Cyclmotion motion control system

Software description

Software version number： B-2024-04-06-001

Cyclmotion Intelligent Technology Co., Ltd.

2024Y 04M 07D

Amend Record

Date	Software version	Main Content	Remark
2024.4.7	B-2024-04-06-001	Initial Release	

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一. Overview

Cyclmotion motion control system includes control software and control cards. The products are currently divided into three axes (basic model), three axes (with RTCP), four axes (basic model), four axes (with RTCP), and six axes (with RTCP), the software is the same.

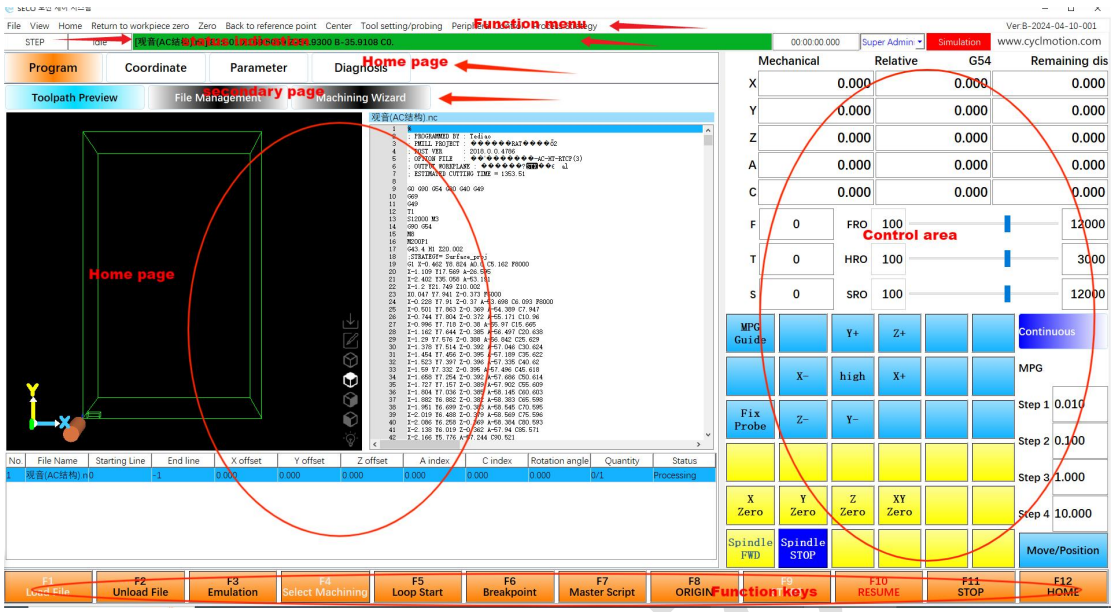
This article mainly introduces the instructions for using the control software。

1.Features

- .Cyclmotion motion control system is a control system with RTCP function and has the following main features:。
- .It adopts configuration design to support users' in-depth configuration customization, rapid secondary development of the interface, and automatic deployment of functional components (all source codes are in the /env directory)；
- .Supports 18 types of machine tool structures ranging from three-axis to six-axis, including double turntable, single-turn single pendulum, double pendulum head, etc.；
- .Supports RTCP (G43.4) and fixed-axis machining (G68.2) functions；
- .Supports 3D dynamic machining simulation, tool path and G code bidirectional positioning；
- .Support MODBUS bus IO expansion；
- .Support servo spindle, rigid tapping；
- .Supports custom function shortcut keys, and the universal input port can be configured as a shortcut function key；
- .Supports multiple processing strategies such as array processing, single-stage processing, cycle processing, breakpoint processing, and nearest point processing.
- .Supports axis mapping；

2.Introduction to interface layout

- .Function menu: the top, which is a fixed area and does not change with the main menu page.；
- .Status indication area: displays status and alarm information；
- .Main page: including 4 pages of program, coordinate system, parameters, and diagnosis. There are several secondary pages under each page. The corresponding function keys also change, and the function keys can be customized.；
- .Control area: It is a fixed area and does not change with the main page. The control function keys can be customized。
- .Function keys: Follow the changes of the main page. Different function keys can be defined on different main pages.



The window size can be adjusted by dragging between the main page and the control page.

二. Function menu introduction

It includes 10 items including files, views, mechanical zero return, workpiece zero return, workpiece zero return, reference point return, centering, tool setting/probing, peripheral control, and machining strategies. Each function menu pulls down to select each submenu function, as shown in the table below.

The axis-related functions in the table will change according to the change of coordinate display axis configuration. For example, if the five-axis system is selected for the machine tool structure, A/B/C axes can be configured in the coordinate display in the control area, and the function menu will also add corresponding functions.

"√" will be displayed in front of the selected function.

These functions can be defined in the function keys.

Document	View		Mechanical zero return		Workpiece return to zero
Processing G code	Side view		X axis returns to mechanical zero		X axis returns to w orkpiece zero
Uninstall G-code	Front view		Y axis returns to mechanical zero		Y axis returns to w orkpiece zero
Quit	House view		Z axis returns to mechanical zero		Z axis returns to w orkpiece zero
	Oblique view		All axes return to mechanical zero		XY axis returns to w orkpiece zero
	Entity file...		Mechanical coordinate clearing		XYZ axis returns to w orkpiece zero
	Workpiece model center axis			X-axis	All return to mechanical zero
		X-axis		Y-axis	
		Y-axis		Z-axis	
		Z-axis			
	Show turntable				
	Display soft limit frame				
	Show w orkpiece frame				
	Turntable transparent				
	The knife shaft is transparent				
	Automatically adjust view port				
	Show tool path				
	Clear tool path				
	Know the tool path before starting a new process				
	Rendering mode				
		External light source			
		Internal light source			
		No rendering			

Work piece clearing	Return to reference point	Score	Tool setting/detection	Peripheral control	Processing strategy
X-axis w orkpiece clearing	Return to G28 reference point	X-axis centration	Fixed tool setting		Choose processing
Y-axis w orkpiece clearing	Return to G30P1 reference point	Y-axis centration	Floating tool setting		Cycle processing
Z-axis w orkpiece clearing	Return to G30P2 reference point	Z-axis centration	Tool length measurement		Processing at the nearest point
XY-axis w orkpiece clearing	Return to G30P3 reference point		Corner detection		load pause breakpoint
XYZ-axis w orkpiece clearing					load stop breakpoint
Clear all w orkpieces					Load pow er-off breakpoints
					Tool spindle raised
					Deepening of the cutter axis

Some functions are explained below.

1. Load G code

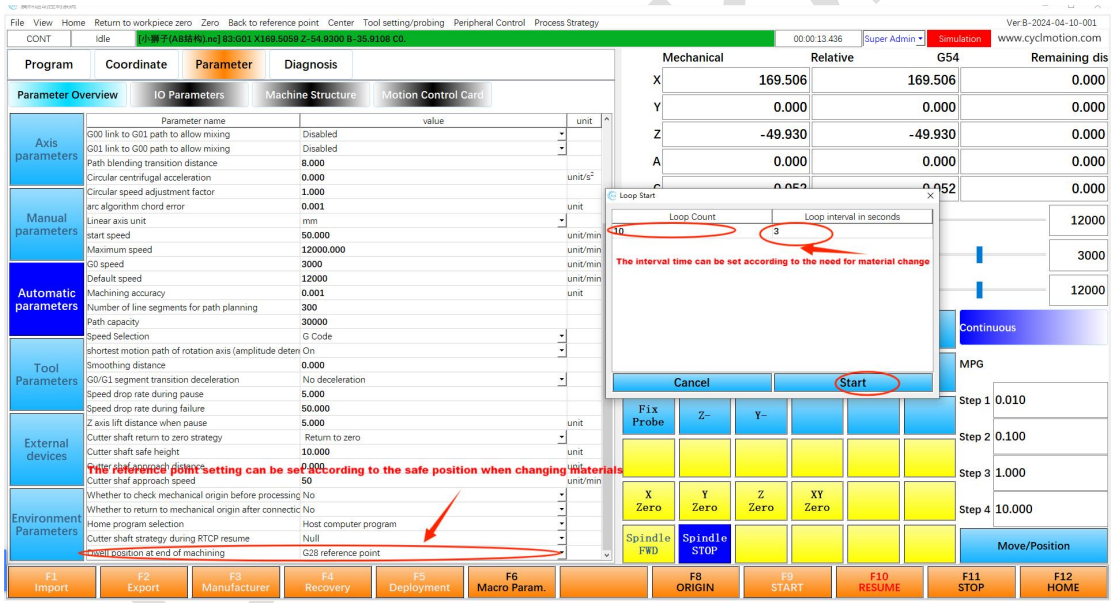
Load G code. This function can only load a single file. For details on loading multiple files, see the function in file management.

2. Cycle processing

Click Processing Strategy - Cycle Processing, and a dialog box will pop up. You can edit the number of cycles and cycle interval time. After completion, press Start to start processing.

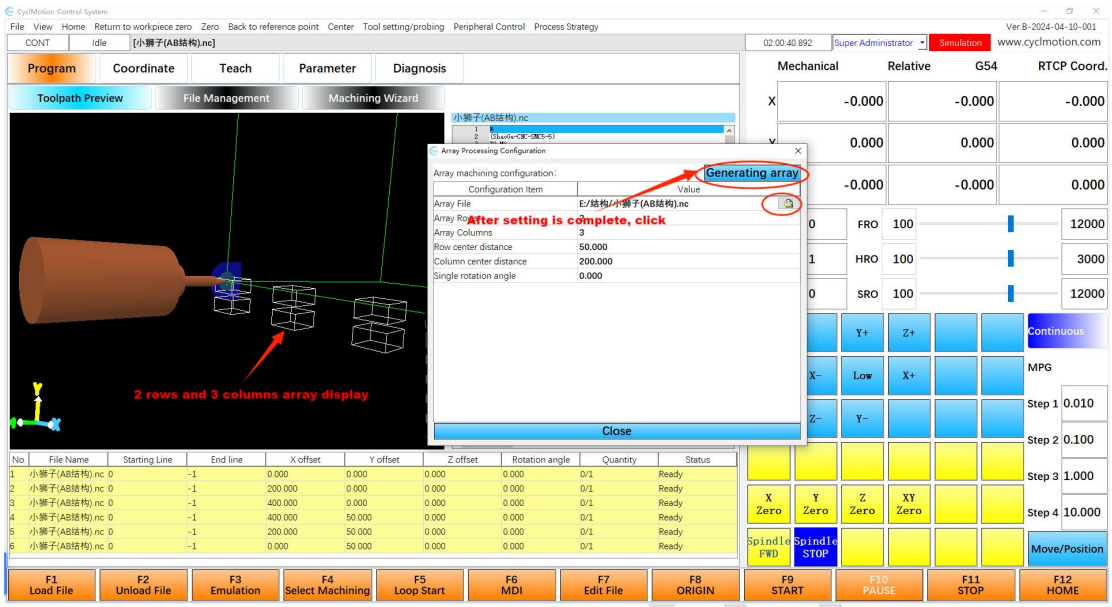
Small application examples：

Combined with the parameters - automatic parameters - the dwell position at the end of processing, and setting it as a suitable reference point, the material changing function during processing can be realized.



3. Array processing

Click Machining Strategy - Array Processing to pop up the configuration dialog box. After loading the array file and setting the parameters, click Array Generation. When the display workpiece frame is turned on, the array shape will be displayed in the simulation tool path.

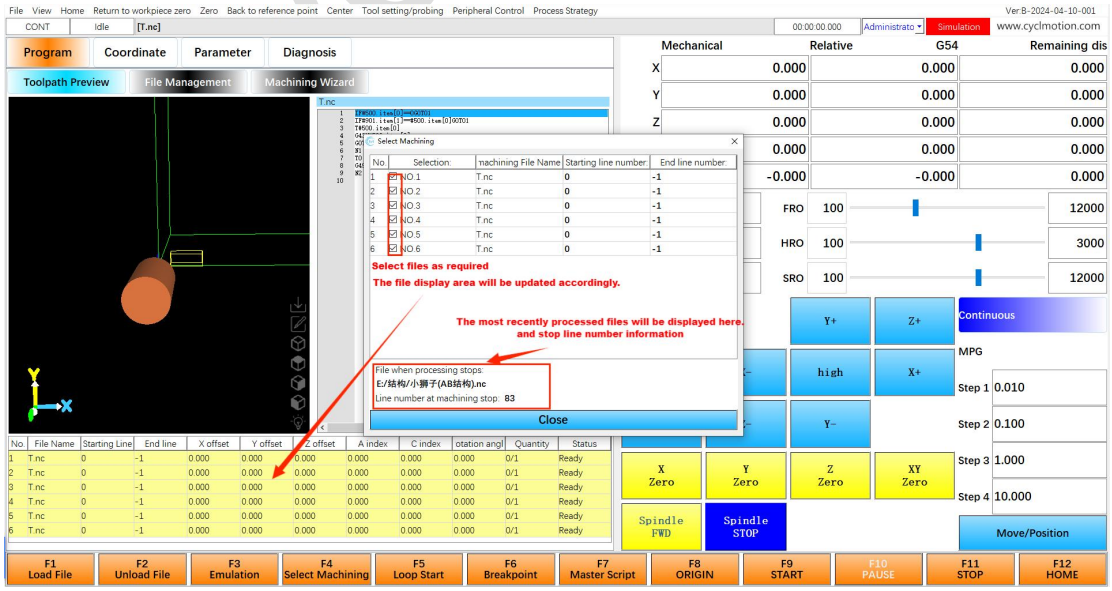


4. Choose processing

Click Processing Strategy—Select Processing, and a dialog box will pop up. You can select the required files in the current file list as needed.

You can set the starting line number and ending line number for each file to perform breakpoint processing or area processing.

The bottom of the dialog box will display the file name of the latest processing and the line number when the processing stopped, which can facilitate breakpoint processing.



5. Peripheral control

In parameters—IOparameters—IOAfter configuring the output port in the output configuration，Optional after restarting.

三. Status Bar

Instruct separately:

1. Control mode (automatic/continuous/inching/manual)

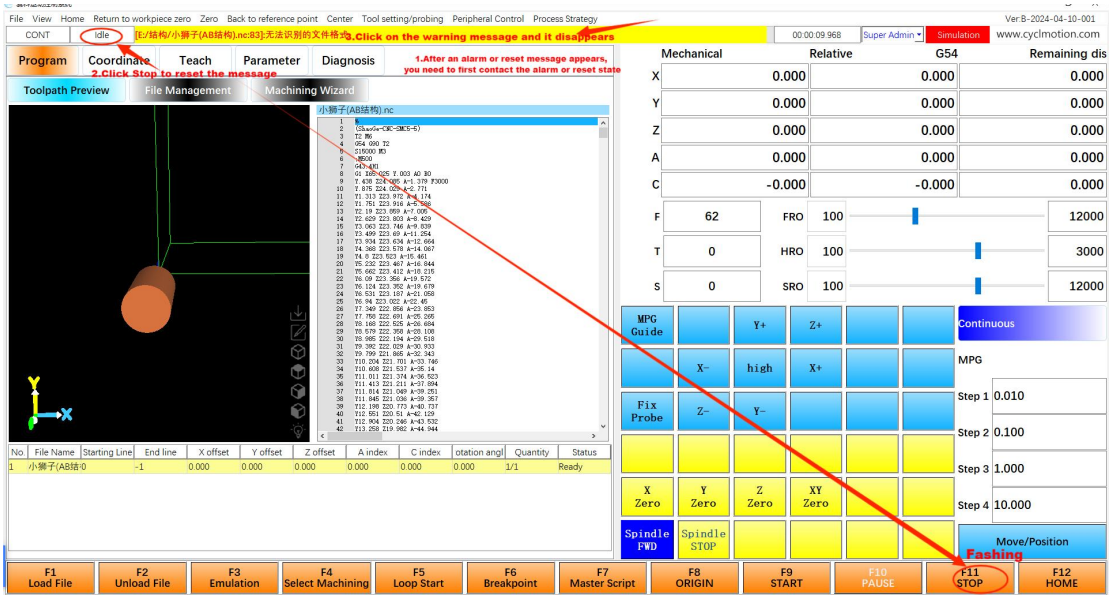
- When online processing, it will be automatically locked in "automatic" mode;
- Continuous/inch/manual, select control through control area。
- Continuous: Press and hold the movement direction key to continue movement.。
- Inching: moving according to a given step distance。
- Handwheel: controlled by handwheel. Host control is invalid。

Note: When online,

- When the handwheel axis is selected off, the handwheel control is invalid and can only be switched between continuous/inch operation and is controlled by the host.
- When the handwheel axis is switched from off to other gears, or between other gears, it automatically switches to the handwheel state and is controlled by the handwheel.
- When the handwheel axis selection is not off, continuous / handwheel / inching can be switched.

2. Idle/reset/device busy:

- When not processing, it shows idle, when processing, it shows the device is busy;
- It will flash when a reset occurs. After the reset state is released, press the function key "Stop" or "Reset" to eliminate the flashing;



3. **Processing files/alarm information：**
   - The processing file is displayed in the normal state, and the alarm information is displayed in the event of an alarm.；
   - When an alarm occurs during processing, double-click this area to automatically locate the fault line.

4. **Processing time: refers to the processing time of a single file, and does not count when paused.**

5. **Administrator rights：**
   - Login/Administrator/Super Administrator, click to switch.
   - Administrators and super administrators can set passwords.
   - Administrator rights: Visible and configured axis parameters in Parameters—Parameter Overview；
   - Super administrator authority: the highest authority, which can configure parameters, control areas and function keys.

6. **Simulation/online**
   - After the connection is successful, "Online" is displayed in green, otherwise "Simulation" is displayed in red.；
   - When multiple hosts are connected to the same control card, the first one successfully connected is the master machine, and the rest are monitoring machines. "Monitoring" will be displayed here.。

四. Main page introduction

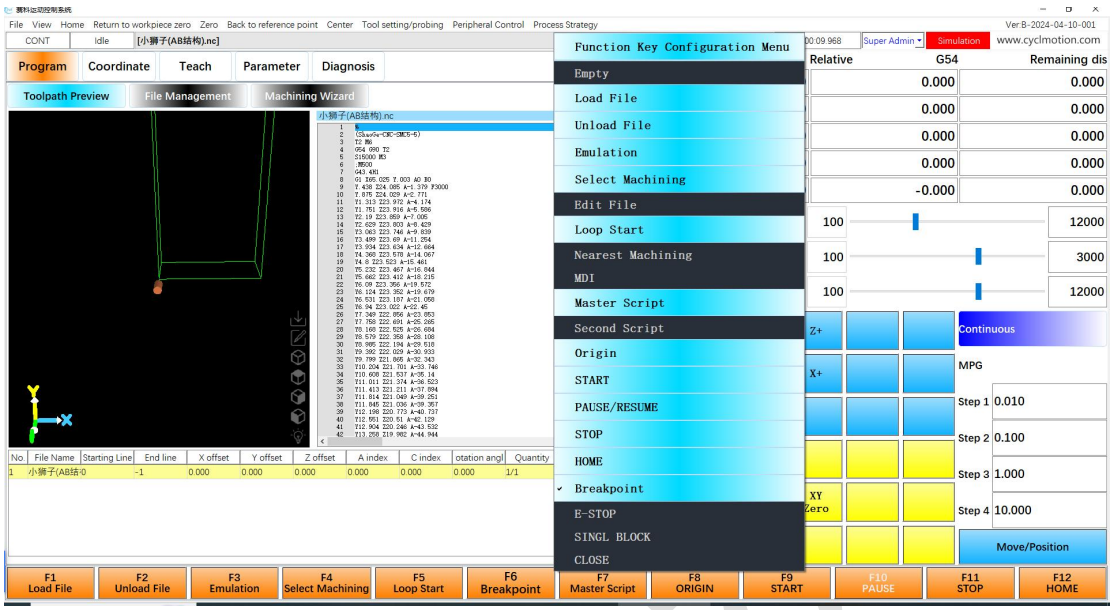
The main page includes 4 pages: program, coordinate system, parameters and diagnosis.

1. Program

Divided into three secondary pages: tool path preview, file management, and processing wizard。The current page is blue background.

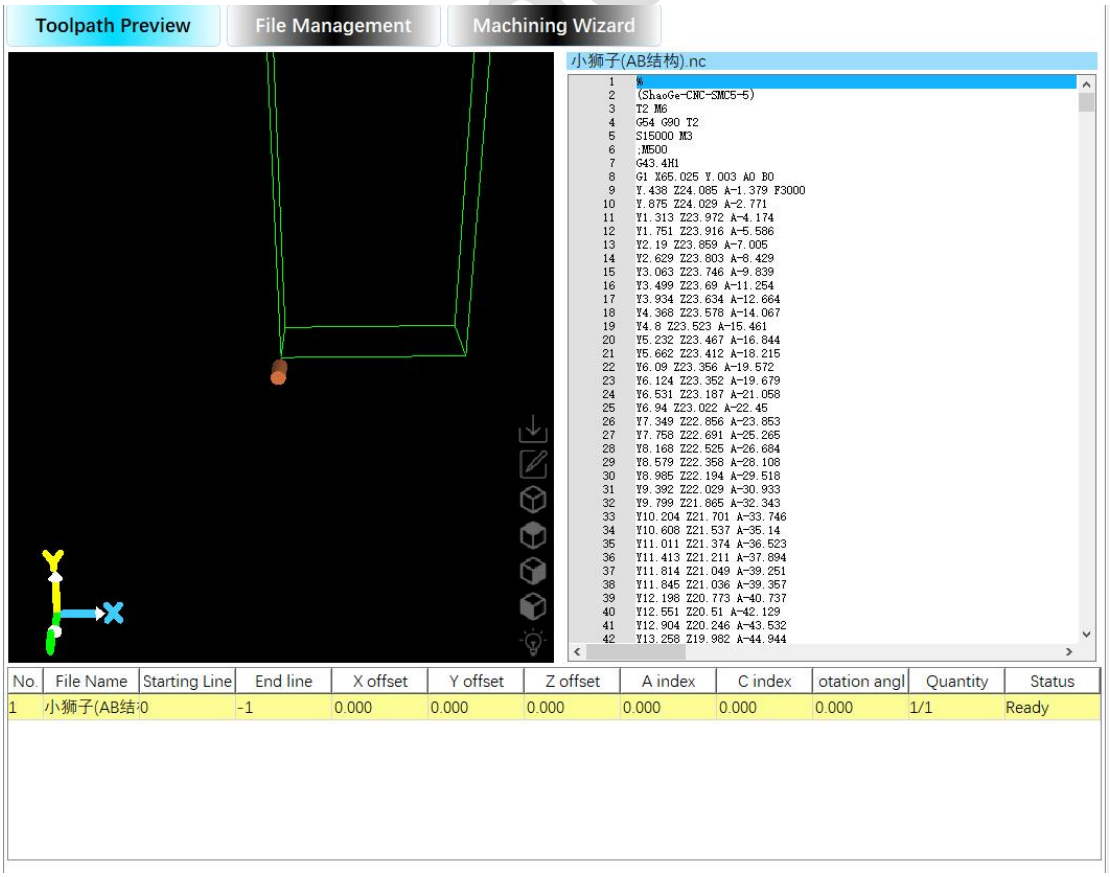
At the bottom of the program page, you can right-click to customize related function keys, as shown below。Blue indicates that the function key has been defined, black indicates that it has not been defined, and the current function key is marked with √.

The font color of the function key is white to indicate that this status is unavailable, and black to indicate that it is available.



1) Tool path preview

The left side is the simulation area, the right side is the G code display area, and the bottom is the loading file display.



Basic operating instructions for the simulation area：

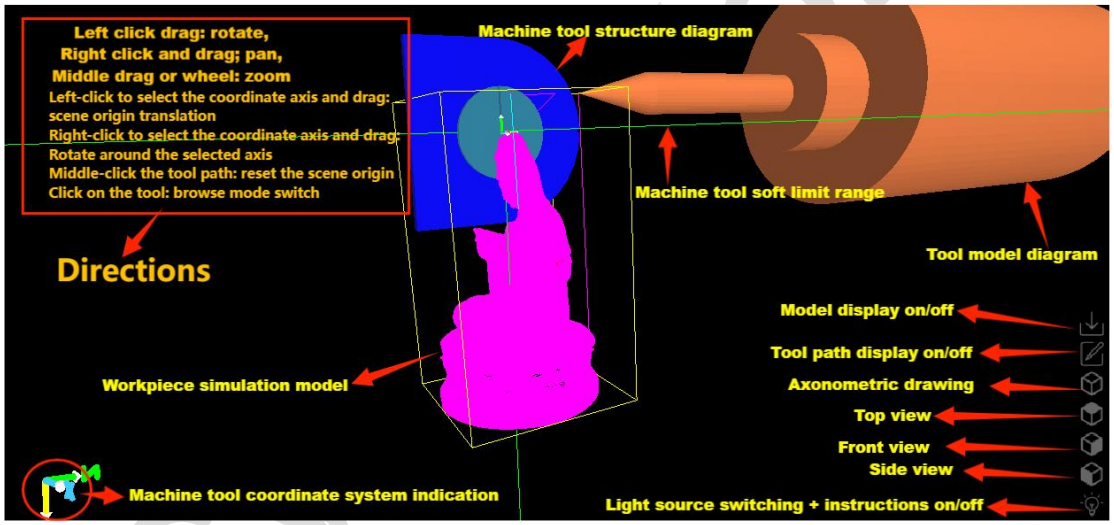
- Left-click drag: rotate around the rotation center.
- Right-drag: pan.

- Middle-click drag or wheel: zoom.
- Click the tool: the tool turns red and the tool tip point is placed in the center of the display. Click again to cancel. Unable to pan at this time.
- Middle-click the tool path: set the rotation center, but it can only be selected on the workpiece or tool path. If there is no workpiece or tool path yet, you can simulate it first.

Operation on the body coordinate system：

- Left-click to select the coordinate axis and drag: translate along the selected axis.
- Right-click to select the coordinate axis and drag: Rotate around the selected axis.

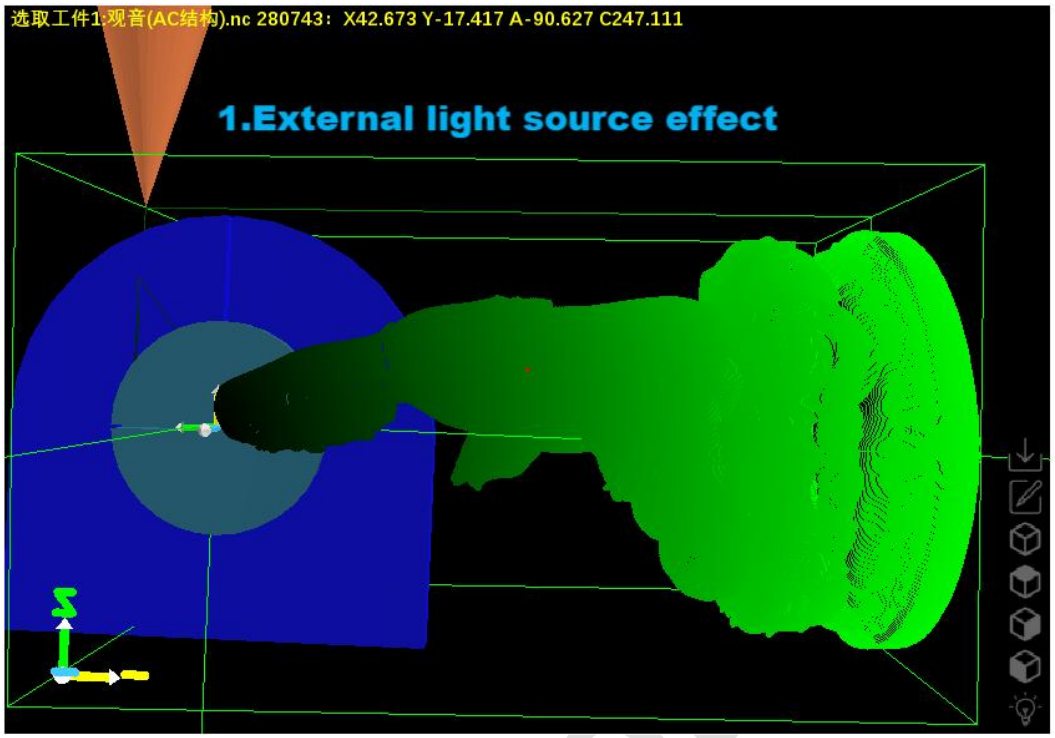
The meaning of the icons on the right side of the simulation area is shown in the figure below.

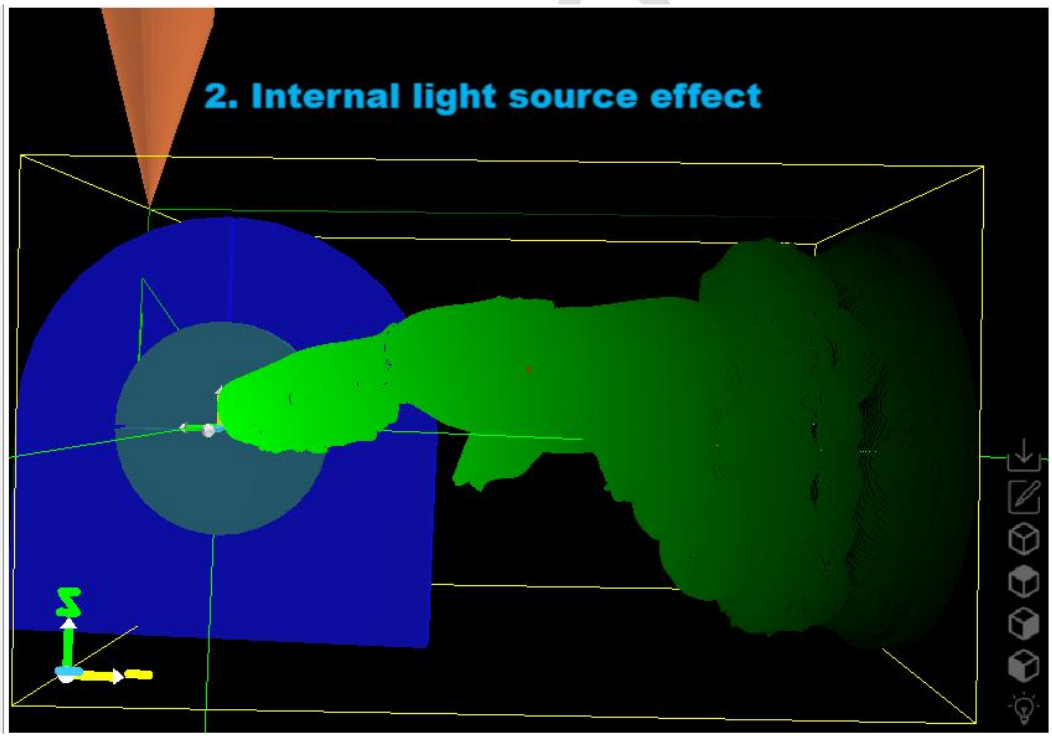


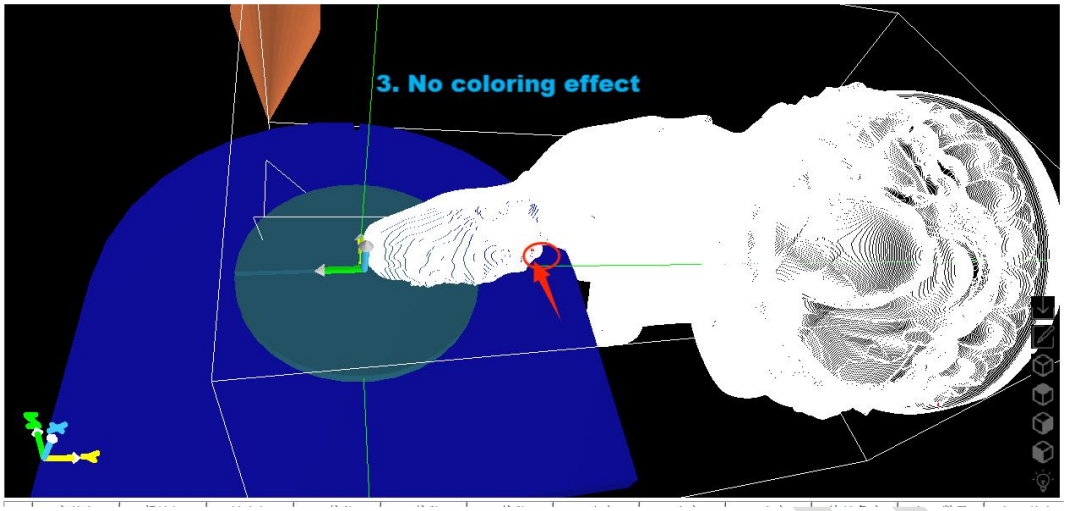
When the mouse stays on the simulated tool path, the current tool path turns red, and the G code line number and code content are displayed. At the same time, the G code display area is tracked in real time.

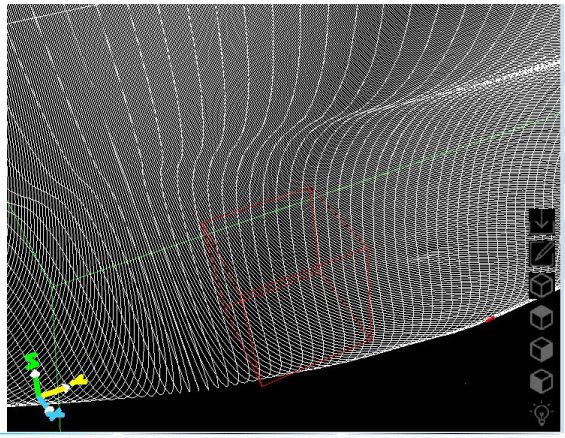
Select the tool path and right-click, a drop-down menu will appear. You can pick the starting line or the ending line and automatically add it to the starting line or ending line in the file area below.。

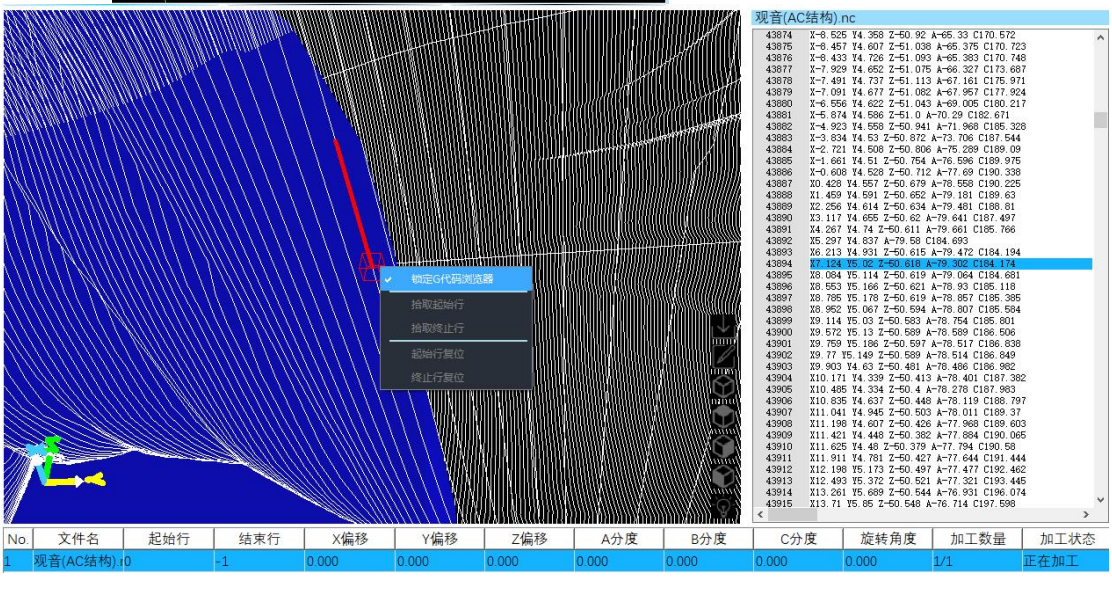
Example of light source switching effect：


选取工件1:观音(AC结构).nc 280743：X42.673 Y-17.417 A-90.627 C247.111
1.External light source effect


2. Internal light source effect

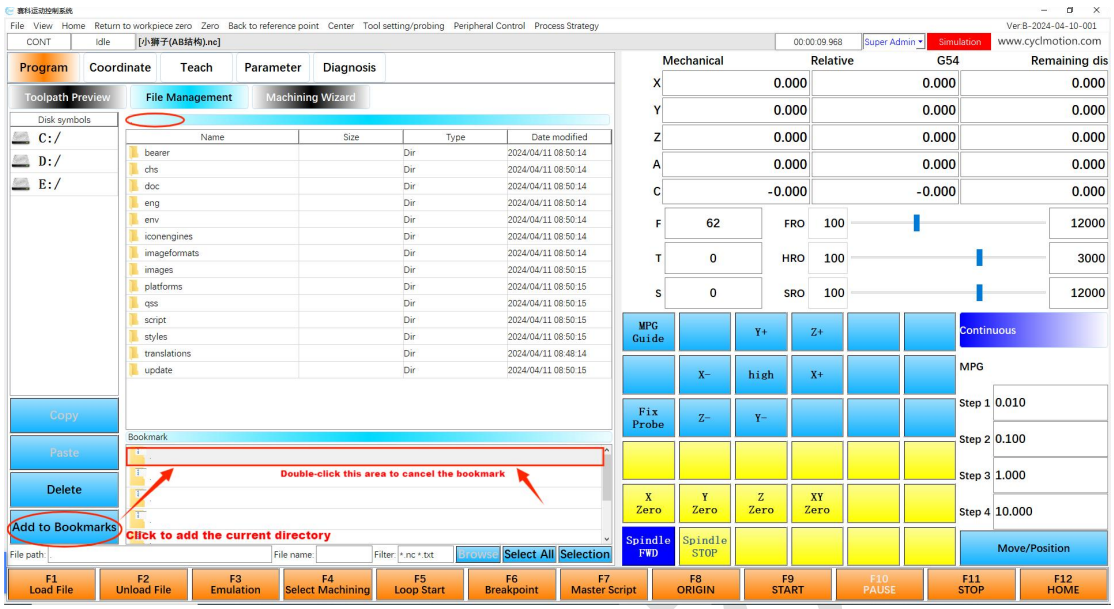






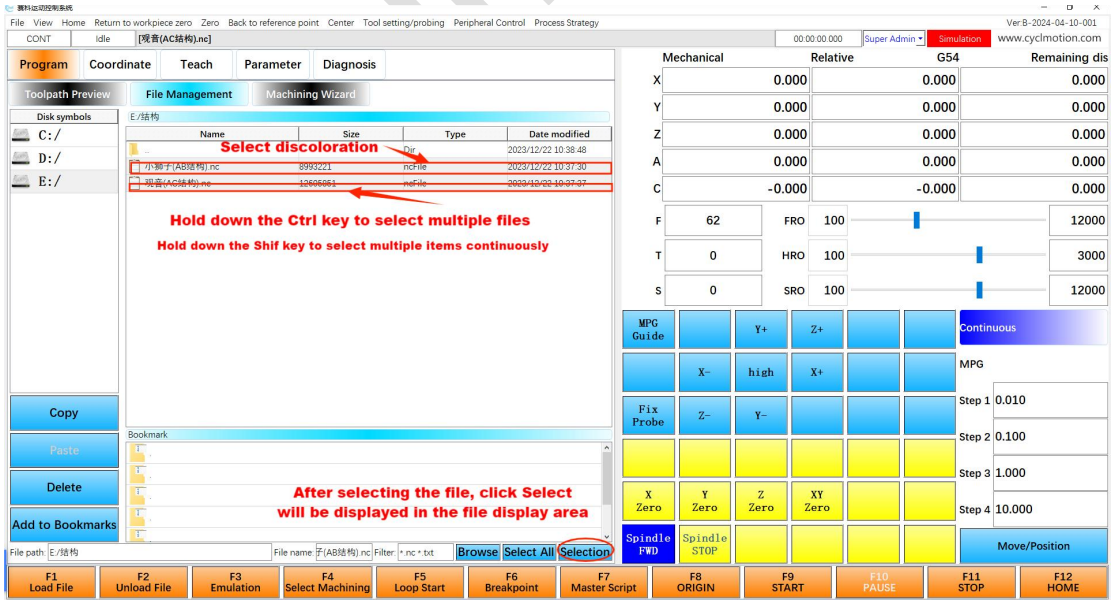
2) File management

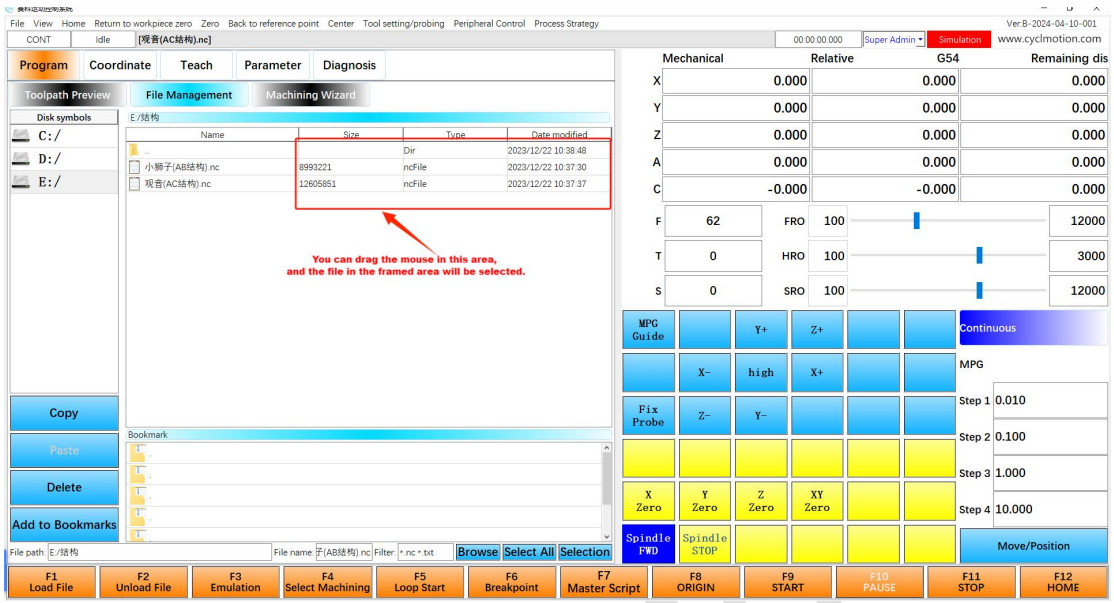
You can add the current file directory to bookmarks and double-click the bookmark to cancel.。



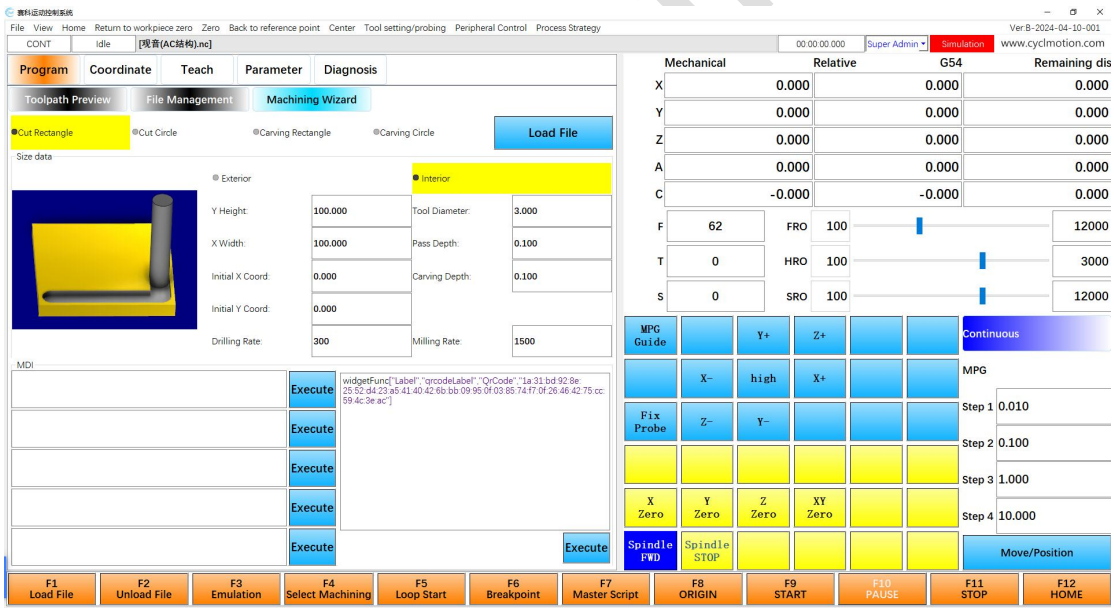
Multiple files can be selected：

- Hold down Ctrl to select multiple items individually；
- Hold down Shift to select multiple items continuously；
- Drag the mouse in the specified area in the diagram, and the file in the framed area will be selected；
- Click Select All to select all files in the current directory.





3) Processing Wizard



Currently, we have provided square-cut frames, circular-cut frames, rectangular milled bottoms, and circular milled bottoms, all with animated instructions.

After setting the parameters, click to load the file.

Commands can be entered and executed in MDI. Single-line input is available on the left and multi-line input is available on the right.

2. Coordinate System

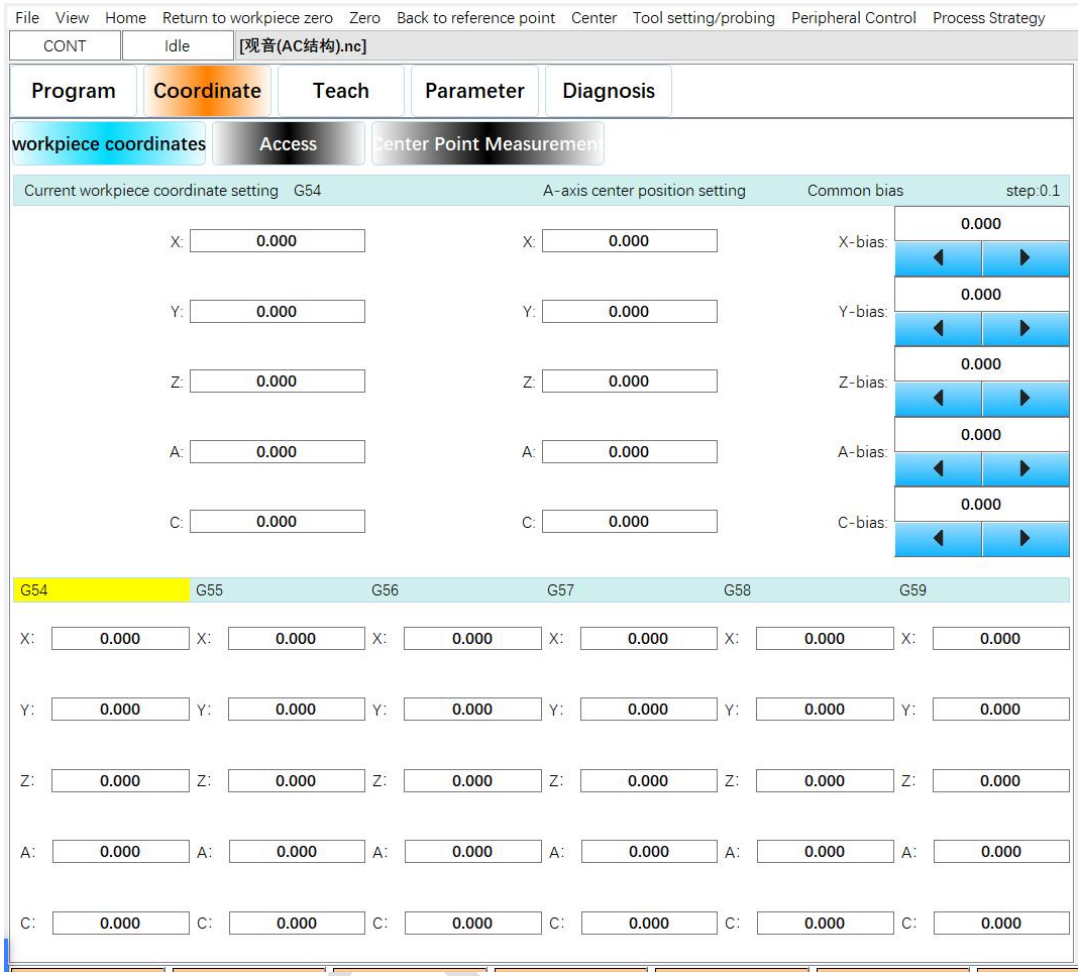
At the bottom of the coordinate system page, you can right-click to customize related function keys, as shown below. Blue indicates that the function key has been defined, black indicates that it has not been defined, and the current function key is marked with √

The font color of the function key is white to indicate that this status is

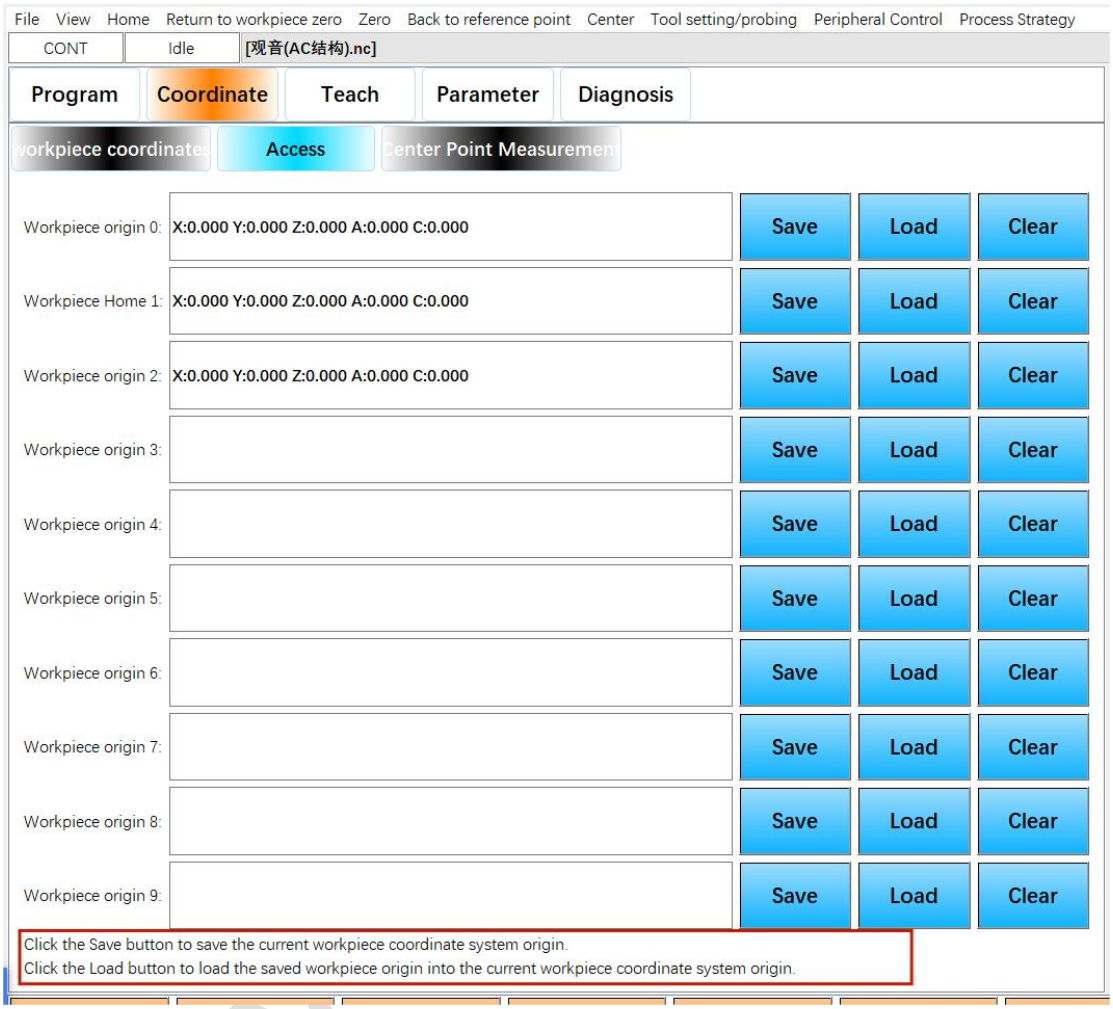
unavailable, and black to indicate that it is available.

1) Workpiece coordinates

- G54-G59 coordinate offset can be set;
- The common offset of each axis can be set, click to edit or adjust using the arrow keys below;
- Click to adjust the step distance, you can choose the step distance 0.01, 0.1, 1.


File View Home Return to workpiece zero Zero Back to reference point Center Tool setting/probing Peripheral Control Process Strategy
CONT
Idle
[观音(AC结构).nc]
Program
Coordinate
Teach
Parameter
Diagnosis
workpiece coordinates
Access
Center Point Measuremen
Current workpiece coordinate setting G54
A-axis center position setting
Common bias
step:0.1
X: 0.000
Y: 0.000
Z: 0.000
A: 0.000
C: 0.000
X-bias: 0.000
Y-bias: 0.000
Z-bias: 0.000
A-bias: 0.000
C-bias: 0.000
G54
G55
G56
G57
G58
G59

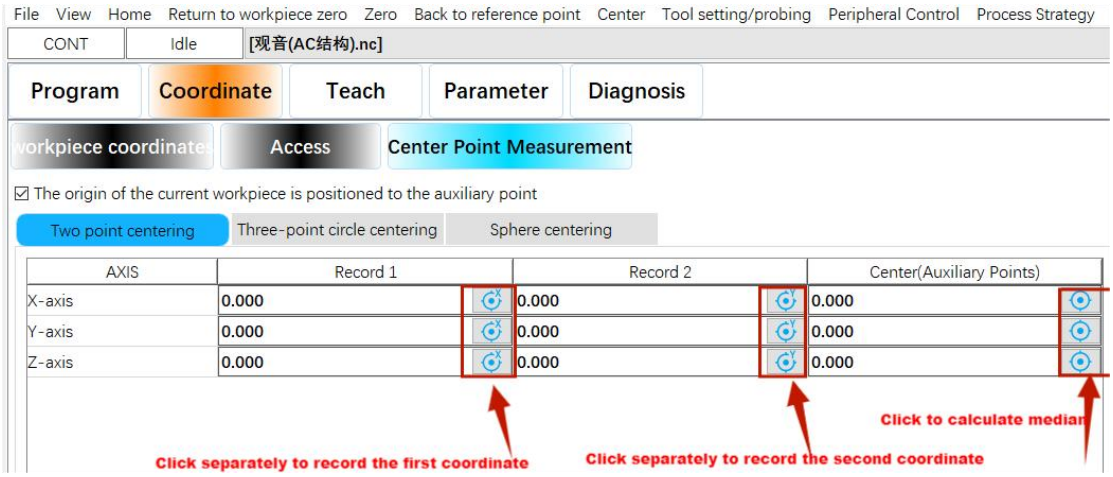
2) Access



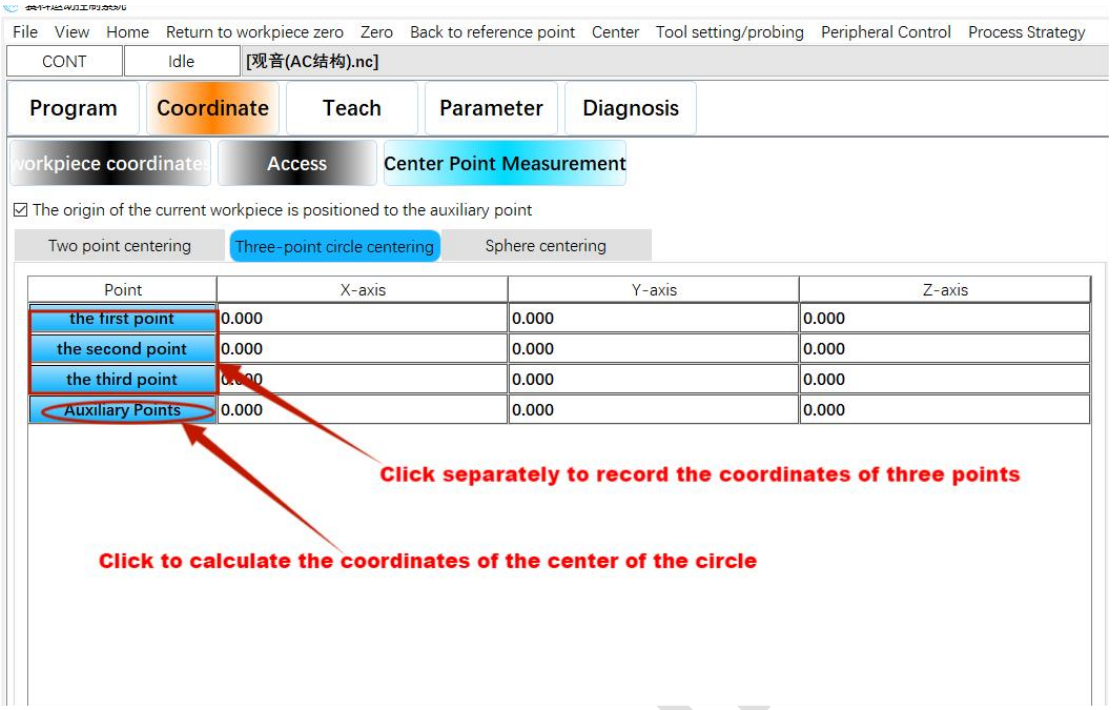
3) Center point measurement

Including two-point centering, three-point centering of a circle, and three-coordinate centering of a sphere.

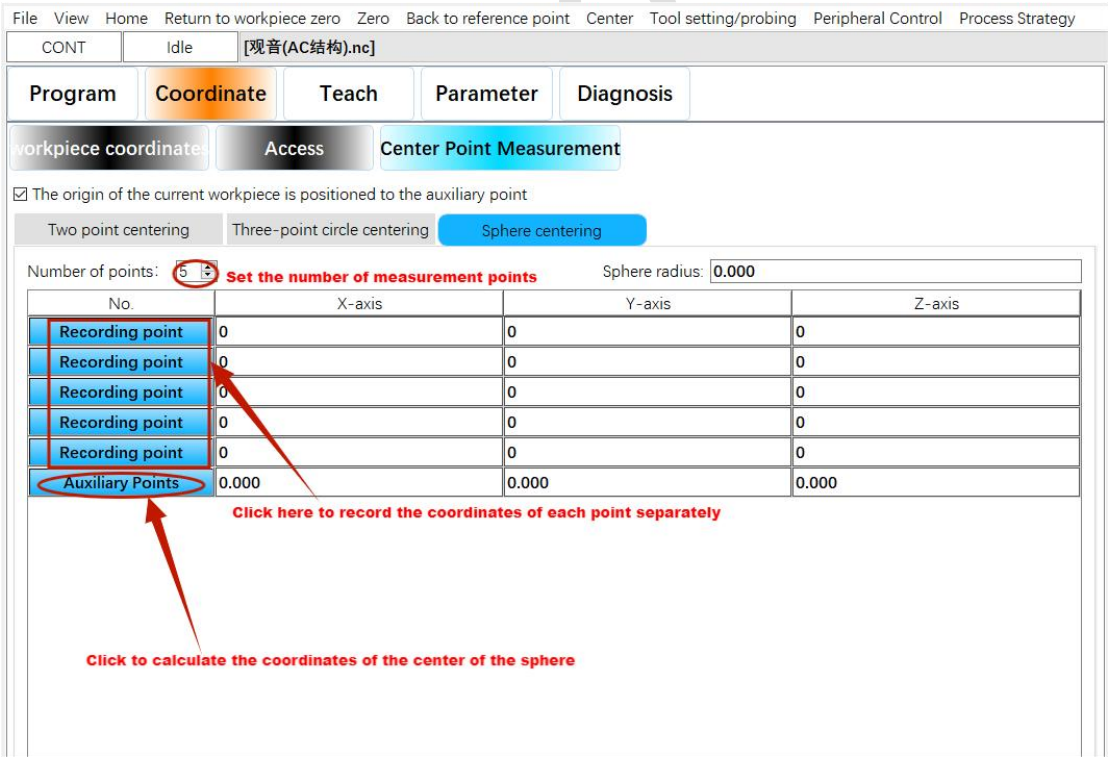
a) Two point centering：



b) Three points determine the center of the circle：



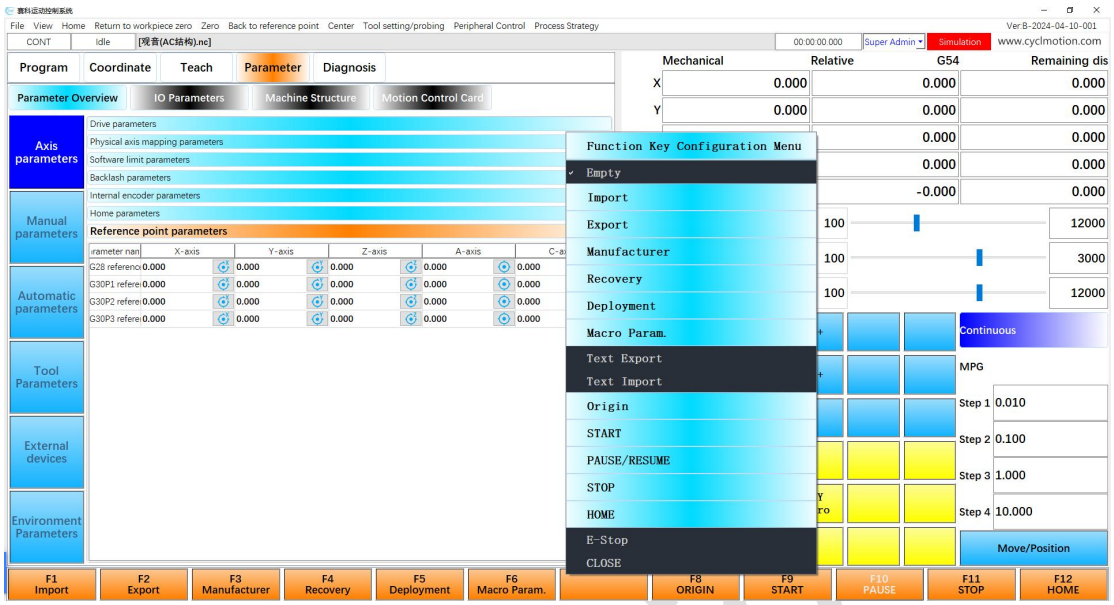
c) Three coordinates to determine the center of the sphere：



3. Parameter

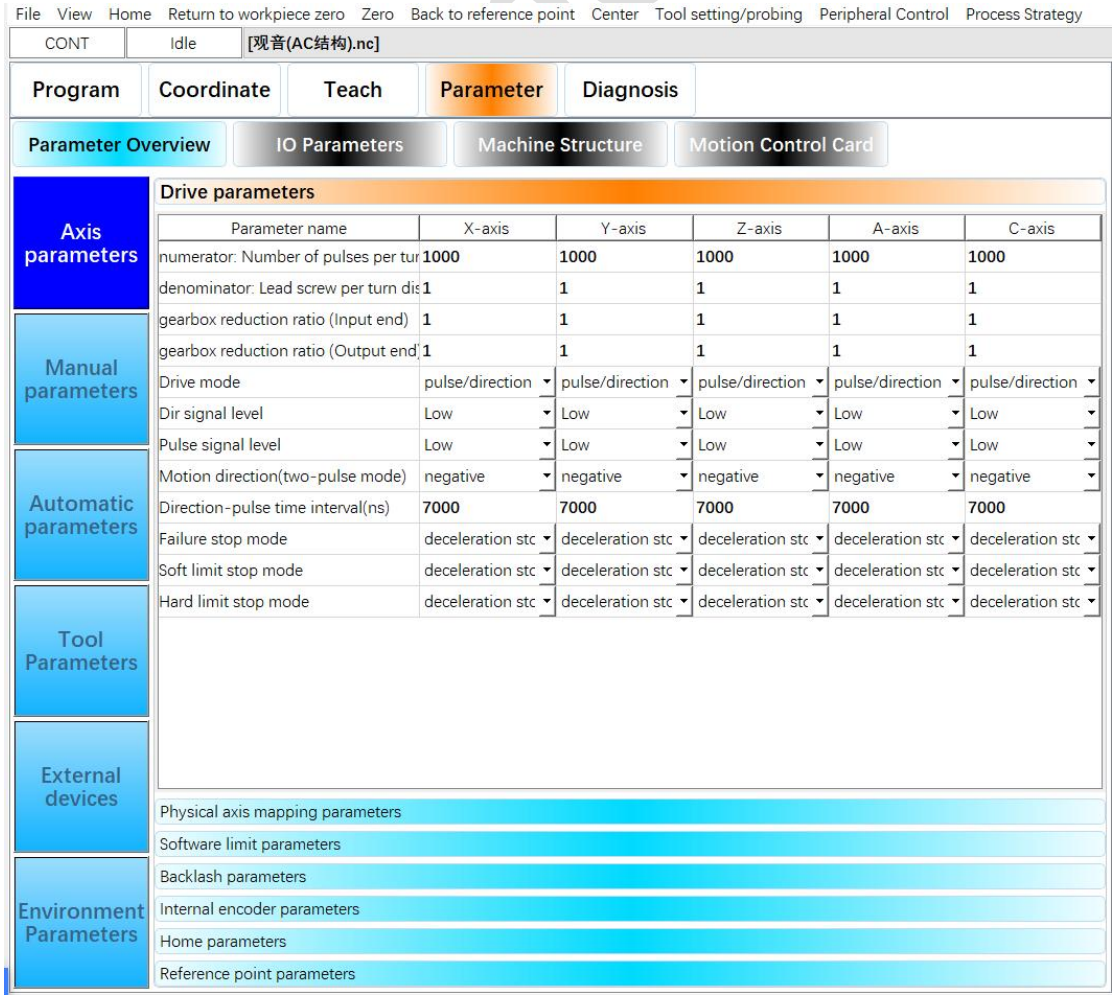
Including 3 sub-pages: parameter overview, IO parameters, and motion control card.For detailed instructions, please refer to the 《Parameter Description File》。

At the bottom of the parameter page, you can right-click to customize the relevant function keys, as shown below.



1) Parameter overview

There is a lot of content, divided into several parts: axis parameters, manual parameters, automatic parameters, tool parameters, external equipment, and environmental parameters. Each part has sub-items.。



2) IO parameter

Including IO input configuration and IO output configuration.

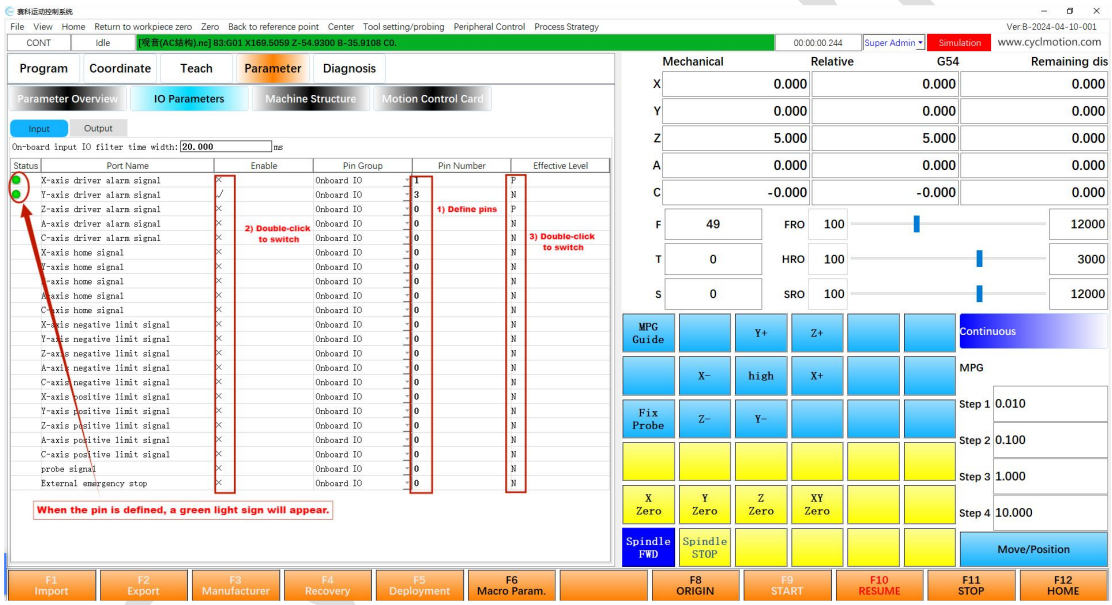
Here is the port number configured based on the fixed input/output signal.

The difference from the hidden function - IO function customization is that the latter uses the port number as a guide to define the input/output signal.

a) IOEnter configuration

After defining the pin number：

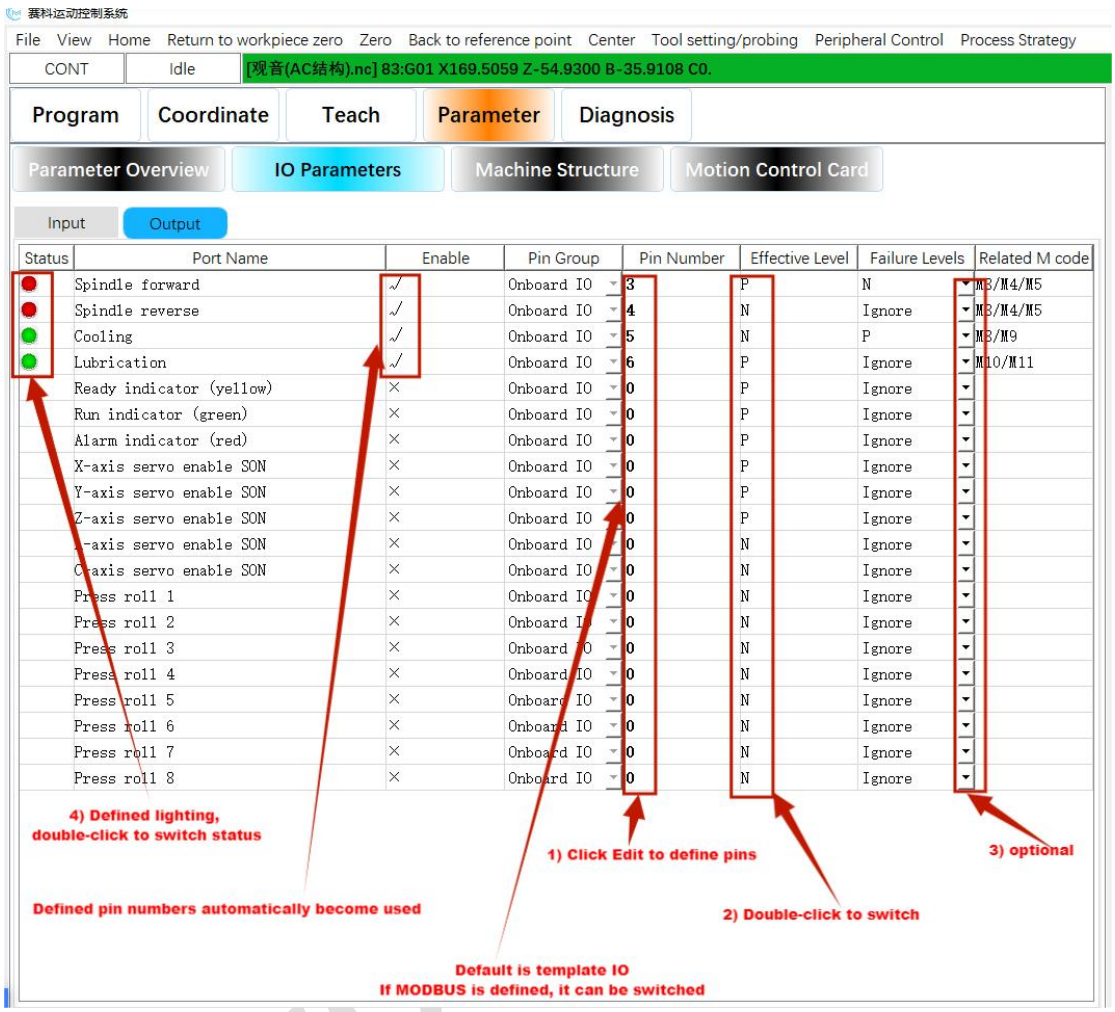
- There is a green light sign in the status bar on the left；
- Double-click the enable bar to switch enable (√) or disable (x)；
- Double-click the effective level to switch N or P.
- The pin group can be switched after MODBUS is configured.



b) IO output configuration

After defining the pin number：

- There is a green or red light sign in the status bar on the left, and the status can be switched by double-clicking the mouse.；
- The status of the enable column changes to enabled (√)；
- Double-click the effective level to switch N or P；
- When the system fails, the level can be optionally ignored, N, and P.；
- The relevant M codes are M instructions corresponding to the output signals, as follows, see for details《M command description》。
  - M3/M4/M5：Spindle forward/Spindle reverse/Spindle stop
  - M8/M9：Coolant on/coolant off
  - M10/M11：Lubricant on / Lubricant off
- The pin group can be switched after MODBUS is configured.

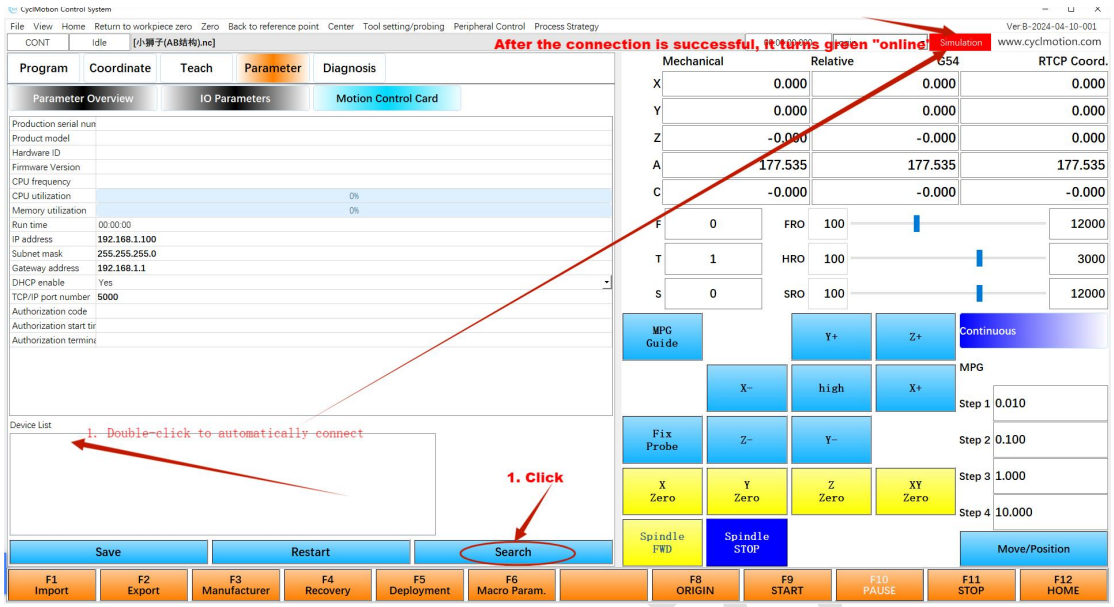


3) Motion control card

When online, click Search Devices and existing devices will be listed in the device list. Double-click the device you want to connect to connect.

When the connection to the control card is successful, a successful connection prompt box will pop up and a green "online" will be displayed in the status bar.

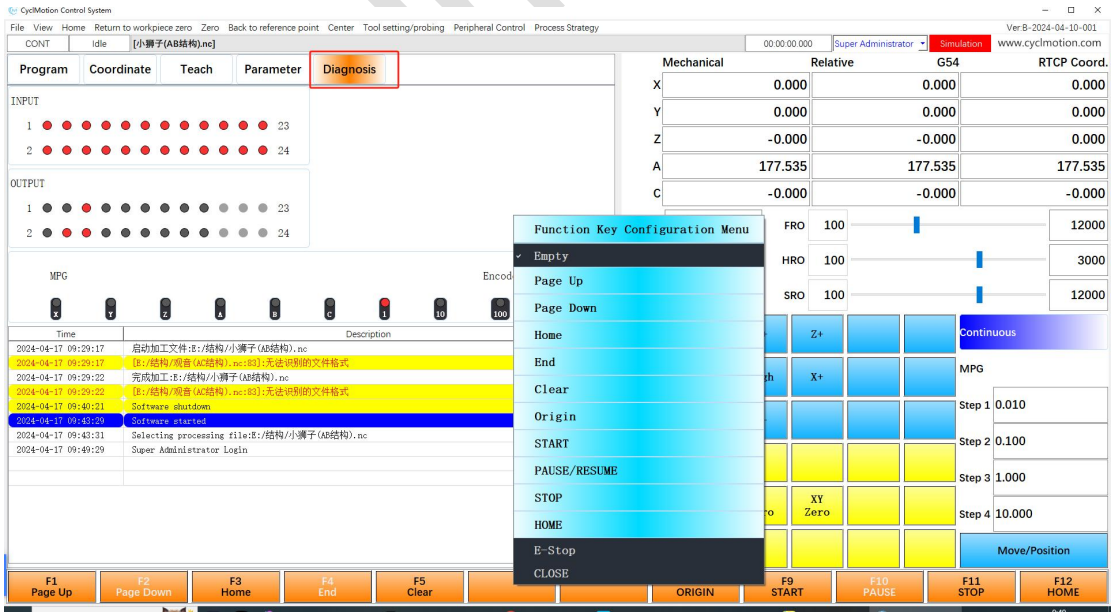
If there are more than 2 hosts connected to the same set of control cards, the first one connected is the main control machine, and the others are monitoring machines. They only have monitoring rights and no control rights. Monitoring opportunities display "Monitoring" (red) to the right of "Online" (green).



4. Diagnosis

At the bottom of the diagnostic page, you can right-click to customize related function keys, as shown below.

All system logs will be recorded here and can be deleted with super administrator privileges.



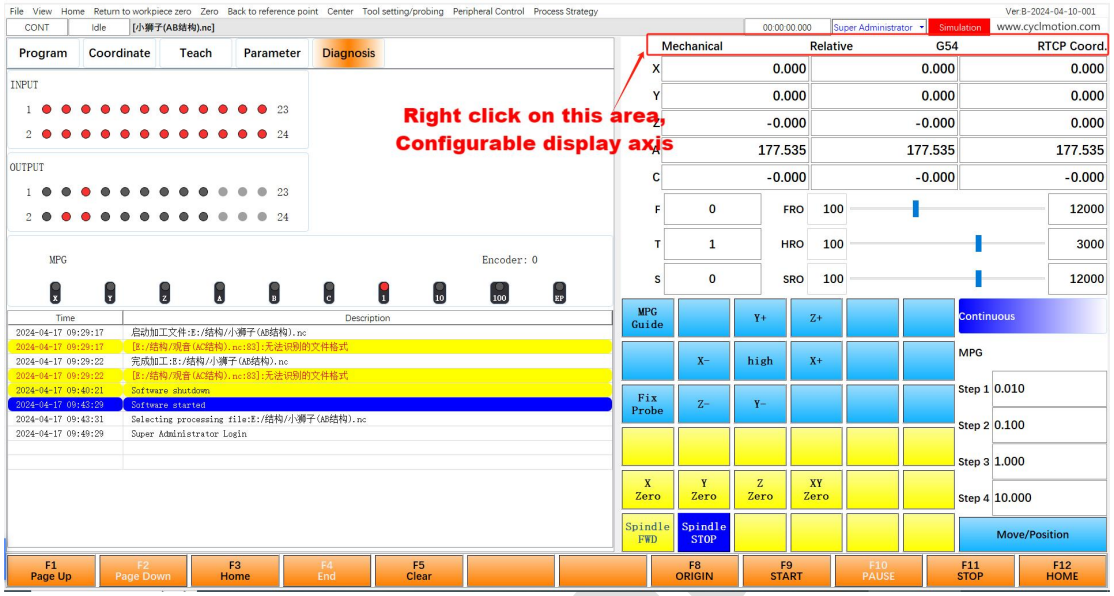
五. Control Area

1. Coordinate display axis configuration

Right-click the mechanical coordinate title bar (picture area) to select the coordinate display axis. The selectable axes match the machine tool structure, that is,

for the four-axis-4th (A), only XYZA can be selected.

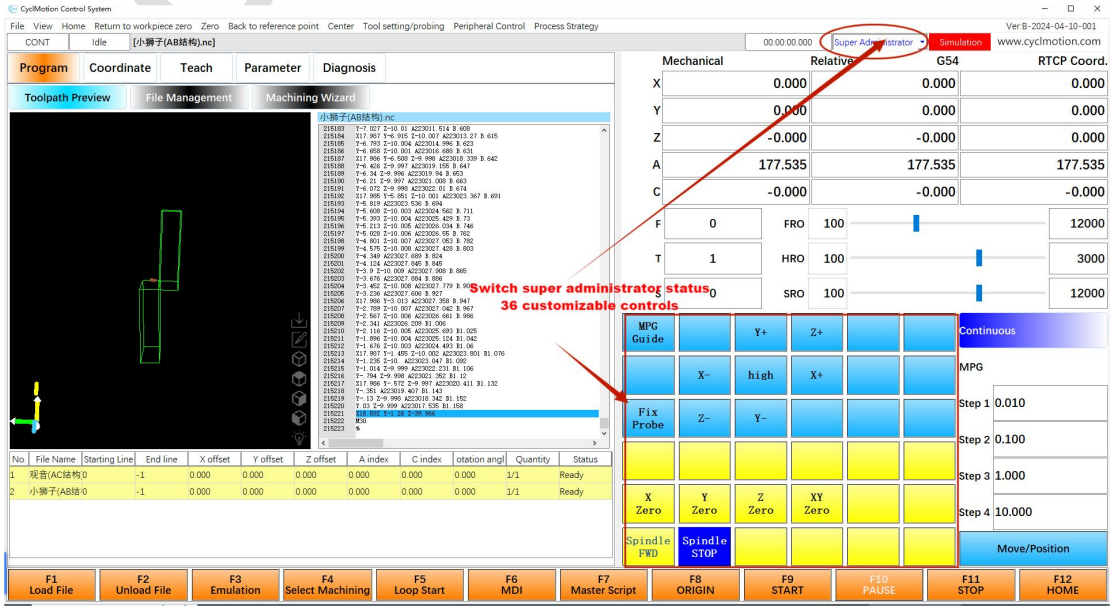
After configuration, the function menu and function key customization and axis-related functions will be updated accordingly.

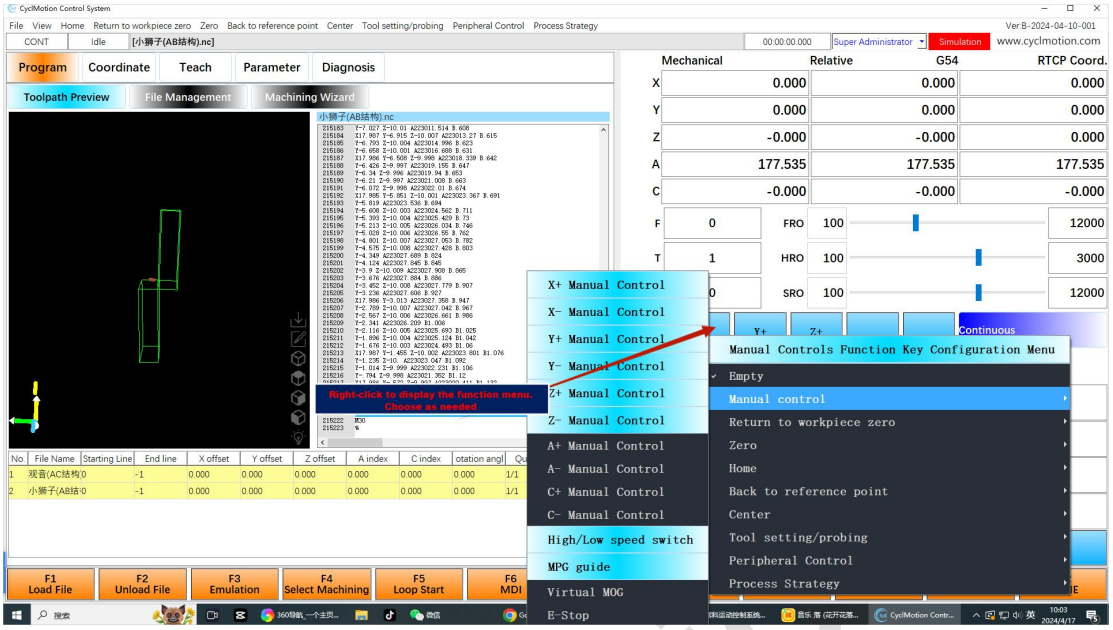


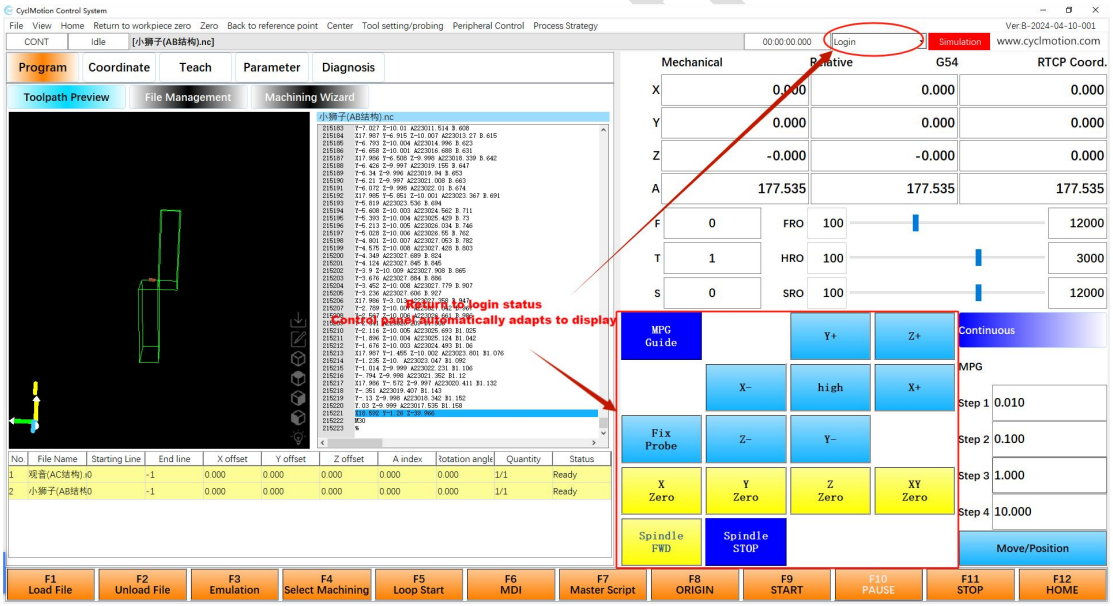
2. Control customization

The functions and positions of controls in the control area can be customized, and up to 36 controls can be displayed:

1) Switch to super administrator;
2) Right click on each control to select the function;
3) Return to login status。







3. Hand wheel guidance

Only valid when online.

Click to switch to handwheel guidance. When selected, it has a dark blue background and enters handwheel guidance mode.

4. Mobile Positioning

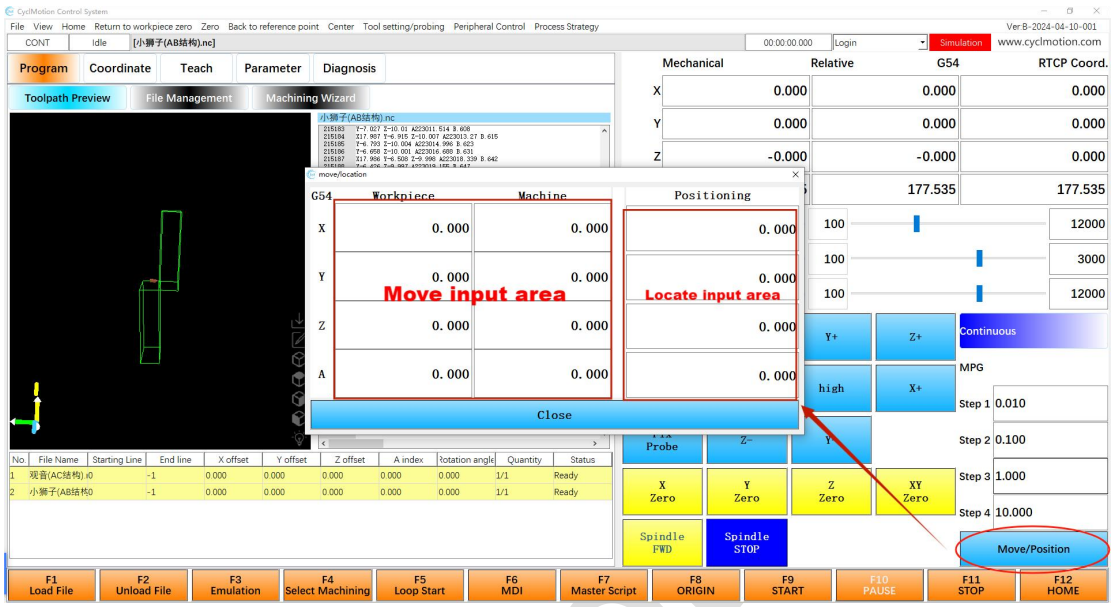
The input coordinate values are all absolute coordinate values.

a) Click Move/Position and a dialog box will pop up. When editing coordinates, you need to press Enter after entering the value.

b) Move: Enter in the workpiece coordinates, that is, move to the specified workpiece coordinate position; enter in the machine coordinates, that is, move

to the specified machine coordinate position.

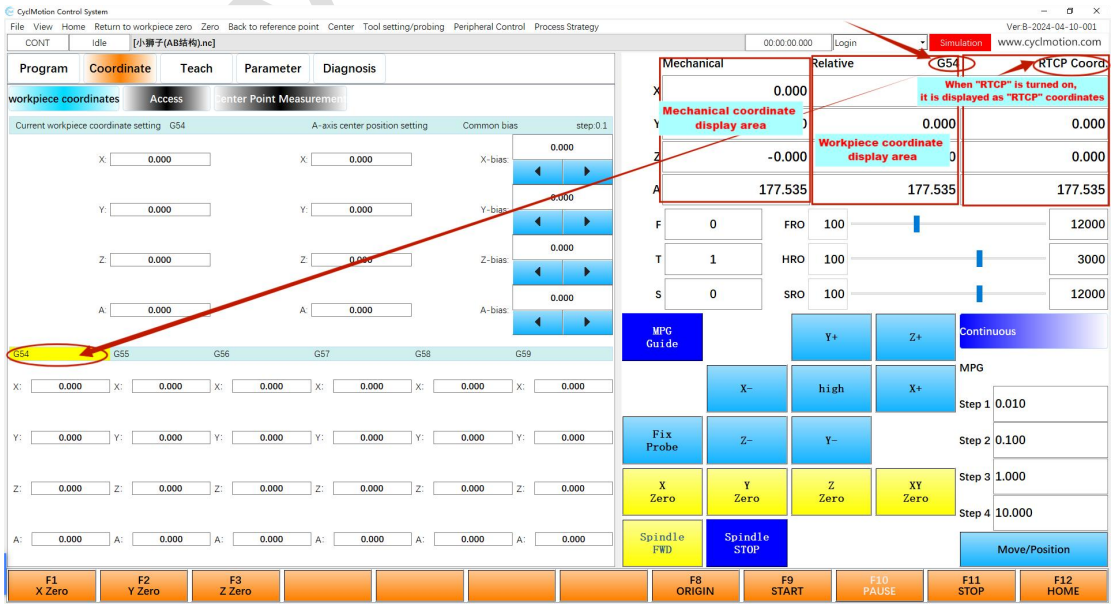
c) Positioning: After the coordinates are input, the workpiece coordinates will be updated to the position.



5. Other Instructions

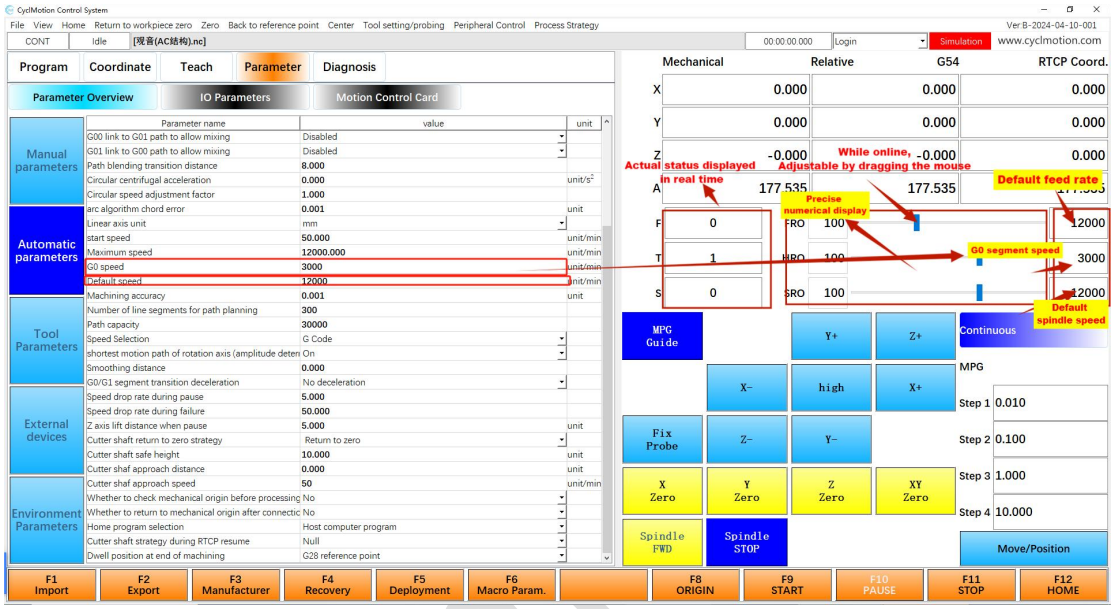
The coordinates display the current mechanical coordinates, workpiece coordinates, and remaining distance. The remaining distance is only displayed when the RTCP function is not turned on. It refers to the distance between the current point and the target point in each G code.

- When RTCP is turned on, "Remaining Distance" will become "RTCP Coordinates"。

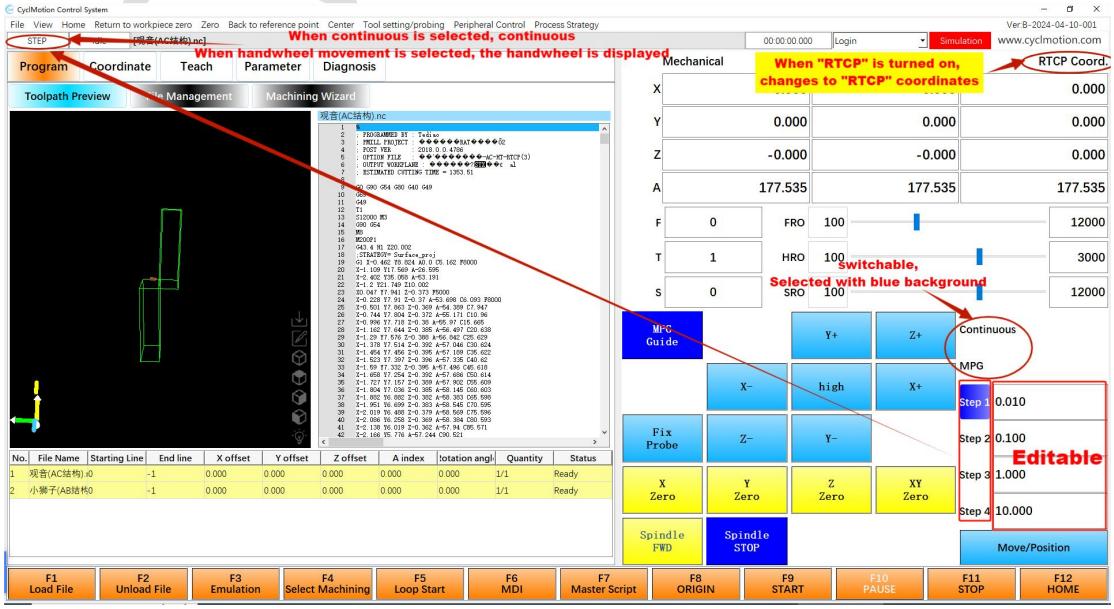


- The feed rate, manual control rate, and spindle rate can be changed by dragging the adjustment bar with the mouse while online, and the values will change accordingly；

- Displayed on the right side of the real-time speed is the default feed rate, which can be set in Parameters - Parameter Overview - Automatic Parameters;
- The speed in the second line on the right is the G0 segment speed, which can be set in Parameters—Parameter Overview—Automatic Parameters.;
- The speed in the third line on the right is the default spindle speed, which is set in Parameters—Parameter Overview—External Devices—Spindle;



- Continuous, handwheel movement, and inching can be switched. The selected one has a blue background, and "continuous", "handwheel" or "inching" is displayed in the status bar.
- There are 4 inching steps available, and the step length of each step can be edited. After editing, press Enter or click elsewhere, and the focus will move to the place where you just edited.



六. Hidden functions

For all hidden functions, press the key combination once to open it and press it again to hide it.

1. Ctrl+Alt+1：Machine tool structure

The machine tool structure subpage appears under the parameter page. In super administrator mode, the machine tool structure and related parameters can be configured.。

1） Choose the appropriate machine tool structure type。

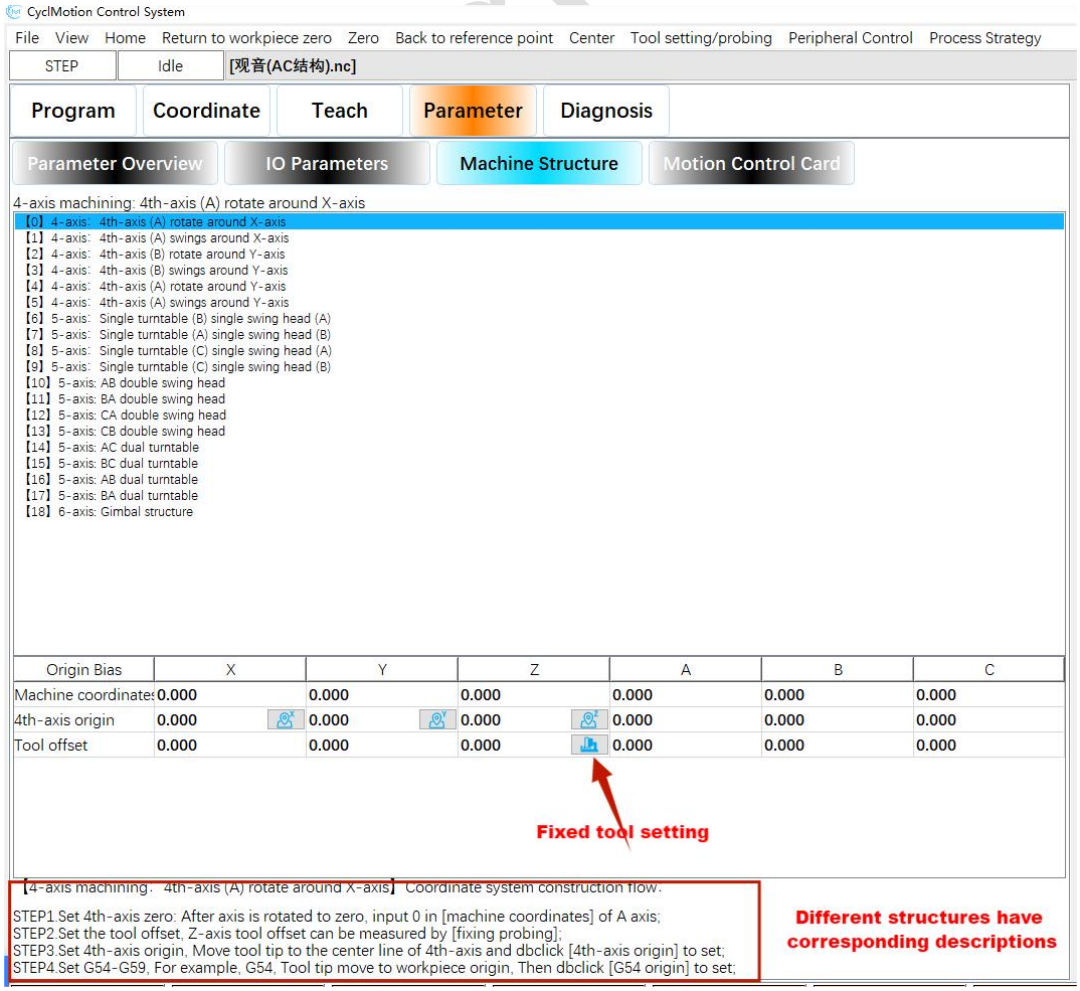
Choose according to the actual machine tool structure. If it is a three-axis machine tool, you can choose arbitrarily.。

2） Set machine parameters。

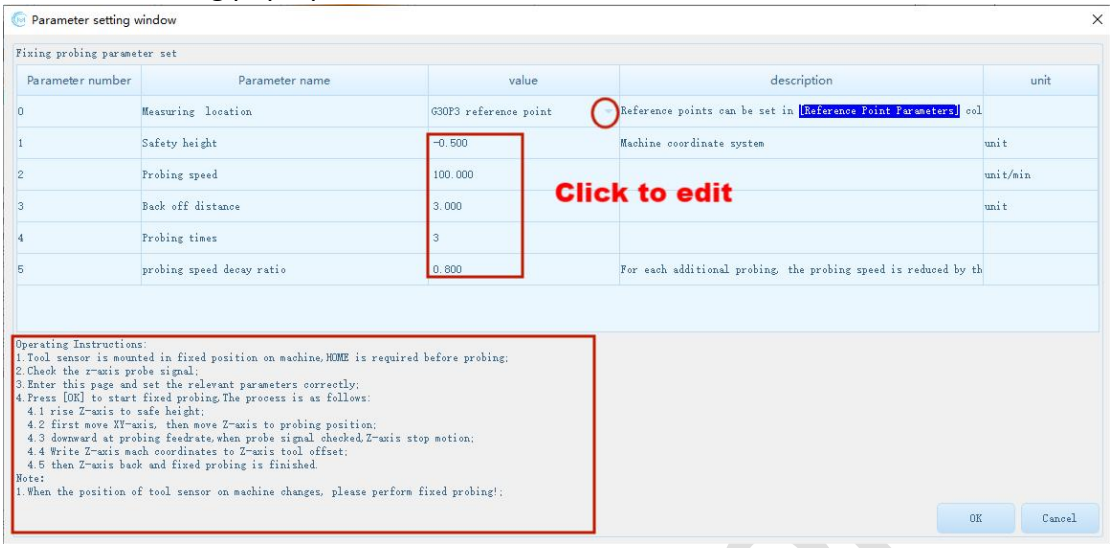
Set according to the actual parameters of the machine tool, so that the simulation display corresponds to the actual machine tool。

Calibration methods are provided below for reference.。

The machine tool model can be replaced with your own machine tool structure stl file。



Fixed tool setting pop-up window：



2. Ctrl +Alt+0：IO Function customization

The IO function customization subpage appears under the parameter page for IO port customization. Including input IO and output IO two sub-pages.

The port number column is divided into green and red. Green means connected and red means disconnected.

1) EnterIO

a) Click the port description (i.e. port name) to edit, and you can customize the port name；

b) Button configuration is only useful when the input port is configured as a button, otherwise it is ignored. Optional normally open, normally closed, edge.

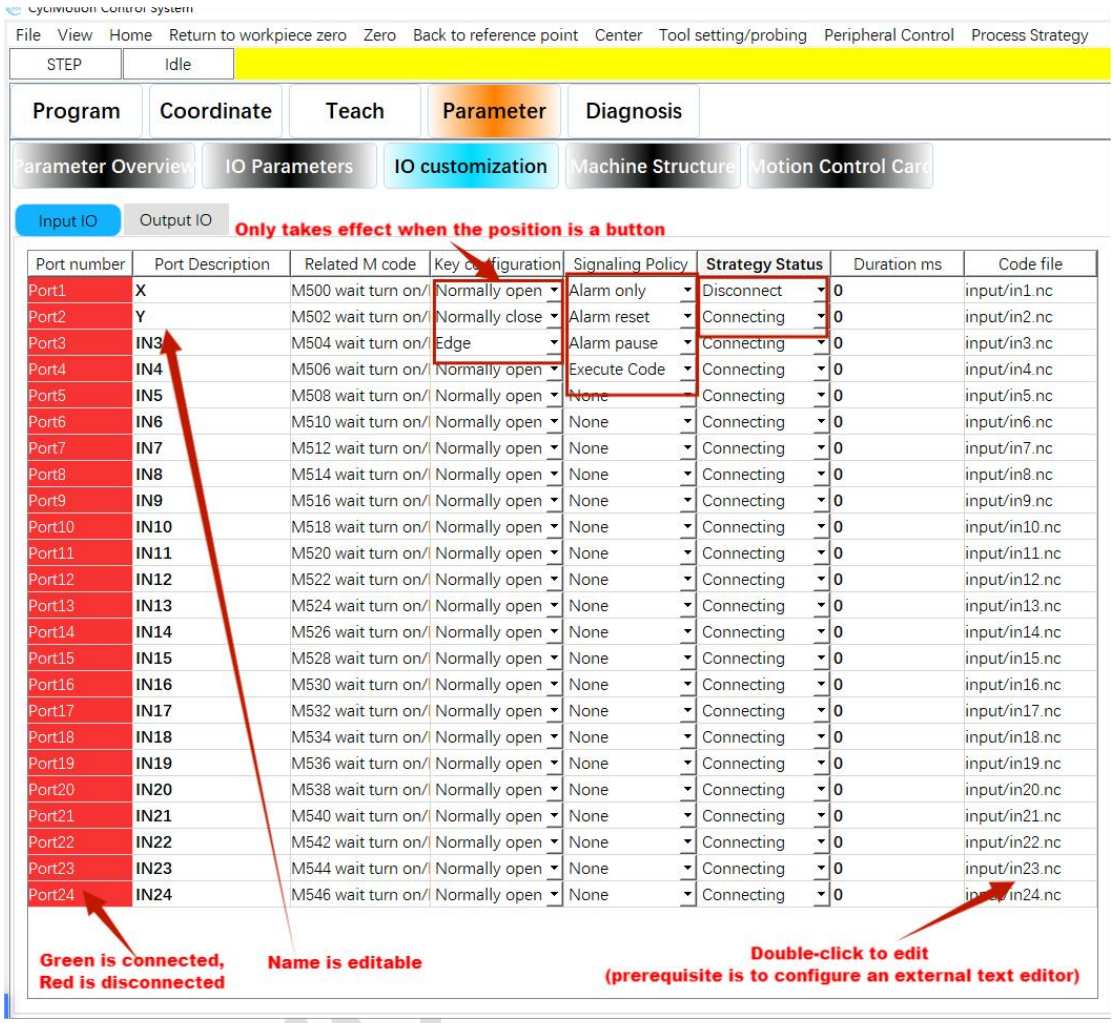
c) Signal strategy optional：

- NO
- Warning only: Alarm when the policy status is not met；
- Warning reset: Warn and reset when the policy status is not met.；
- Warning and suspension: Warn and suspend when the policy status is not met;
- Execute code: Execute the code file in the right column when the policy status is not met；

d) The policy status can be switched on or off；

e) Duration editable；

f) Click the code file to open it for editing, but you need to configure the external text editor first in Parameters - Parameter Overview - Environment Parameters - External Text Editor.



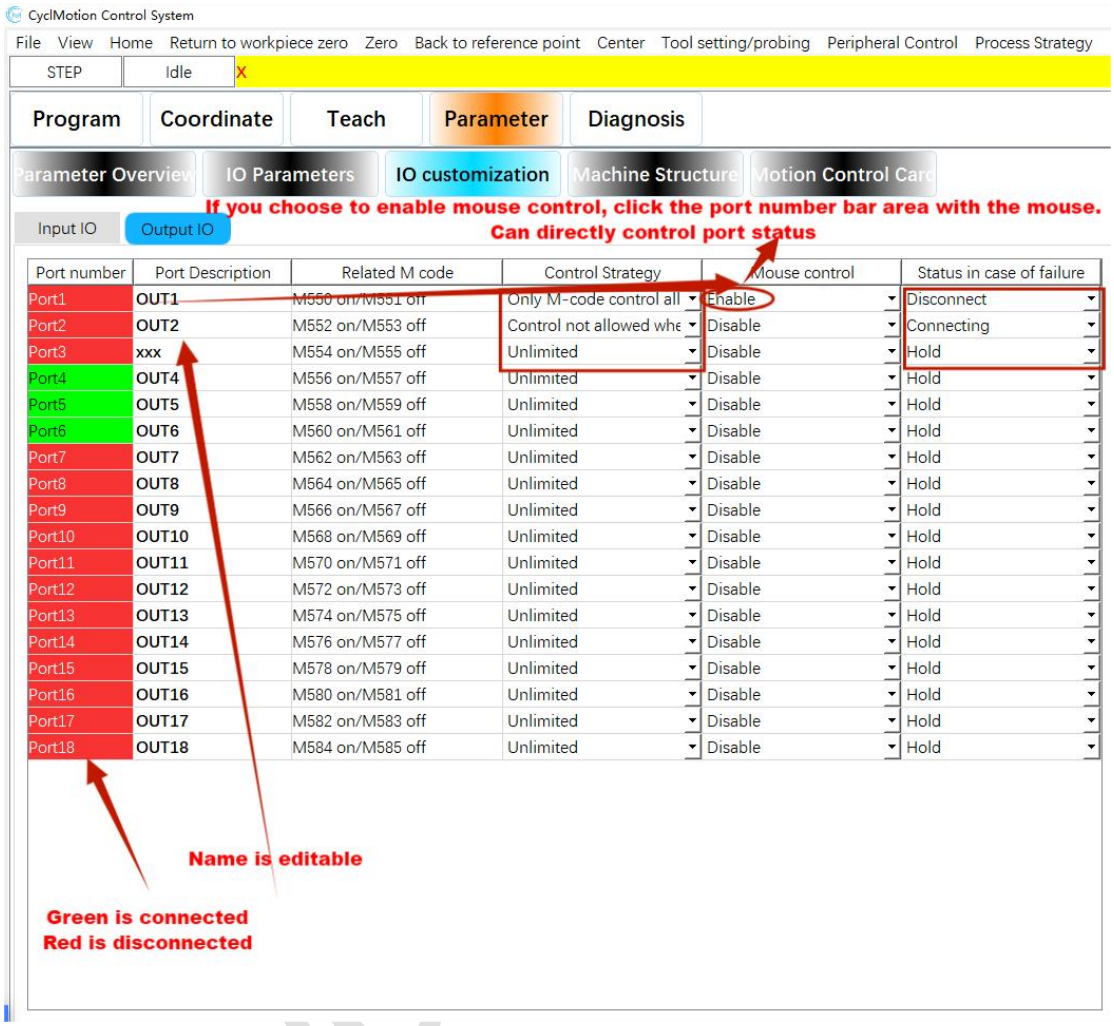
2) Out put IO

a) Click the port description (i.e. port name) to edit, and you can customize the port name;

b) There are 3 control strategies available: unlimited, only M code control allowed during operation, and no control allowed when the spindle is turned on;

c) Mouse control is disabled by default. If you choose to enable it, you can directly control the port status by clicking the port number bar area with the mouse.;

d) Status when a fault occurs: maintain, disconnect, and connect optional.



3. Ctrl +Alt+9：Teach

A teaching page appears in the main page bar to realize parameterized programming.

1) Instructions

- Choose different instructions and set parameters according to your needs；
- Click Generate Line of Code, and the instruction line will be generated on the Tutorial-Program subpage.；
- After all command lines are completed, click Load Code and it will be loaded in the G code display area of the main page.。

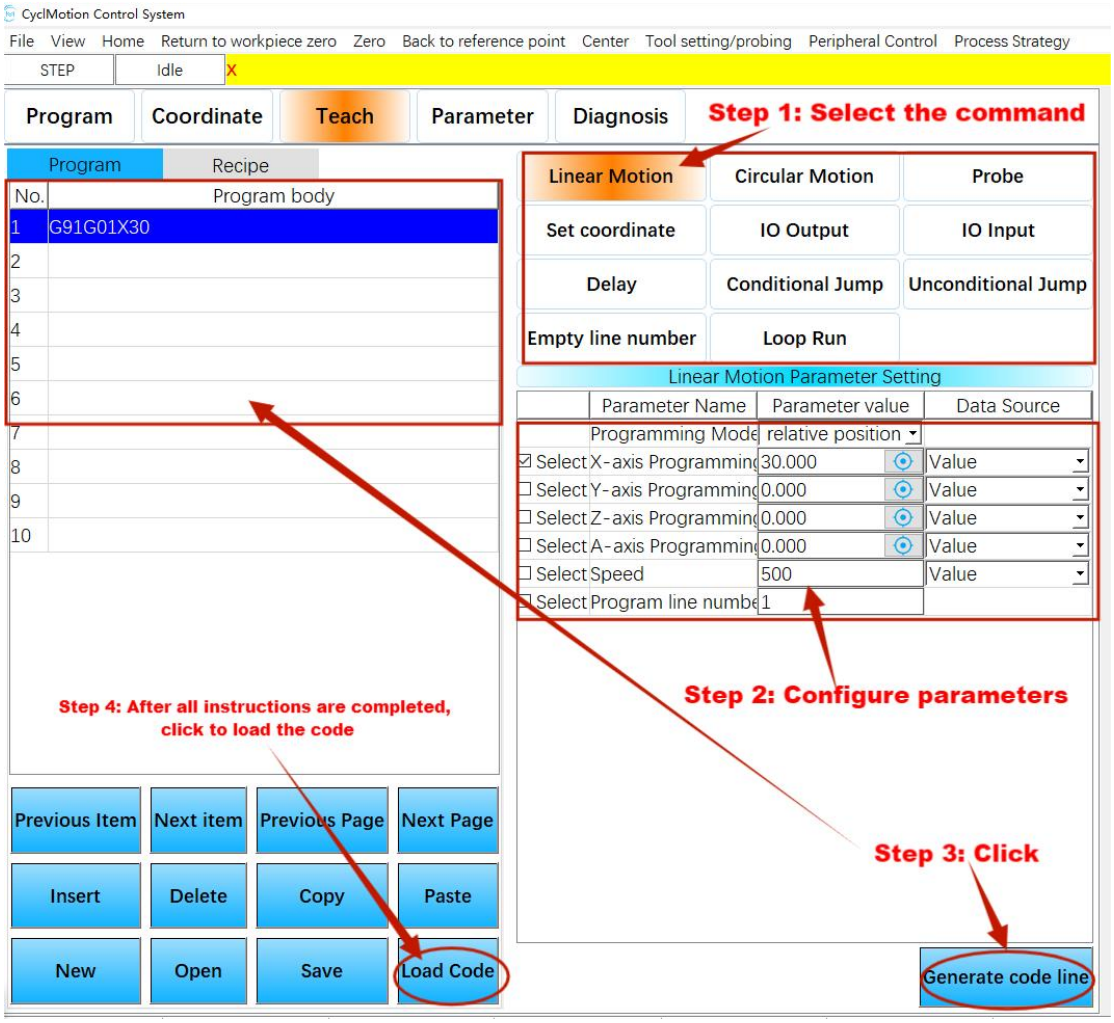
Note: Function keys at the bottom of the teaching-program page：

a) Previous item/next item, previous page/next page, insert, delete, copy, and paste are operations performed on the command line of the current program.。
b) New, open, and save are operations on the current program.。
c) New will prompt you to save the current program, otherwise it will be cleared.。

d) The saving path can be defined arbitrarily. If the saving is successful, a prompt box "File has been saved" will appear.。

Notice：

- When there are multiple lines of code, if the speed is set previously, subsequent programs will follow the speed specified most recently.。
- If the entire speed remains unchanged, there is no need to set it here. It will move according to the default moving feed speed (in the parameters)；



2) Recipe parameter application

There are two types of data sources, directly specifying values or indexing with recipe parameters. Recipe parameters can be set on the recipe parameter table page.。

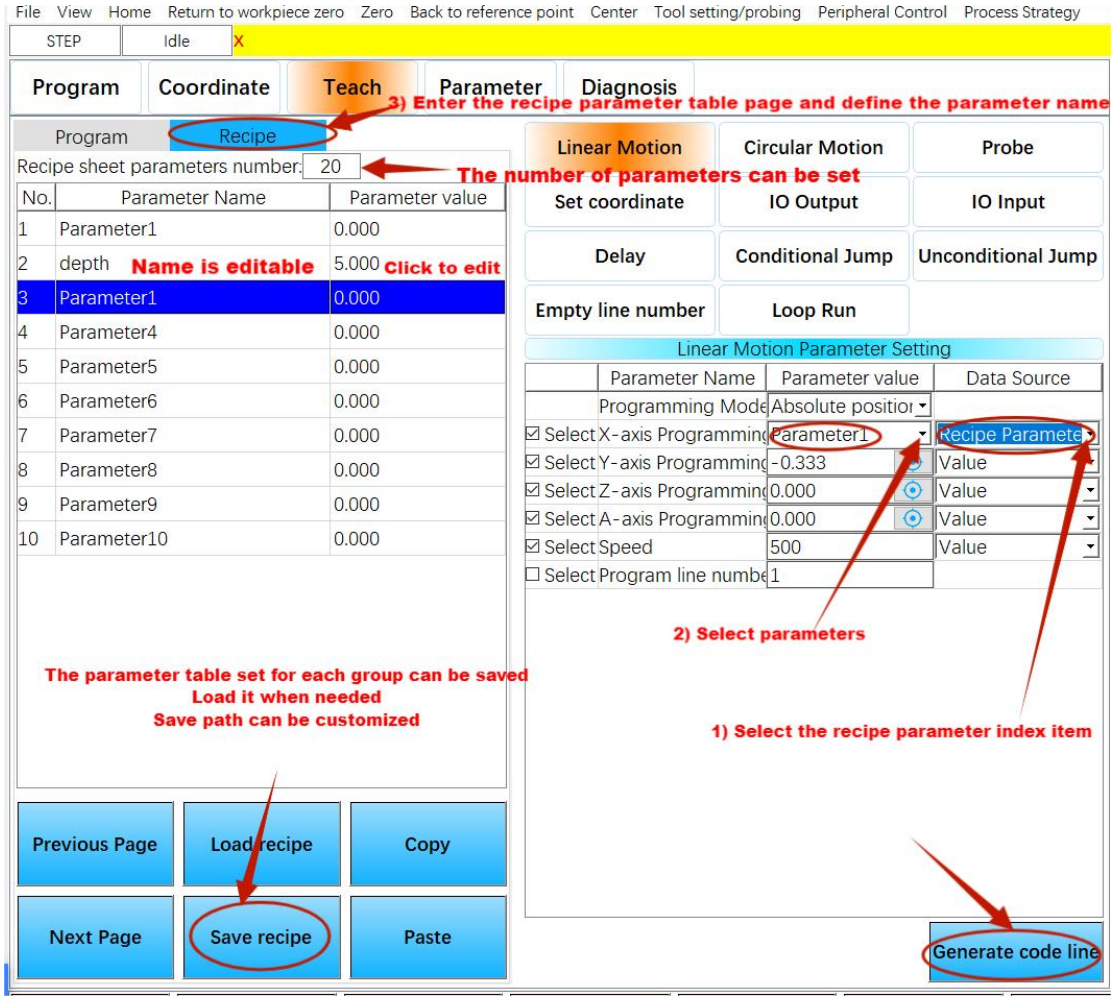
The recipe parameter function is equivalent to introducing variables into the instruction. Flexible use of the recipe function can increase the versatility of the program and reduce the amount of program changes.。

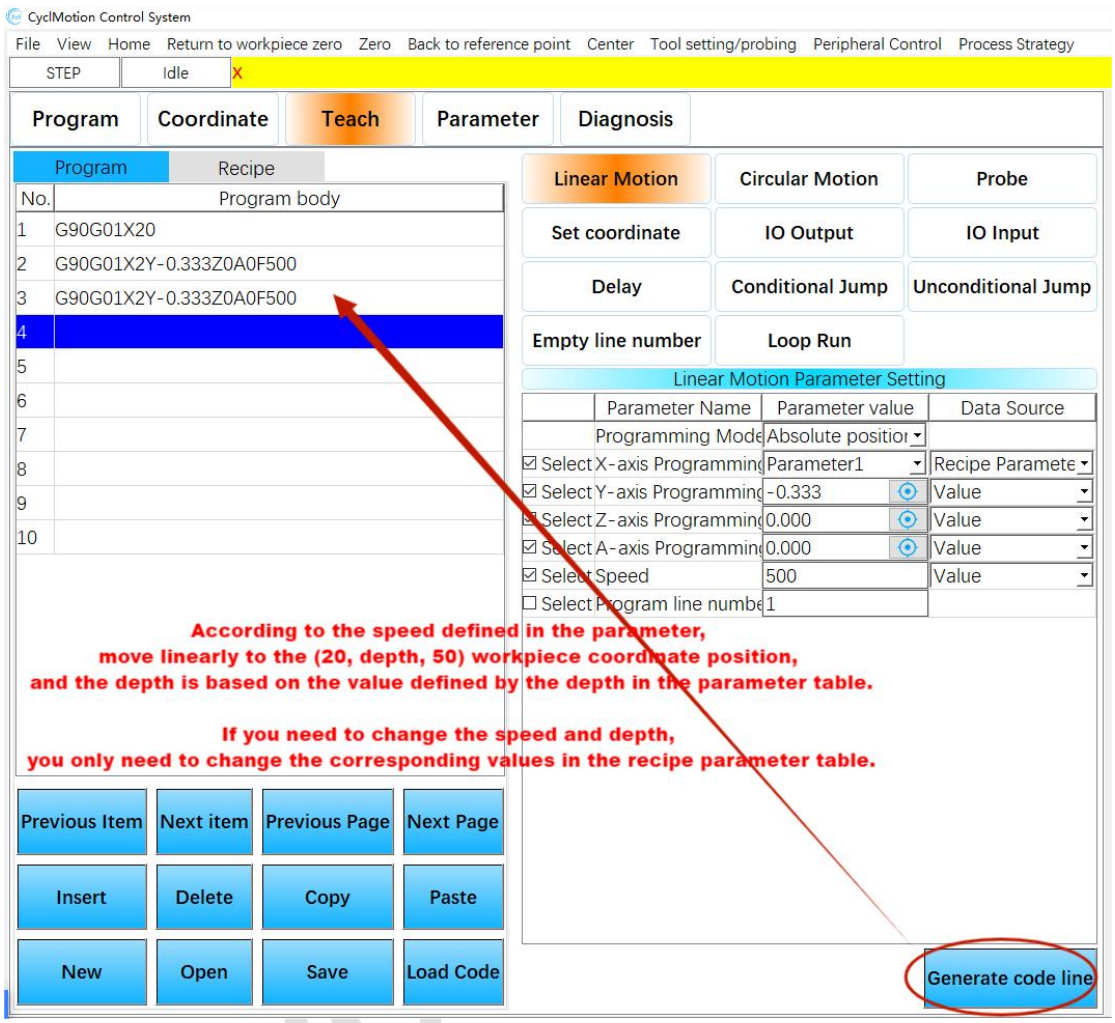
- The number of parameters can be edited. If you change the number, the number

in the list below will change accordingly. You can click "Previous Page" below , "Next page" to turn the page to view.

- The parameter name can be customized. After the name is changed, the command page options will also be changed accordingly to facilitate identification.
- Parameter value can be edited by clicking on it。
- Each set of parameter values can be saved as a recipe, and different recipes can be loaded into different plans. Save path can be customized.

Take the linear motion command as an example, see the figure below.



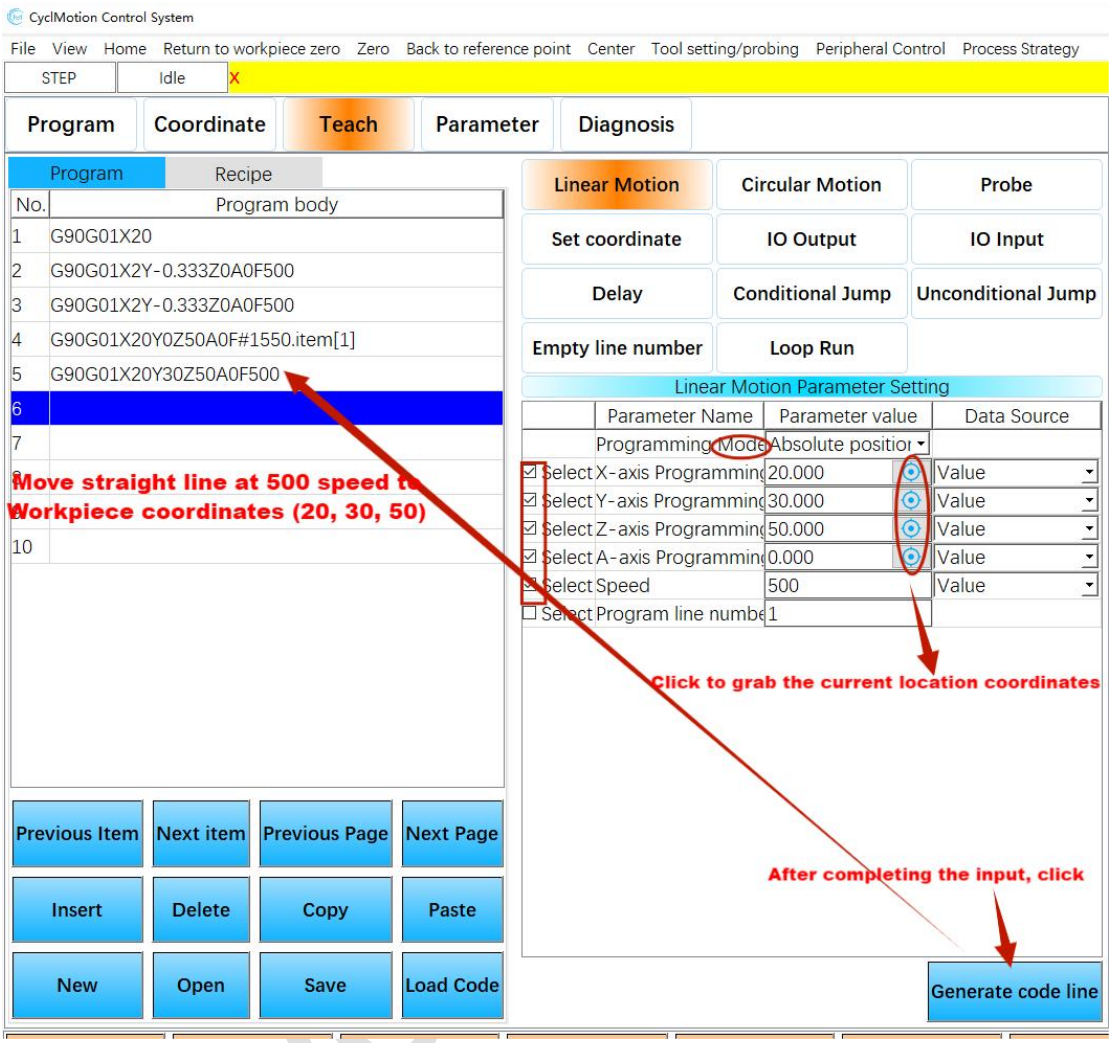


3) Instructions introduction

When the display is incomplete, you can drag to the right to adjust the size of the main page.

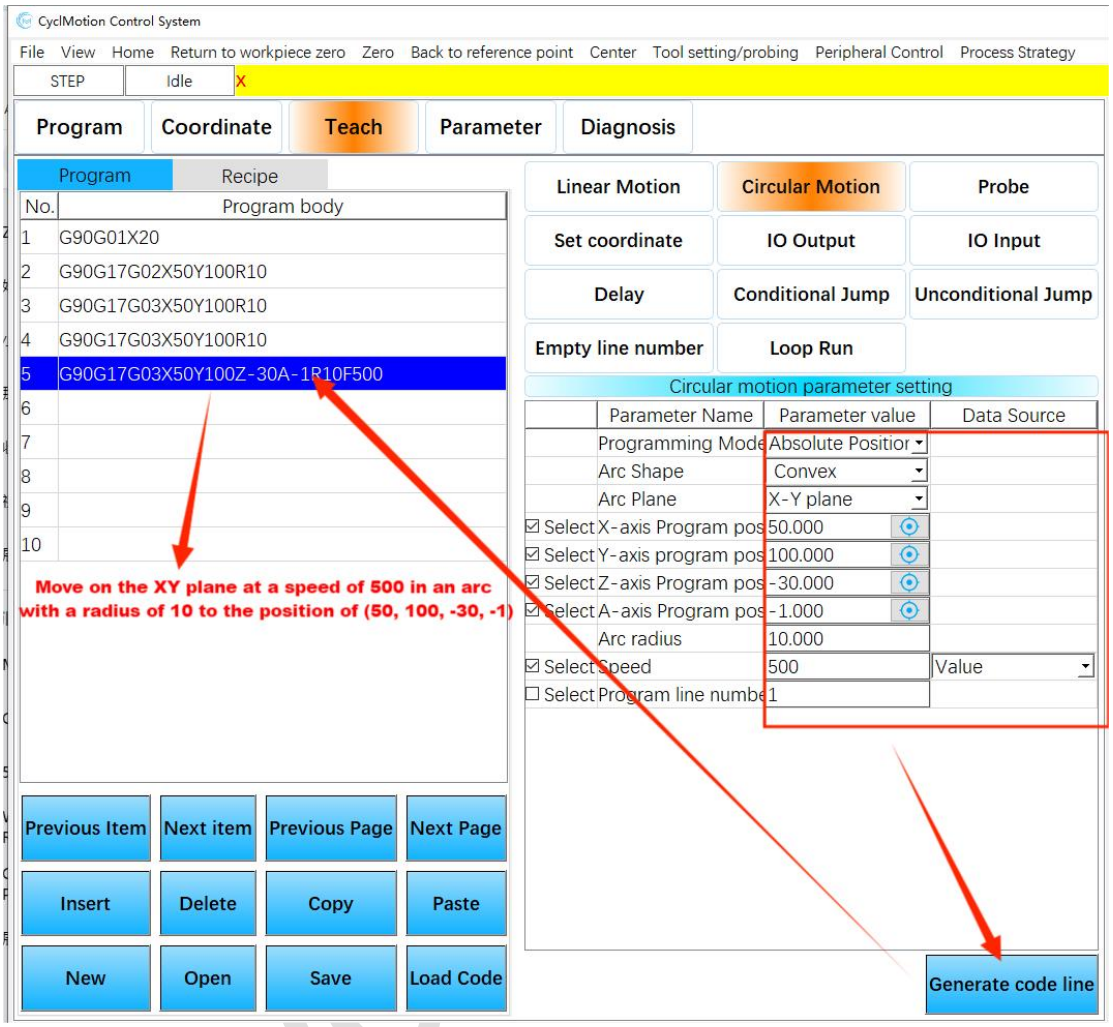
a) Linear motion command

- Move straight to the specified position at the specified speed;
- When the data source selects a value, you can enter it directly, or you can click the icon on the right to grab the current position.The same below;
- Can move 4 axes at the same time. The same below;
- Modes can be selected: workpiece absolute position, relative position, mechanical absolute position;
- Axes 1-4 here correspond to the XYZA axis respectively. The same below;
- The program line number only needs to be set when conditional jump is required. After selection, Nxx (xx is the line number) will be added before this instruction. The same below;



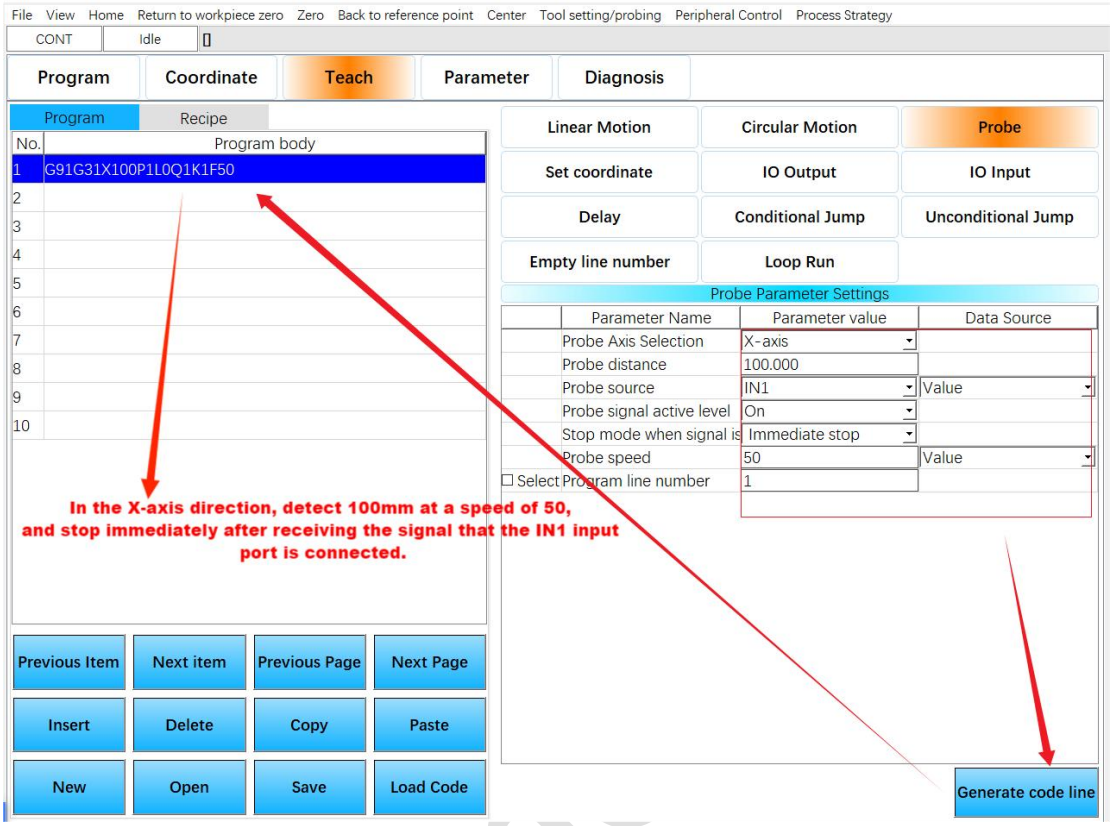
b) Arc motion command

- Draw an arc at the specified speed and move to the specified position;
- Can specify whether it is a convex arc or a concave arc.



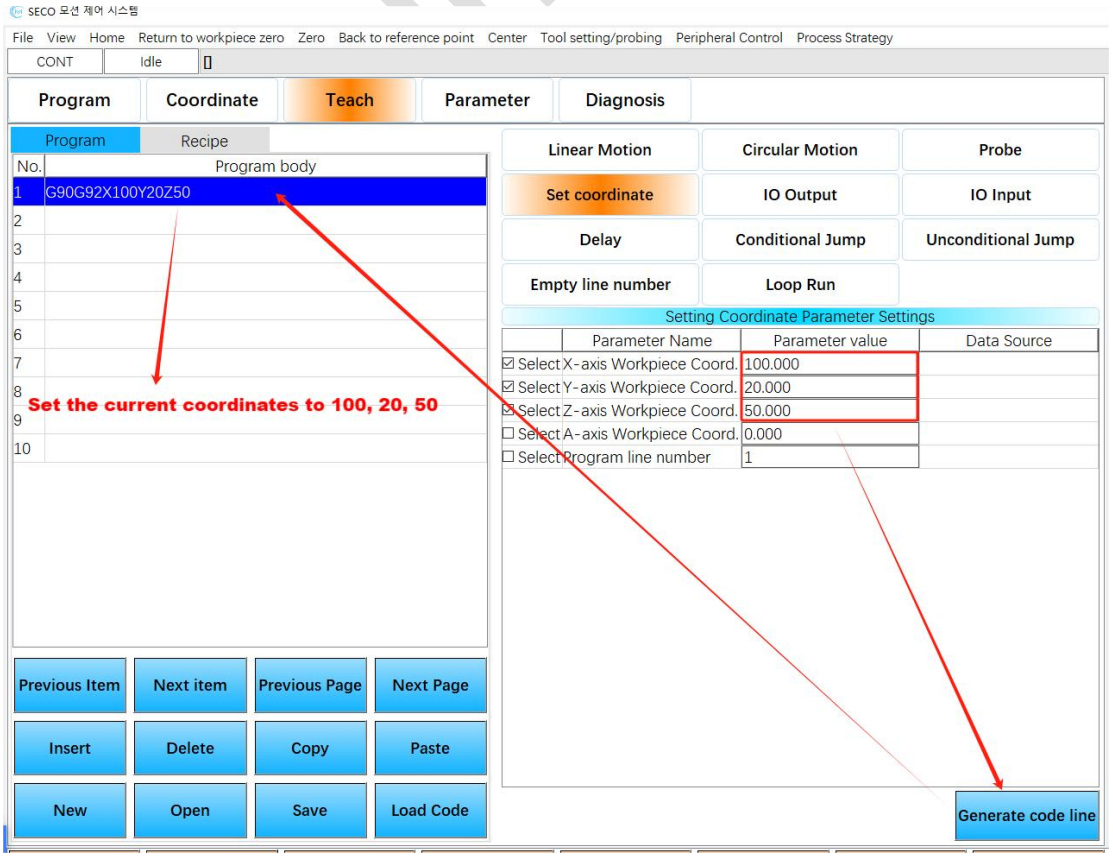
c) Detection command

- Detect signals in the direction of the selected axis at a specified speed;
- The detection distance can be edited by clicking on it. If you need unlimited detection, you can enter a large enough distance.;
- When the detection signal source is a numerical value, you can pull down to select the input signal IN1-24, which corresponds to the input port number. The name can be changed in the hidden function-IO function customization;
- Stop mode when a signal is detected, including immediate stop and deceleration stop;



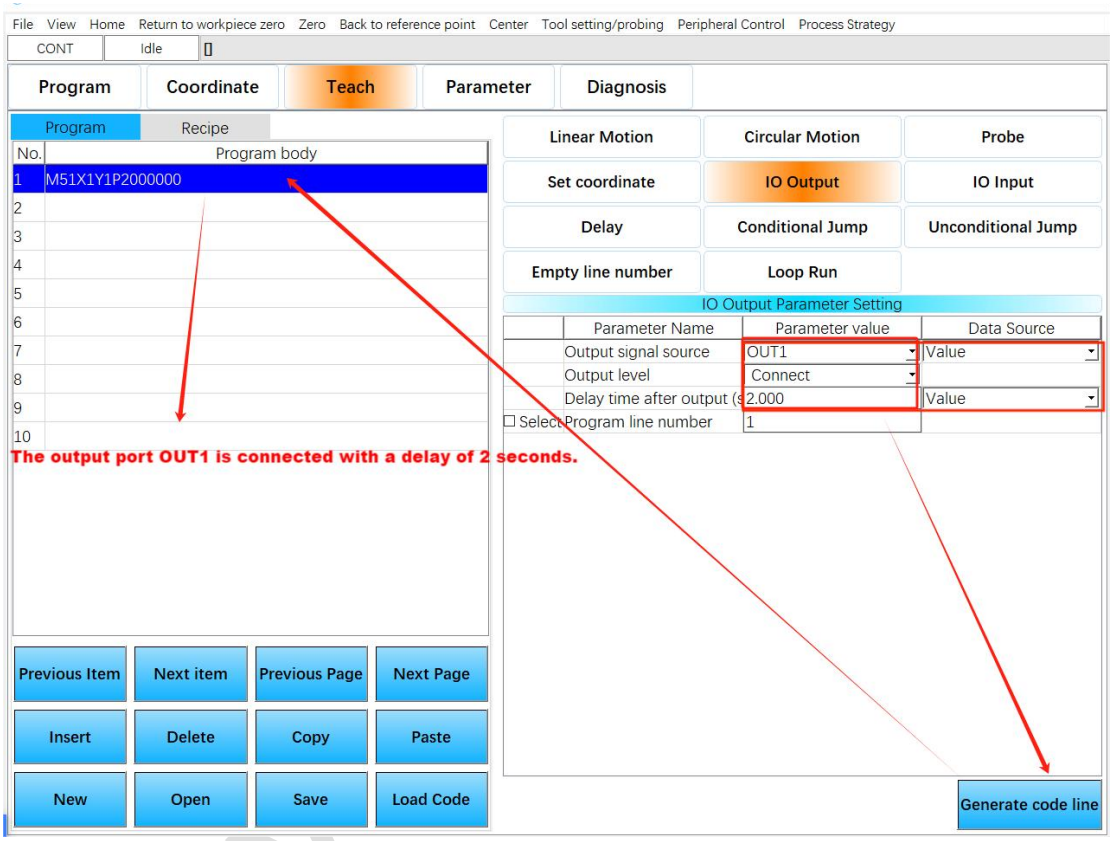
d) Set coordinate system command

- Change the current workpiece coordinates;



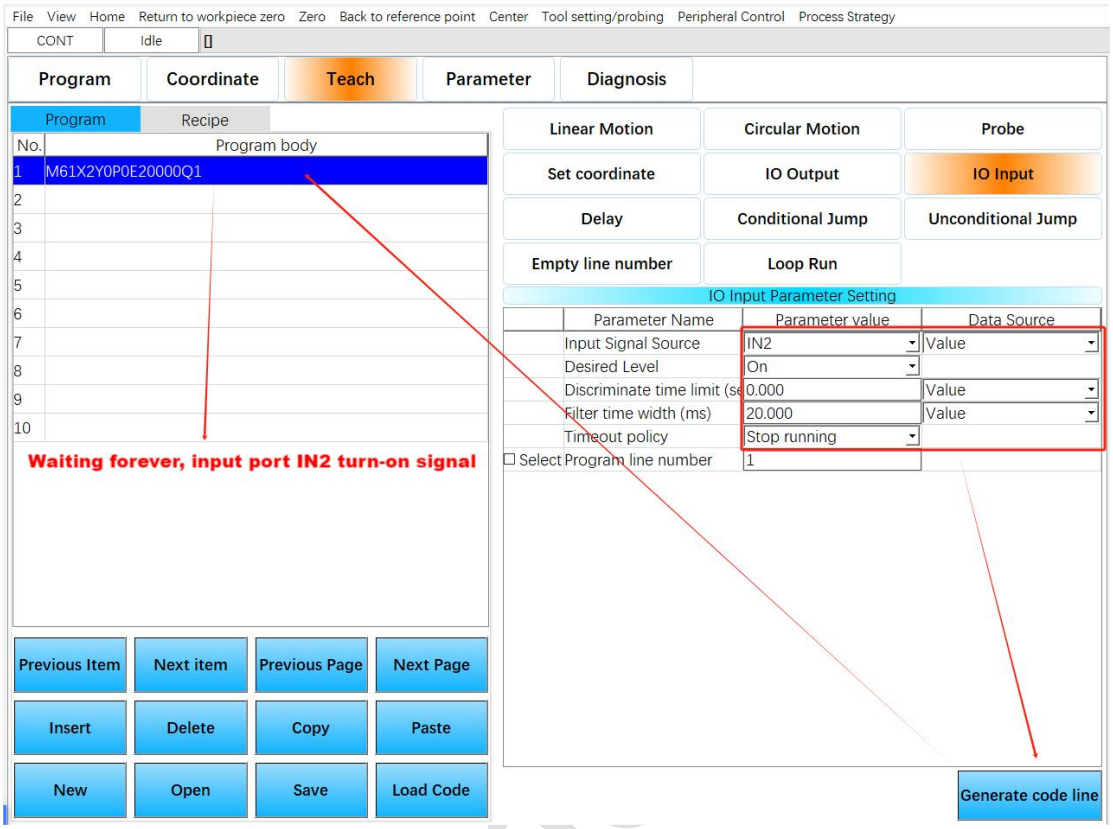
e) IOOutput integration instructions

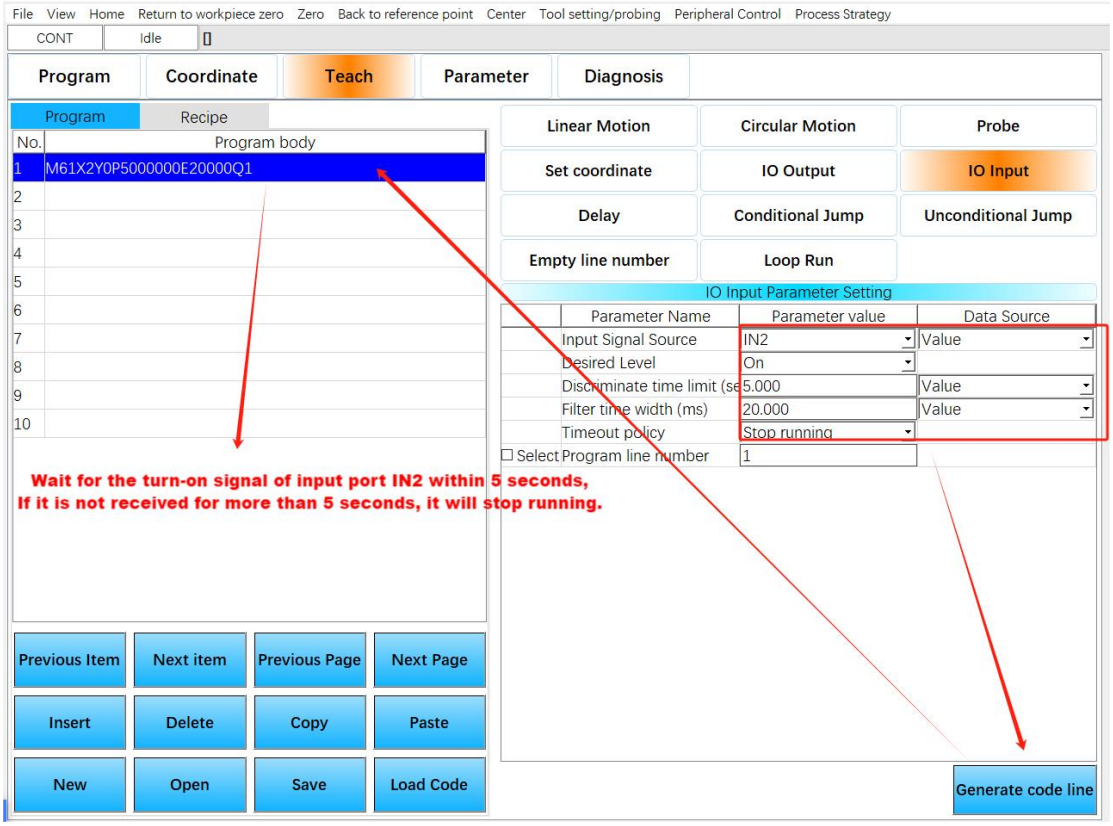
- The output signal source pull-down selectable output port number, the name can be changed in the hidden function-IO function customization；
- Tip: You can select a recipe as the data source of the output signal source, and define the signal name in the recipe parameters for easy identification. In this way, when the port is replaced, only the parameter values need to be changed, and no instructions need to be modified。



f) IO Enter integration instructions

- If the judgment time is 0, it means waiting forever. If it is set to 5, it will wait for 5 seconds and then follow the timeout processing policy.；
- The filtering time width is generally 20 by default.；
- Timeout processing strategy can optionally continue running or stop running.；





g) Delay command

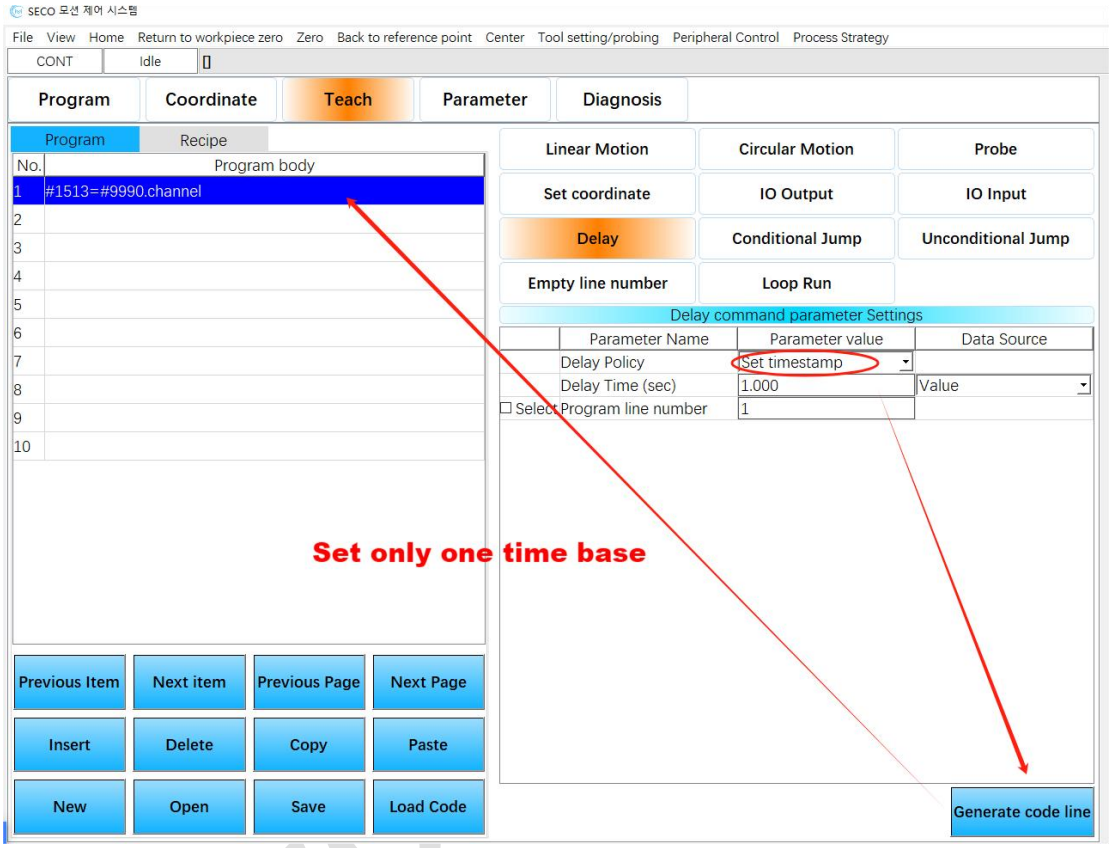
Generate delay instructions。

Delay strategy optional：

- Single line delay: Start timing with this instruction line, delay for the set

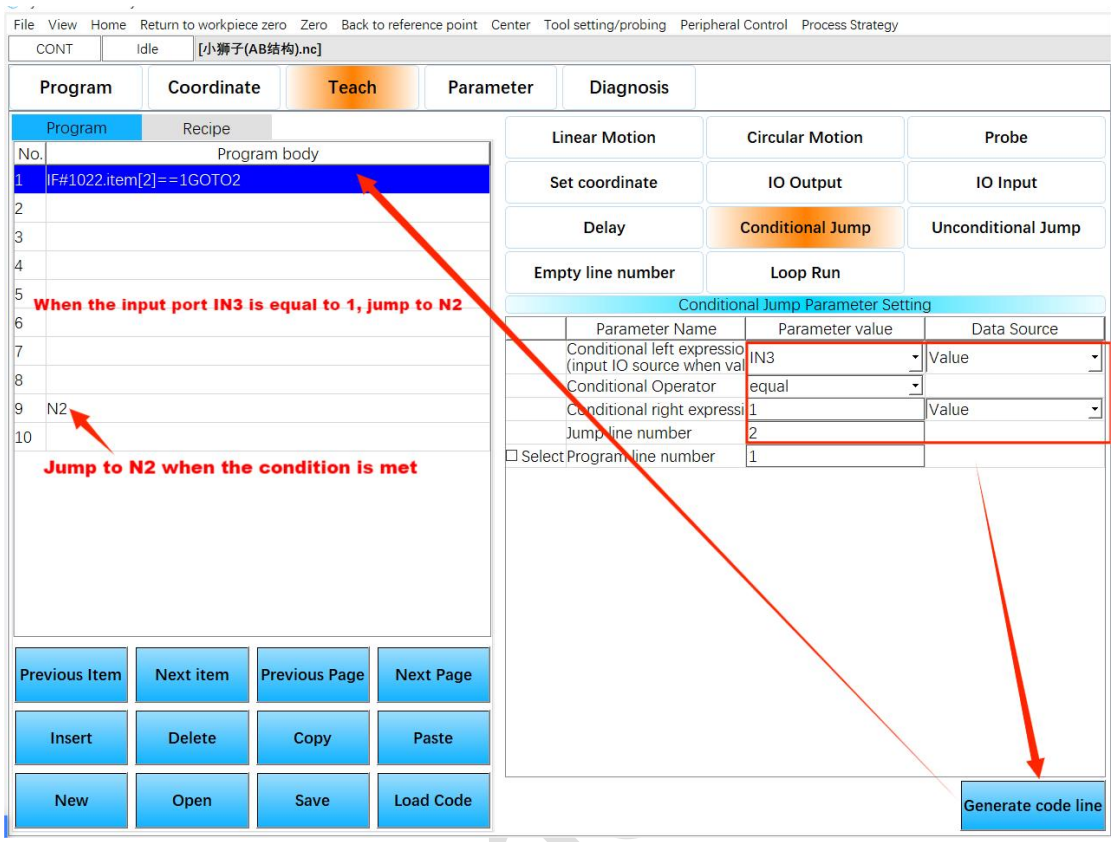
time, and continue to execute the next instruction.;

- Set timestamp: use this command line time as the reference point and use it with paragraph delay. The pause time setting is ignored under this policy;
- Paragraph delay: The delay time is the time from "set timestamp"。



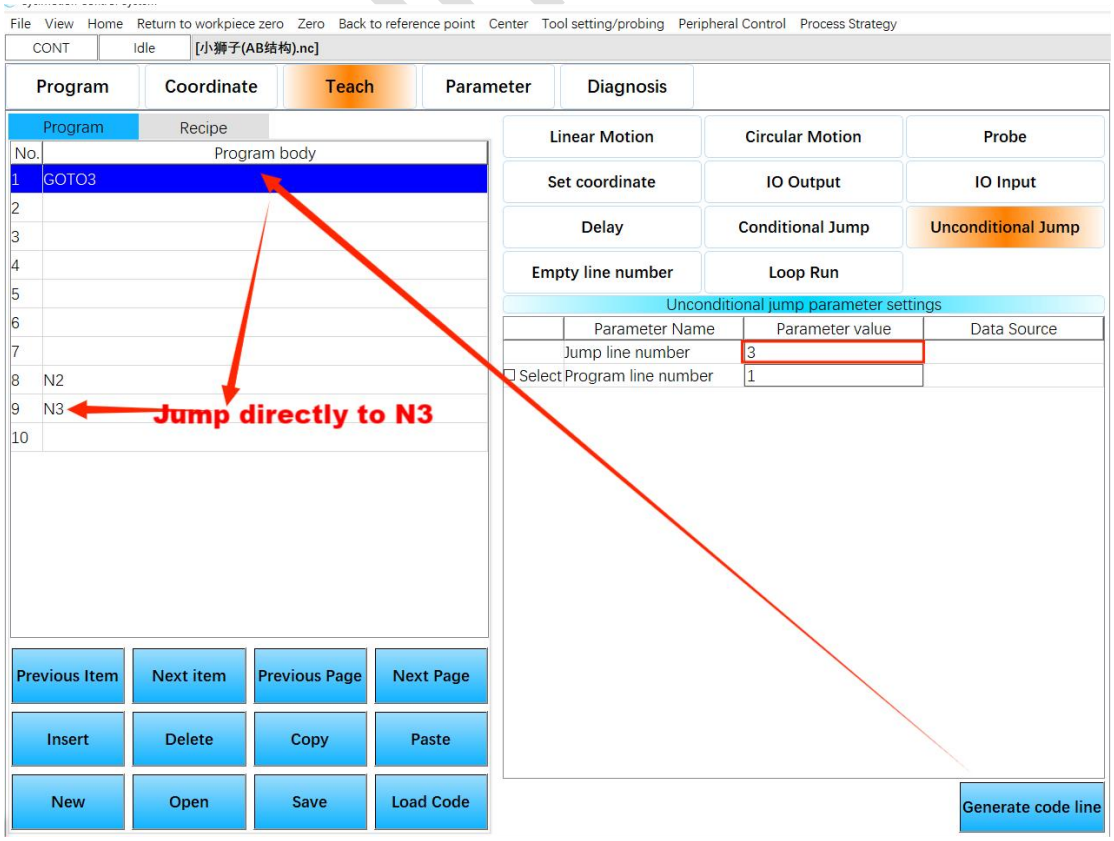
h) conditional jump instruction

- When the condition is met, jump to the specified line; when the condition is not met, execute the following instructions sequentially。



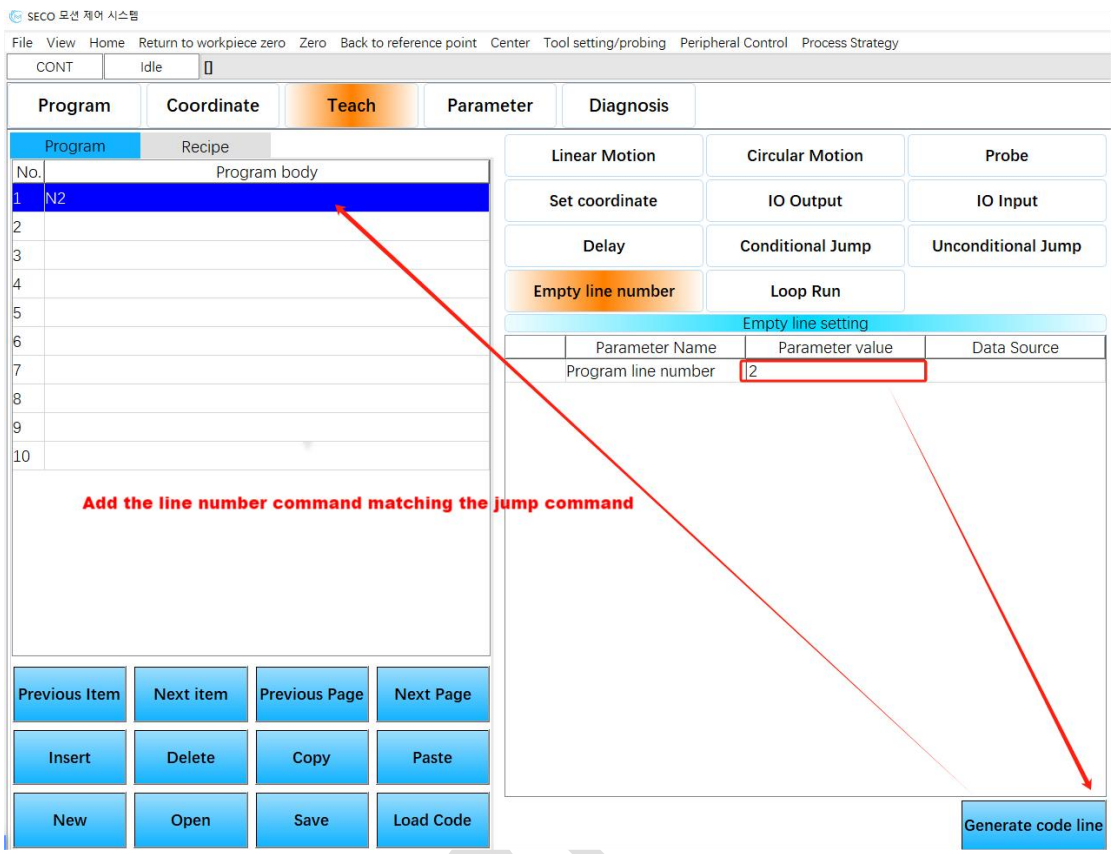
i) Unconditional jump instruction

- Generate GOTO instructions。



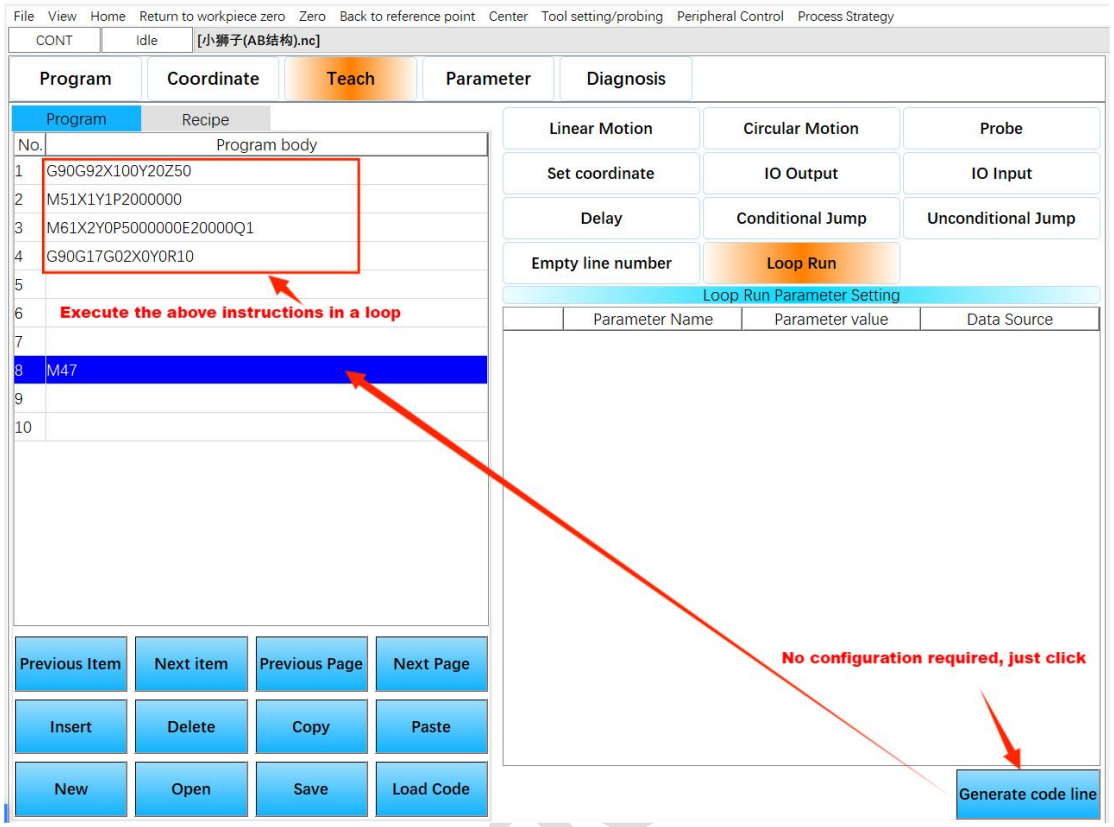
j) Blank line number

- Generate jump line number instruction Nxx (xx is the jump line number)。



k) Loop operation instructions

- There is no setting content. Click directly to generate the code line to complete adding the loop operation instruction.;
- Note that this instruction can only be used at the end, and only loops all instructions before this one.;
- Click the "Cycle Start" function key on the home page, or select the function menu "Processing Strategy" - Cycle Processing, and you can configure the number of cycles;


File View Home Return to workpiece zero Zero Back to reference point Center Tool setting/probing Peripheral Control Process Strategy
CONT
Idle
[小狮子(AB结构).nc]
Program
Coordinate
Teach
Parameter
Diagnosis
Program
Recipe
No.
Program body
1 G90G92X100Y20Z50
2 M51X1Y1P2000000
3 M61X2Y0P5000000E20000Q1
4 G90G17G02X0Y0R10
5
6
7
8 M47
9
10
Execute the above instructions in a loop
Linear Motion
Circular Motion
Probe
Set coordinate
IO Output
IO Input
Delay
Conditional Jump
Unconditional Jump
Empty line number
Loop Run
Loop Run Parameter Setting
Parameter Name
Parameter value
Data Source
No configuration required, just click
Previous Item
Next item
Previous Page
Next Page
Insert
Delete
Copy
Paste
New
Open
Save
Load Code
Generate code line