# MiniBot 7-Axis User Manual



**Version: 1.0**

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## Document Version

| Version | Release |
|---|---|
| 1.0 | First released. |

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# 1. Introduction

## 1.1. Manipulator specifications

| | | | |
|---|---|---|---|
| Degree of freedom | | 7 | |
| Payload | | rate : 1 kg | |
| Drive system | | Servo motor | |
| Position detection method | | Absolute encoder | |
| Joint equipment | J1 | Motor | 200W |
| | | Brake | Yes |
| | J2 | Motor | 200W |
| | | Brake | Yes |
| | J3 | Motor | 100W |
| | | Brake | Yes |
| | J4 | Motor | 80W |
| | | Brake | Yes |
| | J5 | Motor | 50W |
| | | Brake | Yes |
| | J6 | Motor | 50W |
| | | Brake | None |
| | J7 | Motor | 30W |
| | | Brake | None |
| Motion range (degree) | J1 | 334 ° (+167 ° ~ -167 ° ) | |
| | J2 | 220 ° (+110 ° ~ -110 ° ) | |
| | J3 | 334 ° (+167 ° ~ -167 ° ) | |
| | J4 | 210 ° (+105 ° ~ -105 ° ) | |
| | J5 | 334 ° (+167 ° ~ -167 ° ) | |
| | J6 | 170 ° (+85 ° ~ -85 ° ) | |
| | J7 | 360 ° (180 ° ~ -180 ° ) | |
| Reduction ratio | J1 | 145.2 | |
| | J2 | 120 | |
| | J3 | 126.25 | |
| | J4 | 106.667 | |
| | J5 | 110.528 | |
| | J6 | 50 | |
| | J7 | 10 | |
| Encoder Resolution | J1 | 17 bit | |
| | J2 | 17 bit | |
| | J3 | 17 bit | |
| | J4 | 17 bit | |
| | J5 | 17 bit | |
| | J6 | 17 bit | |

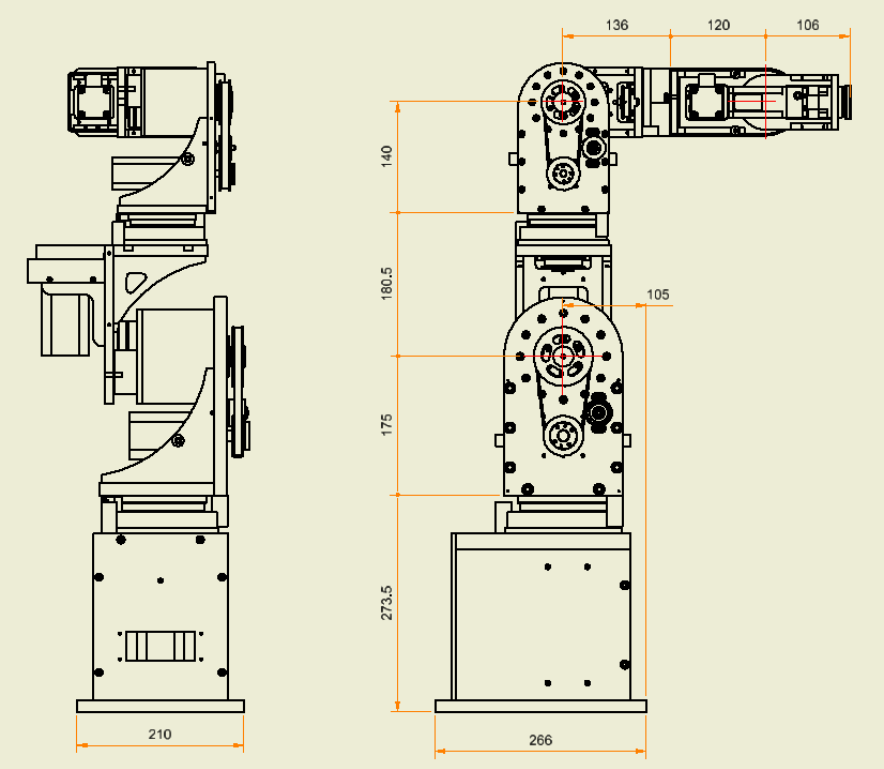
(*1) Cycle time：

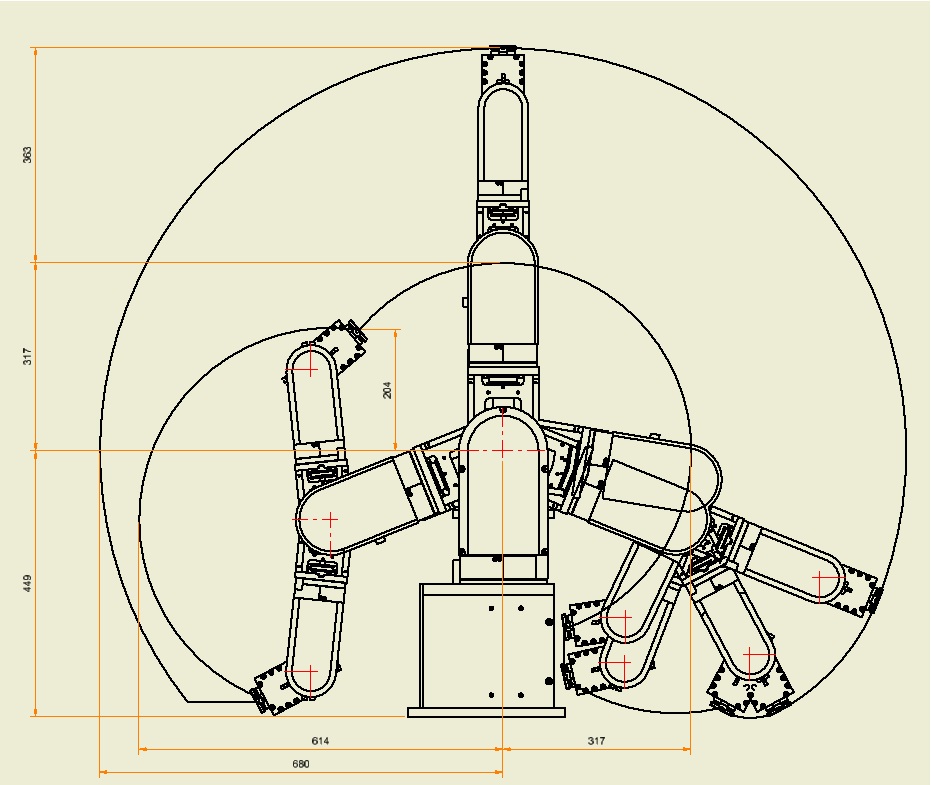
The cycle time is the time that the robot moves forward and backward in the vertical height 25mm and the horizontal distance 300mm with 1 kg load.

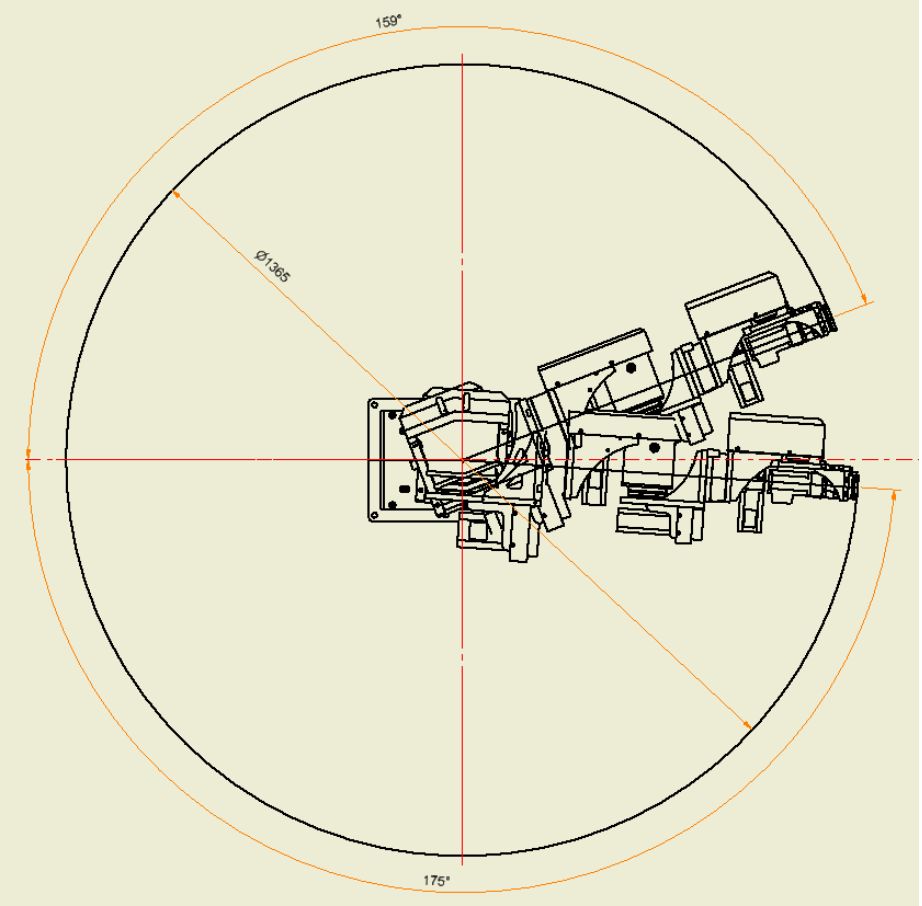



## 1.2. Manipulator Outer Dimension and Motion Range



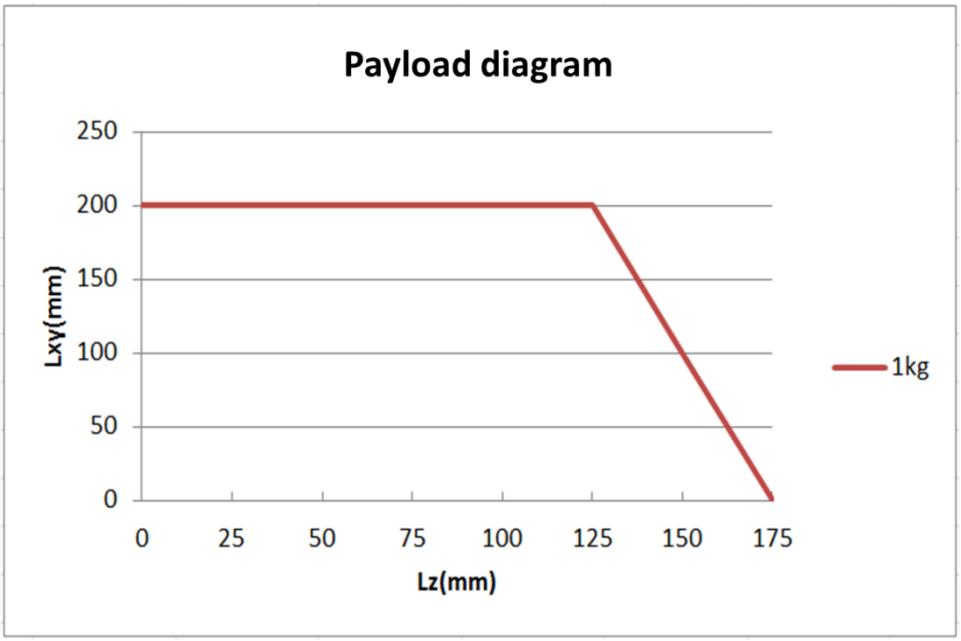

136
120
106
140
180.5
105
175
273.5
210
266


363
317
204
449
614
317
680




## 1.3. Manipulator Wrist Moment diagram

This robotic arm is designed with an effective payload of 1 kg. The figure below shows the location of center of gravity when the 1kg payload and the distance limits and range of motion for the tip of the arm. The horizontal axis indicates the distance in X-direction (or Y-direction) parallel to the flange surface at the tip of the arm, whereas the vertical axis indicates the distance in Z-direction perpendicular to the flange surface at the tip of the arm, both in mm.



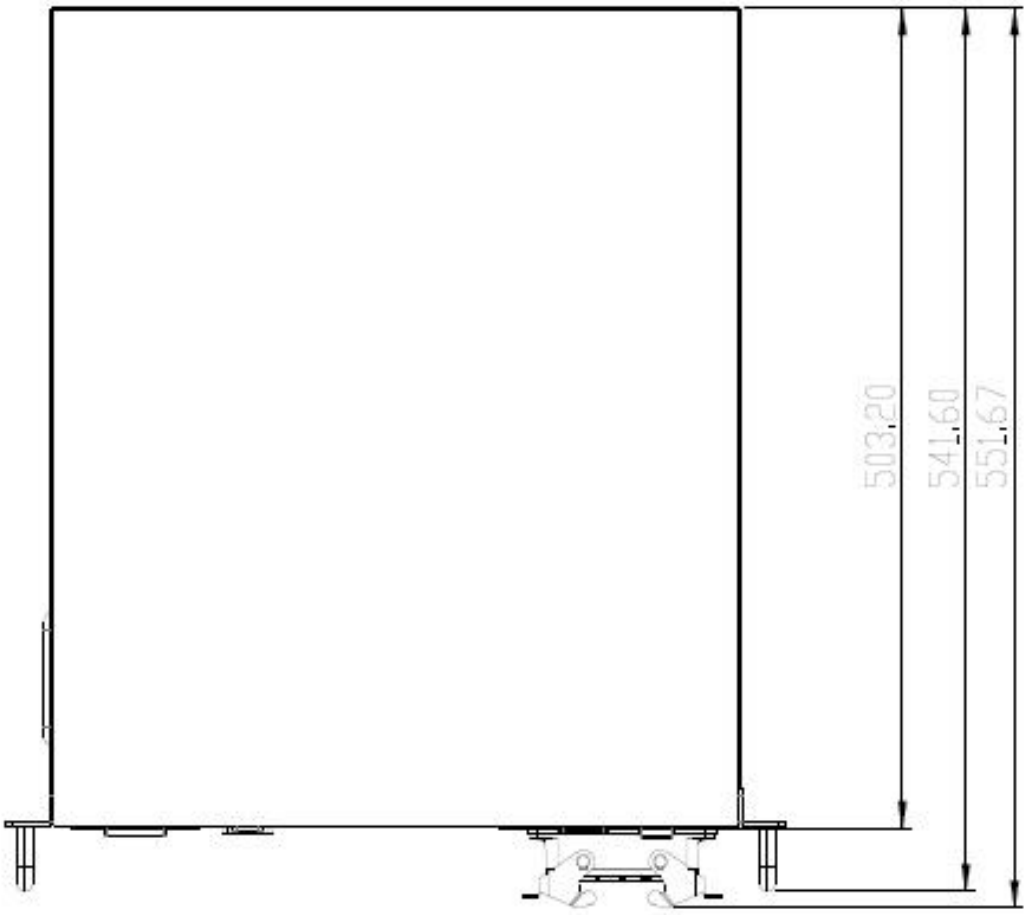

Attention is also needed that the range of payload for the arm is related to the current posture of the arm as well as its velocity and acceleration when it moves around. For overloading during a motion (the driver overload alarm will occur in this case), it can be dealt with by adjusting the arm's posture and/or reducing acceleration or deceleration.

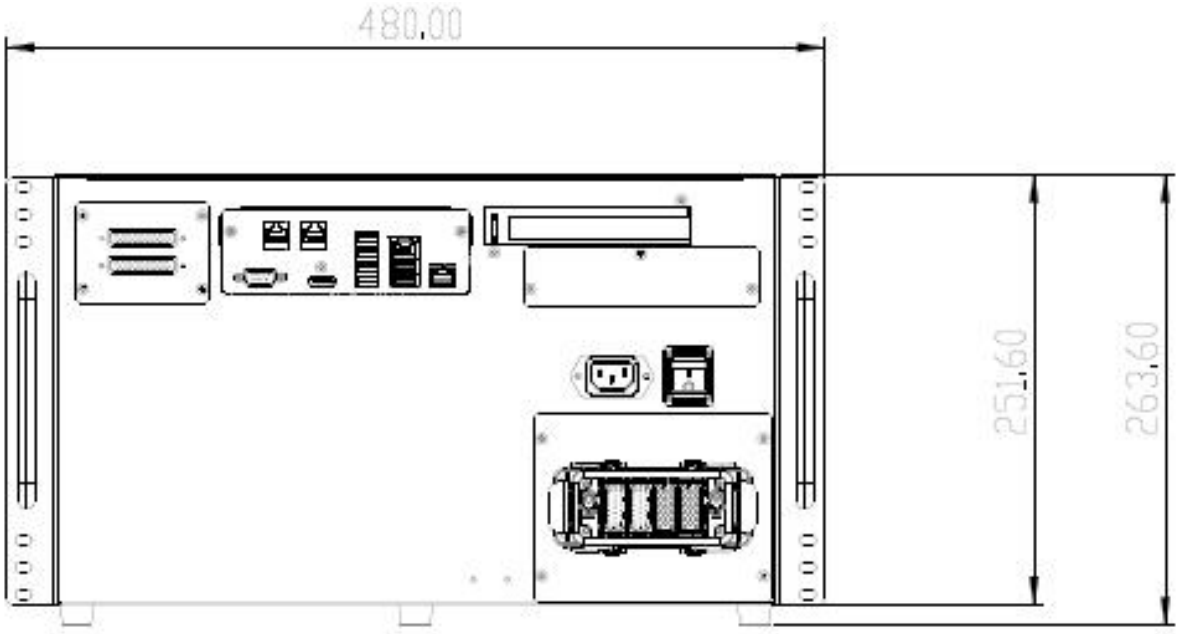
## 1.4. Cabinet specifications

| Item | | Specification |
|---|---|---|
| Axis | | 7 |
| Motion type | | Point To Point<br>Continuous Path |
| Drive system | | Servo Motor |
| Protocol | | EtherCAT |
| I/O | | Input：16<br>Output：15 |
| Power Consumption | Input voltage(VAC) | Single phase 220VAC |
| | Max. rated current | 10A |
| | Voltage frequency(Hz) | 60Hz |
| Dimension | | 480W*552D*264H |
| Weight | | 32kg |

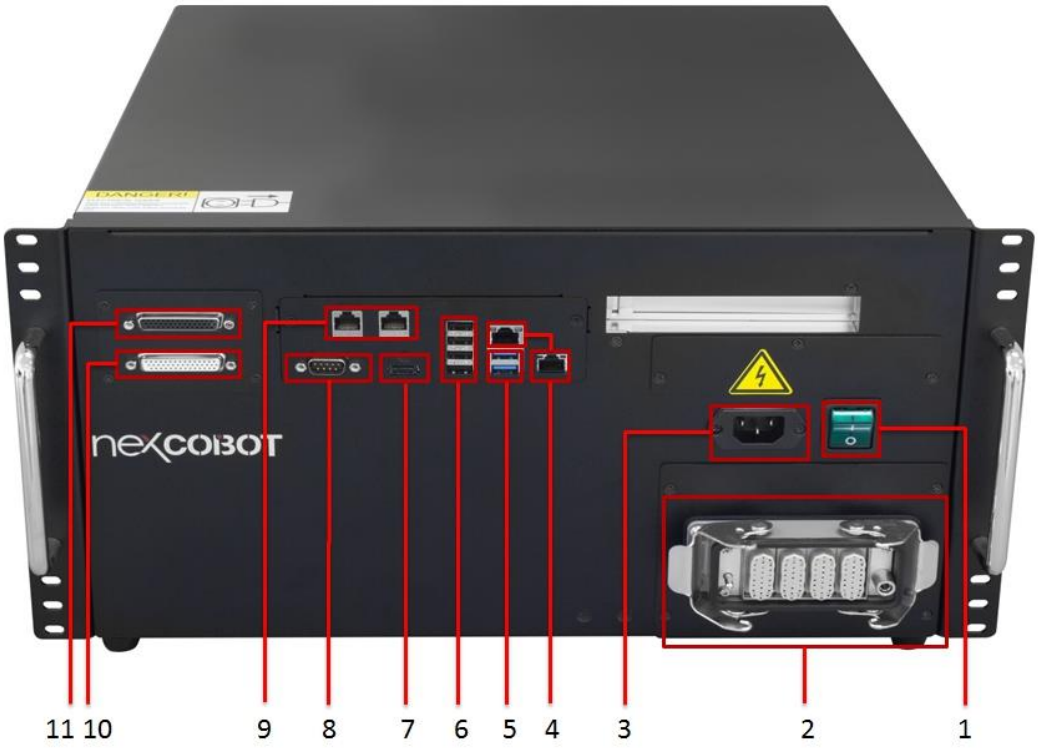
## 1.5. Cabinet Outer Dimension

The dimensions of the electric control box in mm are shown below:



## 1.6. Cabinet Outer interfaces

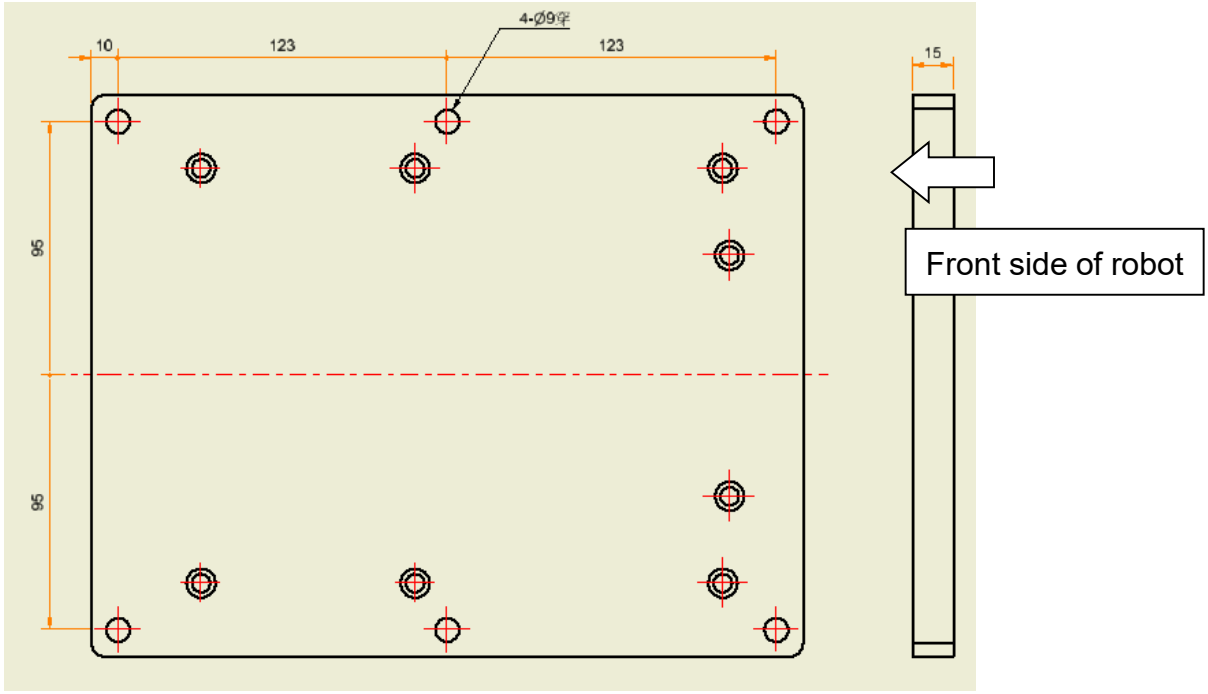



| Item | Interface | Description |
|---|---|---|
| 1 | Power switch | "I" power on, "O" power off |
| 2 | Manipulator port | Insert the connection cable between the arm and electric control box here |
| 3 | Power supply connector | Single phase 220VAC 60Hz 10A |
| 4 | Lan port | Connect the Ethernet cable |
| 5 | USB 3.0 ports | Connect the USB memory |
| 6 | USB 2.0 ports | Connect the USB memory |
| 7 | HDMI port | Connect the Monitor |
| 8 | RS232 port | This port is used for the RS-232C communication with external devices |
| 9 | Lan port(option) | Connect the Ethernet cable |
| 10 | Teach pendant port | Connect the Teach Pendant |
| 11 | I/O port | This port is used for input/output devices of the user |

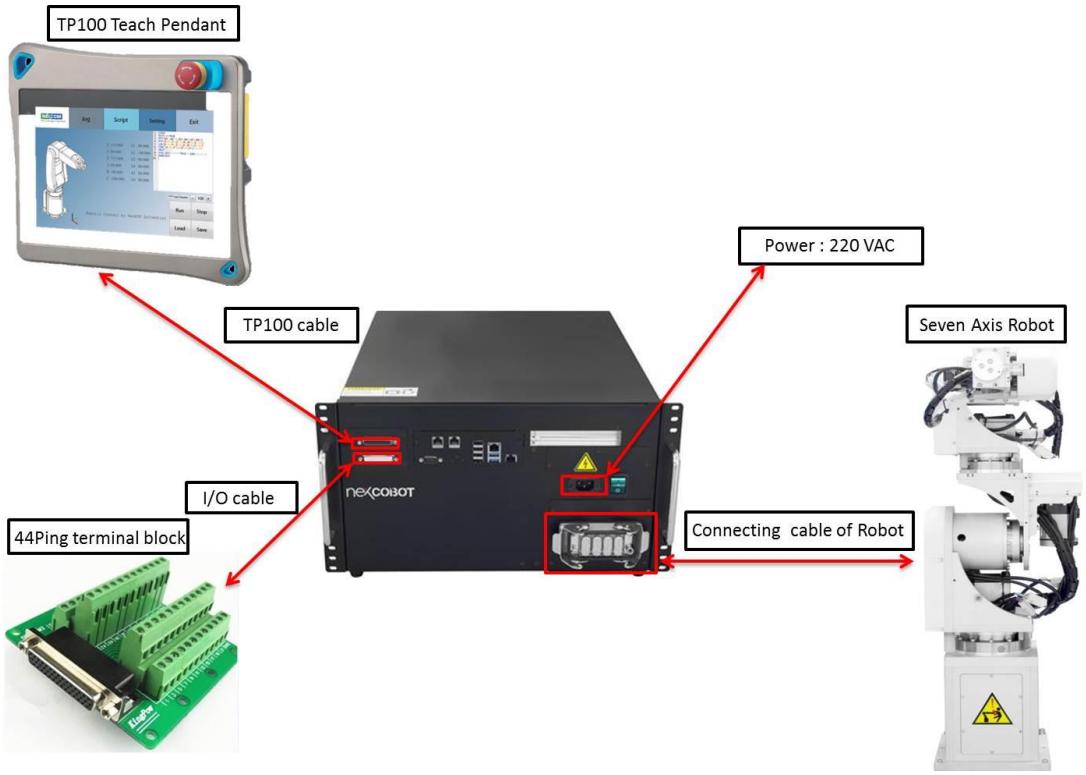
# 2. Installation

## 2.1. Mounting base

The installation base is shown below.




## 2.2. The robot consists of the following components:

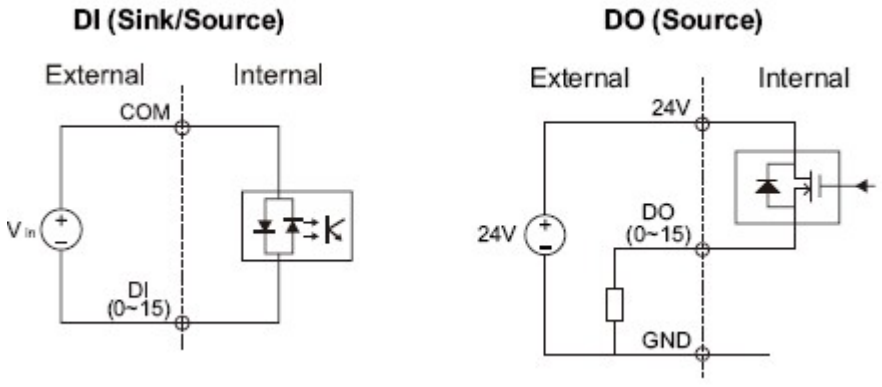


## 2.3. I/O Description

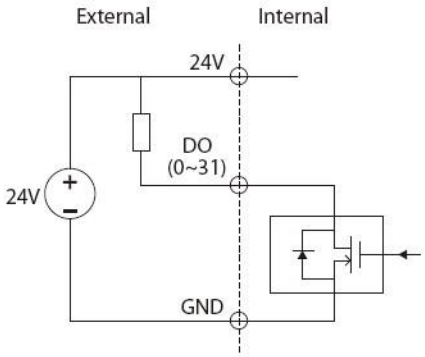
| Ping | Signals | Ping | Signals |
|---|---|---|---|
| 1 | DI [0] | 23 | DO [2] |
| 2 | DI [1] | 24 | DO [3] |
| 3 | DI [2] | 25 | DO [4] |
| 4 | DI [3] | 26 | DO [5] |
| 5 | DI [4] | 27 | DO [6] |
| 6 | DI [5] | 28 | DO [7] |
| 7 | DI [6] | 29 | 24V |
| 8 | DI [7] | 30 | 0V |
| 9 | 24V | 31 | DO [8] |
| 10 | 0V | 32 | DO [9] |
| 11 | DI [8] | 33 | DO [10] |
| 12 | DI [9] | 34 | DO [11] |
| 13 | DI [10] | 35 | DO [12] |
| 14 | DI [11] | 36 | DO [13] |
| 15 | DI [12] | 37 | DO [14] |
| 16 | DI [13] | 38 | DO [15] |
| 17 | DI [14] | 39 | 24V |
| 18 | DI [15] | 40 | 0V |
| 19 | 24V | 41 | EXT_EMG_1A |
| 20 | 0V | 42 | EXT_EMG_1B |
| 21 | DO [0] | 43 | EXT_EMG_2A |
| 22 | DO [1] | 44 | EXT_EMG_2B |

DI[1]：DI[1]　is used for Emergency Button.

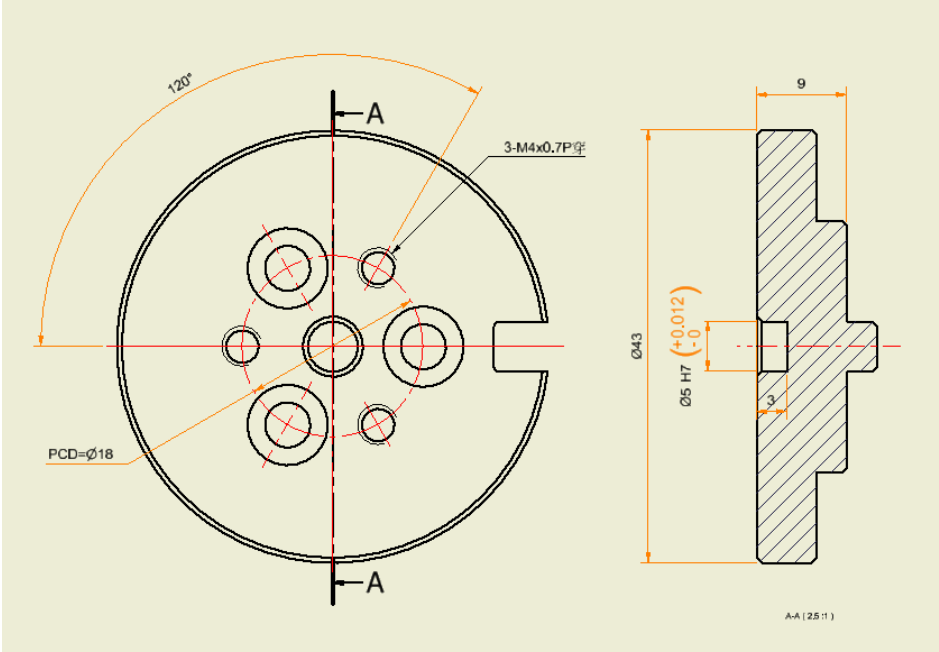
DI connection drawing：



DO connection drawing：




## 2.4. Mounting flange




## 2.5. The power switch side is show below




Step: "I" represent power on "O" represent power off

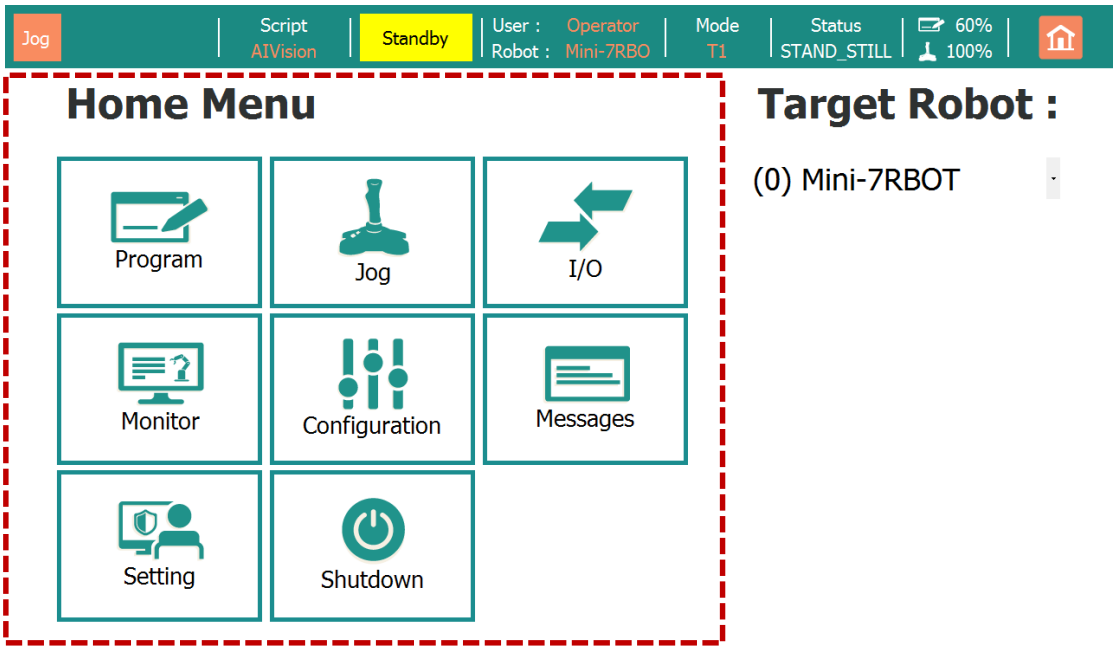
# 3. Operation tool

## 3.1. NexGRC

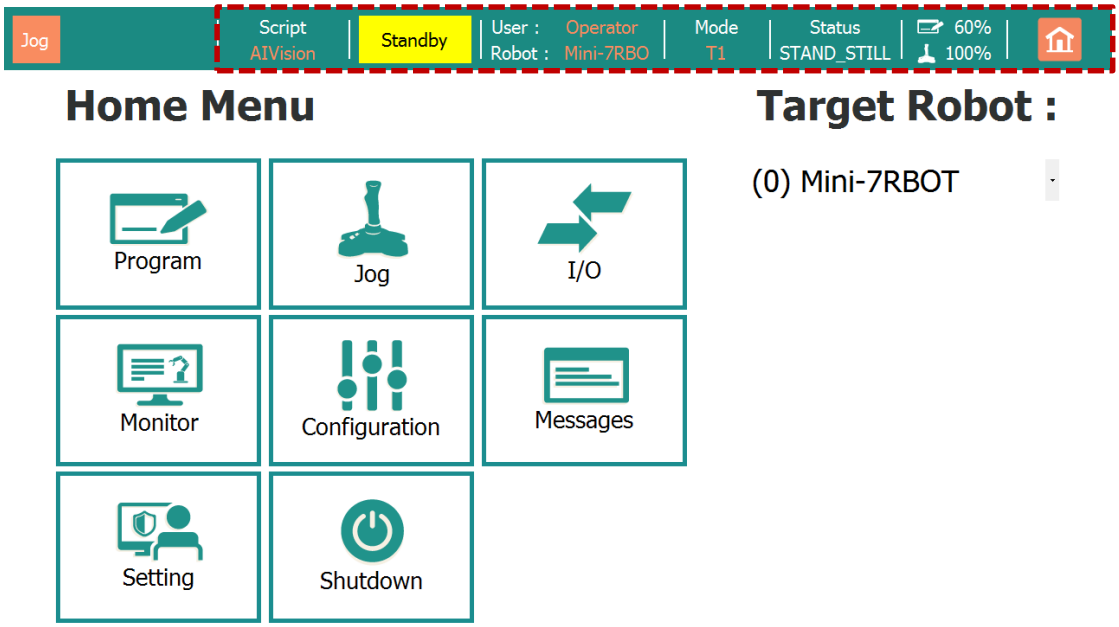
After installing Cabinet, robot and NexGRC software on the Cabinet.

### 3.1.1. Home Menu

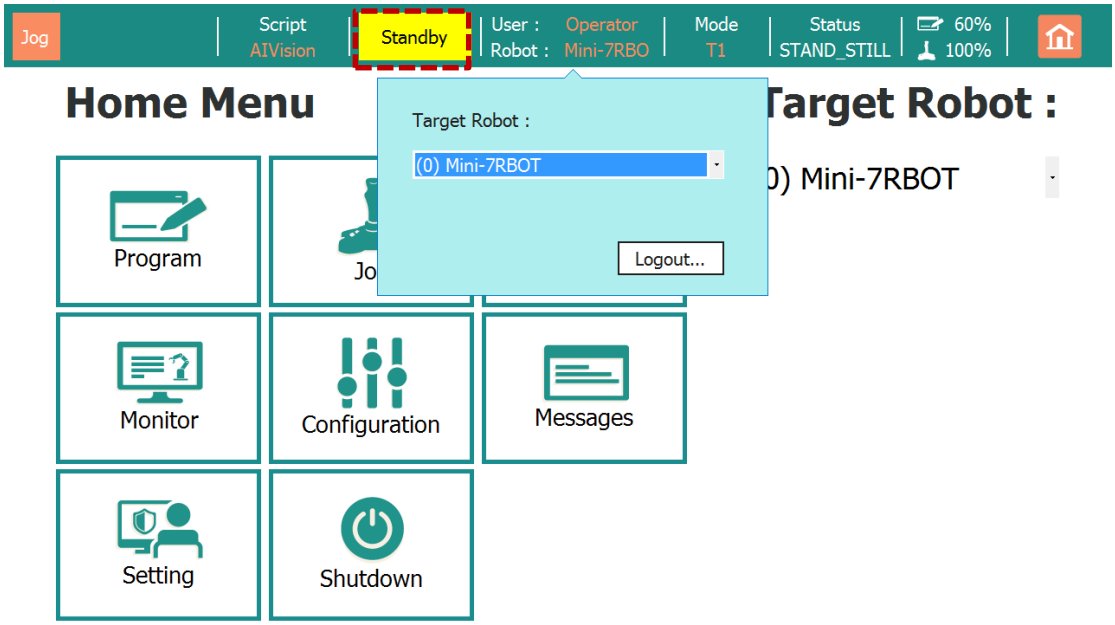
NexGRC main page is shown as below, Home Menu is highlighted with red box which include 『Program』、『Jog』、『I/O』、『Monitor』、『Configuration』、『Message』、『Setting』、『Shutdown』



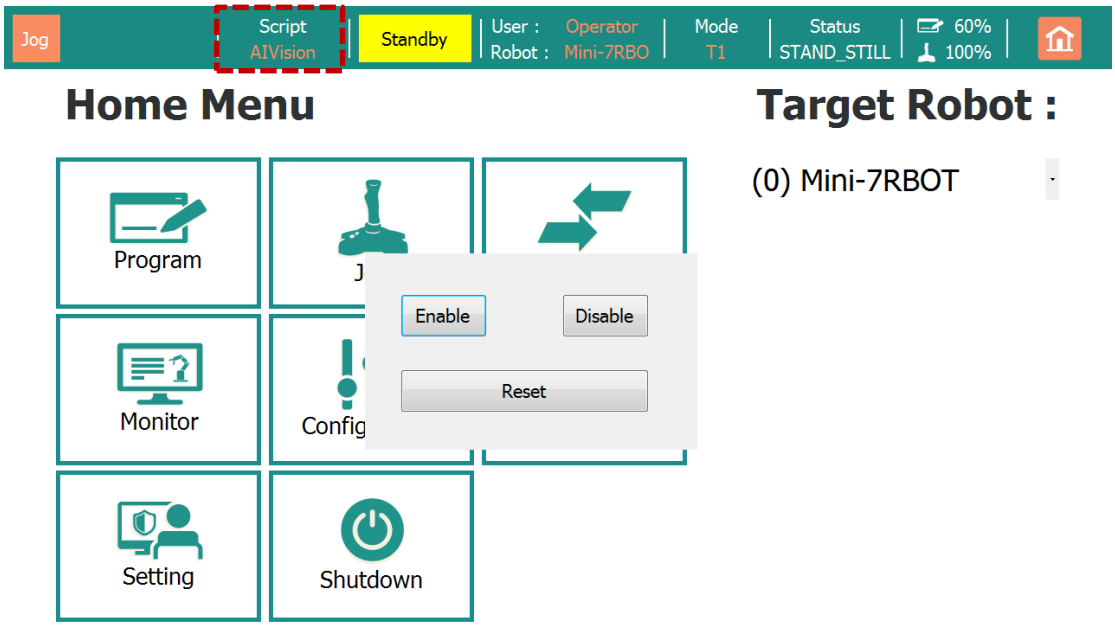
### 3.1.2. Status



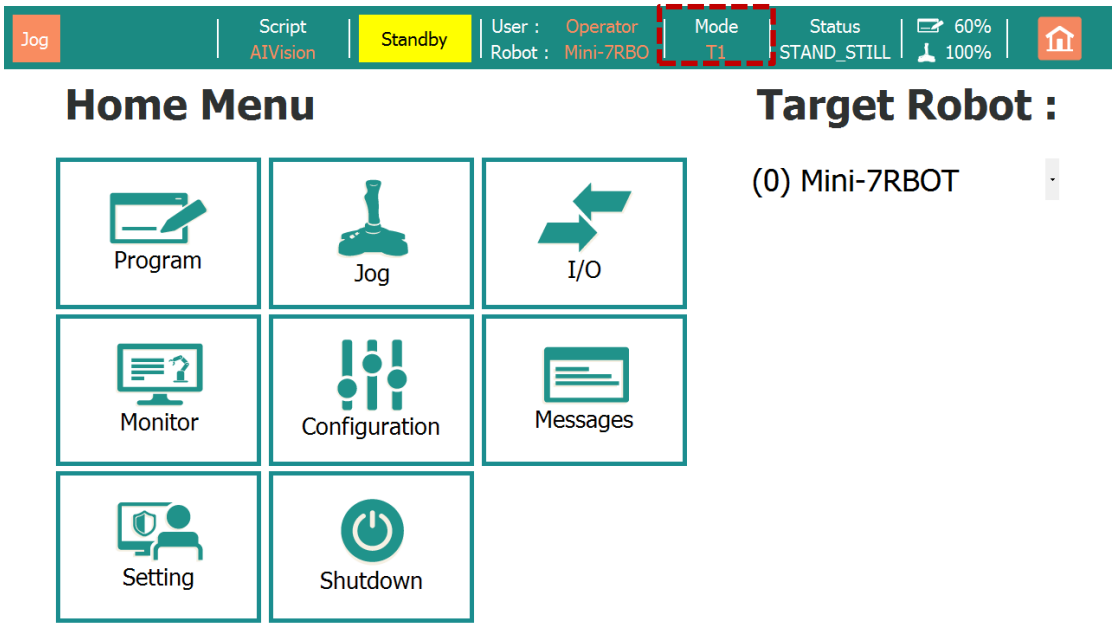

- User can choose which robot to use.



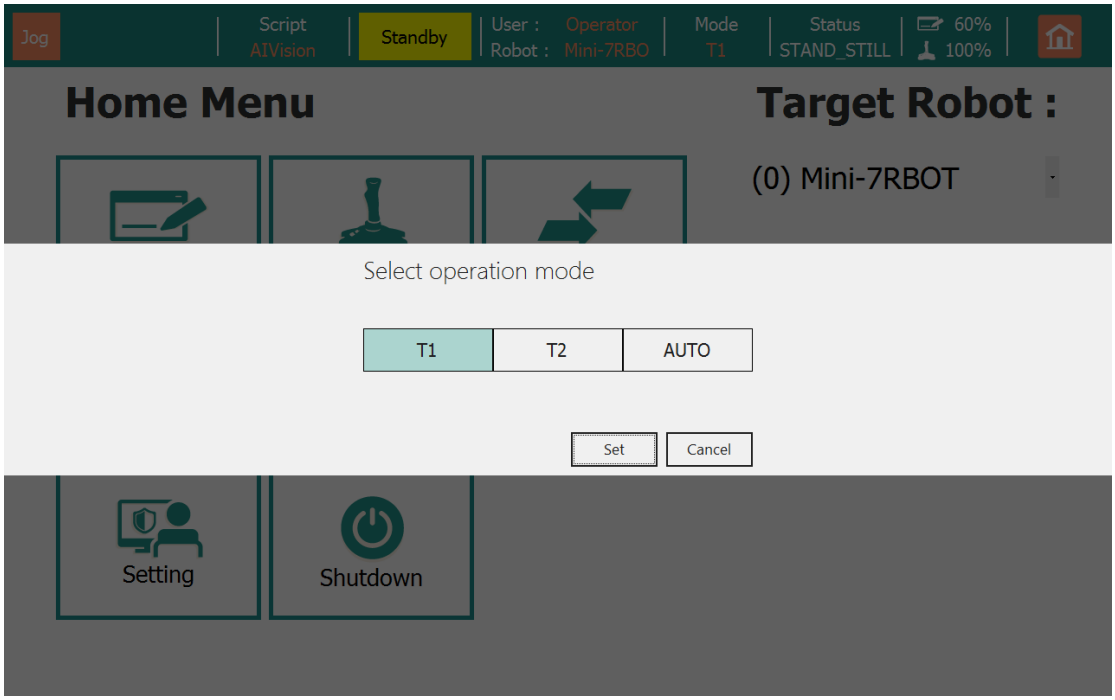
- Click『Enable』if user wants to start control robot. The status will become Standby。



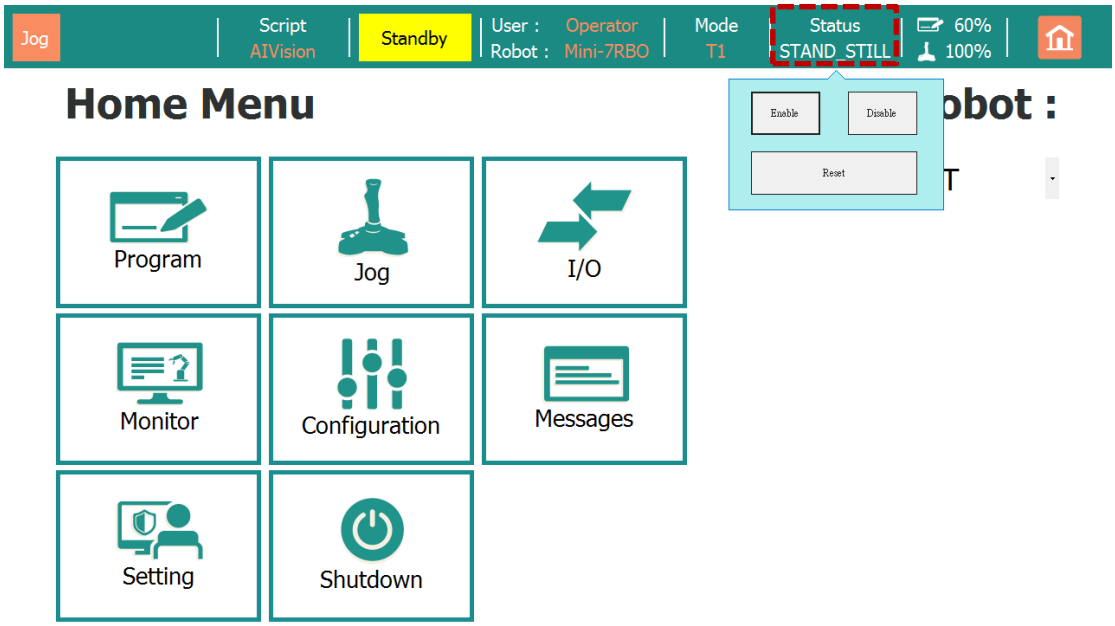

- Operation Mode



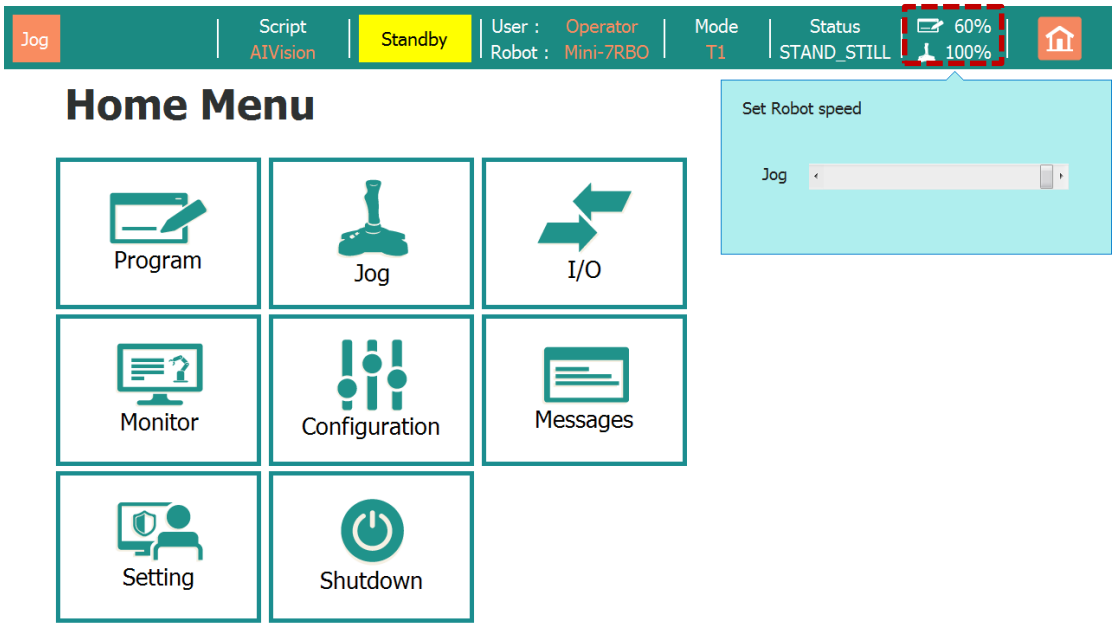
- Select operation mode before user operator robot. T1 and T2 are manual mode , AUTO is auto mode .




- Click『Enable』to start control robot, then status will become STAND STILL.

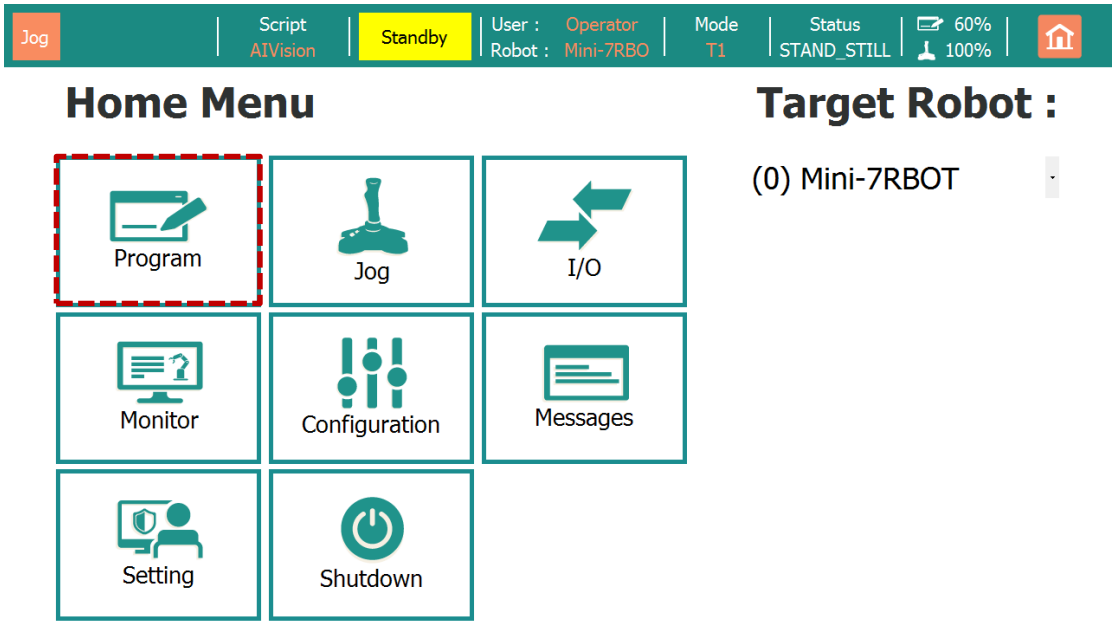


- Speed: The speed icon describe the speed percentage of robot movement while executing program or jogging robot. User can change speed percentage value from 0% to 100%.

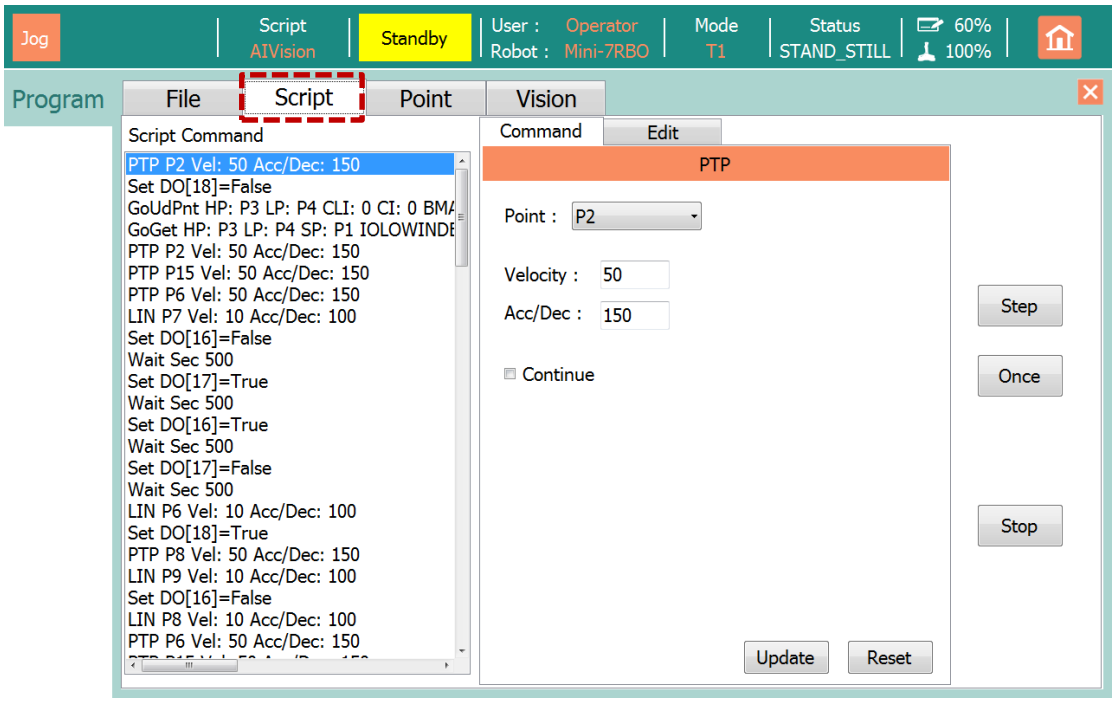



### 3.1.3. System function

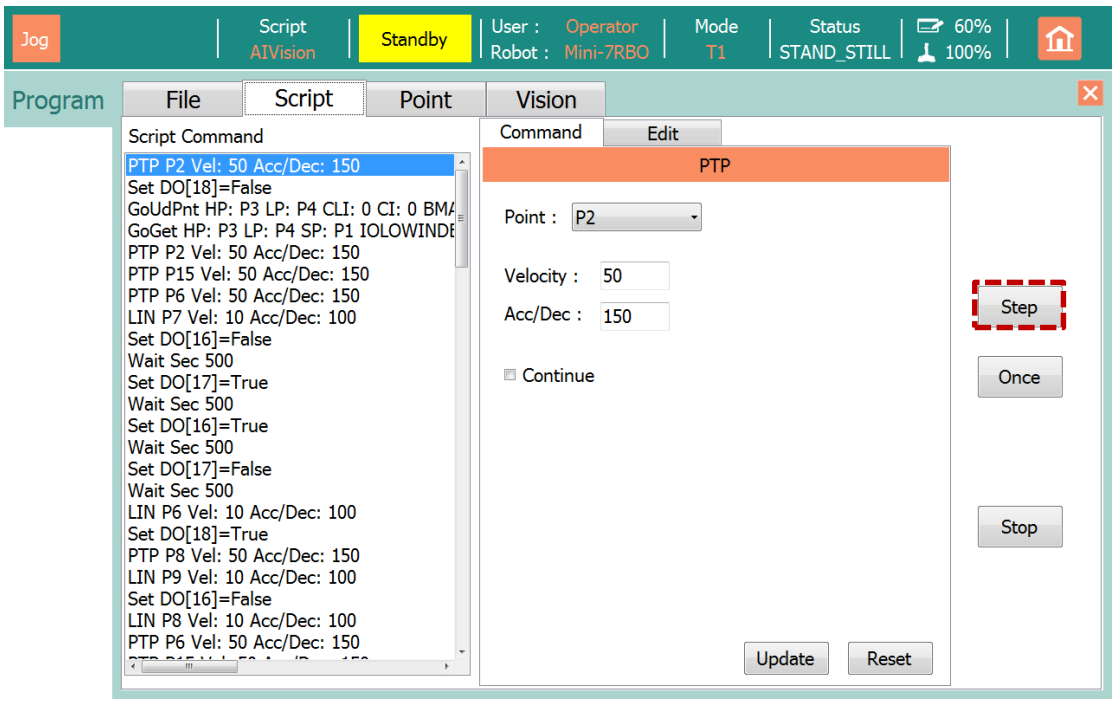
- Program



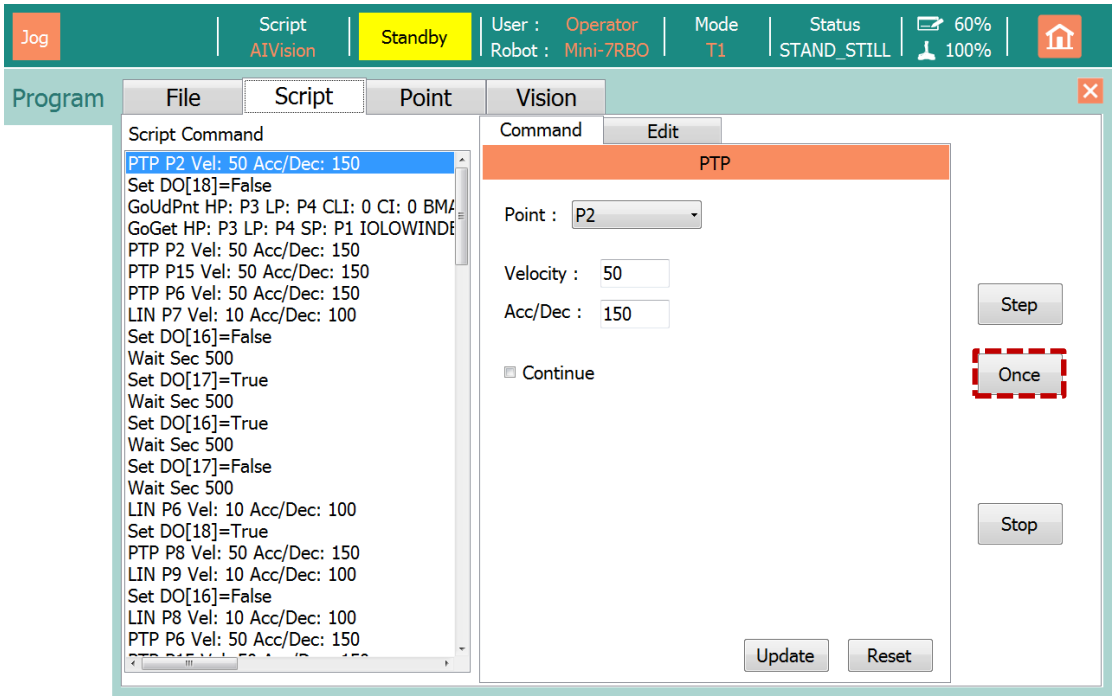
- Script Page: User can write a robot script to ask robot to move to desire target by desire movement. While writing a robot script, user need to use command page to select desire command for robot script, and user also need to set the desire parameters for selected command.



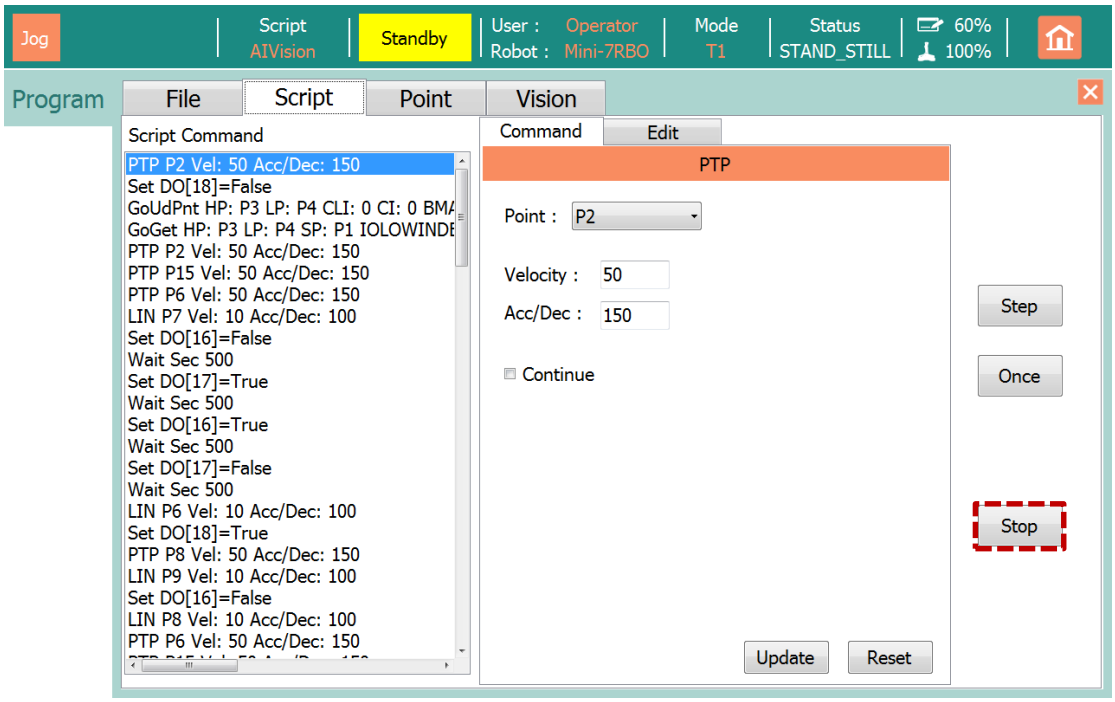

- For example if user want to control robot to move to P2 point, first step is selecting 『PTP P2 Vel:50 ACC/Dec 150』 from Script Command and keep pressing 『Step』button, and then robot will move to P2 position.



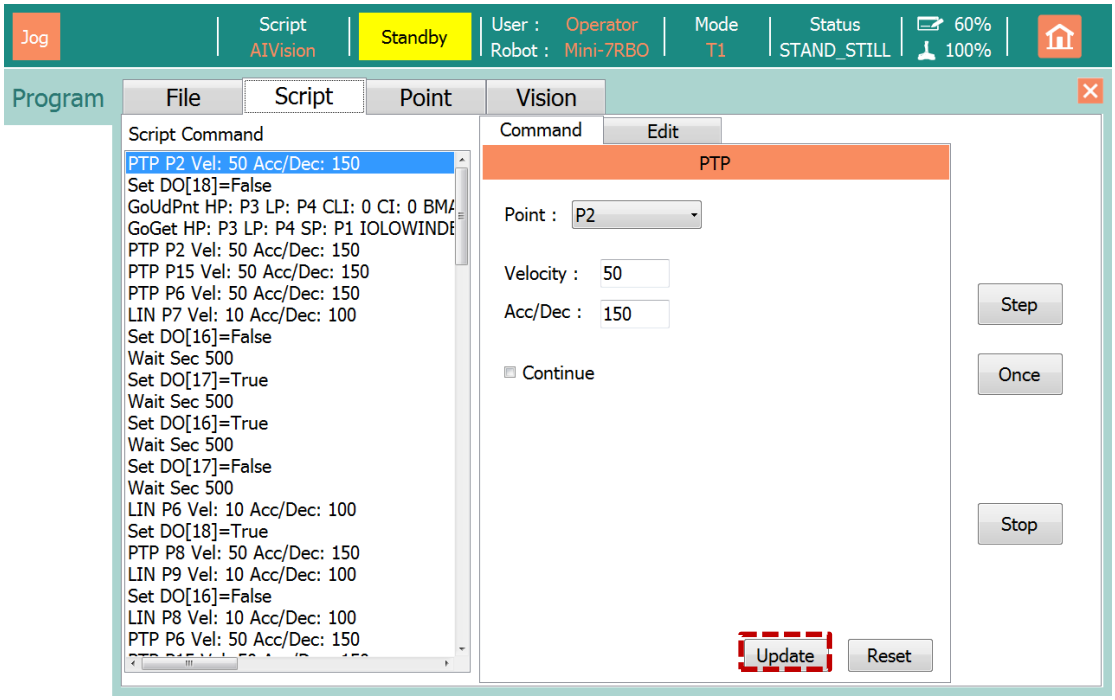
- If user want to operate robot to run whole robot script once, user should keep pressing 『Once』 button until robot movement is finished




- While operating with auto mode, If robot will have collision with obstacle, user can click『Stop』button to stop robot.

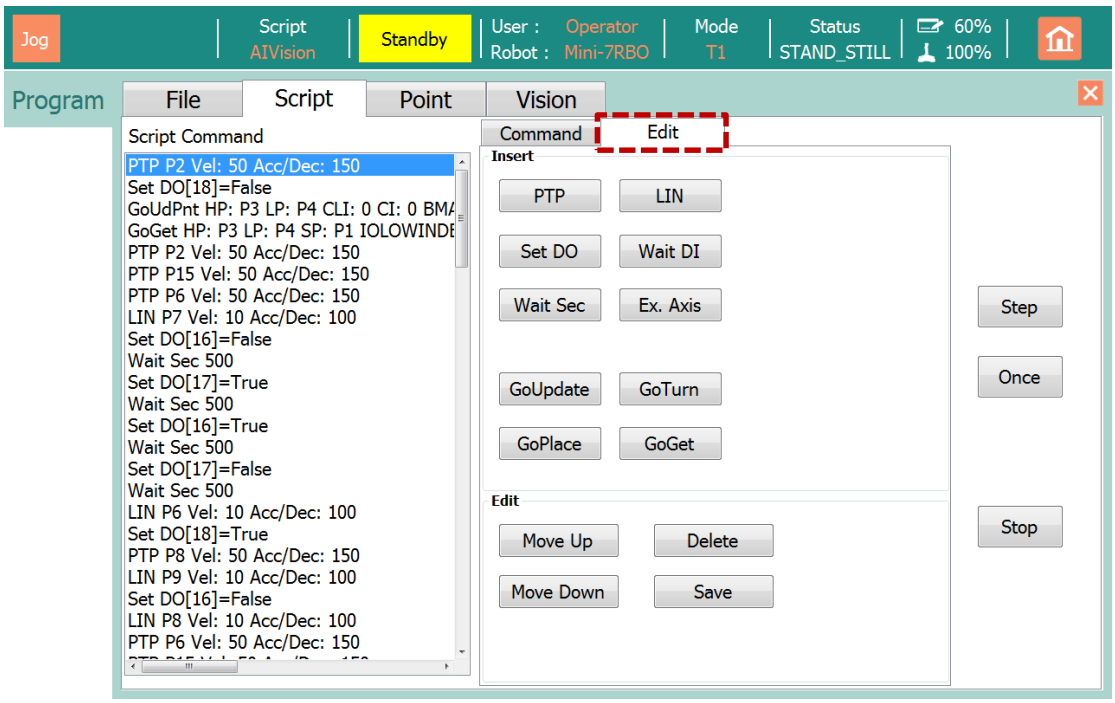


- User need to click『Update』to save position of point when user change Velocity and Acceleration.

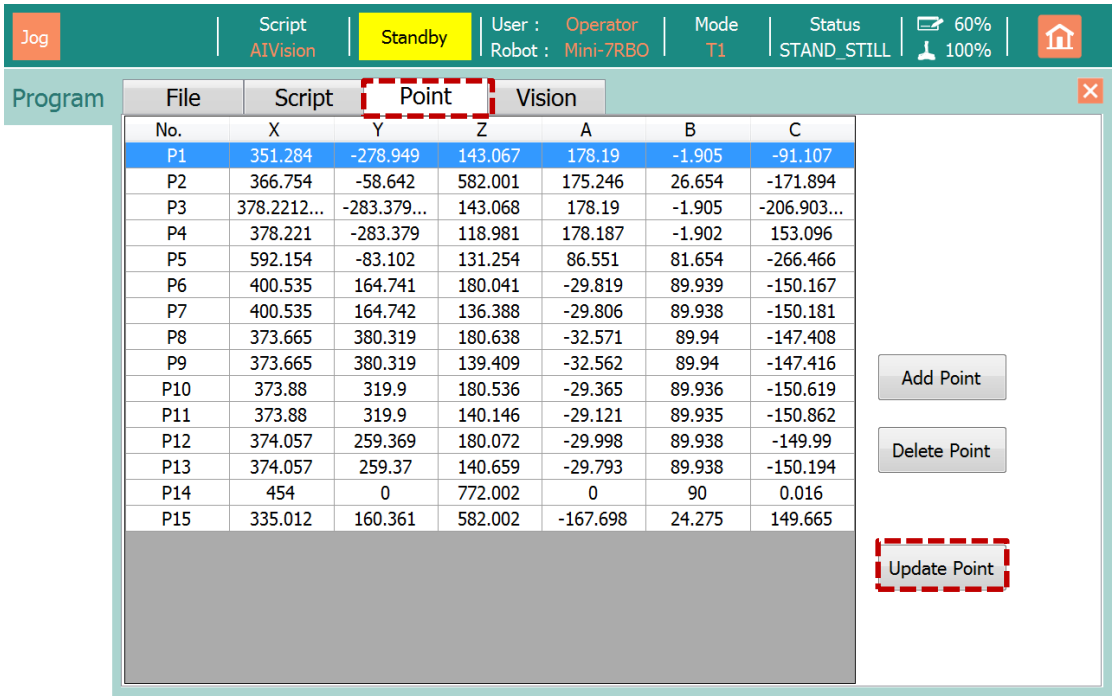



- 『PTP』、『LIN』、『Set Do』、『Wait DI』、『Wait Sec』、『Ex. Axis』 are the commands for user writing their own robot script.

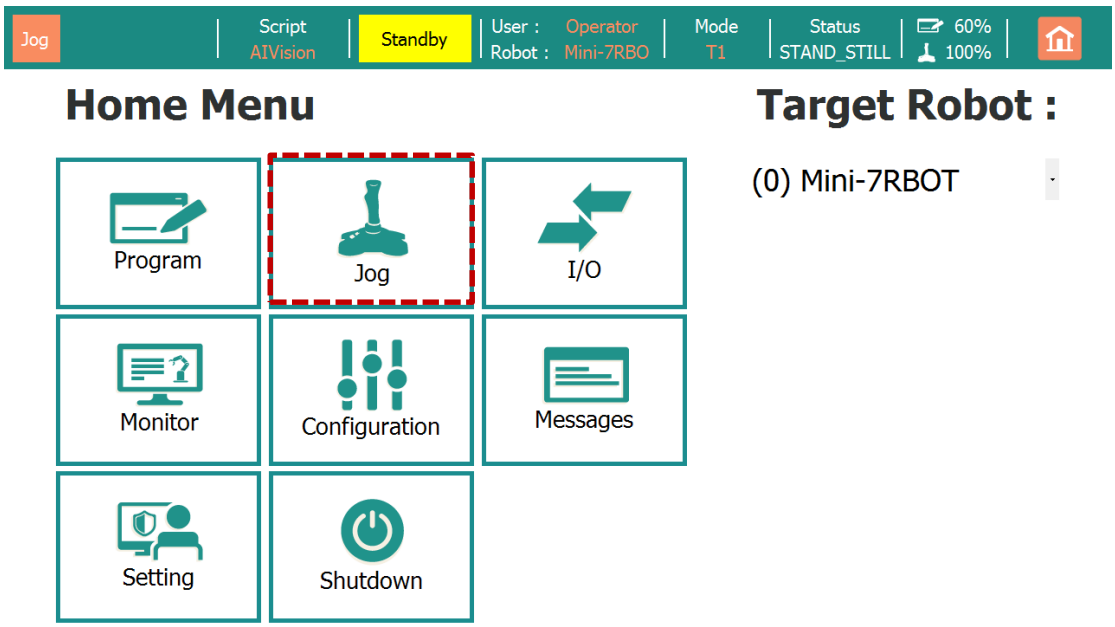
- User can use『Move Up』、『Move Down』or『Delete』command to change the script line sequence, after changing script line sequence, user need to click save button for saving current robot script to file.



- User can see position of each point in Point page. User need to click Update Point to save new position to selected point.

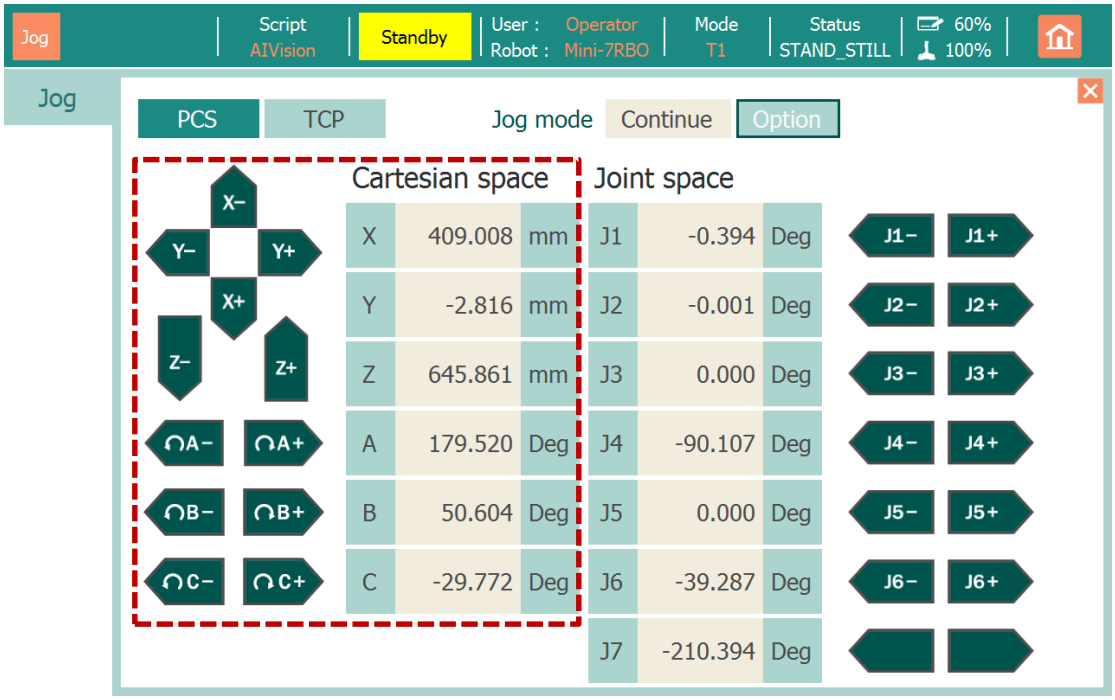



### 3.1.4. JOG

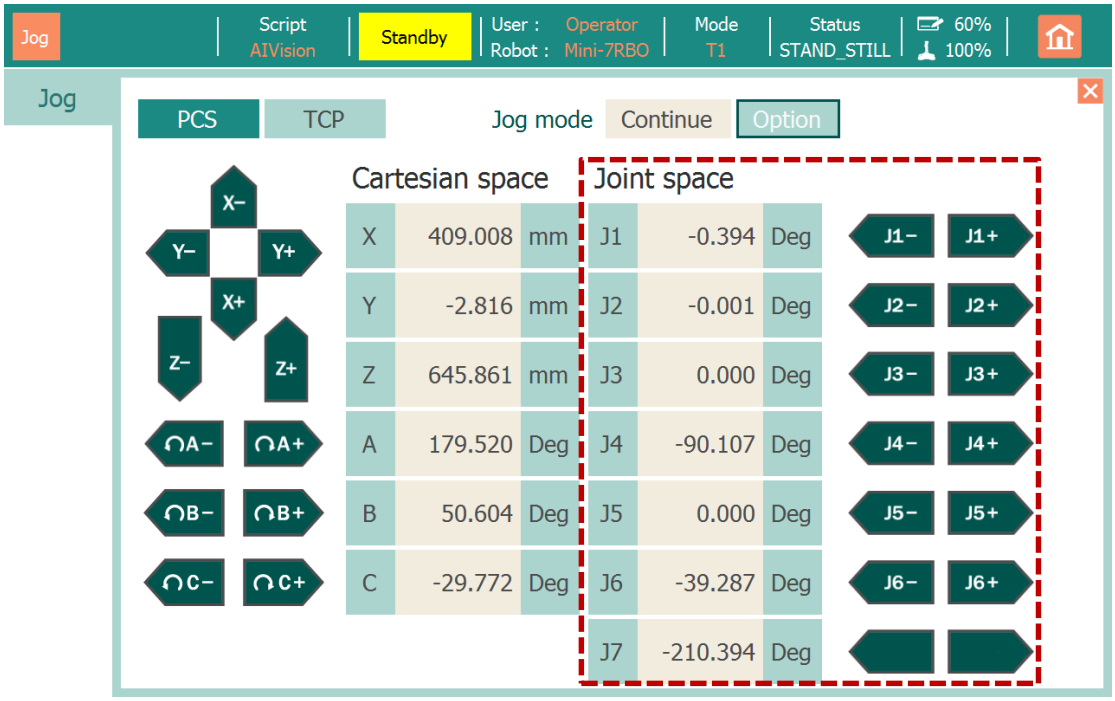


- There are two methods to control robot.

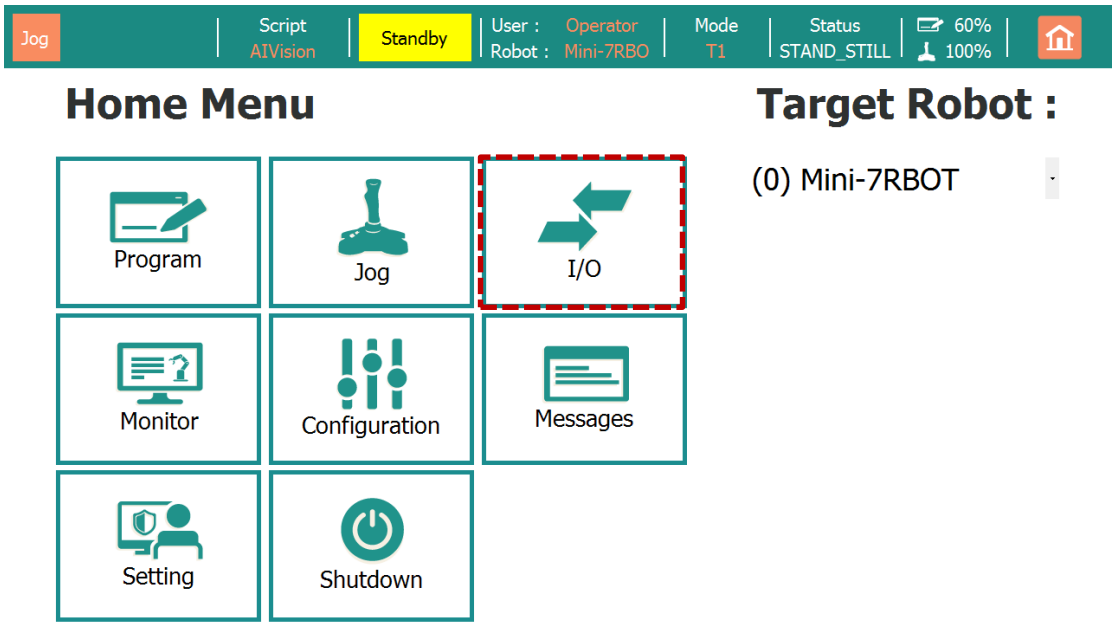
1. You can control robot by Cartesian space.



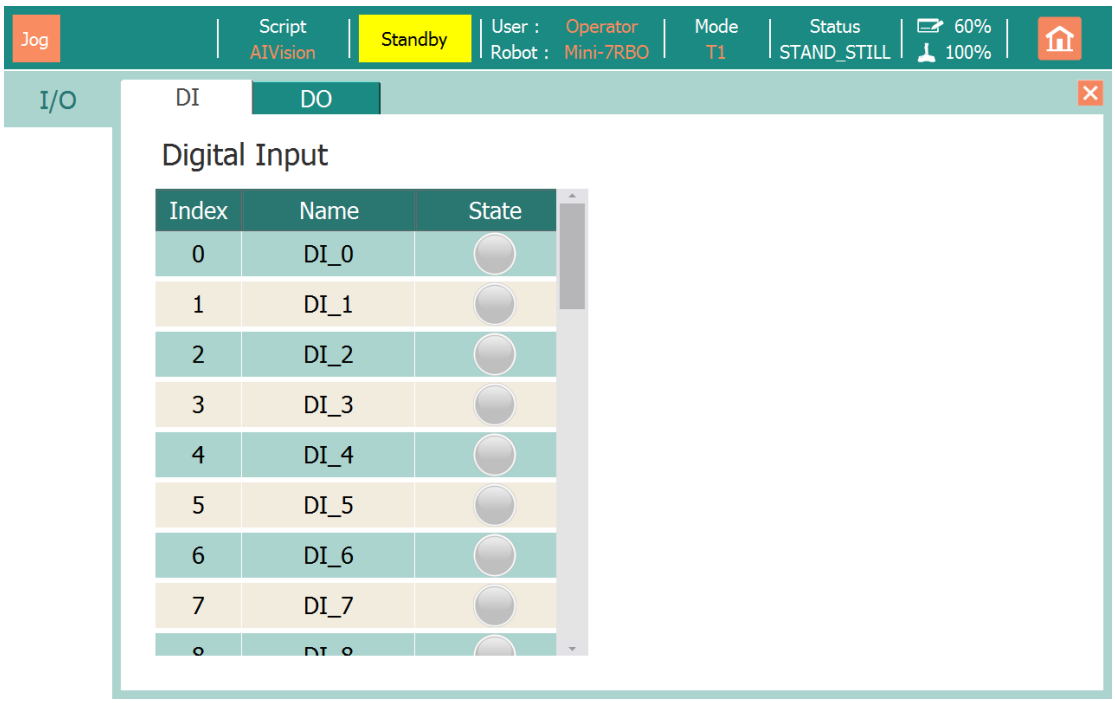

2. User can jog robot In Jog page.



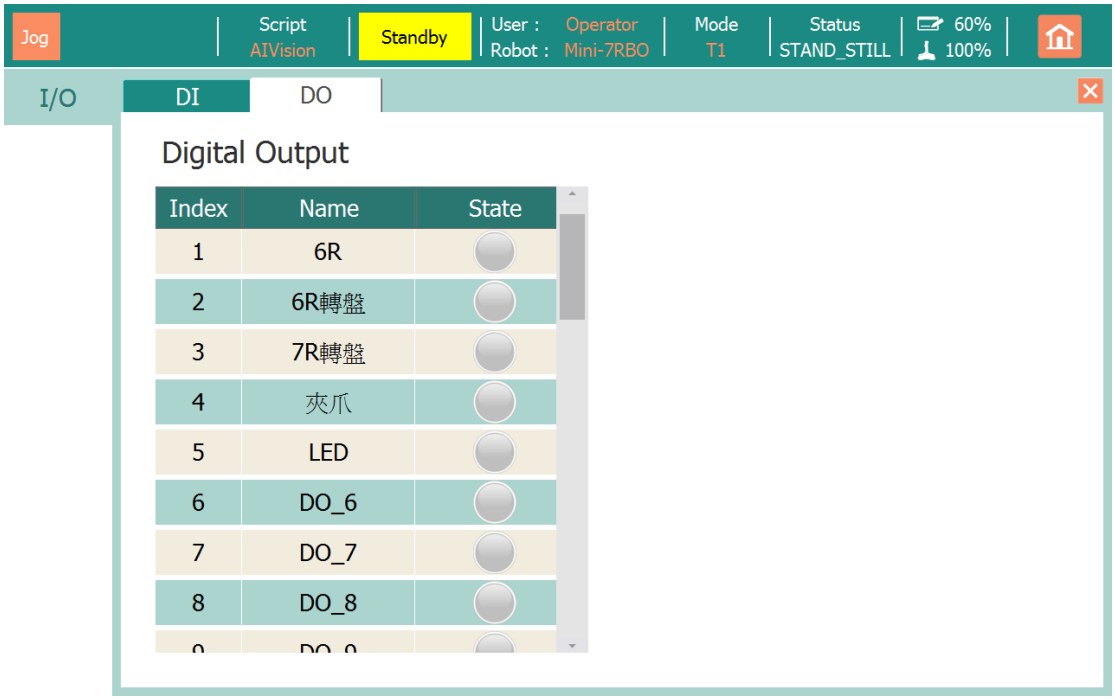
### 3.1.5. I/O



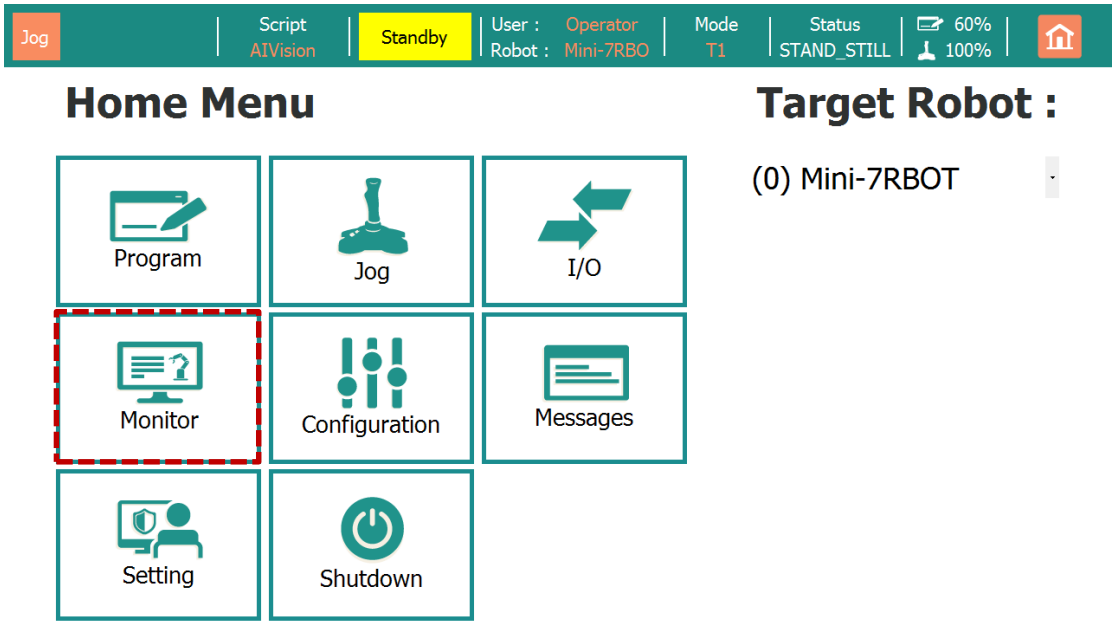

- The status of each DI (digital input) and DO (digital input) channel appears on the I/O channel setup page. User need to click state if user would like to actuating device through I/O.



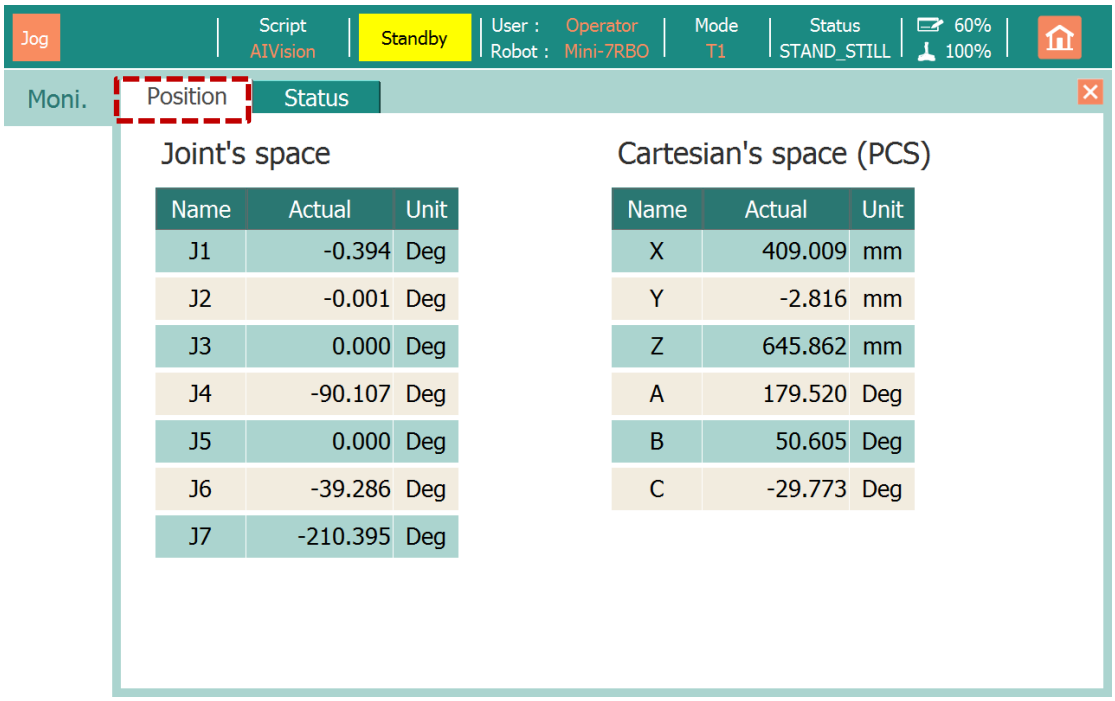
- For example if user would like to control robot gripper through I/O device, then user will see state become green after you enable state.



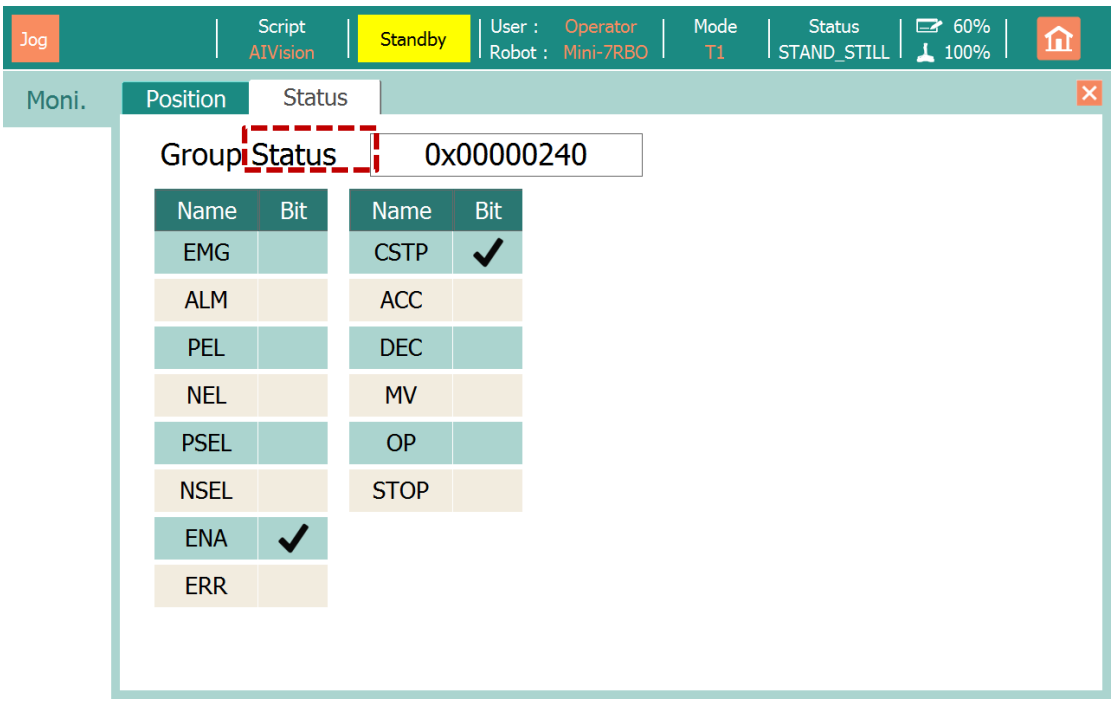

### 3.1.6. Monitor



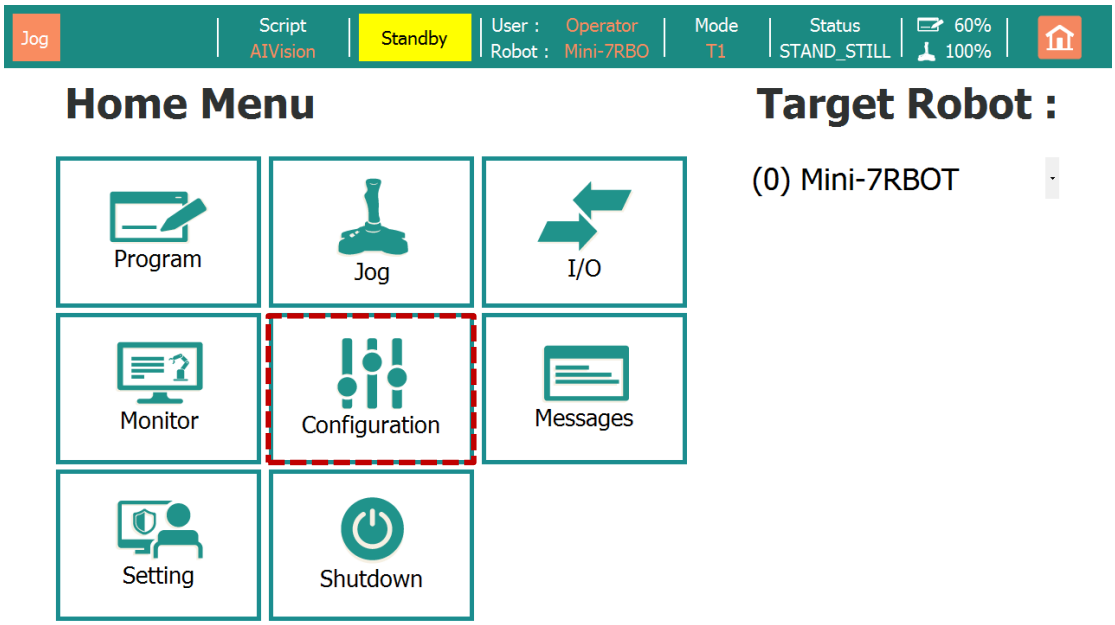
- In position page, you can see degree of axis and Cartesian's space.



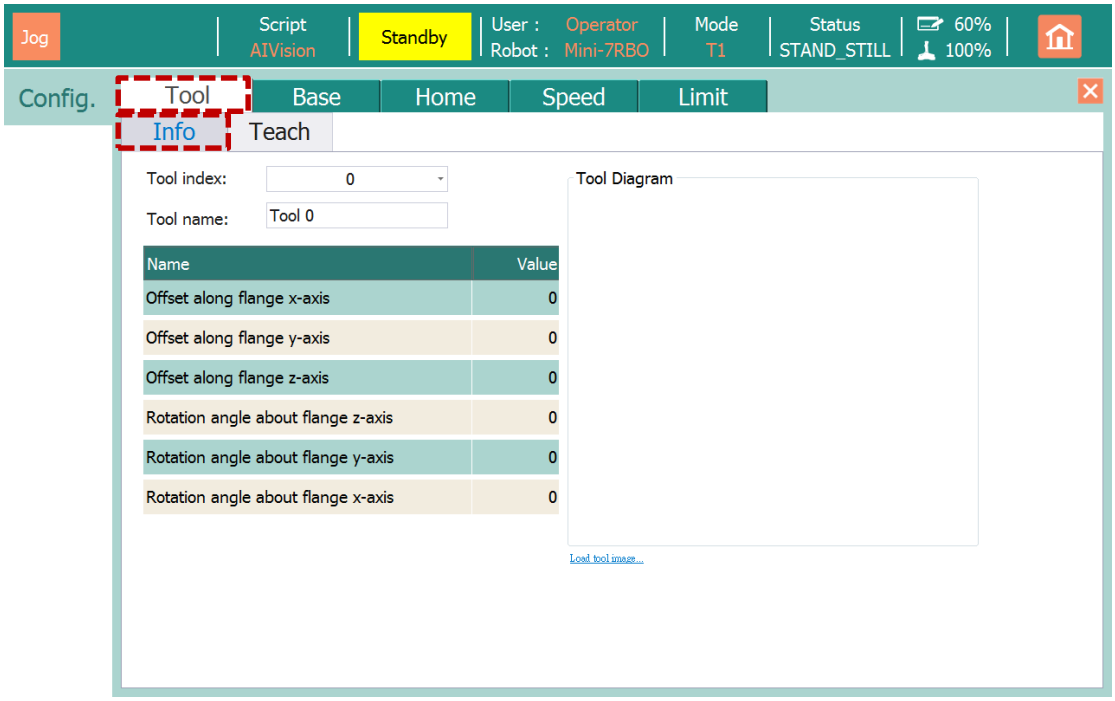

- In status page, OP bit will become on if robot is doing PTP movement.
- ACC、MV and DEC bit will become ON if robot is doing linear movement



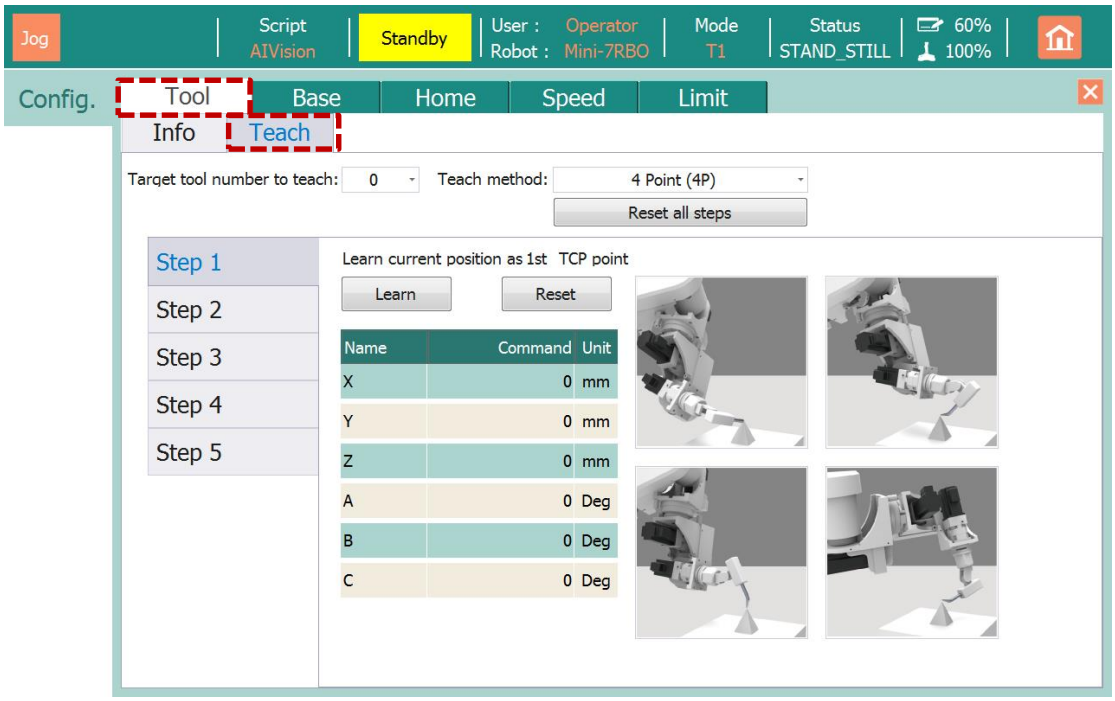
### 3.1.7. Configuration



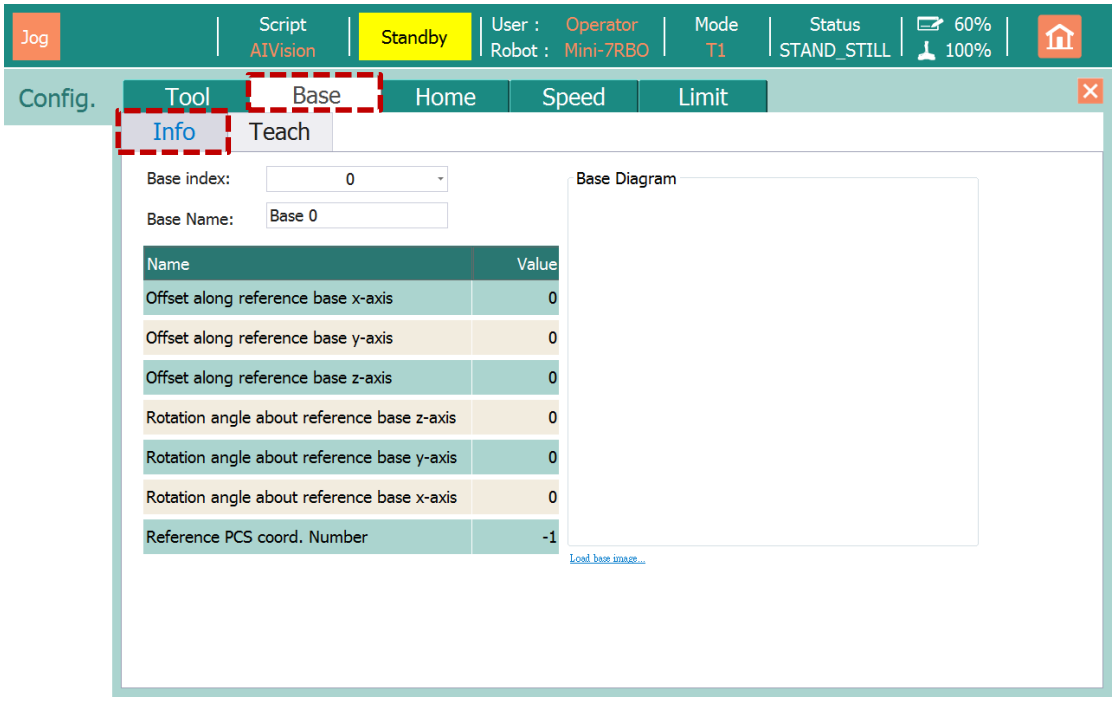

- Tool Information



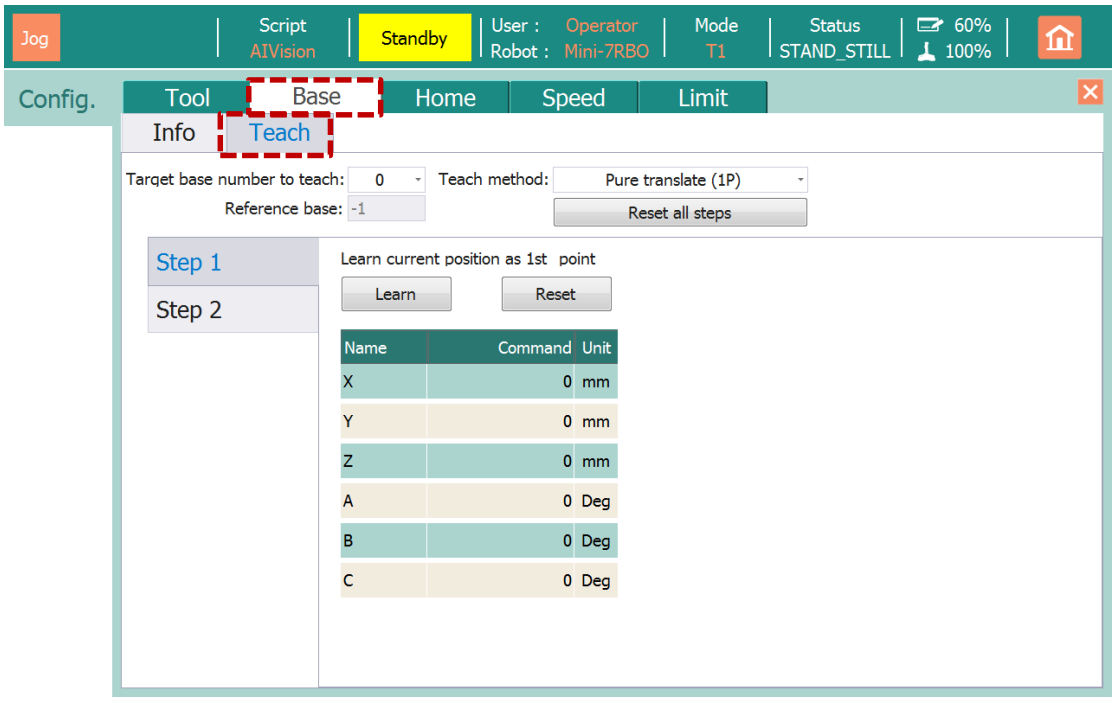
- Manipulator and tool setting page



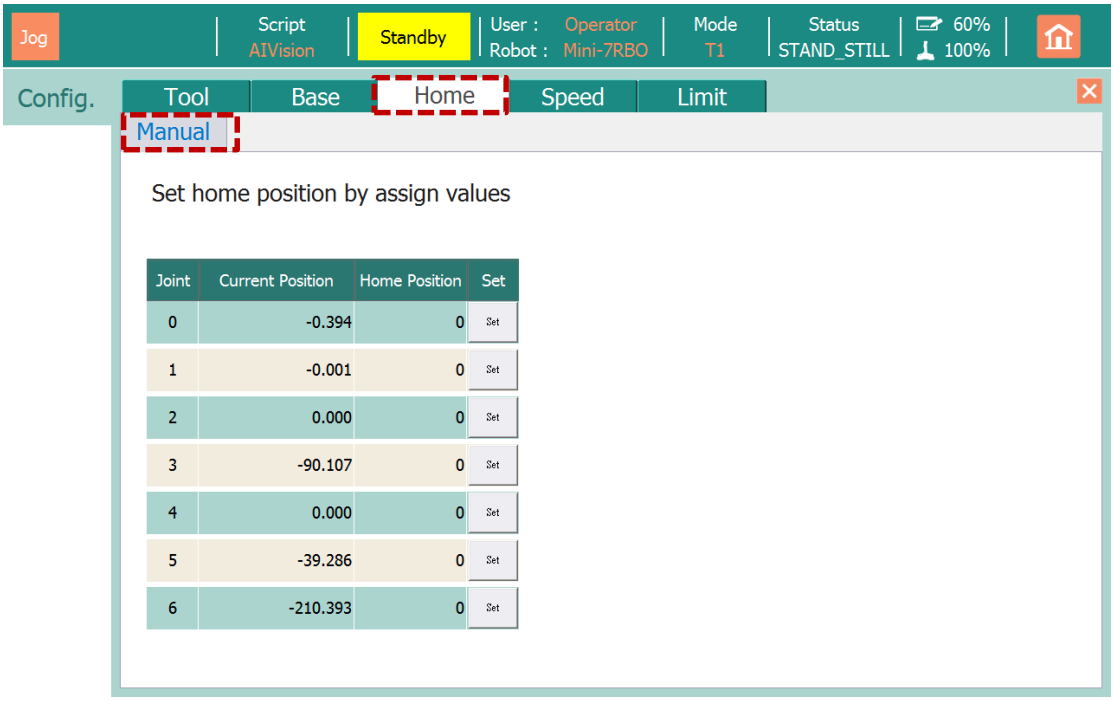

- Tool coordinate origin information



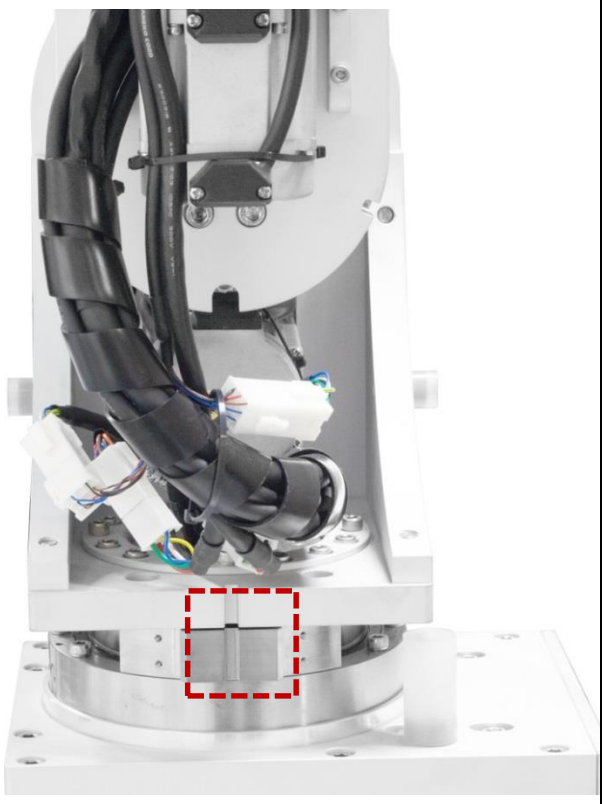
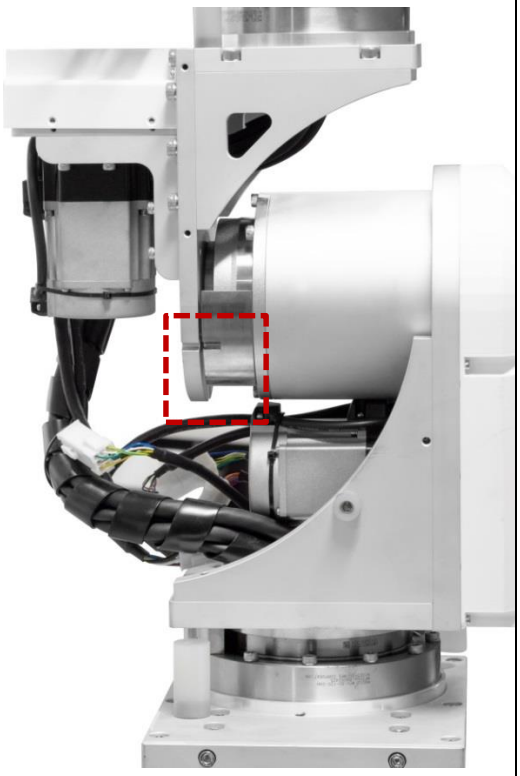
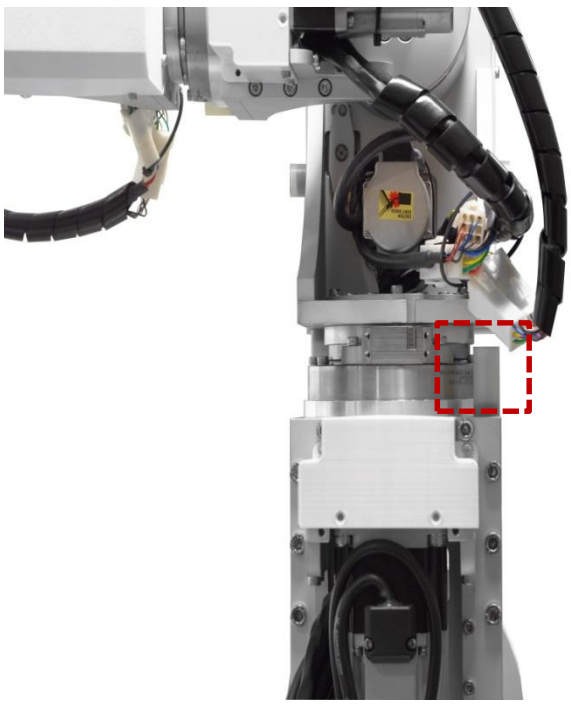
- Homing Setting of tool

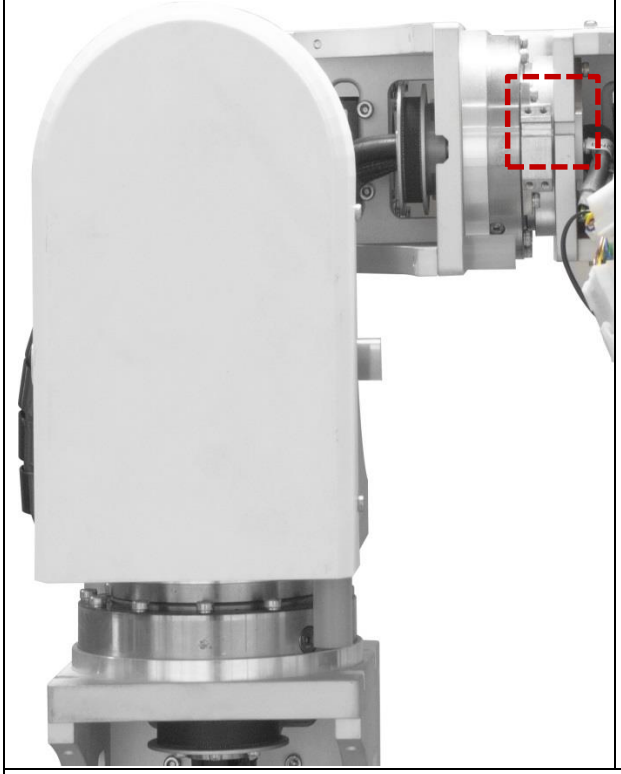
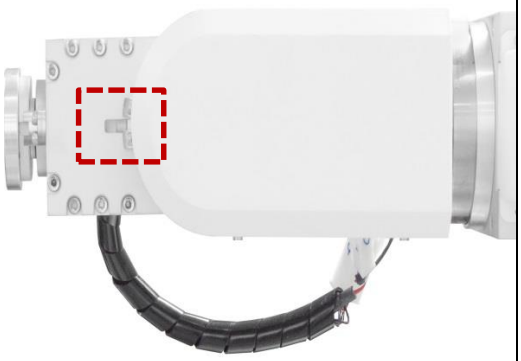



- User can set home position of robot in Home page.

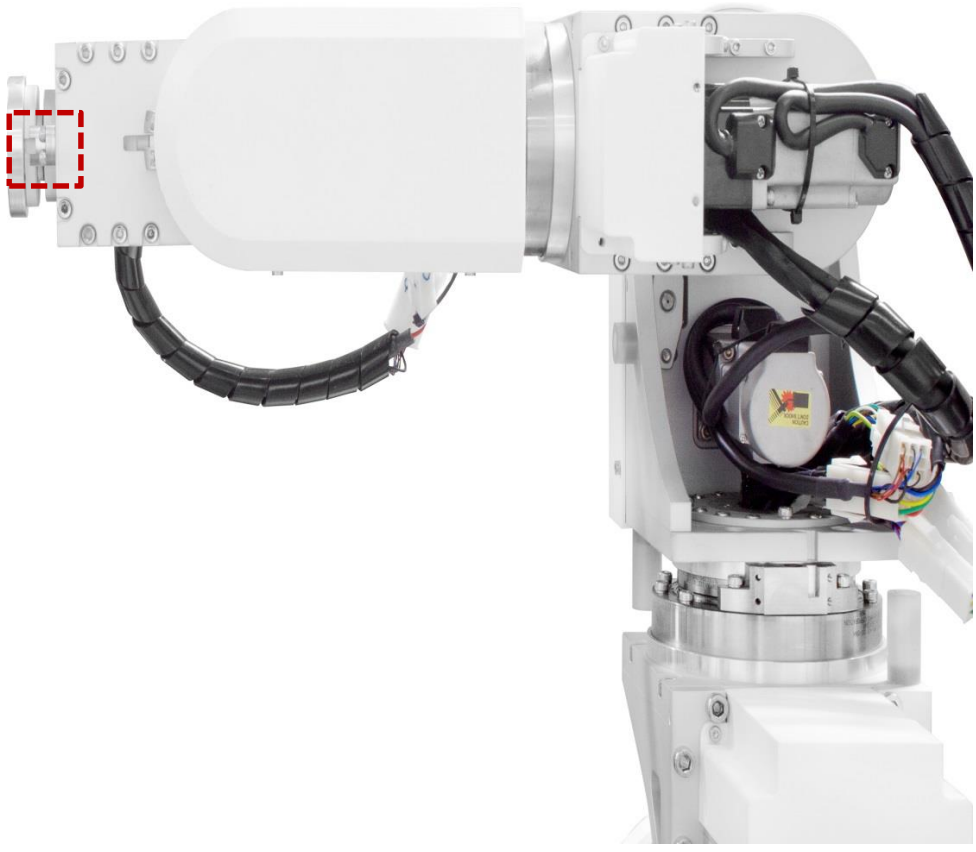


Please make sure robot is on homing position before start to control robot. And please check each joint's groove is aligned which is shown as below.

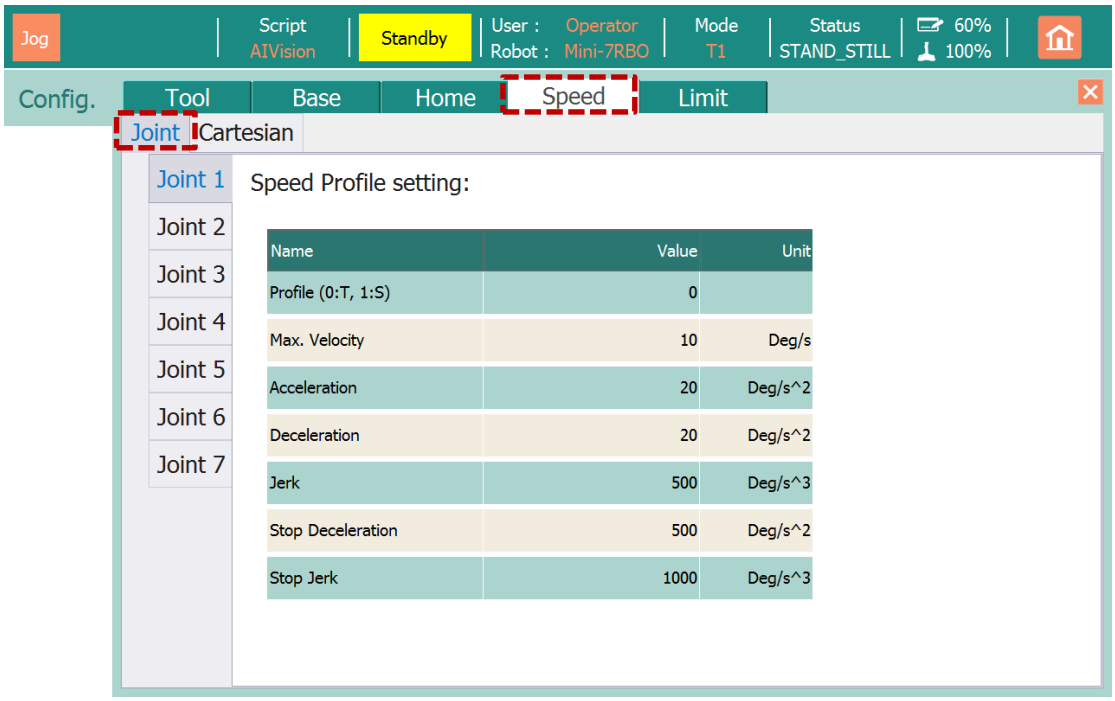
| Axis 1 | Axis 2 |
| --- | --- |
|  |  |
| **Axis 3** | **Axis 4** |
|  |  |

| Axis 5 | Axis 6 |
| --- | --- |
|  |  |

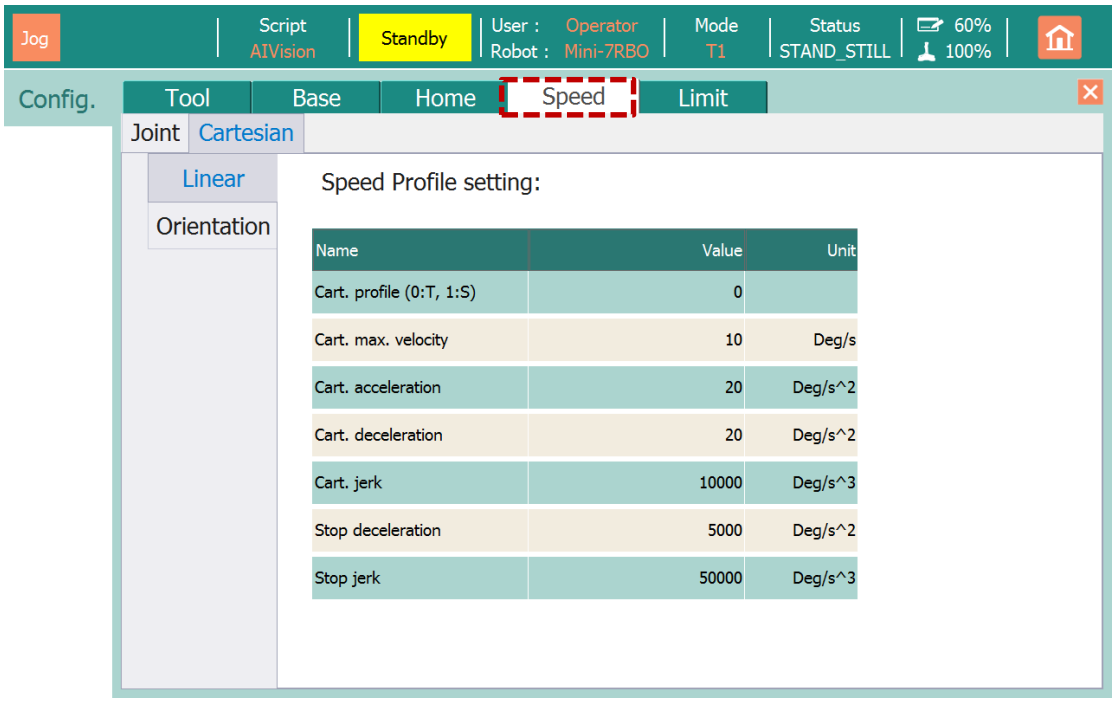
Axis 7



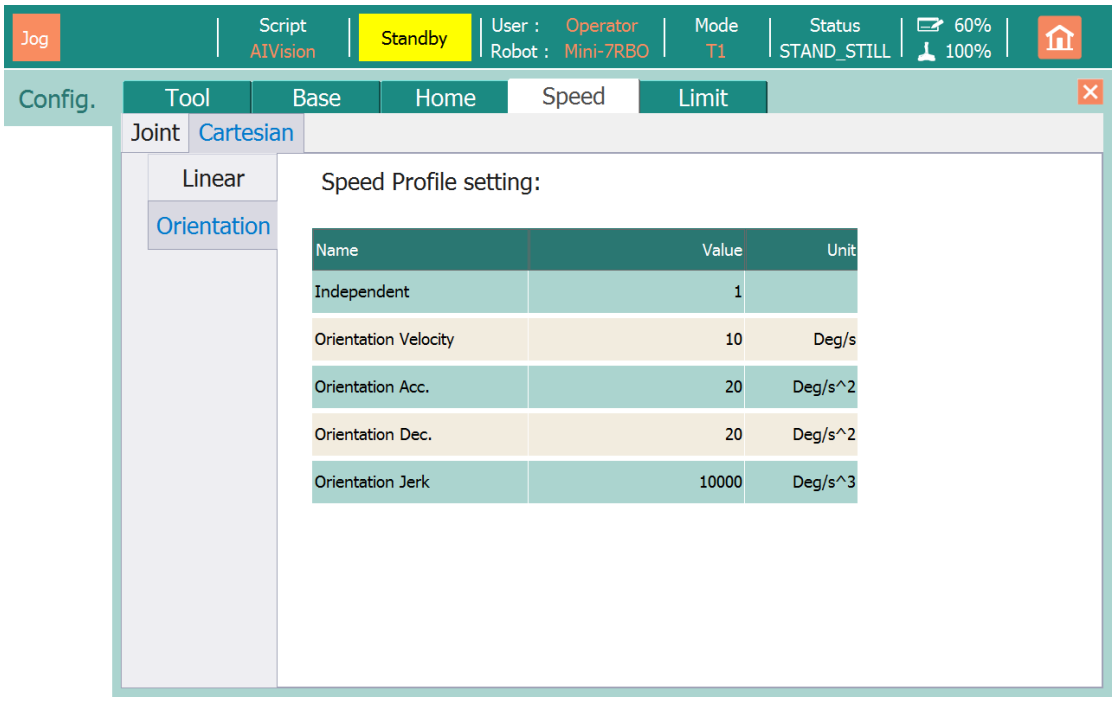
- User can set velocity and deceleration for each axis.



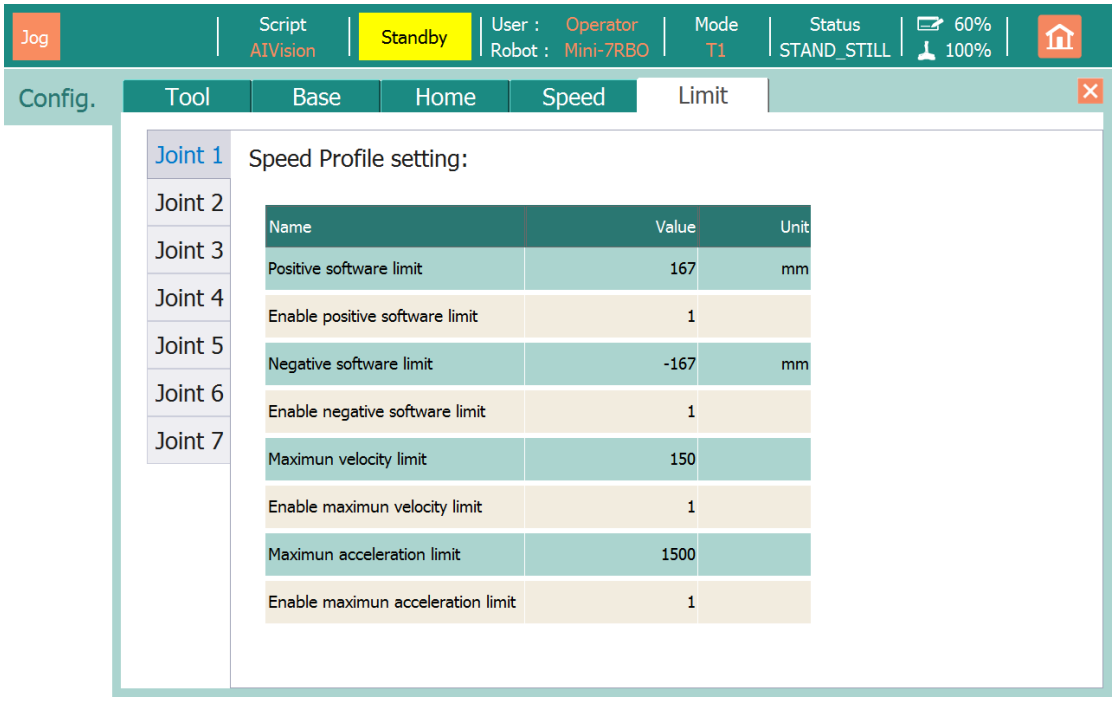

- User can set velocity and deceleration with Cartesian space.



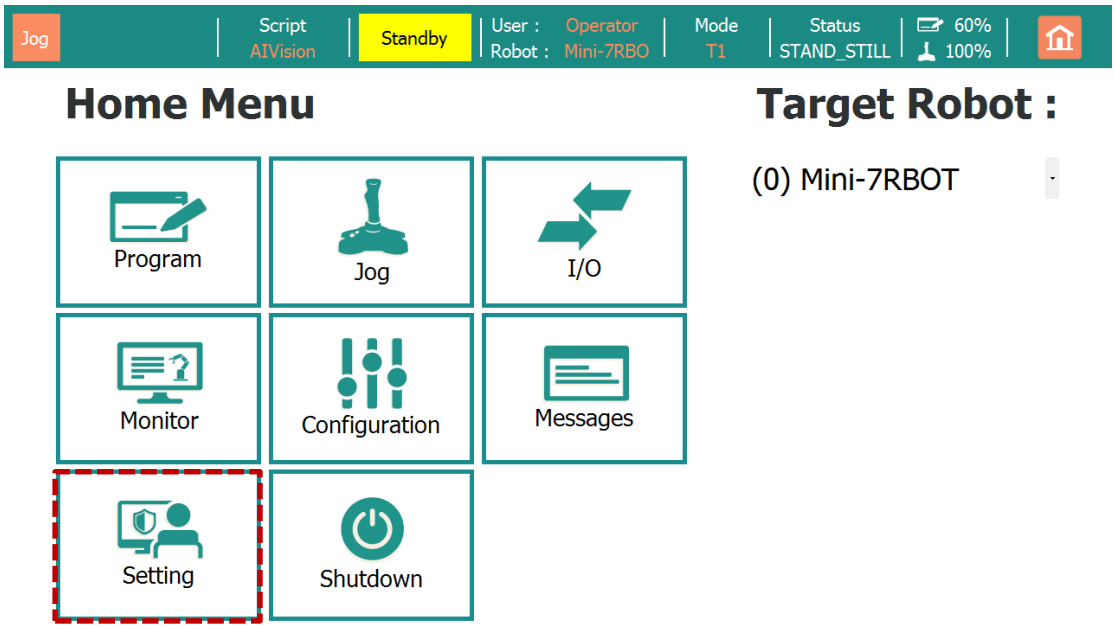
- User can set velocity and deceleration of orientation with Cartesian space.



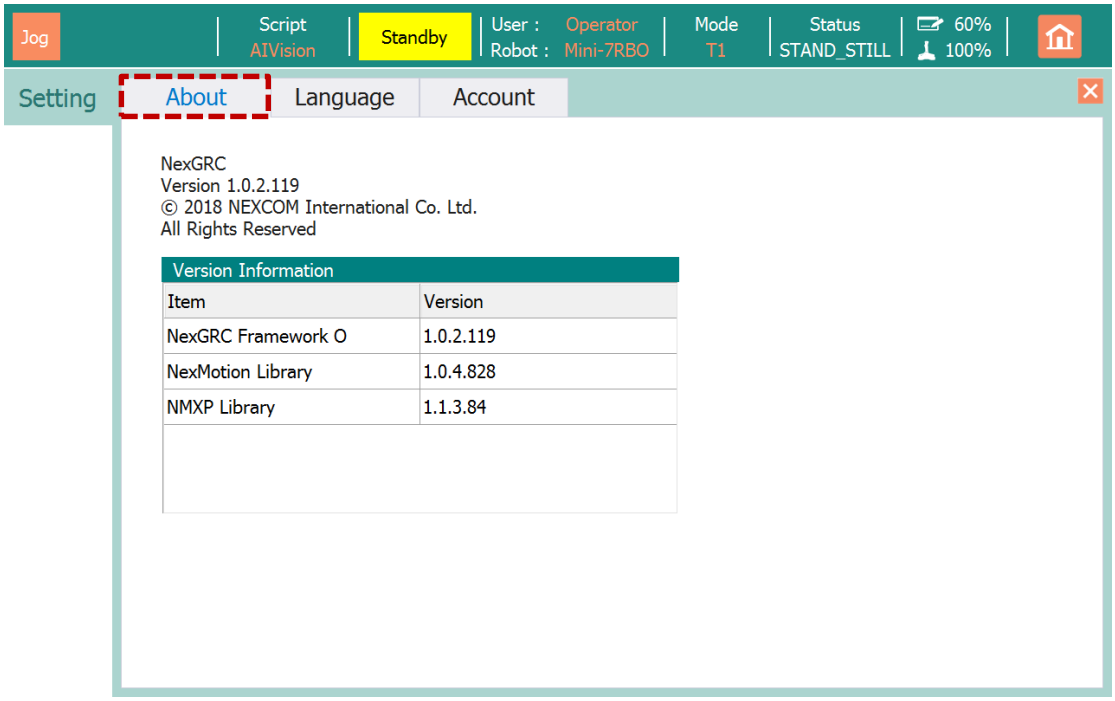

- User can set velocity limit of position and maximum acceleration limit in limit page.



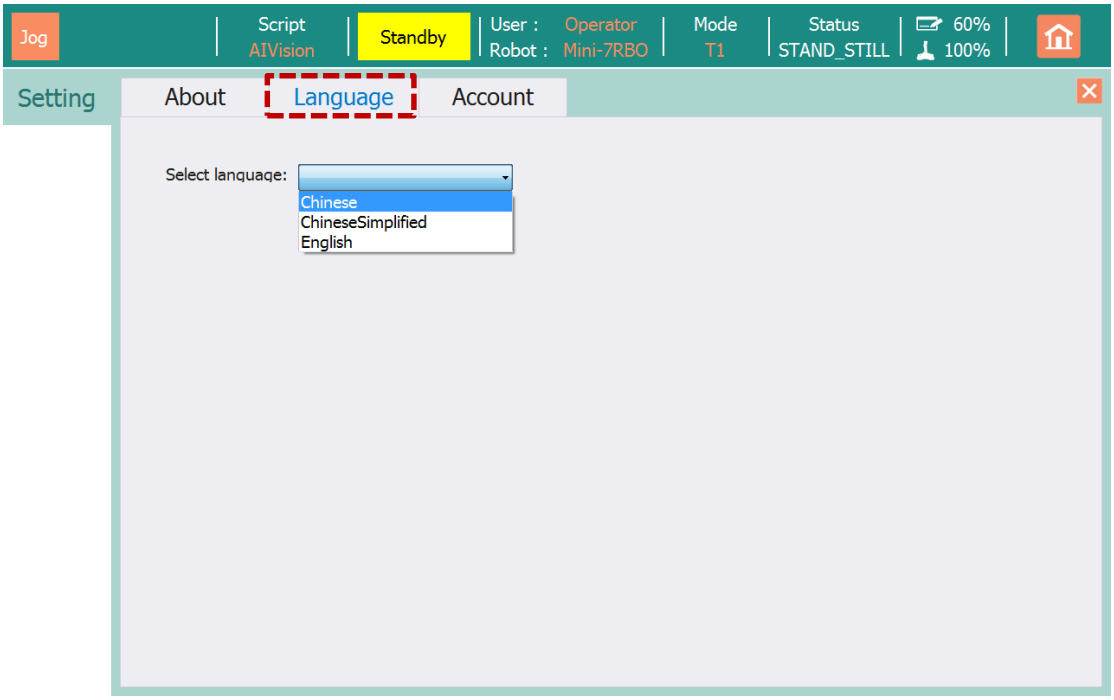
### 3.1.8. Setting




- Setting page list NexGRC Framework version, NexMotion Library version and NMXP Library version.

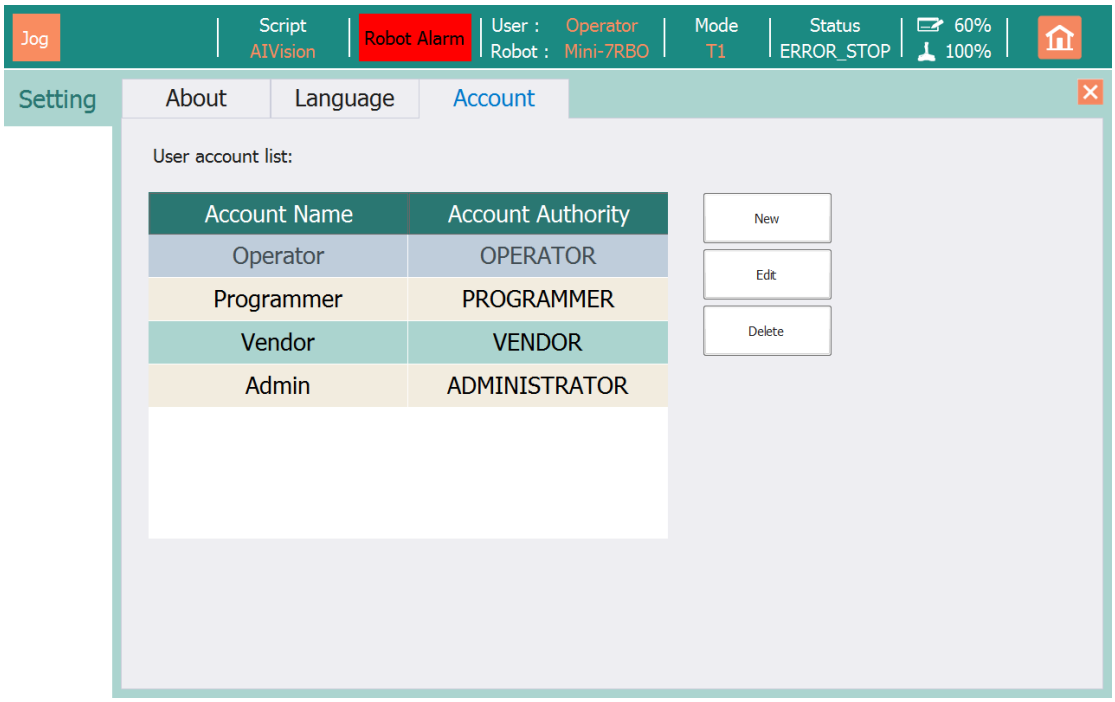


- User can choose desire language from Language page. Currently NexGRC support Chinese, Chinese Simplified and English.



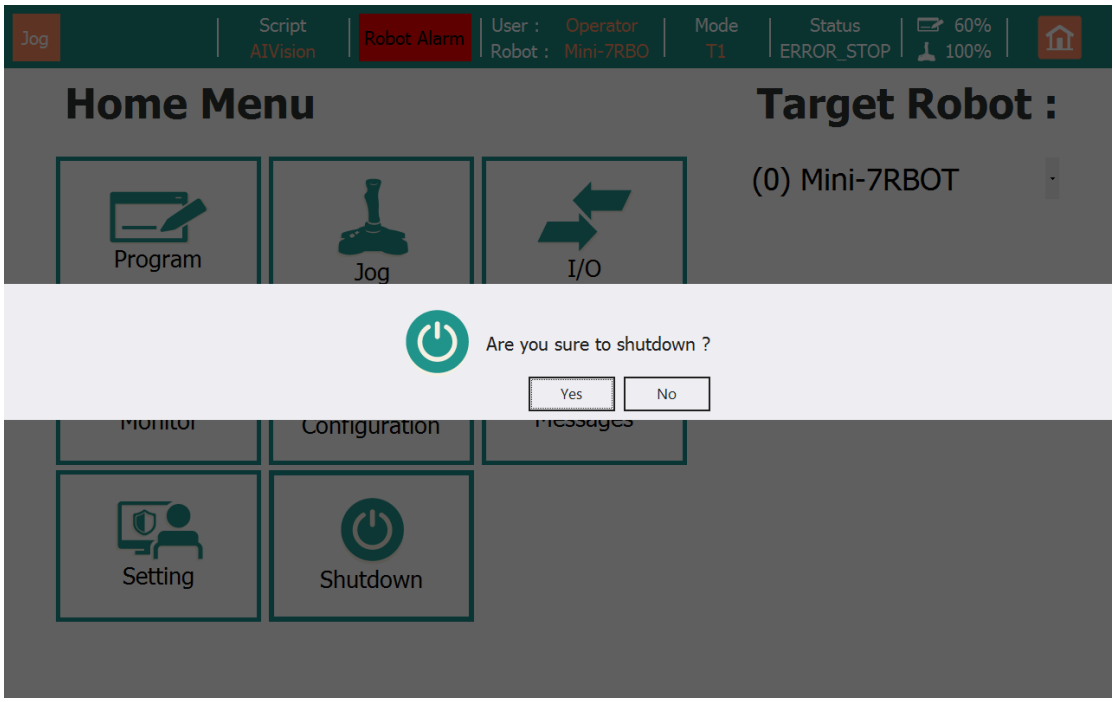

### 3.1.9. User login

- System default password is empty which you can edit Account Name and Account Authority. Strong password recommended-For your device own safety, please create a strong password of your own choosing.



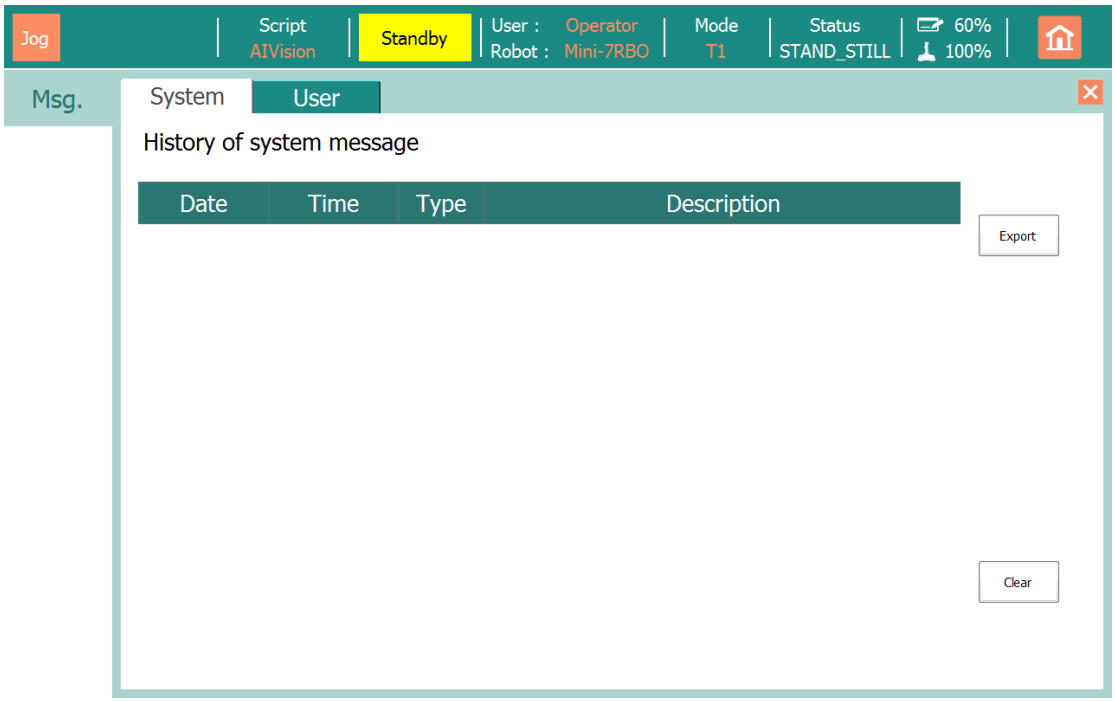
### 3.1.10. Shutdown

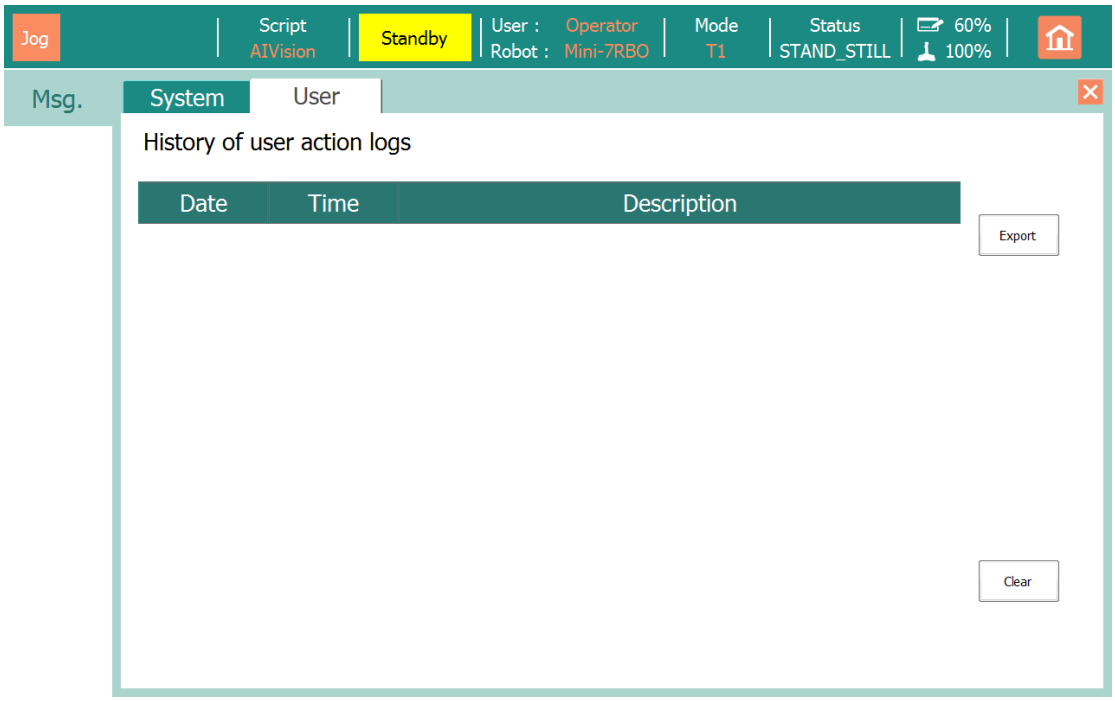
- Always shut down the controller properly. Please use the shutdown function in the Home Menu.




## 3.2. Message

- Message page include two pages: System page and User page.




Jog
Script
AIVision
Standby
User : Operator
Robot : Mini-7RBO
Mode
T1
Status
STAND_STILL
60%
100%
Msg.
System
User
History of user action logs
Date
Time
Description
Export
Clear