Update April 18, 2021. 1. Corrected and Added manual operation section, PP. 24 and PP. 11
HL

TURIN ROBOTICS

Turin Smart Robot
General Operation Manual

Shanghai Turin Smart Robot Co.,Ltd.

Version TRC2-V2.0

Statement

The Operation Manual comprehensively describes the composition and operation, etc. of Turin Industrial Robot. You shall please read in earnest and understand sufficiently the Operation Manual before operating this robot.

- The diagrams herein are plotted by taking off the cover or safety hood in order to describe the details. For operating such parts, users must restore the cover or safety hood according to regulations, and then operate such parts according to the Operation Manual.
- The diagrams and pictures herein are representative examples, and are possibly different from the products purchased.
- The Operation Manual will possibly be revised properly for reason of product improvement, specification change, and change of the Operation Manual itself, in order to facilitate the use.
- Customers' product reconstruction at their own discretion shall not be within the scope of repair guarantee, and for such reconstruction, the Company shall not assume any responsibility.

CONTENTS

1 Basic Information

1.1 Robot System

Turin Robot System mainly consists of three parts: Robot Body, Control Cabinet and Programming Demonstration Box. The accessories include the cables for connecting control cabinet with the mechanical body, like encoder cable, power cable, as well as feed cable supplying power for the whole system, and the transformer.

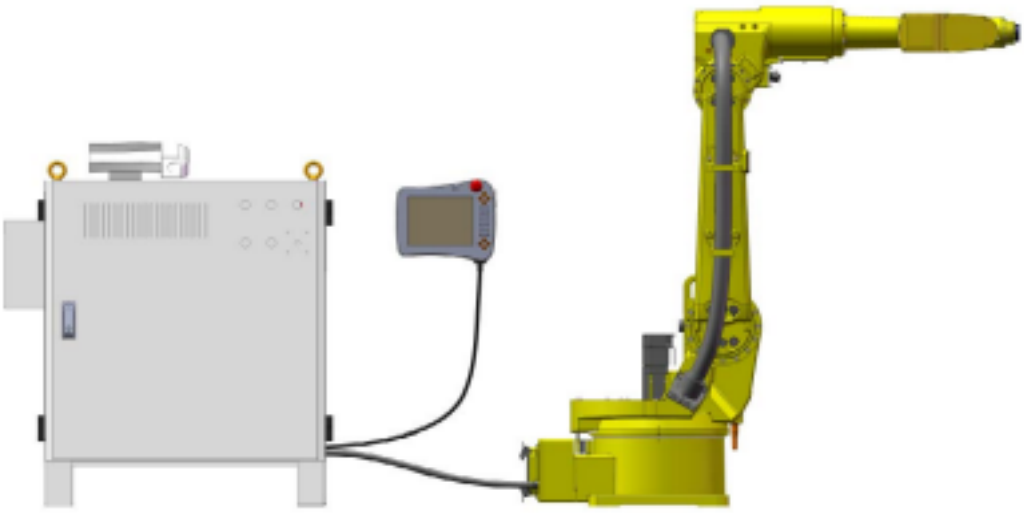


Figure 1.1 Structure Chart of Robot System

1.2 Robot Body

Robot Body generally has 6 axes, all of which are rotation axes.

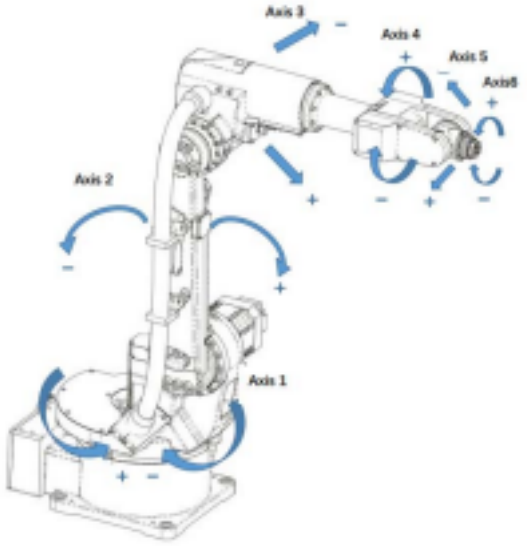


Figure 1.2 Schematic Diagram of the Movement of the Body and Each Axis of TKB1400 Robot

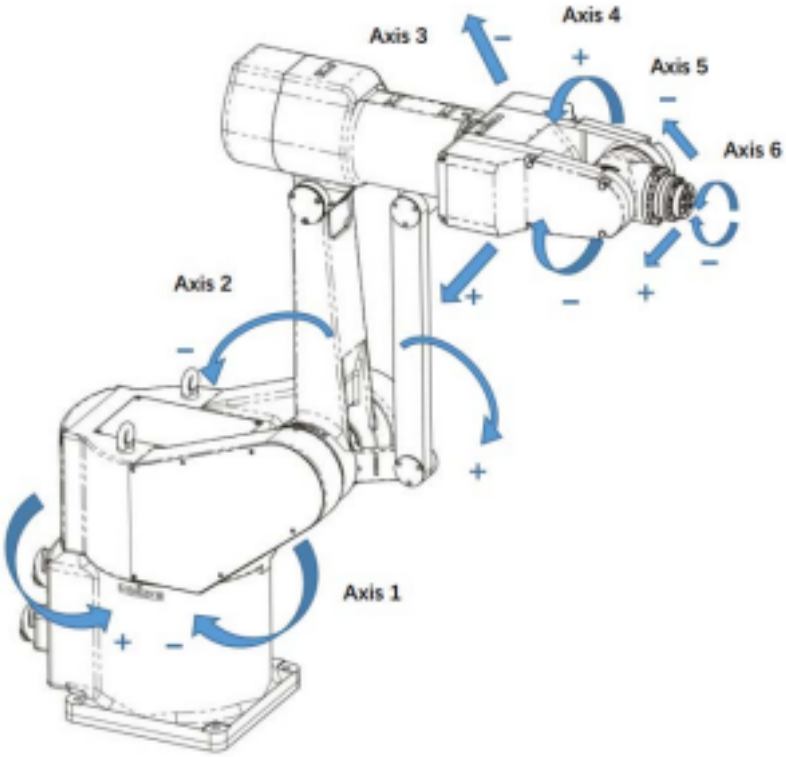


Figure 1.3 Schematic Diagram of the Movement of the Body and Each Axis of TKB050 Robot

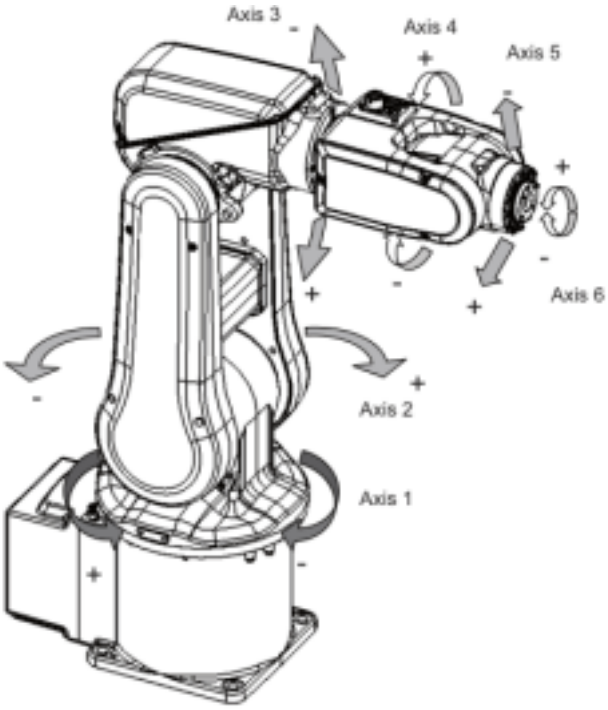


Figure 1.4 Schematic Diagram of the Movement of the Body and Each Axis of TKB030 Robot

1.3 Control Cabinet

1.3.1 Appearance of Control Cabinet

On the front panel of control cabinet of Turin Robot, there are control cabinet power switch, emergency stop switch, manual/ automatic switch, door lock and each button/ indicator light. Demonstrator is placed just above the control cabinet, and at the lateral side of control cabinet, there is interconnected cable interface.

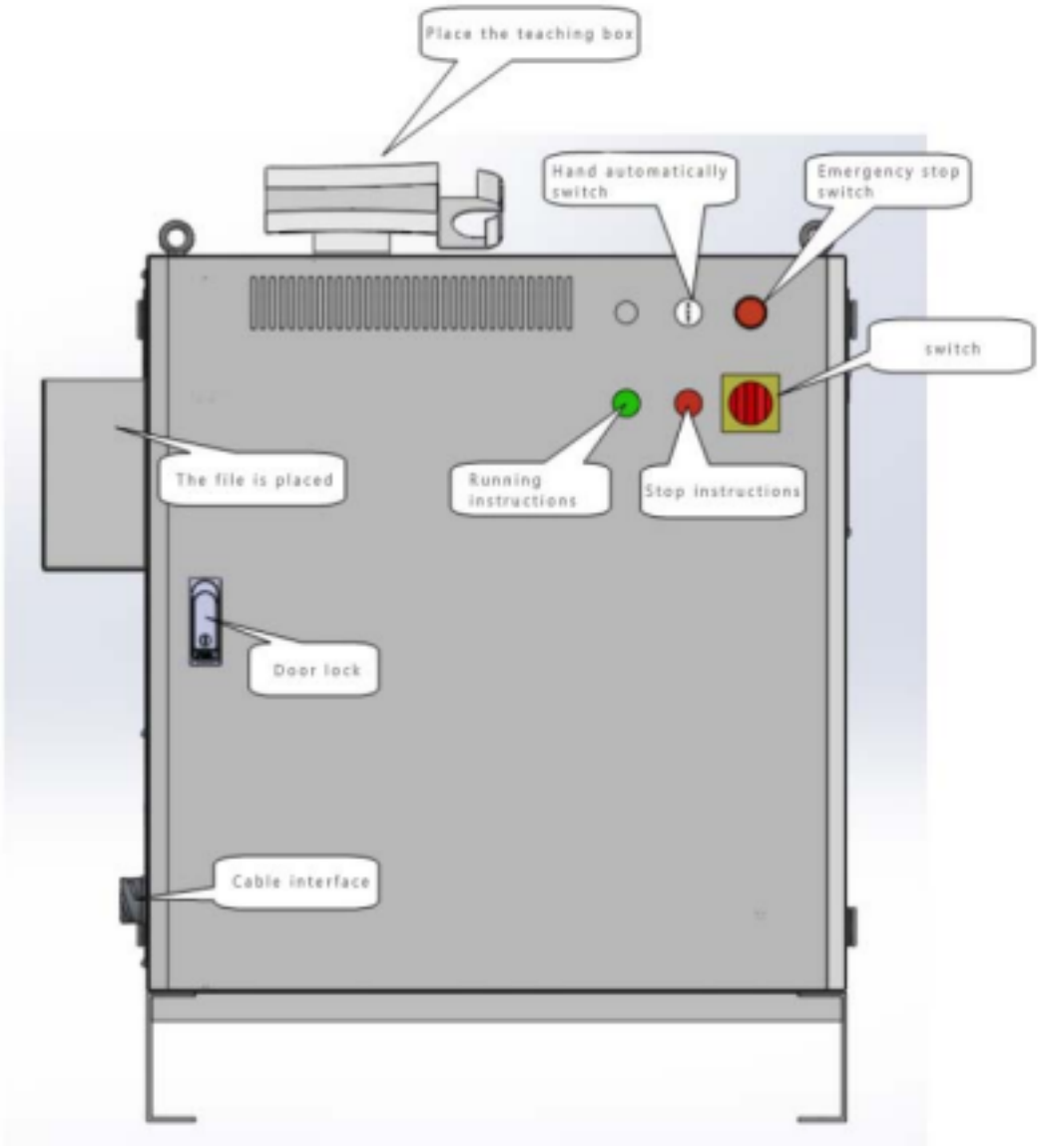


Figure 1.5 Control Cabinet

1.3.2 Introduction to Buttons/ Indicator Lights

Figure 1.6 Buttons/ Indicator Lights of Control Cabinet

- Manual/ Auto Switching

  The key switch on control cabinet is the manual/ automatic switch, which is used to switch the manual and automatic operation of industrial robot.

- Emergency Stop

  When this button is pressed, the power for servo driving and motor will be cut off immediately. If the robot is in Movement, the Movement will be stopped immediately, without a deceleration process; if this button is rotated or pulled, emergency stop may be rescinded. If the robot is in operation, please press the Demonstrator Suspend Button at first, instead of turning off the power supply or press the Emergency Stop Button directly during the Movement of the robot, in order to avoid impact damage to the machinery.

- Operation Indicator Light

  The ON of this light represents that the industrial robot is in automatic operation.

- Stop Indicator Light

  The ON of this light indicates that the industrial robot stops running.

- Power Switch

  It is the switch for overall power supply for the industrial robot.

- External Interface (Lateral)

  It indicates the VGA and USB interfaces provided by control cabinet, or the 485 or 232 interface provided upon the demand of customers.

1.4 Demonstrator

1.4.1 Demonstrator Appearance

Demonstrator is a man-machine interaction machine. Through it, operators may operate the Movement of robot, complete the programming of demonstration, and realize the setting and failure diagnosis of the system, etc. On the front side, there are Emergency Stop switch, touch screen and touch keys. The Enable switch is at the right side of the demonstrator, convenient for operators' grasp during operation.

HL, 2021-4-18
The New Version of the monitor has a key here, so position the key to "Teach" to manual operate the robot.

Figure 1.6 Demonstrator Appearance

1.4.2 Description about the Functions of Keys

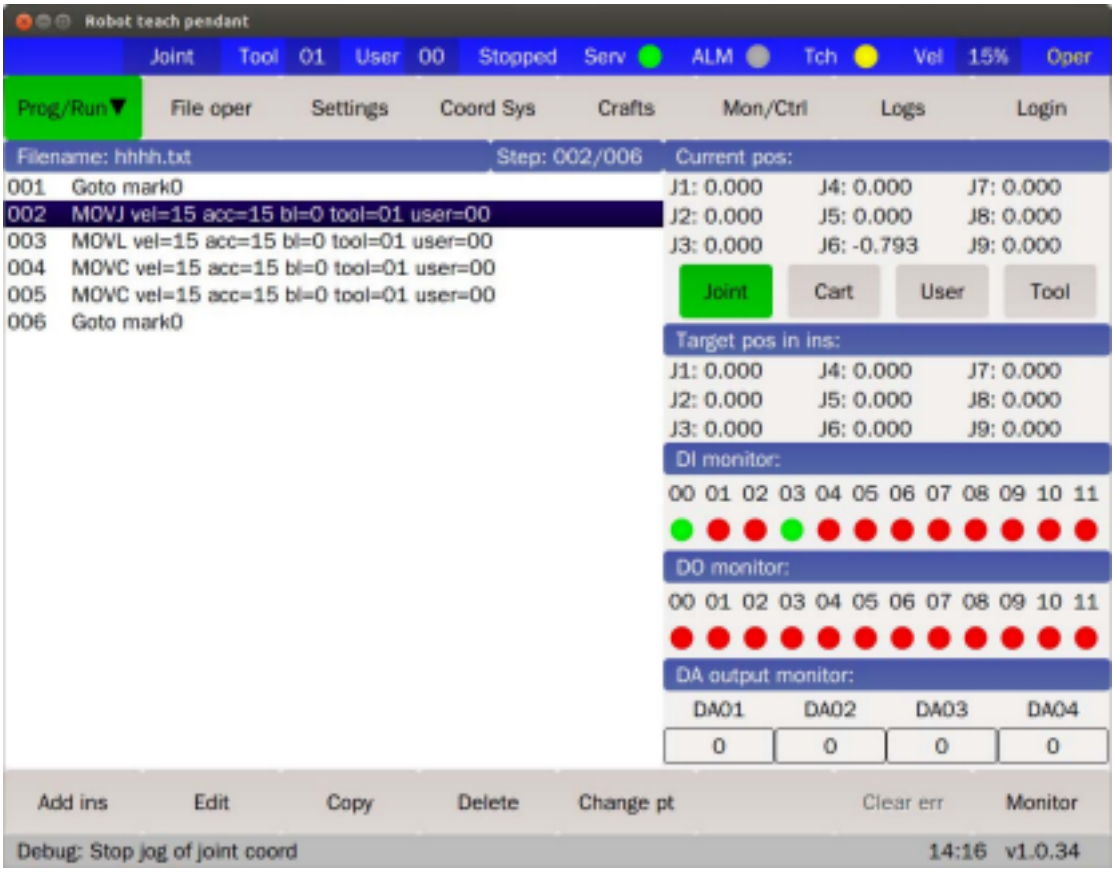
Keys	Definitions
F1	Presetting key, 1-4. For detailed information on how to define its various functions, please refer to the section “Keys Setting” herein.
F2	Presetting key, 1-4. For detailed information on how to define its various functions, please refer to the section “Keys Setting” herein.
F3	Presetting key, 1-4. For detailed information on how to define its various functions, please refer to the section “Keys Setting” herein.
F4	Presetting key, 1-4. For detailed information on how to define its various functions, please refer to the section “Keys Setting” herein.
J1-	The Movement of joint 1 to negative direction, or to negative direction of X axis
J1+	The Movement of joint 1 to positive direction, or to positive direction of X axis
J2-	The Movement of joint 2 to negative direction, or to negative direction of Y axis
J2+	The Movement of joint 2 to positive direction, or to positive direction of Y axis
J3-	The Movement of joint 3 to negative direction, or to negative direction of Z axis
J3+	The Movement of joint 3 to positive direction, or to positive direction of Z axis
J4-	The Movement of joint 4 to negative direction, or to negative direction of RX axis

J4+	The Movement of joint 4 to positive direction, or to positive direction of RX axis
J5-	The Movement of joint 5 to negative direction, or to negative direction of RY axis
J5+	The Movement of joint 5 to positive direction, or to positive direction of RY axis
J6-	The Movement of joint 6 to negative direction, or to negative direction of RZ axis
J6+	The Movement of joint 6 to positive direction, or to positive direction of RZ axis
SA	START button, AUTO (recurrence) model starts to execute programs; MANUAL (demonstration) model starts single-step Movement.
BK	BACK button. After this button is pressed, robot joint will move to zero position. After it is released, the Movement will stop.
ST	STOP button, AUTO (recurrence) model stops program execution.
FW	Button for clearing drive alarm

1.4.3 Touch Screen Layout

The display screen adopted is an 8-inch 1024*768 liquid crystal display screen, and the touch screen adopted is resistance touch screen. The screen is divided into the following several parts:

- In the top row, from the left to the right are respectively the selection of coordinate system, tool coordinate and user coordination under the model of manual operation; then the information such as operation state, servo state, alarm state and demonstration stage, etc.; and at the very right side is the selection of manual operation speed.
- In the second row is the main menu, which includes the selection of 8 main menus.
- At the left side in the middle row is the program content display area, where the contents of programs compiled and operated are displayed.
- At the right side in the middle row, from the upside to the downside are respectively the real-time displayed value of joint coordinates and the command position value, and the lower half part is the real-time display of IO state.
- At the bottom is the operation key area under every menu.
- At the very bottom is the real-time state and alarm information display column.


Robot teach pendant
Joint
Tool 01
User 00
Stopped
Serv
ALM
Tch
Vel 15%
Oper
Prog/Run
File oper
Settings
Coord Sys
Crafts
Mon/Ctrl
Logs
Login
Filename: hhhh.txt
Step: 002/006
001 Goto mark0
002 MOVJ vel=15 acc=15 bl=0 tool=01 user=00
003 MOVL vel=15 acc=15 bl=0 tool=01 user=00
004 MOVC vel=15 acc=15 bl=0 tool=01 user=00
005 MOVC vel=15 acc=15 bl=0 tool=01 user=00
006 Goto mark0
Current pos:
J1: 0.000
J4: 0.000
J7: 0.000
J2: 0.000
J5: 0.000
J8: 0.000
J3: 0.000
J6: -0.793
J9: 0.000
Joint
Cart
User
Tool
Target pos in ins:
J1: 0.000
J4: 0.000
J7: 0.000
J2: 0.000
J5: 0.000
J8: 0.000
J3: 0.000
J6: 0.000
J9: 0.000
DI monitor:
00 01 02 03 04 05 06 07 08 09 10 11
DO monitor:
00 01 02 03 04 05 06 07 08 09 10 11
DA output monitor:
DA01
DA02
DA03
DA04
0
0
0
0
Add ins
Edit
Copy
Delete
Change pt
Clear err
Monitor
Debug: Stop jog of joint coord
14:16
v1.0.34

2 Coordinate Systems of Robot

2.1 Robot Axes and Coordinate Systems

2.1.1 Definition of Robot Axis

Robot axis could be rotation axis or translation axis, and the operation method of axes is determined by mechanical structure.

Robot axis is divided into the Movement axis and external axis of robot body.

External axis is further divided into sliding stable and positioner.

If not specified clearly, robot axis indicates the Movement axis of robot body.

2.1.2 Types of Robot Coordinate System

Under the demonstration model, the Movement direction of robot axis is related to the coordinate system selected at present. Turin robot supports 4 coordinate systems, namely joint coordinate system, rectangular coordinate system, tool coordinate system and user coordinate system.

- **Joint Coordinate System**

With each axis of the robot acting separately, the system is called as joint coordinate system.

- **Rectangular Coordinate System**

The control centre point of the robot operates along the set directions of X, Y and Z.

- **Tool Coordinate System**

Tool coordinate system is on the fixture of wrist flange plate of the robot, and is defined by users. The effective direction of the fixture is defined as the Z axis of the tool coordinate system.

- **User Coordinate System**

User coordinate system is on the work piece scratched by the robot, and is defined by users.

2.2 Joint Coordinate System

The definition of each joint Movement axis of the robot is as shown below.

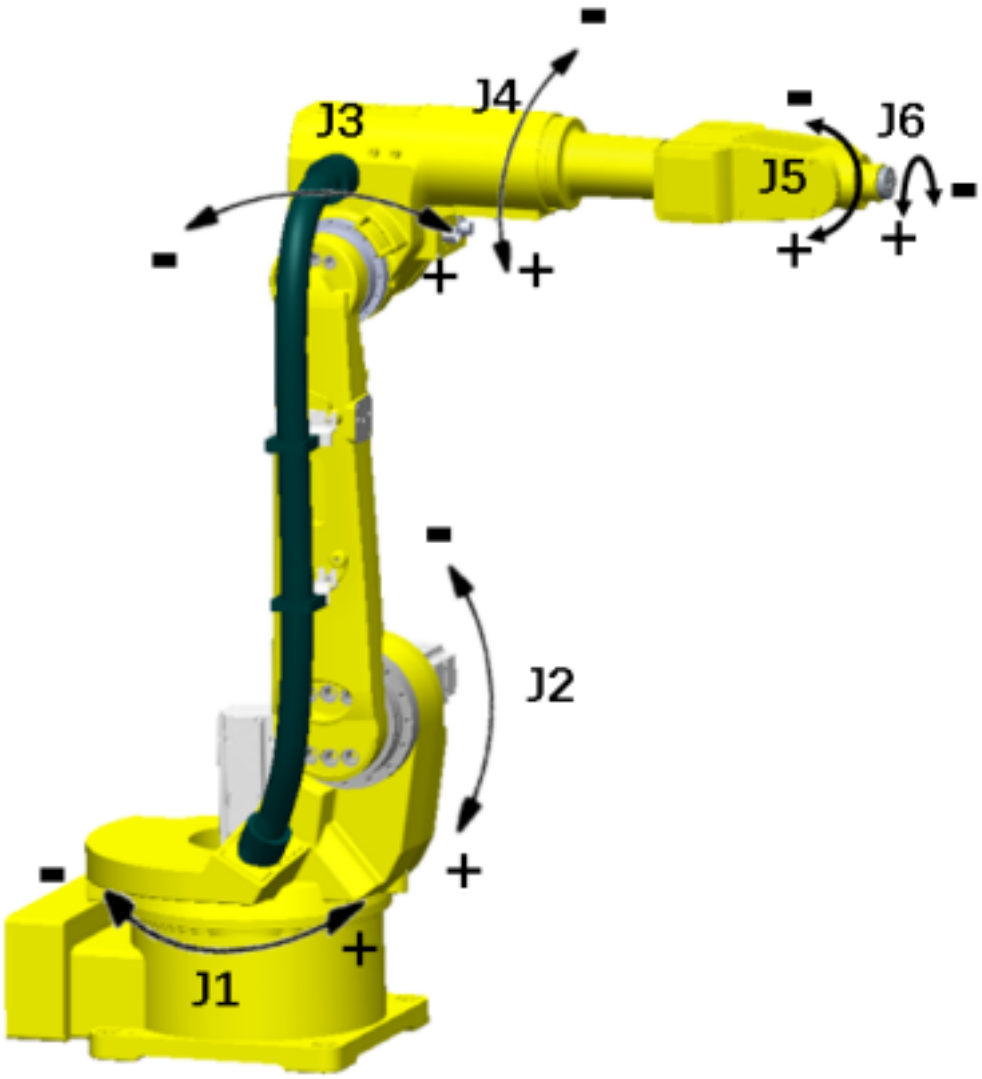


Figure 2.1 Joint Coordinate System Diagram

When the present coordinate system is set up to be joint coordinate system, the demonstrator will operate the Movement in positive and negative directions of the six axes of the robot after J1-J6 keys are pressed, the industrial robot will move in my direction.

If [Positioner] coordinate system is selected from the coordinate systems, press J1-J3 axes operation keys, and three external axes will act.

2.3 Rectangular Coordinate System

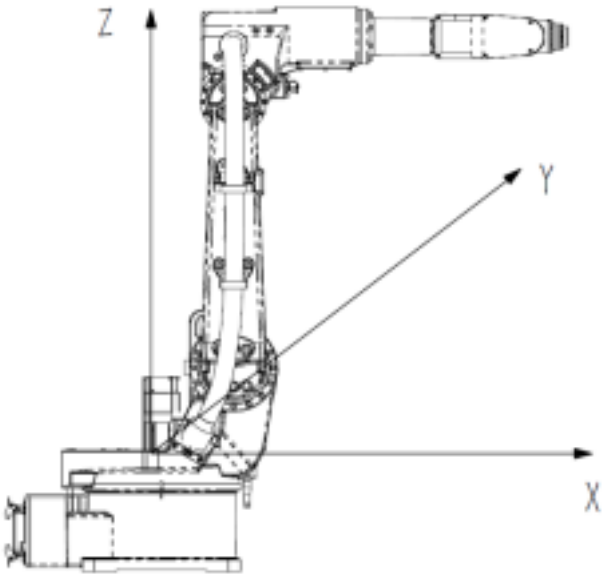


Figure 2.2 Rectangular Coordinate System Diagram

The origin of Rectangular Coordinate System is defined on the axial line of axis 1 of the robot, and it is the intersection point with axis 2 for translation in negative direction.

The direction in which there is a cable socket on the base of the robot is the rear part, and the small arm (axis 3) of the robot points at the front side. The regulations on the direction of rectangular coordinate system: X axis is directed forward; Z axis is directed upward, and Y axis is directed according to right-hand rule.

In the rectangular coordinate system, the Movement of robot indicates the Movement of robot control centre point. For the action of control centre point when axis operation key is pressed, please refer to the following table. J1-J6 are corresponding to X/Y/Z/RX/RY/RZ respectively.

2.4 Tool Coordinate System

2.4.1 Definition of Tool Coordinate System

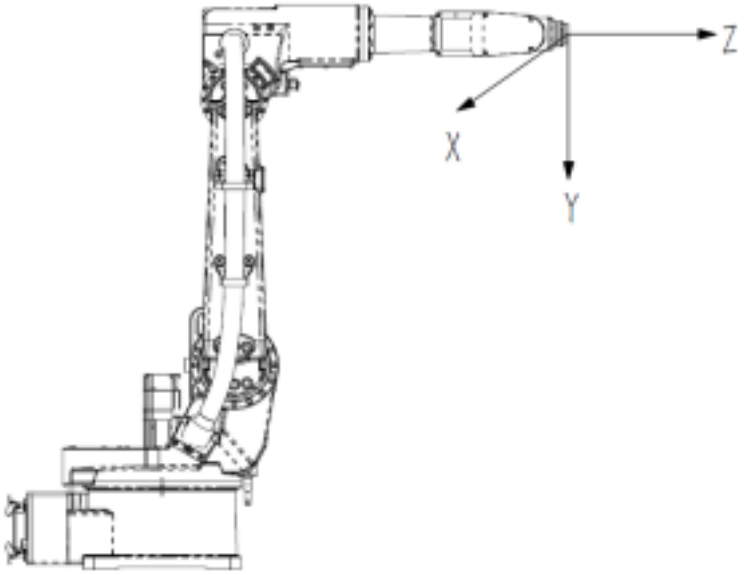
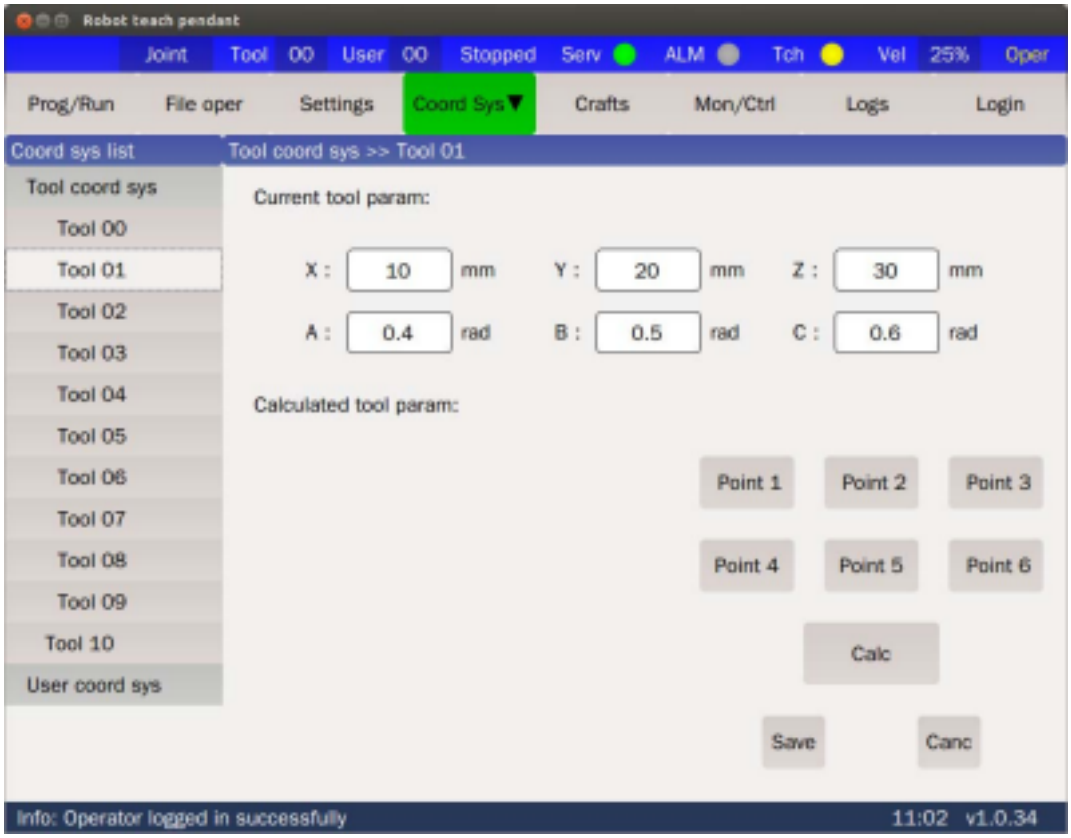


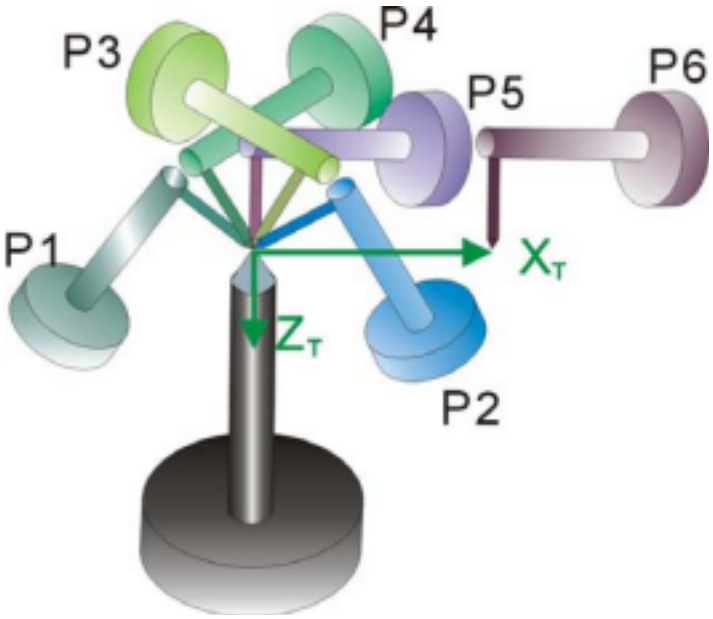
Figure 2.3 Tool Coordinate System Diagram

Coordinate system is defined on the tool, and defined by users. Generally, the effective direction of tool is defined as the Z axis direction of tool coordinate system, and the direction of X axis and Y axis is defined according to the right-hand rule.

2.4.2 Calibration of Tool Coordinate System



For tool verification, it is necessary to demonstrate 6 different gestures with control point as benchmark, calculate the size of the tool automatically according to the 6 data. After one point is determined, click corresponding “Record Point” button. The point determined is as shown below:



Description: As shown in the above figure, the change in the gestures of P1-P4 point shall be possibly big. At P5 point, the welding wire (the straight part at the tail end of welding gun) must be kept at a straight line with the gun calibrator. P6 point is used to determine the X direction of tool coordinate, namely the connecting line of P5 point and P6 is the X direction for visiting tool coordinate.

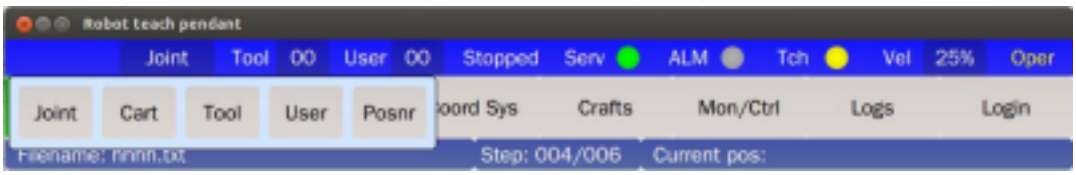
Note: For calibration of tool coordinate, the plane where the industrial robot is fixed must be on the same horizontal level with the plane where the gun calibrator is placed!

2.4.3 Selection of Tool Coordinate System Number

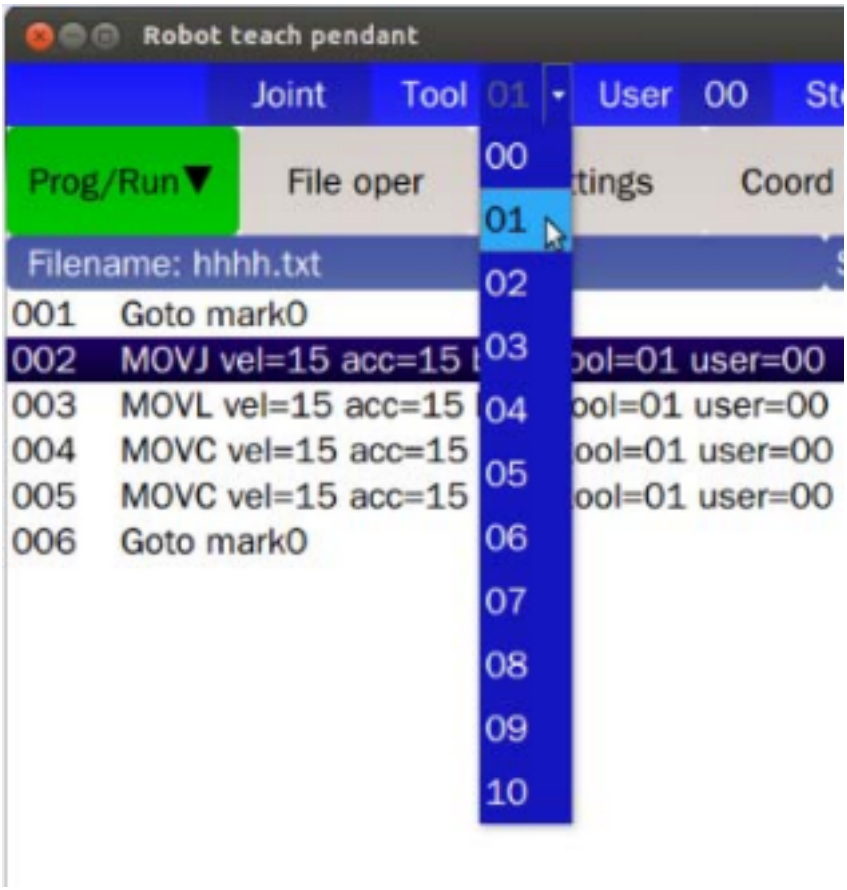
In Turin robot system, user may establish ten tool coordinate systems. The selection of tool coordinate system number is divided into the selection of tool coordinate system before axis-operated the Movement of robot (under manual/ demonstration model) and that in the program.

1. The selection of tool coordinate system before axis-operated Movement of robot

Firstly, select [Tool] coordinate system from coordinate systems.



Then, select the desired tool coordinate system number from the Selection of Tool Coordinate System.



The present tool coordinate system number is different, and after Axis Movement key is pressed, the direction of Movement will be different; the present tool coordinate system number is different, the location point information (gesture value) recorded by adding Movement command after the Movement of robot will be different.

Before the Movement of robot with tool coordinate system, select the tool coordinate system number used at present first. Newly demarcate and set up one tool coordinate system, and after Exit button is pressed, the present tool coordinate system number will be changed to the demarcated and set tool coordinate system number.

2. The selection of tool coordinate system number in the program

As for the Movement Command in the program, such as [Joint Movement] Command, it is available to specify the tool coordinate system number in the command parameters.

```
001   Goto mark0
002   MOVJ vel=15 acc=15 bl=0 tool=01 user=00
003   MOVL vel=15 acc=15 bl=0 tool=01 user=00
004   MOVC vel=15 acc=15 bl=0 tool=01 user=00
005   MOVC vel=15 acc=15 bl=0 tool=01 user=00
006   Goto mark0
```

3 Demonstration Programming

3.1 Preparation before Demonstration

Out of the consideration for safety, the following operations shall be executed firstly before demonstration:

- Select local key switch;
- Confirm whether Emergency Stop key could work normally;
- Be familiar with the demonstration programming interface;

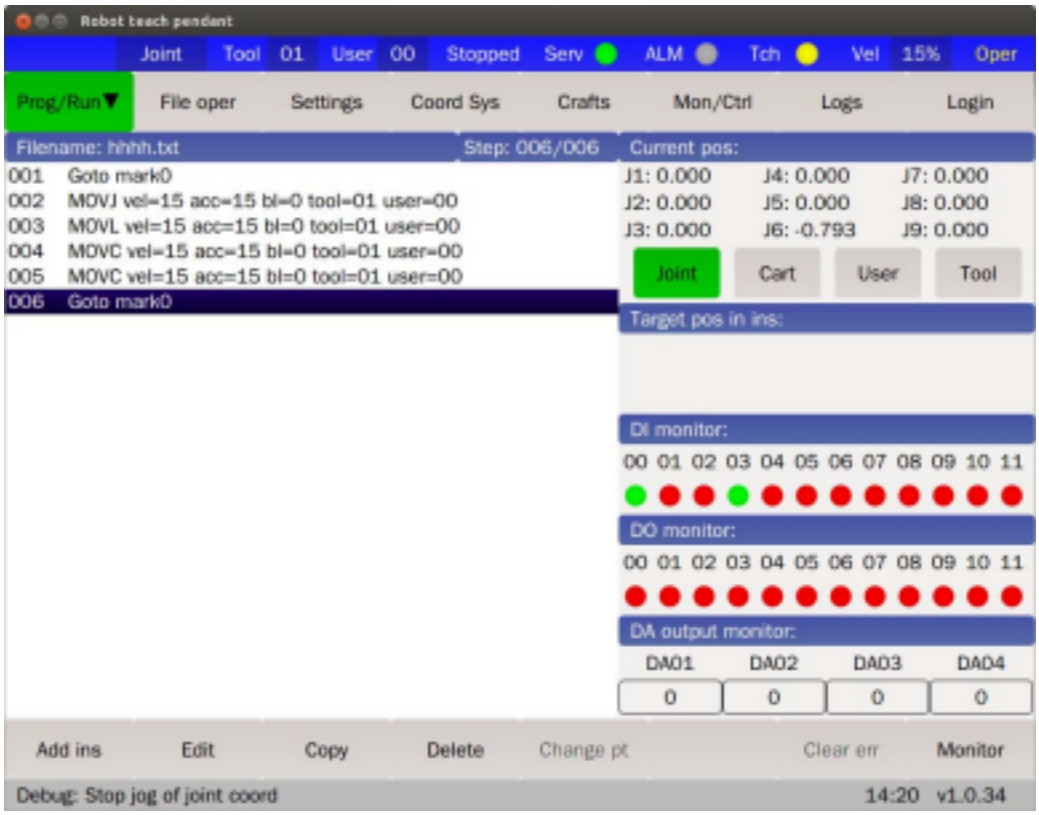
3.1.1 Selection of Local Key Switch

Select local key switch on the control cabinet to prevent the input of peripheral signals during operation process, since this will arouse mis-operation of the robot before the operator knows the situation.

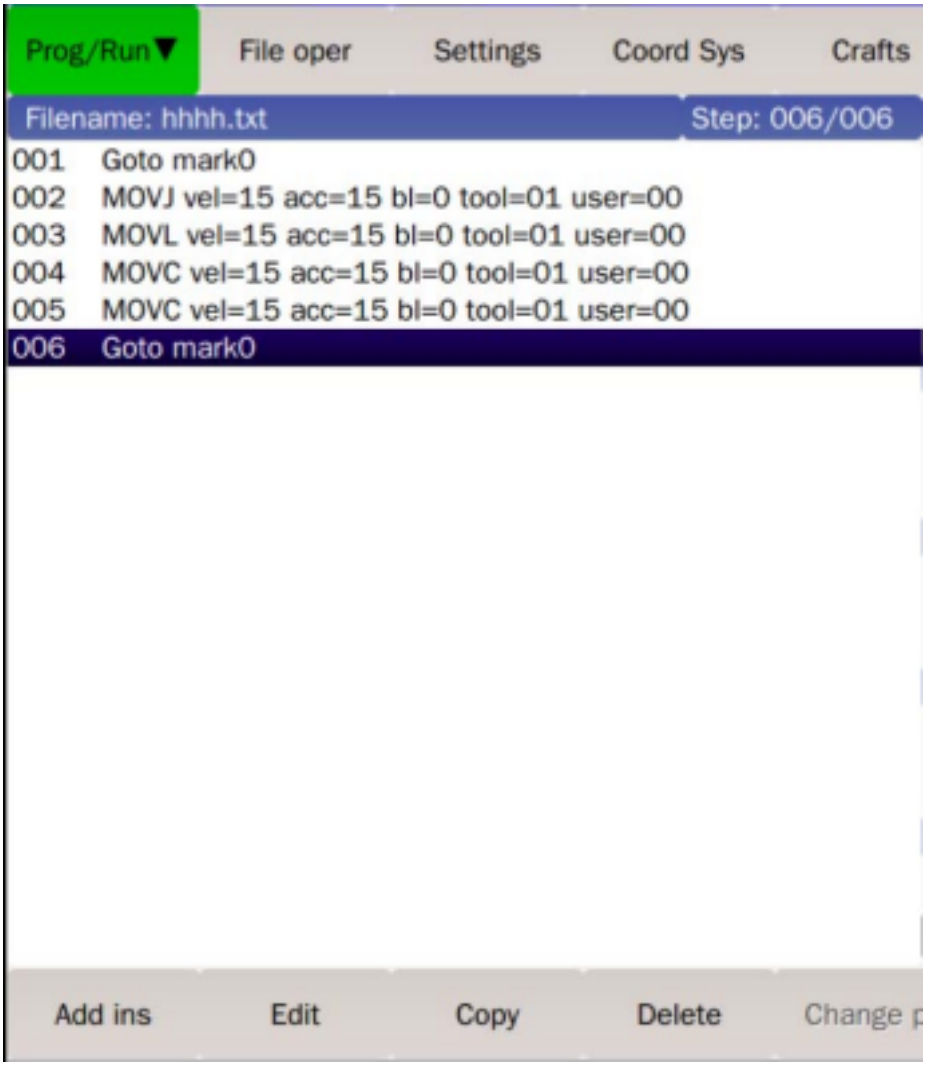
3.1.2 Confirmation of Emergency Stop Key

Emergency Stop is an important guarantee for the safety in the operation of the robot. If the servo driving unit is powered on, then after the Emergency Stop (of the control cabinet or demonstration box) is pressed, the servo driving unit shall be off the power immediately and the contact shall be disconnected, and everything shall be normal after the power is supplied once again.

3.1.3 Demonstration Programming Interface



3.1.4 Composition of Programming Area



Click the [Program and Operation] of the menu to display the contents of the program compilation area, which consists of four parts:

- File name

  The name of the program opened currently is displayed at the top left side of the Program Edit area.

- Currently operated step number

  The number of the step executed at present is displayed at the top right side of the Program Edit area.

- Step number

  Program Step number is displayed at the very front side of every row of programs. The command steps of programs are counted automatically. If a command is inserted or deleted, the step number will be arranged over again.

- Command

Command: It indicates the function realized by the present row of robots. If the command is [Arc Movement], the robot of this row will realize Arc Movement Function.

Operators may change the numerical value upon demand. It is generally the speed and time, relying on the type of command. According to the meaning of parameters, input the desired suitable digital data or text data.

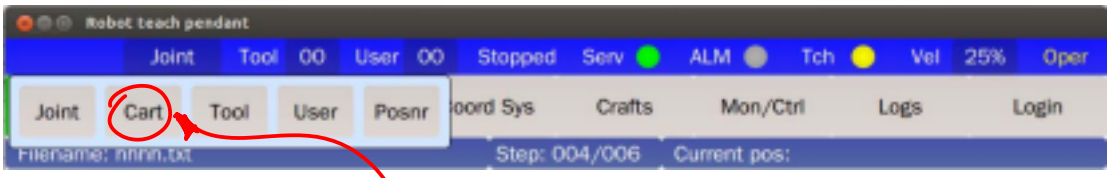
3.2 Manual Movement of Robot

If the key switch for the manual/ automatic switching of control cabinet is at "Manual" position, then anytime when the "Enable" switch at the lateral side of the demonstrator is pressed to enable the driver, it will be available to operate the industrial robot manually to the desired location.

For manual operation of industrial robot, it will be necessary to select the coordinate system (internal axis and external axis) and set up manual speed at first.

3.2.1 Selection of Coordinate System

The default Movement coordinate of the robot is joint coordinate.

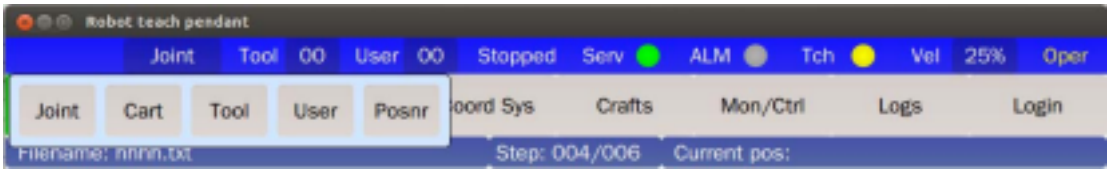


Select the Selection of Coordinate System in the Tool column at the top right corner of the touch screen. There are "Joint", "Rectangular", "Tool", "User" and "Positioner" (External Axis) Coordinate Systems for selection. It is available to switch the robot coordinate system to corresponding coordinate system.

Note: It is necessary to execute operation under corresponding coordinate system.

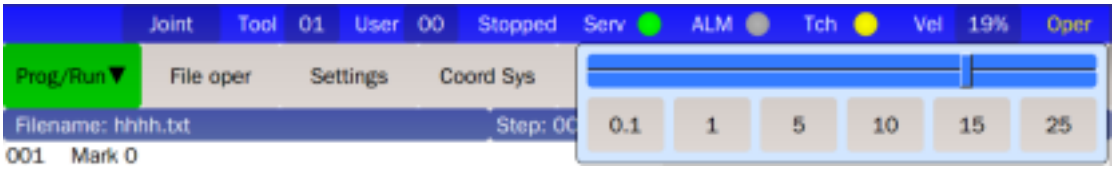
3.2.2 Selection of Tools and User Coordinate System Number

In Tool column, it is available to select tool and user coordinate system number.



3.2.3 Selection of Manual Speed

The maximum speed under the manual operation of the robot is 25% of the rated speed.



Click the “Speed” at the top right corner of the touch screen to manually set up the robot’s Movement speed of manual demonstration.

3.2.4 Manual Operation of Robot

Hold the demonstrator with the left hand and press [Enable Switch], and operate corresponding axis Movement with the right hand.

3.3 Movement Command

Generally, Movement command records location data, Movement type and Movement speed.

Location data record the current location information of the robot, and when recording Movement command, they record the location information.

Movement type indicates the Movement track between demonstration points during execution. The robot generally supports 3 types of Movement, namely Joint Movement (MOVJ), Linear Movement (MOVL) and Arc Movement (MOVC).

Movement speed indicates the speed at which the robot executes the movement between demonstration points.

For adding movement command, it is necessary to press “Enable” switch to enable the drive

unit.

Note: Unless for special demand, it is necessary to set up the same percent value for acceleration as that for the speed.

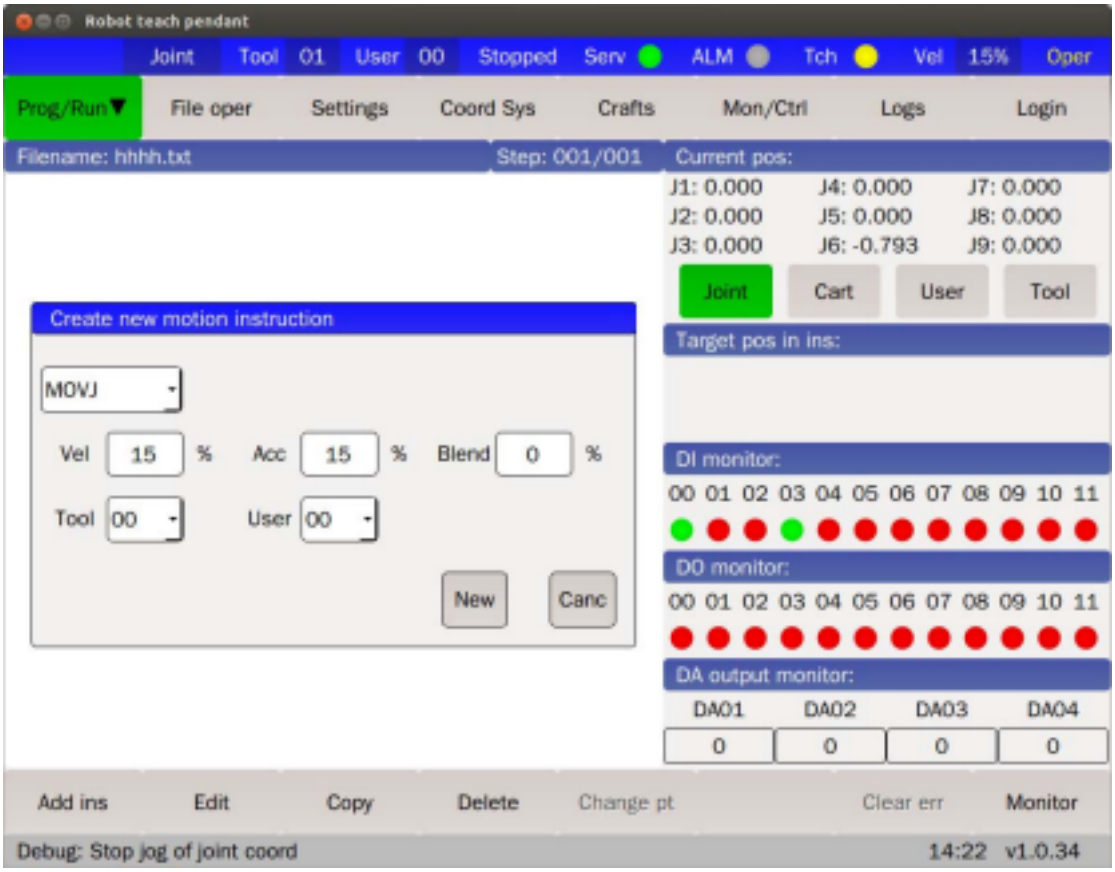
3.3.1 Types of Joint Movement

If it is unnecessary for the robot to move to the present demonstration point according to specified path, joint movement shall be adopted. The movement command corresponding to joint movement is [Joint Movement] (English command: MOVJ). Generally, for the sake of safety, joint movement shall be used at the starting point of the program.

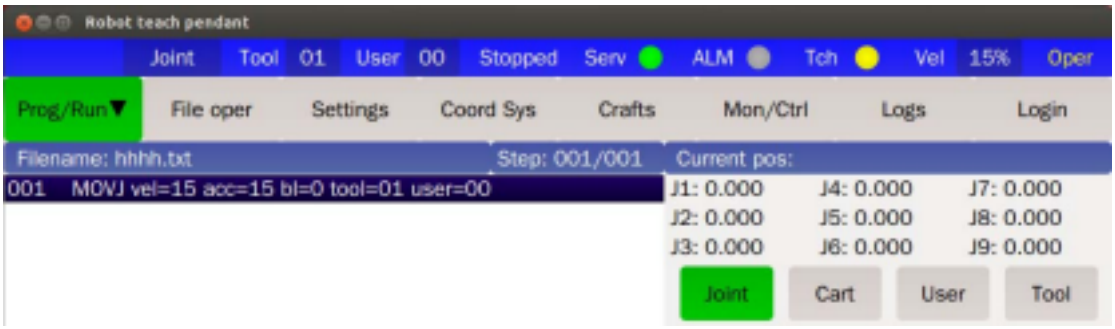
Joint movement is featured by the quickest speed and unknown path. Therefore, such type of movement is generally applied to spatial points, and before automatic operation of program, it is necessary to carry out low-speed examination and observe whether the actual movement track of the robot is subject to the inference of peripheral equipment.

The operation for adding [Joint Movement] Command is as shown below:

Click the [Add Command] ->[Movement Command] ->[Joint Movement], input relevant parameters like speed, acceleration, smoothness and tool, and user coordinate, etc., and then click the [New] button.

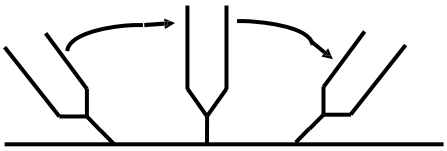


The command established is as shown below. The present demonstration location becomes the ending point of joint movement.



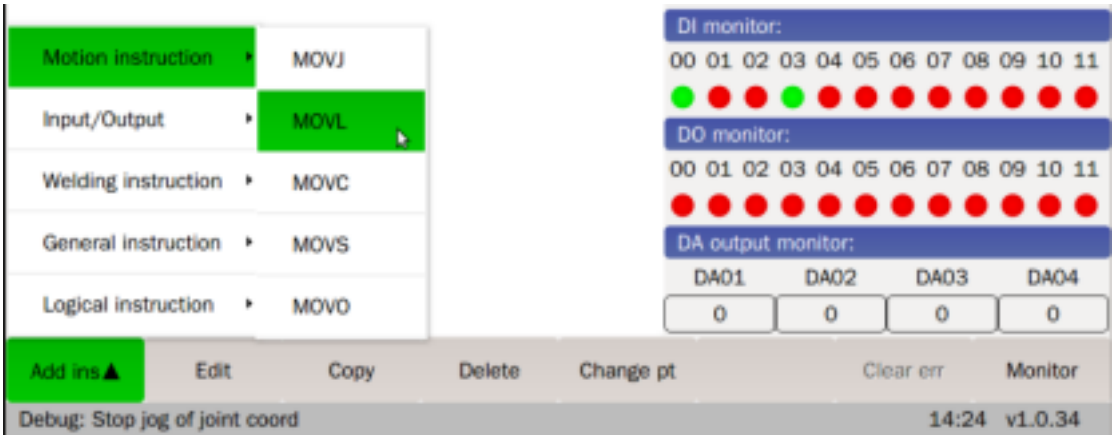
3.3.2 Types of Linear Movement

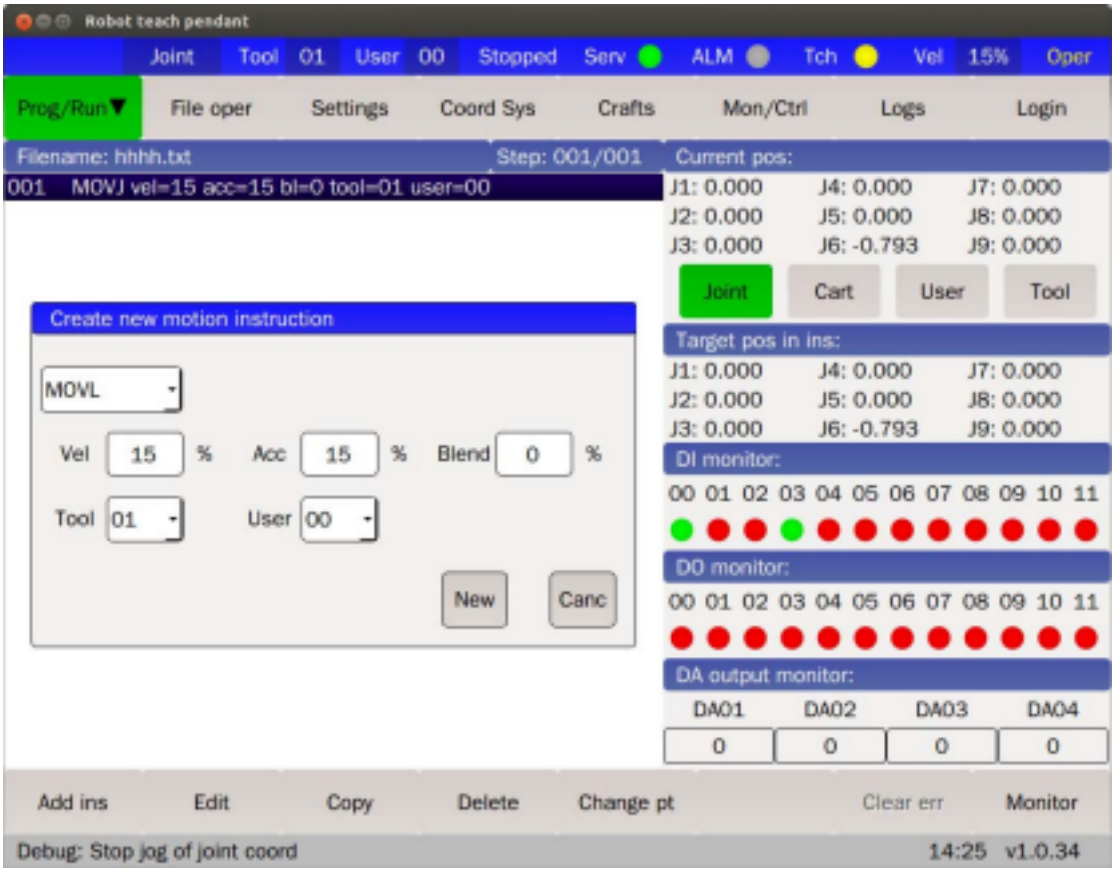
If the robot needs to move to the present demonstration point through linear path, then linear movement shall be adopted. The Movement Command corresponding to linear movement is [Linear Movement] (English command is MOVL). The starting point of linear movement is the demonstration point of the previous movement command, and its ending point is the demonstration point of the present command. For linear movement, during the movement, the robot's movement control point shall follow straight line, and the gesture of fixture shall be changed as follows automatically:



The operation of adding [Linear Movement] Command is as shown below.

The ending point of the previous Movement Command is the ending point of linear movement. Move the robot to the ending point of linear movement manually, click the [Add Command] ->[Movement Command] ->[Linear Movement], input relevant parameters such as speed, acceleration, smoothness and tool, user coordinate, etc., and then click the [New] button.





The command established is as shown below. The present demonstration location becomes the ending point of Linear Movement.

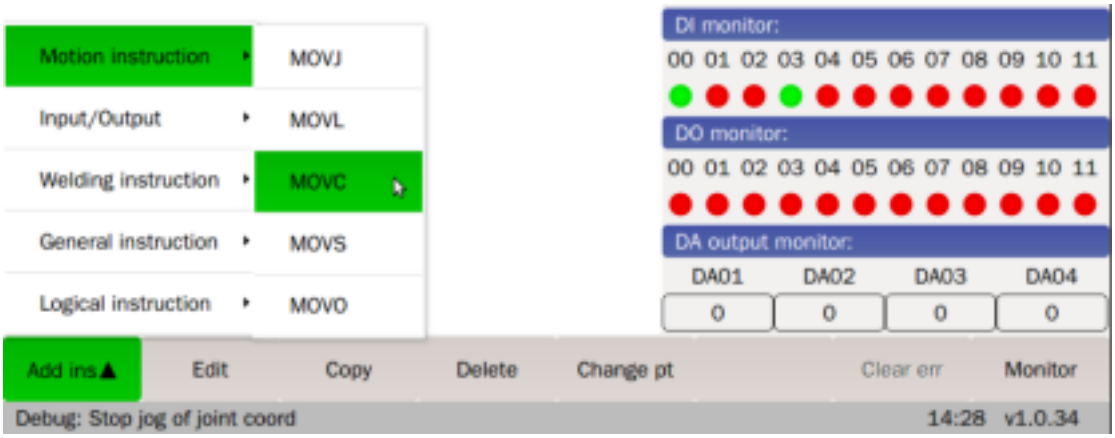
3.3.3 Types of Arc Movement

If the robot needs to move to the present demonstration point through arc path, arc movement shall be adopted. The Movement Command corresponding to the arc movement is [Arc Movement] (English command is MOVC).

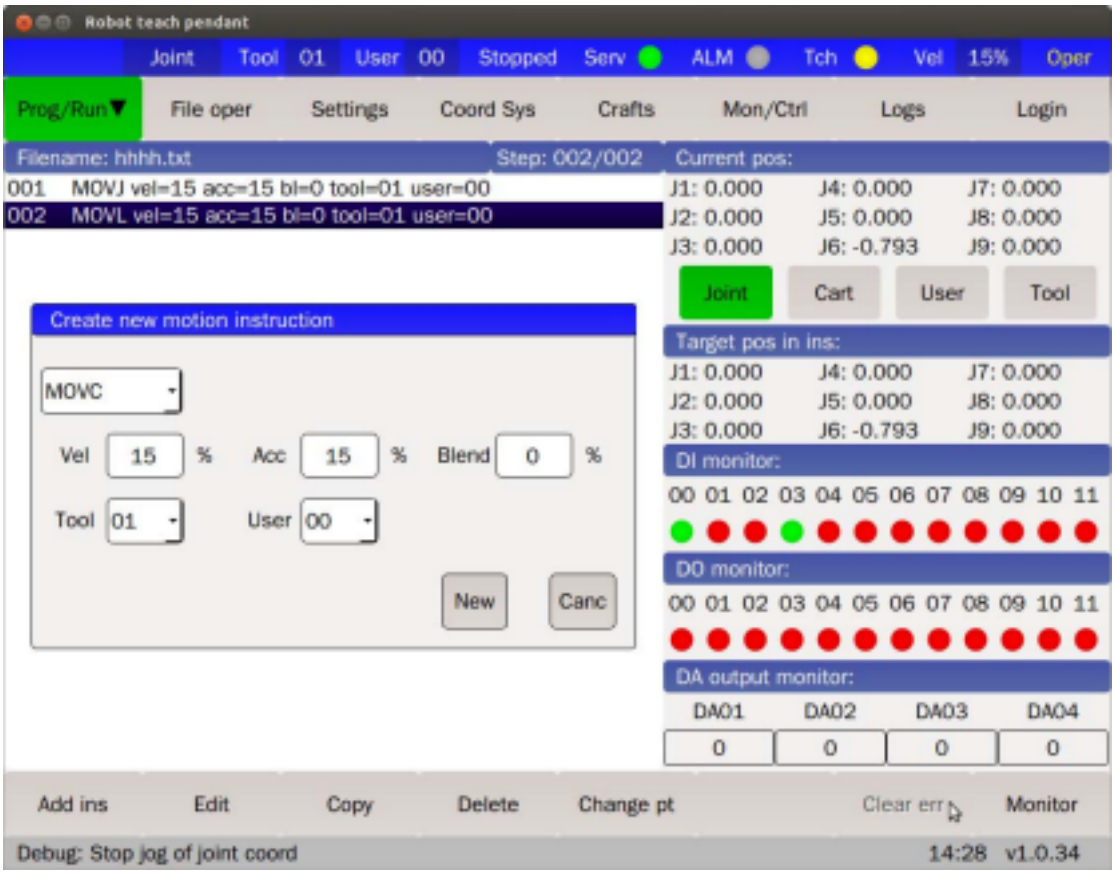
Three points determine a unique arc, so three movement points are needed for arc movement. Arc movement is followed to start from the present point, pass by the first point (auxiliary point) and reach the second point (ending point). Two commands are needed.

The operation of adding [Arc Movement] command is as shown below.

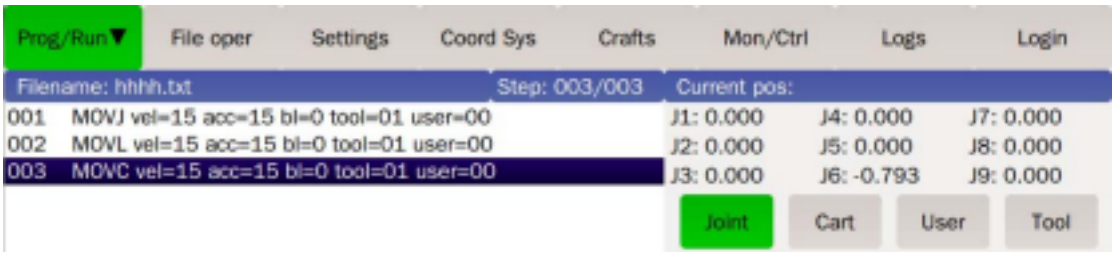
The ending point of the previous Movement Command is the starting point of arc movement. Move the robot to the auxiliary point of arc movement manually, click the [Add Command] ->[Movement Command] ->[Arc Movement], input relevant parameters such as speed, acceleration, smoothness and tool, and user coordinates, etc., and then click the [New] button.



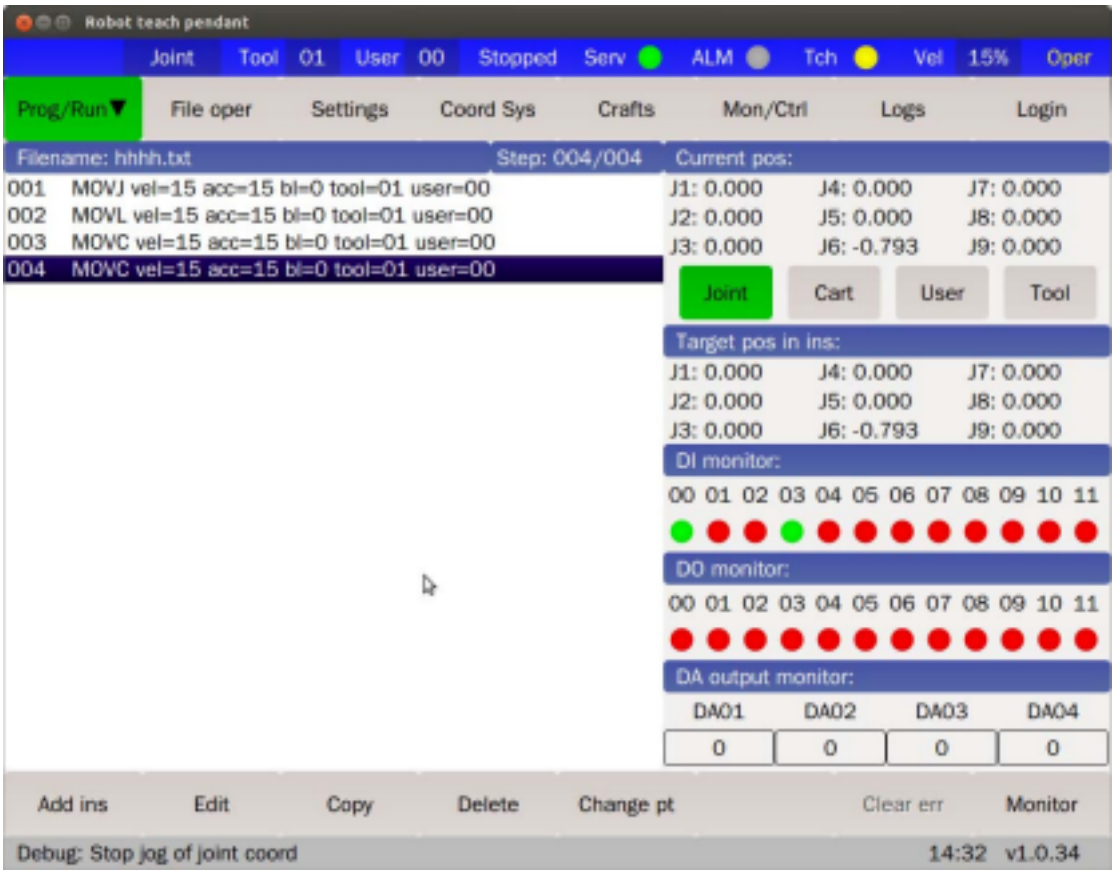
Set up parameters in the window bounced out and click New.



After establishment, as shown below: The command moved to the auxiliary point is over, as shown below:

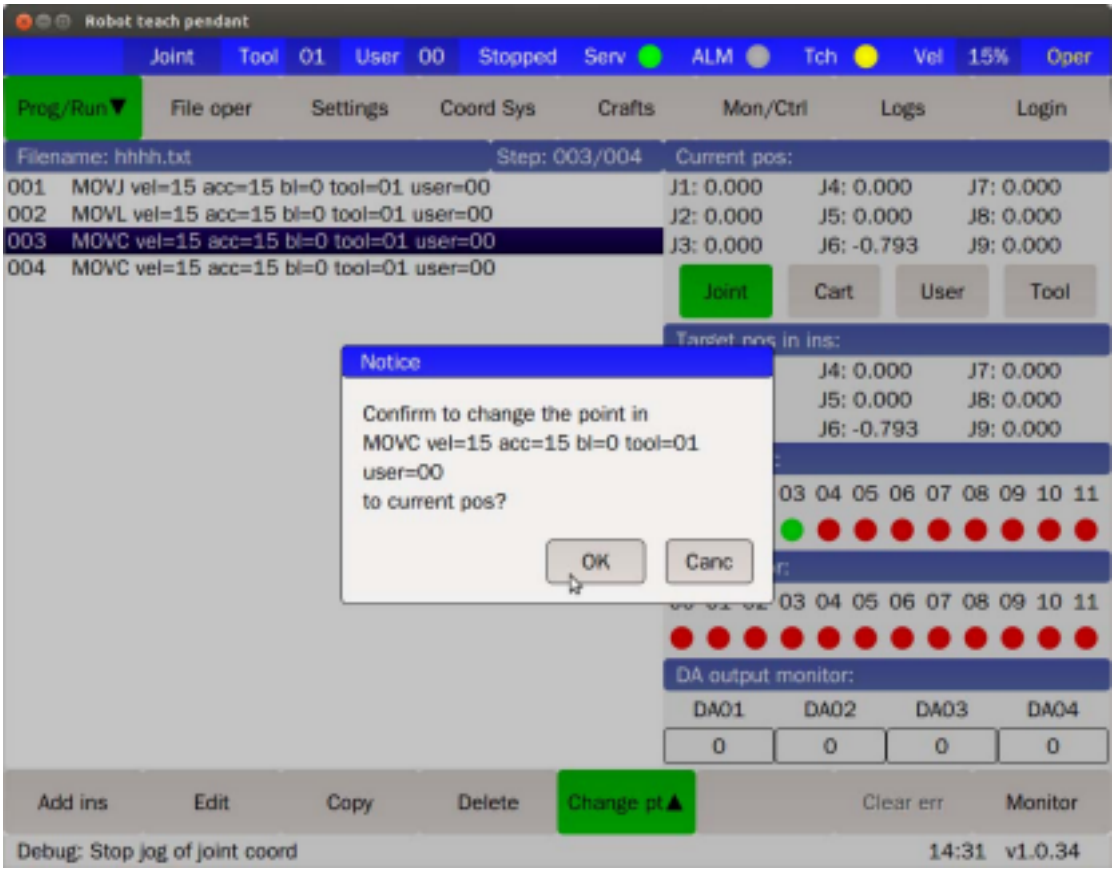


Move the machine continuously to the ending point of the arc, click the [Add Command] -> [Movement Command] ->[Arc Movement], set up parameters and execute New successfully, as shown below. In this way, a complete arc movement track consisting of two [Arc Movement] Commands is established.



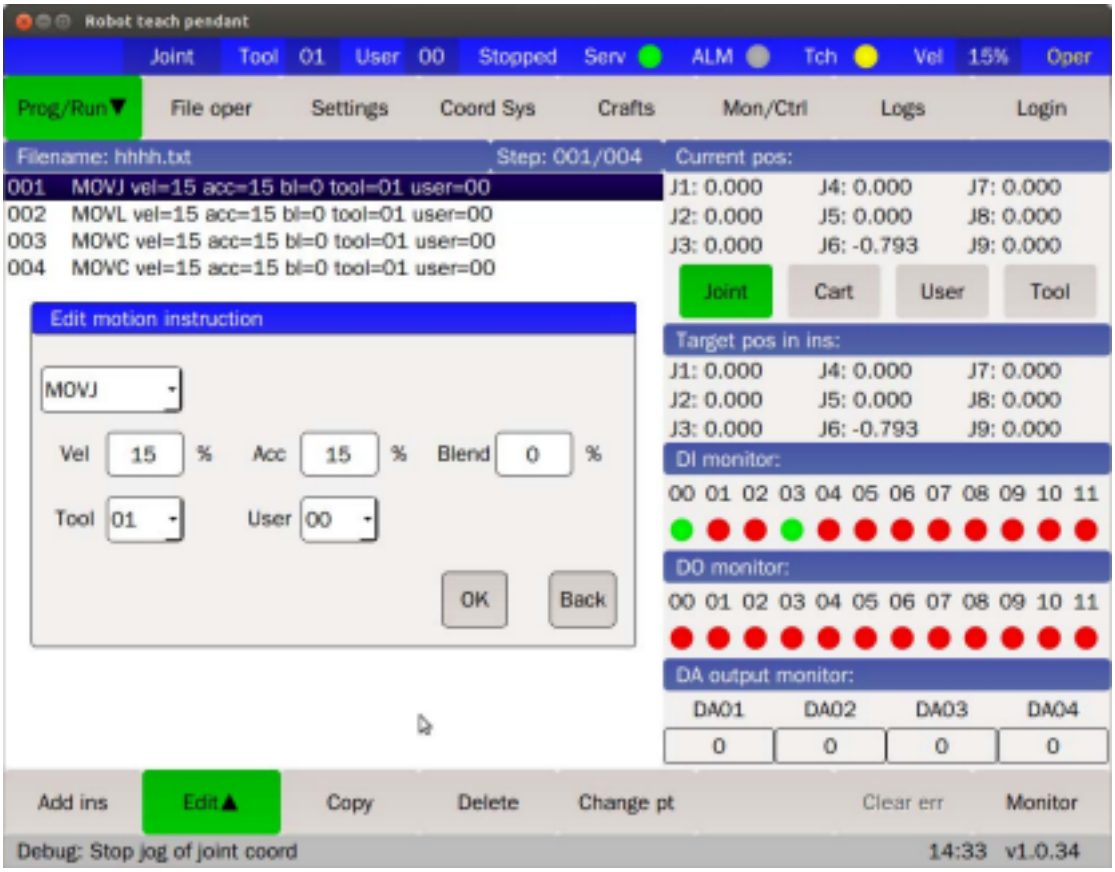
3.3.4 Modification of Movement Position

To record the location of robot, the present location of the robot shall be recorded in the Movement Command. If it is necessary to modify the location in the command, just move the robot to the desired location manually, and record the operation process of the Movement Command repeatedly. For the transition of from command record to operation, press [Change of Point Location] and [OK].



3.3.5 Modification of Movement Speed

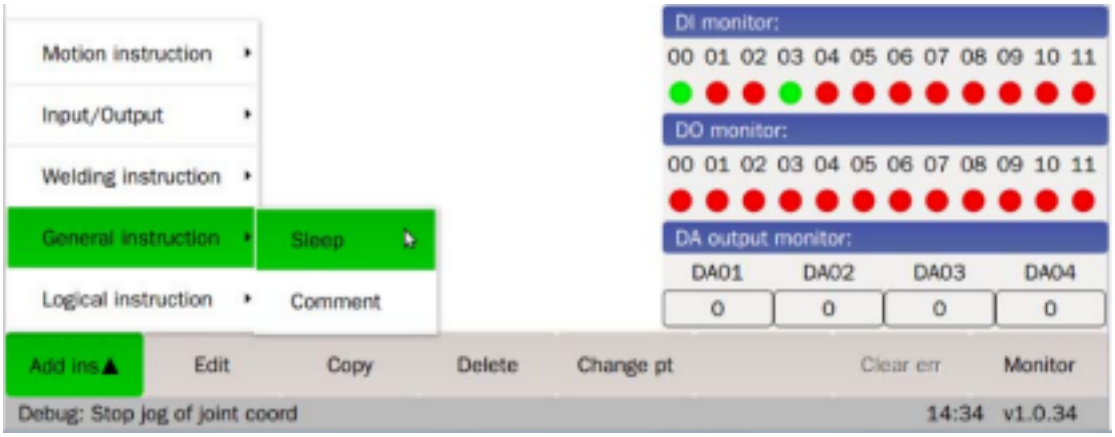
Select the command to be modified, press [Edit], and amend the movement speed in the window bounced out.



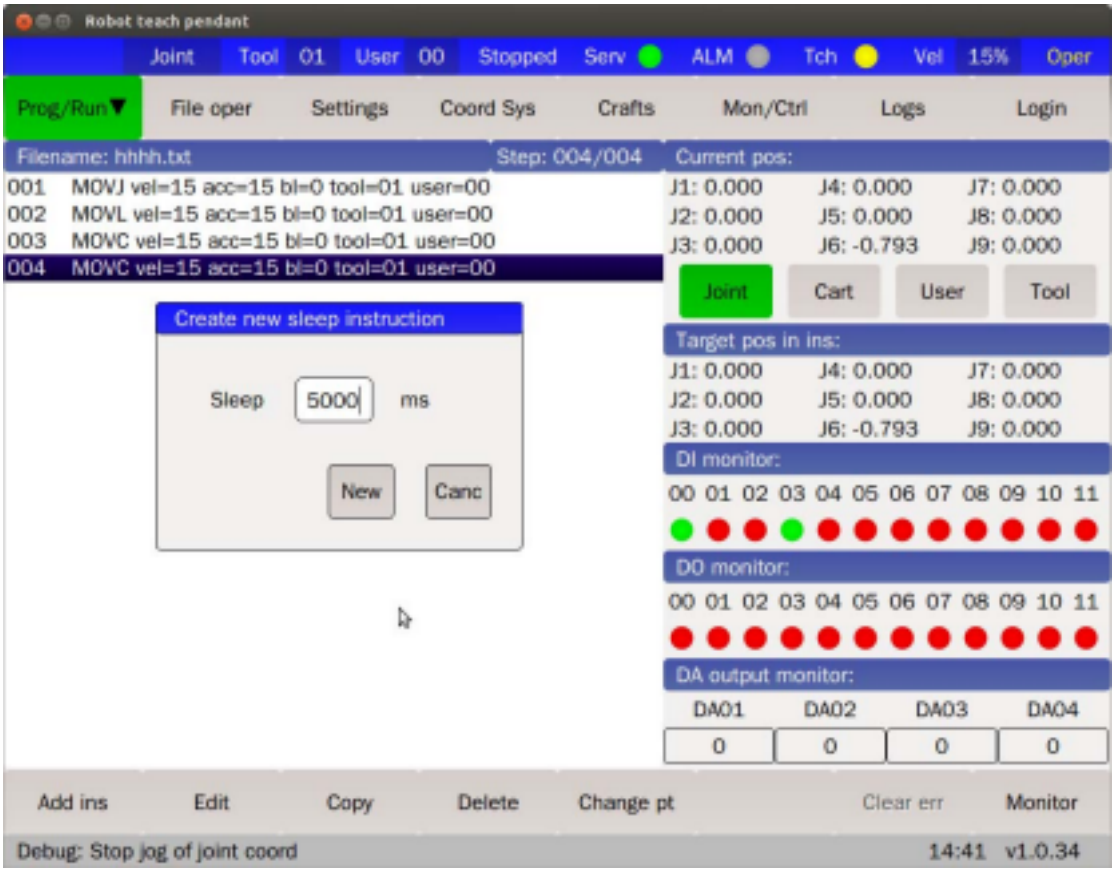
3.4 General Command Operation

3.4.1 Adding of One Command

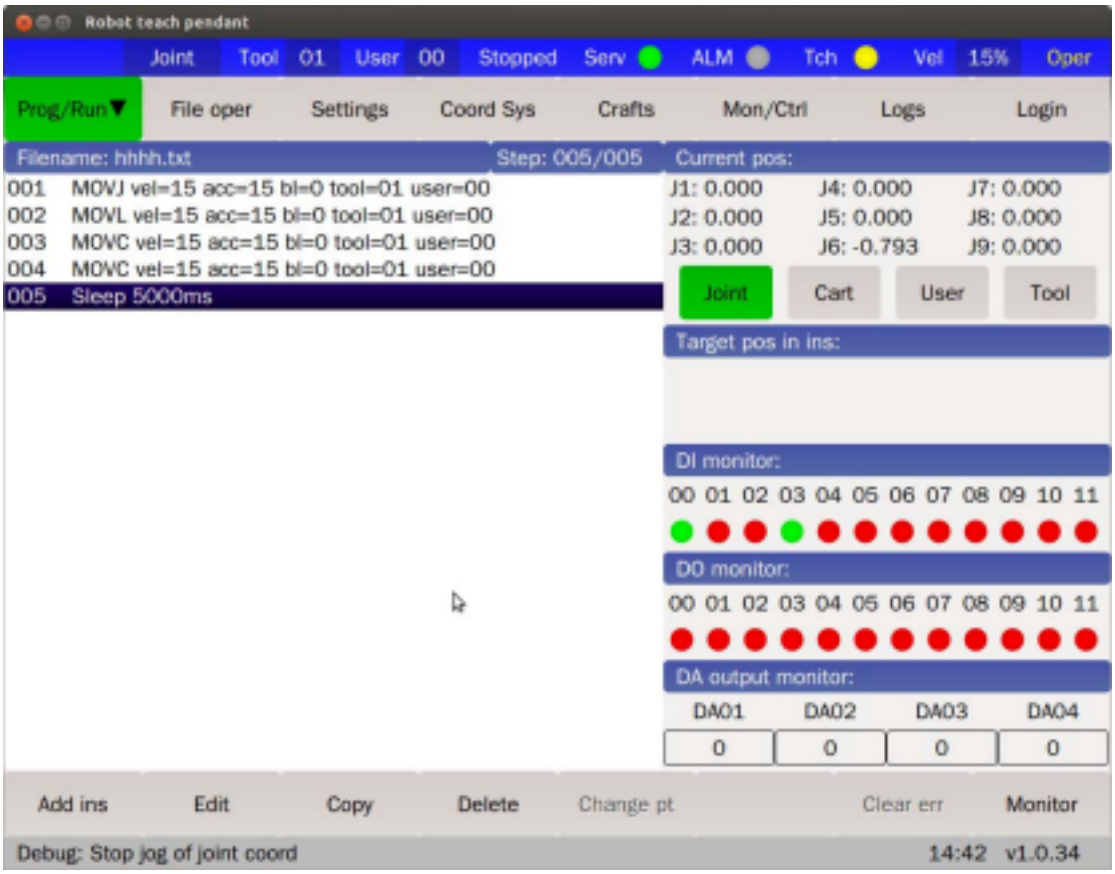
With the “Time Delay” Command as an example.
Click the [Add Command], [Regular Command] and [Time Delay].



Input the numerical value and click the [New] in the window bounced out.

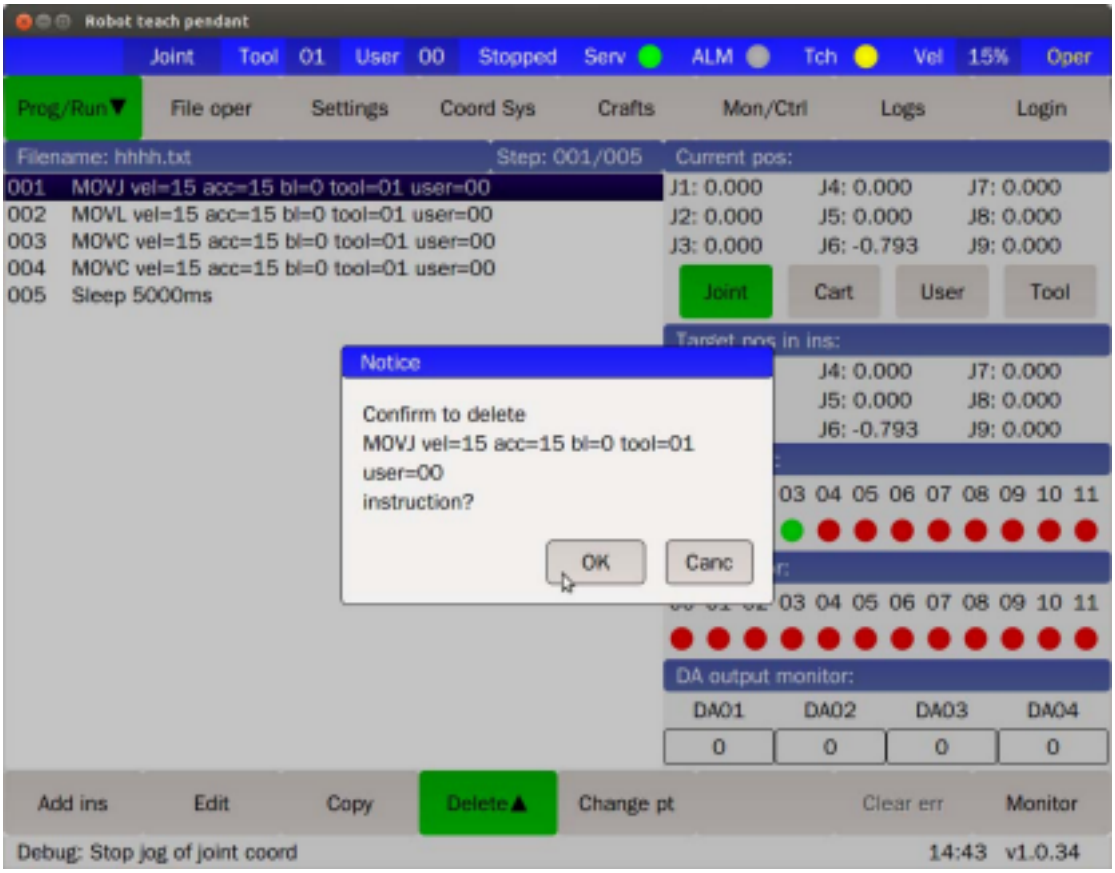


After completion, it is as shown below.



3.4.2 Deletion of Command

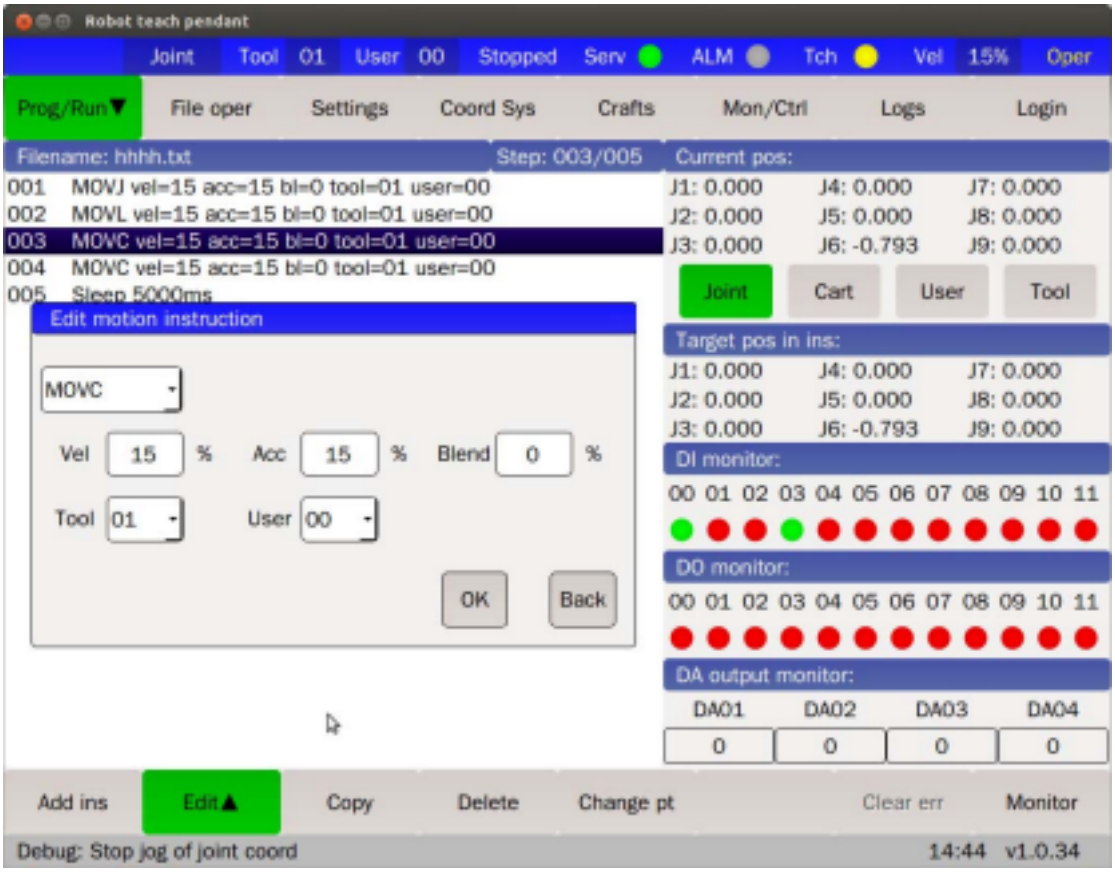
Command , Select the command to be deleted, and click the [Delete] and [OK].



3.4.3 Modification of Command

For modification of command, it is only available to modify the parameters in the command of the row where the cursor is, and it is not available to modify the command of this row into other command; if it is necessary to modify such command into other command, just delete such command of this row first, and then insert new command. The following will introduce how to modify command parameter.

Select the command to be modified, click [Edit], and modify the parameters therein in the window bounced out.



3.5 Program File Management

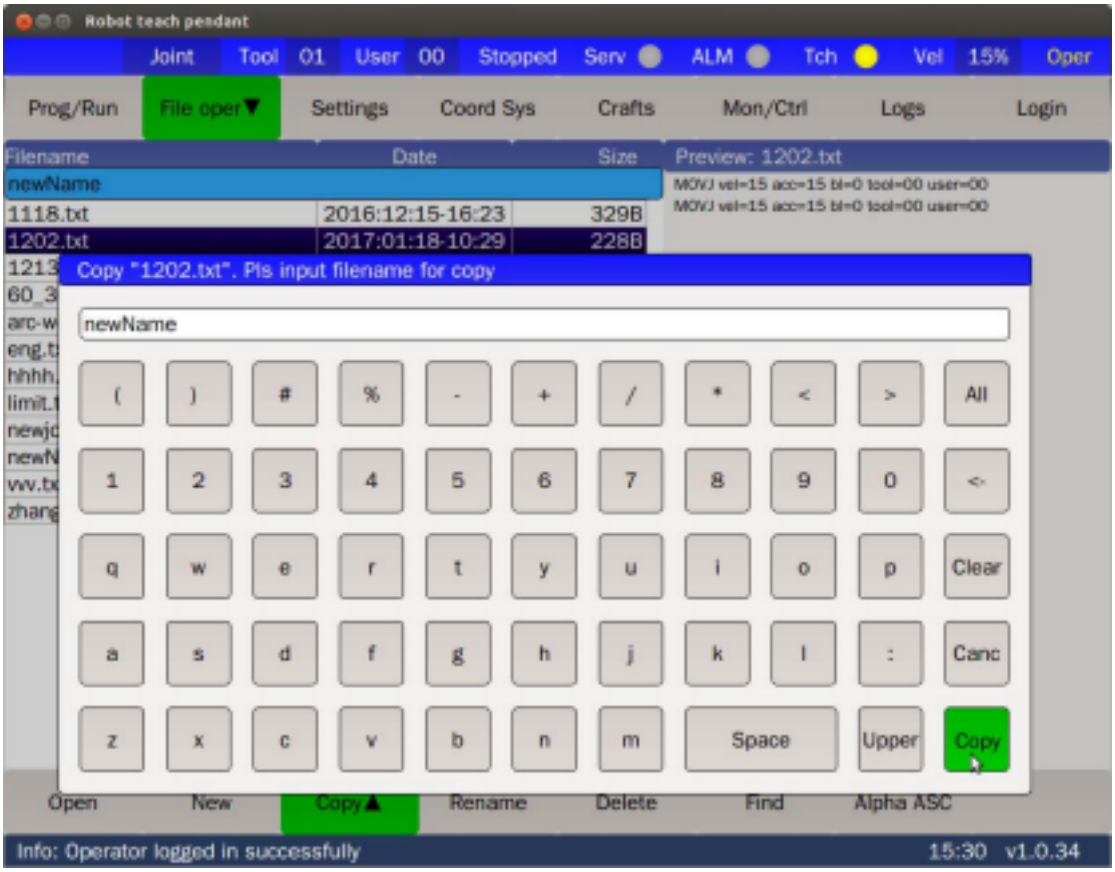
The result of demonstration exits in the form of program, the program consists of command, and command includes not only movement command, but also control command and IO command, etc. The program consisting of different commands could complete many functions including robot's actions. Program is also called as operation.

It's unavailable to establish many testing programs during debugging process, but the storage capacity in the robot controller is limited, and operator needs to often manage the existing programs. Program files may be operated under the menu [File Operation], including the operations such as [Open], [New], [Copy], [Rename], [Delete], [Search], [Sequence].

1. Open Program

The method for the selection of foreground job (demonstration job) and background job (program) are the same, only that the location of menu is different. The menu location and operation of the selection of foreground job:

Select the file to be opened, and click the [Open] button at the lower right corner.

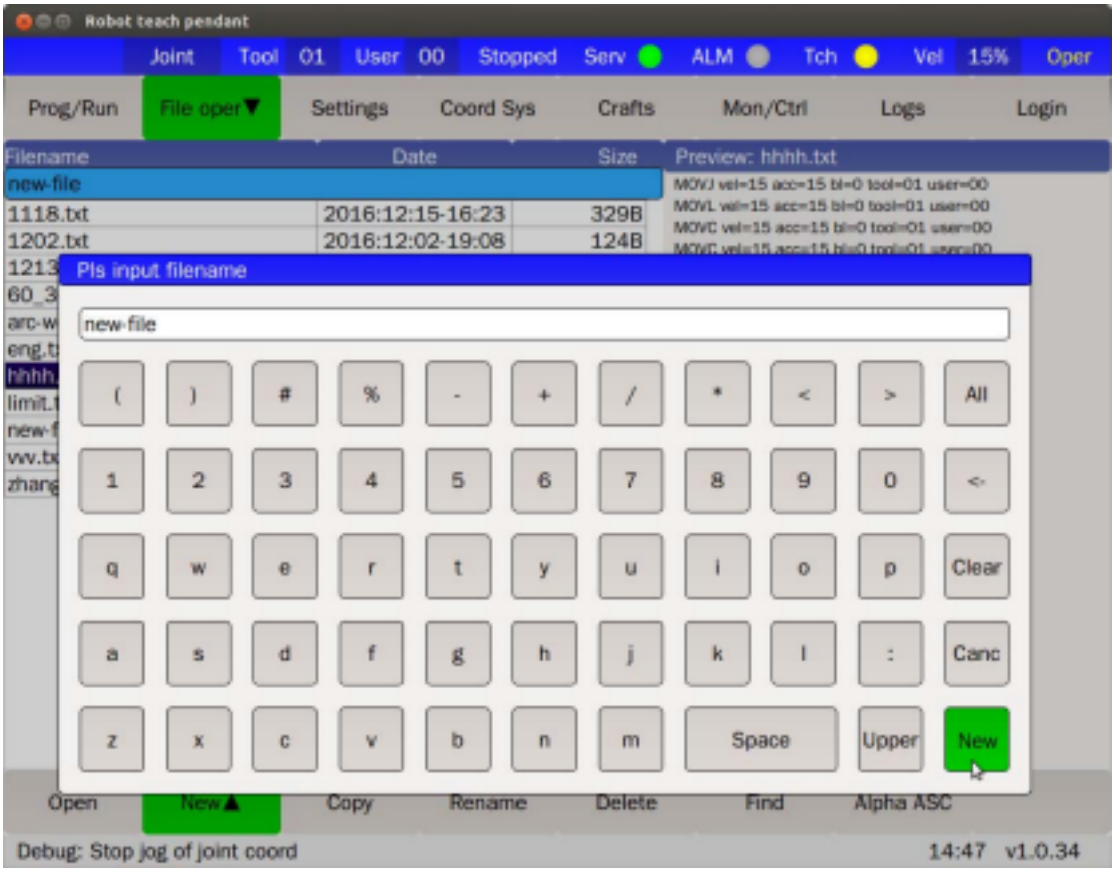


2. New Program

The method for newly establishing the foreground job (demonstration job) and background job (program) are the same, only that the location of menu is different. The job name supports upper-case letters and figures.

Newly establish the menu location and operation of the foreground job:

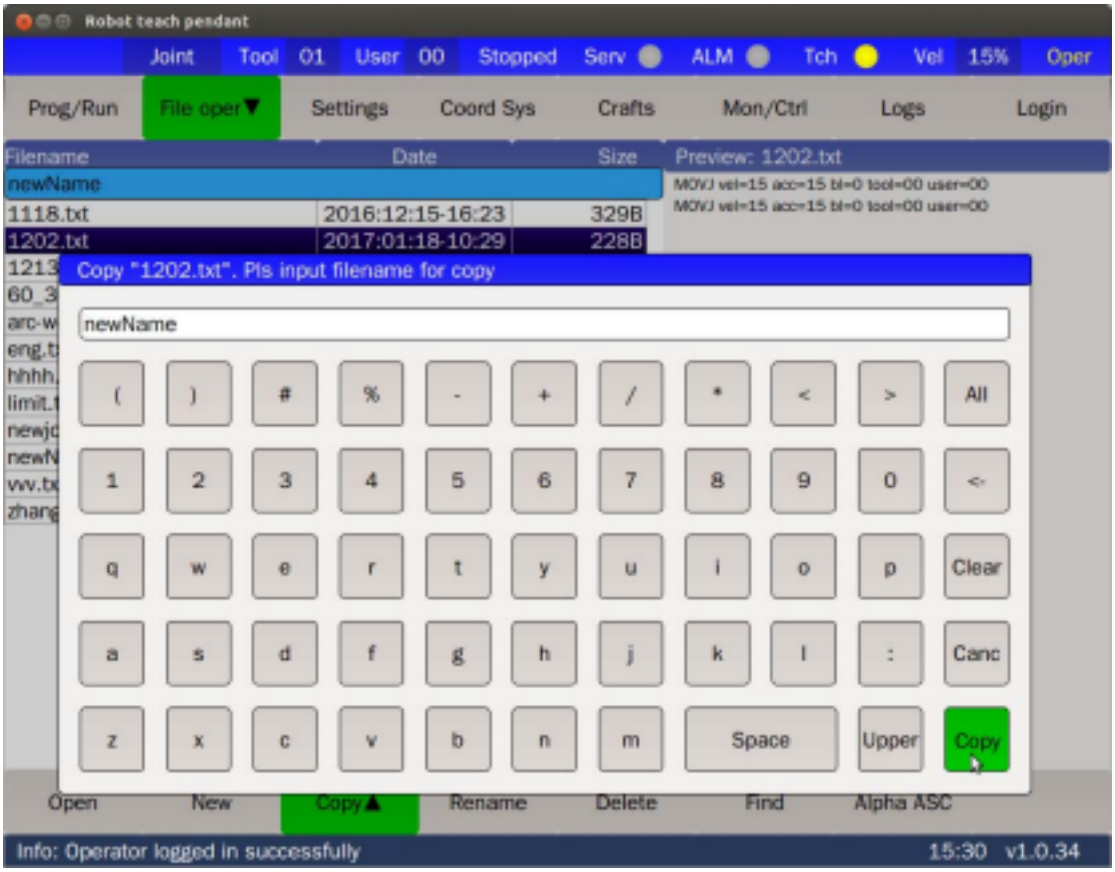
Click [File Operation] in the page selection area, click [New], and input file name in the window bounced out.



3. Copy Program

Select the initial row of the program to be copied, for example, reproduce the third row to after the sixth row.

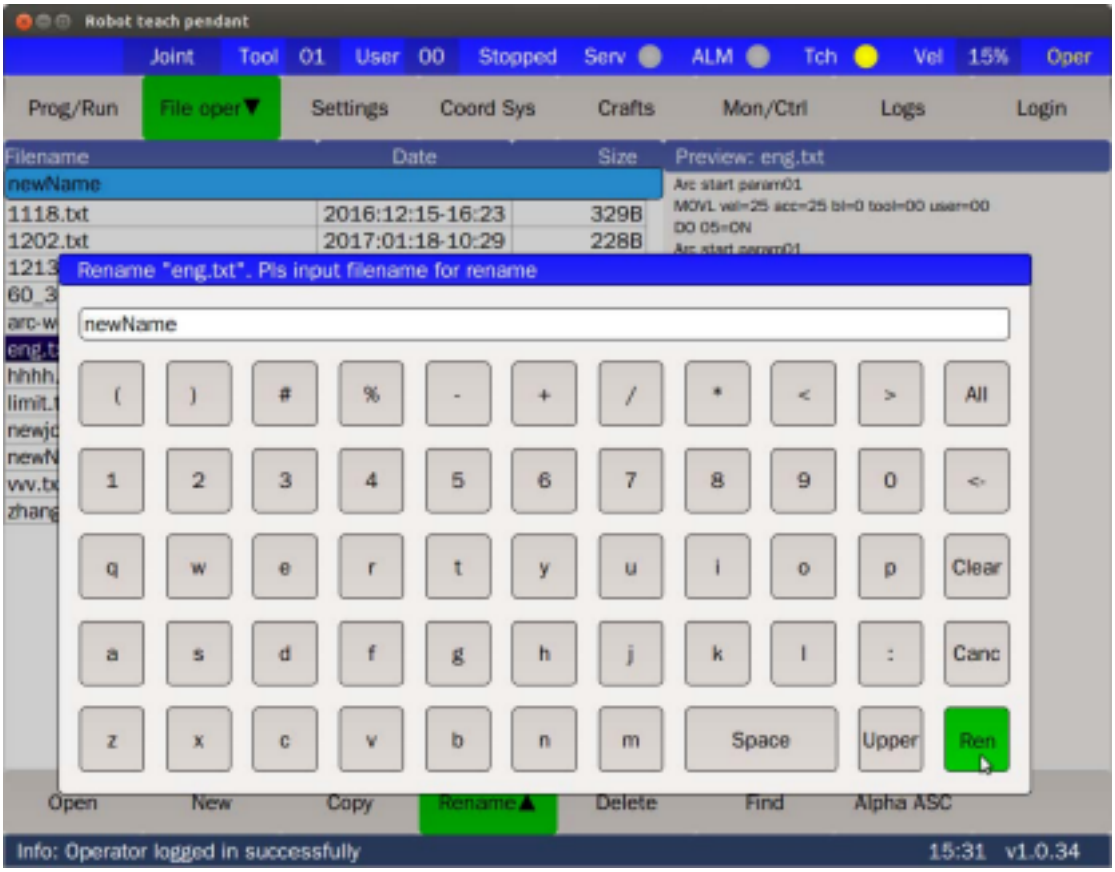
As shown below:



4. Rename Program

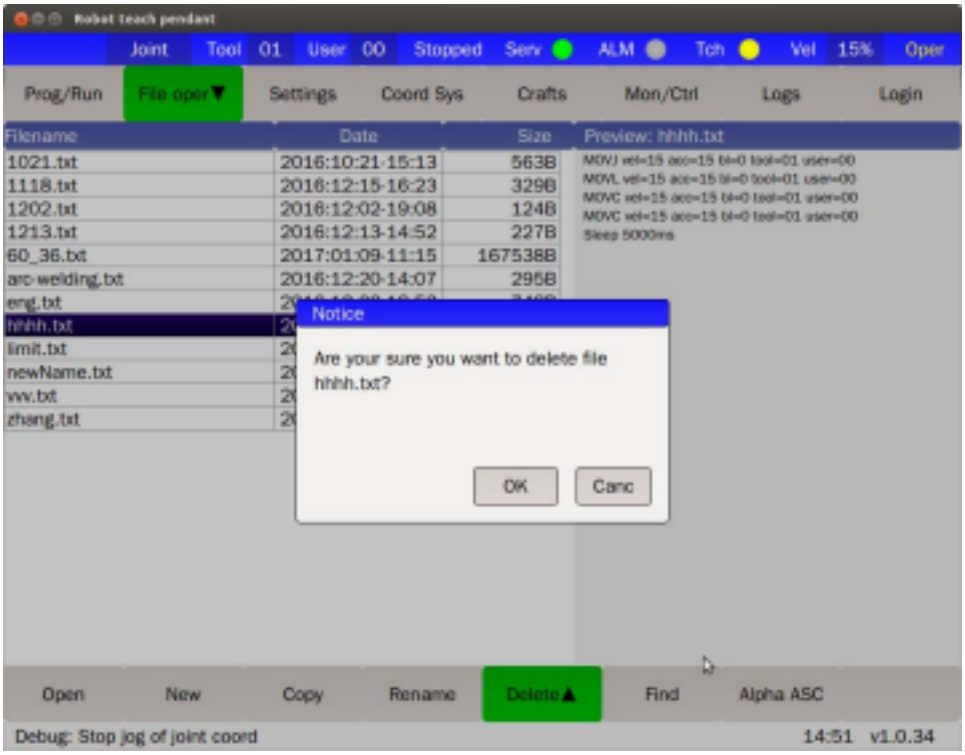
Select a file, click [Rename], modify the name, and then click [Rename].

As shown below:



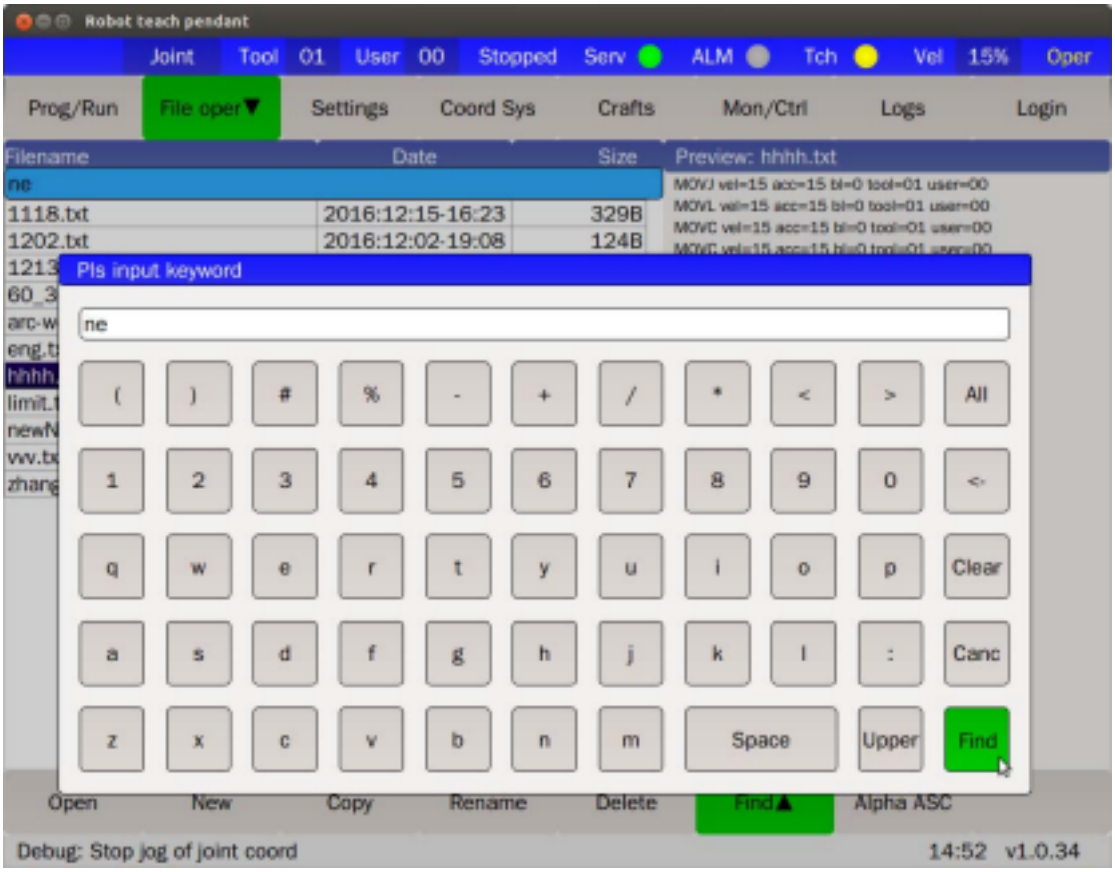
5. Delete Program

Select the program to be deleted, and click [Delete] and [OK]. As shown below:

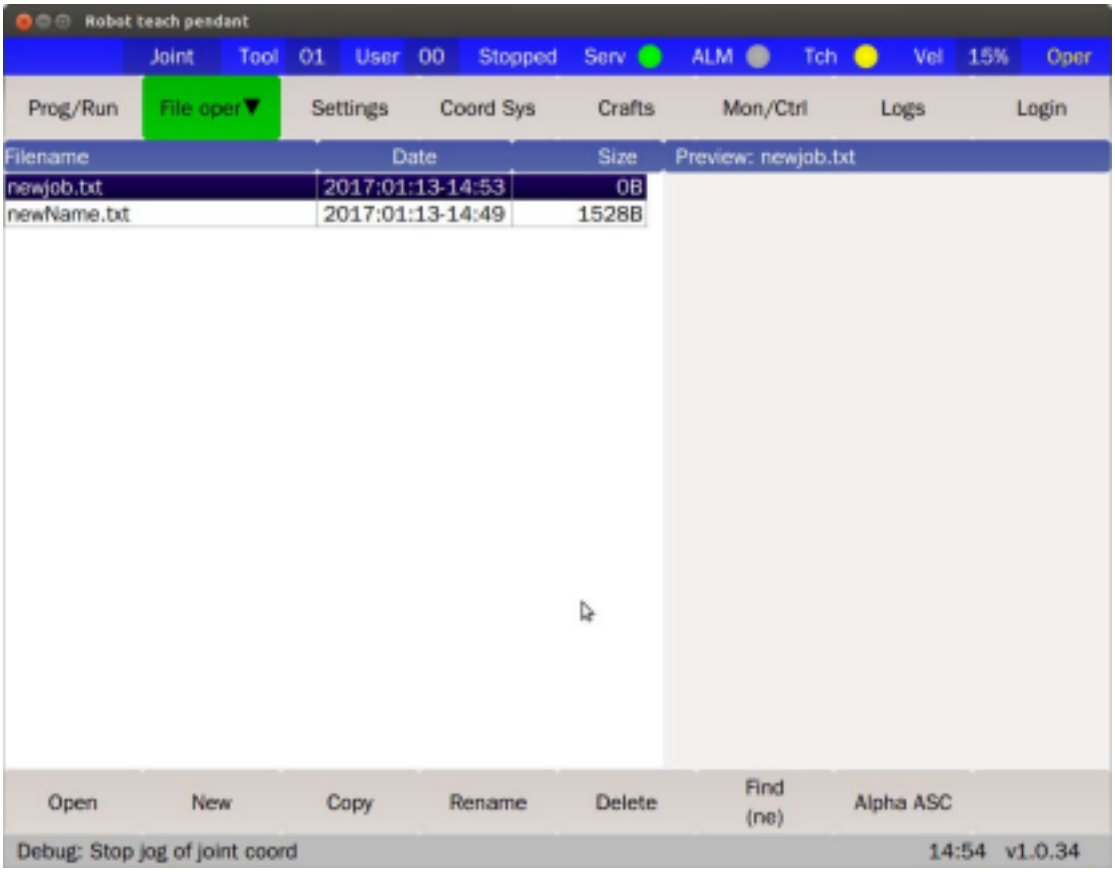


6. Search Program File

In order to move the cursor to the place to be modified quickly in a relatively complicated program, it is available to realize the movement through the Search function. Under demonstration model, click [Search] function, input partial letters of the file searched, and click [Search].

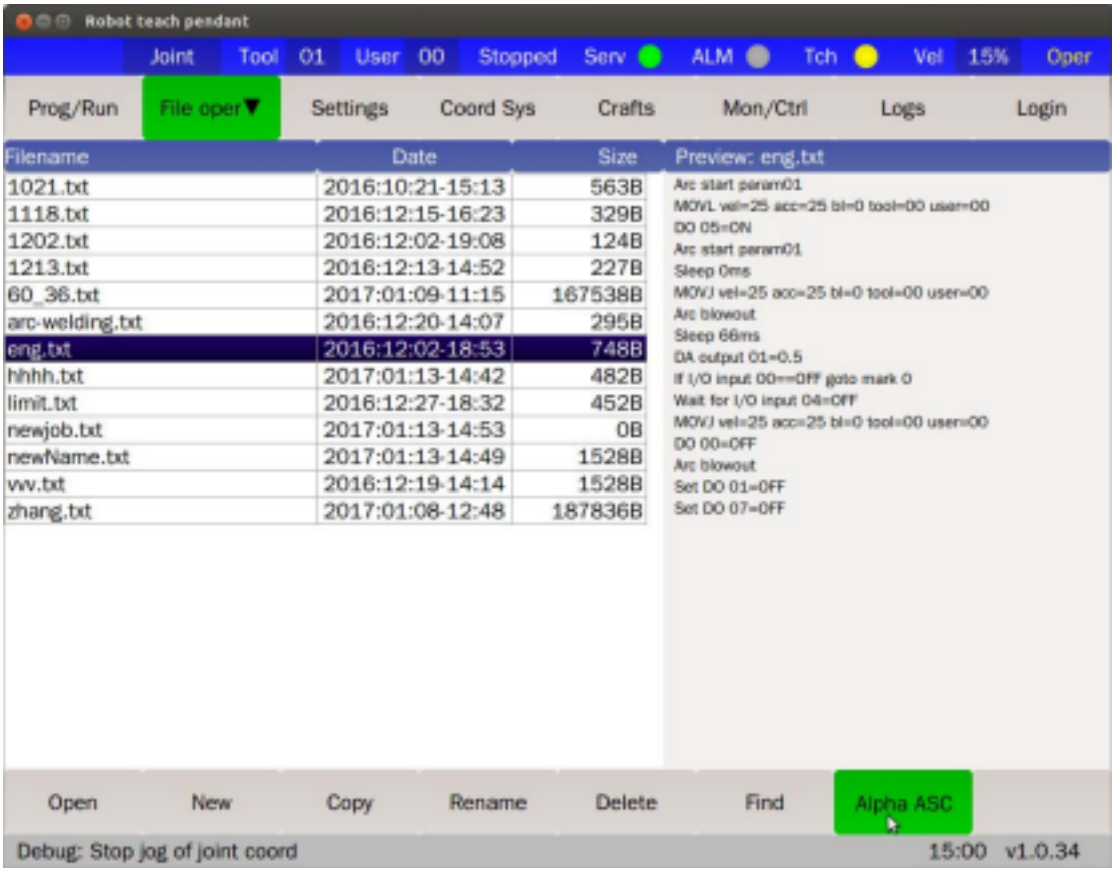


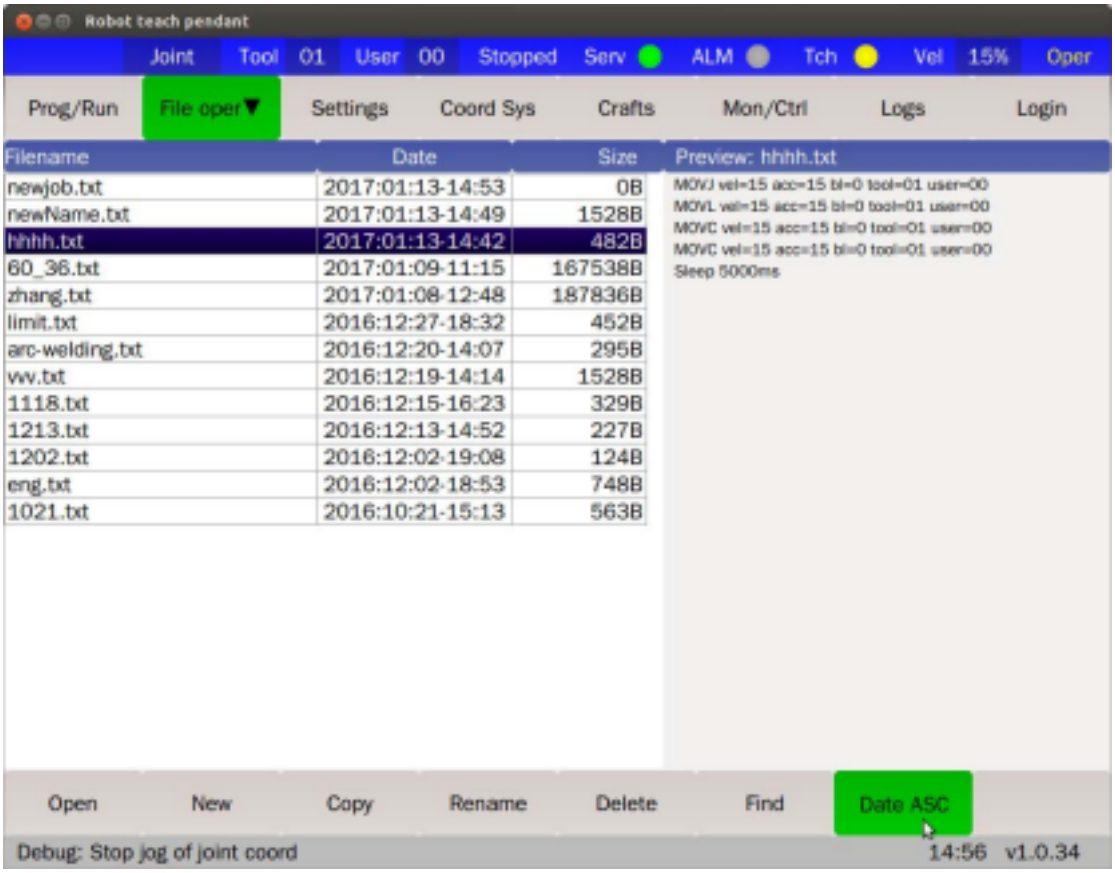
After search, as shown below:

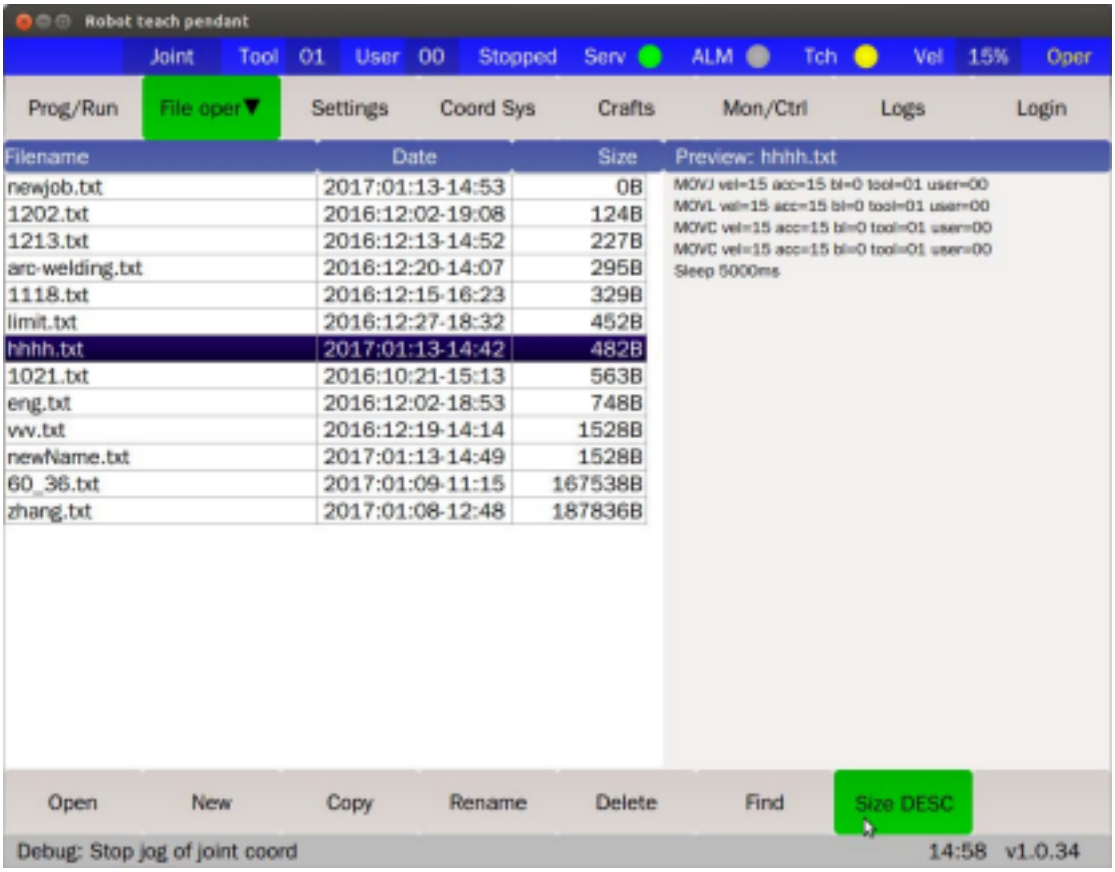


7. Document Sequencing

It's available to execute ascending and descending of files by file size, time and letter (both ascending and descending are available). Click the same button at the lower right corner. This button may be switched in several models, as shown below:


Robot teach pendant
Joint Tool 01 User 00 Stopped Serv ALM Tch Vel 15% Oper
Prog/Run File oper▼ Settings Coord Sys Crafts Mon/Ctrl Logs Login
Filename Date Size Preview: eng.txt
1021.txt 2016:10:21-15:13 563B
1118.txt 2016:12:15-16:23 329B
1202.txt 2016:12:02-19:08 124B
1213.txt 2016:12:13-14:52 227B
60_36.txt 2017:01:09-11:15 167538B
arc-welding.txt 2016:12:20-14:07 295B
eng.txt 2016:12:02-18:53 748B
hhhh.txt 2017:01:13-14:42 482B
limit.txt 2016:12:27-18:32 452B
newjob.txt 2017:01:13-14:53 0B
newName.txt 2017:01:13-14:49 1528B
vvv.txt 2016:12:19-14:14 1528B
zhang.txt 2017:01:08-12:48 187836B
Arc start param01
MOVL vel=25 acc=25 bl=0 tool=00 user=00
DO 05=ON
Arc start param01
Sleep 0ms
MOVJ vel=25 acc=25 bl=0 tool=00 user=00
Arc blowout
Sleep 66ms
DA output 01=0.5
If I/O input 00==OFF goto mark 0
Wait for I/O input 04=OFF
MOVJ vel=25 acc=25 bl=0 tool=00 user=00
DO 00=OFF
Arc blowout
Set DO 01=OFF
Set DO 07=OFF
Open New Copy Rename Delete Find Alpha ASC
Debug: Stop jog of joint coord
15:00 v1.0.34


Robot teach pendant
Joint Tool 01 User 00 Stopped Serv ALM Tch Vel 15% Oper
Prog/Run File oper▼ Settings Coord Sys Crafts Mon/Ctrl Logs Login
Filename Date Size Preview: hhhh.txt
newjob.txt 2017:01:13-14:53 0B
newName.txt 2017:01:13-14:49 1528B
hhhh.txt 2017:01:13-14:42 482B
60_36.txt 2017:01:09-11:15 167538B
zhang.txt 2017:01:08-12:48 187836B
limit.txt 2016:12:27-18:32 452B
arc-welding.txt 2016:12:20-14:07 295B
vvv.txt 2016:12:19-14:14 1528B
1118.txt 2016:12:15-16:23 329B
1213.txt 2016:12:13-14:52 227B
1202.txt 2016:12:02-19:08 124B
eng.txt 2016:12:02-18:53 748B
1021.txt 2016:10:21-15:13 563B
MOVJ vel=15 acc=15 bl=0 tool=01 user=00
MOVL vel=15 acc=15 bl=0 tool=01 user=00
MOVC vel=15 acc=15 bl=0 tool=01 user=00
MOVC vel=15 acc=15 bl=0 tool=01 user=00
Sleep 5000ms
Open New Copy Rename Delete Find Date ASC
Debug: Stop jog of joint coord
14:56 v1.0.34


Robot teach pendant
Joint
Tool 01
User 00
Stopped
Serv
ALM
Tch
Vel 15%
Oper
Prog/Run
File oper
Settings
Coord Sys
Crafts
Mon/Ctrl
Logs
Login
Filename
Date
Size
Preview: hhhh.txt
newjob.txt 2017:01:13-14:53 0B
1202.txt 2016:12:02-19:08 124B
1213.txt 2016:12:13-14:52 227B
arc-welding.txt 2016:12:20-14:07 295B
1118.txt 2016:12:15-16:23 329B
limit.txt 2016:12:27-18:32 452B
hhhh.txt 2017:01:13-14:42 482B
1021.txt 2016:10:21-15:13 563B
eng.txt 2016:12:02-18:53 748B
vv.txt 2016:12:19-14:14 1528B
newName.txt 2017:01:13-14:49 1528B
60_36.txt 2017:01:09-11:15 167538B
zhang.txt 2017:01:08-12:48 187836B
MOVJ vel=15 acc=15 bl=0 tool=01 user=00
MOVL vel=15 acc=15 bl=0 tool=01 user=00
MOVC vel=15 acc=15 bl=0 tool=01 user=00
MOVC vel=15 acc=15 bl=0 tool=01 user=00
Sleep 5000ms
Open
New
Copy
Rename
Delete
Find
Size DESC
Debug: Stop jog of joint coord
14:58
v1.0.34

4 Program Processes

Turin industrial robot provides special process software packages of the following several different applications, including welding, stacking, spray-painting and visual tracking, etc. Turin will provide possibly many process software packages upon the demand of actual applications.

4.1 Welding Process

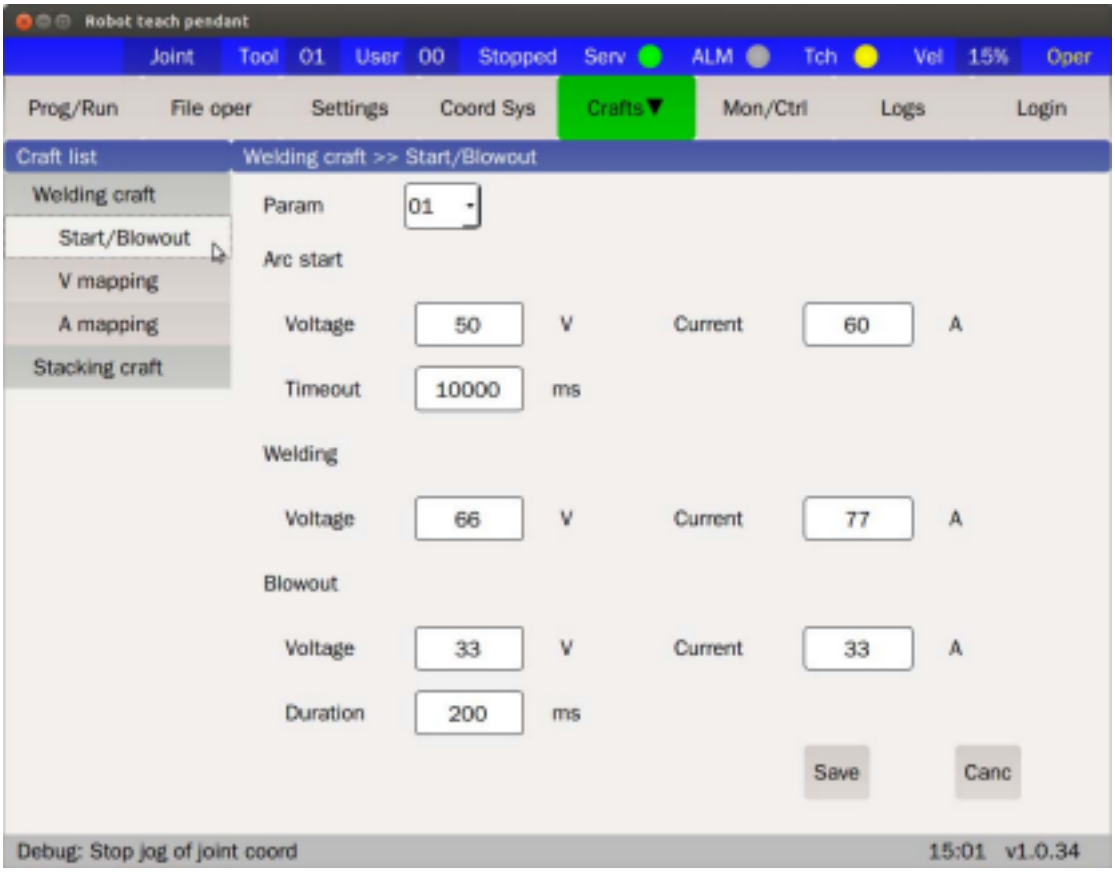
4.1.1 Welding Process Description

The welding process software packages provided by Turin at present mainly aim at welding field. The industrial robot tallies with automatic wire feeding device and welding power supply lamp. It is available to carry out welding operation aiming at the welding seams in various spaces, and the welding operation is featured by being available to carry out long-term welding operation, and guaranteeing high productivity, high quality and high stability of welding operation, etc.

4.1.2 Welding Parameters Setting

Robot control system could control the previous corresponding setting of welding machine according to the basic characteristics of welding machine, and the connecting circuit between welding machine and control cabinet.

Select [Process] in the main menu, then select [Welding Process] to set up welding process parameters, including arc starting, arc extinguishing, voltage matching table and current matching table. The three lists of welding process are as shown in the following figures, and the concrete welding parameter setting shall be adjusted according to actual welding demands.



The following two figures are the matching tables of the voltage and current of welding machine, and it is to match the two routes of analog voltage (0-10v) output by the controller with the voltage and current displayed on the welding machine. In this way, during welding, it will be available to reversely reckon and calculate the value of voltage that the controller needs to output according to the operating voltage and current of welding machine. Click “OK” to make the controller output corresponding voltage value, and here fill in the voltage or current value displayed on the welding machine, and after input of total 20 levels, click “Save”.

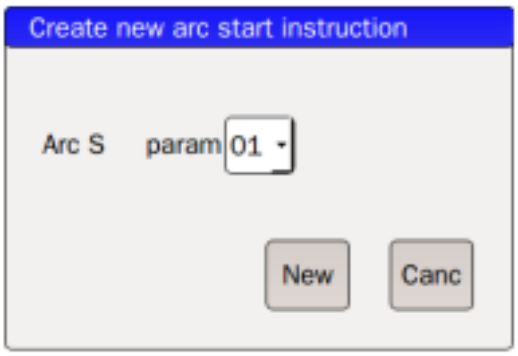

Robot teach pendant
Joint Tool 01 User 00 Stopped Serv ALM Tch Vel 15% Oper
Prog/Run File oper Settings Coord Sys Crafts▼ Mon/Ctrl Logs Login
Craft list
Welding craft >> V mapping
Welding craft
Start/Blowout
V mapping
A mapping
Stacking craft
No. Output Oper Machine No. Output Oper Machine
V 01 0.5 Enb 4 V 11 5.5 Enb 24
V 02 1.0 Enb 6 V 12 6.0 Enb 26
V 03 1.5 Enb 9 V 13 6.5 Enb 27
V 04 2.0 Enb 11 V 14 7.0 Enb 28
V 05 2.5 Enb 12 V 15 7.5 Enb 33
V 06 3.0 Enb 14 V 16 8.0 Enb 34
V 07 3.5 Enb 16 V 17 8.5 Enb 35
V 08 4.0 Enb 19 V 18 9.0 Enb 37
V 09 4.5 Enb 22 V 19 9.5 Enb 39
V 10 5.0 Enb 23 V 20 10 Enb 40
Save Canc
Debug: Stop jog of joint coord
15:02 v1.0.34


Robot teach pendant
Joint Tool 01 User 00 Stopped Serv ALM Tch Vel 15% Oper
Prog/Run File oper Settings Coord Sys Crafts▼ Mon/Ctrl Logs Login
Craft list
Welding craft >> A mapping
Welding craft
Start/Blowout
V mapping
A mapping
Stacking craft
No. Output Oper Machine No. Output Oper Machine
A 01 0.5 Enb 5 A 11 5.5 Enb 45
A 02 1.0 Enb 11 A 12 6.0 Enb 46
A 03 1.5 Enb 15 A 13 6.5 Enb 50
A 04 2.0 Enb 18 A 14 7.0 Enb 51
A 05 2.5 Enb 20 A 15 7.5 Enb 56
A 06 3.0 Enb 25 A 16 8.0 Enb 57
A 07 3.5 Enb 29 A 17 8.5 Enb 59
A 08 4.0 Enb 32 A 18 9.0 Enb 65
A 09 4.5 Enb 38 A 19 9.5 Enb 70
A 10 5.0 Enb 44 A 20 10 Enb 80
Save Canc
Debug: Stop jog of joint coord
15:02 v1.0.34

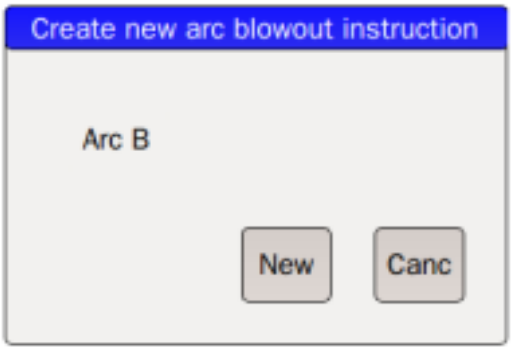
4.1.3 Welding Process Command

- Arc starting: It's available to select multiple methods for welding arc starting, and set up "arc starting method 1" as shown below.

As concerning arc starting command, make welding arc starting parameters. For welding arc starting, it's available to make parameter contents through program setting interface to "welding process", and use such contents together with arc extinguishing command.



- Arc extinguishing: Select the command for arc extinguishing of welding machine.



4.2 Stacking Process

Please refer to the separate Operation Manual.

4.3 Spray-Painting Process

Please refer to the separate Operation Manual.

4.4 Visual and Tracking Process

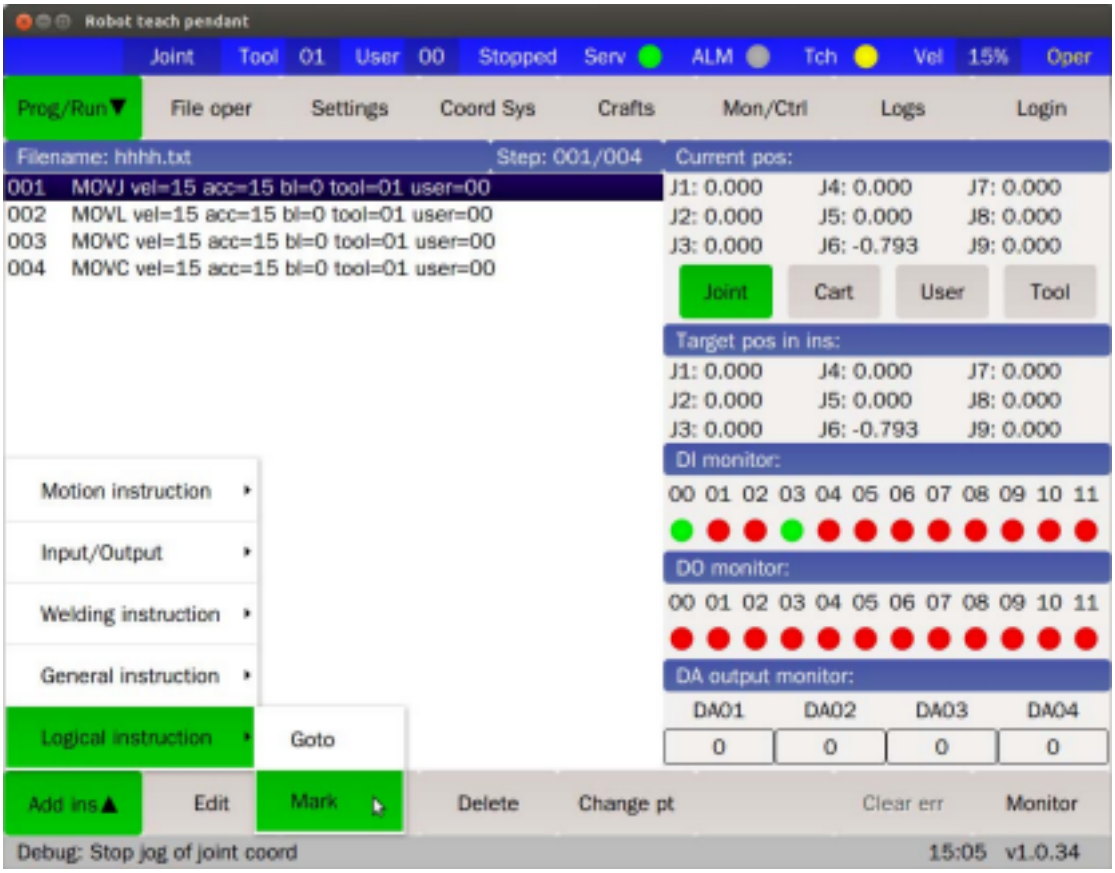
Please refer to the separate Operation Manual.

5 Program Operation

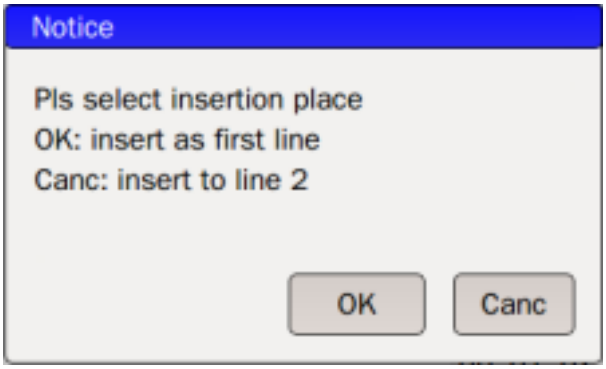
5.1 Writing Program of Circular Operation

Under MANUAL (demonstration) model, it's available to circulate the program execution through [Mark] and [Skip] under [Add Command] and [Logic Command].

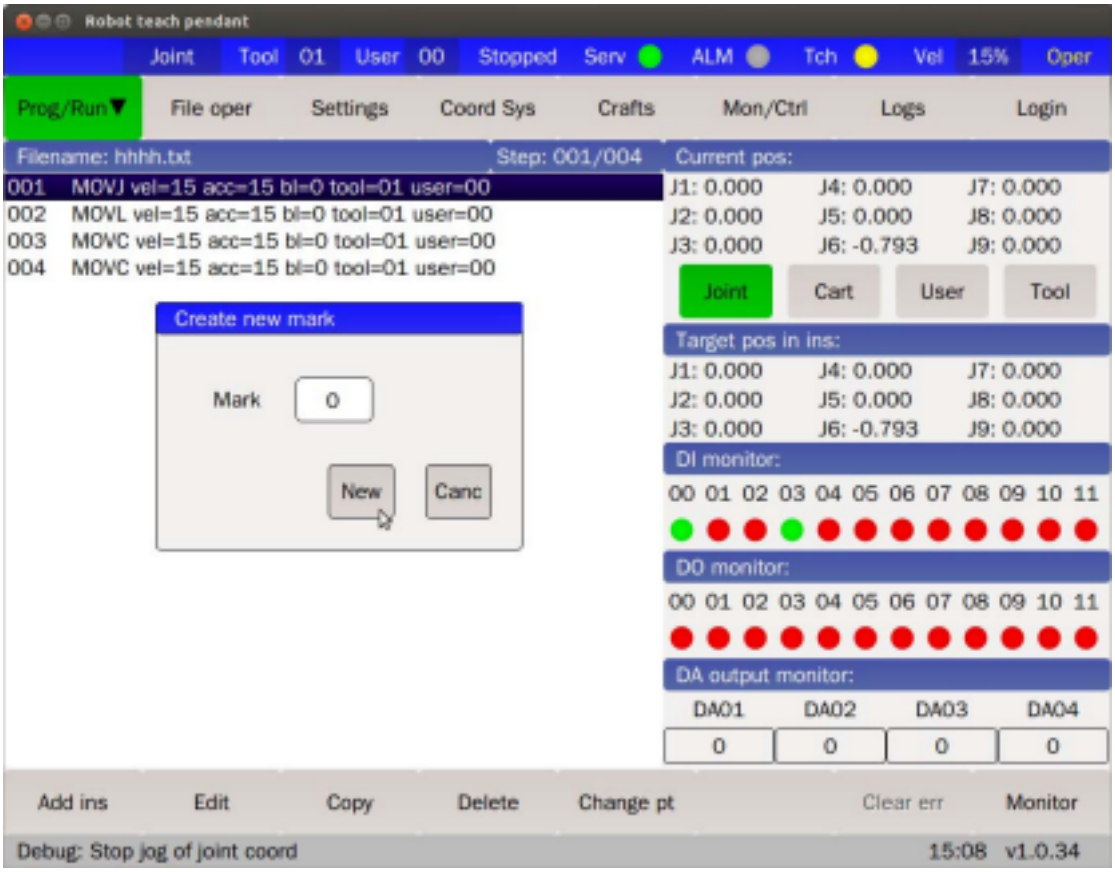
Add mark: For example, add one mark before the first line, with the mark number set up to be 0, as shown below;



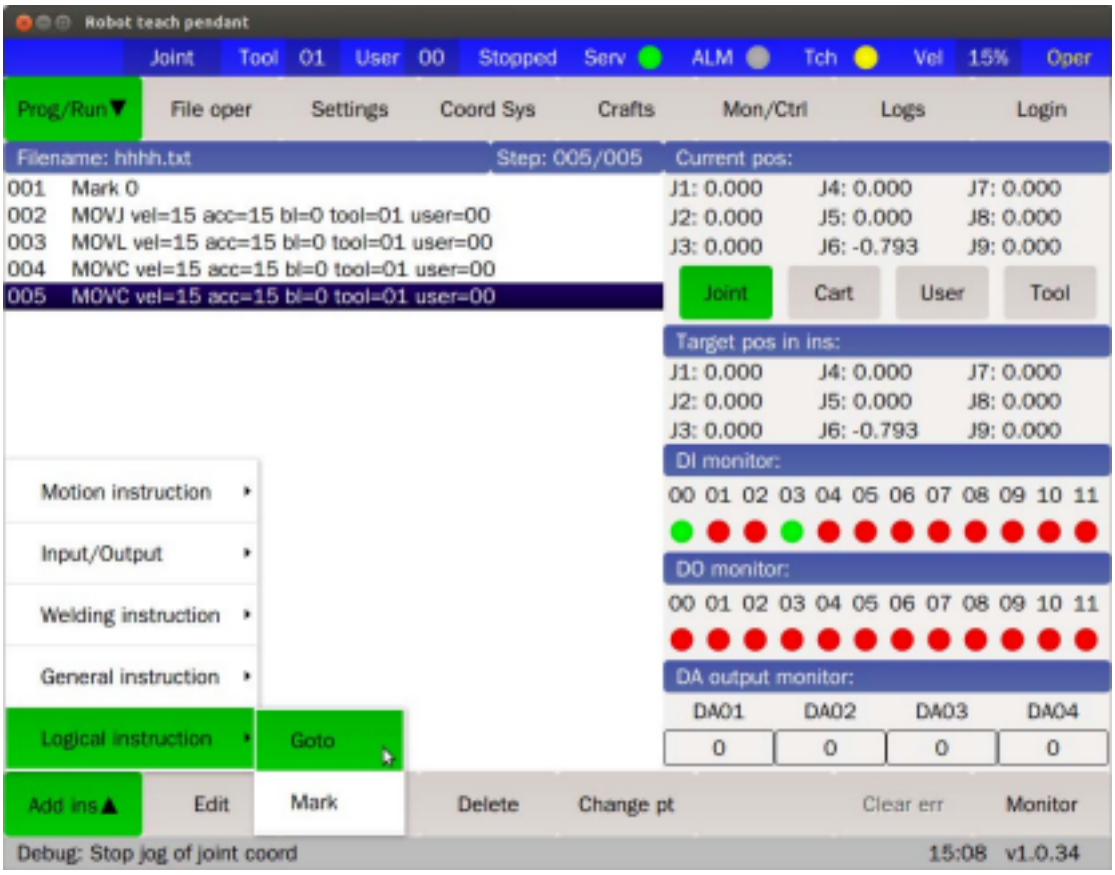
Determine the insertion position, click [OK] and insert to the head of the line, click [Cancel] an insert to the second line.



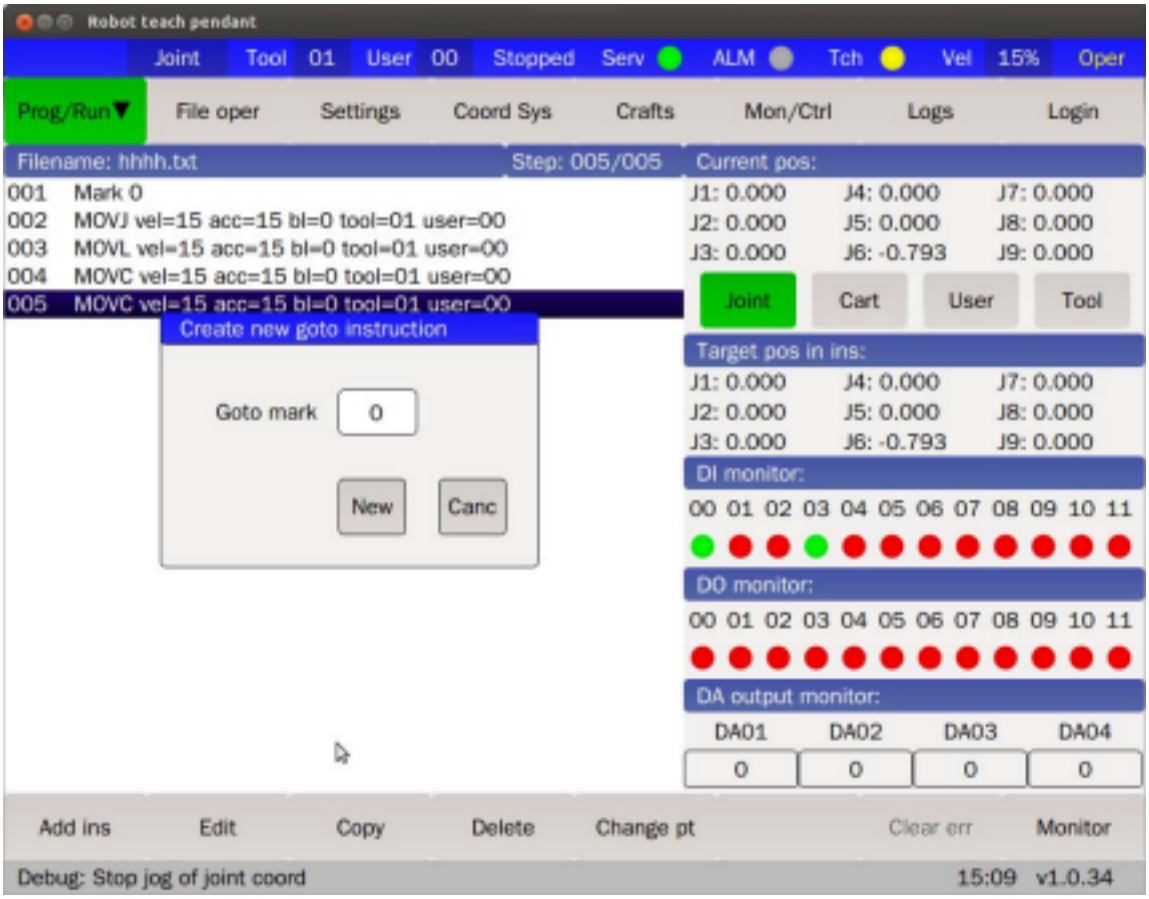
After setting of mark number, click [New].



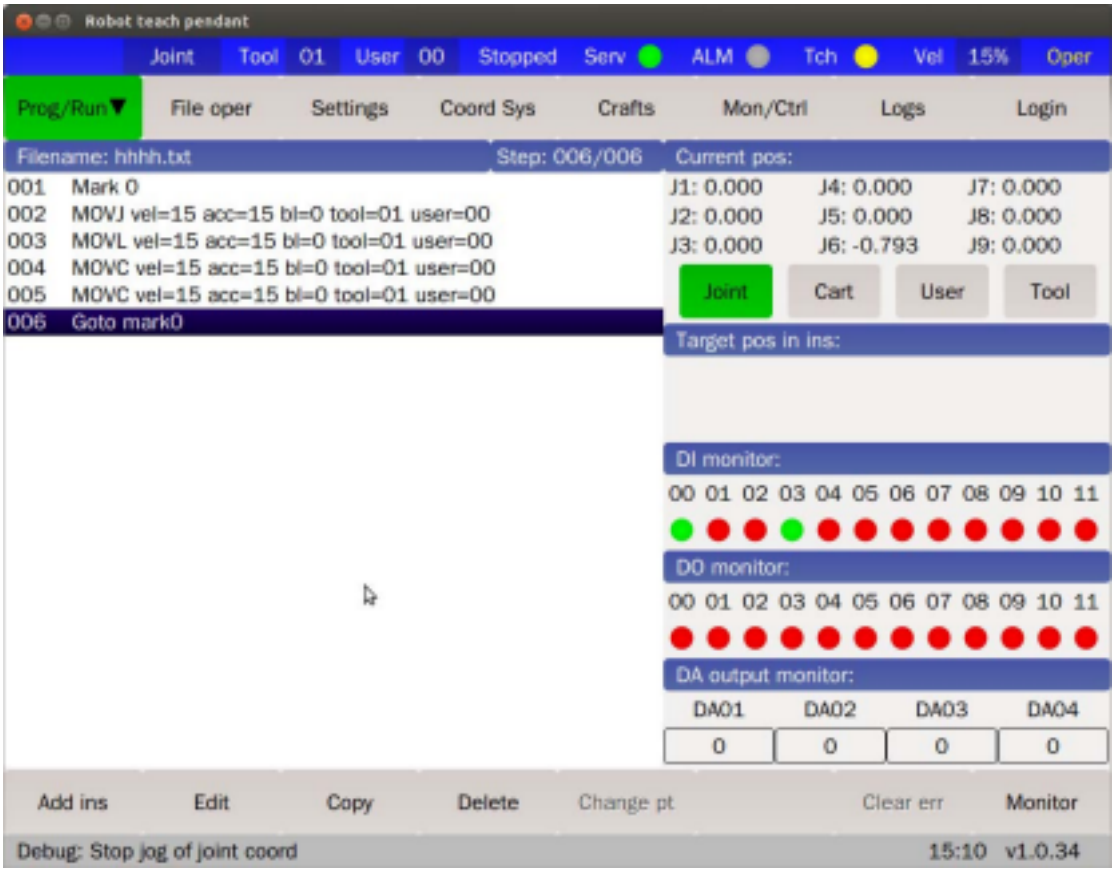
After establishment of mark, add [Skip] command to the end of the program.



As shown below:



It's as shown below after establishment. After the program is executed to line 6, it will skip to line 1, and it will be executed in a recycling way.

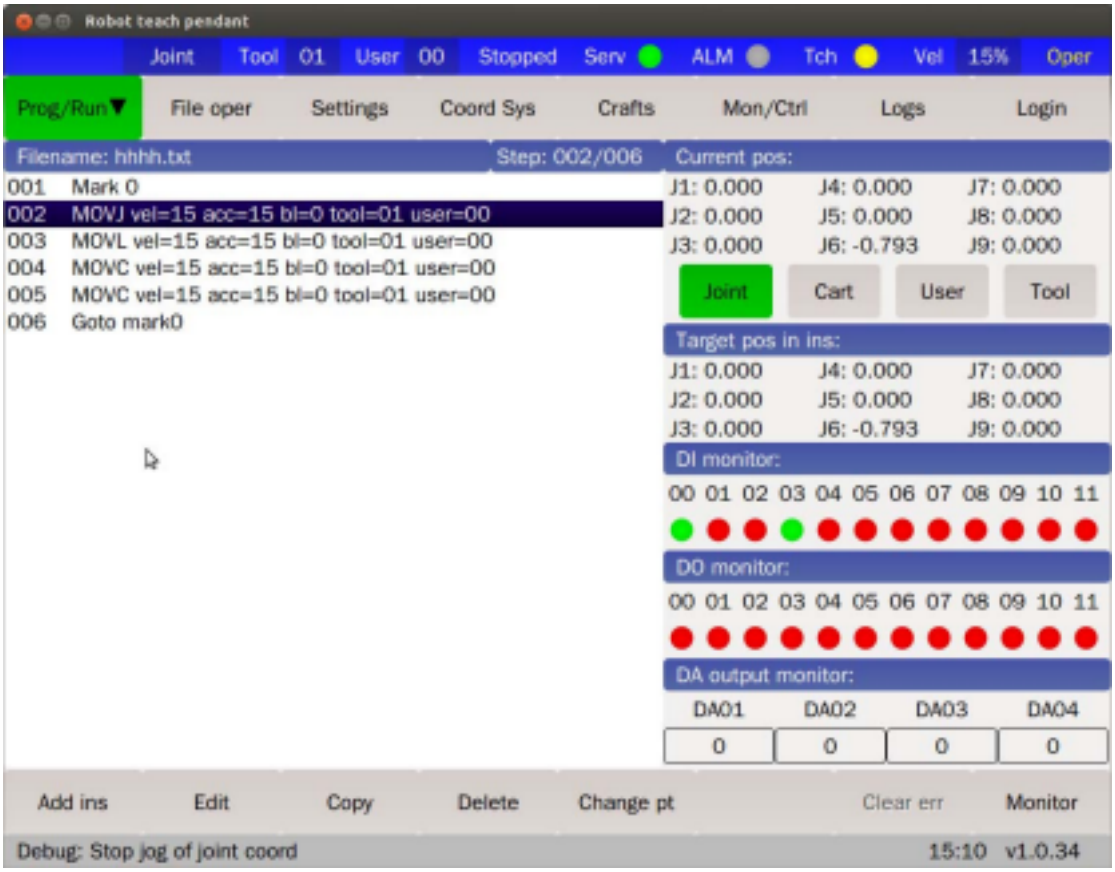


5.2 Program Examination

Under MANUAL (demonstration) model, after completion of programming, it will be available to complete the operation once through single-step operation and verify whether the program is correct. Press “Enable” switch to enable the driver, select one line of programs, then press SA key to realize single-step operation of this program, and loose SA key to immediately stop the movement.

After completion of the present operation, the cursor will skip to the next line automatically. Press SA key once more to start the single-step operation of the next line.

Arc Starting and Arc Extinguishing Commands will not execute true arc starting and arc extinguishing actions during single-step operation.



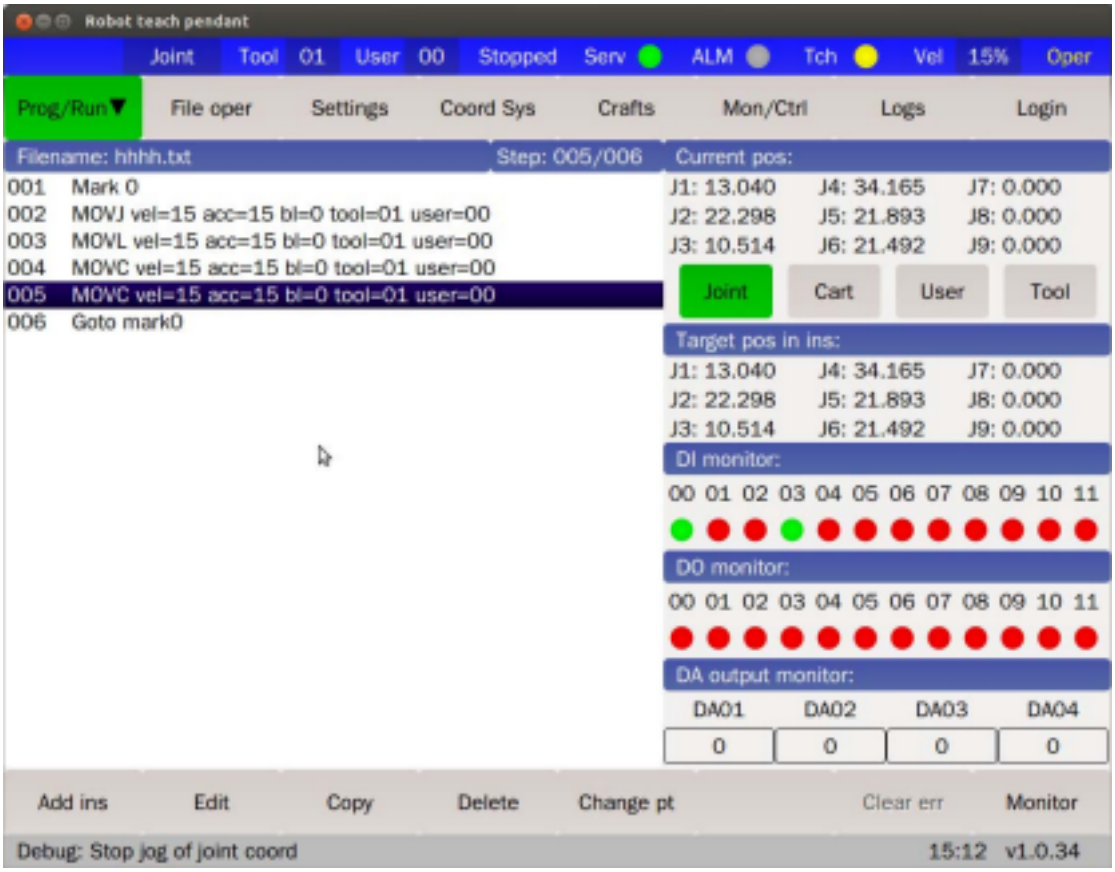
5.3 Preparation before Auto Operation

5.3.1 Notices for Auto Operation

- Ensure that there is no person around the robot before starting execution.
- Operator shall be outside the maximum scope for the operation of the robot.
- Observe the robot from the front side, and make sure that there is a safe exit under emergencies.
- After being used, demonstration programming unit must be placed at the original position. If demonstration programming unit is placed on robot, fixture or floor by accident, then when the robot works, the demonstration programming unit will touch the robot or tool, and induce the danger of personal injury or equipment damage.

5.3.2 Auto Operation Speed

Under AUTO (recurrence) model, the speed at the top right corner is overall operation speed, and may be modified if the program is not started or is suspended.



5.4 Program Start and Suspension

Under AUTO (recurrence) model, press SA key or the START button on the control cabinet to start automatic operation of the program from the line where the cursor is. During the operation process, press ST key or the STOP button on the control cabinet to suspend operation.

If the program does not set up circulating operation, the program will operate for only once automatically. After completion of operation, the cursor will stop in the first line.

6 Parameters Setting

6.1 System Logon

System logon is divided into operator logon and system logon.

6.1.1 Operator Logon Setting

Operator logon setting includes three functions, namely operator logon, operator logout, and password modification. The default password for operator logon is "33333333".

Operator logon: Button, input correct operator's password, and the logon is successful. Operator has the authority to modify program design and instruct point location.

Operator exit: After exit operator logon, operator could only carry out basic operations such as operation program and stop program, etc.

Password modification: Modify the password for operator logon.

6.1.2 System Logon Setting

System logon setting includes three functions, namely system logon, system logout and password modification. The default password for system logon is "12345678".

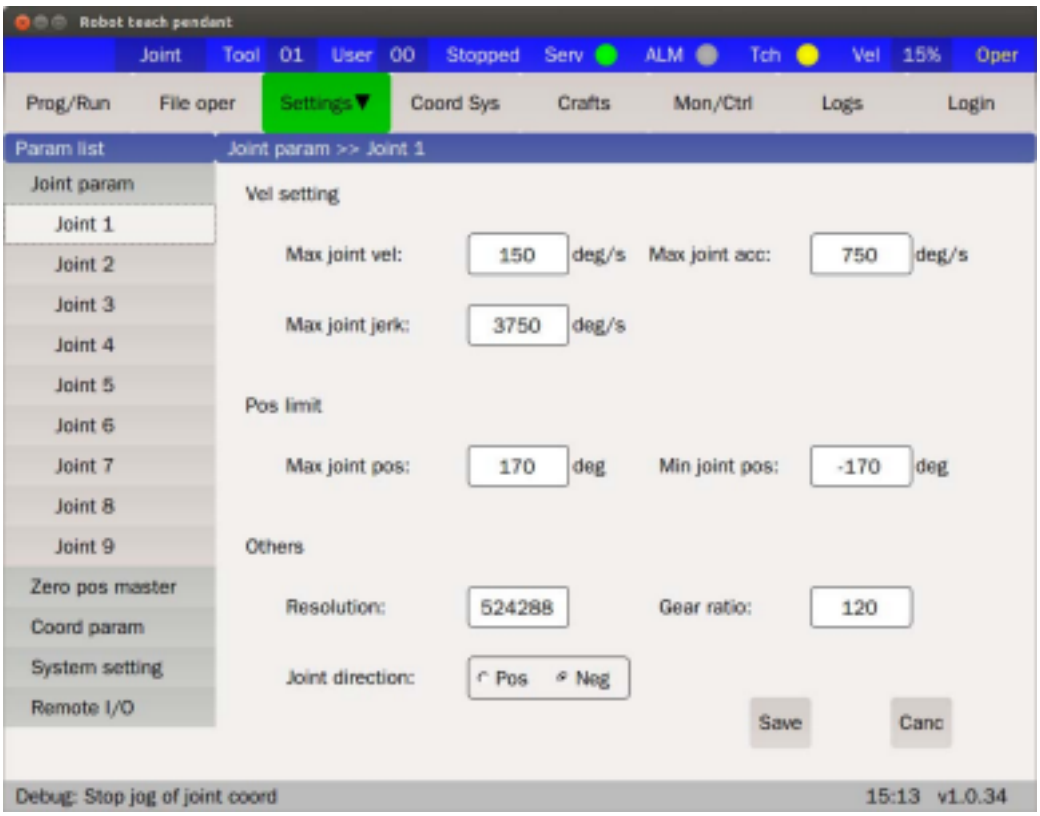
System logon: Input correct system password. After successful logon, operator will have the authority to execute mechanical parameter setting and ontology location, etc. System logon shall only aim at engineering personnel or senior users, and shall not be developed to common operators. Inaccurate parameter setting will directly affect the operation of the robot.

System logout: Exit from system logon.

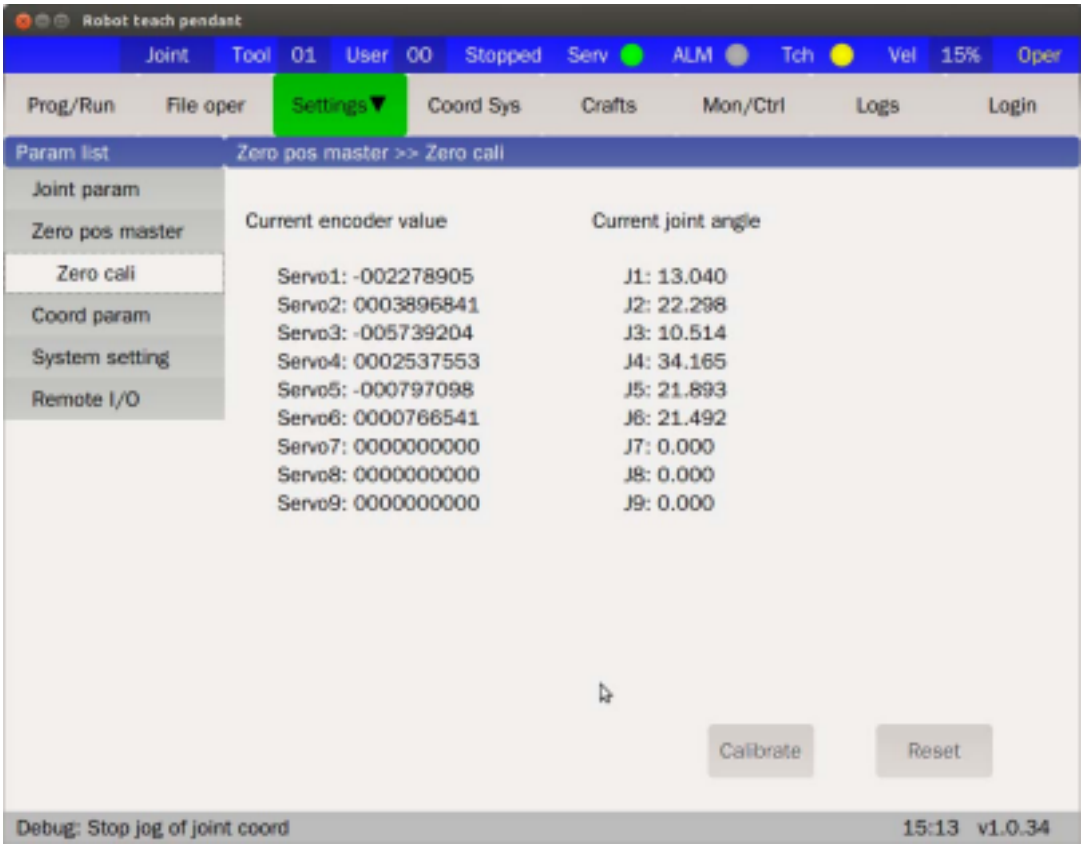
Password modification: Modify system password.

6.2 Joint Parameters Setting

The interface for setting of demonstrator joint parameters is as shown below. The operator is not recommended to change these parameters at random, since improper modification will lead to abnormality in the work of the robot. Therefore, the manufactory is suggested to carry out debugging before using the interface to set up parameters.



6.3 Robot Zero Position



Zero gesture indicates the gesture when the joint value of each axis is 0. Zero calibration is actually to calibrate the default zero gesture of the system and the actual zero gesture of the robot.

Dismantle and replace the motor, reducer, and mechanical driving parts, and then execute zero calibration once at the current position. Zero calibration operation is as shown below:

Move the robot to zero gesture, look for zero label, and align zero label.

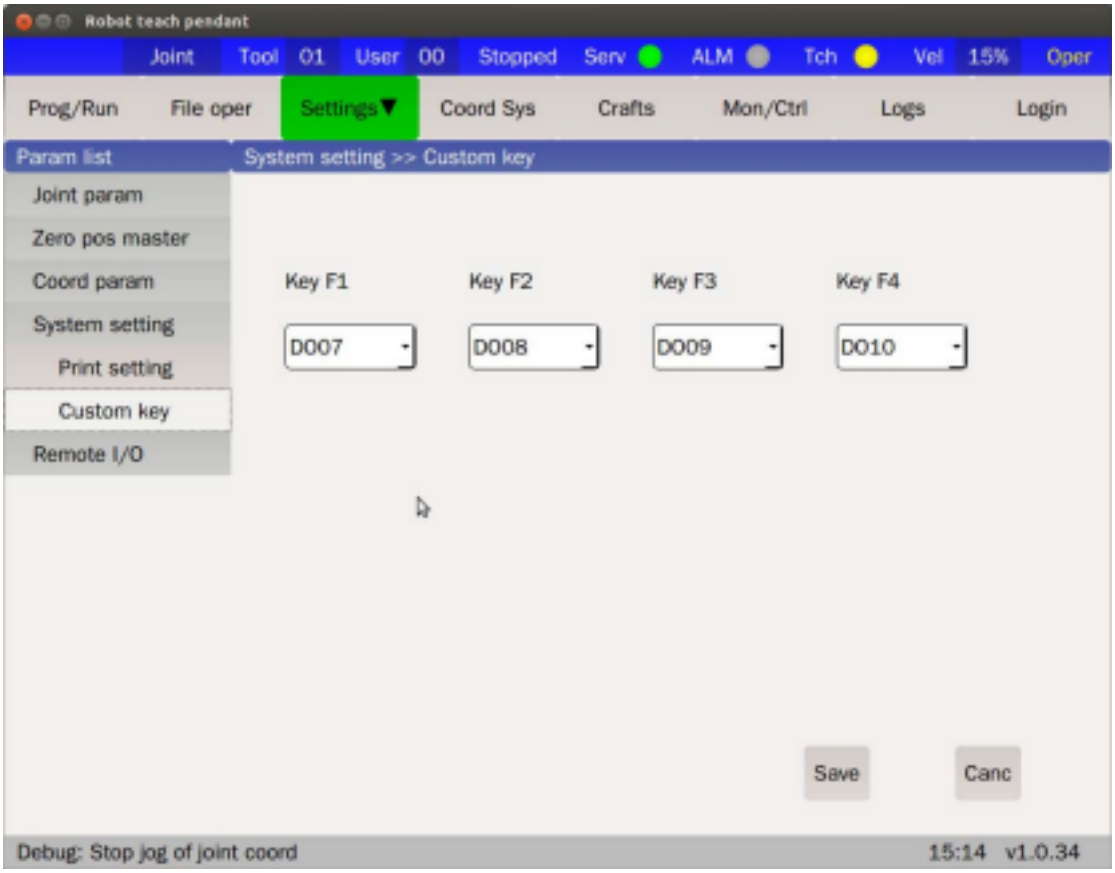
After zero calibration, restart the machine, and check the current joint value of the robot. The joint value of each axis shall be 0. If the value is not 0, it indicates that the zero calibration is not successful, and it will be necessary to carry out zero calibration once again.

6.4 Calibration of Tool Coordinate System

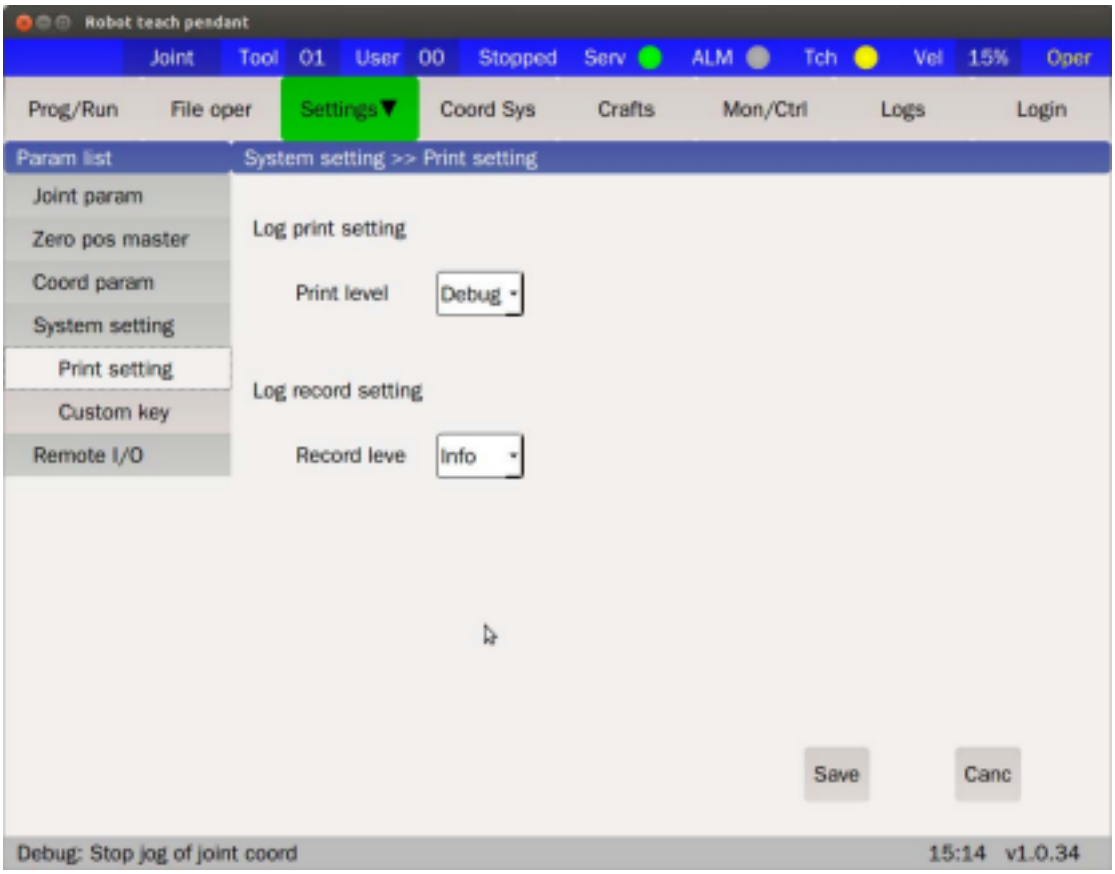
Refer to the Calibration of Tool Coordinate System in 2.4.2.

6.5 System Setting

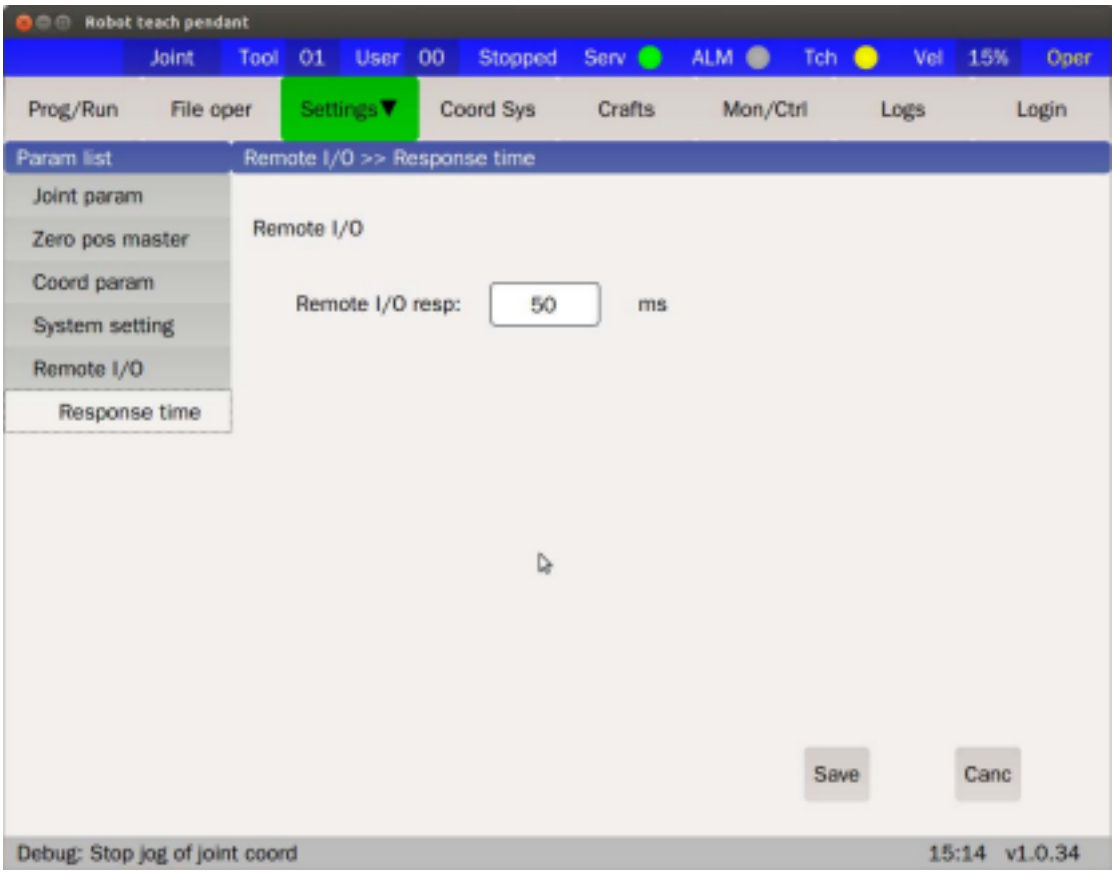
6.5.1 Keys Definition



6.5.2 Log Printing Setting



6.6 Long Distance Operation



7 List of Basic Commands

7.1 Movement Command

Joint Movement Command Function Move between two points by means of joint interpolation.

Format Joint Movement Speed=〈Parameter term〉 Acceleration=〈Parameter term〉 Smoothness=〈Parameter term〉 Tool =〈Parameter term〉 User =〈Parameter term〉

Location Data Corresponding location information is not displayed in Movement Command.

Joint Movement Description:

Speed Parameter term Meaning: Joint Movement Operation Speed Unit: % Scope: 0~100

Acceleration Parameter term Meaning: Joint Movement Operation Acceleration Unit: % Scope: 0~100

Smoothness Parameter term Meaning: Joint Movement Operation Smoothness Unit: % Scope: 0~100

Tool Parameter term Meaning: Joint Movement Tool No. Scope: 00-10

User Parameter term Meaning: Joint Movement User No. Scope: 00-10

Example Joint Movement Speed=100 Acceleration=25 Smoothness=0 Tool =00 User =01

Linear Movement Command Function Move between two points by means of linear interpolation.

Format Linear Movement Speed=〈Parameter term〉 Acceleration=〈Parameter term〉 Smoothness=〈Parameter term〉 Tool =〈Parameter term〉 User =〈Parameter term〉

Location Data Corresponding location information is not displayed in Movement Command.

Linear Movement Description:

Speed Parameter term Meaning: Linear Movement Operation Speed Unit: % Scope: 0~100

Acceleration Parameter term Meaning: Linear Movement Operation Acceleration Unit: % Scope: 0~100

Smoothness Parameter term Meaning: Linear Movement Operation Smoothness Unit: % Scope: 0~100

Tool Parameter term Meaning: Linear Movement Tool No. Scope: 00-10

User Parameter term Meaning: Linear Movement User No. Scope: 00-10

Example Linear Movement Speed=100 Acceleration=25 Smoothness=0 Tool =00 User =01

Arc Movement Command Function Move between two points by means of arc interpolation.

Format Arc Movement Speed=〈Parameter term〉 Acceleration=〈Parameter term〉 Smoothness=〈Parameter term〉 Tool =〈Parameter term〉 User =〈Parameter term〉

Location Data Corresponding location information is not displayed in Movement Command.

Arc Movement Description:

Speed Parameter term Meaning: Arc Movement Operation Speed Unit: % Scope: 0~100

Acceleration Parameter term Meaning: Arc Movement Operation Acceleration Unit: % Scope: 0~100

Smoothness Parameter term Meaning: Arc Movement Operation Smoothness Unit: % Scope: 0~100

Tool Parameter term Meaning: Arc Movement Tool No. Scope: 00-10

User Parameter term Meaning: Arc Movement User No. Scope: 00-10

Example Arc Movement Speed=100 Acceleration=25 Smoothness=0 Tool =00 User =01

Positioner Movement Command Function Movement of positioned assisting with the work of the robot

Format positioner Movement Speed=〈Parameter term〉 Acceleration=〈Parameter term〉 Smoothness=〈Parameter term〉 Tool =〈Parameter term〉 User =〈Parameter term〉

Location Data Corresponding location information is not displayed in Movement Command.

Positioner Movement Description:

Speed Parameter term Meaning: positioner Movement Operation Speed Unit: % Scope: 0~100

Acceleration Parameter term Meaning: positioner Movement Operation Acceleration Unit: % Scope: 0~100

Smoothness Parameter term Meaning: positioner Movement Operation Smoothness Unit: % Scope: 0~100

Tool Parameter term Meaning: positioner Movement Tool No. Scope: 00-10

User Parameter term Meaning: positioner Movement User No. Scope: 00-10

Example positioner Movement Speed=100 Acceleration=25 Smoothness=0 Tool =00 User =01

Increment Movement Command Function Not supported temporarily.

7.2 Logic Command

Mark Command Function Establish mark, available to use together with Skip Command.

Format Mark〈Parameter term〉

Mark Command Description:

Parameter term Mark No., Scope: 0~1000

Example Mark 0

Skip Command Function used to skip to a mark.

Format skip to Mark 〈Parameter term〉

Skip Command Description:

Parameter term Mark No., Scope: 0-1000

Example skip to Mark 0

7.3 Input/ Output Command

I/O output Command Function Control the switch of I/O output pin

Format I/O output Pin No.〈Parameter term〉 = Switch〈Parameter term〉

Command description:

Pin No.〈Parameter term〉Scope 00-11

Switch 〈Parameter term〉Scope : ON or OFF

Example I/O output 02 = ON

Wait I/O Input Command Function Wait I/O signal input

Format Wait I/O Input Pin No.〈Parameter term〉 = Switch〈Parameter term〉

Command description:

Pin No.〈Parameter term〉Scope 00-11

Switch 〈Parameter term〉Scope : ON or OFF

Example Wait I/O signal input 02 = OFF

I/O Input Skip Command Function Command skip through I/O signal input

Format If I/O Input Pin No.〈Parameter term〉 = Switch〈Parameter term〉 skip to Mark 〈Parameter term〉

Command description:

Pin No.〈Parameter term〉Scope 00-11

Switch 〈Parameter term〉Scope : ON or OFF

Mark 〈Parameter term〉 Scope 0-1000

Example If I/O Input Pin No. 00= OFF skip to Mark 0

DA output Command Function Set up DA output voltage value

Format DA output Output〈Parameter term〉 = Voltage Value〈Parameter term〉

Command description:

Pin No.〈Parameter term〉Scope 00-11

Voltage Value〈Parameter term〉Scope : 0-10.0

Example DA output 0 1= 2

7.4 Regular Command

Time Delay Command Function Applied to Time Delay

Format Time Delay〈Parameter term〉 ms

Command description:

Time Delay〈Parameter term〉Scope 0-1000000

Example Time Delay 5000 ms

Annotation Command Function Used to annotate program

Format ---〈Annotation Content〉 ---

Command description:

Annotation content: Available to input independently by the operator.

Example ---hanjiekaishi---

7.5 Welding Command

Arc starting Command Function Welding arc starting

Format Arc starting Parameter 〈Parameter term〉

Command description:

Parameter term Scope 01-10

Example Arc starting Parameter 01

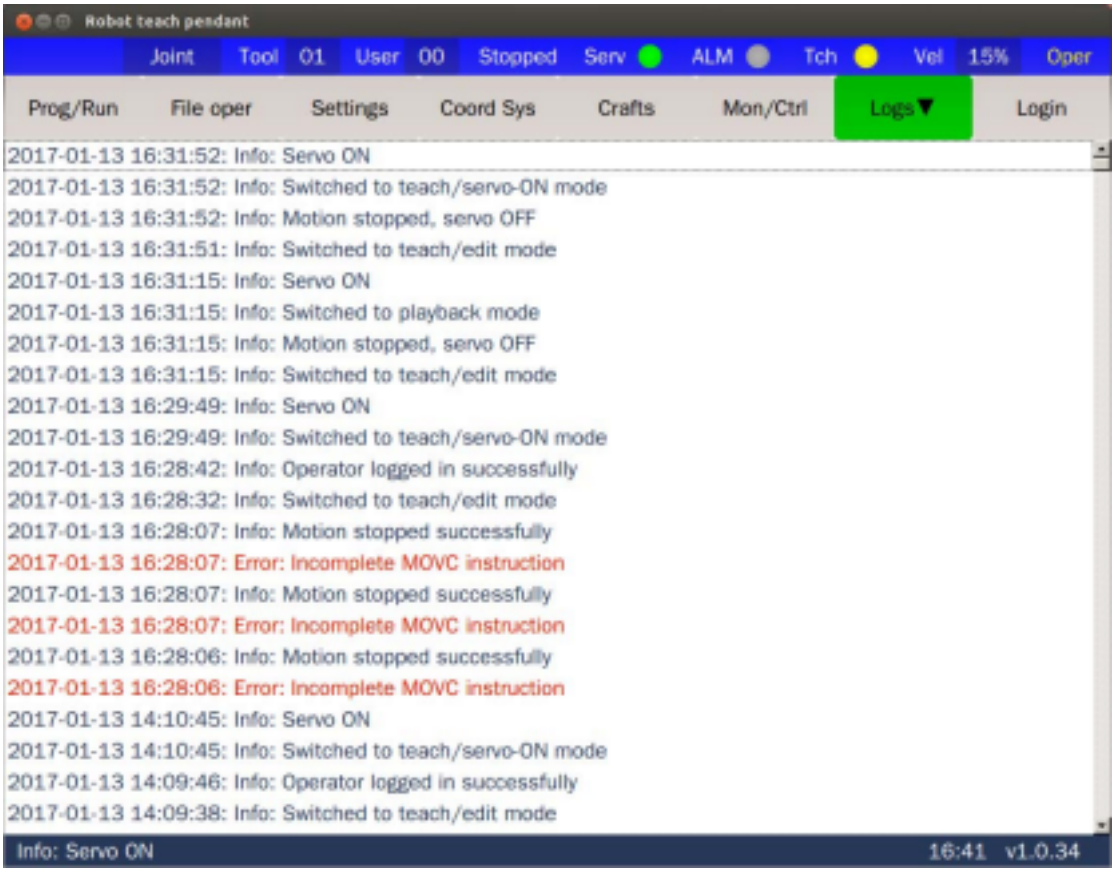
Arc extinguishing Command Function Welding arc extinguishing

Format Arc extinguishing

Example Arc extinguishing

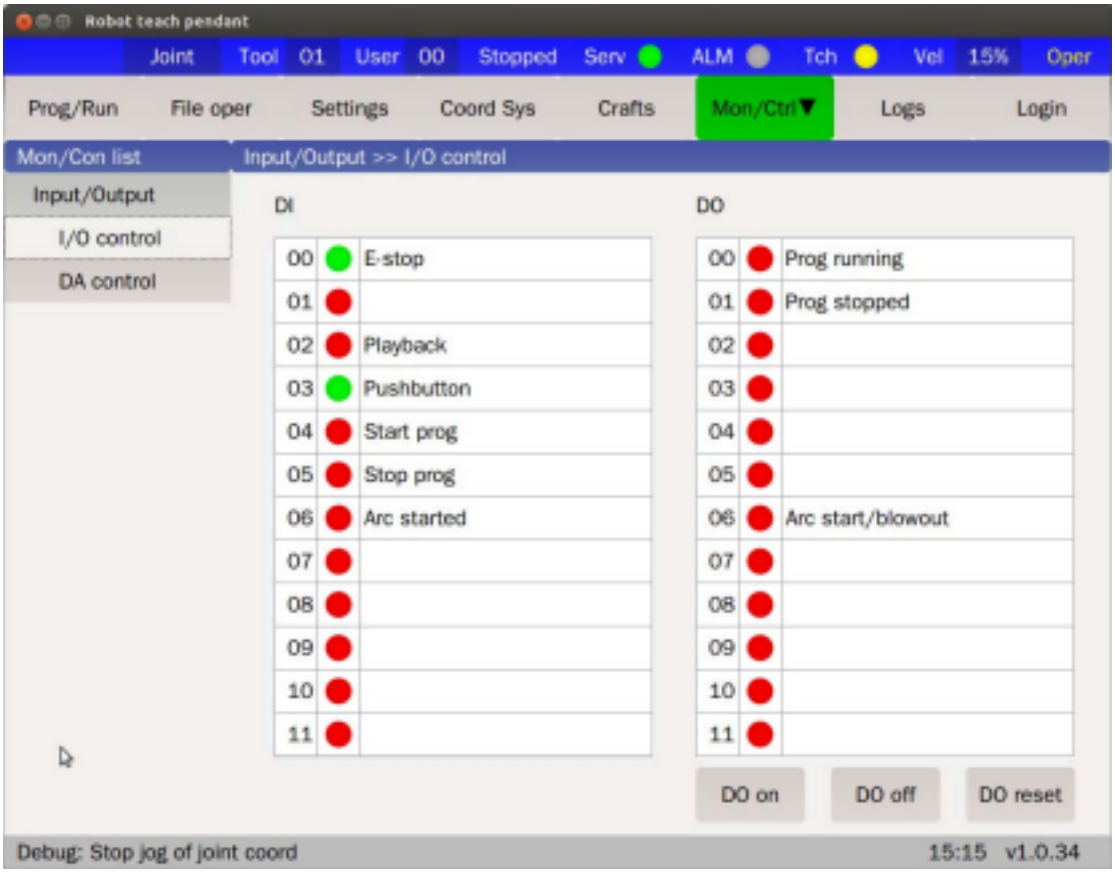
8 System Diagnosis

8.1 Operation Log

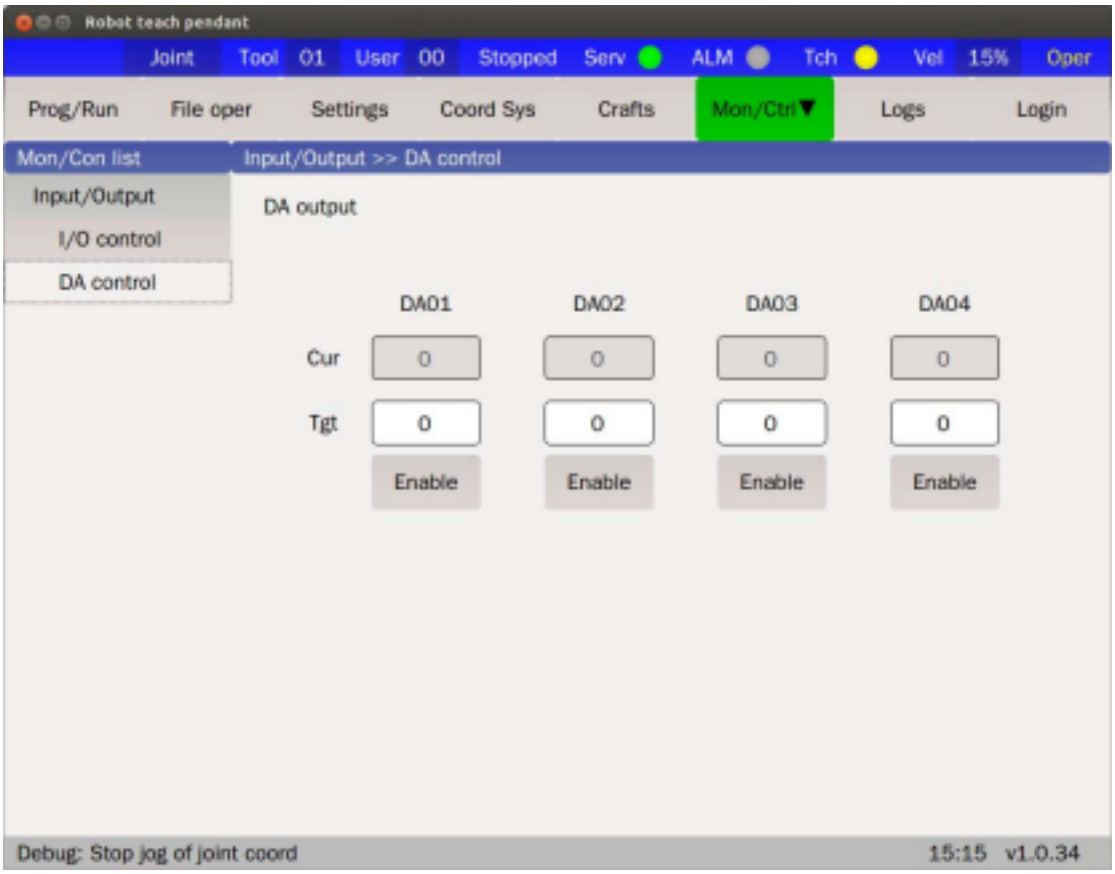


8.2 I/O

8.2.1 I/O Control



8.2.2 DA Control



8.3 Real-time Display of Coordinate Value