Dobot Magician
User Manual

AN01010101 V1.2.4 Date: 2017/7/12

Shenzhen Yuejiang Technology Co.,Ltd

Revised History

Version	Date	Reason
V1.0.0	2016/09/27	Create a document
V1.0.1	2016/11/10	Add iOS APP and Bluetooth module tutorial
V1.1.0	2016/12/12	Add system adaptation description in the home page
V1.1.0	2016/12/12	Add shade laser engraving tutorial
V1.2.0	2017/2/28	Revised several function instructions
V1.2.4	2017/7/12	Add function and operation description of Linear Rail, Add angle calibration instruction, Add Beitong joystick instruction

Contents

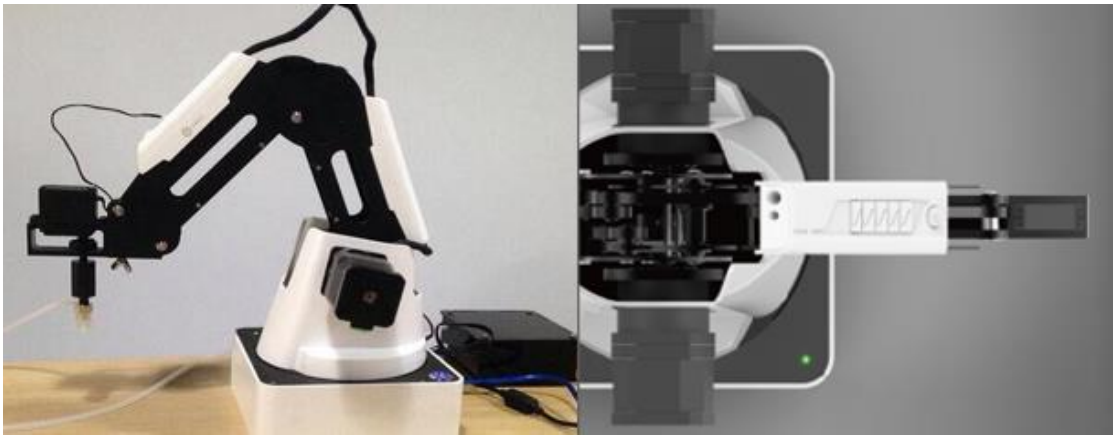
Dobot Magician User Manual Instruction and Precautions 8
1. Dobot Magician Driver Installation Instruction 10
1.1 Download CH340 driver package and install it 10
1.2 Check if the equipment can work properly in the device manager 12
2. DobotStudio Operating Instructions 13
3. Teaching & Playback 24
3.1 Air pump kit 24
3.2 Pneumatic Gripper Kit 25
3.3 Demo of Teaching & Playback 26
4. Advanced function of Teaching&Playback 28
4.1 StepRun 28
4.2 Offline mode 28
4.3 EIO multiplex 30
4.3.1 EIO locations 30
4.3.2 EIO multiplex function 32
4.3.3 EIO multiplex Demo 33
5. Write & Draw Manual 36
5.1 Installation of writing accessories 36
5.2 Connect DobotStudio 37
5.3 Import pictures and set parameters 39
5.4 Adjust the position and start writing 42
6. Laser Engraving 45
6.1 Laser Installation 45
6.2 Connect DobotStudio 45
6.3 Import pictures and set parameters 48
6.4 Adjust the focus and start writing 51
7. The Tutorial of Shade Laser Engraving 55
7.1 Installation of Laser Accessories 55
7.2 Connect DobotStudio 55
7.3 Import Pattern and Set Parameters 57
7.4 Adjust Focus and Start to Engrave 58
8. The Tutorial of 3D Printing 63
8.1 Installation of Accessories of 3D Printing 63
8.2 Repetier Host 66
8.2.1 Switch into 3D printing 66
8.2.2 Parameter Settings of 3D printing for the first time 68
8.2.3 Preparation before Printing 72
8.2.4 Adjust the printing space and get printing coordinates 74
8.2.5 Import Model 76
8.2.6 Set slice parameters and slice up 77
8.2.7 Start to Print 82

8.3 Cura Introduction for 3D printing 85
8.3.1 Cura parameter settings 85
8.3.2 Preparation before Printing 90
8.3.3 Adjust the printing space and get printing coordinates 93
8.3.4 Start printing 93
8.3.5 Text note 95
9. Base Calibration and Sensor Calibration 102
9.1 Base Calibration 102
9.2 Sensor Calibration 105
10. Bluetooth Kit 110
11. WIFI Kit 111
11.1 Set Dobot WiFi module 111
12. Stick controller kit 114
12.1 GameSir Joystick Instruction 114
12.2 Beitong Joystick Instruction 116
13. Leap Motion Kit 119
14. Mouse control 123
15. Blockly 125
15.1 Blockly Interface 125
15.2 Blockly Demo 126
16. Function Description of LinearRail 127
17. More support 136

Dobot Magician User Manual Instruction and Precautions

1. Please refer to the Dobot Magician User Manual along with the box before using.
2. Precautions:

1) Power On: Please align the Dobot into the “neutral position” by making a 45° angle between the forearm and rear arm (shown below), press the power button, and the stepper motors will lock. After about 5 seconds, there will be a short sound. If the status light switches from orgnge to green, the Dobot is ready to use. Note that if the light turns red, it indicates that the Dobot is at a limited position, so please make sure the forearm and rear arm are kept in the normal range of motion.



2) Power Off: If the status light at the bottom right of the Dobot is green, press on the power button to turn off Dobot. In this process, Dobot will move slowly to the “resting” position. **Be safe and watch your hands!**
3) If the Dobot becomes unaligned with the computer, press the **Reset** button behind the controller to recalibrate. The Dobot will automatically disconnect with the computer and reset. Then you can reconnect it.
4) Please turn off the Dobot completely first before plugging or unplugging external modules, such as Bluetooth, WIFI, Stick controller, Infrared sensor, Color sensor etc...Not powering down the Dobot before doing so may damage or break your Dobot! Note that only once the status light completely turns off, the Dobot has powered down.
5) When packing and transporting the Dobot, please unplug the left and right motors wires located near the sides to avoid damage to your Dobot.

3. Important Safety Notice：

- Small spare parts are included, so please keep them away from children, as they are a choking hazard.
- DO NOT let children play with the Dobot alone. All processes need to be monitored while running. After processes have finished, please turn off the equipment promptly.
- While using the laser module, please wear protective glasses. Avoid eye or skin exposure to direct radiation. Keep a safe distance from the laser to avoid accidental injury.
- When using the 3D printing module, the heating rod will produce temperatures up to 250℃, please be careful!
- DO NOT put hands into the operating zone while the Dobot is running. Not doing so runs the risk of bruising and/or pinching.

4. More Materials
   Follow us to get first-hand material about Dobot Magician:
   Tutorial: http://dobot.cc/tutorial/
   Download Center: http://dobot.cc/download-center/
5. DobotStudio platforms: Windows XP (DobotStudio does not support using Blockly function and Leapmotion function in Windows XP), win7 SP1 x32/x64, win8/win10, mac osx10.10 and mac osx10.11, mac osx10.12.
6. Should you have any further questions, feel free to email us at support@dobot.cc

1. Dobot Magician Driver Installation Instruction

When first connecting the Dobot, connect the Dobot to PC through the USB port. Then, power on the Dobot, then the system will recognize the corressponding hardware automatically and will search for the correct driver and install it. However, if it fails to install, you can install it again manually. The installation flow chart as follows:

1.1 Download CH340 driver package and install it

There are two versions of the driver based on Windows/Linux, so please choose the corressponding version to your OS to download. The driver can be located at the download address：

http://www.dobot.cc/downloadcenter.html?sub_cat=70#sub-download

After downloading, unzip and install the driver. The driver file is in the file **attachment** of root directory:

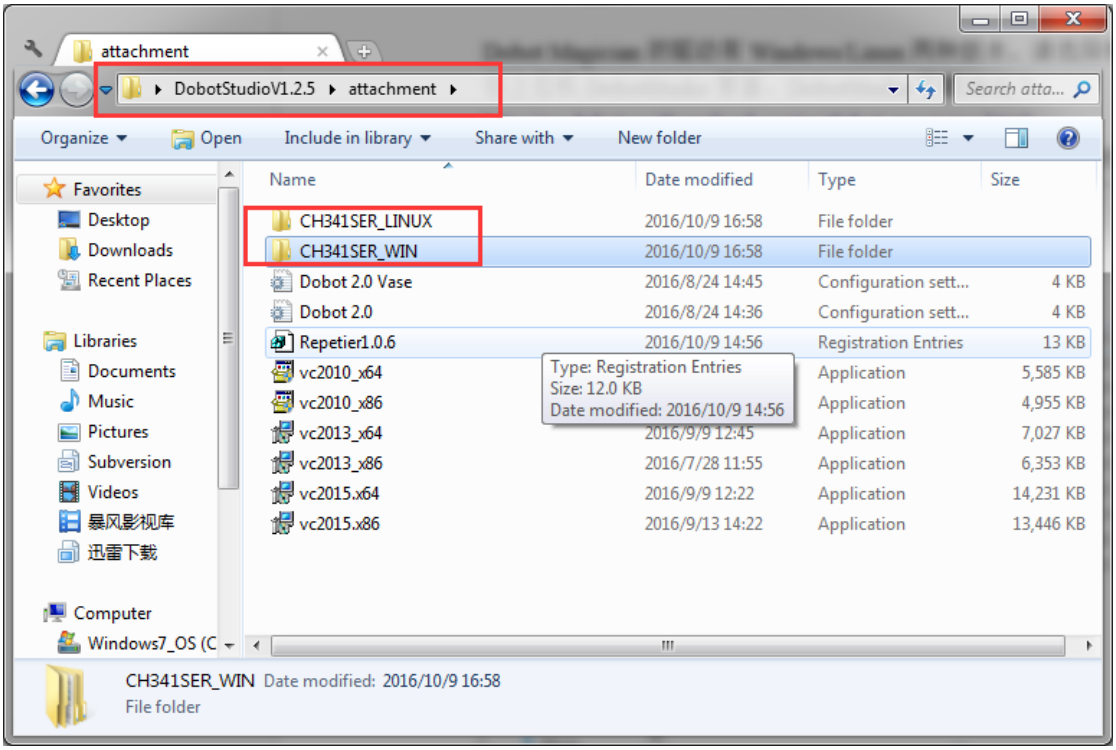


Figure 1.1 Driver file

For example, on Windows, enter into the subfolder **CH341SER_WIN->CH341SERCH341SER**. Double click **SETUP.exe** and install it, as follows:

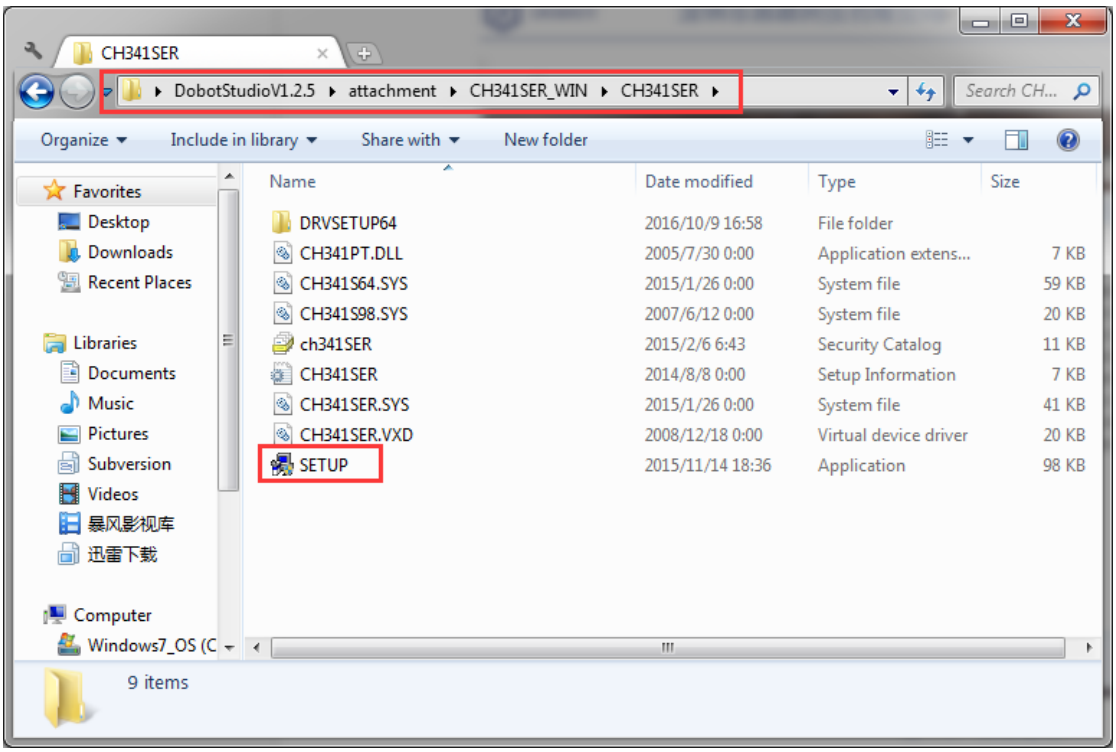


Figure 1.2 Install driver

Click **Install**:

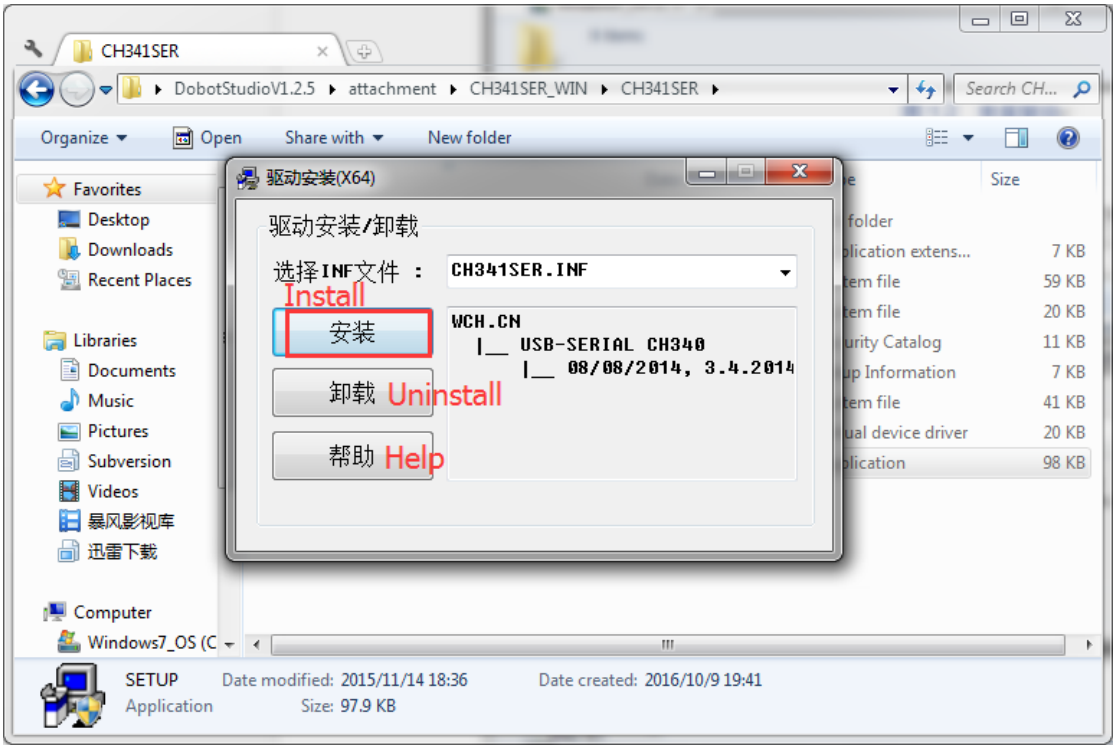


Figure 1.3 Click Install

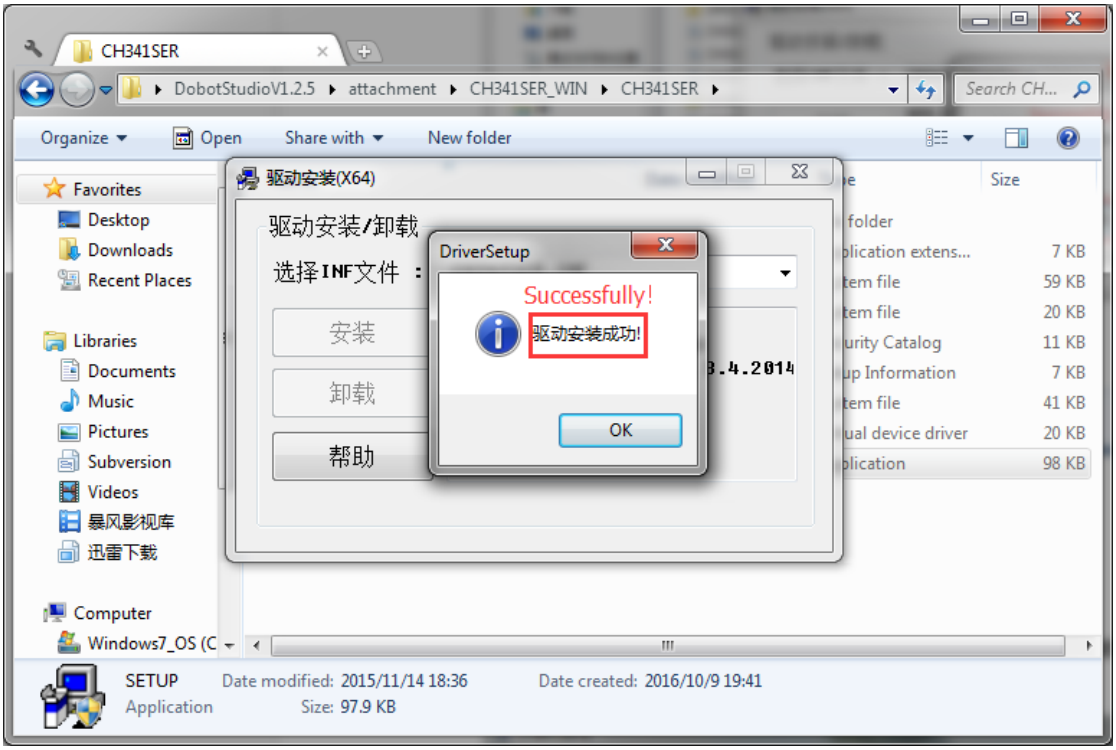


Figure 1.4 the driver was installed successfully

1.2 Check if the equipment can work properly in the device manager

1.2.1 Open the device manager and if you can find the corresponding COM port of "**USB-SERIAL CH340**", then it shows the driver is installed successfully. The correct installation is shown below:

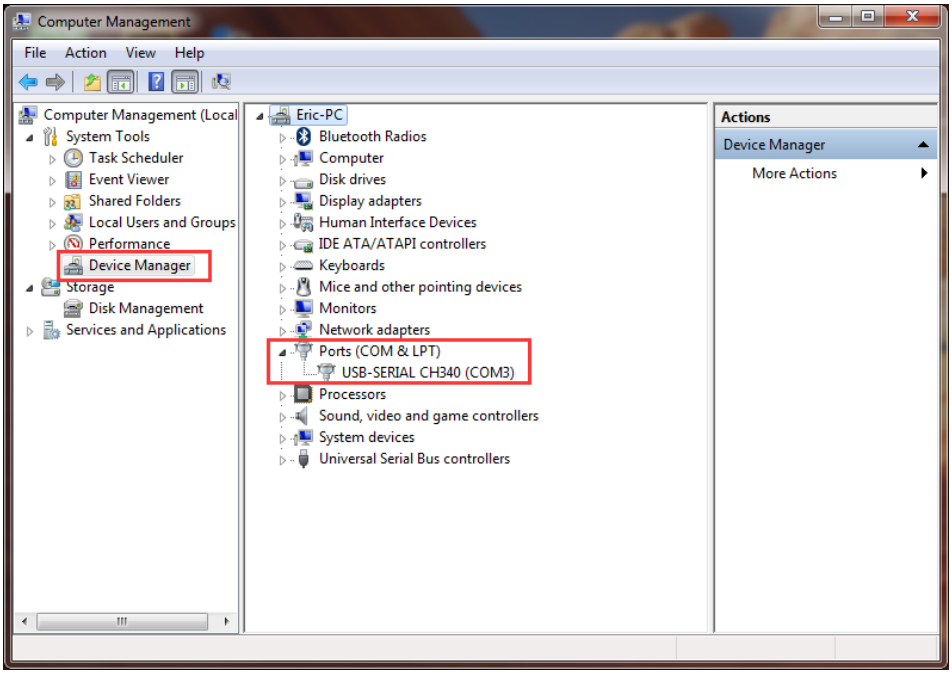


Figure 1.5 The COM port in the device management

2. DobotStudio Operating Instructions

The software used by Dobot Magician is **DobotStudio**, and you can download the latest version from our official website:

http://www.dobot.cc/downloadcenter.html?sub_cat=70#sub-download

After the file successfully downloads, unzip and double click DobotStudio.exe. Then, open the software. The result should be as follows:

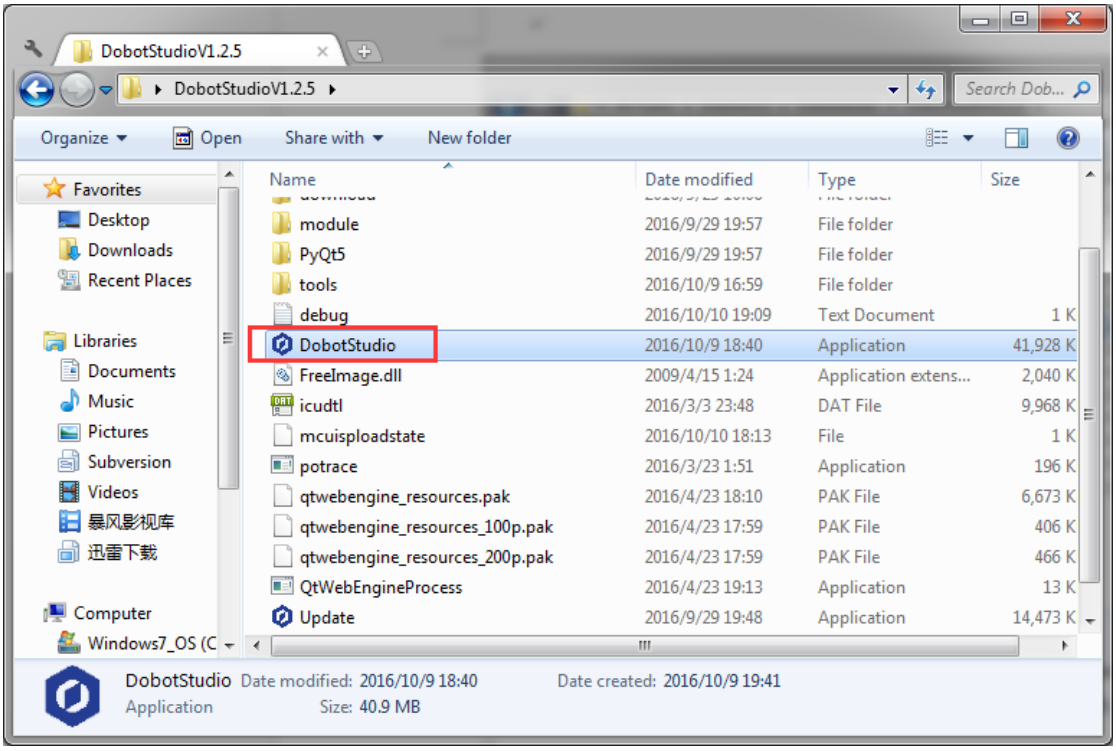


Figure 2.1 DobotStudio file

Figure 2.2 DobotStudio

Note: There may be small errors when opening DobotStudio, as shown below:

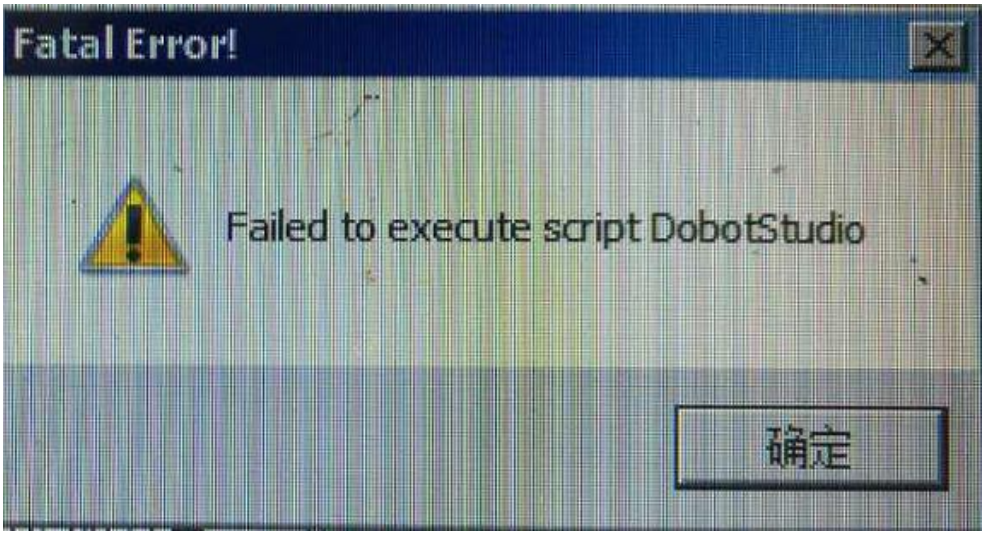


Figure 2.3 An error screen when open DobotStudio

Please right-click the DobotStudio icon and choose to run the software as administrator.

1. Select the corresponding Dobot serial port, by the top left corner of DobotStudio, and click **"Connect".** After a successful connection, **"Disconnect"** will be shown. When the Dobot is connected, the coordinate parameters will be updated on the right side of the interface as shown below:

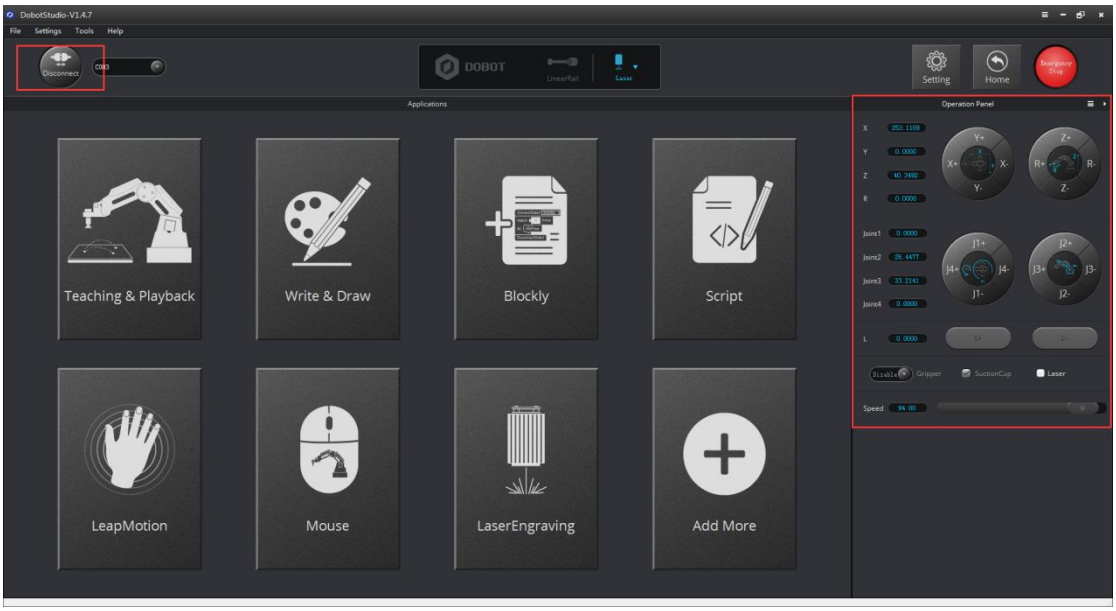


Figure 2.4 Connected successfully

There are eight modules on the main software interface:

（1）**Teaching & Playback:** A system to teach the Dobot how to move. It enables the Dobot to accomplish recorded movements by manual control.

（2）**Write & Draw:** Controls the Dobot to write, draw or laser engrave.

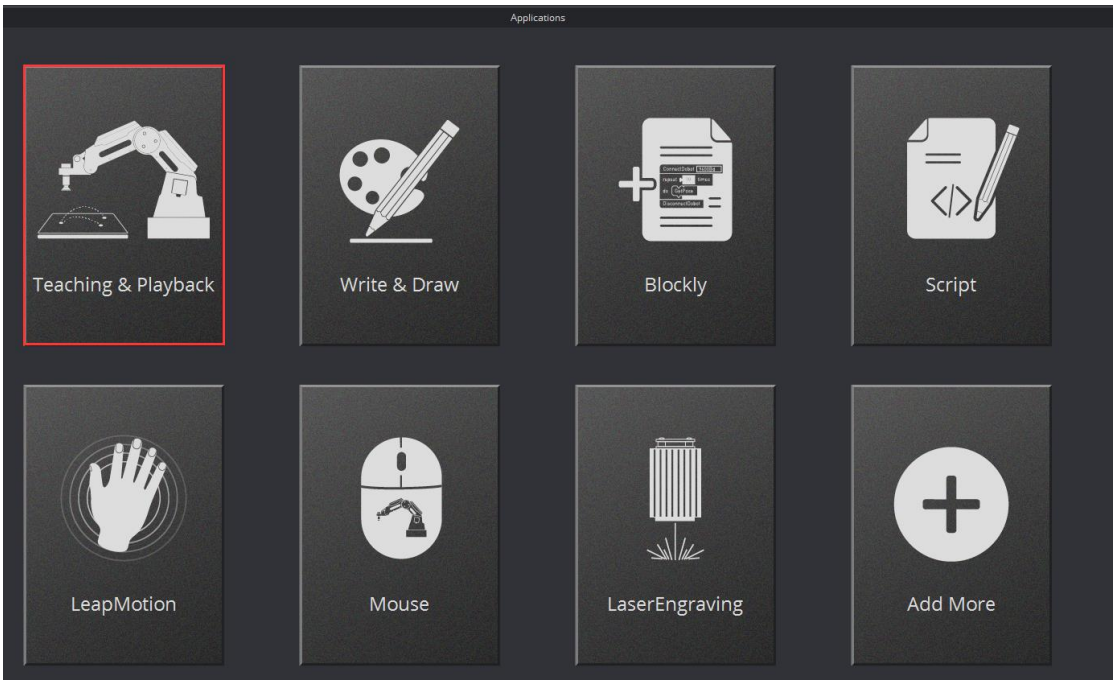
（3）**DobotBlockly**：Teaches basic programming through a puzzle interface. Intuitive and easy to understand.

（4）**Script:** Edit scripting language to control the Dobot.

（5）**LeapMotion:** Control the Dobot by gesture.

（6）**Mouse:** Control the Dobot by mouse.
（7）**LaserEngraving:** Engraves images, shapes, and words through bitmap with the Dobot.
（8）**Add More:** Add even more functions for the Dobot!

Here we will introduce Teaching & Playback at first.
Click **Teaching & Playback**, the brief introduction of each area as follows:



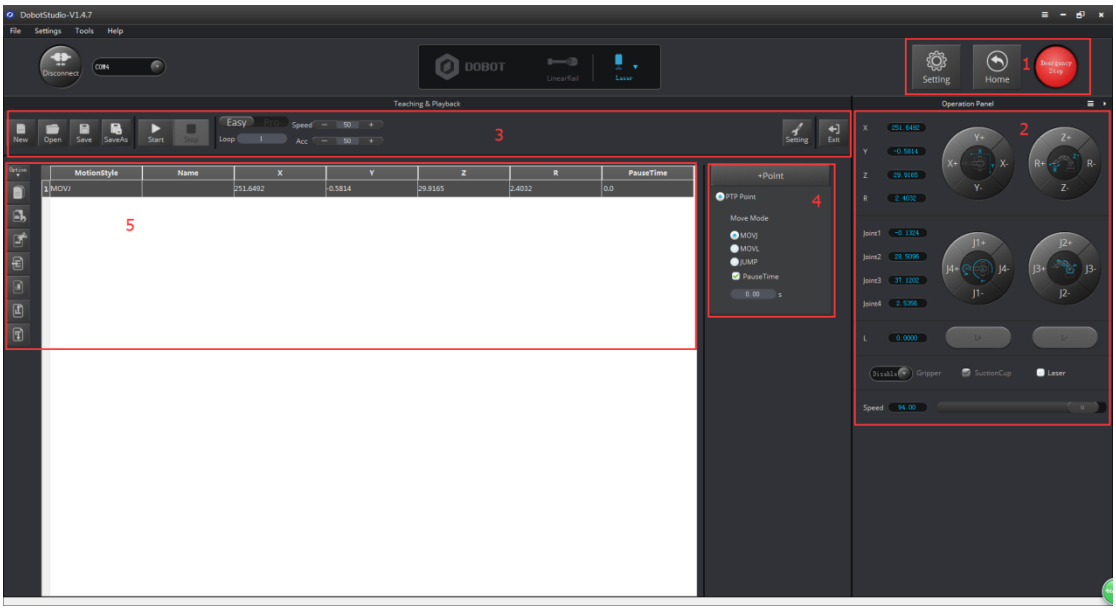


Figure 2.5 The main interface of teaching & playbac

Area 2：
Here comes with Dobot movement area, linear mode and jog mode.
Linear mode: Based on the body axes coordinate system X, Y, Z with the origin at the center of three motors. X, Y, Z is the coordinate of the center of the end platform, and the direction of X is perpendicular to the base forward, Y is perpendicular to the base

towards the left, and Z is vertical upward. R indicates the rotation of the servo joint relative to the coordinate frame (counter-clockwise is the positive direction).

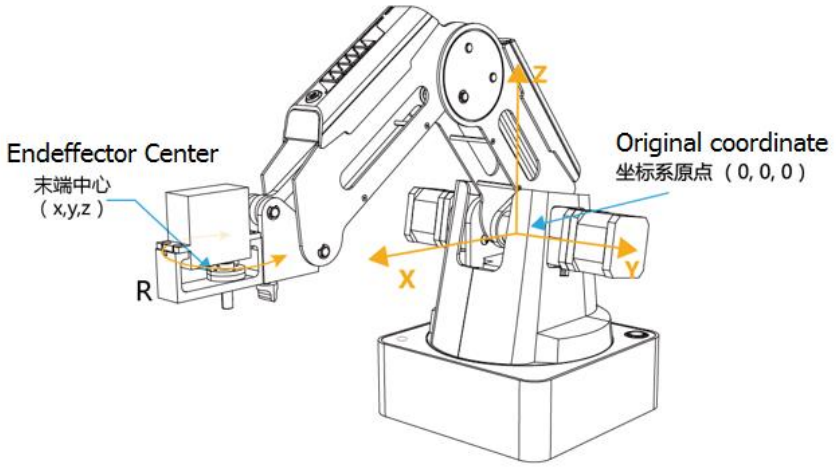


Figure 2.6 Coordinate system

（1） Click X+,X- and Dobot will move along X in the negative or positive direction;

（2） Click Y+,Y- and Dobot will move along Y in the negative or positive direction;

（3） Click Z+,Z- and Dobot will move along Z in the negative or positive direction;

（4） Click R+,R- and Dobot will move along R in the negative or positive direction.

Note:

The R-axis will move together with Y-axis during the movements, so make sure the terminal posture relative to the origin of coordinates stays constant.

Jog mode：This movement is aimed for a single axis. Hold down the button, and the corresponding axis will move independently. Once the axis is maxed out, the joint will stop moving. Each axis has counterclockwise as the positive direction. Joint1、2、3、4 refer to base, rear arm, forearm and servo respectively.

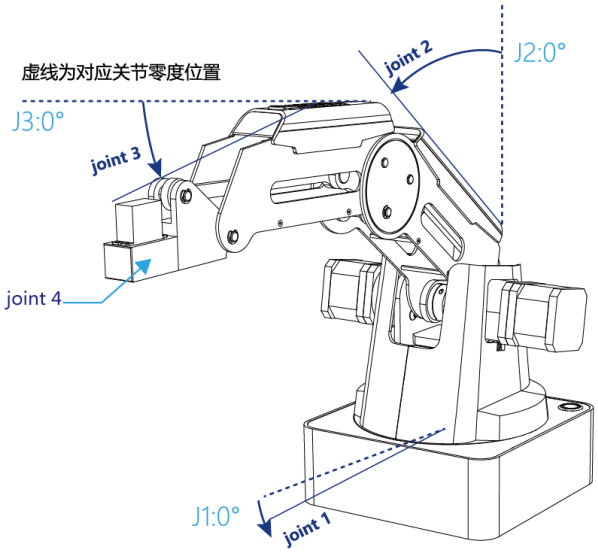


Figure 2.7 Single axis coordinate system

（1） Click Joint1+、Joint1- and control the Dobot base motor to rotate in the negative or positive direction;

（2） Click Joint2+、Joint2- and control rear arm motor to rotate in the negative or positive direction;

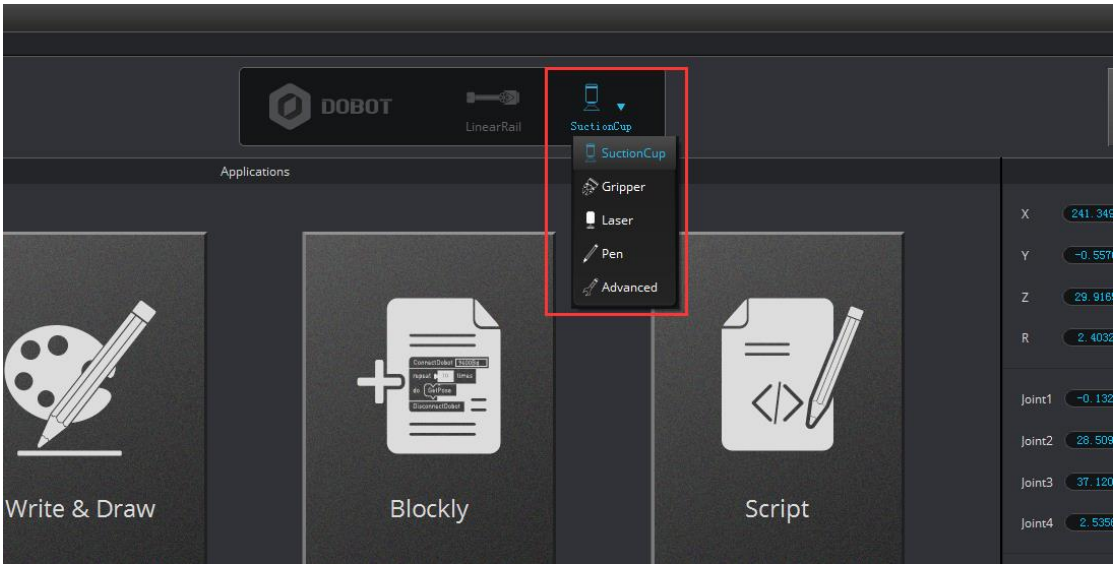
（3） Click Joint3+、Joint3- and control forearm motor to rotate in the negative or positive direction;

（4） Click Joint4+、Joint4- and control servor to rotate in the negative or positive direction;

Among this, the rotation range of Joint4 is ±150 °.

Pen/Gripper/SuctionCup/Laser:

Through choosing the corresponding buttons, open gripper/suction cup/laser.



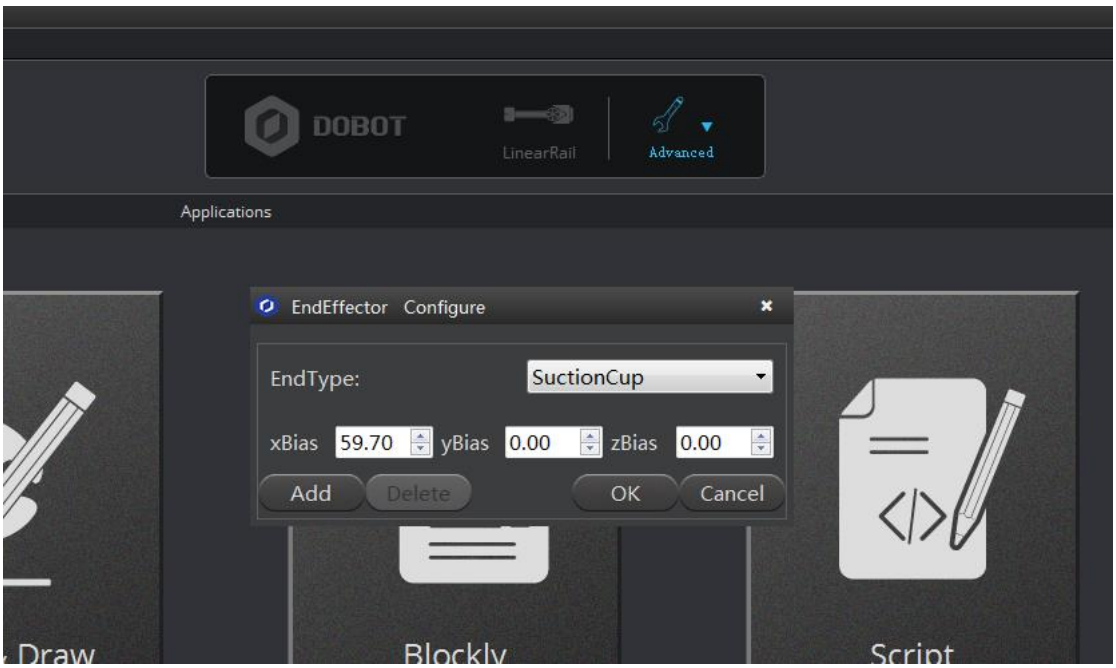


Figure 2.8 Select End Effector

You can also customize the **End Effector Configuration** according to the relative coordinate of the terminal center. The central terminal is shown as follows:

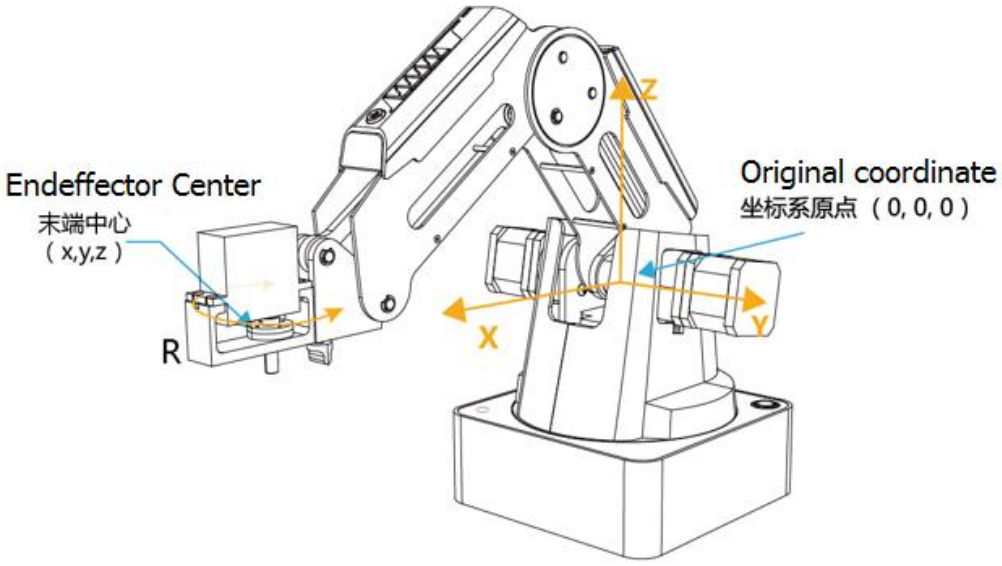


Figure 2.9 The central terminal

Speed：Adjust the ratio bar to change the velocity ratio of the movement of the jog control. The movement velocity is calculated by multiplying the corresponding percentage. Click **Settings** in Area 3 to get a fast adjustment of parameters.

Area 1：

Home：The Dobot will automatically reset to it original neutral position. When this button is pressed, the Dobot will rotate back to its preset home position. In this process, the **Home point** can be self-defined, which will be explained in area 5.

Emergency Stop： Automatically stops all processes.

Area 3：

New/ Open/Save： Create / Open / Save point list.

Start/stop: Start / Stop playback motions.

Click **Start** to start from the beginning. (The button will now change into **Pause**.) Click **Pause** when the dobot moves, and the button will change into **Resume**. Click **Resume** and it will continue to move.

Loop: Set how many times the playback will loop.

Easy/Pro： Mode switch, including offline mode and I/O settings, and refer to the detailed tutorial: The tutorial of advanced functions.

Speed/Acc: Detailed parameter configuration of playback speed and acceleration.

Settings：Set movement parameters.

You can also set the velocity and acceleration of single joint.

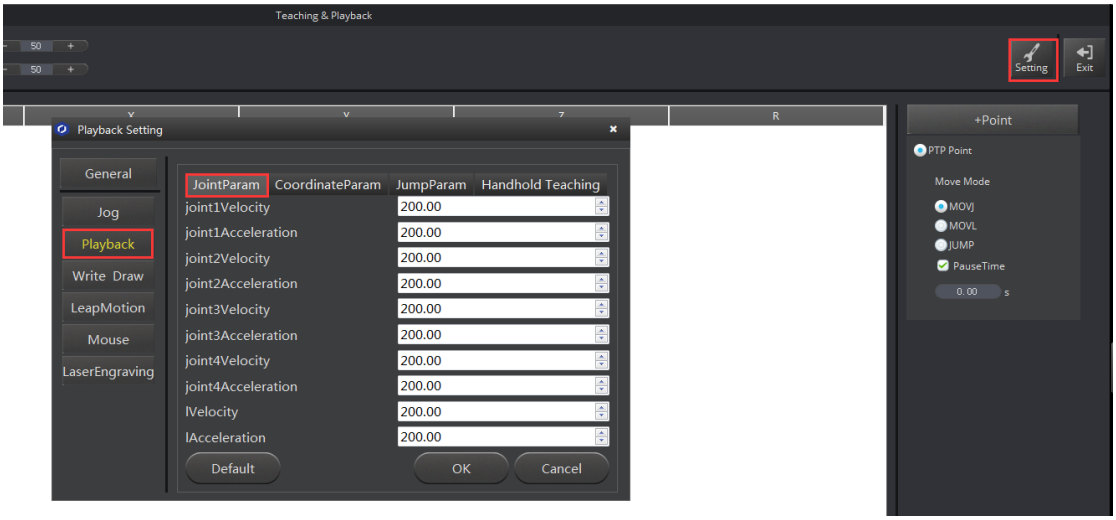


Figure 2.10 Parameters of single joint movement

Set velocity and acceleration of coordinates:

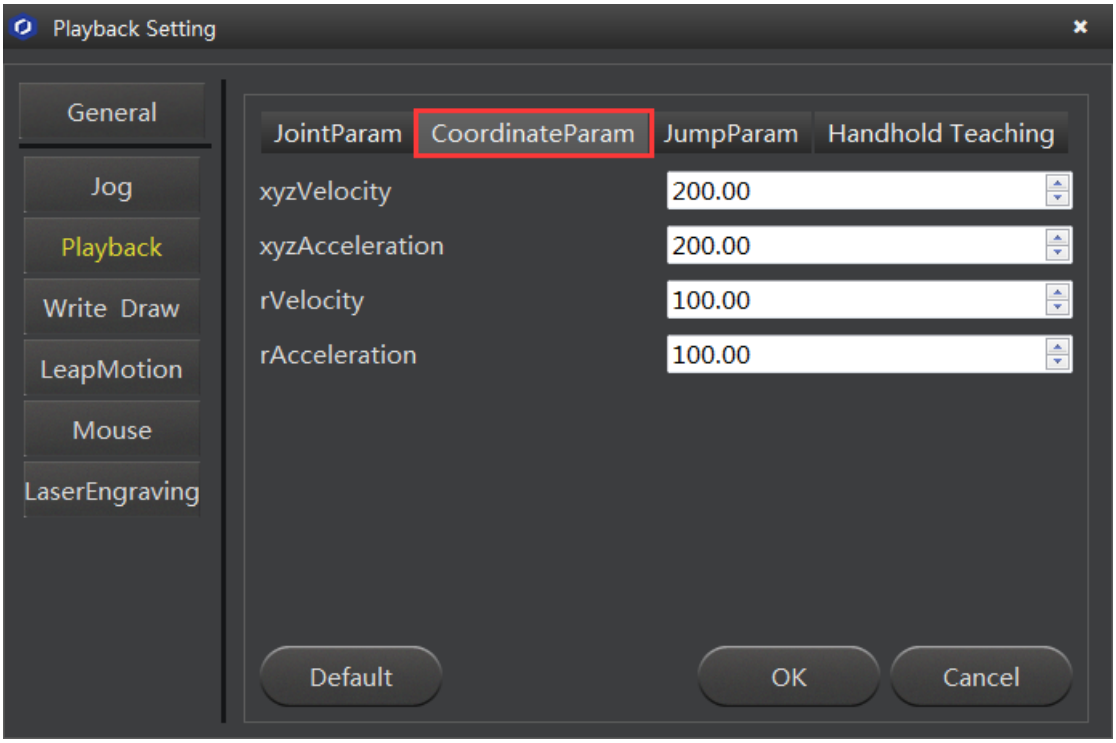


Figure 2.11 Parameter settings of coordinates

The height and Z limit of Jump mode:

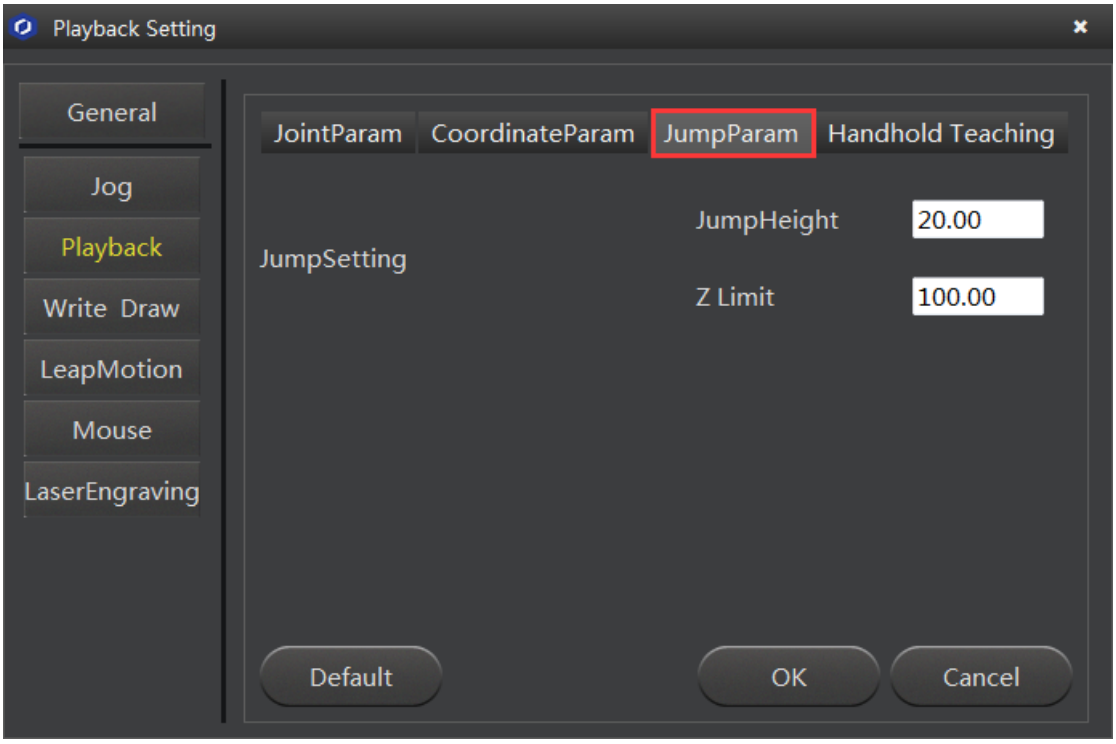


图 2.12 Jump mode settings

Handhold teaching: Tick the function says, “Enable Handhold Teaching”. Then, press and hold down Unlock on the forearm and drag the Dobot to any position. You can save a point after letting

go of the Unlock button. Of course, you can save points continuously. After all the points are recorded, Dobot will be able to play back the programmed trajectories.

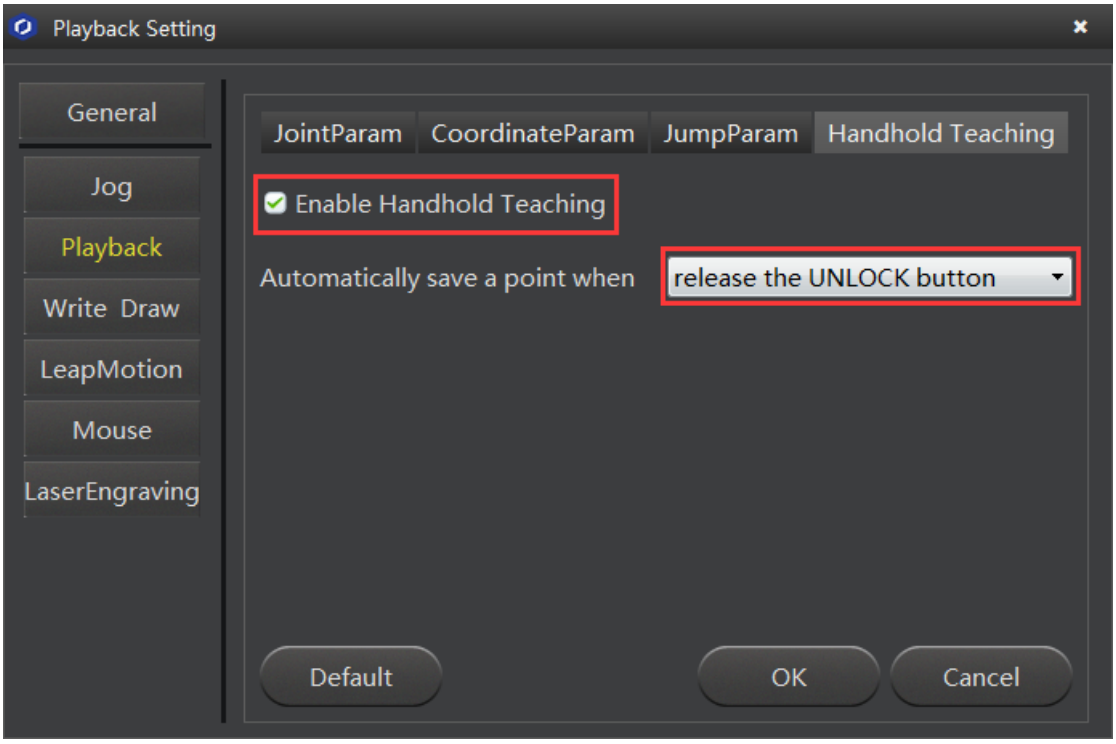


图 2.13 Playback settings

Area 4：Select save mode.

1. Click **+Point,** you can save the current point information in area 5.
2. **PTP Point**：Point mode, and three modes between saved points, **JUMP**、**MOVJ**、**MOVL** respectively.

   JUMP： From point A to point B, the trajectory is shown below, the end effector will lift upwards by amount of Height (in mm) and move horizontally to a point that is above B by Height and then move down to Point B.

Figure 2.14 JUMP Mode

MOVJ：Joint movements. From point A to point B, each joint will run from initial angle to its target angle, regardless of the trajectory. The motion time for all joints are the same which

means all joints will start and finish at the same time.

MOVL：The joints will perform a straight line trajectory from point A to point B.

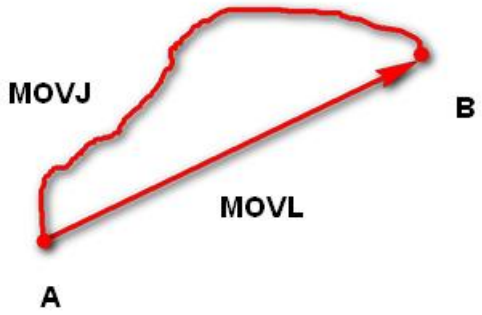


Figure 2.15 MOVL/MOVJ Mode

3. **Pause Time**：The pause unit of time is 1 second.
4. **CP Point**：Track points, saved points between velocity and acc transmit smoothly.

Area 5：Playback list that can be edited.

To show the current endeffector coordinates, Move Mode, pause time and any other parameters, double click to edit every single saved point coordinate. You can also edit from the sidebar on the left side or press right –hand button:

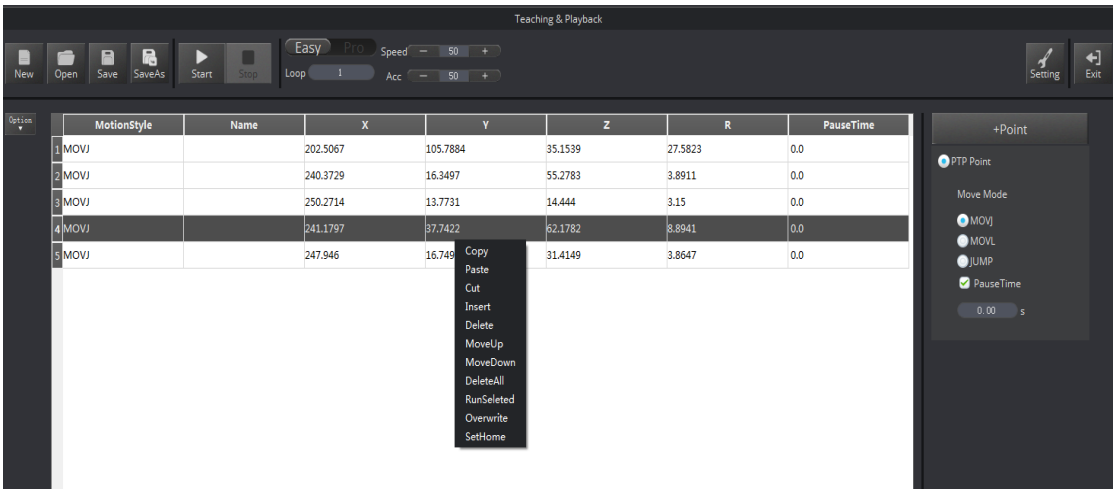


Figure 2.16 Right click options of the saved point list

1. **MotionStyle：JUMP、MOVJ、MOVL.**
2. **X, Y, Z** is the coordinate of the center of the end platform.
3. **RHead** indicates the rotation of the servo joint relative to the coordinate frame (counter-clockwise is the positive direction).
4. **PauseTime**.
5. **Insert**：Insert a line of saved points.
6. **MoveUp/MoveDown**: Move up/Move down the line of saved point.
7. **Delete**：Delete selected saved points。
8. **DeleteAll**: Delete all saved points.

9. **RunSeleted**: Execute selected points.
10. **Overwrite**：Overwrite current saved points.
11. **SetHome**:Set as Home point location.

3. Teaching & Playback

Here we will learn how to suck up or grab simple objects using the function of Teaching & Playback. Because we need to use the air pump kit for the suction cup and the gripper kit, we will introduce these two kits together.

3.1 Air pump kit

The default installation of the Dobot Magician is the suction cup. The pump box and suction cup kit is shown below:

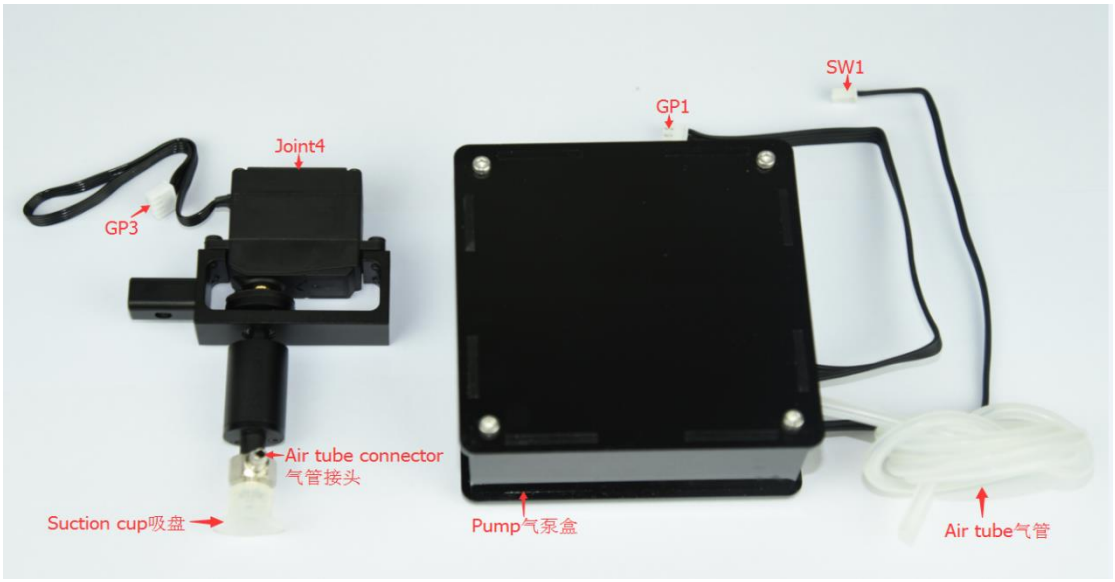


Figure 3.1 Air pump kit

Installation Steps:

1. Connect power line SW1 on the pump box with interface SW1 on the controller box, connect signal line with interface GP1;
2. Tighten air pump kit into the end of the socket with butterfly nut;
3. Connect windpipe on the controller box with pipe connector on the pump box;
4. Connect GP3 of Joint4 servo line with forearm connector①GP3.

The installation effect as follows:

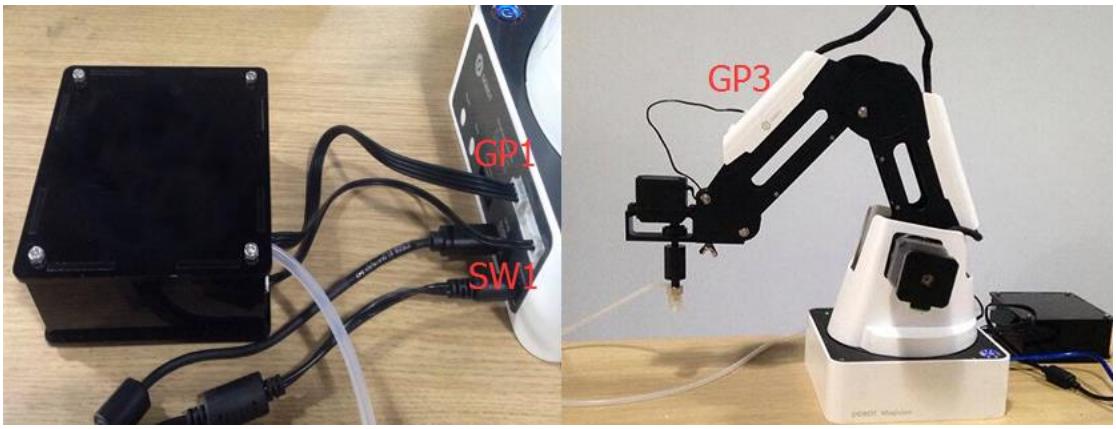


Figure 3.2 The installation effect of air pump kit

3.2 Pneumatic Gripper Kit

1. Pneumatic accessories are shown in following picture:

Figure 3.3 Pneumatic Gripper Kit

2. The gripper kit shares the air pump kit of suction cup. You can remove the suction cup from Joint4. Unscrew the fixed on the suction cup with the hex wrench, shown in Figure 3.4:

Figure 3.4 Remove suction cup

3. Install the gripper kit on Joint4 with the coupler, as shown in Figure 2.5:

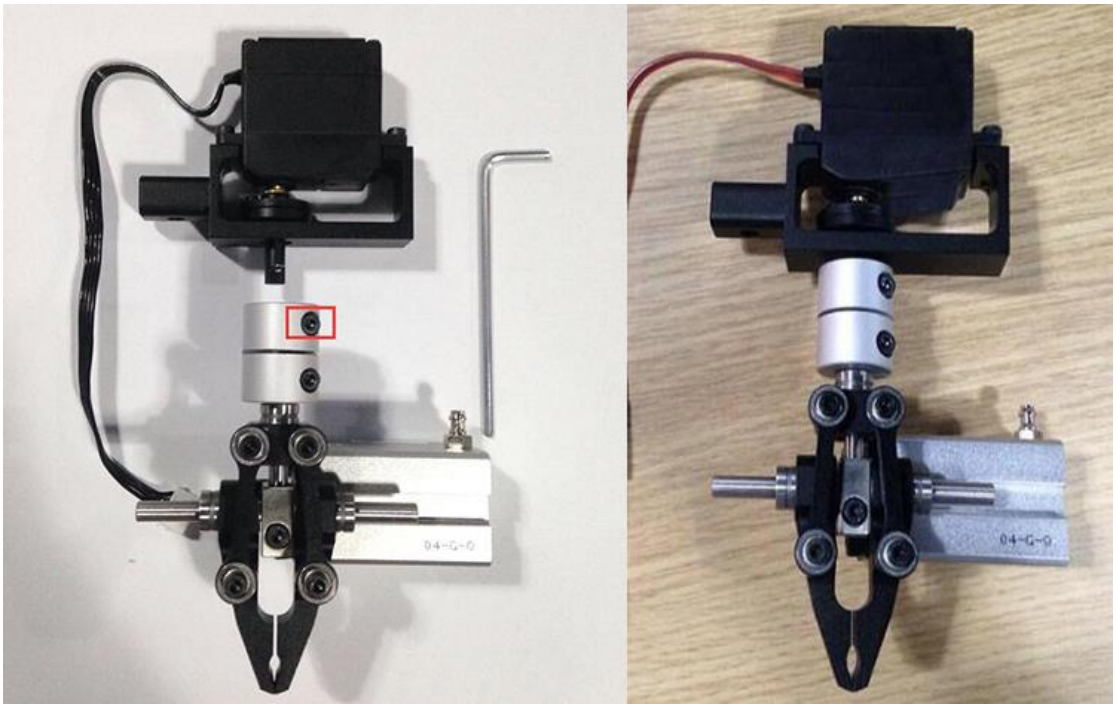


Figure 3.5 Gripper Installation

4. The connection method of gripper is the same with air pump kit. You can refer to air pump kit method above.
5. The installation effect of gripper kit as follows:

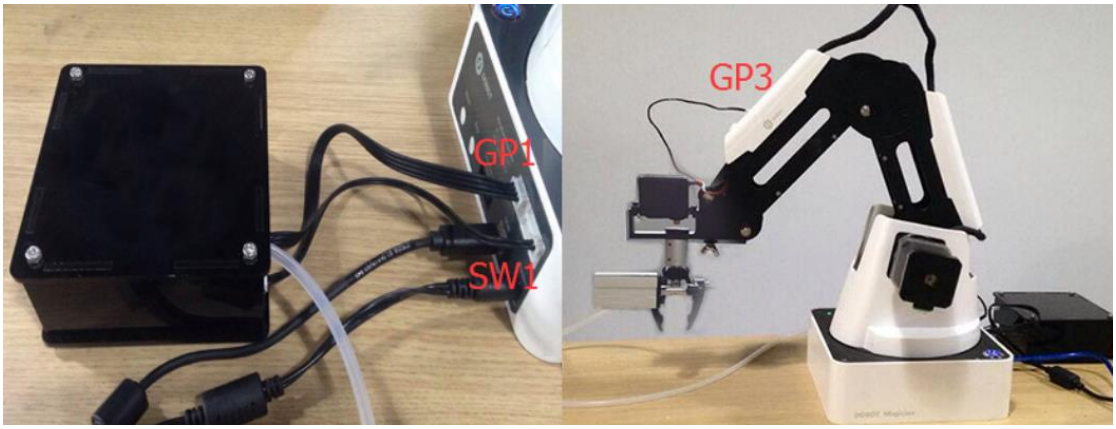


Figure 3.6 Gripper Installation

3.3 Demo of Teaching & Playback

After learning about the software, now we can try to make Dobot Magician move. Through the function of Teaching & Playback, we can make it move a small object.

1. Select the terminal tool as **SuctionCup** on the software interface and select **JUMP** mode.
2. Place a small object nearby and move the Dobot above the small object. Click **Area 2**, tick **SuctionCup** and open the pump. The small object will be sucked up.
3. Click **+Point** and save a point.

4. Click **Z+** to raise the Dobot and move the arm to another position. Place the small object on the table, uncheck **SuctionCup,** and close the pump.
5. Click **+Point** and save one more point.
6. Put back the small object and click **Start**. Our task for moving the object from the current location to another location has been completed successfully.

4. Advanced function of Teaching&Playback

You can switch Easily into Pro when pressing the button "**Easy/Pro"**, as shown below:

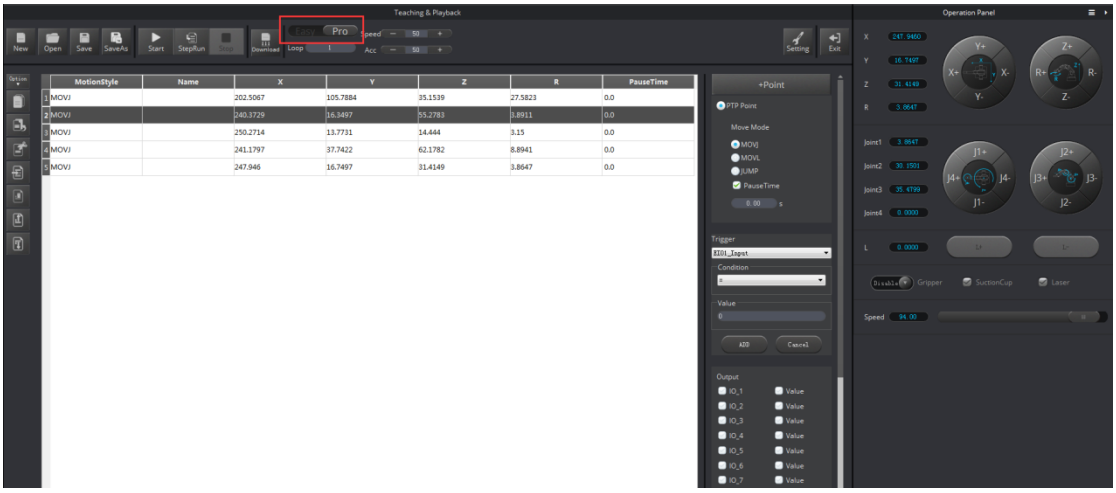
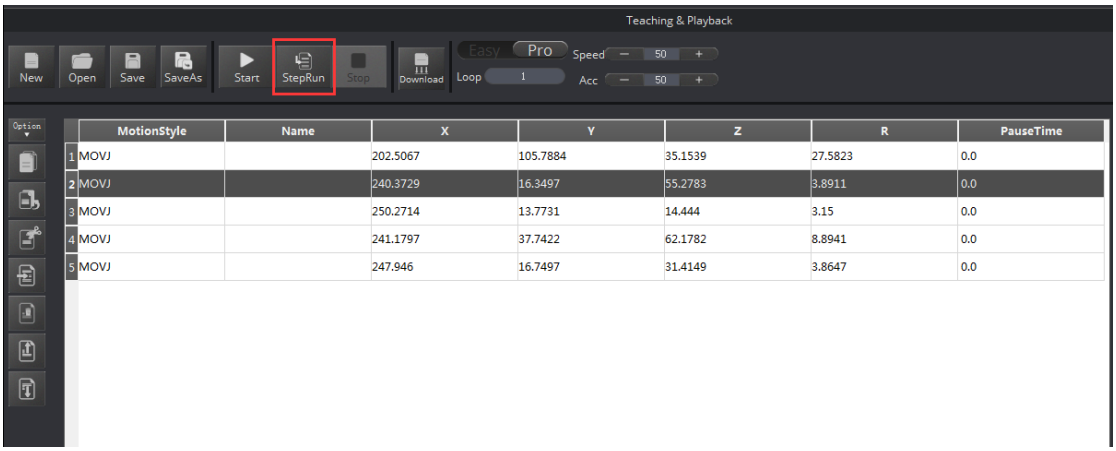


Figure 4.1 Advanced function of teaching&playback

4.1 StepRun

1. **StepRun:** StepRun allows you to execute one command at a time. Pressing it once executes the first motion, and subsequent presses will execute commands down the list one at a time.



	MotionStyle	Name	X	Y	Z	R	PauseTime
1	MOVJ		202.5067	105.7884	35.1539	27.5823	0.0
2	MOVJ		240.3729	16.3497	55.2783	3.8911	0.0
3	MOVJ		250.2714	13.7731	14.444	3.15	0.0
4	MOVJ		241.1797	37.7422	62.1782	8.8941	0.0
5	MOVJ		247.946	16.7497	31.4149	3.8647	0.0

Figure 4.2 StepRun

2. Click **Stop** and then you can exit the mode of StepRun.

4.2 Offline mode

1. Click **Download** to download the current saved points list into the Dobot. A USB cable will not be needed for use.

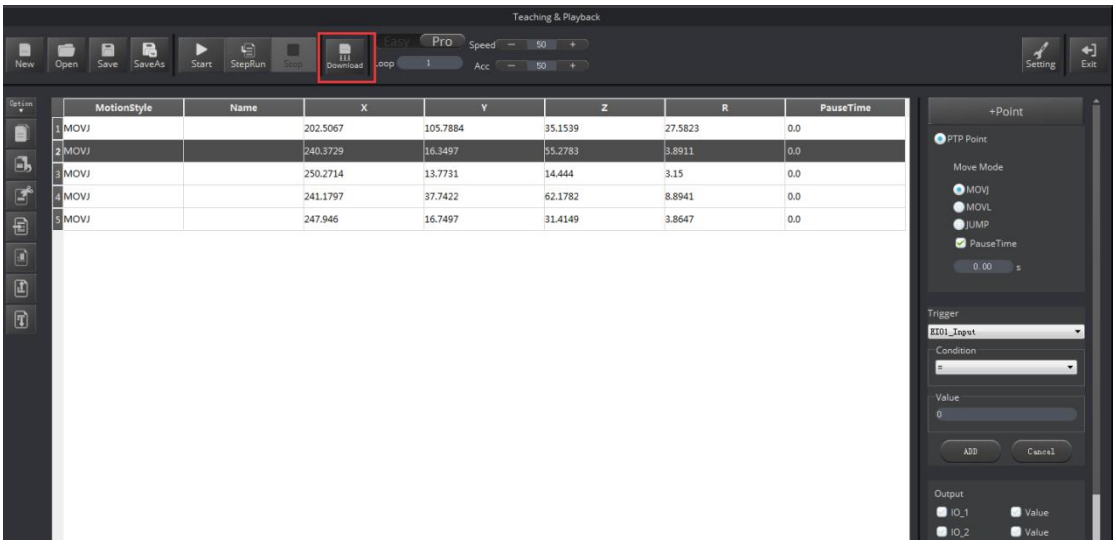


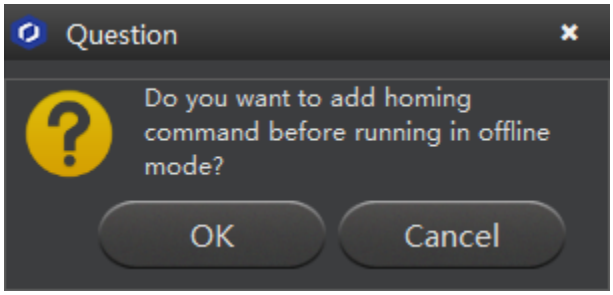
Figure 4.3 Download saved point list

2. After downloading, pull out the USB cable, press **Key** behind the controller box, and execute the downloaded program. The program will stop executing when it is pressed again.

Figure 4.4 Offline mode button

Note: Before offline mode can be used, the Dobot needs to be reset by pressing Home. Switch on the Dobot, wait 20 seconds after the green light is on, and click **Home** when the sensor is stable.

1) The blue light will flash during homing. It is completely normal for that to happen. Do not operate the Dobot until the green light is on.
2) After homing, you can save points and then download. Click **OK** in the dialog box.



Playback steps:
Switch on the Dobot, wait 20 seconds after the green light is on, and then click **Key** to move offline when the sensor is stable.

4.3 EIO multiplex

The EIO (Extended I/O) in Dobot has multiple functions and uses. This chapter aims to address all the functions for DobotV2.0 EIO.

The EIO interface of advanced functions is shown below:

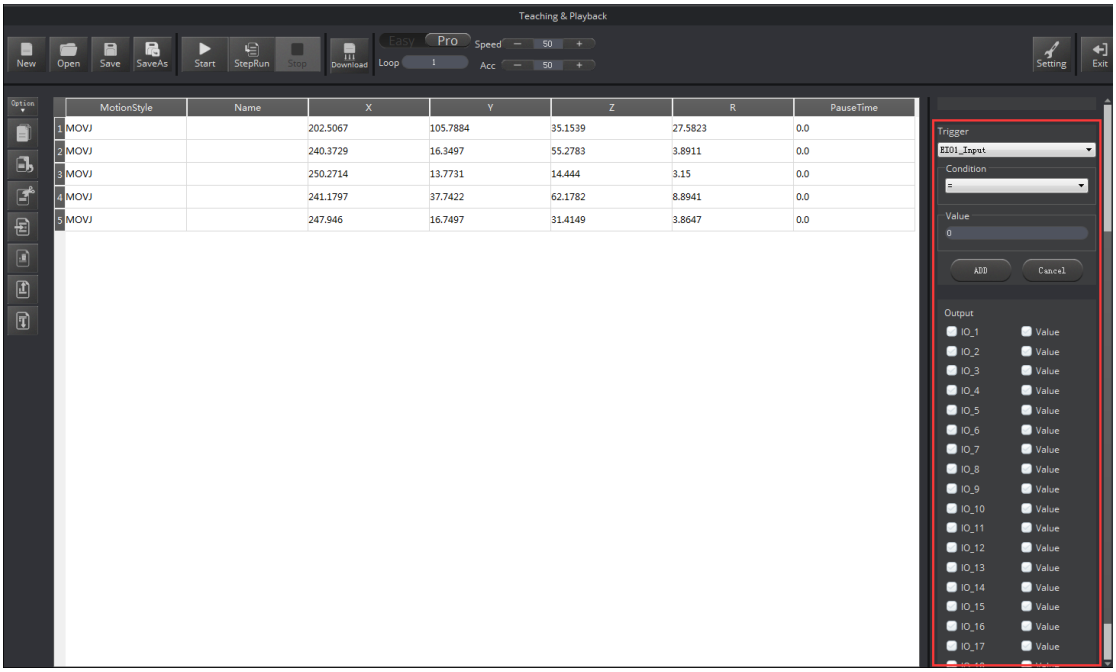


Figure 4.5 EIO Interface

4.3.1 EIO locations

EIO are located near the base and forearm separately in DobotV2.0.

1）EIO located in the forearm are shown below:

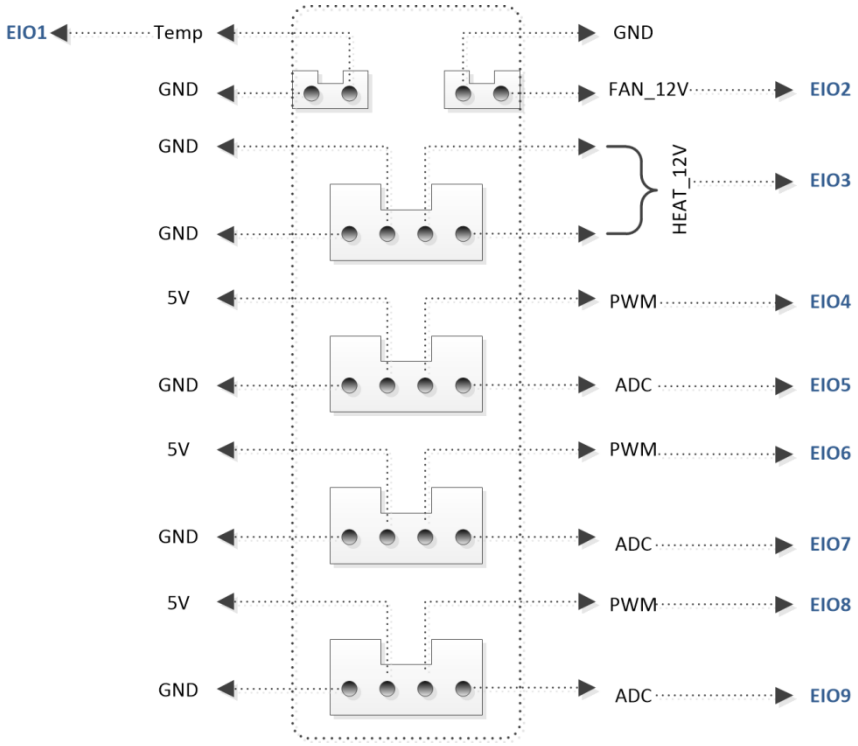


Figure 4.6 EIO addressing in forearm

2）EIO located in the base 18PIN interface board are shown below:

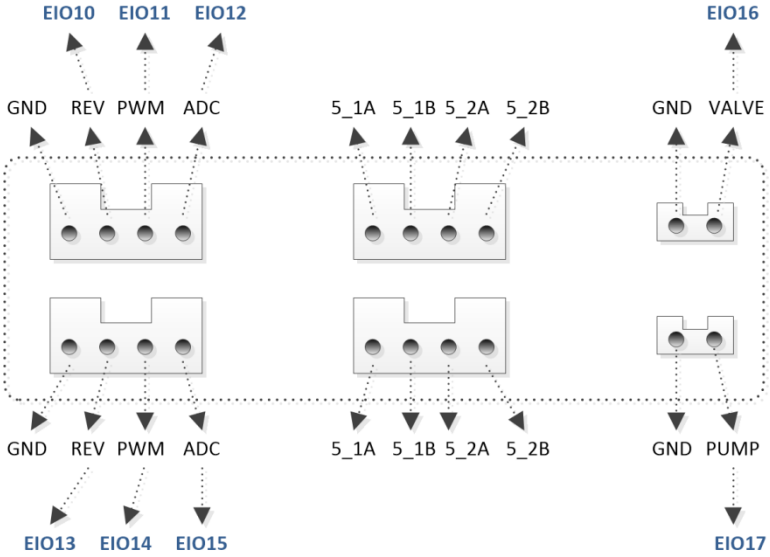


Figure 4.7 EIO addressing in base 18PIN

3）EIO located in the base 10PIN interface board are shown below:

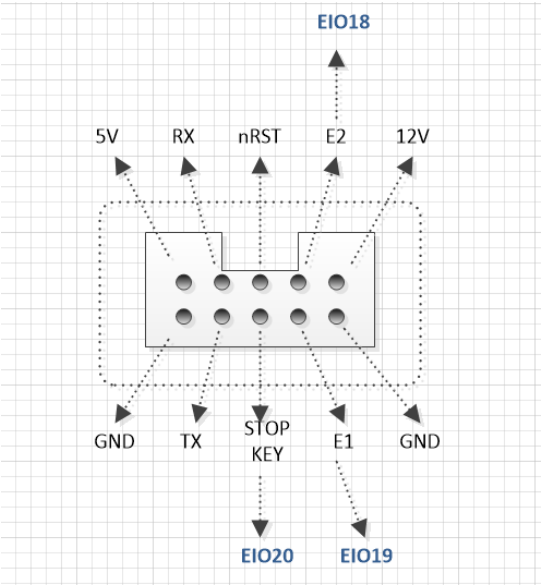


Figure 4.8 EIO addressing in base 10PIN

4.3.2 EIO multiplex function

Now let's describe the EIO multiplex function. (Depending on hardware)

1）EIO multiplex instruction of forearm interface board, as shown below:

Figure 4.1 EIO multiplex instruction of forearm interface board

EIO addressing	Level Range	Level Output	PWM	Level Input	ADC
O1	3.3V	√		√	√
O2	12V	√			
O3	12V	√			
O4	3.3V	√	√	√	
O5	3.3V	√		√	√
O6	3.3V	√	√	√	
O7	3.3V	√		√	√
O8	3.3V	√	√	√	
O9	3.3V	√		√	√

2）EIO multiplex instruction of 18PIN interface board on the base, as shown below:

Figure 4.2 EIO multiplex instruction of 18PIN interface board on the base

EIO Addressing	Level Range	Level Output	PWM	Level Input	ADC
10	5V	√			
11	3.3V	√	√	√	
12	3.3V	√		√	√
13	5V	√			
14	3.3V	√	√	√	
15	3.3V	√		√	√
16	12V	√			
17	12V	√			

3） EIO multiplex instruction of 10PIN interface board on the base, as shown below:

Figure 4.3 EIO multiplex instruction of 18PIN interface board on the base

EIO Addressing	Level Range	Level Output	PWM	Level Input	ADC
18	3.3V	√		√	
19	3.3V	√		√	
20	3.3V	√		√	

4.3.3 EIO multiplex Demo

Selected corresponding EIO, set input/output condition, and then you can multiplex each unique EIO. Here we have detailed explanation of level output, level input, ADC input and PWM output.

1） Level Output

Take EIO01 on the forearm connector for an example, it can configure level output into 3.3V. Shown as follows:

EIO Addressing	Level Range	Level Output	PWM	Level Input	ADC
O1	3.3V	√		√	√

Tick **IO_1**(in the output option) **-> tick Value**, -> **+Point**, and then it can be configured into high-level output of 3.3V(If you don't tick it, please choose low-level output).

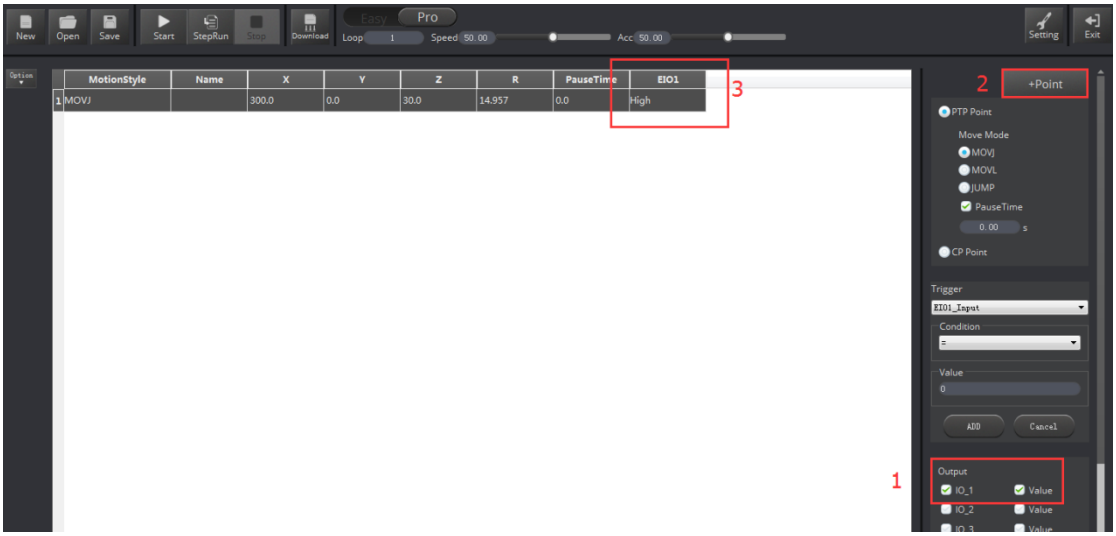


Figure 4.9 High level output of EIO1 demo

2） Level input

Also, take EIO01 on the forearm connector for an example, if you get an external photoelectric sensor, it will trigger Dobot move and can be configured into low/high level input trigger mode when access to an inductive object. Select trigger point->**EIO1_Input** (Trigger area on the bottom right)-> **Condition=1->add ADD key.** Cancel key can delete trigger settings of the current point. Trigger Value=0 denotes a low level and Value=1 denotes a high level.

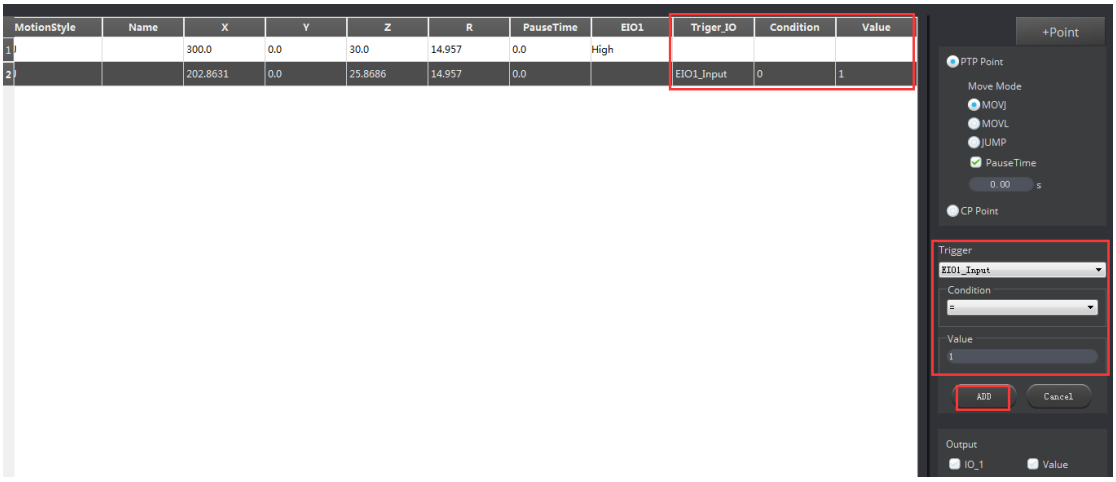


Figure 4.10 High level output of EIO1 demo

3） ADC input

ADC input operational method is the same with level input. Select configured saved point and pins of the ADC (such as EIO1), set ADC value less than 200, and click ADD key to finish. The trigger value settings range is from 0 to 4095.

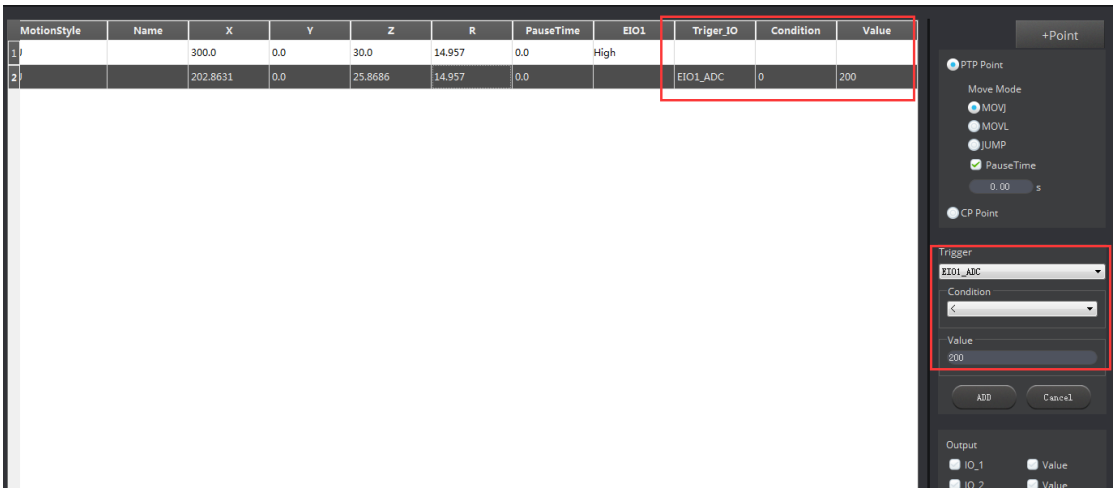


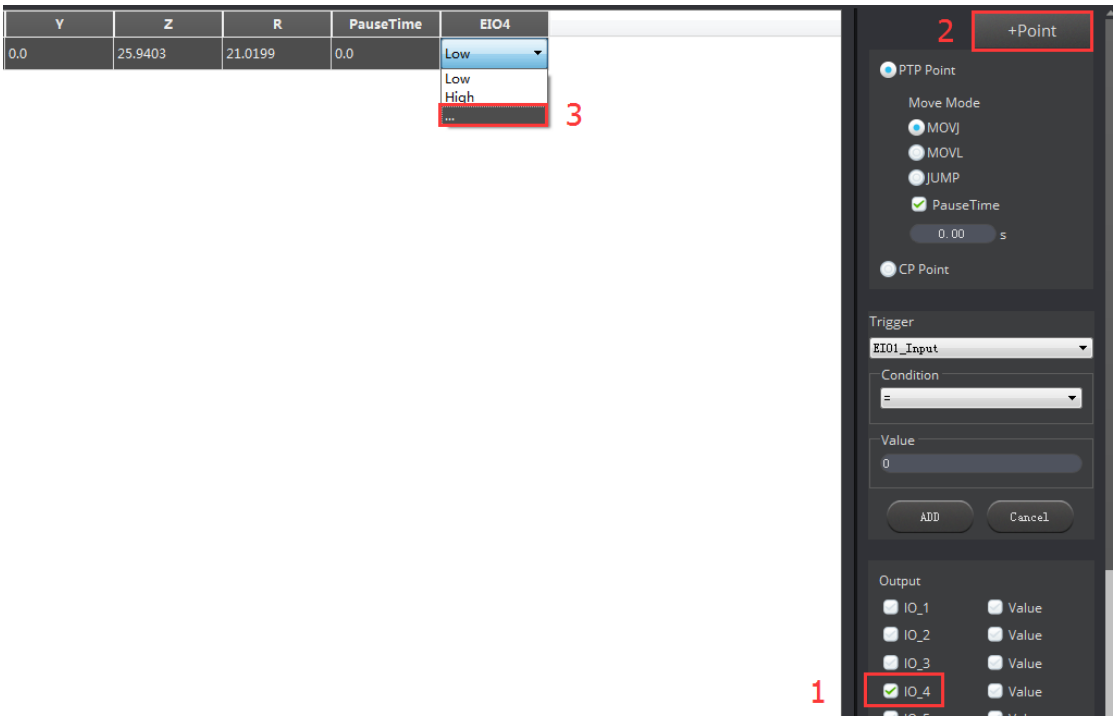
Figure 4.11 EIO1 ADC input demo

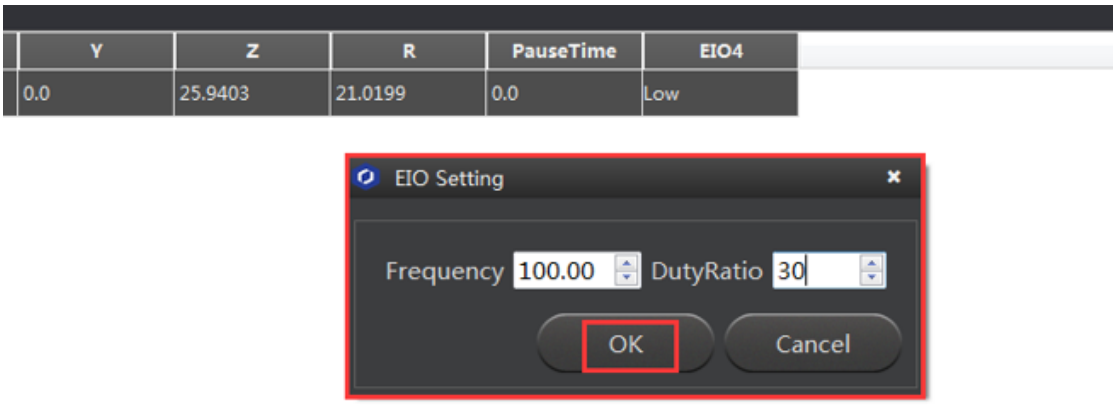
4） PWM Output

PWM: Take EIO4 for a demo

EIO Addressing	Level Range	Level Output	PWM	Level Input	ADC
O4	3.3V	√	√	√	

Tick **IO_4** pin in the Output area, click **+Point** to save new points, double click **EIO4** table cell, select "…" in the drop-down box, and set **Frequency, unit of KHZ， 10HZ-1MHZ** and **DutyRatio**（0-100%) in the pop-up dialog, as shown below:





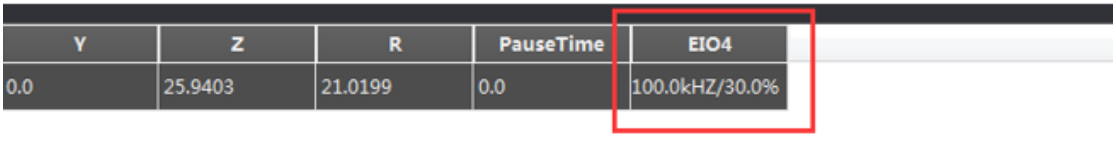


Figure 4.12 EIO4 PWM output demo

Above is the four multiplex demo.

5. Write & Draw Manual

The whole flow chart as follows:

5.1 Installation of writing accessories

A pen and pen holder included in the Write & Draw kit. The steps to install are as follows:

1. Install the pen into the fixture;
2. Lock the fixture into the end-effector with butterfly nut.

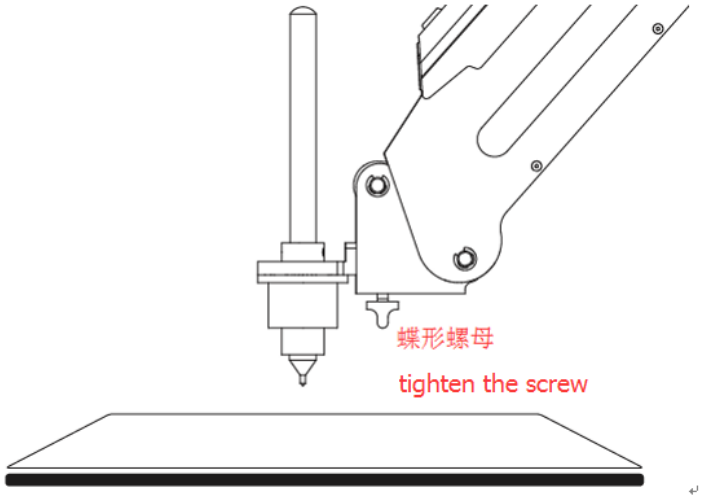


Figure 5.1 Installation of pen

If you want to change the pen, just loosen the four screws on the pen holder.

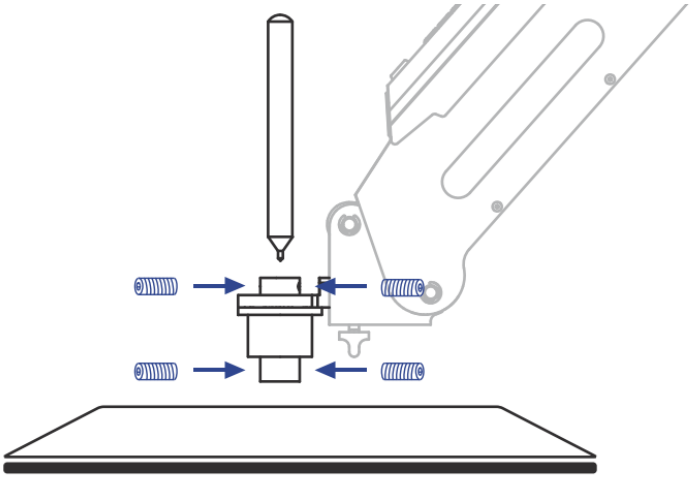


Figure 5.2 Pen installation

5.2 Connect DobotStudio

1. The software used by Write & Draw is DobotStudio, and the hardware itself is applicable for DobotStudio, so you can connect it directly. Open the software and click the Write & Draw module. The interface of Write & Draw is shown below:

Figure 5.3 Writing & drawing interface

2. If the current hardware is not the hardware of Write & Draw itself, there will be a pop up to change the firmware. For example, if the current firmware is for 3D printing, there will be a pop up for a selected window. Here, we can choose DobotStudio in the drop-down box:

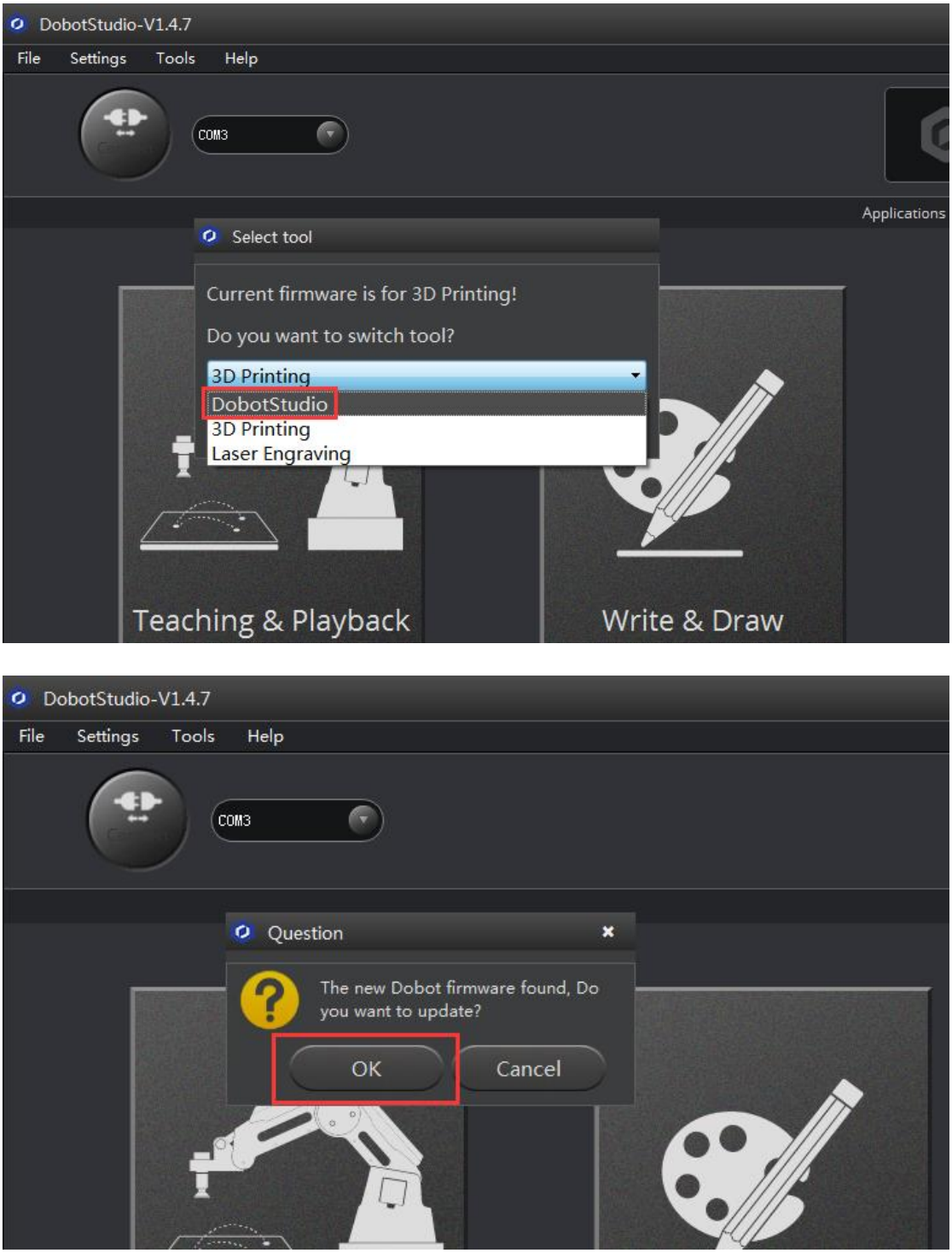
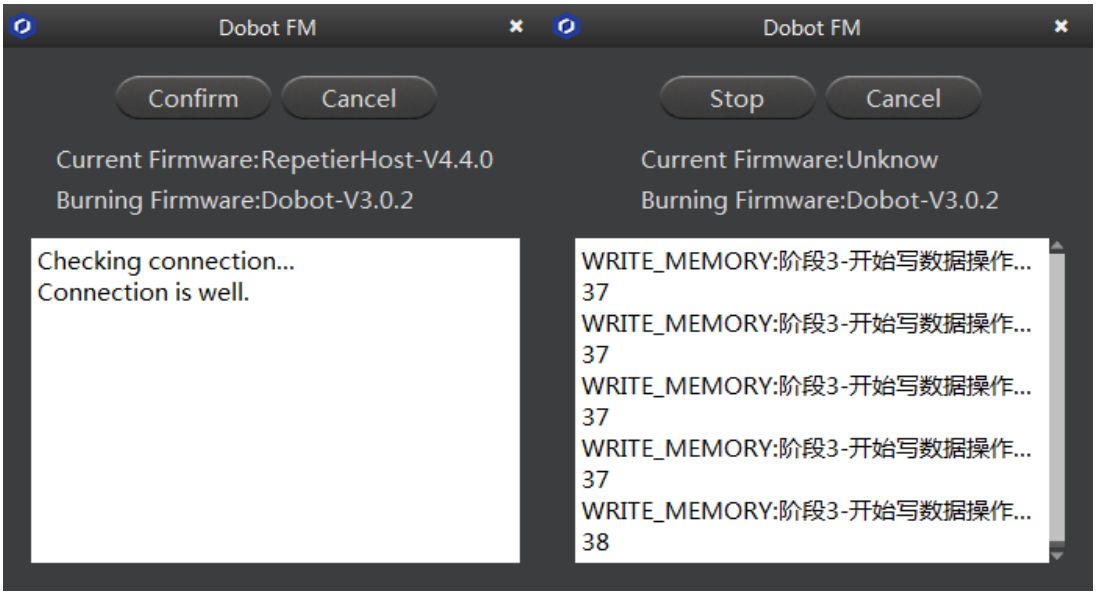


Figure 5.4 Select DobotStudio

Then click **OK**. A pop up window will ask to burn hex. Click **Confirm** to do so:



After burning, **DobotStudio** will be opened automatically. Also, after about ten seconds, you will hear a short sound from the built-in buzzer, which shows a successful burning. At the same time, the light on the bottom right will also turn green. Finally, we can connect Dobot according to the above operation.

5.3 Import pictures and set parameters

1. The imported picture should be put into the sector area of the main interface, as Dobot will be at a limited position if beyond the standard range of motion because of unnatural writing. There will be a warning of a red highlighting if beyond range.

1） Click **Open**, and import the ready PLT or SVG file:

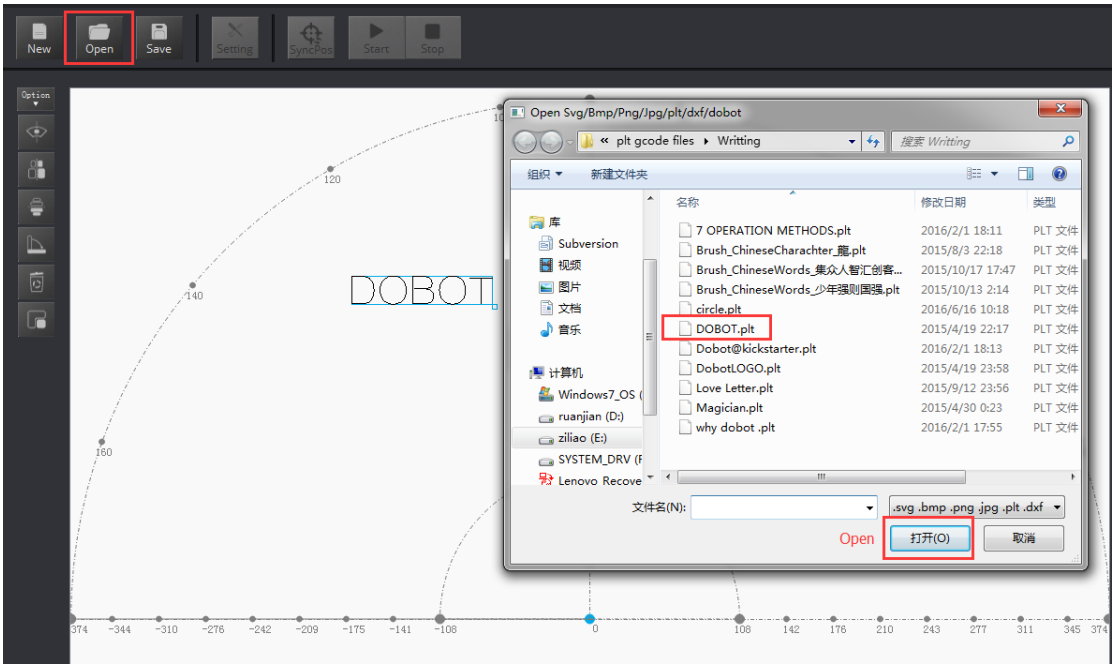


Figure 5.5 Open the file

2） Insert the included pictures of DobotStudio;

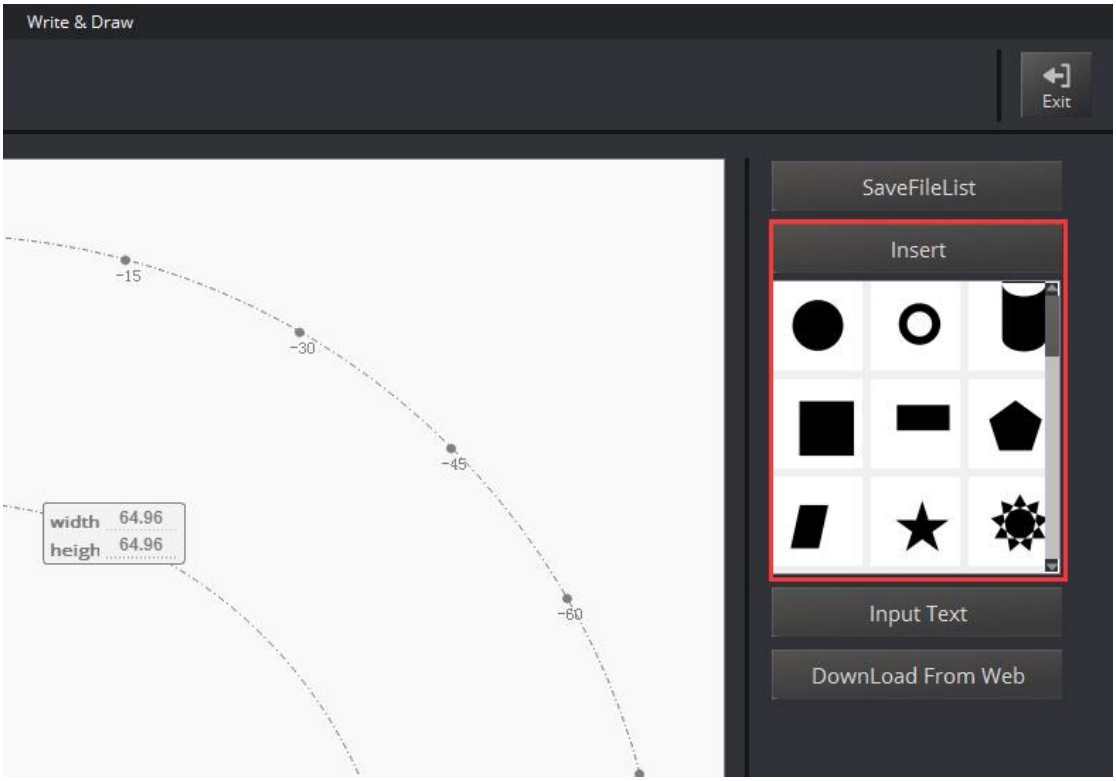


Figure 5.6 Insert the included file

3） Input text manually;

Figure 5.7 Input text manually

4） You can also import pictures. You need convert these formats（BMP/JPEG/JPG/PNG and so on） into SVG (the format recognized by Dobot).

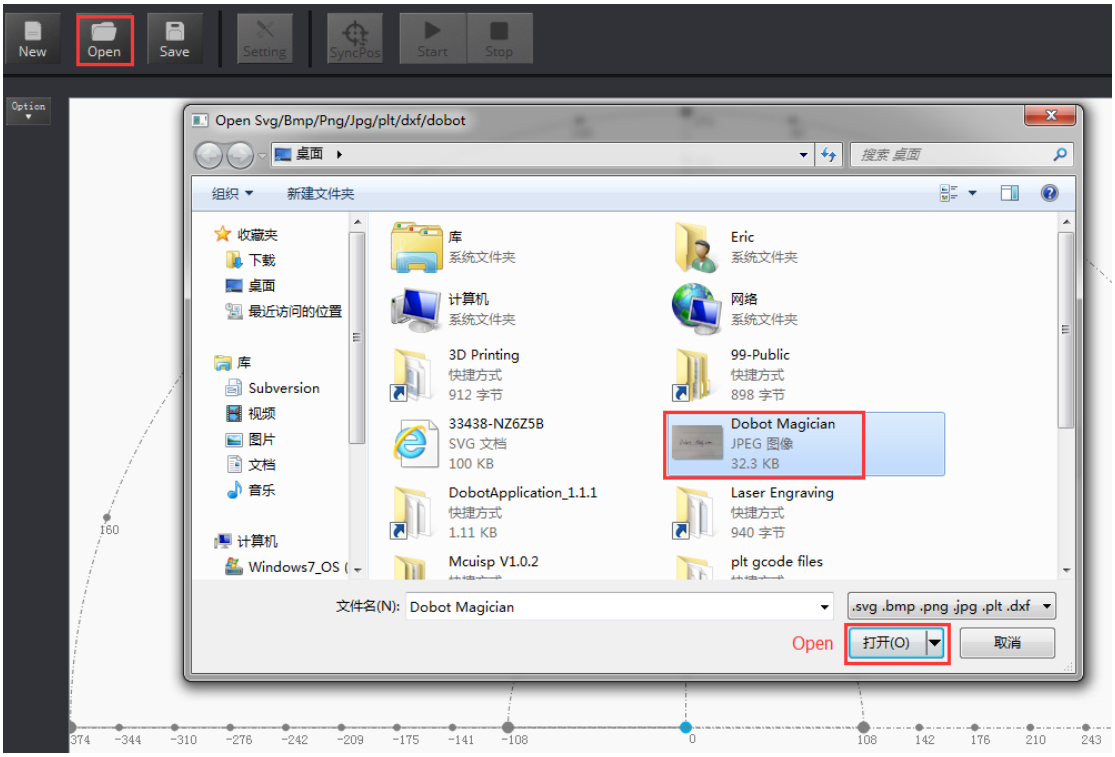


Figure 5.8 Import pictures

After opening the picture, adjust the image to desired size and click **Convert Bitmap**. The SVG path file will come out automatically. Then, click **Plot to Main Scene,** and the file will be loaded in writing main interface, as shown below:

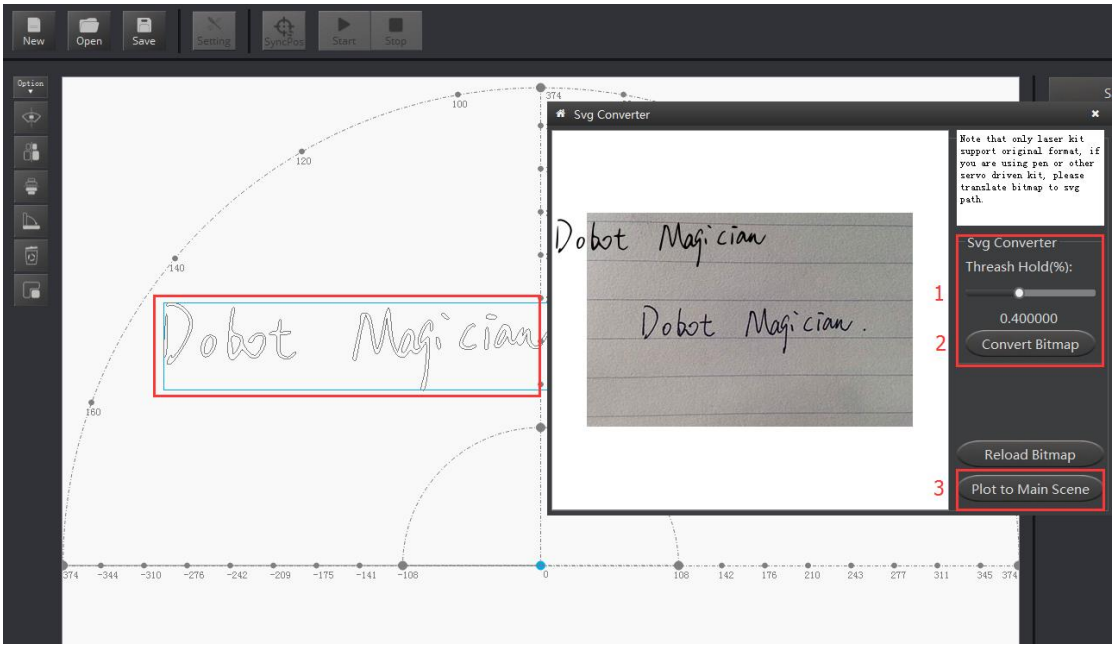


Figure 5.9 Import pictures into SVG files

2. Set writing parameters: set velocity and acceleration(0~500mm/s) and PenUpOffset;

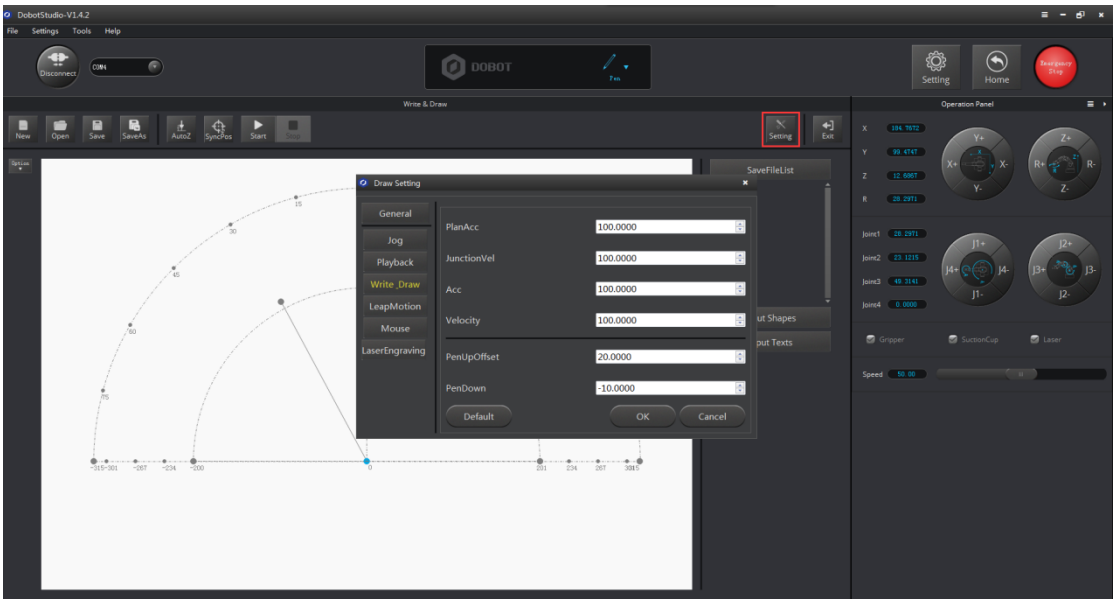


Figure 5.10 Set velocity and acceleration

5.4 Adjust the position and start writing

1. Set endeffector as Pen. Here, you can choose from **Settings**->EndEffector, as shown below:

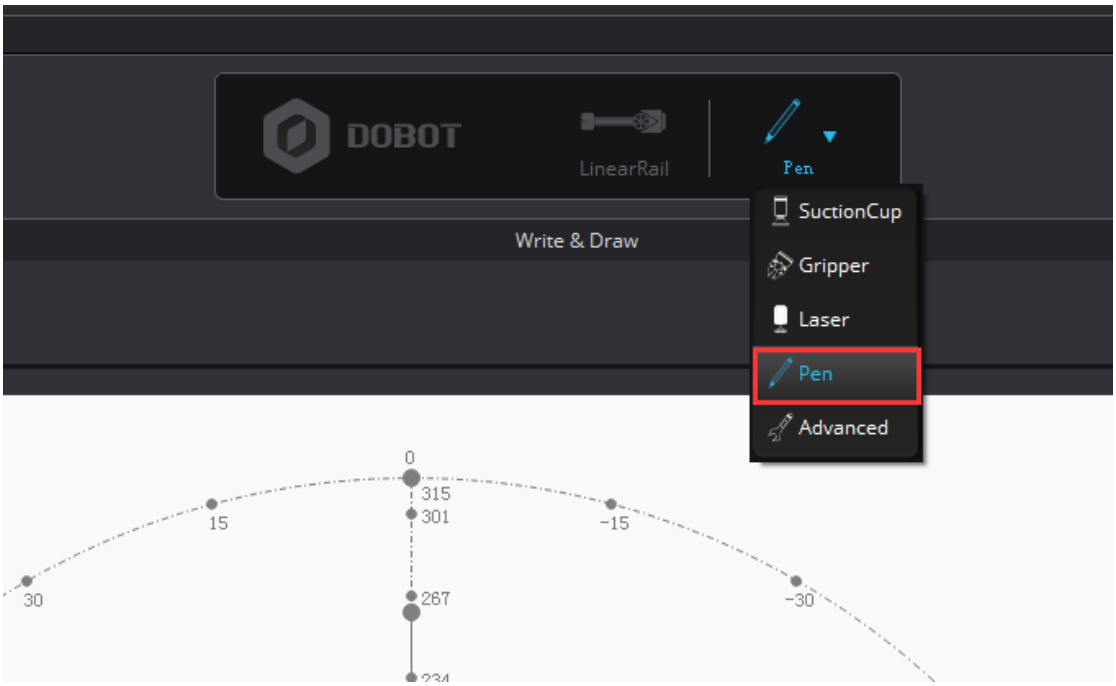


Figure 5.11 Set EndEffector

2. Adjust the nib position: press and hold down **Unlock key on the forearm** and drag the forearm to make the nib contact to paper. Also, you can control Z axis moving down to paper gradually, shown as follows:

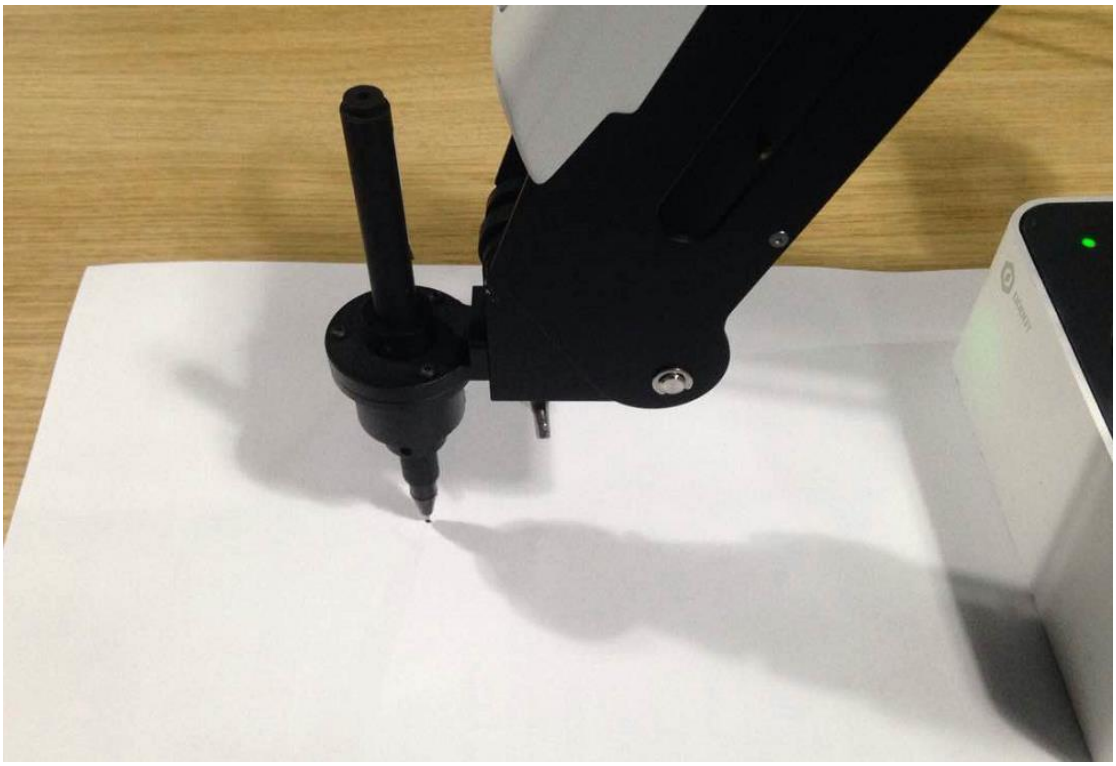


Figure 5.12 Adjust the nib position

3. Click **AutoZ** and get the current Z value. This is so you don't need to adjust the nib position when you write next time. Then, follow these steps: **import pictures-> SyncPos->Start** to start.

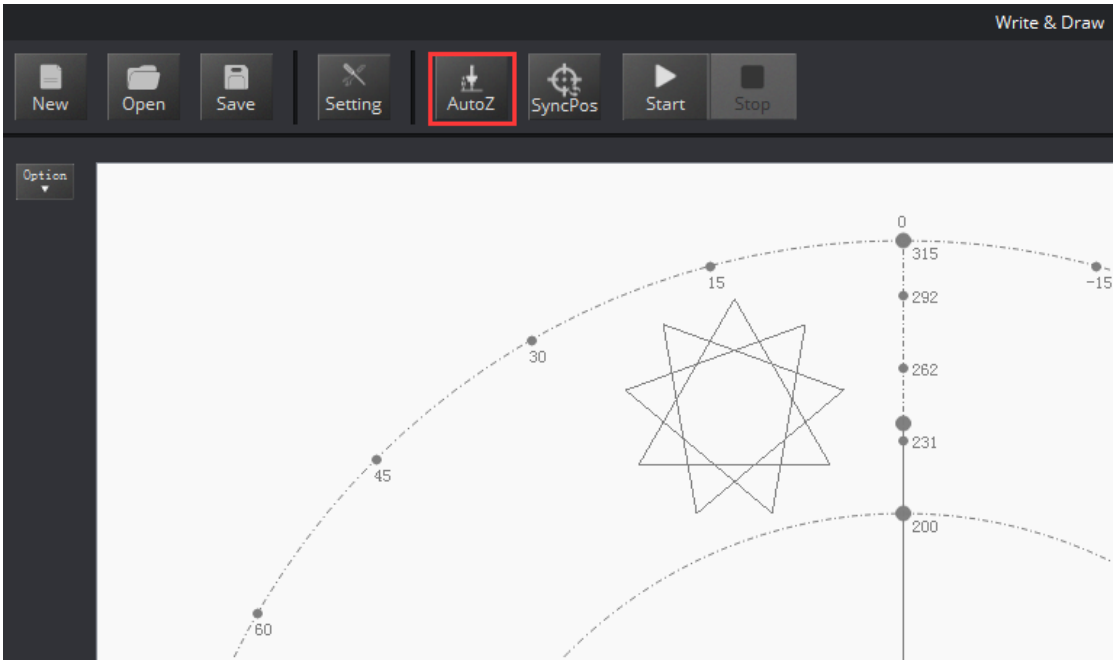


Figure 5.13 Lock writing height

You can check the **PenDown parameter** from here:

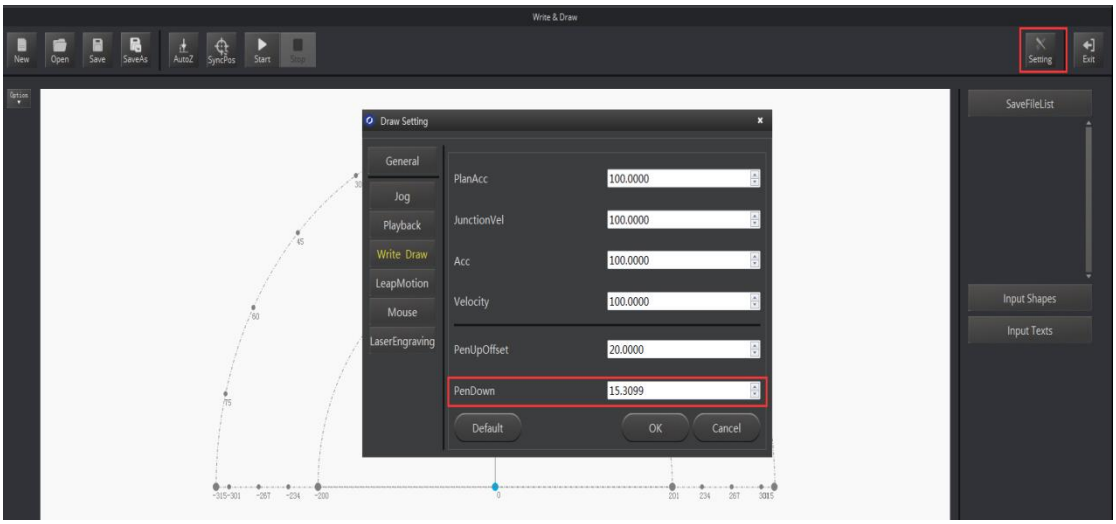


Figure 5.14 Pendown parameters

If the writing is not very clear, the nib height may need to be adjusted slightly. Revising the value of Pendown may also help.

4. Click **SyncPos** and the Dobot will move into the top position of writing starting point automatically.
5. Click **Start, Pause and Stop** to control Dobot.
6. The result is shown below:

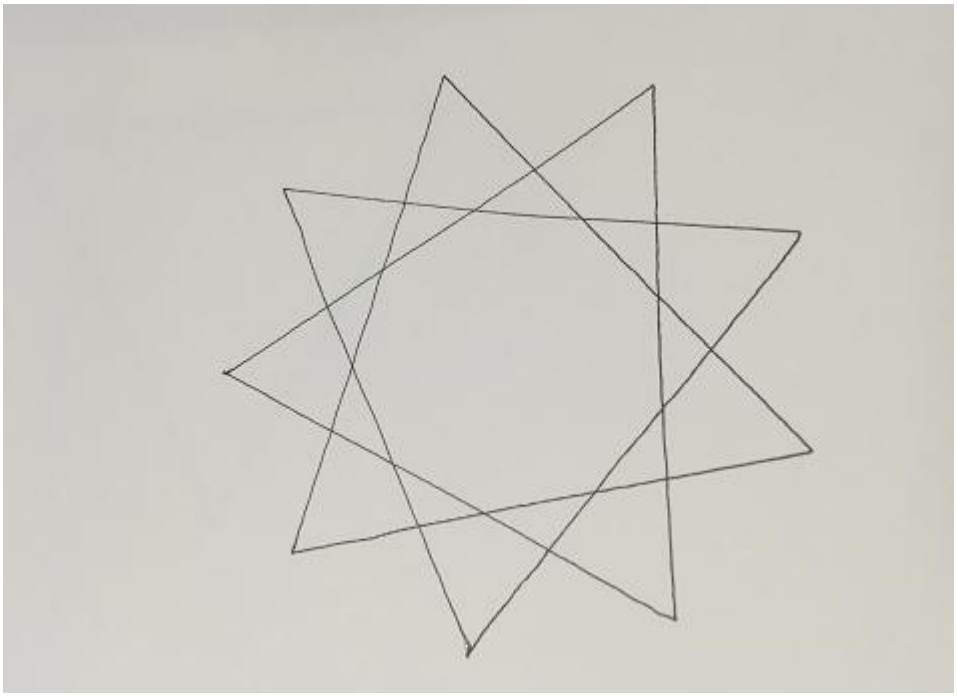


Figure 5.15 The effect of writing

6. Laser Engraving

The entire process of laser engraving is as follows:

Notice:

Laser engraving and shade laser engraving are different functions. The firmware and upper computer used by laser engraving are the same as the ones used in Write & Draw, which can only engrave pictures that are composed of a single line. However, shade laser engraving can achieve the function of bitmap engraving .(For example, it can engrave figures and head portraits.) If you want to use the function of shade laser engraving, please refer to Dobot2.0 Shade Laser Engraving.

6.1 Laser Installation

1. Fasten the laser by butterfly nut;
2. Connect 12V power line with interface ⑤**SW4** and connect TTL control line with interface ③**GP5**.

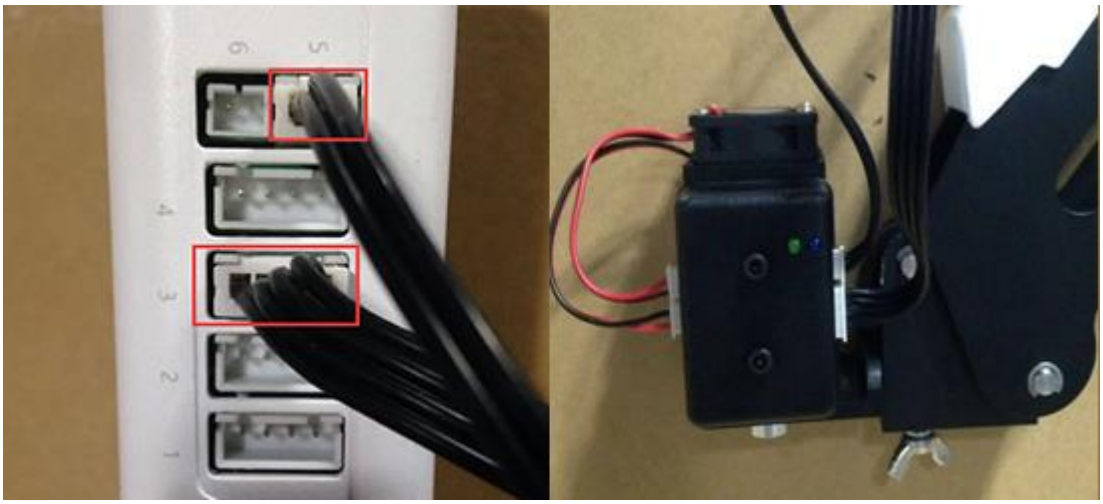


Figure 6.1 Install Laser

6.2 Connect DobotStudio

1. The software used by laser engraving is **DobotStudio**, so please open the software, click **Write & Draw,** and enter into laser engraving interface, as shown below:

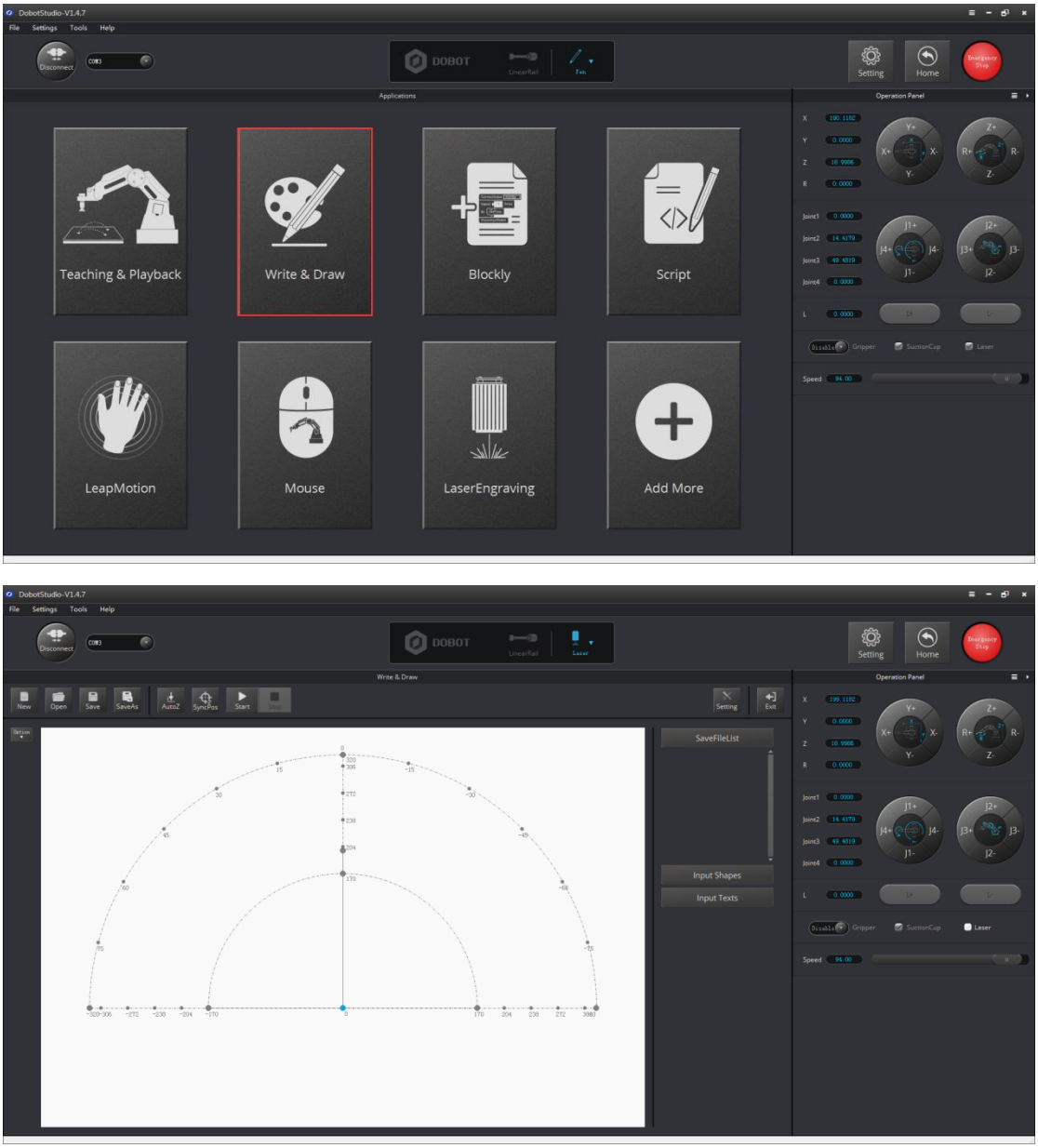


Figure 6.2 Laser engraving interface

2. If the current firmware is not for laser engraving, for example, if it is for firmware 3D printing, then a pop up dialog will give the option to choose **DobotStudio** in the drop-down box:

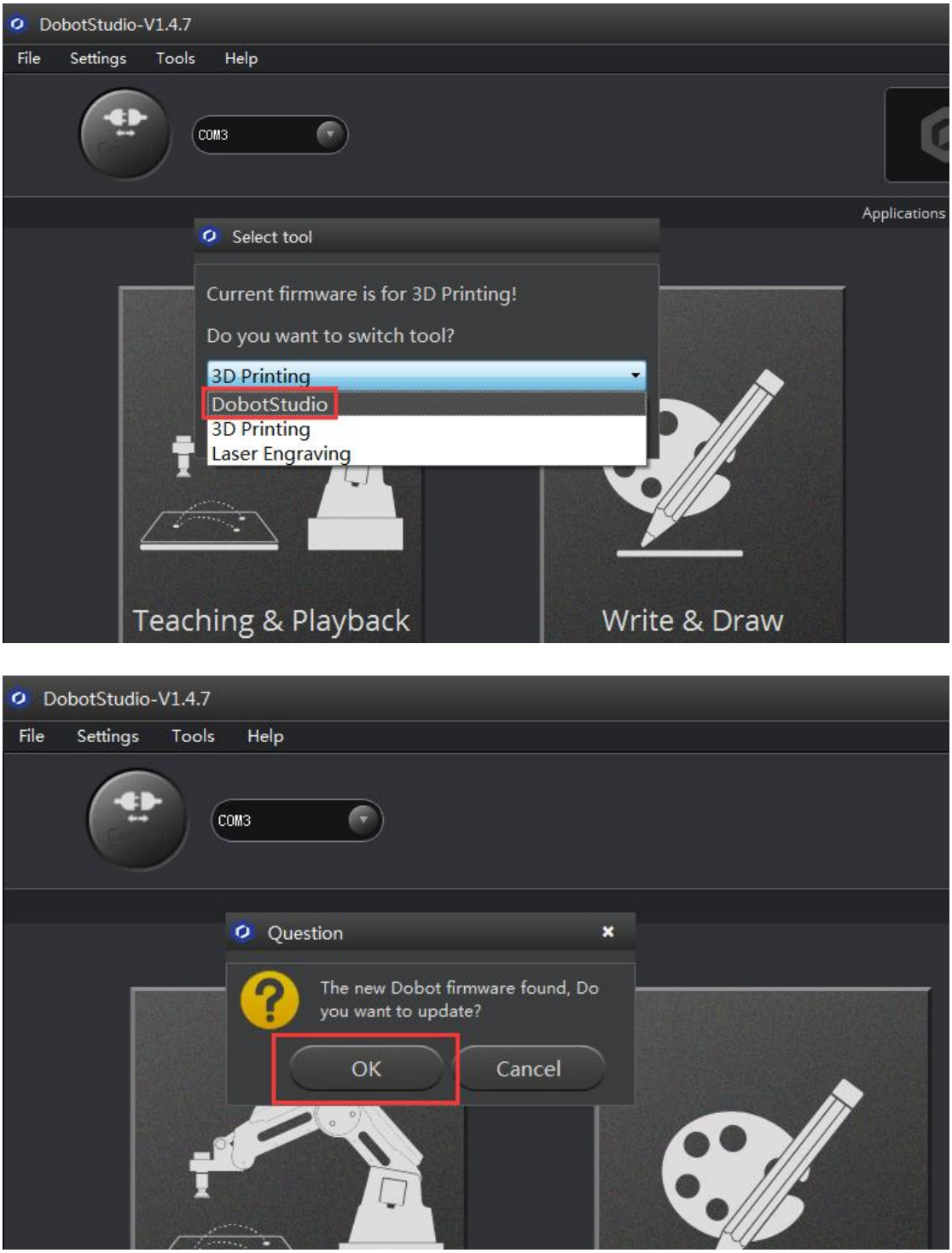
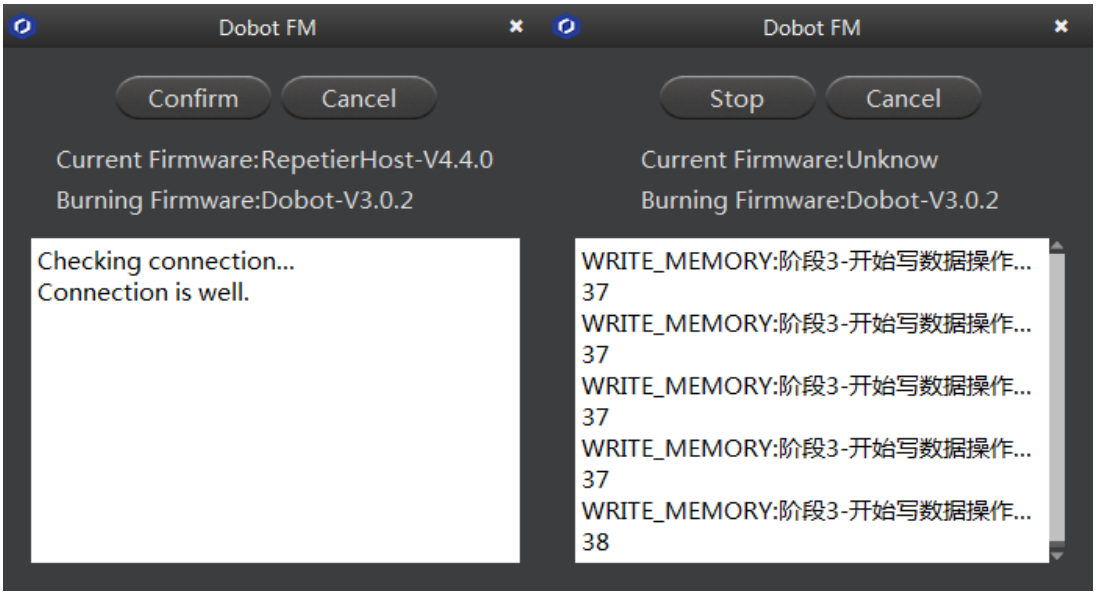


Figure 6.3 Connect DobotStudio

Click **OK** aand a window will pop up asking to burn hex. Click **Confirm** to burn hex:



After burning, **DobotStudio** will be opened automatically. Also, after about ten seconds, you can hear a short sound from built-in buzzer, which shows a successful burning. At the same time, the light on the bottom right will turn into green. We can then connect Dobot according to the above operation.

6.3 Import pictures and set parameters

1） The imported laser engraving file should be put near where the Dobot arm is, as the Dobot will be at a limited position if beyond the standard range of motion. There will be a flashing red light to warn you if the arm is beyond its natural range.

2） Click **Open**, and import the ready PLT or SVG file:

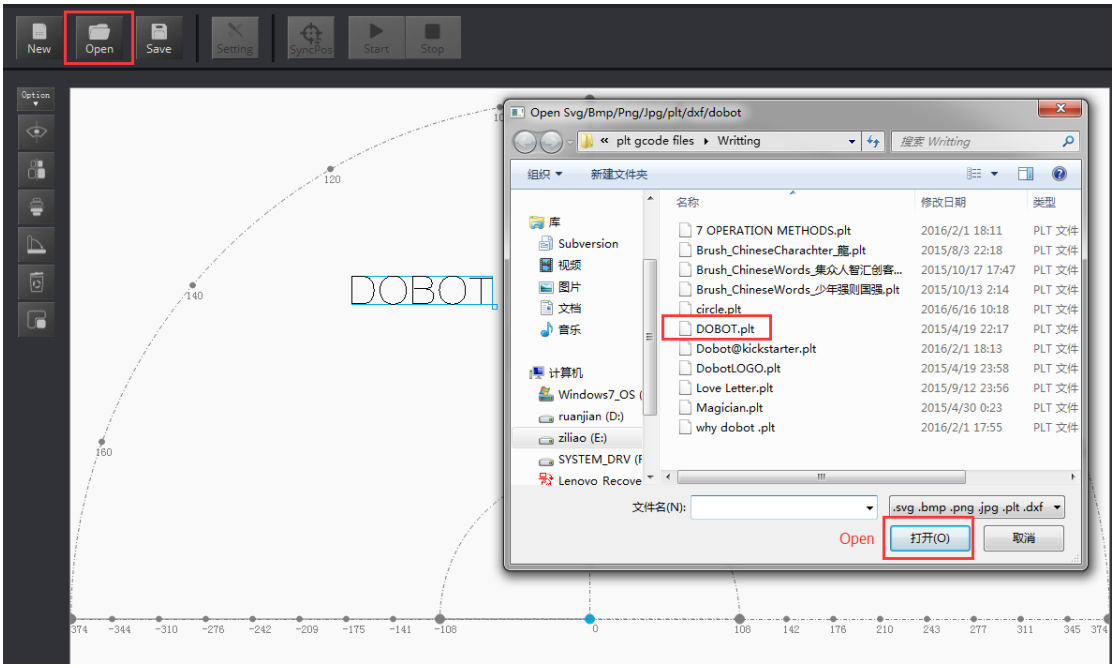


Figure 6.4 Open PLT File

3） Insert the included pictures of DobotStudio;

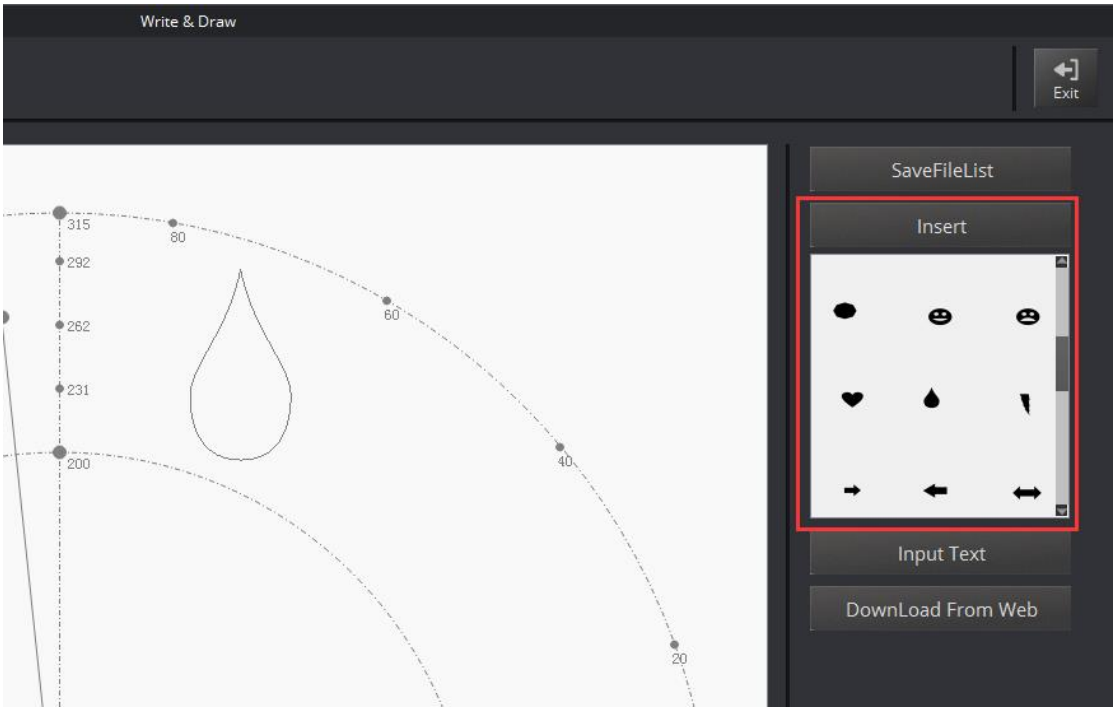


Figure 6.5 Insert included pictures

4） Input text manually;

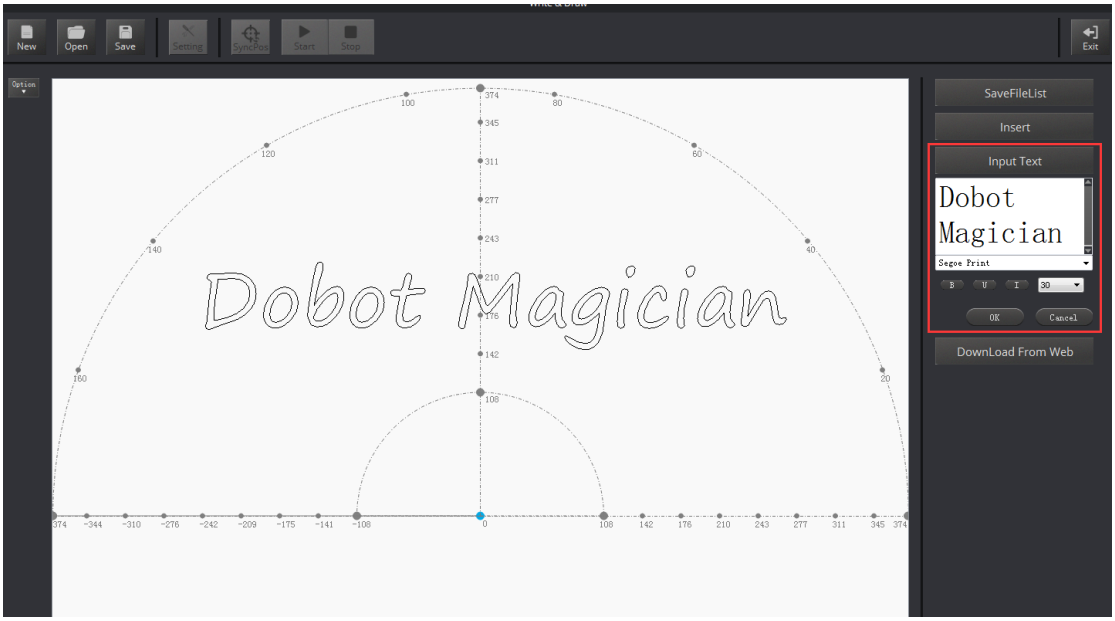


Figure 6.6 Input text manually

5） You can also import pictures. You need convert these formats (BMP/JPEG/JPG/PNG and so on) into SVG (the format recognized by Dobot).

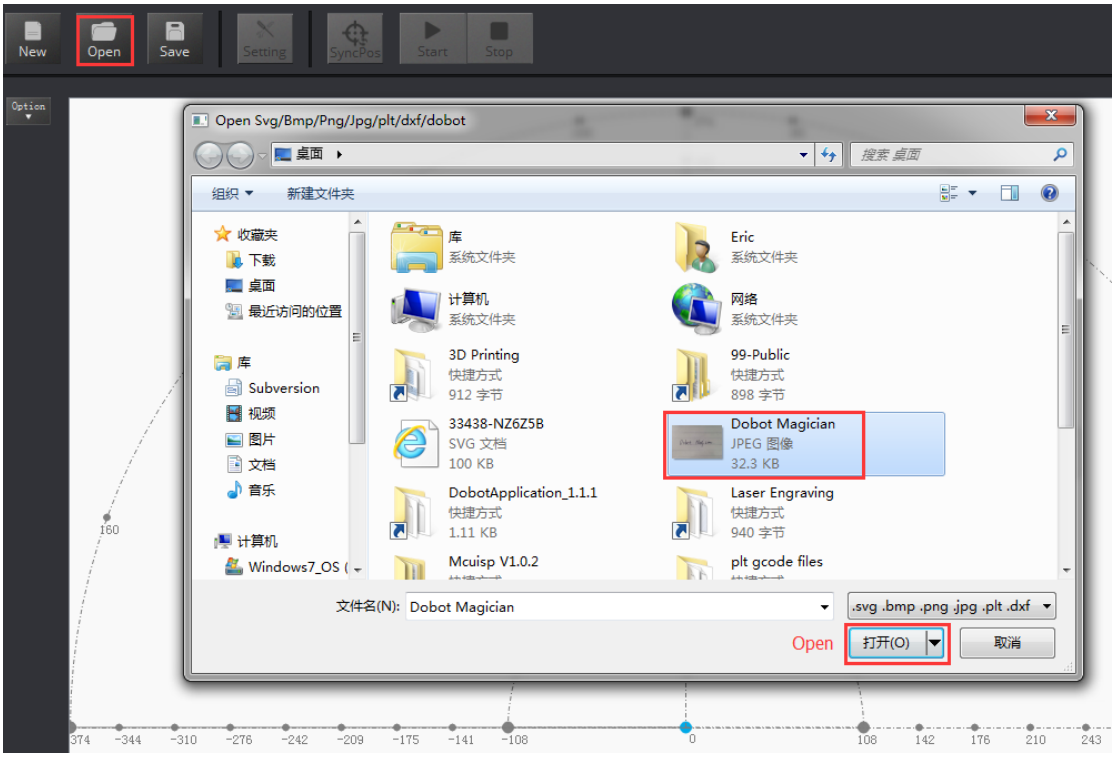


Figure 6.7 Import pictures

After opening the picture, set proper switching threshold, click **Convert Bitmap**. The SVG path file will come out automatically. Then, click **Plot to Main Scene** and the file can be loaded in writing main interface, as shown below:

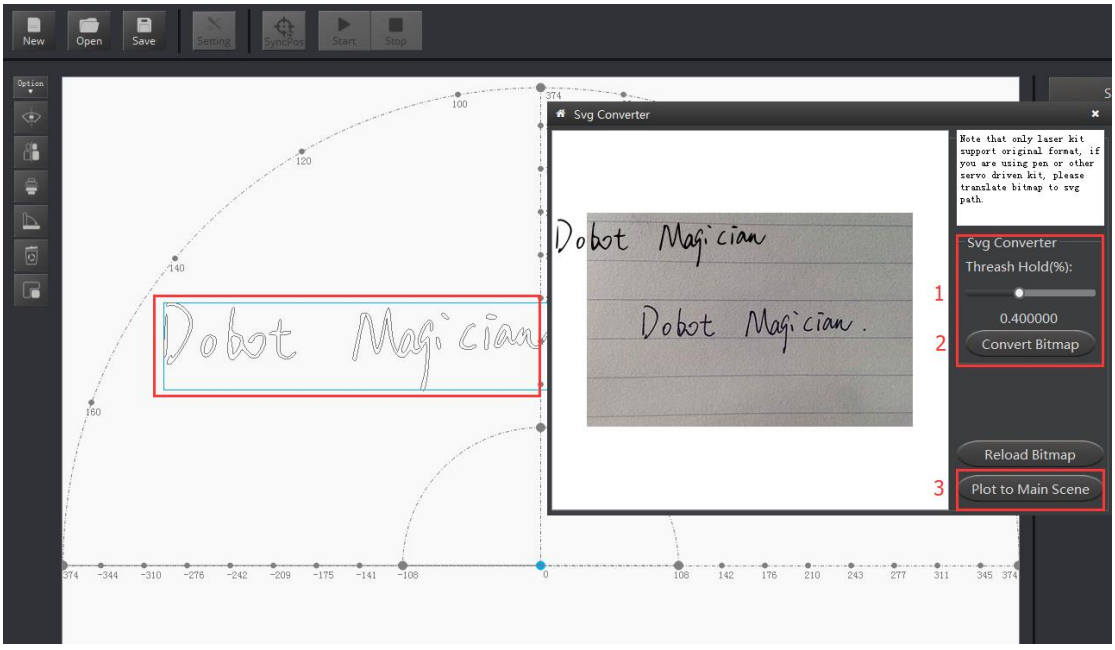


Figure 6.8 Import pictures and SVG path file will come out automatically

1. Set laser engraving parameters: set velocity and acceleration(suggested value is 3) and PenUpOffset. On here, just keep the default 20;

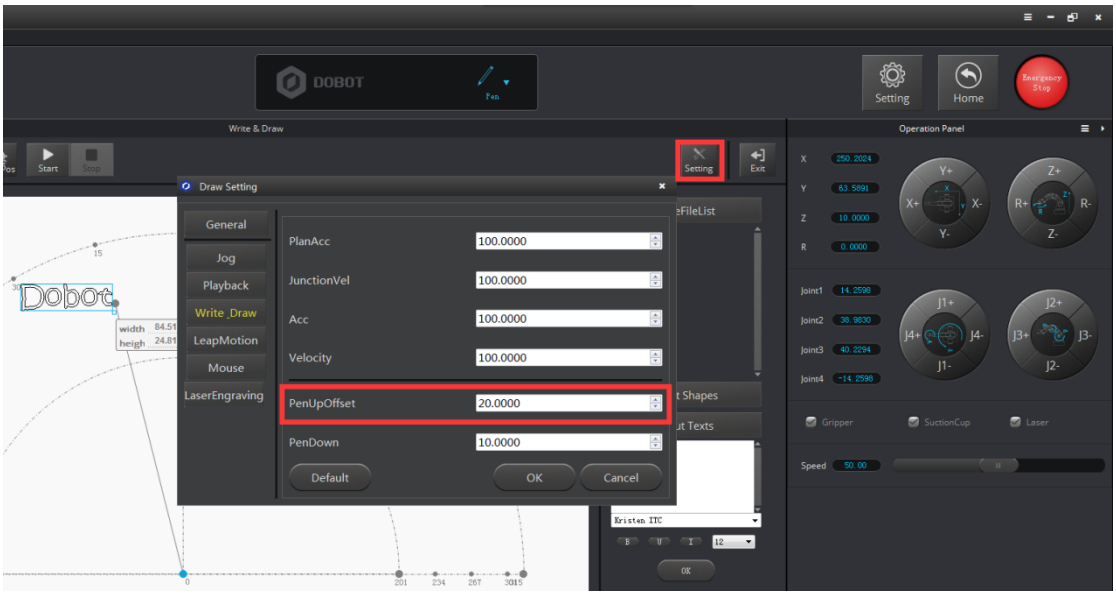


Figure 6.9 Set parameters of laser engraving

6.4 Adjust the focus and start writing

1. Select the EndEffector as **Laser**, shown as follows:

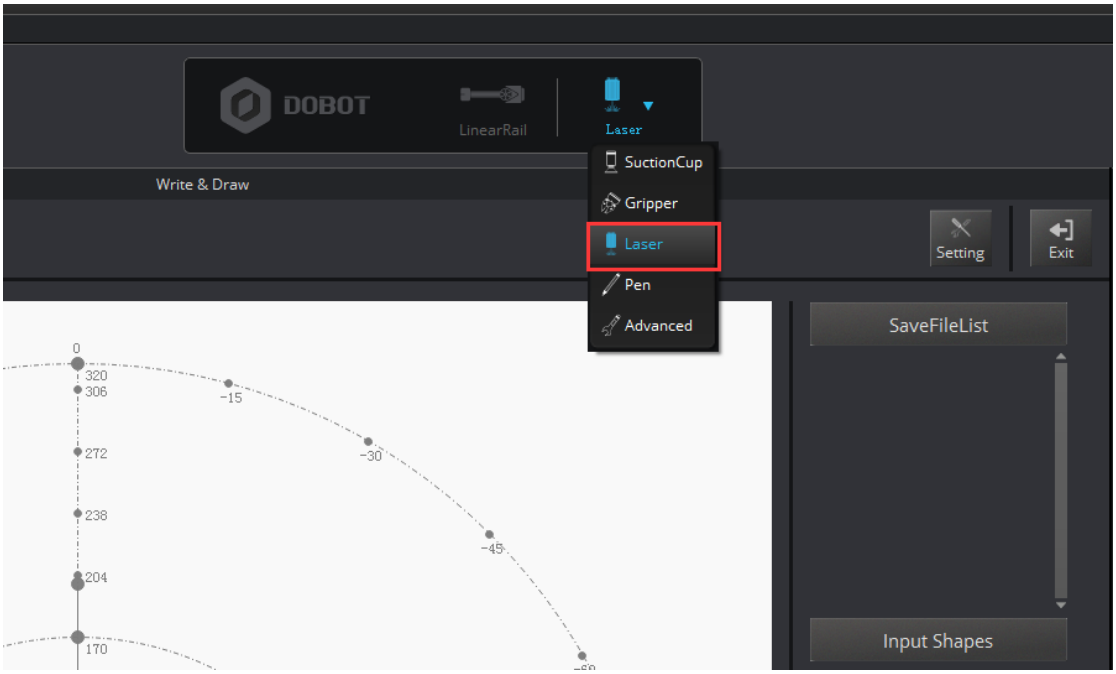


Figure 6.10 Set EndEffector

2. Tick ON on the Operation Panel to open the laser;

Figure 6.11 Open the laser

Focus Adjustment: Hold down the **Unlock Key** to adjust the distance between laser and the surface of the material, and then adjust the knob to focus it properly. It will be at the right height when the laser dot burns the brightest. Burn marks on the paper will be another indicator that you have done so correctly. You can turn off the laser by unticking the box after adjusting.

If it still cannot focus, then the focus of the laser is wrong. We can rotate the metal knob of the laser to adjust (as shown on the bottom right) and refocus again.

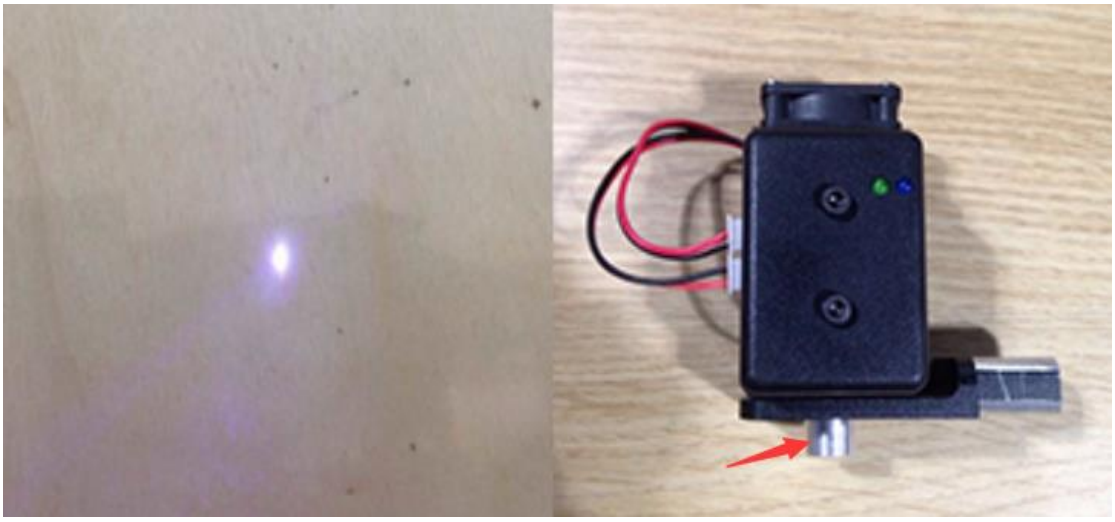


Figure 6.12 Focus Adjustment

Notice：

The laser can heat objects when it is in a focused state, so objects like paper or wood can

be engraved or burned.

! DO NOT focus the laser on people or animals

! DO NOT let children play with it alone.

! The process needs to be monitored when it is running.

! After the process, please turn off the laser promptly.

3. Click **AutoZ** and get the current Z value. This way, you do not need to adjust the focus manually when you engrave next time. To do so, here are the steps: **import pictures->SyncPos->Start**.

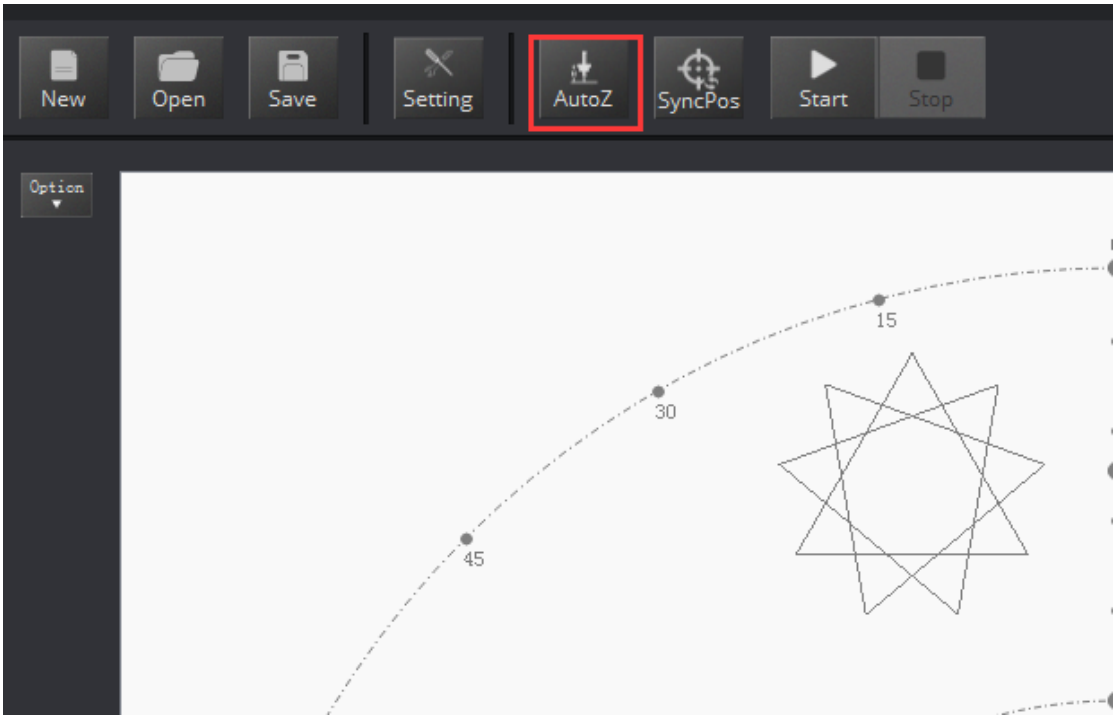


Figure 6.13 Lock writing height

You can check the **Pendown parameter** from here:

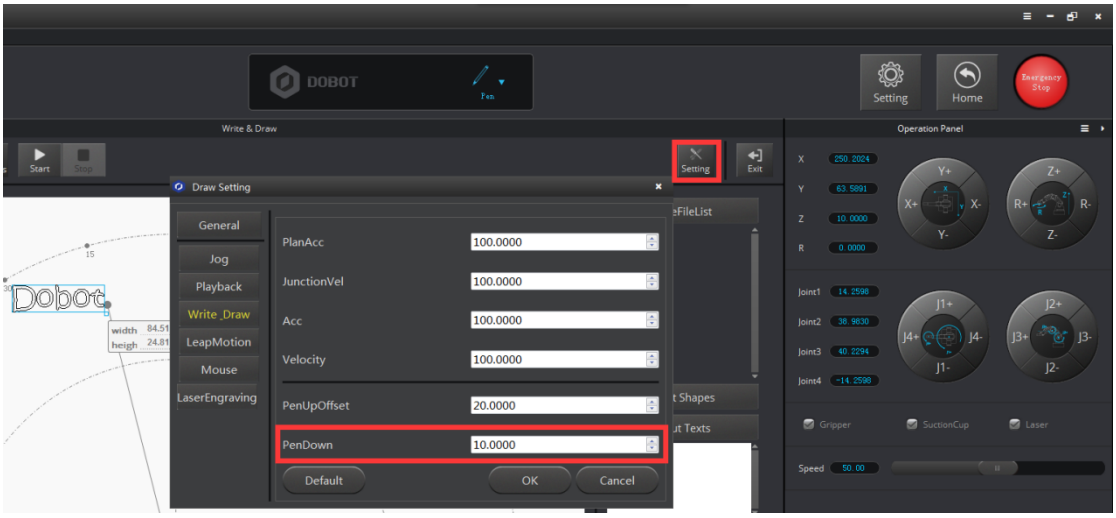


Figure 6.14 Pendown parameters

If the engraving isn't clear, the laser height needs to be adjusted slightly. Revising the value of **Pendown** also helps.

4. Click **SyncPos**, Dobot will move into the top position of the starting point automatically.
5. Click **Start, Pause and Stop** to control Dobot.
6. The effect shown as follows:

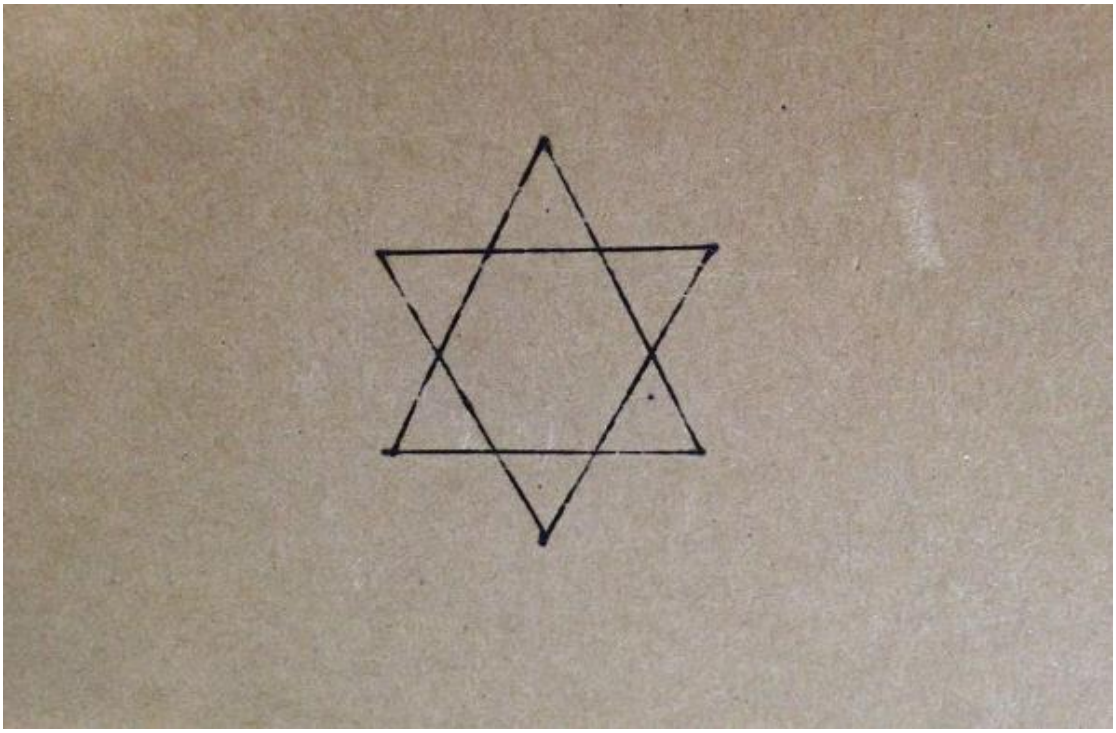


Figure 6.15 The product of laser engraving

7. The Tutorial of Shade Laser Engraving

The whole flow chart of shade laser engraving is shown below:

Note: Shade laser engraving is also a kind of laser engraving!

7.1 Installation of Laser Accessories

Shade laser engraving and laser engraving share the same kit. Please refer to the chapter pertaining to laser engraving installation.

7.2 Connect DobotStudio

1. Open DobotStudio and select the EndEffector as **Laser**.

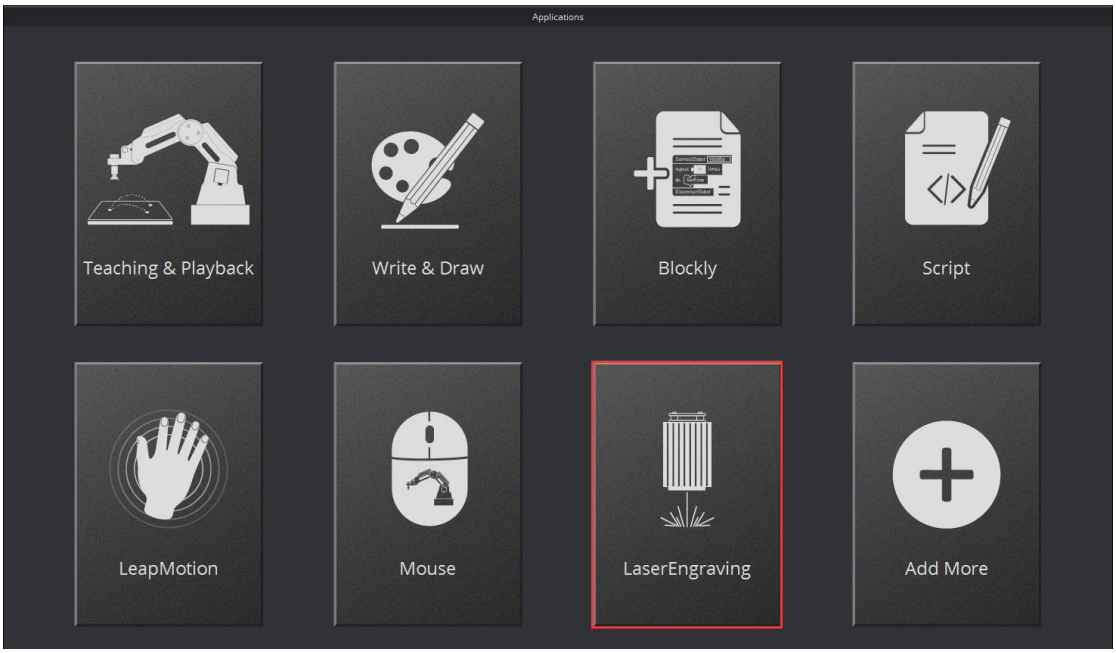


Figure 7.1 Open laser engraving interface

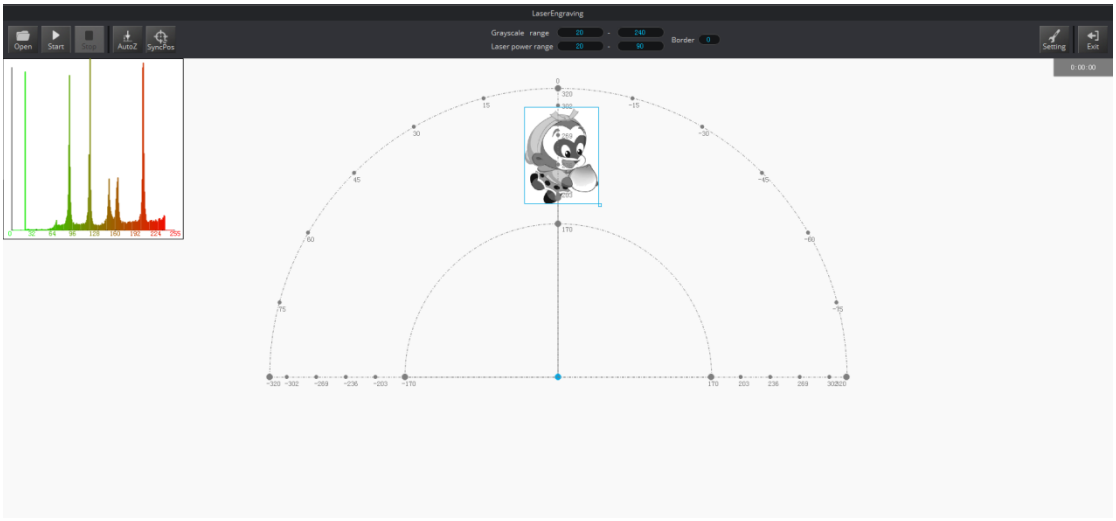
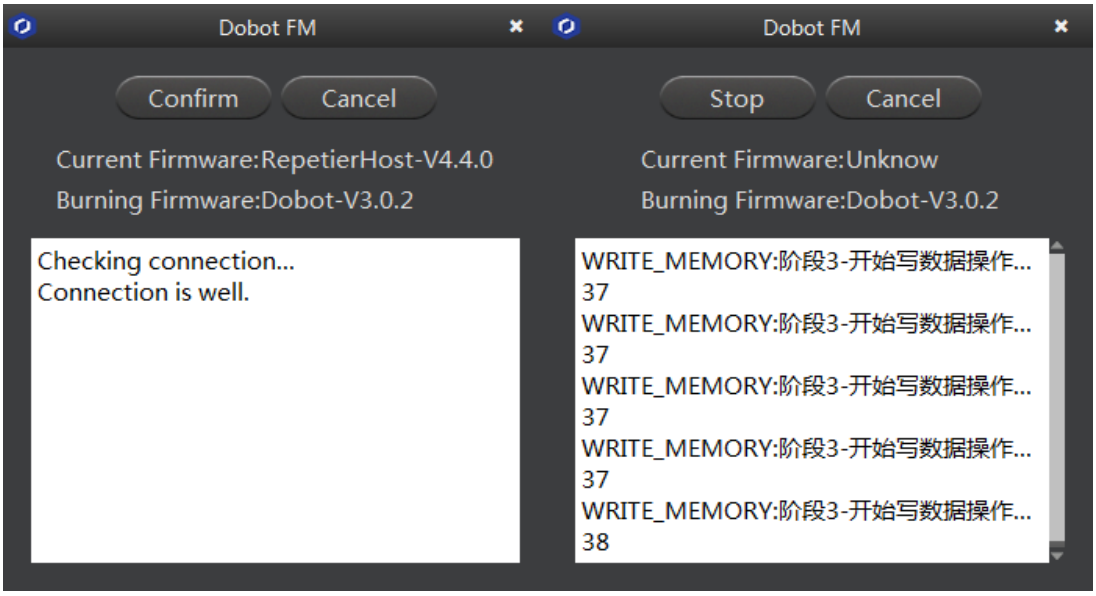


Figure 7.2 Enter the shade laser engraving interface

2. If the current firmware is not for **DobotStudio**, (for example, 3D printing) a pop up window will ask for you to switch. Then, we can select **DobotStudio** in the drop-down box:

Figure 7.3 Select DobotStudio

Then click **OK**, and a window will pop up asking to burn hex. Click **Confirm** to burn hex:



After burning, **DobotStudio** will open automatically. Also, after about ten seconds, you can hear a short sound from built-in buzzer, which shows a successful burning. At the same time, the light on the bottom right will turn into green. We can then connect Dobot according to the above operation.

7.3 Import Pattern and Set Parameters

1. The imported picture should be put into an area near the Dobot's arm, as it will be at a limited position if beyond the standard writing range. If the Dobot is out of reach, then a red light will flash.

   You can also import pictures. Convert these formats (BMP/JPEG/JPG/PNG and so on) into SVG, which is recognized by Dobot.

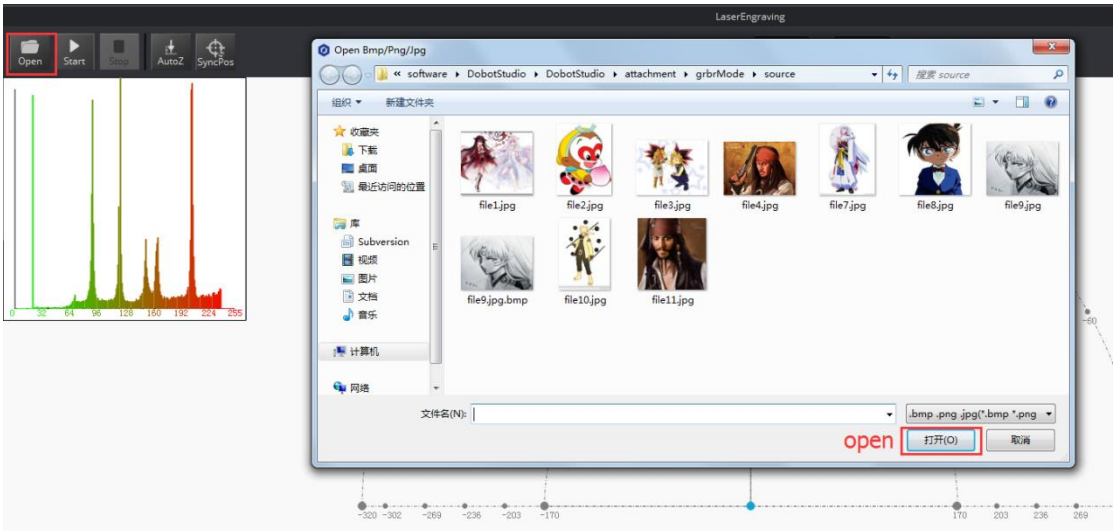


Figure 7.4 Import engraving pictures

Open the picture, adjust the gray scale(0-255), laser power(0-100%) and the border for the customized engraving effect.

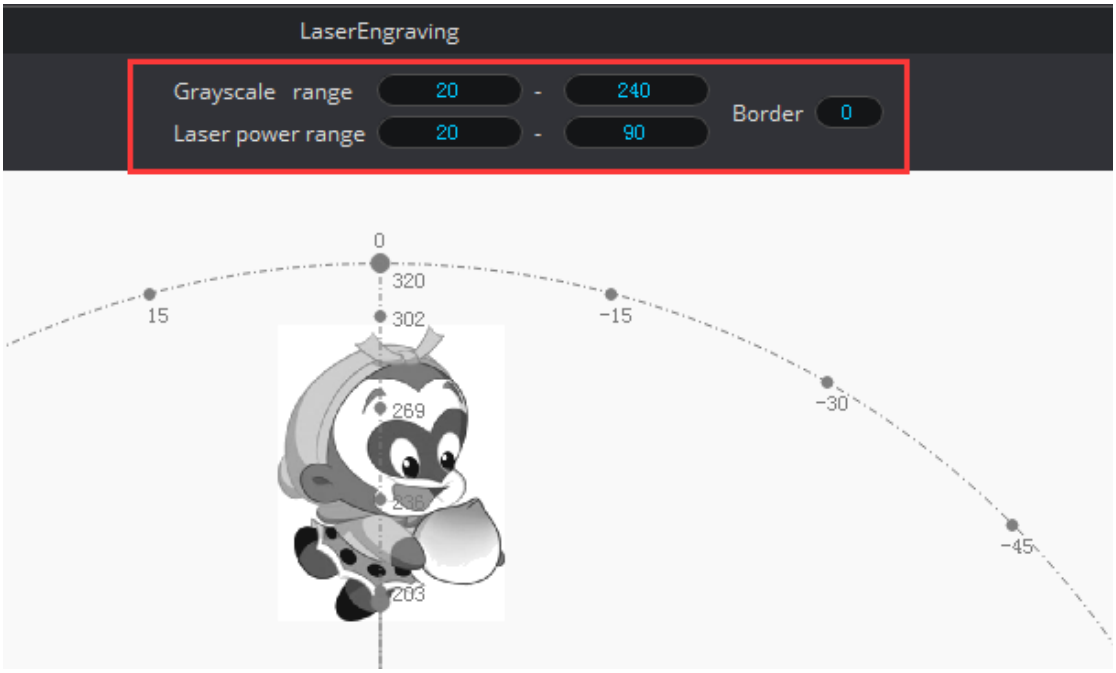


Figure 7.5 Import the pictures into SVG file

2. Set shade laser engraving velocity and acceleration, here we suggest 5, as shown below:

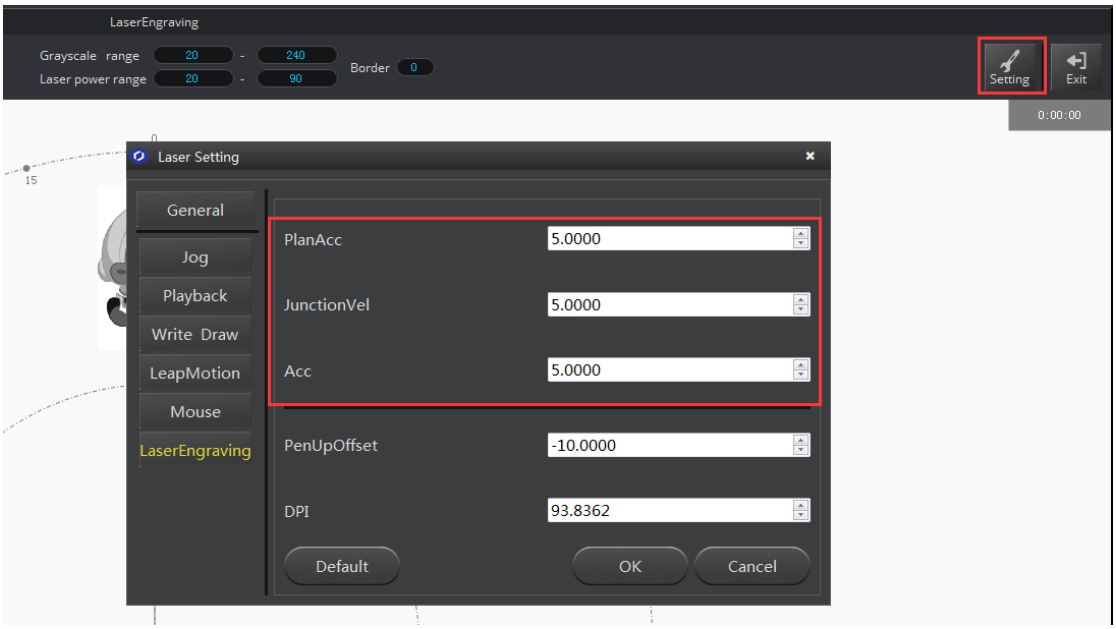


Figure 7.6 Set the parameter

7.4 Adjust Focus and Start to Engrave

1. Set the endeffector as **Laser**, as shown below:

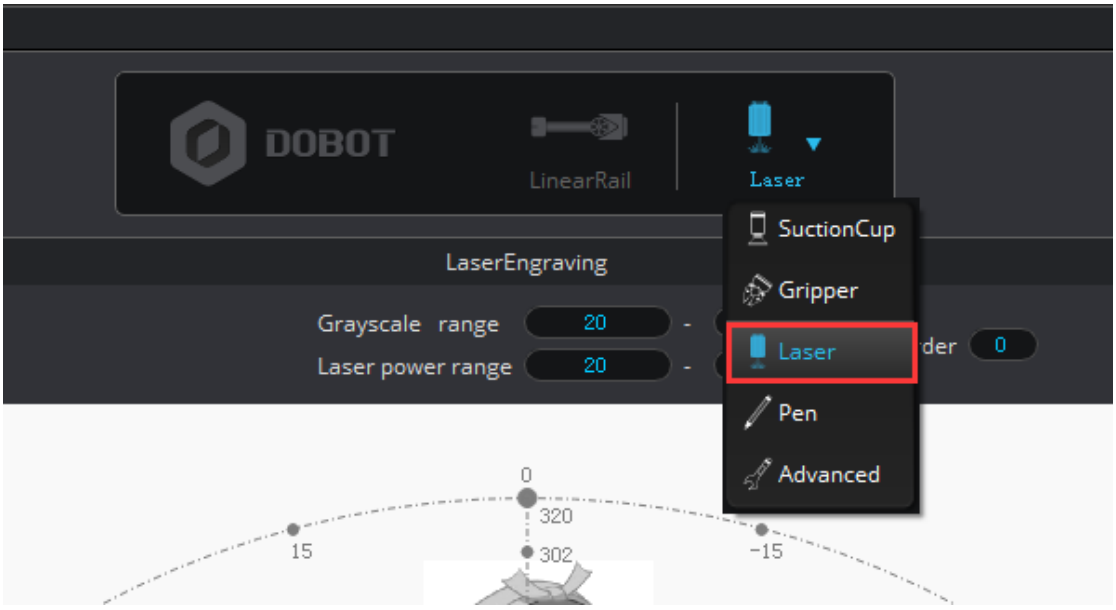


Figure 7.7 Set EndEffector

2. Focus adjustment. Adjust the distance between the laser and engraving material and check **ON** to open the laser.

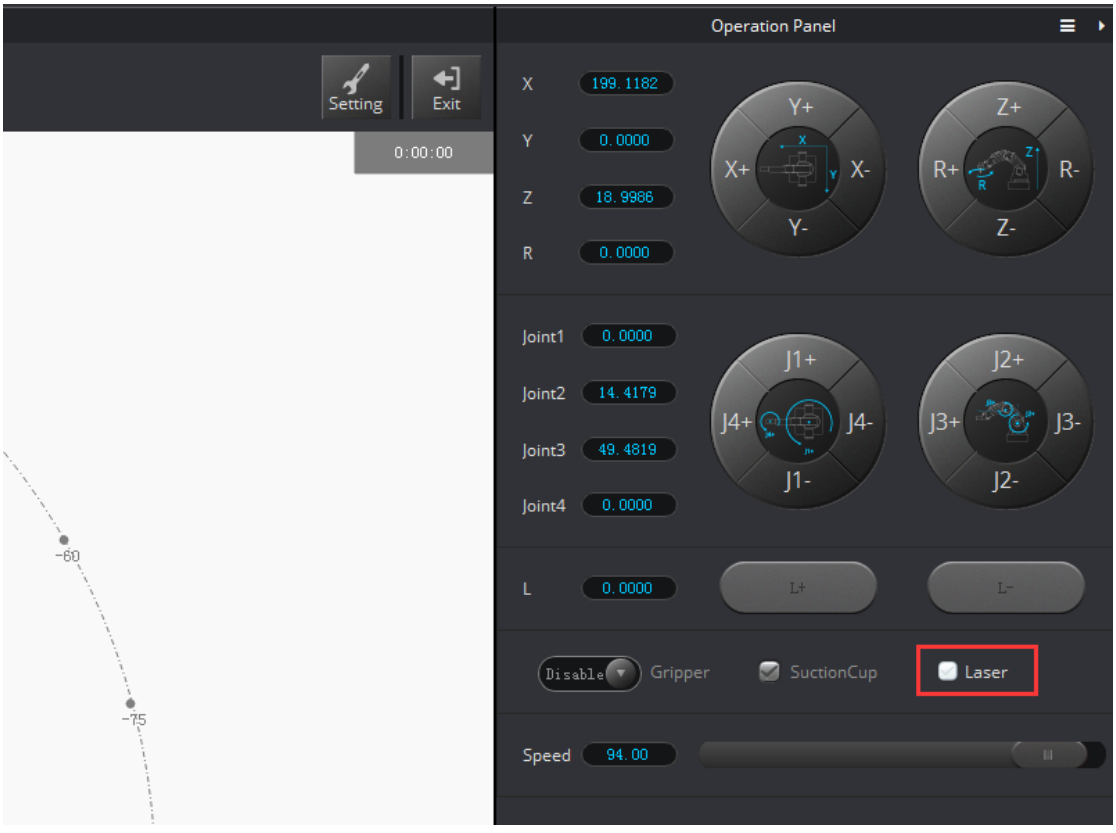


Figure 7.8 Check the laser

Focus Adjustment. Hold down the **Unlock Key** to adjust the distance between laser and the surface of the material, and then adjust the knob to focus it properly. It will be at the right height when the laser dot burns the brightest. Burn marks on the paper will be another indicator that you have done so correctly. One can cancel ticking to close laser after adjusting.

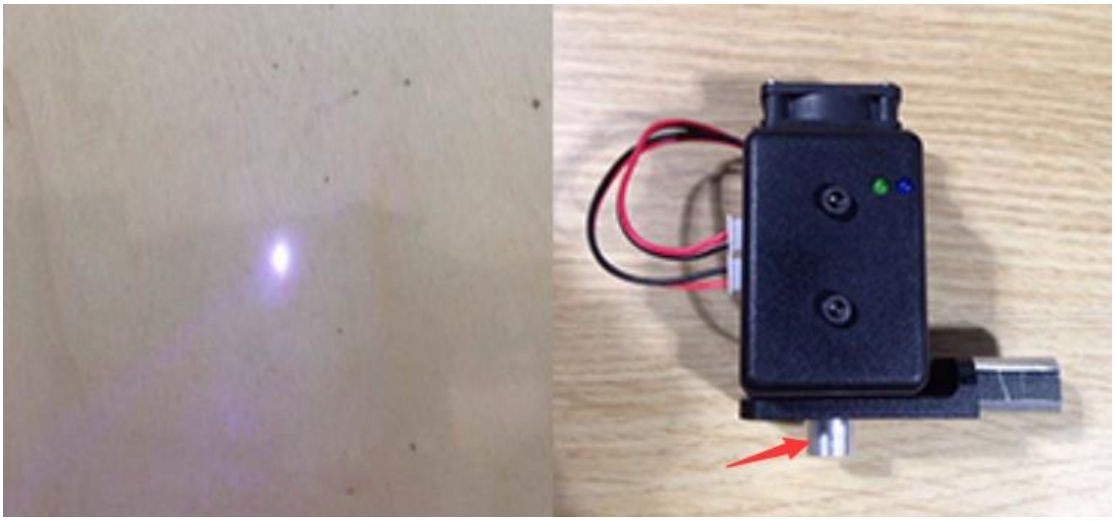


Figure 7.9 Focus adjustment

⚠ Notice：

The laser can heat object when it is in focused state, objects like paper board or wood can be engraved or burned.

! DO NOT focus the laser on people or animals

! DO NOT let children play with it alone.

! The process needs to be monitored when it is running

! After the process, please turn off the laser promptly

3. Click AutoZ to set the current Z value, and then follow these steps: **import pictures->Synchronous->Start**)

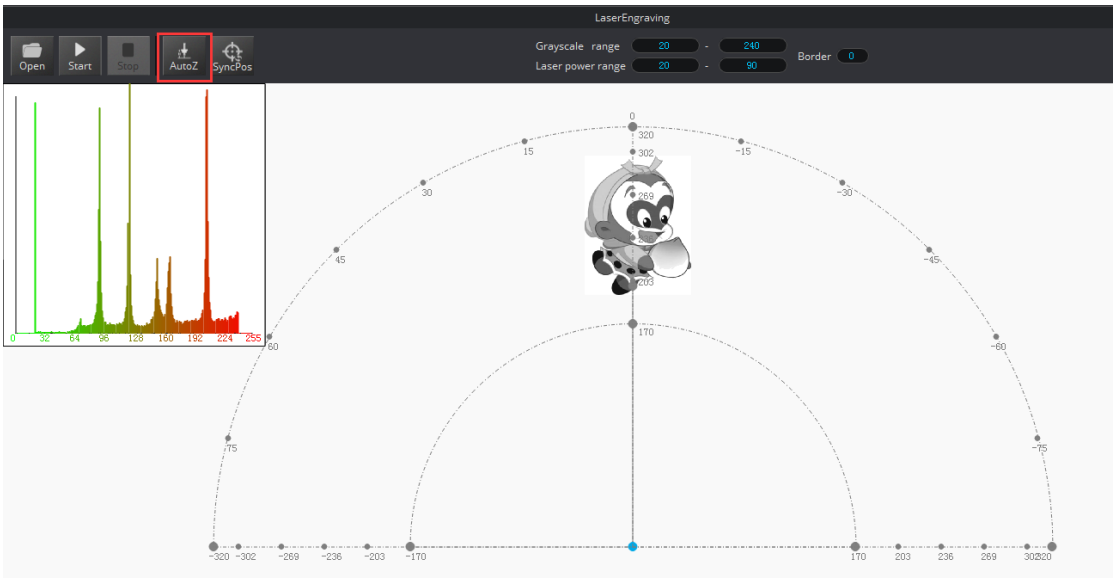


Figure 7.10 Lock the height

Saved value of Z, check from here:

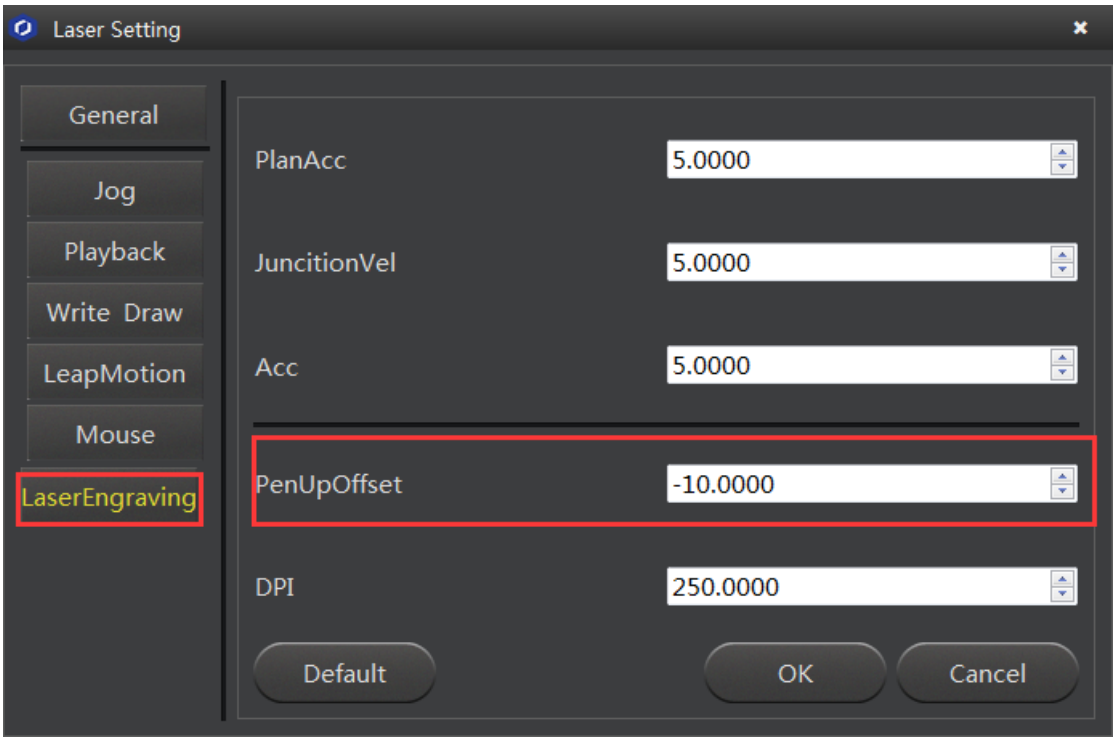
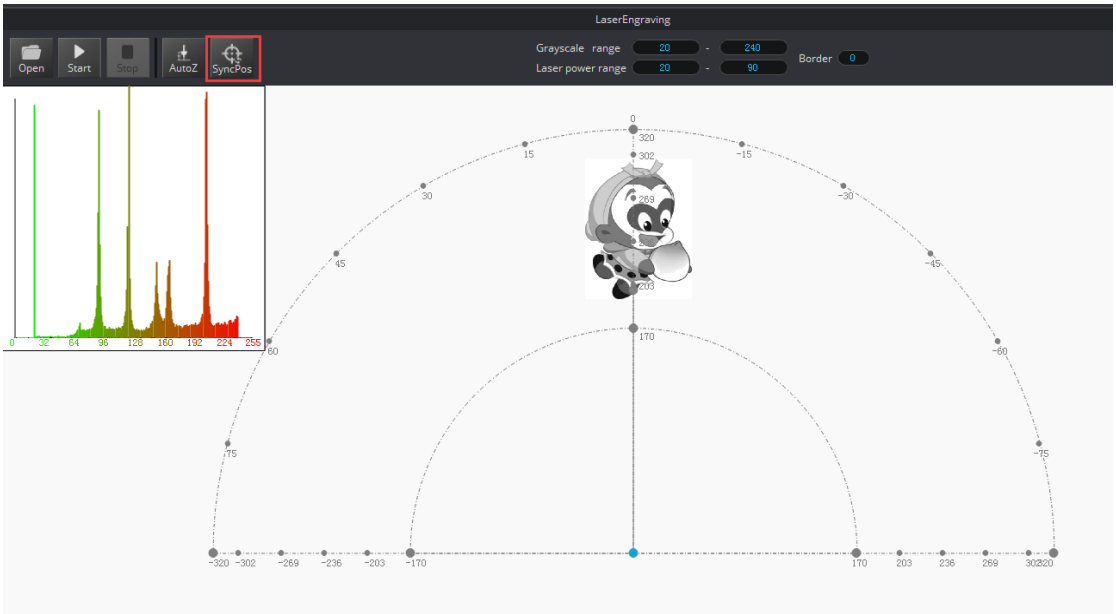


Figure 7.11 Check the height

If the engraving isn't clear, the laser height needs to be adjusted slightly. Revising the value of **Pendown** also helps.

4. After focus adjustment, click **SyncPos**. The Dobot will move to the start position.



5. Click **Start**, **Pause** and **Stop** to control the Dobot.
6. The result is shown below:

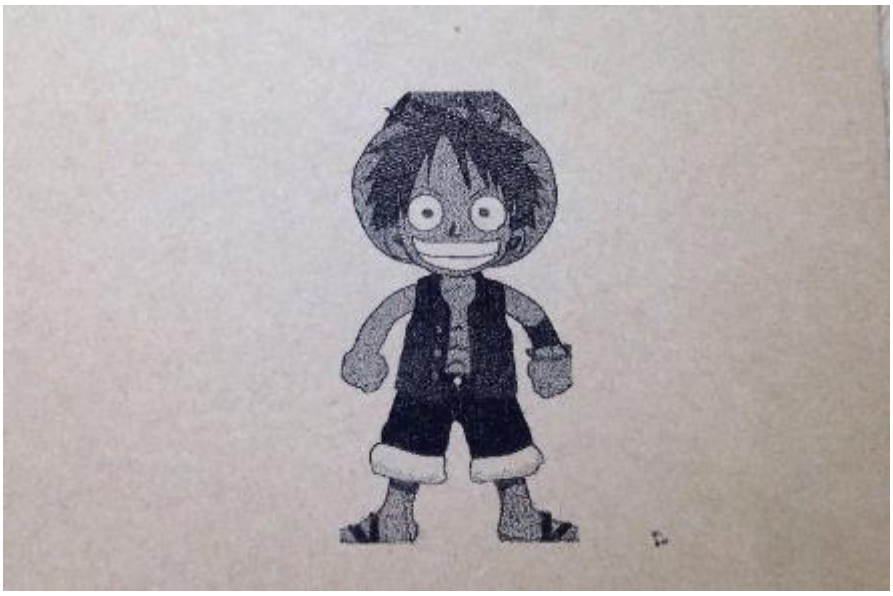
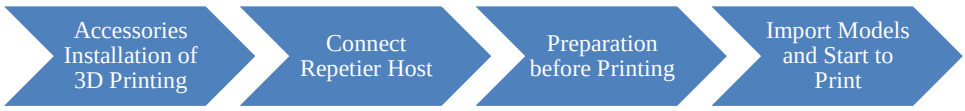


Figure 7.12 The Engraving Effect

8. The Tutorial of 3D Printing

The whole flow chart of 3D printing as shown below:



3D printing can use Repetier Host and Cura:

- Cura: Slicing is fast and stable, has strong inclusiveness to 3D model structure, less parameter settings, more users.
- Repetier-Host: It can slice, check and modify G-Code, and control 3D printing manually. While it doesn't offer built in slicing, it can use 3rd party slicing software, such as CuraEngine, Slic3r and so on. Finally, it has more parameter settings, making it very flexible.

Here will introduce the details separately from the second step.

Note: On Mac OS, Dobot can only use Cura, please refer to the tutorial of Cura.

8.1 Installation of Accessories of 3D Printing

3D printing accessories: extruder, hotend, motor cable and filament, as shown below:

Figure 8.1 **Accessories of 3D Printing**

The steps as follows:

1. Press down the lever on the extruder by hand, and push down the filament to the bottom of the hole via the pulley.

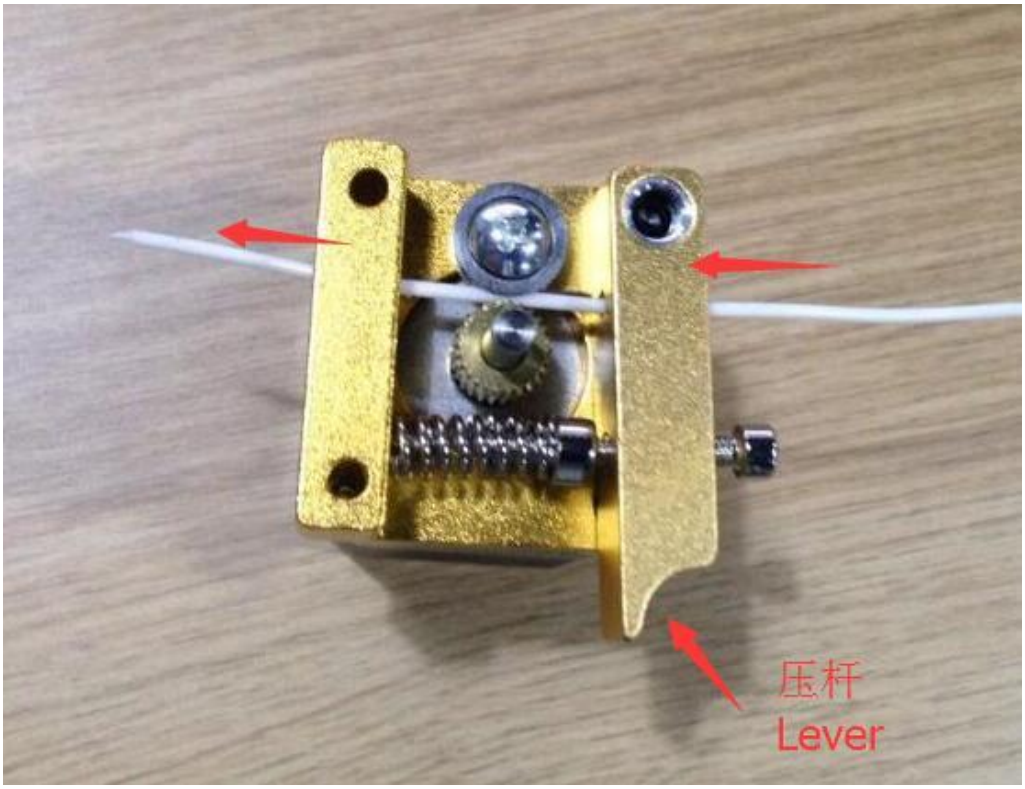


Figure 8.2 Insert filament

2. Insert the filament to PTFE Tube and push it down the bottom of the hotend, then tighten the Push-in fitting on the extruder. Notice: Make sure the PTFE Tube itself is pushed down to the hotend bottom. Otherwise, it will cause abnormal discharge.

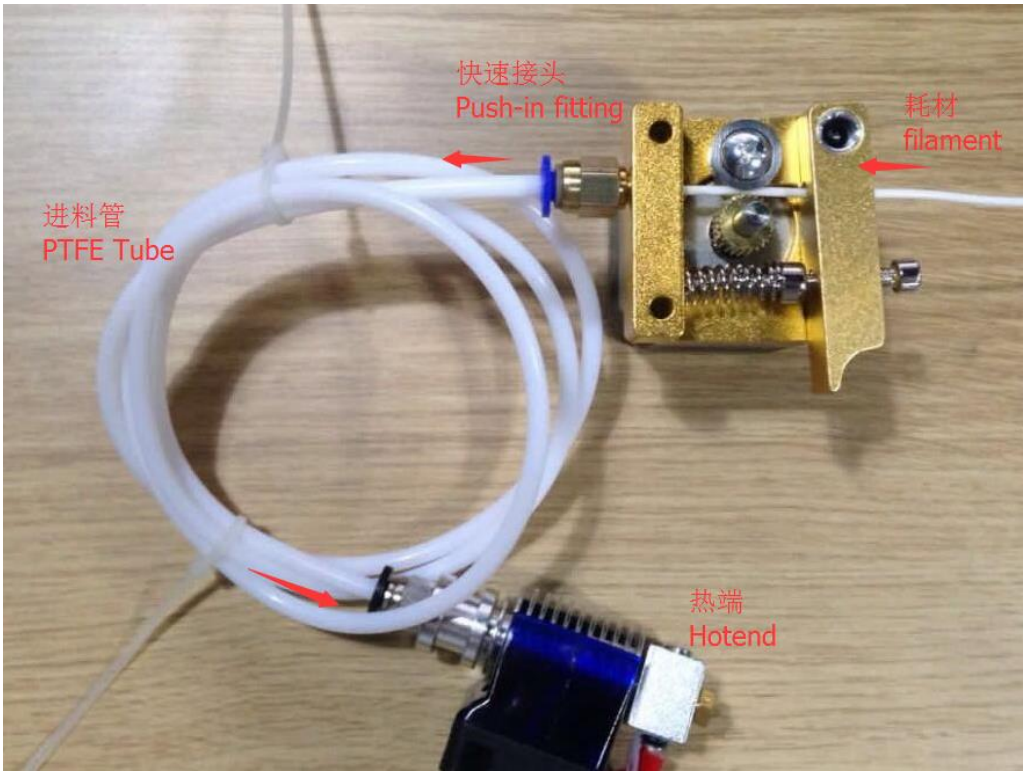


Figure 8.3 Connect extruder and hotend

3. Fasten hot end with butterfly nut;
4. Connect power line of heating cable with interface 4 on the forearm, link power line of fan with interface 5, and connect thermistor line with interface 6.

Figure 8.4 Connection of forearm

5. Connect extruder motor line with Stepper1 on the controller.

Figure 8.5 Connection of extruder

6. The whole kit should look like this:

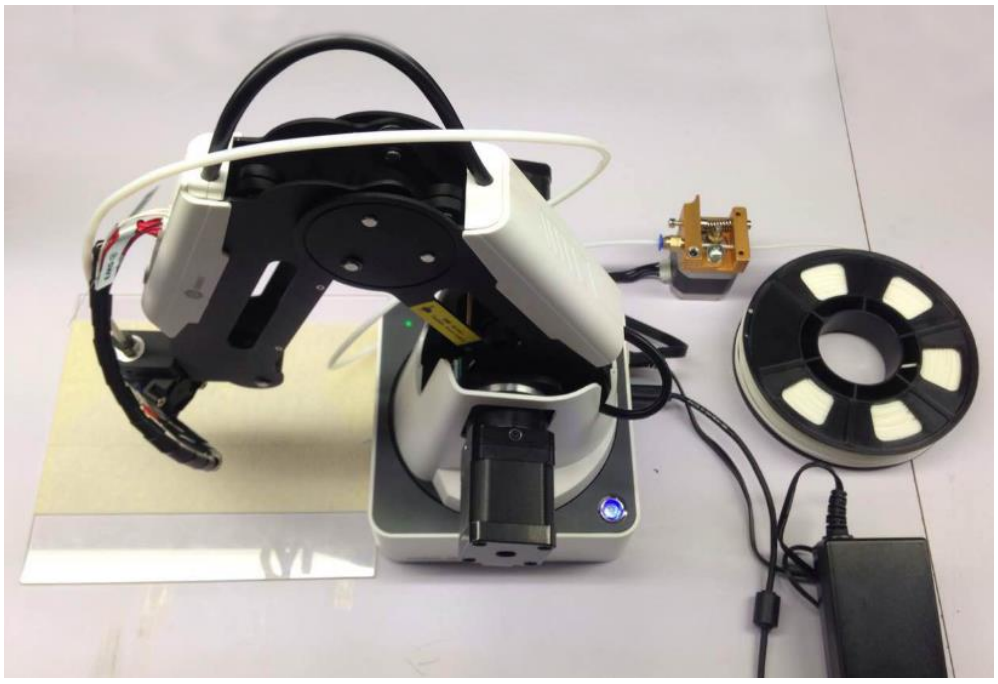
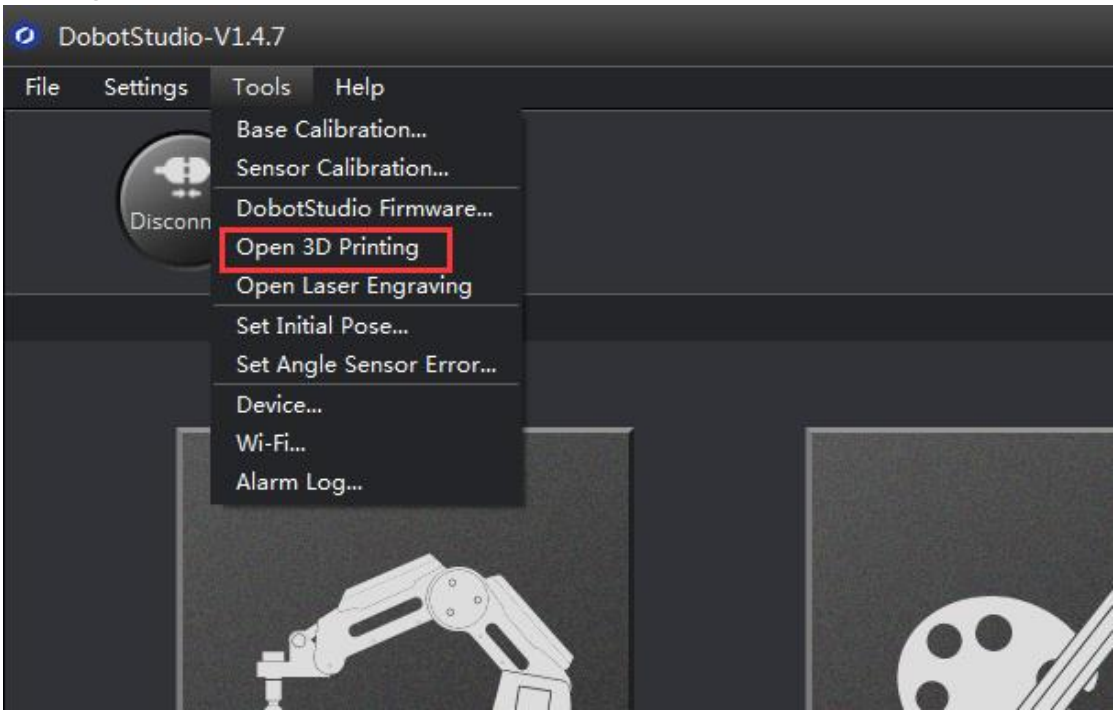


Figure 8.6 3D printing installation

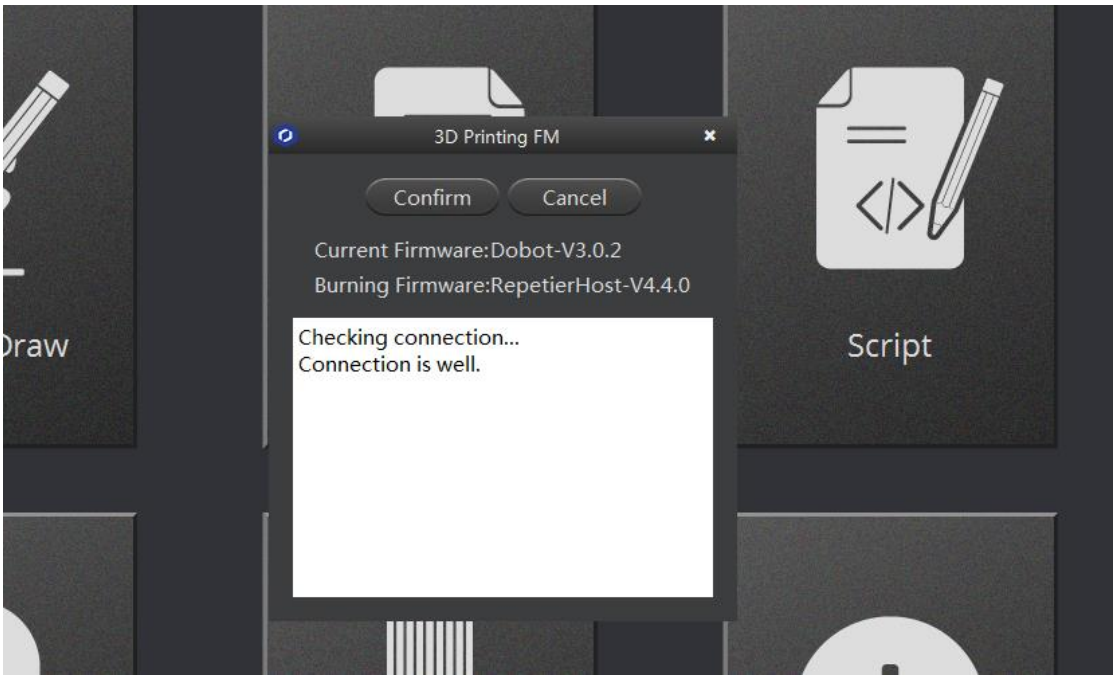
8.2 Repetier Host

8.2.1 Switch into 3D printing

Repetier host has been built into DobotStudio. Open DobotStudio, click **Tools-> Open 3D Printing**:



A pop up a dialog of 3D printing burning firmware will appear. Click **Confirm**, and then Repetier Host will pop up automatically, as shown below:



The interface of Repetier Host:

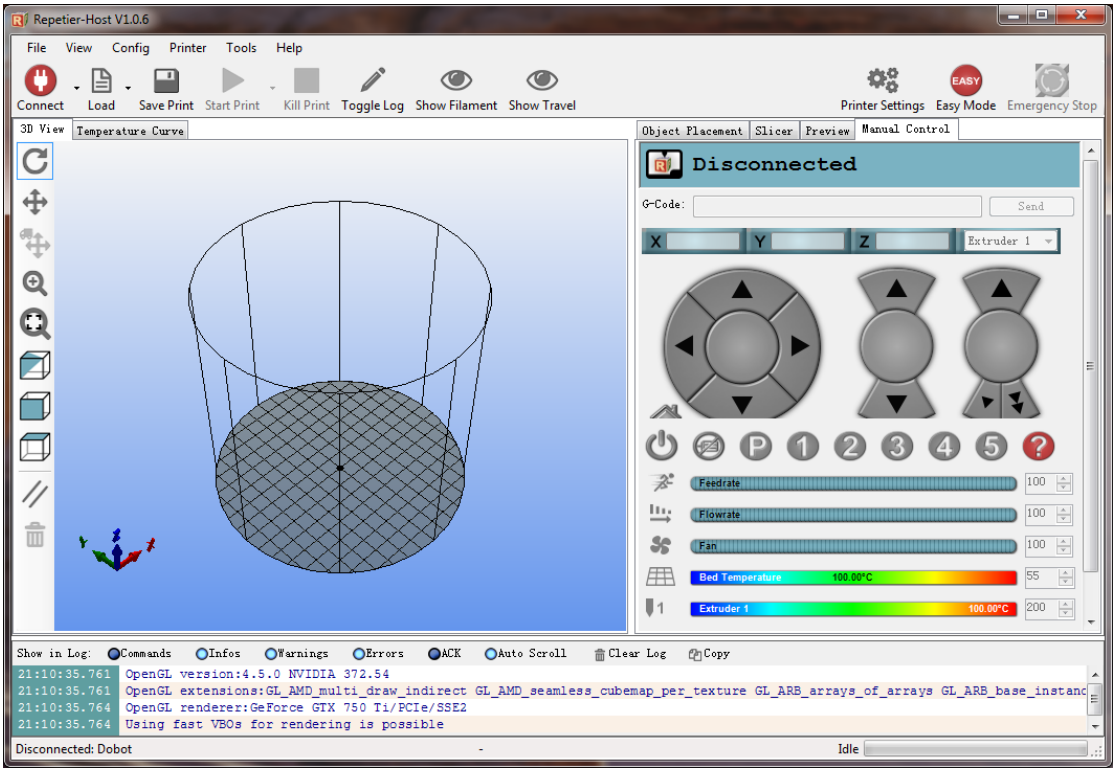


Figure 8.7 Repetier host

Note: If the current software is set for 3D printing, you can open DobotStudio directly when you want to use next time. Click **Connect**, select **Ok**, and then you can switch to Repetier Host, as follows:

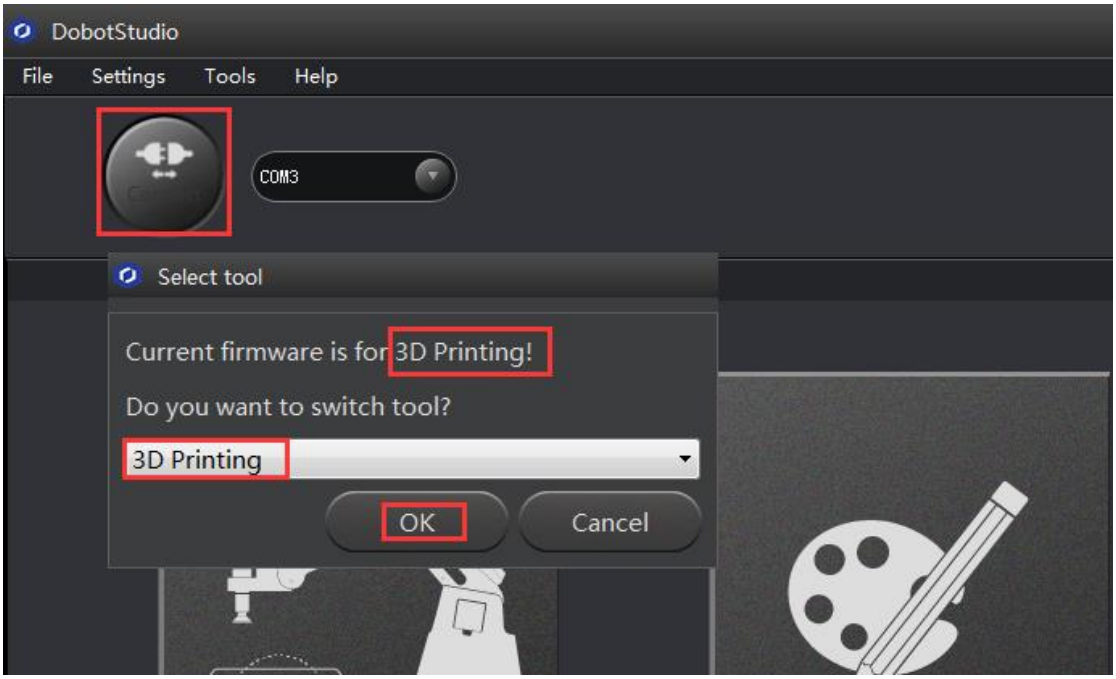


Figure 8.8 Switch into 3D printing automatically

8.2.2 Parameter Settings of 3D printing for the first time

Set this up when you use it for the first time ONLY. (You don't need to do this twice!)

Click '**Printer settings**' in the top right corner of the interface, and set related parameters in the pop up diaglogue box:

（1）Connection lable settings

Printer Name: Dobot (can be named by oneself)

Select Dobot Serial Port: Dobot serial port

Baud Rate: 115200

Reset on connect:DTR low->high->low

Reset on Emergency： Send emergency command+DTR high->low(If failed to connect, please try other options)

Receive cache size: 63

The rest keep the default settings, click **Apply** after setting.

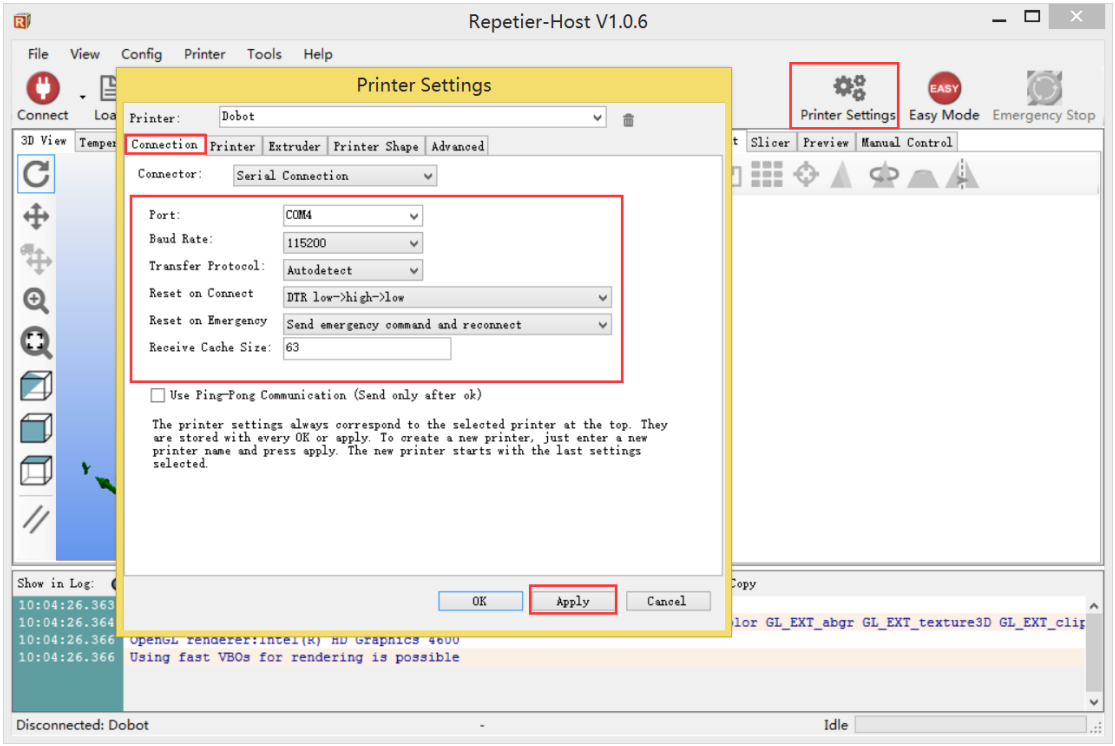


Figure 8.9 Connection Settings

（2）Connection Lable Settings

uncheck the following three settings and keep the rest default:

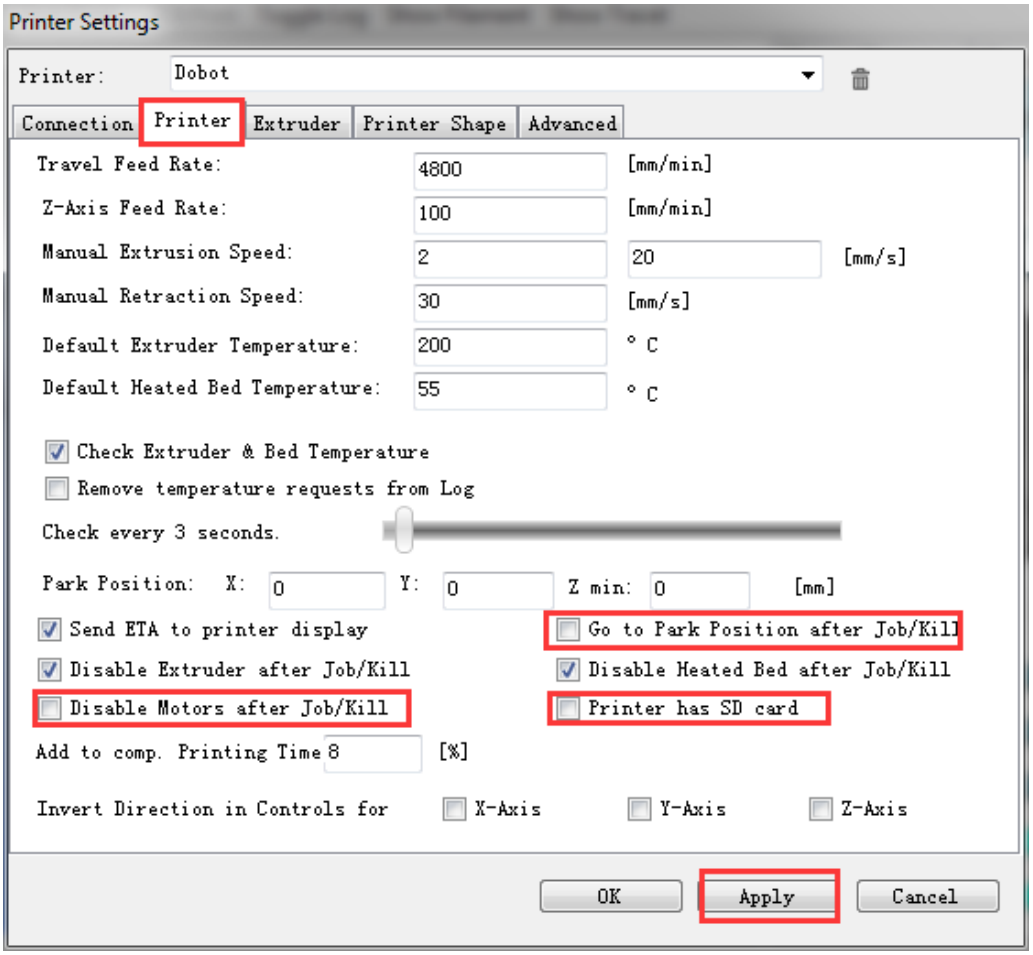


Figure 8.10 Printer settings

（3）Extruder Settings

The number of extruder setting: 1

The nozzle diameter: 0.4mm

Keep the rest default.

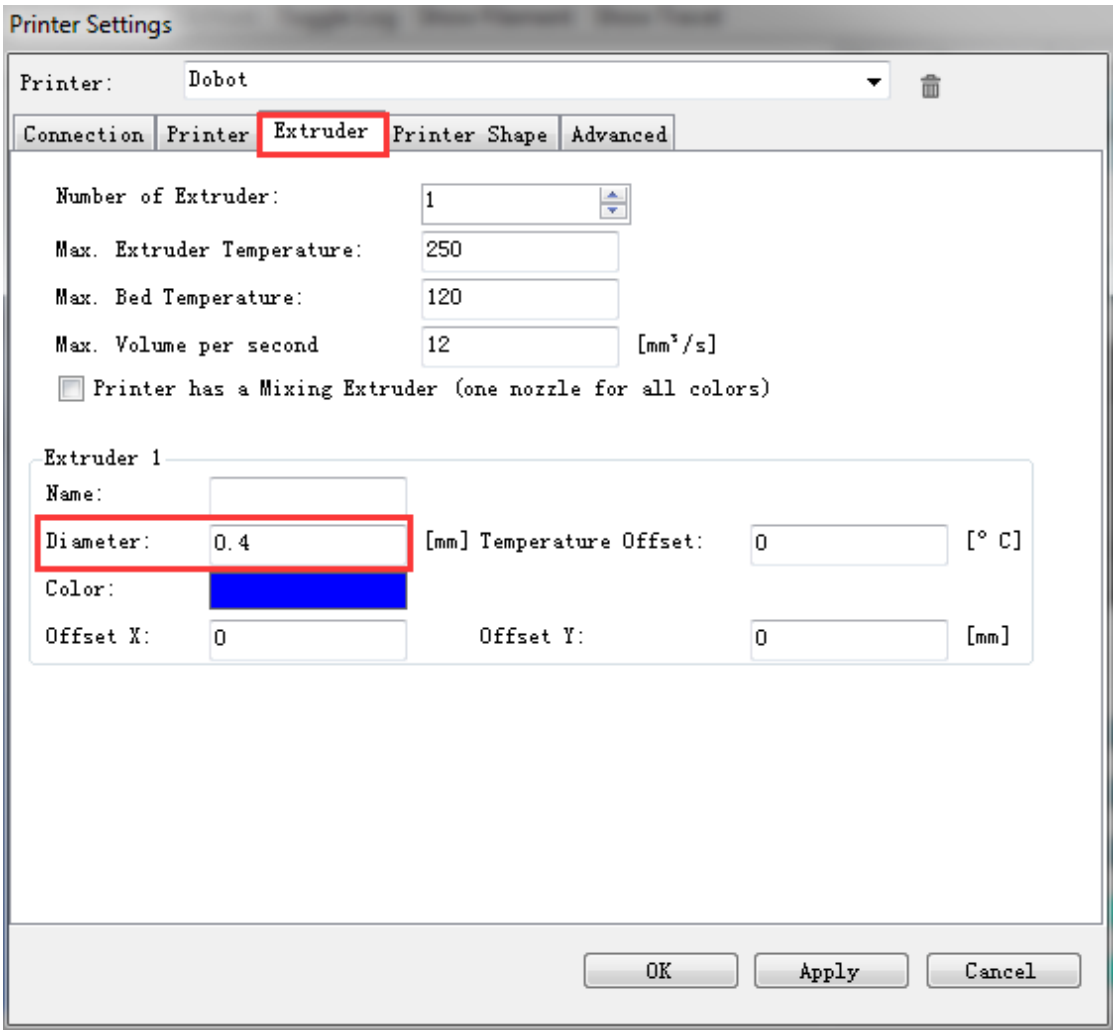


Figure 8.11 Extruder Settings

（4）Printer Shape Settings

Select **circle printer** and the detailed parameters as follows:

Home X： Min

Home Y： Min

Home Z： 0

Print area radius: 80mm

Print area height: 150mm

Click **Apply** after setting.

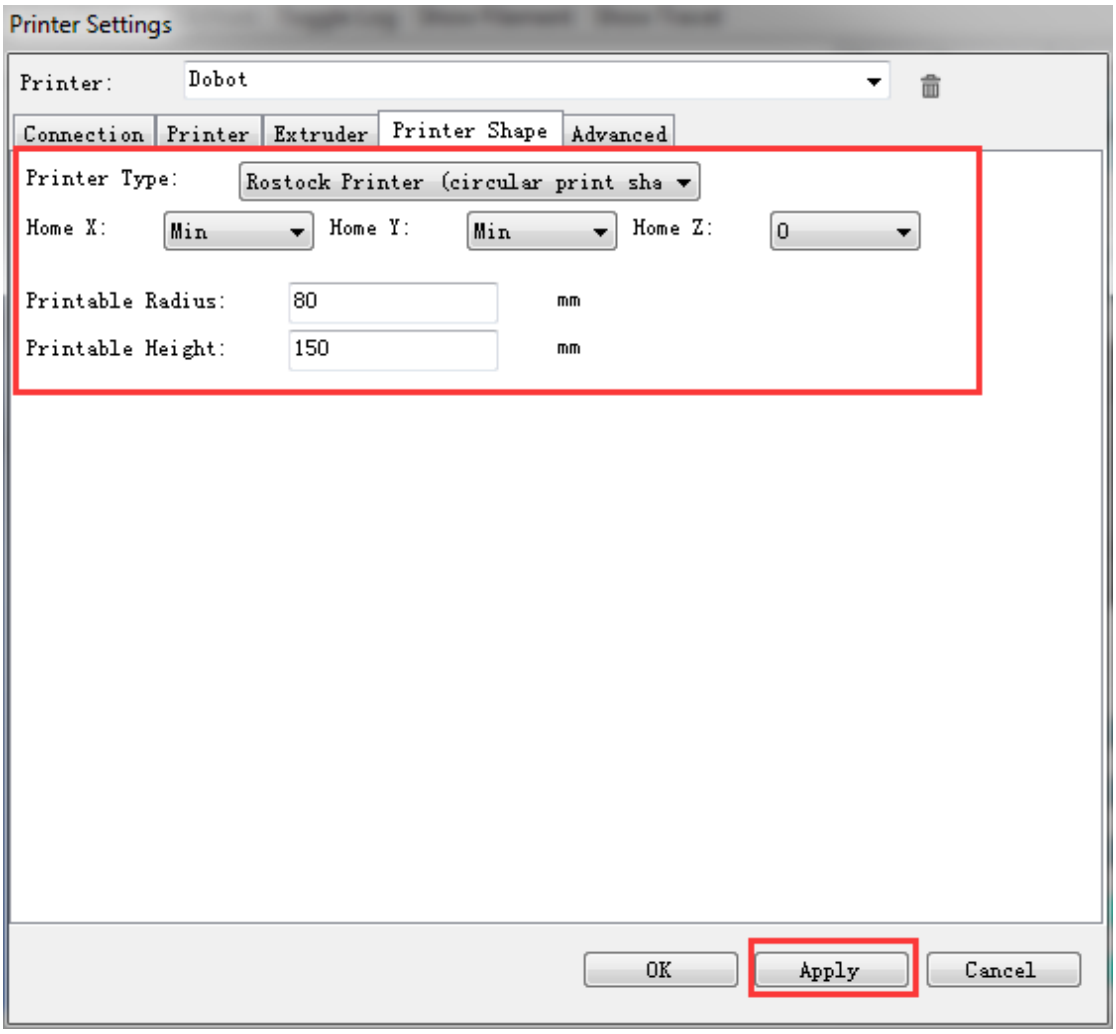


Figure 8.12 Printer Shape Settings

After setting parameters, return to the main interface. Open the Dobot main power supply, insert USB, and click **Connect** at the top left corner of main interface. Then, we can connect Dobot. The LED will turn green and the temperature will be shown below the interface:

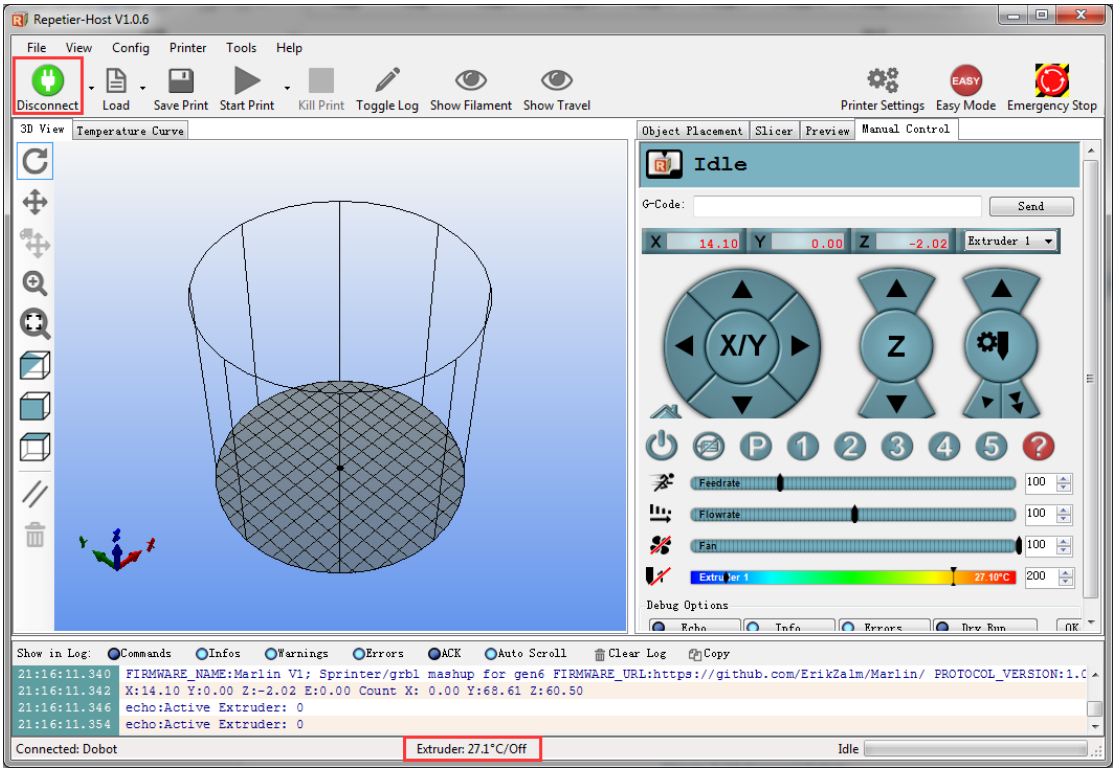


Figure 8.13 Connect Dobot

8.2.3 Preparation before Printing

We need to melt the plastic to be able to have it flow properly, so we first heat the extrusion head.

Here, set heating temperature to 200℃ and then click the **heating button** on the control panel to heat it. s

⚠ Notice：

The heating rod will produce high temperature up to 250℃, so please be careful！

DO NOT let children play with it alone.

The process needs to be monitored when it is running.

After the process, please turn off the equipment promptly.

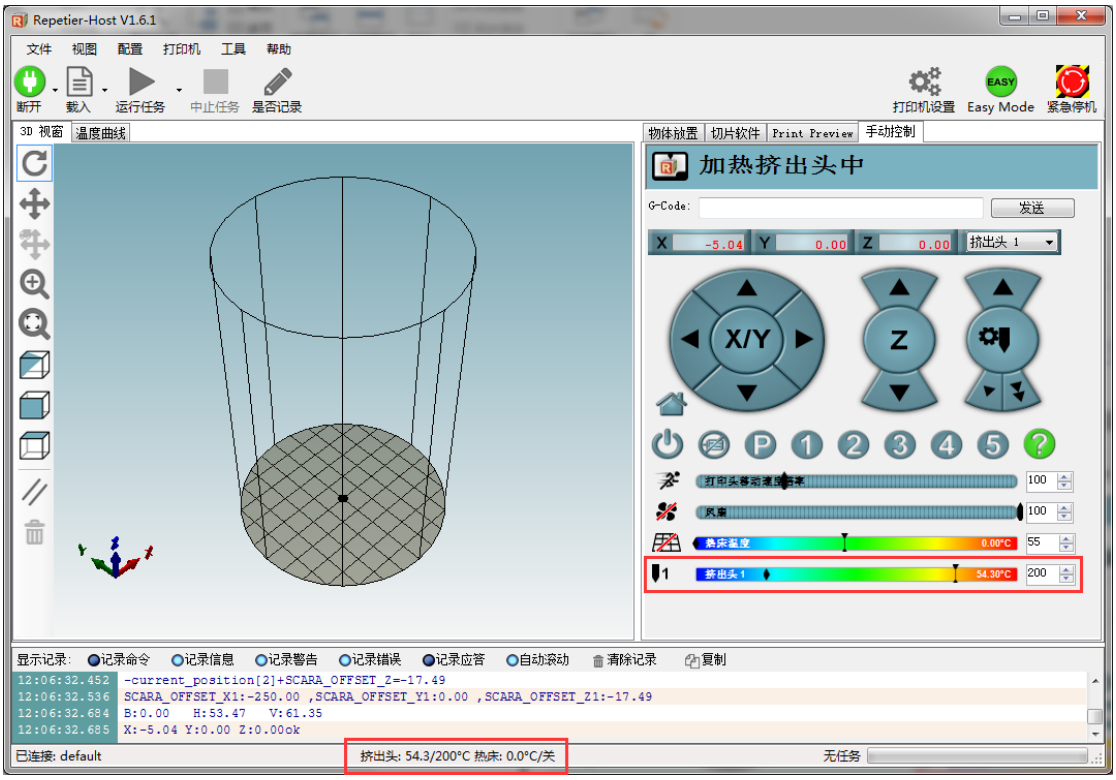


Figure 8.14 Heat the Extrusion Head

When the heating temperature is up to 200℃, click the extruder feeder and feed up to 10-30mm, as shown below:

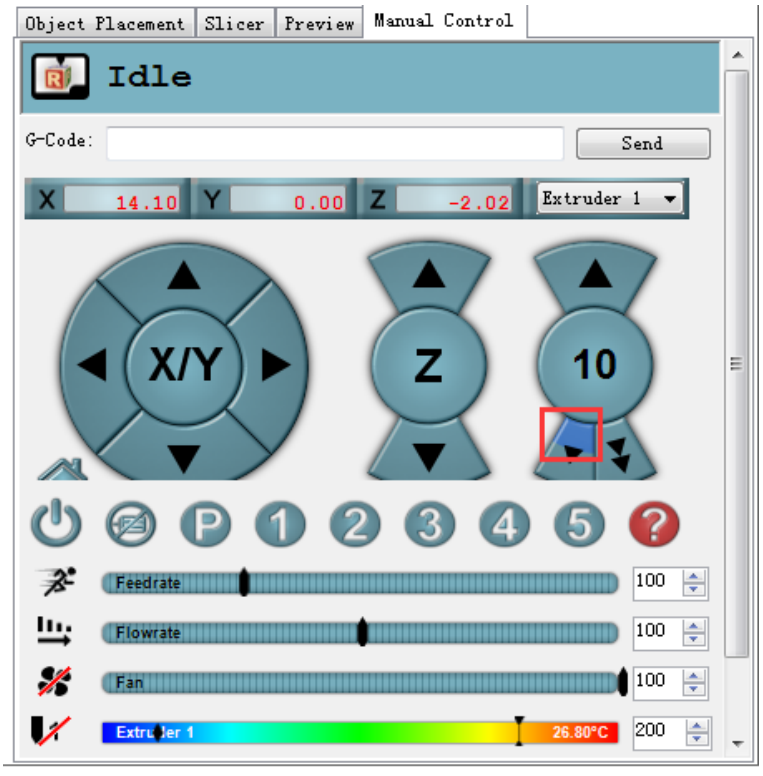


Figure 8.15 Extrude filaments

If melted materials flows from nozzle of the extruder, then it means the extruder is working properly:

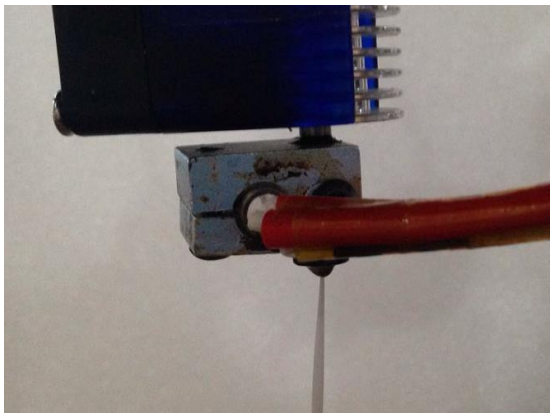


Figure 8.16 Filament Extrusion

Note: If the filament extrusion is in the opposite direction, simply remove the filament, turn the extruder around, and replace the filament.

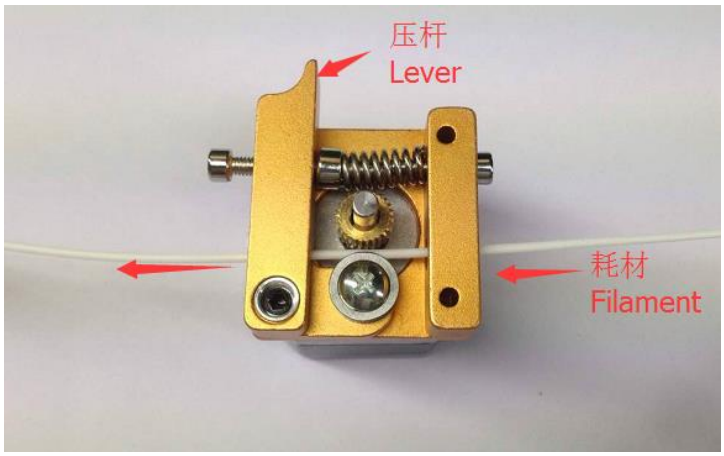


Figure 8.17 Reverse installation diagram of the extruder

8.2.4 Adjust the printing space and get printing coordinates

During printing, if the distance between the nozzle and print is too large to paste the print bed of the first layer or if the distance is too small, which will cause a blockage, we need to adjust the proper distance for smooth printing. Generally, the thickness of a sheet of paper is OK so paste a layer of masking tape on the glass print bed in order to have the first layer printed adhere better.

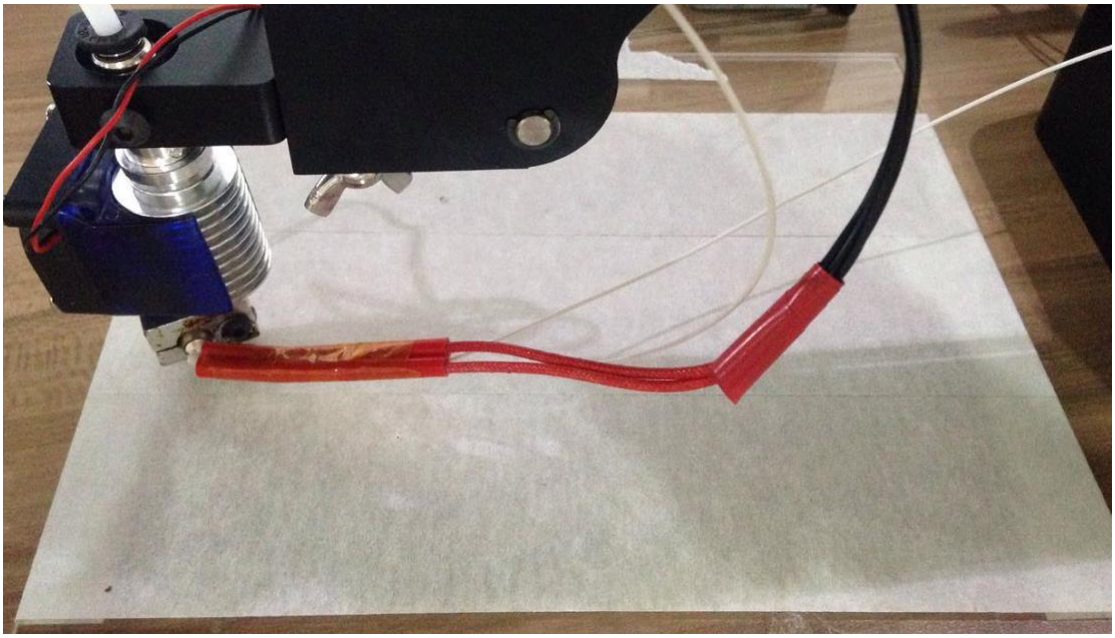


Figure 8.18 Masking tape

Adjustment process: Press the **Unlock** key on the forearm and drag the printing head to contact the surface of the masking tape. Then, press “key” at the base of the Dobot to save the current Z value (or insert **M415** in the command line, enter and get the current Z value).

Notice:

After sending M415 or press “KEY”, Dobot will get current coordinates, if it is successful, you will hear a beep. Also, you don’t have to insert the command next time when printing.

The window of command is shown below：

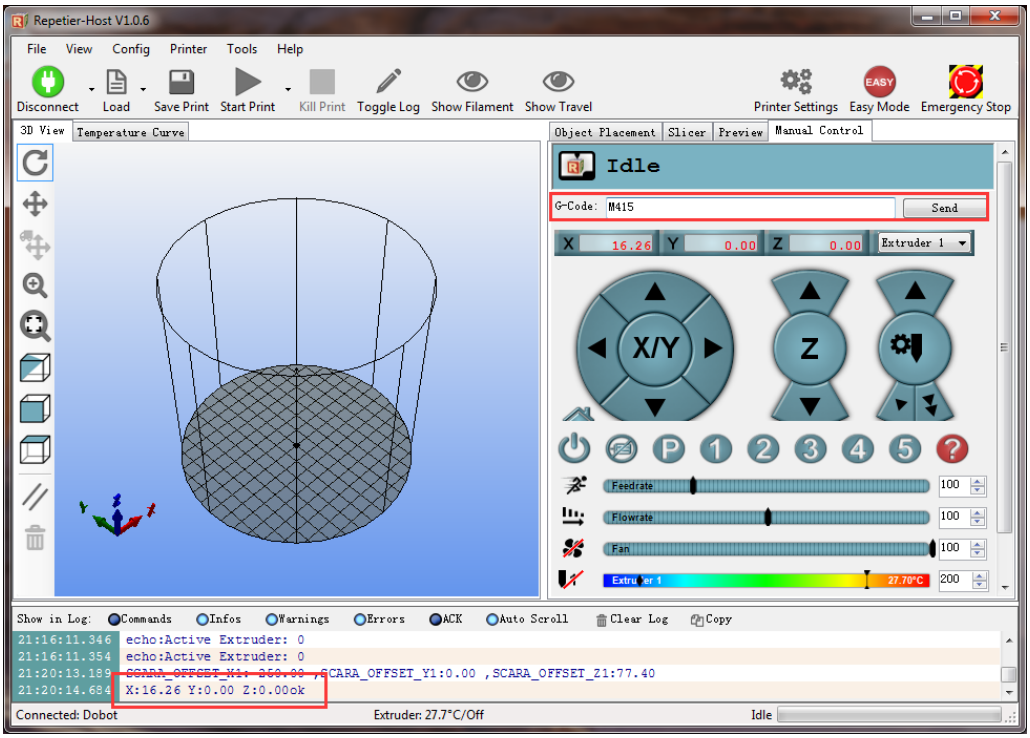
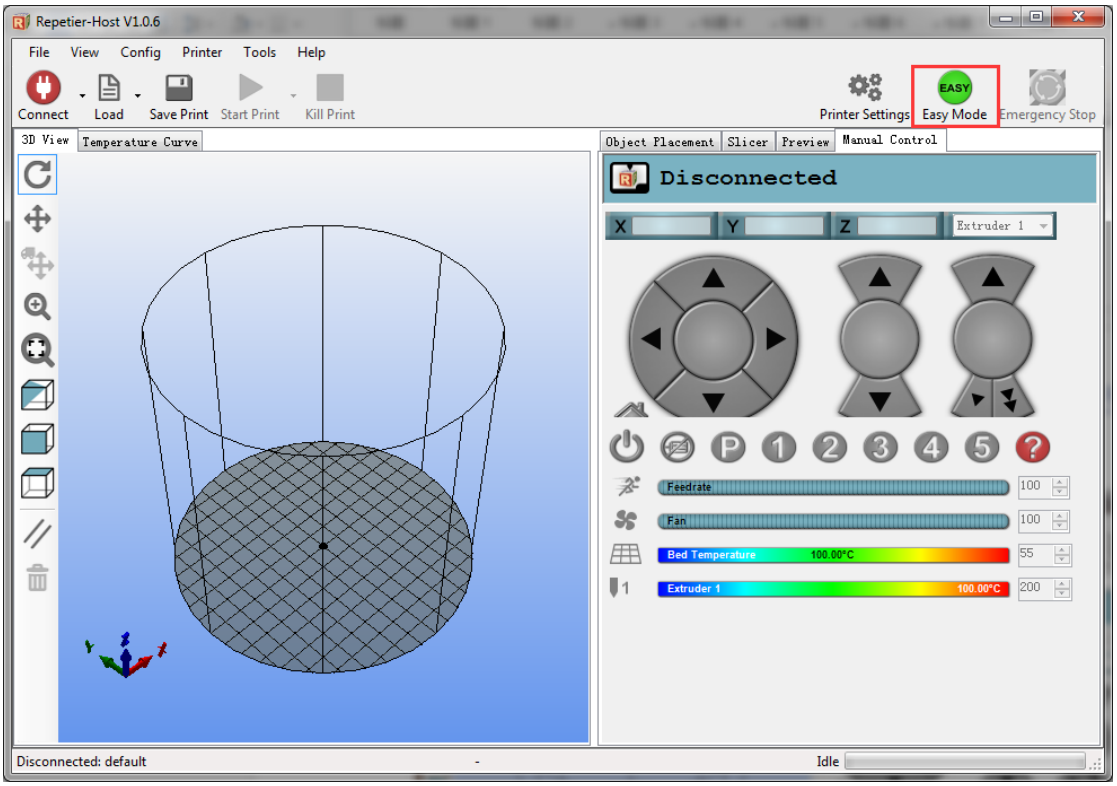
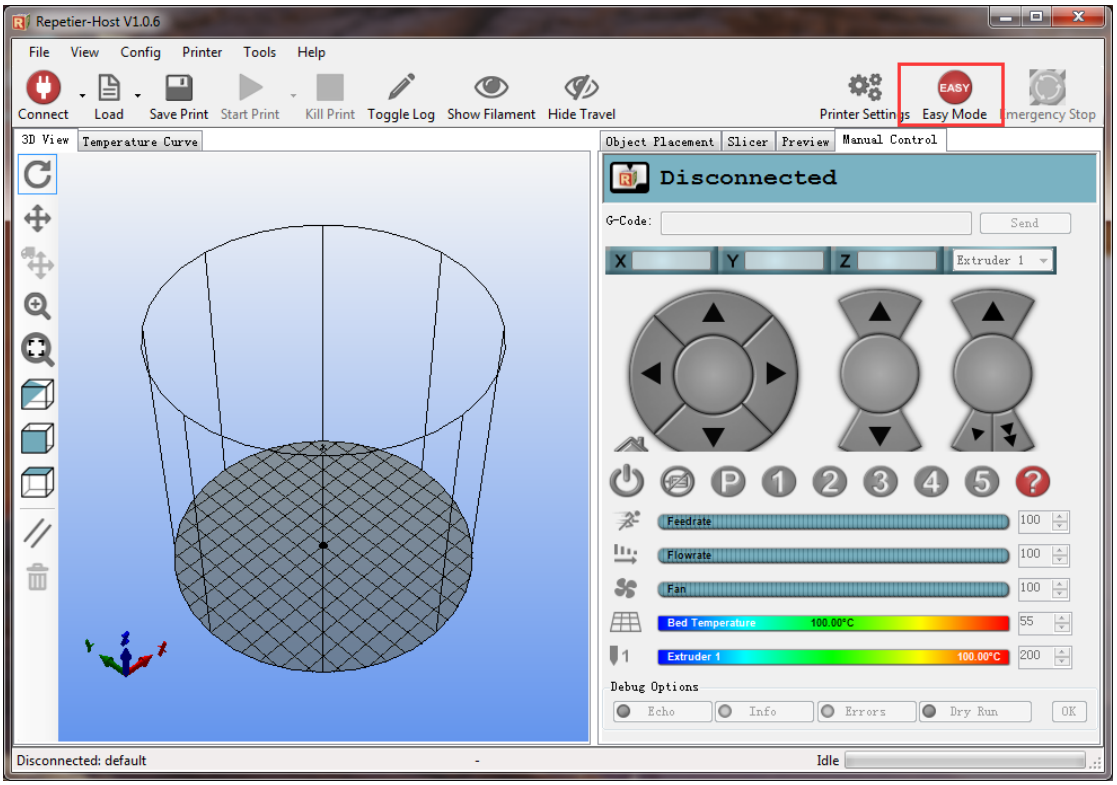


Figure 8.19 Sending out M415 command

If you cannot find the command line window, please close **Easy** mode, as shown below:





8.2.5 Import Model

The file format of 3D printing is STL, which is employed universally.

Users can build one's own 3D model and transfer it into a STL file, or search for free models to import them directly. Click open, import 3D model file (in STL format), as shown below:

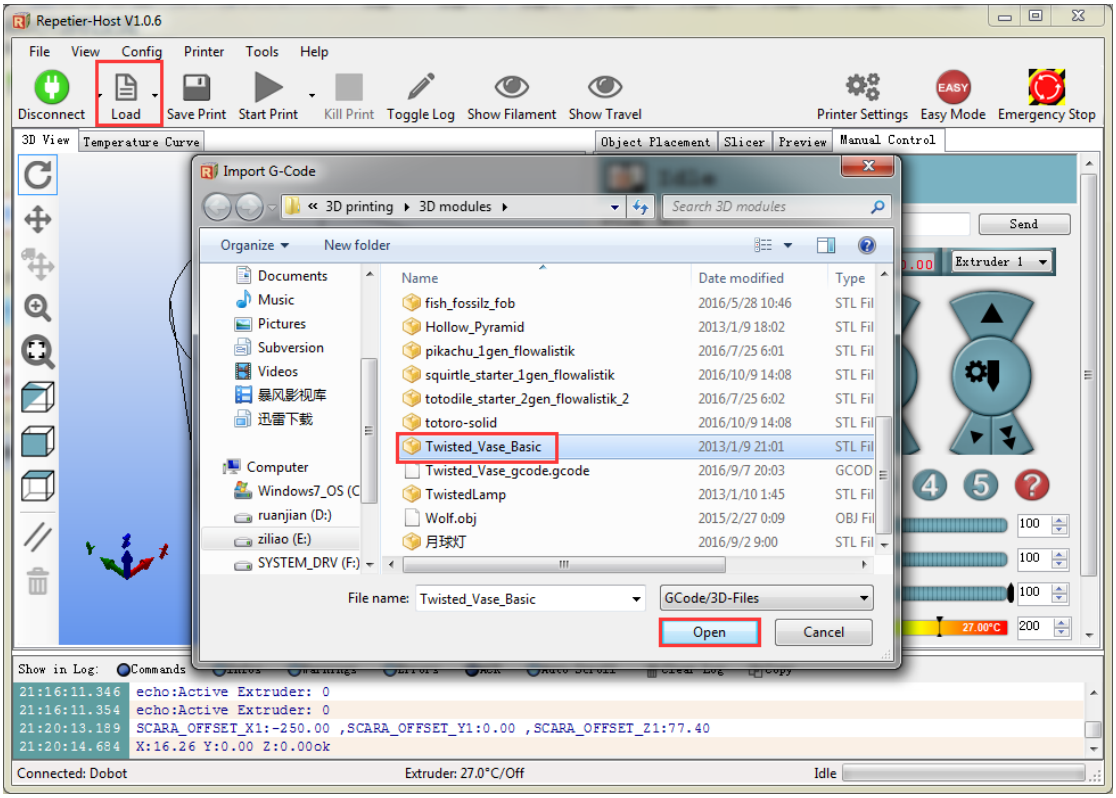


Figure 8. 20 Import Models

Model Center/Scale: Users can operate the model to place in the middle, zoom or rotate and any other functions.

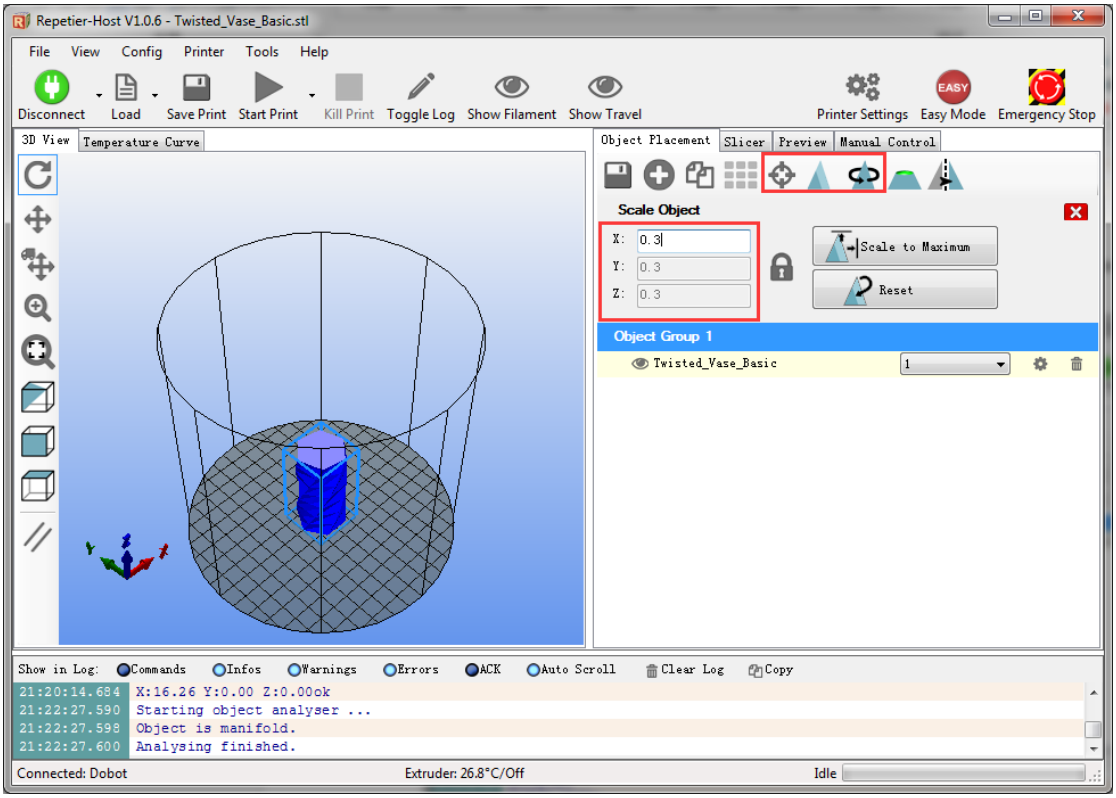


Figure 8.21 Model Center/Scale

8.2.6 Set slice parameters and slice up

Select slice engine Slic3r and click Configuration to set slice parameters.

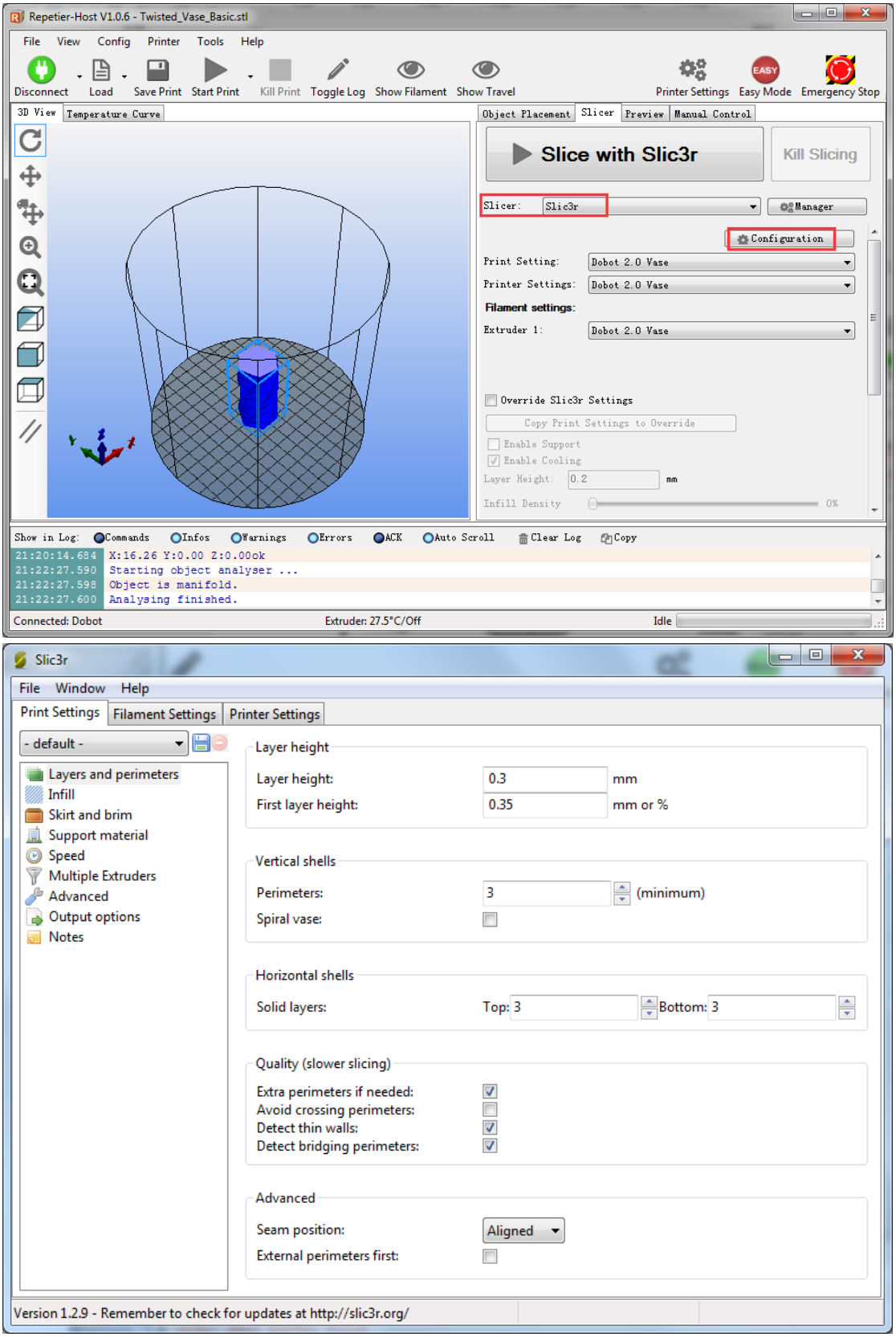


Figure 8.23 Main interface of parameter settings

Its important to set slice parameters, so users should get the best slice parameters according to printed models and tested performance of the equipment. Here we suggest a configuration file that can be impoted from **attachement** of DobotStudio:

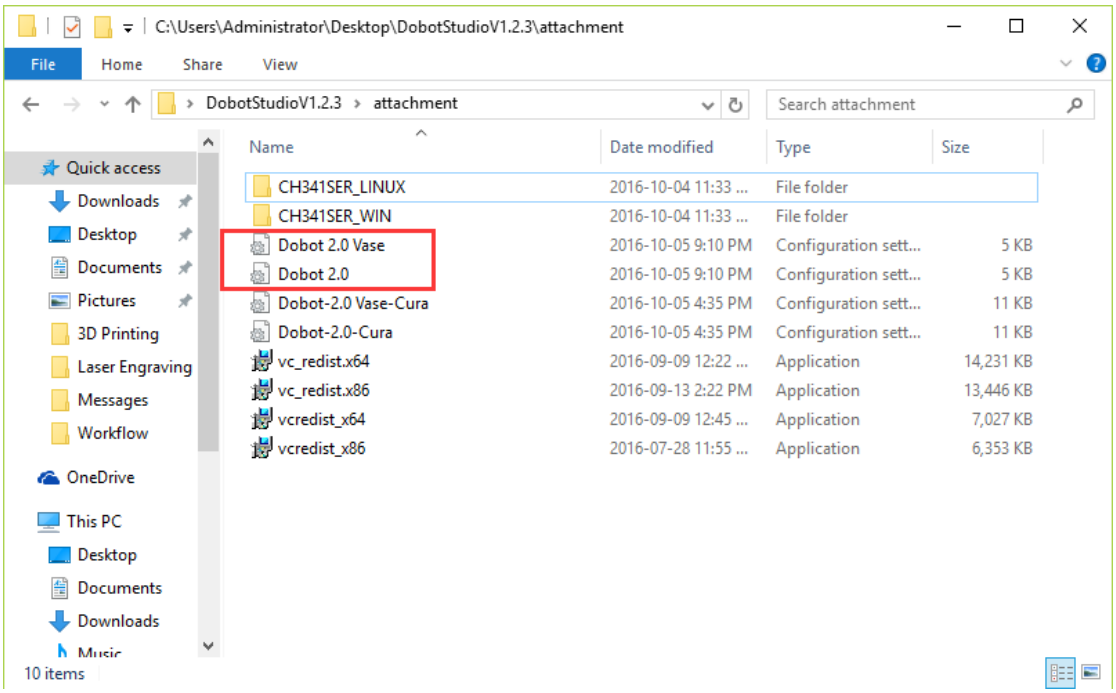


图 8.24 Config files

Dobot-2.0-Vase.ini is used for printing a thin-valled vase, while Dobot-2.0.ini is used for filling, (the filling rate is 15%).

Import the file after downloading: Click **File->Load configto load**.ini file.

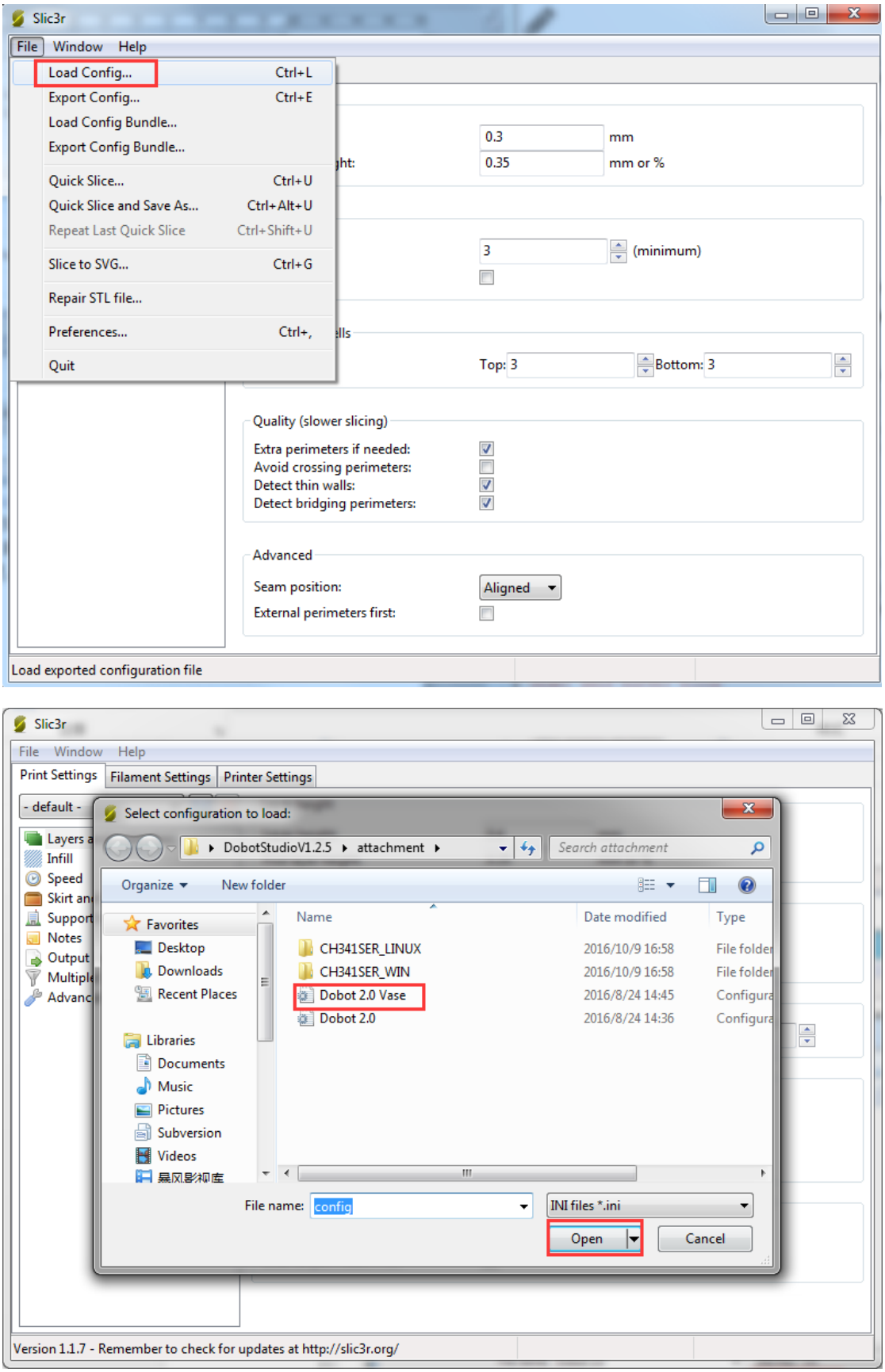


Figure 8.25 Import configuration file

After importing the file, users need to save the three labels: Print settings, Filament settings and Printer settings. Users can rename them, but the default names are recommended for clarity:

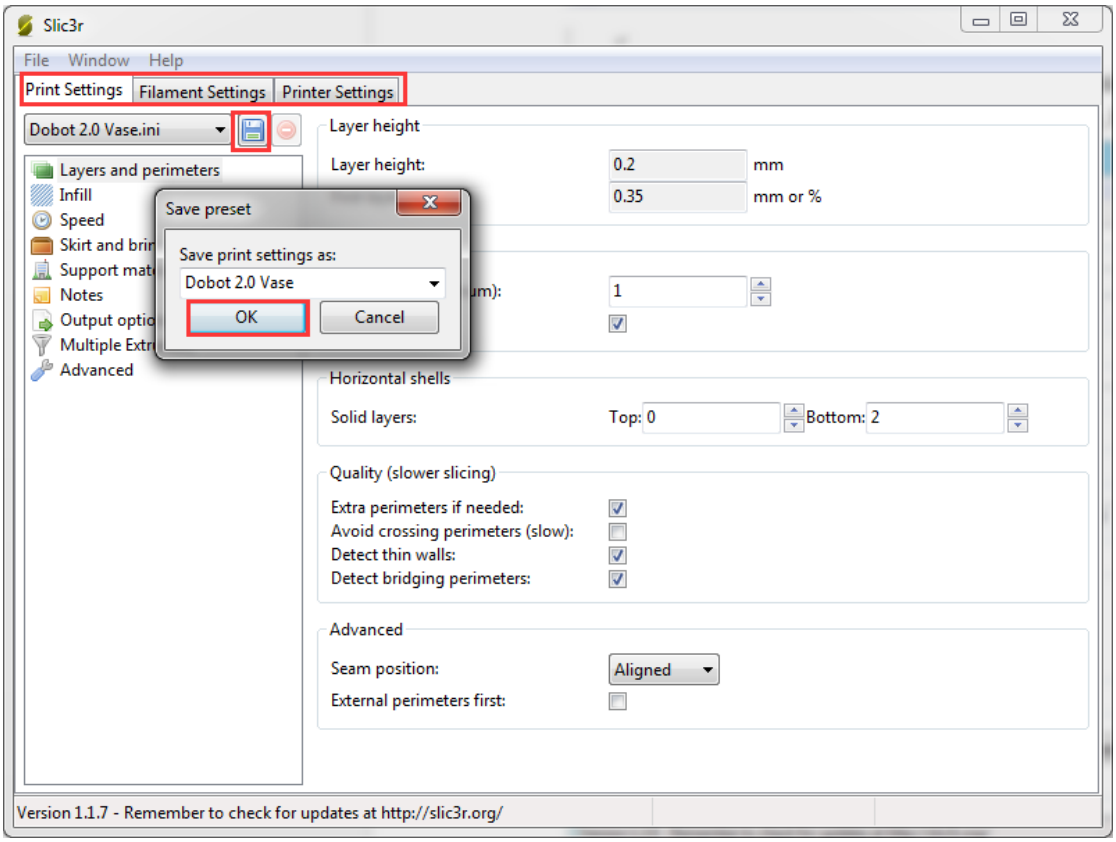


Figure 8.26 Save configuration file

Slice: After finishing above settings, save the settings of each label, and return to main interface. Select **slic3r**, import slice settings and **click Slice with Slic3r.io**

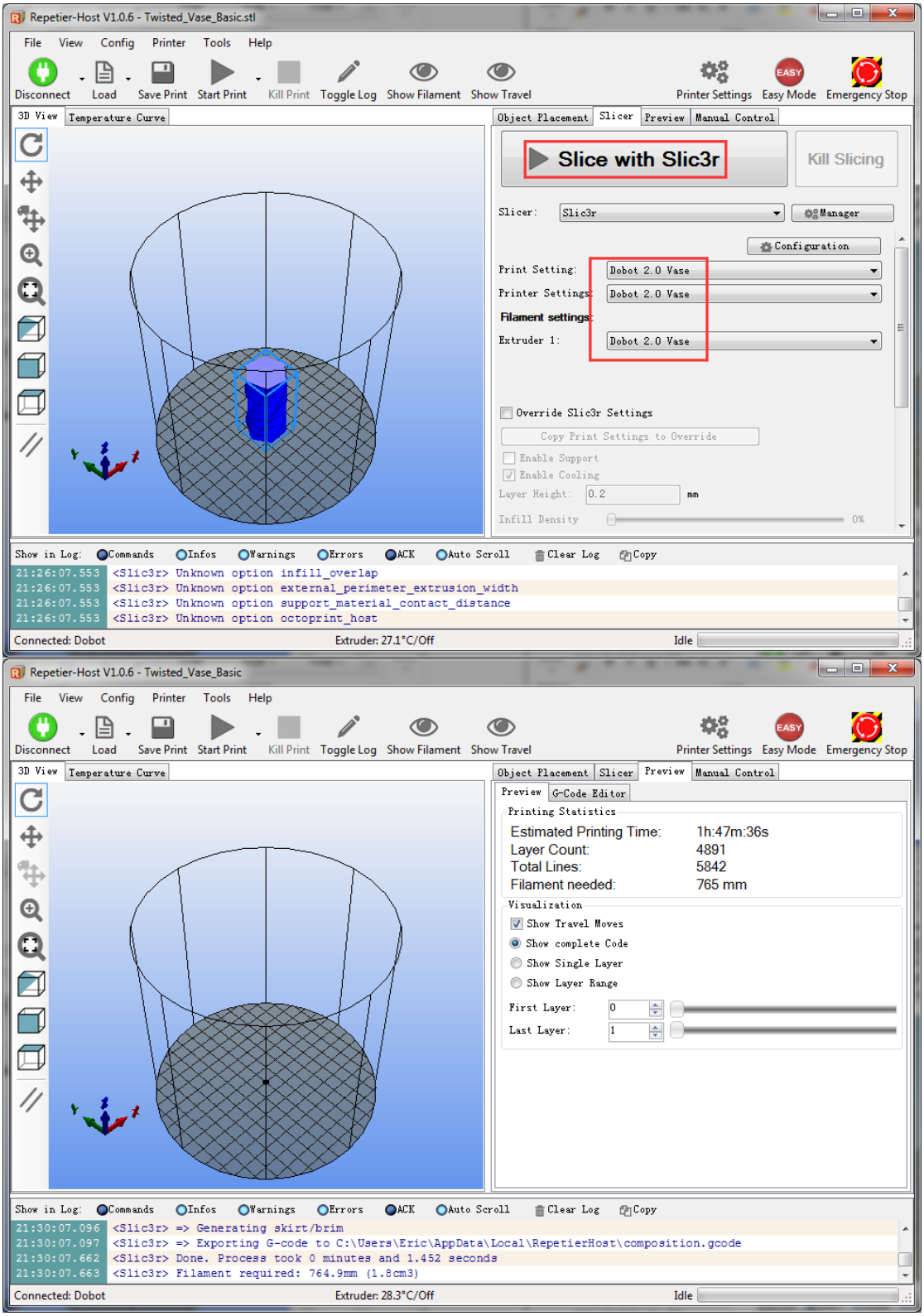
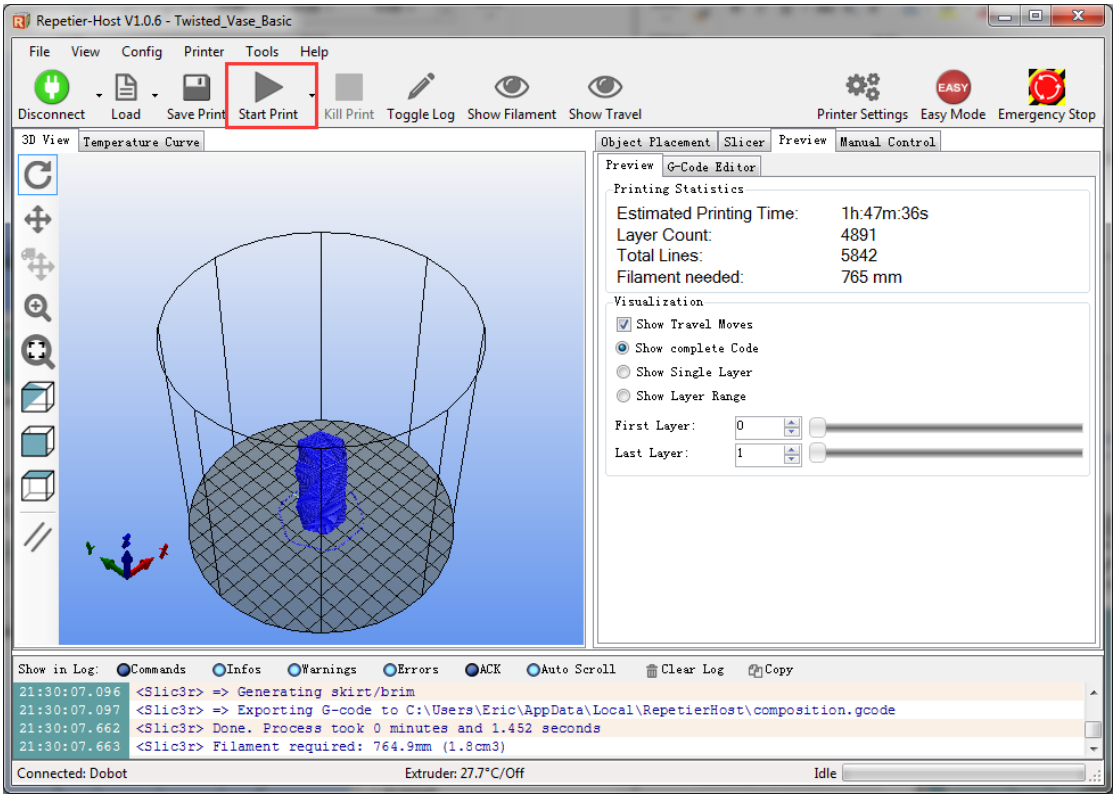
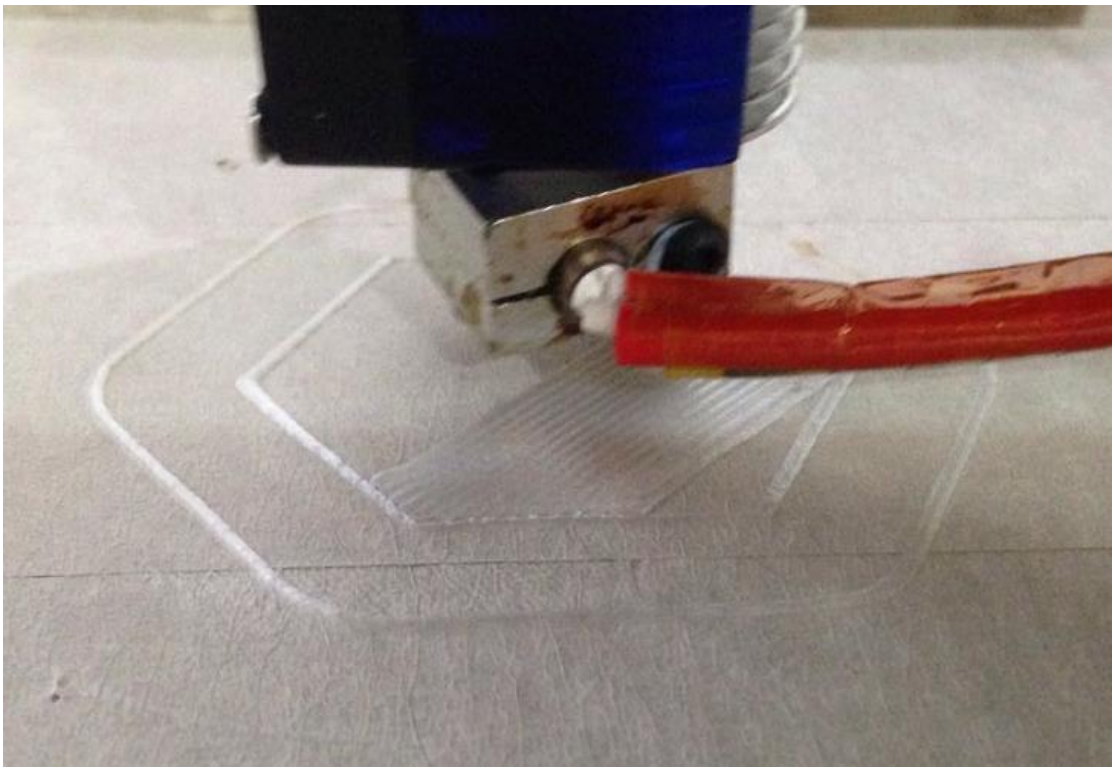


Figure 8.27 Finish slice

8.2.7 Start to Print

Now, click **Start print** at the top left corner of main interface to print:





Here we choose **vase mode**, and the product after printing as follows:

Figure 8.28 The Product of Printing

8.3 Cura Introduction for 3D printing

If you want to use Cura for 3D printing, the details seen as follows:

Notice: Installation of accessories and firmware burning shown as Repetier Host 3D printing.8.2 Repetier Host

8.3.1 Cura parameter settings

Cura is a free software that can be downloaded on its official website. We recommend you to use Version **V14.07**. You can download the software here:

https://ultimaker.com/en/products/cura-software/list

The software interface is as follows:

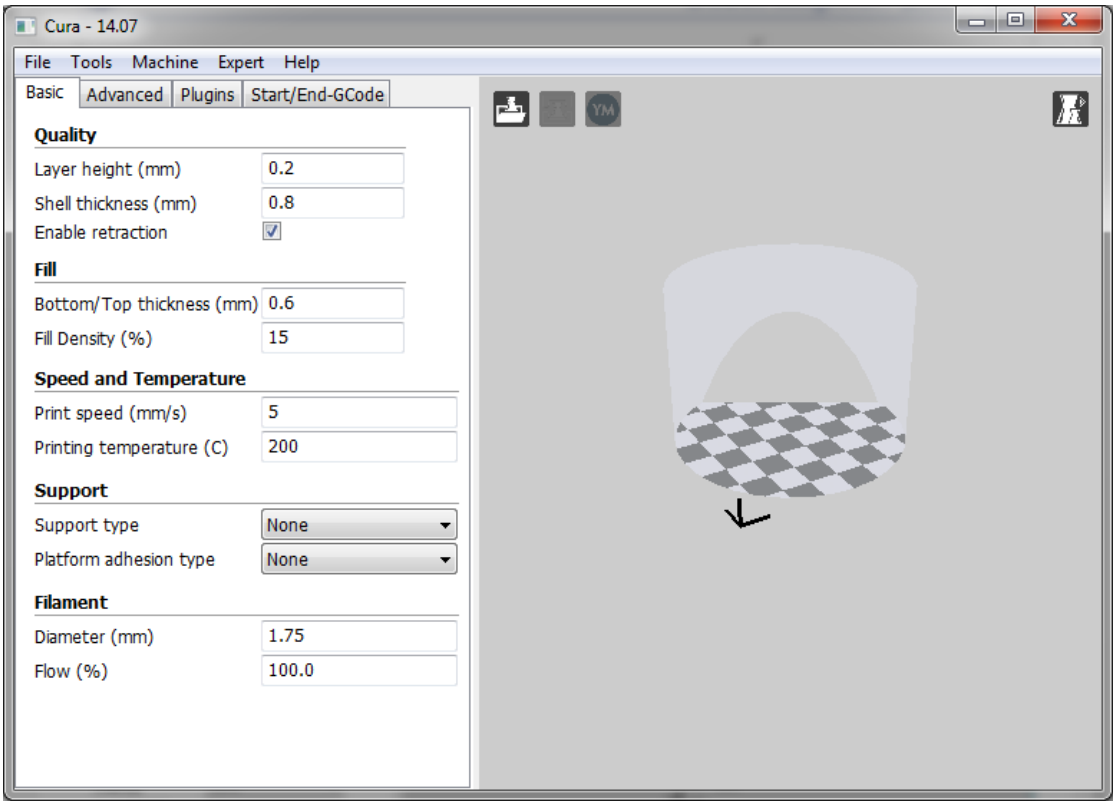


Figure 8.29 Cura interface

Machine->machine settings, set related parameters in the pop-up dialog:

（1）Connection label settings

maximum width：80mm **maximum depth**：80mm **maximum height**：150mm；

Machine center 0,0：Need tick

Build Platform shape: Circular

COM port setting: The corressponding COM port in the device management

Baud rate：115200

You can also choose to change the machine's name. Keep the rest of the default settings and click OK after finishing.

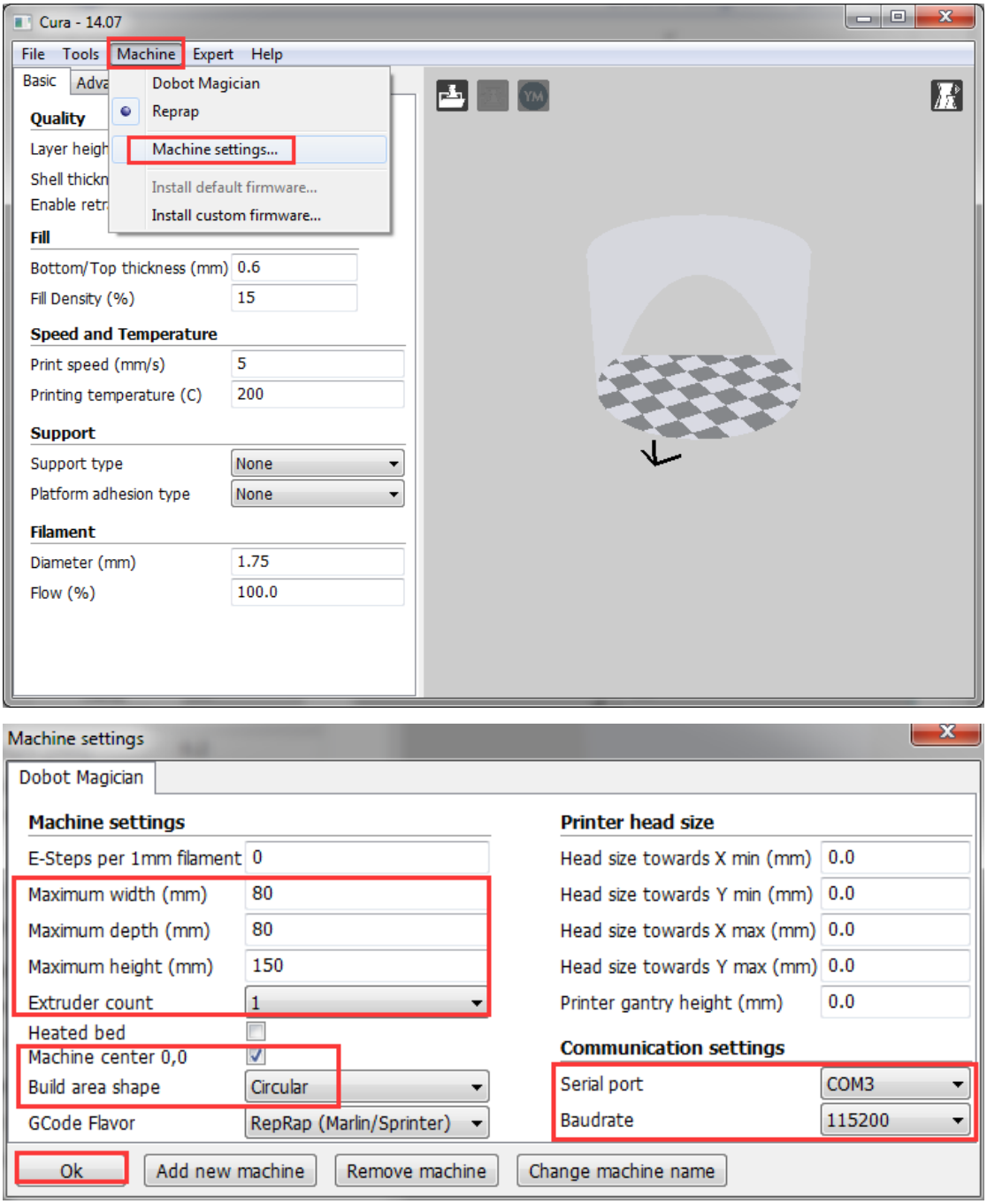


Figure 8.30 Machine settings

（2）Import configuration file

It is vital to set slice parameters so users should get the best slice parameters according to printed models and tested performance of equipment. Here we suggest a configuration file that can be impoted from **attachment** of DobotStudio:

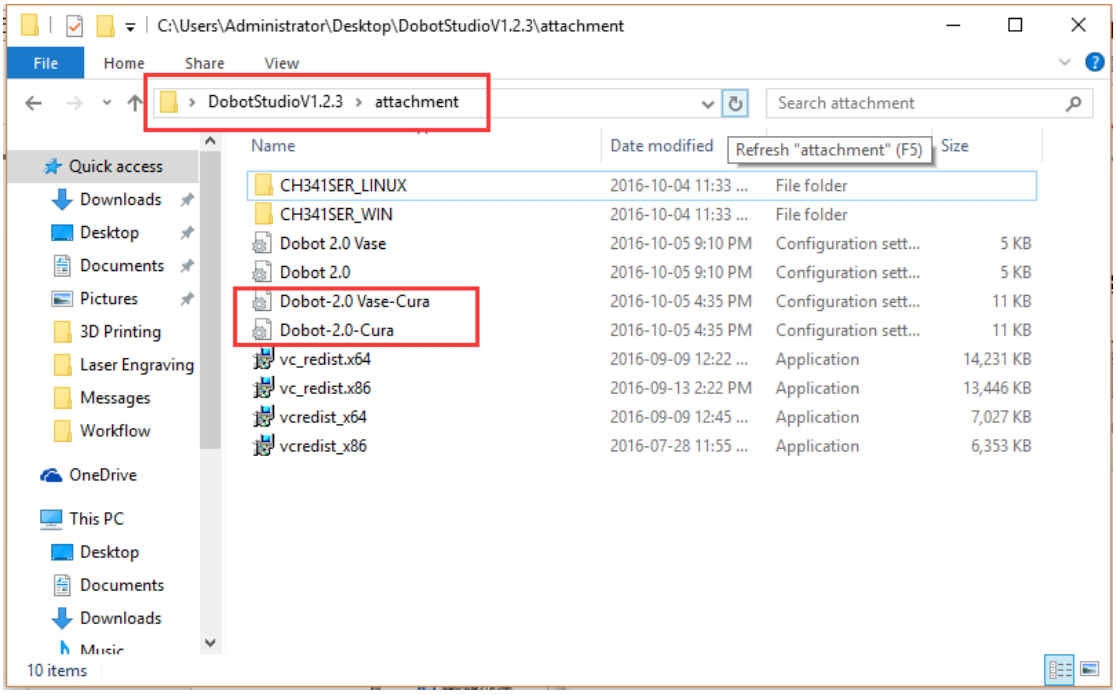
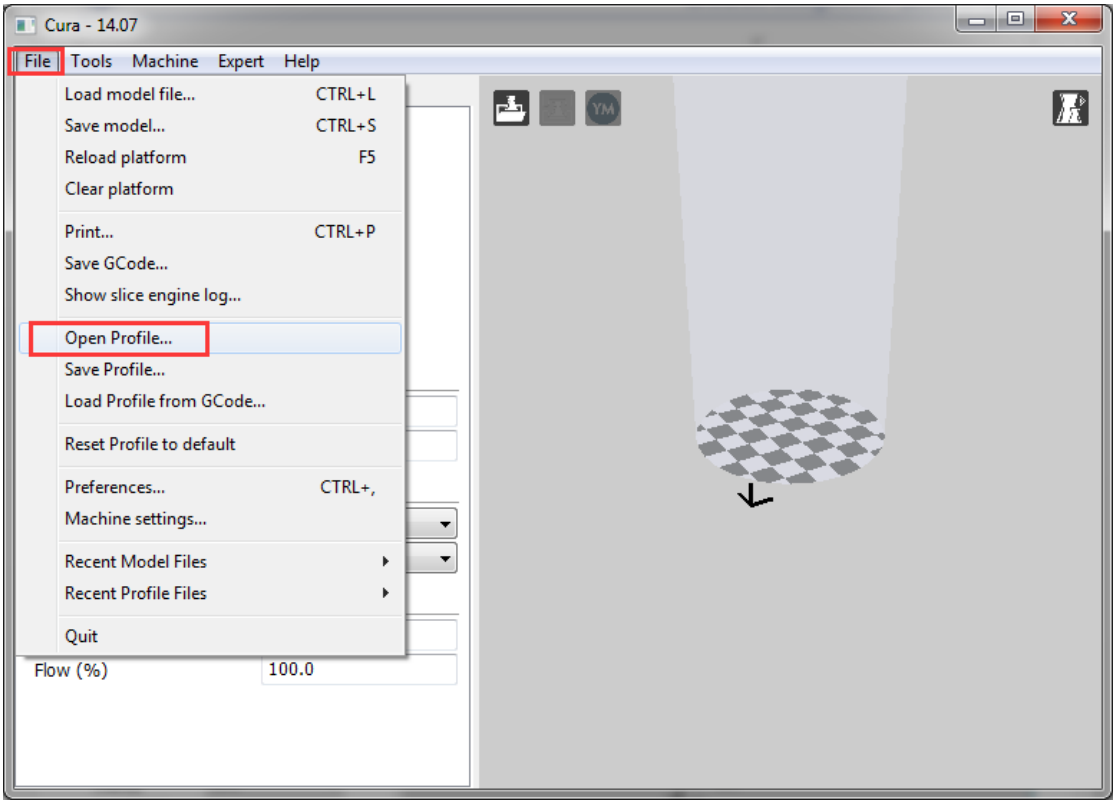


Figure 8.31 Configure files

Dobot-2.0-Vase.ini is used for printing a thin-valled vase, while Dobot-2.0.ini is used for the filling. (The filling rate is 15%.)

Import the file after downloading: Click **File->Load Profile**.



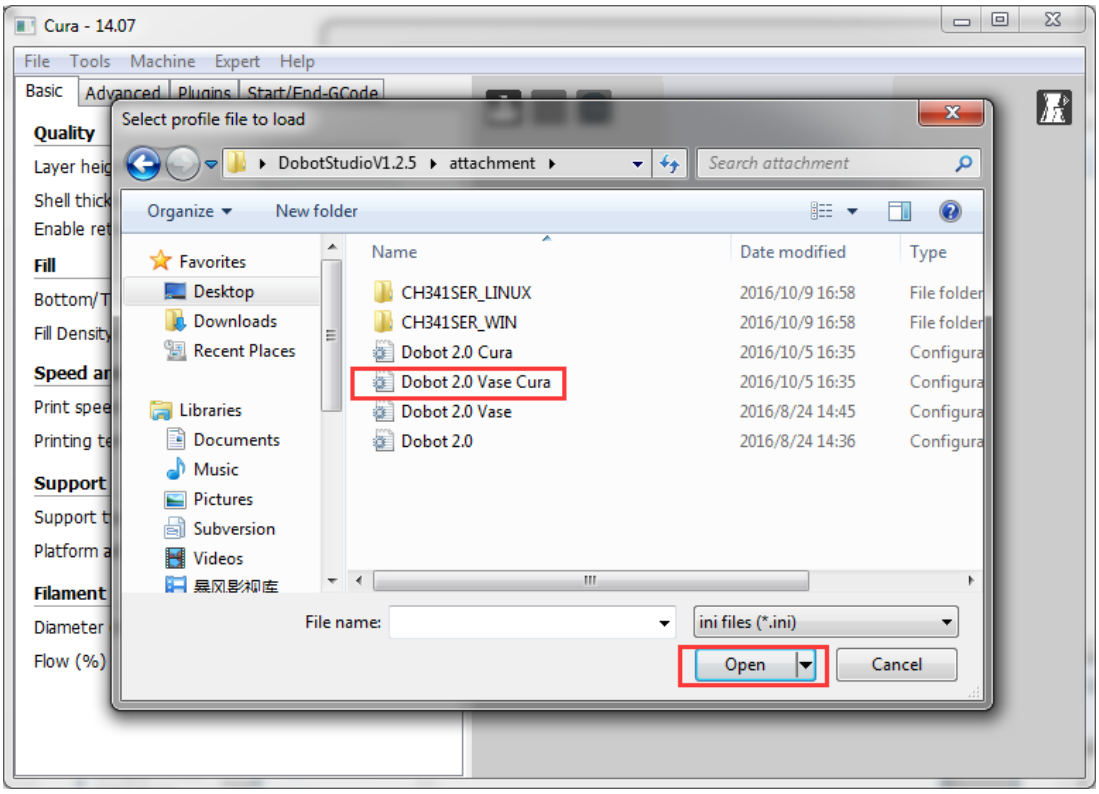
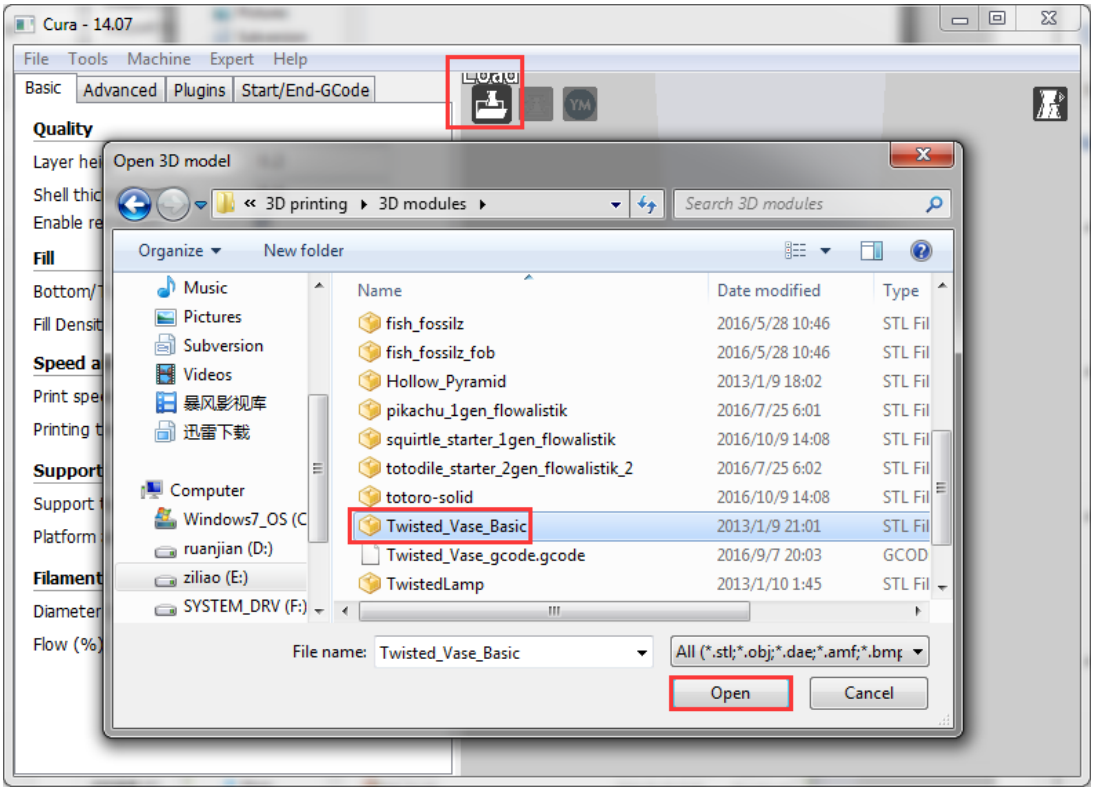


Figure 8.32 Import configuration settings

For more detailed printing parameters, go to the Cura website!

（3）Open the model and connect Dobot

Click **Load**, import a 3D model, and Cura will slice up automatically. You can also select different modes in the drop-down list located on the right to check if its trajectory is correct or not:：



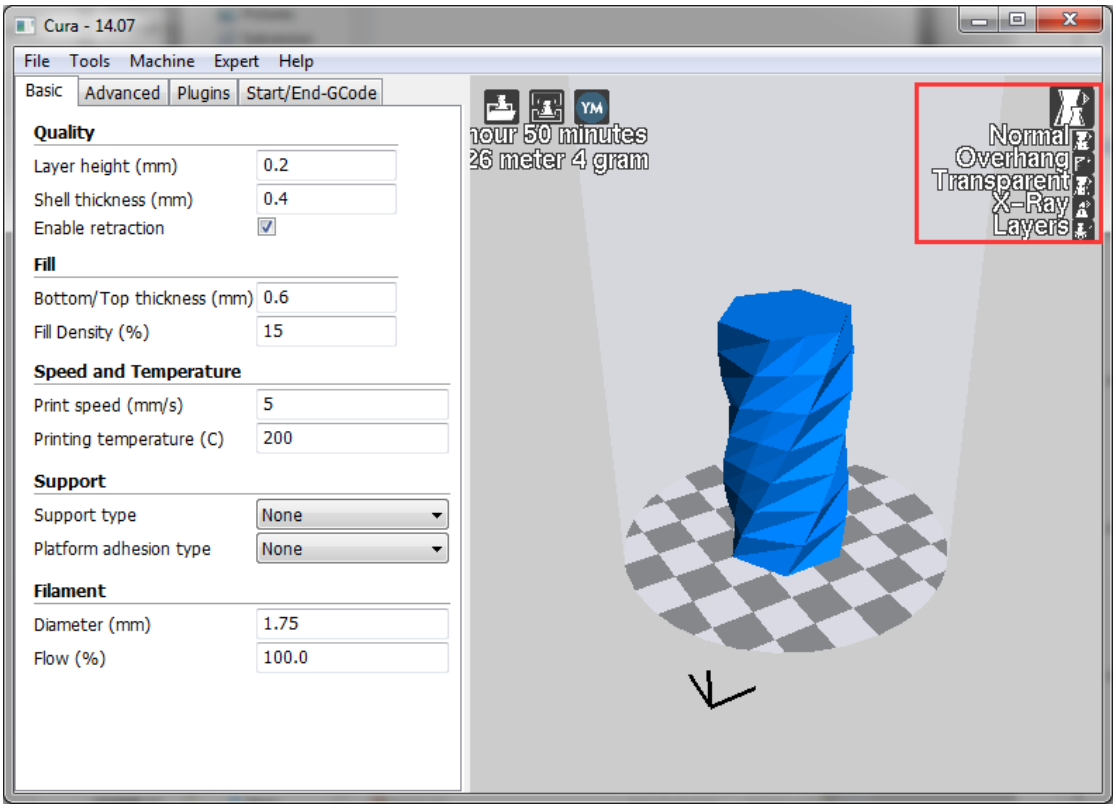
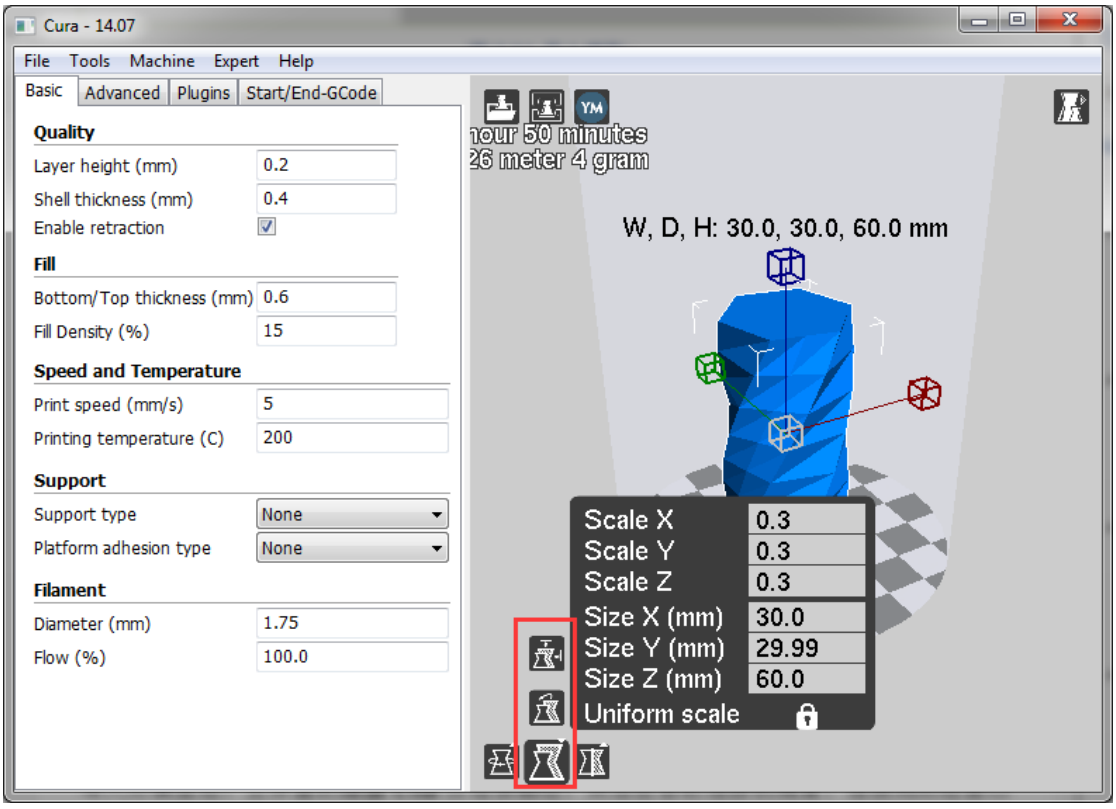


Figure 8.33 Import a model

Click the model to operate it. You can place it in the middle, zoom or rotate, as well as other functions.



After importing a model, **Print with USB** on the main interface will be activated. Click it to connect to Dobot automatically. The screen will show the current printing temperature on the top corner of the window. At the same time, the Printing key will be activated, as shown below:

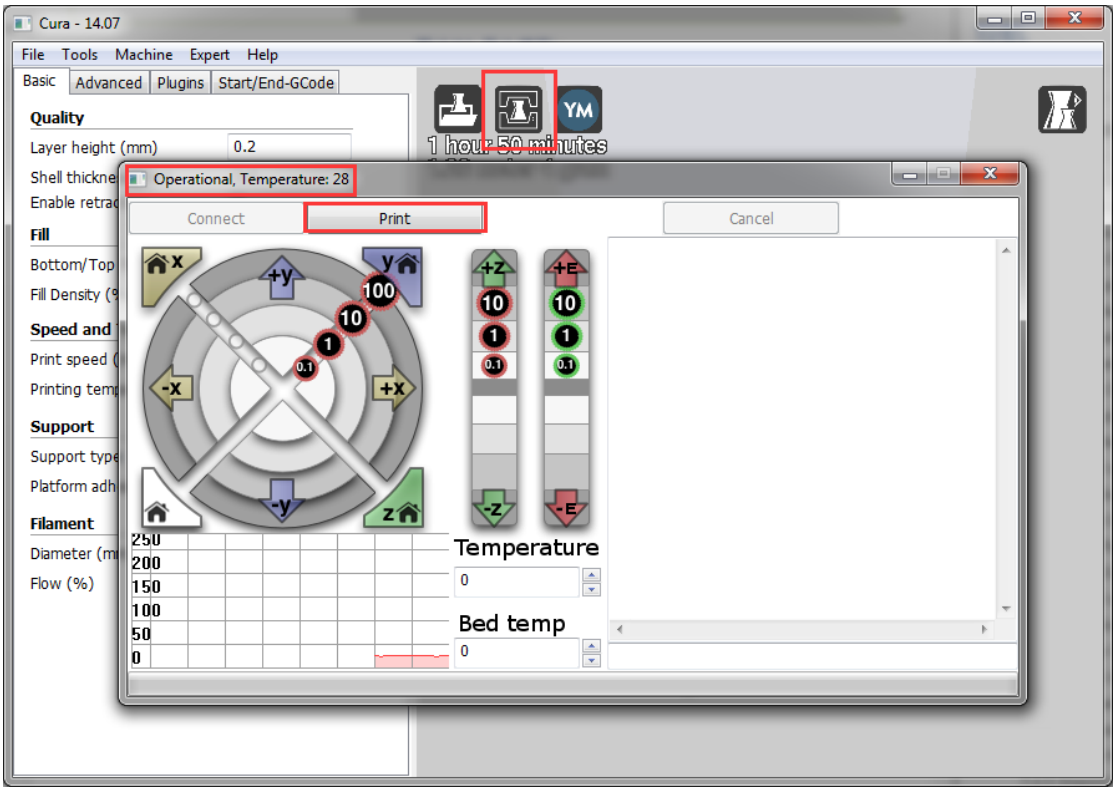


Figure 8.34 Connect Dobot

8.3.2 Preparation before Printing

Before printing, test the function of the extruder. Test to see if the filament flows in and out and if the direction of the filament is in reverse. Set the heating temperature to 200℃ and then press enter to heat the nozzle.

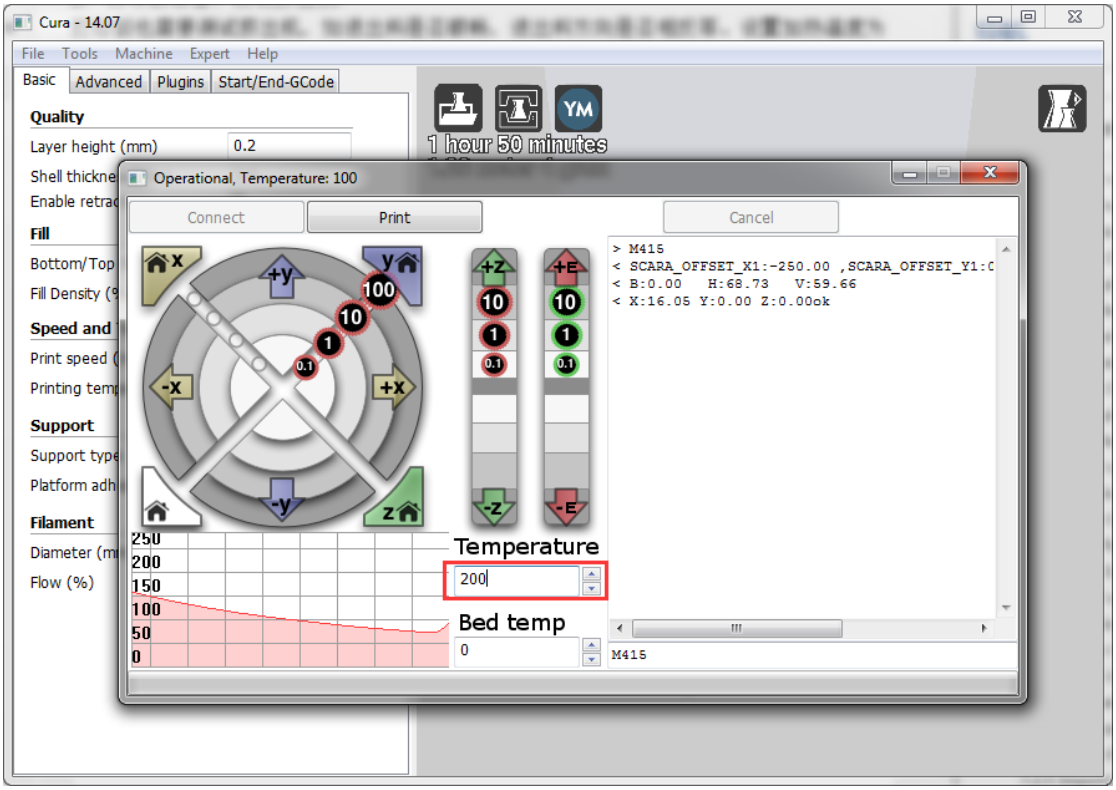
⚠ Notice:

The heating rod will produce high temperatures up to 250℃, please be careful!

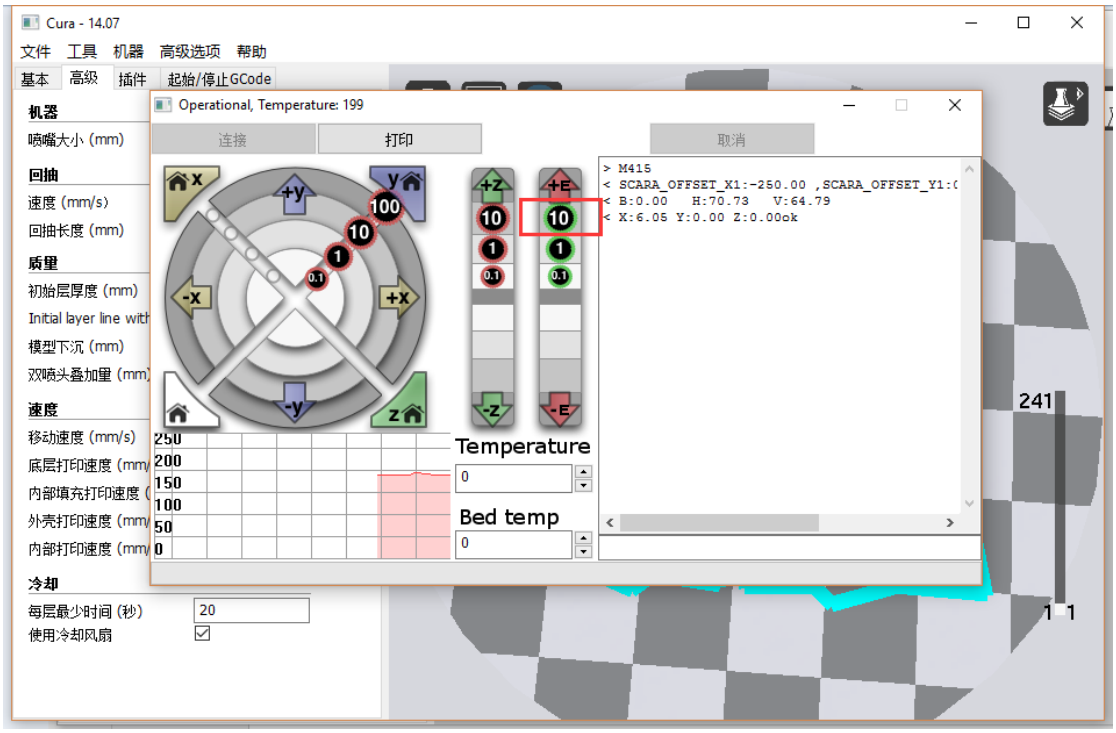
DO NOT let children play with it alone.

The process needs to be monitored when it is running.

After the process, please turn off the equipment promptly.



In the heating process, the fan will turn on automatically. When the heating temperature is up to 200℃, click the feedstock extruder and feed up to 10-30mm, as shown below:



If melted filament flows from the nozzle of the extruder, then it means the extruder is working properly:

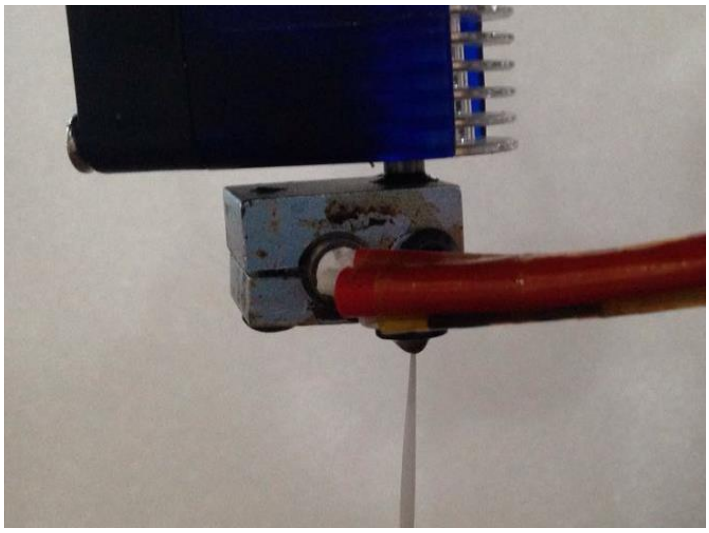


Figure 8.35 Filament Extrusion

Note: If the filament extrusion is in the opposite direction, simply remove the filament, turn the extruder around, and replace the filament.

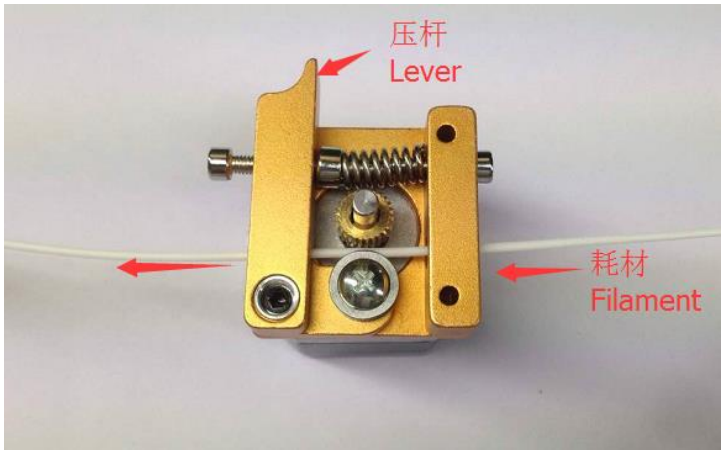


Figure 8.36 Reverse installation diagram of the extruder

8.3.3 Adjust the printing space and get printing coordinates

Note: For more detailed steps, please refer to the above chapter Repetier Host.

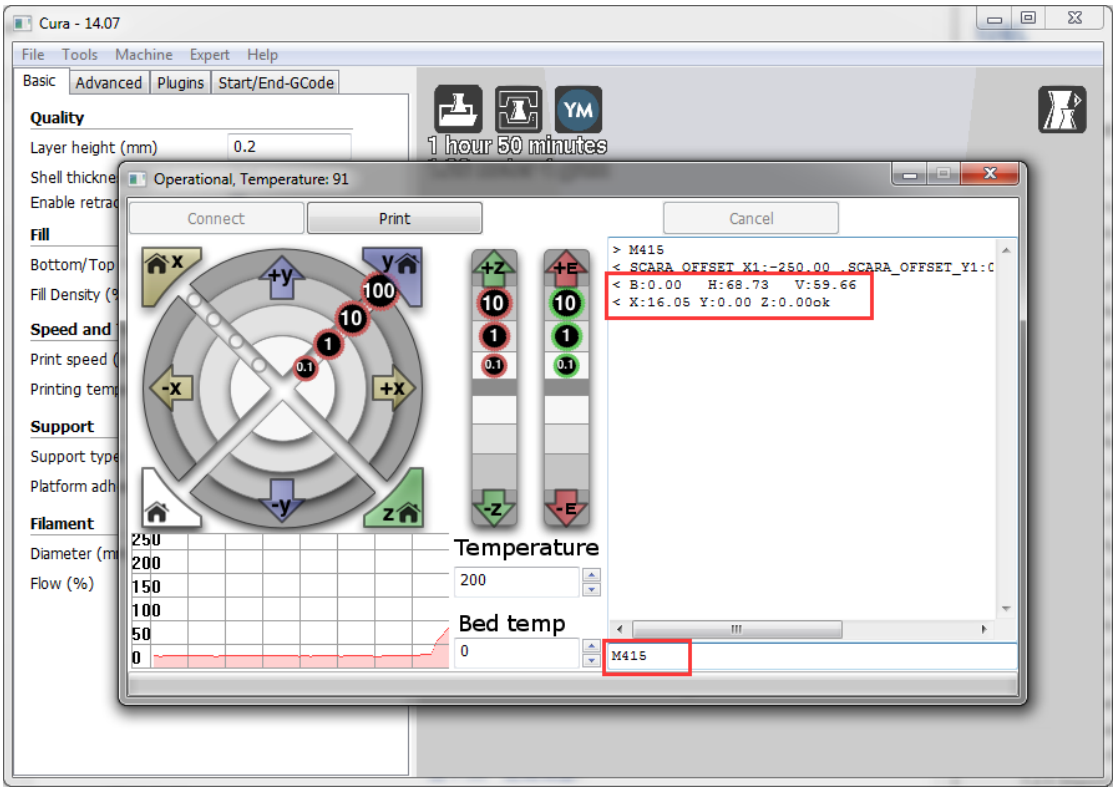
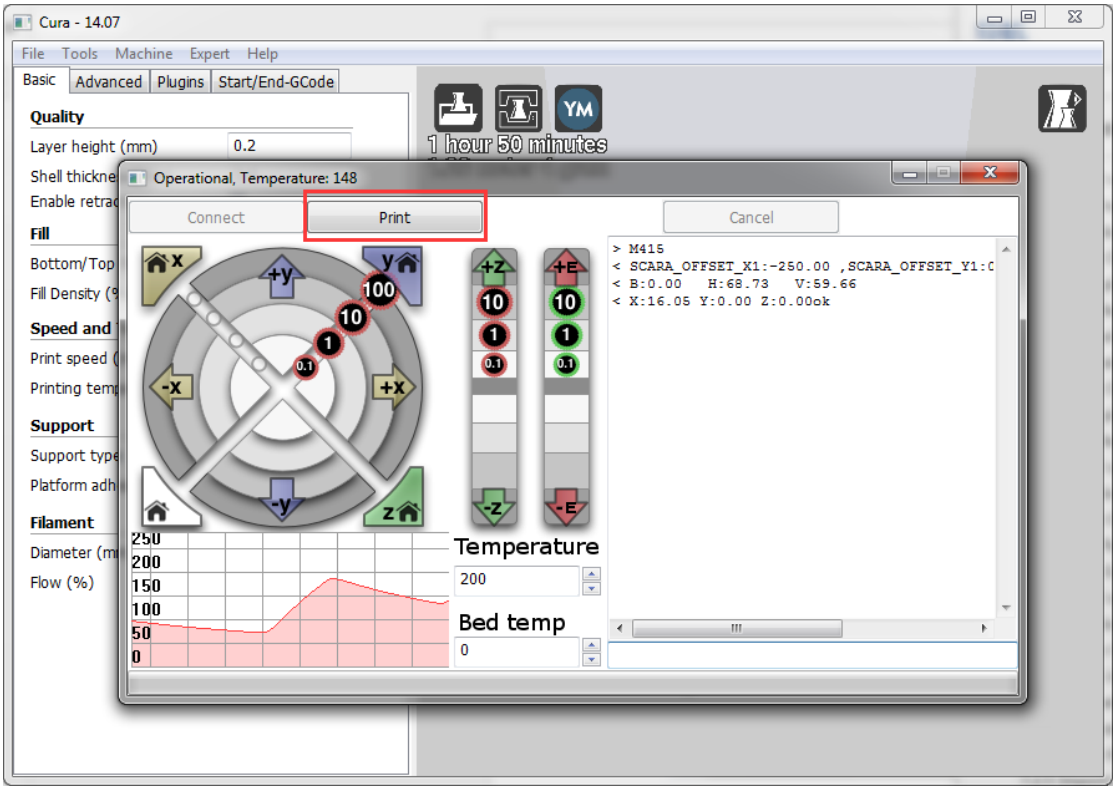


Figure 8.37 Distance adjustment

8.3.4 Start printing

Just click **Print,** and then start printing.



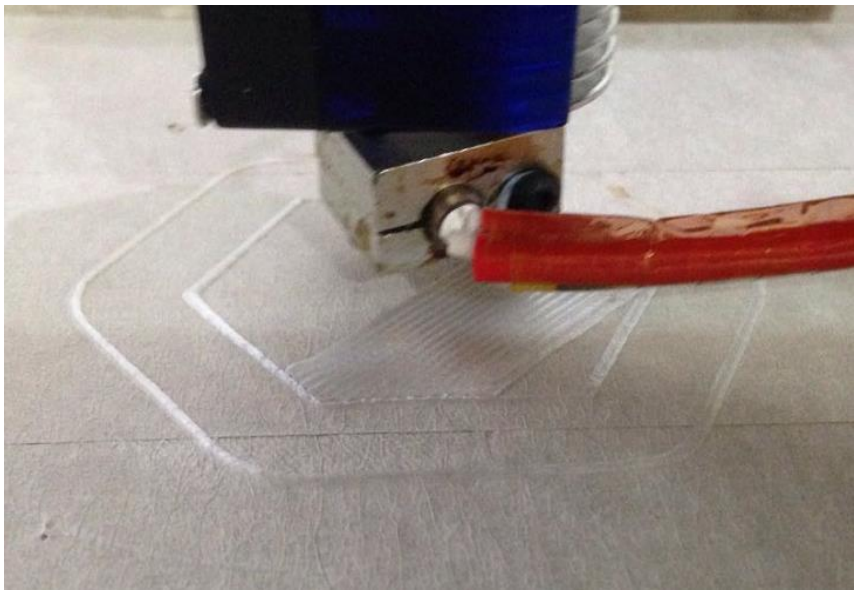


Figure 8.38 Start printing

Note: During the printing, if the distance between the nozzle and print is too large or too small to paste the print bed of the first layer, there may be a blockage. We need to adjust the proper distance for smooth printing. If it is not proper height when printing the first layer, we can change the parameters in the **initial-layer thickness**. (For example, -0.1mm or +0.1mm.) After fixing it, Cura will slice the model automatically.Then you can test the print again. After testing, the default heught of first layer is 0.87mm.

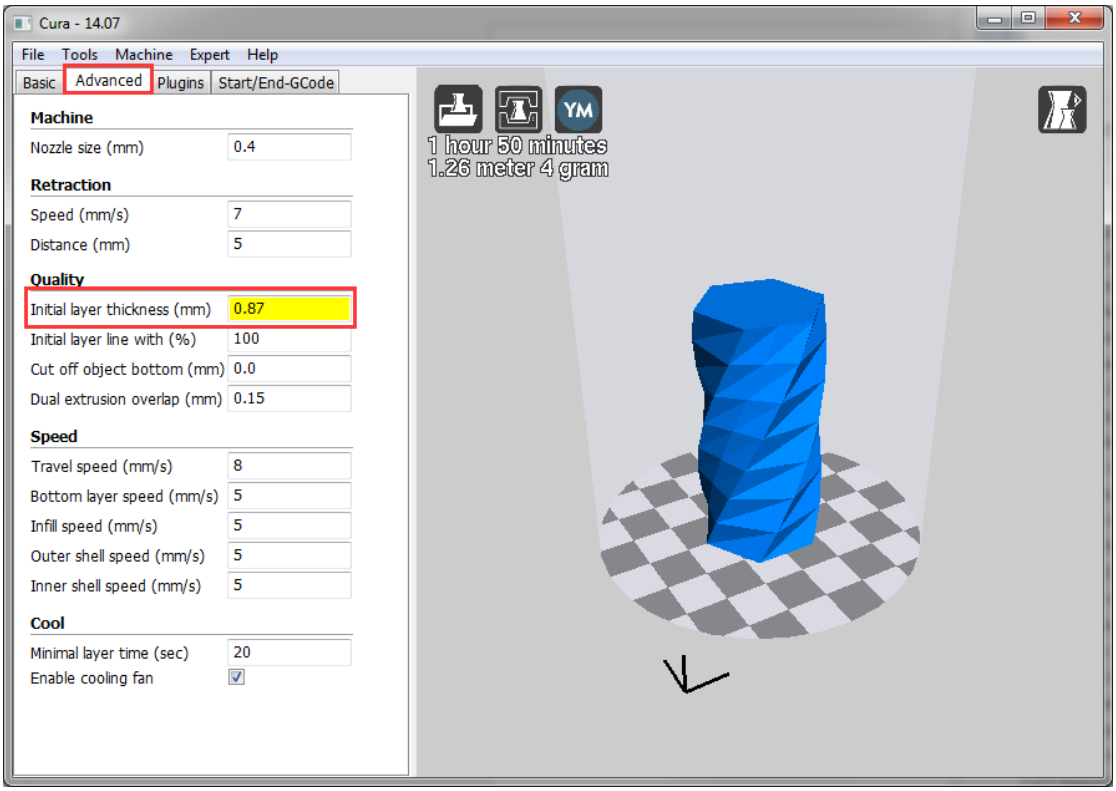


Figure 8.39 Amend the height of first layer

Here we choose **vase mode**, and the product after printing as follows:

Figure 8.40 The Product of Printing

8.3.5 Text note

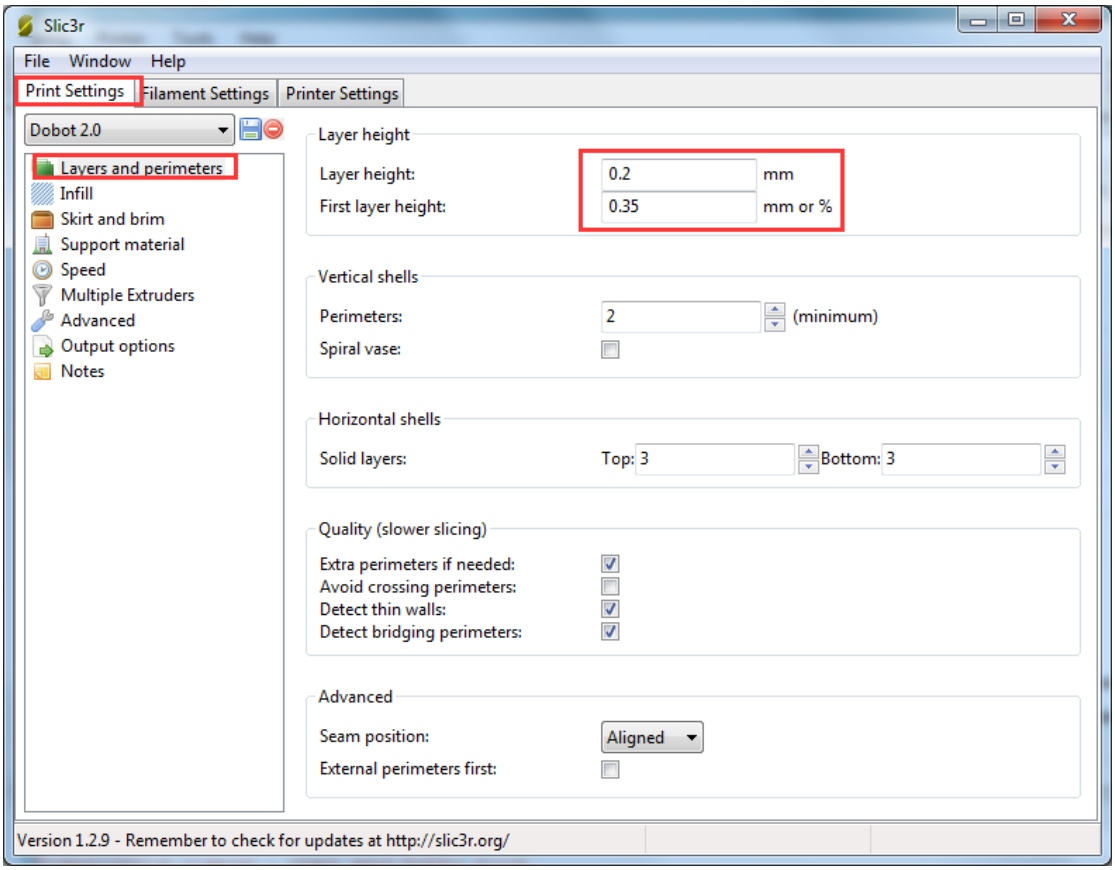
Parameters Introduction of 3D printing

Here we only introduce necessary parameter settings, and one can review the related links about the rest parameters: http://manual.slic3r.org/

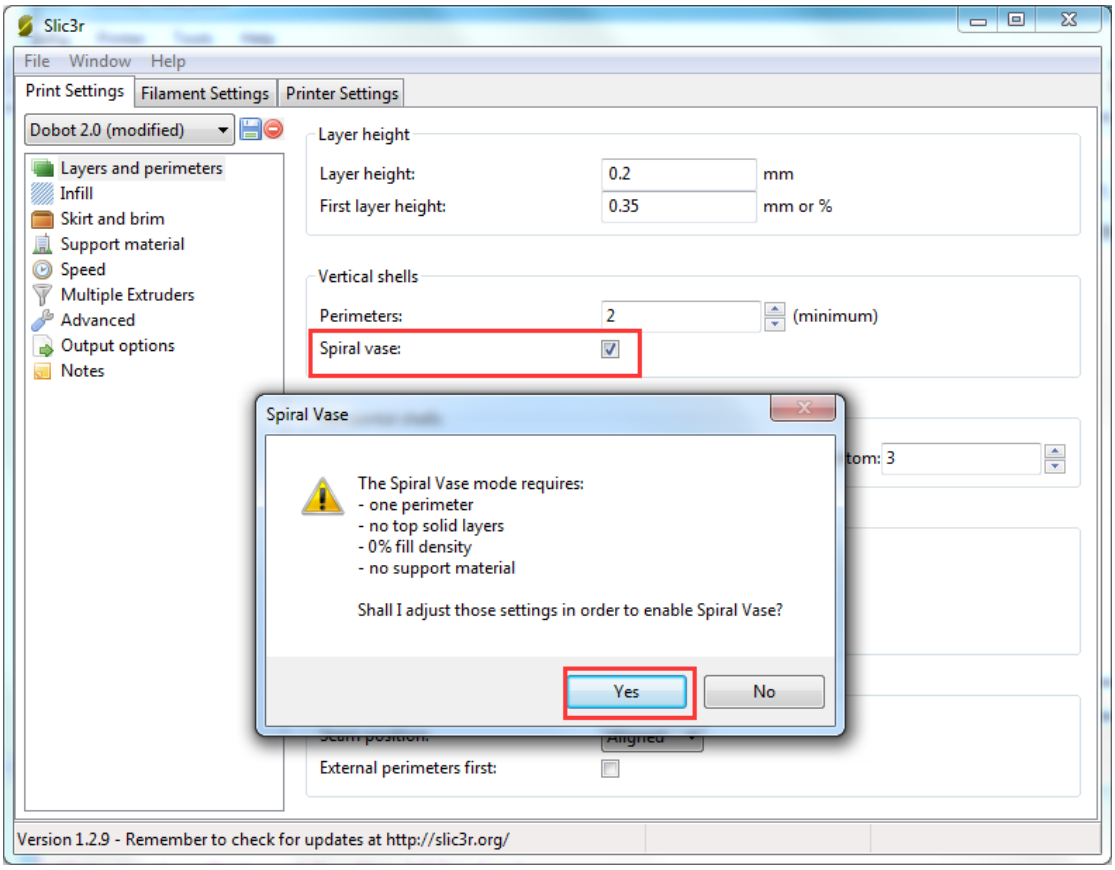
（1） Printer settings

Set the height of print layer: 0.2mm；

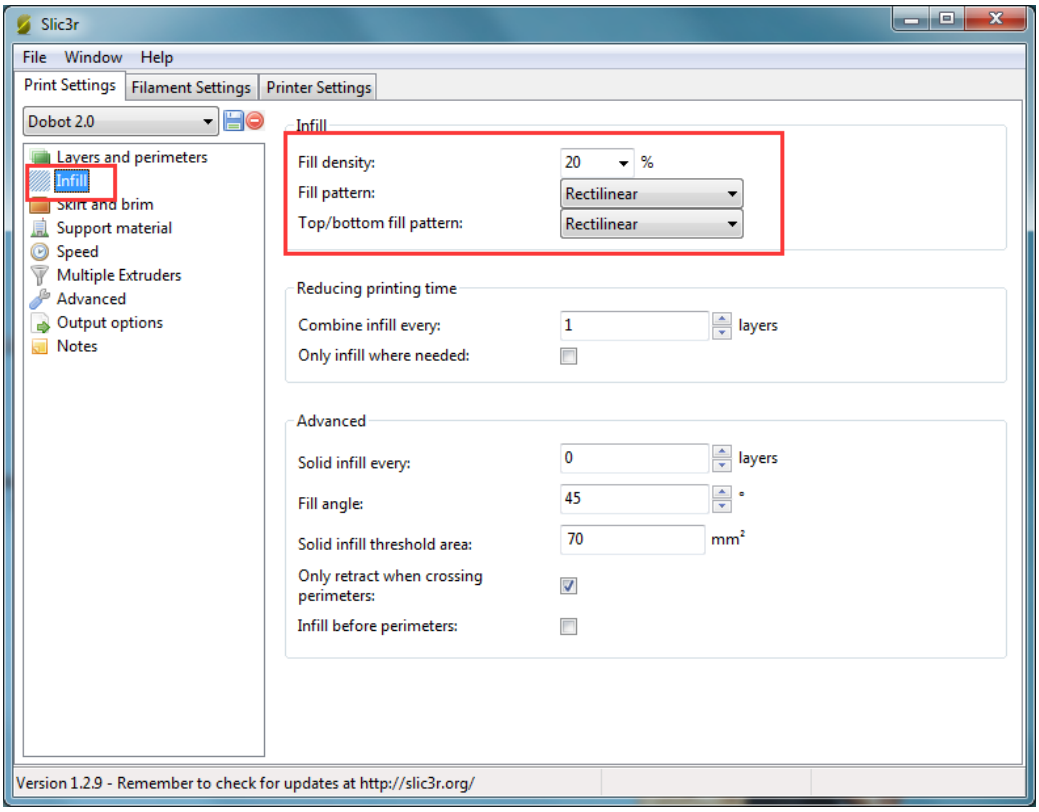
The height of first layer: 0.35mm；



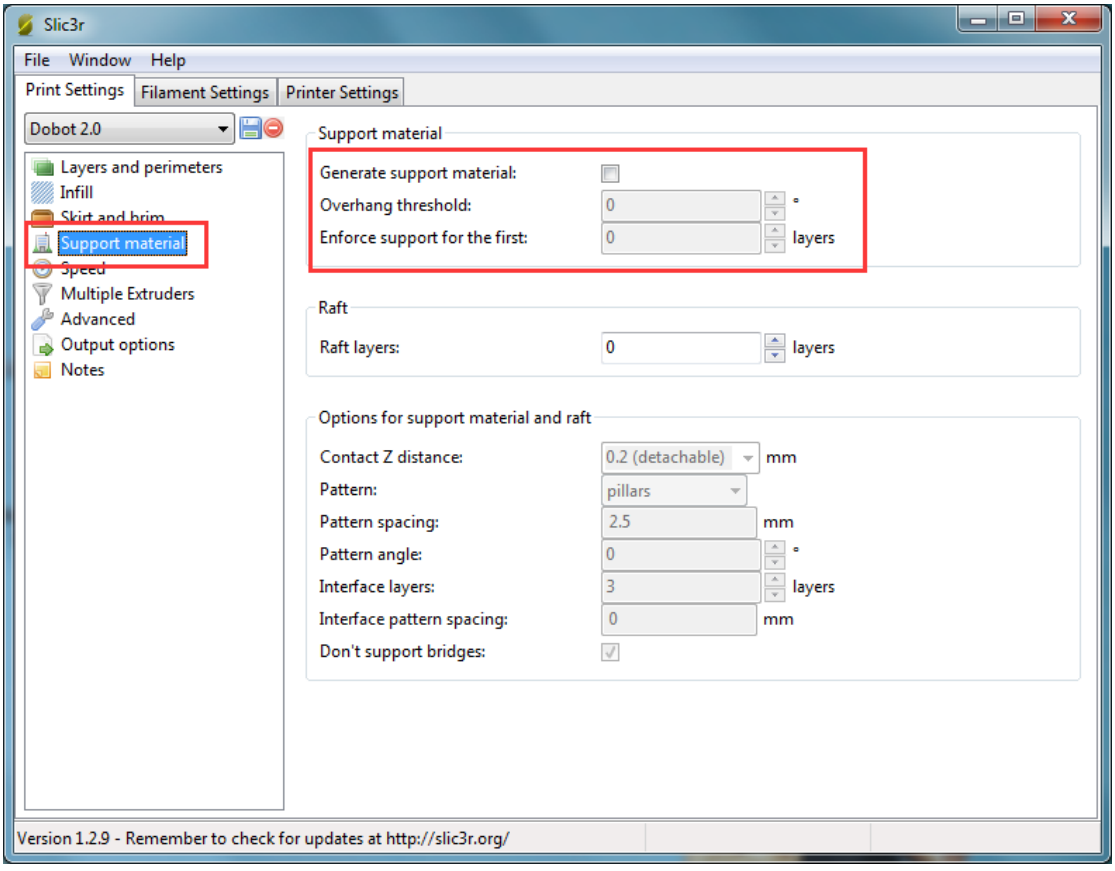
Spiral vase: Check this one and click **Yes**. Then we can print unfilled vase.



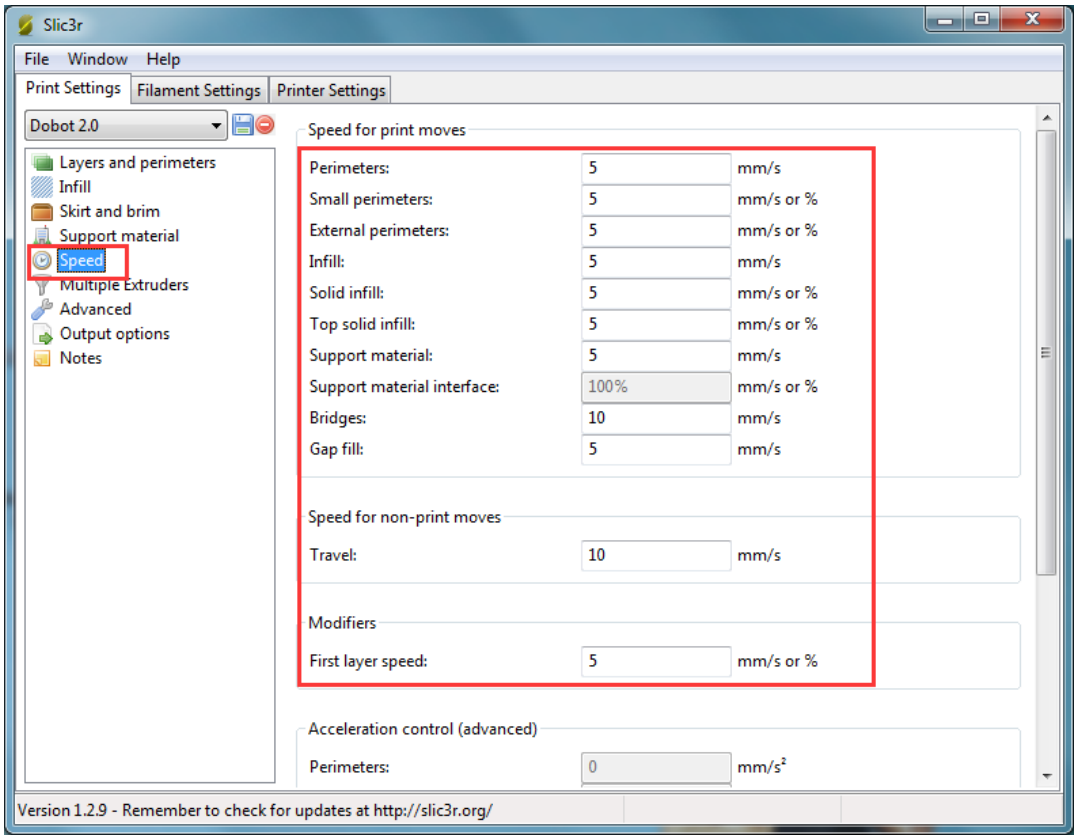
The fill rate settings:



If users need print support, please tick Generate support material:



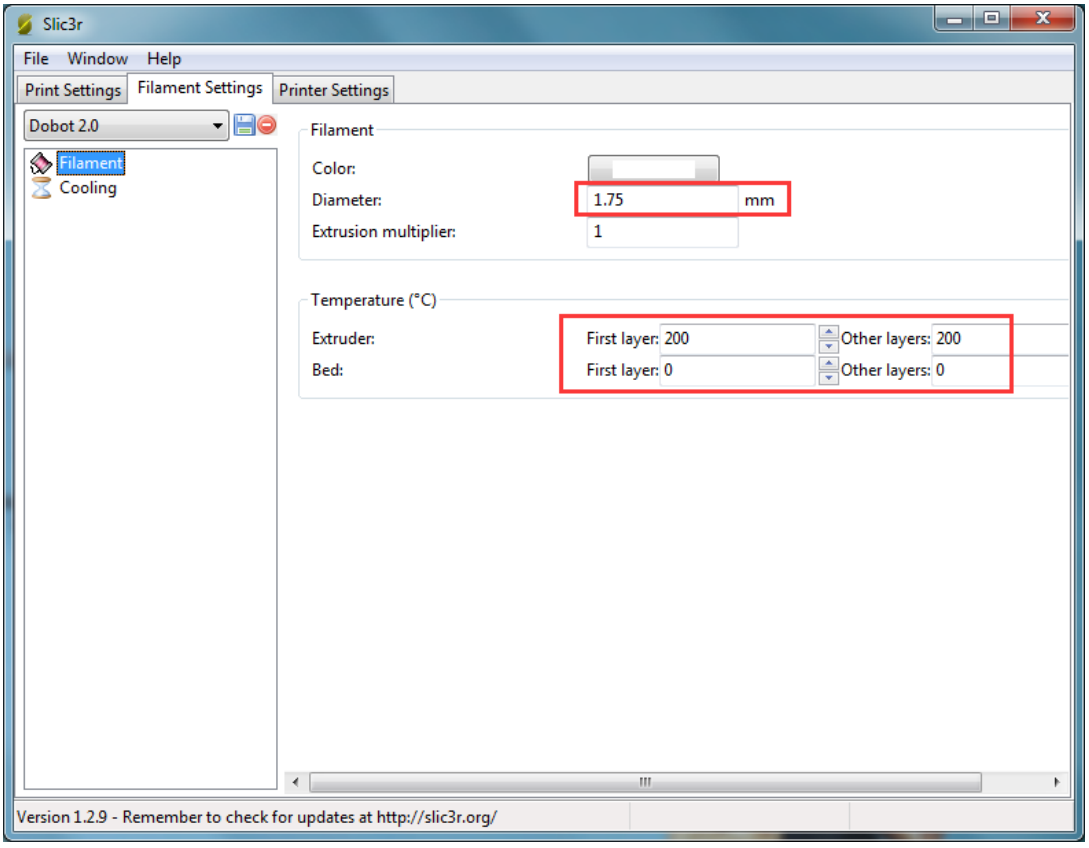
The speed settings:



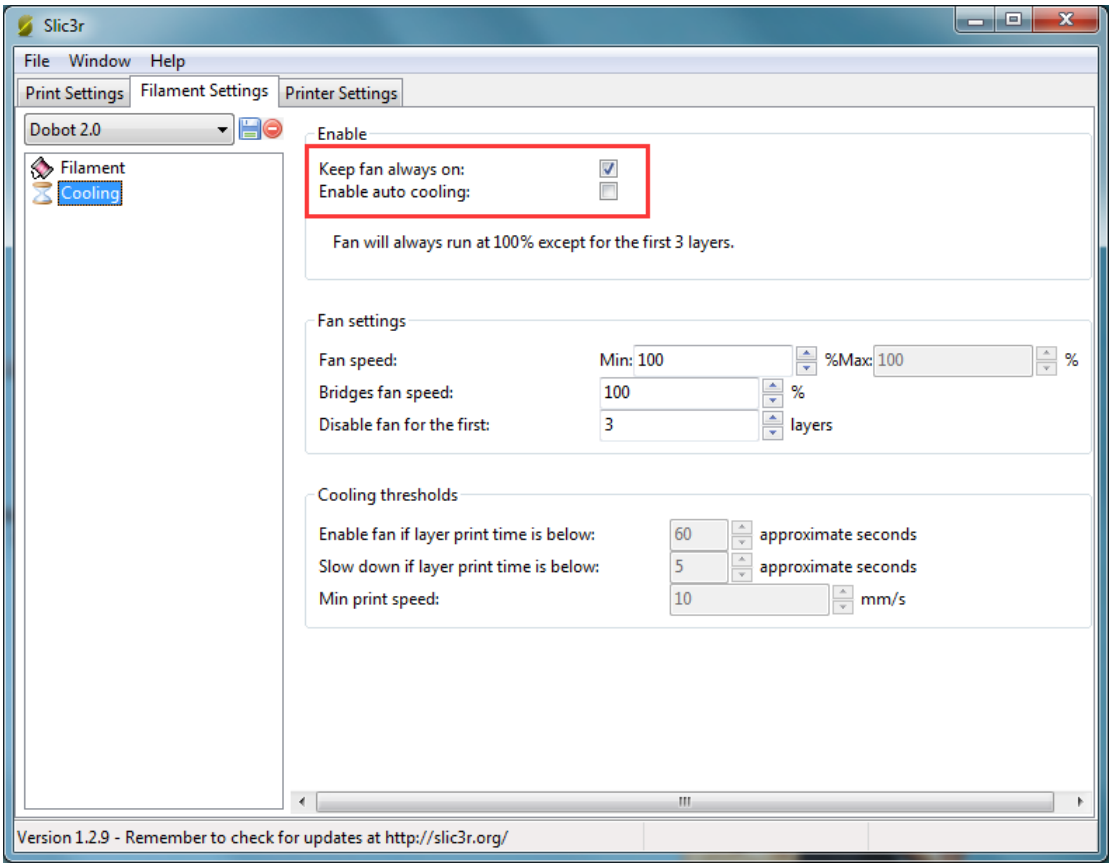
（2） Filament settings

Consumable diameter: 1.75mm

The temperature: 200℃



Open the fan:

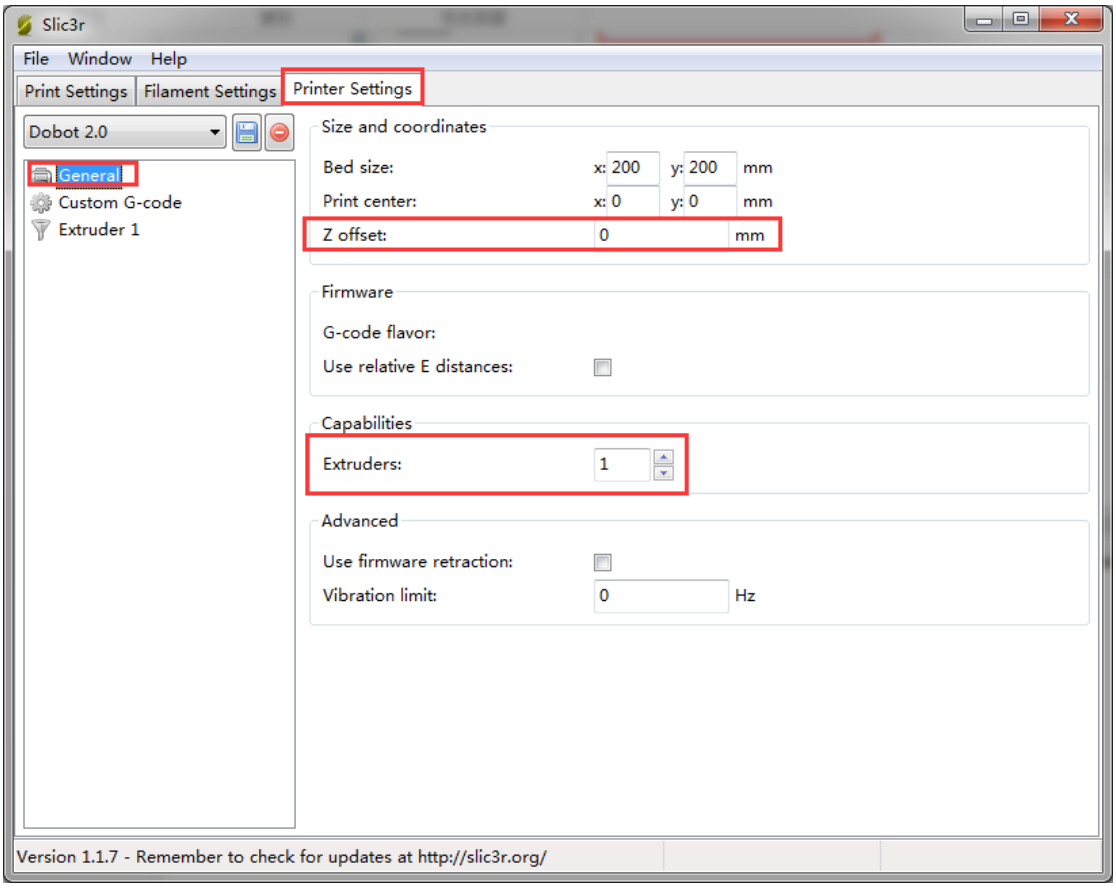


（3） Printer settings

The number of Extruder: 1

The nozzle Z offset of extruder: 0mm

Notice: If the height of nozzle is so large that consumables cannot paste onto the print bed or so small that it cannot discharge when printing the first layer, users can amend the height from this interface, such as -0.01mm or +0.01mm, thus, one need not adjust the height again.



G-code Settings:

Start G-code: **M106**

End G-code:

M104 S0 ; turn off extruder

G91 ;relative positioning

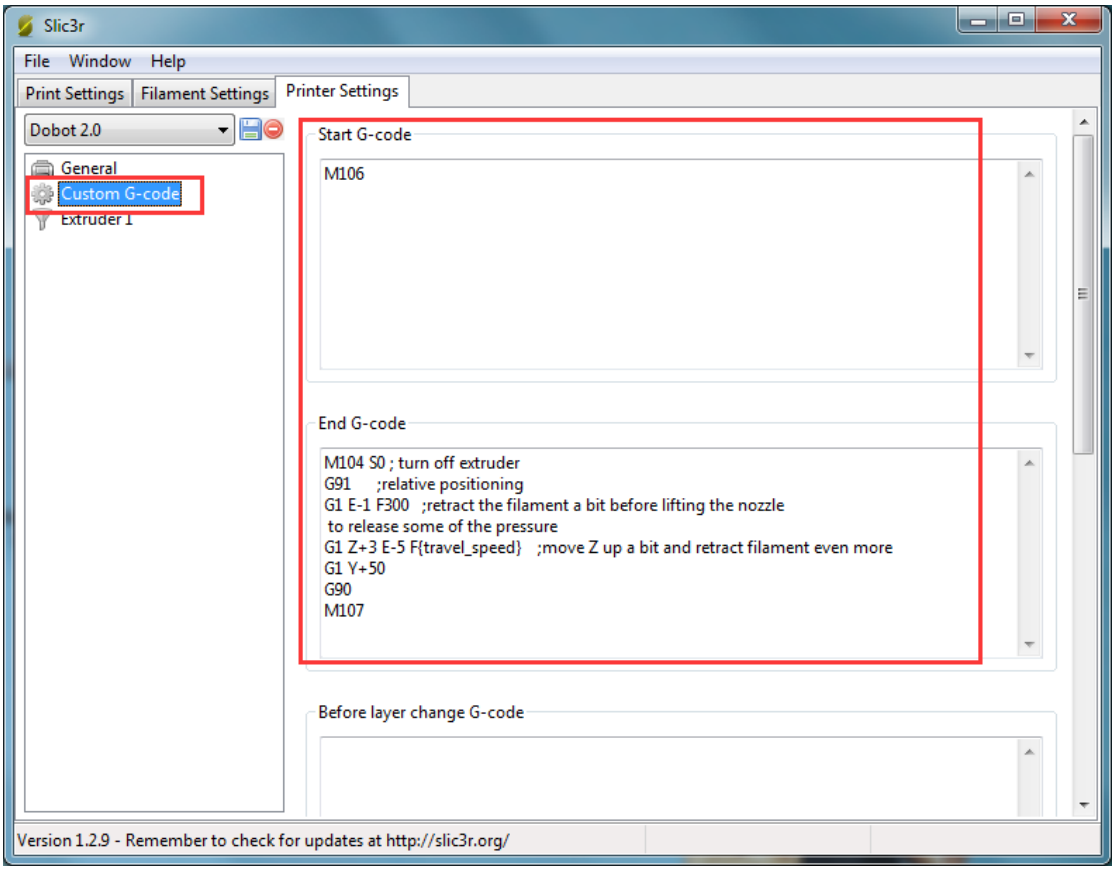
G1 E-1 F300 ;retract the filament a bit before lifting the nozzle to release some of the pressure

G1 Z+3 E-5 F{travel_speed} ;move Z up a bit and retract filament even more

G1 Y+50

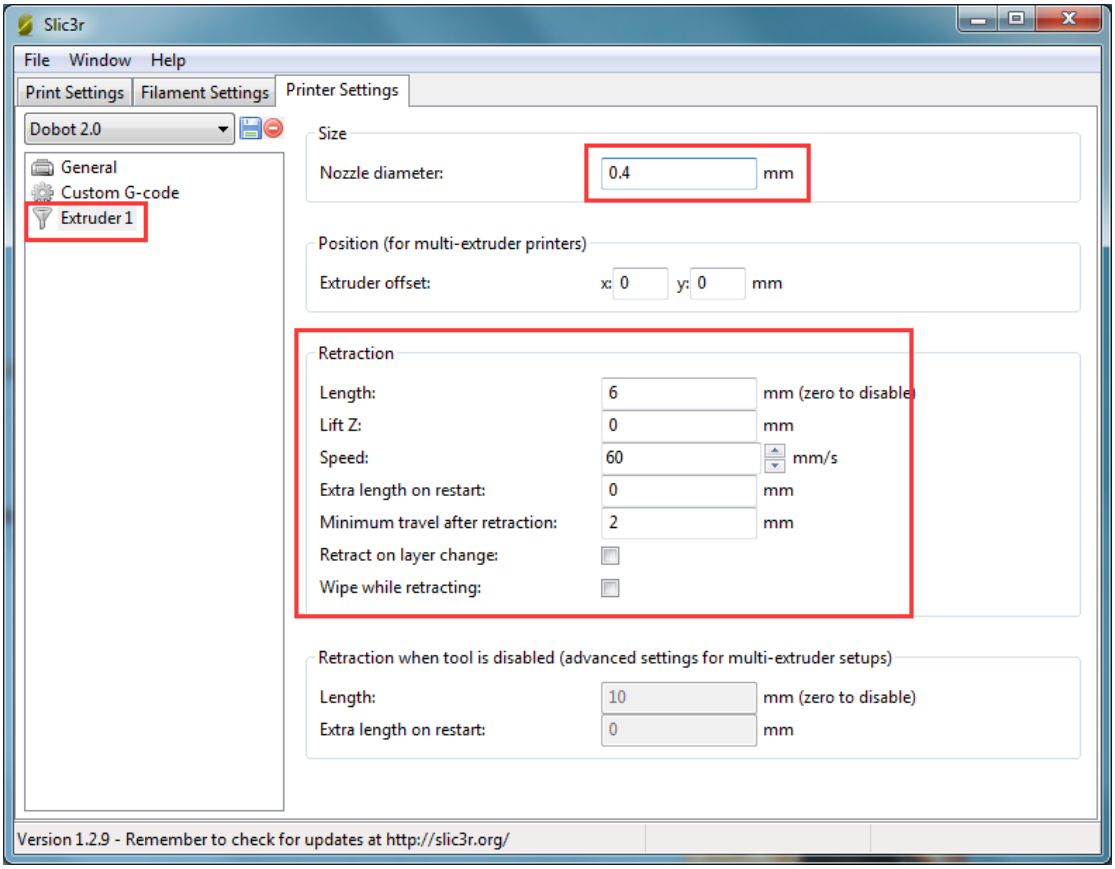
G90

M107



The nozzle diameter settings: 0.4mm；

The pump back speed settings: length=6 mm，speed=60 mm/s.



9. Base Calibration and Sensor Calibration

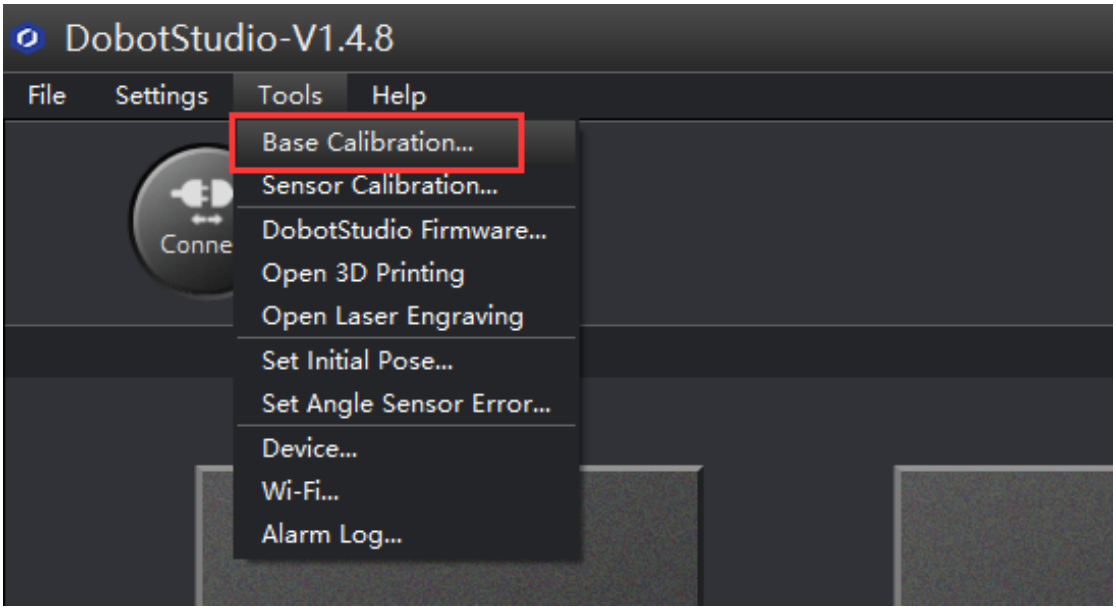
9.1 Base Calibration

Dobot Magician has been carefully calibrated before being shipped out. If the home position isn't in the middle when you use the Dobot(errors between 1° -2° is in the allowable range), it needs to be re-calibrated.

1. Put Dobot in the marked place, as shown below.

1. Figure 9.1 Put dobot in the marked place

2. Open Dobot Studio, click **Tools**, and choose **Base Calibration**, as shown below:



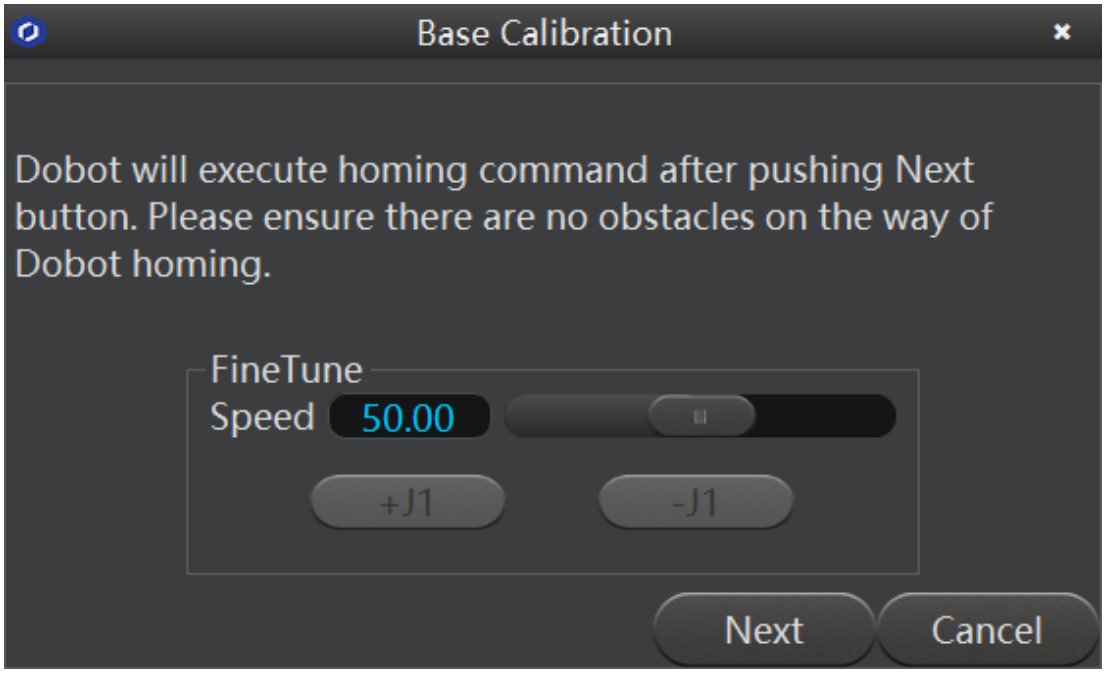


Figure 9.2 Base Calibration

3. Click **Next**, and Dobot will begin auto-homing. You can do the next step when the button changes from grey to white.
4. You need to fine tune the home position through **+J1** and **-J1** before clicking **Calibration**. put the nib in the line between A3 and B3, as shown below.

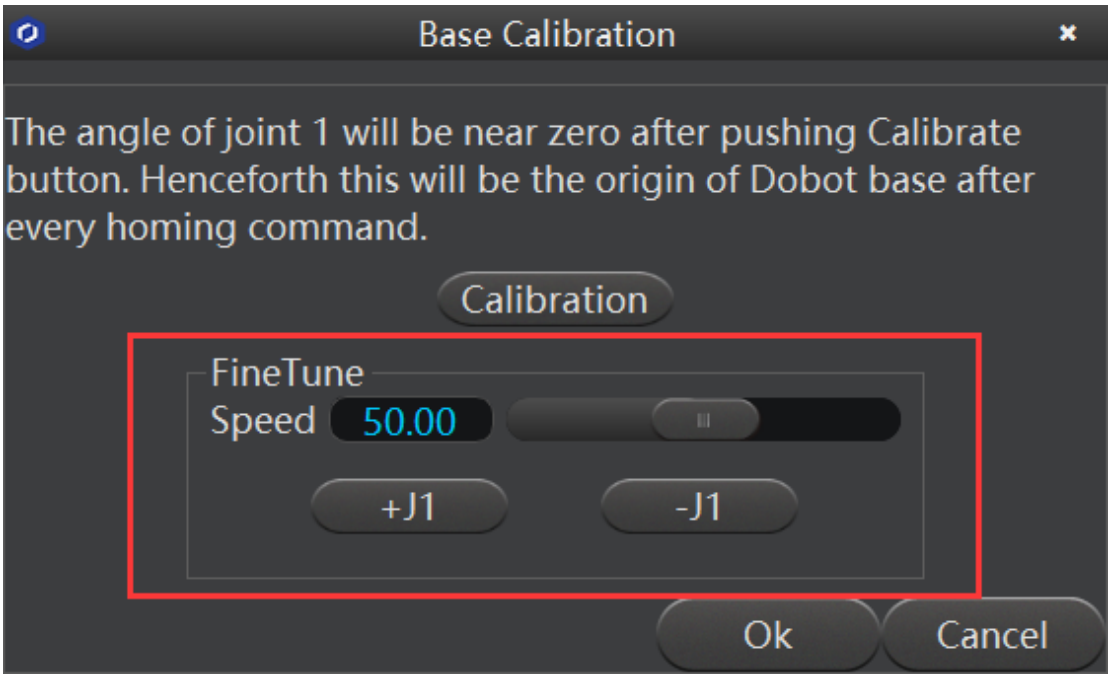
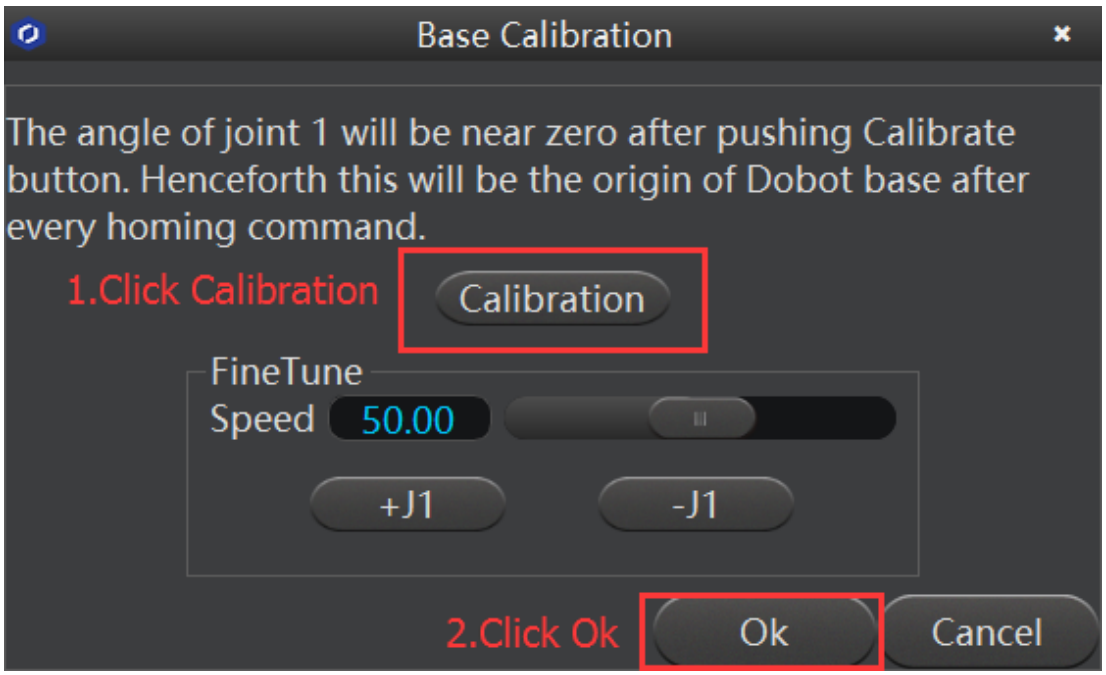


Figure 9.3 Base Calibration

5. Click **Calibration**, the Base Calibration will be finished.



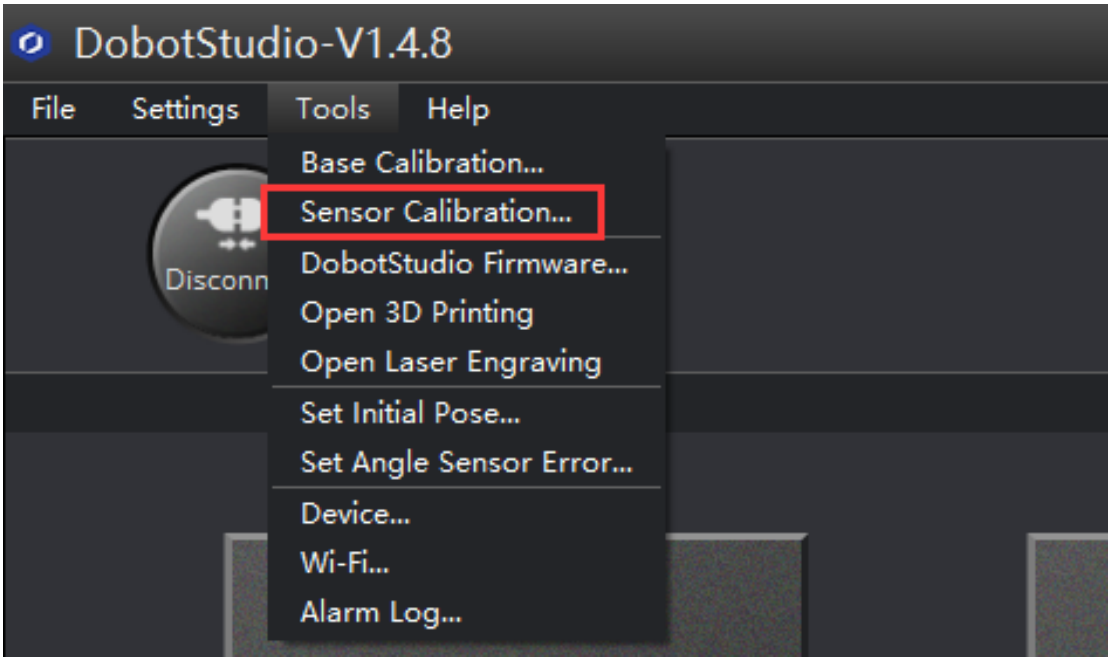
9.2 Sensor Calibration

If you find the pen faces upward paper during writing & drawing or 3D printing, the sensor needs to be calibrated. (The Dobot Magician has been carefully calibrated before shipping out. You don't need to re-calibrate it before using it.)

1. Put Dobot on the marked place, shown as below.

Figure 9.4 Put dobot in the marked place

2. Open Dobot Studio, click **Tools**, and choose **Sensor Calibration**, shown as below.
   Notice: Don't calibrate the sensor until all end effectors are removed!



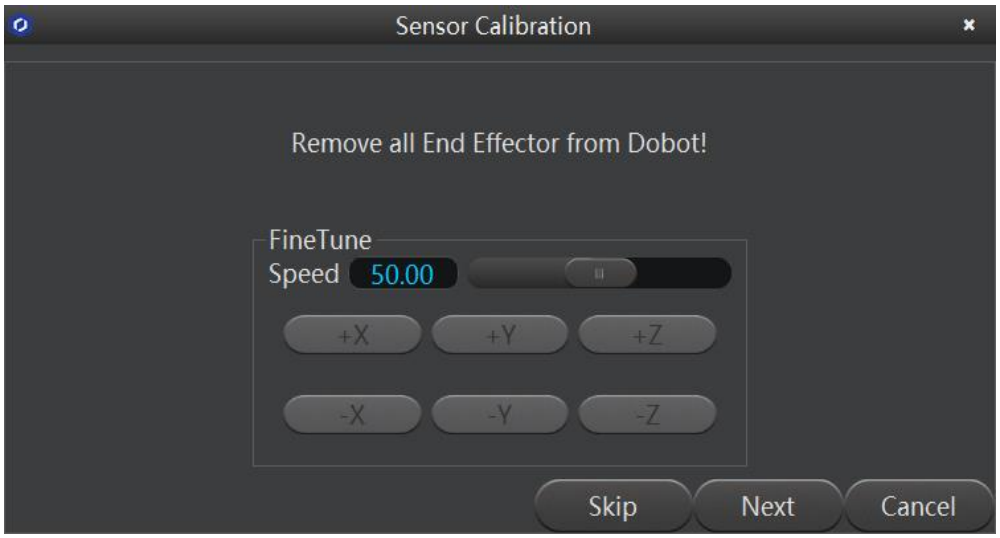


Figure 9.5 Sensor Calibration

3. Click **Next**, and the Dobot arm will carry out a preset action to compensate for the sensor coefficient of the front arm and rear arm.

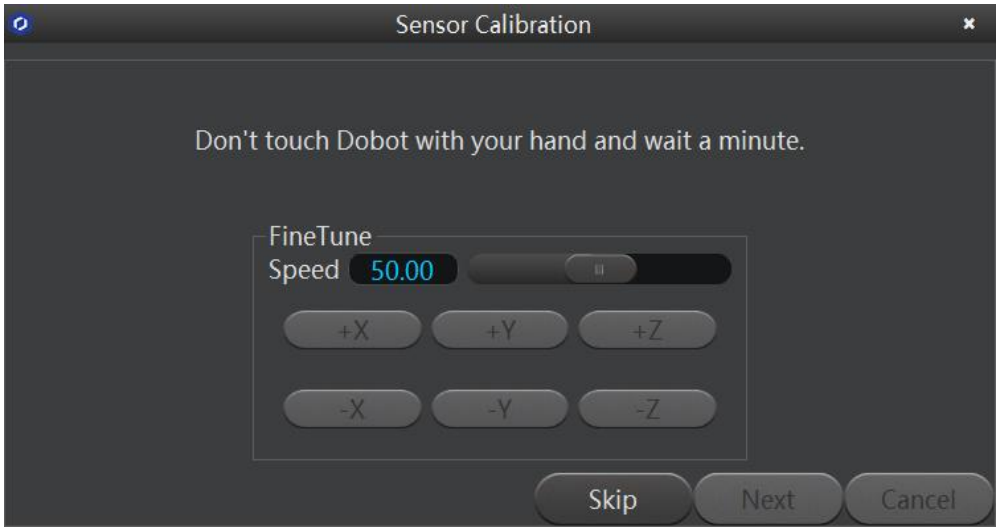


Figure 9.6 Sensor Calibration

4. Click **Next** when the operation interface appears the instructions, shown as below.

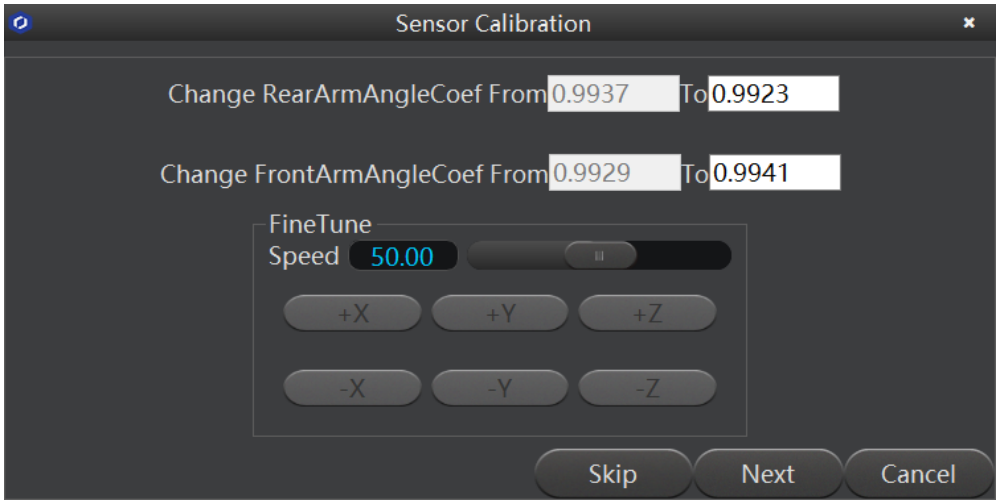


Figure 9.7 Sensor Calibration

5. Continue to click **Next**.

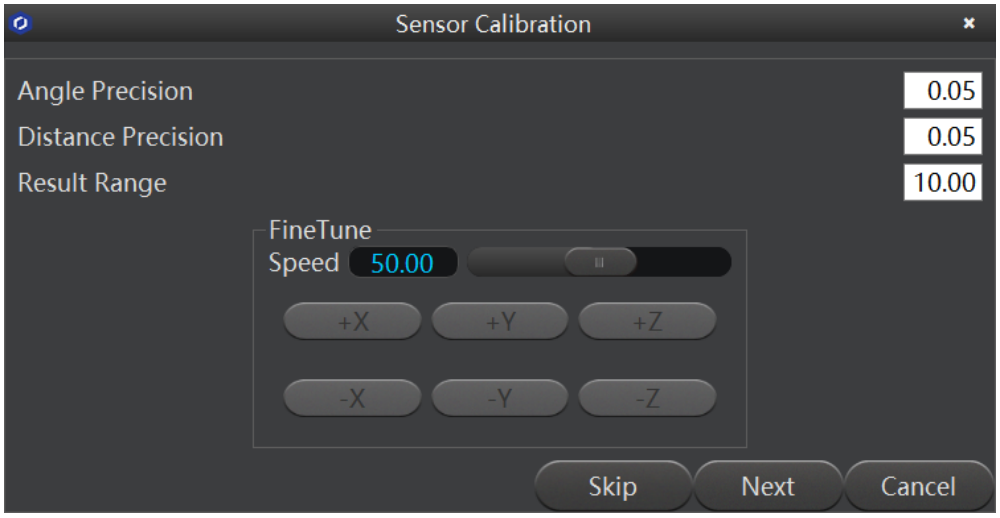


Figure 9.8 Sensor Calibration

6. Follow the instructions to calibrate sensor they appear and then click **Next**.

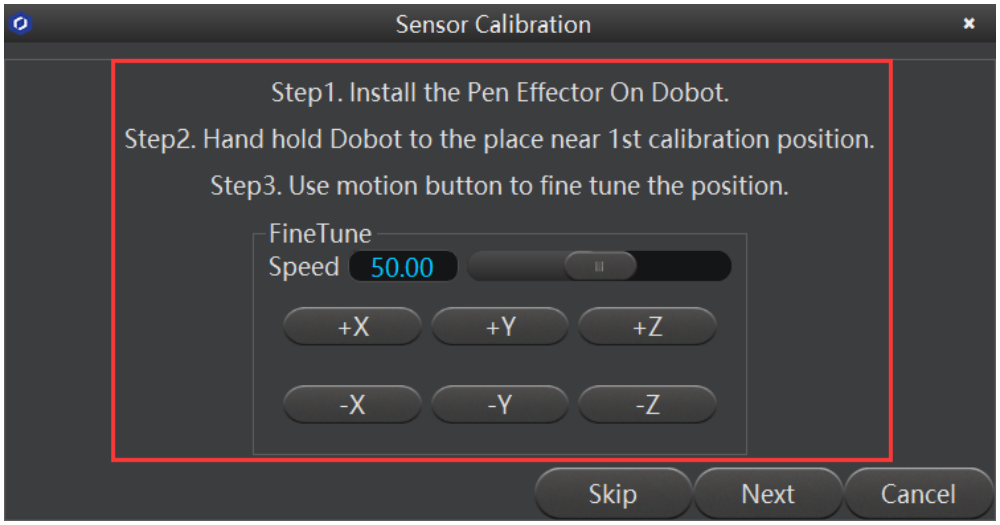


Figure 9.9 Sensor Calibration

After fine tuning, the nib should be in the center of A3, as shown below.

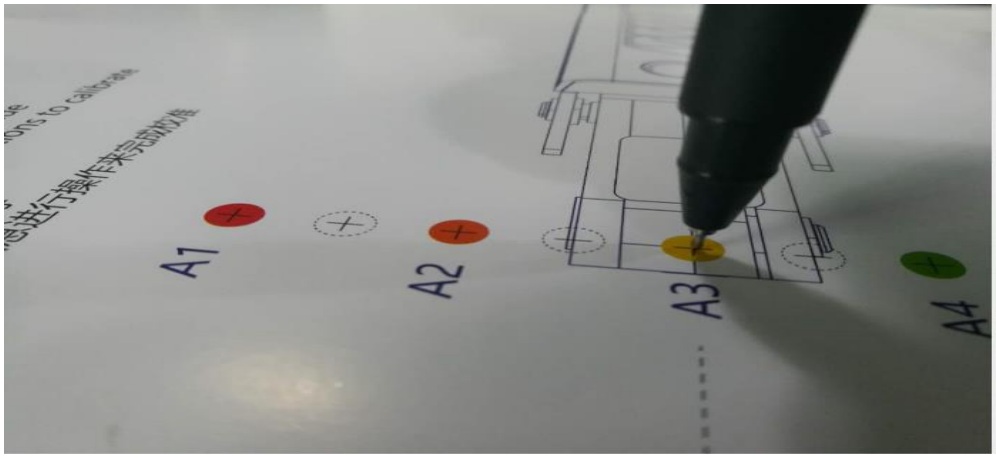


Figure 9.10 Sensor Calibration Board

7. Follow the instructions below, then click **Next**.

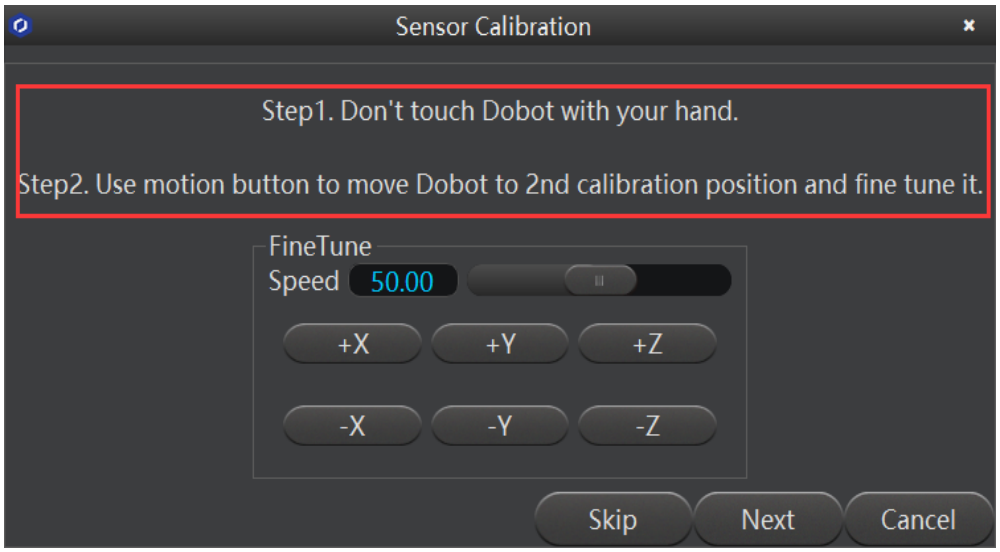


Figure 9.11 Sensor Calibration

Do not touch the Dobot. Use the motion button and move Dobot to 2nd calibration position and fine tune it. Click **Next** when the nib is in the center of B3. Shown as below:

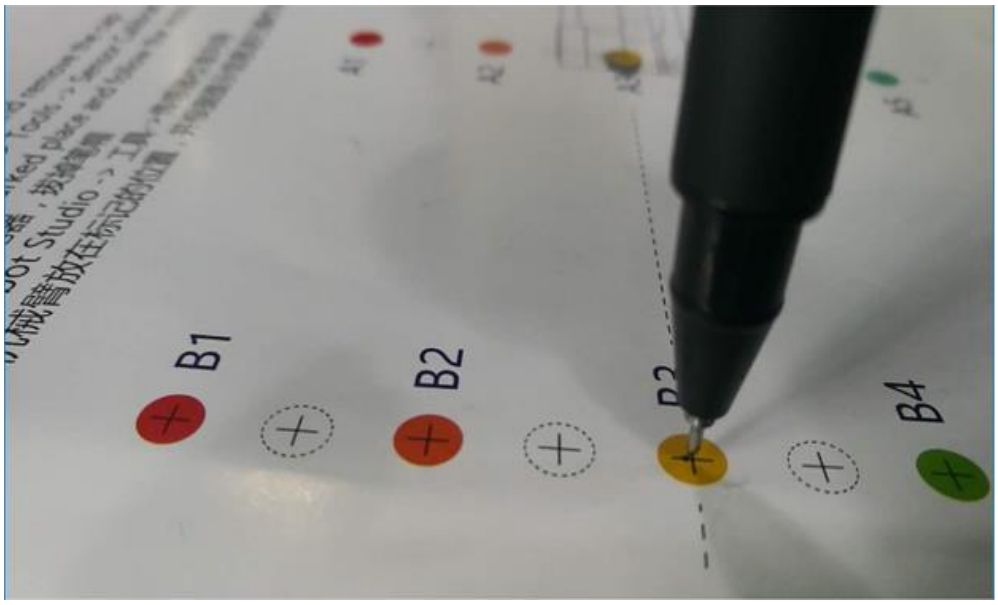
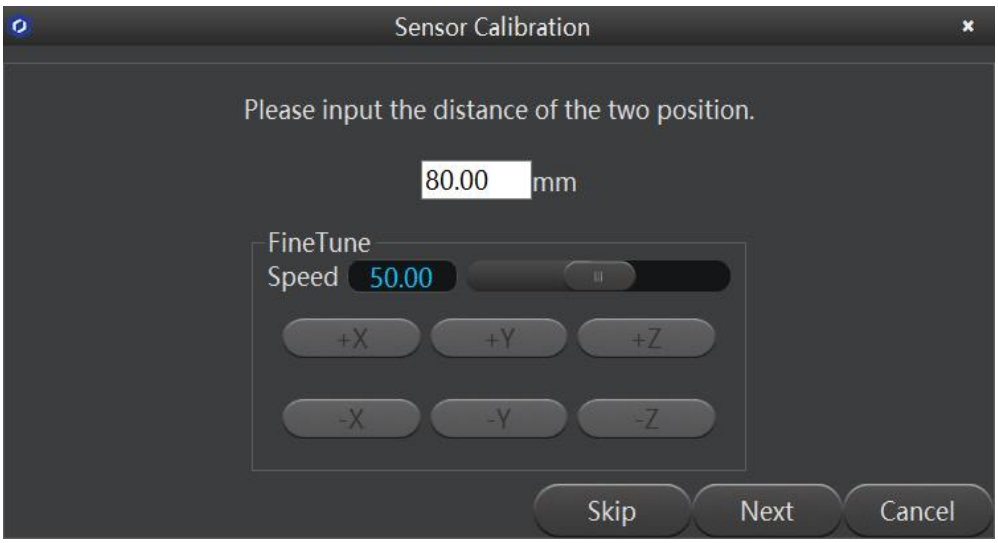
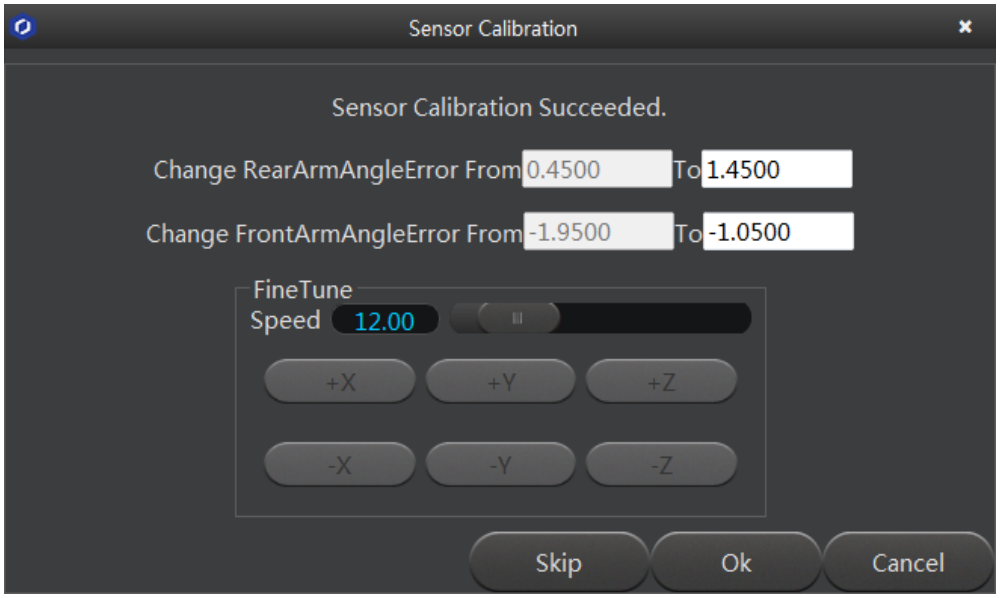


Figure 9.12 Sensor Calibration

8. The distance between A3 and B3 is 80mm, so you don't need to change the distance. Continue to click **Next**.



9. Click **Ok** to finish sensor calibration.



10.Bluetooth Kit

10.1 Bluetooth module is included in this kit, and the installation shown as follows:

Figure 10.1 Bluetooth module installation

10.2 Switch off the Dobot and plug the Bluetooth module into the communication interface. After installation, power on the Dobot and you will hear three short beep sounds. This means the Bluetooth module has been installed. At this time, a blue light is on and a green light is flashing.
10.3 Turn on bluetooth on your phone (IOS), and then open the Dobot App to connect the Dobot arm .

You can refer to the detailed tutorial on Youtube:
https://www.youtube.com/watch?v=kyeXwuf17IY

Notice: Please make sure Dobot is completely powered down before connecting/disconnecting extenal modules such as Bluetooth module, WIFI module, USB-Host module, Infrared sensor, Color sensor,etc. Otherwise, you risk damaging the Dobot! Remember that only until the status indicator light is off is when the Dobot is powered down.

11. WIFI Kit

The WIFI kit contains a WiFi module. Connect it into Dobot extensible port and use the USB cable to connect the Dobot together with your PC, as shown below:

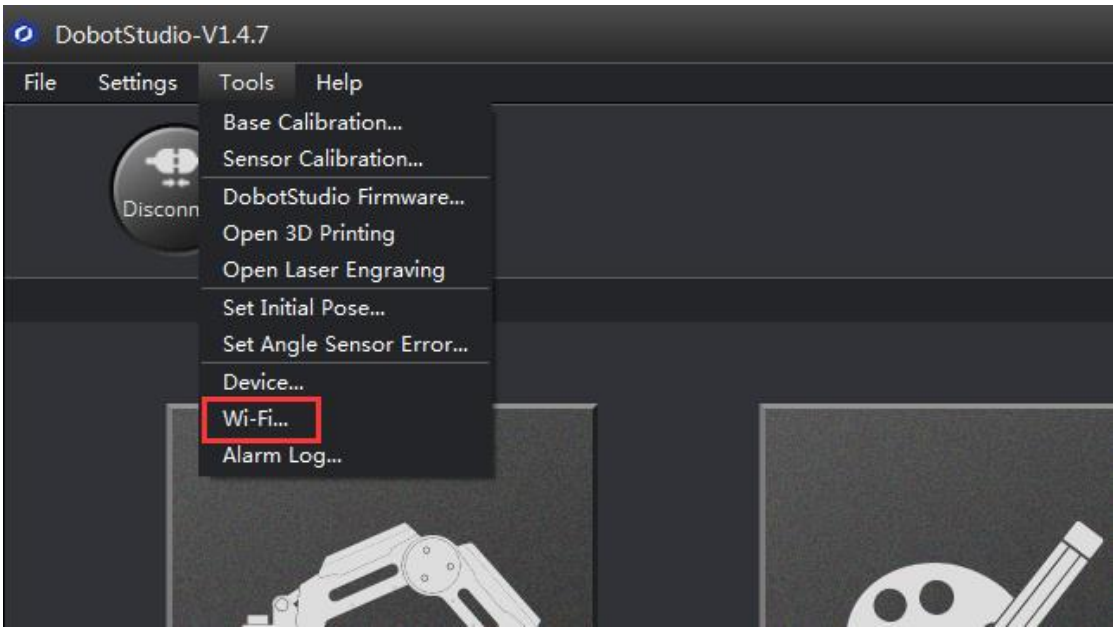
Figure 11.1 WiFi module

Notice: Please make sure the Dobot is completely powered down before connecting/disconnecting extenal modules such as Bluetooth module, WIFI module, USB-Host module, Infrared sensor, Color sensor,etc. Otherwise, you risk damaging the Dobot! Remember that only until the status indicator light is off is when the Dobot is powered down.

11.1 Set Dobot WiFi module

When first using the WiFi module, you need connect the USB to configure the WiFi module. This is to create a virtual serial port. After setting it up, you can use the WiFi module alone without the USB cable.

1. Open DobotStudio, Click **Connect->Tools->Wi-Fi**, and enter into the parameter setting interface.



2. Input related parameters of WLAN.

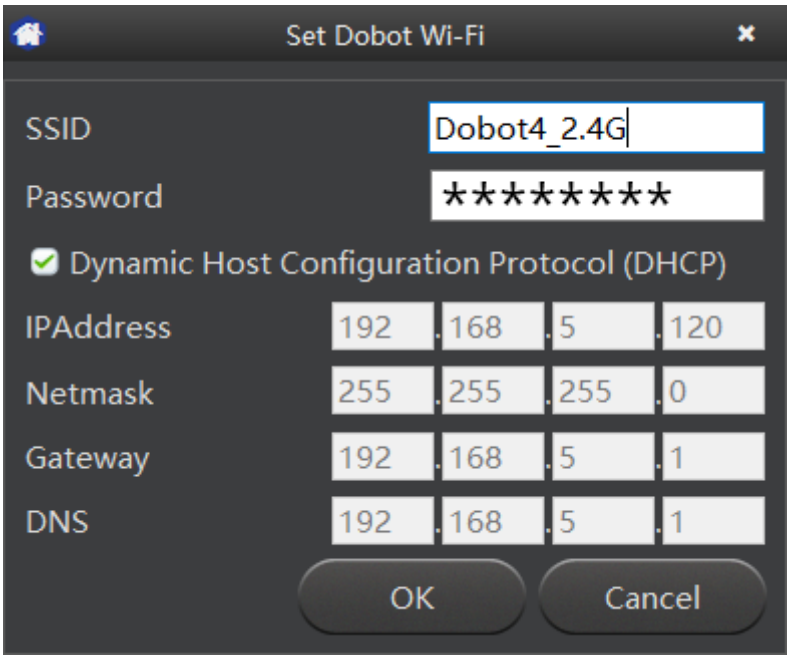


Figure 11.2 Wi-Fi interface

- Fill in Wifi name at “SSID” input box;
- Fill in Wifi password at “Password” input box;
- If you want to use function of DHCP, please tick checkbox;
- Otherwise, fill in“IPAddress”、“Netmask”、“Gateway”、“DNS” and any other parameters.

Generally, use DHCP. Click **OK** to finish setting up. Wait several seconds, and the green indicator of the Dobot WiFi wireless module will be on, which means that the Dobot has been connected with WLAN.

Figure 11.3 Connected with WLAN

Then you will find out the IP address, located on the main interface of DobotStudio as shown below:

Figure 11.4 Dobot IP address

Select the address, click Connect, then you can control the Dobot through WiFi. On future uses, just insert the WiFi module and connect the Dobot through the address.

12. Stick controller kit

12.1 GameSir Joystick Instruction

1. The Stick controller kit includes a gamepad and USB Host module. Connect wireless module into the 10pin communication port behind the controller. There are two ways to connect, wired and wireless, shown as follows:

Figure 12.1 Installation of stick module

2. For wireless mode: (Before starting, make sure to install the module first!) When syncing the gamepad, the green LED will light up and you will hear 4 short beeps. This means that the gamepad has finished initializing. At the same time, press the button **Home** and **A** to start up the gamepad.

Notice: Please make sure the Dobot is completely powered down before connecting/disconnecting extenal modules such as Bluetooth module, WIFI module, USB-Host module, Infrared sensor, Color sensor,etc. Otherwise, you risk damaging the Dobot! Remember that only until the status indicator light is off is when the Dobot is powered down.

Figure 12.2 Start up the stick

Now, the front button LED will turn on, and the LED beneath will flash:

Figure 12.3 Stick at work

3. There are two way to use the gamepad, **Linear mode and Jog mode,** which can be switched by button **L1/R1(L1 refers to jog mode and R1 refers to linear mode)**.The control mode details are shown below:

（1） Linear mode

Function	Corressponding buttons
Turn on stick	Hold down **Home** and **A** for 2 seconds
Turn off stick	Hold down **Home** for 2 seconds
Dobot X+/X-	Left Stick: front/back
Dobot Y+/Y-	Left Stick: left/right
Dobot Z+/Z-	Right Stick: front/back
Joint4 servo rotation R+/R-	Right Stick: left/right
Suction cup ON	**Y key**
Gripper ON	**X** key
Release suction cup/gripper	**B** key

Chart 12.1 Linear mode

（2）Jog Mode

Function	Corressponding buttons
Turn on stick	Hold down **Home** and **A** for 2 seconds
Turn off stick	Hold down **Home** for 2 seconds
Dobot Joint1+/ Joint1-	Left Stick: front/back
Dobot Joint2+/ Joint2-	Left Stick: left/right
Dobot Joint3+/ Joint3-	Right Stick: front/back
Joint4 servo rotation R+/R-	Right Stick: left/right
Suction cup ON	**Y** key
Gripper ON	**X** key
Release suction cup/gripper	**B** key

Chart 12.2 Jog mode

12.2 Beitong Joystick Instruction

The Beitong joystick kit includes a joystick, USB Host, charger, and a wireless receptor.

Figure 12.4 Joystick Module

1. Before plugging in the charger into the Dobot Magician, Connect the USB Host with the Dobot Magician via the 10pin communication interface on the back of the unit.

Figure 12.5 Installation of Beitong Joystick

2. Plug the charger and turn on the Dobot Magician. When the installation is finished, the green light on the USB Host will turn on and four short sounds will be heard, which means the initialization is completed. Press the Logo button on the joystick and it will start.

Notice: Please make sure the Dobot is completely powered down before connecting/disconnecting extenal modules such as Bluetooth module, WIFI module, USB-Host module, Infrared sensor, Color sensor, etc. Otherwise, you risk damaging the Dobot! Remember that only until the status indicator light is off is when the Dobot is powered down.

Figure 12.6 Start Joystick

The red light between the left bar and the right bar will flicker.

Figure 12.7 The operating Joystick

3. You can control the Dobot arm through the joystick. There are two control modes: **Linear Mode** and **Jog Mode** (**LB refers to jog mode and RB refers to linear mode**). They can be easily switched through the corresponding keys on the Joystick.
The instructions are shown below:

(1)Linear Mode

Function	Corresponding buttons
Turn on Joystick	Press the Logo Key for 3 Seconds
Turn off Joystick	Auto Turn off
Dobot X+/X-	Left Stick: front/back
Dobot Y+/Y-	Left Stick: left/right
Dobot Z+/Z-	Right Stick: front/back
Joint4 servo rotation R+/R-	Right Stick: left/right
Suction Cup ON	**Y** key
Gripper ON	**X** key
Release Suction Cup/Gripper	**B** key

Chart 12.3 Linear Mode

(2)Joy Mode

Function	Corresponding buttons
Turn on Joystick	Press the Logo Key for 3 Seconds
Turn off Joystick	Auto Turnoff
Dobot Joint1+/Joint-	Left Stick: front/back
Dobot Joint2+/ Joint2-	Left Stick: left/right
Dobot Joint3+/ Joint3-	Right Stick: front/back
Joint4 servo rotation R+/R-	Right Stick: left/right
Suction Cup ON	**Y** key
Gripper ON	**X** key
Release Suction Cup/Gripper	**B** key

Chart 12.4 Jog Mode

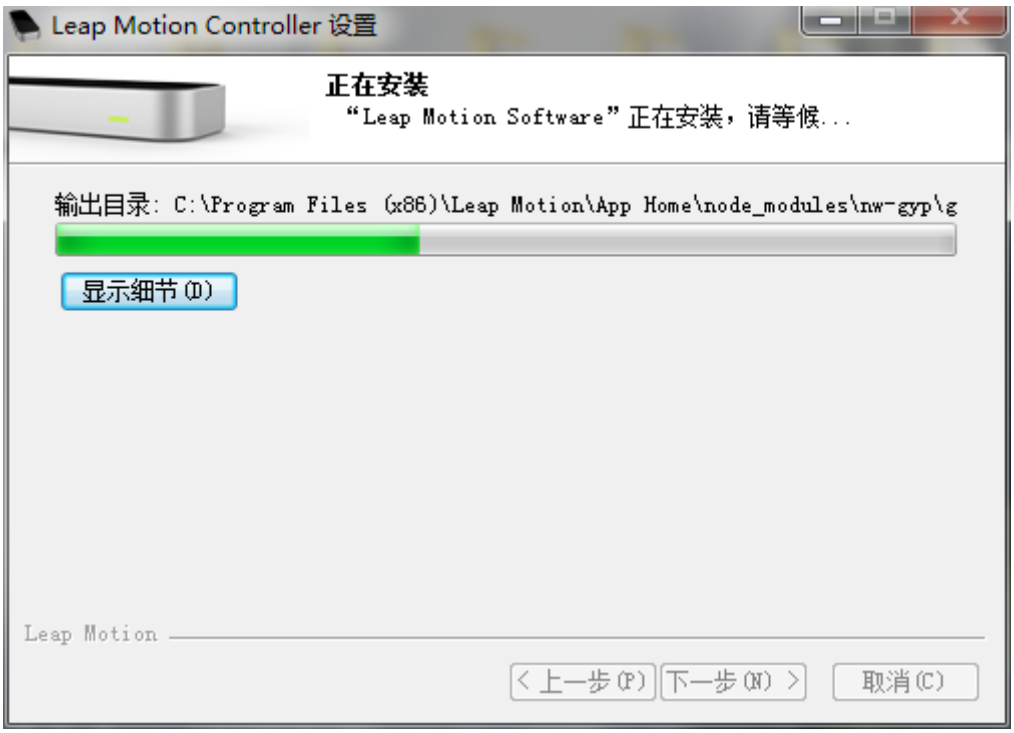
Note: If the Joystick cannot control the Dobot Magician after pressing the Logo key, hold the Logo key to reset connection.

13.Leap Motion Kit

13.1 Connect the Leap Motion module to the PC through USB cable.

Figure 13.1 Leap motion module

13.2 Download the Leap motion driver and install it. (Here is the link: https://www.leapmotion.com/setup)



Follow the directions below and keep installing until it’s done.

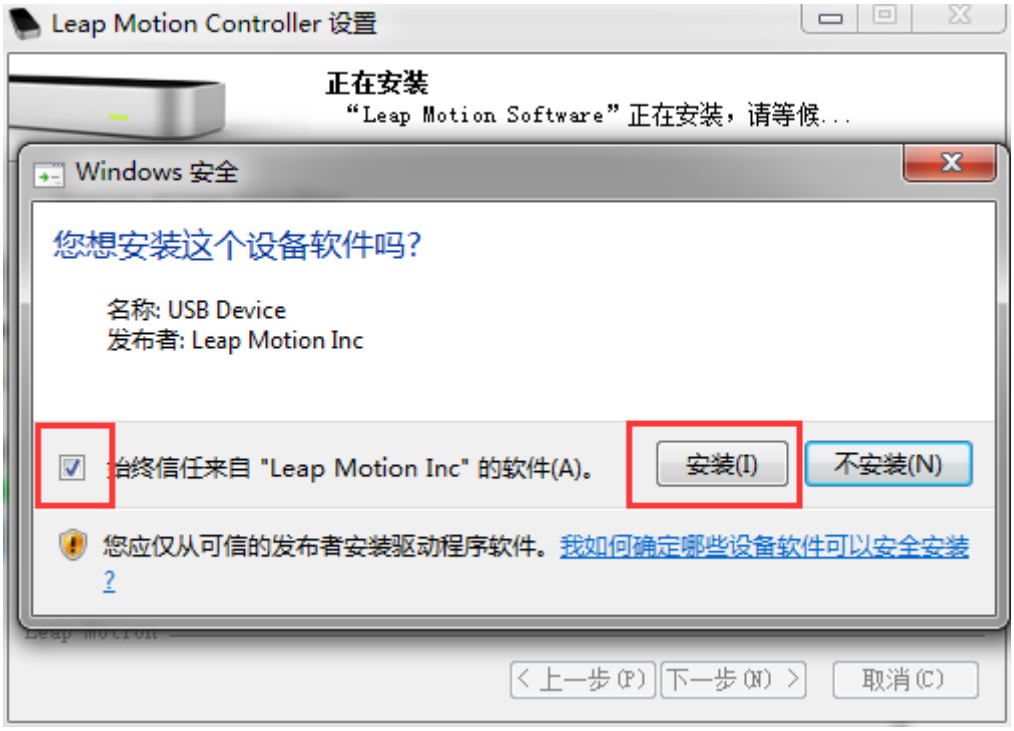


Figure 13.2 Successful installation

13.3 After installing, start up the equipment and open DobotStudio. Click Leap Motion to enter the interface:

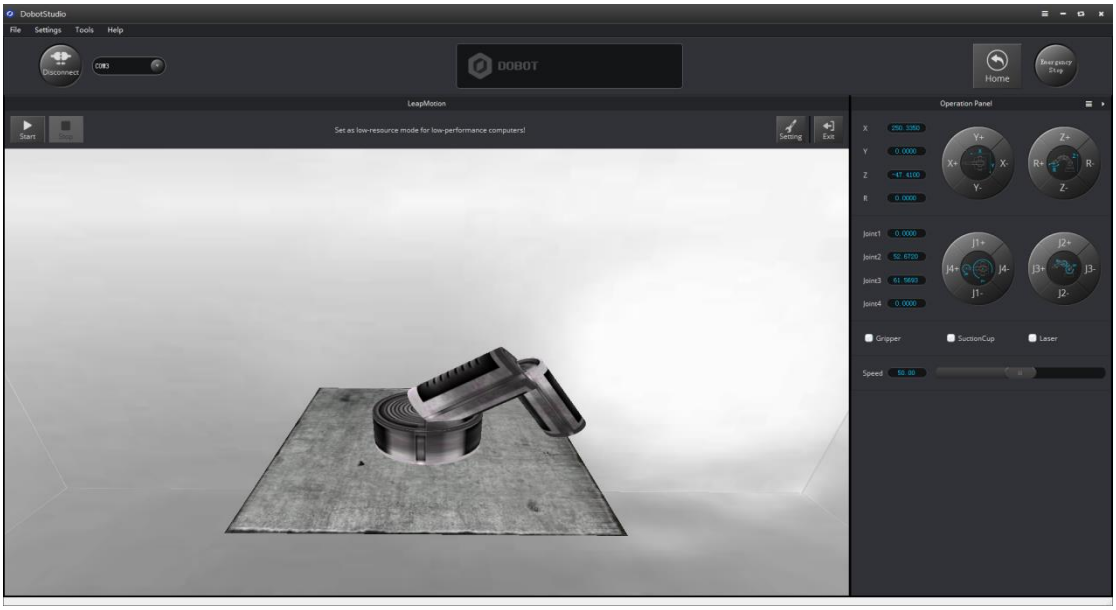


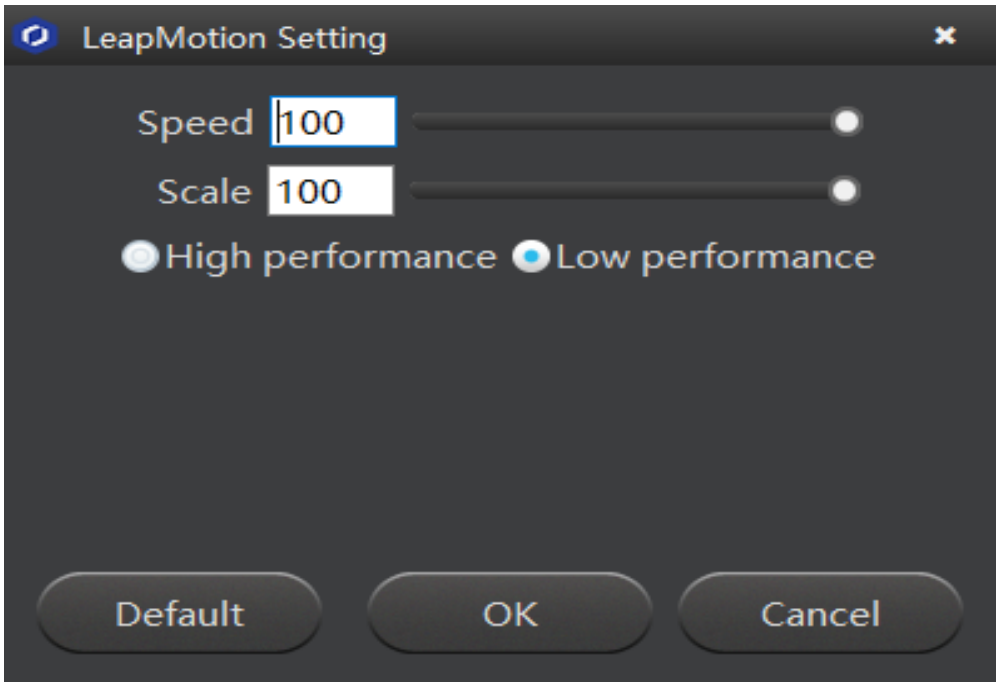
Figure 13.3 Leap motion interface

13.4 **Start**: To keep the Dobot stable, turn your palm up to move into controlled area of Leap Motion. The Dobot will move accordingly. (Hold hands to trigger the suction cup or gripper.)

13.5 **Turn palm up**: remove hand from surveyed area of Leap Motion.

13.6 **Stop**: Exit **Leap Motion** mode.

13.7 **Settings:** Set up speed and scale ratio;



Speed：Speed adjustment;

Scale：Coordinates ratio between leap motion and Dobot;

Low resource/high resource: Set as low-resource mode for low-performance computers.

14.Mouse control

14.1 The software used for mouse control is **DobotStudio**. Please open the software and enter into mouse module interface, as shown below:

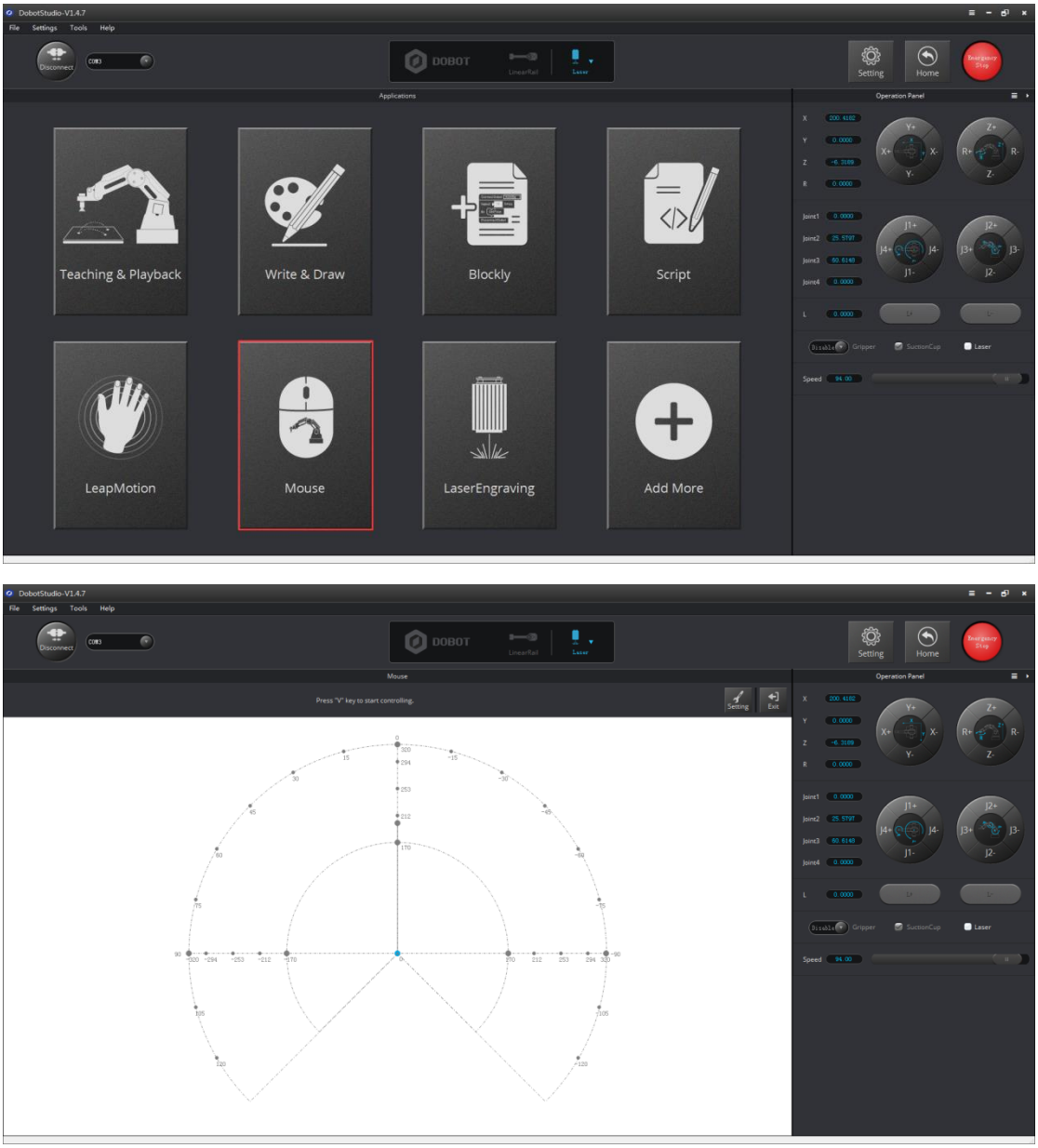


Figure 14.1 Enter into mouse controlling interface

14.2 **V key:** Start and Stop;

14.3 **Settings:** Set up related velocity and acc;

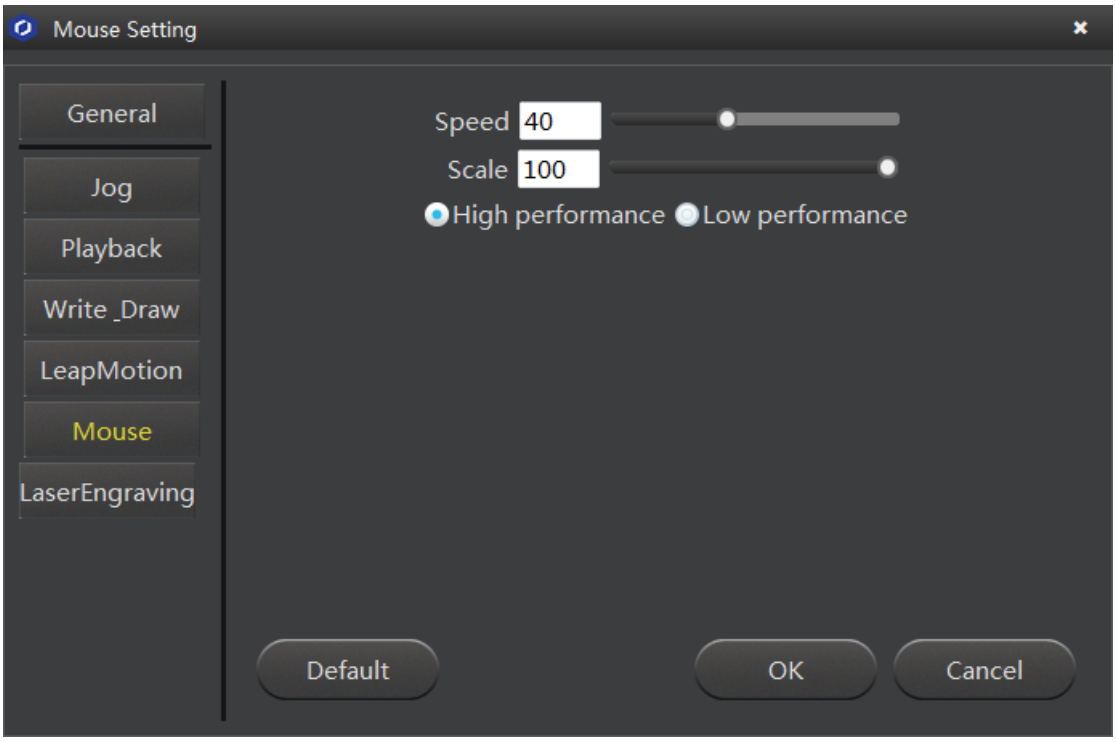


Figure 14.2 Parameter settings

Speed (percentage)：0-100, we suggest 50；

Scale (percentage): 0-100, we suggest 100;

We suggest users with a lower performance computer to opt for the low performance option.

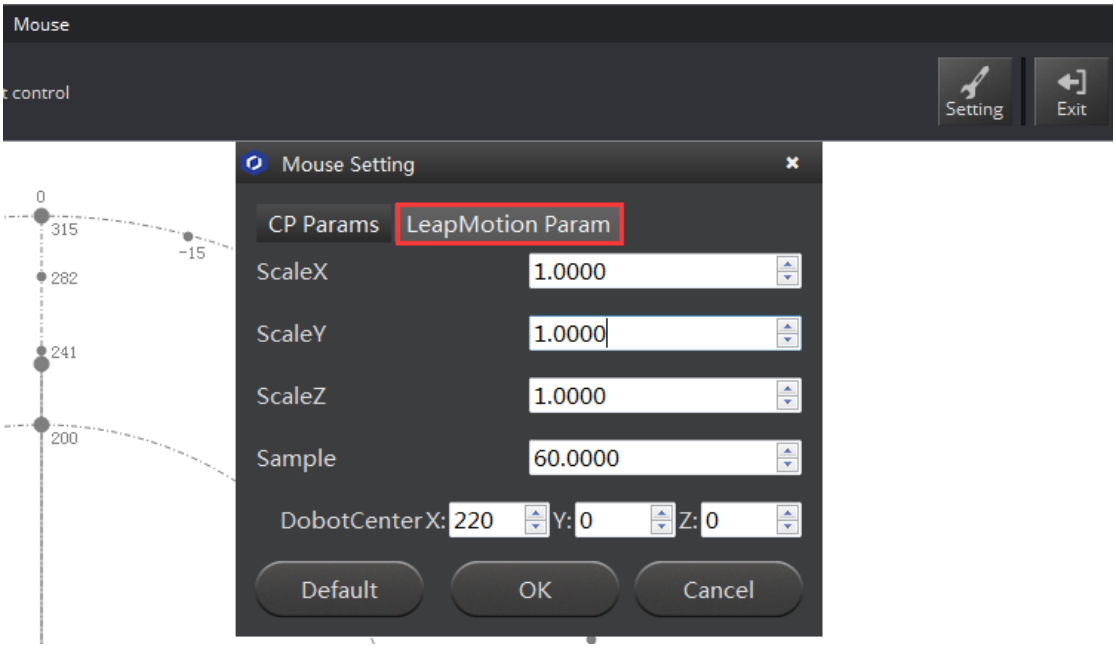


Figure 14.3 Parameter settings

Scale X/Y/Z：Scale ratio between mouse coordinates and Dobot coordinates;

Sample：20-60, depending on PC performance;

DobotCenter: Keep default settings;

15.Blockly

Dobot Blockly is a programming platform based on Google Blockly. In this process, users can program through the puzzle format, which is straightforward and easy to understand. Also, users can use the integrated API of Dobot anytime.

15.1 Blockly Interface

1. Open **DobotStudio** and click **DobotBlockly**:

Figure 15.1 Enter into DobotBlockly

2. 5 areas are included in this window:

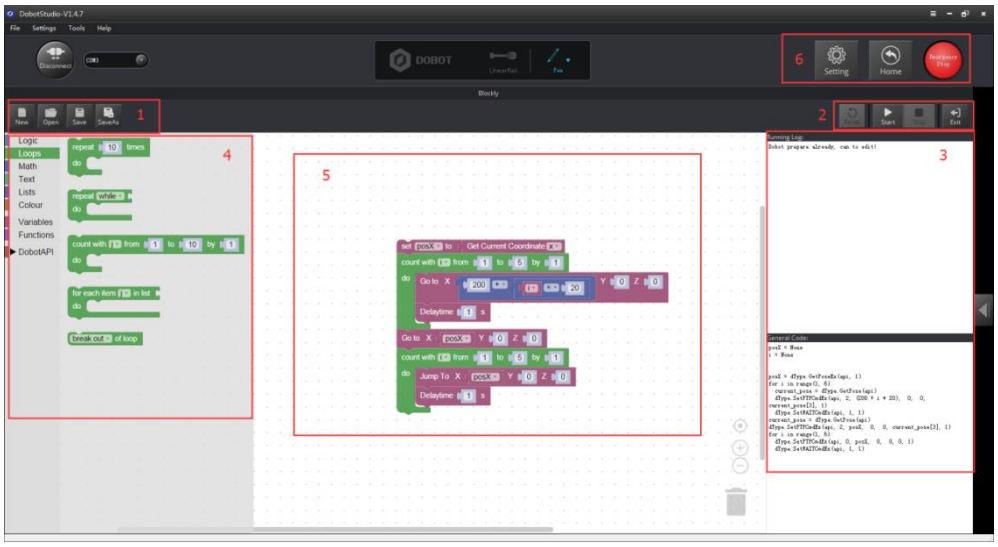


Figure 15.2 DobotBlockly Interface

Area 1：

New/Open/Save：New/Open/Save the current files

Area 2：

Start/Stop

Area 3：

This part includes the current point location info of Dobot. Log information is in the middle, while programming code is on the left:

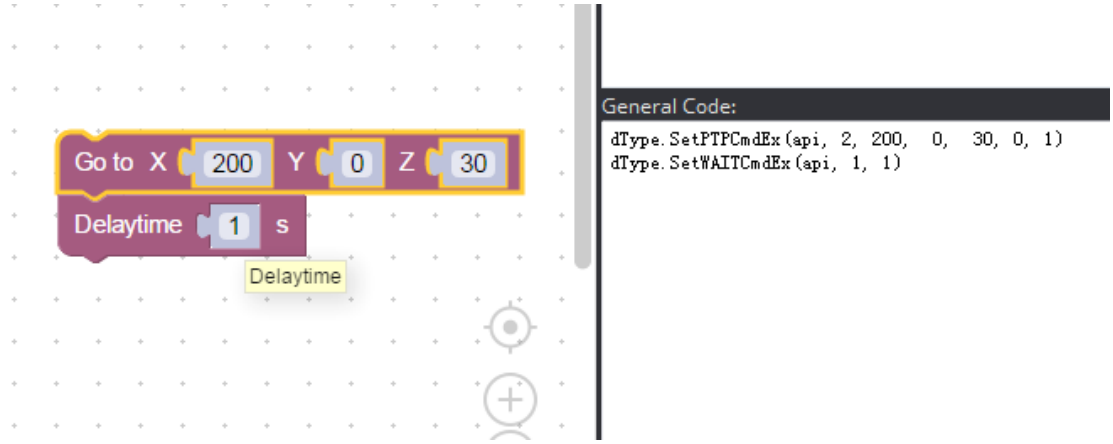


Figure 15.3 Code information

Area 4：

This part has the selection area of blockly module, including logistic, loop, math, Dobot API and so on. Just drag them to the window that is OK.

Dobot API has many functions, such as velocity/acc, end effector settings, move mode, linear or jog mode and each interface of I/O configuration. It is very convenient for secondary development.

Area 5：

Main window of blockly programing

Area6:

Home and emergency stop.

15.2 Blockly Demo

Here is one basic demo, shown as follows:

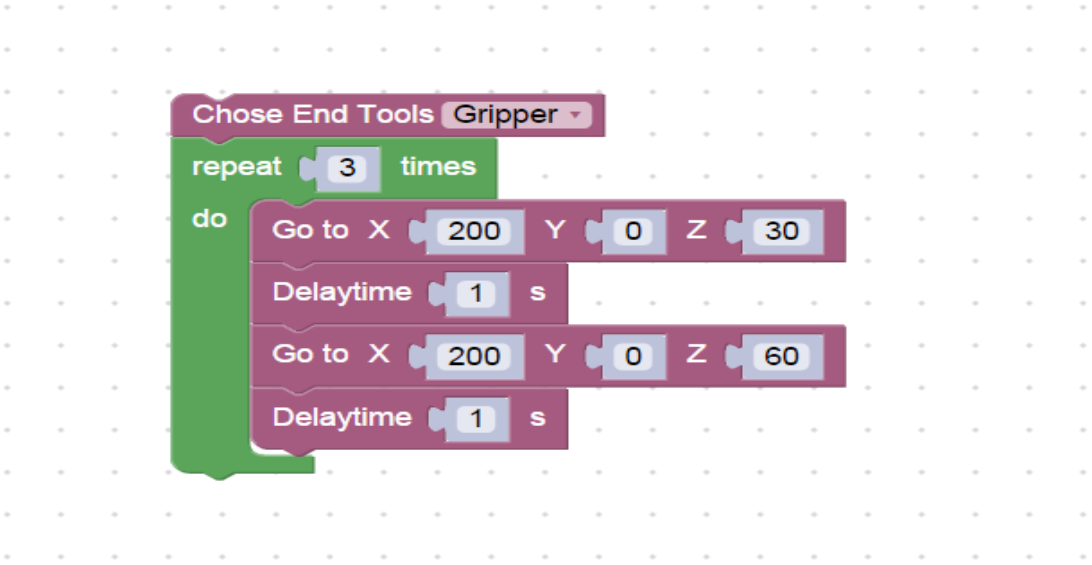


Figure 15.4 Programing demo

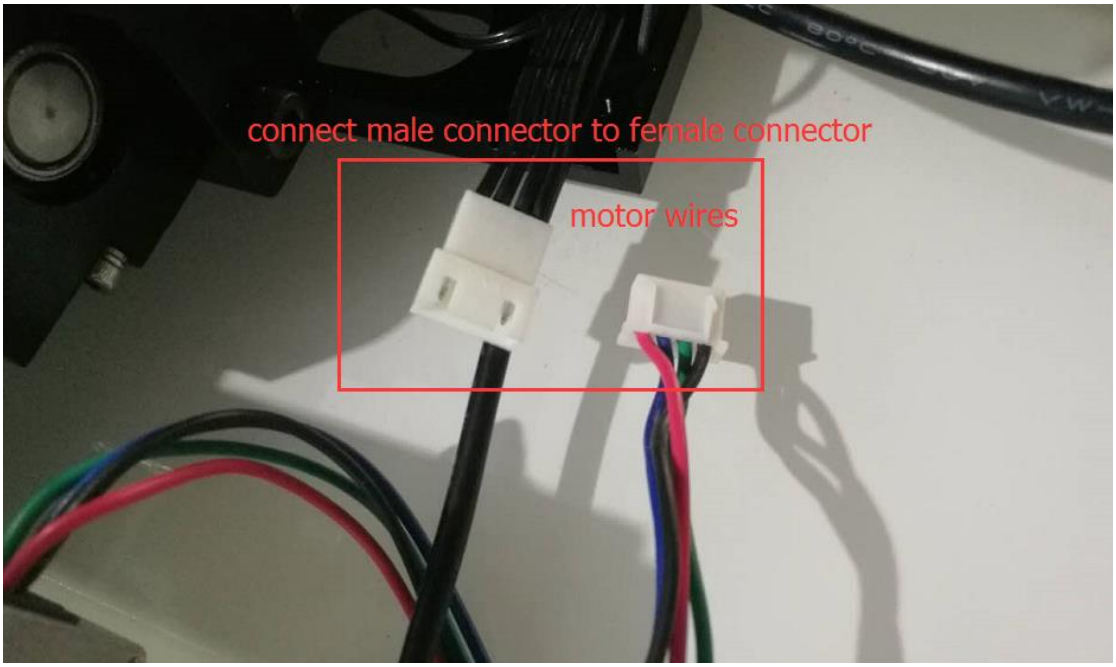
Explanation of Demo: Set endeffector as gripper, set the loop number as 3, and make the Z axis move back and forth 3 times. After this, click **Start**, and the Dobot will move accordingly.

16.Function Description of LinearRail

About connecting the rail with Dobot, you can refer to the installation instructions of LinearRail. Plug the wires into the base of Dobot after connecting LinearRail with the Dobot. As shown below:

Figure 16.1 LinearRail connect to Dobot arm

Notice: Please make sure the Dobot is completely powered down before connecting/disconnecting extenal modules such as Bluetooth module, WIFI module, USB-Host module, Infrared sensor, Color sensor,etc. Otherwise, you risk damaging the Dobot! Remember that only until the status indicator light is off is when the Dobot is powered down.



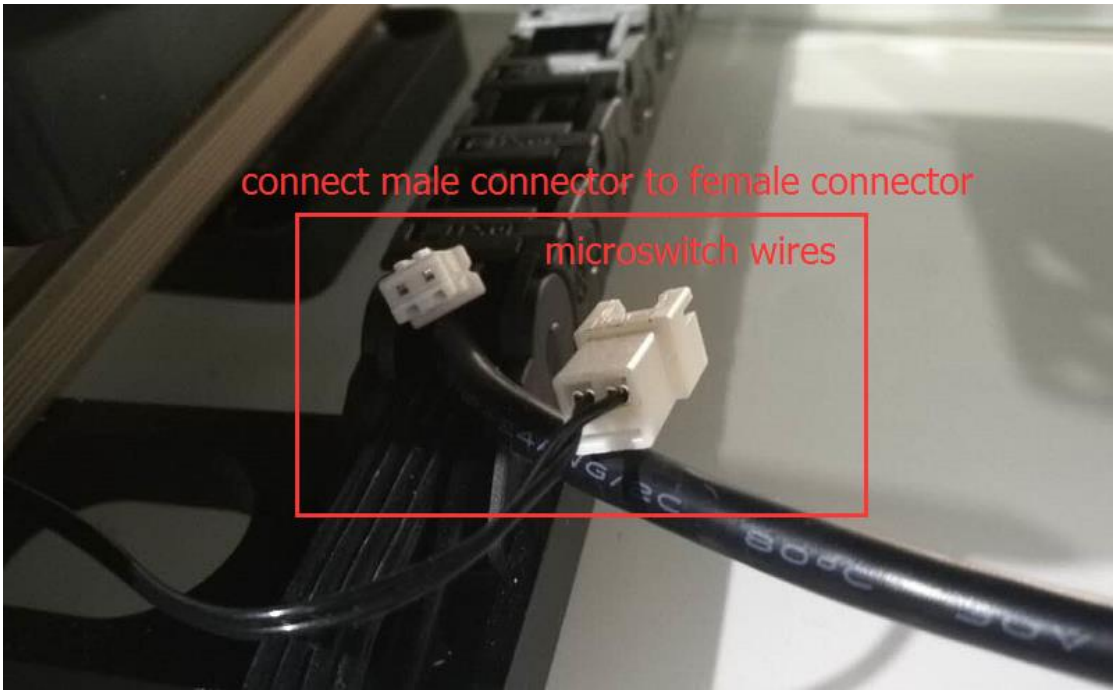


Figure 16.2 LinearRail wiring diagram

How to write & draw through the LinearRail: You can use CorelDRAW X7 to transform content into PLT format. The software can be downloaded from internet. For more details about software operation, refer to the PLT format instructions document.

1. Open DobotStudio, click **LinearRail** and the button at the right corner of Operation Panel, and choose **Linear Rail control**, as shown below:

Figure 16.3 Click LinearRail

2. After clicking **LinearRail**, you need to test whether the LinearRail can move properly. Click **L+** or **L-.** The Dobot would move left or right.

Click **Setting** and choose **Jog** to change the velocity and acceleration of the LinearRail.

Available distance of LinearRail: 0-1000 mm;

Maximum load: 5kg.

Figure 16.4 LinearRail motion test

3. The Dobot needs to reset. Press the **Home** button before you do anything else.
   Notice: Before you press the **Home** button, please take the pen off and/or raise the dobot arm up.

Figure 16.5 Home test

4. Click **Write&Draw** after finish homing.

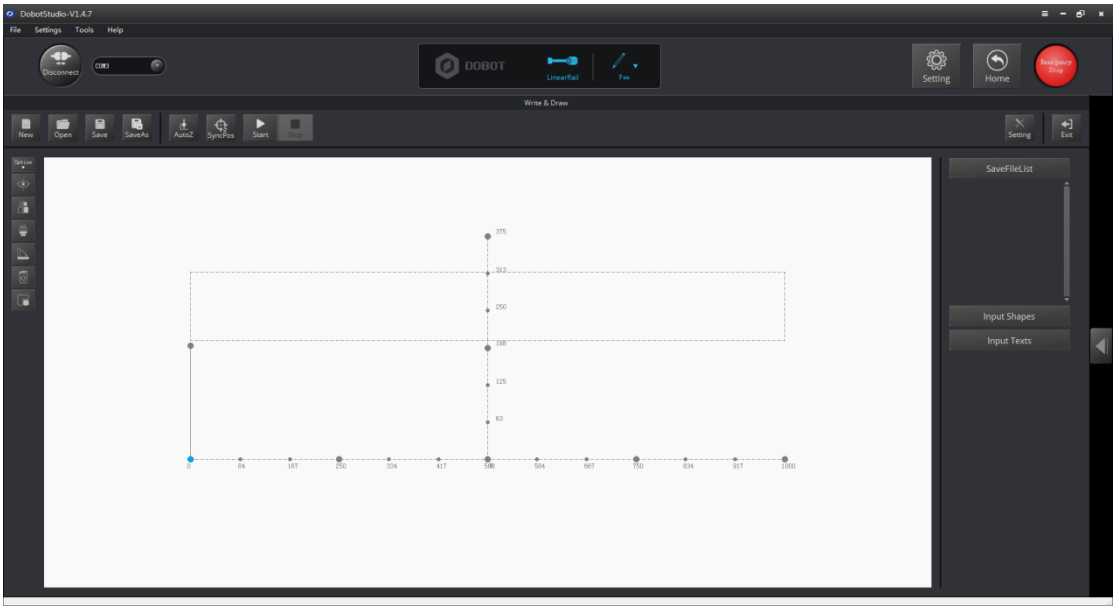


Figure 16.6 LinearRail operation panel

5. Click **Open** to import the PLT files.

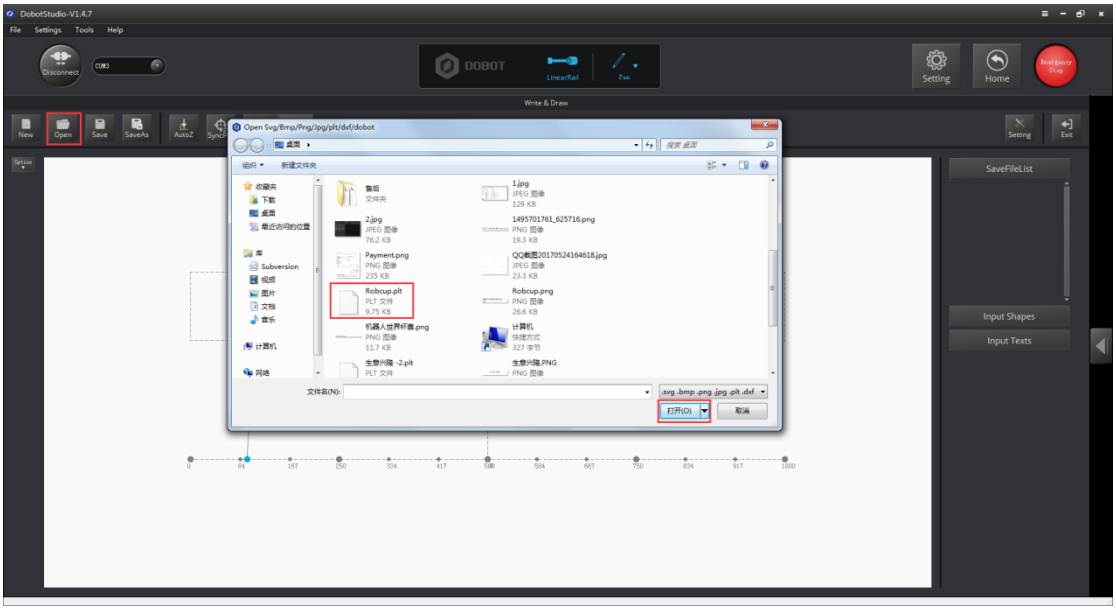


Figure 16.7 Import file

6. Click options in the left side of Write&Draw to adjust position and size of characters.

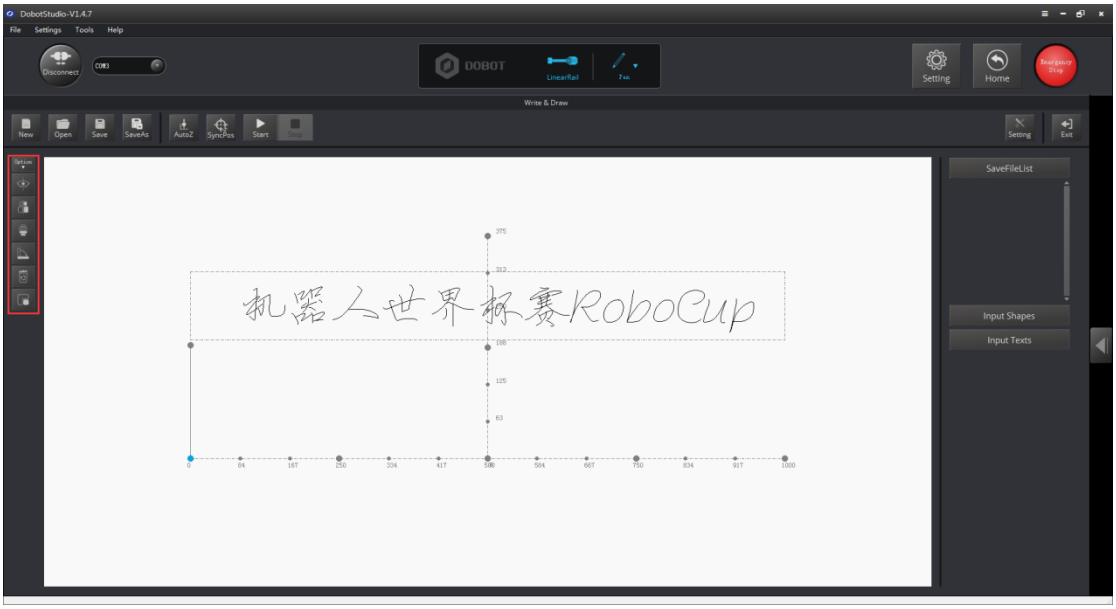


Figure 16.8 Operation Panel

7. Adjust the height of pen, as shown below:

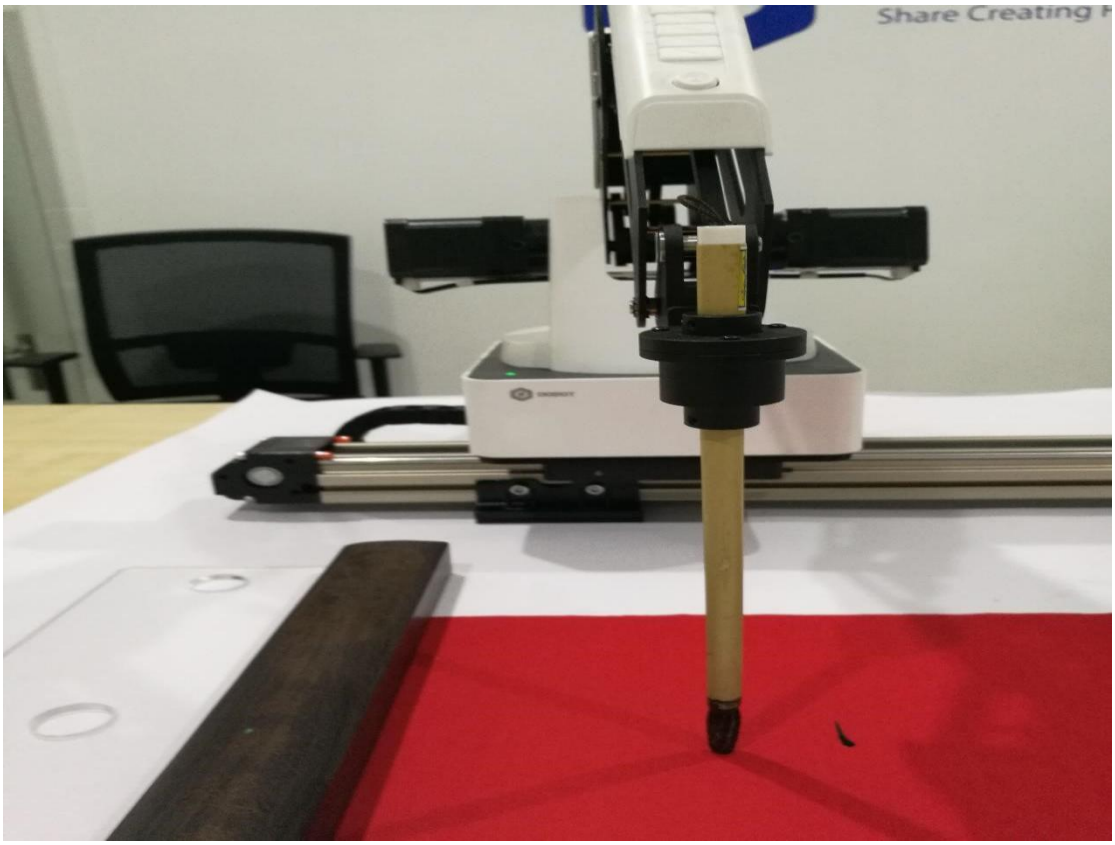


Figure 16.9 the height of pen

8. Click **AutoZ** to save the height of the pen (i.e. keep the position coordinate of Z-axis).

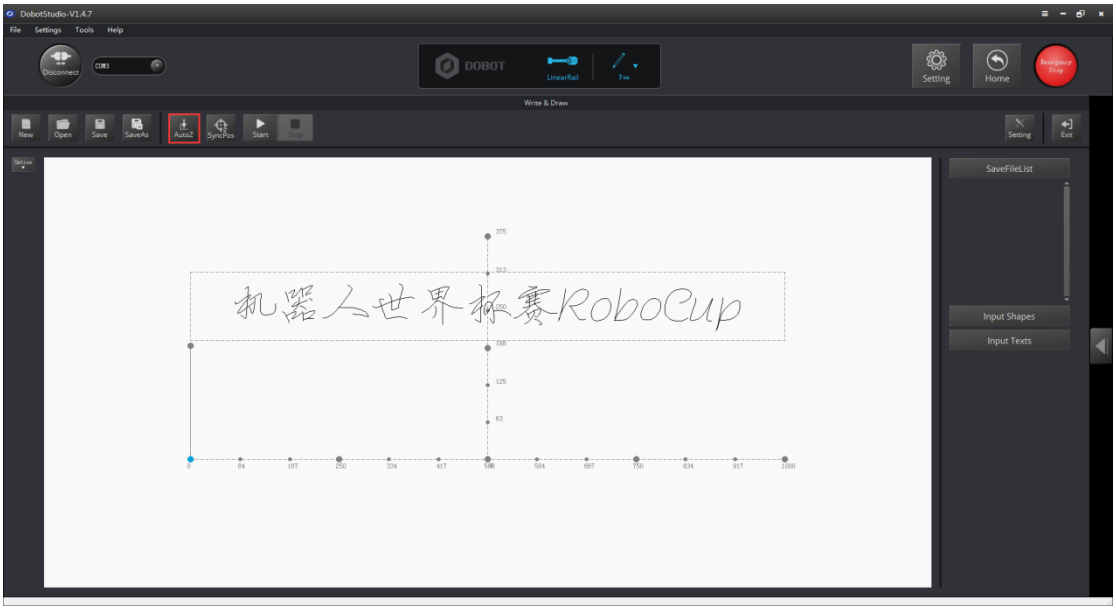


Figure 16.10 AutoZ

9. Click **SyncPosition** and the Dobot will move to the initial position.

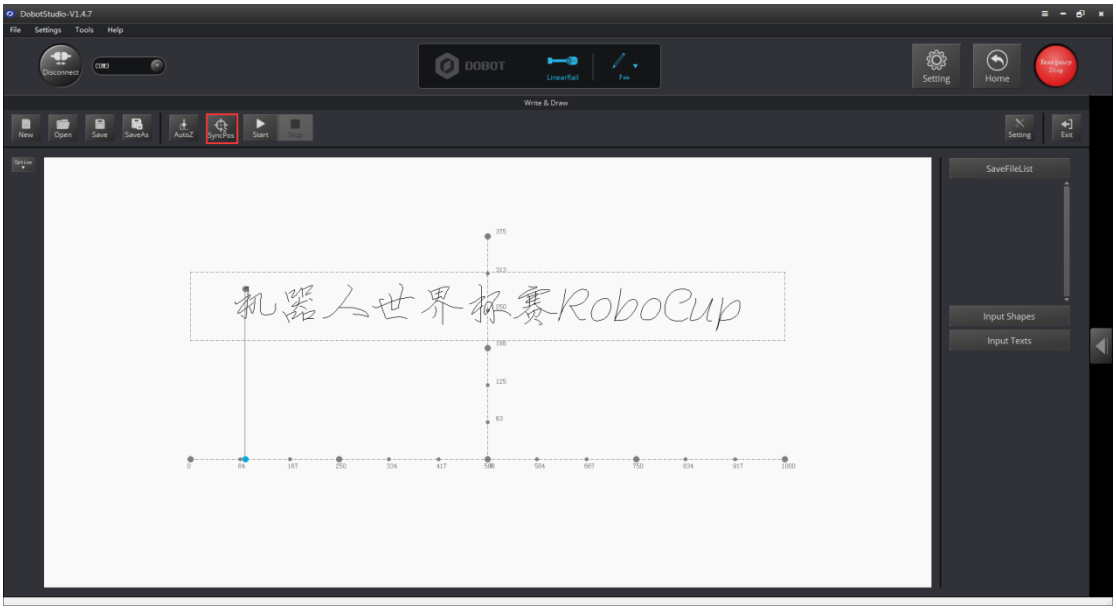


Figure 16.11 SyncPosition

10. Click **Start** and the Dobot will write automatically.

Note: If users want to set an action to dip the pen into the ink, please refer to the steps below. It uses the Teaching & Playback module. (Everytime you press Unlock Key and then release, the Dobot records a point's position.)

（1） Set ink dipping position, as shown below, right click blank spaces, and add playback triggers.

A playback trigger causes one ink dipping motion.

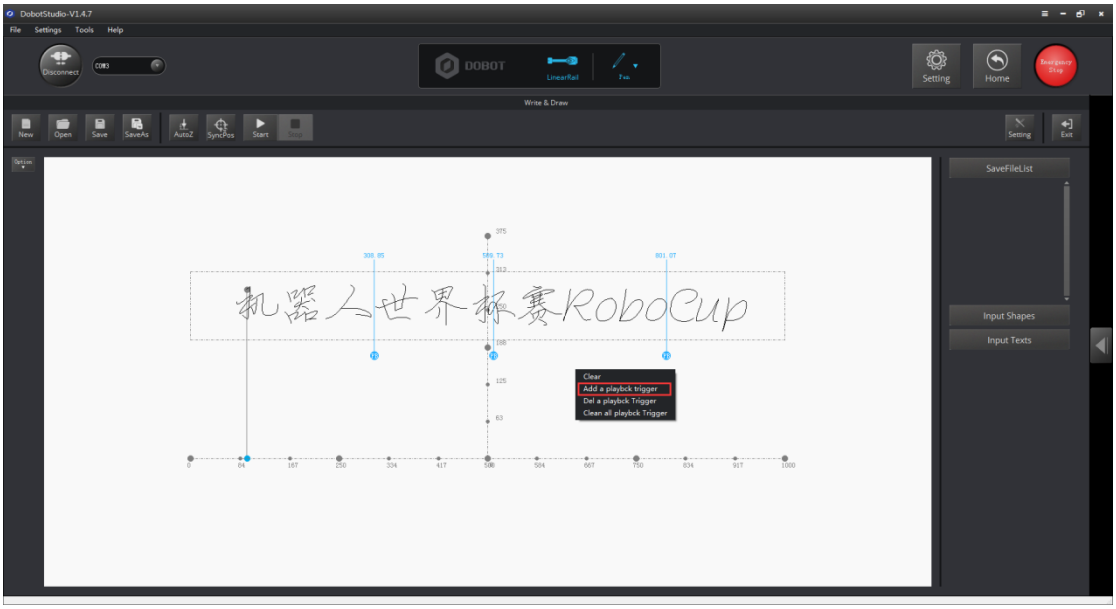


Figure 16.12 Set dip ink position

（2） Return to Teaching & Playback module to set ink dipping actions.

Figure 16.13 Return to Teaching&Playback

（3） Press the Unlock Key in forearm, move the forearm to the right place, and release the Unlock Key to record the first point position. This point position need to be a little high, but do not over the limit position. It will prevent the writing brush from touching the inkstone.

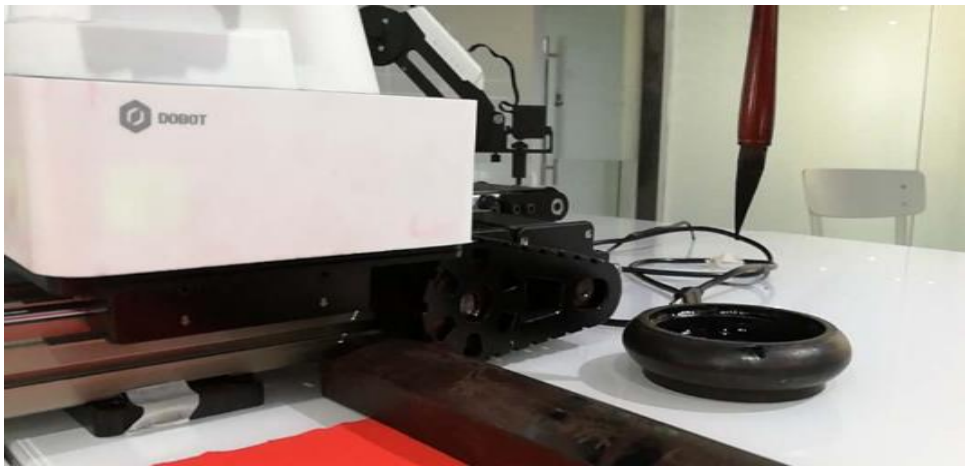
Follow the following steps for save points. Move the forearm to the related position, and use Teaching & Playback to record these points, as shown below:

Figure 16.14 Simulate the actions of ink dipping

These are the actions to shake off loose ink between the right and left sides.

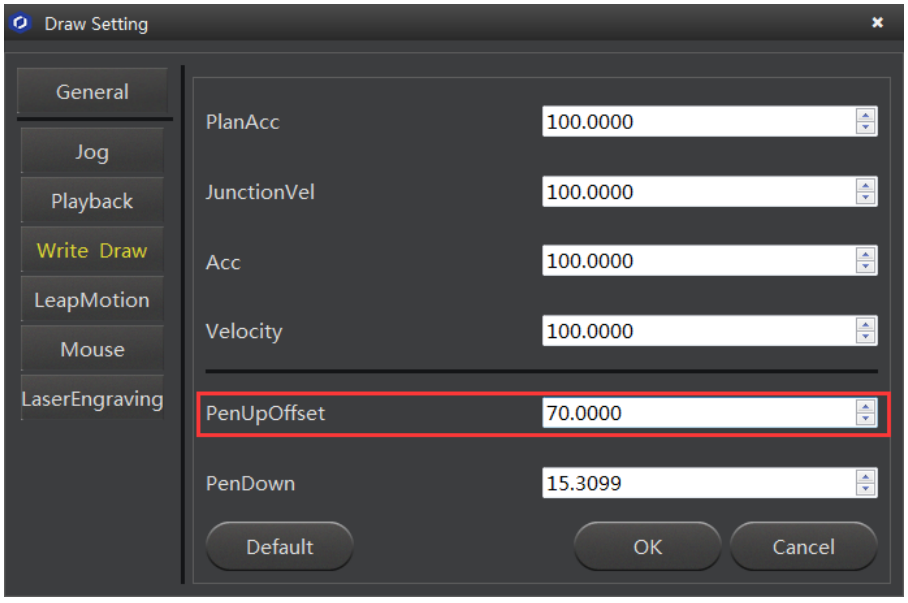
Figure 16.15 Simulate the actions of ink dipping

Raise the writing brush up to prevent it from touching the inkstone.



Finish recording the ink dipping actions and return to the Write & Draw module to start writing in LinearRail.

Notice: The inkstone has its own height, so you need to set a suitable rising height to prevent the writing brush from touching the inkstone. (We recommend doing PenUpOffset between 50 to 75.)



17.More support

- For more information,visit http://cn.dobot.cc/
- For more detailed material about software, second development and any others,visit http://cn.dobot.cc/download-center/dobot-magician.html
- Share your idea on Dobot forum http://forum.dobot.cc/
- Further question, welcome to send email at support@dobot.cc

Shenzhen Yuejiang Technology Co.,Ltd

Website：*www.dobot.cc*

4F, A8, Tanglang Industrial Area, Taoyuan Street, Nanshan District, Shenzhen, China