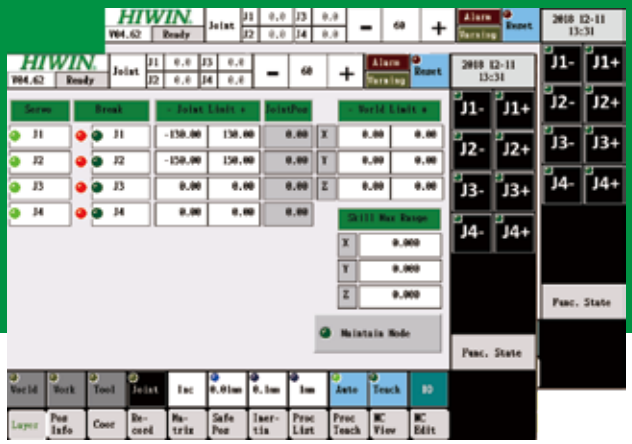
HIWIN®

SCARA Robot Software-

RS403, RS406

User Manual



Original Instructions

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Multi-Axis Robot

Pick-and-place / Assembly /
Array and packaging / Semiconductor /
Electro-Optical industry /
Automotive industry / Food industry

- Articulated Robot
- Delta Robot
- SCARA Robot
- Wafer Robot
- Electric Gripper
- Integrated Electric Gripper
- Rotary Joint

Single-Axis Robot

Precision / Semiconductor /
Medical / FPD

- KK, SK
- KS, KA
- KU, KE, KC

Direct Drive Rotary Table

Aerospace / Medical / Automotive industry /
Machine tools / Machinery industry

- RAB Series
- RAS Series
- RCV Series
- RCH Series

Ballscrew

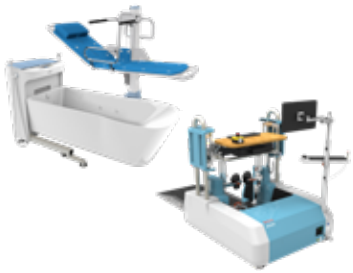
Precision Ground / Rolled

- Super S series
- Super T series
- Mini Roller
- Ecological & Economical lubrication Module E2
- Rotating Nut (R1)
- Energy-Saving & Thermal-Controlling (C1)
- Heavy Load Series (RD)
- Ball Spline

Linear Guideway

Automation / Semiconductor / Medical

- Ball Type--HG, EG, WE, MG, CG
- Quiet Type--QH, QE, QW, QR
- Other--RG, E2, PG, SE, RC



Medical Equipment

Hospital / Rehabilitation centers /
Nursing homes

- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Bearing

Machine tools / Robot

- Crossed Roller Bearings
- Ballscrew Bearings
- Linear Bearing
- Support Unit

AC Servo Motor & Drive

Semiconductor / Packaging machine
/SMT / Food industry / LCD

- Drives-D1, D1-N, D2T
- Motors-50W~2000W

Driven Tool Holders

All kinds of turret

- VDI Systems
  Radial Series, Axial Series, MT
- BMT Systems
  DS, NM, GW, FO, MT, OM, MS

Linear Motor

Automated transport / AOI application
/ Precision / Semiconductor

- Iron-core Linear Motor
- Coreless Linear Motor
- Linear Turbo Motor LMT
- Planar Servo Motor
- Air Bearing Platform
- X-Y Stage
- Gantry Systems

Torque Motor (Direct Drive Motor)

Inspection / Testing equipment /
Machine tools / Robot

- Rotary Tables-TMS,TMY,TMN
- TMRW Series
- TMRI Series

Table of Content

Revision History

Version	Date	Remark
V1.0	2015/05/12	First issuance
V2.0	2016/01/01	Adjusted the function page according to the interface
V2.1	2016/06/01	1. Added communication setting 2. Added the description of R Bit
V2.2	2016/07/12	1. Added he screen lock 2. Modified the example of G code 3. Added trigger by R value
V2.3	2016/09/26	1. Added the Inertia Page 2. Added the Function Status Page 3. Modified the Resource Planning Table 4. Added the Recon Teaching 5. Modified the Communication Setting
V2.4	2017/02/03	1. Modified G Code 2. Modified the Inertia Page
V2.5	2017/05/16	1. Changed the IO number of 4 Bit CASE
V2.6	2017/06/14	1. Modified the example of API
V2.7	2017/12/26	1. Added the software number of Interference Area 2. Added the software number of grating deceleration 3. Added the command for PC Communication Function 4. Added the C2 Path Reset 5. Added the R Value
V2.8	2018/12/18	1. Modified cover page and content 2. Modified part of the title 3. Correct the page number

Operating Manual for SCARA Robot
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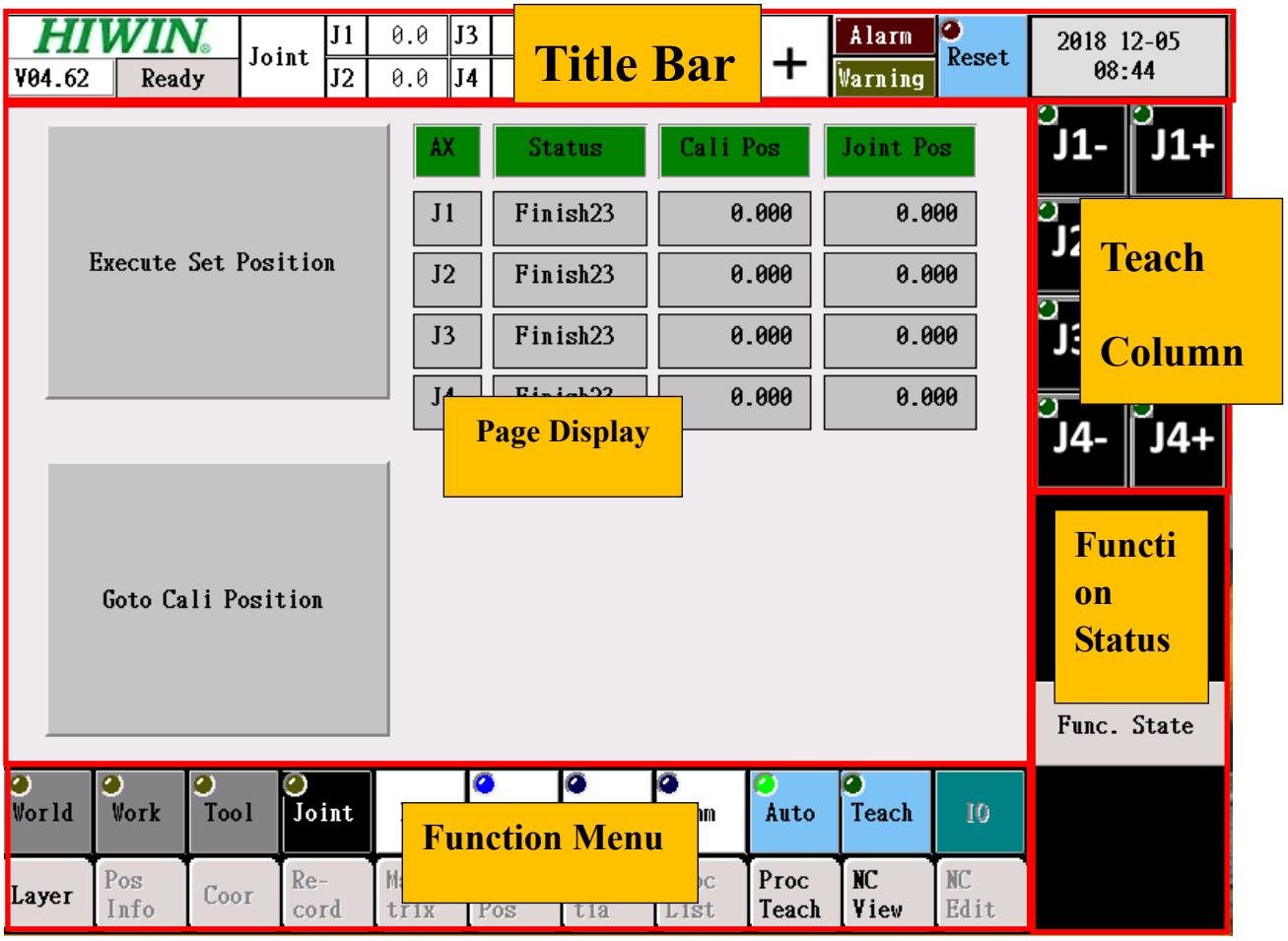
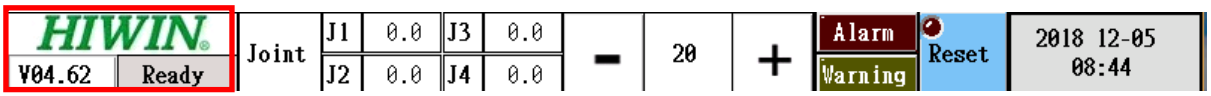
1. Layout Description of Operating Page

The operating page of system is layout as follows:



1.1. Title Bar



Display the current system status and the system version. Click the system status to open the system lock.

Not ready:

When any coordinates are not confirmed, the motor will stay in this status. The auto mode in this status can't be used. The teaching mode can operate the joint coordinates only.

Ready:

When the coordinates for each motor have been confirmed, it will show this status to enter the auto mode. After the coordinates are correct, the algorithm path will be meaningful.

Running:

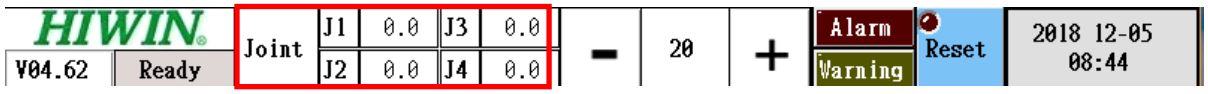
Auto run

Pause, section stop:

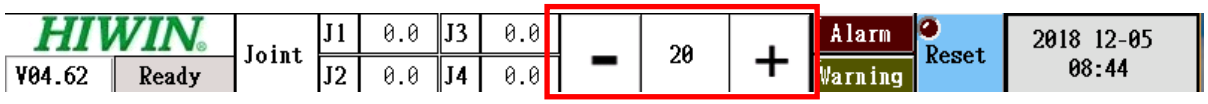
In the pause status when the system runs.

Teaching:

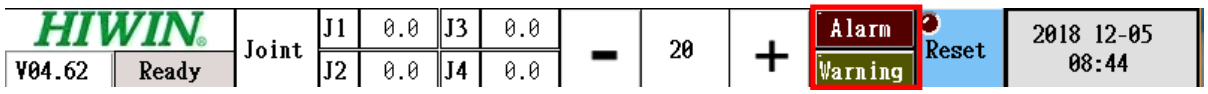
Manually operating



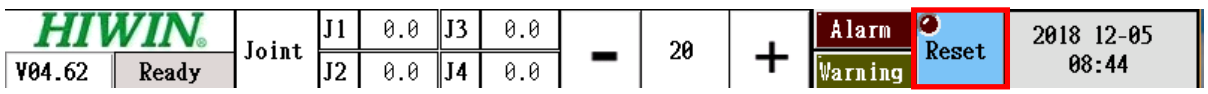
This area will show the coordinates according to the selected coordinate system (world, work, tool, and joint).



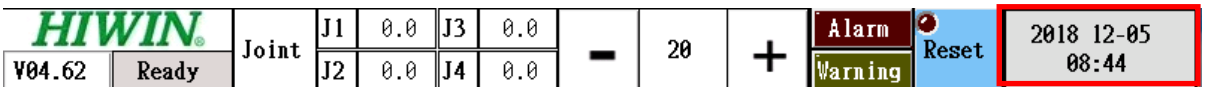
The speed percentage when the system automatically runs.



Hint the system shows the alarm or the warning. You click the alarm or the warning to show the current contents.

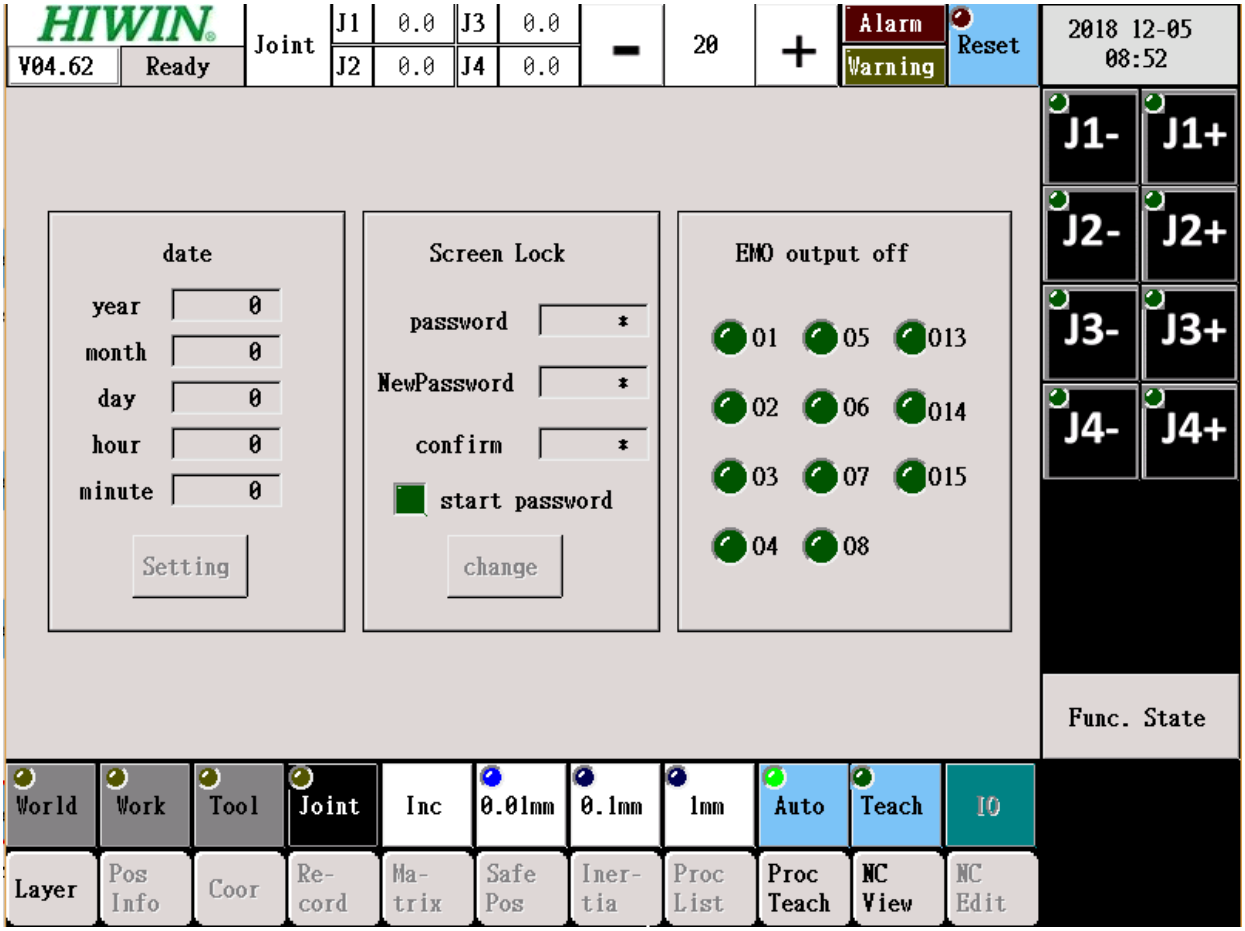


Reset the system (clear the current alarm or warning status, and stop any action).



Display the current time, and click it to enter the setting page (date, screen lock, and emergency stop output).

Setting Page



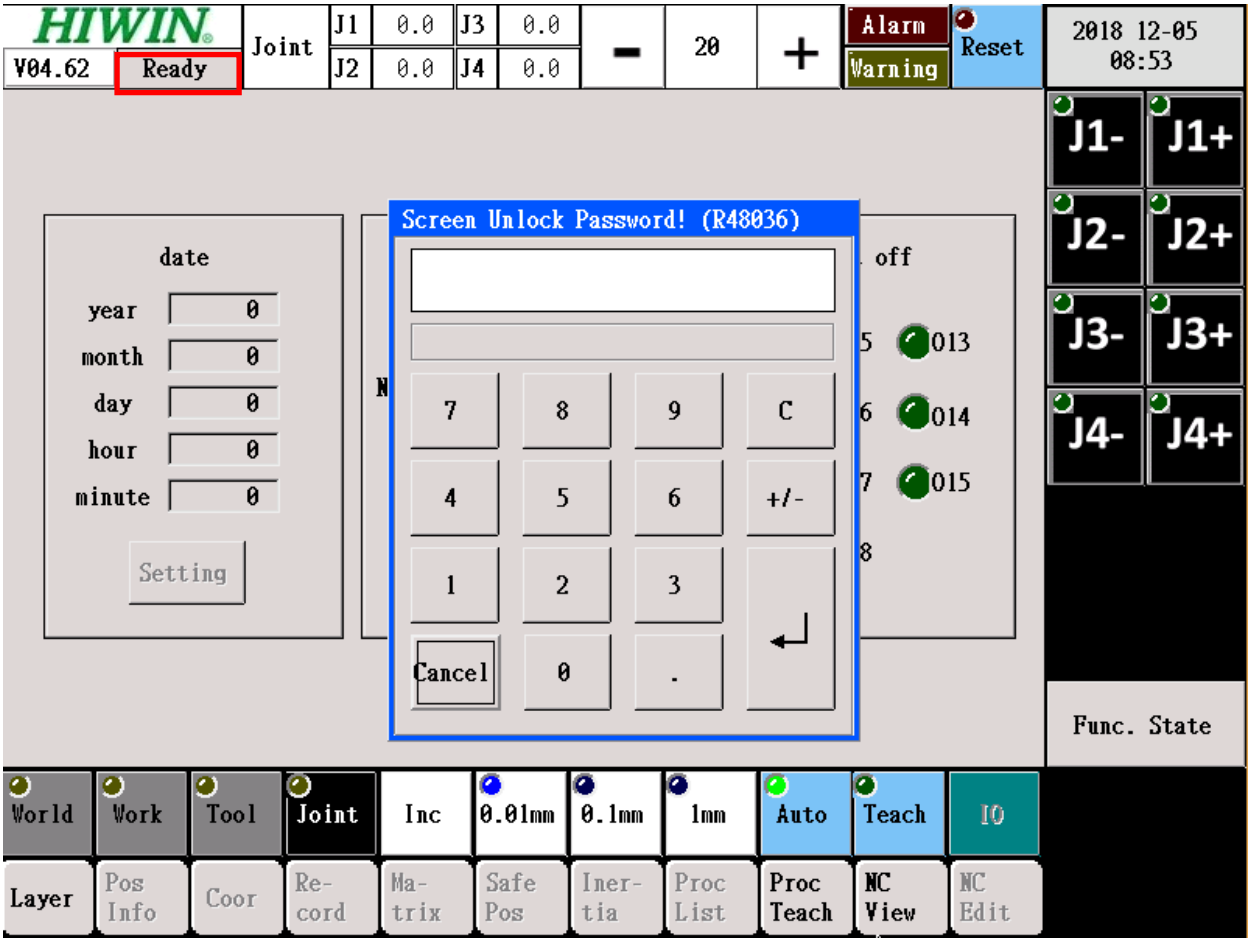
1. Date: Set the system time.
2. Screen lock: Change the password of the screen lock.

After the auto lock indicator lights up, the screen lock will be automatically started when booting.

3. Emergency stop output: Auto close output when setting the emergency stop.

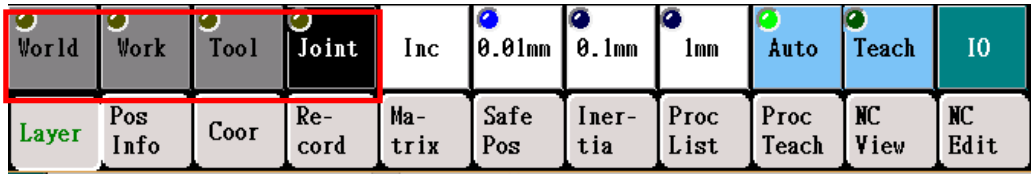
After the output pin indicator lights up, the pin status will be switched to OFF when triggered in the emergency stop.

Screen Lock Screen

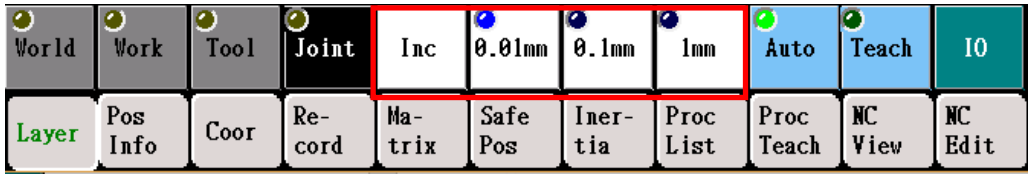


Click the status (in the red frame) to show the screen lock frame. The default password is **123456**.

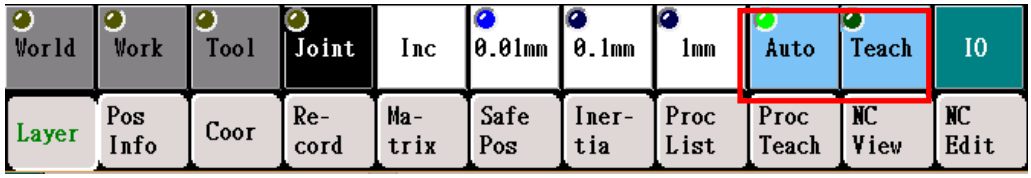
1.2. Function Menu



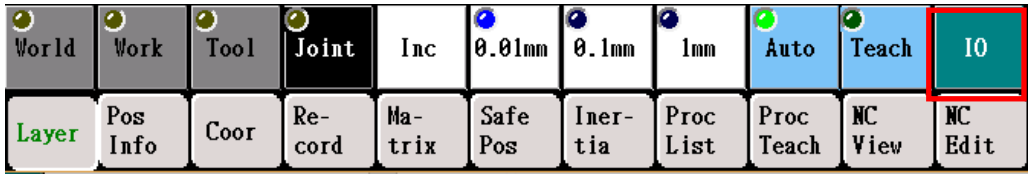
Select the coordinate system.



It may select the continuous or increment movements (distance and speed) under the teaching mode.

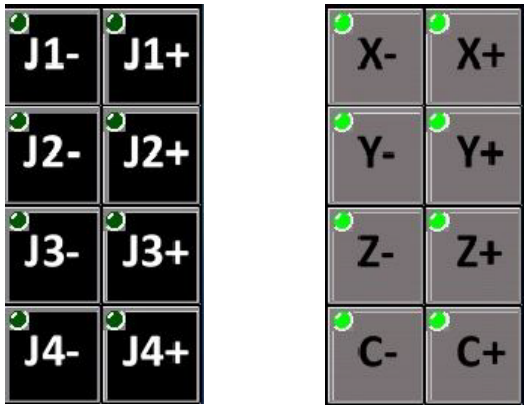


Select the modes.



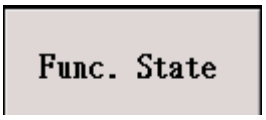
Display the current IO status.

1.3. Teaching Column

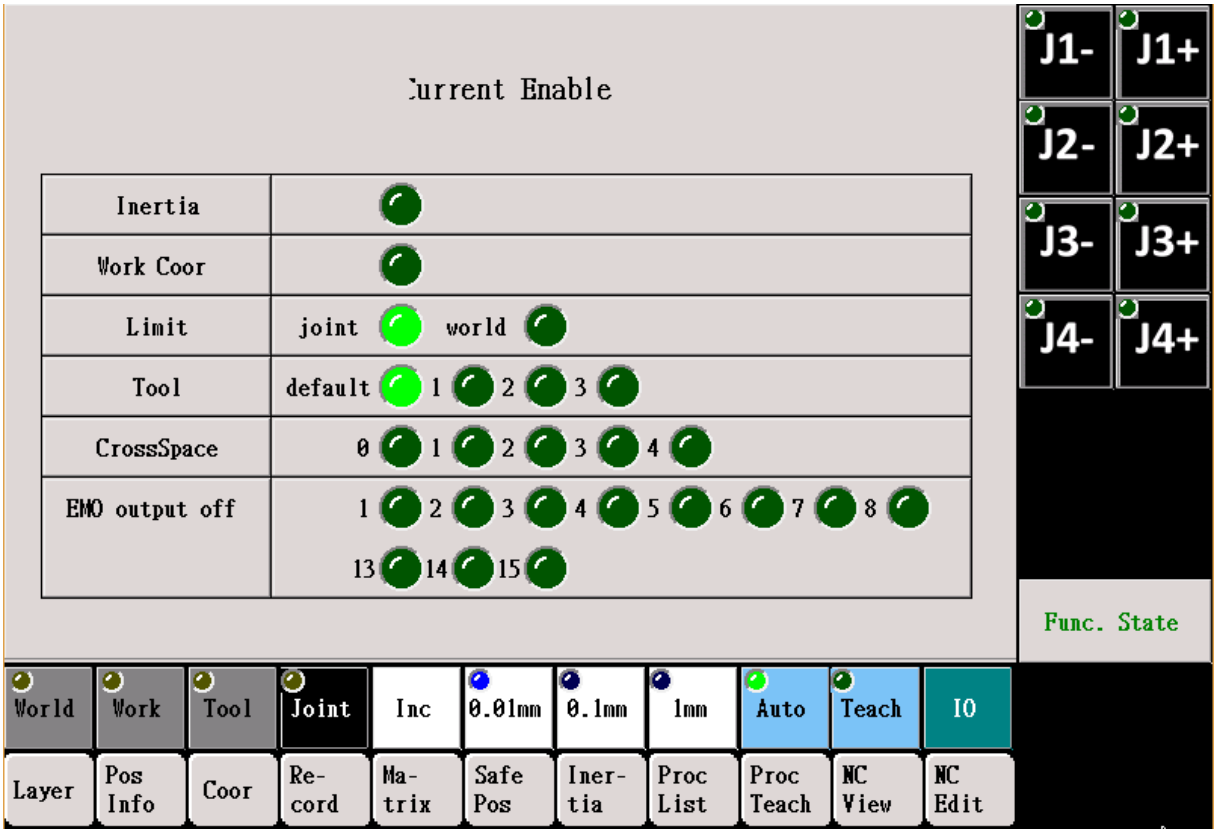


Manually move under the teaching mode (present the different figure according to the selected coordinate system, where the world/work/tool and the joint show in gray and black.).

1.4. Function Status



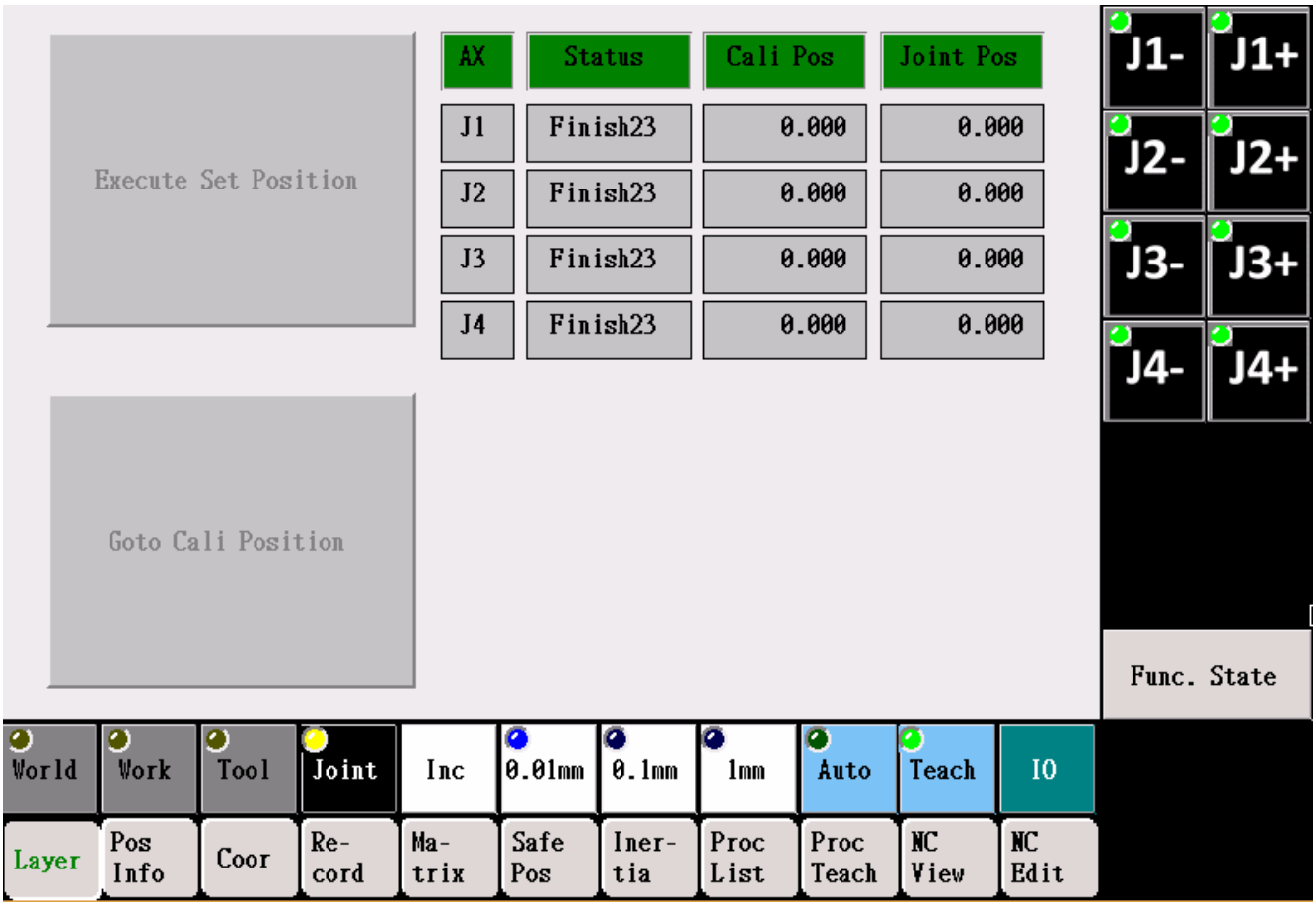
Display the function status currently started or set.



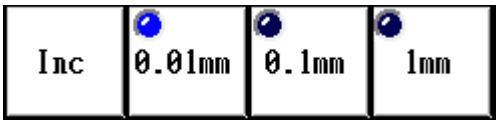
Inertia: Display current inertia. If current inertia isn't set as 0, the indicator will light up.
Work Coordinate System: Display the coordinate origin in the Work Coordinate System. If the origin of work coordinate isn't set as 0, the indicator will light up.
Limit: Display the current limit of joint/world. If the value isn't set as 0, the indicator will light up.
Tool: Display the tool number of Tool Coordinate System.
Interference Area: Display the number of the activated Interference Area.
Emergency Stop Output: Display the number of emergency stop output currently set.

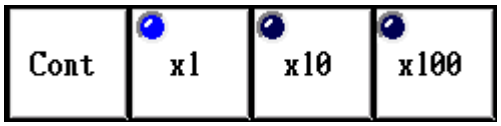
2. Teaching Operation

The Teaching Column on the right corner of the screen can be used to operate the each kind of operation for the robot. Before you operate it, you need to switch to the “Teaching” mode and start the procedure. Note that the system status must be ready, and the safety button on the side of the Teaching Pendant is needed to hold under the teaching.



2.1. Continue/Increment





Press the Continue/Increment button to switch the moving approach.
Under “Continue”, press the movement button, and the motion will continue to move in accordance with the selected function until the button is up. The moving speed can be determined by selecting from three (3) different speeds of underneath. Under “Increment”, press the movement button, and it will move the robot for a fixed distance, and the length of distance will be determined by three (3) different selection of distance of underneath.

The common use is: When the distance is far enough to the target point, use “Continue” mode in order to approach the target point more rapidly. When approaching to the target position, change to use “Increment” mode in order to adjust for reaching the target point precisly.

2.2. Coordinate System of Movement Basis

According to the different coordinate system selected, the moving direction will be transformed from that coordinate system.

World Coordinate System:

The origin of the coordinate system is based on the mechanical home and the direction, and the XYZ directions in the vertical coordinate as the coordinate expression. The meaning of the world coordinate is the end point of the tool relative to the distance (X, Y, Z) and direction (C) of the mechanical home.

Work Coordinate System:

All actions are decided according to the position where a workpiece is put. When many robots in the production line are required to perform the same work, the same procedures should be performed by each robot. However, because the relative position between the machine and the workpiece is difficultly consistent during the installation, the coordinate system is required to define and used to describe the position to place the workpiece and the rotation angle.

Tool Coordinate System:

In the course of the procedures, the movement is sometimes done according to the direction of the fixture at the end of the robot. For example, the actions to load and change the material in the mill require the direction of the fixture at the end of the robot, which will straightly stretch to take and load the workpiece. When the current posture is used for the reference, the tool coordinate system can be set.

Joint Coordinate System:

The joint coordinate is based on the joint angle as the basis of the movement, independent of the mechanical dimensions. Because the joint movement will not suffer from the singular point when calculating, it is often used when going across the simulation point. The special attention should be paid to the collision when it is used.

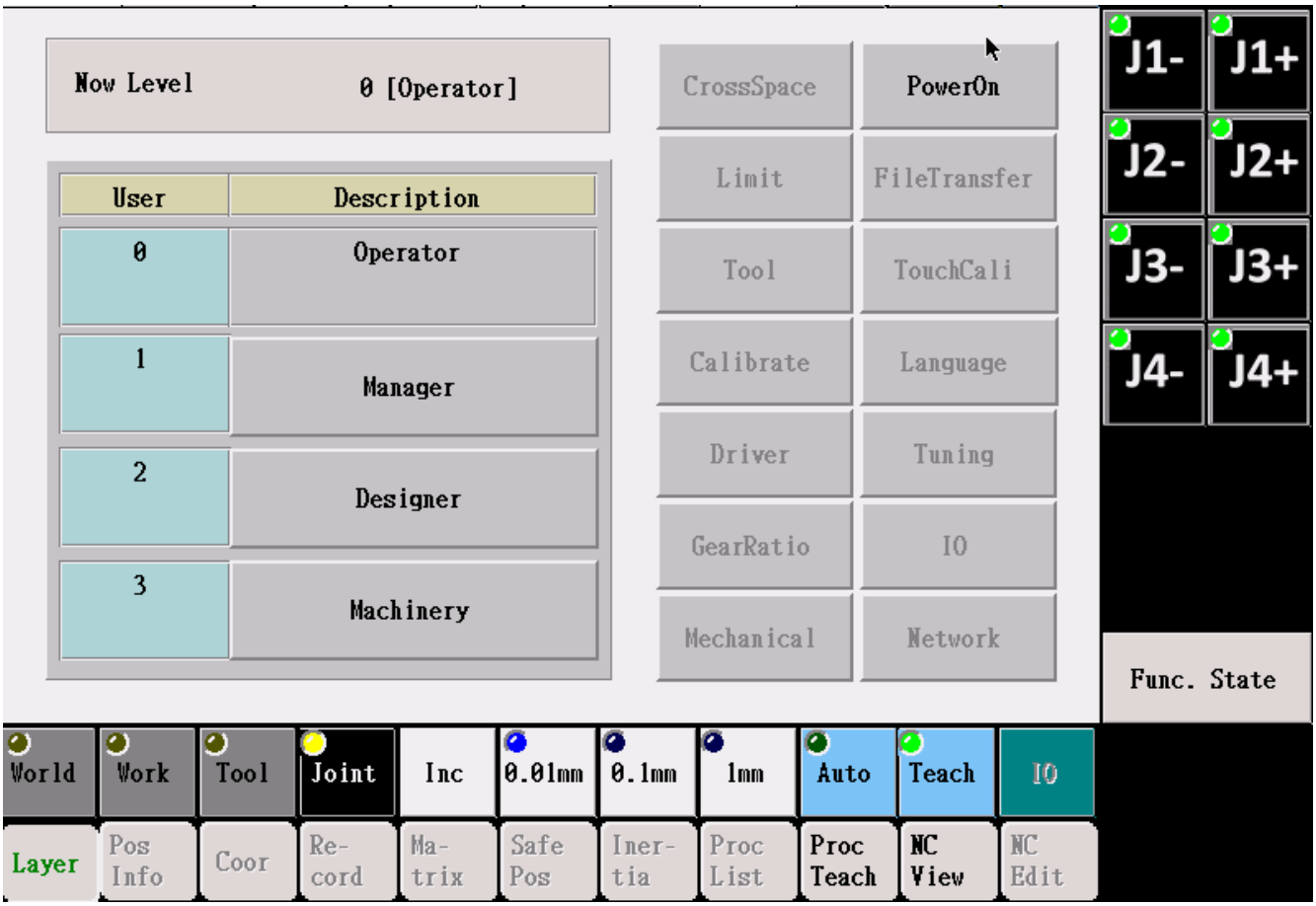
2.3. Movement Button

According to the moving mode (continue/increment), speed (1%, 10%, 100%) or distance (0.01mm, 0.1mm, 1mm) and the coordinate system (world/work/tool/joint), the behavior will also be different when you press the movement button.

Buttom	Description
	Wolrd, work, and tool coordinate systems: The end point moves toward to the X-axis direction of the selected coordinate system. Joint coordinate system: The first joint rotates clockwise/counterclockwise.
	Wolrd, work, and tool coordinate systems: The end point moves toward to the Y-axis direction of the selected coordinate system. Joint coordinate system: The second joint rotates clockwise/counterclockwise.
	Wolrd, work, and tool coordinate systems: The end point moves toward to the Z-axis direction of the selected coordinate system. Joint coordinate system: The third joint rotates clockwise/counterclockwise.
	Wolrd, work, and tool coordinate systems: The end point rotates toward to the C-axis direction of the selected coordinate system. Joint coordinate system: The fourth joint moves positiviely/negatively.

3. Permissions Page

3.1. Permissions



There are four permissions in this system:

0 Operator: The operator takes responsibility to operate the machine, but can't program the procedures.

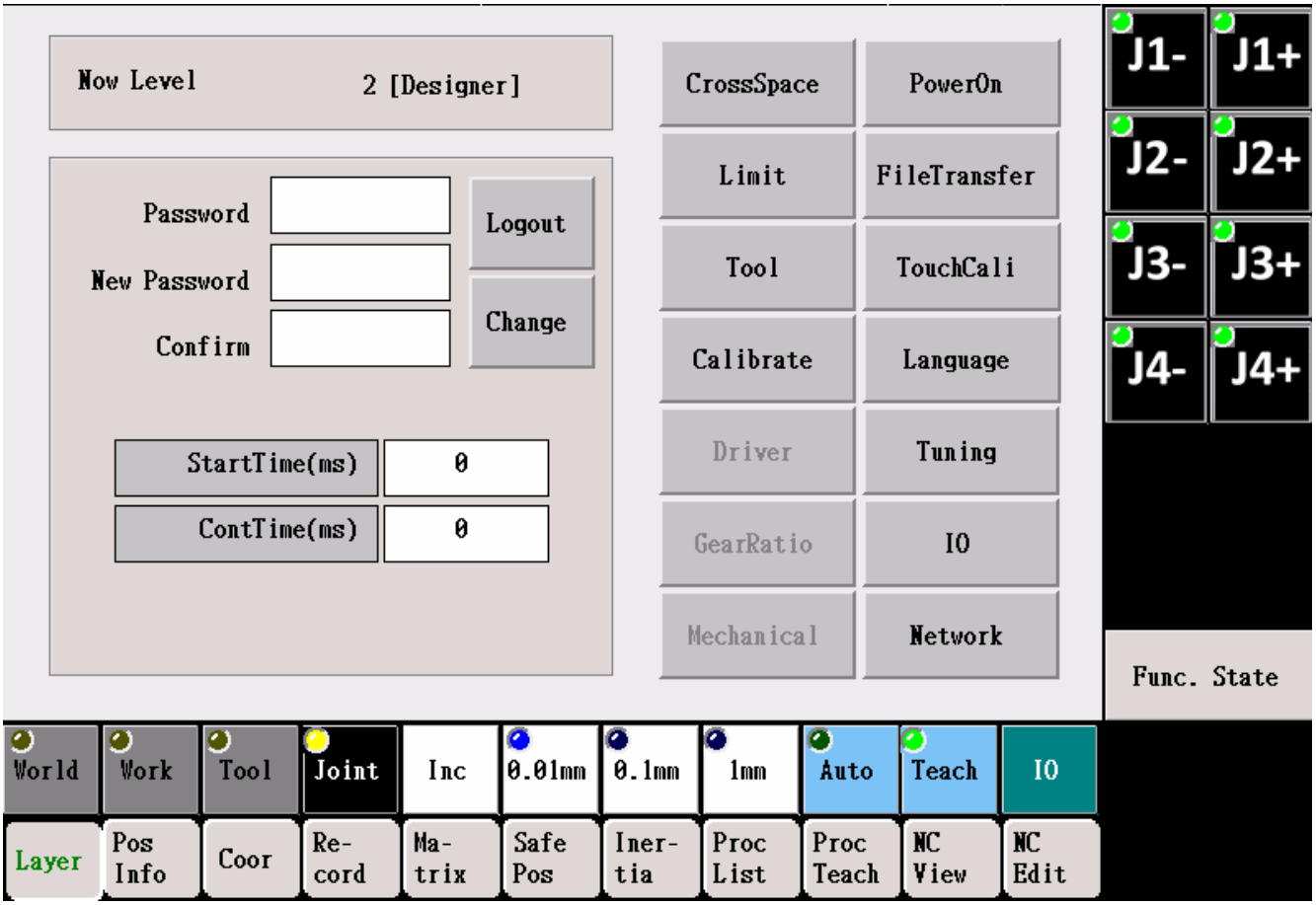
1 Manager: The manager takes responsibility to edit and program the procedures. The default password is 2222.

2 Developer: The developer takes responsibility to program the machine flow. The default password is 1111.

3 Machinery: The supplier who manufactures the robot takes responsibility to set and adapt the machine.

There are four permissions currently opened for the use of customers including the operators and managers. As the name implied, the Operator can only perform the running of procedures; in addition to running the procedures, the Manager can also modify programs. The Developer can use the additional functions.

Login permission: When you click one of the Administrator or the Developer, the screen to enter password will show up. You must enter correct password.



Login: Login the current permission, and change as the Operator.

Change: Change password to login the permission.

Time for start:

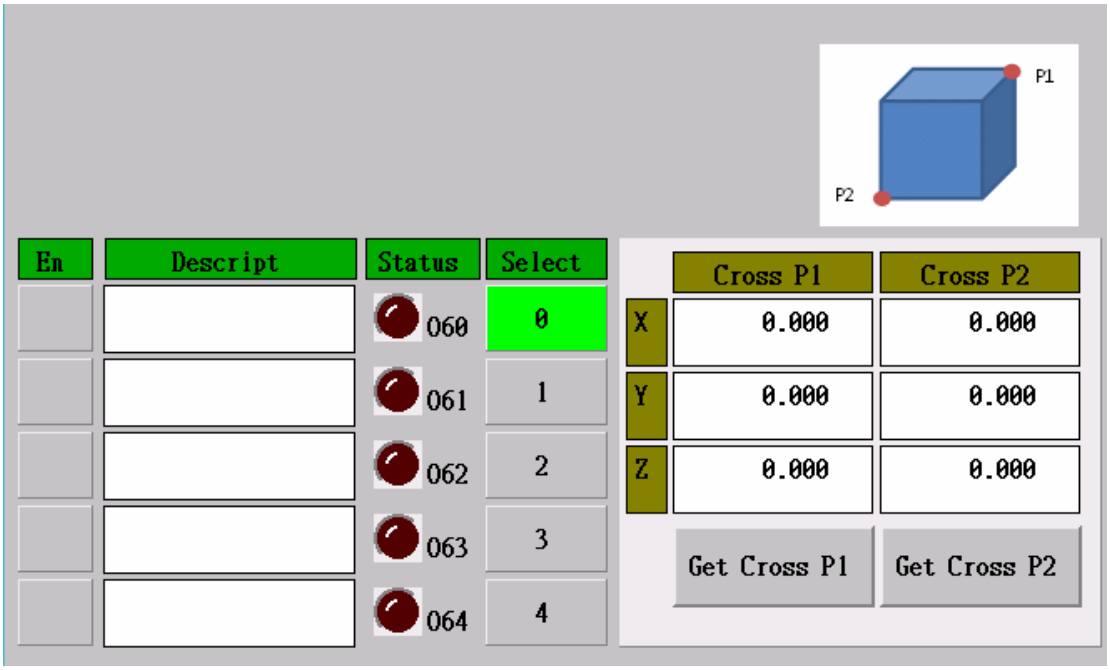
When you want to start program, you must hold the Setting Start button to avoid improper start.

Time for continue:

When you want to continue the paused programs, you must hold the Continue Setting button to avoid the improper start.

3.2. Interference Area

This function is used to define the area where overlaps with the actions from external equipment. The system will automatically detect the end position of the robot. When the robot enters the defined rectangular space, the output signals will be activated to notify external equipment. When external equipment is in the action or non-action state, the input signals will be provided to the robot as well. If the output signals from the robot are simultaneously activated with the input signals from external equipment, the system will alarm to stop the robot and avoid damage.



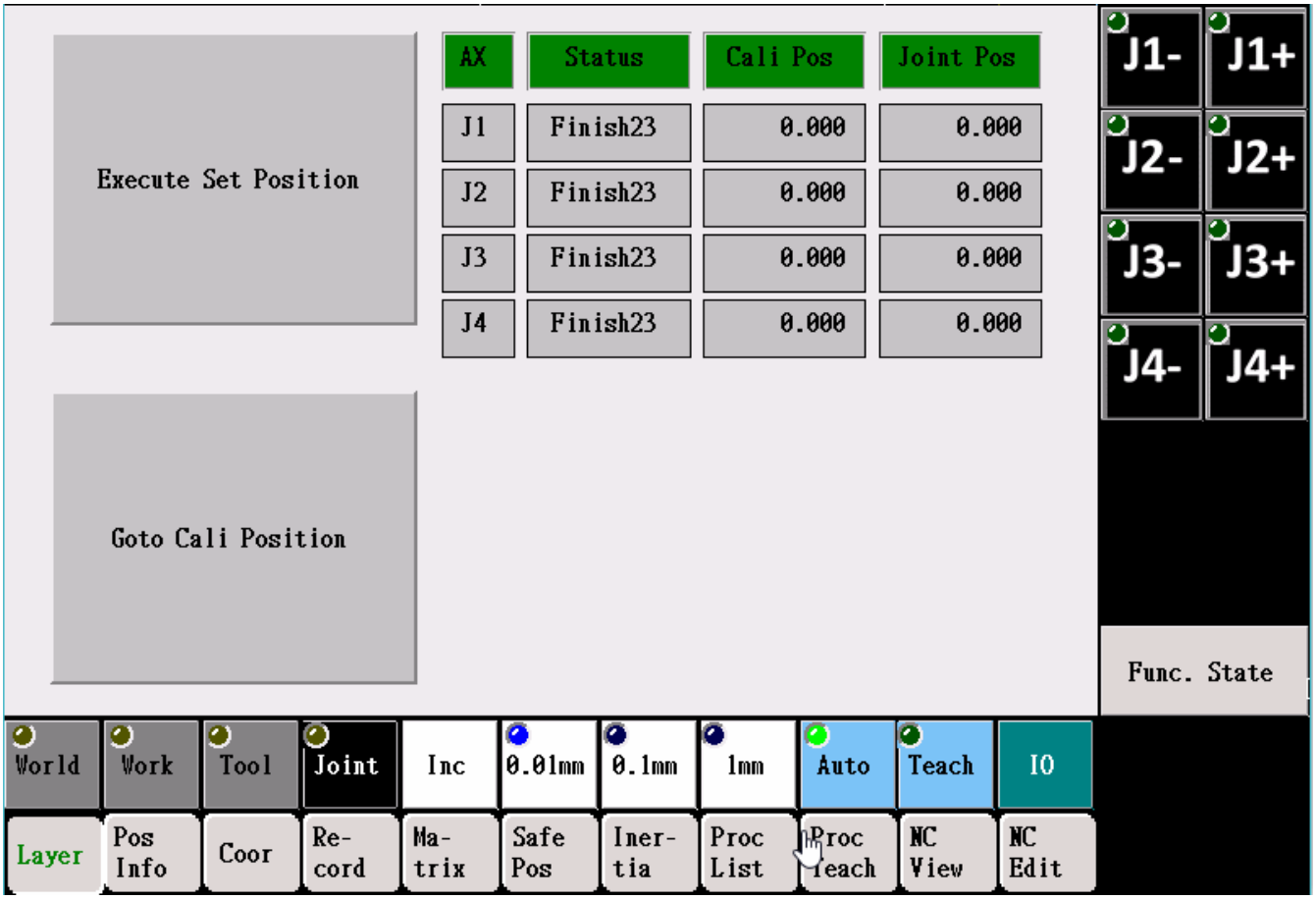
The diagonal point 1 and 2 define the overlapping area. After the robot can be manually moved to the diagonal point, press the “Take Diagonal Point 1” and “Take Diagonal Angle 2”. The system uses the rectangular space formed by two diagonal points in the world coordinate system as the interference area.

The system can set up to five sets of interference area. If you select to activate  , the system will output the signals and logic by alarm.

The output signals from five sets of interference area correspond to O60~O64. Five input signals from external equipment correspond to I60~I64.
When O60 and I60 are activated, the system will alarm.

3.3. PowerOn

The coordinate status and values at all axes can be viewed in this page.



Execute Auto Set Coordinates:

In the Auto mode, you can press this button to automatically execute the coordinate setting. All axes will read the coordinate values again.

Goto Calibration Point:

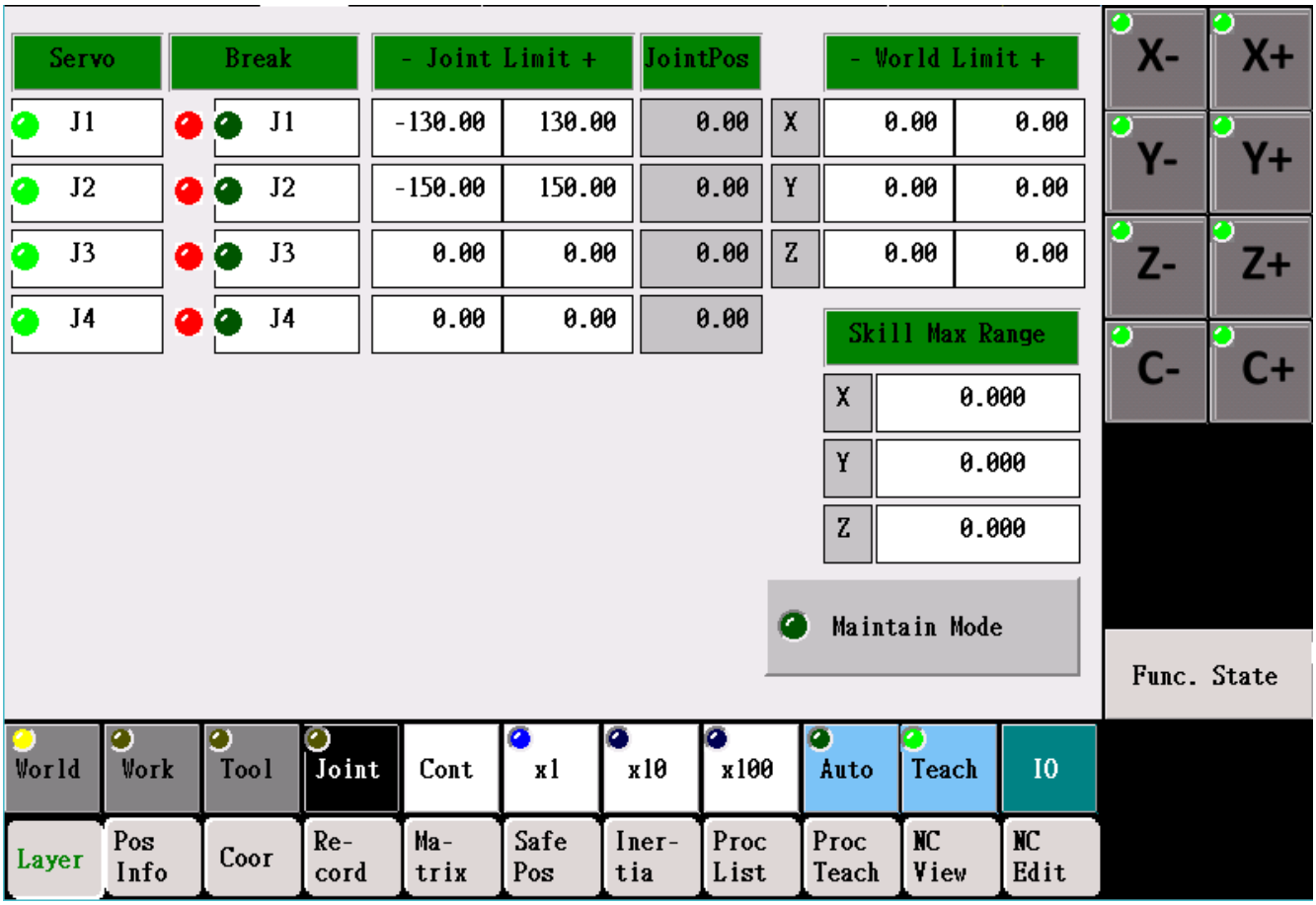
In the Auto mode, you can hold this button so that the coordinates the machine moves to the calibration point can gradually move. The action will stop when the coordinates are reached or the button is released.

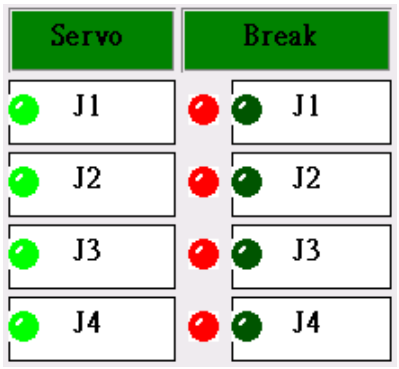
The coordinate status at all axes is described as follows:

-10: Encoder communication error
0: None (wait to search for Z or read the encoder value)
10: Wait to enter the calculation coordinates
20: Wait to enter the setting coordinates
23: Complete the coordinate setting

3.4. Limit

The large rotation range could not be accommodated because of the mechanical interference or internal wire scrolled or snapped.





This page not only sets the limit, but also individually controls the servo start and brake at all axes. In the servo OFF and brake ON, the mechanism can be manually pushed to directly observe the coordinates at all axes.

The green servo indicator represents motor excitation. The green brake indicator represents the brake release of motor.

- Joint Limit +		JointPos
-130.00	130.00	0.00
-150.00	150.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00

Set the joint limit, where the values are the joint coordinates (deg), used to limit the rotation angle at all axes.

	- World Limit +	
X	0.00	0.00
Y	0.00	0.00
Z	0.00	0.00

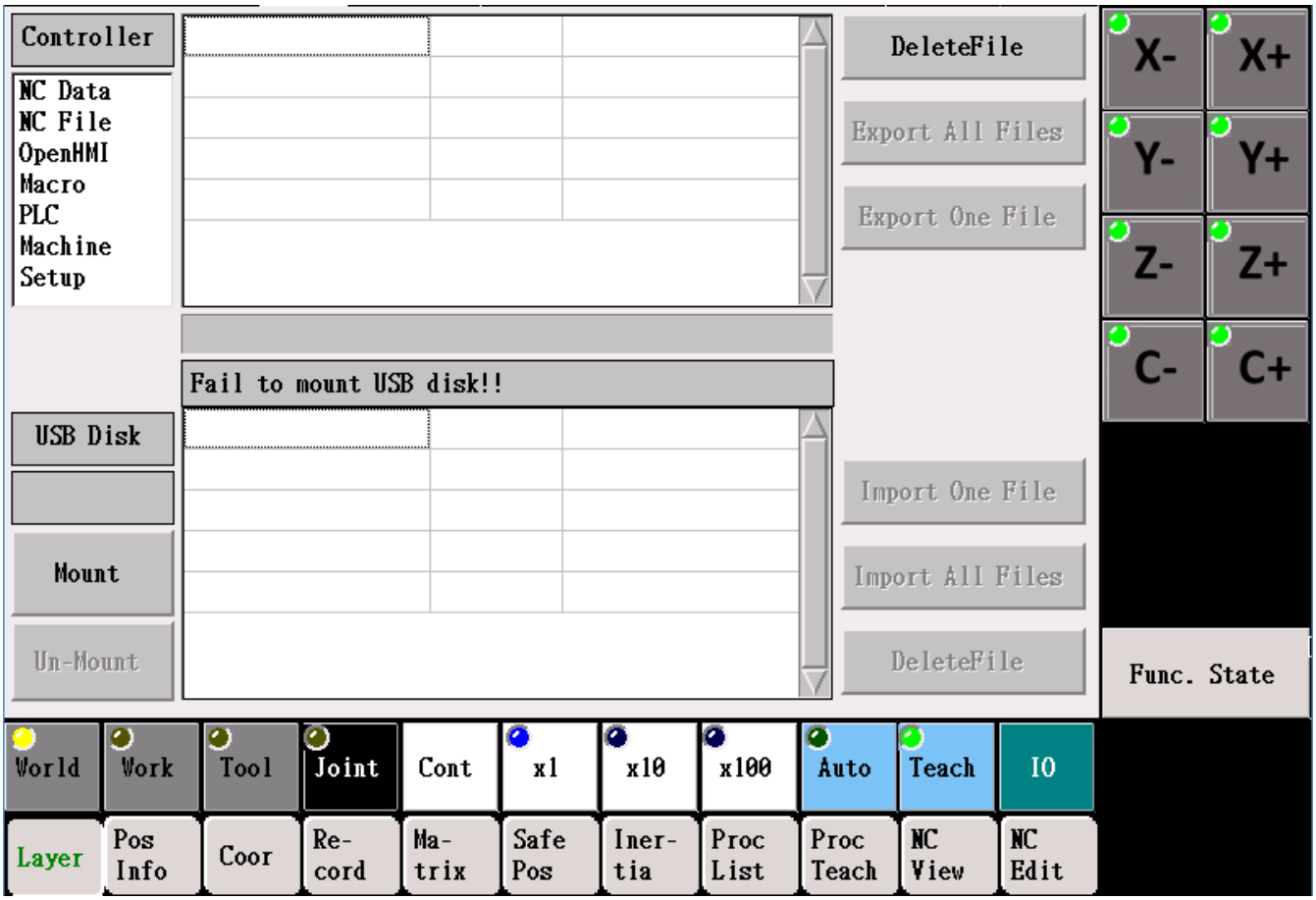
Not only the joint limit but also the moving range of the end fixture can be set. The world limit is to define this range, where the values are the world coordinates (mm) and the limit range is a space cube.

Skill Max Range	
X	0.000
Y	0.000
Z	0.000

When “Skill Setting” is used in the procedures, this parameter can be set to avoid accident by improper skill offset. The input values represent the permissible range of the skill offset.

3.5. File Transfer

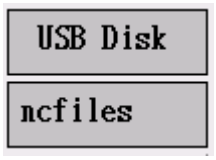
NC file is saved in ncfiles. The file name has the special format, and the length is in 30 bytes.



Display the file type that current login permissions can access (The Manager can view “Machining Data” and “Machining File” only.).

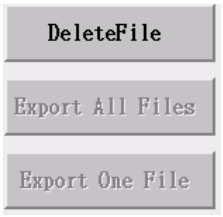
Machining data: Including the procedure files and image files.

Machining file: NC files and module files.



Select the folder in USB memory.

Plug and unplug USB memory.



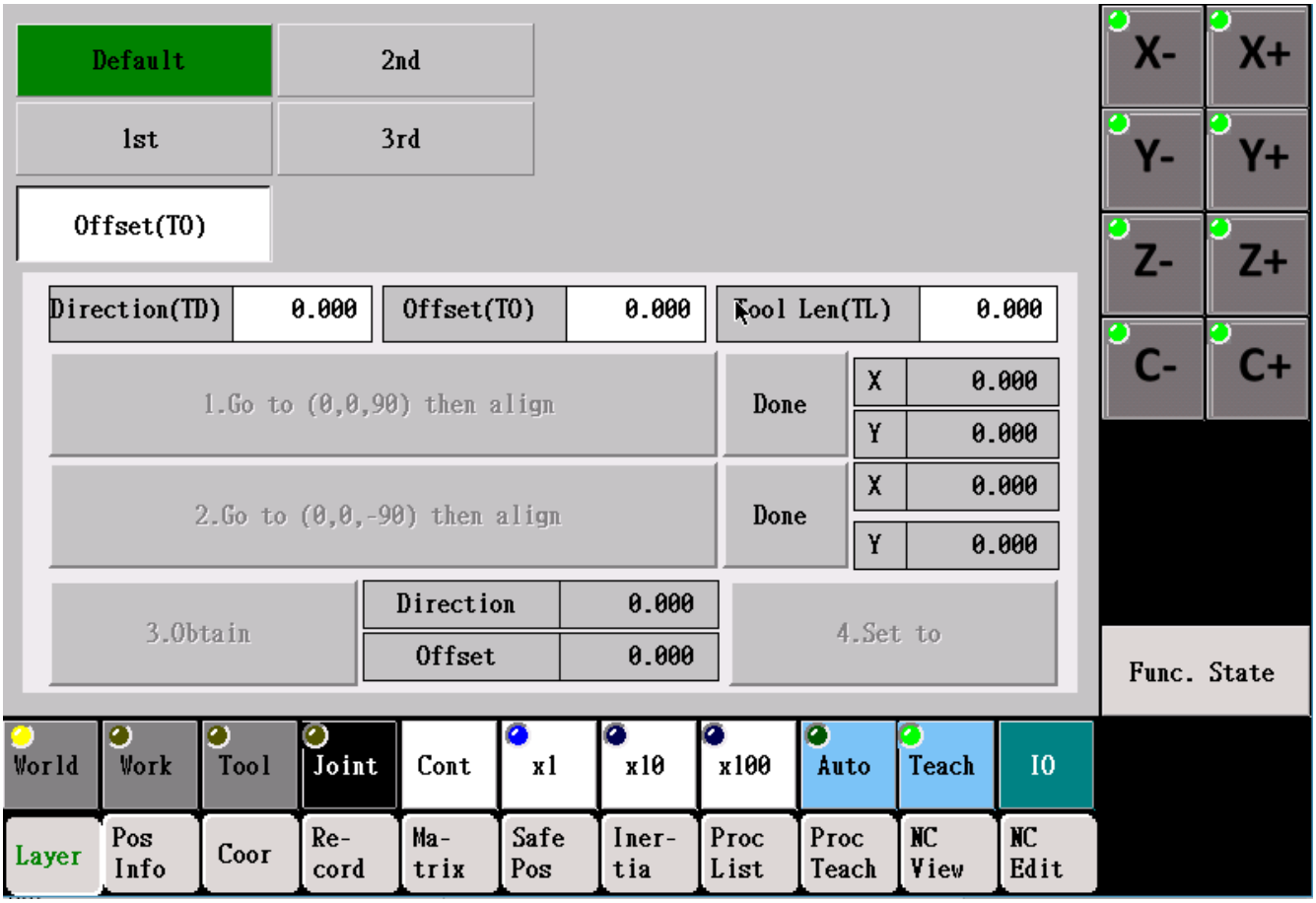
Operate the files in the controller:

Delete File: Delete the selected file.
Export All Files: Download all files to USB memory.
Export Selected Files: Download the selected files to USB memory.

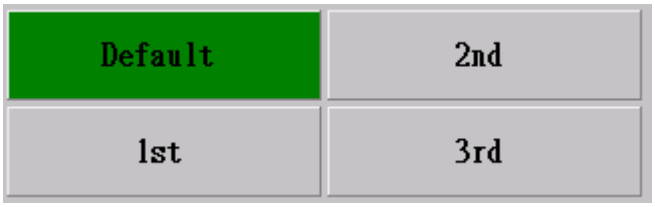
Operate the files in the controller:

Import Selected File: Transfer the selected file to the controller.
Import All Files: Transfer all files to the controller.
Delete File: Delete the selected file.

3.6. Tool

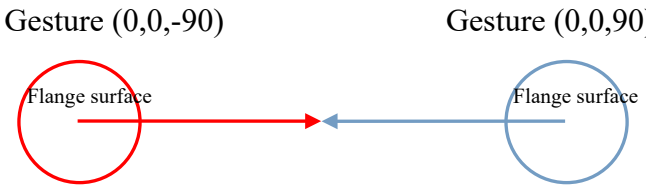


The tool offset can simultaneously record up to four sets of tool parameters.

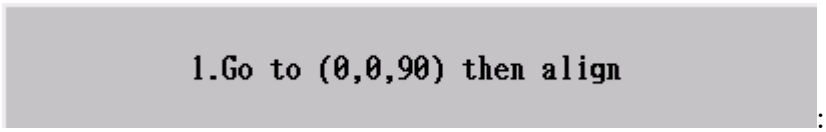


Switch to the current tool parameters.

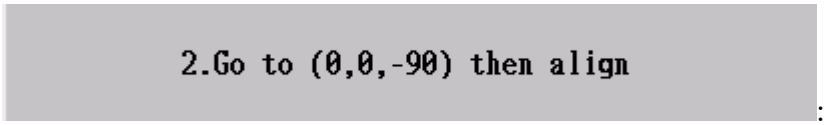
The operation to calibration the tool offset is described as follows:
From the top view to observe the tool installed on the front end of the robot, the arrow indicates the direction to install the tool, and the arrow tip indicates the tool end, as shown in the following figure.



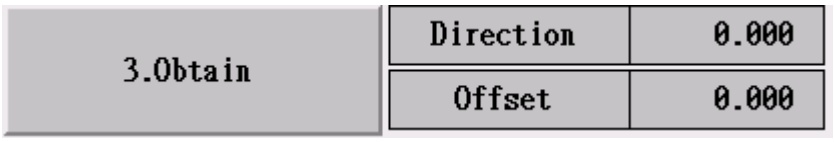
When you operate, please follow the order and the description according to the buttons on the screen.

1. 

: The arm will move the posture to (0, 0, 90), and then the XY Movement Button is used to align the tool tip with the calibration point (a fixed point set by yourself). Press the “OK” button after completed. The XY coordinates on the screen will become the world coordinates.

2. 

: The arm will move the posture to (0, 0, -90), and then the XY Movement Button is used to move the tool tip to the calibration point aligned in the Step 1. Press the “OK” button after completed. The XY coordinates on the screen will become the world coordinates.

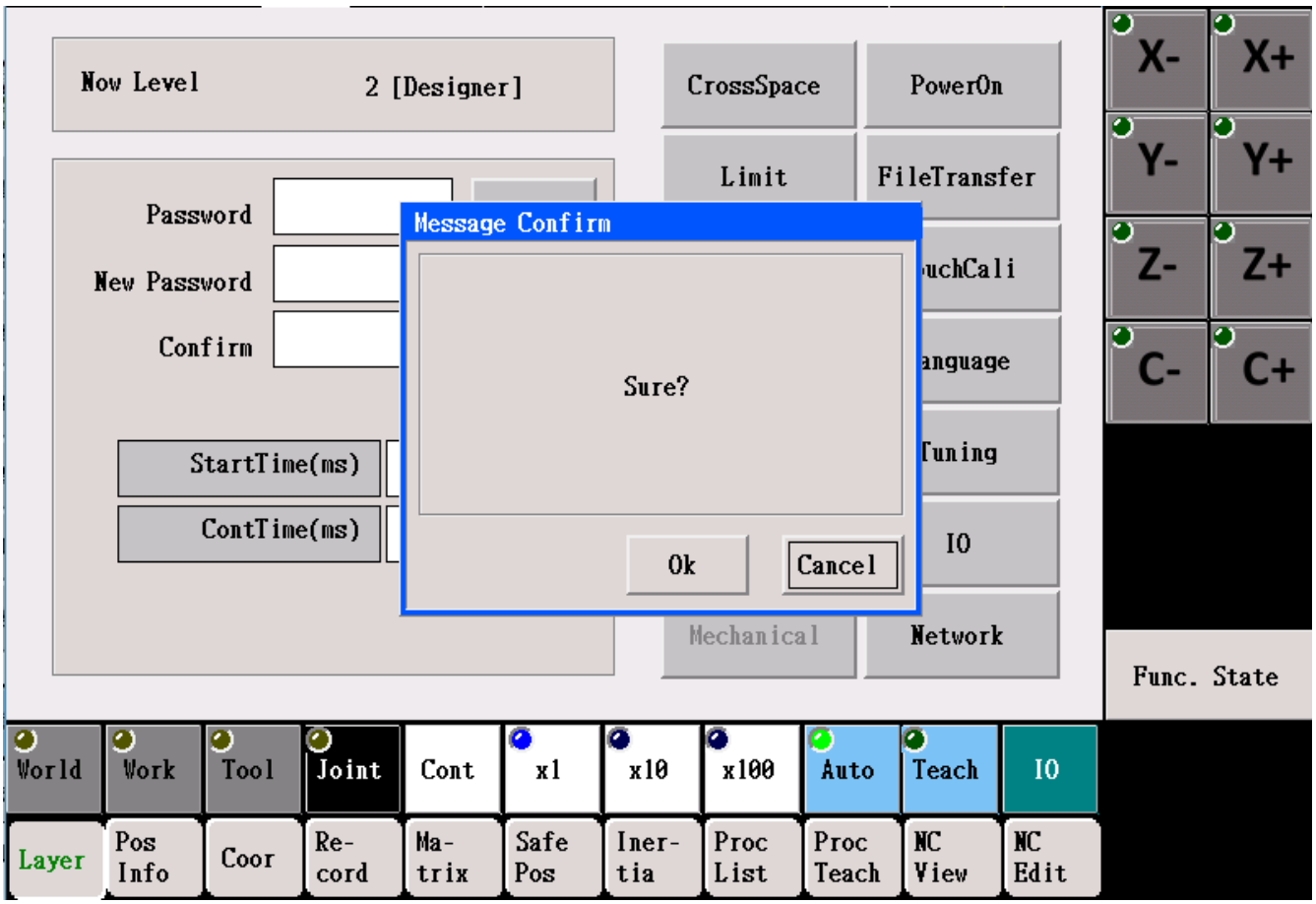
3. 

: Calculate the direction and offset according to two coordinates in Step 1, and 2.

4. 

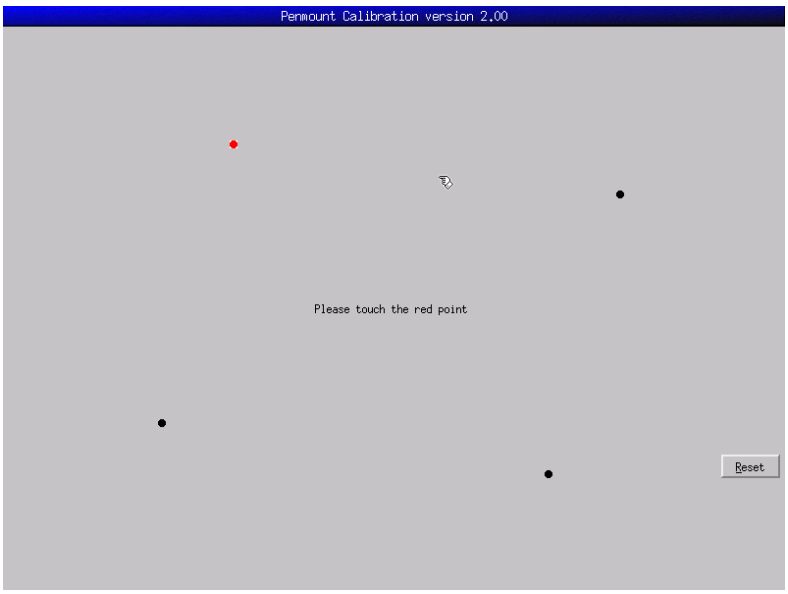
: Add the compensation values into the setting ones.

3.7. Touch Calibration

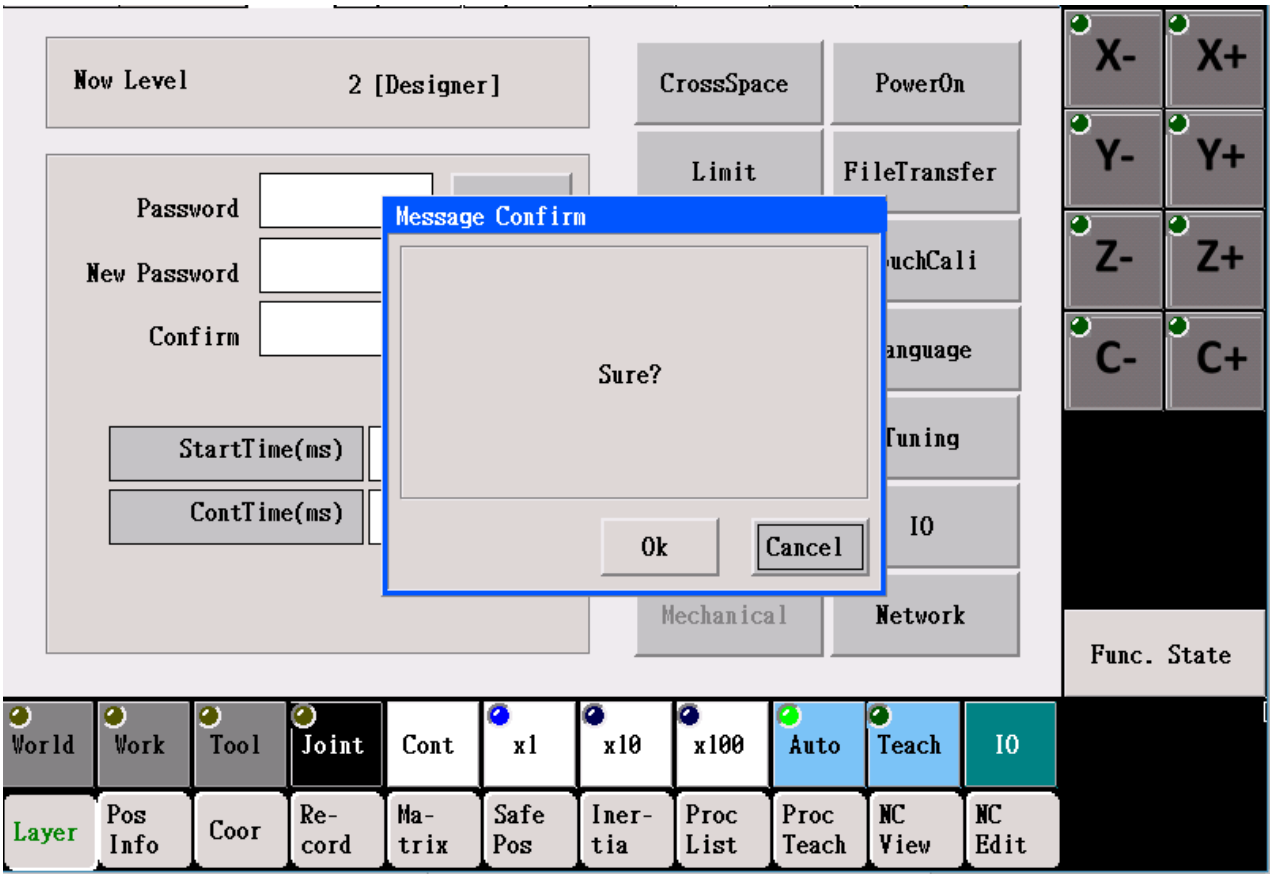


Pop-out to inquire the dialogue frame of Touch Calibration is executed when you press the OK button.

Pop-out the Touch Calibration screen after you press the OK button.

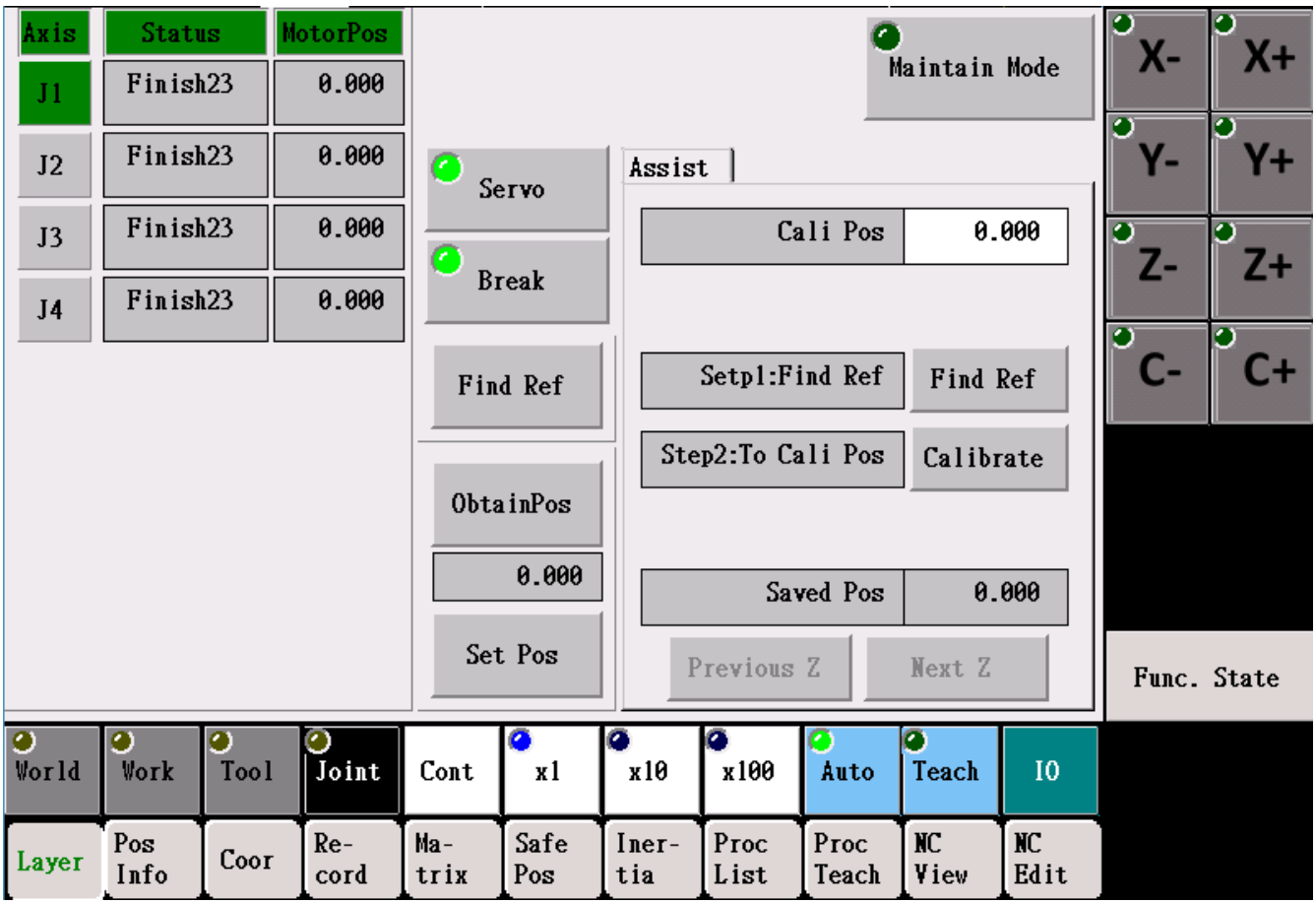


Click the red point in order to complete the calibration. The system will automatically start after completed, and the following screen will appear.



If you can click on the correct point and press the “YES” button, the touch calibration can be done. If you can’t click the correct points, the improper touch could take place in the course of the touch calibration. Don’t force to adjust the position you click YES. After the countdown ends, the controller will automatically restart and return to the condition before not calibrated.

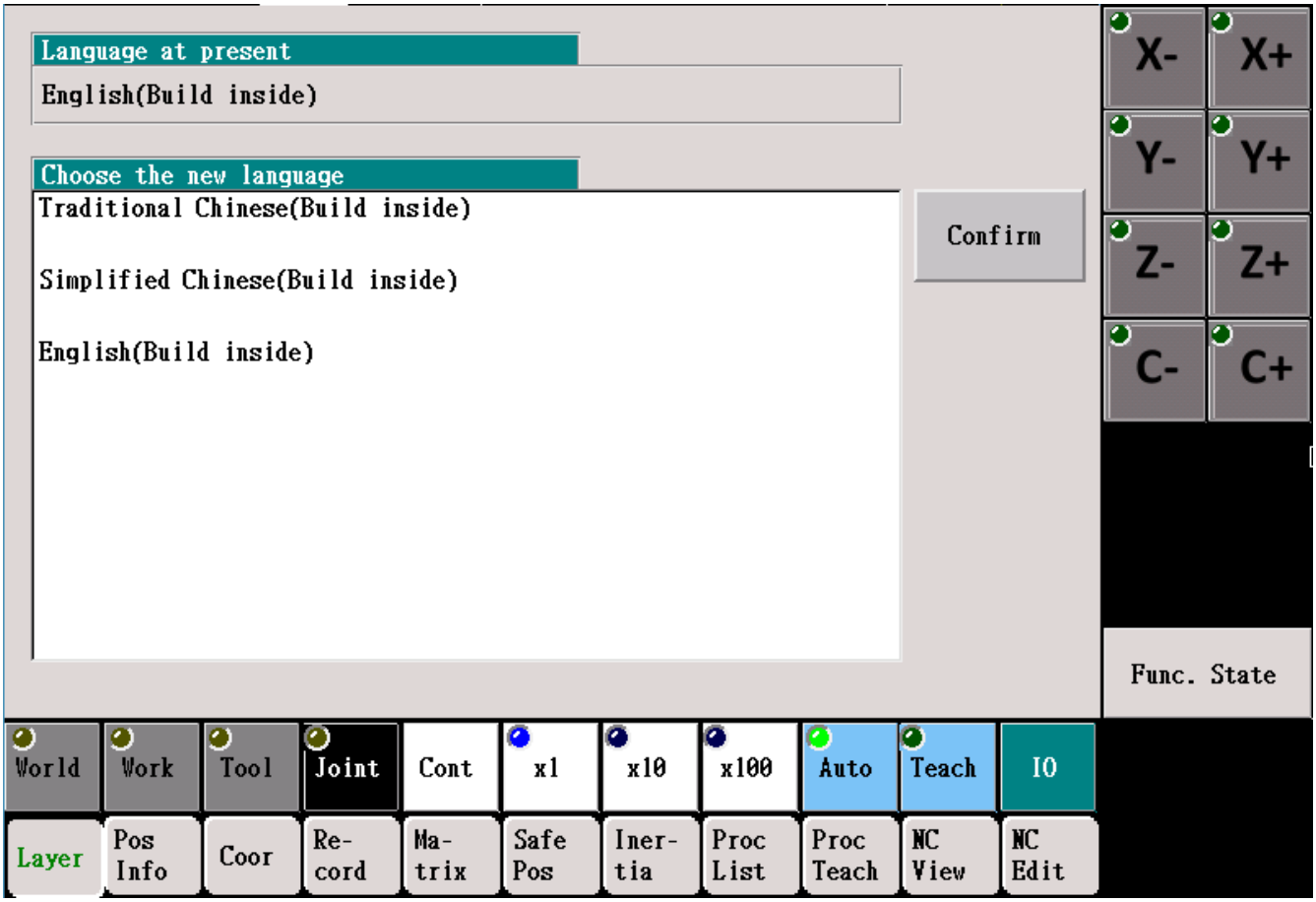
3.8. Calibrate



The correction method for the origin is described as follows:

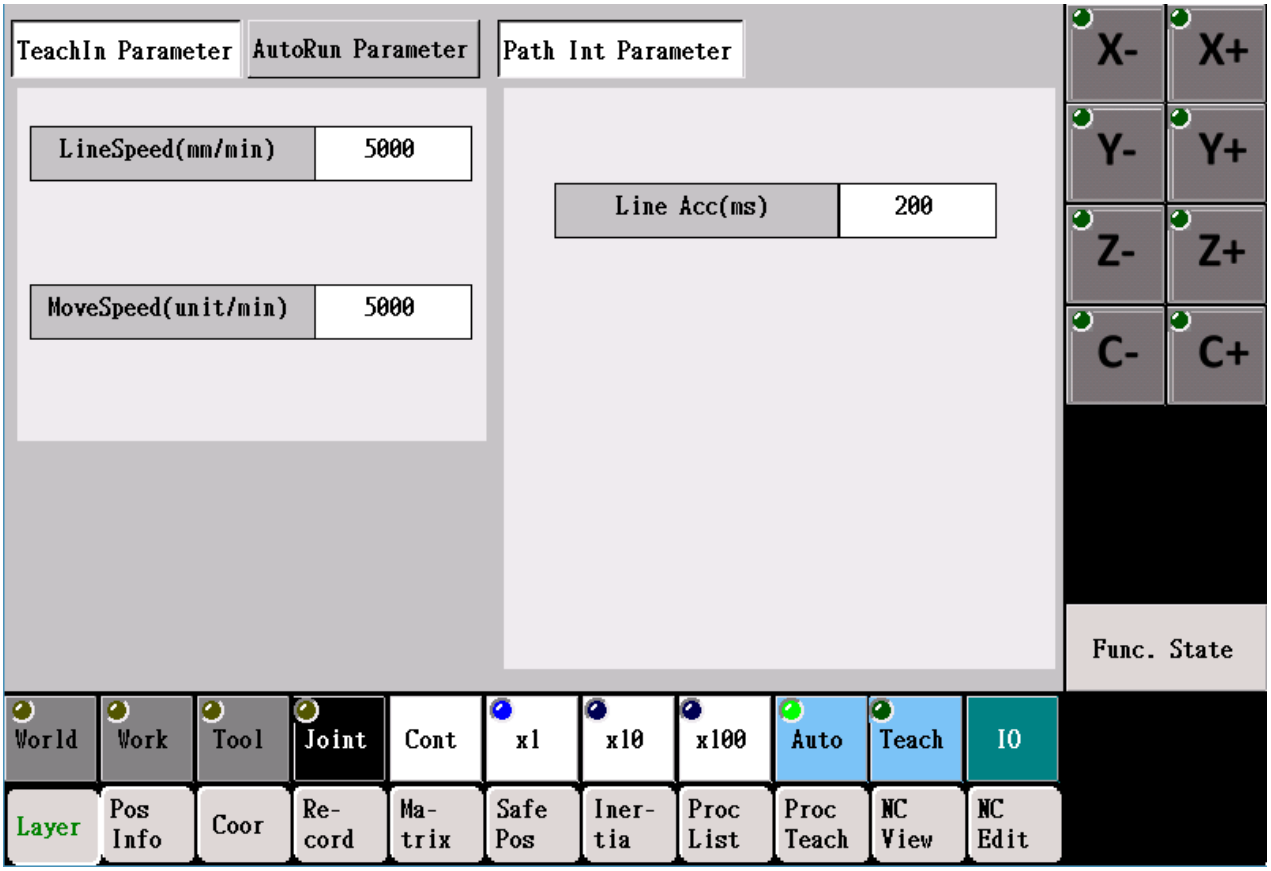
1. Use the teaching movement option or the emergency stop button to move each joint to the position of correction point (The robot stretches in line. The color button is pushed from down to up so that can keep a limit distance about several mm.). If this robot is used for the purpose of engraving or gluing in which the accuracy of path is highly concerned, the appropriate instrument shall be used for precision correction.
2. After you press the “Correction” button, the system will convert “Coordinate of Correction Point” to obtain the origin coordinate, and the current coordinates will be set as the origin coordinates.

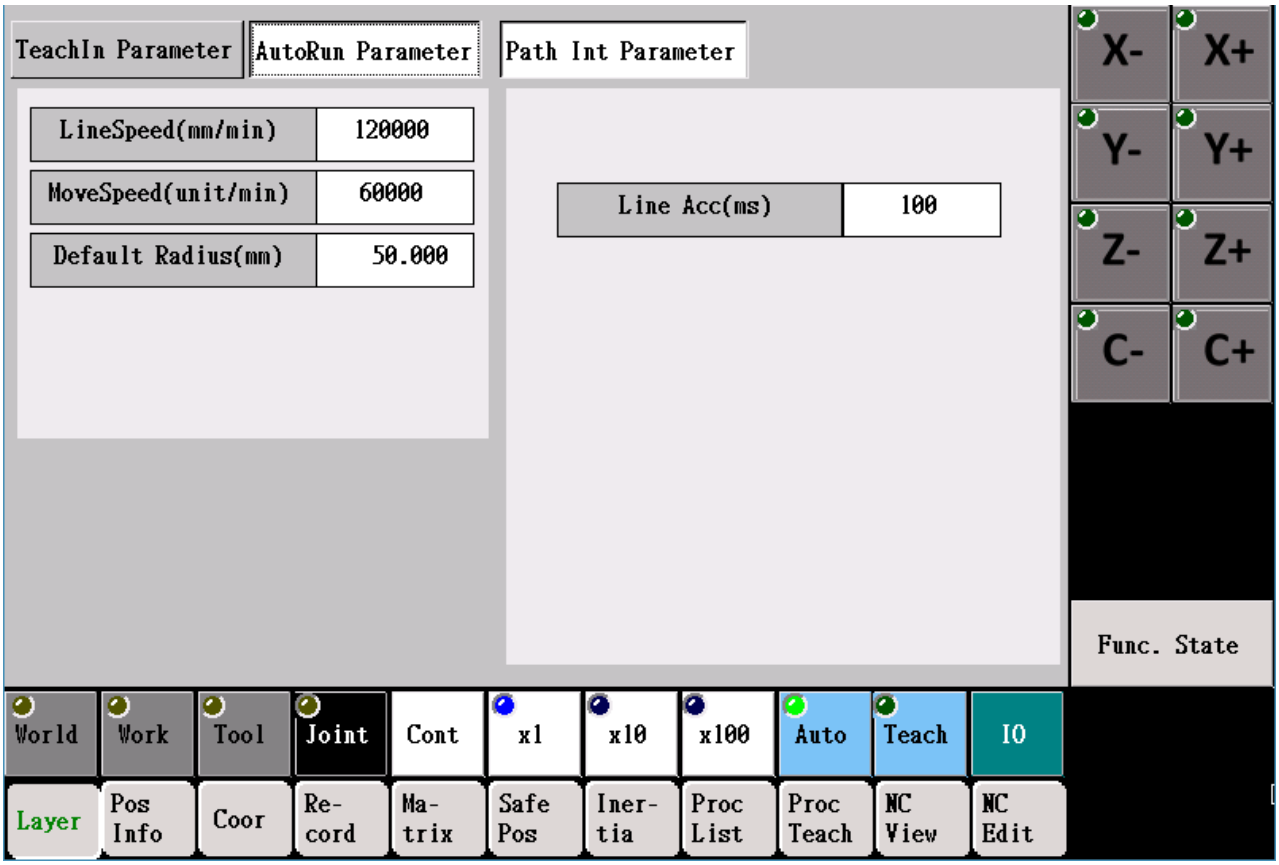
3.9. Change Language

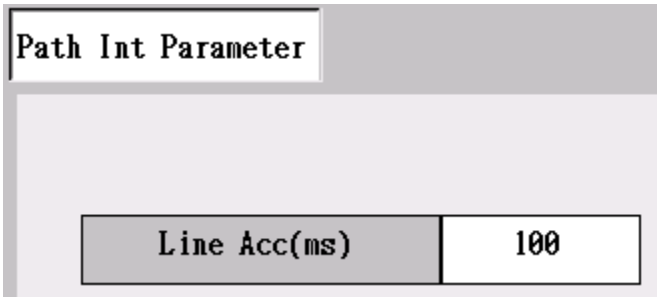


After you select the language you want to change and press the YES button, the system will automatically reboot to change the language.

3.10. Tuning

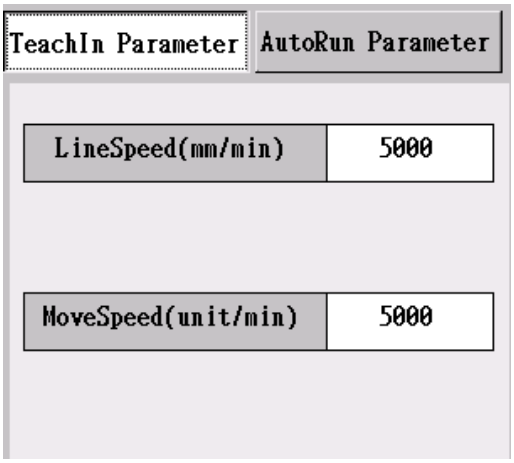

TeachIn Parameter
AutoRun Parameter
Path Int Parameter
LineSpeed(mm/min)
5000
MoveSpeed(unit/min)
5000
Line Acc(ms)
200
X-
X+
Y-
Y+
Z-
Z+
C-
C+
Func. State
World
Work
Tool
Joint
Cont
x1
x10
x100
Auto
Teach
IO
Layer
Pos Info
Coor
Re-cord
Ma-trix
Safe Pos
Iner-tia
Proc List
Proc Teach
NC View
NC Edit


TeachIn Parameter
AutoRun Parameter
Path Int Parameter
LineSpeed(mm/min)
120000
MoveSpeed(unit/min)
60000
Default Radius(mm)
50.000
Line Acc(ms)
100
X-
X+
Y-
Y+
Z-
Z+
C-
C+
Func. State
World
Work
Tool
Joint
Cont
x1
x10
x100
Auto
Teach
IO
Layer
Pos Info
Coor
Re-cord
Ma-trix
Safe Pos
Iner-tia
Proc List
Proc Teach
NC View
NC Edit



Straight line acceleration and deceleration time (ms):

Decide the G value of acceleration and deceleration. The time is increased to slow down acceleration and deceleration. However, it will be more helpful to the smoothness of movement. It can be changed according to the requirement and the actual operation when actually used.



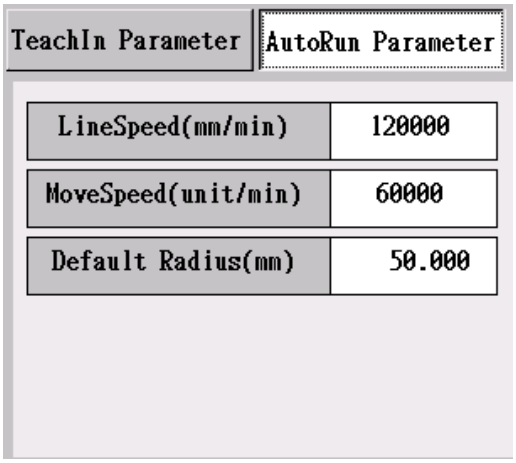
Suitale in the teaching mode.

Path speed (mm/min):

When the world, work, and tool coordinates are used to move, this speed can be employed.

Movement speed (deg/min):

When the joint coordinates are used to move, this speed can be employed.



Suitable in the auto mode.

Path speed (mm/min):

The speed is defaulted for the straight line movement command in the process.

(If the another speed is assigned in the process, the assigned one has priority.)

Movement speed (deg/min):

The speed is defaulted for the rapid movement command in the process.

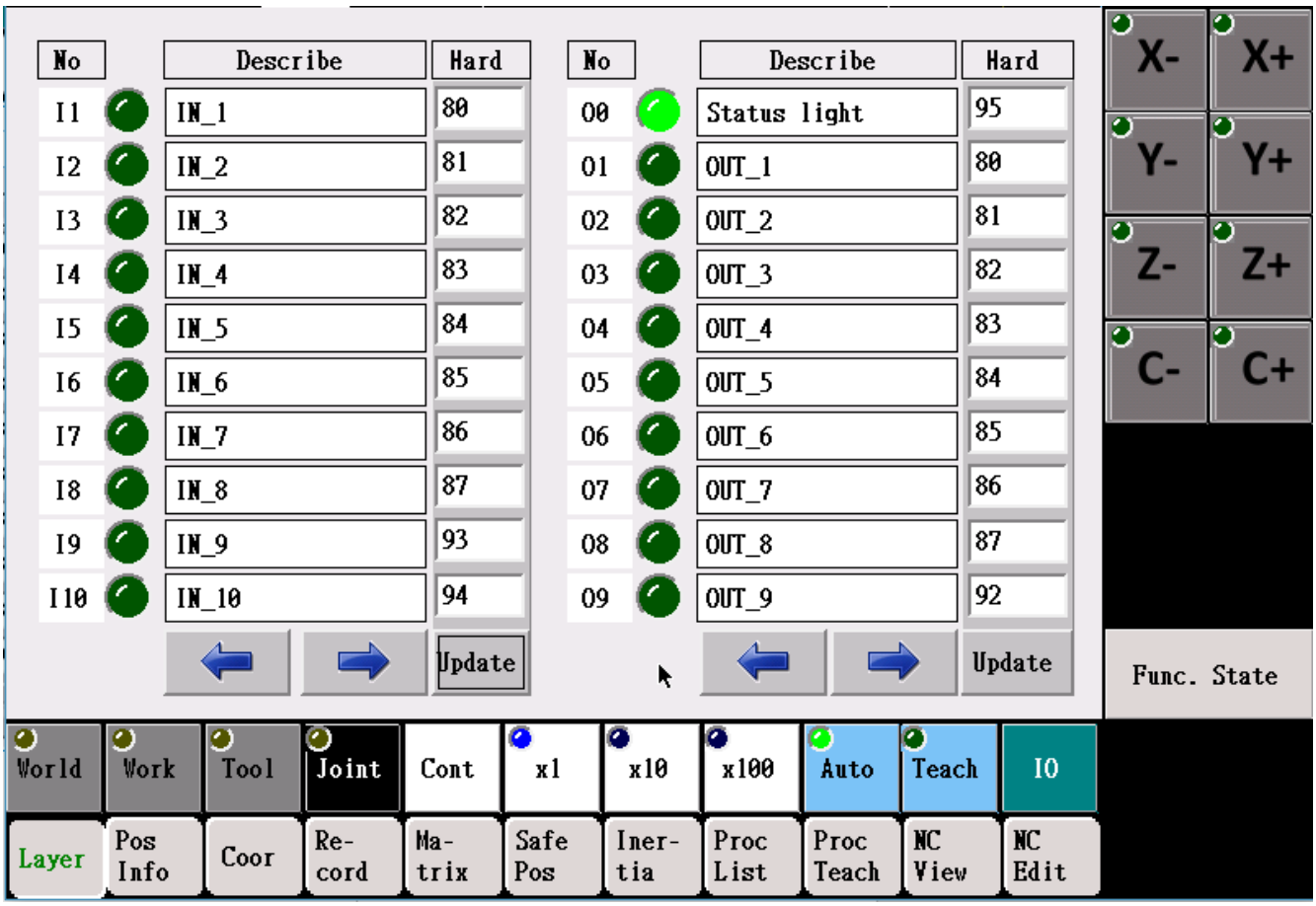
(If the another speed is assigned in the process, the assigned one has priority.)

Default radius:

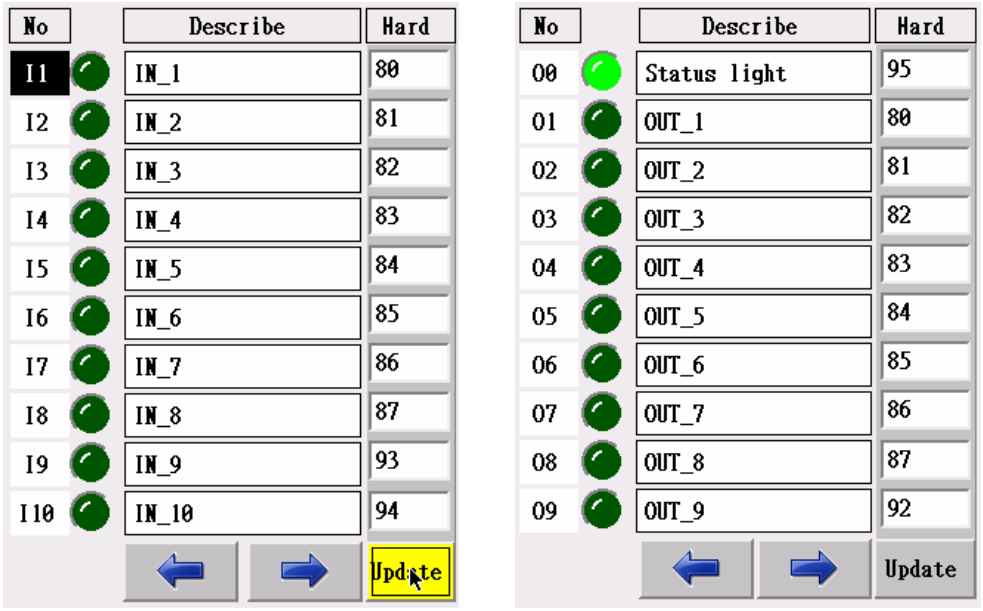
The radius is defaulted for the arc transition in the process.

(If the another arc radius is assigned in the process, the assigned one has priority.)

3.11. IO

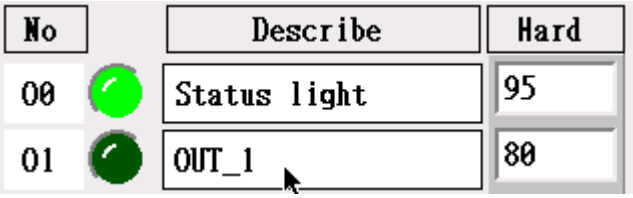


The left side and the right side show Input and Output.



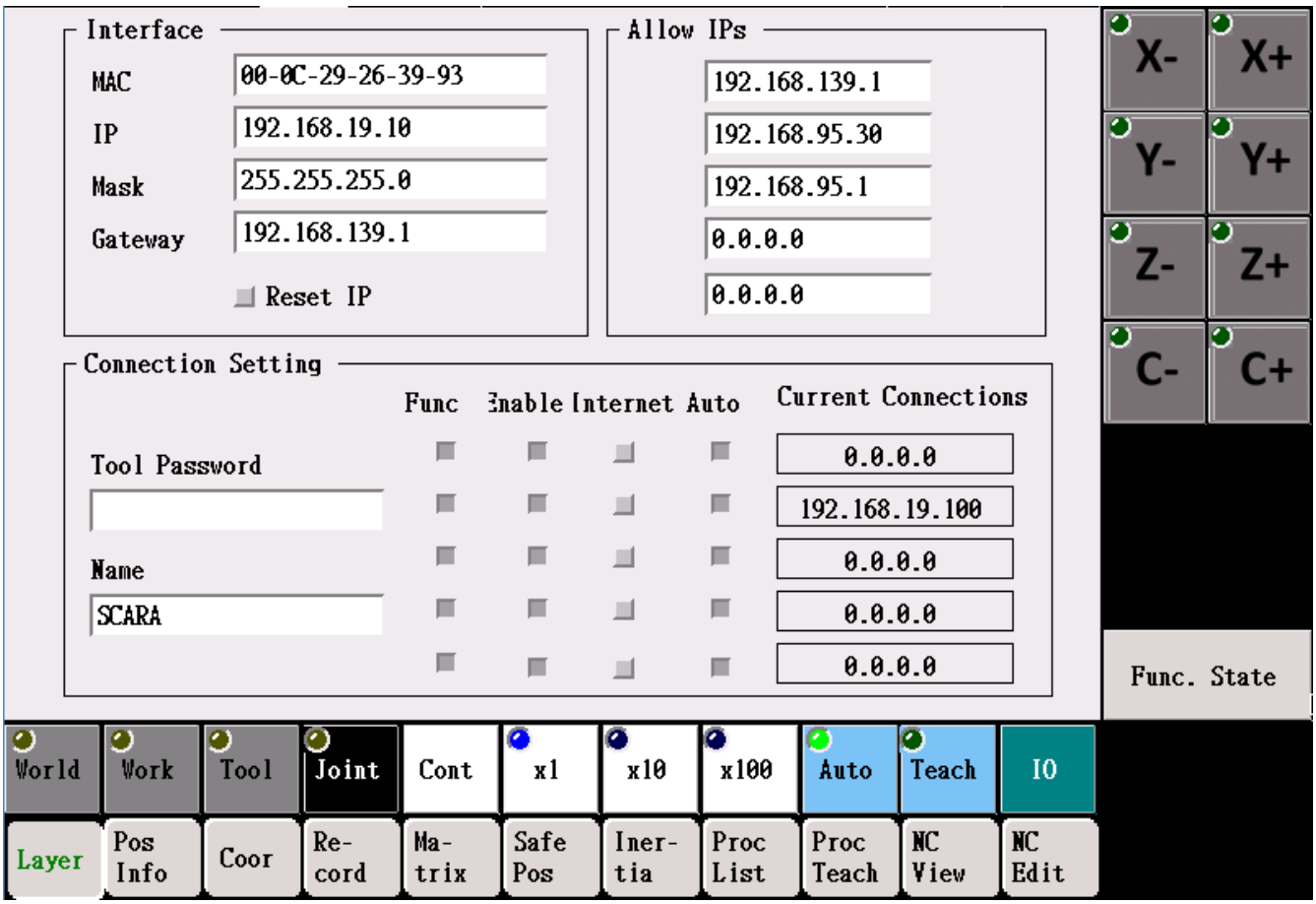
After clicking the number column and Update, the input signals can be inverted.

Switch the page buttons.

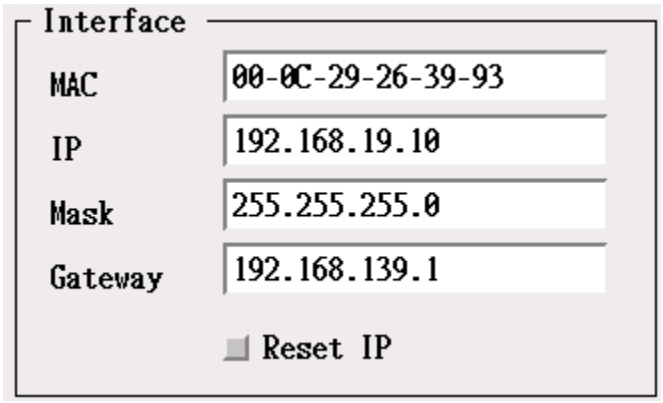


Click the column or the indicator for point O to directly change the output status.

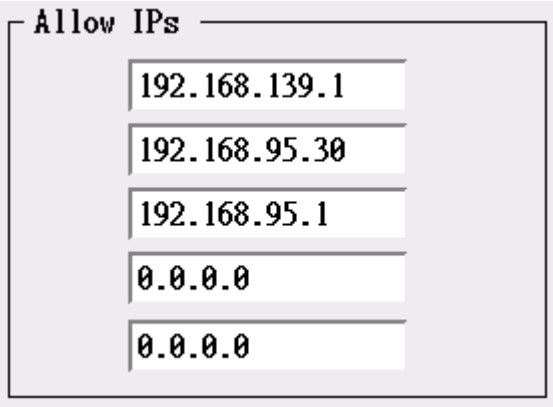
3.12. Network Setting



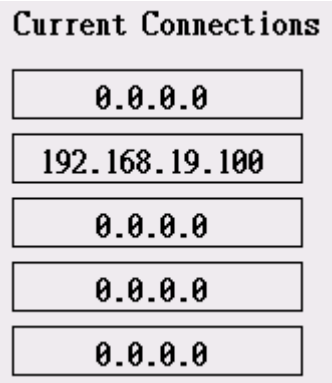
If you want to change IP for SCARA, press the Reset Network button after you change IP address. Wait two seconds, and then press it again.



Controller IP and MAC



Permissible IP from external connection

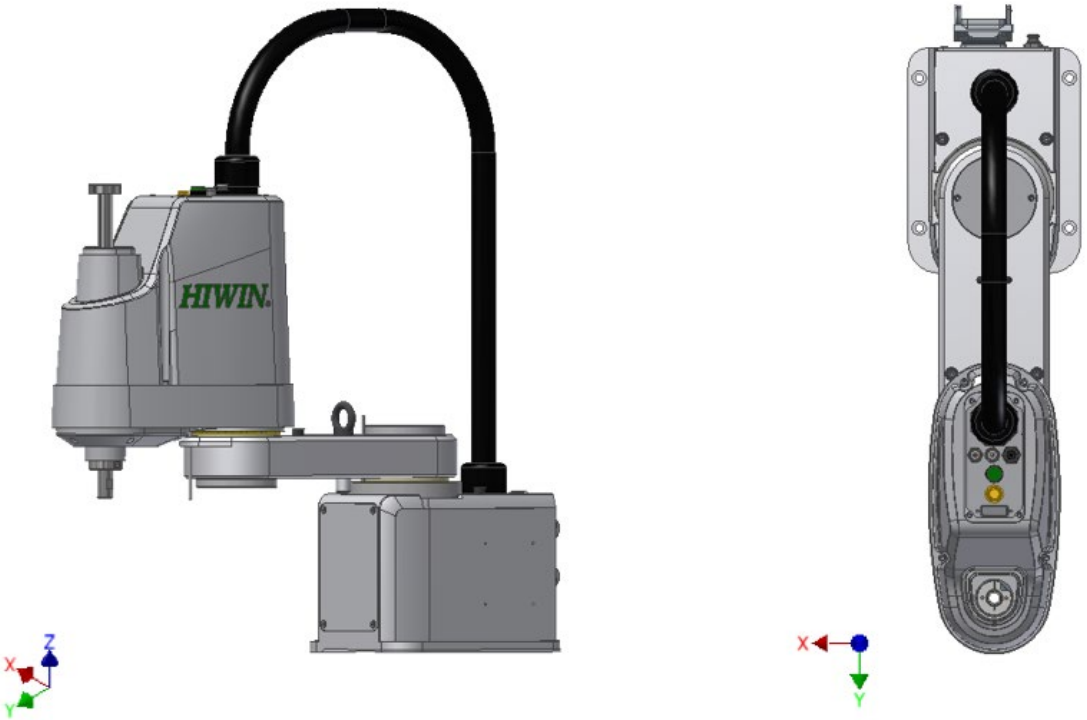


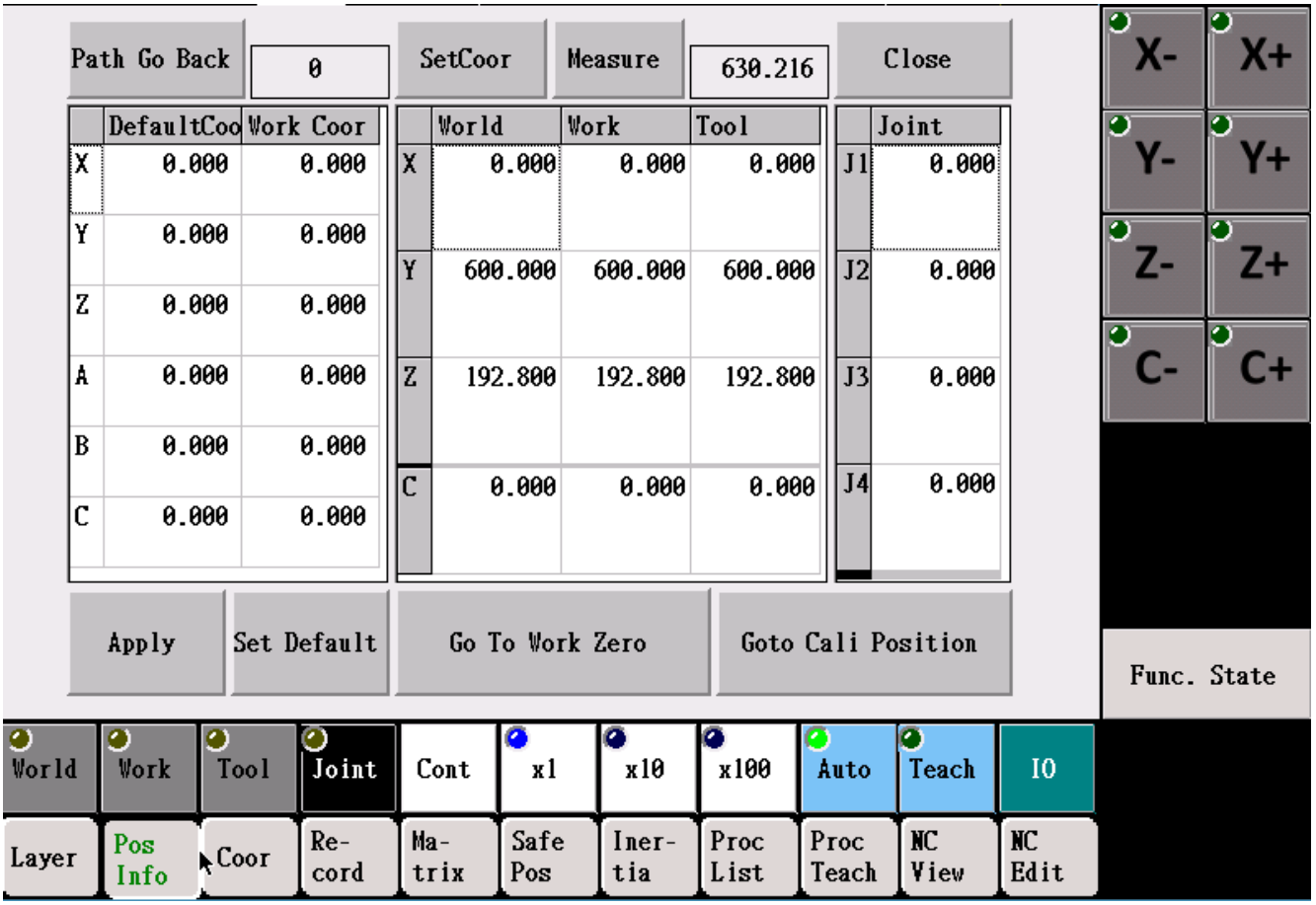
Currently connected IP

4. Coordinates

SCARA RS406-601S-H-B World coordinate system

SCARA RS403-400-150-N World coordinate system





The system will automatically record the path ever traveled. The number on the right shows the recorded steps. This function can return in the opposite direction according to the traveled path. In the auto mode, you just hold this button. The action will stop when it reaches or you release it.
When the robot is in the movement, the coordinates will be recorded per 20ms. If the movement is found, the coordinates will be recorded up to 20000.
When the procedure is started, the coordinates will be cleared so that can return the starting point.

	DefaultCoo
X	0.000
Y	0.000
Z	0.000
A	0.000
B	0.000
C	0.000

When booting, the system will set this value as the current work coordinate system. You can enter the value on the column.

Work Coor
0.000
0.000
0.000
0.000
0.000
0.000

Currently use the work coordinate system, which the value can be entered in the column.

Set the current world coordinates as the work coordinate system.

Reset the current tool coordinates, so that can observe the moving distance.
Note: When you press “Tool” selected by coordinates or move a path in the tool coordinate system, XYZC in the tool coordinates will become 0. The XYZ values in the tool coordinates can be used to calculate the current position and the acutal offset distance between the tool coordinate systems.

Hold this button, so that the robot can move to the calibration points. The action will stop when it reaches or you release it (the same as Goto Calibration Point in the Boot page).

Apply the coordinates in the work coordinate system to the current working coordinate system.

Set the current work coordinate system as the default work coordinate system, so that can be used for next booting.

Hold this button, so that the robot moves to the origin of the work coordinate system. The action will stop when it reaches or you release it.

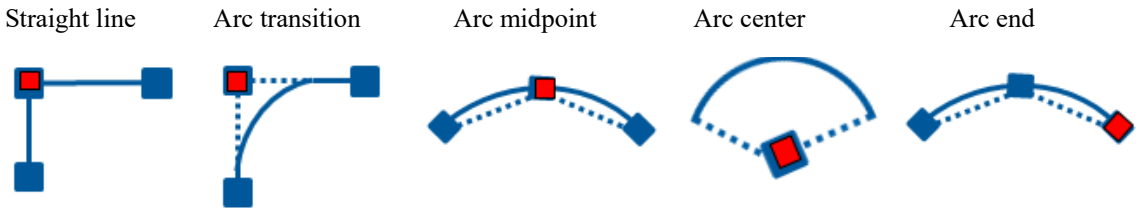
5. Teaching Procedure

5.1. Description of Motion Behavior and Motion Path

The motion behavior and the motion path can be briefly classified as follows:

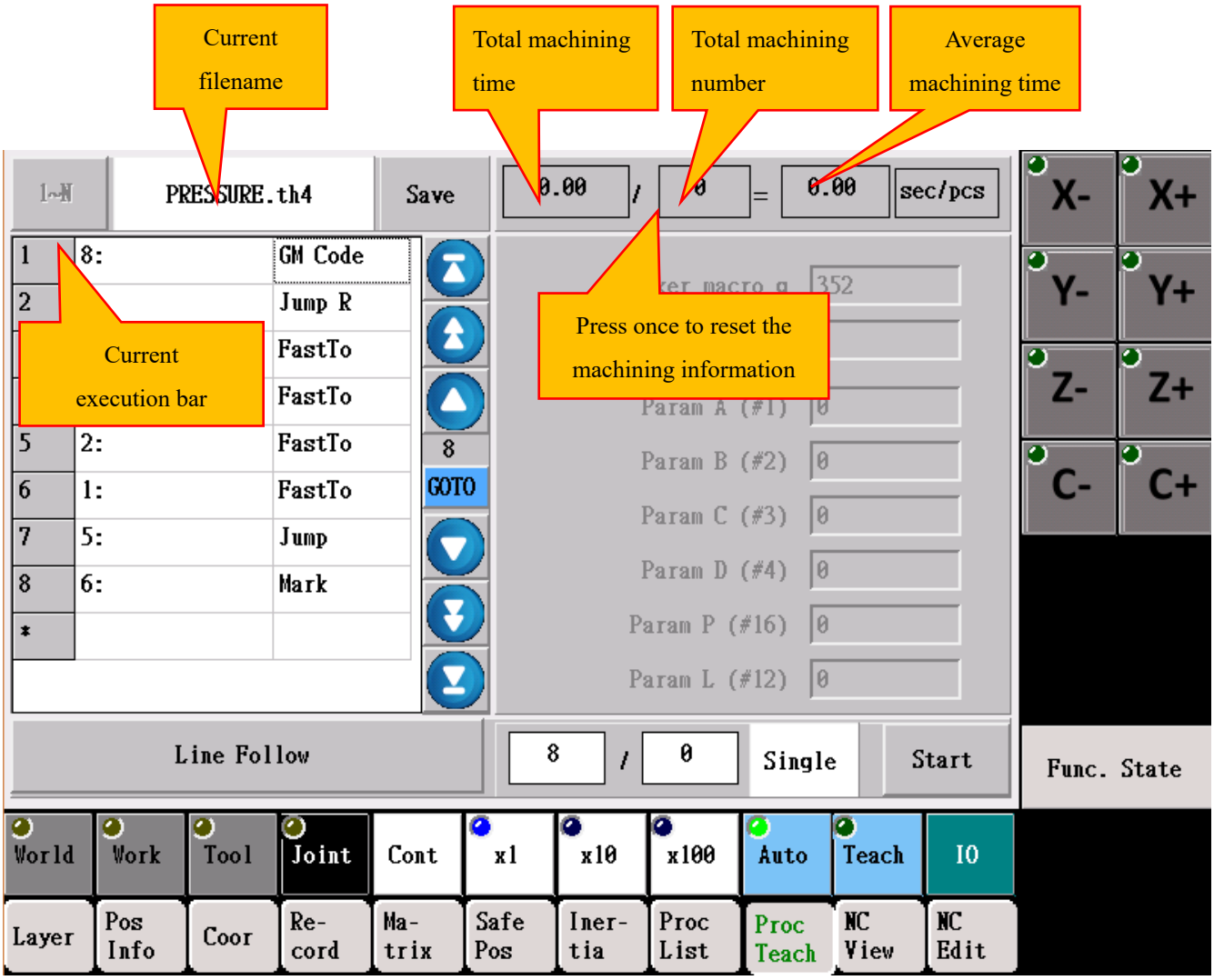
Motion Behavior	Purpose
Quick Movement	The changes in each joint are proportionally transformed according to the difference between the current and target joint coordinates. Therefore, the target points can be fastest reached. Because the posture changes are related to the current coordinates in the course of the actual transformation, the changes can't be ensured. Special attention should be paid when using them.
Straight Line Movement	The system will automatically generate the motion path according to the path coordinates and commands, and ensure the whole moving speed meets the setting Straight line speed.

When the straight line movement is used, the path can be expressed by setting the point coordinate and its property in space. The following figure shows an illustration of the point property and the formed path:

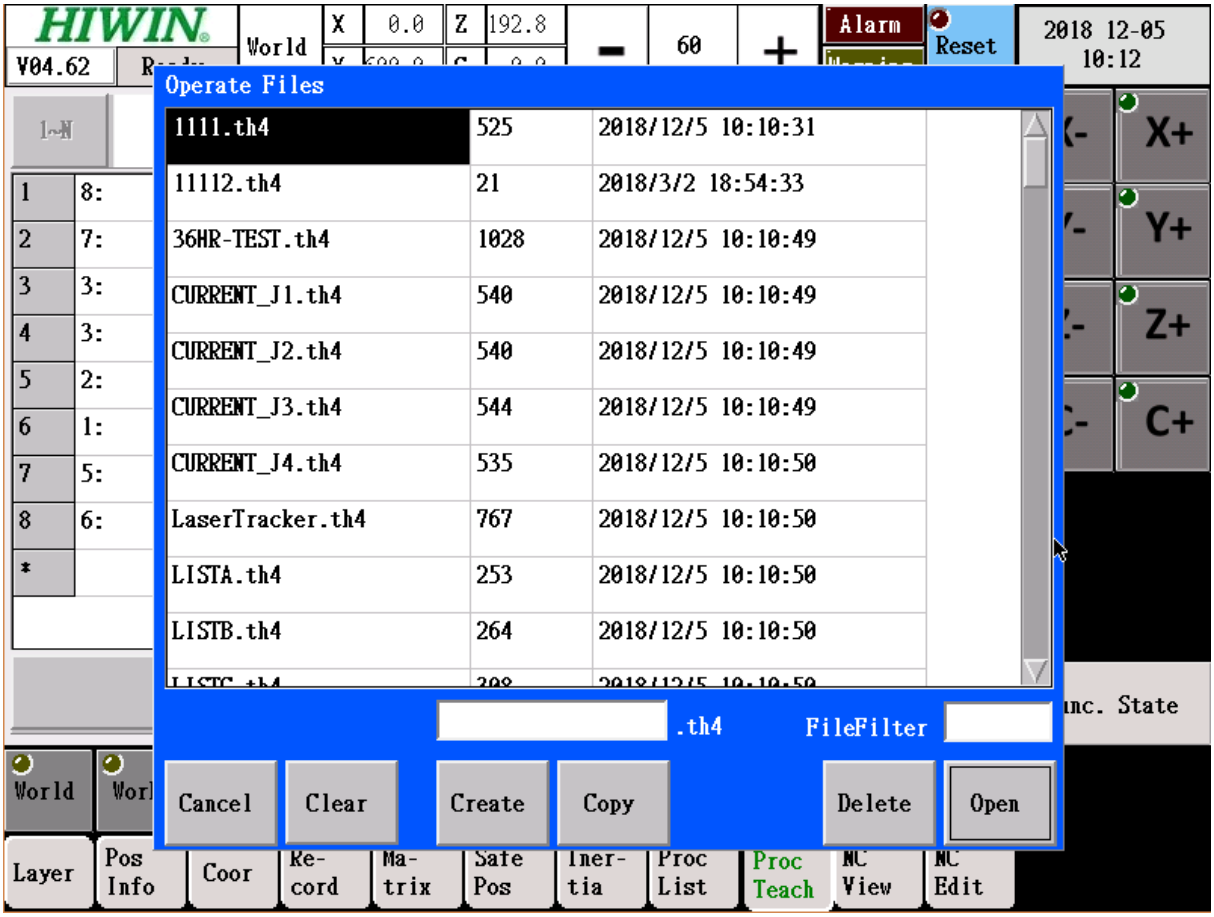


Except for the tool endpoint as the basis of the calculation in the course of movement, the system will calculate the posture changes with a distance in proportion as well.

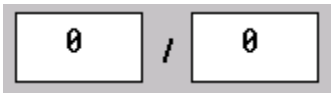
5.2. Programming in Auto Mode



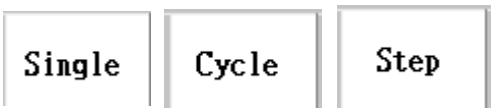
Display the current filename. Click it to open other saved files or new file. The screen is shown as follows:



Save the currently edited file. When the file contents are changed, this button will turn to yellow to hint save, which indicates the contents are sent to the register. Please press the button once to enter the system, so that can ensure the system executes the correct contents. If you directly start without saving the file, the contents in the previous file could be executed to generate the unprecedented results.

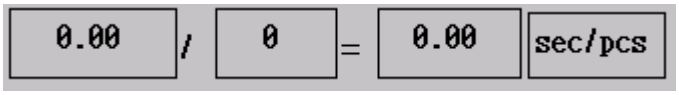


Set to execute the current operated time/target operation time in “Cycle”. If the target is set as 0, it will indicate the continuous operation. The current times can be entered by you according to the actual situation.



There are three execution modes, where “One Return” is performed according to the current procedure line, and stopped after one return: “Cycle” is repeatedly operated according to the current procedure line until the target time is reached; “Single Step” is performed according to the current procedure line, and stopped after one line is executed, so that can ensure the results in each procedure.

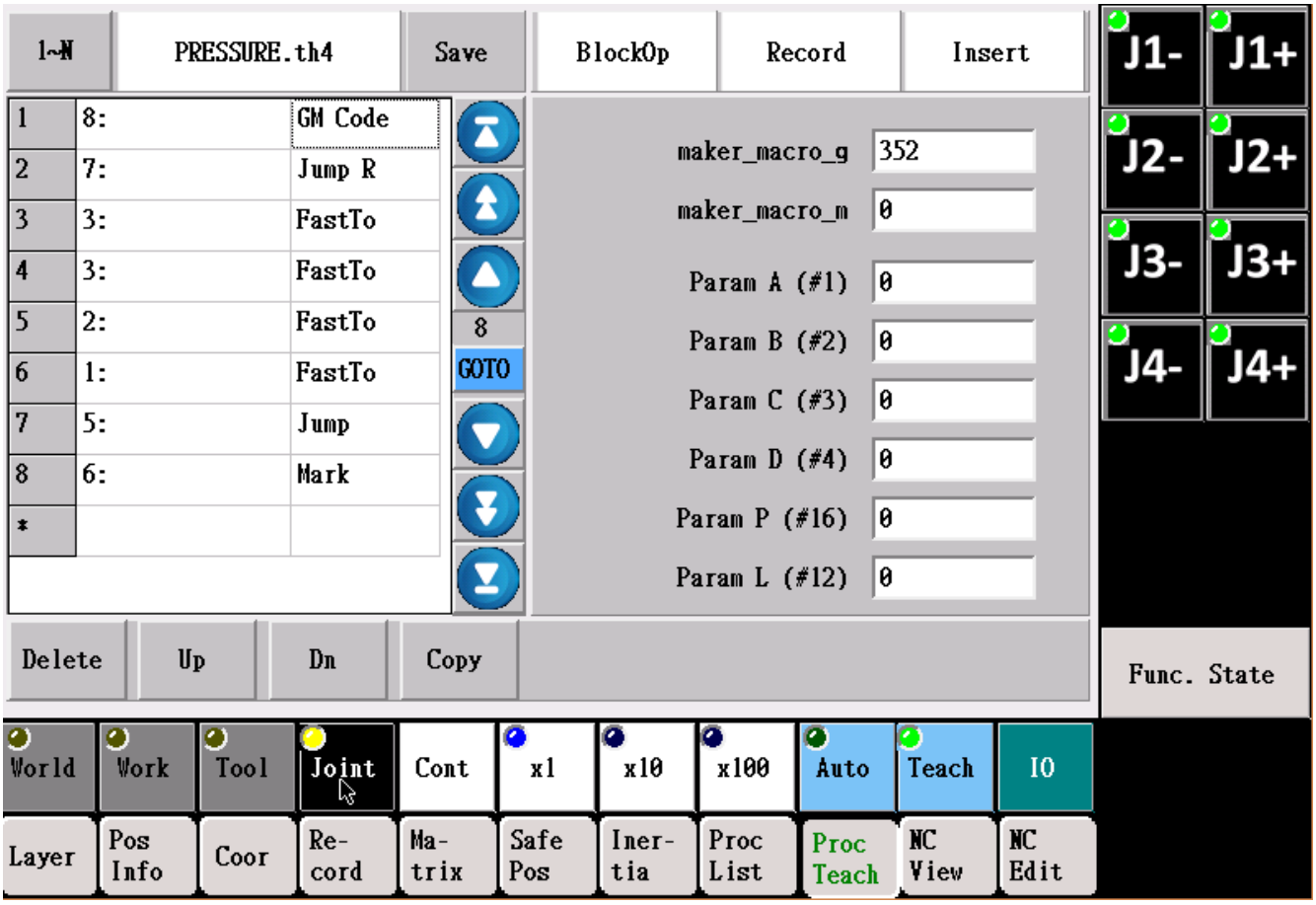
Operate the currently synchronized contents.
The speed ratio that the procedures operate depends on the value displayed on the Title Bar, which you can press +/- to change the speed ratio.



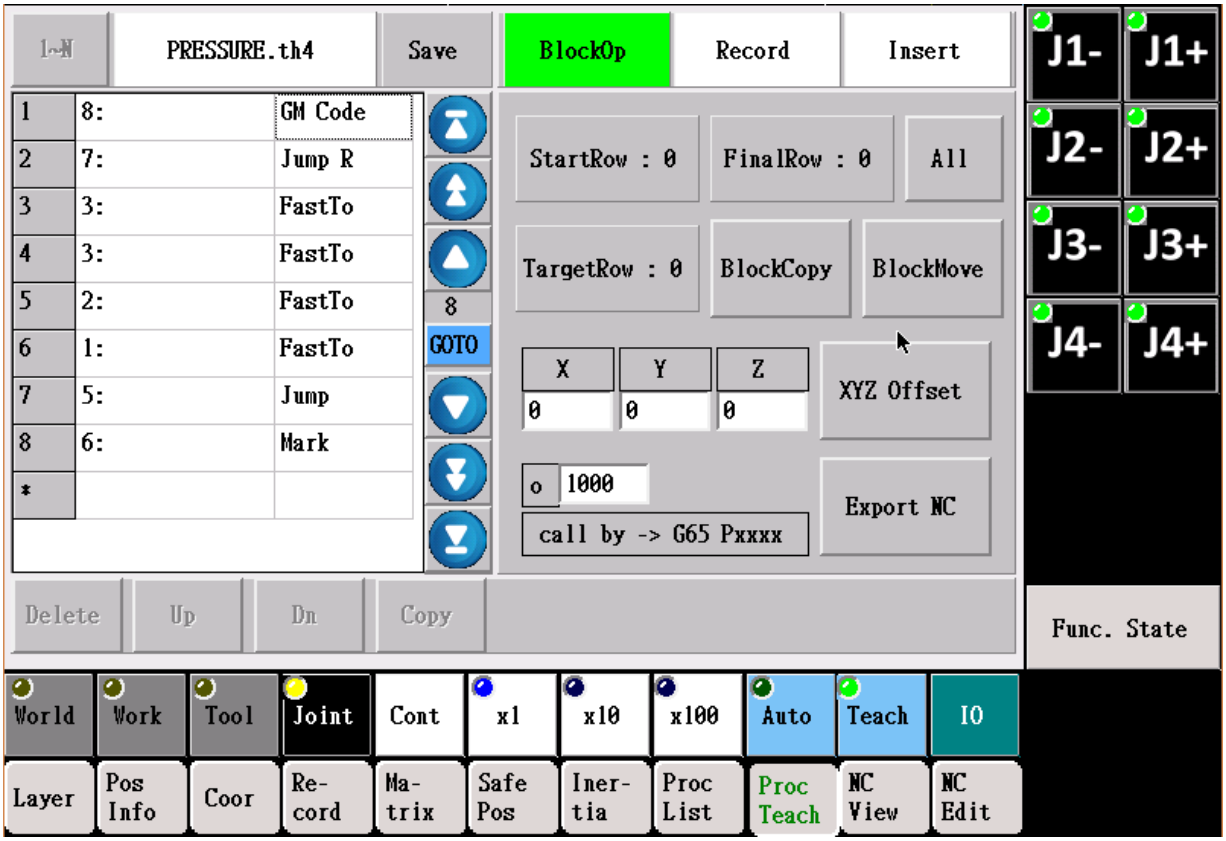
Display the average machining time: Click the time box to reset the count.

5.3. Procedure Edit

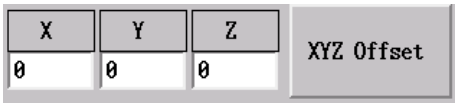
Note: The Procedure Edit can be operated with the permission above “Administrator”.



5.3.1. Block Operation



Used to move the whole procedures. After you press the Block Operation, the command detail will be displayed as follows. First click the line on left, and then press ”Start Line”, “End Line”, and “Target Line” to set the range, following to copy or move according to the requirements, press “Block Copy” and “Block Move” to operate. Press the Block Operation again to end this operation.

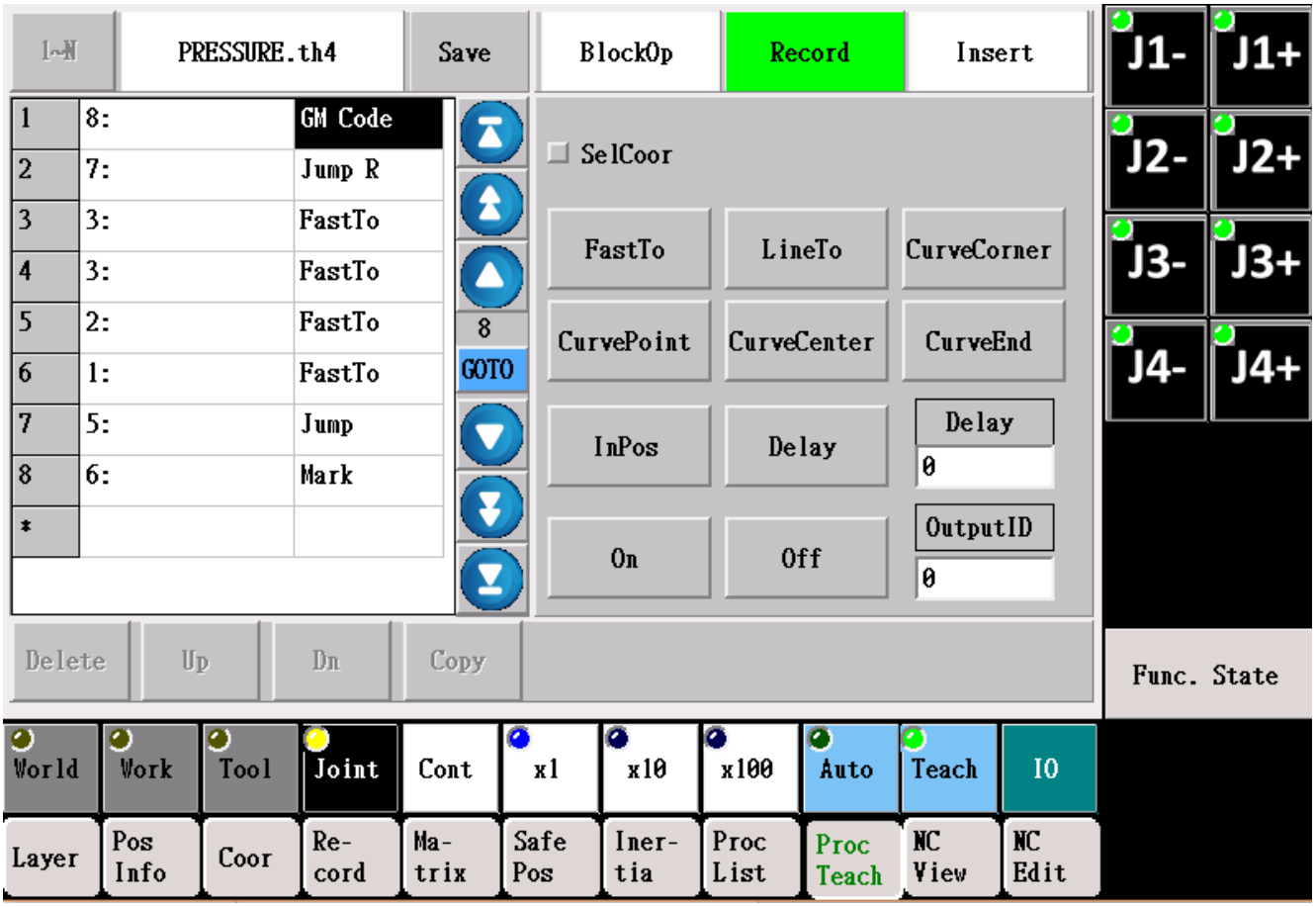


Offset XYZ coordinates by the movement command from the starting line to the end line (valid only for world and work coordinate systems).

Transform the procedure program to NC program with a filename of o1220, so that can conveniently execute by module.

※Note 1: The “GM Code” command like G65 P1220 can the used in the procedure.
※Note 2: The self NC program uses G65 P1220.

5.3.2. Record



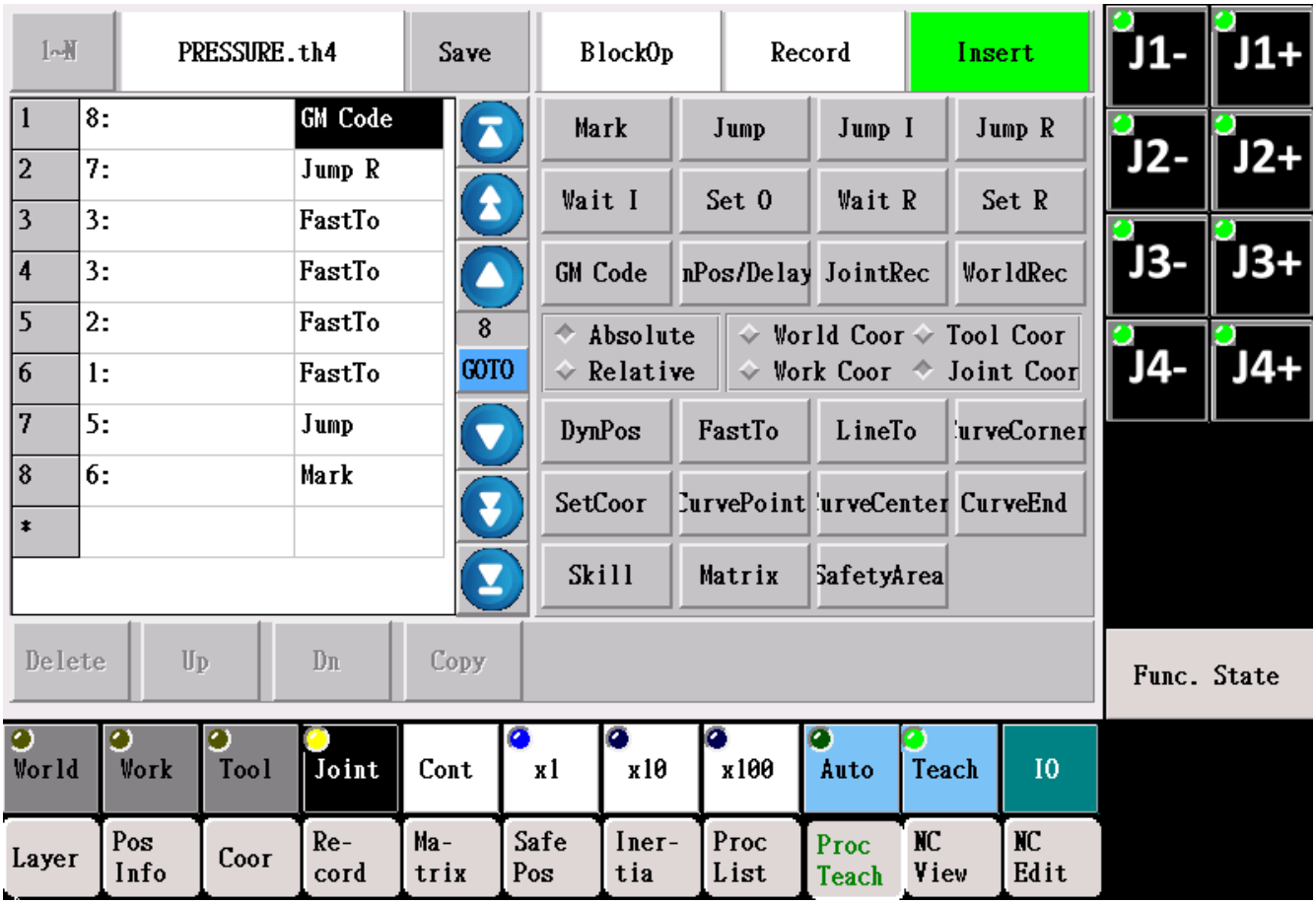
The main function of Record is to conveniently and quickly teach an action path. Therefore, there are several path commands and output control commands on the screen only.

When using, switch to the teaching mode. After the robot moves to the defined position, press the button to perform an action for this position. This process is called as “Record”. Because there are many expressions for the coordinate system of the robot position, the coordinate system in the current teaching will be directly employed when recording.

Record Command	Command Parameter
Select Coordinate System	Take the selected coordinate system as the recorded coordinate system.
Quick Path	If you don’t open “Select Coordinate System”, the coordinate system by teaching to move is used as the recorded coordinate system to generate a command line which moves to the current position. Take the coordiate system of teaching movement as the coordinate system of record to generate a path
Straight Line Path	
Arc Midpoint	
Arc Transition	
Arc Center	
Arc End Point	

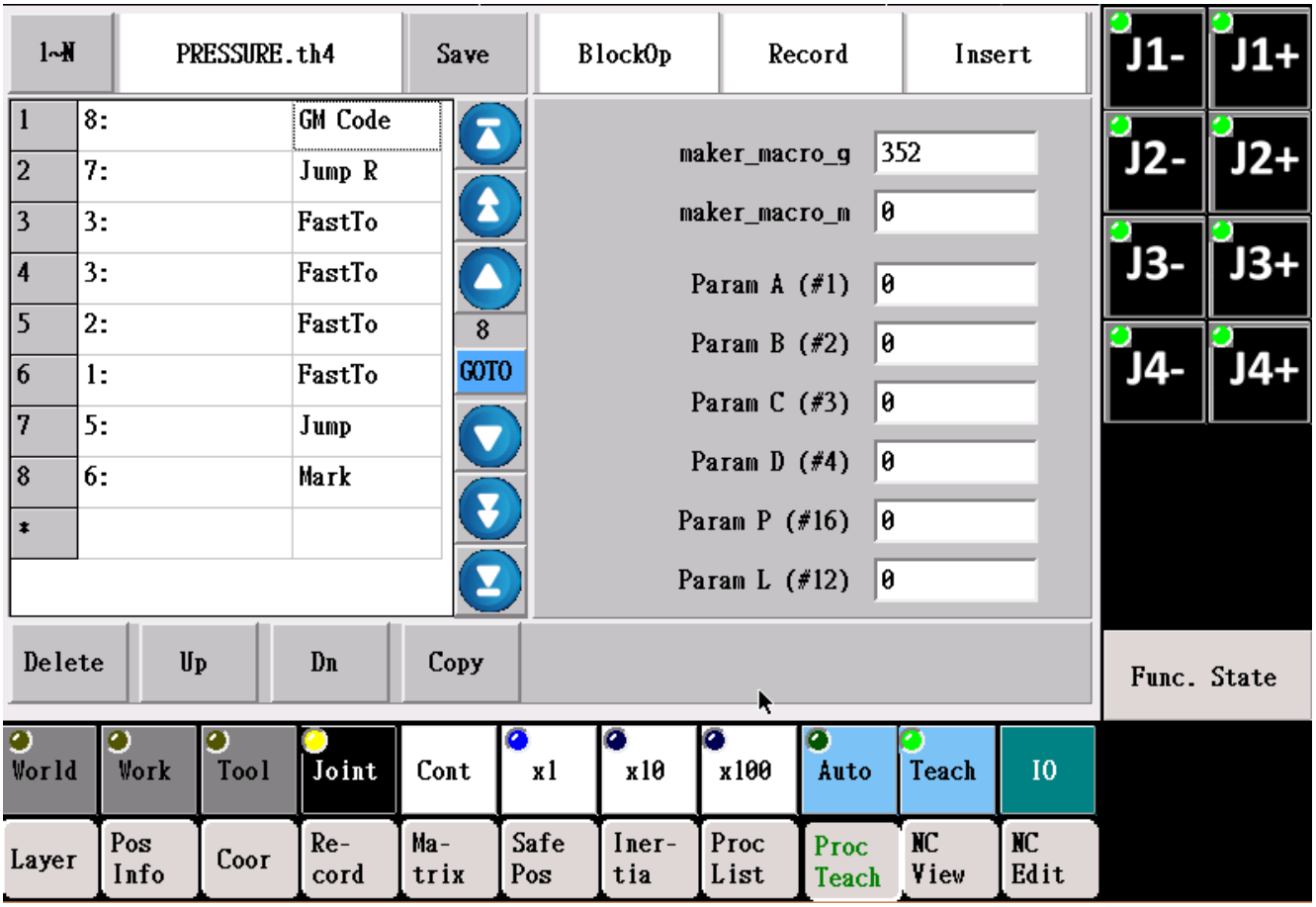
	command of moving to the current position. If you open “Select Coordinate System”, the selected coordinate system selected behind will be used for the recorded coordinate system.
In Position/Delay	In position, delay time
In Position/Delay	In position, delay time
Set O	ON for output number
Set O	OFF for output number

5.3.3. Insert



When you press the Add button once, each command available will be displayed. After you click one of commands, the details will be shown so that can be edited. After you edit and press the “Yes” button, the command can be added to the procedure list.

5.3.4. Edit



`

Rearrange the order in the description according to the line number in the procedure. The main purpose of this action is that a user can understand the operation order, so that can convniently adjust the command orer by “Up”, “Down” and “Block Operation” when the position is incorrectly added.

Delete the currently selected line.

Upwardly move the currently selected line.

Downwardly move the currently selected line.

Copy the currently selected line.

5.4. Description of Procedure Content and Command

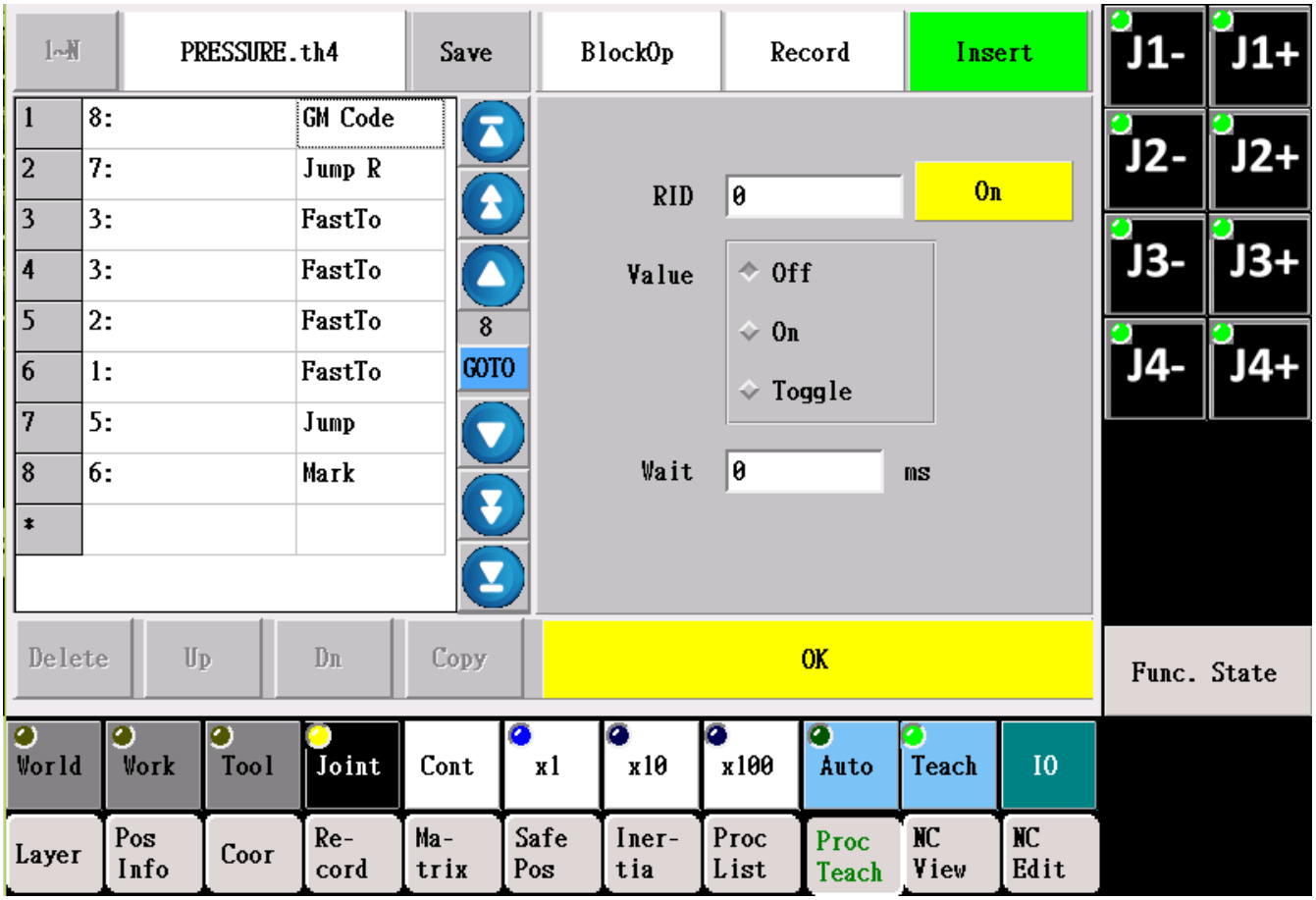
The commands included in the system may be generally categorized as follows:

Command Category	Command Item	Command Description	Parameters
Status Setting	Set O	Configure the status of O point	Numbering, On/Off/Reverse, Waiting time
	Set R	Configure the content of R-value	Numbering, Absolute/Relative/Numbering/Add 1, Value, Waiting Time
Waiting Type	Delay	Waiting time before action	Waiting time
	Wait I	Wait until I-point meets the status, then continue running	Numbering, Value, Waiting time, Failure disposal
	Wait R	Wait until R-value meets the status, then continue running	Numbering, Comparison Mode, Value, Waiting time, Failure handling
Flow Control	Caption	Configure caption, provide as the reference for jump setting	Caption number
	Jump	Jump to a certain line directly	Jump mode, Lines/Line Number, Times
	I-Jump	When the status of I-point is able to meet, start to jump	Numbering, Status, Jump mode, Lines/Line Number,
	R-Jump	When the content of R-value is able to meet, start to jump	Numbering, Comparison Mode, Value, Jump mode, Lines/Line Number
Create Freely	GM Code	Calling for the procedure written manually by the operator	G, M, Parameter 1, Parameter 2, Parameter 3
Motion Control	To world record	To world record position (Straight line path)	Record ID, Speed
	To joint record	To joint record position (Rapid movement)	Record ID, Speed
	Set Work Coordinate System	Configure the work coordinate system	Options, (World record ID), (Setting value)
	Skill Setting	If the special moving	Disable/Enable/Enable(R-Value

		mode is required to use for configuring the path movement, such as arc of welding.	setting) Skill Coordinate System Skill Type Skill Range Skill Proportion Skill Initial Position
	Quick Path	Configure running path	Absolute/Relative Coordinate System Setting Value XYZABC Speed
	Straight Line Path		
	Arc Transition		
	Arc Midpoint		
	Arc Center		
	Arc End Point		
	Go To Dynamic Position	Determine the moving position based on R-value (straight line path)	Absolute/Relative Coordinate System R Numbering of Setting Value XYZABC R Numbering of Speed

To add a line of command to the procedure, please select the position to be added in the procedure and click “Add”. After the command is selected, press “Yes” to add the procedure, and then click “Add” to close.

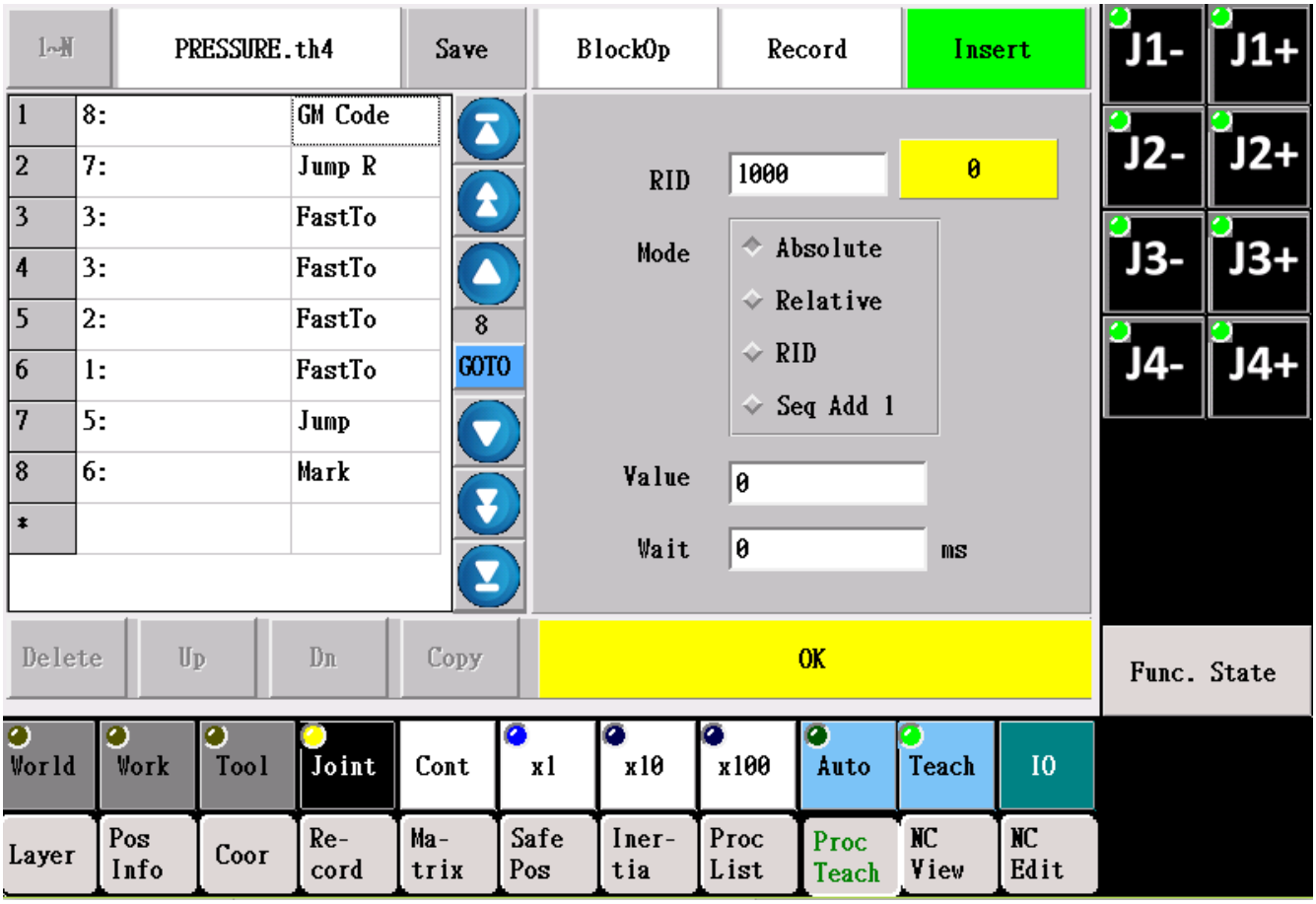
5.4.1. Set O



Configure the status of output point.

Numbering: O-Point ID Number
Value: Off, On, Change Phase (Change to another status based on the current status at that O-point)
Wait: Configure the time for waiting before running the next line.

5.4.2. Set R



Configure the content of R-value.

Numbering: R-Value ID Number

Mode:

Absolute: Configure the content of R-value as the content of “Value” column directly.

Relative: Accumulate the content of “Value” column based on the current content of R-value.

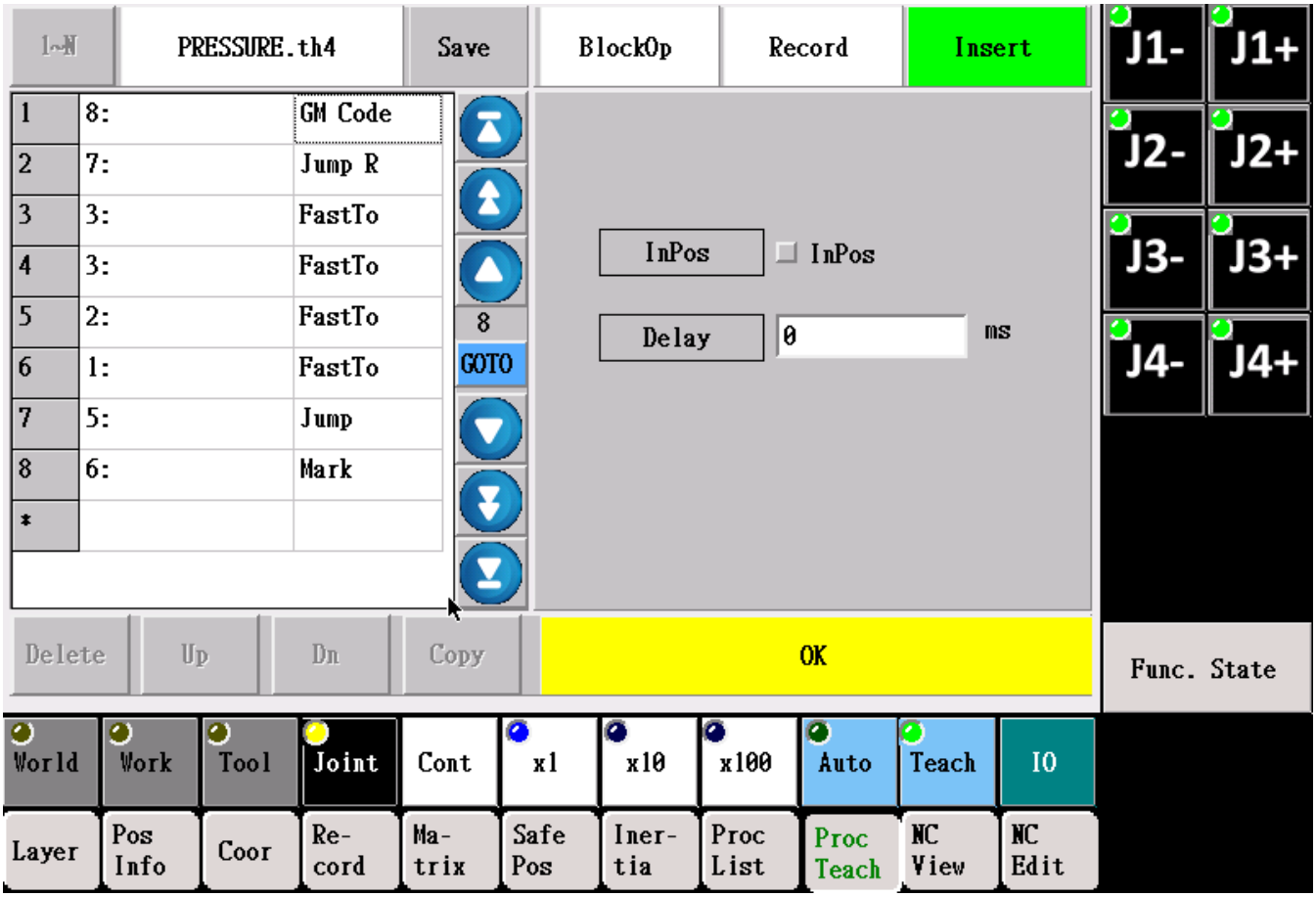
Numbering: Configure the R-value content of R ID number assigned in the “Value” column to this R-value.

Cycle Add 1: Add 1 to the current content of R-value. When the value is greater than the setting value in the “Value” column, configure to 0.

Value: Refer to the description of Mode.

Wait: Configure the time for waiting before running the next line. If this value is blank, the program will be executed between two positioning motions i.e. it will not ruin the motion continuity of robot. However, it will only be effective when the configured mode is “Absolute”.

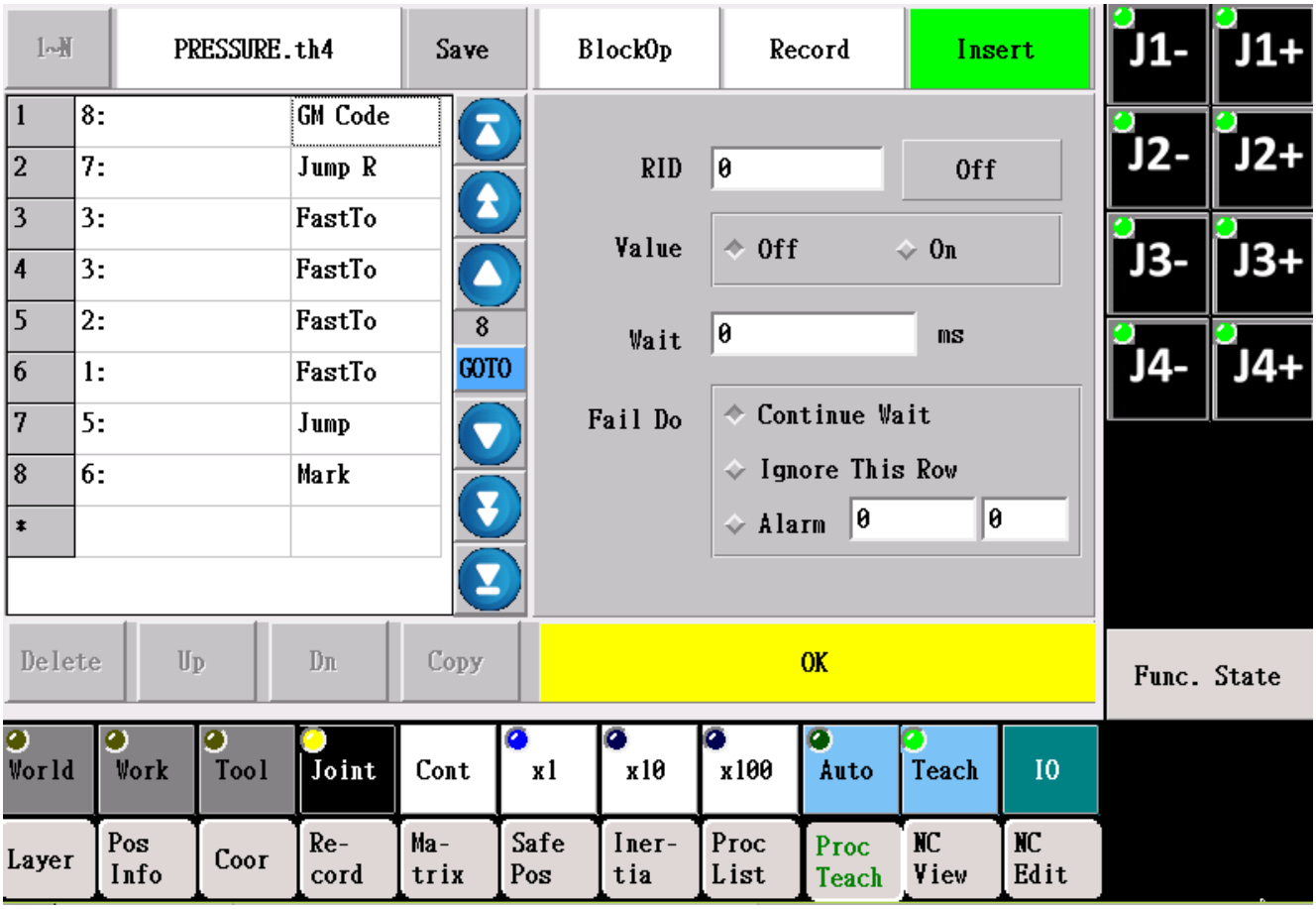
5.4.3. InPos/Delay



In Position: When you press In Position, the system will check each axis is in position and continue to run next line.

Delay: Time to be waited.

5.4.4. Wait I



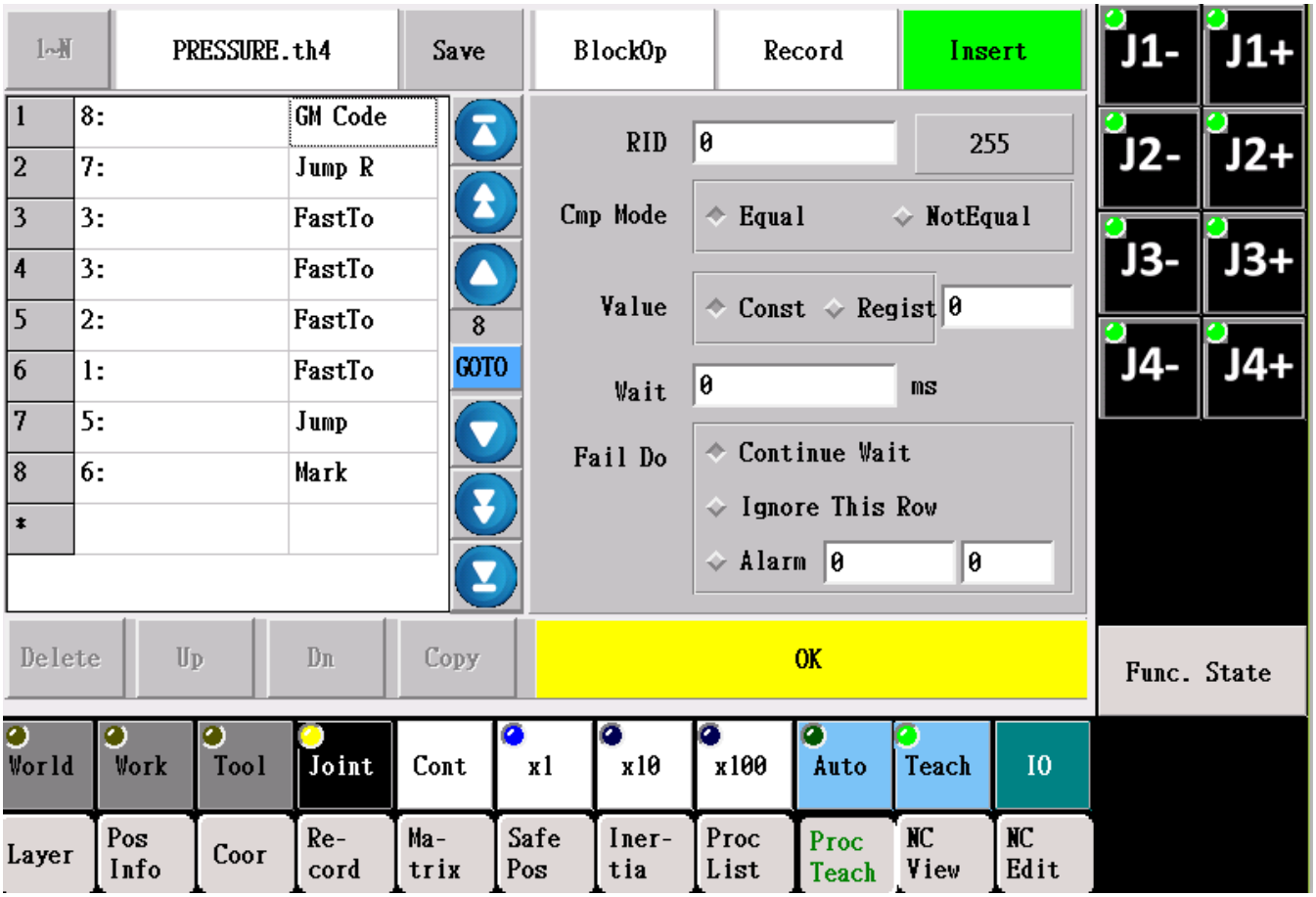
Numbering: I-Point ID Number

Value: When the status of I-Point is able to meet this setting, the next motion will continue.

Wait: The longest waiting time.

Failure Handing: Handling approach after exceeding the waiting time.

5.4.5. Wait R



Numbering: R-Value ID Number

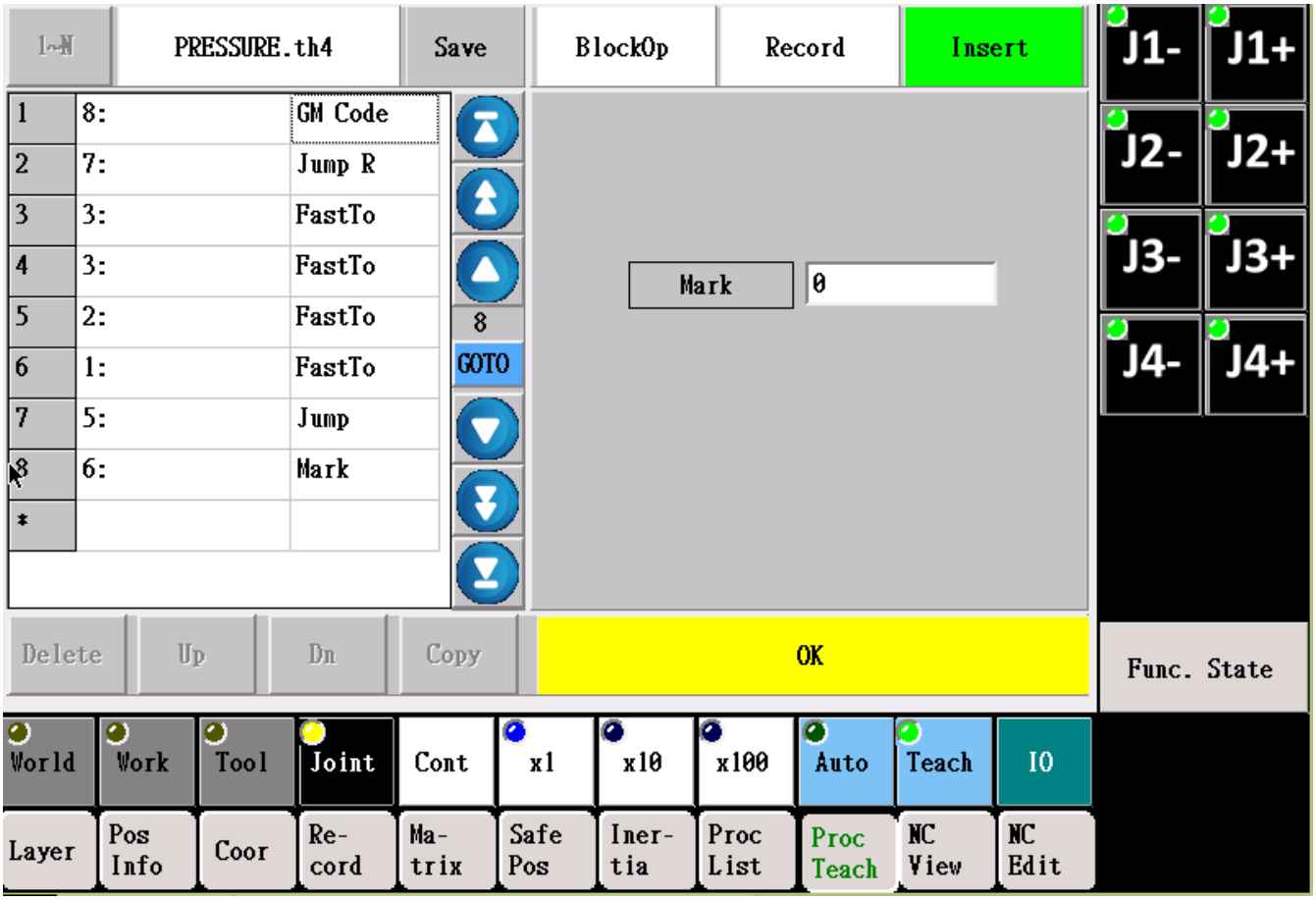
Comparison Mode:

Value: Constant (fixed value). R-value (refer to the content of another R-value ID number). Right side box (constant/R-value ID number)

Wait: The longest waiting time.

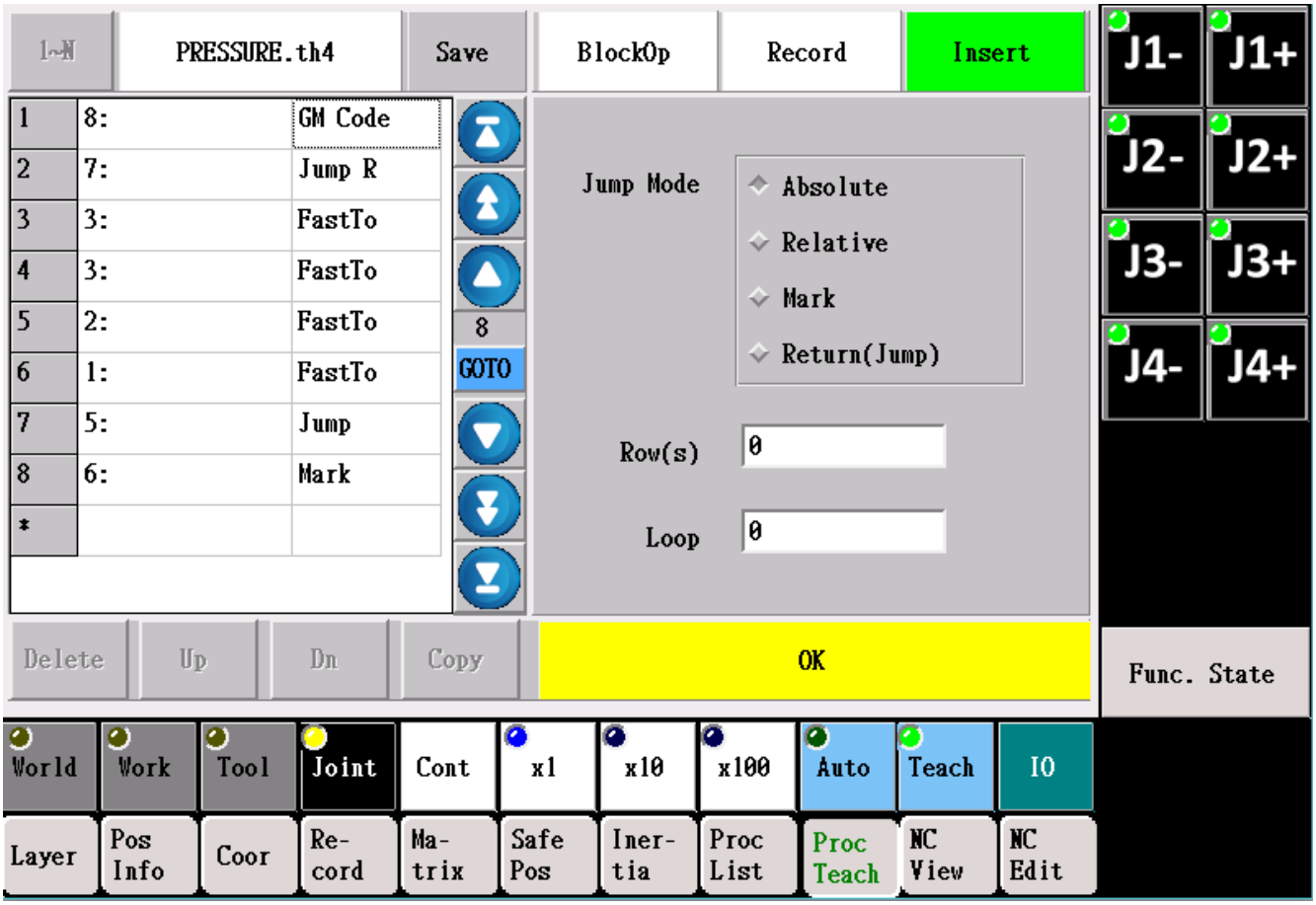
Failure Handing: Handling approach after exceeding the waiting time.

5.4.6. Mark



Configure the caption of current row number for the use of jump command.

5.4.7. Jump



Jump Mode:

Absolute (that is the actual program line number).

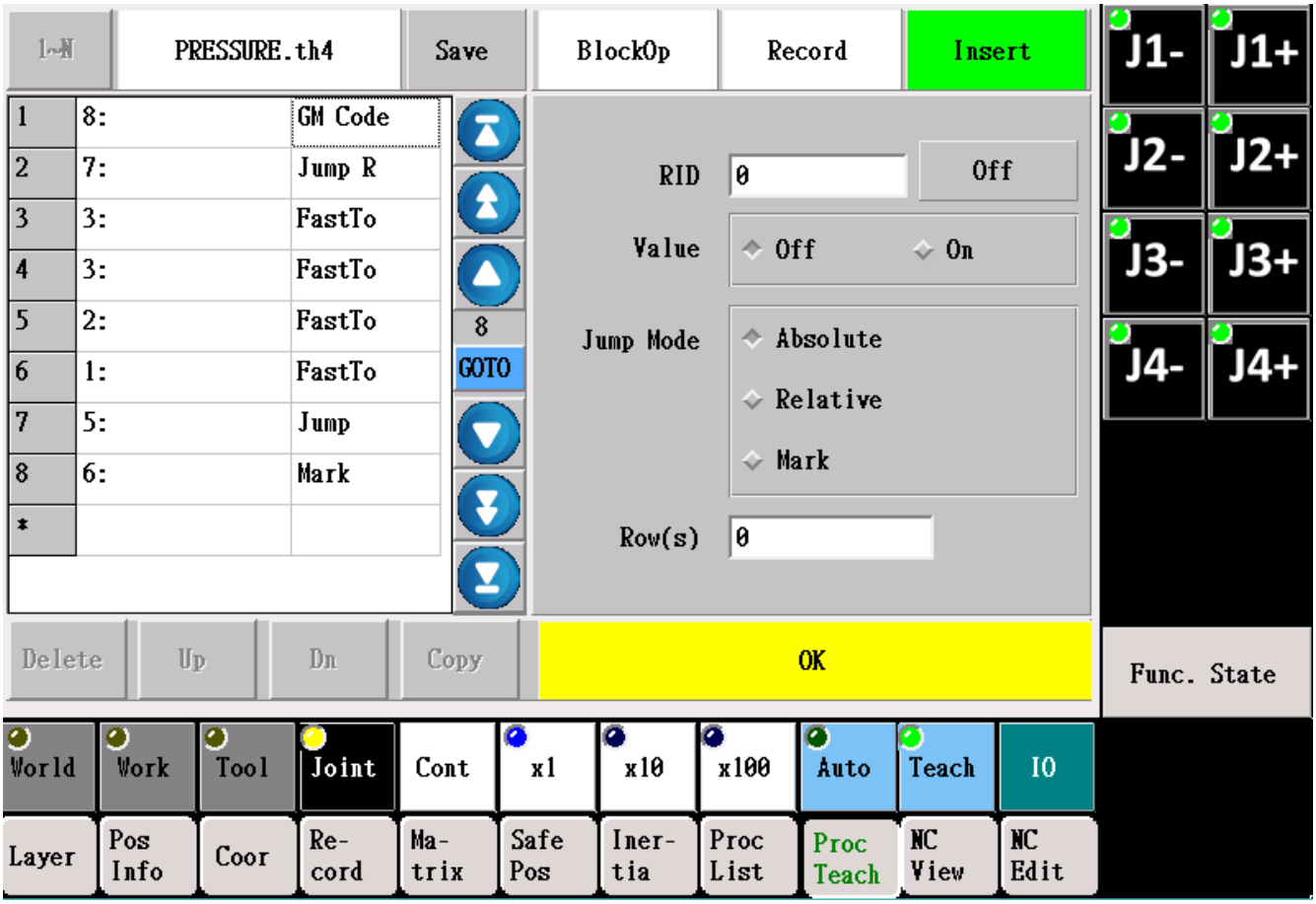
Relative (lines relative to the current line number. For example, the current line number is the 8th line, -4 indicates to jump to 8-4 = 4th line).

Caption (that is the caption row configured previously)

Line Number/Lines: Refer to the Jump Mode

Times: Times for repeating this jump action

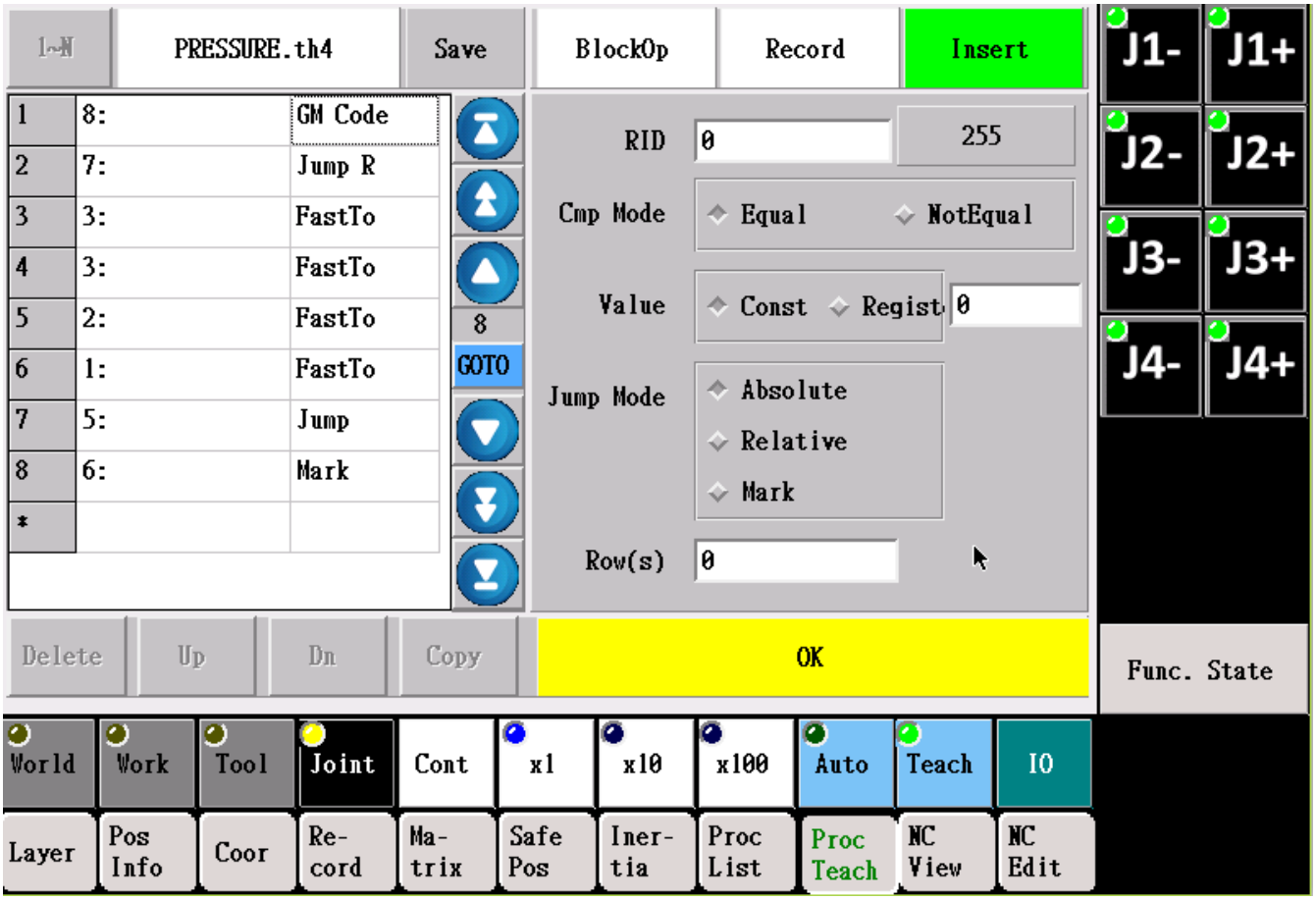
5.4.8. Jump I



Determine to jump to which line for continuing execution based on the status of I-point.

Numbering: I-Point ID Number
Value: When the status of I-point is able to meet this setting, the jump action will continue.
Jump Mode: Absolute (that is the actual program line number). Relative (lines relative to the current line number).
Line Number/Lines: Refer to the Jump Mode.

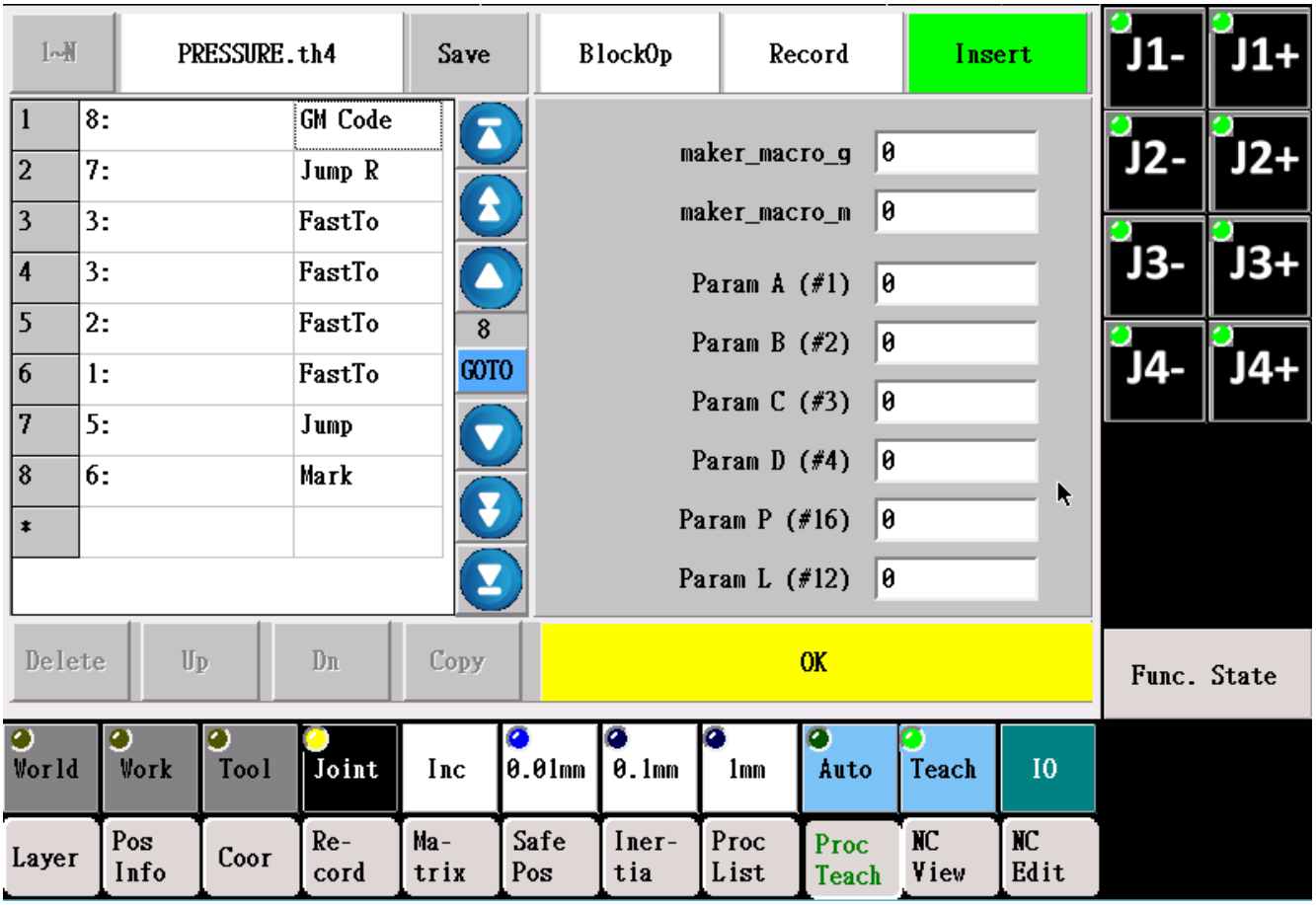
5.4.9. Jump R



Determine to jump to which line for continuing execution based on the content of R-value.

Numbering: R-Value ID Number
Comparison Mode: Determine the trigger condition
Value: Constant (fixed value). R-value (refer to the content of another R-value ID). Right side box (constant/R-value ID number)
Jump Mode: Absolute (that is the actual program line number), Relative (lines relative to the current line number), and Caption.
Line Number/Lines: Refer to the Jump Mode.

5.4.10. GM Code

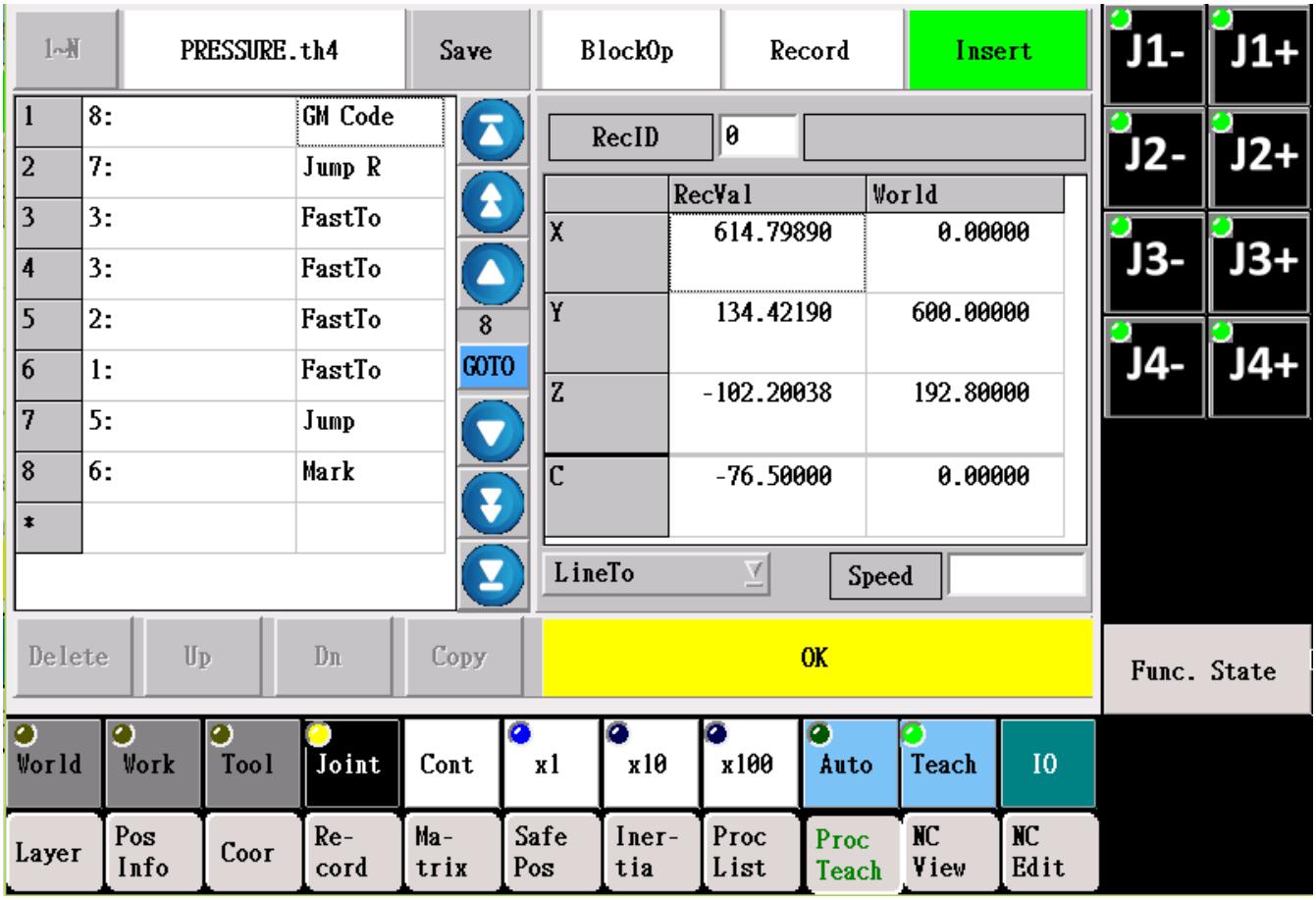


Configure the ID number for GM code for calling the program written with GM code by the operator to provide greater flexibility.

Directly configure the ID for G code or M code.
Param A (#1): The first parameter to be sent to G code or M code.
Param B (#2): The second parameter to be sent to G code or M code.
Param C (#3): The third parameter to be sent to G code or M code.
Param D (#4): The fourth parameter to be sent to G code or M code.
Param P (#16): The fifth parameter to be sent to G code or M code.
Param L (#12): The sixth parameter to be sent to G code or M code.

Note: The following are the commands for GM Code frequently used.
Switch Tool Parameter: G5 A1, where A is set to 0~3, indicates the used tool parameter number.
Call NC module file o1234 exported by “Procedure”: G65 P1234.
Check on a single safety point: G113 A0 is used to check it is in the first set of safety points.

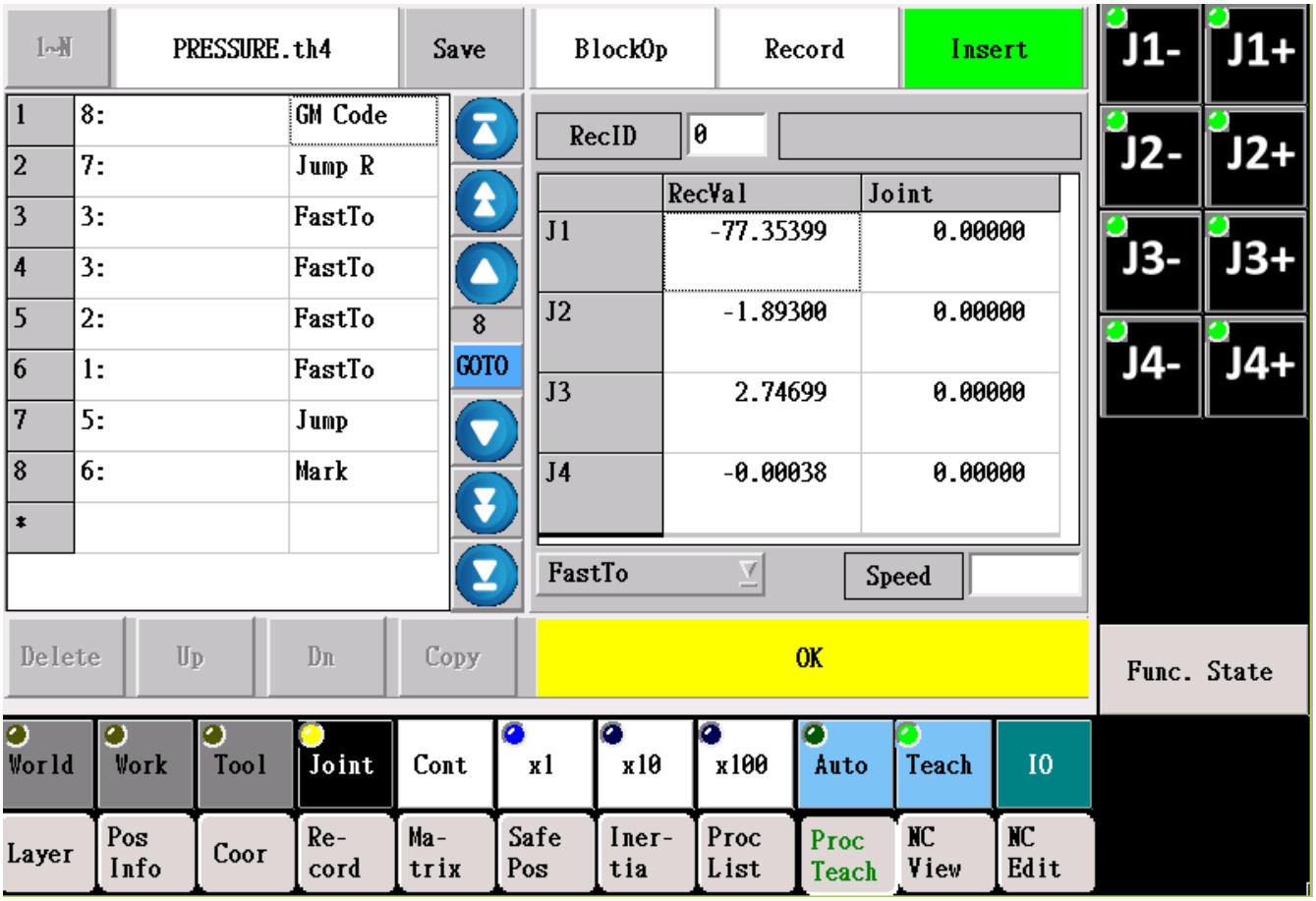
5.4.11. World Record



Move to the coordinates of world record.

Record ID Number: Based on the record ID number.
Coordinate Record Value: Retrieve the value of world record directly for display based on the record ID number.
World Coordinate: Display the current world coordinates.
Path: Select the movement to this record point.
Speed: If the speed is blank, it indicates that the defaulted straight line speed will be used.

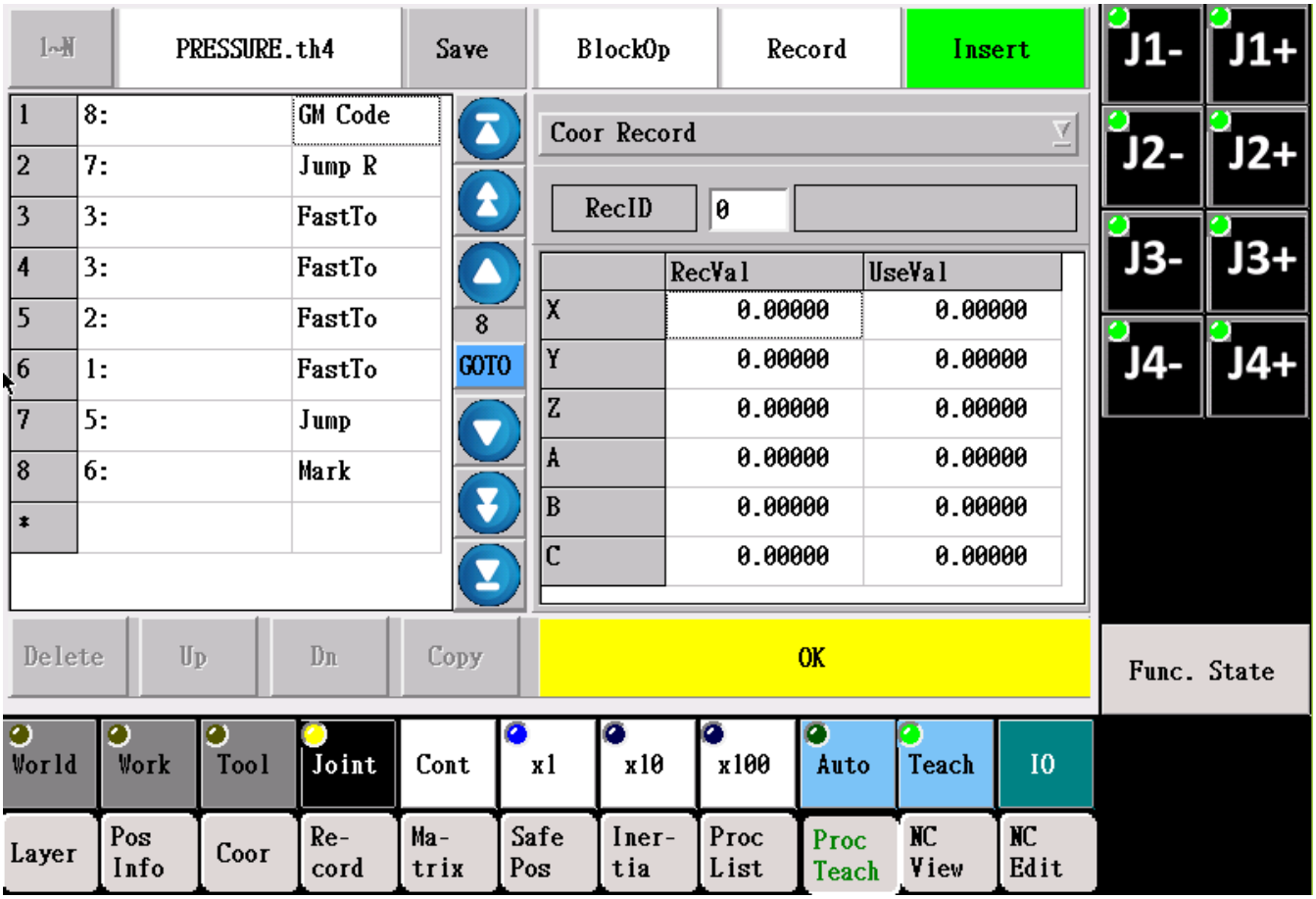
5.4.12. Joint Record



Move to the coordinates of joint record.

Record ID Number: Based on the record ID number.
Coordinate Record Value: Retrieve the value of joint record directly for display based on the record ID number.
Joint Coordinate: Display the current joint coordinates.
Path: Select the movement to this record point.
Speed: If the speed is blank, it indicates that the defaulted straight line speed will be used.

5.4.13. Set Coordinate System



According to the options, select or configure the current work coordinate system

Direct setting: The contents entered in the table are used as the current work coordinate system.

World Record XYZ: Configure the position of (X, Y, Z) set up in the world record ID number into "Work Coordinate System", whereas (A, B, C) is configured as 0.

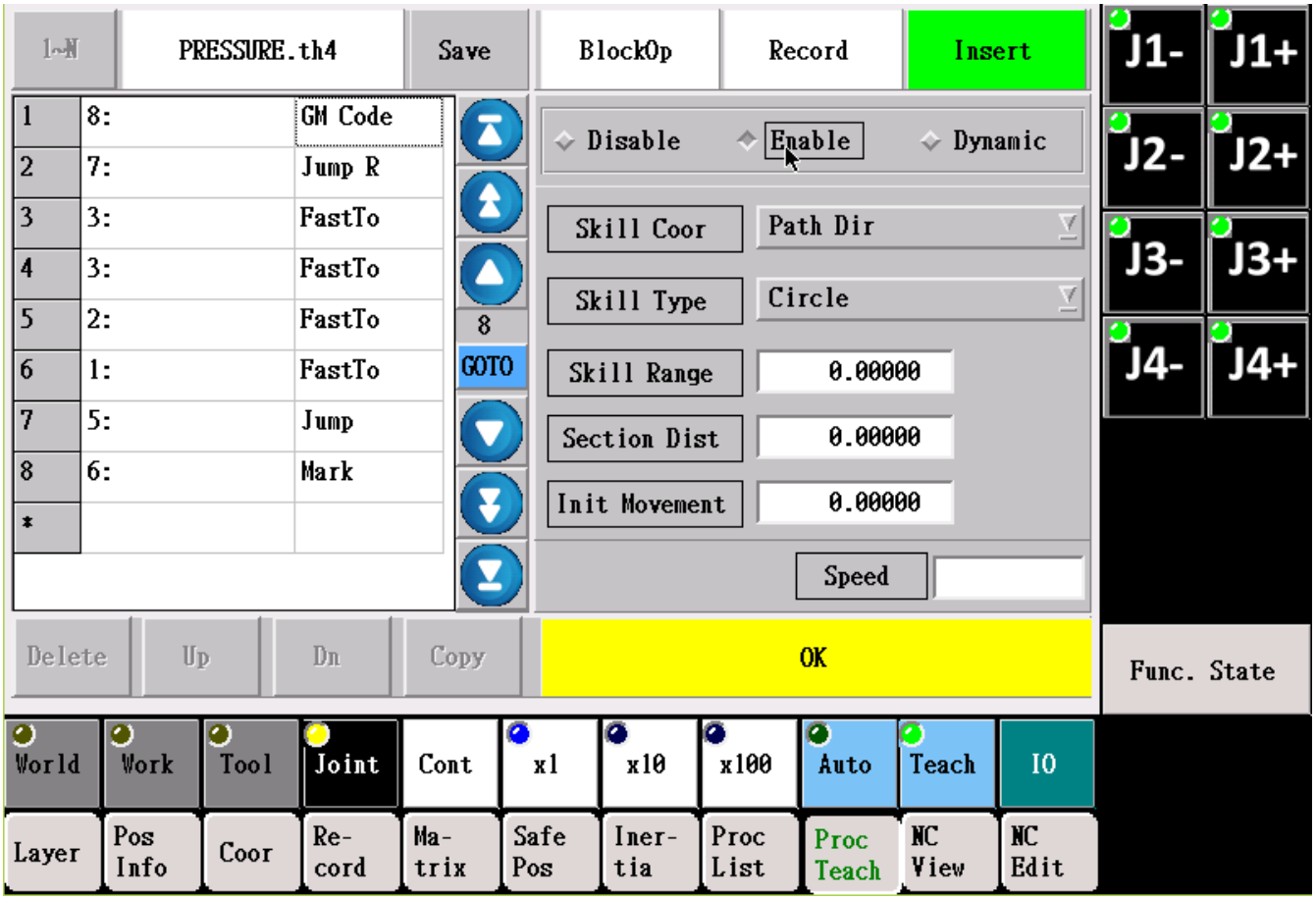
Position and Posture of World Record: Configure the positions of (X, Y, Z) and (A, B, C) set up in the world record ID number into the "Work Coordinate System".

Coordinate System Record: Configure the coordinate system record into the "Work Coordinate System".

Current Position and Posture: Configure the world record positions of (X, Y, Z) and (A, B, C) when the procedure executes to this line into the "Work Coordinate System".

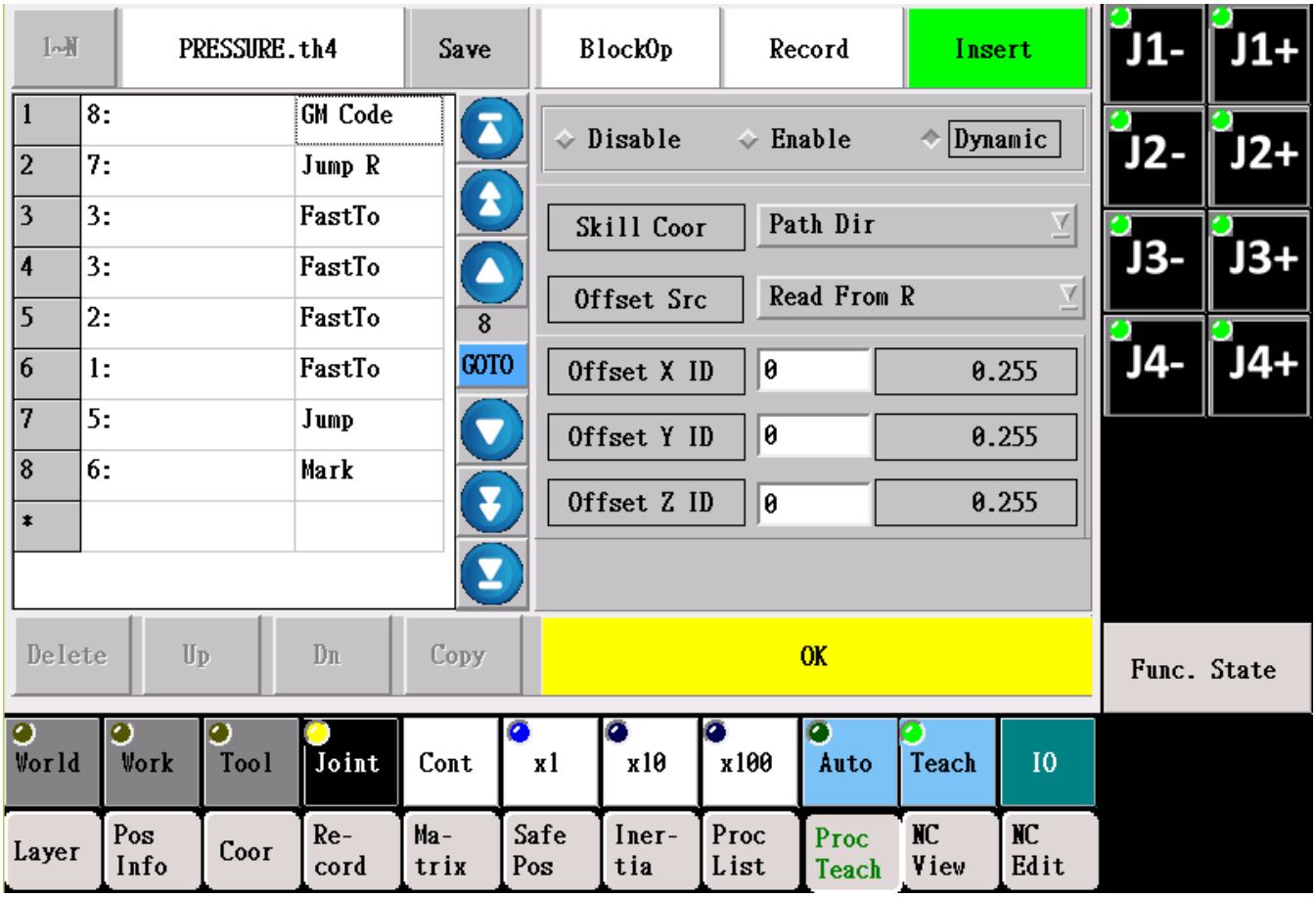
Dynamic Position and Posture: Read the content from the configured R-value and use it as the value for the "Work Coordinate System".

5.4.14. Skill Setting



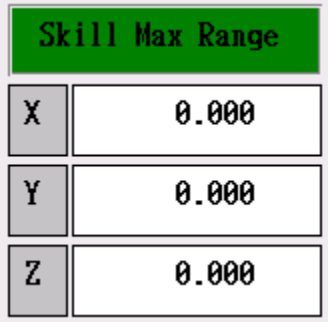
The special moving mode is required if configuring the path movement, such as arc of welding.

Disable Skill: If the skill was enabled originally, this command will move the position generated by skill offset to the straight line path of original position.
Enable Skill: If the skill was disabled originally, this command will move the current position to the straight line path of skill offset position.
If the skill was enabled originally, this command will move the position generated by skill offset to the straight line path of new position.
Skill Coordinate System: The coordinate system is followed by the skill path.
Skill Types: There are circle, move back and forth, move left and right.
Moving Range: Swinging range i.e. the maximum distance offsets from the original path.
Section Distance: The swinging position will repeatedly appear after every interval of a certain section distance on the path,
Initial Movement: The initial movement in the beginning of skill while the moving distance is 0.

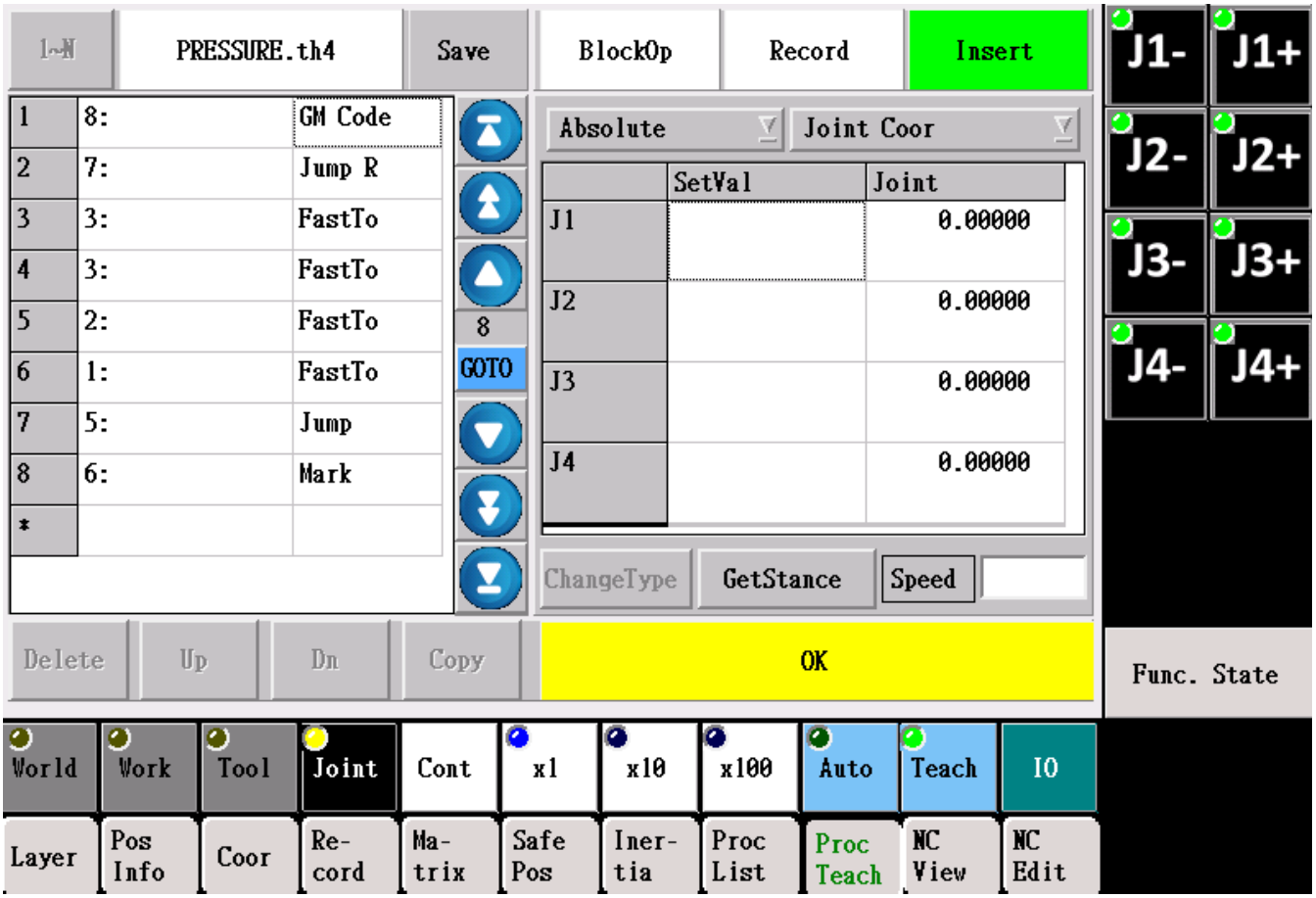


Dynamic Skill: Same as Enable Skill. It is merely that the skill parameters are determined by the contents of R value.

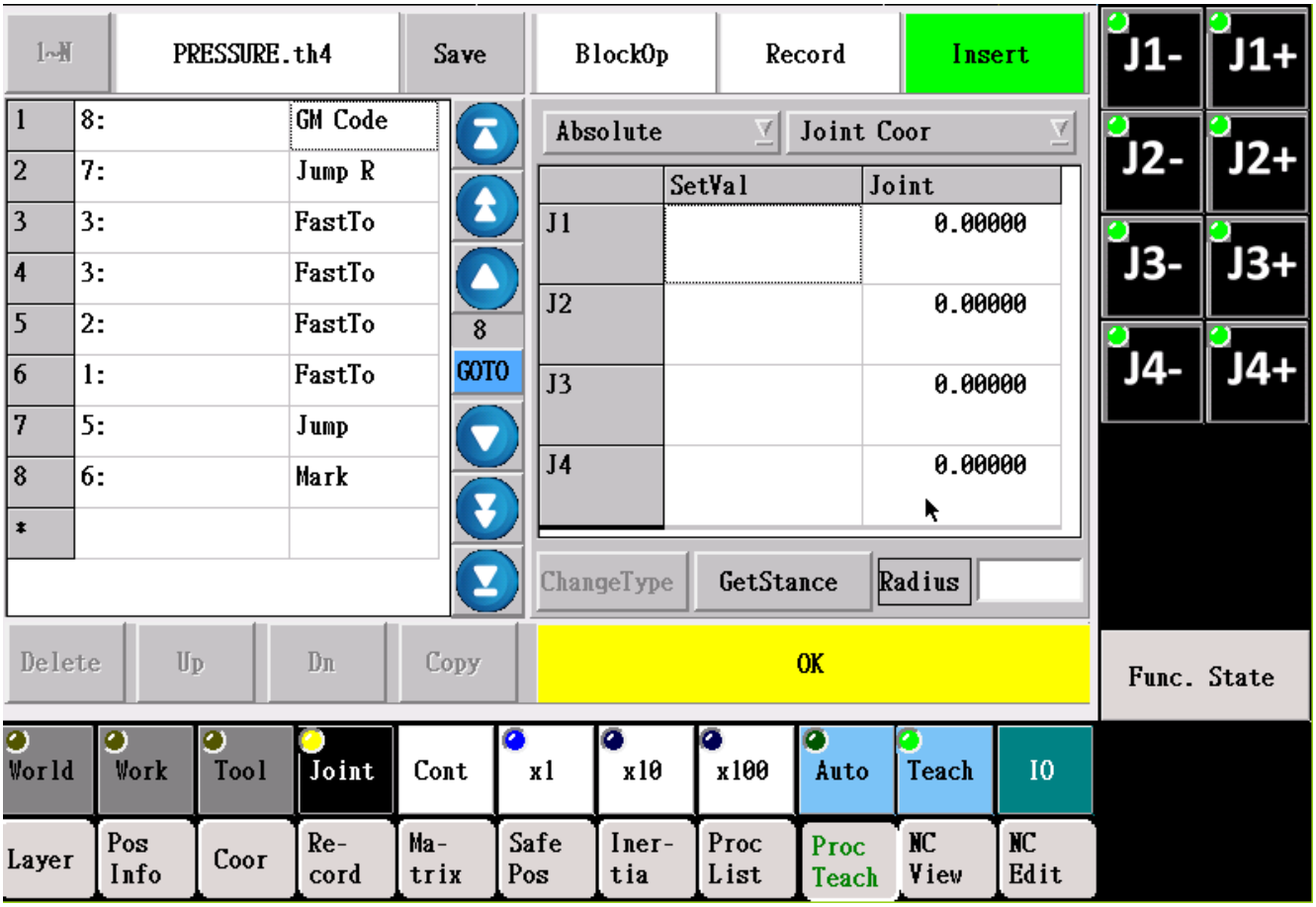
Note: When this function is used, the calculated skill offset must be less than the “Skill Maximum” in the “Limit” page. Otherwise, an alarm will take place.



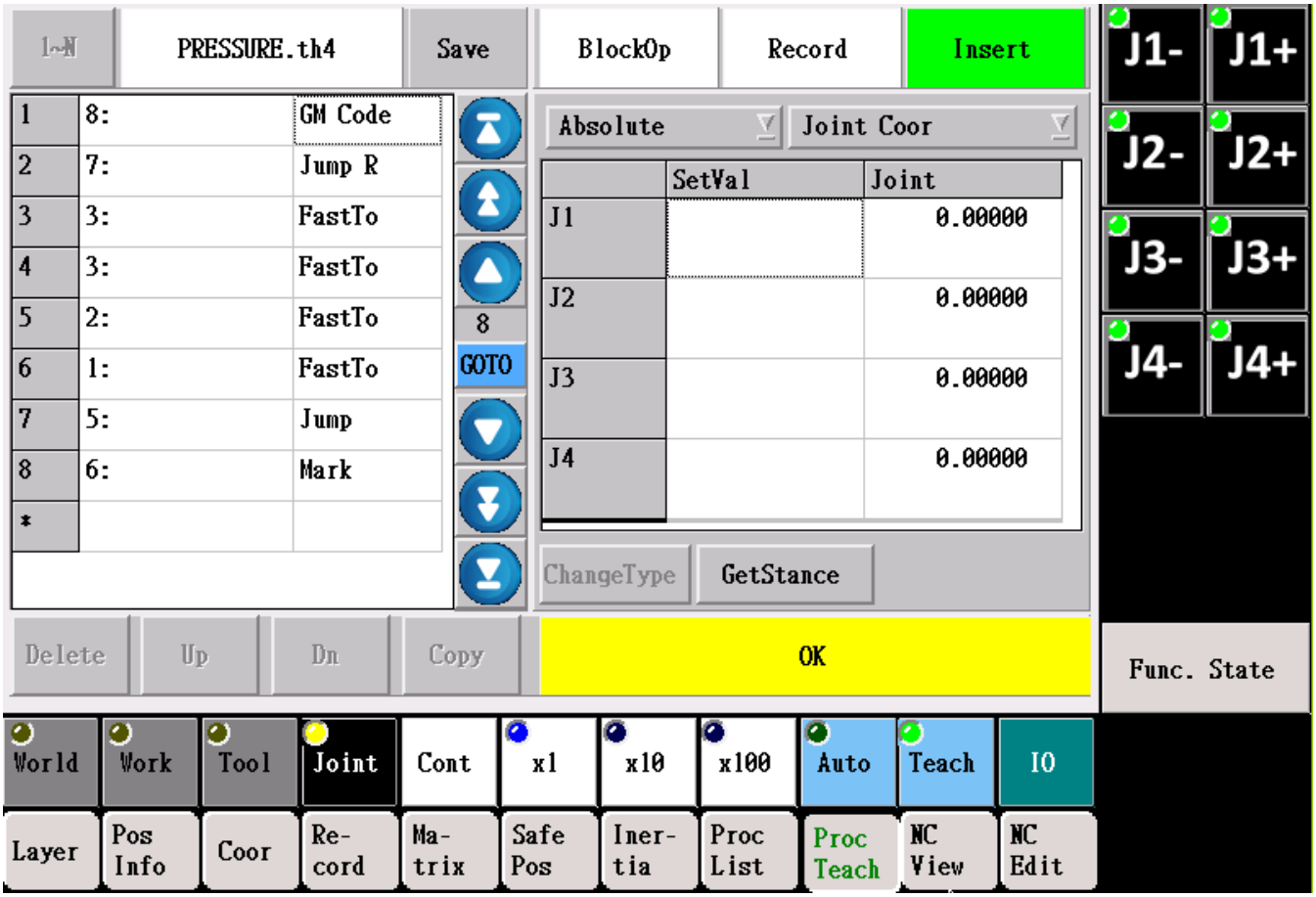
5.4.15. LineTo



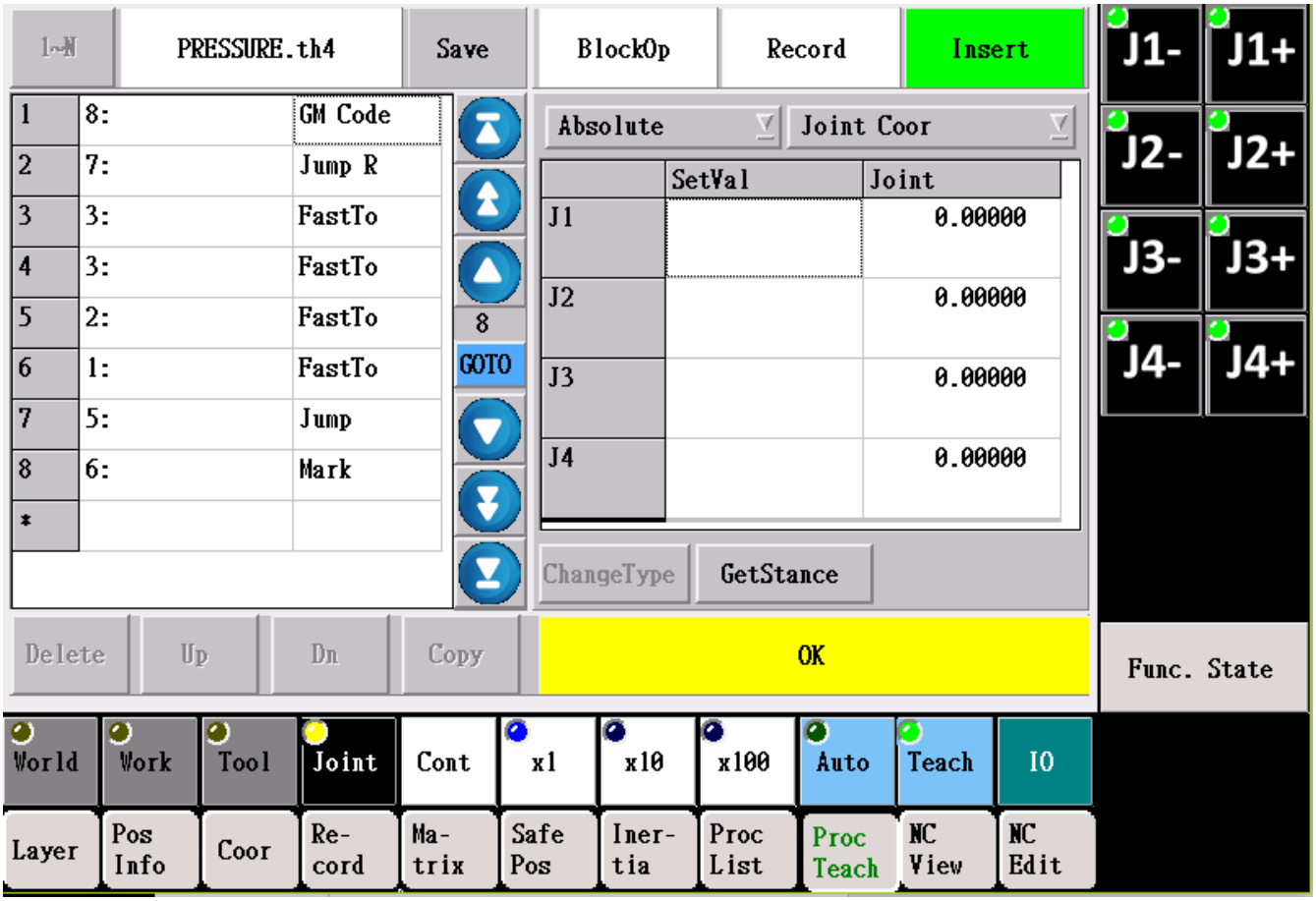
5.4.16. CurveCorner



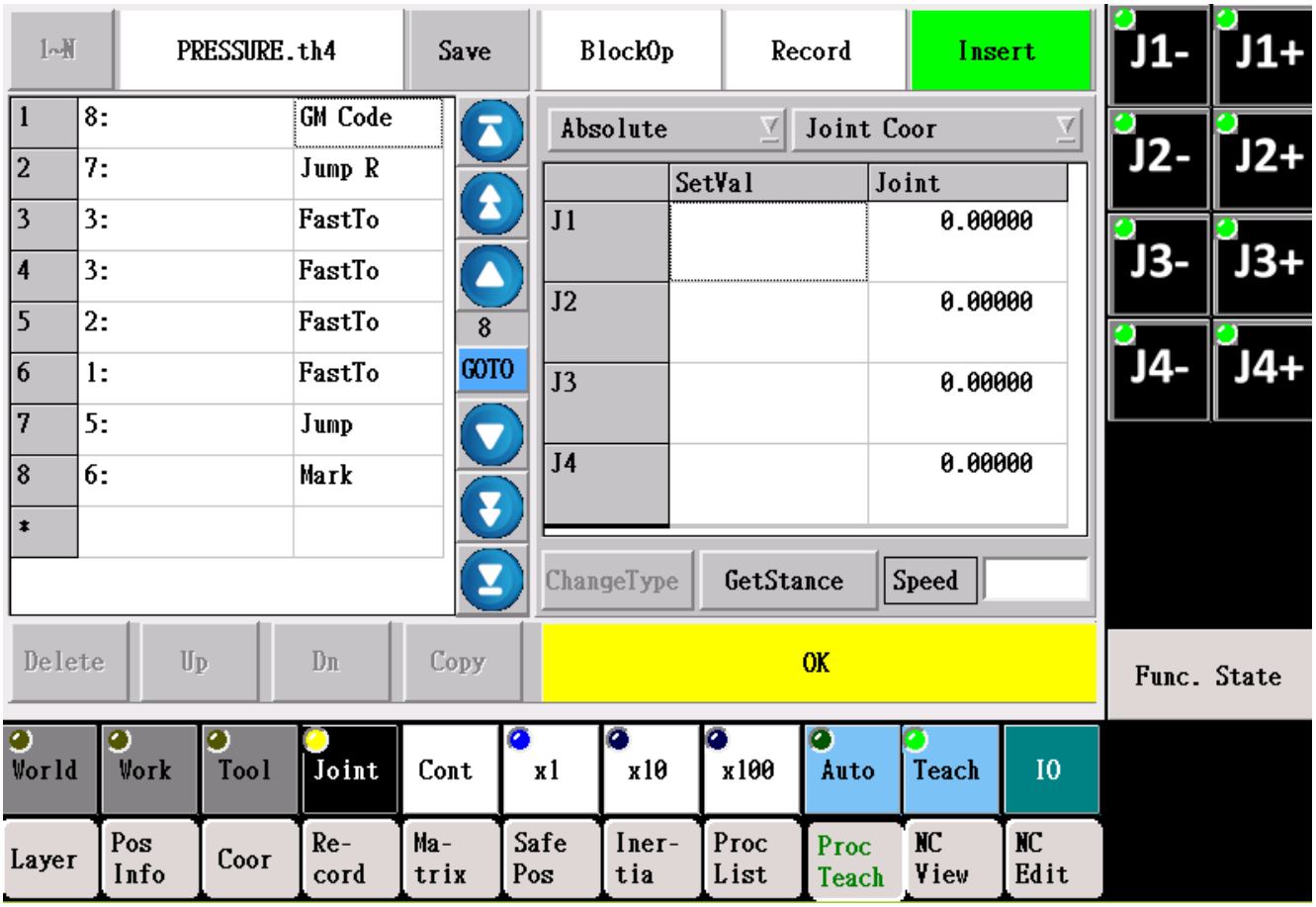
5.4.17. CurvePoint

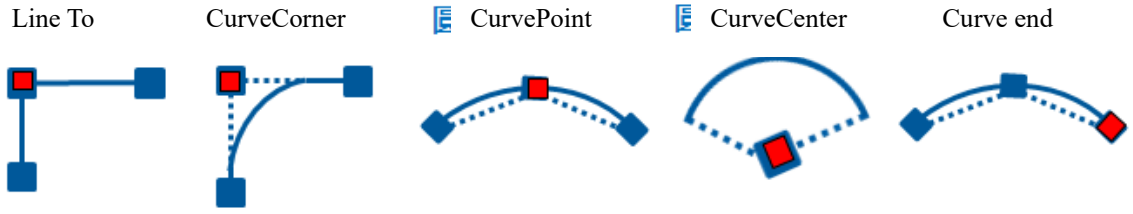


5.4.18. CurveCenter



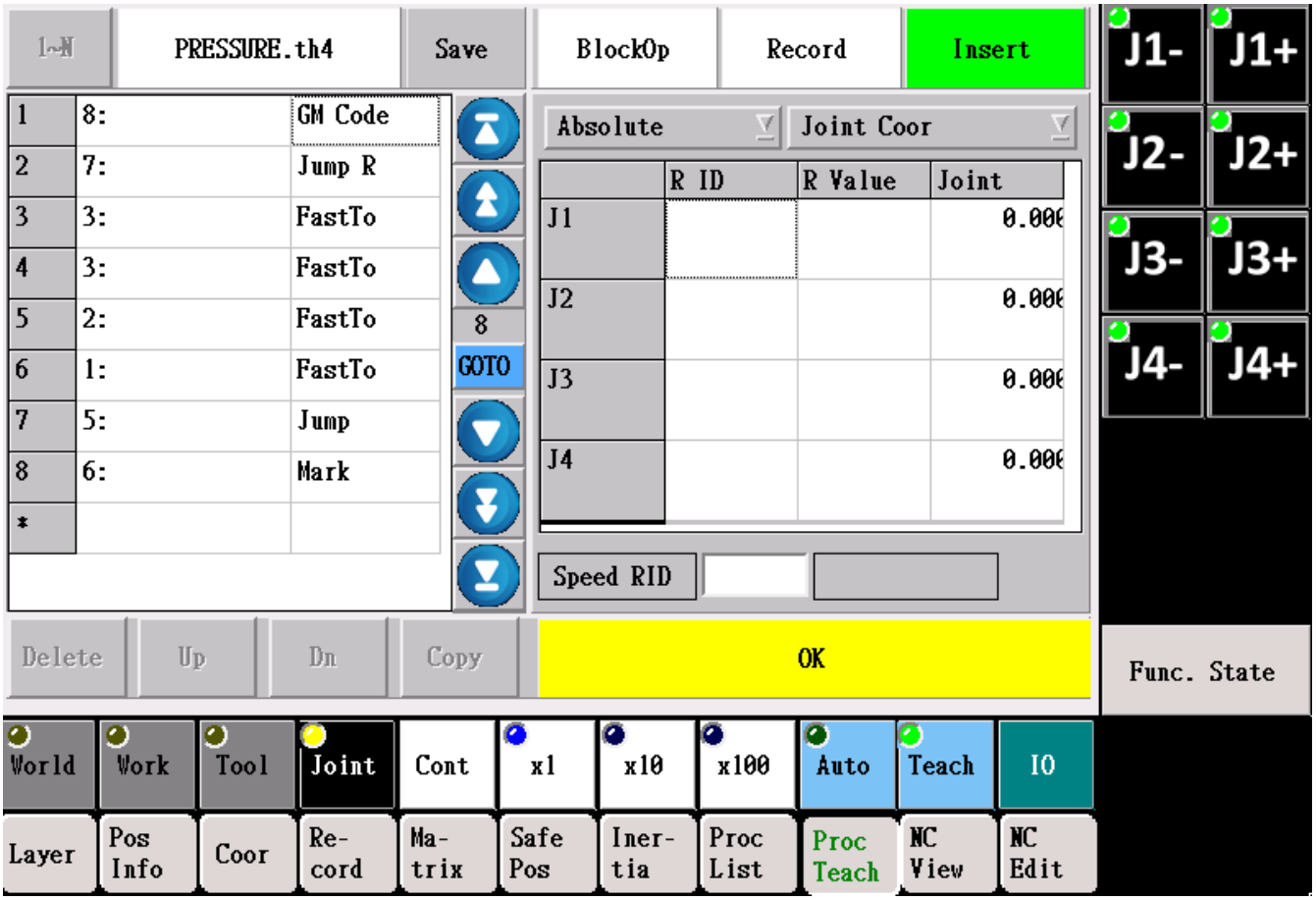
5.4.19. CurveEnd





Absolute/Relative: Indicate the contents of setting value are absolute to the selected coordinate system or relative to the current coordinate under the currently selected coordinate system.
Coordinate System: Indicate the coordinate system used by the contents of the setting value.
Setting Value: Coordinate point reached by this movement.
Coordinate: Current coordinate value.
Speed: If the speed is blank, it indicates that the defaulted straight line speed will be used.
Get Current Coordinate: According to the selected coordinate system, fill the current coordinate of that coordinate system in the setting value.
Change Type: Switch the movement type.

5.4.20. Dynamic Position



Absolute/Relative: Indicate the contents of setting value are absolute to the selected coordinate system or relative to the current coordinate under the currently selected coordinate system.

Coordinate System: Indicate the coordinate system used by the content of the setting value.

R Number: Get the source registers of XYZABC coordinate information. If this column is blank, it indicates that the previous coordinate will be continued to use.

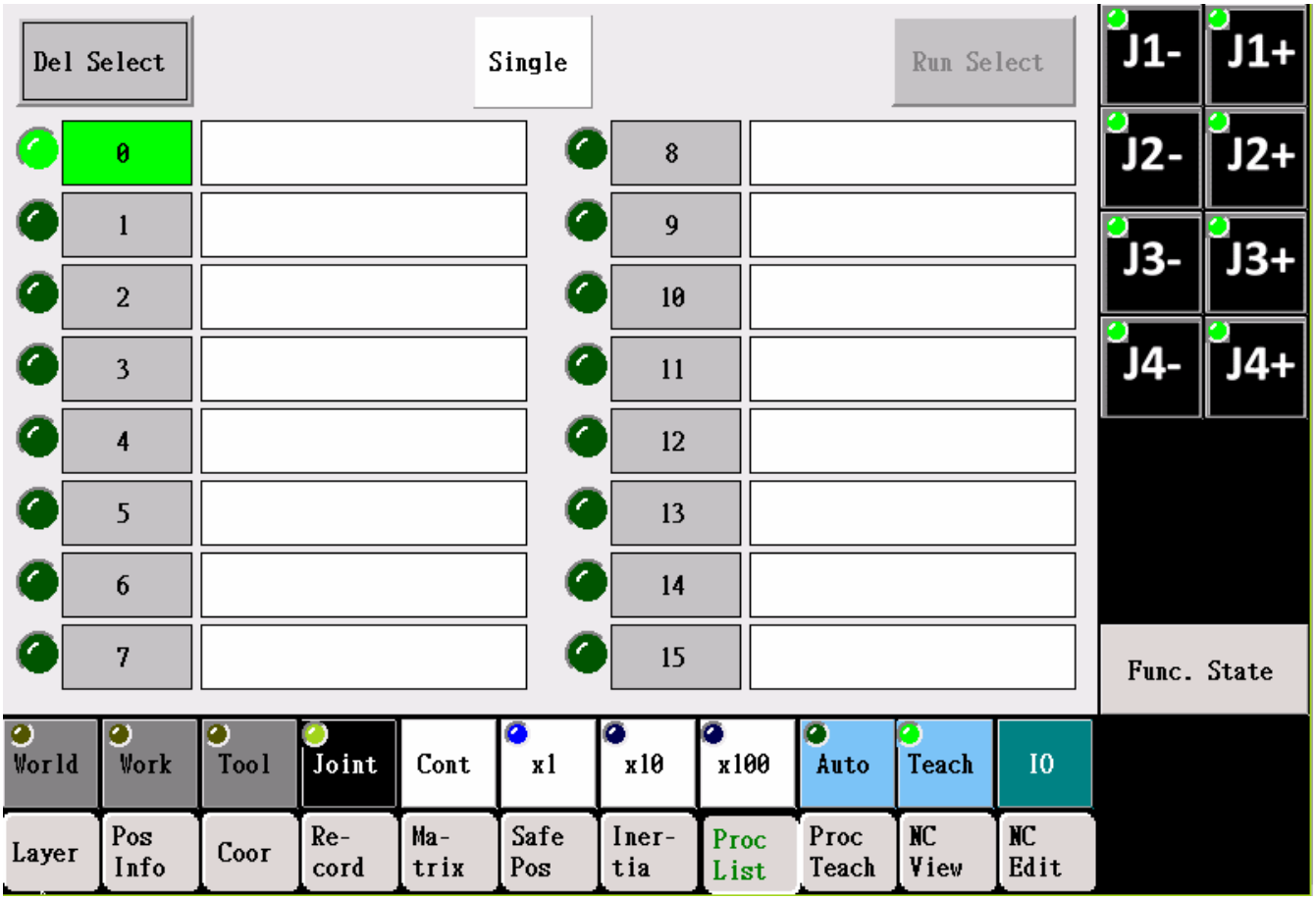
R Value: The value in the R-number register.

Speed R Number: Get the source registers of speed information. If this column is blank, it indicates that the defaulted straight line speed is used.

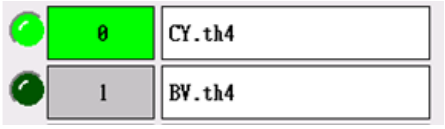
Go to Dynamic Position always uses “Straight Line Path” mode.

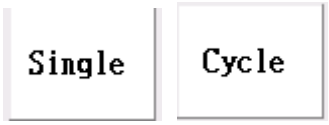
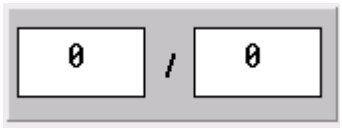
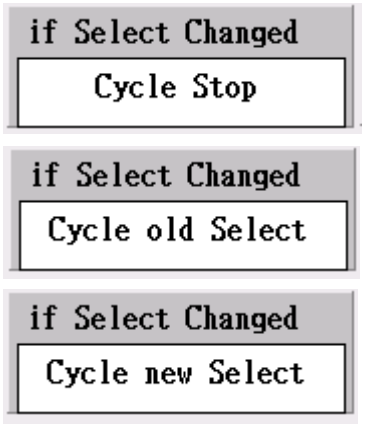
This command is applicable for working with the visual system or PC to fill in the target position and notify the robot of performing motions.

6. List

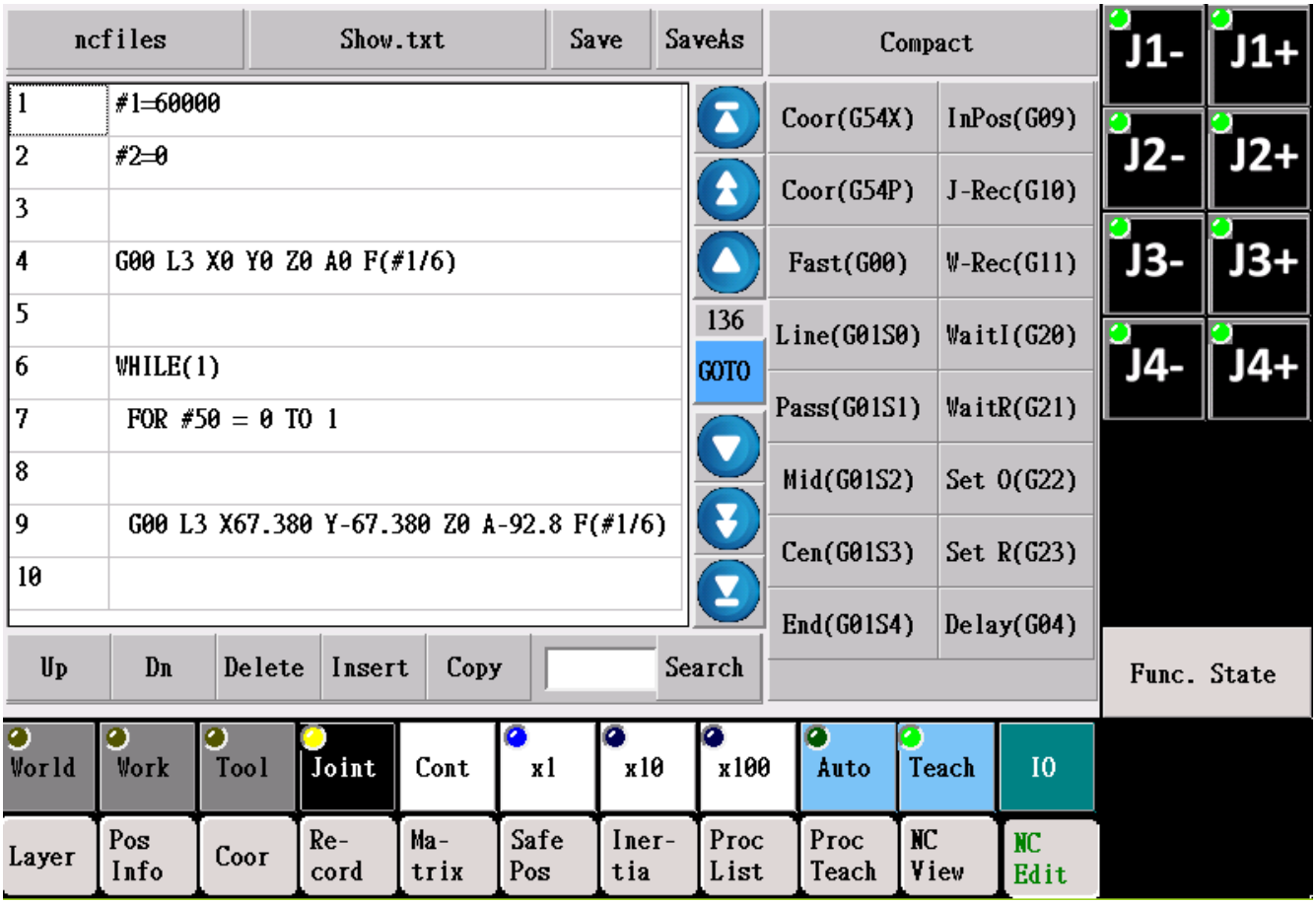


This page is used to record the frequently used filenames of teaching procedure so that can facilitate the follow-up usage. It can also select the record ID number through external I point and work with the Start button to directly start the selected procedure without requiring the Teaching Pendant.

	16 positions to record the filename, where the red indicator in the front represents the file in the number is the item selected by external I point, the gray box in the middle can be clicked to select the item. When the item is selected, it will turn to green background. If you click the white filename box, you can select the corresponding procedure filename.
	Clear the procedure filename for the clicked item.
	Start the procedure filename selected on the screen.

	There are two actions, where “One Turn” indicates to stop per one execution, and ”Cycle” indicates to repeatedly execute.
	Currently executed time/execution time by target program. If the target is set as 0, it indicates to continuously execute without stopping. The current time can be also filled in according to the actual condition.
	Select the handling method in cycling: Stop the procedure currently executing. Continue to execute the original procedure. Switch new procedure.

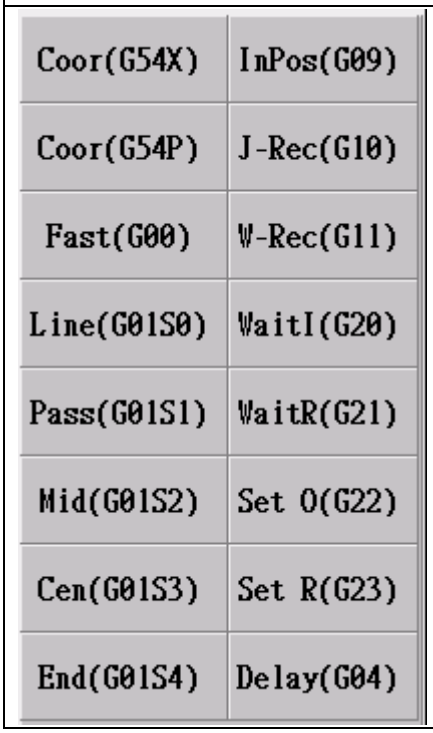
7. NC Edit



The function of this page is:

1. Directly record the procedure file by NC.
2. Make some modifications for the saved file.

ncfiles	Select the folder. When you permit to login as “Manager”, you can select “ncfiles” only. When you permit to login the level over “Developer”, you can select “macro_maker”.
Show.txt	When you click this button, you can select the saved file or new file.
Save SaveAs	Operate by the selected program.

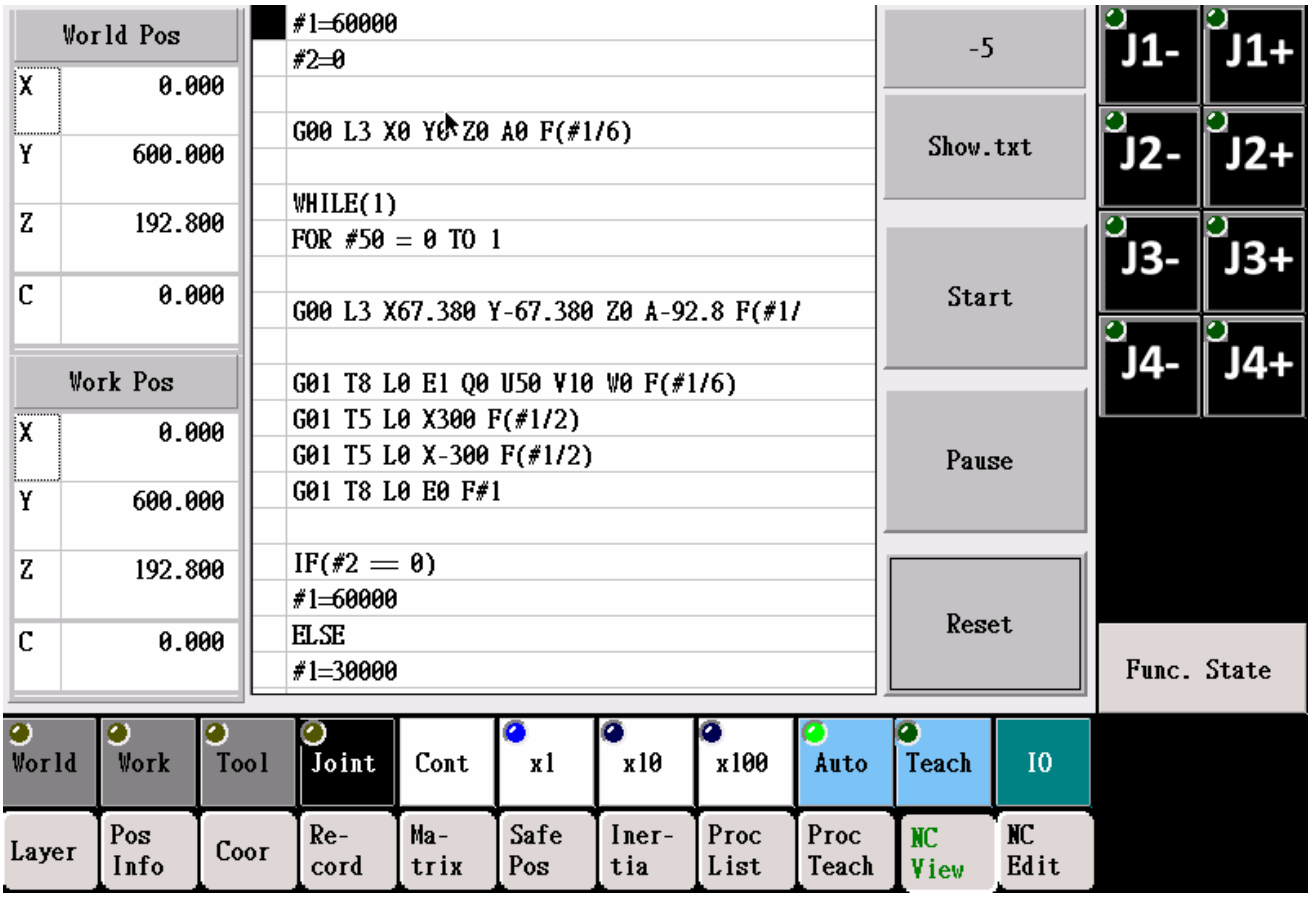
	Search a file.
	**Clicking the number column can popout the text box for modification.**
	The types of text input are shown when you select Edit,"Simplified Keyboard" and "Full Keyboard".
	Record the commands, whose functions are described in text.
	Operate by the selected program.

Note 1: The file can be saved as o2234, and called to use in the "Procedure".

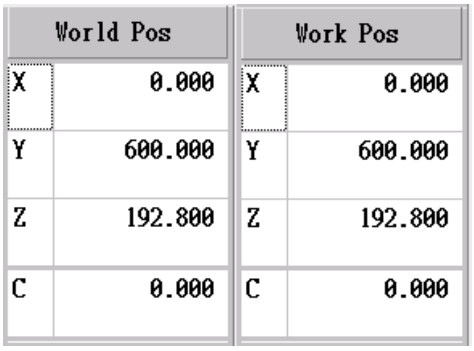
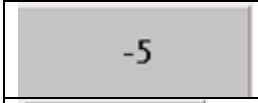
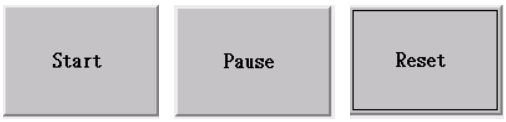
Note 2: The end command for the procedure is PROG_END.

Note 3: The command to return the main procedure is M99.

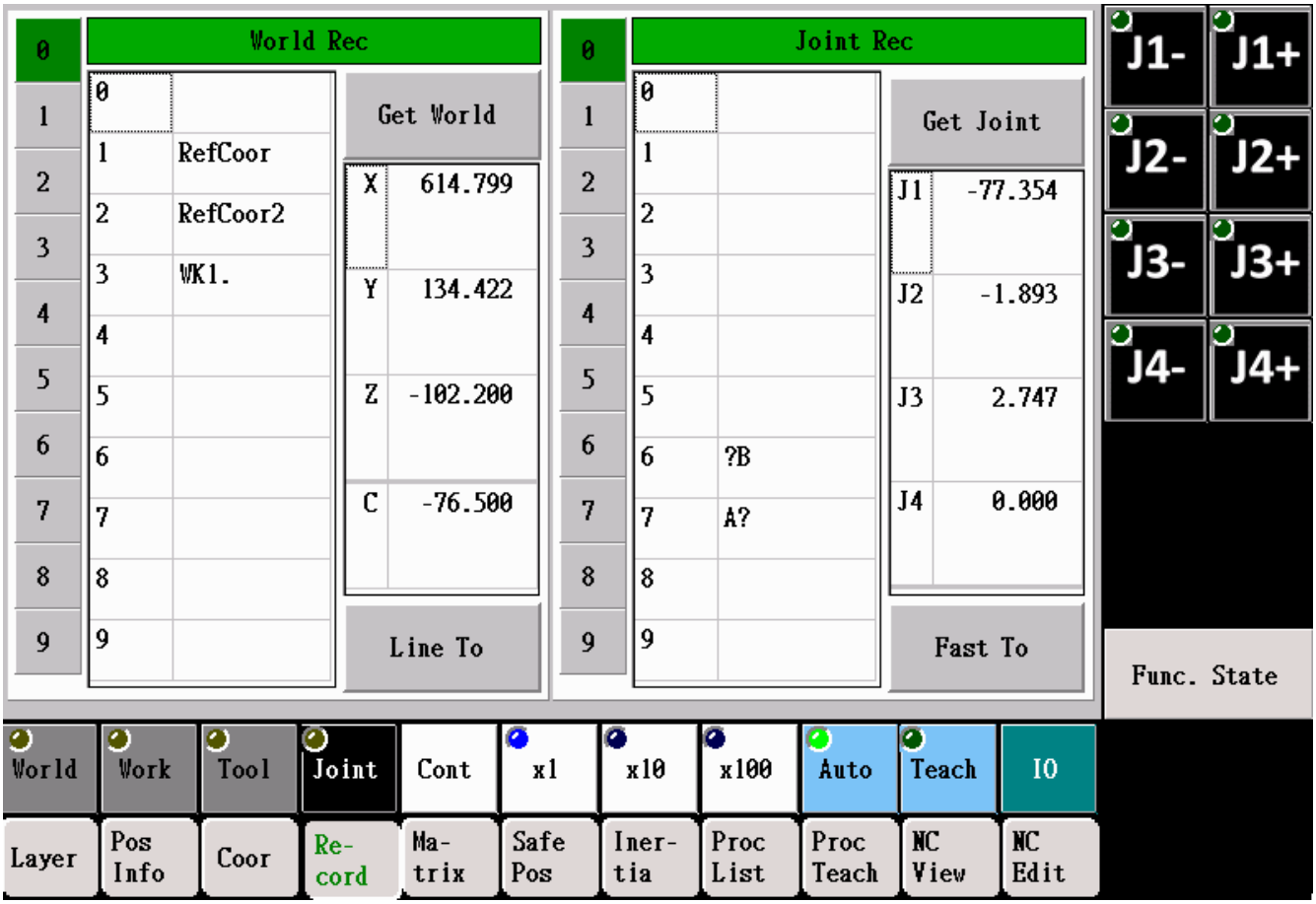
8. NC View



The function of this page is to directly execute ncfiles.

	Display the coordinates. Click the coordinate title to change the displayed coordinate system.
	Currently executing line, -5 indicates the procedure is not started.
	Currently executing filename, click to select the saved file.
	Execution control on the procedure.

9. Point Record



The coordinate record includes two (2) categories: world record and joint record. Press the “Point Record” button to show the coordinate record page as follows:

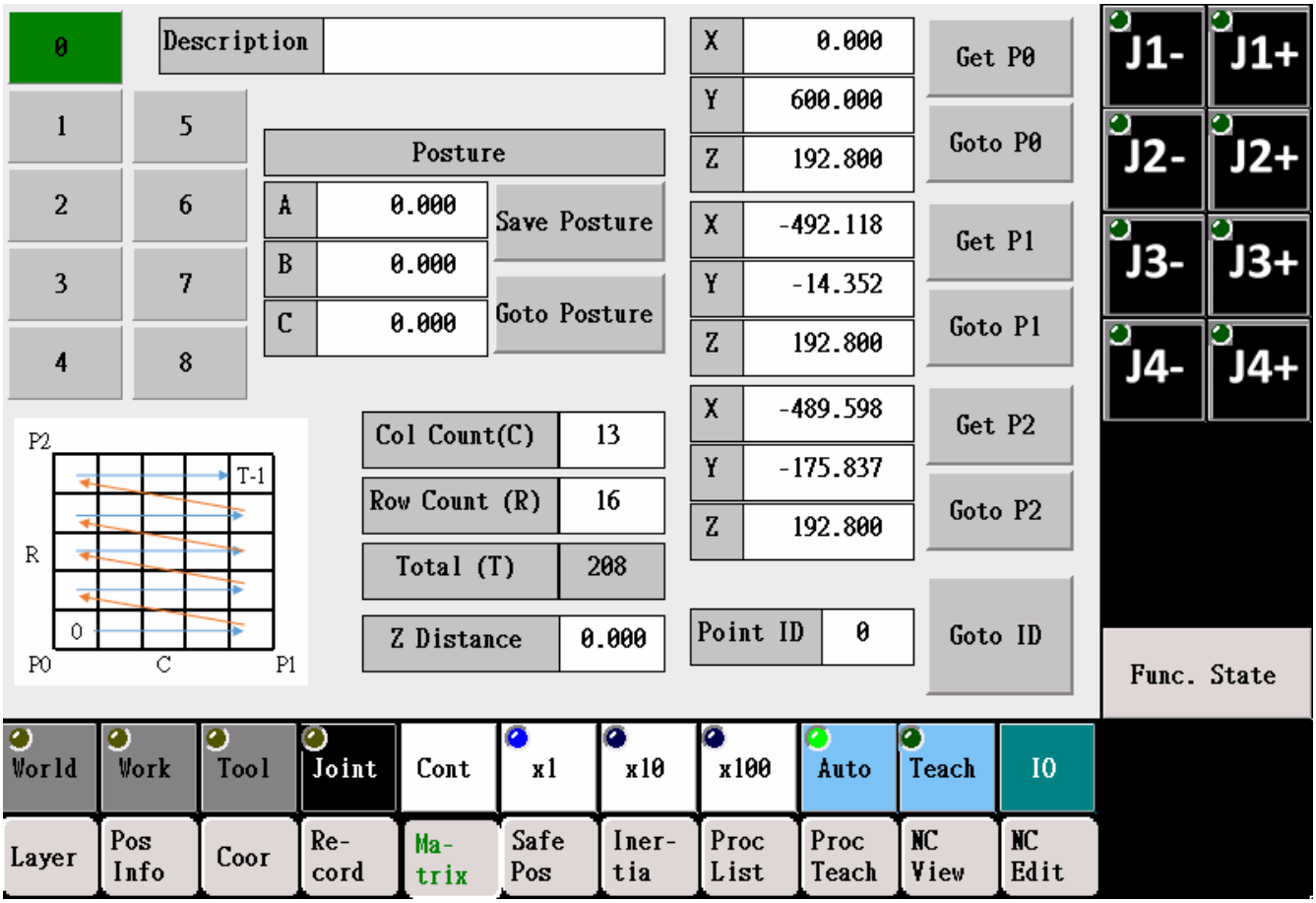
There are 100 sets of record each. You not only can click the column of the record number to select and record, but also click the column beside the record number to set the name for the point position. The length of the name can be up to 11 English letters.

There are two function buttons for the world/joint record:

: Update the currently selected world/joint coordinates to the current world/joint record.

: Calculate the staright line path for movement based on the current and target positions.

10. Matrix



This function is provided for the convenience of picking and placing material with matrix approach. Easily through the correction of three point positions and entering column/row count, it will be able to obtain each position point. The system provides nine (9) sets of matrix for save.

1. 

, select the matrix set order (0~8) to be configure. For the convenience of identification, the text can be entered in the “Description” column for the description.
2. After entering the “Teaching Mode”, the posture ABC will be adjusted to the monitoring view.
3. Click 

to record the posture.

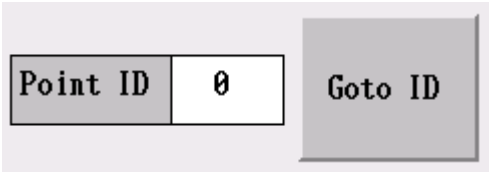
4. Click X+, X-, Y+, Y-, Z+, Z- to adjust the position.
5. After you adjust to the position of P0, click 

.
6. After you adjust to the position of P1, click 

.
7. After you adjust to the position of P2, click 

.
8. After you enter the column and row count, the system will automatically calculate total counts.
9. Switch to the “Auto Mode”.
10. Click 

to turn the posture to the recorded appearance by machine.
11. Click 

to move the robot to the connection position.
12. 

Enter the point identification, and then click “Go to ID” to move the robot to the point identification in the matrix (The number point starts from 0.).
13. For the course of the actual operation, please refer to G16 in G Code.

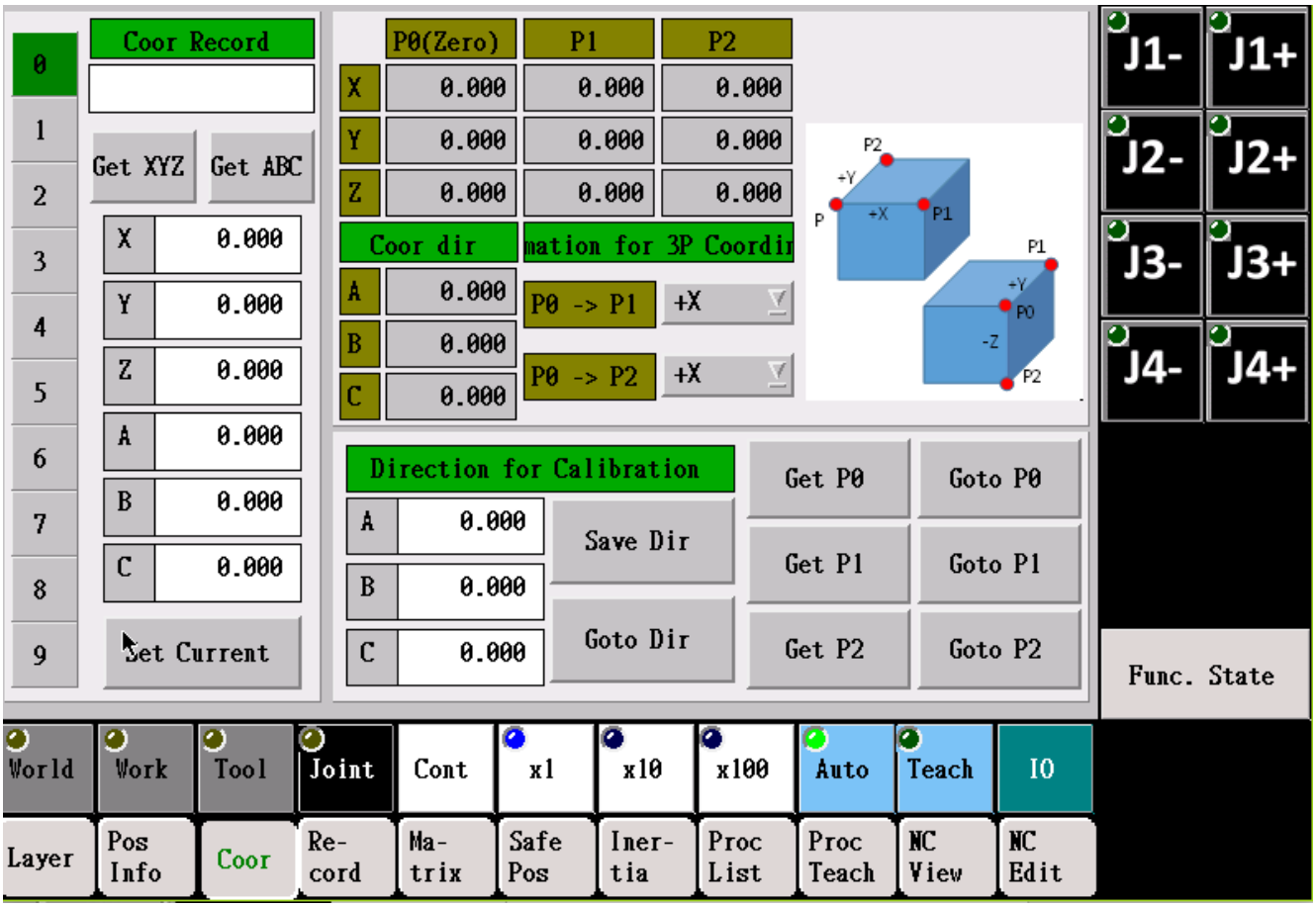
11. Coordinate System

11.1. Purpose of Coordinate System

Because the relative position between the place where workpiece is loaded and the robot body will not be the same when programming, a method must be provided to adapt the variation between positions. The coordinate system is used for such purpose. Not only the offset of spatial point but also the rotation and tilt in the coordinate system of the robot can be compensated.

Because the robot may be simultaneously used at the multiple working areas, this system can provide up to ten (10) sets of work coordinate for the use of the customer use according to the actual requirements.

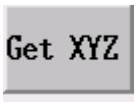
There are two areas divided in the figure below. The left area is used to view the current coordinate system records. The right area uses the 3-point coordinate system method to assist calculating the position offset, the direction of rotation and the tilt of the coordinate system.



After 3-point is used to fix the coordinate system, it can be saved in the coordinate system for the use of the procedure.

11.2. Records of Coordinate System

0 ~9: Click to select the number of the coordinate system to be operated.



Get XYZ: Bring XYZ of P0 on the right side into the records of the coordinate system.

Get ABC: Bring ABC in the “Posture of Coordinate System” calculated by 3-point coordinate system into the records of the coordinate system.

Set Current: Set up the recording value of the selected coordinate system as the present work coordinate system.

11.3. Principle and Operation of 3-Point Coordinate System

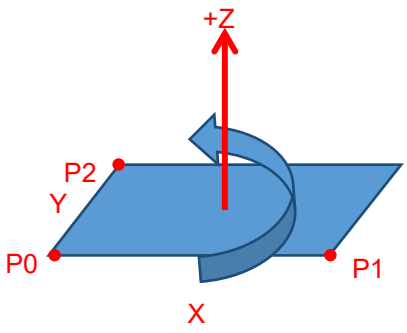
In mathematics, we can determine a coordinate system through the positions of three (3) points, where:

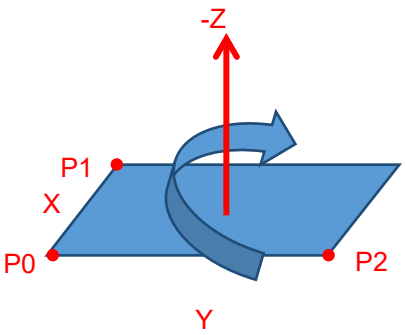
P0: Origin of the coordinate system

P1: Upward point of primary axis

P2: Upward point of secondary axis (on plane)

According to the differences of actual workpieces or the motion direction, the direction of primary axis may be possibly one point on +X, -X, +Y, -Y, +Z, -Z, so are the direction of secondary axis. Therefore, there are twenty-four (24) types of 3-point coordinate system.





X cross Y => Z
Z cross X => Y
Y cross Z => X

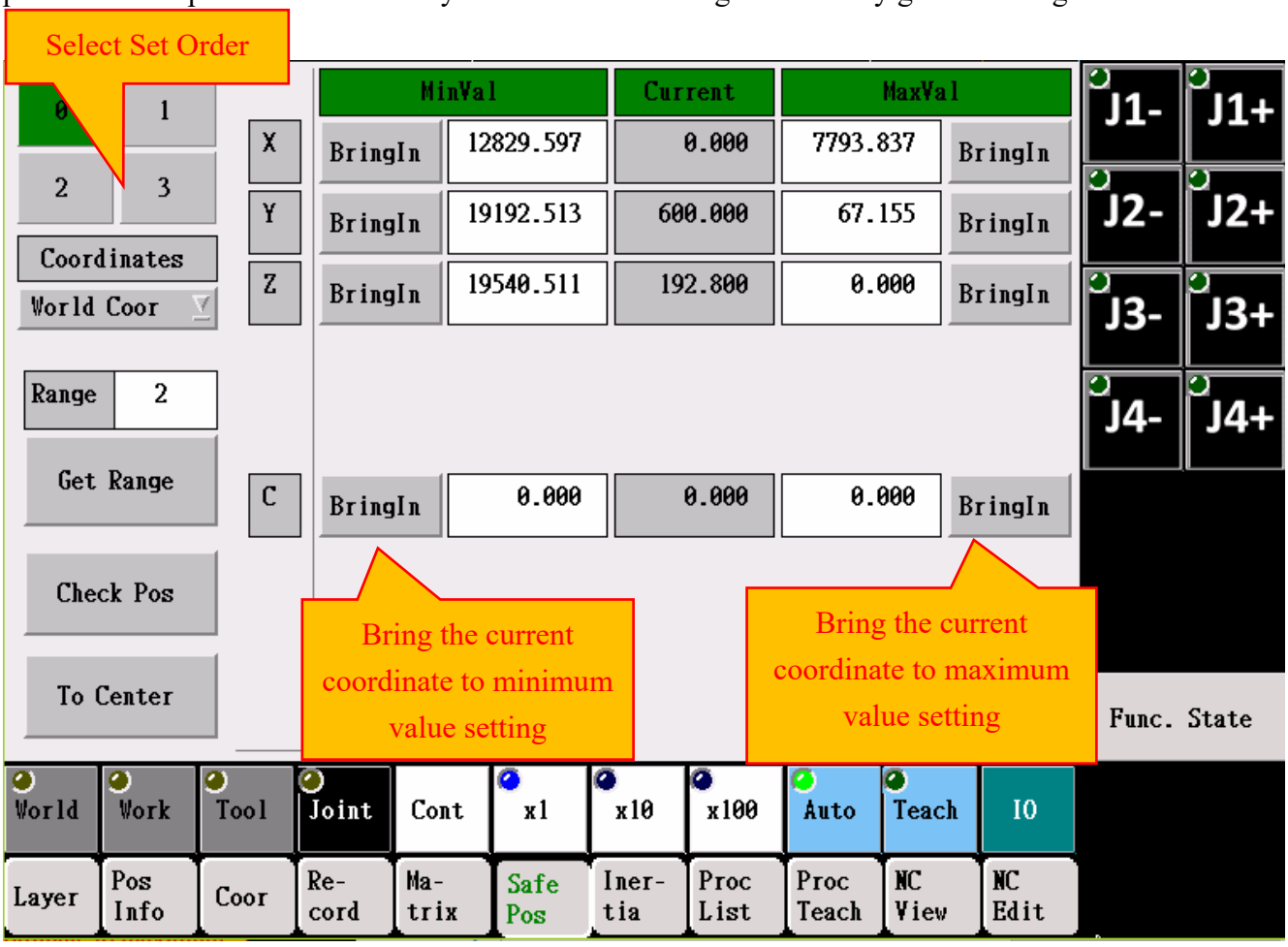
After you select the relative position between the workpiece in the working area and the robot, the 3-point coordinate system can be set. The operating approaches are described as follows:

1. When it is used at the first time, you will set up the posture to be taught. The arm posture will be adjusted as the posture to be taught, and then you click “Record Calibrated Posture” so that can be taught with the same posture every time.
2. Click “To Calibrated Posture” to adjust the robot as the recorded calibration posture.
3. First select the origin P0, P1 and P2 used for the basis of calculating the coordinate system.
4. According to the axial direction where P1 and P2 are located, click the selection of the axial direction on the top to switch the axis.
5. Move the robot to align the tool end point to P0, and then click “Get P0” to bring “Present World Coordinate” into P0 coordinate.
6. If you only intend to use the position of the offset coordinate system without changing the rotation of the coordinate system, you just need to correct P0.
7. Move the robot to align the tool end point to P1, and then click “Get P1” to bring “Present World Coordinate” into P1 coordinate.
8. Click the XYZABC below to align the tool end point to P2, and then click “Get P2” to bring “Present World Coordinate” into P2 coordinate.
9. The system will automatically calculate the posture of the coordinate system.

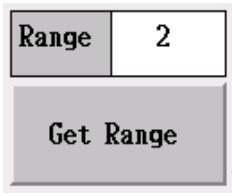
12. Safety Point

When the procedure runs, the sudden power disconnection or reset could take place, so that the restarting position is different from the ideal one. If the robot stops in a position where may cause the interference, it will be dangerous to start the procedure hastily. Therefore, this system provides this function to conveniently check the current position of the robot in the program, which can reduce the danger and property loss.

There are four (4) sets (0~3) of position checking intervals as planned by the system. The position interval can be set through the following page: by repeating the adjustment of the robot position to the permissible boundary and then click “Bring In” to easily get the configured interval.



Coordinate type of safety point.



Using current coordinates of the robot plus and minus the range setting as the range

of safety point.

Check the current coordinates are in the setting range.

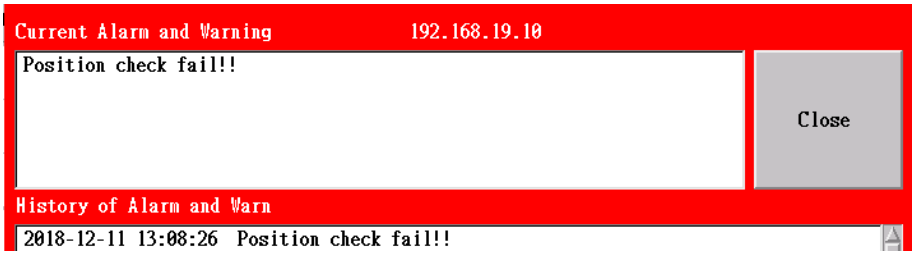
Calculate the half summation of the maximum and minimum values as the target point of the movement, and hold this button to move toward the target point. If you release it, it will stop.

During the procedure process, the safety point can check the current position through G13.

The operation principle is that when a code is used to transmit the checked set order, G13 will put the checked results into the all-domain variable @40. When the results are successfully checked, the value of @40 is 1. If they are failed, the value of @40 is 0.

The following are the macro contents of G113:

```
G13A0       ;check if the current coordinates are in the setting interval of the zeroth set.
IF (@40!=1)
      ALARM("Position check fail!!")
END_IF
PROG_END
```

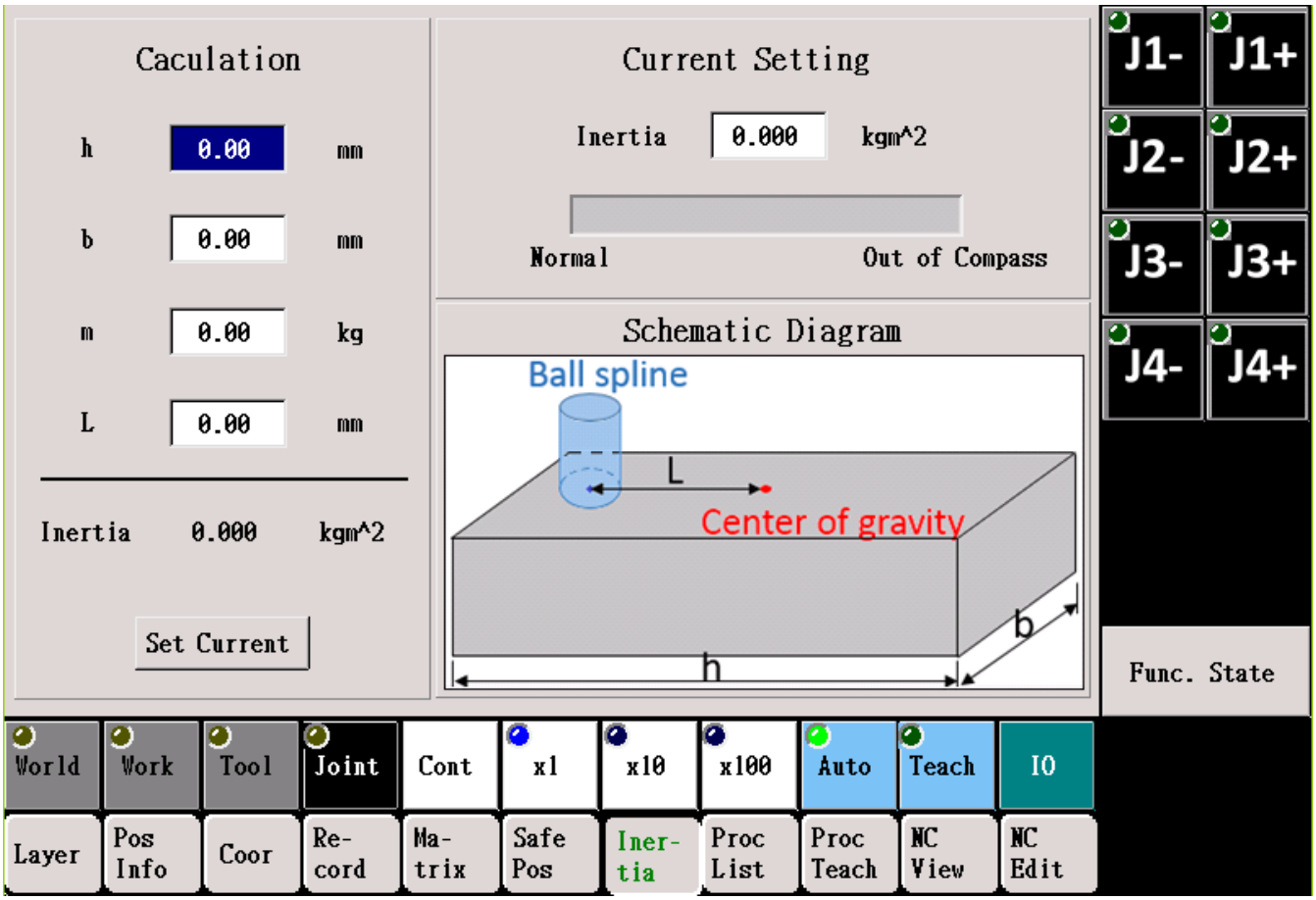


In order to conveniently use in the teaching procedure, the system pack the check as the additional G code. As long as the command of GM Code is used, G113 will be assigned and brought into the set order parameters A(0~3). If the check fails, the incorrect messages will be shown and the procedure execution will be stopped.

13. Inertia

When SCARA installs the object (such like end fixture/jig) on J3 axis, the inertia moment of load must be considered. The inertia moment that RS406 can sustain is $0.01\ \mathrm{kg}m^2$, where the maximum one is $0.12\ \mathrm{kg}m^2$. When load inertia at the end of SCARA exceeds the rating inertia, you must set

inertia as the current column. There is a progress bar under the column to remind of the current value being located in the range (If inertia in the current column isn't 0, the System will automatically set the maximum speed corresponding to inertia.).



The Sheet provides a simple calculation of inertia, where h, b, m and L represent the length, the width, the weight and gravity offset of end fixture.

14. G Code

14.1. Summary Table

G Code	Function	Description
G00	Quick Movement	L: 0 for world, 1 for work, 2 for tool, 3 for joint (default: work) M: 0 for absolute, 1 for relative (default: absolute) X: coordinate X or J1
G01	Path Movement	

		Y: coordinate Y or J2 Z: coordinate Z or J3 A: coordinate A or J4 B: coordinate B or J5 C: coordinate C or J6 F: Speed
G04	Delay	
G05	Switch Tool Parameters	Used to switch the tool
G09	Correct Position	
G10	Joint Record Movement	
G11	World Record Movement	
G13	Safety Point Check	
G16	Matrix Point Calculation	
G20	Wait I	
G21	Wait R	
G22	Set O	
G23	Set R	
G31	Sense Stop	
G54	Set Coordinate System	O0: Directly assign the offset position and the posture O1: Use the position in the world record O2: Use the position and the posture in the world record O3: Use the record of coordinate system O4: Use the current position and the posture

14.2. Quick Movement (G00)

G00 X100 Y100 Z10 C39 F4000	Move to the position of the work coordinate (100, 100, 10, 39) with 4000 deg/min
G00 L0 X100 Y100 Z10 C39 F4000	Move to the position of the world coordinate (100, 100, 10, 39) with 4000 deg/min
G00 M1 X100 Y100 Z0 F4000	Move to the position relative to the

	current work coordinate (100, 100, 0) with 4000 deg/min
G00 L0 M1 X100 Y100 Z0 F4000	Move to the position relative to the current world coordinate (100, 100, 0) with 4000 deg/min
G00 L2 M1 Z-20 F4000	Move to the position relative to -20 at Z axis of the current tool coordinate with 4000 deg/min
G00 L3 X100 Y100 Z10 A39 F4000	Move to the position f the joint coordinate (100, 100, 10, 39) with 4000 deg/min

14.3. Path Movement (G01)

14.3.1. Straight Line (S0)

Use G01 S0 for setting. Since S0 is the default value, no need to write.

G01 X100 Y100 Z10 C39 F4000	Straight line to the position of the work coordinate(100, 100, 10, 39) with 4000 mm/min
G01 L0 X100 Y100 Z10 C39 F4000	Straight line to the position of the world coordinate (100, 100, 10, 39) with 4000 mm /min

G01 M1 X100 Y100 Z0 F4000	Straight line to the position relative to the current work coordinate (100, 100, 0) with 4000 mm /min
G01 L0 M1 X100 Y100 Z0 F4000	Straight line to the position relative to the current world coordinate (100, 100, 0) with 4000 mm /min
G01 L2 M1 Z-20 F4000	Straight line to the position relative to -20 at Z axis of the current tool coordinate with 4000 mm/min
G01 L3 X100 Y100 Z10 A39 F4000	Straight line to the position of the joint coordinate (100, 100, 10, 39) with 4000 mm /min

14.3.2. Arc Transition (S1)

Use G01 S1 to set up arc transition point.

The R code is the radius of arc transition.

G01 S1 X100 Y100 Z10 C39 R50 F4000	Arc transition to the position of the work coordinate (100, 100, 10, 0, 0, 39) with 4000 mm/min.

14.3.3. 3-Point Arc (S2, S4)

G01 S2 is used to set up the point on arc. G01 S4 is used to set up the arc end point.

G01 S2 X100 Y90 Z80 G01 S4 X100 Y100 Z10 C39 F4000	Take the current position as starting point. The work coordinates (100, 90, 80) are one point on arc, and the work coordinates (100, 100, 10) are the arc end point.

14.3.4. Arc Center (S3, S4)

G01 S3 is used to set up the arc center. G01 S4 is used to set up the arc end point. When using G01, D2 and D3 will be used to assign clockwise-arc or counterclockwise-arc.

G01 S3 X100 Y90 Z80 G01 S4 D2 X100 Y100 Z10 C39 F4000	Take the work coordinate (100, 90, 80) as the arc center, the arc end point as work coordinate (100, 100, 10) to draw the clockwise-arc. When the arc end point is reached, the posture is (0, 0, 39).

14.4. Delay (G04)

G04 P100	Delay 100 ms
G04 X1	Delay 1 sec

14.5. Switch Tool Parameters (G05)

G05 A0 Switch to the default tool parameters.
G05 A1 Switch to the first set of tool parameters.
G05 A2 Switch to the second set of tool parameters.
G05 A3 Switch to the third set of tool parameters.

14.6. Joint Record Movement (G10)

G10 P2 F1000	Quickly move the position of No. 2 ”Joint Record” with 1000 deg /min.

14.7. World Record Movement (G11)

G11 P67 F2000	Straight line to the position of No. 67 “World Record” with 2000 mm/min.

14.8. Safety Point (G13)

G13 A0	Check the current coordinate is in the interval of the 0^{th} set. After executed, check @40 equal to 1 represents in the safety range.

14.9. Matrix Point (G16)

G16 T1 P5	Get the coordinate of 1^{st} group, 5^{th} point.
G16 T3 P0 H20	Get the coordinate of 3^{rd} group, 20mm over 0^{th} point.
G16 T0 P7 H50	Get the coordinate of 0 group, 50mm over 7^{th} point.

After calling G16, the position of matrix point will be saved in the global variable @51~@56.
The height of the upward movement will follow the Z-axis direction (P0~P1 cross P0~P2) of the

coordinate system for point in Matrix 3. An example is taken as follows.

```
G16 T1 P2                                   ;call the first set of the coordinate point for the
second point in matrix
G01 X@51 Y@52 Z(@53+50) C@56 F3000          ;move to the position in Z axis for +50 at the point
G01 X@51 Y@52 Z@53 C@56 F10000              ;drop to the point
```

14.10. Wait I-Point (G20)

G20 I2 S1	Wait I2 for changing to 1.
G20 I2 S0 T1000 F1	Wait I2 for changing to 0. If the waiting time exceeds 1000ms, this line will be skipped.
G20 I2 S1 T2000 F2 A29010 B3	Wait I2 for changing to 1. If the waiting time exceeds 2000ms, an alarm of R29010.3 will be alerted.

I: I-Point Number

S: Comparison Value (Waiting Value)

T: Waiting Time

F: Failure Processing Mode, where 0 for continue waiting, 1 for skip this line, and 2 for alarm

A: Alarm ID Number

B: Alarm Bit

14.11. Wait R-Value (G21)

G21 R1100 V1	Wait R1100 for changing to 1.
G21 R1100 V0 T1000 F1	Wait R1100 for changing to 0. If the waiting time exceeds 1000 ms, this line will be skipped.
G21 R1100 M1 V99 T1000 F1	Wait R1100 for changing equal to R99. If the waiting time exceeds 1000 ms, this line will be skipped.
G21 R1100 M1 V99 C1 T1000 F1	Wait R1100 for changing not equal to R99. If the waiting time exceeds 1000 ms, this line will be skipped.
G21 R1100 V1 T2000 F2 A29010 B3	Wait R1100 for changing to 1. If the waiting time exceeds 2000 ms, an alarm of R29010.3

	will be alerted.

R: R-Value ID Number

C: Comparison Mode, where 0 for equal to and 1 for not equal to

M: Mode, where 0 for constant and 1 for R value

V: Comparison Value (Waiting Value)

T: Waiting Time

F: Failure Handling Mode, where 0 for continue waiting, 1 for skip this line, and 2 for alarm

A: Alarm Number

B: Alarm Bit

14.12. Set O (G22)

G22 O1 S0 P200	After O1 is set as OFF, it will pause 200ms.
G22 O1 S1	Set O1 as ON
G22 O1 S2	Switch the status of O1

O: Number of Output Point

S: Status of Output Point, where 0 for OFF, 1 for ON, and 2 for Toggle

P: Waiting Time in ms

14.13. Set R (G23)

G23 R2010 T0 V3 P200	After R2010 is set as 3, it will pause 200ms.
G23 R2011 T1 V2	R2011 = R2011+2
G23 R2012 T2 V2060	R2012 = R2060
G23 R2013 T3 V10	R2013 = R2013+1. If R2013>10, set R2013=0.

R: R Number

T: Value Type (0 for absolute, 1 for relative, 2 for numbering, and 3 for cycle + 1)

V: Status of Output Point

P: Waiting Time in ms

14.14. Sense Stop (G31)

G31 M1 Z-100 F3000 R6130 S1 T1	Drop 100mm with 3000 mm/min. If R6130.0 = 1 in the course of drop, the actions not completed by this

	command will be omitted without execution.
G31 Z-100 F3000 R6130 S3 T3	Move Z axis to -100mm in the work coordinates with 3000 mm/min. If R6130.0 = 1 and R6130.1 = 1 in the course of drop, the actions not completed by this command will be omitted without execution.

Except for R, S and T codes, other G codes will be the same with using the G01 command.

R: R Number

S: Mask value operated with the value of R number by AND. For example, when the bit0 of R value is monitored only, S1 can be used; when bit1 if R value is monitored only, S2 can be used; when bit0 and bit1 are simultaneously monitored, S3 can be used.

T: The values operated by AND are the same with ones for this code to stop by trigger.

Note: I70~I73 will be built in the system to correspond to R6130.x, which the I point triggered to stop can be set as this number to conveniently use this function.

14.15. Set Work Coordinate System (G54)

The rotation and tilt of the work coordinate system may refer to the example as illustrated in 2.2. There are three (3) ways to assign the work coordinate system described as follows:

14.15.1. O0 (Default) Directly Assign Offset Position and Posture

G54 X0 Y100 Z300 A0 B0 C0	Set up (0,100,300) as the origin of the work coordinate system No rotation and tilt
G54 X20 Y100 Z300 A0 B0 C30	Set up (20,100,300) as the origin of the work coordinate system Horizontally rotate at 30^{o}
G54 X20 Y100 Z300 A0 B10 C30	Set up (20,100,300) as the origin of the work coordinate system Posture of the coordinate system as (0, 10, 30)

14.15.2. O1 Use Position XYZ in World Record

G54 O1 P8	Use XYZ of No. 8 (P8) world record as the work coordinate system. No rotation and tilt.

14.15.3. O2 Use Position and Posture XYZABC in World Record

G54 O2 P6	Use XYZABC of No. 6 (P6) world record as the work coordinate system.

14.15.4. O3 Use Coordinate System Record

G54 O3 P8	Use No.8 coordinate system record.

14.15.5. O4 Use Present Position and Posture

G54 O4	Use the coordinate XYZABC of procedure at that time as the work coordinate system.

15. Macro Syntax

15.1. Variable

15.1.1. Local Variable:

There are 200 local variables (floating point type) in each file:
#1~#26: If macro files are called, 26 variables in macro correspond to 26 letters in A~Z. When calling macro, A~Z codes can be used in the command and brought to the variables corresponding to macro file. If they are Ncfiles programmed by a user, the purpose can be planed by a user.
#27~#199: Planned by a user.

15.1.2. Global Variable:

When the procedure runs, the global variable can be used (floating type):
@1~@50: There are 50 variables which can be planned by a user.

The global variables can be accessed by the files. Therefore, they can be used as a channel among the different files.

15.2. Resource Access

The following table is a list of all resources and access functions in the articulated robot.

Resource	Read for R, write for W (Immediately execute after the program is started)	Read for R, write for W (Execute when the program is executed to the line)	Read for R, write for W (Execute when the program is executed to the line) synchronously execute with the action command	Description
I (Input)	R_MLC_I_F	R_MLC_I		Set the software number to correspond the actually output hardware point.
O (Output)	R_MLC_O_F W_MLC_O_F	R_MLC_O W_MLC_O	W_MLC_O_AT	
R (Register)	R_REG_F	R_REG		

	W_REG_F	W_REG		
R_BIT	R_REG_BIT_F W_REG_BIT_F	R_REG_BIT W_REG_BIT		

#32 = R_MLC_I(206)	Read the contents of I206 to local variable No. 32
W_MLC_O(123, 1)	Set O123 as ON
#35 = R_REG(1200)	Read the contents of R1200 to local variable No. 35
#35 = R_REG_BIT(1200, 0)	Read the contents of 0^{th} bit of R1200 to local variable No. 35
W_REG(1200, 3434)	When the program is executed to the line, the contents of R1200 will be set as 3434.
W_REG_BIT(1200, 0, 1)	When the program is executed to the line, the 0^{th} bit of R1200 will be set as 1.
W_REG_F(1200, 3434)	When the program is started, the contents of R1200 will be immediately set as 3434.
W_REG_AT(1200, 3434)	When the program is executed to the line, the contents of R1200 will be set as 3434 to synchronously execute with the action command (avoid action pause).

#1.00 => indicate Bit0 of #1

#1.03 => indicate Bit3 of #1

#1.32 => When 32 bits or more are assigned, an alarm will sound.

#1.01 => R_MLC_I(1) => The assigned value of Bit1 in #1 is one for input signal 1.

15.3. Math Function

The following table is the math functions supported in the robot system.

Math Function	Description
SIN(DEG)	SIN function
COS(DEG)	COS function
TAN(DEG)	TAN function
ASIN(VALUE)	ASIN function
ACOS(VALUE)	ACOS function
ATAN(VALUE1，VALUE2)	ATAN function
SQRT(VALUE)	Get the root mean square value
ABS(VALUE)	Get the absolute value
ROUND(VALUE)	Get the value rounded off
FIX(VALUE)	Round off without condition

MOD(VALUE, VALUE2)	Get the remainder
+	Add two numbers
-	Subtraction of two numbers
*	Multiplying two numbers
/	Dividing two numbers
||	or
&&	and
!=	Not equal
==	equal

15.4. Program Flow Control

The following table is syntax of program flow control supported in the articulated robot.

Flow Control Command	IF ~GOTO
Select Statement	IF …ELSE
Select Statement	SELECT
Loop	FOR … END_FOR, EXIT_FOR
Loop	DO …UNTIL, EXIT_DO
Call Function	CALL_SUB, EXIT_SUB

15.4.1. Select Statement (IF…ELSE, SELECT)

- **IF…ELSE**

If the condition statement holds, it will execute. If not, it will skip.

Example

```
#1 = R_REG(100)          ; Read the value of R100 and assign to variable #1.

IF( #1 == 1 )            ;When #1 == 1, write 1 to R50.
    W_REG(50, 1)
ELSEIF (#1 == 2)         ;When #1 == 2, write 1 to R51.
    W_REG(51, 1)
ELSE
    W_REG(52, 1)             ;When #1 doesn't meet the conditions above, write 1 to R52.
END_IF                       ;End IF condition.
```

- **SELECT**

Select the executed block according to the parameters.

Example

```
#1 = R_REG(100)

SELECT(#1)                  ; Determine variable #1
    CASE 0:                 ;When #1 is 0, execute G01 X10.
        G01   X10
    CASE 1:                 ;When #1 is 1, execute G01 X20.
        G01   X20
    CASE 3,4,5:             ;When #1 is 3, 4 and 5, execute G01 X30.
        G01   X30
    CASE_ELSE               ;When #1 doesn't meet the conditions above, execute G01 X40.
        G01   X40
END_SELECT
```

15.4.2. Flow Command (IF…GOTO)

- **Conditional jump, unconditional jump**

Example

```
IF( #1 == 100)   GOTO   200      ;When #1=100, jump to N200.
G01   X30
END_IF
GOTO 100                         ;Jump to N100
…
N100
G01   X20
…
N200
G01   X10
```

15.4.3. Loop (FOR, DO UNYIL, WHILE)

- **FOR**

Use the parameter accumulation to determine the execution loop

Example

```
FOR    #1 = 1 TO 10            ;#1 = 1 to 10
       G00 X#1
       #2 = R_MLC_I(55)
       IF(#2 == 1)             ;When #2 == 1, it will exit the FOR loop.
            EXIT_FOR
       END_IF
END_FOR                        ;When #1 == 10, it will end the FOR loop.
```

- **DO UNTIL**

If the determination of the condition statement is not held, repeatedly execute the loop.

Example

```
DO
       IF(#1 == 8)             ;When #1 = 8, exit the loop.
            EXIT_DO
       END_IF
       G0    X#1
       #1 = #1 + 1
UNTIL(#1 >= 20)                ;When #1 >= 20, end the loop.
```

- **WHILE**

If the determination of the condition statement is held, repeatedly execute the loop.

Example

```
WHILE(#1<20)                   ;When #1 is less than 20, execute the program in the loop.
```

```
    IF( #1 == 10)           ;When #1 = 10, exit the WHILE loop.
        EXIT_WHILE
    END_IF
    G04 X1                  ;Wait for one second.
    #1 = #1 + 1
END_WHILE
```

15.4.4. Call Subfunction (CALL_SUB)

- **Call the function in the same program (The string in CALL_SUB ”Function Name“ can include Chinese, English and number.)**

Example

```
#1 = R_REG(555)             ;Information read
CALL_SUB”HIWIN”             ;Call sub-program ”HIWIN”
G04 P500
PROG_END                    ;End the program

SUB”HIWIN”                  ;Sub-program ”HIWIN”
    IF(#1 == 1)             ;When #1=1, exit the subfunction and return to the main program.
        EXIT_SUB
    END_IF
    G01    X5
END_SUB
```

15.4.5. Call Macro

- **File Call**

After a piece of program is saved as macro program, the main program can be used to call by G code (G65). (The name to save macro can be the lowercase English or number, which needs to be saved in ncfiles<no extension filename> of a project folder).

Example

```
G04 X5
G65 “hiwin” L2 A1 B2 C3     ;Call the name of file macro (“hiwin”), execute twice (parameter L), and
                              bright into #1=1, #2=2, #3=3.
G01   X30                   ;M99 is needed to add on the latest end of subprogram “iwin”, so that
                              can return to this line and continue.
```

Variable Table:

A~Z Alphabet										
NC File	A	B	C	D	E	F	G	H	I	J
Local variable	#1	#2	#3	#4	#5	#6		#8	#9	#10
NC File	K	L	M	N	O	P	Q	R	S	T
Local variable	#11	#12	#13		#15	#16	#17	#18	#19	#20
NC File	U	V	W	X	Y	Z				
Local variable	#21	#22	#23	#24	#25	#26				

- **G Code Defined by User**

After a piece of program is saved as macro program, the main program can be used to call by G code (The saved name is maker_macro_gXXX, which is saved in the system folder < macro_maker >.).
G code defined by a user is among G1000~G1100.

Example

G04 X5

G1000 A1 B2 C3 ;Use G1000 to call macro (maker_macro_g1000), and bring to #1=1, ;#2=2, and #3=3.

G01 X30 ; M99 is needed to add on the lastest end of subprogram "maker_macro_g1000", so that can return to this line and continue.

M99 description: Return after the subprogram ends
When NC in the main program is executed to M99, it will return the beginning of the program to execute it again. In the subprogram, M99 must be used as the program end, so that the program can execute to return the main program.

15.5. Example Program of Ncfile

The following is an example of NCFile using the command above-mentioned:

```
#1 = 10000              ;Set the movement speed

G00 L3 X-90 Y90 Z0 A0 F#1       ;Move to the joint coordinate

WHILE(1)                        ;Execute the infinite loop

    G20 I3 S1 T100 F0                   ;Wait for I3 to input and continue to execute

    IF(R_MLC_I(1) == 1)                     ;Determine I1 is input
        G01 T5 L0 X-300 Y400 Z192.8 C0 F#1
        G04 P100
    ELSEIF(R_MLC_I(2) == 1)             ;Determine I2 is input
        G01 T5 L0 X300 Y400 Z192.8 C0 F#1
```

```
        G04 P100
    ELSE                            ;Execute when I1 and I2 are not input
        G01 T5 L0 X0 Y400 Z192.8 C0 F#1
        G04 P100
    END_IF
    SELECT(R_REG(7000))             ;Read the value in Register 7000 and determine
        CASE 0:                     ;Execute when Register 7000 = 0
            CALL_SUB ”PROG1”        ;Call PROG1
        CASE 1:                     ;Execute when Register 7000 = 1
            G301                    ;Call G 301(maker_macro_g301)
        CASE 2,3,4:                 ;Execute when Register 7000 = 2, 3, and 4
            G00 L3 X-90 Y90 Z0 A0 F#1
            G04 P100
    END_SELECT

    FOR #2 = 1 TO 5                 ;Execute the FOR loop for five times
        G00 L3 X-90 Y90 Z0 A0 F#1
        G00 L3 X0 Y0 Z0 A-100 F#1
        G00 L3 X90 Y-90 Z0 A0 F#1
        G00 L3 X0 Y0 Z0 A-100 F#1
    END_FOR
END_WHILE
SUB “PROG1”                         ;PROG1
    G01 L0 X300 Y400 Z100 C0 F#1
    G01 L0 S2 X0 Y590 Z100 C0 F#1
    G01 L0 S4 X-300 Y400 Z100 C0 F#1
END_SUB

PROG_END
```

16. Built-in I/O and Register

16.1. Summary Table

Input	Note	Description
I1~I39	IN Point	Input signal for customer
I42	Safety Grating	When a signal is triggered, the robot will pause.
I43	Safety Grating	
I44	Reset	Reset and clear the alarm status
I51	NC Start	Start NC File
I52	Teaching Start	Start the current procedure
I53	Pause	Pause the path
I54	Path Reset	Reset the path
I55	Record Start	Start the record selected by a list
I56	Machine Reset	Interrupt the procedure in time and execute macro
I57	IN Point	Input signal for customer
I47	Safety Grating	When a signal is triggered, the robot will pause.
I60	IN 1	Interference Area
I61	IN 2	

I62	IN 3	
I63	IN 4	
I64	IN 5	
I70	Skip for I Point	
I71	Skip for I Point	
I72	Skip for I Point	
I73	Skip for I Point	
I75	Bit 0	4 Bit Select CASE
I76	Bit 1	
I77	Bit 2	
I78	Bit 3	
I83	ListIN1	List the record selection
I84	ListIN2	
I85	ListIN3	
I86	ListIN4	
Output	**Note**	**Description**
O1~39	OUT Point	Output signal for customer
O40	Alarm Status	
O50	Running	
O51	Pausing	
O52	Prepared	
O60	OUT 1	Interference Area
O61	OUT 2	
O62	OUT 3	
O63	OUT 4	
O64	OUT 5	
O75	Bit 0	CASE transforming 4 Bit output
O76	Bit 1	
O77	Bit 2	
O78	Bit 3	
Register	**Note**	**Description**
501	4 Bit Select CASE	
502	CASE Transforming 4 Bit Output	
542	Trigger Function	R542.0: NC start R542.1: Teaching start R542.2: Pause

		R542.3: Path reset

16.2. Protection of I42 and I43 Work Area (Using Signal from Grating)

I42	Safety Grating	This signal should be connected to the grating signal installed on the surrounding of the machine. When the signal is trigger, the robot will pause.
I43	Safety Grating	

If the system uses I42 and I43 as the signal source of the work area, any signal is riggered to pause the ongoing action. If you want to continuouslt execute the work, you must press the Start button once on the the Teaching Pendant or trigger the start signal from other operation interface.

16.3. Bit (IN) Select CASE

I75, I76, I77 and I78 correspond to Bit0, Bit1, Bit2 and Bit3.

Bit3	Bit2	Bit1	Bit0	Total
2^3	2^2	2^1	2^0	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
1	1	1	1	15

*The total values will be saved in the number R501.

Example:

```
WHILE(1)
IF(R_MLC_I(51)==1)    ;Determine I51 is input
SELECT(R_REG(501))  ;Read the value in Register 501 and determine

CASE  1:
            G01 T2 L3 X90 Y90 Z0 A0 F4000
CASE  5:
            G01 T2 L3 X-90 Y-90 Z0 A0 F4000
CASE  11:
            G01 T2 L3 X60 Y60 Z10 A0 F4000
CASE  15:
            G01 T2 L3 X30 Y30 Z0 A0 F4000
CASE_ELSE
            G01 T2 L3 X90 Y90 Z0 A0 F4000
END_SELECT
END_IF
END_WHILE
PROG_END
```

Add the document file, and edit CASE 0~15.

1. Upload txt to a folder of ncfile.
2. Select the case from I75~I78, and start by I51 (NC Start).

16.4. Machine Reset Control

When certain signals take place in some circumstances, the on-going procedure will be immediately stopped. Meanwhile, the machine executes the other procedure to reset to the safe position. The system uses the signal source of mechanical reset for I47. If the other procedure is executing after the command for mechanical reset is started, it will be stopped and then reset macro (add Macro 119) is started. Because the application situation is dfferent, the action to reset will vary. Macro for reset action defaulted by the system will not do anything. A user can edit macro for reset (maker_func_ins_macro119) to overwrite the reset action defaulted by the system.

16.5. Procedure Control

I51	NC Start	Start the procedure selected in the “NC Execution” page.

I52	Teaching Procedure Start	Start the procedure in the current “Procedure” page.
I53	Pause	Pause the procedure execution.
I54	Path Reset	Reset the procedure.

16.6. List Procedure Start

I83	List Procedure Select Bit0	
I84	List Procedure Select Bit1	
I85	List Procedure Select Bit2	
I86	List Procedure Select Bit3	
I55	Record Start	Start the procedure in the list comprising I83~I86

16.7. Interference Area

I60	Forbid Entering Interference Area 1	Output signal for external signal to Interference Area 1
O60	Output Signal for Entering Interference Area 1	If the tool tip enters the Interference Area after the Interference Area 1 in this system is started, the system will send the output signal O60.
When I60 and O60 are simultaneously ON, the system will sound an alarm.		

Interference Area 2~5 in the similar method

I61	Forbid Entering Interference Area 2	Output signal for external system to Interference Area 2
I62	Forbid Entering Interference Area 3	Output signal for external system to Interference Area 3
I63	Forbid Entering Interference	Output signal for external system to Interference Area

	Area 4	4
I64	Forbid Entering Interference Area 5	Output signal for external system to Interference Area 5
O61	Output signal when entering the Interference Area 1	Output signal for tool tip entering Interference Area 2
O62	Output signal when entering the Interference Area 1	Output signal for tool tip entering Interference Area 3
O63	Output signal when entering the Interference Area 1	Output signal for tool tip entering Interference Area 4
O64	Output signal when entering the Interference Area 1	Output signal for tool tip entering Interference Area 5

16.8. Sense Stop Signal

I70	Skip for point I	Please refer to the Introduction to G31
I71	Skip for point I	
I72	Skip for point I	
I73	Skip for point I	

16.9. CASE Transforming to Bit (OUT)

O75, O76, O77, and O78 correspond to Bit0, Bit1, Bit2, and Bit3.

Bit3	Bit2	Bit1	Bit0	Total
2^3	2^2	2^1	2^0	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
1	1	1	1	15

You can enter 16 sets of signal by using the R value (R502).

Example: When you enter 5 0r 1 (ON state) in R502, it will correspond to O75 or O77.

17. Controller Communication

17.1. Introduction to Communication Protocol

There are many built-in communication protocols in the system, including COM port and Ethernet port.

Each communication protocol corresponds to the parameterw file with ini. The parameter file is correctly set so that the communication contents are correct. If you have any requirements, please contact the agent to obtain the corresponding parameter file and load it into the controller.

Com Protocol

1. Modbus RTU Server: Provide to access the controller contents by external machines.
2. Modbus RTU Client: Read and write the data contents from the controller to the peripheral machines.

Ethernet Protocol

1. Modbus Server TCP: Provide to access the controller contents by external machines.
2. Modbus Client TCP: Read and write the data contents from the controller to the peripheral machines.

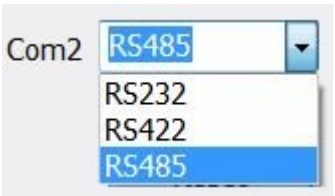
17.2. MODBUS Setting

17.2.1. RTU Mode

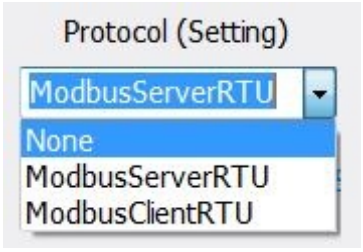
Format setting:

Step1: After opening Scon, yo can enter the Communication page.

Step2: Select RS232, RS422 and RS485.

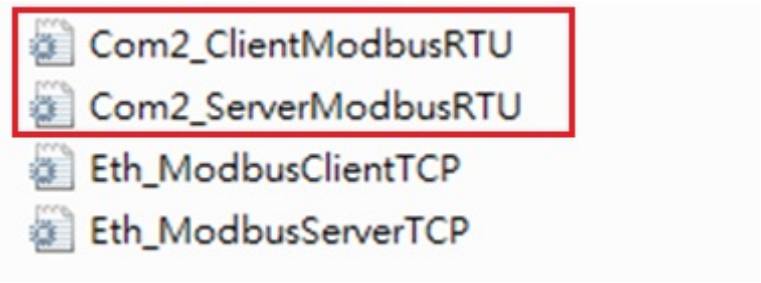


Step3: Select SCARA as ModbusServerRTU (Slave) or ModbusClientRTU (Master).



Parameter setting:

Set File can be searched in the machine on the SCARA via Scon.



RTU set at Server (Slave):

ServerModbusRTU.ini

[Common]

DebugLevel=0 If DebugLevel=2, You can see the content of the communication when you use keyboard " Ctl+Alt+F2" change to background.

Baudrate=38400 Baudrate

Bytesize=8 Bytesize

Stop=1 Stop

Parity=Even None, Odd, Even

Timeout=50 Set Timeout

MaxSlaveID=6 Max SlaveID

RegisterMode=32 16bit, 32bit

If RegisterMode=32 , Client set address is the local address multiplied by two.

Ex:
PLC set remote address = 1000
SCARA address=500

Same as Client

Same as Client that setting SlaveID

SlaveIDR=9100 SlaveID(Show the register)

UseSlaveIDR=5000 Currently use the SlaveID(Show the register)

IdleTimeR=5002 Number of Not receive the packet (Show the register)

CounterR=5003 Number of packets have been sent(Show the register)

ErrDataR=5004 Number of error data packets (Show the register)

ErrAddrR=5005 Number of error address packets(Show the register)

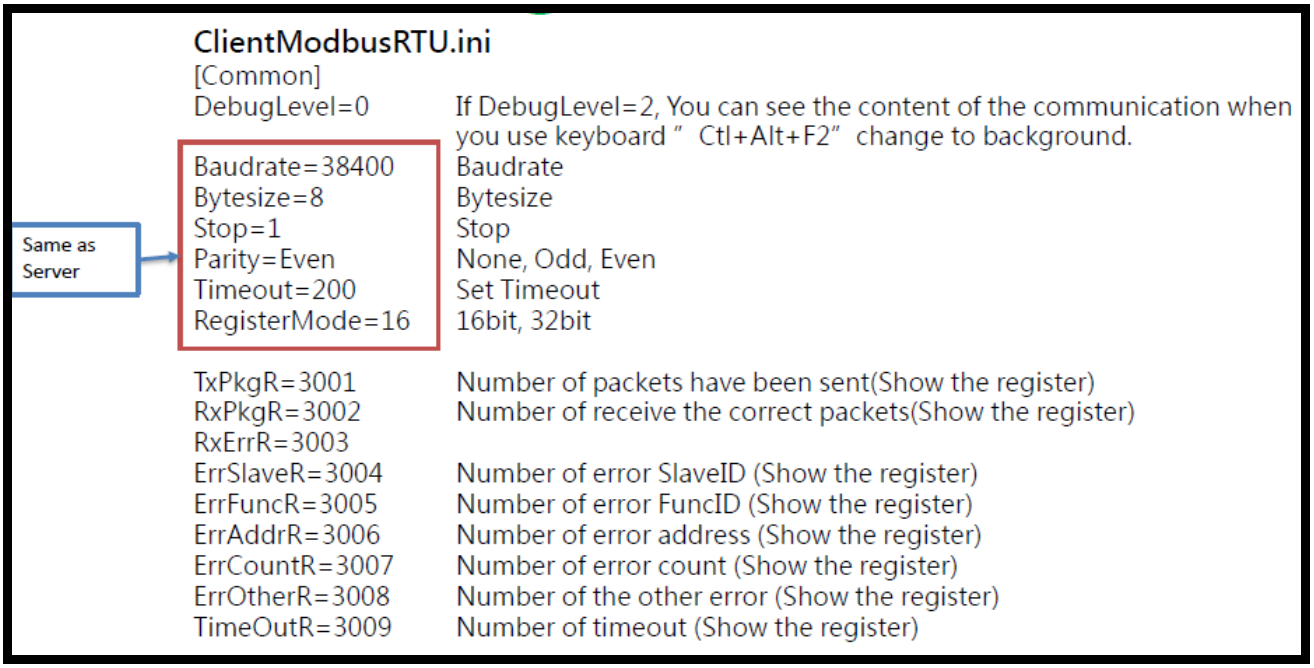
PkgThisR=5006 Number of receive the correct packets(Show the register)

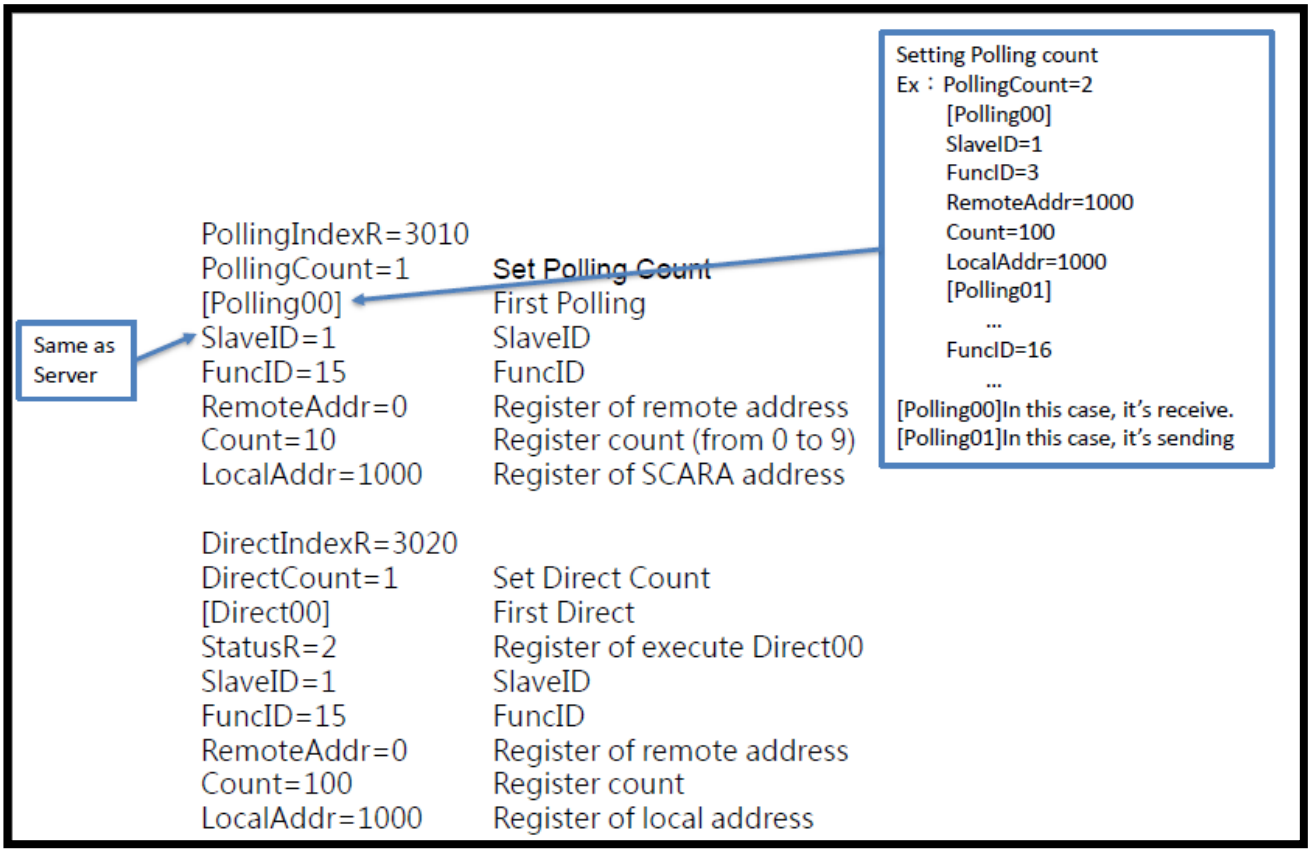
PkgOtherR=5007 Number of packets is sent of other Slave(Show the register)

PkgRspR=5008 Number of packets received in response to the other Slave (Show the register)

PkgExecptionR=5009 Number of packets received exceptional response from other Slave(Show the register)

RTU set at Client (Master):

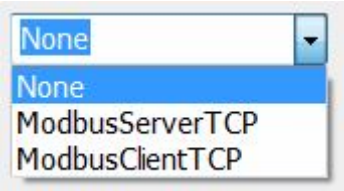




17.2.2. TCP Mode

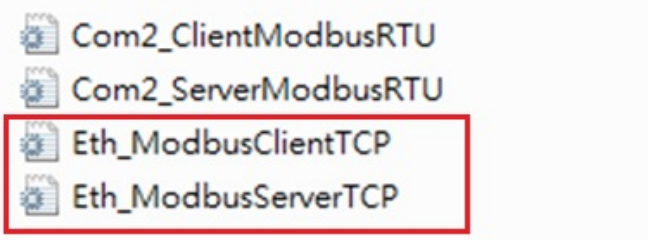
Format setting:

Set SCARA as Modbus Server TCP (Slave) or Modbus Client TCP (Master).

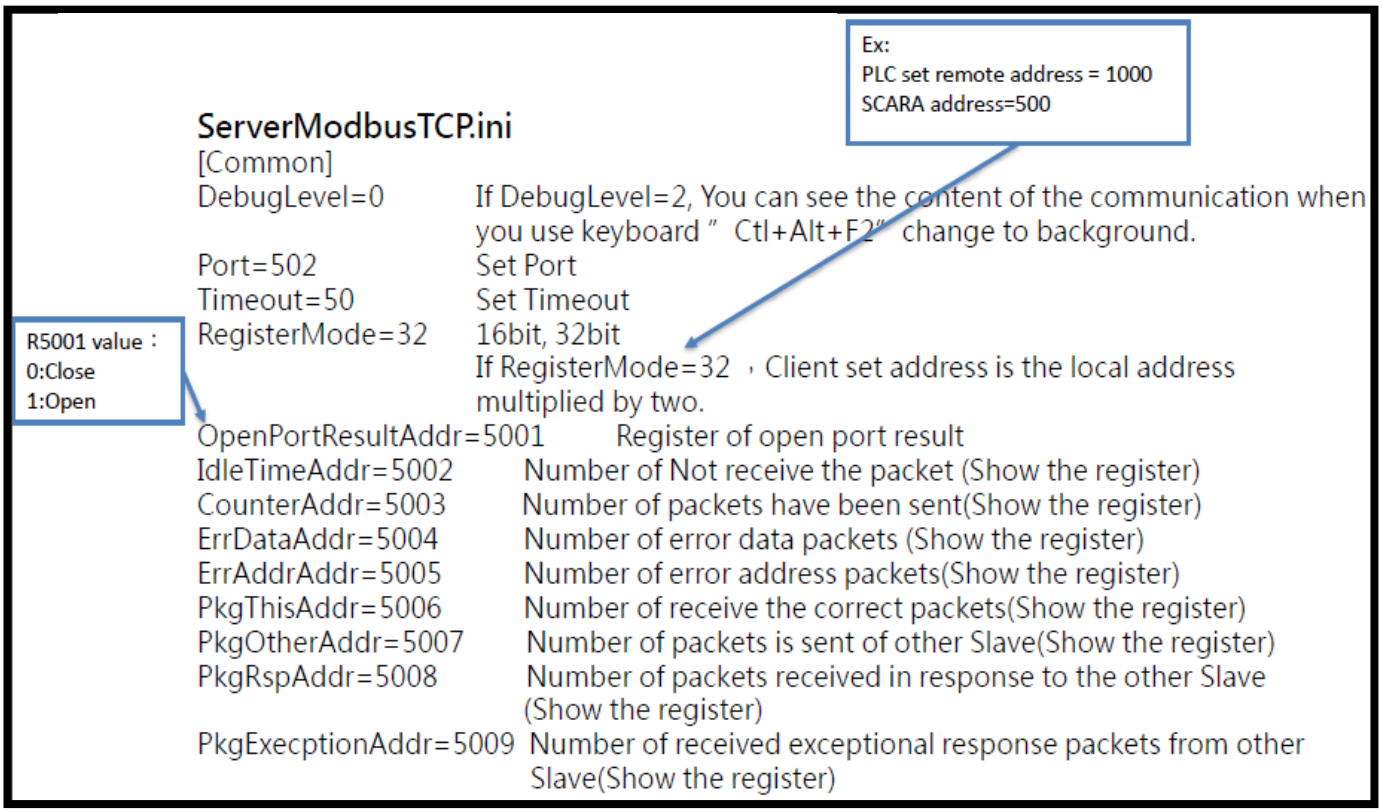


Parameter setting:

Set File can be searched in the machine on the SCARA via Scon.



TCP set at Server (Slave):



TCP set at Client (Master):

ClientModbusTCP.ini

```
[common]
DebugLevel=0          If DebugLevel=2, You can see the content of the communication when
                      you use keyboard " Ctl+Alt+F2" change to background.
ServerCount=2         Set connect count
[Server0]
Addr=192.168.139.203  Connect IP
Port=502              Connect port
Timeout=500           Timeout
MaxRetry=3            Max retry count
RegisterMode=32       16bit, 32bit

StatusAddr=3001       Register of connection status
TxPkgAddr=3002        Number of packets have been sent(Show the register)
RxPkgAddr=3003        Number of receive the correct packets(Show the register)
EcpPkgAddr=3004       Number of exceptional packets
ActCount=2
[Act0_0]
FuncID=15             FuncID
RemoteAddr=0          Register of remote address
Count=100             Register count
LocalAddr=1000        Register of local address
```

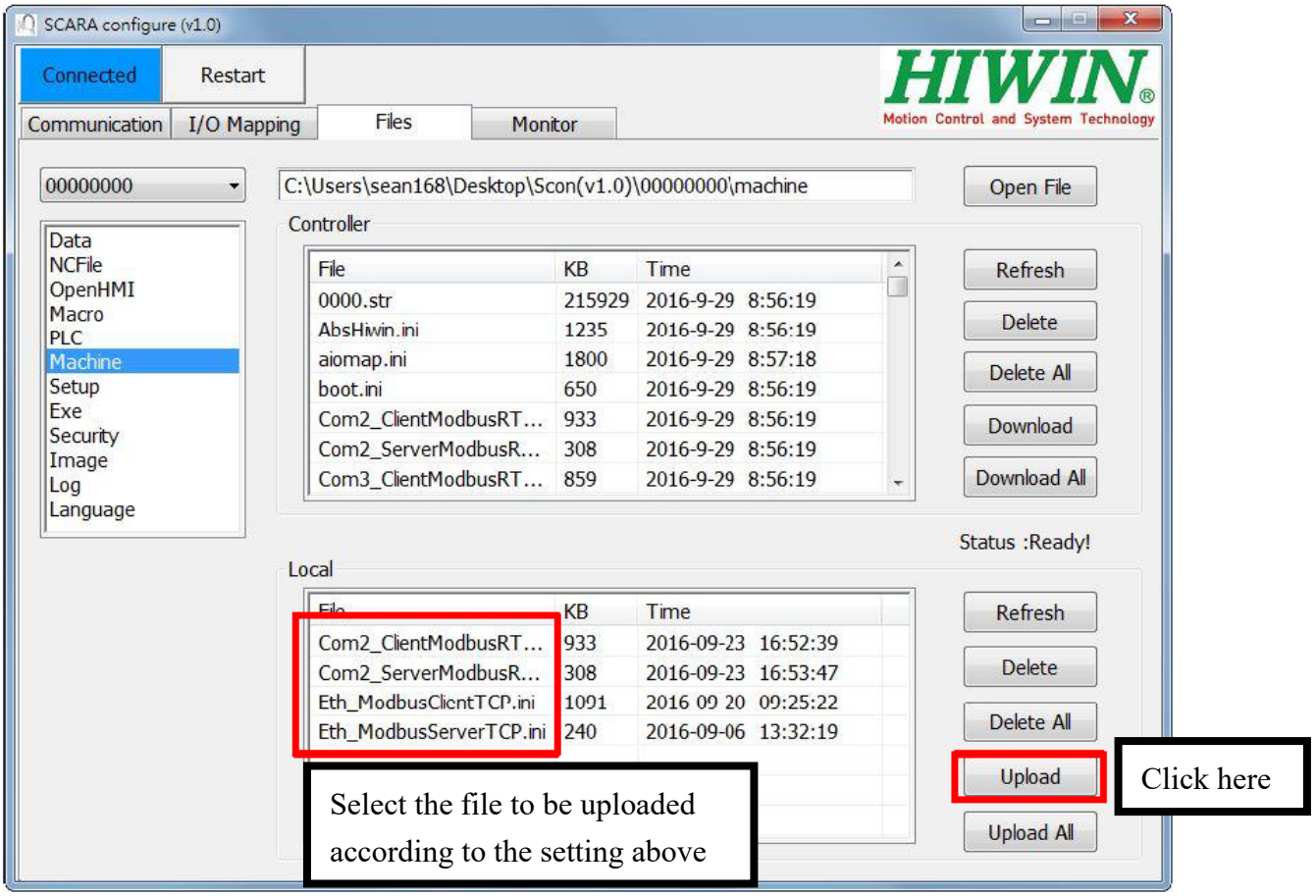
R3001 value：
0:Connection close
1:In connection
2:Connection fail
3:Connection success
4:Connection not response

The operations can be changed by setting FuncID.

FuncID:
1 (Remote O to Local A)
2 (Remote I to Local A)
3 (Remote D to Local R)
4 (Remote R to Local R)
15 (Local R to Remote O)
16 (Local R to Remote R)

17.3. Upload File to SCARA

Upload the file to the SCARA after you finish.



Restart the SCARA after uploading the file.

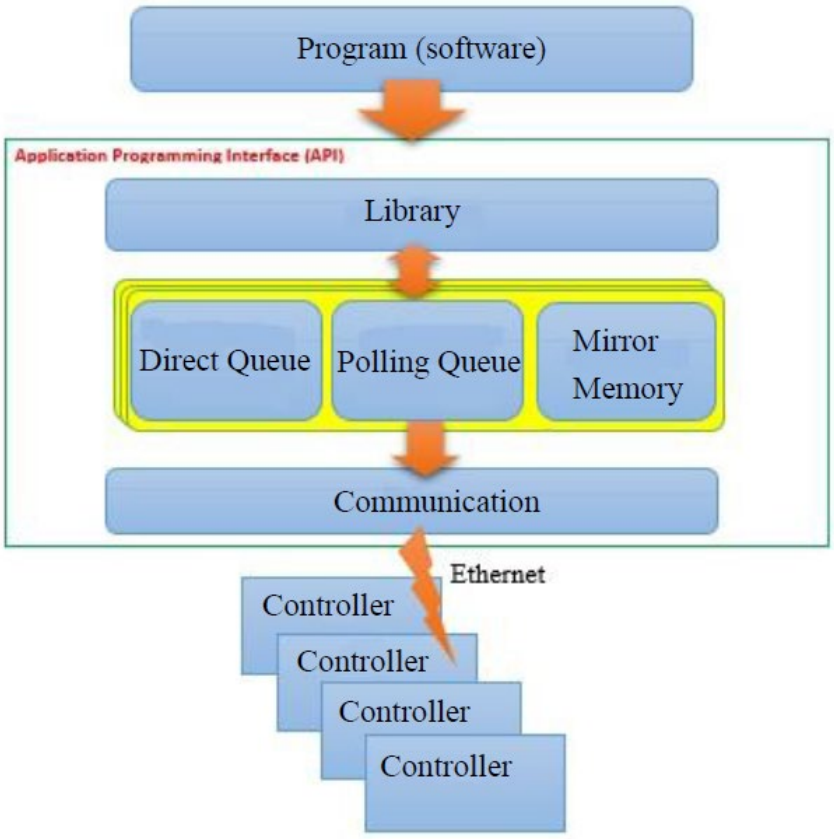
18. PC Communication Function

Provide the communication functions for PC (The operating system needs Window.) and the developer with API library to save the time for developing the communication protocol. With API library, you can access most information in the system, and control the system. For example:

1. Coordinates
2. IO status
3. Alarm
4. Read and write parameters
5. Start, pause, and reset
6. Movement command

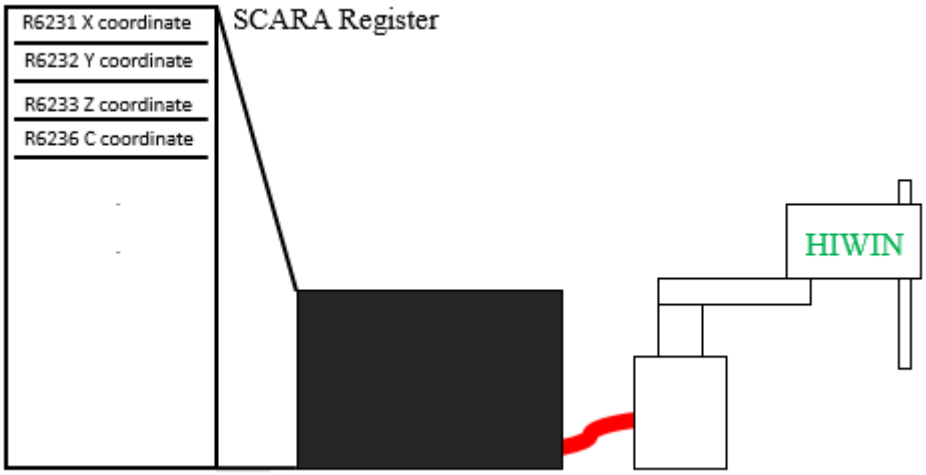
18.1. API Concept

The API (Application Programming Interface) is mainly used as the applications at the upper layer and the communication media for the controller. The applications at the upper layer can save the commands and data in command queue and mirror memory via API, and communicate with the controller by Ethernet to read or write the data. Therefore, the communication between API and the applications at the upper layer can be completed, where the direct queue, the polling queue and the mirror memory data in the command queue are detailed in the section of Connection Function Flow and Communication Command Data below.

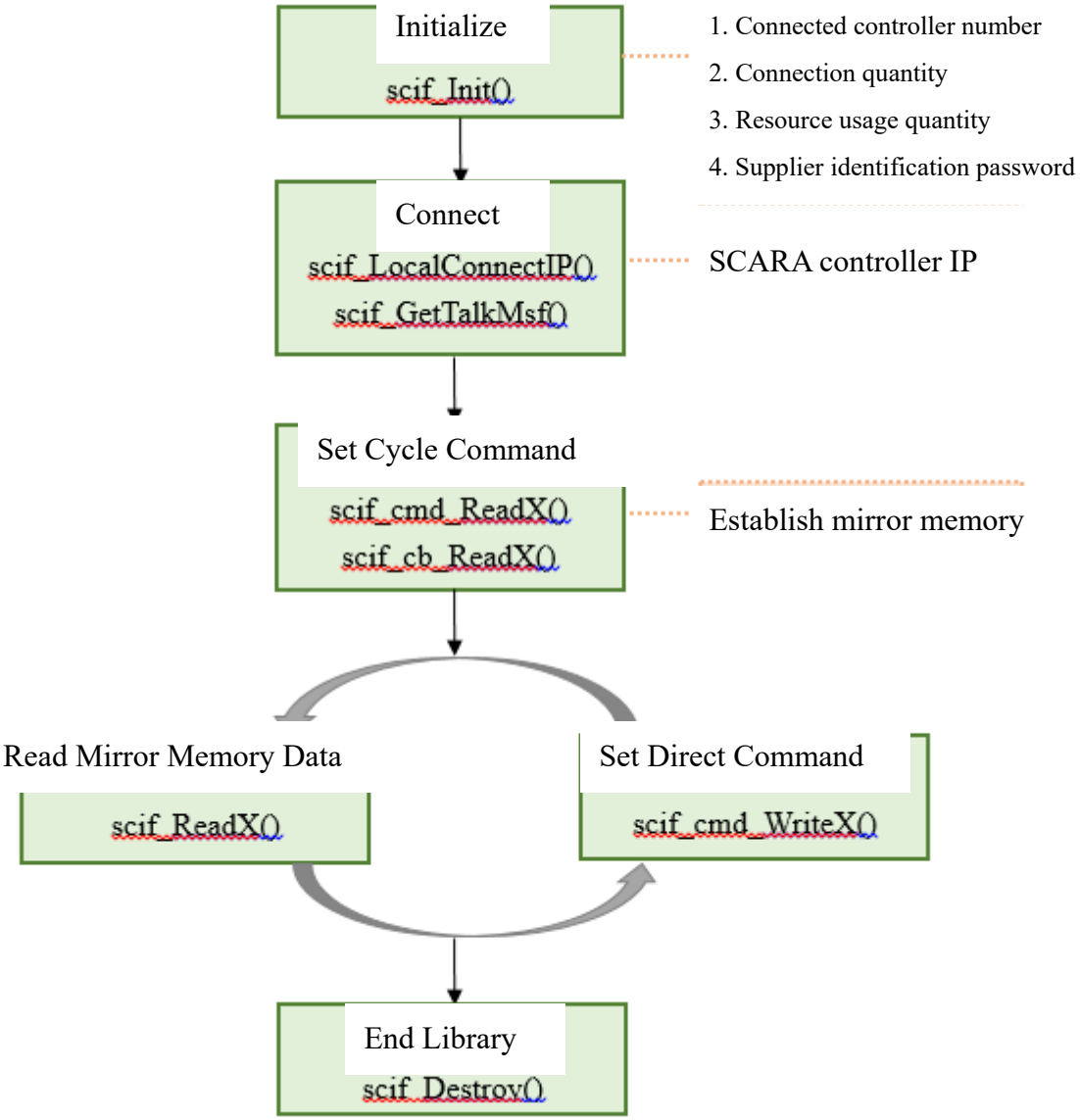


18.1.1. Read/Write Register

The use of the API can read or write the data to the controller, including read SCARA coordinates, control I/O status and so on, so that SCARA can be integrated with the peripherals. Before reading/writing the data in the controller, you need to understand the memory planning inside the controller and the IP meanings. A user can use one part of memory resources, and the other parts will be defined by the controller in advance. When a user read or write the data in the memory, the SCARA will act according to the command represented by the memory position. For the commonly used memory resource planning table, please refer to 18.4.



18.1.2. Connection Function Flow and Communication Command Data



＊The function name X represents the different types of data pattern, including R, I, O…and so on. For example: ReadR/WriteR is to read/write the R value in the memory, ReadI is to read the input value, and ReadO/WriteO is to read/write the output value.

① **Initialize**: When you use the API, the priority step is to initialize scif_Init(). The initialization contents include the connected controller number, the connection quantity, the resource usage quantity and the supplier identification password. By initializing the connection number and identification password, the controller can be connected to control and the identification can be confirmed to connect with the controller, as well as threading can be established. If the password is incorrectly entered, the initialization will fail and the library can't be normally operated.

1	Controller Connection	Each controller can simultaneously support up to five connections. The connection number is needed to set when connected by software.
2	Connection Quantity	The connected controller quantity is used to monitor. When a computer and two controllers are simultaneously comprise a system, many controllers will be needed to connect. This value represents the connected controller quantity.
3	Resource Usage Quantity	In order to conveniently use the library, a mirror memory will be established for each connection at the PC side to save the data read from the controller. When there are many connections, special attention must be paid to the opened memory size in this claim, so that all memories in PC will be occupied.
4	Supplier ID Password	Used to identify the supplier ID, and connect to the controller after a use ID is identified.

② **Connect**: After initializing and connecting to scif_LocalConnectIP(), the controller IP you want to connect must be entered. After the connection is started to ensure the connection is successful, scif_GetTalkMsg() must be called to acquire the connection information. When the successful connection is returned, the API is fully connected.

③ **Set Cycle Command**: In order to establish the communication data with the

controller, the functions can be classified by the user requirement as:

- ✓ scif_cmd_ReadX() for continuous data communication: The continuous data communication means to read the continuous interval address (For example, the address interval is 0~10.).
- ✓ scif_cb_ReadX() for discrete data communication: The discrete data communication means to read discontinuous address in one time (For example, the address is set as 1, 5, 10.).

Except that the data address is read, the patterns of communication command in queue are classified as:

- ✓ SC_POLLING_CMD for continuous update:
  This command will be saved in Polling Queue. The address set to read will be synchronously updated.
- ✓ SC_DIRECT_CMD for single execution:
  This command will be saved in Direct Queue. The address to be read or written will be prioritized to execute, whereas it will be deleted after executed in signal time. When you use the library, it will be used to write the functions in the controller. The communication pattern is defaulted as SC_DIRECT_CMD.

＊Special Note: If the mirror memory used in this connection needs to continually update, the communication command must be set as SC_POLLING_CMD.

After SC_POLLING_CMD is defined, the data can be sorted again by scif_StartCombineSet() and scif_FinishCombineSet() to achieve the purpose that reduces the package quantity.

Assembled Packet Example

char serverindex;
scif_StartCombineSet(serverindex);
scif_cmd_ReadI(SC_POLLING_CMD, serverindex, 0, 100);
scif_cmd_ReadR(SC_POLLING_CMD, serverindex, 10, 50);
scif_FinishCombineSet(serverindex);

④ **Read Mirror Memory Data**: After the mirror memory data are established, scif_ReadX() can be used to enter the data address and read the values in the address memory.

⑤ **Set Direct Command**: In the direct command, scif_WriteX() can be used to write the

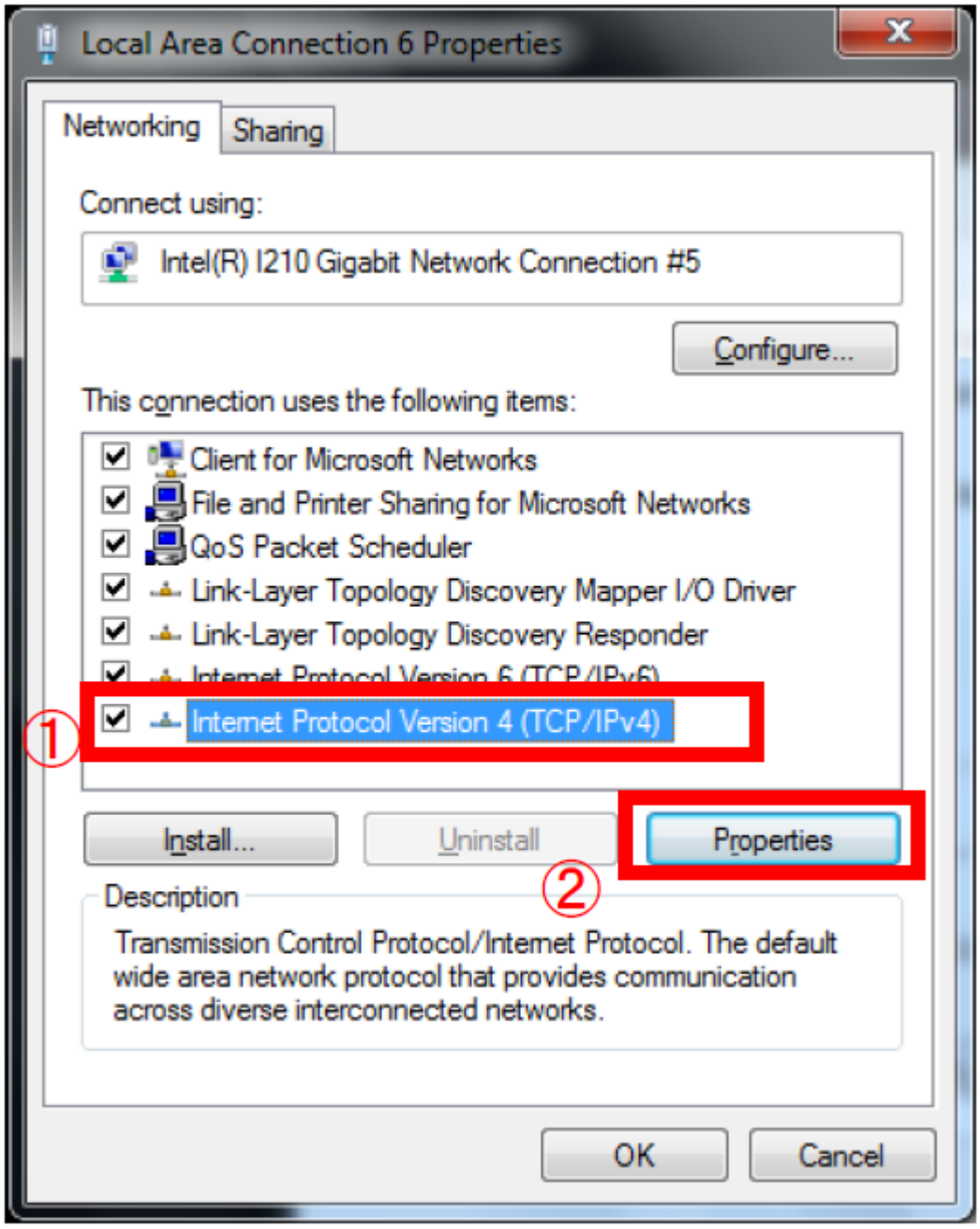
data, and the command can be deleted after completed.

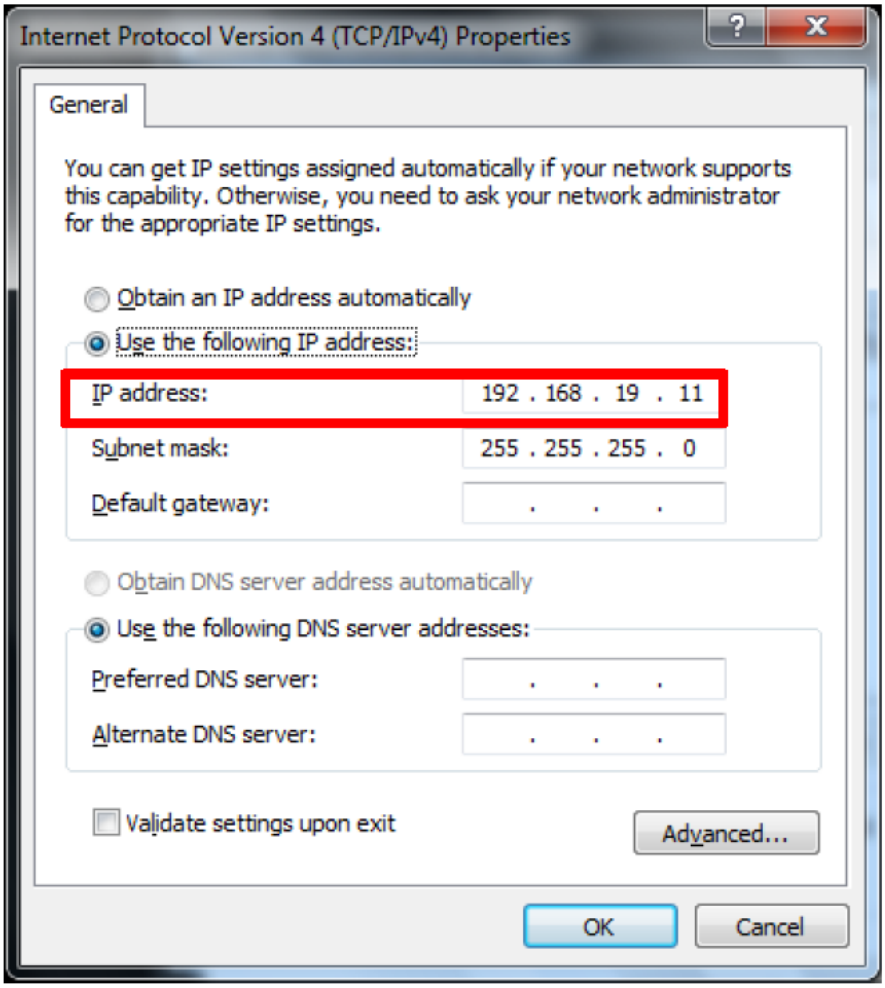
⑥ **End Library**: After the API is connected, scif_Destroy() must be used to end the connection.

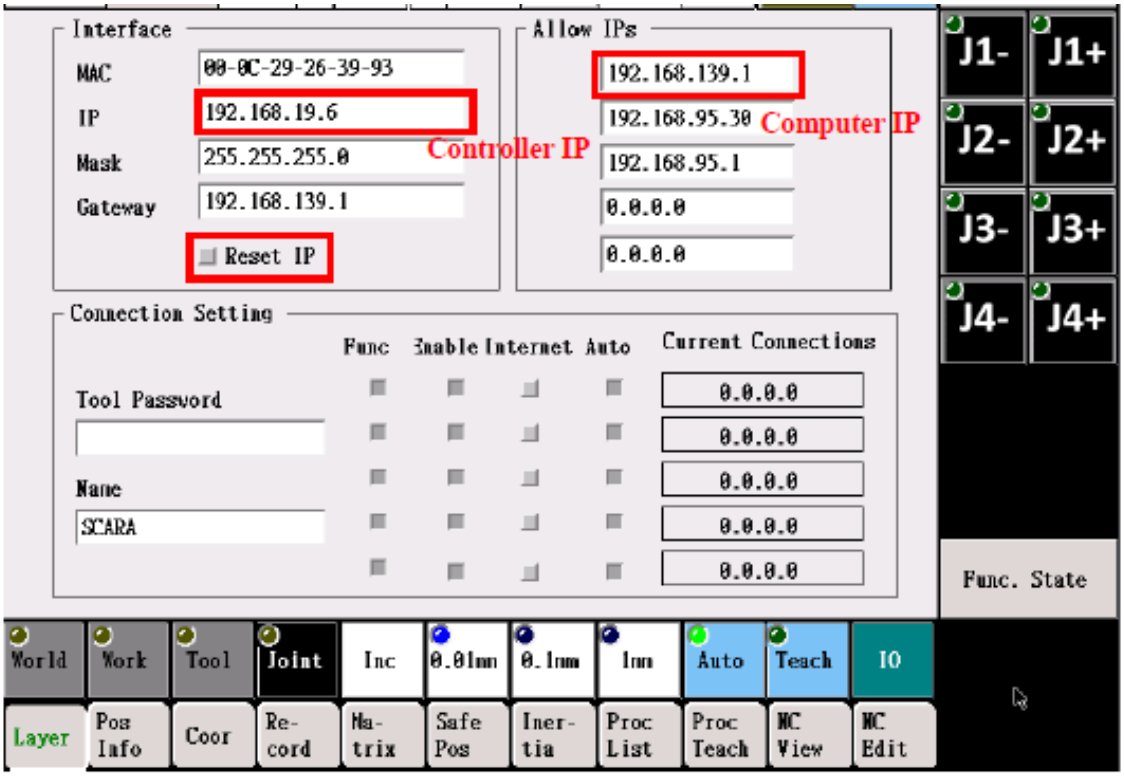
＊For the related libraries mentioned in the flows above, please see Appendix A.

18.2. Communication Example for SCARA

This section will connect with the SCARA controller by the API. First, PC needs to connect with the controller. After you open the network setting in the computer and the “Network Setting” page in the “Permissions” of the Teaching Pendant to confirm PC and controller IP are in the same domain, the permissible address of “Network Setting” in the Teaching Pendant is set as PC IP and “Reset Network” is pressed to complete setting. The program syntax at the upper layer is described in the actual examples how to communicate with the controller via the API, so that can complete to read the coordinate value of the SCARA, JOG and I/O status.


Local Area Connection 6 Properties
Networking
Sharing
Connect using:
Intel(R) I210 Gigabit Network Connection #5
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Link-Layer Topology Discovery Mapper I/O Driver
Link-Layer Topology Discovery Responder
Internet Protocol Version 4 (TCP/IPv4)
1
Install...
Uninstall
Properties
2
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
OK
Cancel


Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 19 . 11
Subnet mask: 255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Validate settings upon exit
Advanced...
OK
Cancel


Interface
MAC 00-0C-29-26-39-93
IP 192.168.19.6
Mask 255.255.255.0
Gateway 192.168.139.1
Reset IP
Controller IP
Allow IPs
192.168.139.1
192.168.95.30
192.168.95.1
0.0.0.0
0.0.0.0
Computer IP
Connection Setting
Func
Enable Internet
Auto
Current Connections
Tool Password
Name
SCARA
0.0.0.0
J1- J1+ J2- J2+ J3- J3+ J4- J4+
Func. State
World Work Tool Joint Inc 0.01mm 0.1mm 1mm Auto Teach IO
Layer Pos Info Coor Re-cord Ma-trix Safe Pos Iner-tia Proc List Proc Teach MC View MC Edit

18.2.1. Connection Example

Connection Example	
Syntax	Description
#include "scif.h"	Header File
int rt; DLL_USE_SETTING DllSetting; DllSetting.SoftwareType = 5; DllSetting.TalkInfoNum = 10; DllSetting.MemSizeI = I_NUM; DllSetting.MemSizeO = O_NUM; DllSetting.MemSizeC = C_NUM; DllSetting.MemSizeS = S_NUM; DllSetting.MemSizeA = A_NUM; DllSetting.MemSizeR = R_NUM; DllSetting.MemSizeTT = 0; DllSetting.MemSizeCT = 0; DllSetting.MemSizeTS = 0;	The initialized items and the software type represent the connected controller number. TalkInfoNum is the connection quantity.
DllSetting.MemSizeTV = 0; DllSetting.MemSizeCS = 0; DllSetting.MemSizeCV = 0; DllSetting.MemSizeF = 0;	

rt = scif_Init(&DllSetting,23594510,
"0B9287F3AE9D949A7751D8C8E51A50BE46FBA406D
7E9CE0B");
if (rt!=100)
{
printf("initialization of library failed!");
return 0;}
	The initialization is the supplier number and the encoded string, and used to determine the function is successfully initialized.

int ok;
ok = scif_LocalConnectIP(0,"192.168.19.200")
if(ok != 1)
{
printf("connection failed!\n");
return 0;
	Set the controller IP and determine the connection is established successfully.

}printf("connected successfully!\n");	

scif_StartCombineSet(0)
scif_cmd_ReadS(SC_POLLING_CMD, 0, 3000, 4);
scif_cmd_ReadR(SC_POLLING_CMD, 0, 3000, 80);
scif_cmd_ReadR(SC_POLLING_CMD, 0, 6300, 50);
scif_cmd_ReadR(SC_POLLING_CMD, 0, 6000, 80);
scif_cmd_ReadO(SC_POLLING_CMD, 0, 0, 100);
scif_cmd_ReadI(SC_POLLING_CMD, 0, 0, 100);
scif_FinishCombineSet(0)
	Provide alarm, warning, and I/O detect via ReadS(), and define ReadR, ReadO, and ReadI must synchronously update the data blocks..

while (1)
{
if (scif_GetTalkMsg(0, SCIF_CONNECT_STATE)
== SC_CONN_STATE_OK)
{
printf("data successfully connected!\n");
break;}
Sleep(100);}
	The data are successfully connected after the use of scif_GetTalkMsg() is confirmed. If it is successfully connected, the connection and the data are established.

18.2.2. Transform Example

Transform Example – Read the coordinate value	
Syntax	Description
int Unit_Transform = 100000; float World_X,World_Y,World_Z,World_C; World_X = (float)((int)scif_Read(6321))/ Unit_Transform; World_Y = (float)((int)scif_Read(6322))/ Unit_Transform; World_Z = (float)((int)scif_Read(6323))/ Unit_Transform; World_C = (float)((int)scif_Read(6326))/ Unit_Transform;	The values in the controller are transformed (divided by 100 thousand time) as the actual coordinate ones, where scif_Read() reads the coordinate ones (R6321~ R6323 are the XYZ coordinate ones and R6326 is the C coordinate one.)

Transform Example - controller mode - teaching mode and auto mode	
Syntax	Description

int Current_Mode;
Current_Mode = scif_ReadR(6039);
if (Current_Mode==0)
{
printf("maintenance mode\n");}
else if(Current_Mode == 1)
{
printf("auto mode\n");}
else
{
printf("teaching mode\n");}
	Read R6039 address via scif_ReadR() to obtain the current controller mode

scif_cmd_WriteA(0, 804, 1);
scif_cmd_WriteR(0,180204,0);
scif_cmd_WriteR(0,47508,1);
	Set the controller mode as the auto mode

scif_cmd_WriteA(0, 805, 1);
scif_cmd_WriteR(0,180204,1);
scif_cmd_WriteR(0,47508,1);
	Set the controller mode as the teaching mode

JOG Example-> continue movement to +X direction of the world coordinate	
Syntax	Description

//JOG button not pressed
scif_cmd_WriteR(0, 6301, 0);
 	
//JOG button not pressed
scif_cmd_WriteR(0, 6302, 1);
scif_cmd_WriteR(0, 6303, 5);
scif_cmd_WriteR(0, 6300, 0);
scif_cmd_WriteR(0, 6301, 1);
	R6301 is the axis command, which is numbered as 1~6 according to XYZABC coordinates. R6302 is 1 to indicate the continue mode. R6303 is 5 to indicate the percentage of movement speed in the continue mode. R6300 is 0 to indicate the world coordinate system.

＊Special Note: Before you select the axis command R6301 as the X-axis direction (R6301 = 1), you must set R6302 for the action mode, R6303 for the speed mode and R6300 for the coordinate system. Otherwise, after R6301 in program is set as the axis direction 1~6, the commands will immediately act according to the current controller status.	

JOG example -> increment movement to -Y direction of the work coordinate	
Syntax	Description

//JOG button not pressed
scif_cmd_WriteR(0, 6301, 0);
 	
//JOG button not pressed
scif_cmd_WriteR(0, 6302, 0);
scif_cmd_WriteR(0, 6303, -10);
scif_cmd_WriteR(0, 6300, 1);
scif_cmd_WriteR(0, 6301, 2);
	R6301 is the axis command, which is numbered as 1~6 according to XYZABC coordinates. R6302 is 0 to indicate the increment mode. R6303 is -10 to indicate the movement distance (-10mm) in the increment mode, where the minus sign represents the opposite direction. R6300 is 1 to indicate the work coordinate system.

18.3. Communication Example by Visual System

The robot has been widely integrated with the visual system. With the communication from the visual system, the information on the object coordinates will be uploaded to the application at the upper layer. With the API, the coordinates will be written to the controller memory. The controller will call the macro command to read the memory address, so that can move the robot to the object identification position.

Macro example

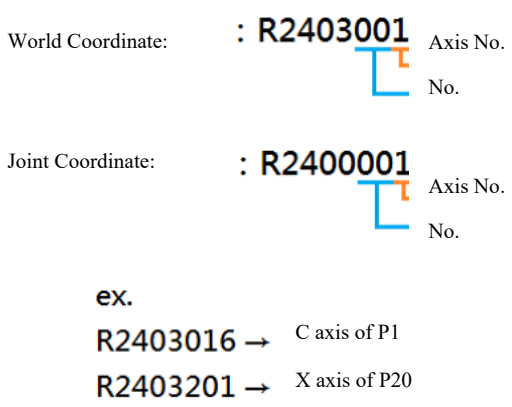
Example when the robot moves to the object identification position	
Syntax	Description

scif_cmd_WriteR(0, 8503, X);
scif_cmd_WriteR(0, 8504, Y);
scif_cmd_WriteR(0, 8505, C);
scif_cmd_WriteR(0, 17004, 300);
scif_cmd_WriteC(0, 22, 1);
Sleep(100);
scif_cmd_WriteC(0, 22, 0);
	The object identification position (X, Y, C) obtained by the visual system is written to the user-defined memory position, and the macro filename maker_func_ins_macro300 is called by R17004, and the macro is triggered to start by C22.

The commands in the macro content are edited by the notepad. The filename is saved as maker_func_ins_macroXXX (example: XXX is 300.), and the filename extension is deleted. With SconConnection Setting, you can select macro folder in “File” (Please see Chapter 20 for uploading.). The edited macro files will be uploaded to the controller. You can insert and start macro via R17004 and C22.

Macro content	
Syntax	Description
#1=(R_REG(8503)/100000); #2=(R_REG(8504)/100000); #3=(R_REG(8505)/100000); G01 L1 X#1 Y#2 C#3 F20000 G04 P300 G00 L0 M0 X250 Y300 Z0 C0 F20000 W_MLC_O(5,1) PROG_END	Read the memory position to obtain the object data, and move to the coordinates of the object position. After delaying in 300ms, move to the loading area, send the output signal, and end the program.

18.4. Resource Planning Table

Register	Comment	Description
R-value record	World Coordinate Joint Coordinate	
R550	Deceleration	R550 is the speed percentage (need to be multiplied by 100) when grating is decelerated to trigger. Ex.: When you want to set I57 as ON, the speed of SCARA will drop to 2%. 2*100=200, and set R550=200.
R1001 to R4999	Provide for a customer to define his own running dynamic data	These 3999 registers will not be saved after power shutoff.
R8001~ R8999	Provide for a customer to define his own parameters	These 999 registers will be saved after power shutoff.
R6011	Machining Mode	One round for 0, one cycle for 1, single step for 2
R6037	Path status	0 for Not Prepared, 1 for Prepared, 2 for Cycle Start, 3 for Hold, and 4 for Stop
R6039	Maintenance, Automatic, Teaching Mode (R)	Mode: 0 for maintenance, 1 for auto, and 2 for teaching
R6300	Coordinate Type	Setting of Coordinate System: 0 for World Coordinate System, 1 for Work Coordinate System, 2 for Tool Coordinate System, and 3 for Joint Coordinate System

R6301	Selection of Axis Direction	Number of Axis Direction 1~6 Corresponding Number: 1, 2, 3, 4, 5, 6 World Coordinate: X, Y, Z, A, B, C Work Coordinate: X, Y, Z, A, B, C Tool Coordinate: X, Y, Z, A, B, C Joint Coordinate: J1, J2, J3, J4, J5, J6
R6302	Motion Mode	Teach the movement mode: 0 for increment, 1 for continue
R6303	Distance/Speed Setting	When 6302=0, the unit is 0.01mm multiplied by the current value; when 6302=1, the current value is speed %.
R6307	Distance/Speed Display	Continue mode/increment mode 1: x1/0.01mm 10: x10/0.1mm 100: x100/1mm
R6321	Coordinate X	Current world coordinate
R6322	Coordinate Y	
R6323	Coordinate Z	
R6326	Coordinate C	
R6331	Coordinate X	Current working coordinate
R6332	Coordinate Y	
R6333	Coordinate Z	
R6336	Coordinate C	
R6341	Coordinate X	Current tool coordinate
R6342	Coordinate Y	
R6343	Coordinate Z	
R6346	Coordinate C	

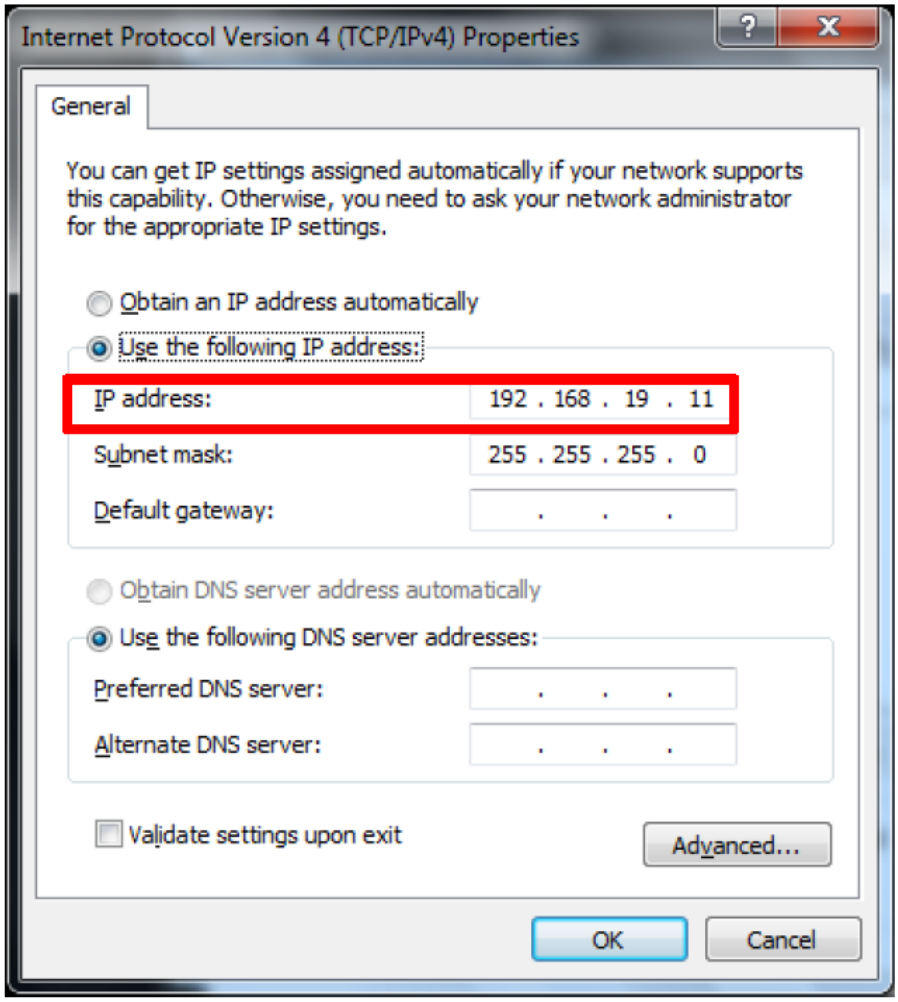
R6351	Coordinate J1	Current joint coordinate
R6352	Coordinate J2	
R6353	Coordinate J3	
R6354	Coordinate J4	
R17004	Macro Control	Insert the macro name. Macro retrieve will read from the folder macro_maker. The retrieved name is maker_func_ins_macro99. It indicates R17004=99.
R48109	Speed Ratio	Use R to modify the speed. 10000 indicate 100%, 5000 indicate 50%, and so on.
A812	Decrease Ratio	Use this value to modify the ratio.
A810	Increase Ratio	Use this value to modify the ratio.
C0	Start	General start
C1	Pause	Pause
C2	Path Reset	Path reset
C22	Macro Start	Use to trigger macro start
C3000	Reset	Reset and clear alarm
S0	Start Status	Display the start status
S1	Pause Status	Display the pause status
S22	Macro Start Status	Display the macro start status
A803	Maintenance Mode (W)	Trigger by pulse signal
A804	Automatic Mode (W)	Trigger by pulse signal
A805	Teaching Mode (W)	Trigger by pulse signal
A830	World Coordinate (W)	Select the coordinate system in the teaching mode.
A831	Work Coordinate (W)	Select the coordinate system in the teaching mode.
A832	Tool Coordinate (W)	Select the coordinate system in the teaching mode.
A833	Joint Coordinate (W)	Select the coordinate system in the teaching mode.

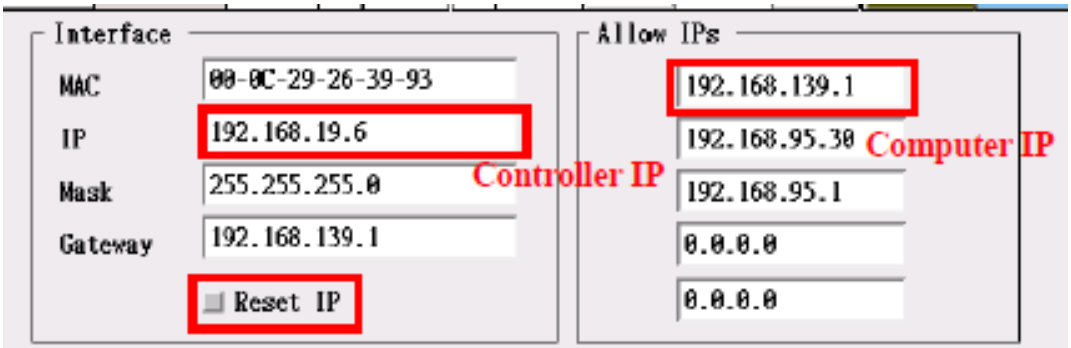
A842	Teaching speed (W)	Teach the movement mode continuous: X1 (speed); increment: 0.01mm (distance)
A843	Teaching Speed (W)	Teach the movement mode continuous: X10 (speed); increment: 0.1mm (distance)
A844	Teaching Speed (W)	Teach the movement mode continuous: X100 (speed); increment: 1mm (distance)

19. Scon Teaching

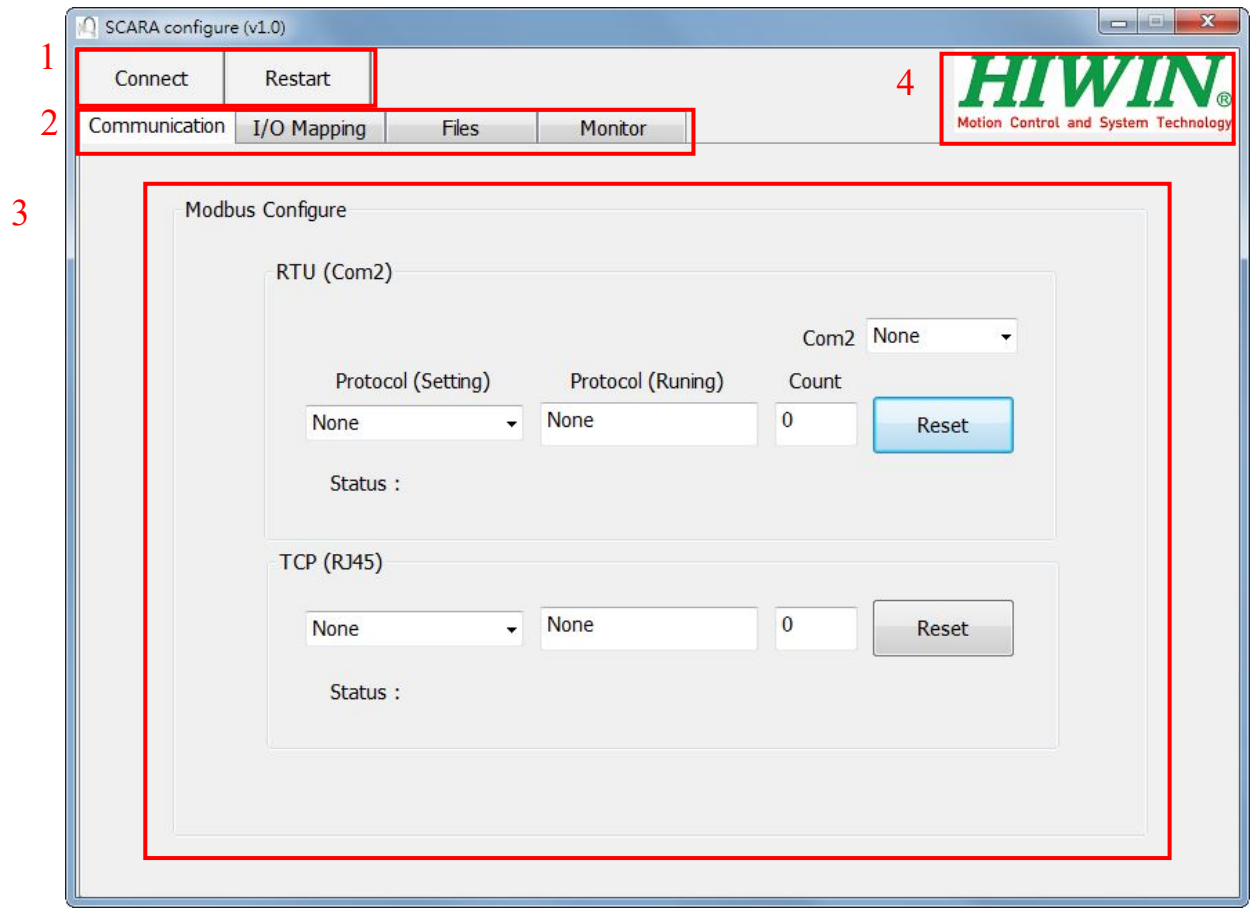
19.1. Preparation

1. Check IP at the PC side (Red Box 1) and SCARA (Red Box 2) are in the same domain.
   *SCARA IP check & modify: From Permissions → Network Setting on Teaching Pendant, you can it is the same domain with PC. If it isn't, click Reset after changing IP.





19.2. Interface Function



Red Box 1: Connect and Restart buttons, click the Connect button to enter the Connection Setting window (same as 1.3), and then click Restart to restart SCARA.

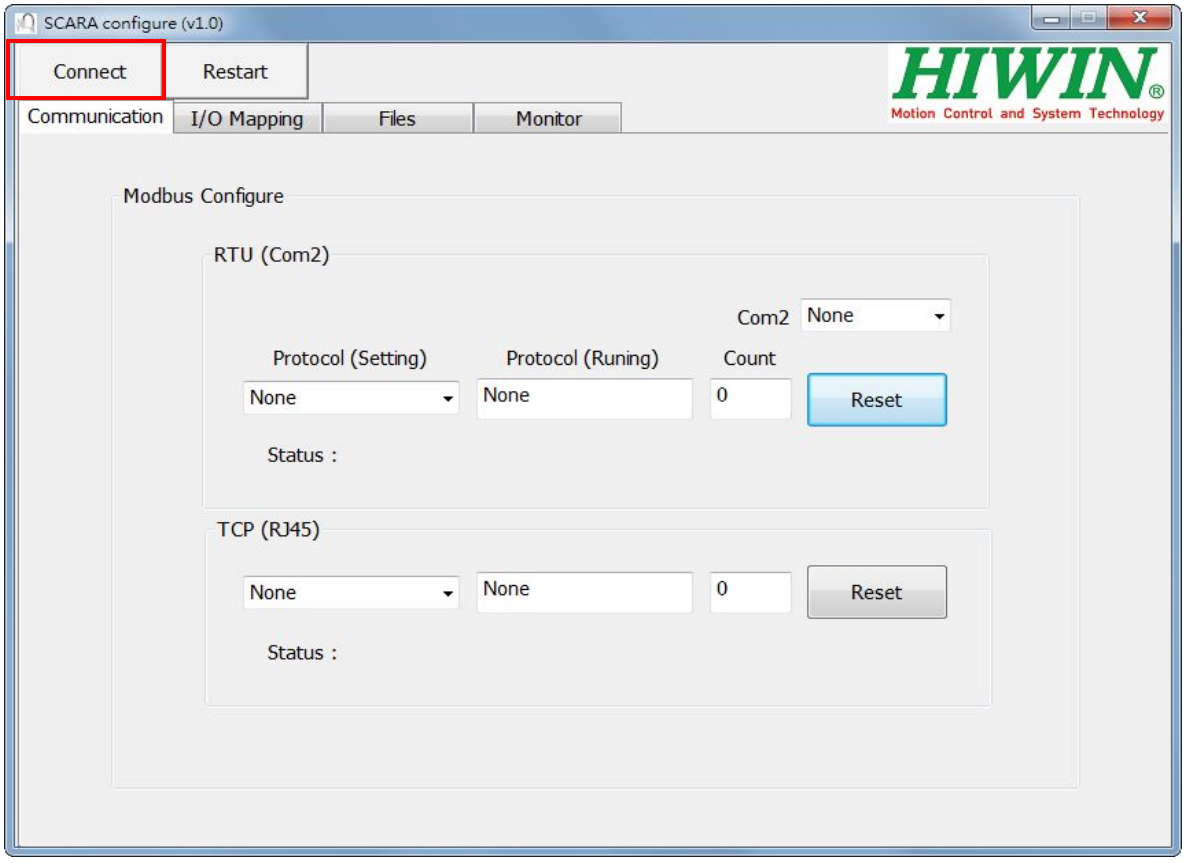
Red Box 2: Change the different pages.

Red Box 3: Display the Function page.

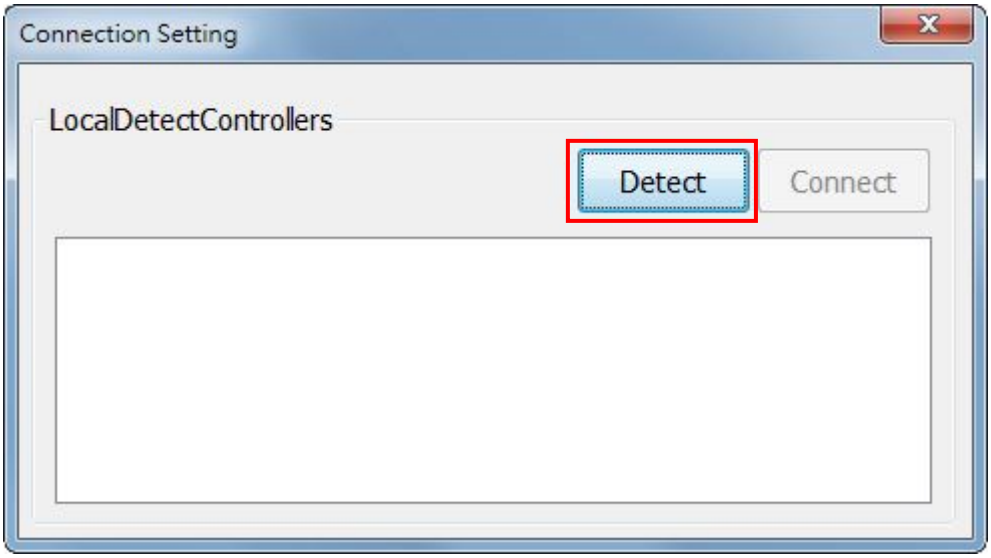
Red Box 4: Click HIWIN to display all file versions available in the controller.

19.3. Connection Setting

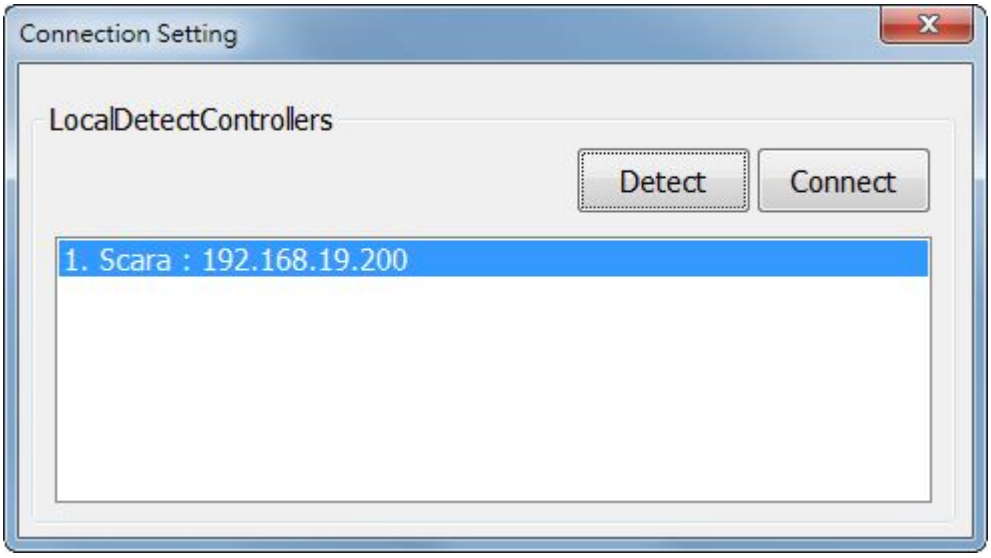
Step1: Click the “Connect” button in the red box to enter the Connection Setting window as follows:

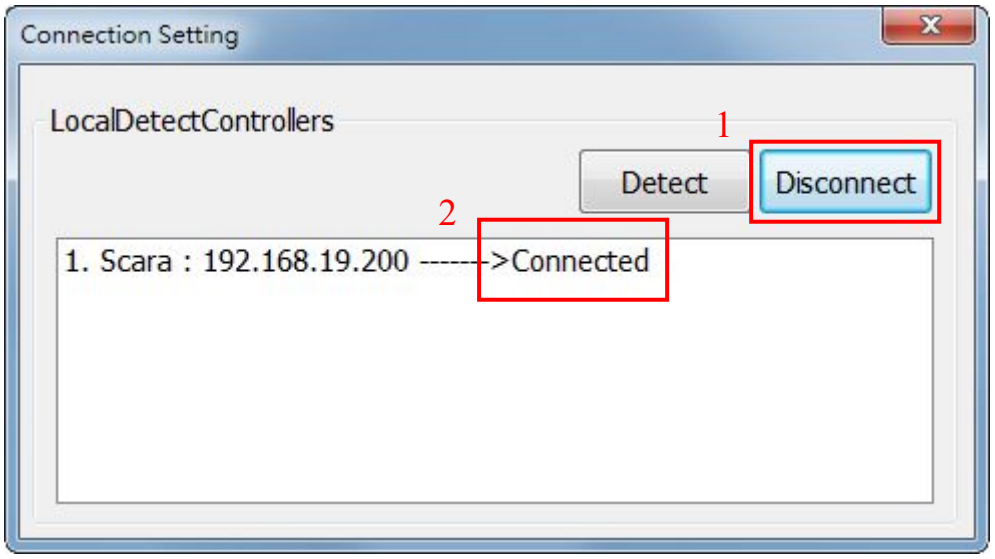


Step2: Click the “Detect” button to search for the SCARA Controller.



Step3: After you find the SCARA Controller, click the “Connect” button for the connection setting.



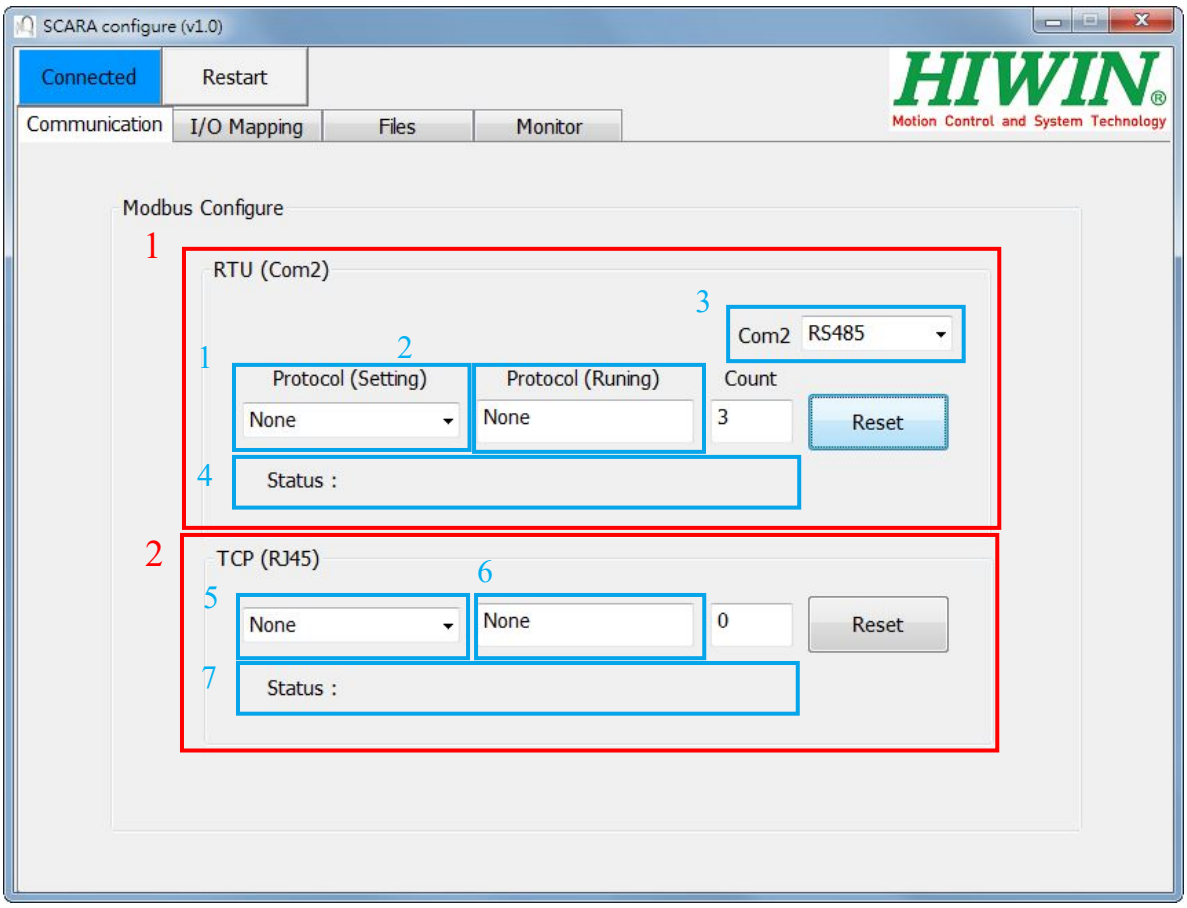


Red Box 1: After the connection setting succeeds, the button will turn to “Disconnect”. At this time, you can click the button to interrupt the connection setting.

Red Box 2: After you click the Connect button, you can check the status related to SCARA Connection. After the connection setting succeeds, you can close the Connection Setting window.

19.4. Communication Setting Page

SCARA currently adopts Modbus protocol, which can provide external controllers for connection setting and data transfer. Because it is established on RTU and TCP/IP, RTU (RS232, RS422, RS485) or TCP/IP (RJ45) must be used to connect with SCARA; the Communication page can be used to complete Modbus settings (For the Modbus setting, please refer to Chapter 18.).

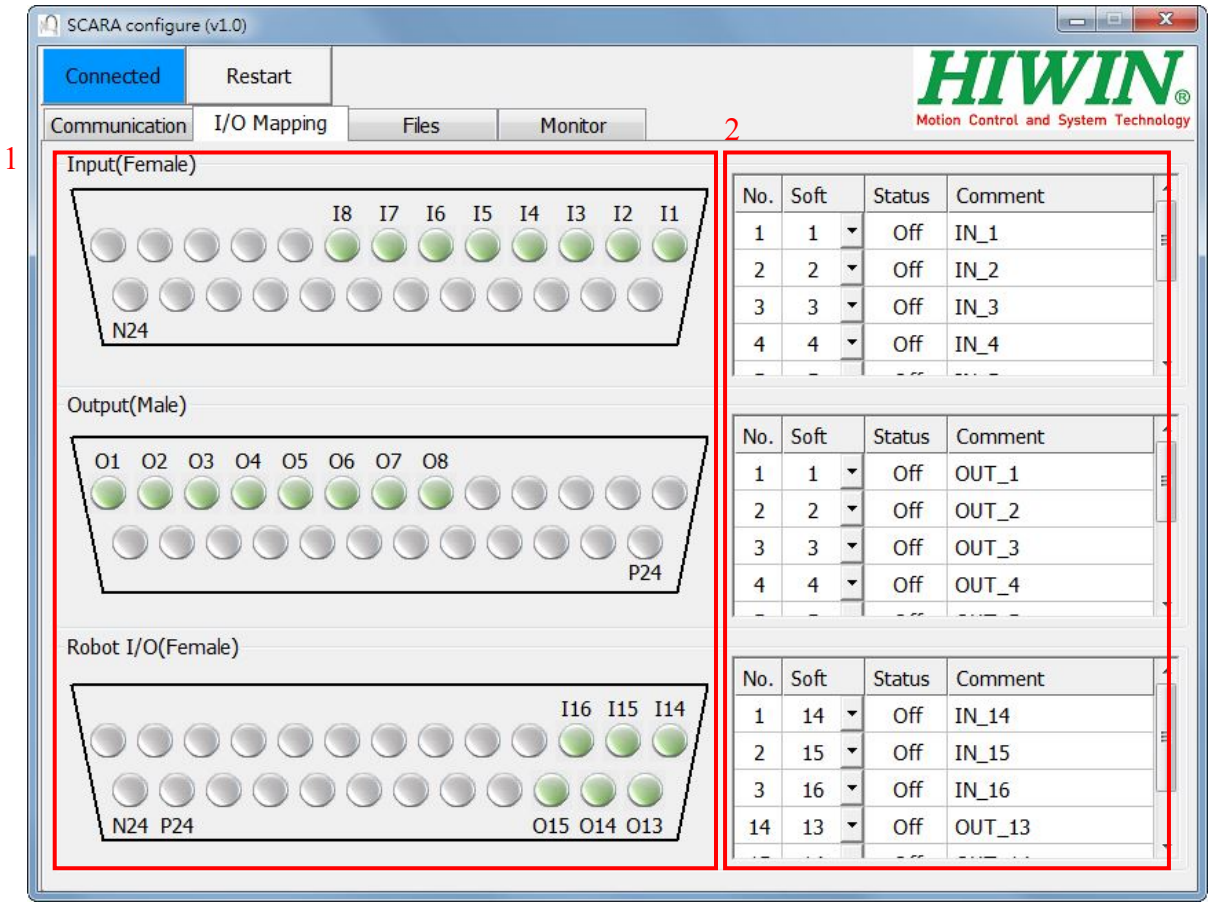


Red Box 1: Area to set ModbusRTU.
Red Box 2: Area to set ModbusTCP.
Blue Box 1: Set RTU as Server (Slave) or Client (Master).
Blue Box 2: Display the current setting status of RTU.
Blue Box 3: Set RTU as RS232, 422, or 485.
Blue Box 4: Display the communication status of RTU.
Blue Box 5: Set TCP as Server (Slave) or Client (Master).
Blue Box 6: Display the current setting status of TCP.
Blue Box 7: Display the current communication status of TCP.

19.5. I/O PAGE

19.5.1. Interface Operation

The IO status, I/O mapping and comment modification can be displayed on the IO page.



Red Box 1: Monitor I/O status, corresponding to the hardware pins of the control panel.

Red Box 2: Software I/O No. and I/O comment can be modified here.

19.5.2. Software I/O

Input:

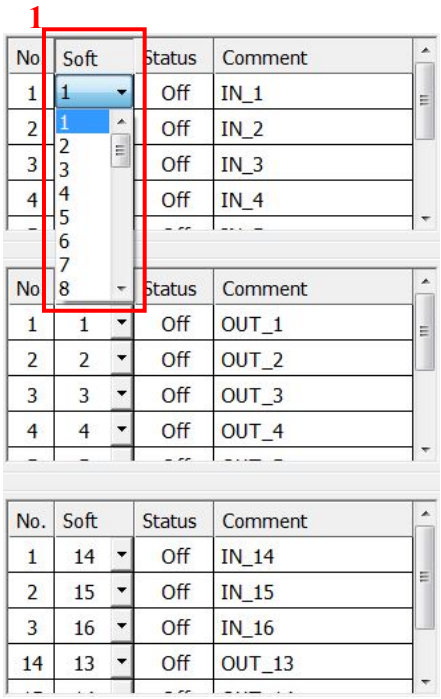
Input	Remark	Description
I42	Safety Grating	When triggered by signals, the robot will stop.
I43	Safety Grating	
I44	Reset	Reset and clear the alarm status
I51	NC Start	Start NC File
I52	Teaching Start	Start the current procedure
I53	Pause	Pause the path
I54	Path Reset	Reset the path
I55	Record Start	Start the record started by List
I47	Machine Reset	Interrupt the procedure in real time and execute Macro
I75	Bit 0	CASE Transforming 4 Bit
I76	Bit 1	
I77	Bit 2	
I78	Bit 3	
I83	ListIN1	Selection recorded by List
I84	ListIN2	
I85	ListIN3	
I86	ListIN4	

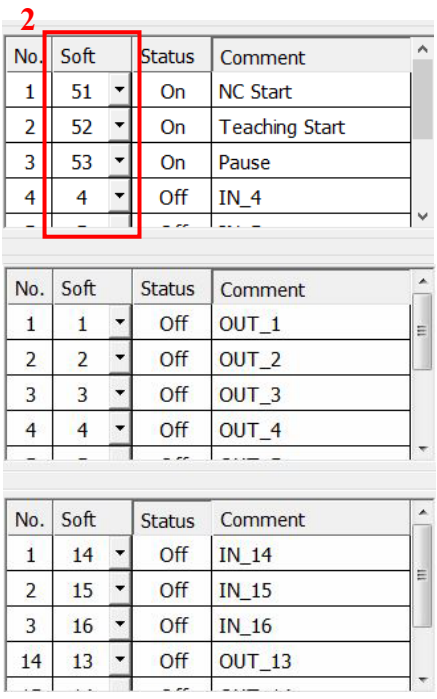
Output:

Output	Remark	Description
O40	Alarm Status	
O50	Running	
O51	Pausing	
O52	Prepared	
O75	Bit 0	CASE Transforming 4 Bit Output
O76	Bit 1	
O77	Bit 2	
O78	Bit 3	

19.5.3. I/O Operation

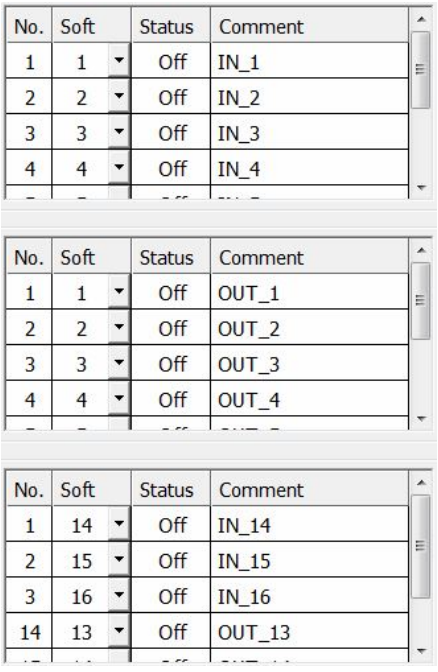
I/O mapping:

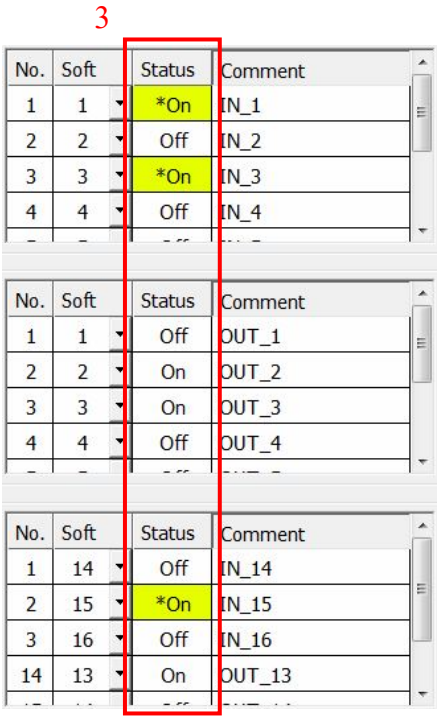




Method: Click the pop-down menu (Red Box 1) in the Soft column to select the software number (The functions are described as the previous page.), and then press the Enter button to complete I/O mapping (Red Box 2).

I/O Reversing:





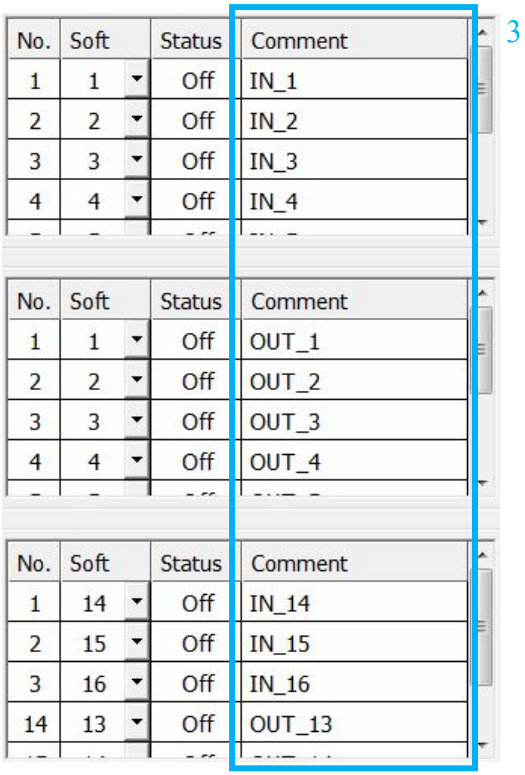
Double-click the item in the Red Box 3 to change the current status.

Input: Reverse input after double-clicked. The box will be turned to yellow background after reversed, and a “*” will be displayed.

Output: Double-click to turn on/off output.

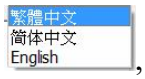
Modification of I/O comment

I/O comment is modified in Scon, which can be used as the determination of signal source.



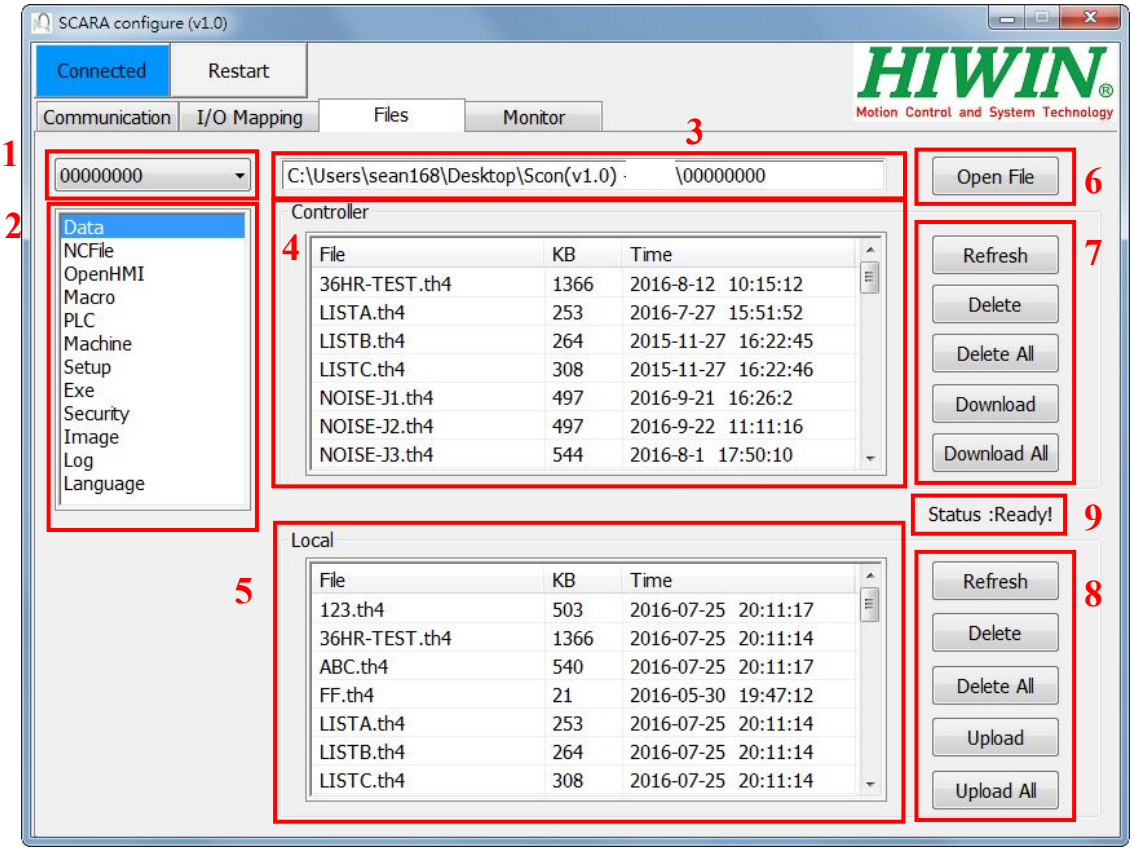
The comments in the I/O page correspond to those on Teaching Pendant (such as Blue Box 1, 2 and 3).

After you modified the comment, cnc_plc_000X.str (Note 1) in plc folder will be uploaded to SCARA and SCARA (need to correspond to files uploaded by language) will be restarted to change the comment on the Teaching Pendant.

Note 1: Language 

, Traditional Chinese (cnc_plc_0000.str), Simplified Chinese (cnc_plc_0001.str), or English (cnc_plc_0002.str), can be selected in the Monitor page.

19.6. File Transfer



Red Box 1: Select the folder in the root path.

Red Box 2: File folder as the table below.

Red Box 3: File path.

Red Box 4: File data in the controller.

Red Box 5: Files in the root folder.

Red Box 6: Open the folder in the path of Red Box 3.

Red Box 7: Run, add, delete, download to PC by controller file.

Red Box 8: Run, add, delete, upload to Controller in the root folder.

Red Box 9: File status.

Name	Function
Data	Folder saving the procedure file.
NCFile	Folder saving NC program.
OpenHMI	Save the folder of human-machine interface file.
Macro	Save the number of maker_macro_g and maker_func_ins_macro.
PLC	Save PLC_ladder in the Controller.
Machine	Save the parameter files of the Controller.
Setup	Save the update file of the Controller.
Security	Save the security file of the Controller (If it is lost, the Teaching Pendant can't be started.).
Image	Save the Boot and human-machine interface files.
Log	Save the Alarm information.
Language	Save the language file.

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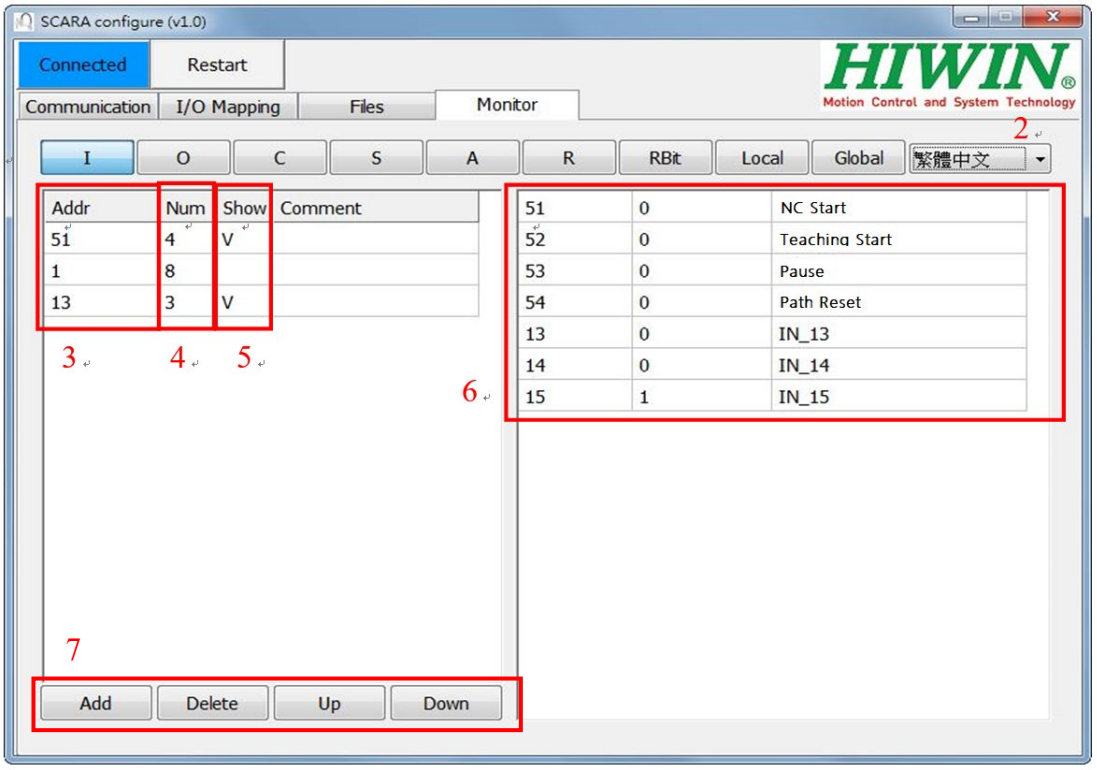
Red Box 10: If you want to upload the files in the red box, SCARA will be restarted to take effect.

19.7. Monitor Page

The values in all registers can be monitored by the Monitor page. The purpose is used to obtain the internal value.



Red Box 1: Change the values of I, O, C, S, A, R, R Bit in the Controller.

Red Box 2: Select the comment language.

Red Box 3: Register address to be monitored.

Red Box 4: Quantity to be monitored.

Red Box 5: Display.

Red Box 6: Display and modify the values in the register, display the comment.

Red Box 7: Run register address.

SCARA Robot Software (Original Instructions) User Manual

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