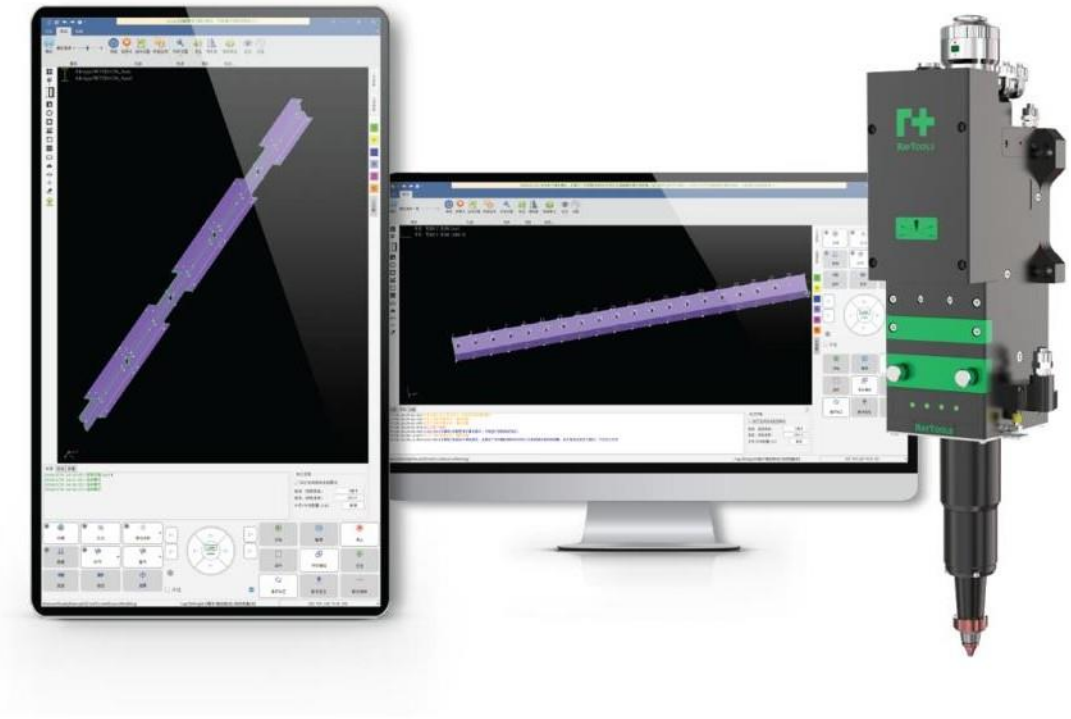
RAYTOOLS

XC4000T SERIES

Tube Cutting System - User Manual



Document History

Edit date	Version	Topic, revision, action taken
2024/9	V1.0	First edition

Thank users for choosing our product!

This manual describes the installation and commissioning of tube cutting system in details so that users can use this product quickly. Users can consult us directly for more details.

Due to the continuous updating of product functions, the product users receive may differ from the introduction in this manual in some aspects.

If users find any errors in this document, please inform us as soon as possible. The data contained in this manual is only used to describe the product and shall not be regarded as a statement of security interest.

For the benefit of our customers, we will constantly try to ensure that the products we develop comply with the latest technology.

Raytools AG

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Disclaimer

- We reserve the right to change the design in order to improve the quality or expand the application or comply to manufacturing workmanship.
- We will not bear any responsibility for losses and accidents caused by wrong operation or improper handling of our products.
- Dismantling of product will lose all warranty claims excluding the normal replacement of worn parts and components required for maintenance or commissioning operations.
- Unauthorized modification of products or use of non-original spare parts will directly lead to the invalidation of warranty and liability exemption.
- It is recommended to only use the spare parts provided by us or submit them to us or the designated professional team for installation.

Use Regulations

- Ensure that the product is used in a dry environment.
- Ensure that the product is used in the environment required by EMC standards.
- The product is only allowed to run within the parameters specified in the technical data.

Personnel Responsibilities

- Be familiar with the basic provisions of work safety & accident prevention and have received equipment operation guidance.
- Read and understand basic safety instructions and operations.
- Users must have studied the relevant regulations and safety instructions and understand the possible hazards.
- Comply with relevant regulations and implement corresponding protective measures.

Safety Instructions

Prevent Electric Shock

-  Parts of the laser head such as nozzle, sensor, sensor interface and attached fasteners may not be fully protected by the ground wire due to function fault. These parts may have low voltage. When installing electrical equipment, please pay attention to taking anti electric shock measures for relevant personnel.
-  Note that the equipment shall be grounded as specified.

Guard against Danger

- Never put usersr hands or other body under the laser head.
- Repair and maintenance work can only be carried out after the power is turned off.
- Do not exceed the specified maximum pressure.
- It must be ensured that the laser head is in normal condition at all times.
- All fasteners such as bolts and nuts must be tightened.

 **Laser Caution**

- Avoid direct laser radiation or scattering to the skin.
- Do not stare at the laser beam even when wearing optical equipment.
- Use special laser protective eyeglasses that meet the requirements of safety standards IEC 60825-1.

Prevent Waterway Corrosion

- In order to avoid corrosion, use the specified coolant and comply with relevant requirements and specified maintenance intervals.

Noise Prevention

- The corresponding measures shall be specified or explained and observed in order to prevent personnel from being harmed by noise when the cutting air pressure is high.

Storage and Transportation

- Observe the storage temperature range allowed by the technical data.
- Take reasonable measures to prevent fire, vibration or impact.
- Do not store in or near the magnetic field.

Contents

1. Quick start

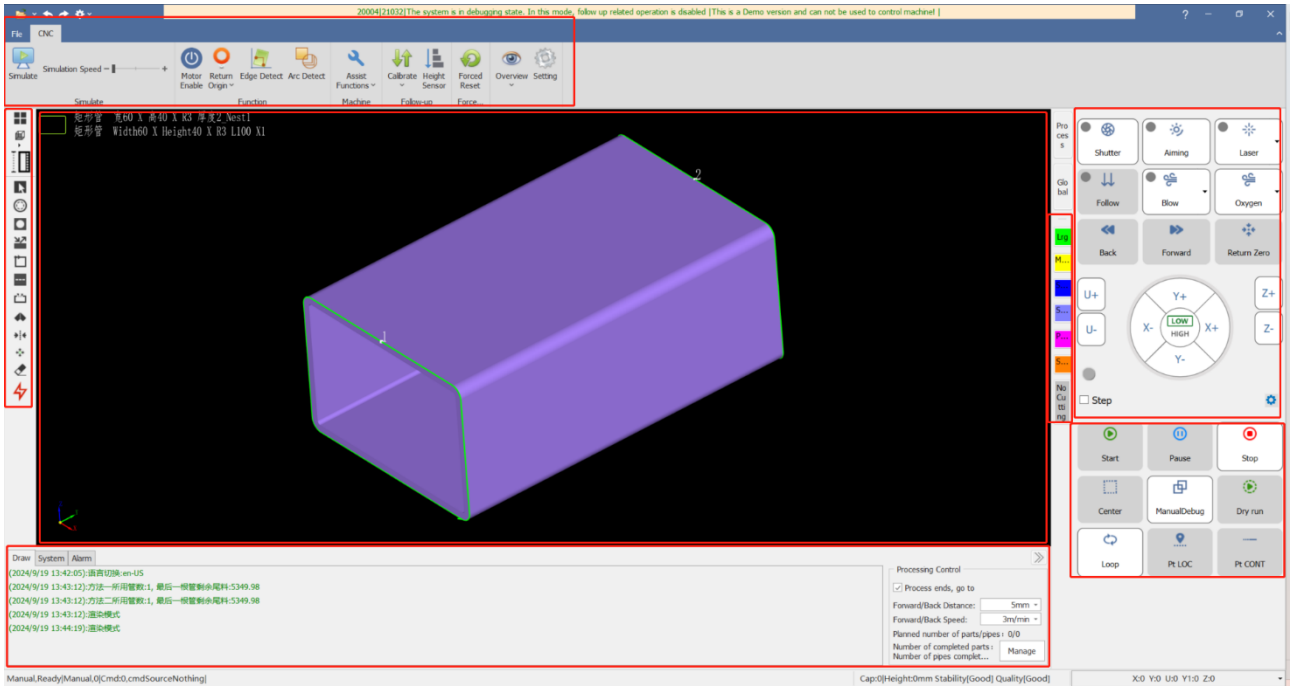
1.1 Open the software

After the software is installed, this icon 

will appear on the desktop. Double-click the left mouse button to run the 3DCutAhead2.0 laser cutting control software to use the software.

2. Introduction to CNC application functions

The main interface of the software is one of the common interfaces, and there are many operation areas as shown in the figure below:



1) **Commonly used toolbars**

2) **Part function shortcut area**

3) **Part graphic display**

4) **Operation usage log**

5) **Cutting motion bar**

6) **Coordinate display column**

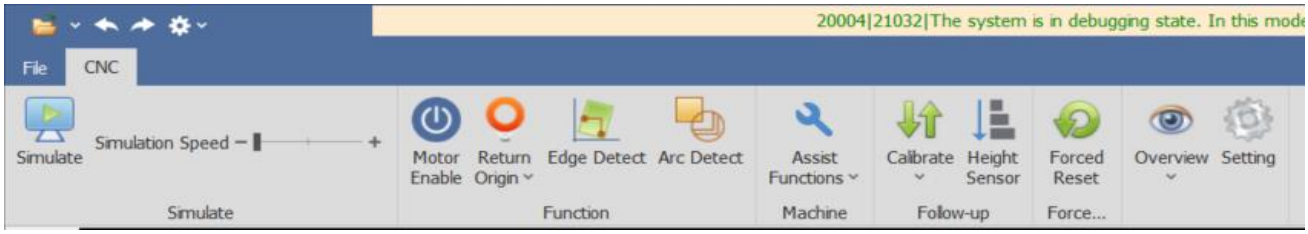
7) **Follow-up control bar**

8) **Process parameter column**

9) **Layer Application Bar**

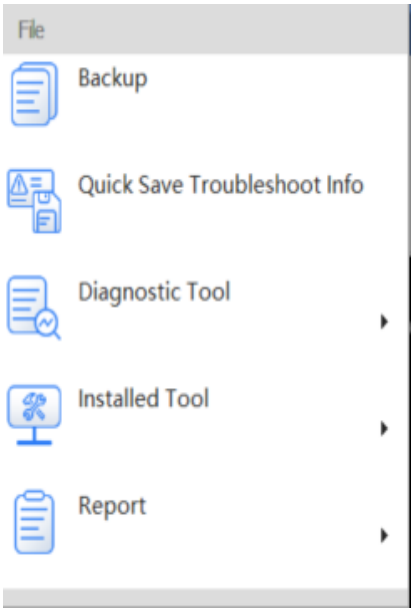
2.1 Common Toolbars

As shown in the figure below, the entire toolbar is divided into two interfaces: CNC and file, etc.
Select different paging to render different contents.



File: The file interface contains software parameter backup and fault information saving.

2.2. 1 File



1 Backup: After mechanical debugging, use this function to make a backup of the debugged parameters to prevent unexpected parameter loss.

2 Quick Save Troubleshoot Info: When there is an abnormal problem during the use of the software, users can save the fault information to facilitate viewing the fault problem points.

3 Diagnostic Tool:

a. pendant detection: mobile APP handheld detection.

b. Io monitoring: monitor board point input and output signal, gas and laser, etc.

c. Capacitance sensor: check standard capacitance curve view, real-time capacitance curve jump.

d. Hardware information: check slave communication information.

e. Gas DA correction: oxygen, nitrogen, and air pressure correction.

f. Machine tool coordinate information: check machine tool coordinates, workpiece coordinates, workpiece zero point, following error, etc.

g. Copy machine test: This function is used to run-in the machine tool when the new machine tool is built or the hardware configuration is replaced. First check the corresponding motion axis and set the start position and motion travel. The setting value depends on the condition of the machine tool. If the movement time is checked, axes will stop moving immediately after the set time is reached; If the movement time is not checked, the axes will stop moving immediately when this interface is closed or the Reset button is clicked.

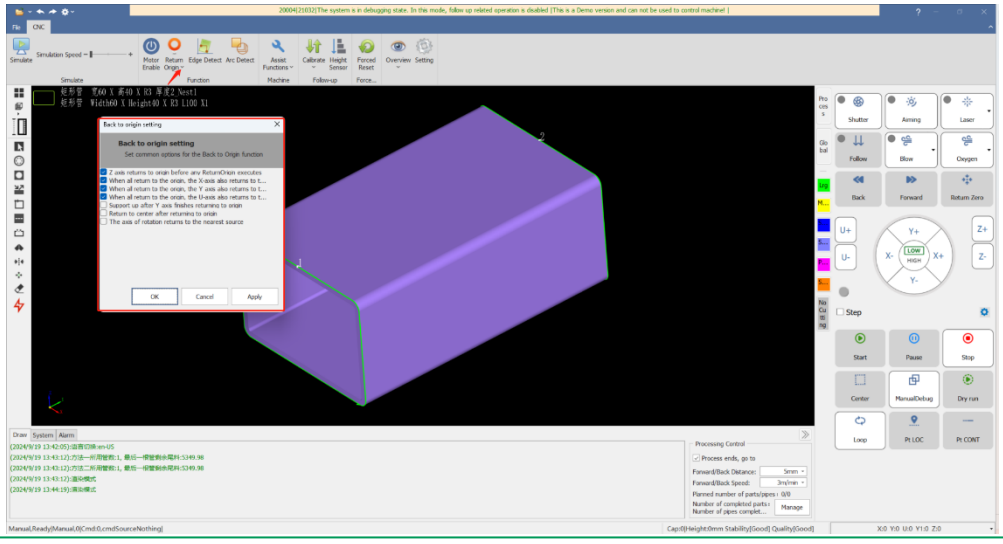
h. Self-tuning: X Y U U2 Z self-tuning. The premise of self-tuning is that all the axes to be tuned have returned to zero point. X Y U and U2 can reciprocate 30mm, and the Z axis must be calibrated successfully to auto tune after homing.

4 Installed Tool: used for installing machine and the interferometer.

5 Report: machining report. Click this button to view the quantity of machined parts or save the machining information.

2.3 Return to the origin

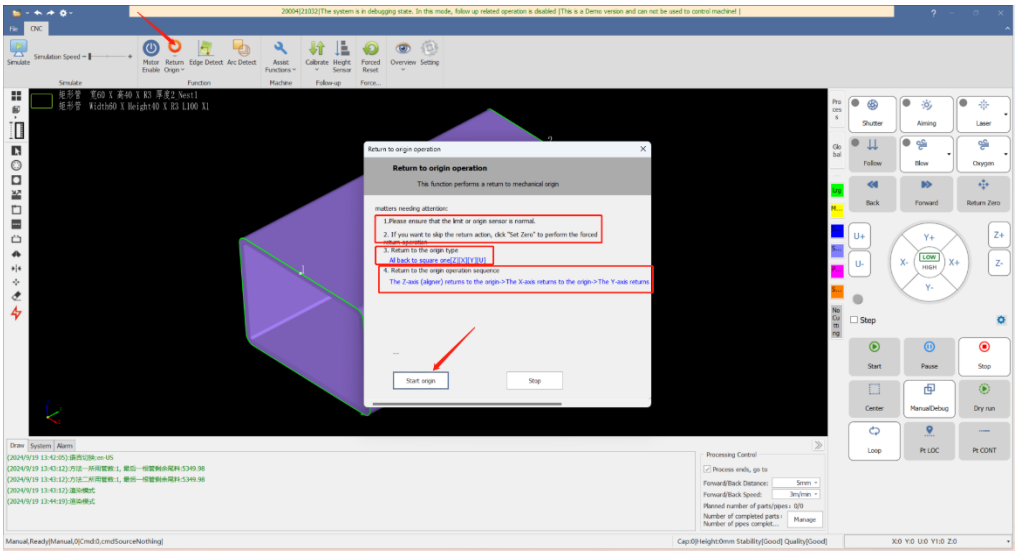
Open the software. After entering the software, click the Return Origin button under the CNC interface. Users can select single axis to return to zero, or users can set all axes to return to origin, or set rotating axes to return to origin synchronously, etc. in the Return to origin setting.



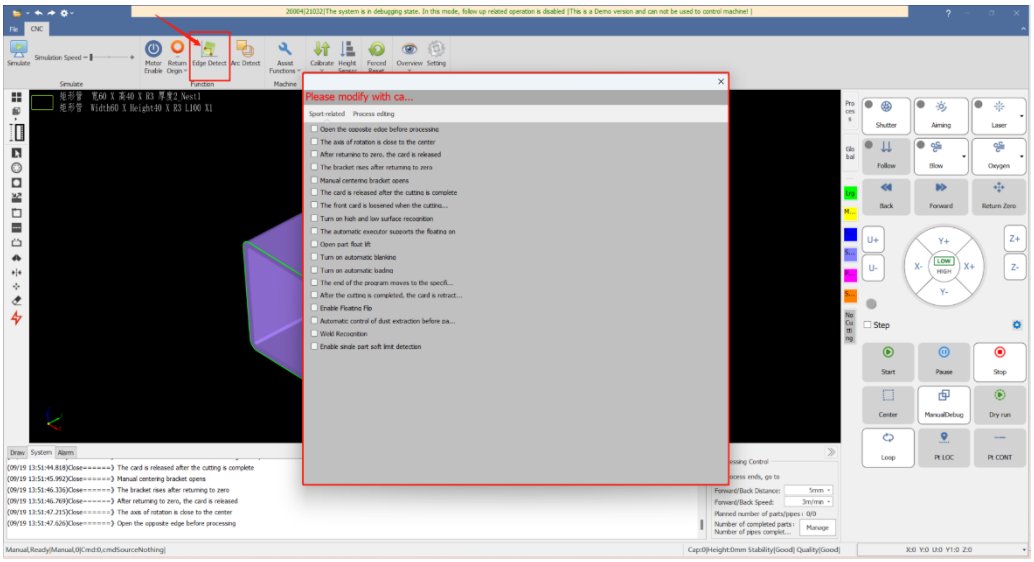
Note: Click the arrow indicator below Return Origin to see the Return Origin setting. Click the Return Origin setting, and a pop-up window will appear. Users can choose a return method according to the zero return method provided in the pop-up window.

Synchronous return of the rotating axis to the original. When the rotating axis returns to the original nearest, users can cooperatively check it to speed up the return efficiency. For example, all brackets are lowered before the Y axis returns to the original, and the support is raised after the Y axis returns to the original, etc. Users can check the required method by yourself.

After checking, click the return to origin button, and the return to origin type and return to origin sequence will pop up. When returning to origin, users must ensure that the limit/origin sensor is normal, and then click to start returning to origin, as shown in the figure below:



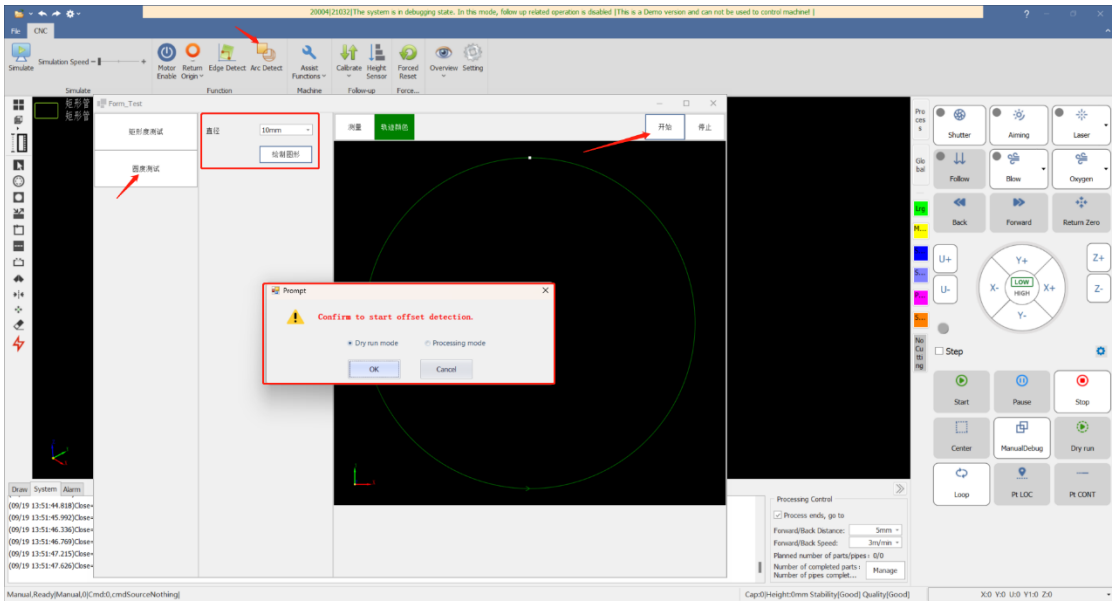
2.4 Motion Setting



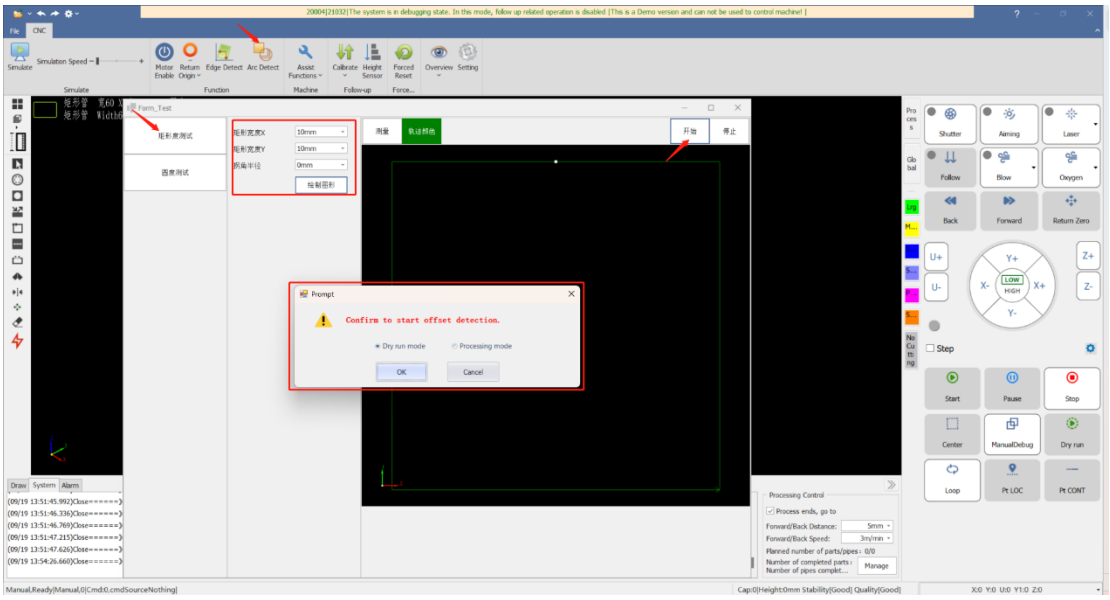
1. Open the opposite edge before processing: Check this function to align pipe heads during machining. (Specific operation: First, make sure that the calibration has been carried out and the calibration is successful, and then there must be a tube under the cutting head. The cutting head moves to the surface of the pipe→the Y axis will move in a negative direction with the pipe→the cutting head will be used to detect the head position of the pipe→the cutting head will rise first after the head position is detected→the Y axis will move forward with the pipe and then move to the retreat distance to start flat head cutting.
2. The axis of rotation is close to the center: check to calculate the nearest distance and return to center.
3. After returning to zero, the card is released: after returning to zero, the card is opened.
4. Manual centering bracket opens: after checking, the support cylinder or shaft will automatically rise up after manual centering.
5. The card is released after the cutting is complete: rear card opened after cutting completion.
6. The front card is loosened when the cutting...: Front card opened after cutting completion.
7. Turn on high and low surface recognition: Check this function to cut a rectangular tube. Generally, the wide surface is judged to be cut on the top under cutting conditions. If the narrow surface is clamped on the top during cutting, it will automatically follow up twice to determine the wide and narrow surfaces and finally adjust the wide surface on the top.
8. The automatic executor supports the floating on: When cutting rectangular tubes after checking, the support shaft will automatically float and support.
9. Open part float lift: When cutting long parts after checking, the blanking shaft will automatically float and support.
10. Tur on automatic blanking: After checking, the blanking action in process editing will be executed.
11. Turn on automatic loading: When the program starts, the loading action in process editing will be executed.
12. The end of the program moves to the specifi...: The Y axis moves to the specified position set after the program cutting is finished
13. After the cutting is completed, the card is retract: Rear card clamping if front card interference occurs during rear card retraction after cutting completion.
14. Enable Floating Flip: Turning cylinder automatically after cutting parts.
15. Automatic control of dust extraction before pa...: Check this function to start cutting and dust extraction will automatically act.
16. Weld Recognition: identify the position of pipe weld seam, select sensor identification, or camera to take pictures

2.5 Arc Detect

2.5.1 Roundness test



2.5.2 Rectangularity test



After clicking on Arc Detect, there are two types: rectangularity test and roundness test. Set the diameter of the circle/length and width of the rectangle, and then click Start. Users can choose dry run processing or actual processing. After the movement is completed, the system will draw the position fed back by the encoder on the software, and users can use measurement to check the roundness error. This error can be used as the basis for adjusting the servo. If the actual feedback trajectory is consistent with the drawn trajectory and the actual circle cut out is not round, the mechanical clearance needs to be adjusted.

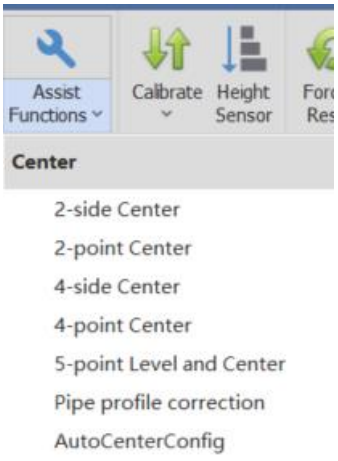
2.6 Assist Functions

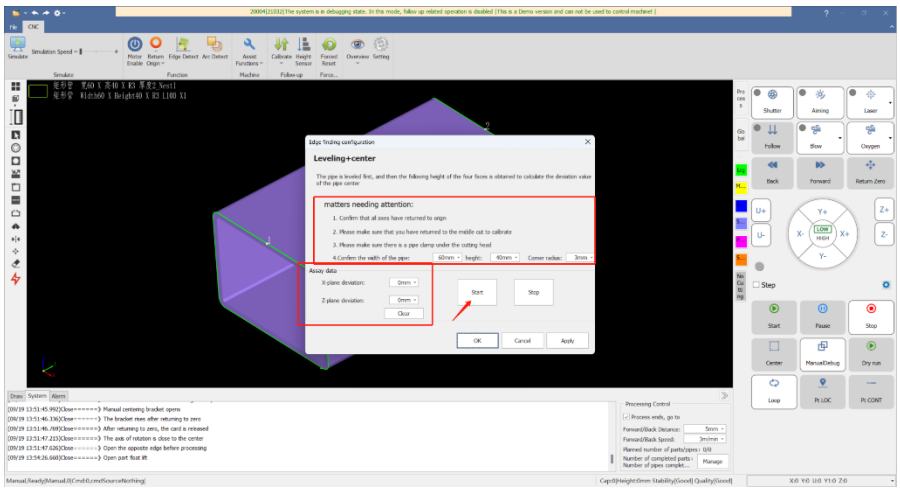
2.6.1 Center

- Center: Calculate the deviation value between the pipe section center and the mechanical center to compensate.
- Center types: single-sided centering, two-sided centering, two-point centering, four-point centering, four-sided centering, five-point centering.
- Centering compensation value: The centering compensation value of pipe center deviation X is applied to 0-degree and 180-degree faces, and the centering compensation value of pipe center deviation Z is applied to 90-degree and 270-degree faces.

Operation steps:

When the discharge result that needs to be cut is imported from the import in the upper left corner-click Generate Code-then click the small indication arrow under the machine tool settings, select the centering method -then click Start in the pop-up window to divide (the premise of center is that it has been returned to zero, level and beam center have been corrected, and there is a pipe below it. Check whether the dimensions are correct. If there is no problem, then centering can be done.





Note:

1. Be sure to confirm that all axes have returned to the origin before centering.

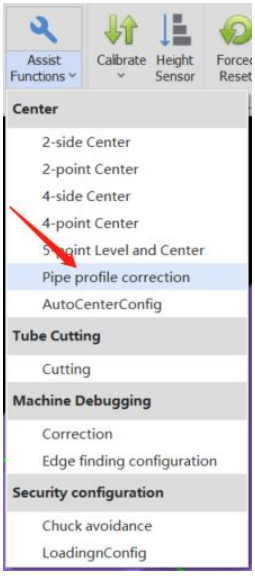
2. XU has been centered and corrected in level.

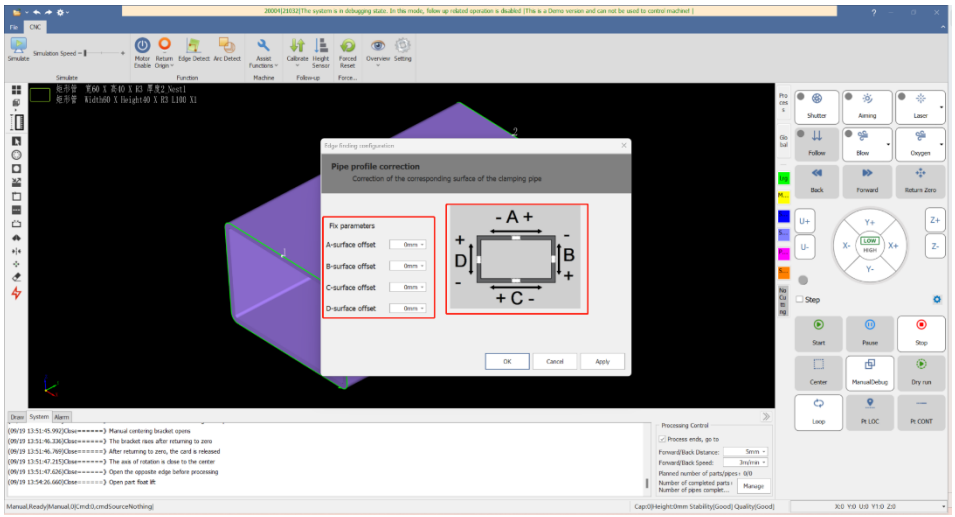
3. Make sure there is tubing under the cutting head and the tubing size is correct

At present, there are five kinds of centering methods, and different pipes correspond to different centering methods For example, round tubes can only be centered at two points, square tubes can all support the five kinds mentioned above, and angle irons currently only support single-sided and two-sided centering. Centering methods must be selected correctly, otherwise the hitting of the laser head will occur.

2.6.2 Pipe Profile Correction

Measure the actual size of the current pipe, and then the difference between the left and right sides of the cut part hole is stable. Users can use the pipe correction to manually compensate the deviation. If the difference between the left and right sides of the cut part hole is unstable, users need to adjust the mechanical levelness.

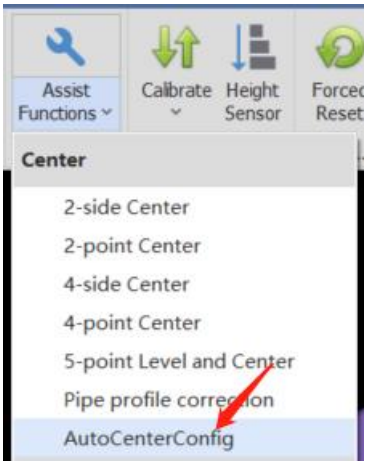


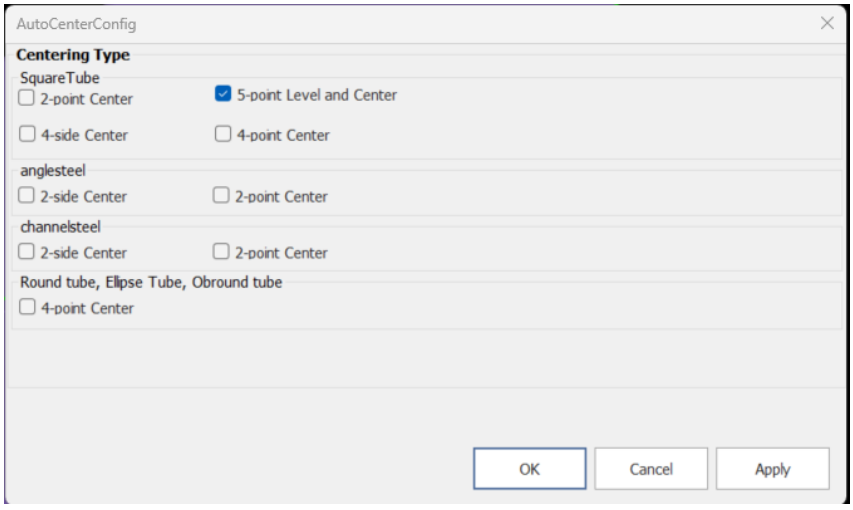


2.6.3 Auto Center Config

Center Mode: Set different centering modes according to different pipes. If the centering mode in the automatic centering configuration is not checked, the centering profile compensation value added separately will not take effect.

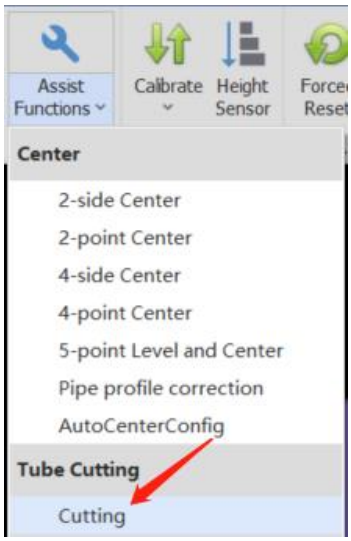
- Square tube: four-sided centering, two-point centering, four-point centering.
- Angle steel: centering on both sides and centering at two points.
- Channel steel: centering on both sides and centering on two points.
- H steel: centering on both sides and centering on two points.
- Round tube, ellipse tube, obround tube: four-point centering.

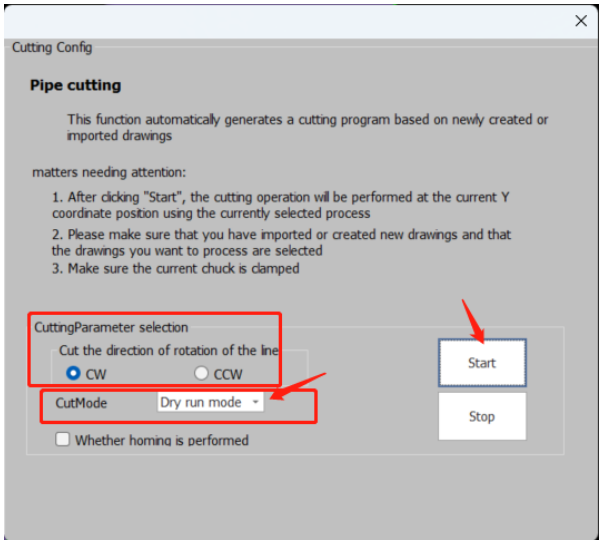




2.6.4 Tube Cutting

Export the nesting results from TubeKet and import them into the software. Select a pattern for “Cut the direction of rotation of the line” and “Cut mode”, and the chuck has been manually clamped. Click Start to carry out the cutting action.



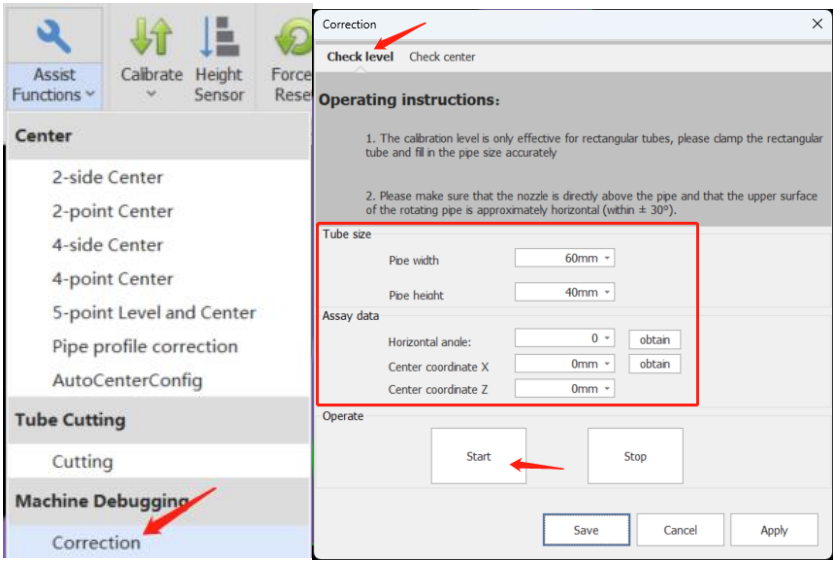


2.6.5 Machine Tool

Correction

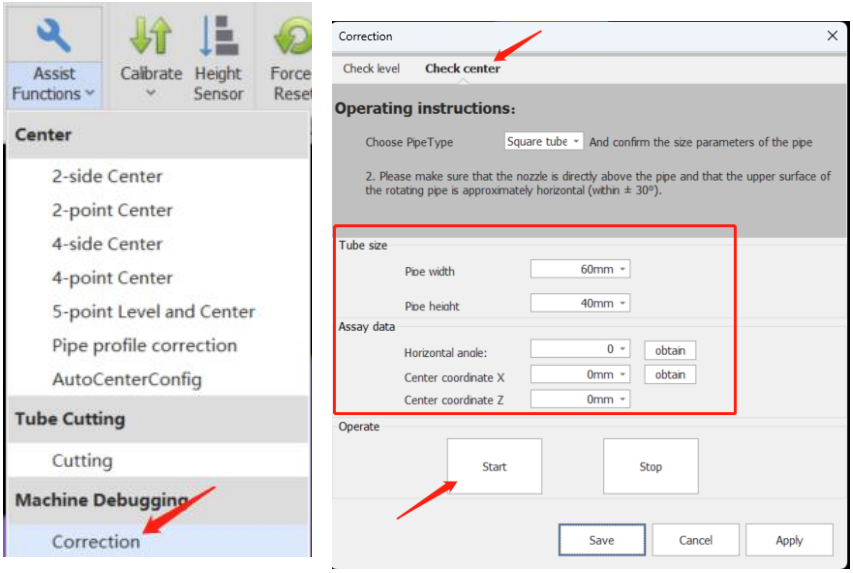
Check level:

To correct the horizontality of the zero-degree surface of the clamping pipe, it is recommended to use standard pipe correction, and the correction surface must be flat. Before correction, make sure that the system X, Z, and U U2 axes have returned to the origin. Users can manually adjust UU2 temporarily. In a horizontal direction, X manually moves to the center position of the pipe, then click to obtain the lower horizontal angle and center coordinate X, and then import the standard pipe nesting result drawn by TubeKit. It is recommended to use rectangular pipe (40 × 40) without R angle.



B: Check center

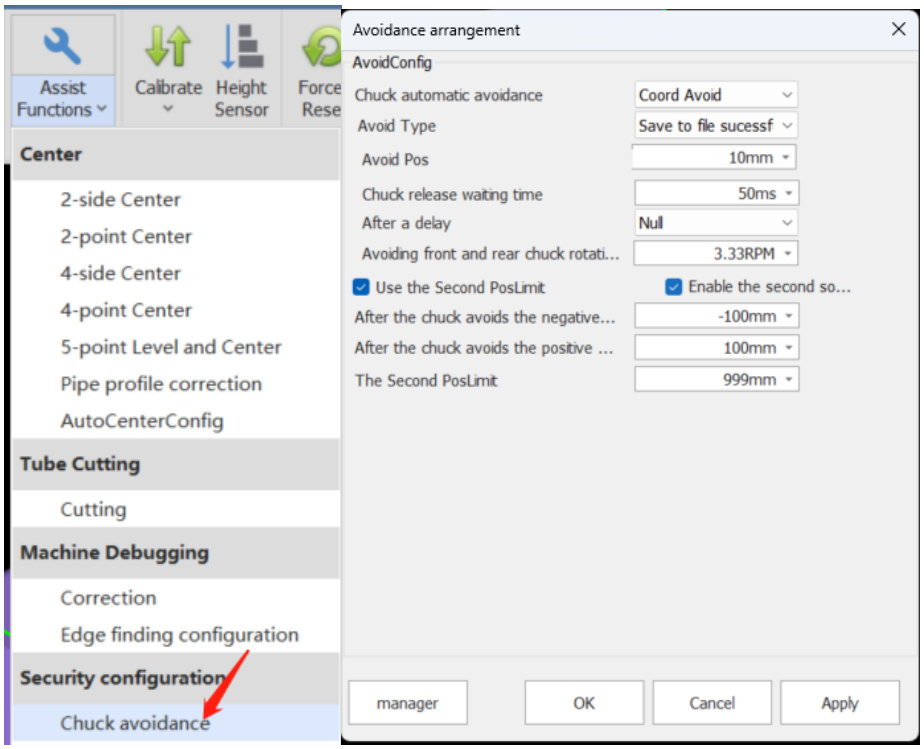
When the mechanical structure is fixed, there will be a fixed rotation center when the U U2 axis rotates, and the center of the beam is the coordinate (X) of this rotation center in the X plane. The determination of the center of the U U2 axis requires the use of a standard rectangular tube (40 × 40) without chamfering. Before checking center, make sure that the X, Y, Z, U and U2 axes of the system have returned to the origin and have been checked level, and the surface must be flat. Then, manually move the X axis to the top of the standard pipe and visually check the center position. Click to obtain the X center coordinates, then import the standard pipe nesting result drawn by TubeKit, and click to start to check center.



2.6.6 Security Configuration

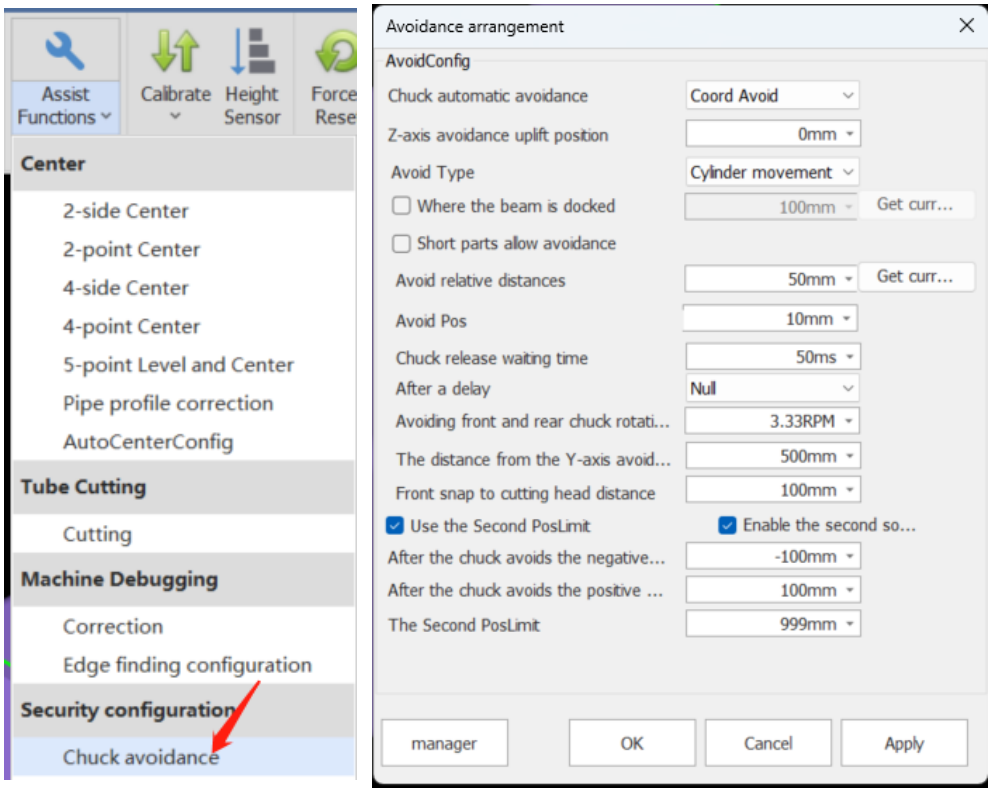
Types of chuck avoidance: no avoid/coordinate avoid

Avoid type: advance avoidance/position avoidance



advance avoidance/position avoidance		
Parameter name	Default Value	Remark
Chuck automatic avoidance		Coord Avoid/No Avoid.
Avoid Type		advance avoidance/position avoidance/cylinder moving avoidance/beam moving avoidance.
Avoid Pos		The Y axis moves the limit coordinate position to trigger the avoidance condition.
Chuck release waiting time		The delay time after the claws avoid opening is judged to complete the opening.
After a delay		Select No/Pause/Signal Detection.
Avoiding front and rear chuck rotati..		Avoidance rotation speed of front and rear chucks during avoidance.
Use the Second PosLimit		When checked, the second positive soft limit of the Y axis after avoidance is enabled, and the first positive soft limit is not available.
Enable the second so...		Enable positive and negative soft limits after X-axis avoidance after checking.
After the chuck avoids the negative.../ After the chuck avoids the positive ...		This value will only take effect after the chuck avoids, and the X positive and negative soft limit before avoidance still depends on the first soft limit.
The Second PosLimit		This value will only take effect after the chuck avoids, and the Y positive soft limit before avoidance still depends on the first soft limit.

B: Cylinder movement avoidance/beam movement avoidance



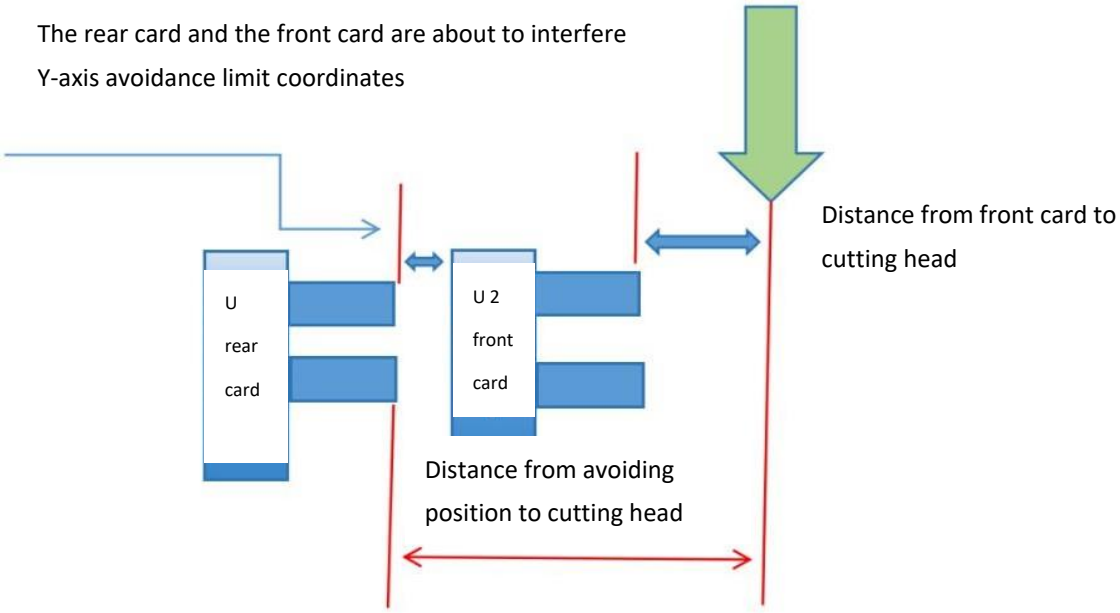
Cylinder movement avoidance/cross beam movement avoidance		
Parameter name	Default Value	Remark
Chuck automatic avoidance		Coord Avoid/No Avoid.
Avoid Type		advance avoidance/position avoidance/cylinder moving avoidance/beam moving avoidance.
Where the beam is docked		The position of the X beam shaft when it is docked.
Short parts allow avoidance		If checked, the front card is allowed to avoid the rear card separately clamping and cutting.
Avoid relative distances		After the front card is pushed forward by a cylinder distance, the maximum positive stroke of the rear card is not relative to the relative distance when the cutting head follows the interference. After measuring the front position of the front card, and then measuring the back position of the front card, this is the relative distance value of the avoidance.
Avoid Pos		Y-axis movement limit coordinate position front card avoidance trigger condition.
The distance from the Y-axis avoid..		The distance from the Y-axis limit avoidance position to the cutting head needs to be actually measured.
Front snap to cutting head distance		Distance from front chuck to cutting head.

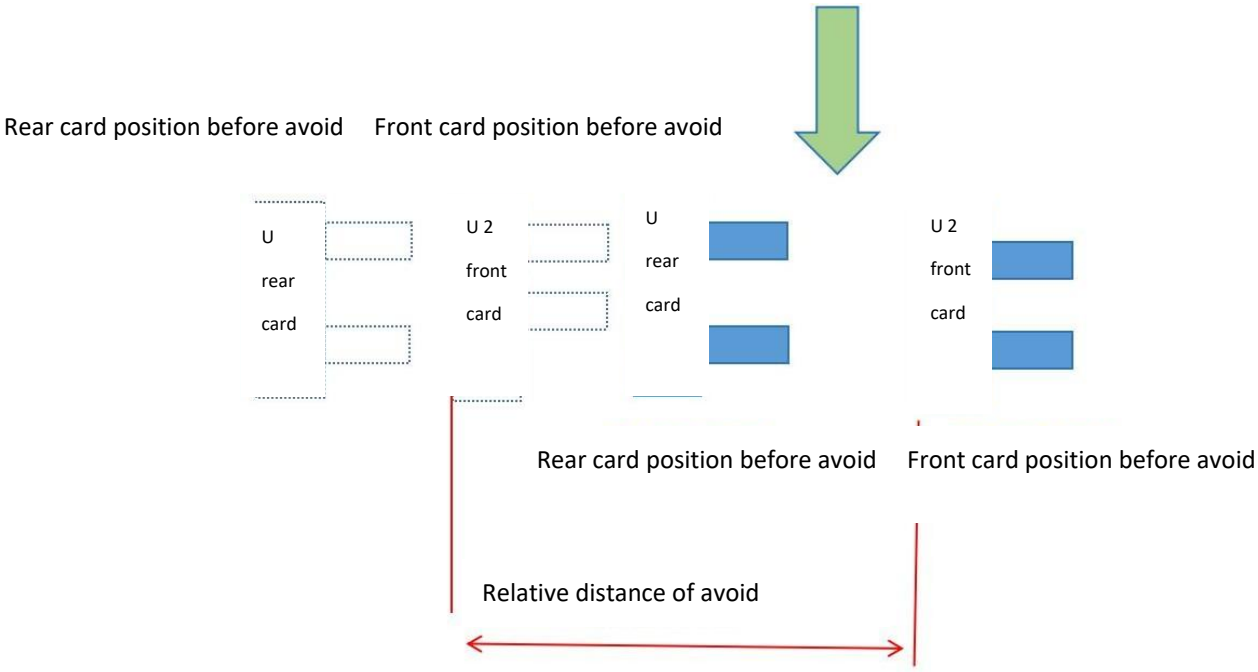
Remark:

After the front card is avoided, the shortest length of clamping cutting between the rear card and the front card: the distance from the avoidance position to the cutting head + the relative avoidance distance-the distance from the front card to the cutting head.

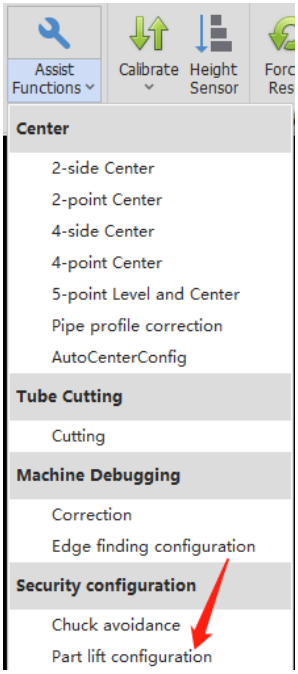
Because the moving position of the front card of the U2 axis is fixed, the distance from the avoidance position to the cutting head and the distance from the front card to the cutting head determine the shortest pipe length of the parts cut by the two cards.

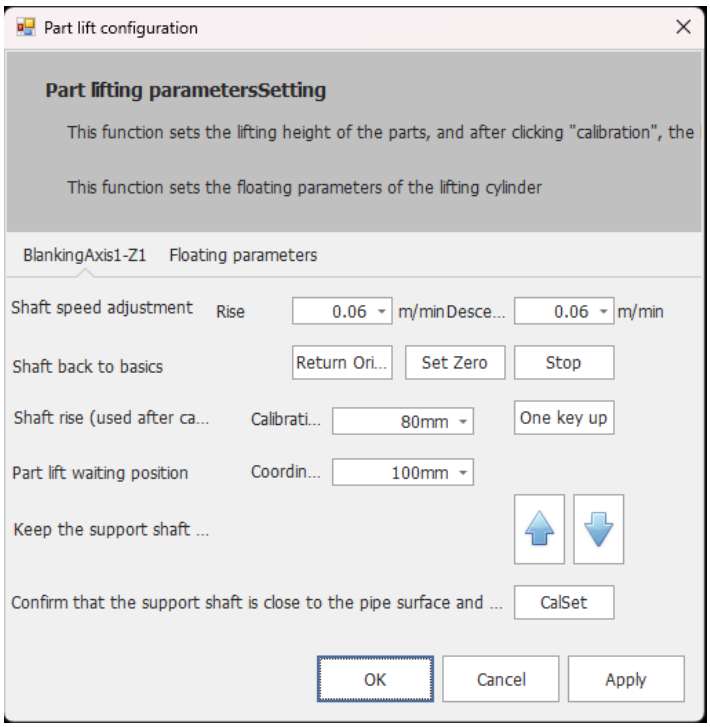
For details, please refer to the diagram below:


The rear card and the front card are about to interfere
Y-axis avoidance limit coordinates
U
rear
card
U 2
front
card
Distance from front card to
cutting head
Distance from avoiding
position to cutting head


Rear card position before avoid
Front card position before avoid
U
rear
card
U 2
front
card
U
rear
card
U 2
front
card
Rear card position before avoid
Front card position before avoid
Relative distance of avoid

2.6.7 Part lift configuration



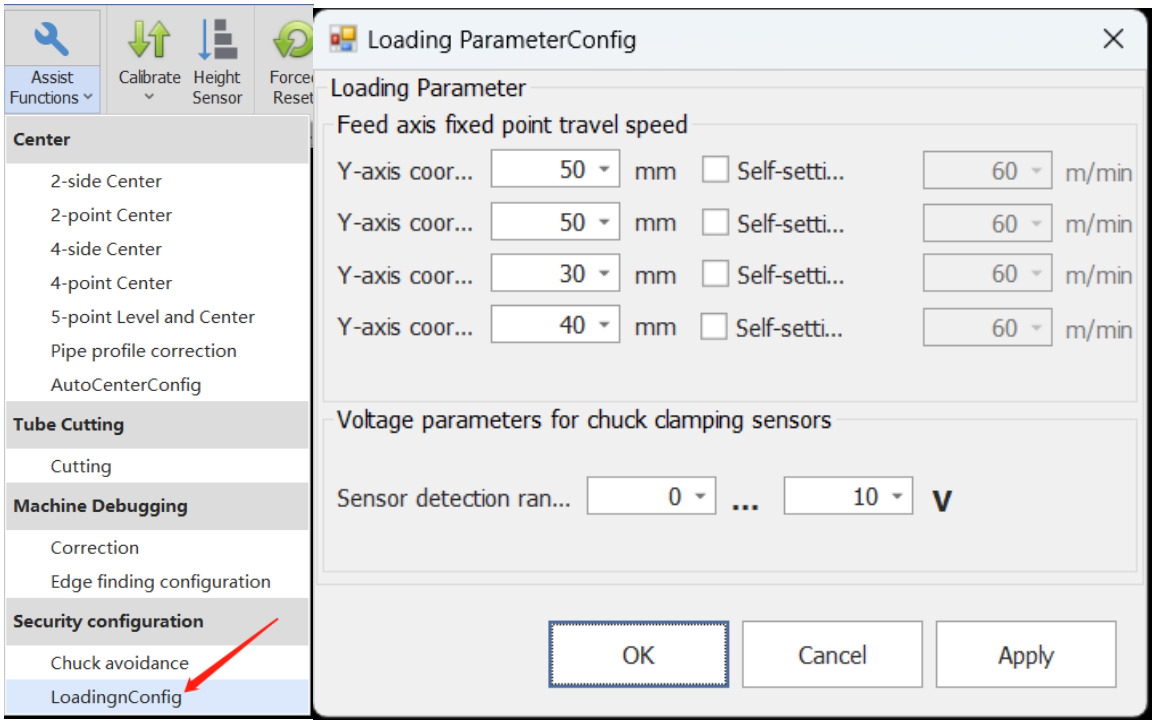


Part lift support: The configuration tool will not be displayed fi without shaft configuration.

Usage method: Click “Shaft back to basics” to support shaft to the origin-then click  to make shaft close to pipe surface-click CalSet to move shaft to the pipe surface- then drop to the set calibration height and wait for the parts to be supported and floated.

Parameter name	Default Value	Remark
Shaft speed adjustment		Shaft floating rise and fall speed.
Shaft back to basics		The support axis returns to the home position, and the current position can be set to zero if there is no limit signal.
shaft rise (used after ca...		After the calibration is completed, click One key up, and the support will rise to the set calibration height.
Part lift waiting position		Support drop position.
BlankingAxis1-Z1		Distance between blanking support shaft 1 and cutting head.

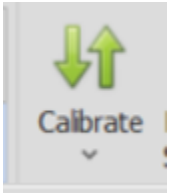
2.6.8 Loading Config



This parameter corresponds to Loading Position 1/ Loading Position 2/ Loading Position 3/ Loading Position 4 in process editing, etc. Each position can set a separate moving speed.

2.7 Calibrate

Calibrate the cutting head height and capacitance value of the cutting head from the pipe surface, and cutting can be performed only after the calibration is completed.



Operation steps: Manually tap the Z-of the software interface to move down to the 3cm high position of the pipe, and then click to start calibration.

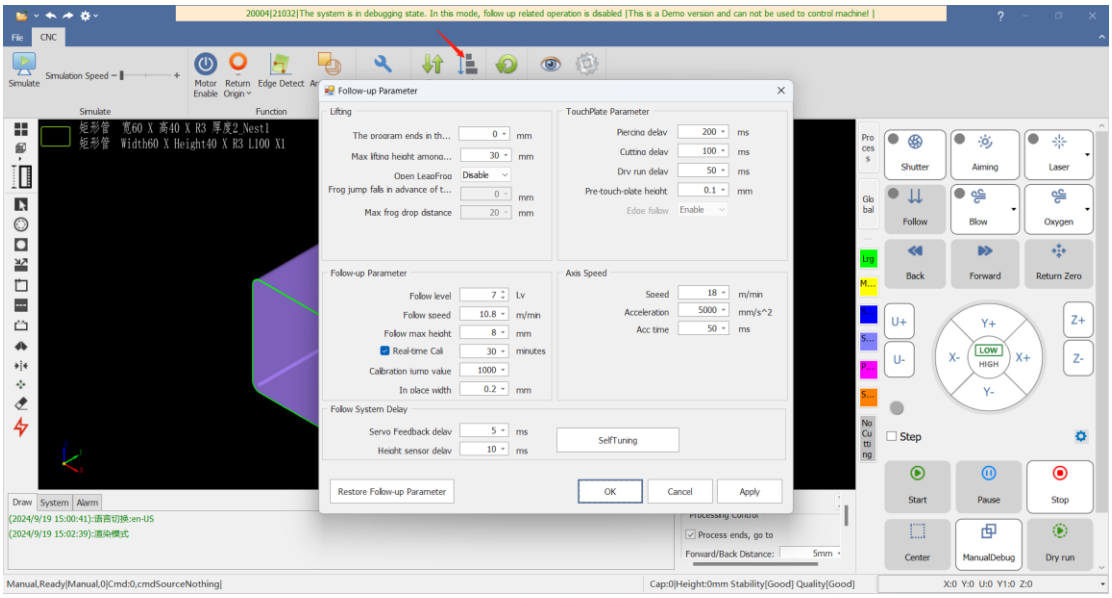
2.7.1 Capacitance sensor

Capacitive sensor interface

1. Users can check whether the calibrated capacitance curve is normal.
2. Weather the capacitor jog is suitable.

For example, when the calibration touch plate alarm cannot be cleared, users can click Reset Capacitance to recalibrate the capacitance curve.

2.8 Height adjuster

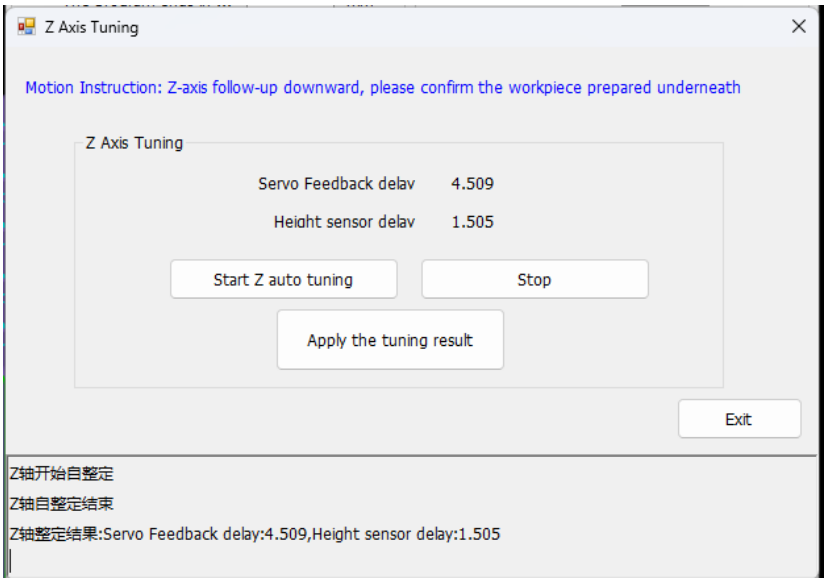


Lifting		
Parameter name	Default Value	Remark
The program ends in th...	0/mm	This parameter indicates that after machining is completed or other machining programs are executed, the Z axis is lifted to one safe position, an absolute position.
Max lifting height amona..	30/mm	The height of the Z-axis lifting, after cutting, relative to the safety point position. This parameter value should not be too large, as tit will affect the processing efficiency.
Open LeapFrog	Disable	Leapfrog function on/off.
Frog jump falls in advance of t...	0°	Frog lifting height.
Max frog drop distance	20	When the middle value from side A to side B is equal to this value, the frog drop is performed.
Follow-up parameter		
Parameter name	Default Value	Remark
Follow level	7	The higher the follow level, the higher the follow-up responsiveness and the higher the lifting responsiveness.
Follow speed	3m/min	Follow falling velocity.
Follow max height	8mm	If the follow height is greater than this value, the cutting head will first follow to the position 1mm away from the plate and then lift to the set height to ensure the accuracy of the height. If the follow-up height is less than this value, the cutting head will

		directly follow to this height to speed up the cutting efficiency Rate.
Real time cal	30/min	According to the set value, the calibration operation is performed once after the time of reaching the set value.
Calibration jump value	1000	This value takes effect when the capacitance jumps is selected as the mode of the plate touch signal during calibration.
In place width	0.2	Changes are not recommended for non-professionals.
Touch plate parameter		
Parameter name	Default Value	Remark
Piercing delay	200/ms	Detection time of touch plate during piercing.
Cutting delay	100/ms	Detection time of touch plate during cutting.
Dry run delay	50/ms	Detection time of touch plate in dry running.
Pre-touch plate height	0.1/mm	Distance from tube surface.

Automatic speed		
Parameter name	Default Value	Remark
Speed	18/m	The lift-up speed of Z in automatic mode reads this value.
Acceleration	5000/ms	Acceleration in automatic mode.
Acc time	50ms	Acceleration time in automatic mode.

Follow system delay		
Parameter name	Default Value	Remark
Servo feedback delay		(Value by self-tuning Z-axis servo feedback).
Height sensor delay		(Z-axis self-tuning feedback value).



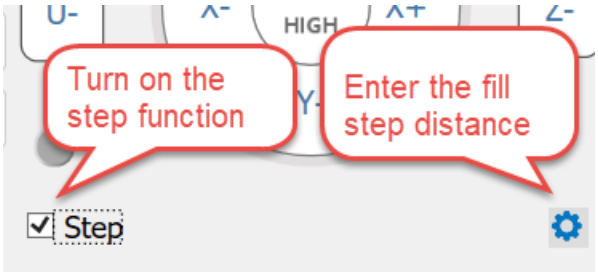
Note:

Note: If the self-tuning fails or the servo delay is too large on the Z axis, it is due to the low rigidity and gain of the driver, which leads to the large feedback delay of the servo system. If the feedback delay of the servo system is greater than 10ms as a result of self-tuning, it is necessary to improve the position loop gain and appropriately increase the system rigidity to ensure that the feedback delay of the servo system on the Z axis does not exceed 10ms before it can be used normally.

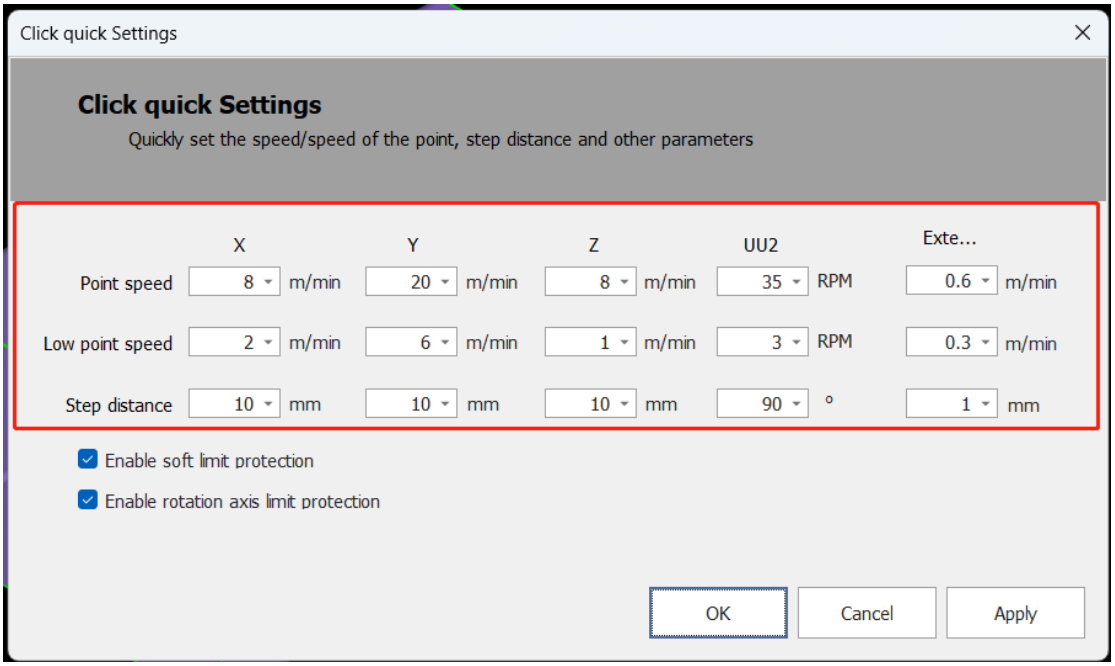
3. Mode Function

3.1 Stepping

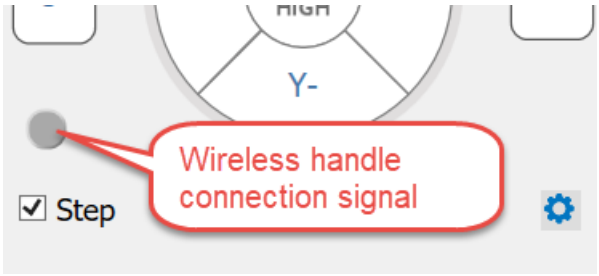
Step button: When this button is checked, the manual movement axis will move in inch movement mode, that is, each axis movement will travel a fixed distance. The length of the step distance is entered in the step box. It should be noted that the maximum inch movement distance of XY is different from that of Z axis, and the step unit of U/U2 axis is angle.



After clicking to enter the step distance filling interface, there is point high-speed and low speed, and step distance. Pay special attention to the fact that the maximum step distance of XY is different from that of Z axis. Fill it in according to actual needs. The step unit of U U2 is angle. Both point low speed and high speed are limited by dry run speed, where the point speed distance of the extended axis is effective for the point motion of all configured auxiliary axes.



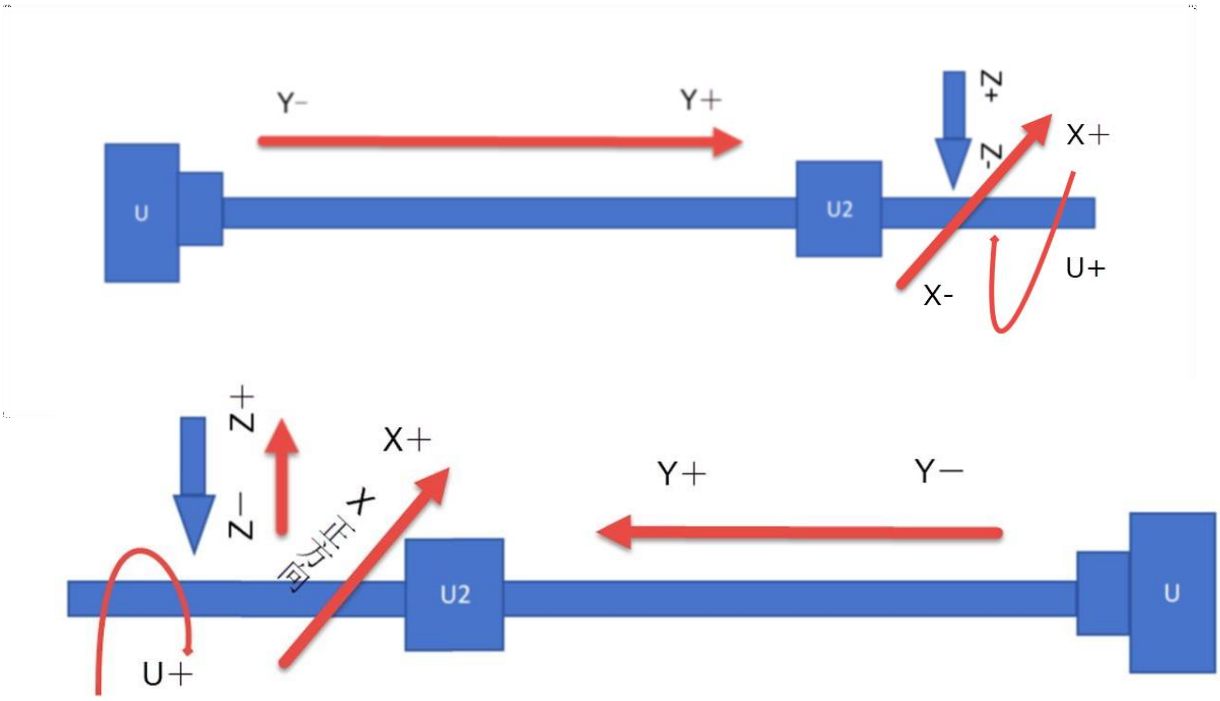
New version of step button: After checking this button, click “Click quick Settings”. Users can fill in the step distance of each axis. It should be noted that the maximum moving distance of X and Y is different from that of Z axis, and the step unit of U/U2 axis is angle. Both point low speed and high speed are limited by dry run speed, where the point speed distance of the extended axis is effective for the point motion of all configured auxiliary axes.



Wireless pendant signal. When the signal light turns green, it indicates that the pendant is connected. Users can use the pendant to control the movement of the axis, etc. If the signal is always gray, it is not connected.

: switch between high speed and low speed.

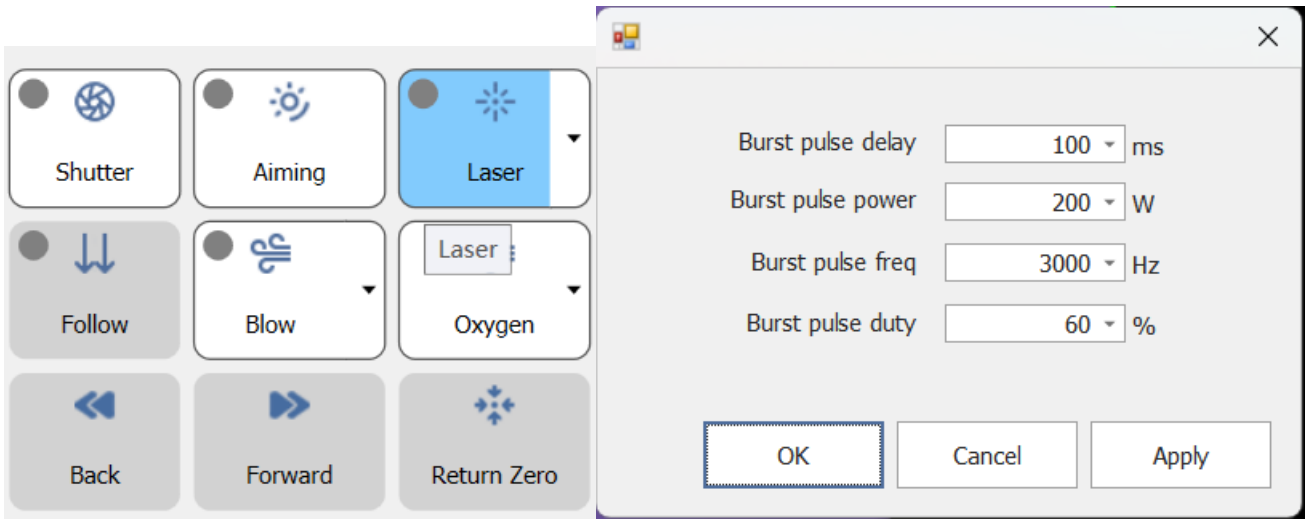
The point axis of the machine tool controls the movement direction:



If the set direction is consistent with that shown in the figure, and the beam is more deviated, change the axis direction in the G code configuration.

3.2 Manual debugging

3.3 Laser dotting



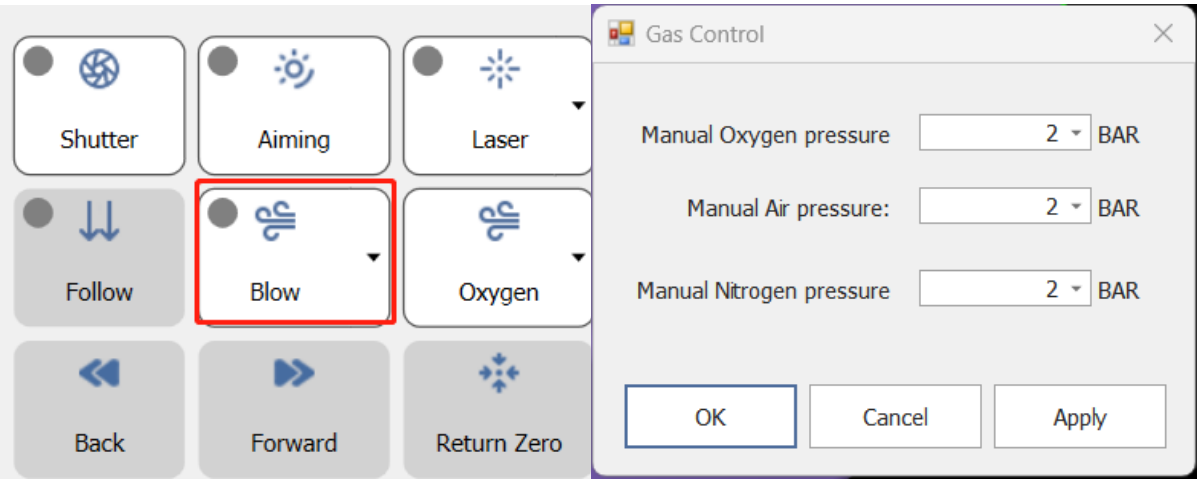
Burst pulse delay: the time to beam out.

Burst pulse power: laser peak power to beam out.

Burst pulse frequency: laser signal frequency to beam out.

Burst pulse duty: laser signal duty to beam out.

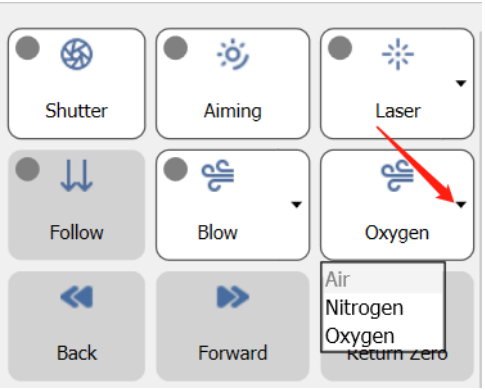
3.4 Gas pressure setting



Manual Oxygen Pressure: manually set oxygen pressure.

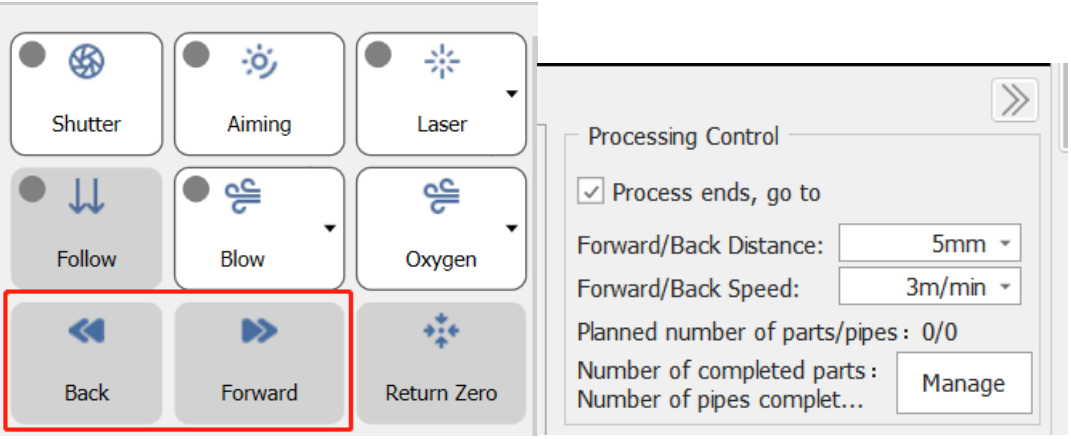
Manual Air Pressure: manually set air pressure.

Manual Nitrogen Pressure: manually set nitrogen pressure.



Click on dropdown button of Oxygen to select the gas used for cutting. The gas pressure used must be configured in the configuration tool to be selected, otherwise the button will be gray and not available.

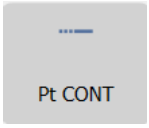
3.5 Forward/Back



When a part is not cut through and cut off, users can use the Back function to back to the previous contour and re-cut it. Similarly, Forward means that users can cross the current part and move forward to the contour that needs to be cut.

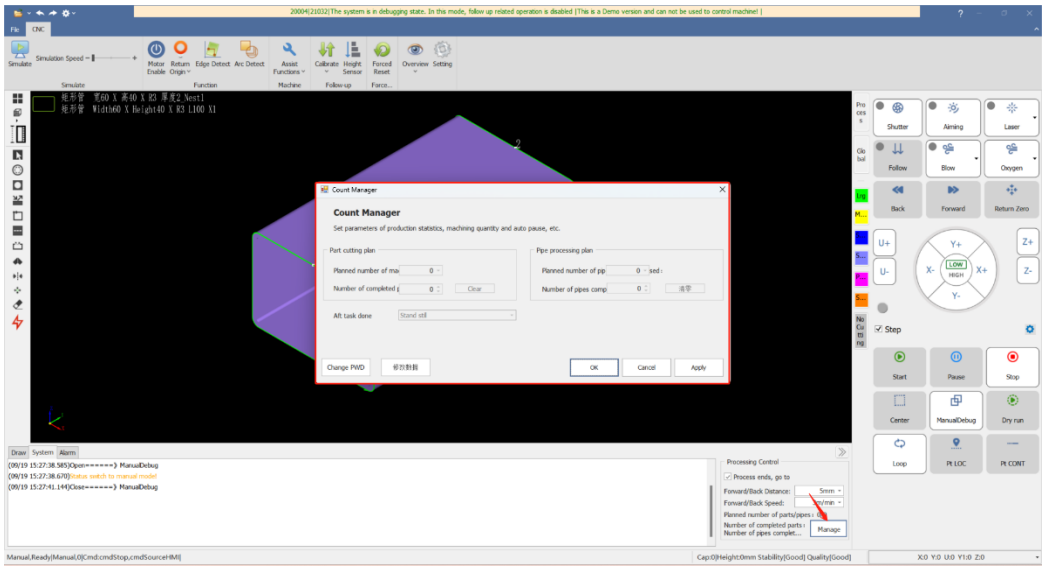
3.6 PT LOC/Pt CONT

Users can enter the breakpoint mode when processing pauses or stops. In breakpoint mode, most functions of the machine will be locked. Customers can manually or by pendant to move the shaft (cannot clamped or release the chuck). Click the breakpoint positioning shaft again to return to the previous position before stopping.



Click the Breakpoint Continue button, Y X U U2 Z will return to the breakpoint positioning coordinates and restore machining.

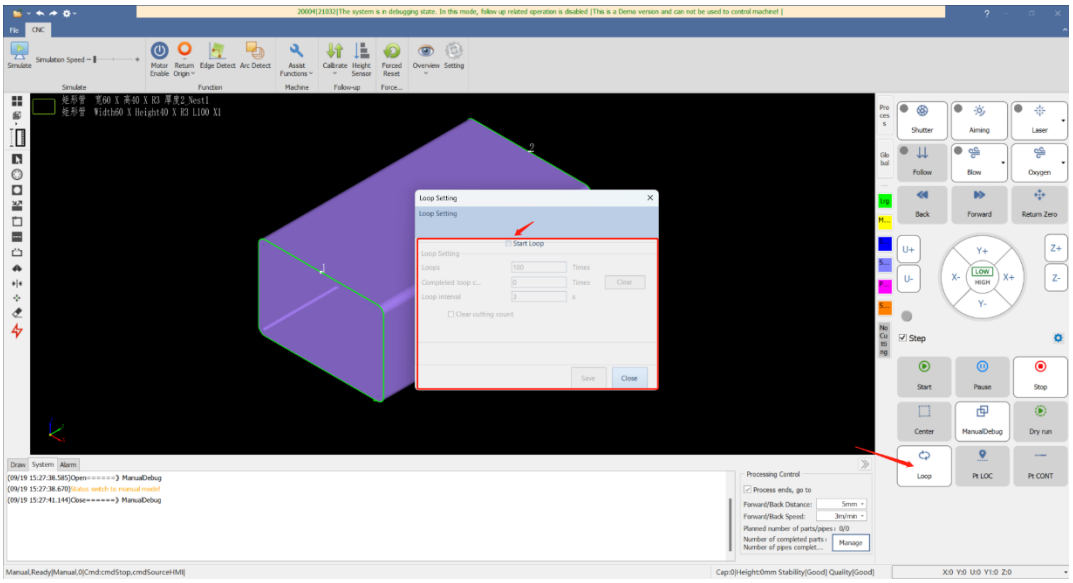
3.7 Count Manager



Count Manager		
Parameter name	Default Value	Remark
Planned number of mac..		Number of planned machining parts settings.
Number of completed...		This value is not recommended to be set manually.
Aft task done		After the machining plan is completed, the machining action can be selected.

Click Manage in Processing Control of the main interface-Set planned number of machining-Clear the number of completed machining workpieces-Select the required prompts after completing the processing plan (no action/pop-up prompts/pop-up prompts and stop processing), then the system will automatically count after starting processing.

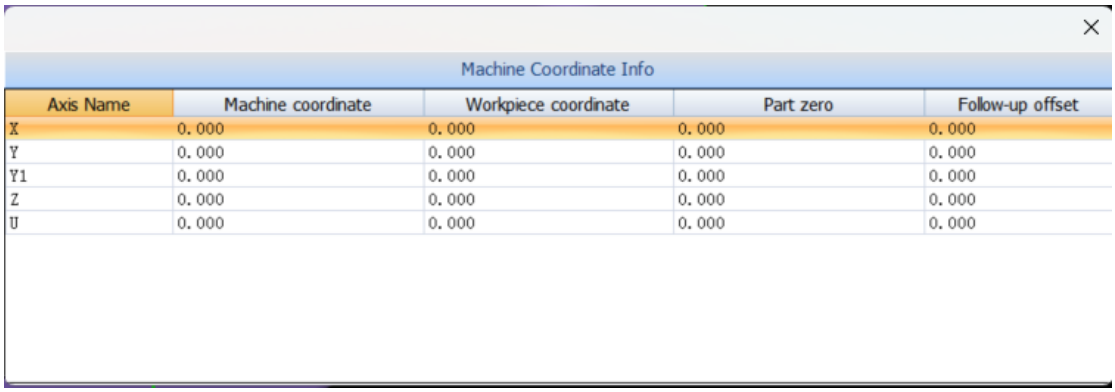
3.8 Loop Setting



Loop Settings		
Parameter name	Default Value	Remark
Loops		Number of cycles required.
Completed loop		Number of processed cycles, which can be cleared and cannot be set manually.
Loop interval		Waiting time between two cuttings.
Clear cutting count		After checking, the number of cycles above will be cleared when processing is started.

Click Loop in the main interface-check Start loop-set loops-modify loop interval-select required machining mode-click Start to process.

3.9 Coordinate Info

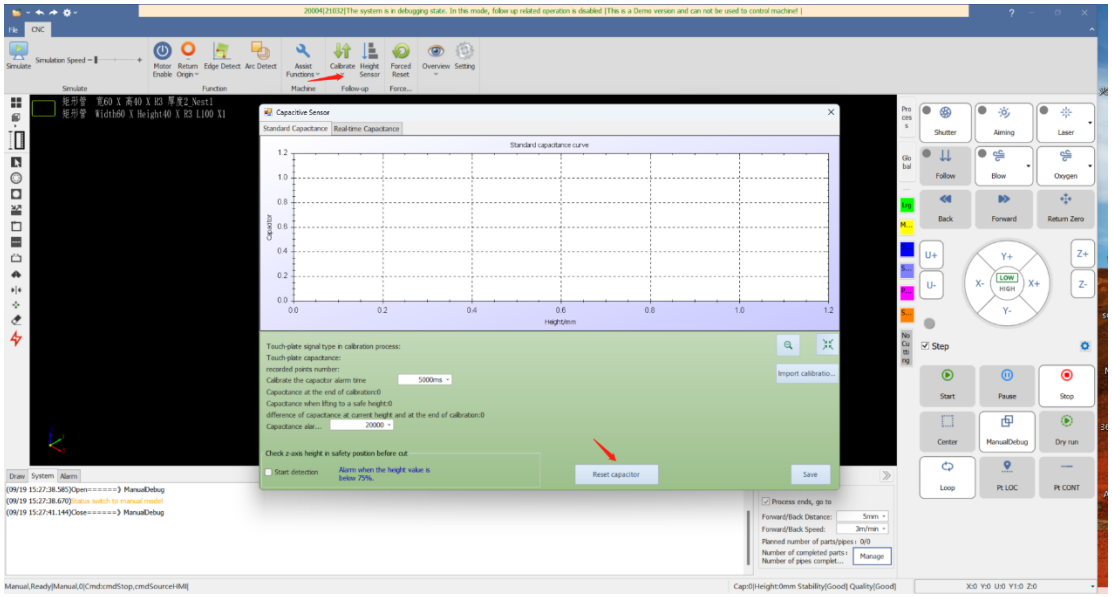


Machine coordinate: The position of the reference mechanical zero point, after the axis returns to origin.

Workpiece coordinate: The coordinates of the zero point of the workpiece referenced by the workpiece during cutting.

Follow-up offset: The deviation between the sent instruction and the actual position of the machine.

3.10 Reset Capacitor

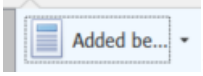


Reset the current capacitance value. When the TRA or cutting head is replaced, the capacitance curve is still the same as the last time. Therefore, the capacitance value may not be correct, for example, the capacitance value is negative. At this time, the touchplate alarm will not be cleared, so we need to reset the height. After resetting, the alarm can be cleared, but it must be automatically calibrated again at this time. Just use the default height from the board surface. If there is a touchplate alarm on the interface that cannot be cancelled, users can use this function to reset the capacitance value. After the reset is completed, users can recalibrate it.

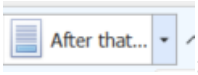
3.11 Process Editor

Turn on Automatic loading: after checking, the system will cooperate with the feeder to execute the automatic feeding function before cutting.

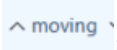
Feeding Process: When [Automatic Feeding Before Cutting] is checked, the system will execute the instructions in [Feeding Process] sequentially before cutting the arranged pipes. The instructions include support control, claw control, delay, centering cylinder control, feed shaft movement control, external interactive signal control, loading support cylinder control and dust extraction control. Each group of instructions contains detailed branch instructions.



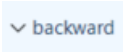
: Add an instruction before the currently selected instruction.



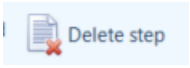
: Add an instruction after the currently selected instruction.



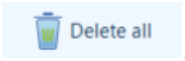
: Swap the current selected instruction and the previous instruction in sequence.



: Swap the current selected instruction and the subsequent instruction in order.



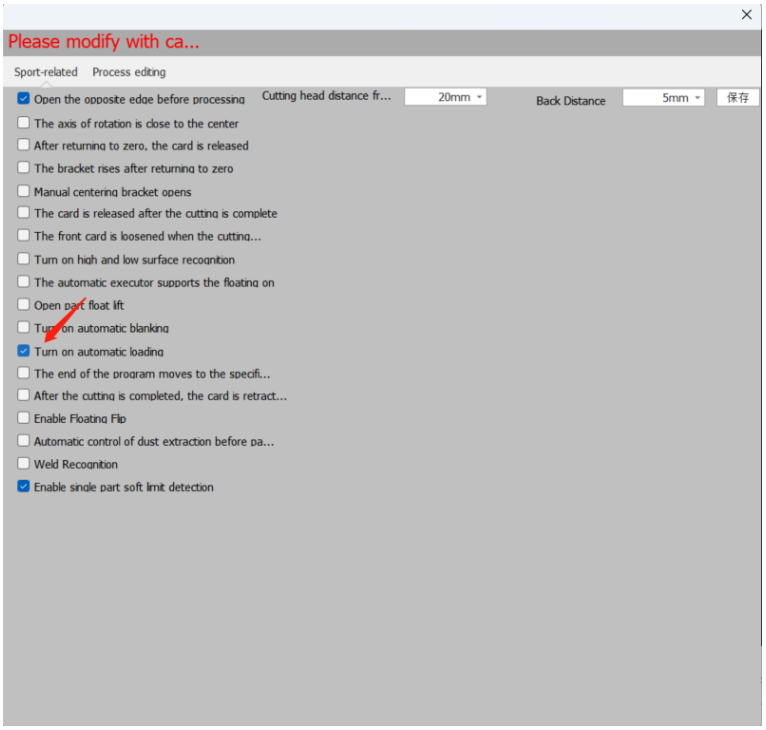
: Delete currently selected instruction.

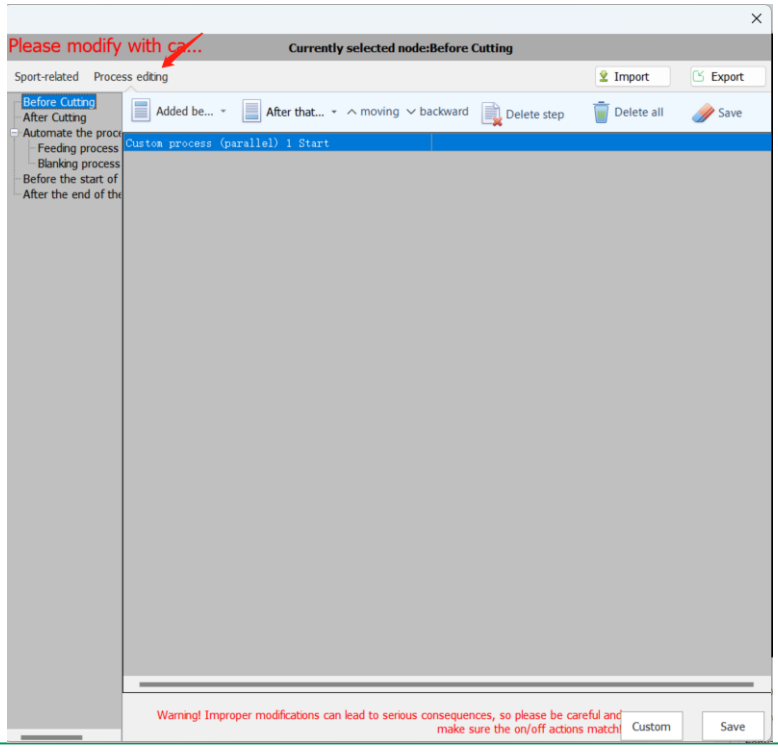


: Delete all instructions in Loading Process.

: Save the instructions in Process Edit.

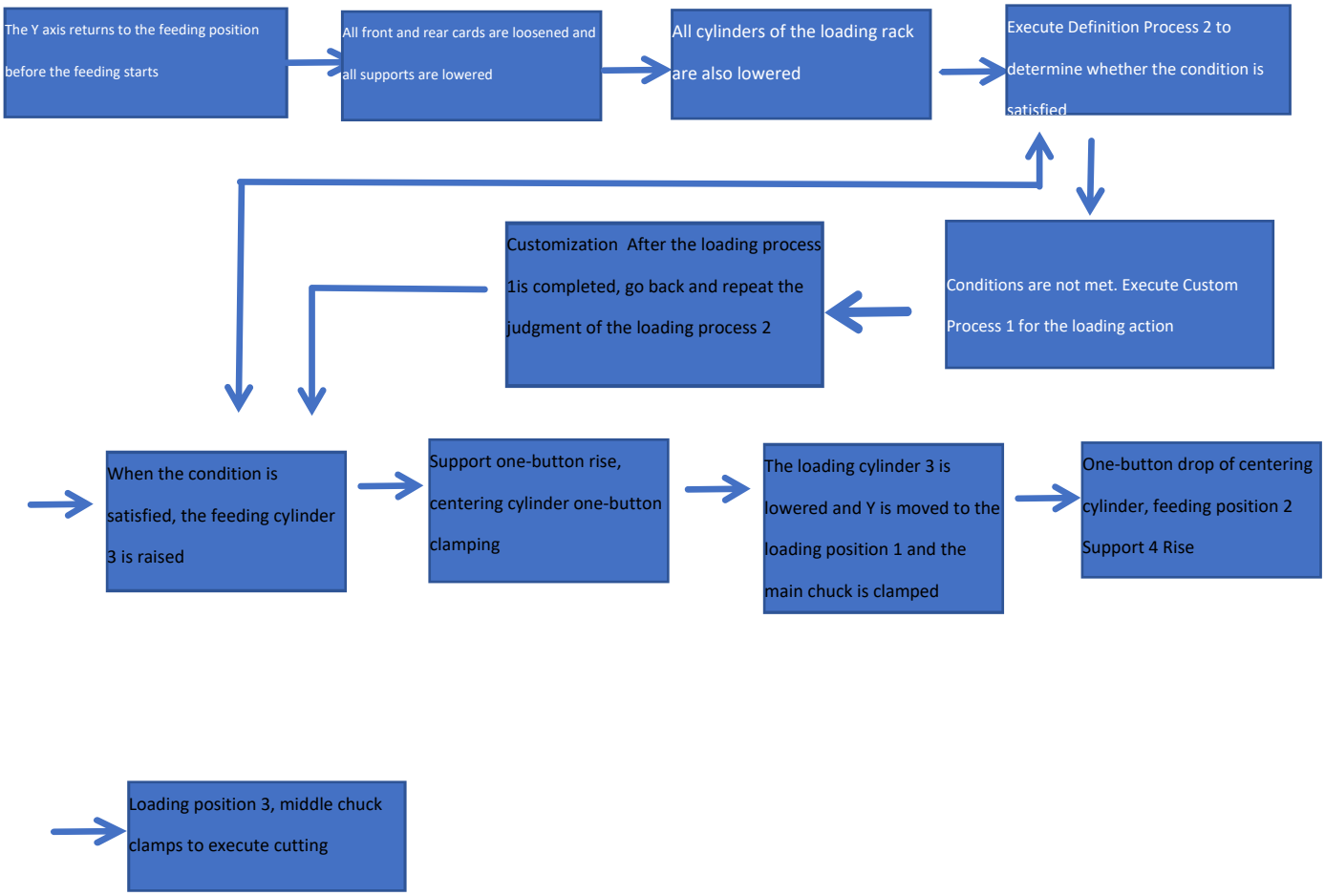
]



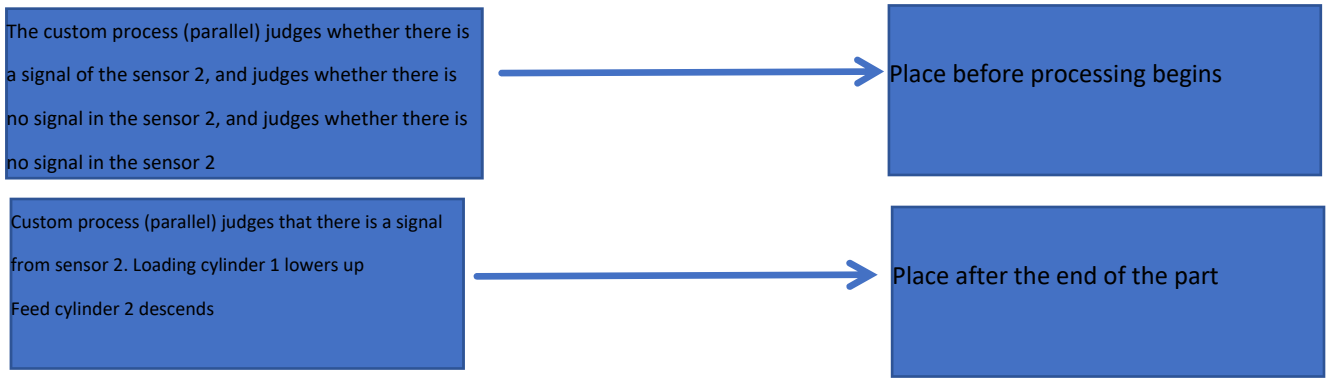


For [Loading Process] in [Process Editor], the instruction action needs to be set and specified according to the on-site requirements. Please refer to [Feeding Process] (for reference only).

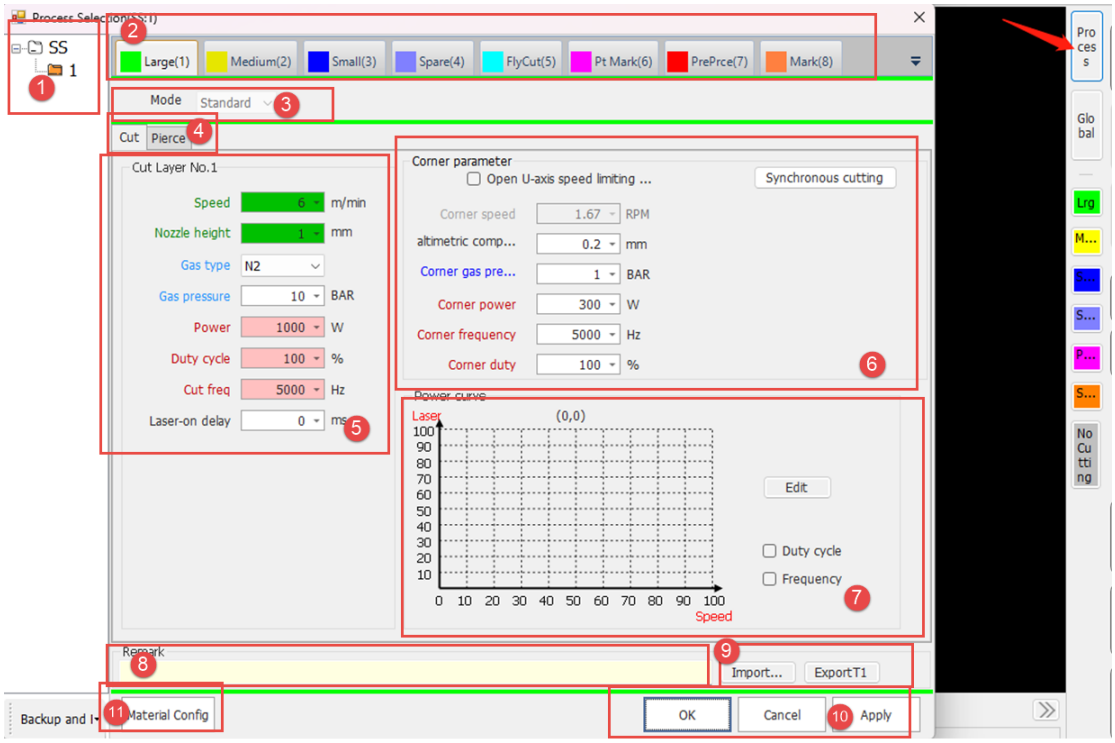
Action Flow



Material preparation process



4. Process Interface

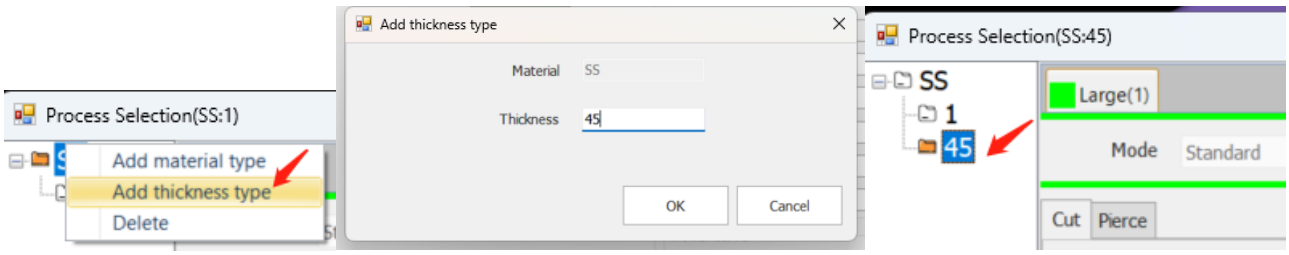


4.1 Process Tree

This software uses tree structure storage process to save the adjusted process parameters in different materials and thicknesses, which is convenient to switch and use.

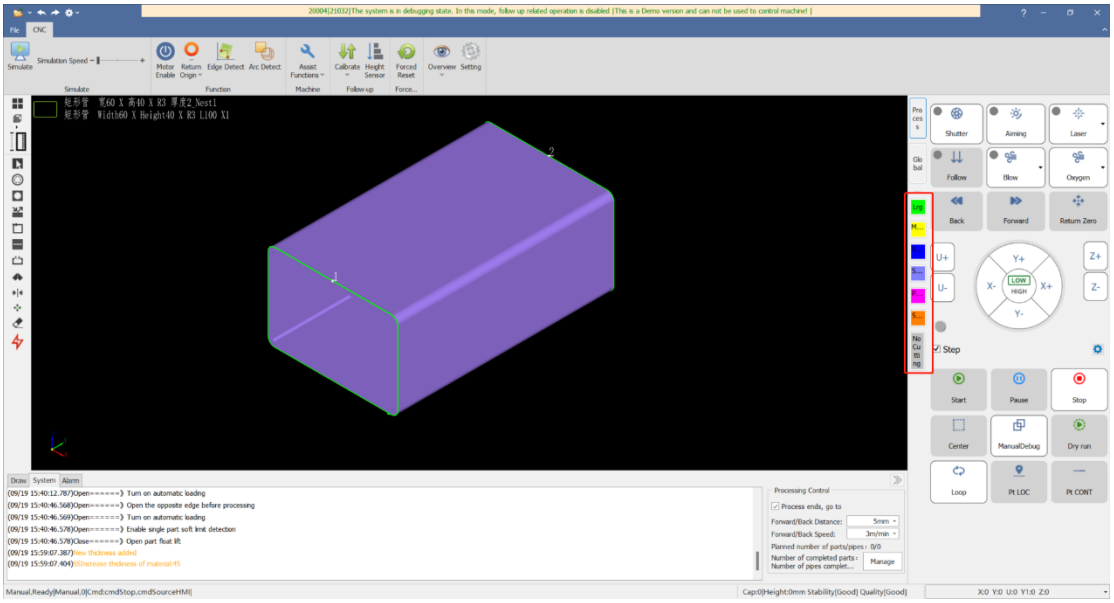
A. After selecting any material in the process bar, right-click the mouse, there will be a pop-up window to add material classification/thickness. Users can add the corresponding pop-up window to the corresponding pop-up window
The material and the thickness under the selected material, as shown in the figure below, add SS as an example:

B. After SS is added, the thickness needs to be added:



4.2 Layers

This software provides 7 processing layers, each layer can be set separately. After the graphics to be cut are imported, users can click the layer button on the right to use different cutting processes for different contours.



4.3 Processing Type

Processing Type		
Parameter name	Default Value	Remark
Standard cutting		Standard follow-up cutting, can cut round/square/oval/waist round tube, etc.
Fixed height cutting		Z-axis fixed height position cutting, can only cut round pipes but cannot follow.
Common cutting		Common cutting without piercing.
Pierce		There will be piercing when cutting after checking.

4.4 Cutting parameters

Cutting parameters		
Parameter name	Default Value	Remark
Cutting speed		Set the command speed of cutting.
Cutting height		Setting the distance between the laser head and the tube during cutting.
Cutting gas		Select oxygen, nitrogen, air to cut.
Cutting gas pressure		The pressure of the gas during cutting.
Cutting power		Setting the peak output power of the laser during cutting.
Duty cycle		Set the light emitting duty cycle of the laser during cutting, that is, the ratio of the light emitting time to the total time in a light emitting period. The larger the value, the higher the average light emitting power. 100% can be considered as that the average power is equal to the peak power.
Cutting frequency		Setting the beam-out frequency of the laser during cutting, that is, the number of light-emitting times of 1 second, the larger the value, The more continuous the light is, 5000Hz can be regarded as continuous light.
Residence time		Set the time delay of the starting point of the drawing machining.

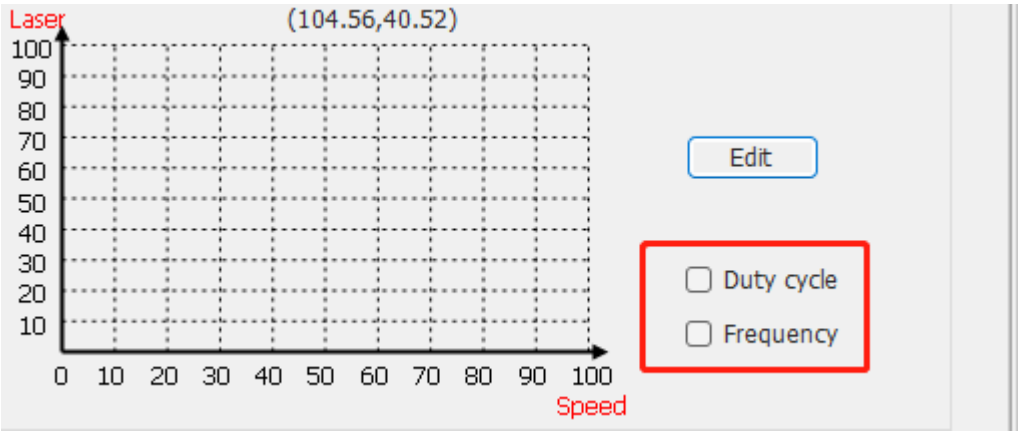
Corner parameter		
Parameter name	Default Value	Remark
Enable U-axis speed limit		When checked, the rotational speed of U will follow the U-axis rotational speed set at the corner.
Corner speed		U-axis over-corner rotation speed.
Height compensation		Cut height compensation when crossing corners.
Corner gas pressure		Gas pressure when cutting corners.
Corner power		The power does not share the same power when cutting corners as when cutting end faces.
Corner frequency		Corner beam-out frequency.
Corner duty cycle		Set the beam-out duty cycle of the laser during cutting, that is, the ratio of the light emitting time to the total time in a light emitting period. The larger the value, the higher the average light emitting power. 100% can be considered as that the average power is equal to the peak power.

4.5 Power Curve

The laser energy output curve can be displayed by checking the corresponding selections:

There are two power-speed curves: duty cycle and frequency. Users can check any combination to display. It is recommended to only check duty cycle, as the effect is more obvious and it is easier to debug.

Click the Edit button to enter the curve editing interface for editing.



The power control curve of this software is fitted by spline curve mode, the abscissa is the speed, the ordinate is the laser output, and the power control curve is fitted by spline curve, with high smoothness.

Readers can choose three kinds of curve editing interfaces on the tab page above.
The duty cycle is 50% when the speed is 0%;
The duty cycle is 60% when the speed is 20% ~ 30%;
The duty cycle is 90% when the speed is 60%;
The duty cycle is 100% when the speed is 90%.

For example, in the processing technology, the cutting speed is 10m/min and the duty cycle is 100%; When the cutting speed is 2-3m/min, the duty cycle is 60%; When the cutting speed is 9-10 m/min, the duty cycle is 100%. The software's default power curve can meet most conventional processing needs, so customers can make fine-tuning based on the software's default curve.

4.6 Pierce

Piercing parameter		
Parameter name	Default Value	Remark
Piercing method		Ordinary piercing, progressive piercing, multi-stage piercing.
Piercing height		When piercing, the height of the nozzle from the tube.
Piercing time		Piercing time.
Piercing power		Beam out peak power of laser when piercing.
Piercing frequency		Set the beam out frequency when piercing.
Duty cycle		When setting the light emitting duty cycle of the laser when piercing, that is, the ratio of the beam out time to the total time in a period. The larger the value, the higher the average power. 100% can be considered as that the average power is equal to the peak power.
Piercing gas pressure		Gas pressure during piercing.
Piercing gas		Gases used in piercing: oxygen, nitrogen, air.
Laser off and gas on		After the piercing is finished, the time with laser off and gas on is used to cool the pipe.
Focus		Set the starting point focus when piercing.

4.7 Remark

In the remarks interface, users can enter some information by themselves, which can be used to remark the precautions of the current process and other related information, for example, remark the current nozzle size and so on.

4.8 Import and Export

To import or export the process parameters of this layer, users should note that this button will only import or export the process of the current process layer.

Export. For example, when using two layers: large outline and medium outline, when clicking the export button on the large outline process interface to save the process, only the processing process in the large outline will be exported. If users need to save the medium outline process, please go to the medium outline interface and click the export button and save it here. The same operation for import.

4.9 Material Library Configuration

Click the Material Library Configuration button in the process interface to open the Material Settings dialog box. There are 7 kinds of existing materials listed. If other kinds of materials need to be added, please click Add to add sheet name and thickness.

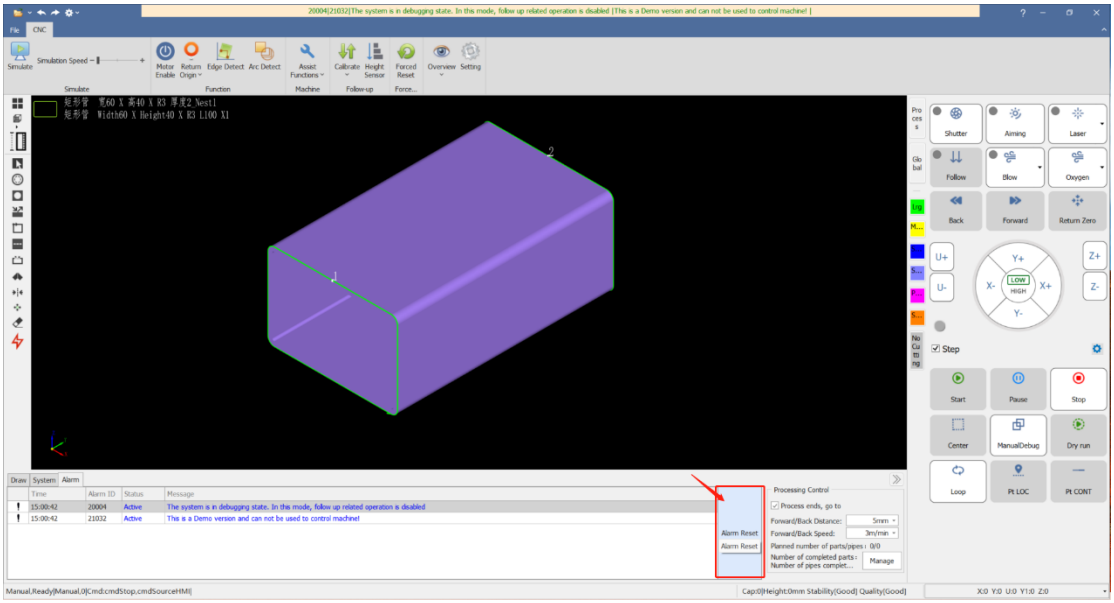
Note: material names can’t be the same.

5. Common Alarm Solution

5.1 Touchplate Alarm

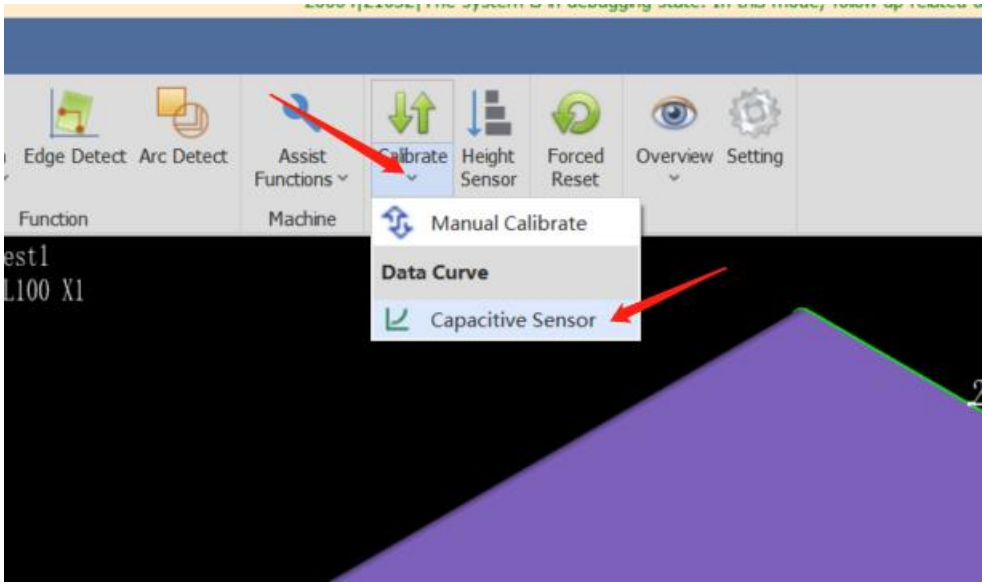
Scenario 1 Handling Method:

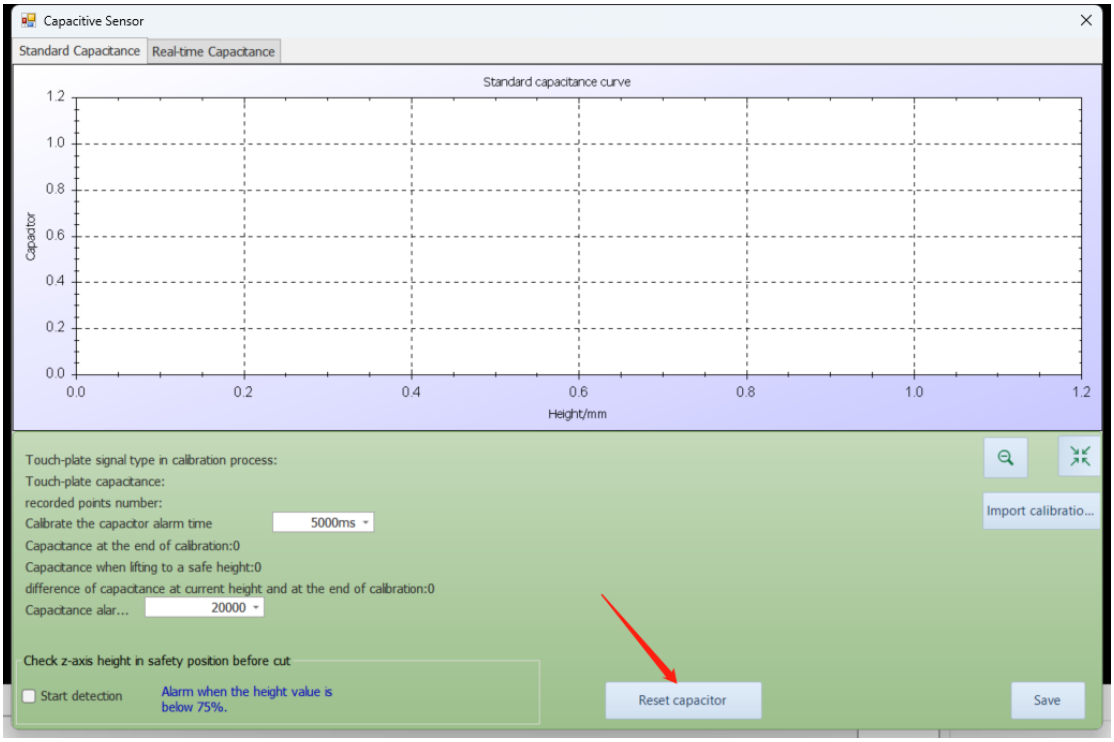
Confirm whether the cutting head hits the plate. If the cutting head hits the plate, the software will prompt "plate touch alarm". Just use wireless handheld or software interface operation to lift the cutting head away from the plate, and click < Alarm Release > on the software. If there is a plate touch during cutting, the cutting head will automatically lift up. Click < Alarm Release > on the software-click < Start > button to continue processing, as shown in the figure below.



Scenario 2 handling method:

If the cutting head does not touch the plate and click the "alarm release" function to clear the "plate touch alarm" on the software interface, we can clear the alarm by resetting the capacitance value. First, we find the main software interface, click the calibration drop-down box on the CNC interface, Find the capacitance sensor and click to enter. Then find the reset capacitor and click [Reset Capacitor]. According to the prompts, users need to perform automatic calibration again, as shown in the figure below.





5.2 The sensor is not connected, and the data cable is disconnected with Alarm

Treatment method:

①. When the cutting head is stationary, observe whether the capacitance value of the software production interface changes dynamically and whether the change value is within the normal range. (The normal change of capacitance value is within 100. If it exceeds the normal value, it needs to be checked in the following way).

②. Check whether the cutting head nozzle is loose.

③. Check whether the connection between the amplifier and the TTW cable is loose or whether there is dust at the

cable interface, resulting in poor contact, etc. It is necessary to blow air to remove the dust.

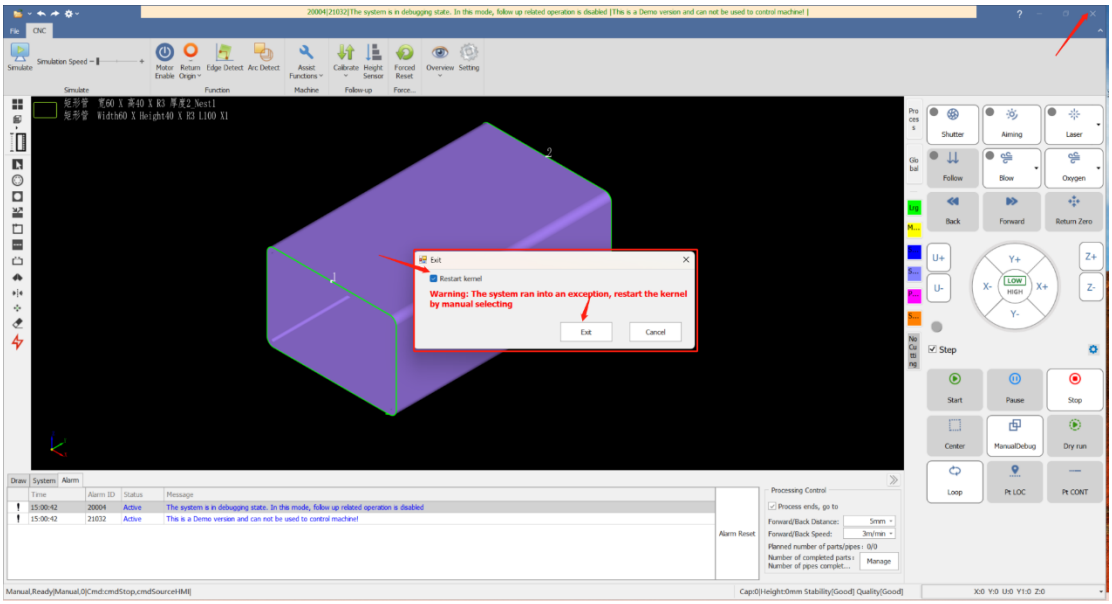
④. If there is still an alarm in the above treatment method, users can contact the personnel of the machine tool manufacturer to deal with it.

5.3 Communication network failure

Treatment method:

1. Through the hardware information in the diagnostic tool, check which slave station communication is interrupted, and then check whether the corresponding slave station hardware has an alarm, or whether the communication interrupted hardware network cable or control line is loose. We see that there is a column displayed on the hardware communication interface. When "op" is displayed, the communication is normal. If "op" is not displayed, the communication abnormal needs to check the hardware communication, such as whether the servo has an alarm and whether the network cable is loose. If the driver has an alarm, the servo needs to be powered off and restarted once. Then hold it wirelessly or click "Clear Alarm" on the software interface.

2. If the slave station shows that the communication of EDS3000 module is interrupted, users need to exit the system and check Restart Kernel before re-entering the software, as shown in the figure below.



5.4 Network communication failure/network communication interruption

The system has been automatically disenabled, and the reset operation processing method must be executed:

1. This alarm is an abnormal communication alarm. It is necessary to check whether the network cable or servo control cable is loose, or whether the servo power supply is turned on.
2. Exit the system (users need to check Restart Kernel) and then restart the system.

5.5 Capacitance sensor disconnected/TRA disconnected or lower end falling off

Treatment method:

1. Check the TTW wire connection between the amplifier and the lower end for falling off or poor contact.
2. Check whether the sensor cable is securely connected to the laser head plug part.
3. Check the nozzle for impact and the ceramic ring for chipping.
4. Reset the capacitor to see if the alarm can be cleared-if it cannot be cleared, please contact the manufacturer.

5.6 Follow-up jitter/follow-up overshoot phenomenon

Treatment method:

1. Check whether servo parameters, rigidity and inertia ratio are too low to cause follow-up overshoot.
2. Check whether the value of the servo self-tuning is within the required range.
3. Check whether the capacitance value jumps too much after upper enabling, causing it to follow up to the tube surface and then jitter back.

5.7 The capacitance value fluctuates greatly

Treatment method:

1. Whether the machine tool has a grounding wire, and whether the ground pile of the grounding wire is standard specification.
2. Whether the strong and weak current of the machine tool are separated, and whether the driver power supply passes through the filter.
3. Is the solenoid valve connected to the diode according to the regulations.
4. Servo brake controlled by relay, whether the power supply of brake is single power supply.

5.8 Motion axis alarm following error

Treatment method:

1. Verify that the pitch and pulse are set correctly.
2. Whether the servo parameter is set as pulse + direction positive logic.
3. Drop enable to push the machine. Is there any abnormal noise or the machine is stuck?
4. For drivers above 1kw, the speed is set very high. If the driver overload or overcurrent suddenly occurs, the driver will alarm, and the software will also prompt the alarm of following error. Then check that the driver does not have a braking resistor. For drivers above 1kw, it is best to add a braking resistor of about 300w50 ohms.