

# Get started guide Probot g602 robot arm

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Revision 2.1.0

2020-03-04

For probot g602 robot

(Hardware version number v2.1.0)

## Advice

Thank you for purchasing and using the probot g602 product. For your safety and benefit, please read the user manual and all the materials provided with the product carefully before using the product. If you do not operate and use the product in accordance with the user manual, it will result in Anyone Robot (Shenzhen) Co., Ltd. will not be liable for any personal injury, property or other losses.

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## 强制

- This manual fully describes the use of the g602 robotic arm. Please be sure to operate the robotic arm after reading it carefully and fully understanding it.
- Before the robotic arm is powered on, please adjust the robotic arm to the initial state and the operator is in a safe position outside the working range of the robotic arm.
- In an emergency, immediately press the emergency stop button. If the mechanical arm cannot be braked in time, it may cause personal injury or equipment damage.

## 注意

- The drawings and photos in the manual are representative examples and may differ from the product purchased.
- The manual is sometimes modified due to product improvements, specifications changes, and ease of use. The revised manual will be updated with the version number under the cover and issued as a revised version.
- If you need to order the manual due to damage, loss, etc., please contact our sales department and order according to the version number on the cover.
- Customers make unauthorized product transformations, which are not covered by the company's warranty, and the company is not responsible.

# table of Contents

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table of Contents.....	5
<b>Document version.....</b>	<b>6</b>
1 product description.....	7
2 Hardware Configuration.....	11
2.1 Hardware interface and wiring.....	11
2.2 Adjust the initial posture of the robot arm.....	13
3 ros environment setup.....	14
3.1 Start ros2go.....	14
4 Running robotic arm.....	16
4.1 Robot arm power on.....	16
4.2 Start ros host computer.....	17
4.3 Simulation / Online Switch.....	17
4.4 Robot arm enable.....	18
4.5 Zero calibration.....	19
4.6 Run the demo routine.....	22
4.7 Shutdown and emergency stop.....	22
4.8 Drag control.....	23
4.9 Joint space jog control.....	25
4.10 Workspace jog control.....	26
4.11 io control.....	27
4.12 Teaching point saving and running.....	28
5 appendix.....	30
5.1 References.....	30

# Document version

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date	version	Author	summary
<b>2019-4-13</b>	1.0		initial version
<b>2019-10-8</b>	2.0		Add teaching point save and run function
<b>2019-12-15</b>	2.1		Add zero calibration function
<b>2020-02-20</b>	2.1.1		Update g602 content

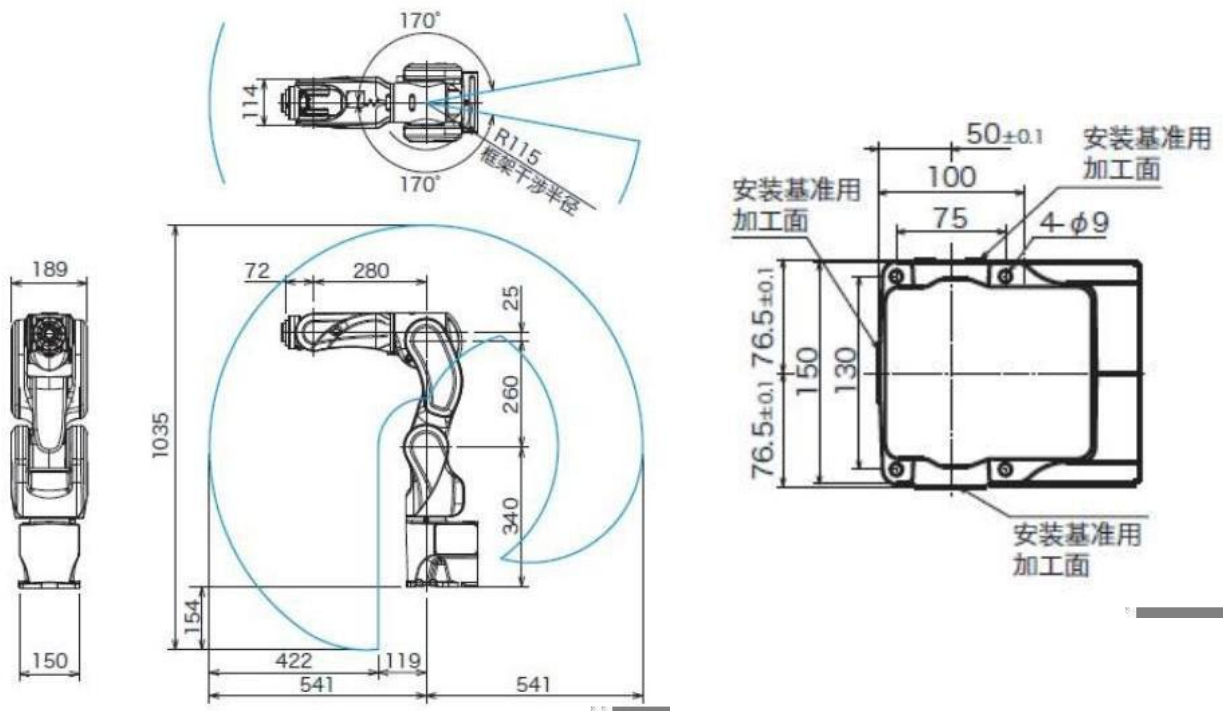
**Table 1: Version History**

# 1 product description

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probot g602 is a lightweight robot with a small size and light weight, suitable for assembling small unit robots, which can complete loading, unloading, sorting, assembly and other tasks at high speed and high precision. At the same time, all robot cables are built in. It can work flexibly in a narrow space, and the installation method can choose floor installation, hanging installation, and flip installation





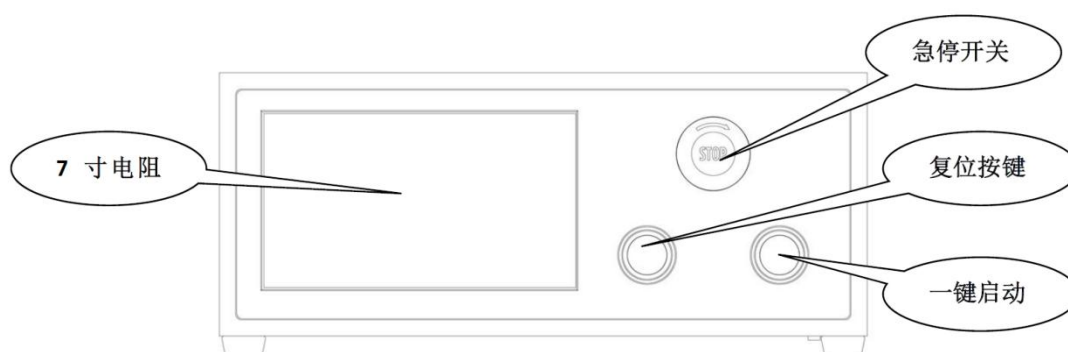
Robotic arm type		Six axis	
axis	Range of motion	Single axis speed	
1st axis	±170°	370°/s	
2nd axis	±110°	370°/s	
3rd axis	+40° ~ -220°	430°/s	
4th axis	±185°	300°/s	
5th axis	±125°	460°/s	
6th axis	±360°	600°/s	
voltage	220V/110V	weight	28KG
Repeatability	±0.1mm	structure type	Tandem
voltage	220V/110V	Reduction gear	Harmonic deceleration
Maximum working radius	540mm	specified load	1.5KG
Motor type	servo motor	Controller	ROBCELL A1

# 2 Hardware Configuration

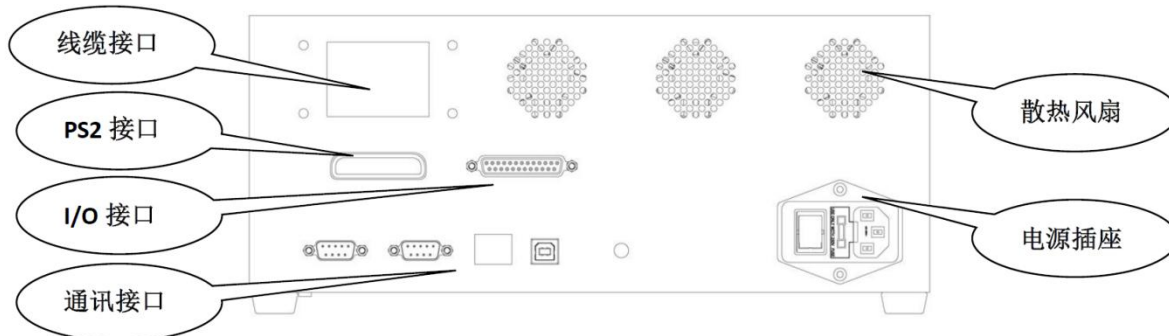
## 2.1 Hardware interface and wiring

Before using, please follow the instructions below to understand the key functions and complete the wiring.

### 1. Control box interface and key description



Control box front end introduction



Control box back end introduction

On the front of the bottom control box, from left to right are: emergency stop button (stop), reset button (reset), one-button start button (button); there is a red power switch on the back of the control box.

(1) Emergency stop button (stop): In an emergency, pressing the emergency stop button down can stop the operation of the robot arm in time; when the robot arm is restarted, it needs to be turned clockwise to release the emergency stop state.

(2) reset button (reset), one-button start button (button): connected to the digital input ports (7, 8) of the robot for user programming.

(3) Power switch: i is on and o is off.

## 2. Hardware wiring

Please follow the steps below to complete the connection between the control box and the robot arm, network cable and digital io interface:

(1) Connect the heavy-duty connector (male) of the robot arm end to the corresponding connector end (female) of the control box;

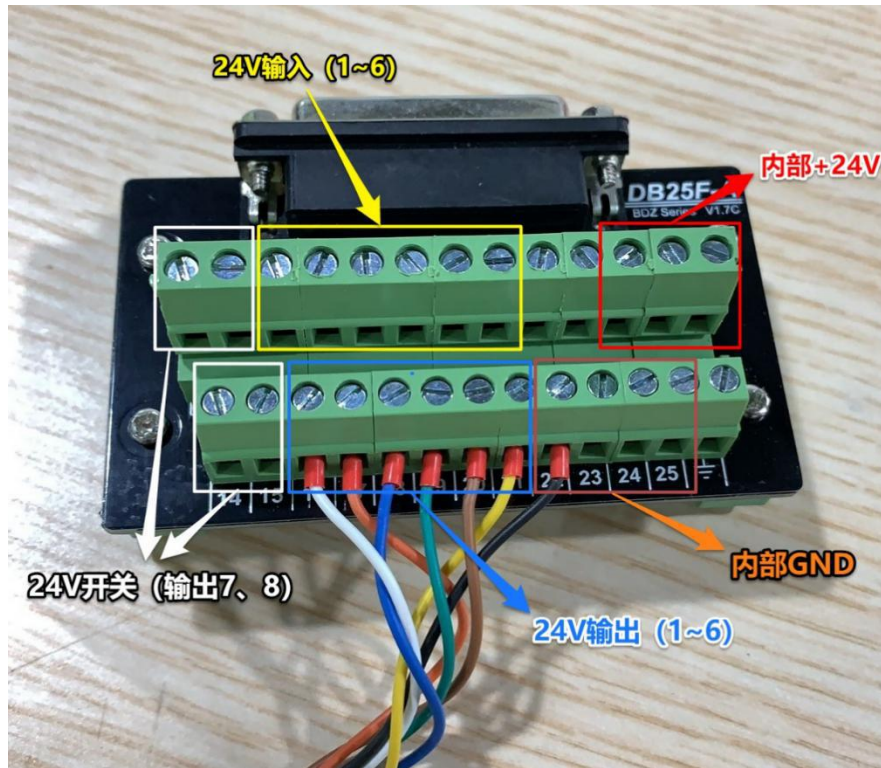
(2) Connect the power line of the robot arm control box to 220v mains;

(3) Use a network cable to connect the network port of the PC to the network port of the robot arm control box;

(4) Connect one end of the db25 connection cable to the io port of the robot arm control box, and connect the other end to the db25 repeater. The device can be directly connected to the input of the db25 repeater.



Control cabinet wiring physical map



db25 repeater connection

## 2.2 Adjust the initial posture of the robot arm

### ⚠ 注意

Some joints of the probot g602 robotic arm cannot be pushed manually, please refer to the zero automatic calibration section, and use this function to achieve automatic zero adjustment.

# 3 ros environment setup

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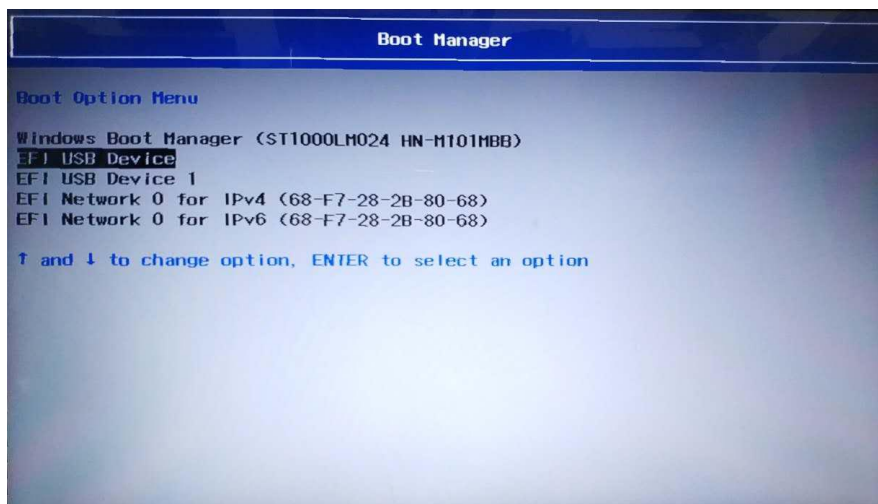
We provide our users with a plug-and-play ros2go mini USB flash drive, and install and deploy a complete set of ros environment and host computer in ros2go. Users can directly use ros2go to start the experience journey!

## 3.1 Start ros2go



ros2go mini u disk

(1) Plug ros2go into the pc, start / restart the pc, and enter the bios settings to boot the u disk using the uefi mode.



## BIOS setup U disk startup diagram

(2) After the setting is completed, wait for ros2go to finish starting. After the startup is successful, you can see the following system desktop.



ros2go system desktop

Note: The use of PROBOT G602 is based on the ROS environment. If you need to install the Ubuntu system and ROS-related software on your PC, please refer to the PROBOT G602 Robotic Arm User Manual-the host computer ROS environment setup, and you can refer to the GitHub open source project README Documentation:[https://github.com/ps-micro/PROBOT\\_G602](https://github.com/ps-micro/PROBOT_G602)

# 4 Running robotic arm

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## 4.1 Robot arm power on

- (1) Check the hardware wiring again to make sure the connection is correct.
- (2) Connect the power socket at the back of the control box to external power, and press the power switch to power on the control box.



Control box power connection physical map

- (3) Wait for about 20s after power-on, you will hear the buzzer sound two consecutive times, the duration is short, indicating that the PROBOT G602 software and hardware system has successfully started.
- (4) Release the emergency stop button.

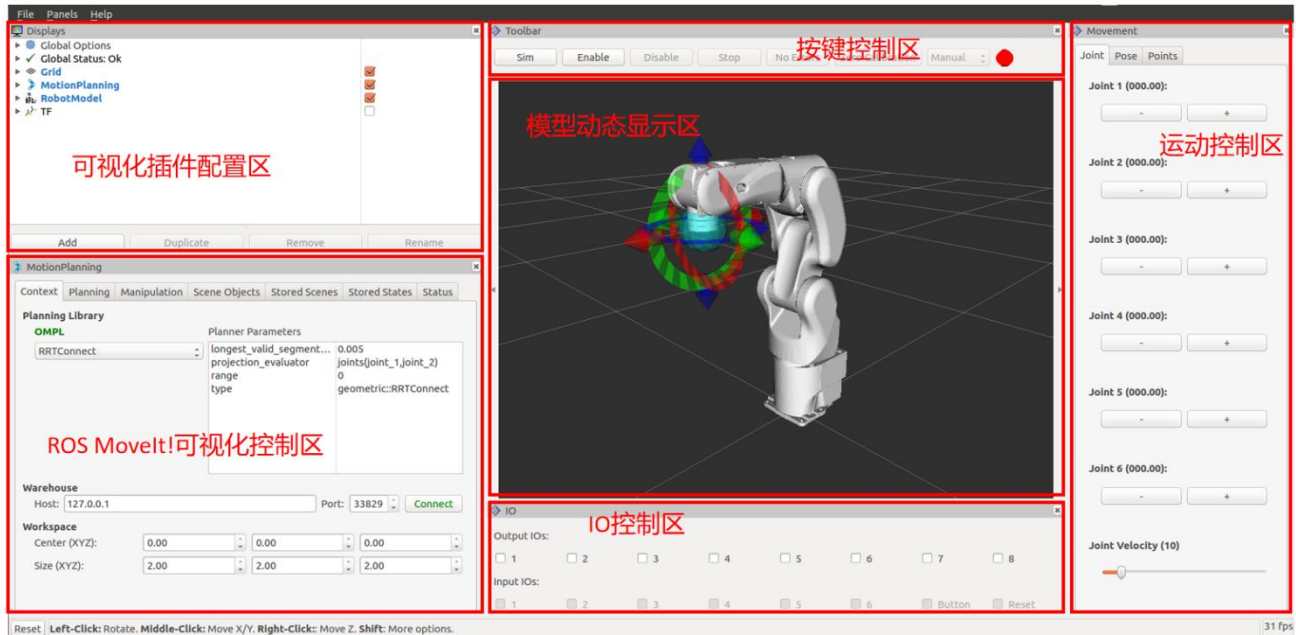
 注意

You must wait for the buzzer to ring twice in succession before you can continue the operation! Otherwise, the software and hardware system of probot g602 has not been started and the ros host computer cannot establish a connection with the controller.

## 4.2 Start ros host computer

After system startup is complete, use the following command to start the ros host computer:

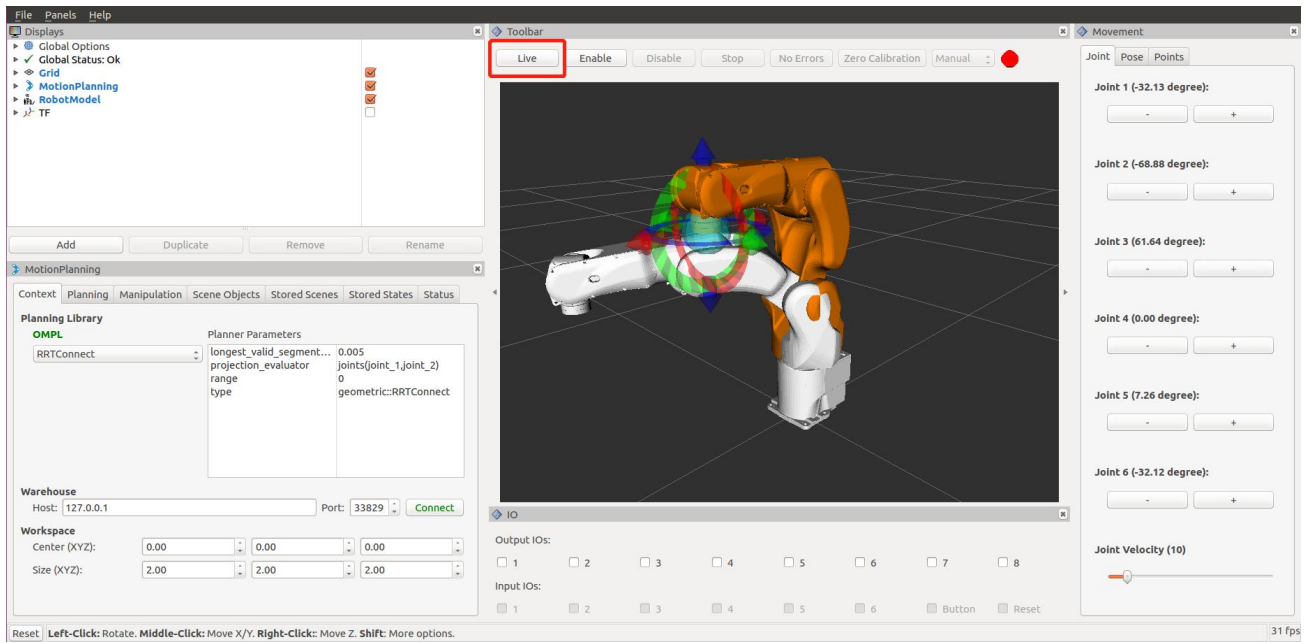
```
$ roslaunch probot_bringup probot_g602_bringup.launch robot_ip:=192.168.2.123
```



ros host computer interface

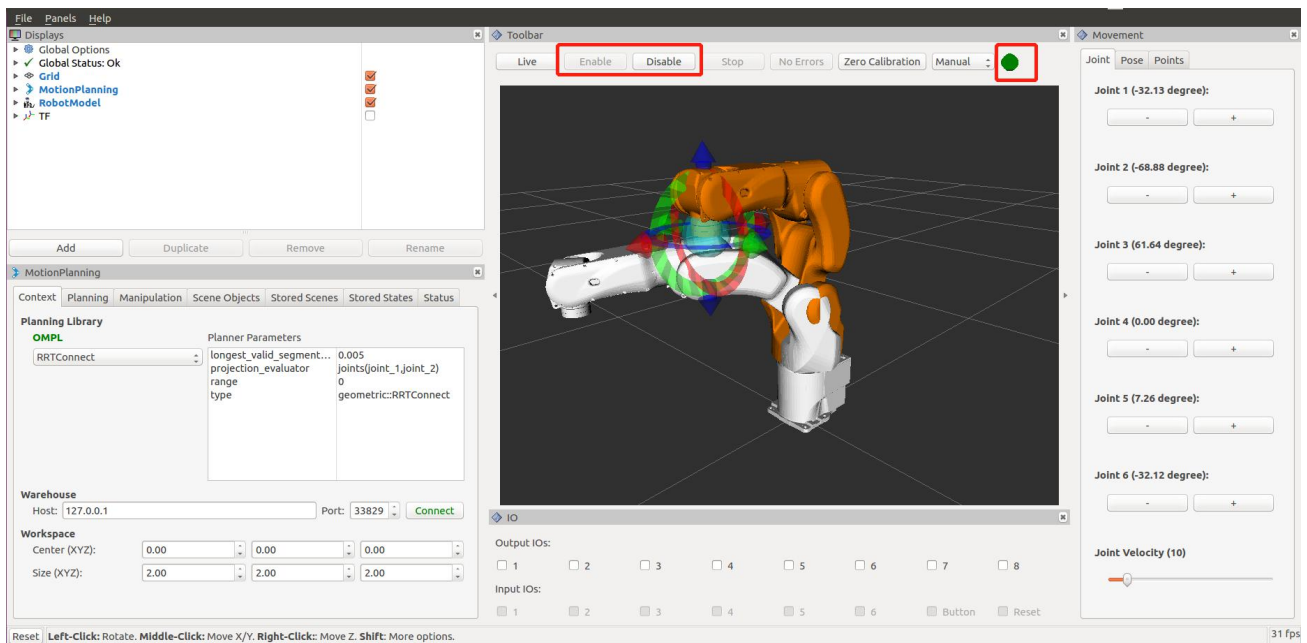
## 4.3 Simulation / Online Switch

After the ROS host computer is started, it runs in the simulation environment by default. You need to click the simulation / real machine switch button in the control bar to switch to the real machine control environment. The button will display Live:



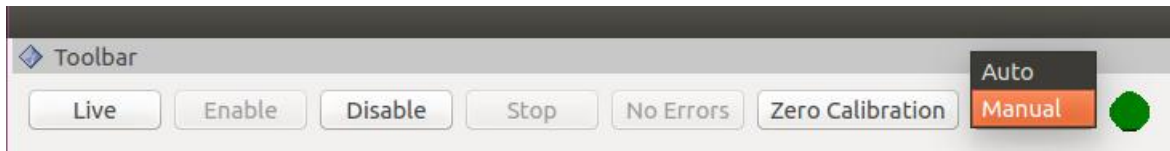
## 4.4 Robot arm enable

Click the enable / disable button in the control bar to enable the robot arm control, and the red indicator light turns green:



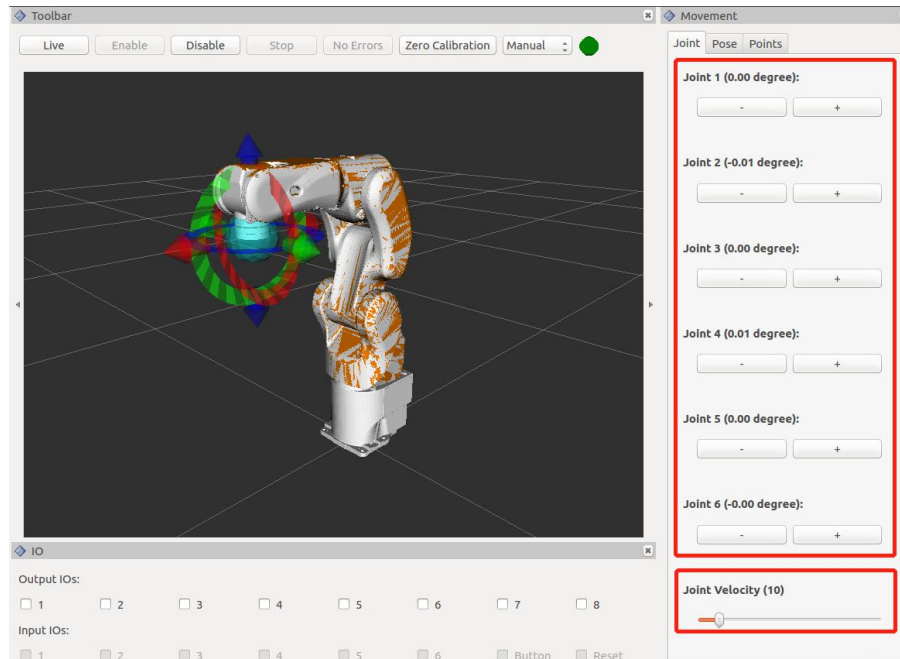
## 4.5 Zero calibration

Zero calibration supports two modes: manual calibration and automatic calibration. First, select the calibration mode as Manual or Auto from the drop-down box. Then, click the Zero Calibration button to start the zero calibration function.



### (1) Manual mode

1. In this mode, each axis needs to be calibrated one by one. After clicking the Zero Calibration button, use the joint space jog control function (Joint) in the motion control area, and press and hold the +/- button to move the axis to be calibrated to the position sensing sensor. When the axis reaches the sensing range of the sensor, the buzzer will sound and trigger the axis to automatically return to the zero position.

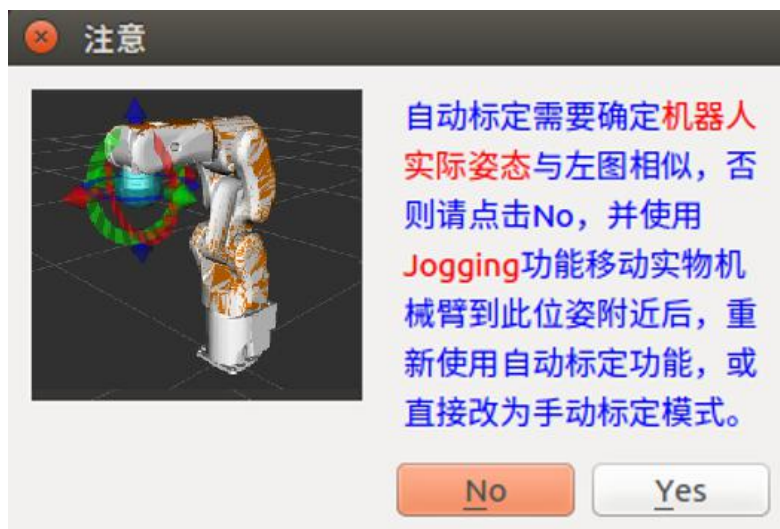


2. During the calibration process, you can click the Stop button in the status bar to stop the calibration.

3. Above, the zero calibration of the single axis has been completed. Repeat the above steps until all the axes have been calibrated.

## (2) Auto mode

1. In this mode, the zero calibration of all axes will be automatically completed at one time. After clicking the Zero Calibration button, the pop-up box will prompt the recommended posture before the automatic calibration of the robot arm, and the actual posture of the robot arm should be as close to the recommended posture as possible. Otherwise, auto calibration may fail.



### 注意

**Before starting the automatic calibration, the operator must maintain a sufficient safety distance from the robotic arm and ensure that there are no obstacles within the reachable range of the robotic arm; otherwise, during the automatic calibration process, the autonomous movement of the robotic arm may hit people or objects around it. Causing personal injury and property damage.**

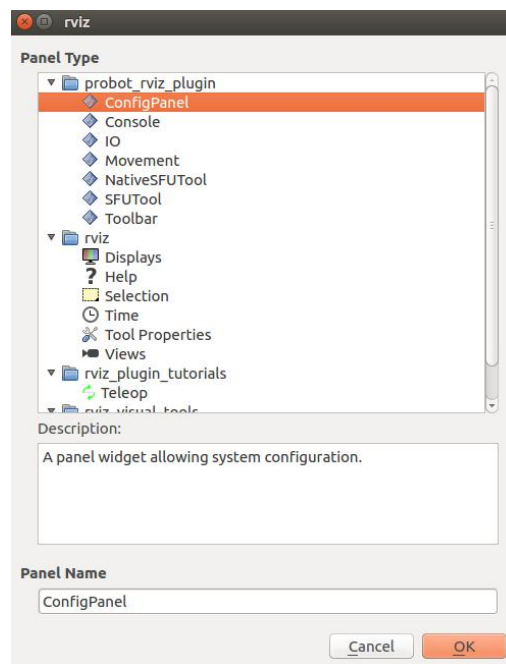
2. After completing all preparations before automatic calibration, click Zero Calibration and click Yes, the robotic arm will start automatic calibration.

3. During the calibration process, you can click the Stop button in the status bar to stop the calibration.

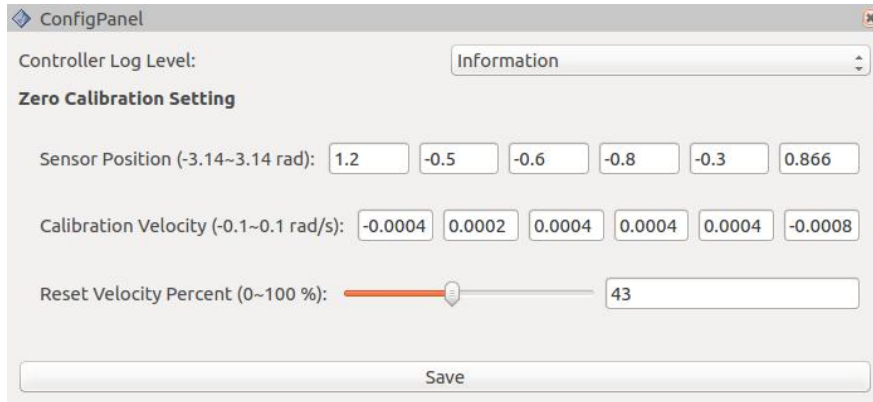
4. After the calibration is completed, you can see that each axis of the robot arm returns to the zero position, and the posture of the robot arm in the upper computer is consistent with the actual posture.

### (3) Zero calibration related parameter configuration

For different individual robotic arms, the sensor installation position may be different. Therefore, the configuration parameters may need to be modified to suit different individual robotic arms. Click Panels in the upper left corner of the host computer, click Add new panel, and select ConfigPanel to open the parameter configuration interface.



The ConfigPanel interface is as follows:



Sensor Position indicates the joint angle when each axis triggers the inductive sensor, the unit is radian. Calibration Velocity indicates the movement speed during the calibration of each axis, the unit is radian / second. Reset Velocity Percent indicates the movement of the robot arm during the automatic return to zero position Speed, as a percentage.

After the configuration is complete, click Save to save the changes and restart the upper computer and the control cabinet to take effect. For the same robotic arm, the parameter configuration will basically not change after the configuration is completed, and there is no need to modify it often.

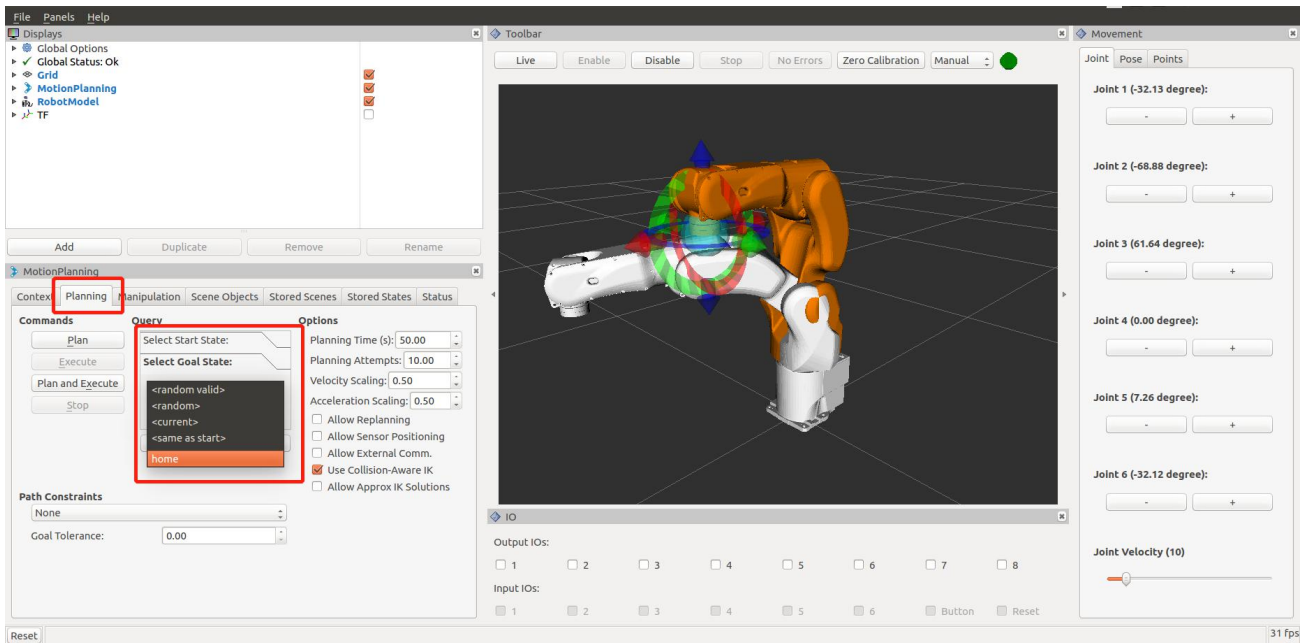
## 4.6 Run the demo routine

Open a terminal in the PC and enter the following command to run the robotic arm demo:

```
$ rosrunc probot_g602_demo moveit_fk_demo.py
```

## 4.7 Shutdown and emergency stop

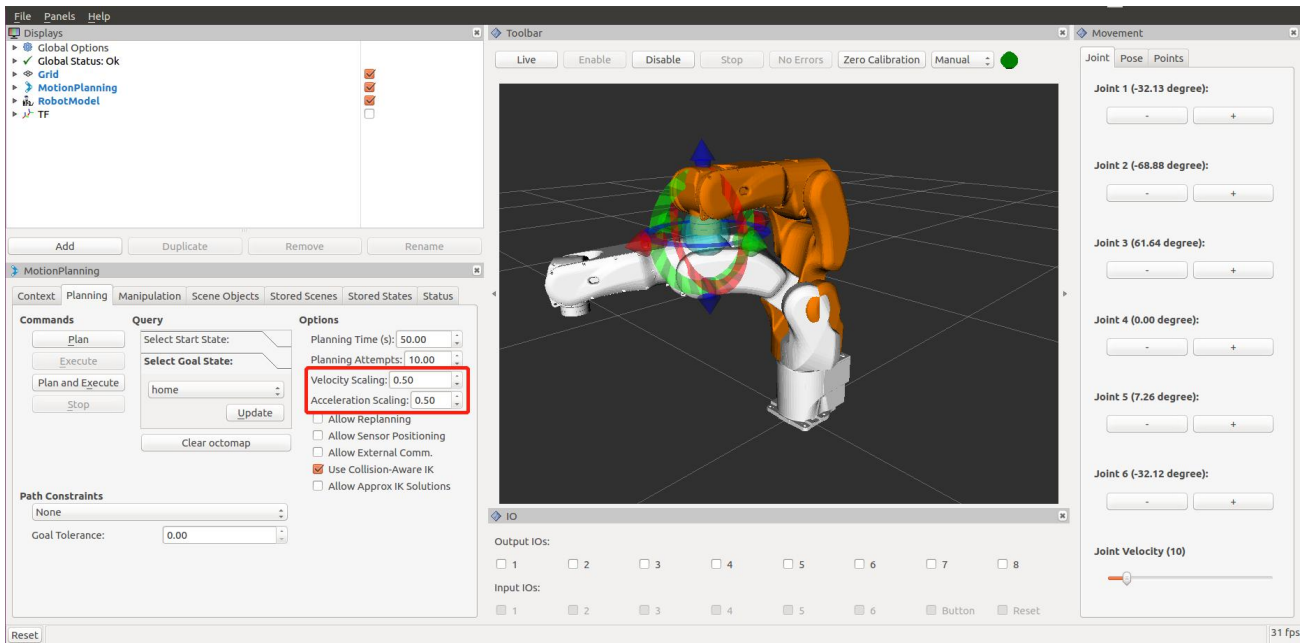
After the operation is completed, please follow the instructions below to control the robotic arm back to the initial position, then click "Disable". After pressing the emergency stop button of the control cabinet, turn off the power of the control cabinet and complete the shutdown.



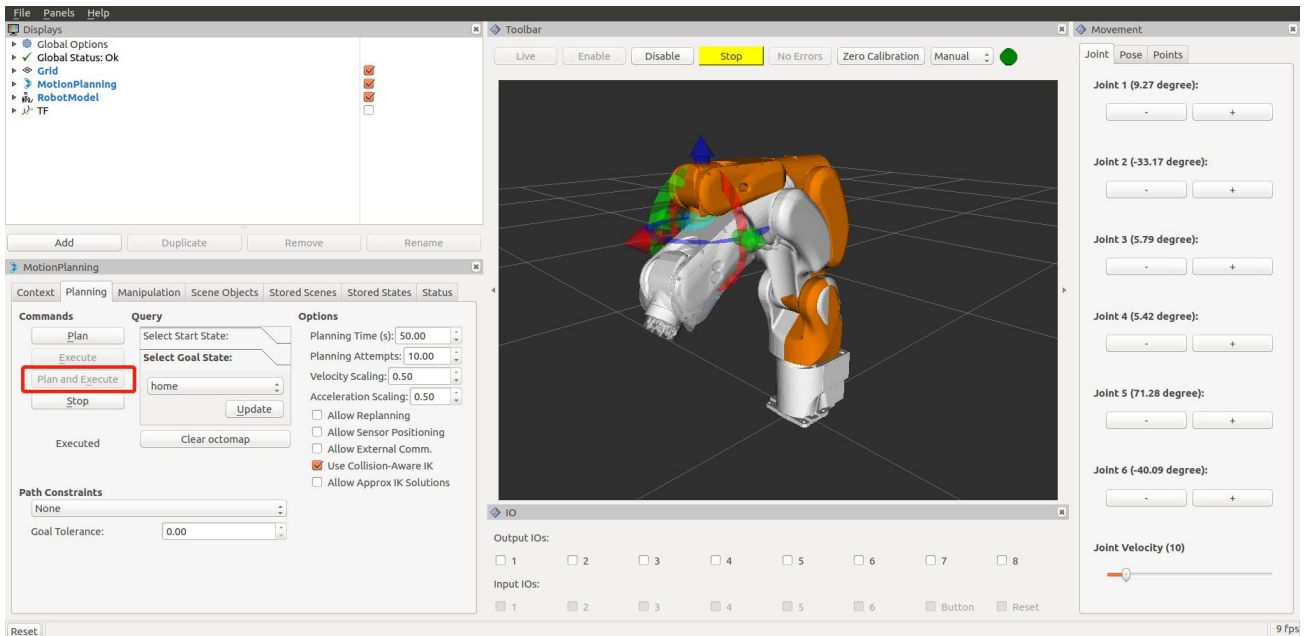
If an unexpected movement occurs during exercise, press the emergency stop button in time.

## 4.8 Drag control

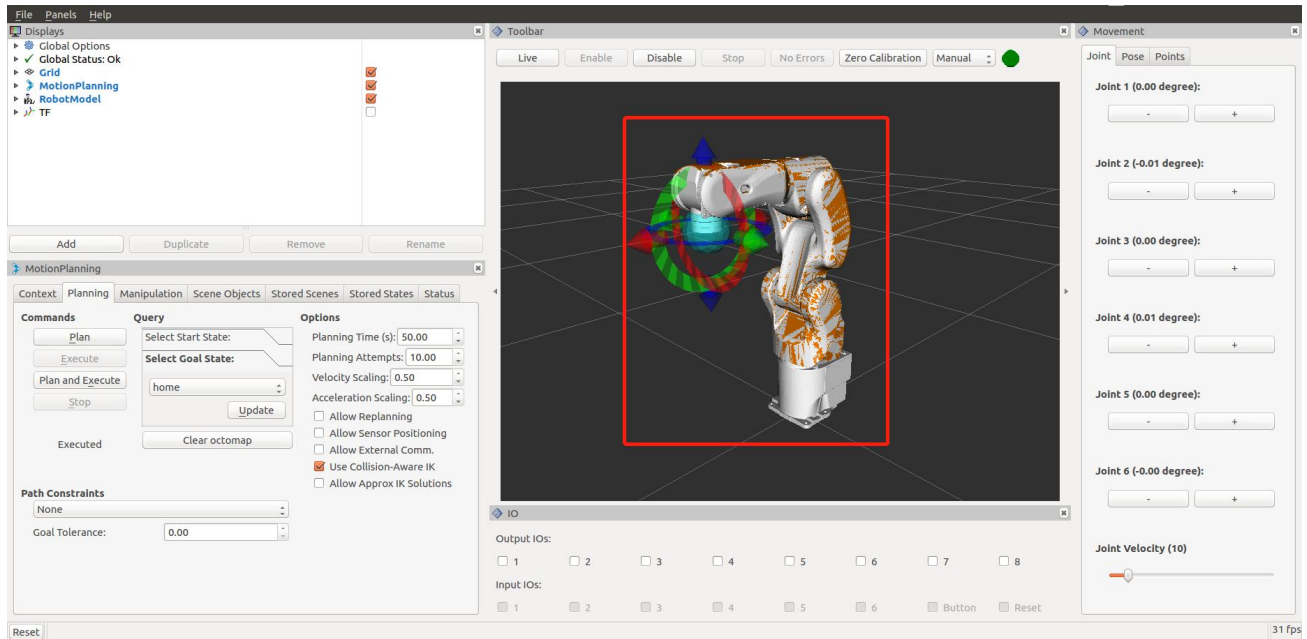
- (1) Position the mouse on the control ball of the robot model terminal, and press and hold the left mouse button to drag the robot. When the mouse is released, the yellow robot model is the target pose, and the silver-white robot model is the current actual pose.
- (2) Set the planned maximum time limit and the speed and acceleration of the robot movement (percent, 1 means 100%, that is set to the maximum value).



(3) Click the Plan and Execute button in the Planning tab of the ROS MoveIt! Visual control area, and the robot model will start to move (During the movement, the Plan and Execute button is grayed out and inoperable, you need to wait for the current action to complete).

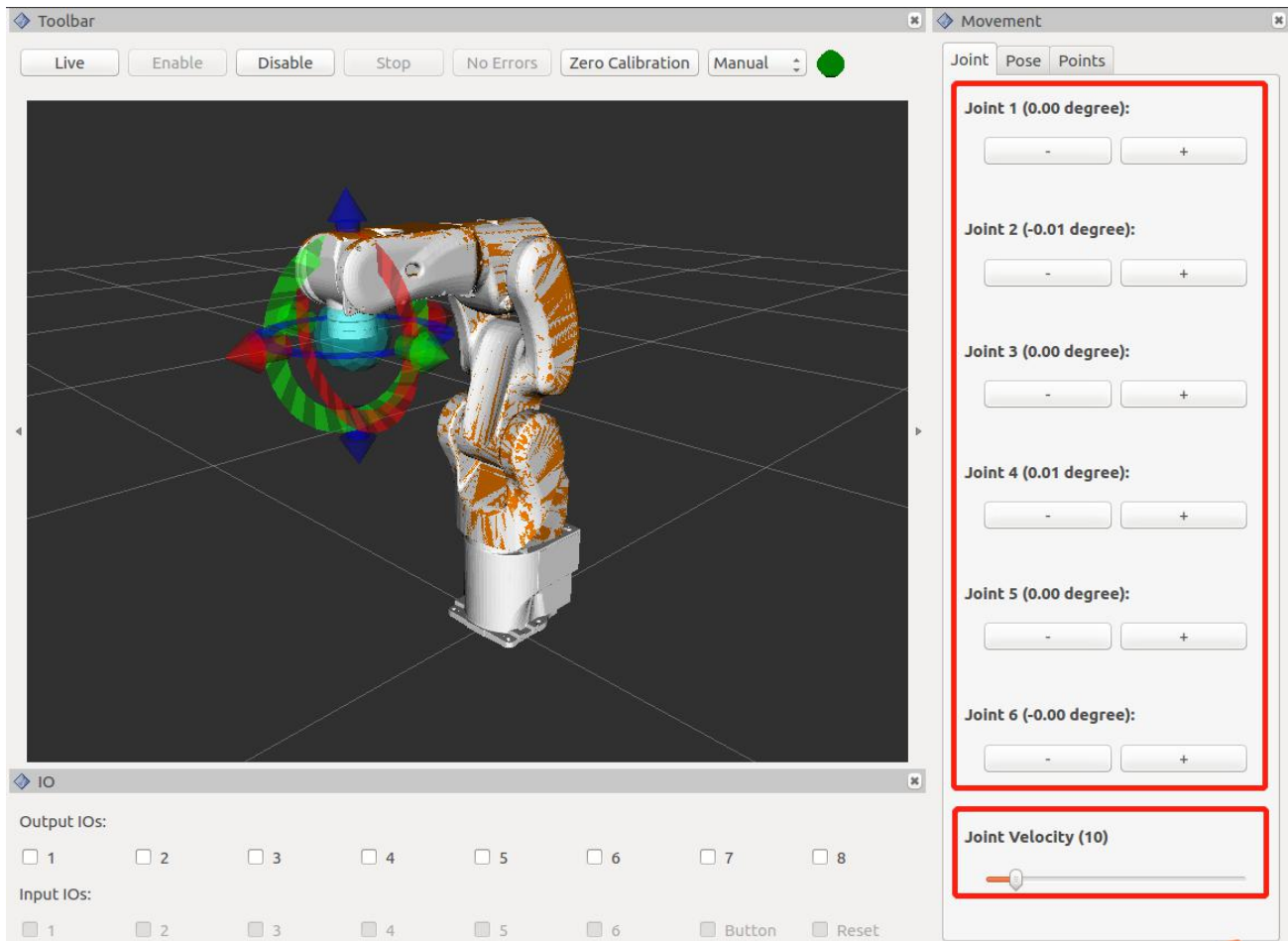


(4) The robot moves from the current pose to the target pose until the interface shows that the two models are completely coincident, and the robot movement ends.



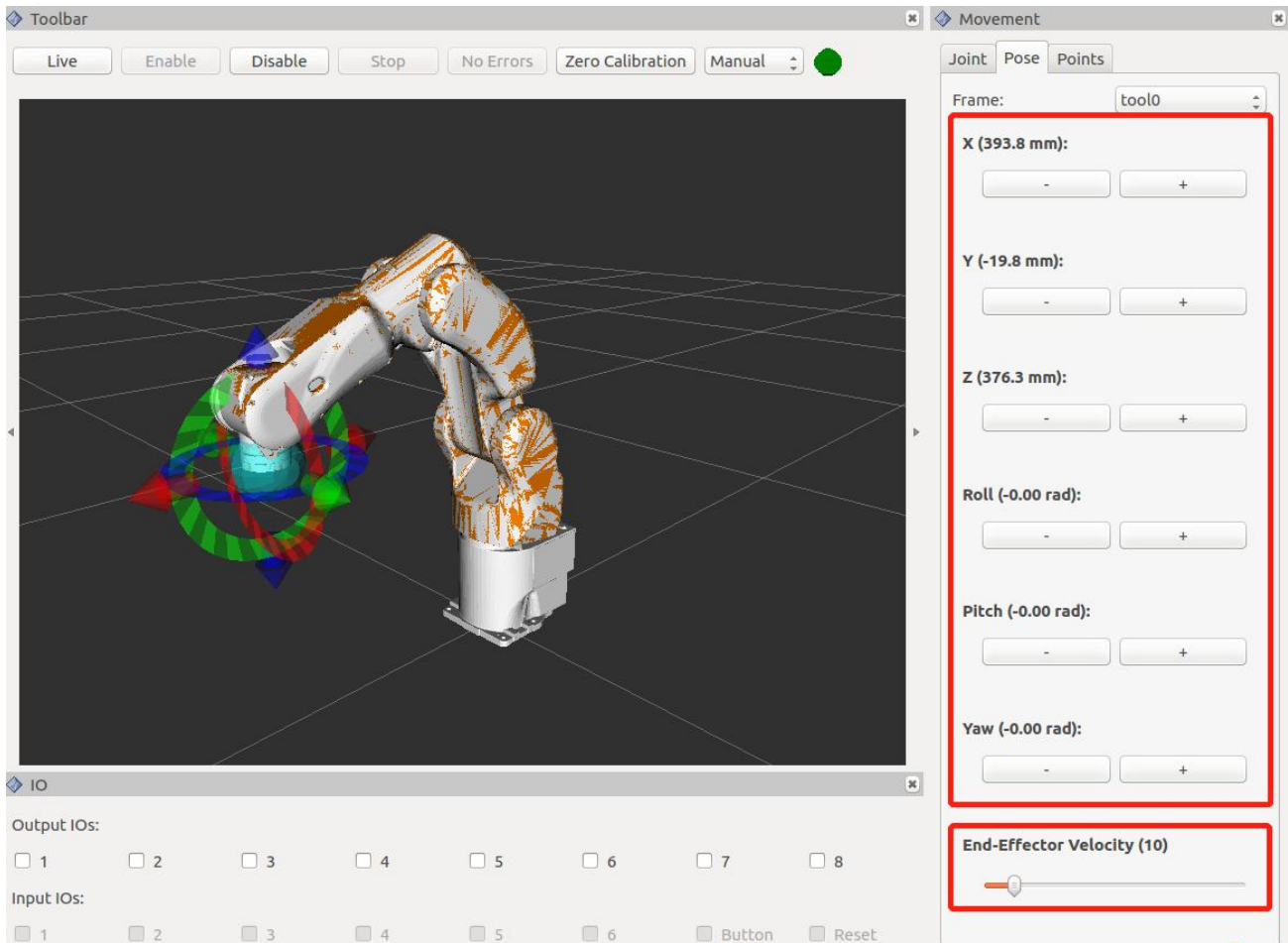
## 4.9 Joint space jog control

- (1) All functions of joint jog are in the Joint tab of the right motion control area.
- (2) Long press +,-to control joint movement, and the joint Velocity slider on the lower side can adjust the movement speed.



## 4.10 Workspace jog control

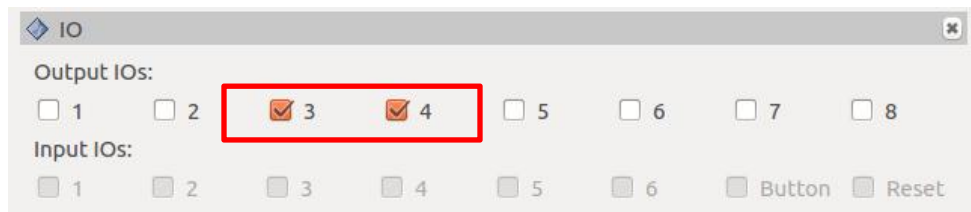
- (1) All the functions of spatial jog are in the Pose tab of the right motion control area.
- (2) By pressing + and-, you can control the end of the robot to perform jogging in the workspace, and the End-Effector Velocity slider on the lower side can adjust the movement speed.



## 4.11 io control

The io control function is in the io control area.

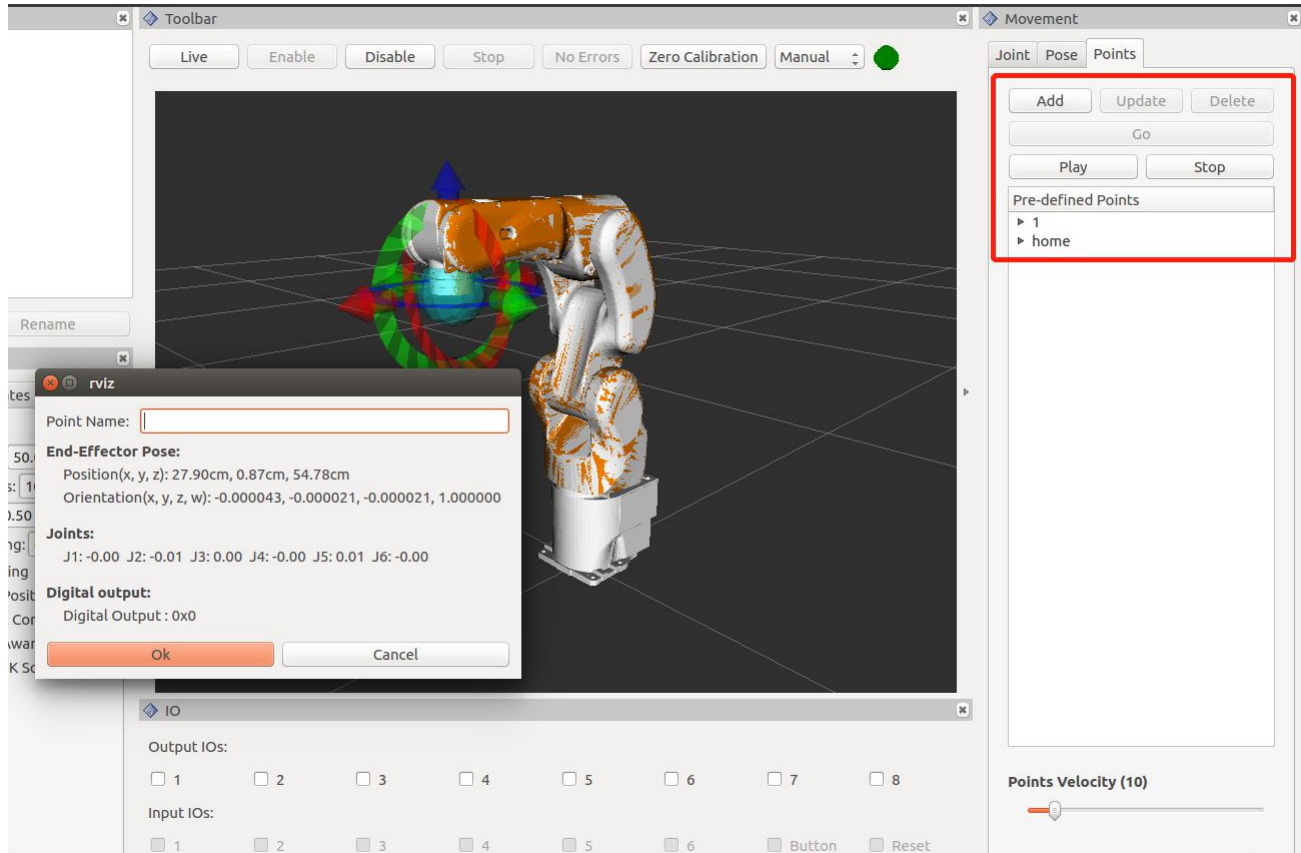
- (1) Left-click on the output ports (Output IOs) you want to control, which will change their output (0/1). A tick in the box in front of the port number indicates that high-level output is enabled;
- (2) In the Input IOs column, you can see the level signal (0/1) of the input port. A tick in the box in front of the port number indicates that the input is high, otherwise it is low / floating.



## 4.12 Teaching point saving and running

The saving and running functions of teaching points are in the motion control area.

(1) Add: Add teaching points.



After clicking the Add button, a dialog box for adding teaching points will pop up, automatically detect the current pose and IO status of the robot arm, and save it as a teaching point with a custom name. After saving, it will be placed in the teaching point list below.

(2) Update: Update the current teaching point.

In any position of the robotic arm, select any teaching point in the teaching point list and click the Update button to update the teaching point to the current posture and IO status of the robot.

(3) Delete: delete the current teaching point

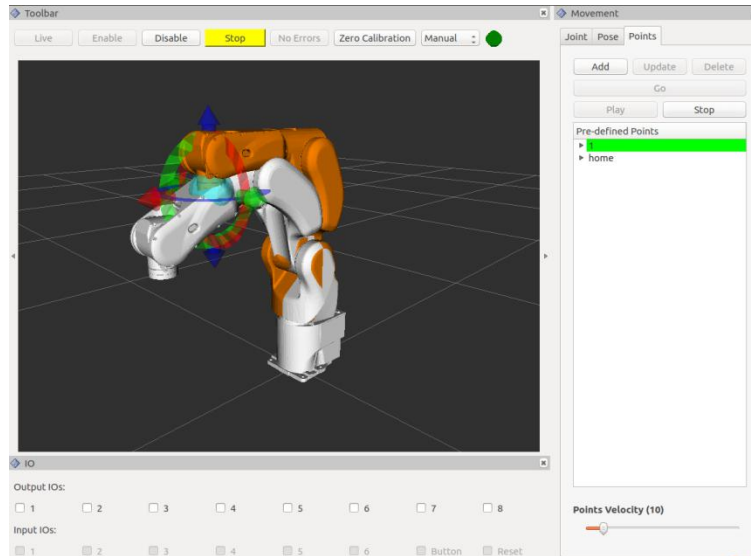
Select any teaching point in the teaching point list and click the Delete button to delete the teaching point.

(4) Go: Move to the teaching point of pointing.

Select any teaching point in the teaching point list and click the Go button to move the robotic arm to the pose and IO state saved by the teaching point.

(5) Play: Cycle through the list of teaching points.

After clicking the Play button, the teaching points in the running list will be cycled from the first teaching point. After clicking the Stop button, the running will stop, and the current running target point will turn into a green background.



(6) Stop: Stops running the list of teaching points in a loop.

(7) Points Velocity: Adjust the speed of teaching point movement.

## 5.1 References

1. Github - PROBOT: [https://github.com/ps-micro/PROBOT\\_G602](https://github.com/ps-micro/PROBOT_G602)
2. MoveIt! Tutorials: [http://docs.ros.org/kinetic/api/moveit\\_tutorials/html/index.html](http://docs.ros.org/kinetic/api/moveit_tutorials/html/index.html)
3. "Ross Robot Development Practice", edited by Hu Chunxu, Machinery Industry Press
4. Robot SFU Firmware Upgrade Tool User Manual