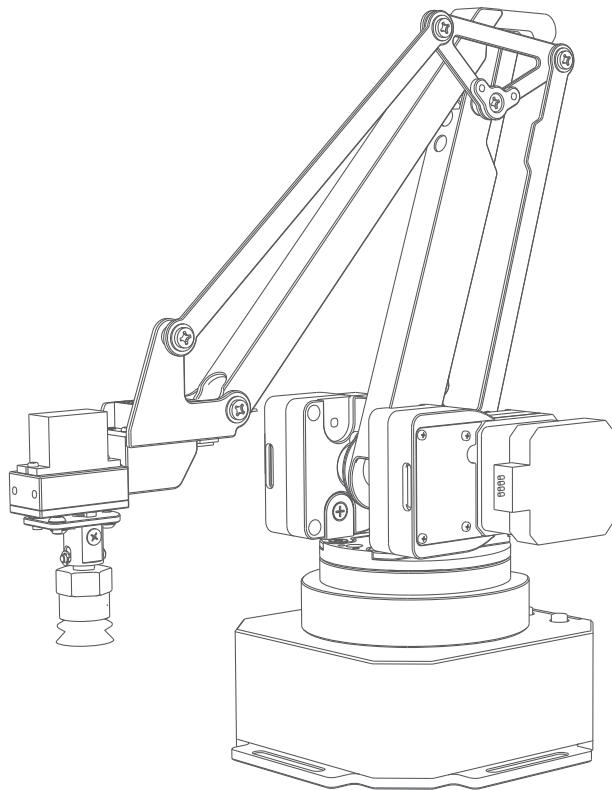




UFACTORY

# UARM Swift Pro

## User Manual



SHENZHEN UFACTORY CO. LTD.

v1.1.0

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# 1. Safety Precautions

This chapter describes the safety precautions that should be taken when using this product. Please read this manual carefully before using it. User should strictly follow this operating manual.

## 1.1 Precautions

1. When working with the robotic arm, do not put your hand between the connecting rods;
2. Please use the official standard power adapter ;
3. Please make sure that there is enough space on the desktop to avoid hitting obstacles during the operation of the robotic arm ;

## 1.2 General Safety

- If an error occurs, please contact support@ufactory.cc in time.
- If the product is scrapped, please comply with relevant laws to properly dispose of industrial waste and protect the environment.
- The robotic arm comes with small spare parts; please keep them away from children to prevent accidental swallowing.
- Parental guidance is required if the operation is conducted by children. Please shut down uArm properly in time when the operation is completed.
- Do not put your hand into the range of motion to prevent accidents.
- It is strictly forbidden to change or remove and modify the nameplate, instructions, icons, and markings of the robotic arm and related equipment.
- Be careful during handling and installation. Pay attention to the instructions on the box and place the robot according to the direction of the arrow. Otherwise, the machine may be damaged.
- Before operating the robotic arm, please refer to the user manual attached to the box.

## 1.3 Emergency stop

Press the power button to stop the drive, all actions and the running program in uArm Studio will be stopped.

- Should not press the power button during normal operation. If the power button is pressed during the action, the trajectory of the robot will then be changed and become different with the initial setting, which may trigger an unexpected situation such as a collision.

## 2.Quick Start

This chapter briefly describes how to control uArm through uArm Studio so that users can quickly understand and start using uArm .

### 2.1 uArmWiring

Step 1 Connect the power cord

Step 2 Turn on the power switch

Step 3 Connect uArm via USB cable and your computer

### 2.2 Installation uArm Studio control software

Users can control the robotic arm through the control software uArm Studio, and to realize teaching reproduction, 3D printing and other operations. This chapter takes the teaching reproduction as an example.

#### 2.2.1 Environmental requirements

Operating systems supported by uArm Studio software are as follows:

Windows 7/Windows 8/Windows 10 (this manual is based on these OS)

macOS 10.10/macOS 10.11/macOS 10.12

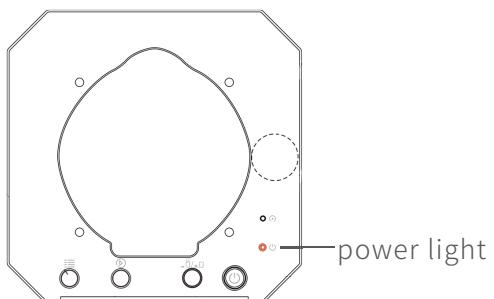
#### 2.2.2 Obtain and install the uArm Studio software package

Before using uArm , please download the uArm Studio software from <http://www.ufactory.cc/#cn/support/> and download and install according to the instructions. Software packages for Mac OS system are also available on this page.

### 2.3 Power On/Off

When the power button is pressed, the power indicator lights up to turn it on.

When the power button is pressed, the power indicator is off and it is turned off.



### 3. Product Description

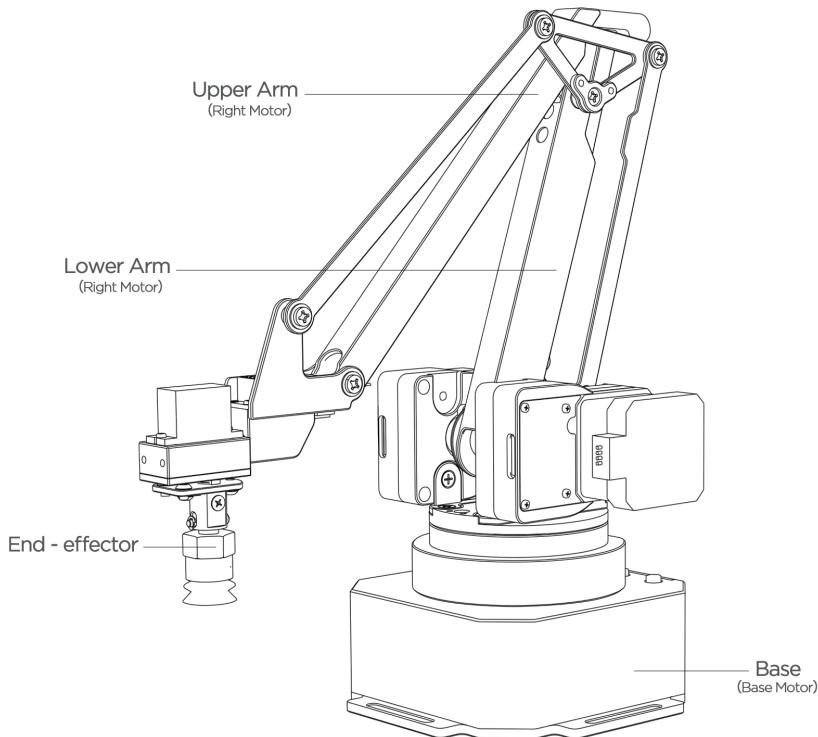
#### 3.1 Overview

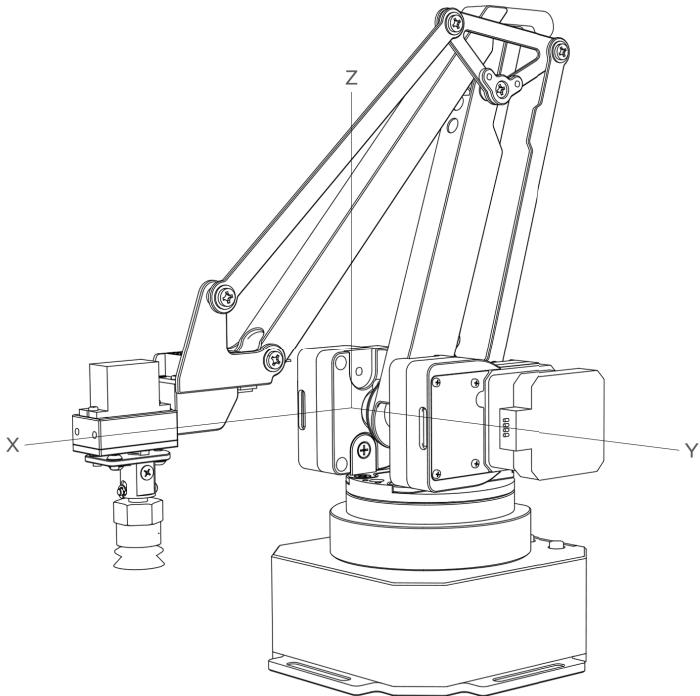
uArm is the world's first open-source desktop robotic arm, it features open source hardware and software, you can expand the development uArm functions to suit your needs. The uArm Swift Pro with uArm vision module to perform image recognition and it is ideal for AI robotics research.

#### 3.2 uArm (Host)

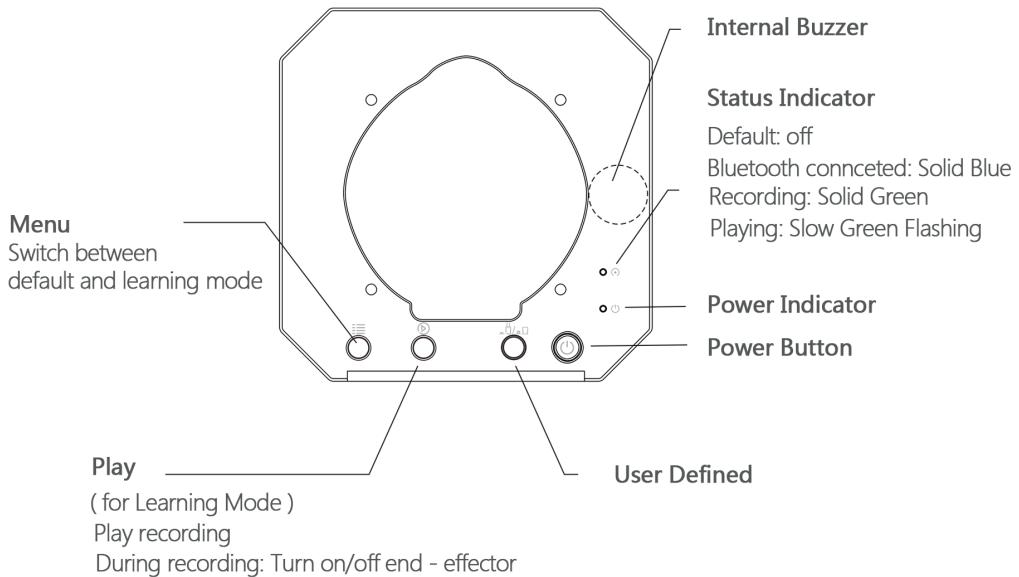
##### 3.2.1 External Structure

The uArm consists of a base, an arm, a forearm and an end effector lamp. The appearance is as shown in the figure.

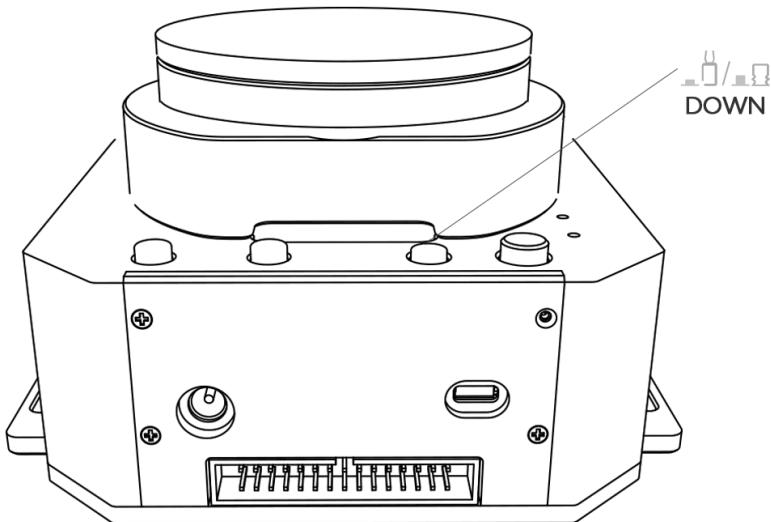




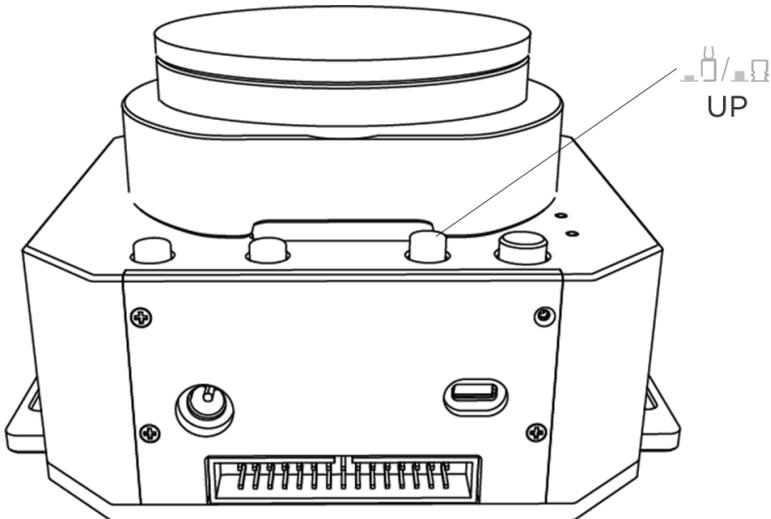
### 3.2.2 Base & Indicator



By default, the custom function button is used for Bluetooth mode /USB mode switching. Before using the USB mode, make sure the custom function buttons are in the up state as shown.



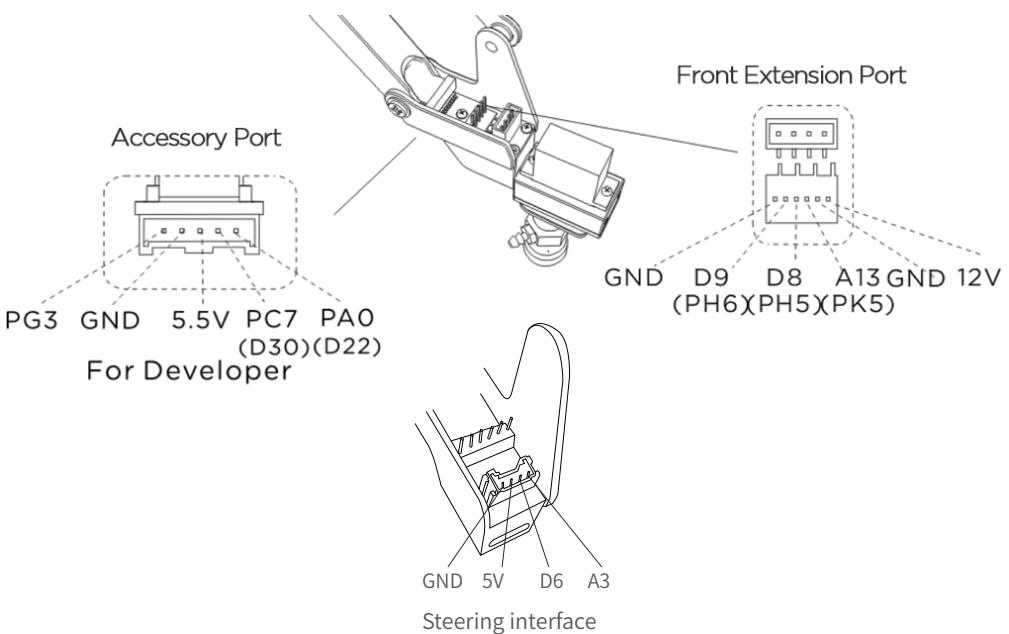
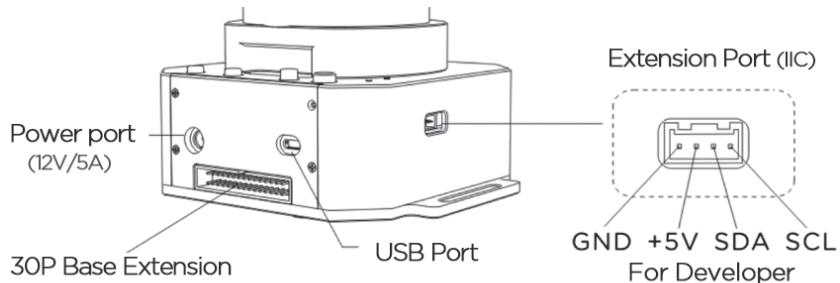
Bluetooth



USB

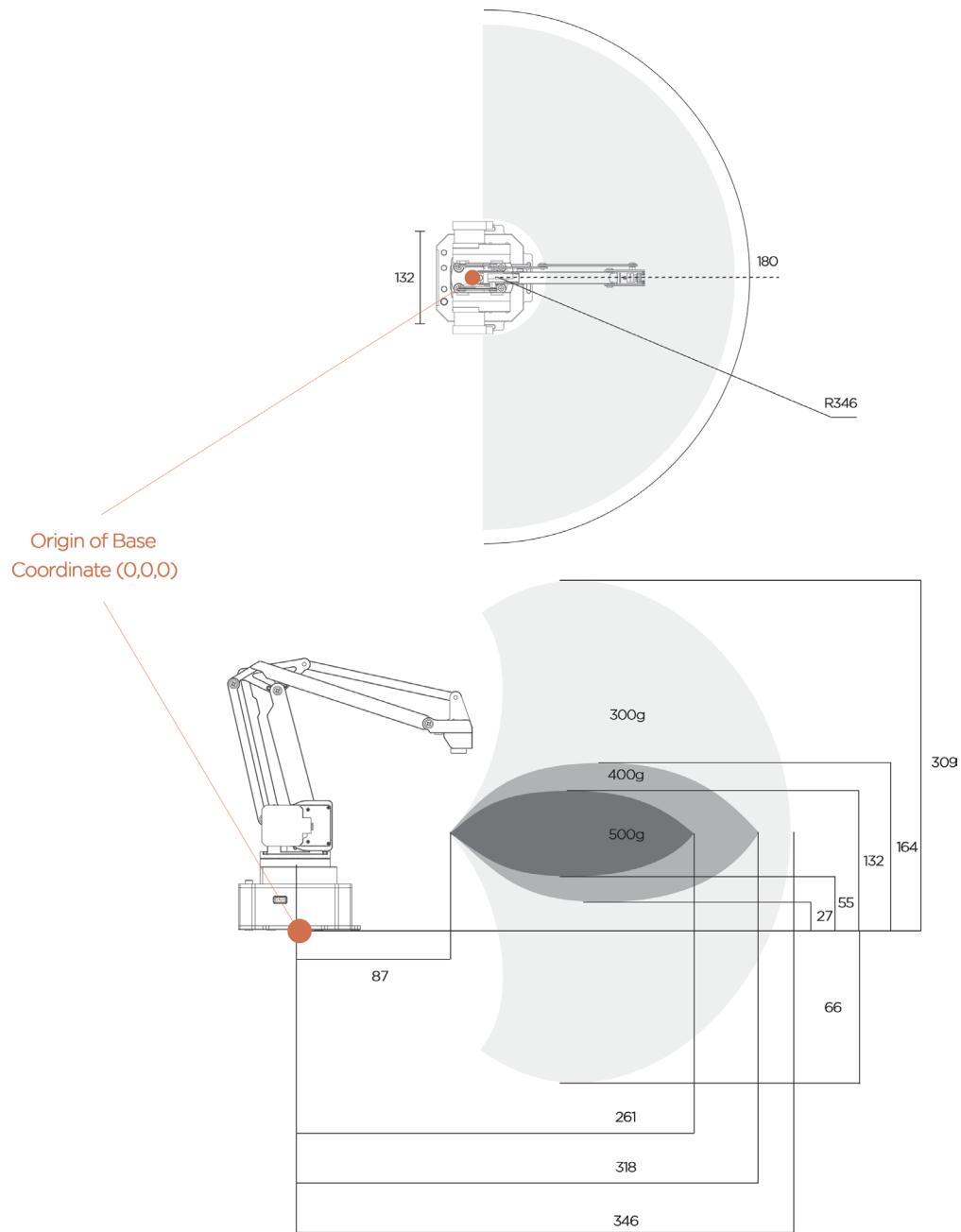
### 3.3 Extension Port

The uArm interface is located on the back of the base and the arm. The diagram of the base interface is shown in the figure.



### 3.4 Workspace

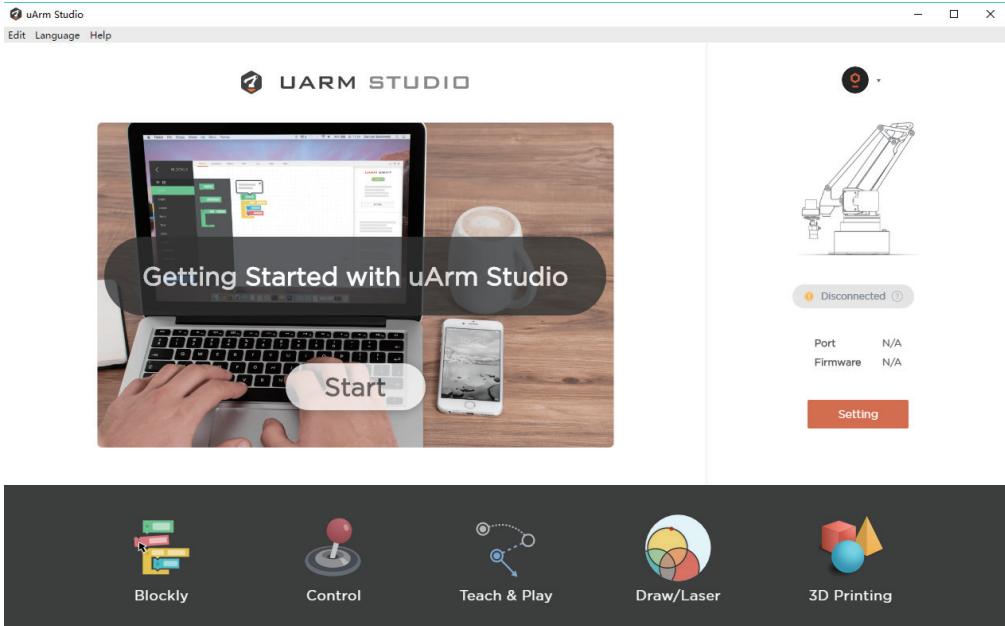
uArm's workspace is shown in the figure.



## 4. Operating Guide

### 4.1 uArm Studio Software User Manual

The uArm robotic arm has hand-guiding, drawing, engraving and 3D printing functions, which can be implemented by uArm Studio software. The functions supported by uArmStudio are shown in the figure, and the detailed functions are as shown in the table.



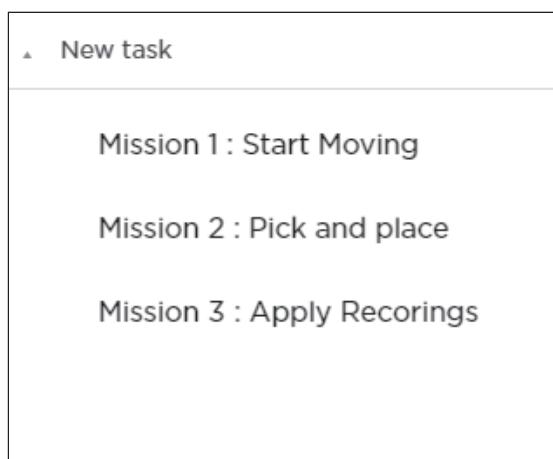
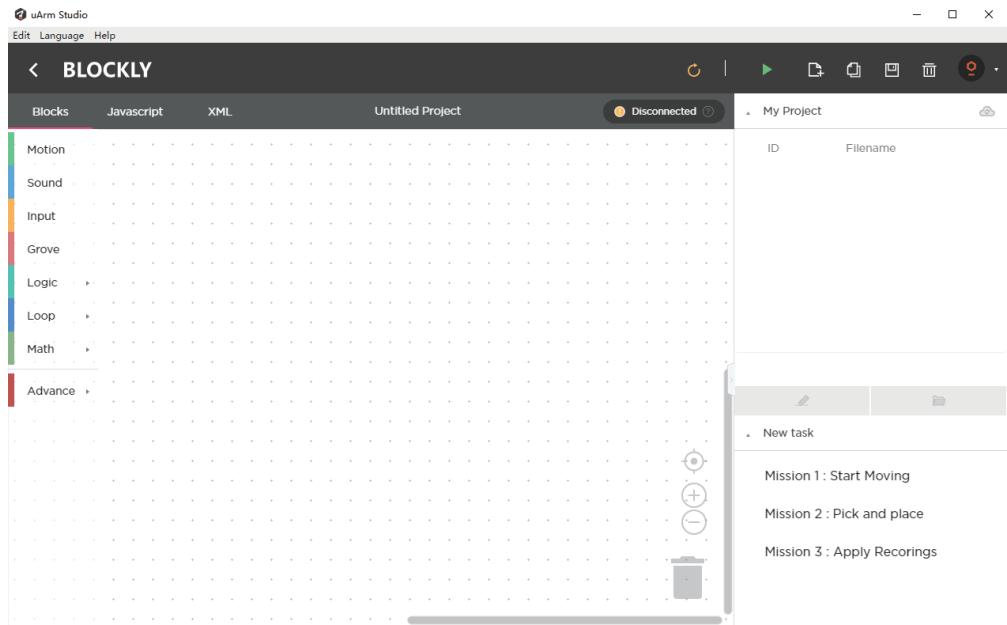
Module	Function
Blockly	The robotic arm is controlled in a visual programming manner, and the user can program by means of drag-n-drop.
Hand-guiding	Once the teaching mode has recorded a series of actions taught to the robotic arm, the robotic arm automatically repeats the recorded actions.
3D Printing	3D printing with robotic arm
Drawing & Engraving	Use the robotic arm to complete the drawing and engraving operations

### 4.2 Blockly: Visual Programming Tutorial

uArm Studio Blockly is a visual programming interface designed specifically for uArm.

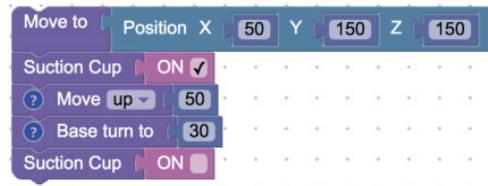
## 4.2.1 Quick Start

There are three tasks for newbie to help you quickly understand Blockly.



## 4.2.2 Blockly Function Description

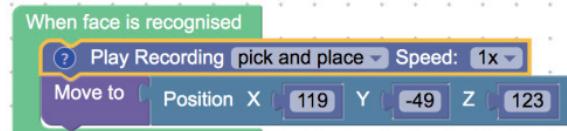
(1) Control the basic motion of uArm



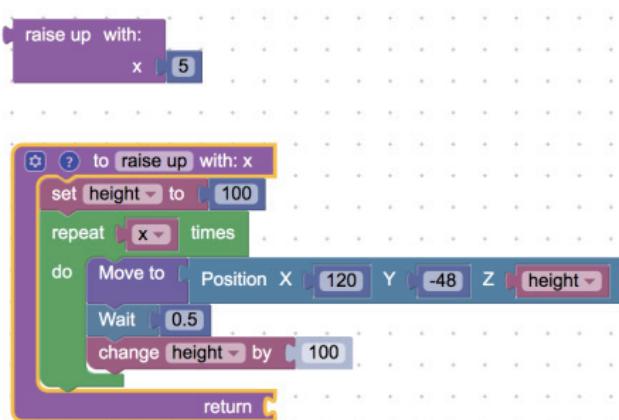
(2) Events ( How to trigger a command )



(3) Apply the action you recorded



(4) Advanced programming ( functions, variables, etc. )



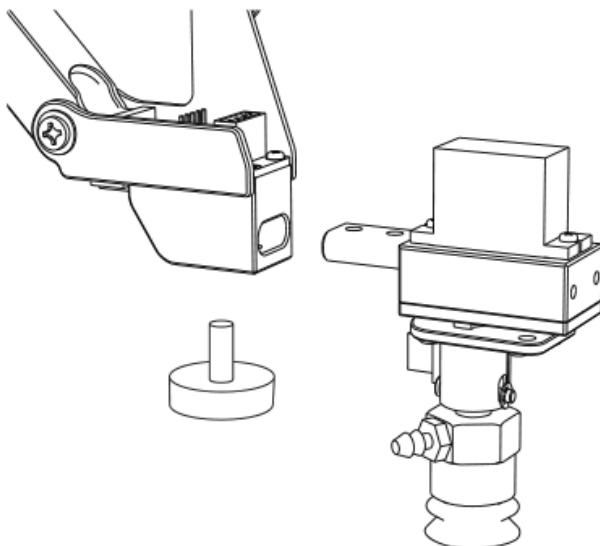
## 4.3 Hand-guiding Tutorial

Holding the uArm to record the action , then playing the recorded action.

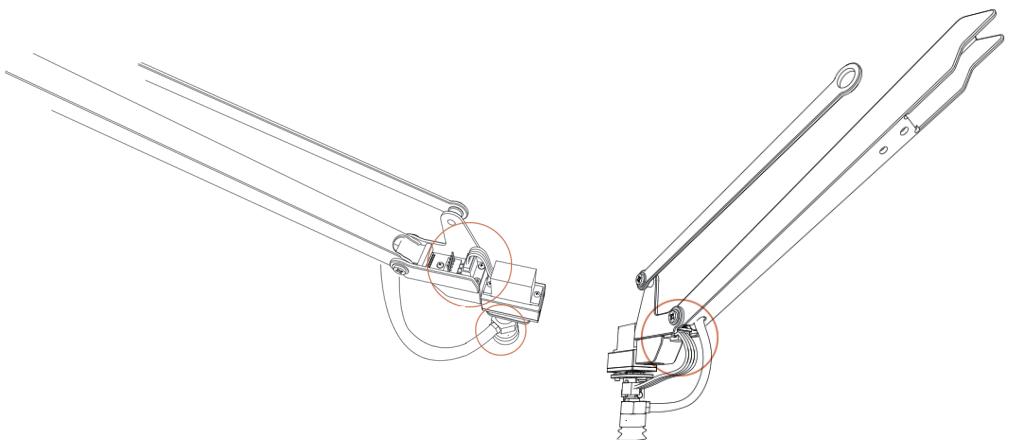
### 4.3.1 Suction Cup Installation Tutorial

Step 1 : Install the suction cup on the fourth axis of the arm and tighten the hand screw.

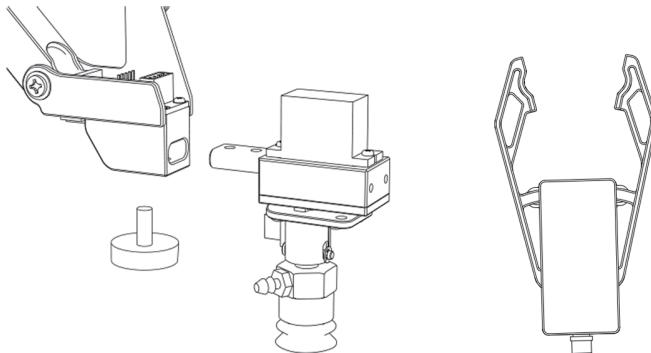
Note : If you need to remove the suction cup, please loosen the hand screw.



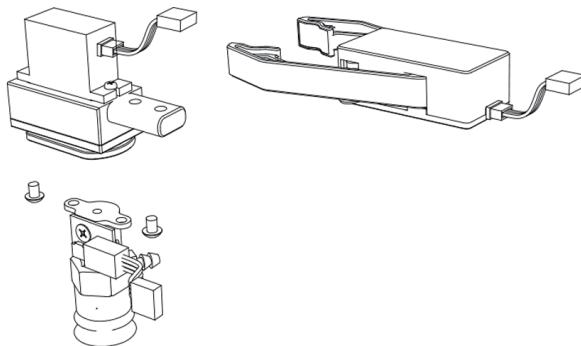
Step 2: Connect the wires of the fourth axis, the suction tube and the limit switch.



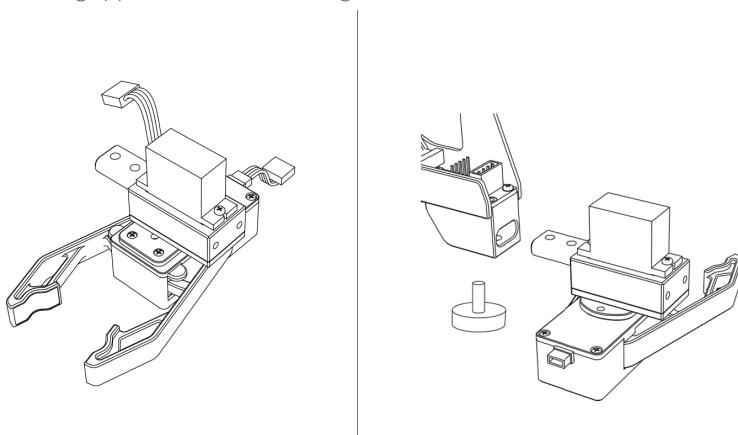
#### 4.3.2 Gripper Installation Tutorial



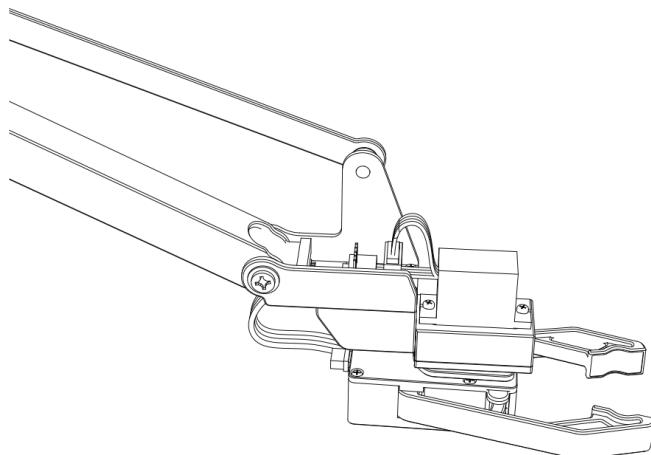
Step 1 Use a hex wrench to remove the suction cup.



Step 2 Install the gripper and lock the fixing screws.



Step 3 Install the fourth axis motor and gripper.



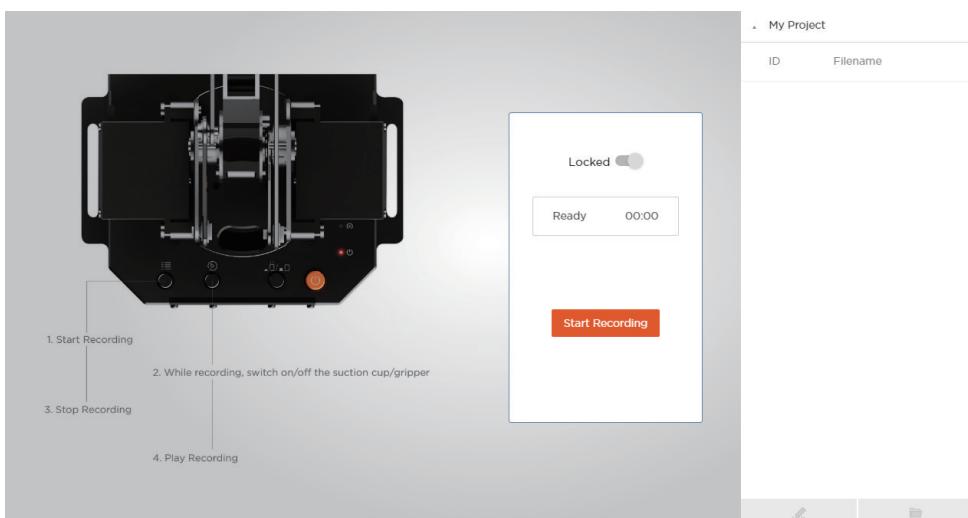
#### 4.3.3 Hand-guiding

Holding the uArm to record the action , then playing the recorded action.

##### 4.3.3.1 Operation Tutorial

###### (1)Record Action

Tap ‘Start Record’ on uArm Studio to activate the function or tap ‘Menu’ to start recording.



(2)Save

(3)Set the playback speed and number of playbacks

Locked

Locked

Stopped 00:02

Stopped 00:02

**Discard**

**Save**

**Discard**

**Save**

Times

1

Times

1

Loop

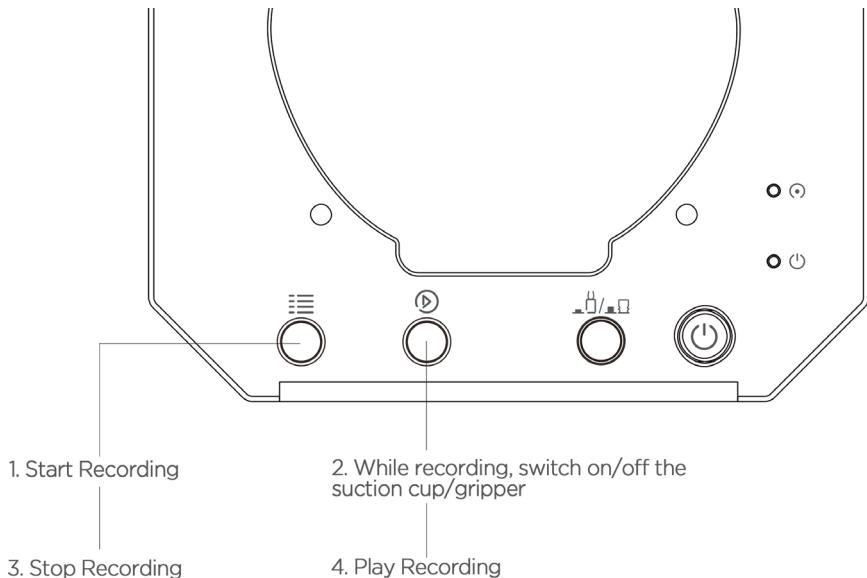
Loop

**Play**

**Play**

#### 4.3.3.2 Offline Teaching Operation Tutorial

Teaching with buttons on the robotic arm when offline.



Recording :

1. Open the teaching mode: press the menu button once, the status indicator turns green .
2. Hold the arm and guide it, press the play button once to open the suction cup/gripper, and then press the play button again to close the cup/gripper. (If custom button is pressed, and the uArm is in gripping/suction cup mode, press the custom button again, otherwise the Bluetooth function will automatically start in this mode.
3. Complete the recording process, press the menu button once, the status indicator will go off.

Play :

1. Press the play button once, single play; long press the play button for 2 seconds for playing in loop .
2. During playback, the status indicator flashes slowly .
3. During playback, press the play button once to stop playback .

#### 4.3.3.3 Difference between hand-guide teaching and offline teaching

(1) Hand-guide teaching has no time limit

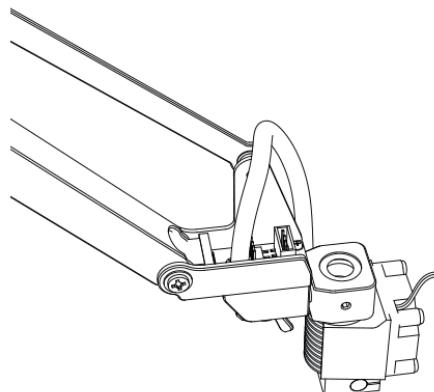
(2) You can save and export your recorded actions, and you can also import actions recorded by others.

(3) You can use your recorded action in Blockly

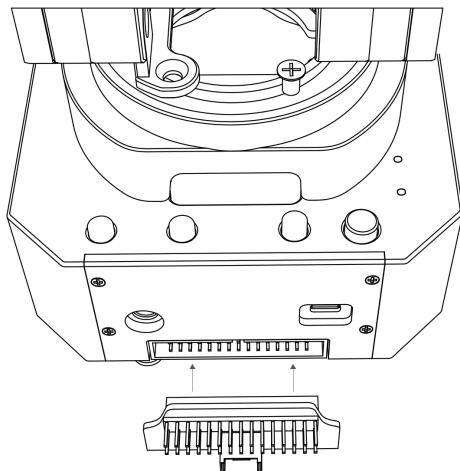
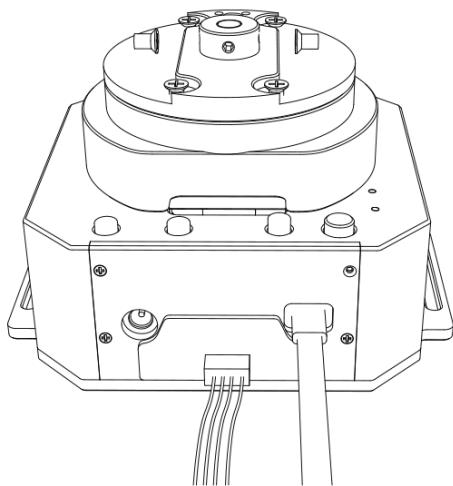
### 4.4 3DPrinting Tutorial

#### 4.4.1 3DPrinting Nozzle Installation Tutorial

Step 1: Install the 3D print nozzle, tighten the fixing screws



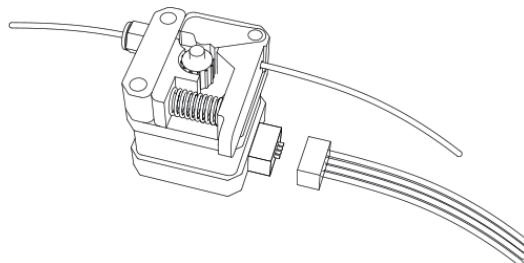
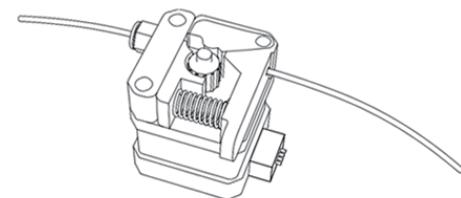
Step 2 : Install the 3D printing feeding system



Plug in

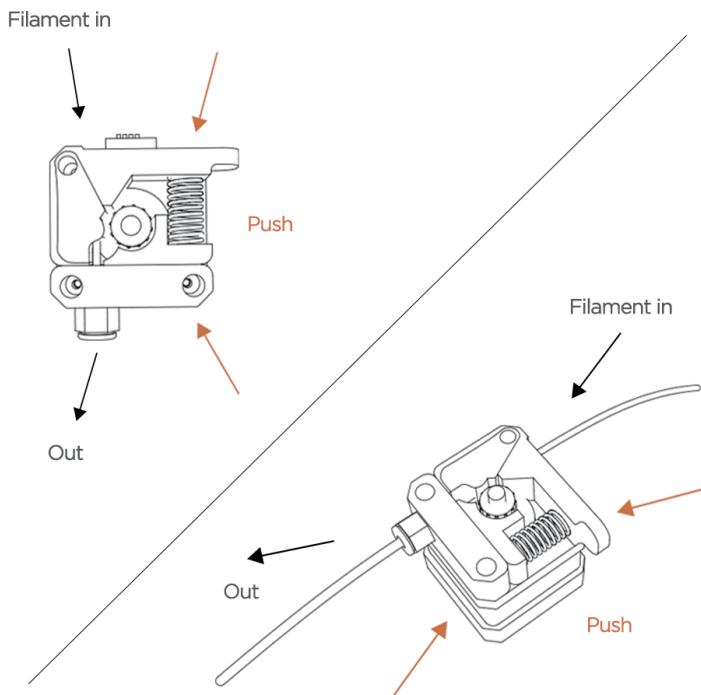
Note : Please make sure the connection is correct, otherwise the computer will not recognize the robotic arm.

Connect the motor and expansion board with a color 4pin cable



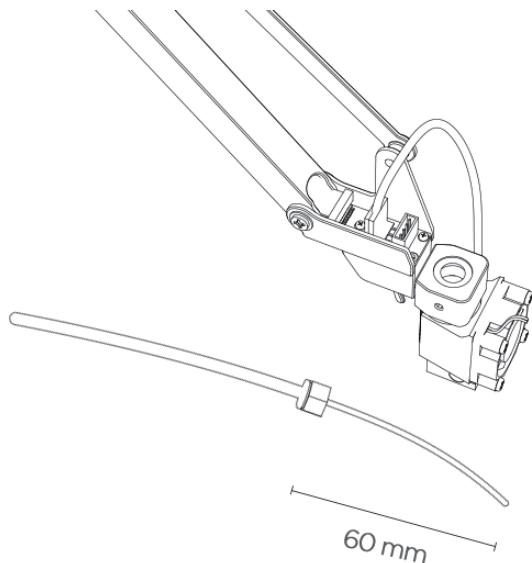
( Importing PLA printing materials into the feeding system)

### Step 3 : Install PTFE catheter



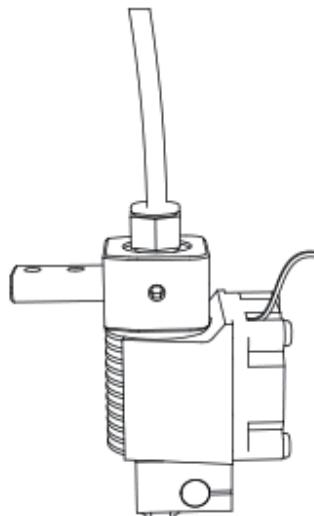
Install printing material and feeding tube

Step 4 : Allow the 3D printed material 60 cm above the catheter

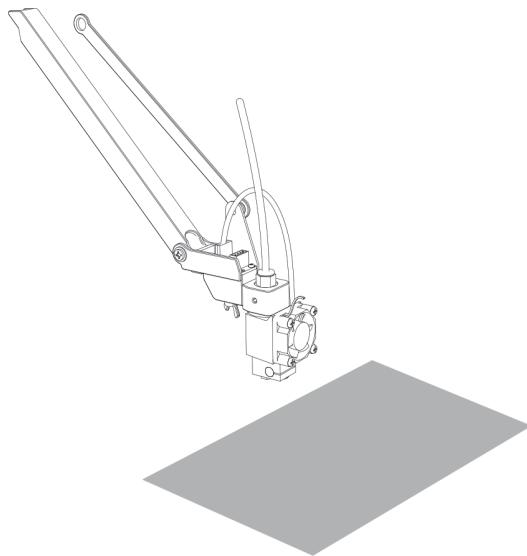


Note : If the printer is unable to discharge, it may be due to the deformation of the end of the printed material.

Step 5 : 3D print nozzle mounting catheter



Step 6 : Paste the tape on the desk.

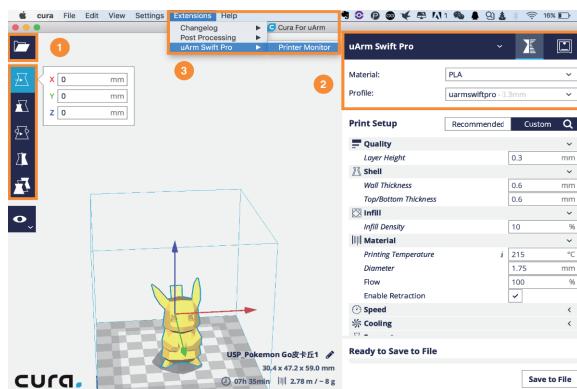


If there is an error in the horizontal state of the arm, please refer to 4.4.3 for the calibration.

#### 4.4.2 Cura For uArm Software Tutorial

(1)Download and install CuraForuArm:<http://www.ufactory.cc/#/cn/support/>

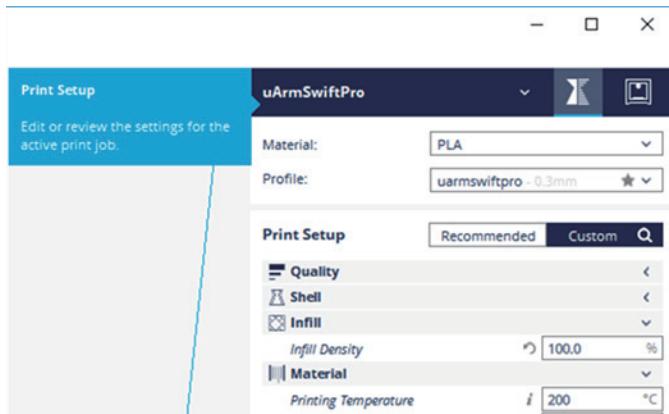
(2)Enter uArm 3D printing, CuraForuArm will automatically start, if it doesn't start, click ‘Open Cura’



Cura for uArm Interface

(3) Import a .stl file and adjust the size/position of the model.

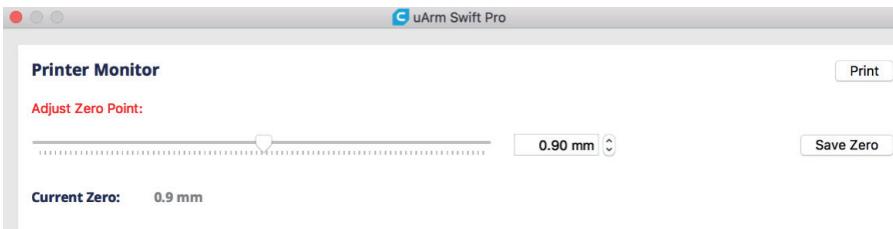
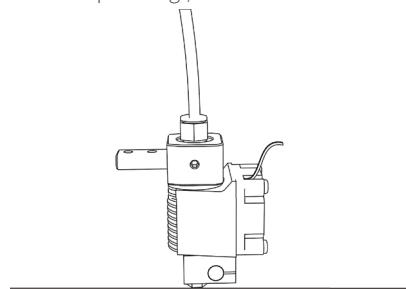
(4) Select “uArm Swift Pro” printer and the corresponding files. It is suggested to use the default setting.



To set the 3D printing parameters, select the "Print Setup" option. If the "Print Monitor" option is selected, the printer will not be found on the interface.

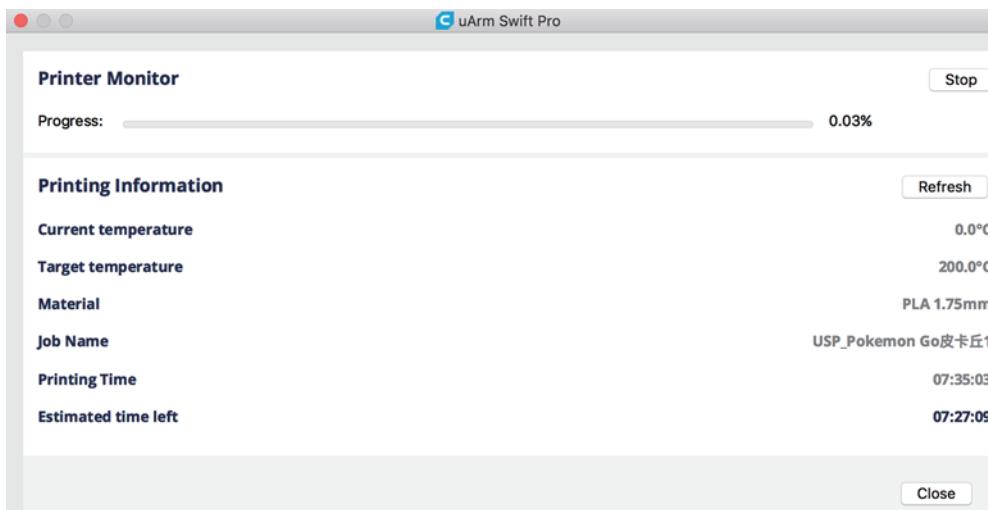
(5) Open Printer Monitor

Note : Adjust the zero point before printing. When you adjust the printhead to just touch the desktop, click "Save Zero" (The zero point of each arm is different, please adjust the zero point according to the above steps before printing)



## (6)Start printing

The 3D print nozzle will be preheated to 200 °C . The robotic arm will wait for the print nozzle to warm up. Please do not touch the metal part of the print nozzle to avoid burns.



### 4.4.3 Calibration tutorial and calibration card

Calibration tutorial

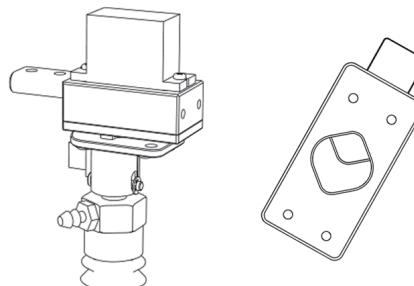
<http://download.ufactory.cc/docs/download/uArm-Swift-Pro-Calibration.pdf>

Calibration Card

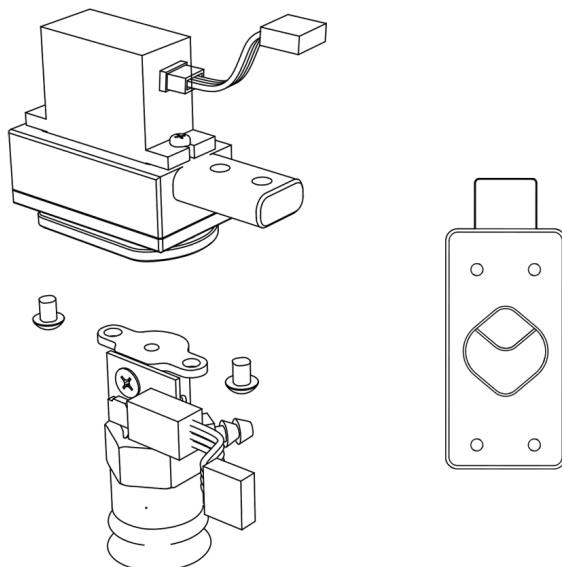
<http://download.ufactory.cc/docs/download/Position-Sheet.jpg>

## 4.5 Drawing / engraving tutorial

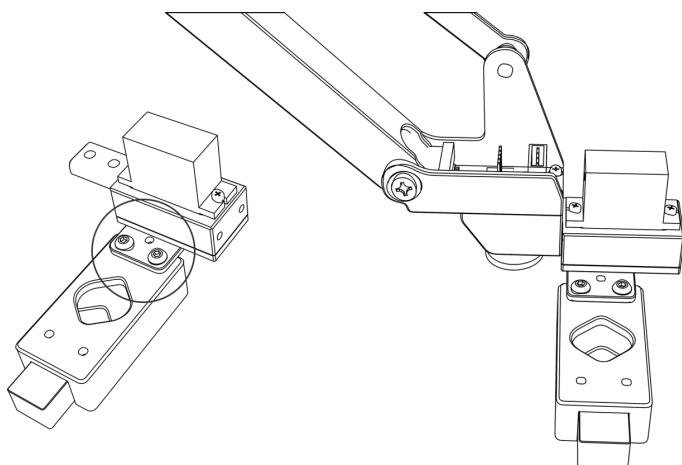
### 4.5.1 Universal pen holder installation tutorial



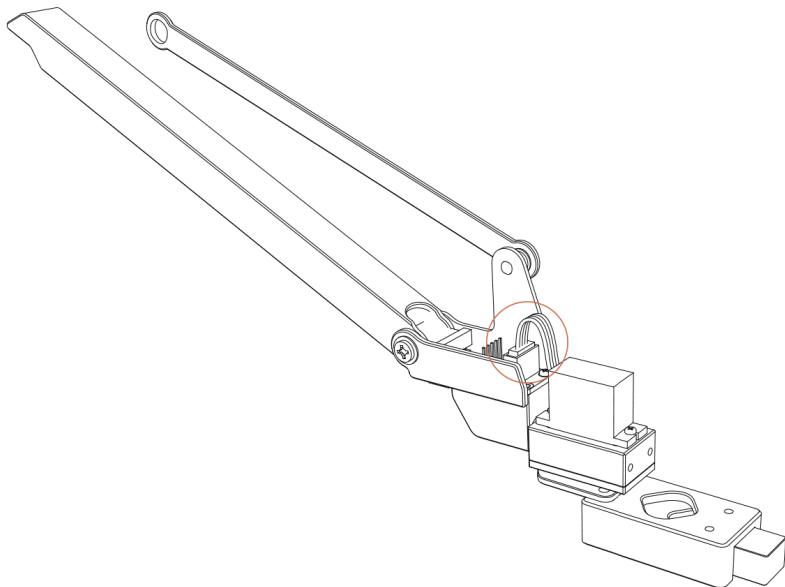
Step 1 : Remove the suction cup with a hexagonal L -wrench



Step 2 : Install the universal clip and tighten the screws

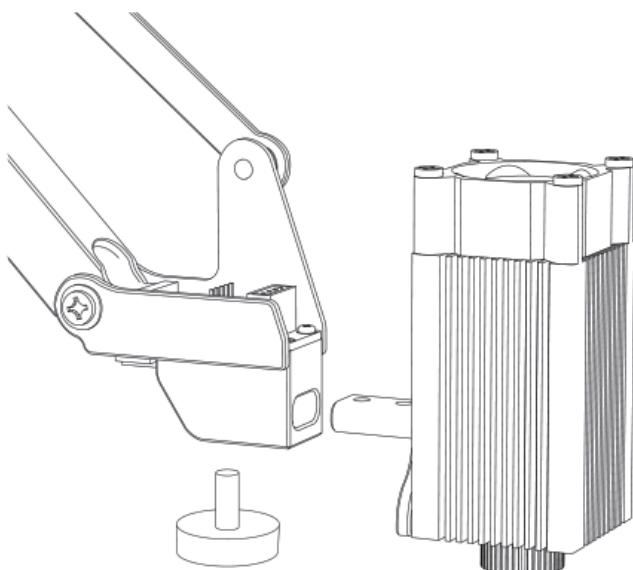


Step 3 : Connect the fourth axis motor

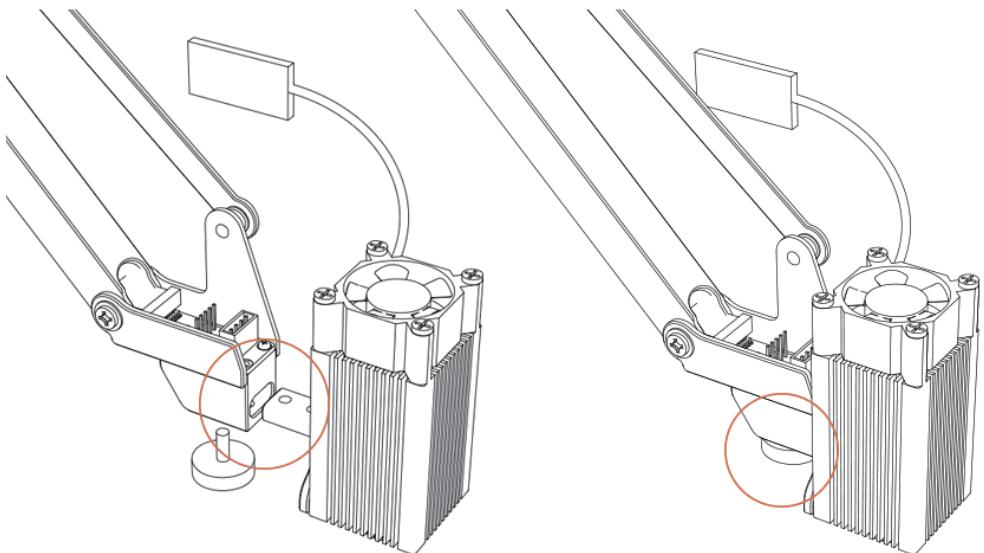


#### 4.5.2 Laser kit installation tutorial

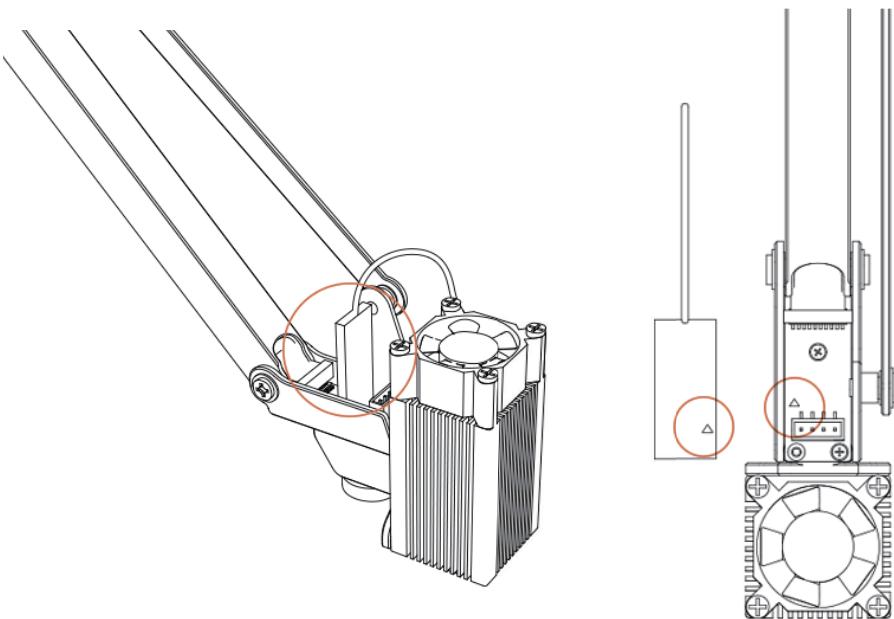
Material ( laser nozzle, hand screw )



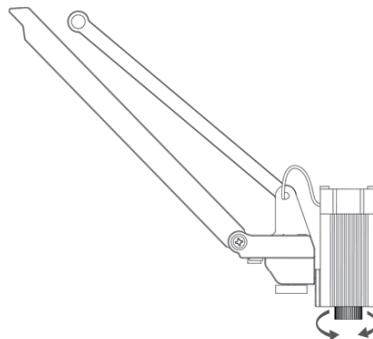
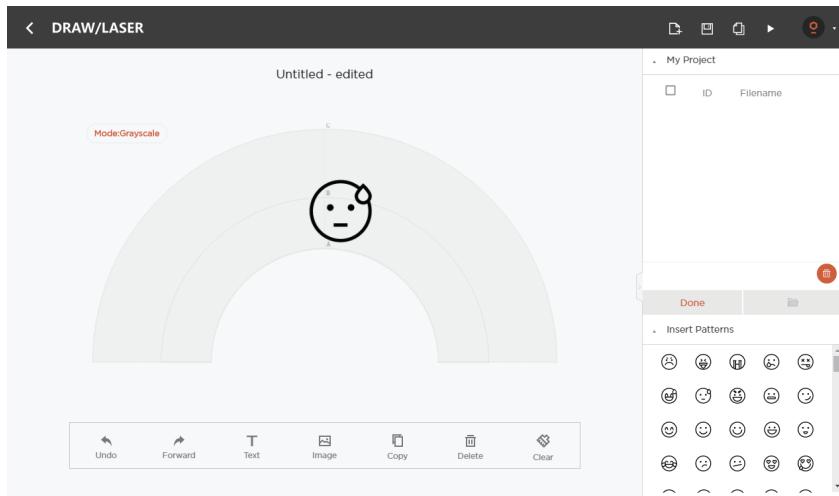
Step 1 : Fix the laser nozzle and tighten the hand screw



Step 2: Insert the laser control board into the end of the arm ( please pay attention to the interface direction )

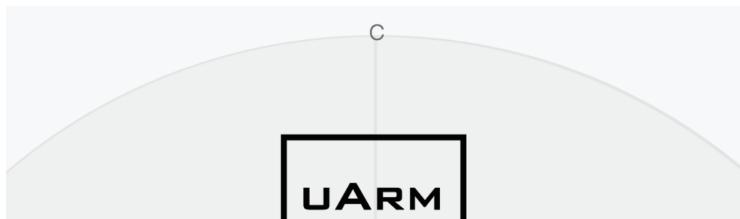


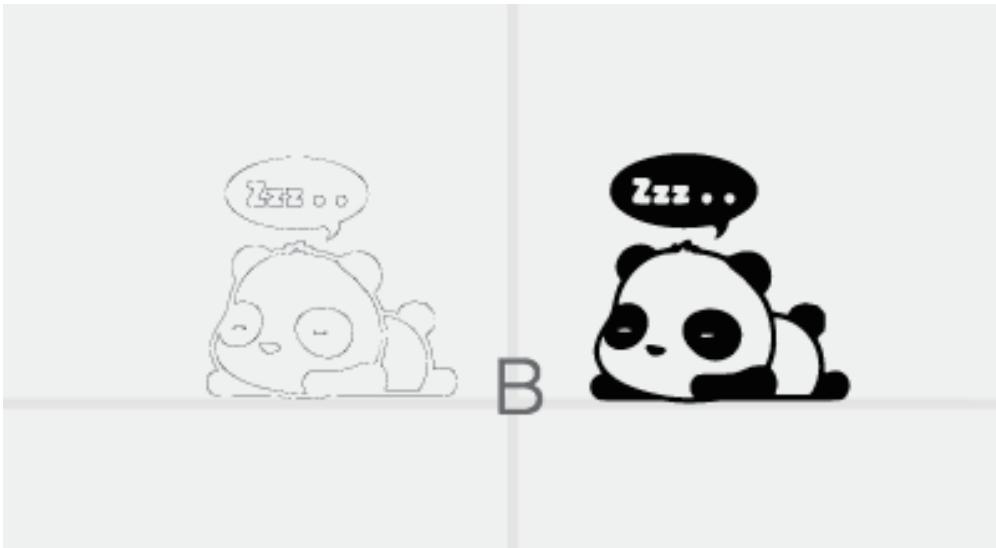
Note : If you cannot perform laser engraving, please open the uArm Studio software, turn on the “ drawing / engraving ” function, and rotate the laser nozzle to adjust the focus. During the engraving process, please do not touch the laser nozzle or place your hand in the laser irradiation area.



#### 4.5.3 Import patterns & Parameters setting

Step 1 Design a pattern, insert text / shape





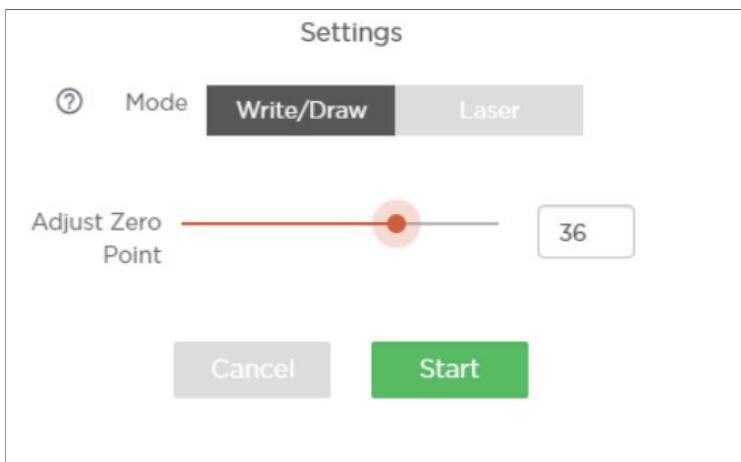
(contour or grayscale mode )

Step 2; Click the " Run " button to start running

Step 3: Start drawing / engraving

#### 4.5.4 Adjust the Zero Point

Before using the “ paint / engraving ” function, please adjust the zero point to ensure that the pen / laser nozzle just touches the table. Engraving speed can be set before laser engraving.



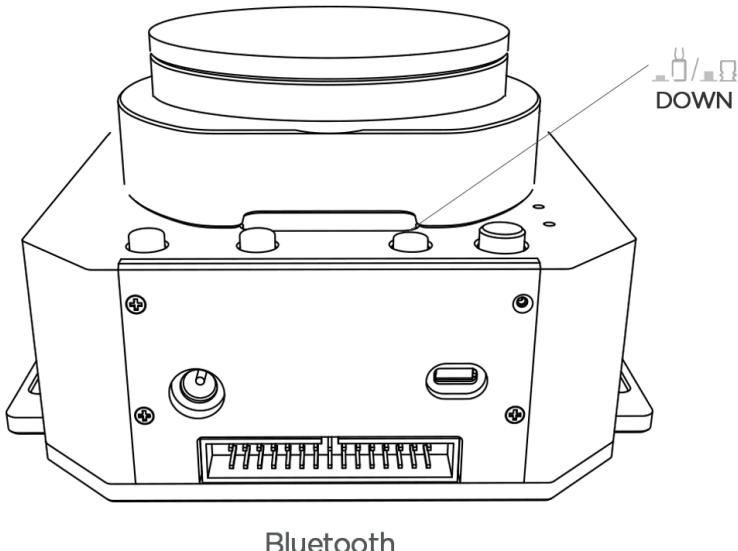
## 4.6 Bluetooth Tutorial

### 4.6.1 Bluetooth Pairing Steps for IOS

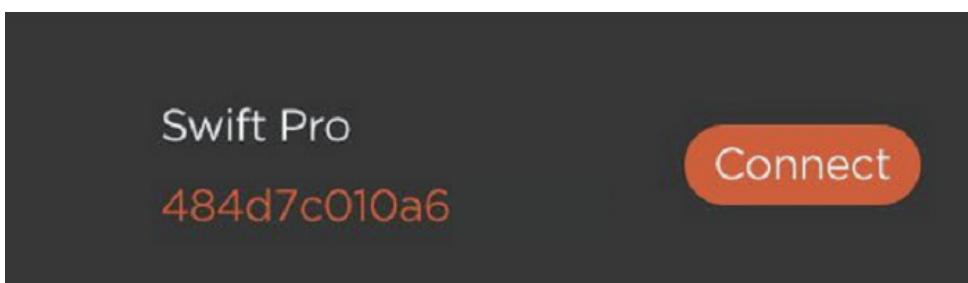
Step 1: Open uArm software and Bluetooth on your phone, click to connection

Step 2: Turn on the uArm power supply

Step 3: Press the Bluetooth button



Step 4: As shown in the figure , the name of uarm will be displayed in the software , click to connect.



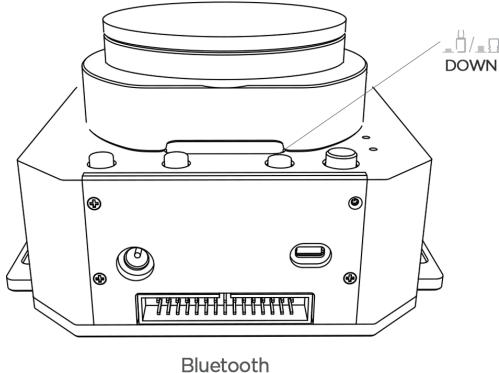
If the indicator status is steady blue, the Bluetooth mode is connected.

## 4.6.2 Bluetooth Pairing Process for Android

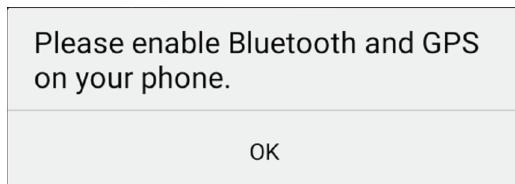
Step 1: Open uArm software and Bluetooth in your phone, click to connect

Step 2: Turn on the uArm power supply

Step 3: Press the Bluetooth button

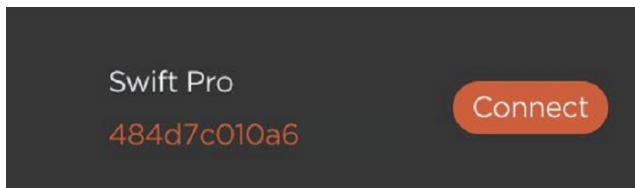


Step 4: After clicking the connection, the following interface will pop up (if no, you can skip to step 5)



In the case of ensuring positioning and Bluetooth opening, you need to open the positioning and Bluetooth usage rights in Settings - Authorization Management- uArm play.

Step 5: As shown in the figure , the name of uArm will be displayed in the software , click to connect.



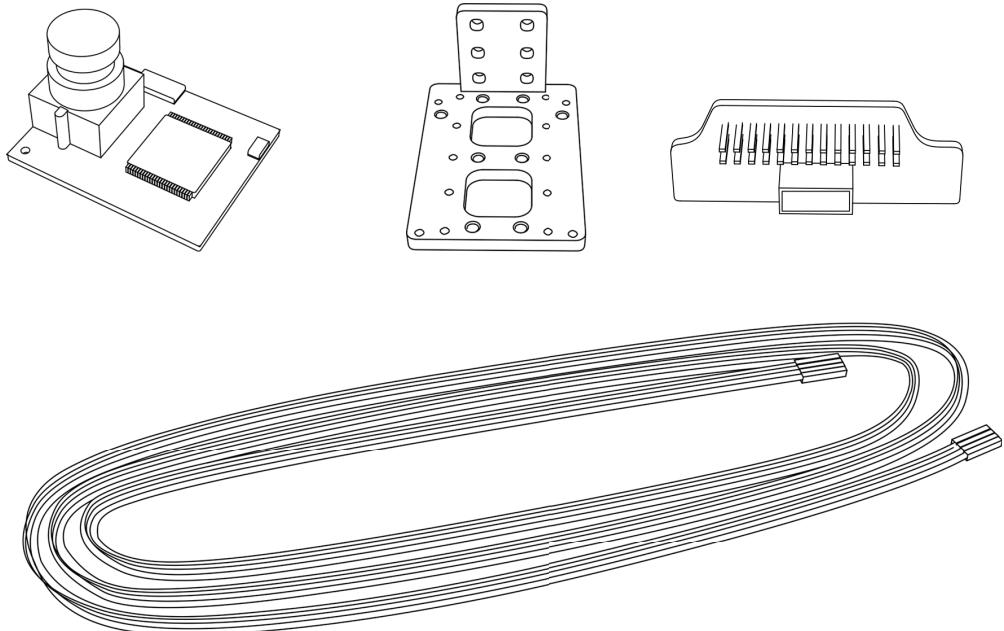
If the indicator status is steady blue, the Bluetooth mode is connected.

## 4.6.3 Precautions

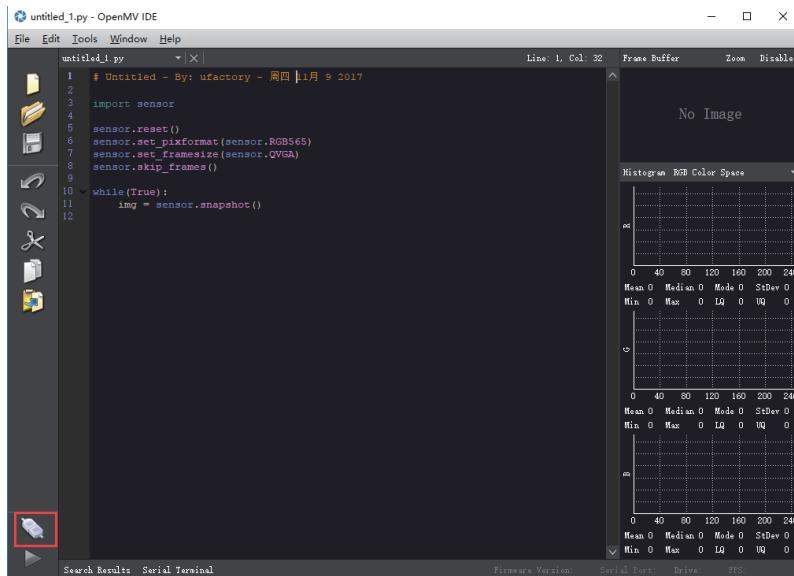
Bluetooth operation only supports firmware 3.2.0 environment.

## Appendix OpenMV module

OpenMV Module (firmware version should be at least 3.1.9 )

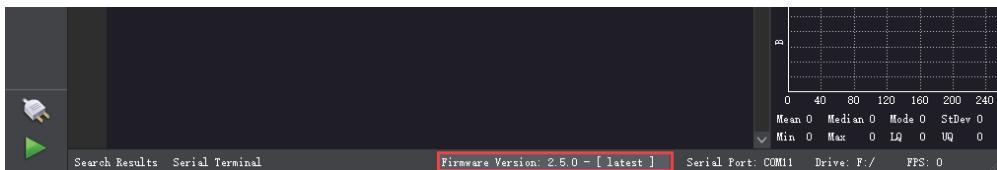


Next: Download the latest OpenMV IDE

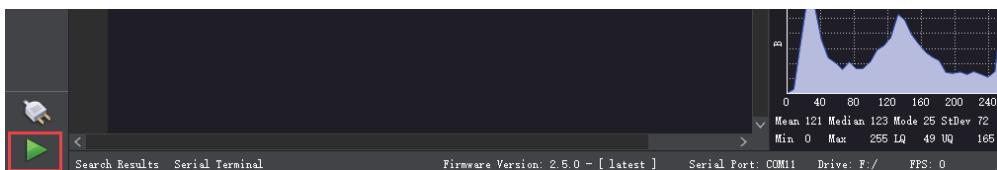


( Download the latest OpenMV IDE: [Https://openmv.io/pages/download](https://openmv.io/pages/download) , after installing OpenMV IDE , connect OpenMV to computer with USB cable , click the “Connect” button in the lower left corner of the software interface ).

Step 2 : Upgrade via OpenMV IDE OpenMV firmware



Step 3: Run helloworld.py to adjust the camera focal length through the image of the software interface.



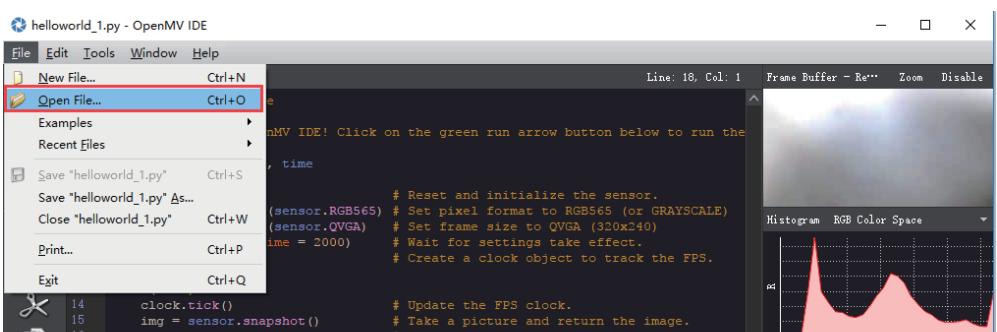
Note : When the IDE captures the image, rotate the lens to adjust the focus (you can clearly see objects outside 20cm ), tighten the screws after the focus is complete.

Step four: Download tracking.py, save to OpenMV

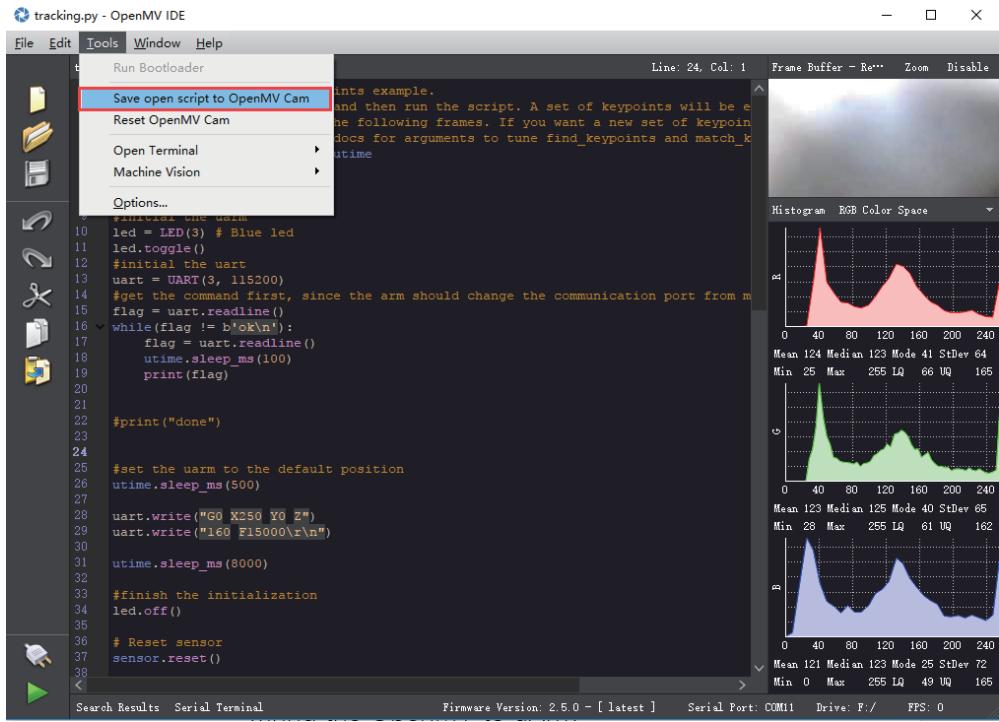
download Tracking.py:

<https://github.com/uArm-Developer/OpenMV-Examples>

Click "File" - "Open File" to import tracking.py



Click "tool" - "Save open script to OpenMV Cam" , after the code is successfully saved, restart OpenMV by plugging in the USB cable . If the code is successfully stored ,after the OpenMV module is connected to USB , the status of OpenMV is light blue.



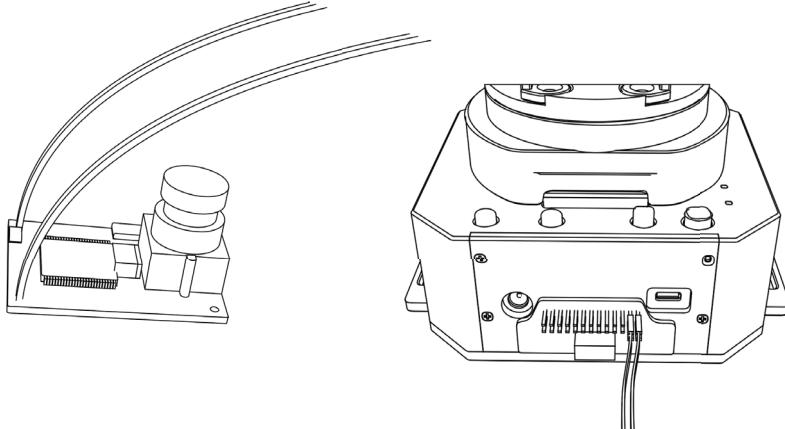
The screenshot shows the OpenMV IDE interface. The main window displays a Python script named 'tracking.py'. The script contains code for controlling an LED, initializing a UART port, and sending commands to a uArm robotic arm. The right side of the interface features three histograms for the RGB color space (R, G, B) with their respective statistical data.

```

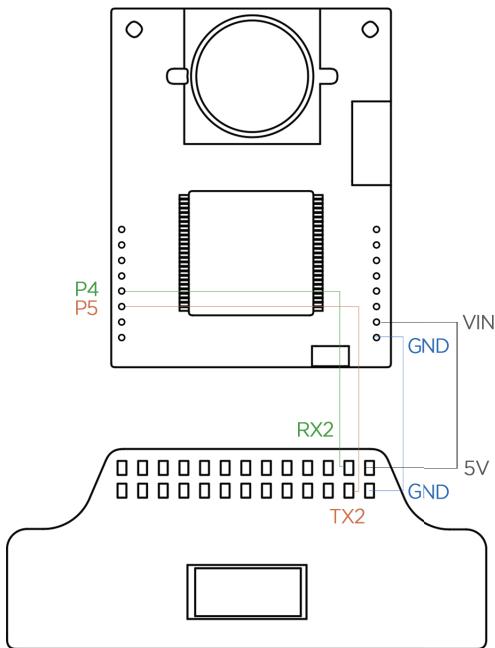
Line: 24, Col: 1
Frame Buffer - Refresh Zoom Disable
File Edit Tools Window Help
Run Bootloader
Save open script to OpenMV Cam
Reset OpenMV Cam
Open Terminal
Machine Vision
Options...
10
11
12
13
14
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```

Search Results Serial Terminal Firmware Version: 2.5.0 - [ latest ] Serial Port: COM11 Drive: F:/ FPS: 0

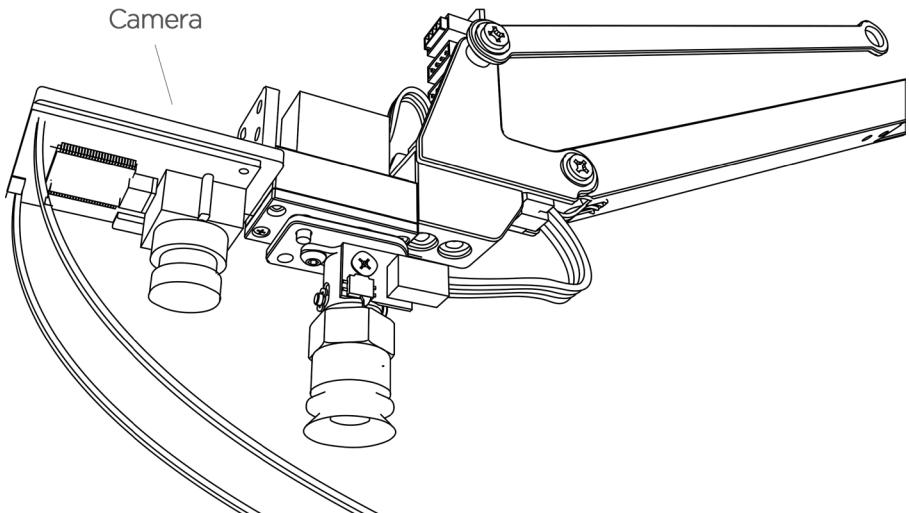
Step 5 : Unplug OpenMV USB cable, connected by wires to the robotic arm OpenMV



Note : Make sure the installation is correct or your computer may not recognize your uArm .

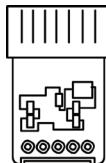


Step 6 : OpenMV secured to the robotic arm end-effector.

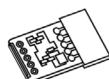
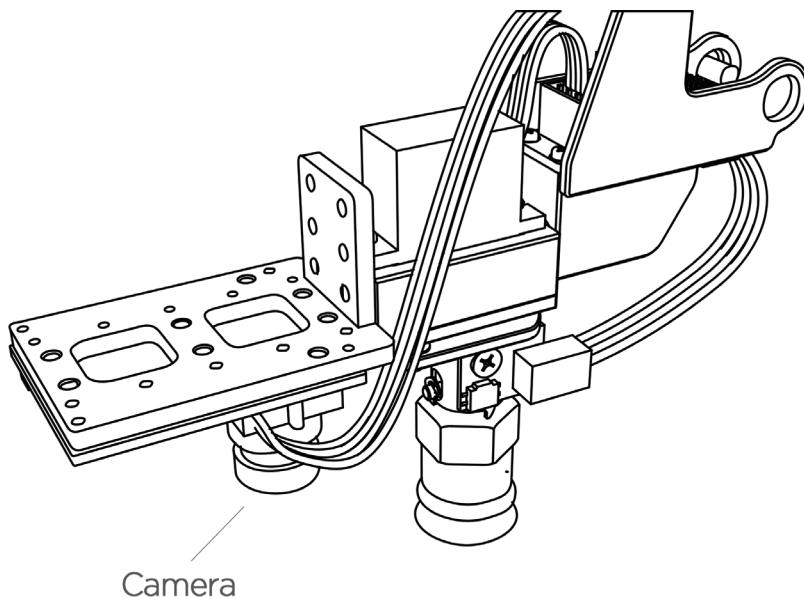


Note : Please pay attention to the installation direction of OpenMV . If the direction is wrong, The arm may move in the opposite direction. Please ensure OpenMV has already been disconnected from the computer, otherwise Open MV IDE will continue to control Open MV

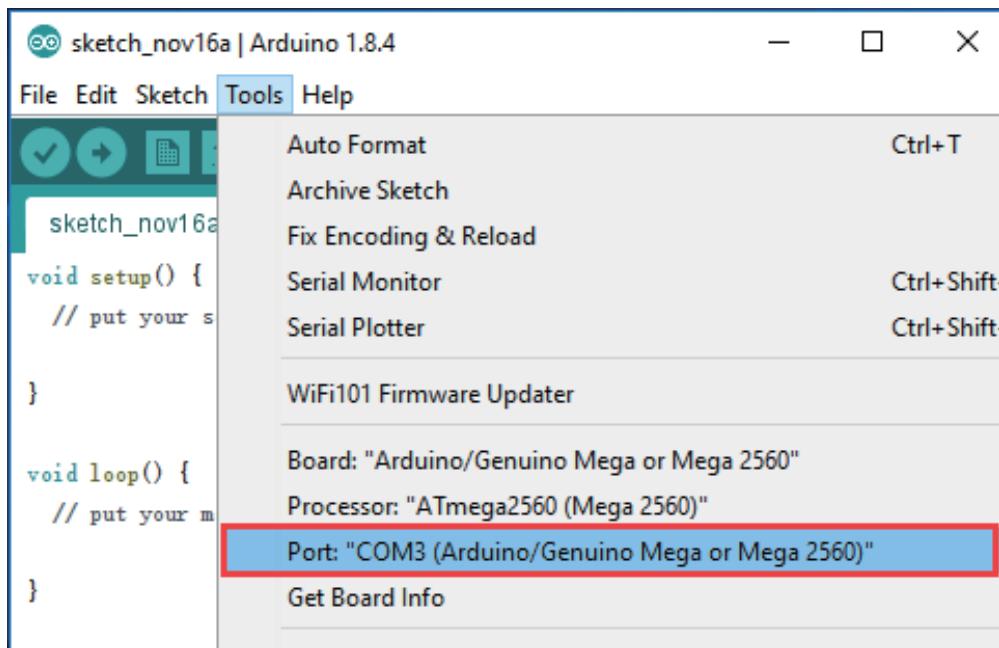
Step 7 : Make sure the desktop is clean and non-reflective. Place an easy-to-recognize object on the table, such as a small PCB with resistors.



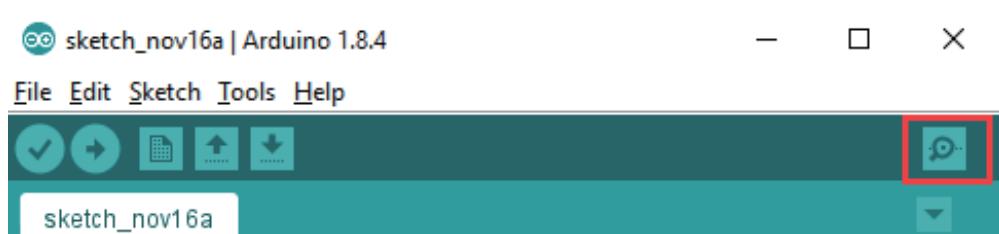
Step 8 : Place the robotic arm about 25 cm above the target object to let the Open MV recognize the object.



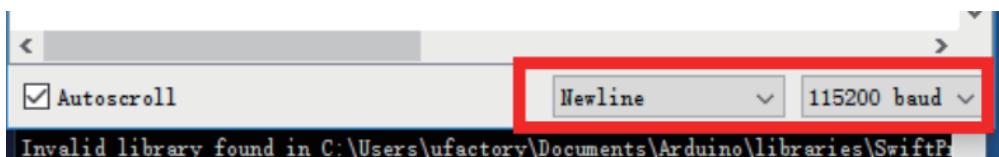
Step 9 : Power on the arm and connect it to the computer to turn on the power switch of the arm. Launch the Arduino IDE ( download the Arduino IDE ) <https://www.arduino.cc/en/Main-Software> ), select the correct COM port : COM (Arduino/ Genuino Mega or Mega 2560)



Step 10 : Click to open the serial monitor.



Step 11 : Change settings ( Line feed & 115200 baud rate ) , send M2500 command, the UART main communication port of the robotic arm will be switch from USB to OpenMV.



Step 12 : Move the object slowly and the arm will follow the target object .

## Link of Developer's Manual

### uArm Community

UFACTORY Official Forum	<a href="http://forum.ufactory.cc/">http://forum.ufactory.cc/</a>
uArm Facebook	<a href="https://bit.ly/2PUOQfE">https://bit.ly/2PUOQfE</a>
uArm Technical Support	<a href="http://www.ufactory.cc/#/cn/ticket">http://www.ufactory.cc/#/cn/ticket</a>
Product Video	<a href="https://bit.ly/30caY9M">https://bit.ly/30caY9M</a>

### Releases History

Version	Releases Description
1.0.7	Added content to 3D printing operation guide and make modification
1.0.8	Added details to OpenMV content Released Content about Laser Nozzle focal Length Released Precautions for Base Expansion Released precautions for Custom Button
1.0.9	Modified the Content of Laser Nozzle Focal Length Adjustment/Gripper Installation
1.0.10	Released OpenMV instructions Released Offline Teaching Content
1.0.11	Modified the content about OpenMV Instructions
1.0.12	Released Guidelines on 3D Printing catheter Installation
1.0.13	Released robotic arm working range diagram
1.0.14	Released 3D printing operation precautions
1.0.15	Modified the content about Gcode in the Developer's Manual
1.0.16	Modified visual kit content
1.0.17	Updated calibration card link



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Website: [www.ufactory.cc](http://www.ufactory.cc) | Email: [info@ufactory.cc](mailto:info@ufactory.cc)  
Address: 2F, Building M-6, Ma Que Ling Industrial Zone,  
Nanshan District, Shenzhen, Guangdong, P.R. China