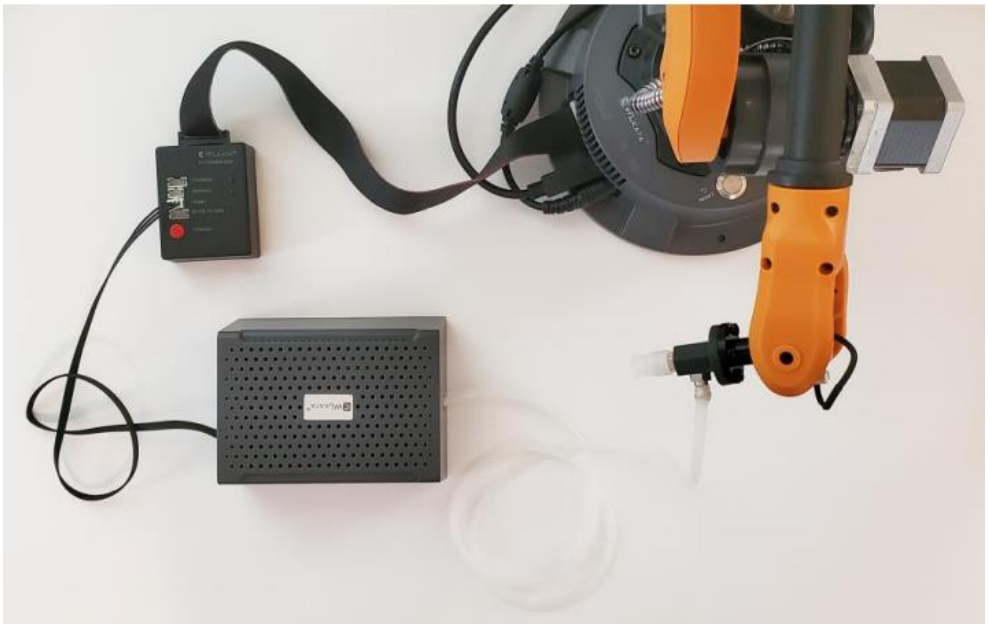


(4) Plug one end of the wire connector into the lower-second socket position (PUMP) on the Extender Box unit.

(5) Plug the other end of the wire connector into the Pneumatic Unit.

(6) Link the air pipe on the Pneumatic Unit with the metal-air outlet on the pneumatic tool. You can pass it as shown below to help to take out the way the air pipe.

(7) Link the Extender Box with the Mirobot by using the supplied IDC cable.

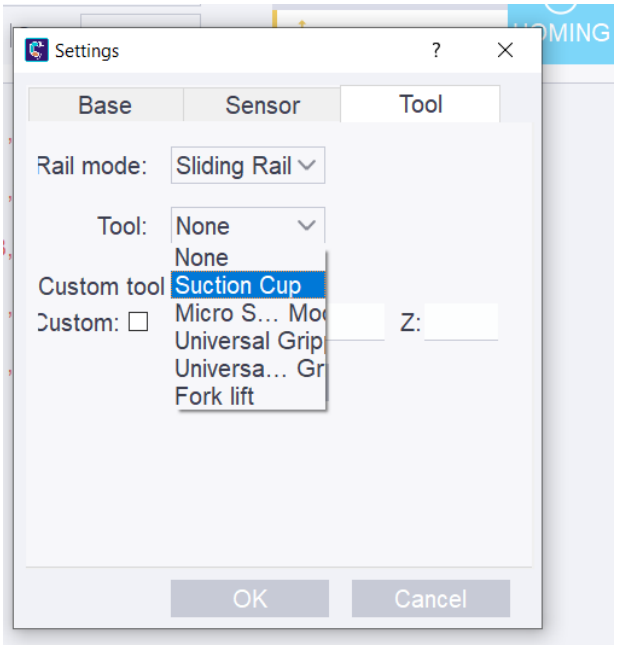


(8) When finish using the Pneumatic Set, power off the manipulator, unplug the IDC cable from the back of the manipulator, unplug the air pipe, uninstall the pneumatic tool and unplug the wire connector on both sides.

8.2 Control the pneumatic tool status

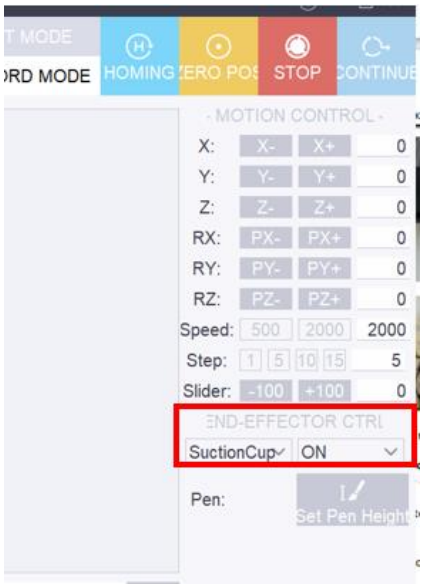
The pneumatic tool can be controlled under the COMMAND, TEACHING and BLOCKY functions in the WLKATA Studio.

On the SETTINGS page, in the Tool section, change the end-effector by Suction Cup and then click on OK.



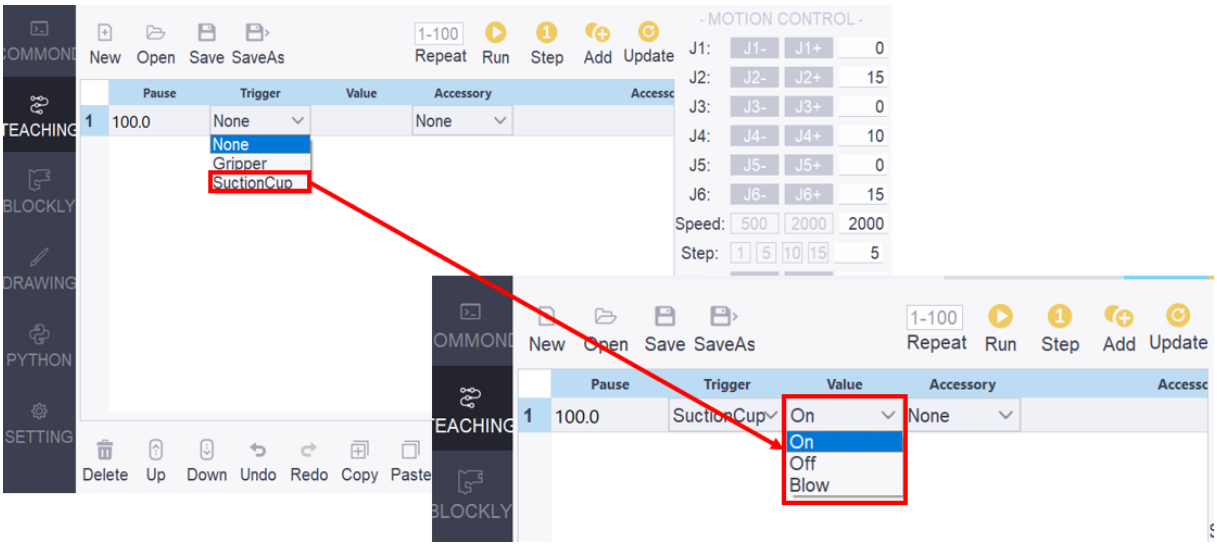
8.2.1 COMMAND

On the **COMMAND** page, control the pneumatic tool by clicking the **End-effect on** and **End-effector off** buttons on the right panel.



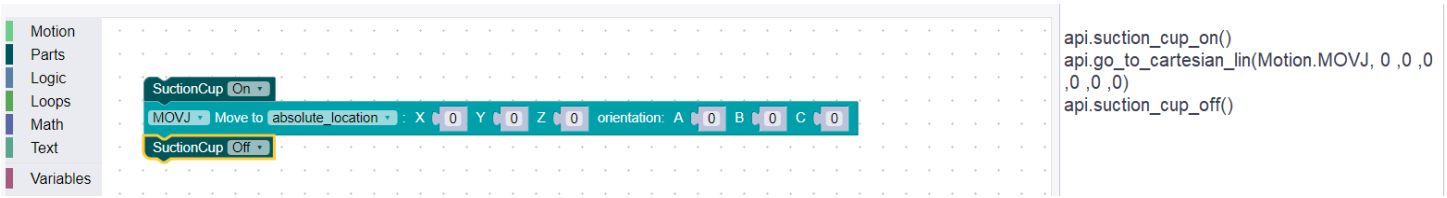
8.2.2 TEACHING

On the **TEACHING** page, control the pneumatic tool by editing the **Trigger** cell and then the **Value** of the teaching point line.



8.2.3 BLOCKY

On the **BLOCKLY** page, control the pneumatic tool by drag and edit the **Suction Cup** module which can be found in the **Parts** panel.



8.2.4 Different pneumatic tools

- Suction cup:

ON	OFF
	

- 2-Finger Gripper

ON	OFF
	

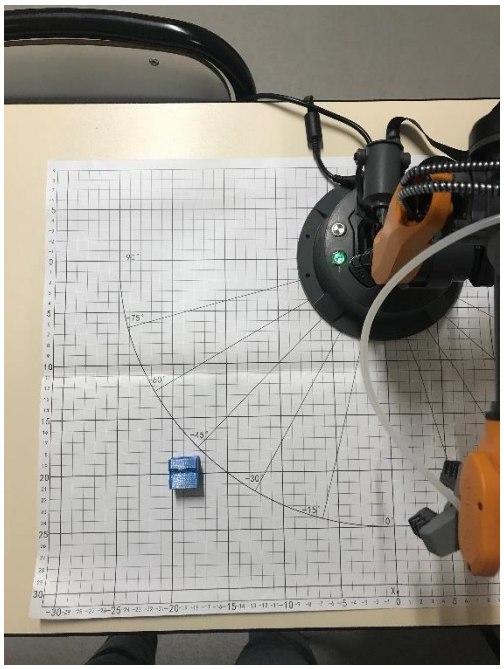
- Three Finger soft-claw

ON	OFF
	

8.3 Example

8.3.1 With the Suction Cup

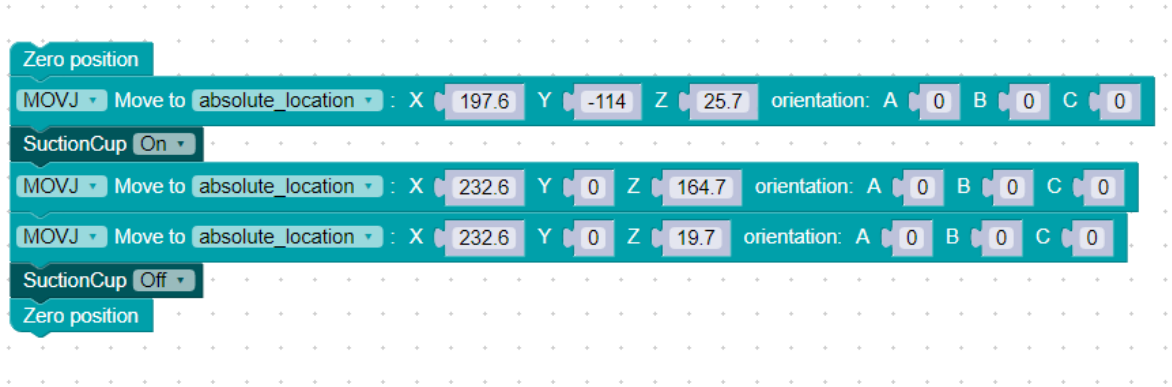
Place the cube as shown below on the template. (Coordinate: -15;15)



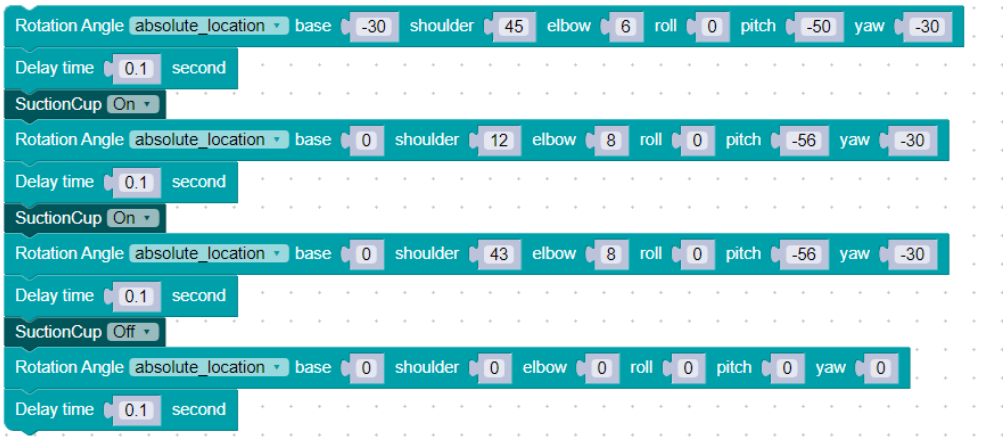
The program below is realised with the Joint Mode with the function TEACHING.

	Motion	Name	J1/X	J2/Y	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value
1	MOVL		-30.0	45.0	6.0	0.0	-50.0	-30.0	2000.0	100.0	SuctionCup	On
2	MOVL		0.0	12.0	8.0	0.0	-56.0	-30.0	2000.0	100.0	SuctionCup	On
3	MOVL		0.0	43.0	8.0	0.0	-56.0	-30.0	2000.0	100.0	SuctionCup	Off
4	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	

The same program with the function BLOCKY and the Coord. Mode.



The same program with the function BLOCKY and the Coord. Mode.



To make this, save the program with the Joint Mode with the function TEACHING. The format will appear in **qnd.** Then go to the BLOCKY page and open the program save before. It will appear as shown before.

8.3.2 With the Three Finger soft-claw

Install the Three Finger soft-claw on the robot arm. Place the blue cross on the calibration panel as shown below.

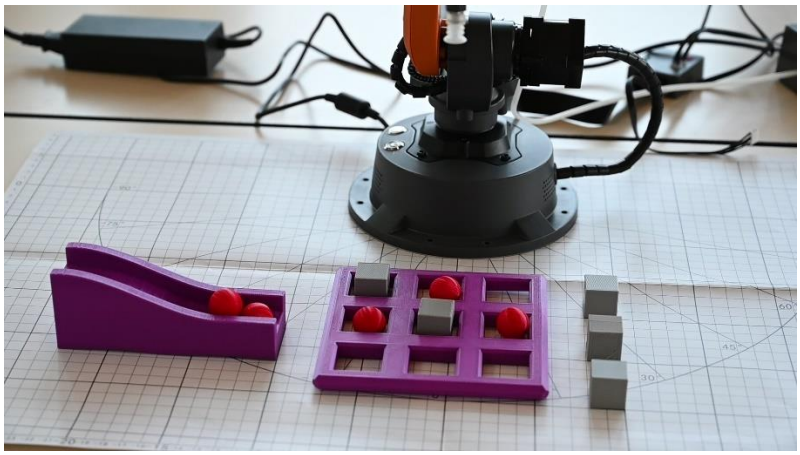
The program below is realised with the function TEACHING in the Joint Mode.

New Open Save SaveAs 1-100 Repeat Run Step Add Updat

	Motion	Name	J1/X	J2/Y	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value
1	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	SuctionCup	On
2	MOVL		-29.0	60.0	-15.0	0.0	-42.0	0.0	2000.0	100.0	SuctionCup	On
3	MOVL		-29.0	60.0	-15.0	0.0	-42.0	0.0	2000.0	100.0	SuctionCup	Off
4	MOVL		-29.0	25.0	-15.0	0.0	-42.0	0.0	2000.0	100.0	None	
5	MOVL		0.0	60.0	-15.0	0.0	-42.0	0.0	2000.0	100.0	SuctionCup	Off
6	MOVL		0.0	60.0	-15.0	0.0	-42.0	0.0	2000.0	100.0	SuctionCup	On
7	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	SuctionCup	On
8	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	SuctionCup	Off

8.3.3 Noughts and Crosses

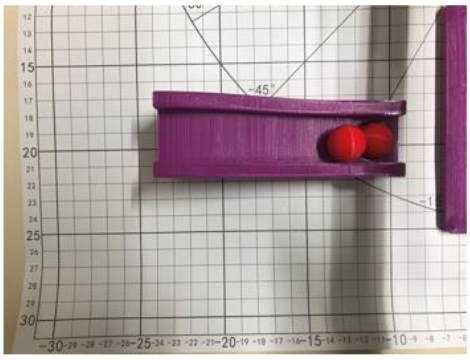
At ECAM, we created pieces for a game of noughts and crosses.

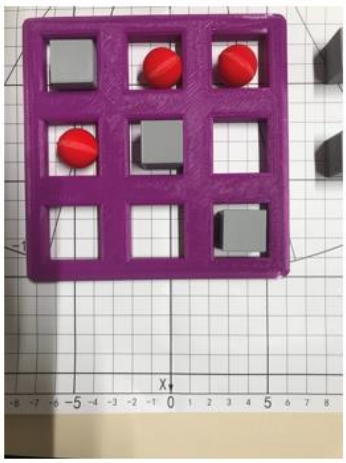


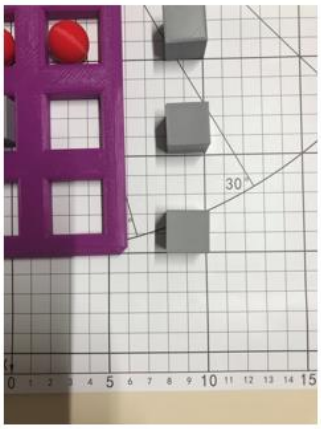
You can find an example below. Now create your program yourself!

	Motion	Name	J1/X	J2/Y	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value
1	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	
2	MOVL		15.0	59.0	-8.0	-1.0	-50.0	0.0	2000.0	100.0	SuctionCup	On
3	MOVL		7.0	26.0	2.0	-1.0	-50.0	0.0	2000.0	100.0	SuctionCup	On
4	MOVL		8.0	43.0	5.0	-9.0	-54.0	12.0	2000.0	100.0	SuctionCup	On
5	MOVL		8.0	43.0	5.0	-9.0	-54.0	12.0	2000.0	100.0	SuctionCup	Off
6	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None	

For this program place the different support as show below:





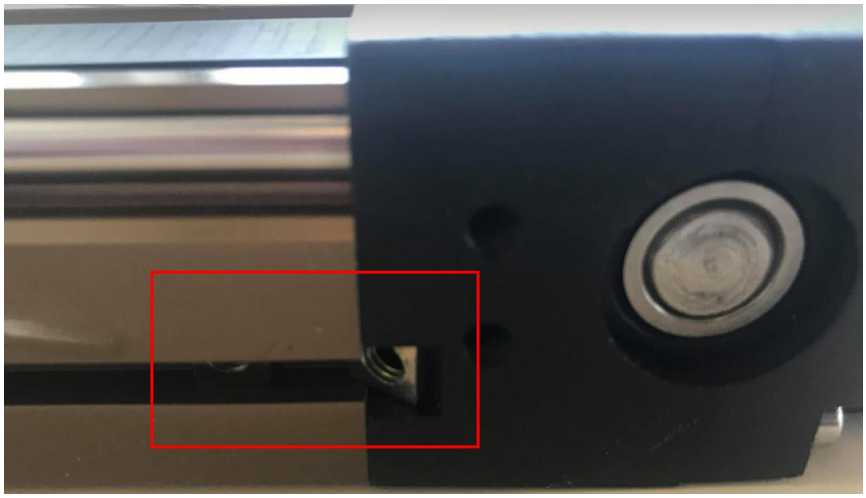


9. Sliding Rail

Power off the manipulator before installing the Sliding Rail, or it could cause damage to the circuits of the Sliding Rail or Extender Box. Disconnect the power supply and the USB cable from the Mirobot.

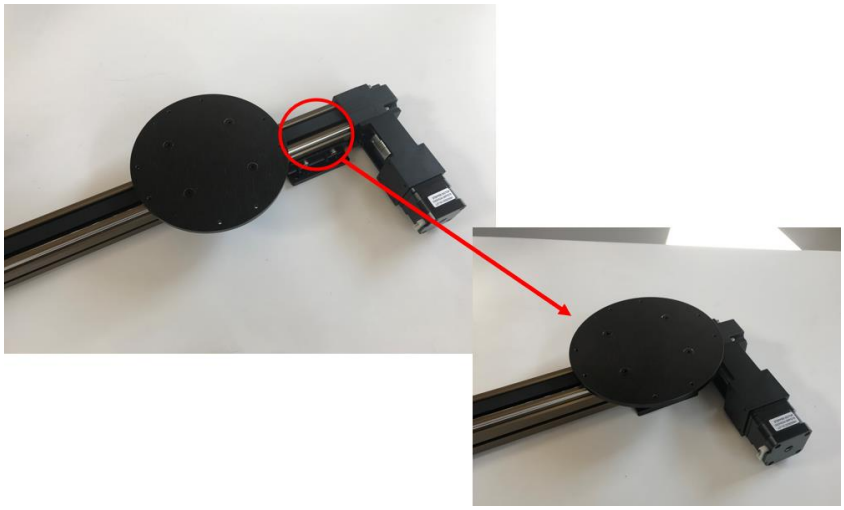
9.1 Installation

(1) When you sort the Sliding Rail from the package, not all the elements are assembled. You will have first to assemble the two supports. First, put the nuts as shown below:

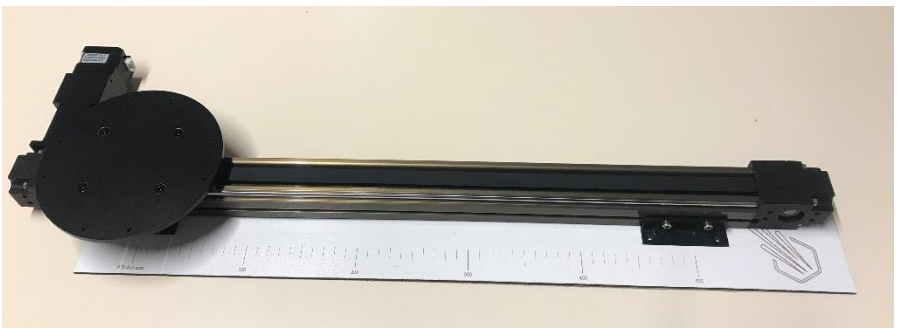


Then put the support and then the screws.

(2) Put the support of the Mirobot against the engine as shown below.



(3) Place the measuring rule as shown below. It will help you when programming the Sliding Rail



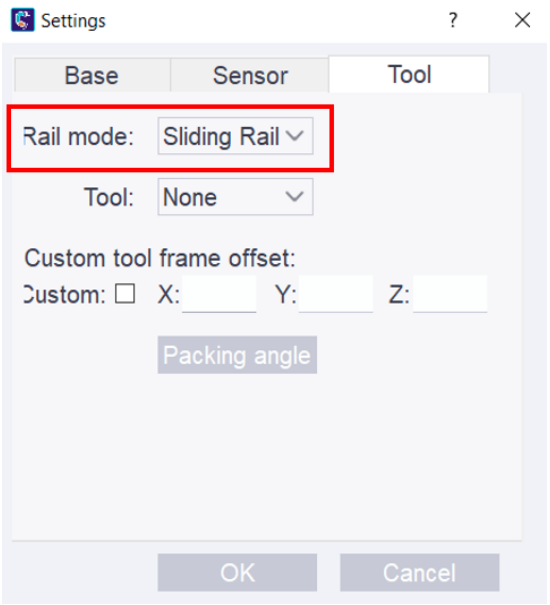
(4) Place the manipulator on the base and aim it at the support.

(5) Connect the power supply and the USB cable to the robotic arm. Connect **the Extender box** to the robotic arm with an IDC cable. Connect one end of the sliding rail motor wire to the **Sliding Rail** motor and the other end to the **STEPPER** part of **the Extender box.**

(6) Power on the manipulator

9.2 Use of the Sliding Rail

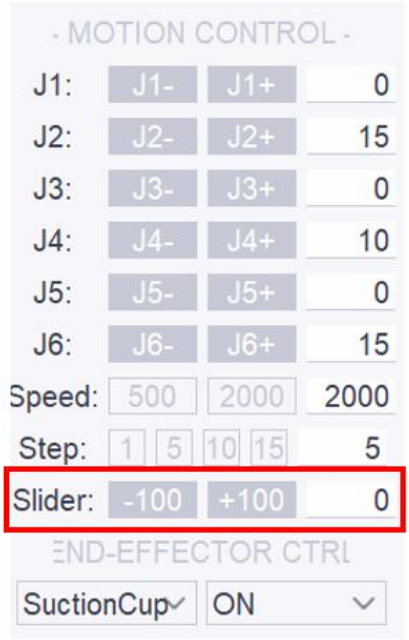
Open Mirobot Studio and enter the “SETTING” interface to change the “End Effector” to “Sliding Rail”. Then click on OK.



Then Enter the “COMMAND” and HOMING the robotic arm.

You can use the Sliding Rail with the different functions of control.

9.2.1 COMMAND



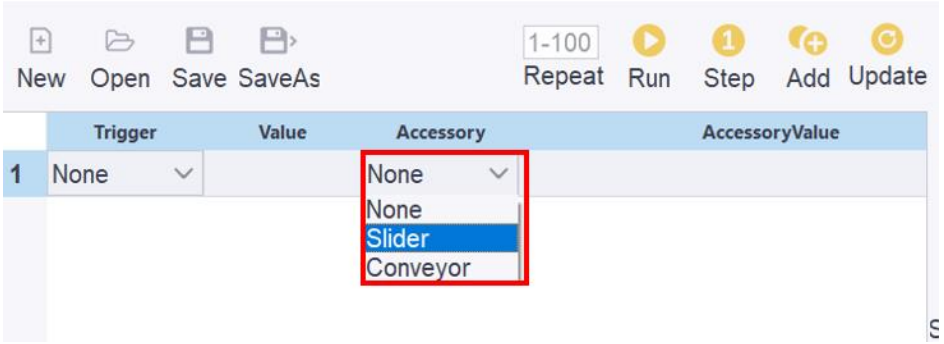
On the COMMAND page, control the Sliding Rail by click on the -100/+100 button or by typing the wanted value in the side frame.

To control the Speed, you can click on the side of “Speed”. Remember it will control the speed of the robot and the Sliding Rail

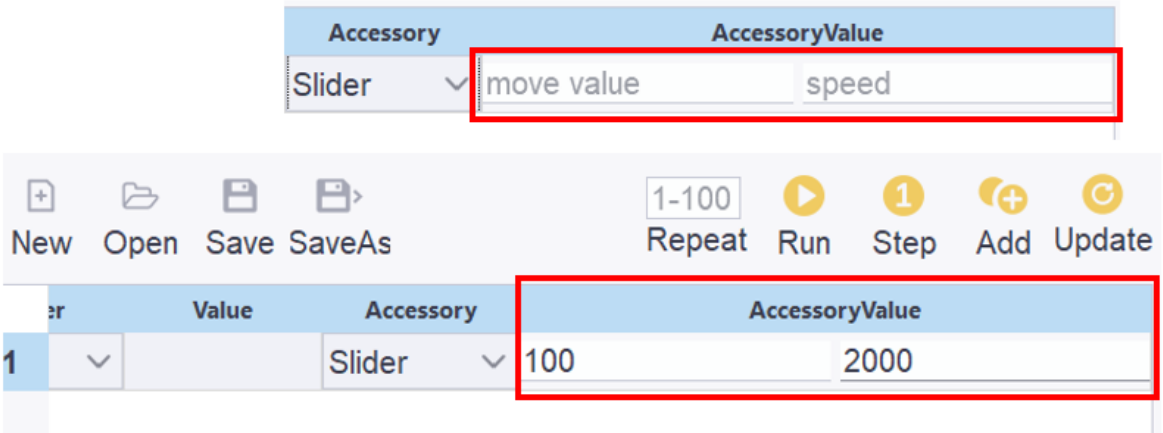
(With the installation as explained before, the button -100 will have no utility as it will explain in the Example.)

9.2.2 TEACHING

On the TEACHING page, click under the “Accessory” to edit the cell to “Slider”.



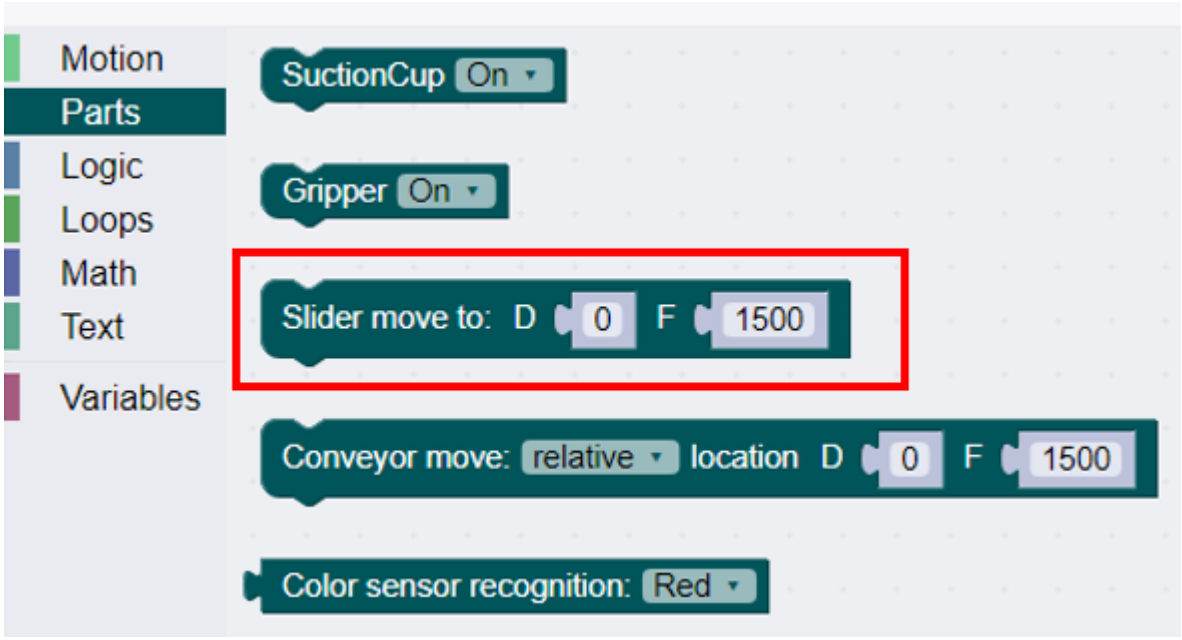
Then in the Value cell, enter the value of distance and speed wanted.



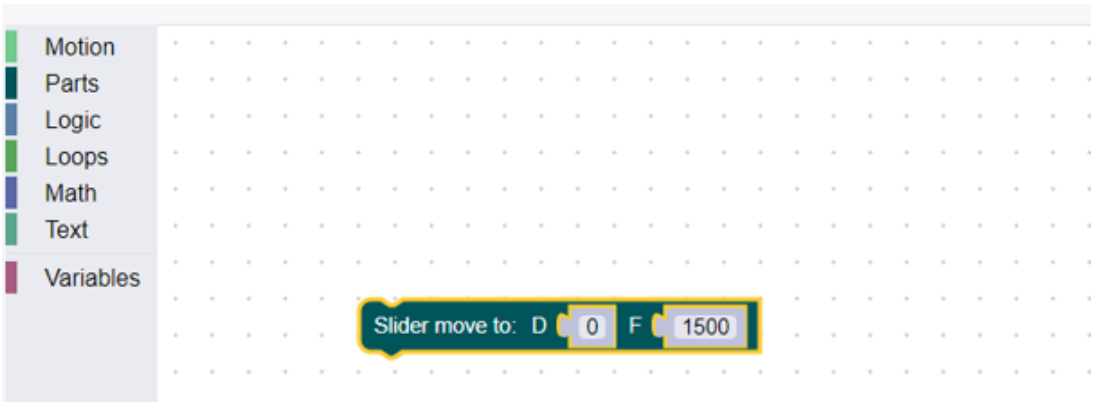
At the end of your program, always add the position O for the Slider to return to its initial position. However, if you don't do this, the Slider will forget its initial position when you will HOMING again.

9.2.3 BLOCKY

On the BLOCKY page, click on "Parts" to access the block which controls the Slider move.



Then you can change the value of the Distance (D) and the speed of the Sliding Rail (F).

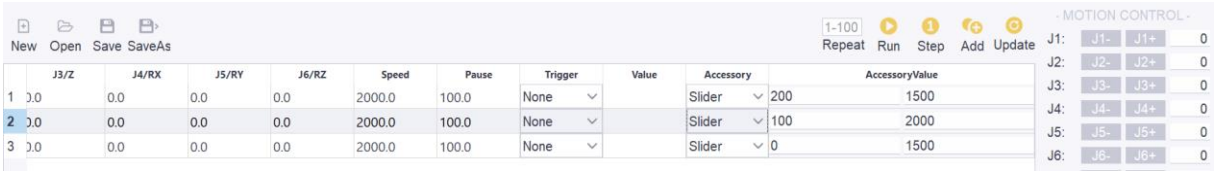


At the end of your program, always add the position O for the Slider to return to its initial position. However, if you don't do this, the Slider will forget its initial position when you will HOMING again.

9.3 Example

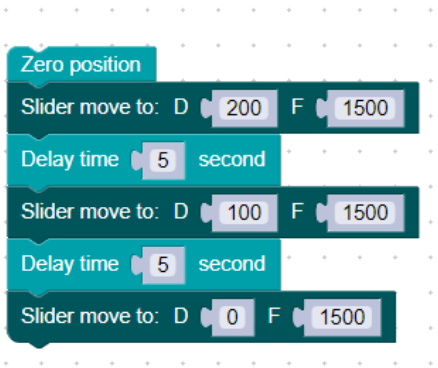
9.3.1 Only the Sliding Rail

With the TEACHING mode and the Joint Mode, try to move the Sliding Rail as shown below.



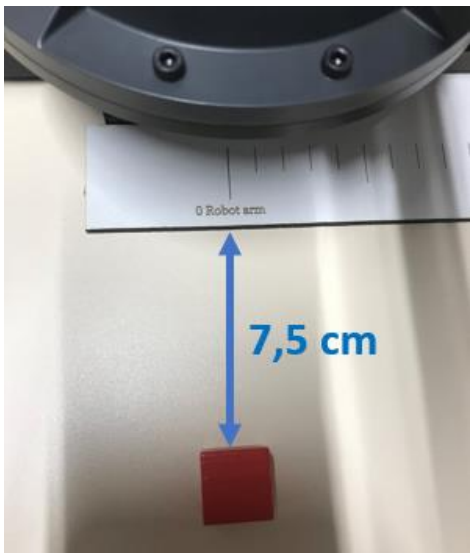
	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value	Accessory	AccessoryValue	
1	0.0	0.0	0.0	0.0	2000.0	100.0	None		Slider	200	1500
2	0.0	0.0	0.0	0.0	2000.0	100.0	None		Slider	100	2000
3	0.0	0.0	0.0	0.0	2000.0	100.0	None		Slider	0	1500

Try another one with the BLOCKY Mode



9.3.2 With the Pneumatic Set

Place the Suction Cup on the robot arm. Place a cube at 7.5 cm from the measuring rule and in front of the “3 Robot arm” as shown below.



Go on the TEACHING page and choose the Joint Mode. Then repeat the program shown below.

	Motion	Name	J1/X	J2/Y	J3/Z	J4/RX	J5/RY	J6/RZ	Speed	Pause	Trigger	Value	Accessory	AccessoryValue	
1	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None		None		
2	MOVL		0.0	67.0	12.0	0.0	-80.0	0.0	2000.0	100.0	SuctionCup	On	None		
3	MOVL		0.0	20.0	2.0	0.0	-80.0	0.0	2000.0	100.0	SuctionCup	On	None		
4	MOVL		0.0	20.0	2.0	0.0	-80.0	0.0	2000.0	100.0	SuctionCup	On	Slider	300	2000
5	MOVL		0.0	67.0	12.0	0.0	-80.0	0.0	2000.0	100.0	SuctionCup	Off	None		
6	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None		None		
7	MOVL		0.0	0.0	0.0	0.0	0.0	0.0	2000.0	100.0	None		Slider	0	2000

In the program, the robot will take the cube, then the Sliding Rail will displace the robot at 300 mm from the initial position.

10. Conveyor

Power off the manipulator before installing the Conveyor, or it could cause damage to the circuits of the Conveyor or Extender Box. Disconnect the power supply and the USB cable from the Mirobot.

10.1 Installation

(1) Connect the power supply and the USB cable to the robotic arm. Connect **the Extender box** to the robotic arm with an IDC cable. Connect one end of the Conveyor motor wire to the **Conveyor** motor and the other end to the **STEPPER** part of **the Extender box.**

(2) Power on the manipulator.

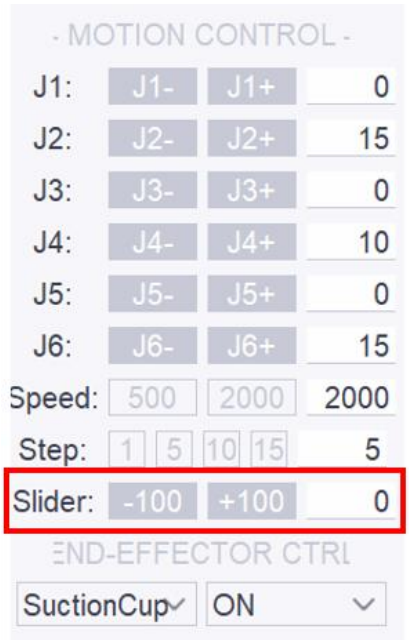
10.2 Use of the conveyor

Open Mirobot Studio and enter the “SETTING” interface to change the “End Effector” to “Conveyor”. Then click on OK.

Then Enter the “COMMAND” and HOMING the robotic arm.

You can use the Conveyor with the different functions of control.

10.2.1 COMMAND

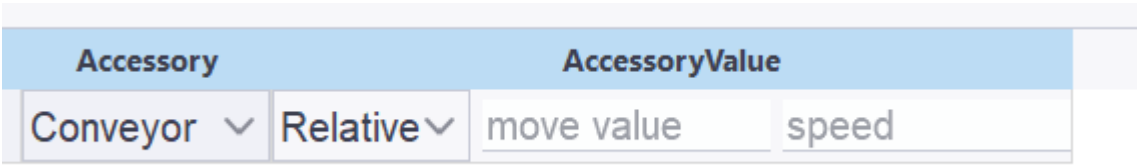


On the COMMAND page, control the Sliding Rail by click on the -100/+100 button or by typing the wanted value in the side frame.

To control the Speed, you can click on the side of “Speed”. Remember it will control the speed of the robot and the Sliding Rail

10.2.2 TEACHING

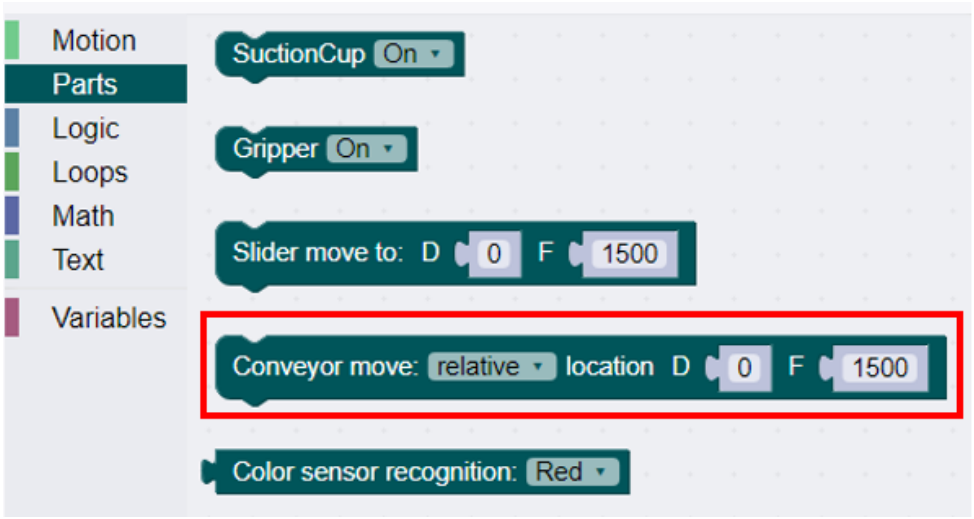
On the TEACHING page, click under the “Accessory” to edit the cell to “Slider”. Then in the Value cell, enter the value of distance and speed wanted.



You can choose if you want the conveyor to move to a relative or absolute position.

10.2.3 BLOCKY

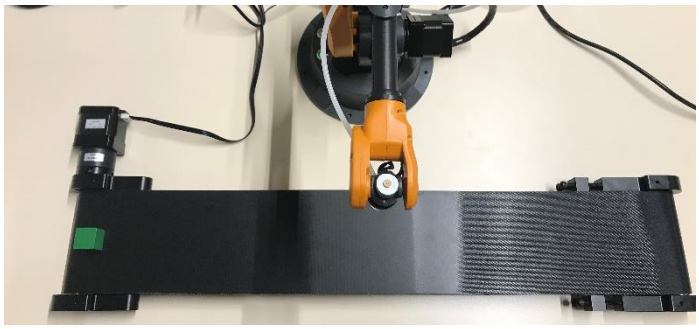
On the BLOCKY page, click on “Parts” to access the block which controls the Conveyor move.

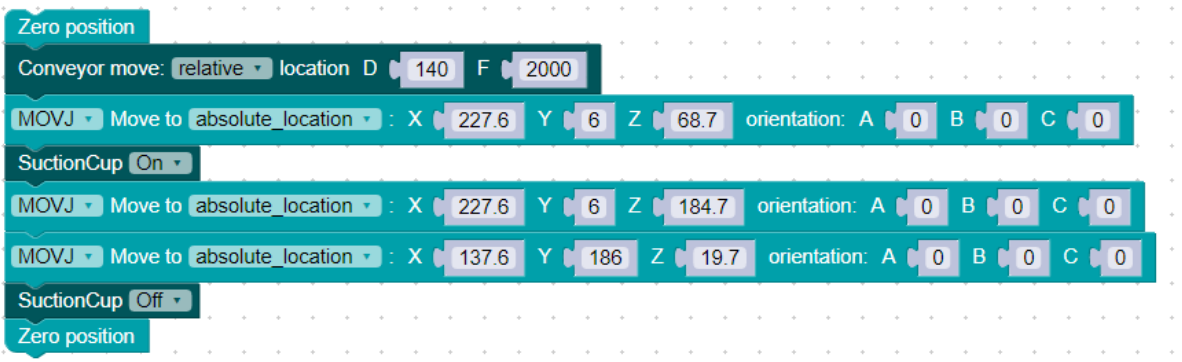


Then you can change the value of the Distance (D), the speed of the Conveyor (F) or choose between a relative or absolute location.

10.3 Example

Enter the BLOCKY page, with the Coor. Mode and place the cube as shown below:





In this program, the conveyor will move the cube and then the robot will take it with the Suction cup and place it in another place.

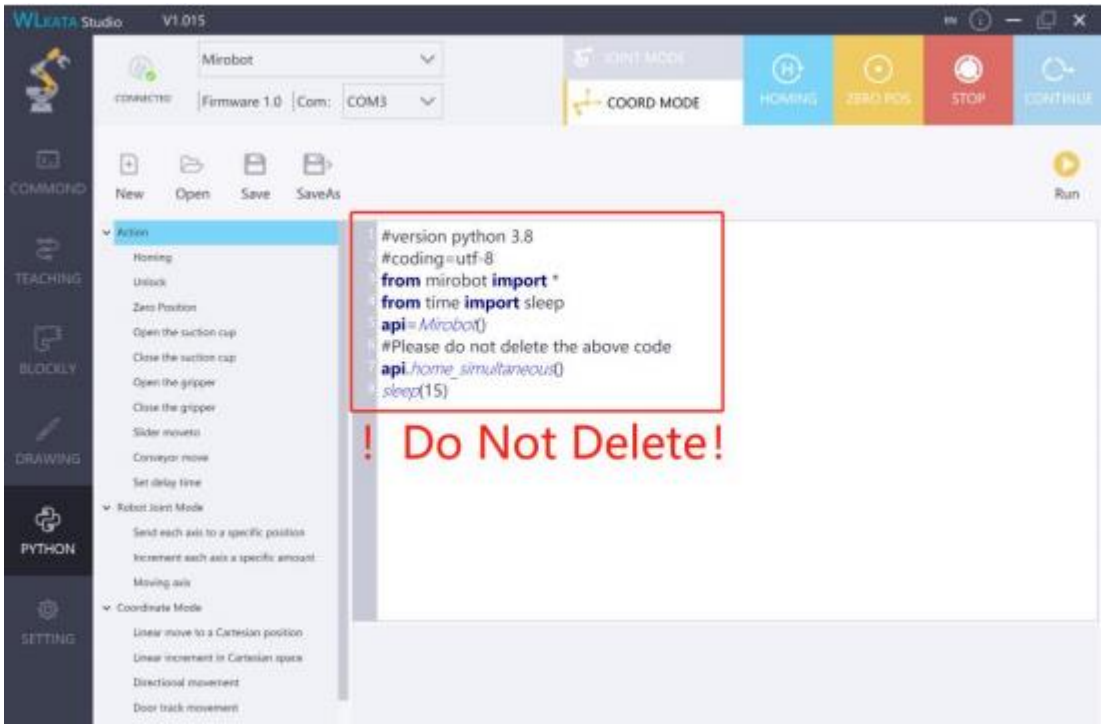
11. The Python functions

11.1 Preparation

(1) Switch to the Python function in the WLKATA Studio by clicking the PYTHON tab in the software interface.

(2) Please DO NOT change the first 8 lines of code in the python window

Please DO NOT change or delete the first 8 lines of code in the python window, or the manipulator may run discordant and cause illegal motions.



11.2 Quick command library in the Python programming

There are three groups of Quick commands in the library, the Action options, Angle control options and Coordinate control options. Double click the Quick command and the code will be inserted into the command line. The list of Quick command and description is as below:

Quick commands group	Quick command	Description
Action options		
Homing	Api.home_simultaneous()	Perform the homing routine on all axis at the same time.
Unlock	api.unlock_shaft()	Unlock the shaft enabling movement.
Go to zero	api.go_to_zero()	Send each axis to its 0 position.
Suction cup on	api.suction_cup_on()	Switch on the suction cup.
Suction cup off	api.suction_cup_off()	Switch off the suction cup.
Slider move to	api.slider_move_to(x, speed)	Move the slide rail to the specified position.
Conveyor Move to	api.conveyor_move_to(ConveyorMode.relative, 0, 1500)	Move the slide rail to the specified position.
Set Delay Time	api.set_delay_time(1)	Delay the next action after the specified time.
Angle control options		
Go to axis	api.go_to_axis(0,0,0,0,0,0,1500)	Mirobot moves from the current position to the specified position in the angle mode.
Increment of each axis	api.increment_axis(0,0,0,0,0,0,1500)	Mirobot moves from the current position to the specified position.
Move axis	api.move_to_axis(MirobotJoint.Joint1, RevolveDirection.cw, 0, 1500)	Rotate specify axis the specified value in the specified.
Coordinate control options		
Go to Cartesian position	api.go_to_cartesian_lin(202,0,181,0,0,0,1500)	Mirobot moves from the current position to the specified position in the coordinate mode.

The increment in Cartesian space	api.increment_cartesian_lin(0,0,0,0,0,0,1500)	Mirobot moves specified number of coordinates in specified direction.
Directional movement	api.direction_mobility(MoveDirection.forward, 0, 1500)	Mirobot moves specified coordinates independently from the current position in the specified direction.
Jump move	api.jump_move(ConveyorMode.relative, 0, 0, 0, 1500)	Jump move to the specified position.
Arc move	api.set_arc_move(MoveMode.relative, RevolveDirection.cw, 0, 0, 0, 60, 1500)	Move in arc path.

11.3 Example

```
#version python 3.8
#coding=utf-8 from mirobot import *
from time import sleep
api=Mirobot()
#Please do not delete the above code
api.home_simultaneous()                    #Home Mirobot
sleep(15)                                  #Delay 15s
for i in range(10):                        #Repeat the following actions 10 times
api.go_to_axis(30,0,0,0,0,0,1500)          #The first axis rotates from the zero position to the absolute position + 30 at 1500°/min
api.go_to_axis(-30,0,0,0,0,0,1500)         #The first axis rotates from the zero position to the absolute position -30 at 1500°/min
api.go_to_zero()                           #Back to zero
```

12. Using the Teach pendant (Bluetooth controller)

Mirobot Bluetooth teach pendant is a Bluetooth controller for wirelessly controlling the Mirobot desktop robotic arm. It supports each axis control mode, Cartesian control mode and teaching record mode.

12.1 Product function and parameter description

12.1.1 Bluetooth teach pedant parameters and appearance

Product Name	Mirobot Teach Pendant
Product Size	Long：145±2mm Width：113±2mm Height：31±2mm
Weight	170g
Power	1000mAh
Voltage	3.7V
Operating Temperature	-10°C~45°C

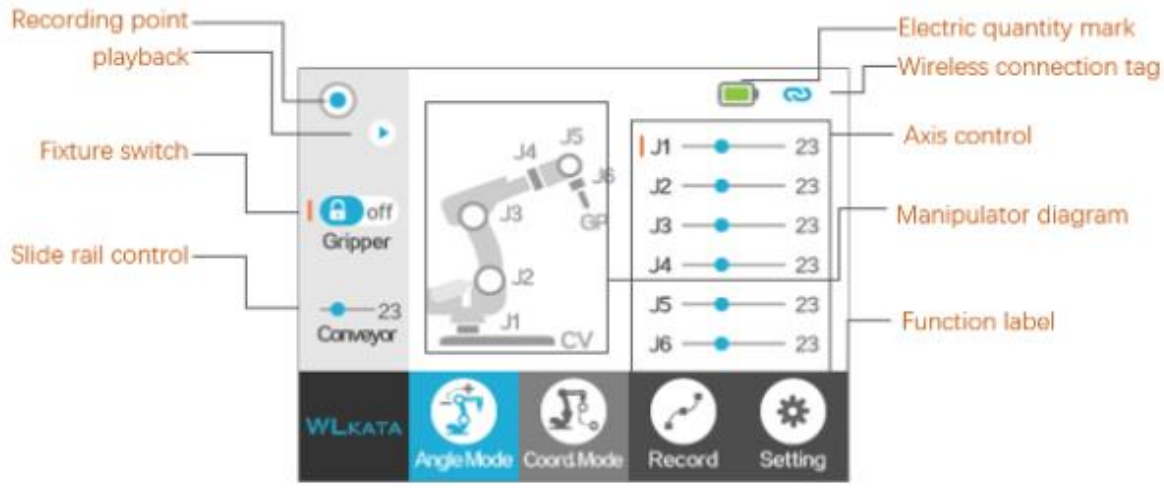
Control on the Teach pendant

12.1.2 Teach pedant control page and main function description

The Mirobot teach pendant is mainly composed of angle mode, coord. mode, record and setting function pages.

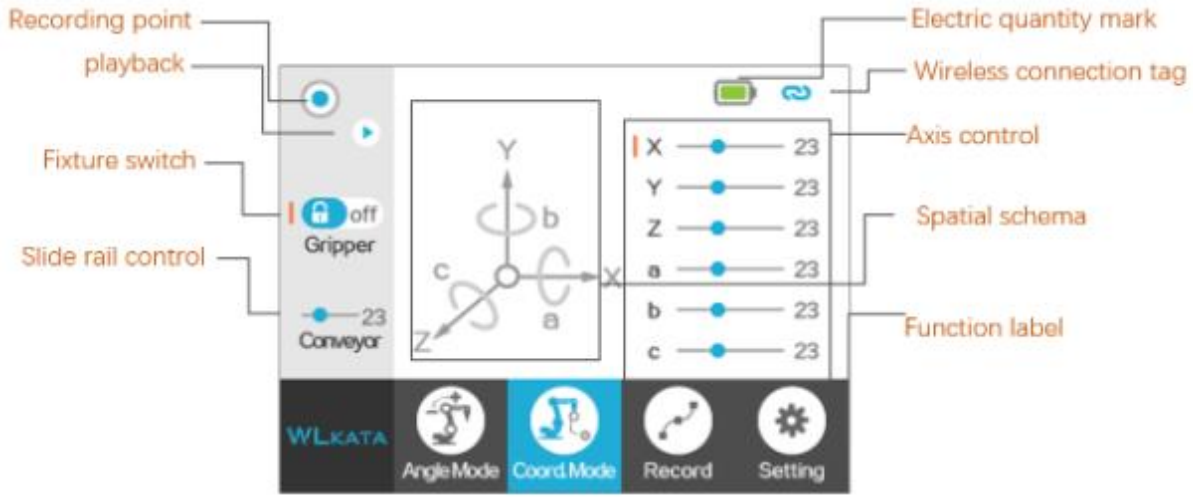
(1) Angle Mode page

The angle mode page is mainly responsible for the motion control of each axis of the manipulator.



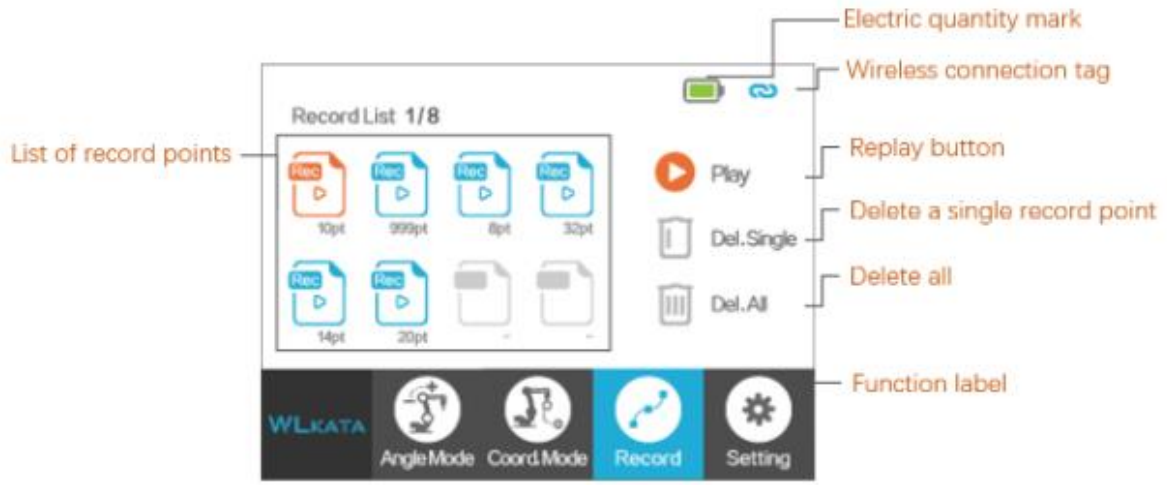
(2) Coord Mode page

Coord mode page is mainly responsible for the movement control of the manipulator in Cartesian mode.



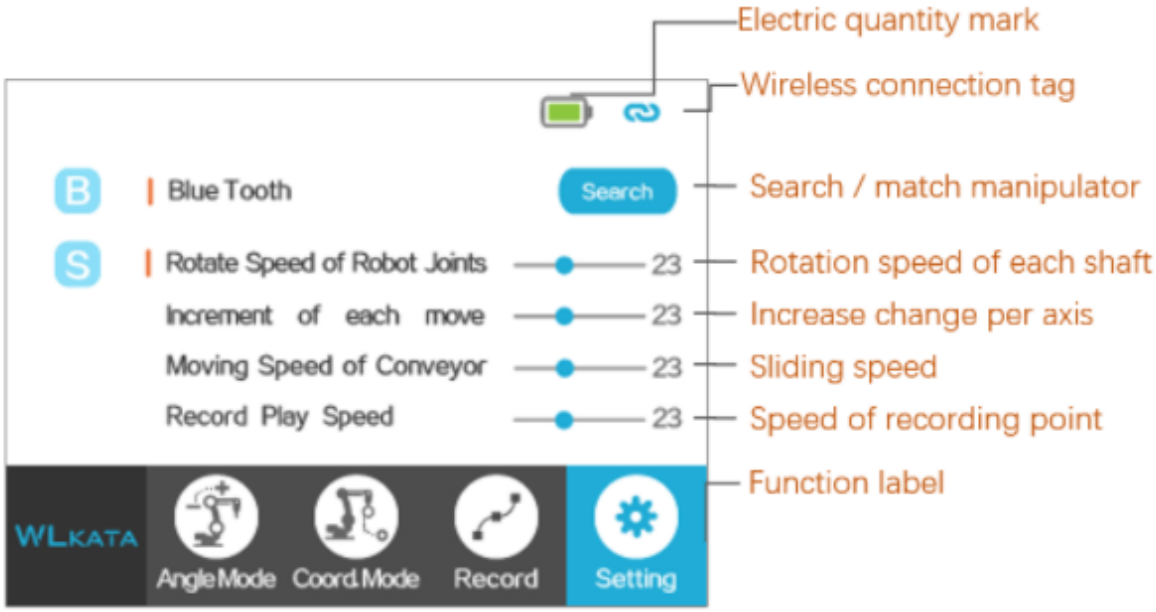
(3) Record page

The record page is mainly responsible for teaching and recurrence of the manipulator.



(4) Setting page

The setting page is responsible for the speed control of the manipulator and Bluetooth connection.



12.2 Operation Guide

12.2.1 Power On/Off

Press and hold the power button on the Bluetooth teach pendant for three seconds to open the teach pendant. Press the same button for three seconds to shut down.

12.2.2 Connection of the Bluetooth teach pendant with the Mirobot manipulator

(1) Connect the Sub Control Box and the manipulator with the IDC cable.
(2) Turn on the power on the manipulator. Wait a few seconds to let the Sub control Box power on.
(3) Press the middle bouton OK of the Sub Control Box for 2 seconds for HOMING the Mirobot.
(4) On the Settings page of the Teach pendant, click on the “Search” button. It will change to “Searching”, wait a few seconds and then it will change to “Link”. This means that it’s connected with the Sub Control Box.
(5) On the Box, make sure the connexion is established by the appearance of a blue Bluetooth flag on the upper right corner of the screen.
(6) Now you can use the Teach pendant to control the Mirobot.

12.2.3 Angle Mode function

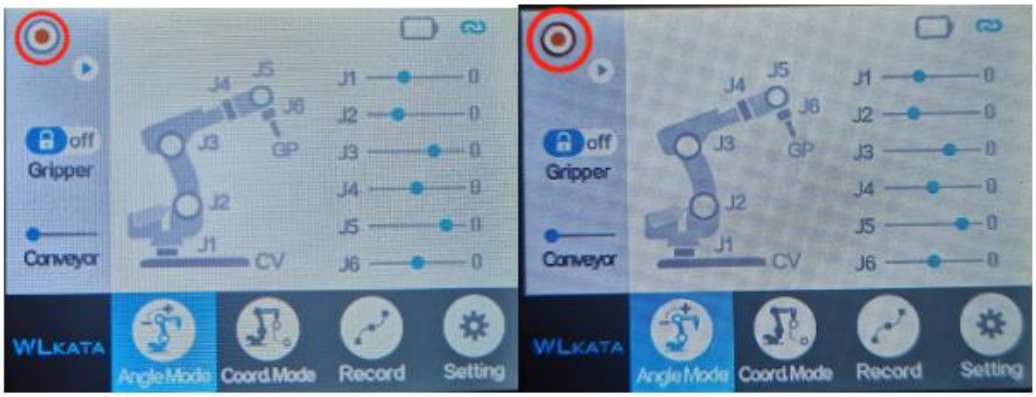
(1) Switch the Teach pendant to the Angle Mode page.
(2) HOMING the manipulator by pressing and holding the red button on the top right for 3 seconds. Wait for the end of HOMING.
(3) To move the joints, press the 6 groups of buttons on the right side to control the 6 corresponding joints to move them in positive and negative directions.

12.2.4 Cartesian Mode function

(1) Switch the Teach pendant to the Coord. Code page.
(2) HOMING the manipulator by pressing and holding the red button on the top right for 3 seconds. Wait for the end of HOMING.
(3) Press the buttons x,y and z to control the corresponding coordinates and a,b and c to control the attitude.

12.3 Recording and reproduction process

(1) Select the Coord. Mode or Angle Mode. Then press and hold the REC key until the outer circle of the recording point in the upper left corner of the screen lights up to enter the teaching mode.

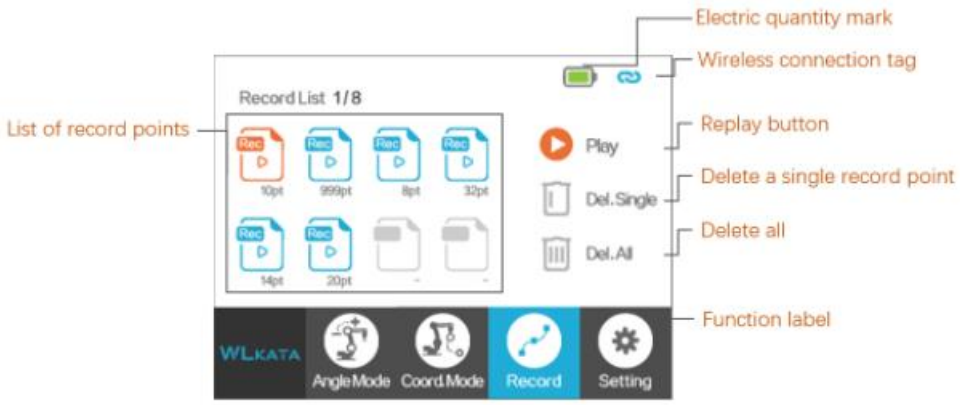


1. The outer ring is off and the teaching mode is not entered.
2. The outer ring lights up and enters the teaching mode.

(2) When the robot is in position, click the REC button to record the current position. Then move to the other position, click again the REC button to record the position. Make this step until all your movements are done.

(3) After your record is complete, press and hold the REC button, wait until the recording point in the upper left corner of the screen goes out (the outer circle of the recording point goes out) to complete the teaching recording.

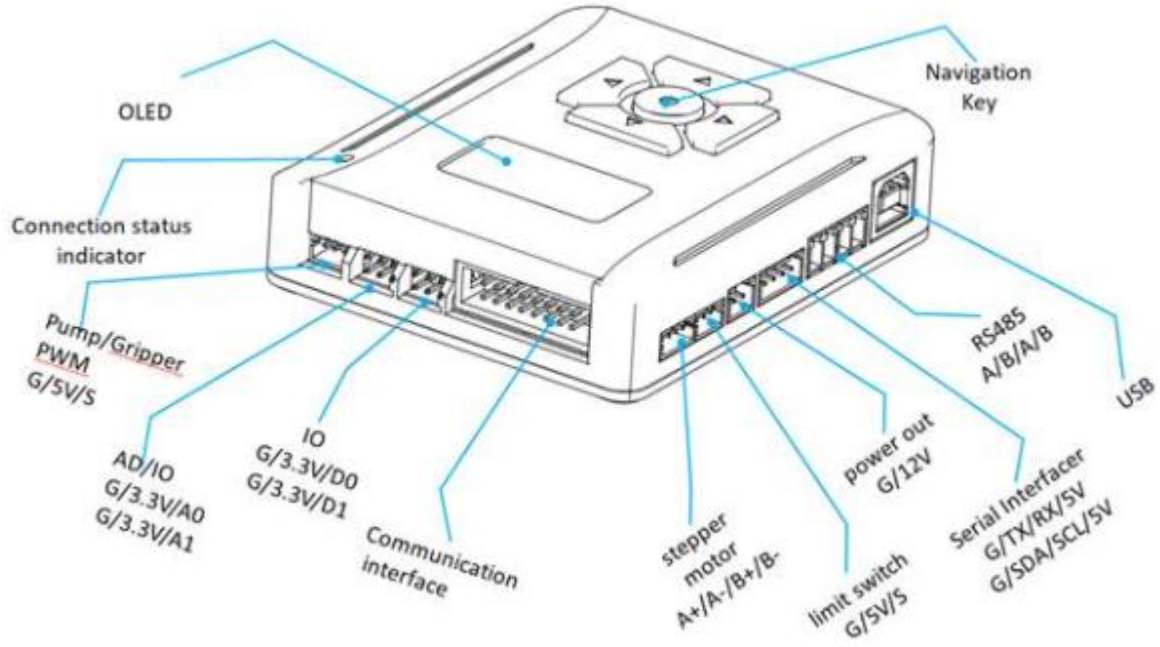
(4) Enter the Record page and click Playback to play the first teaching in the Record page by default. To play other files, enter the Record page and select the corresponding file. Click the OK button or touch the Play icon for 3 seconds.



13. Sub Control Box

The Sub Control Box is a module like the Extender Box. It's used to expand the external interface of the mechanical arm.

13.1 Interface and Appearance



Communication Interface:

An IDC cable needs to be connected between the multifunctional expansion module and the manipulator to enable communication.

PWM Port:

The PWM signal output interface is controlled by the robot arm and it outputs PWM signal. It is used for connecting the pneumatic module and the gripper. Its interface voltage is 5V, and the maximum output is 2A.

Step Motor Port:

This is the seventh axis stepping motor control port, which is used for connecting sliding rail or conveyor belt.

Limit Switch Port:

This is the seventh axis reset switch port, which is used for resetting the seventh axis and the six axes of the robot arm together.

Power Output:

The power output interface is used for supplying power to the external equipment. The output voltage is 12V and the maximum current is 1A.

RS485 Port:

This is the RS485 communication interface for controlling multiple robot arm manipulators.

OLED Screen:

The 1.3-inch OLED screen can display the status information of the manipulator.

State of the LED Light:

The LED light indicates the manipulator's status:

The red-light flashes: Offline, the robot arm is initializing.

The red light remains on: Alarm, the robot arm is locked.

The green light remains on: Idle, the robot arm is standing by.

The blue light remains on: Run, the robot arm is during a motion.

Navigation Keyboard:

Long pressing the middle OK key for 2 seconds, the robot arm will execute the Homing action.

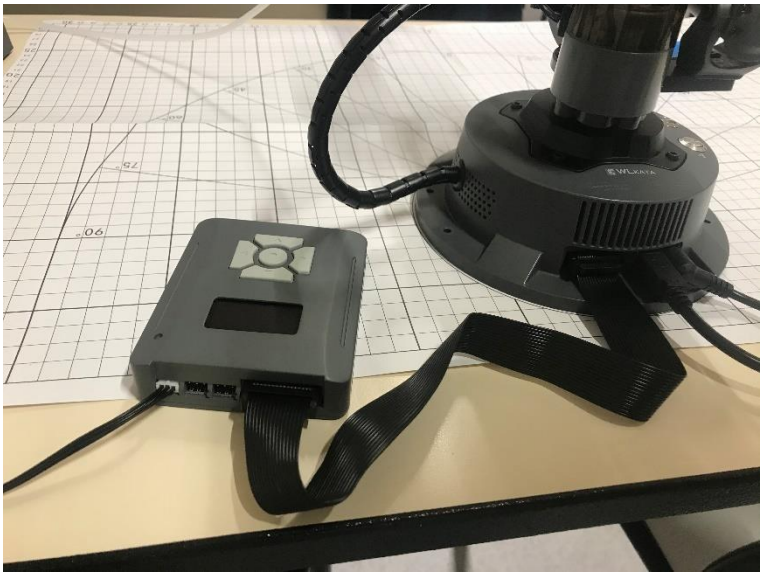
13.2 Quick Start

13.2.1 Cable connection

Connects the manipulator and the Sub Control Box with the IDC cable, as shown. Then turn on the power on the robot.

13.2.2 Using the Pneumatic Set

Connect the Pneumatic Unit to the Sub Control Box with the wire. Place the wire on the third emplacement at the left of the ICD cable.



13.2.3 Using the Sliding Rail/Conveyor

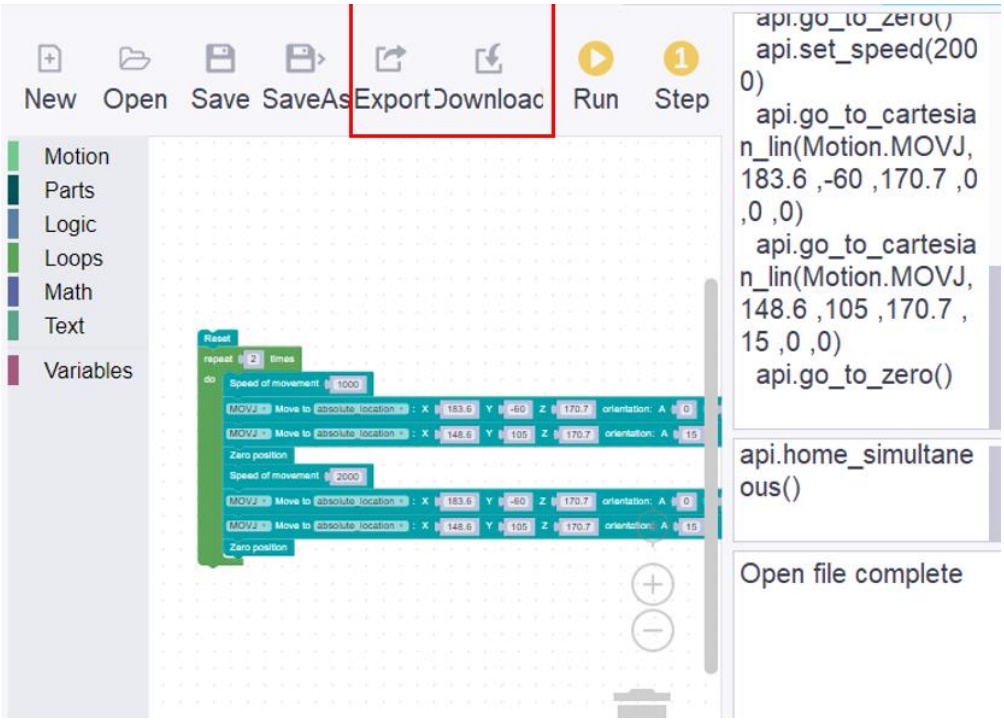
Connect the Sliding Rail/Conveyor to the Sub Control Box with the wire. Place the wire on the first emplacement on the left side of the Sub Control Box as shown below.

13.3 Offline operation

The robot arm can run the pre-downloaded BLOCKY code in the multifunctional expansion module. To achieve this off-line operation, one needs to download the BLOCKY code from the PC to the multifunctional expansion module.

13.3.1 Downloading the File (only supporting BLOCKY at the moment)

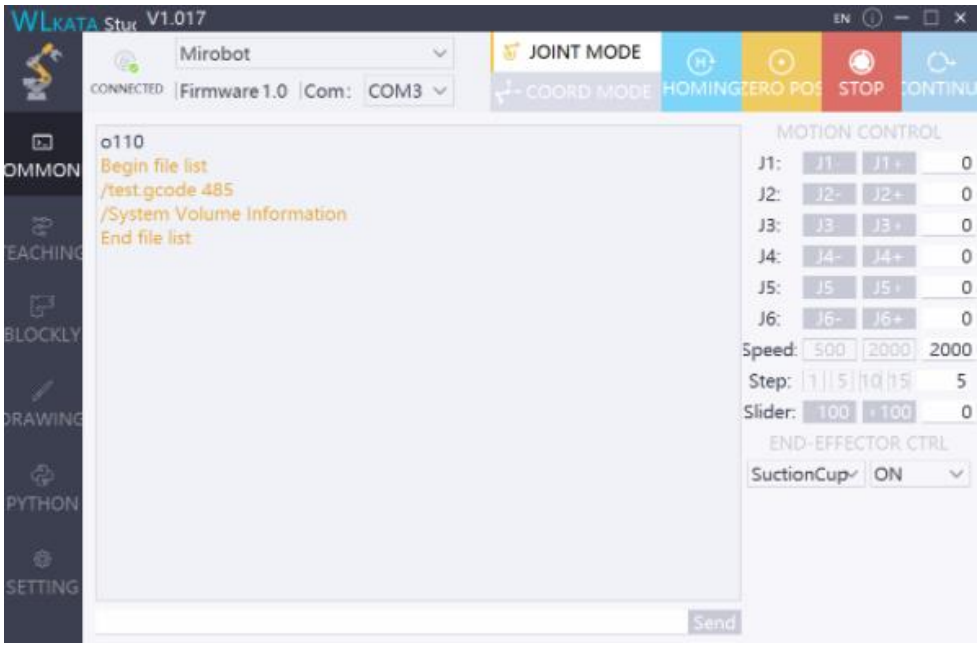
(1) After editing the BLOCKY codes in WLKATA Studio, click the "Download" button.



(2) Select a location to save the file and input a file name (note: the file name only supports English symbols), such as "test". Click OK, and the file should start downloading. If a "GCode Save Completed!" is shown, it indicates the download is successful.

13.3.2 Running the File in WLKATA Studio

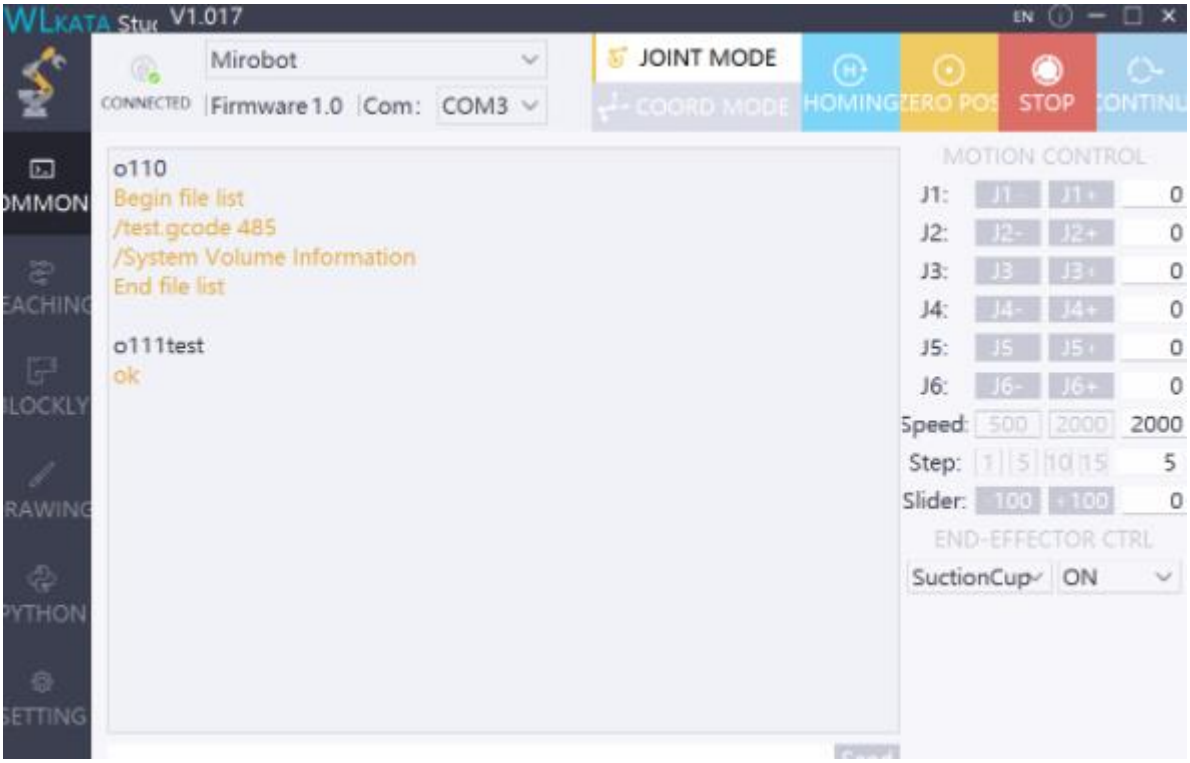
(1) To query the list of downloaded files, switch to the Command panel on WLKATA studio, and send an instruction "o110".



(2) To run the offline file in the WLKATA Studio, send a command "o111" + filename, such as o111test.

If the manipulator returns noIdle, it means that the robot arm is locked. One needs to Homing the robot arm first and then send the command again.

If the manipulator returns OK, the file shall be run successfully.



13.3.3 Running the File Offline

(1) Connect the robot arm and multifunction control module with the IDC cable. If using an end-effector, connect the end-effector cable with the multifunction control module, too.
(2) Power on the robot arm.
(3) On the multifunction control module, the red light starts flashing: means the robot arm is Offline, please wait till the red light remaining on.

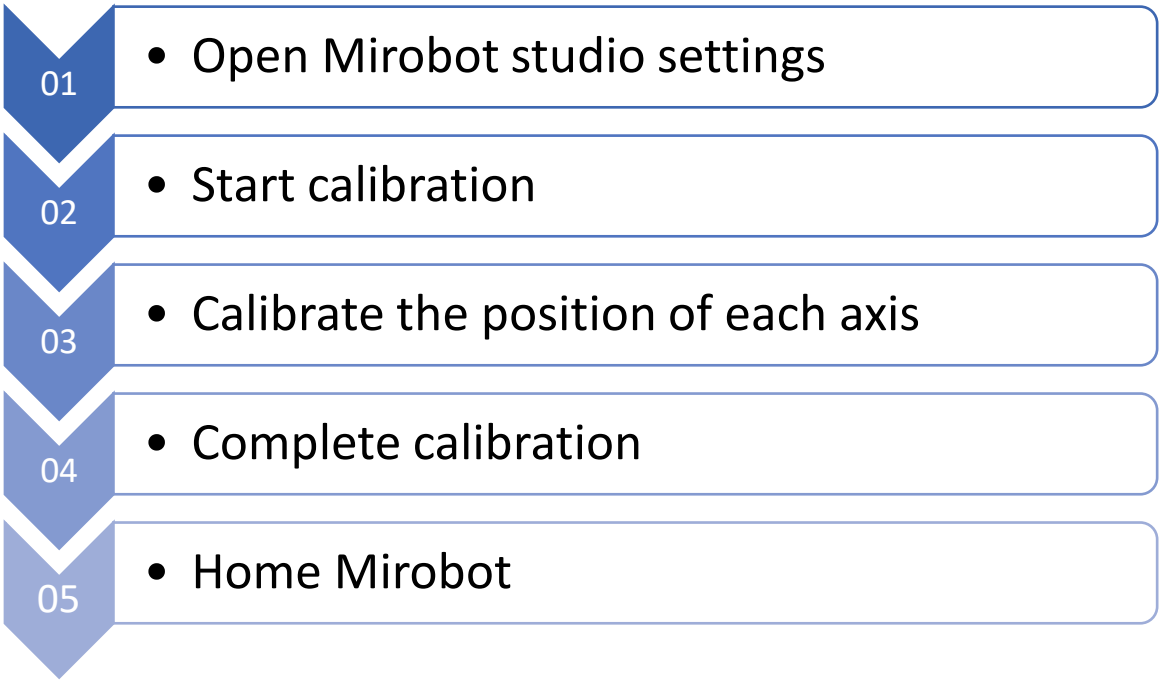
When the red light remains on, it means the robot arm is locked (Alarm status), now please long-press the middle navigation key for 2 seconds, so that the robot arm will homing. After the homing is completed, the manipulator will automatically run the Offline file.

Appendix 1: WLKATA Mirobot Calibration Operation

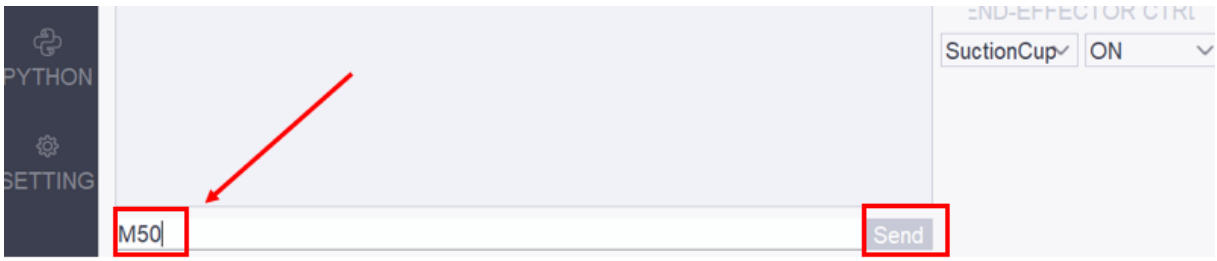
Calibration Operation Procedure:

The Mirobot is calibrated before leaving the factory. In each time the manipulator finishes the HOMING action, joint 1, joint 2, joint 3, joint 4 and joint 5 should be homed to the pre-designed homing position.

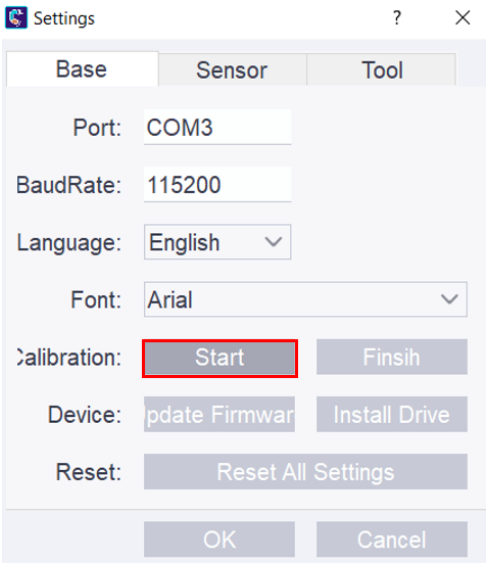
After the HOMING action, if one or more of the joints is/are not in the pre-designed homing position, one need to re-calibrate the manipulator. The Calibration procedure is explained as below:



(1) Turn on the power of the robotic arm. Open the "COMMAND" interface of Mirobot Studio software, enter "M50" and click "Send" to unlock each axis.

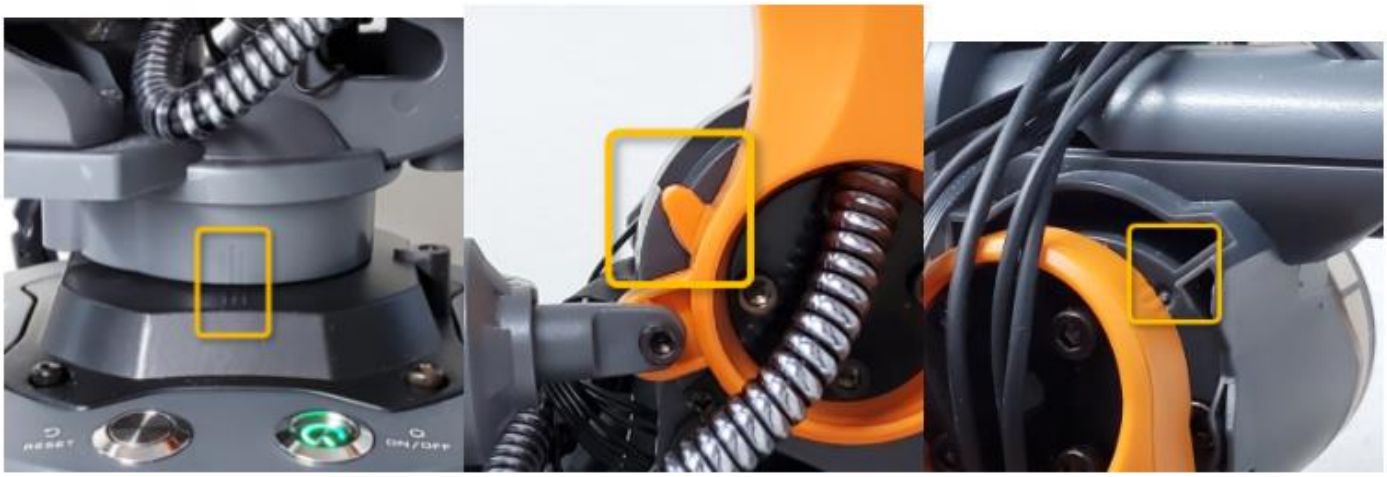


(2) Enter the “SETTING” interface and click on “Calibration-Start”.



(3) In JOINT MODE, control each axis to the corresponding by adjusting the “J1-J6” on the right side of the interface

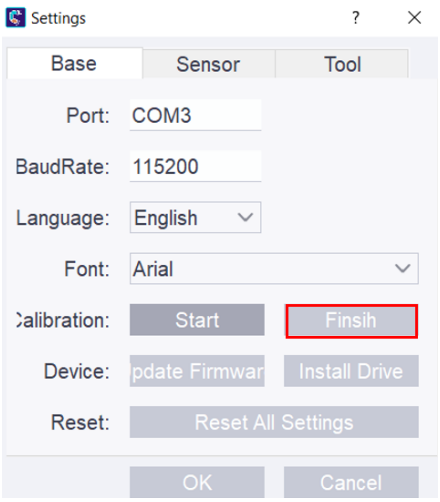
Note: The 4th axis must be adjusted through negative steps (J4-). There have no special requirements for other axes. The 6th axis does not need Calibration.



Joint 1 homing position reference Joint 2 homing position reference Joint 3 homing position reference

Joint 4 homing position reference Joint 5 homing position reference

(4) After each axis rotates to the corresponding position, enter the “SETTING” interface again and click “Finish”.

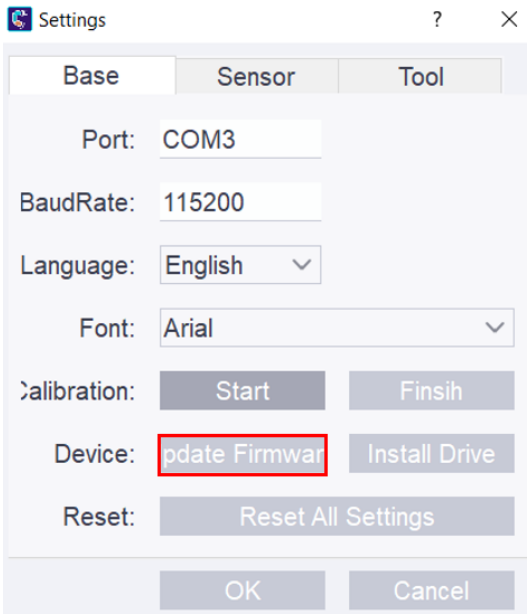


(5) After completing the calibration, click HOMING. The posture of the robot arm after homing is shown in the figure below.

Appendix 2: Mirobot Firmware upgrade

Note: Only WLKATA Studio v1.014 and above supports firmware upgrade of control software.

(1) Use a USB cable to connect the robotic arm and computer. Turn on the power.
(2) Open the WLKATA Studio Software, enter the “Settings” interface and click on “Update Firmware”.



(3) Click “Upload” in the pop-up window to update the firmware.

Wait for the prompt of Wlkata studio firmware refresh success.

* Note: After the firmware upgrade is completed, the Wlkata studio software will automatically send the initial data of each axis before the firmware upgrade, which can directly home the robotic arm. If Wlkata studio does not send the initial data, it is necessary to manually calibrate and home the robotic arm. (Refer to "Mirobot Calibration Tutorial" for manual calibration).

Appendix 3: Trouble shooting list of WLKATA Studio and Mirobot

1. Upgrading to a newer version WLKATA Studio

You could find and download the newest version of WLKATA Studio on www.wlkata.com.

Before installing a new version of WLKATA Studio, remember to clear the local record of Wlkata Studio in the AppData directory:

(1) Go to the directory of C:\User(User Name)\AppData\Local\, delete the whole folder of Wlkata Studio in this file path.

(2) Find the old version of the Wlkata Studio.exe directory, and delete the whole folder.

(3) Decompress the new version of the WLKATA Studio software package to a local root directory such as D:\ or E:\ to avoid potential foreign language character disturbance.

(4) Double-click Wlkata Studio.exe in the directory and start to use the WLKATA Mirobot.

2. If you want to put the Mirobot back into the box, please adjust the Mirobot to the position shown below.

3. The first axis sensor failure problem

Cause: The sensor plug is loose or the one-axis screw is loose, resulting in the sensor not detecting the magnet. Follow the steps below to solve this problem:

Firstly, tighten this screw a little bit:

Secondly, in the WLKATA studio, do the next 8 steps:

Step	Items
1	Enter $20=0 and $21=0 (Remove software limit)
2	Enter M50 to unlock the motor
3	Click J1 to turn the first axis to the position of the scale line to align
4	Click HOMING to see if the rest is successful
5	Stop immediately if the magnet position is exceeded
6	If you still have any questions, please contact the WLKATA customer service
7	If successful, enter $ 20 =1 and $ 21 = 1
8	Then you should be able to use it normally