РУКОВОДСТВО ПО УСТАНОВКЕ ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ ЧПУ КОНТРОЛЛЕРА FSCUT 3000S

Revision record

Revision date	Content	Reviser

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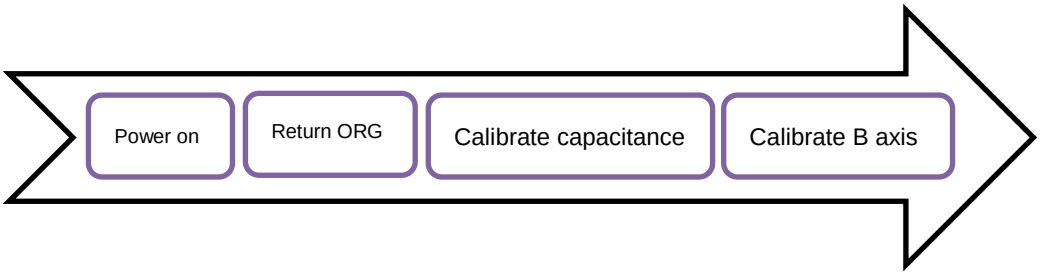
1. Quick start

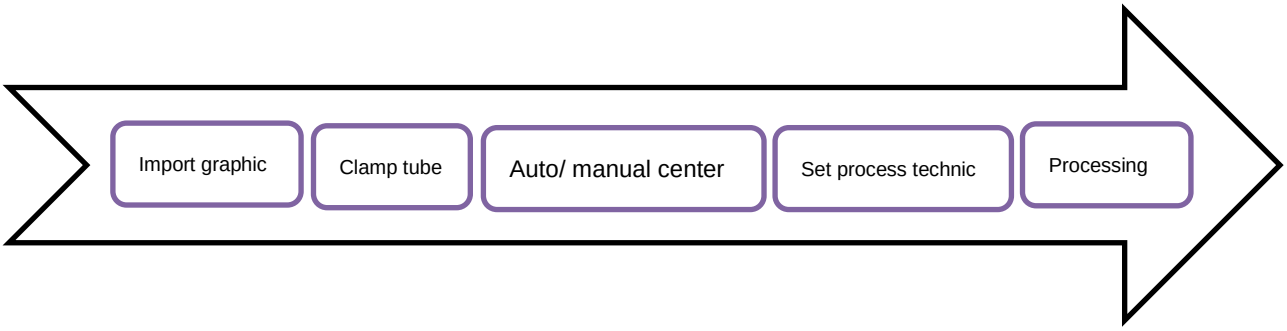
1.2 Functional features

The TubePro system series are developed by Shanghai Friendess Electronic Technology Co., Ltd. including TubePro5000A, Tube5000B and TubePro5000C which are specially used for laser cutting of metal steel tubes, featuring high precision and efficiency.

1.3 Adjust process



1.4 Processing flow



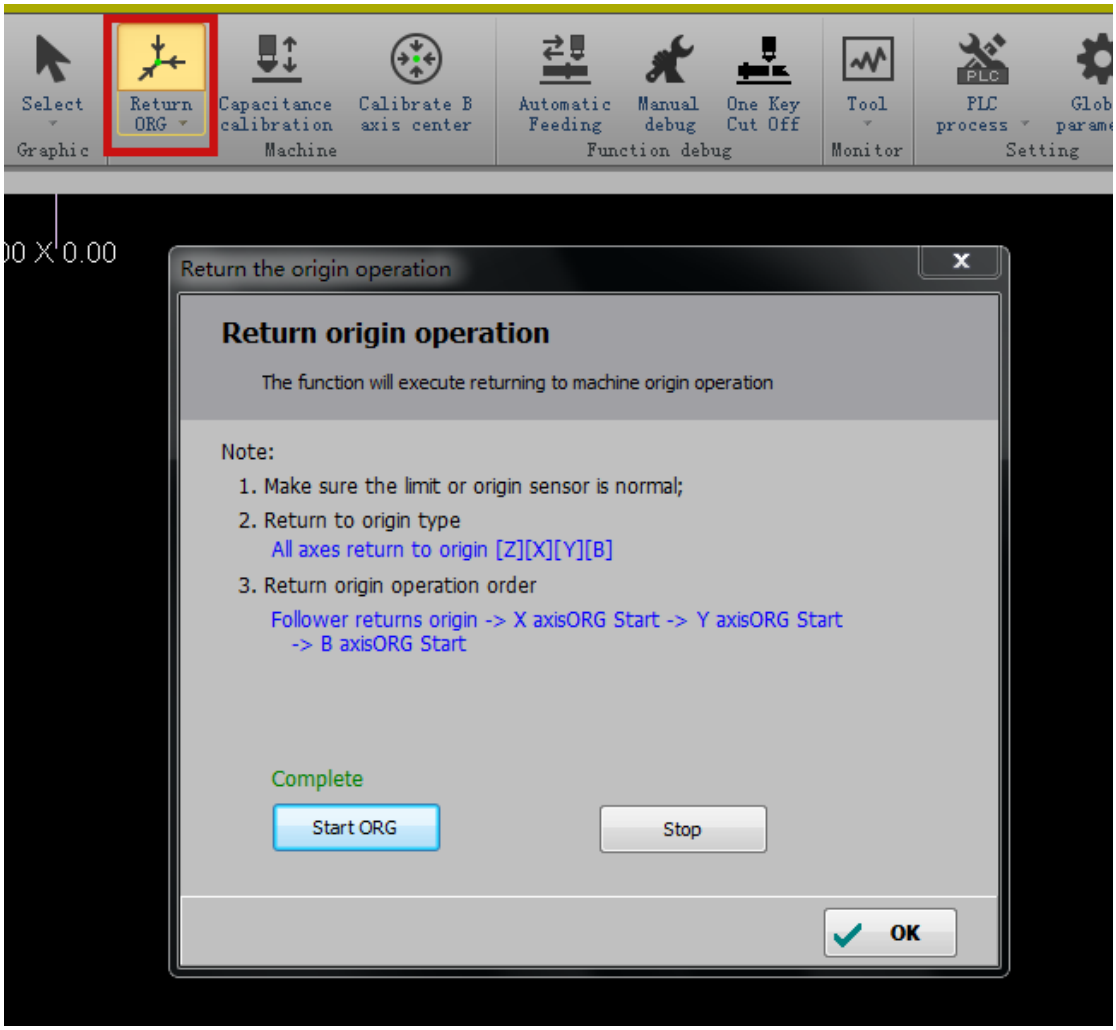
1.5 Function and Operation

1. System returns ORG

Open TubePro software, click [Return ORG] menu-> [All Return ORG].

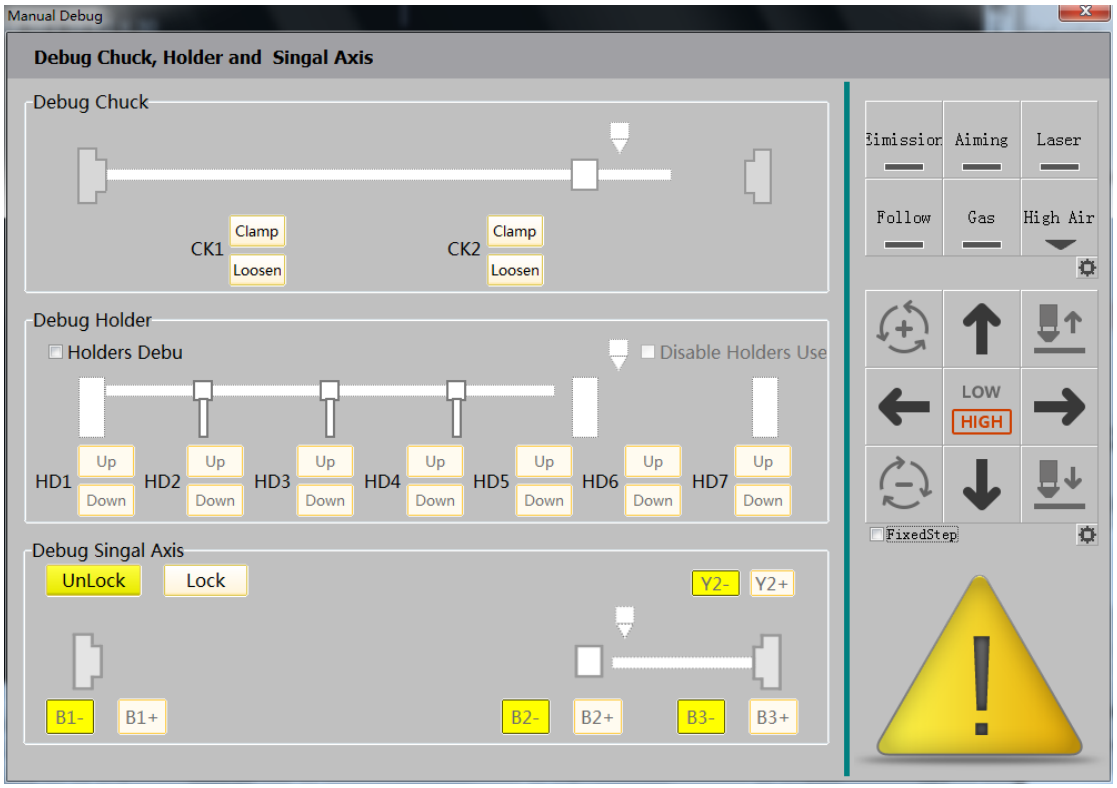
Return ORG operation menu prompts and specifies the actions to be executed in return ORG process: Holder goes down-> Z axis returns ORG ->X axis returns ORG-> Y axis returns ORG-> B axis returns ORG. When the return ORG process is successfully completed, click [OK] to exit dialog.

Notice: In the first-time adjust, please adjust single axis return ORG separately before execute All Return ORG operation.



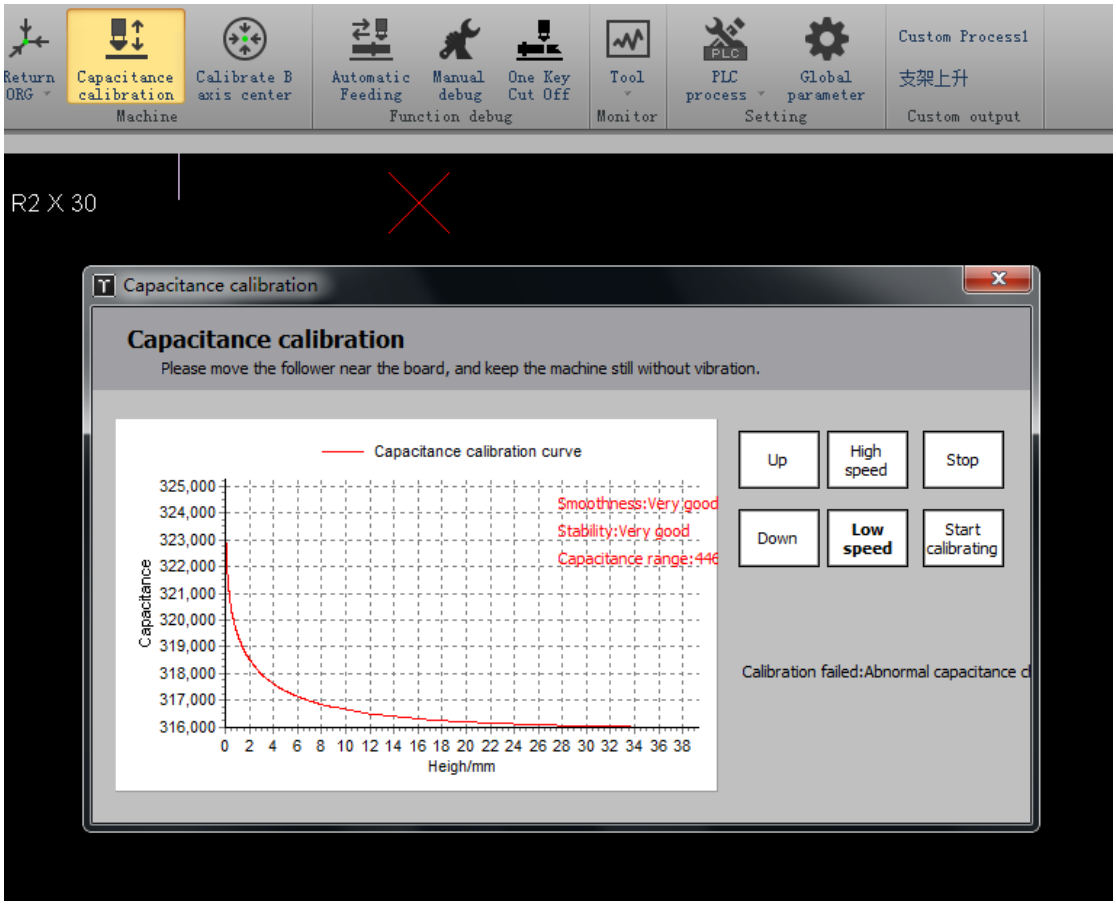
2. Load and clamp tube material

Click [Manual Debug] prompts the Chuck, Holder and Single axis debug menu. Clamp the tube material to be processed by click the Clamp/ Loosen button. You can also adjust the holder up/ down to assist the loading of long tube if the holder is equipped.



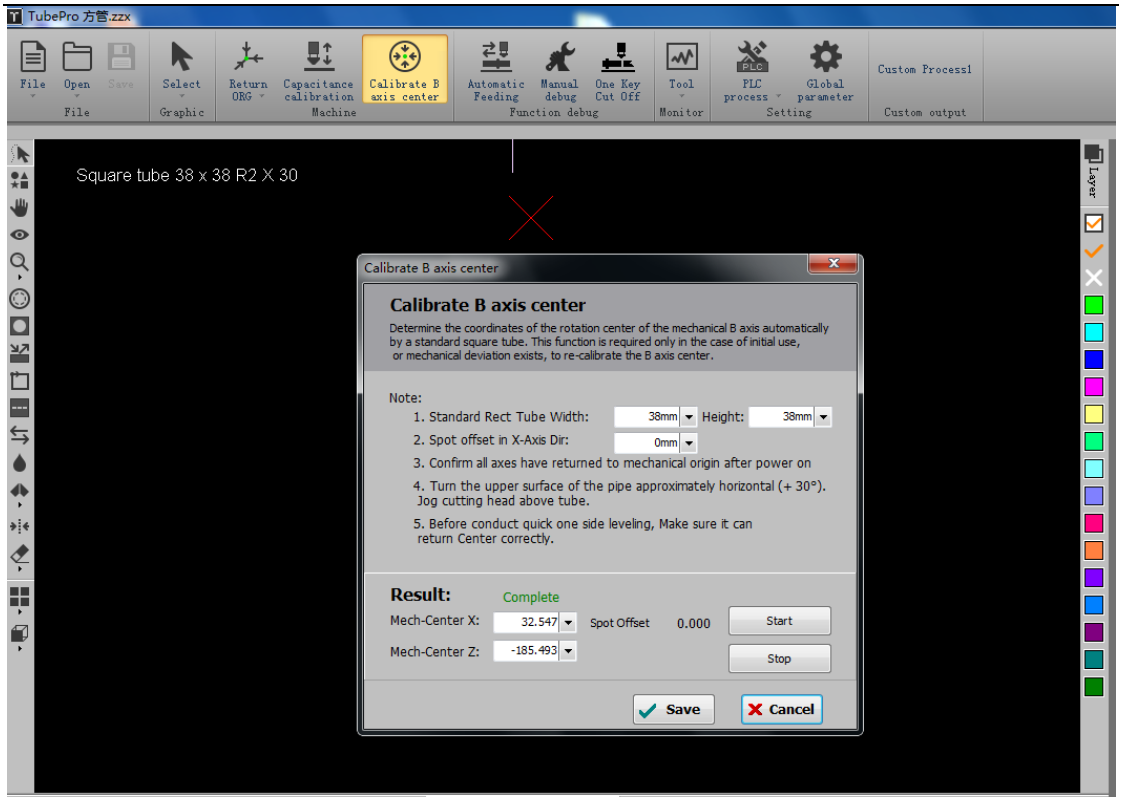
3. Calibrate height controller

Move the rectangular steel tube under the nozzle by Jog the X/Y/B axis. Then level the upper surface of the tube horizontally and Jog the Z axis to move the nozzle close to tube material. In TubePro5000C system, please click [one key calibration] on menu bar; In TubePro5000A and 5000B systems, please click [capacitance calibration], select [OK] on Confirm Security dialog box. Then BCS100 height controller starts calibration.



4. Calibrate B axis center

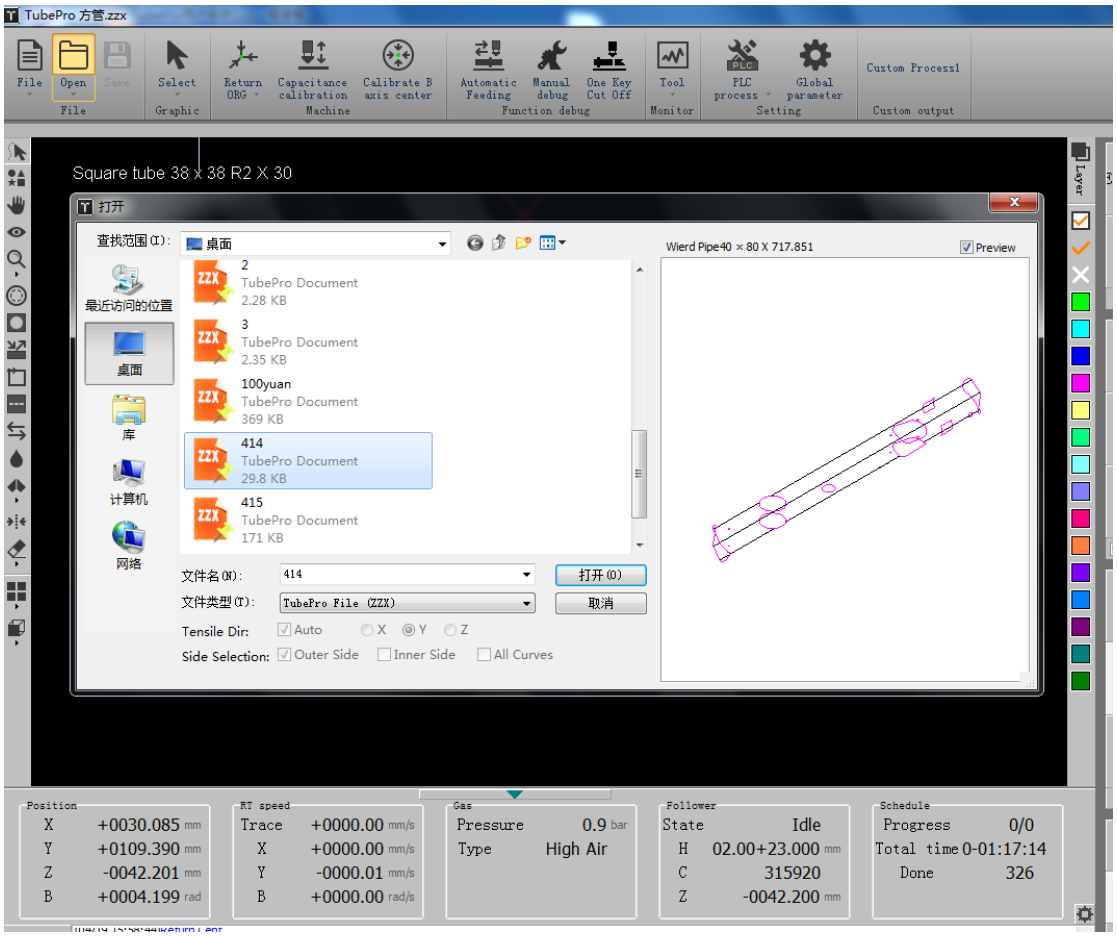
Move the rectangular steel tube under the nozzle by Jog the X/Y/B axis and level the upper surface of the tube horizontally. Then click [Calibrate B axis center] on menu bar, enter the size of tube, click [Start calibrate center], and click [save] exit.



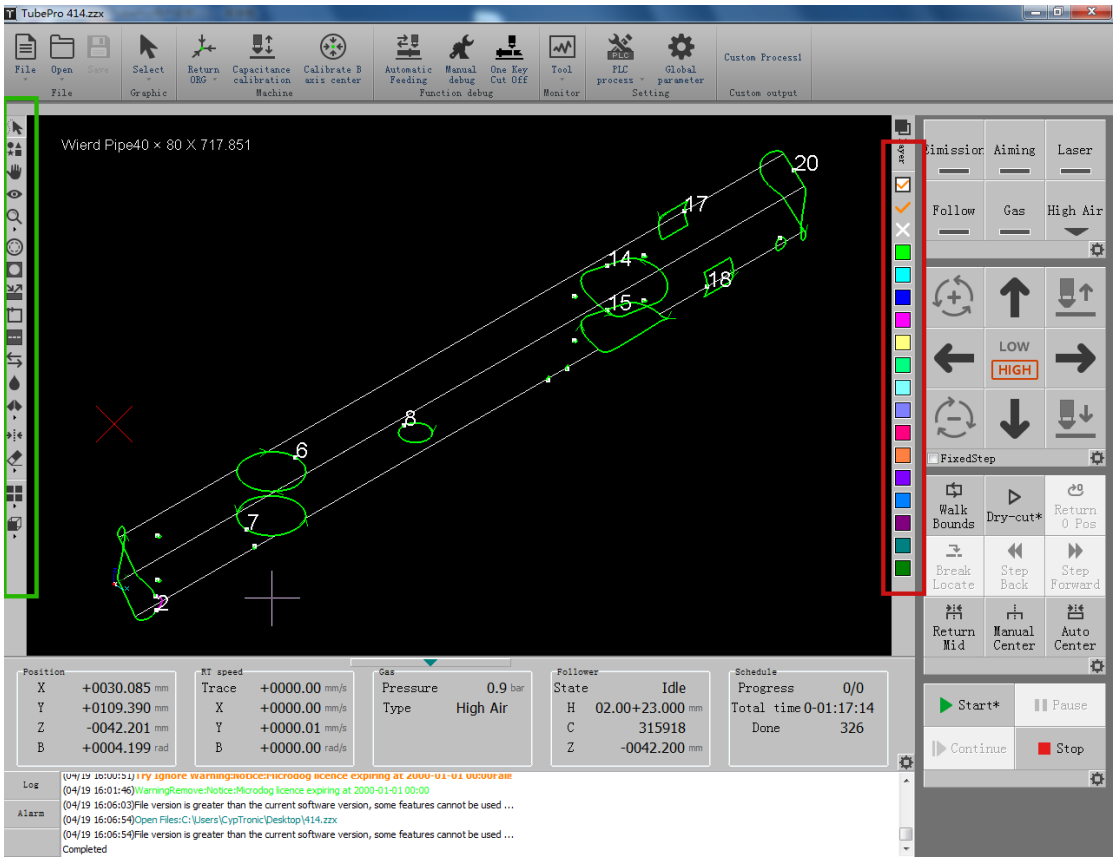
Notice：It requires accurate and reliable X/Z/B axis coordinates before calibrate B axis center, which means you need to execute Return ORG to every single axis then load and clamp the tube material and calibrate B axis center.

5. Import graphics

Click [Open] on menu bar, select the *.zzx file to be processed. Open the right side of the menu you can preview the graphics and its size.



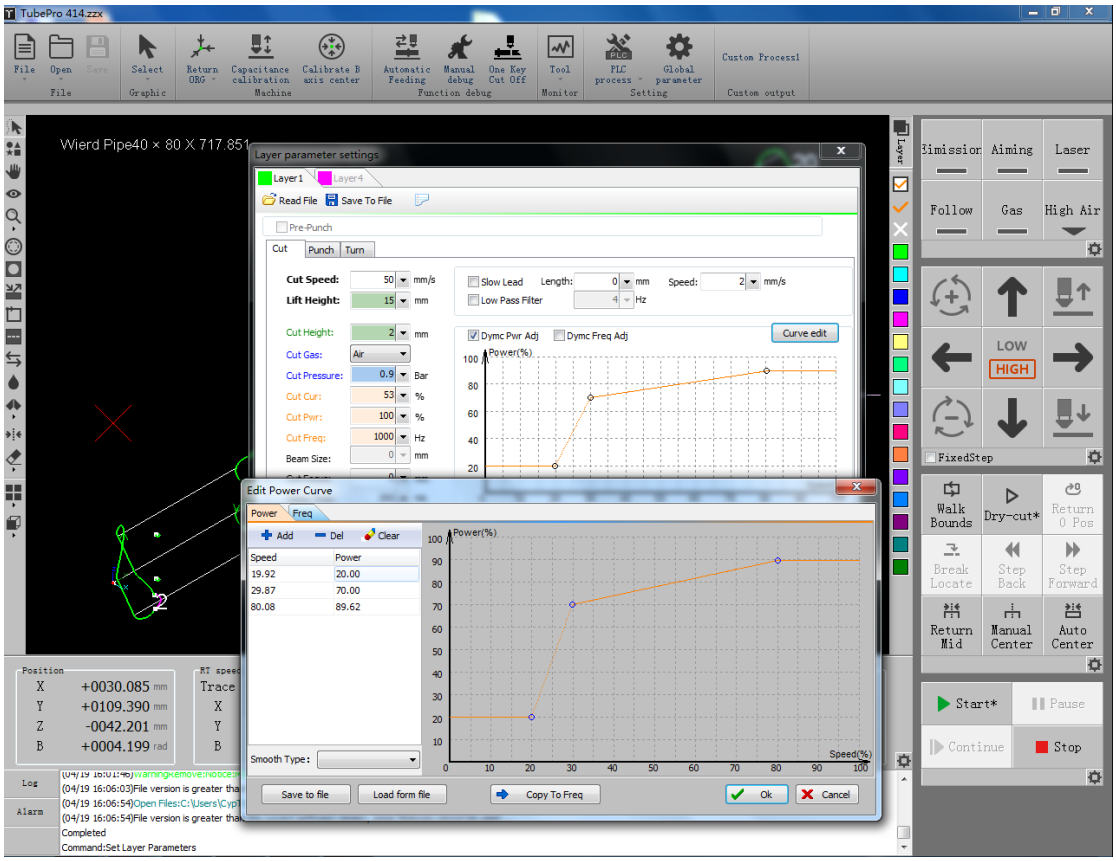
Then you can quick-set the start point, lead-in line, mid-point with CAD left tool bar and set the graphic layer and layer parameters on the right side tool.



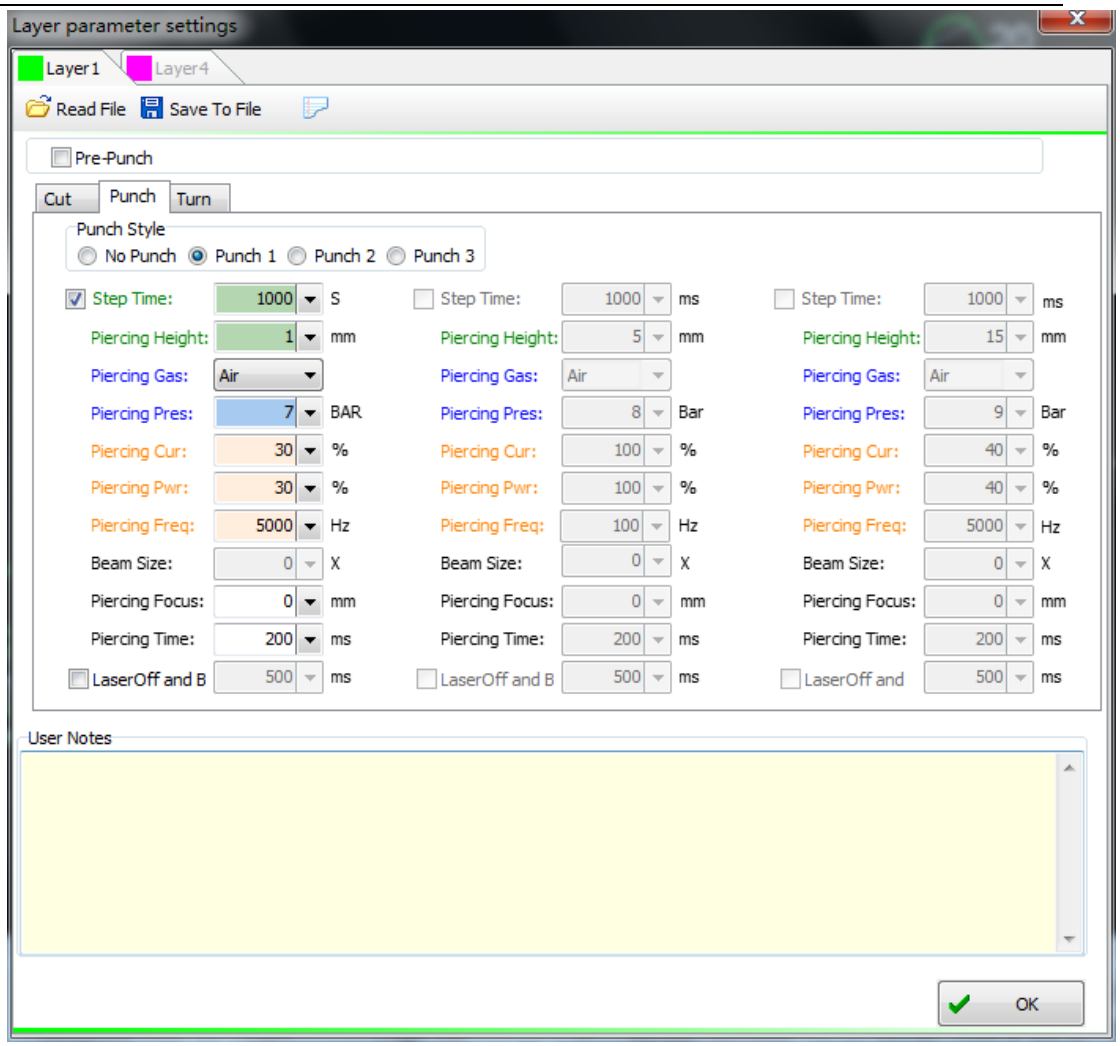
6. Layer parameters setting

Click [Layer] in tool menu to set the process parameters of the layer.

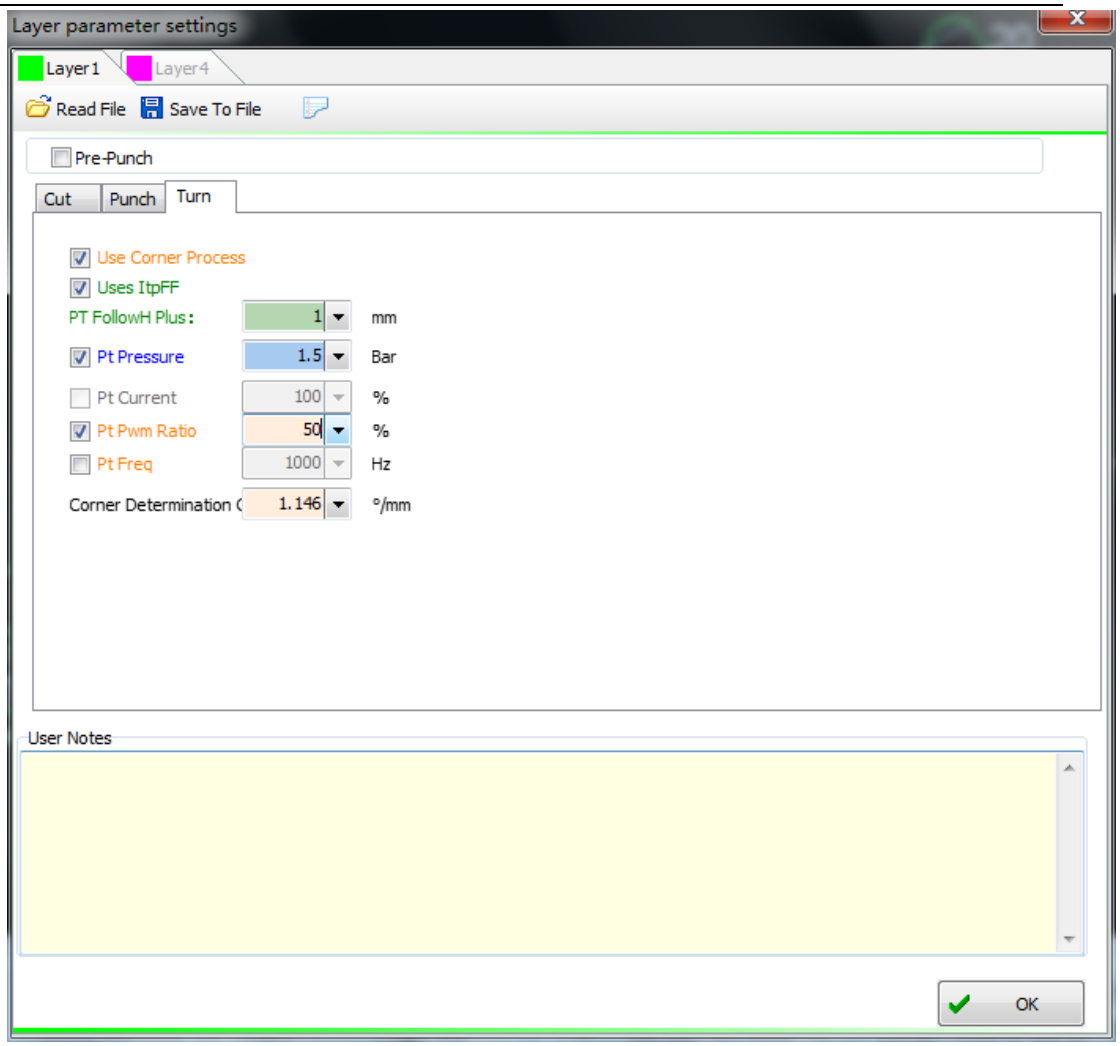
Click into [Cut] page, for example, set the cut speed as 50 mm/s , peak power as 50%, and enable Dymc pwr adj(dynamic power adjustment) and Dymc Freq adj(dynamic frequency adjustment).



Click into [Punch] page to set the step time under Punch 1 as 1000ms.

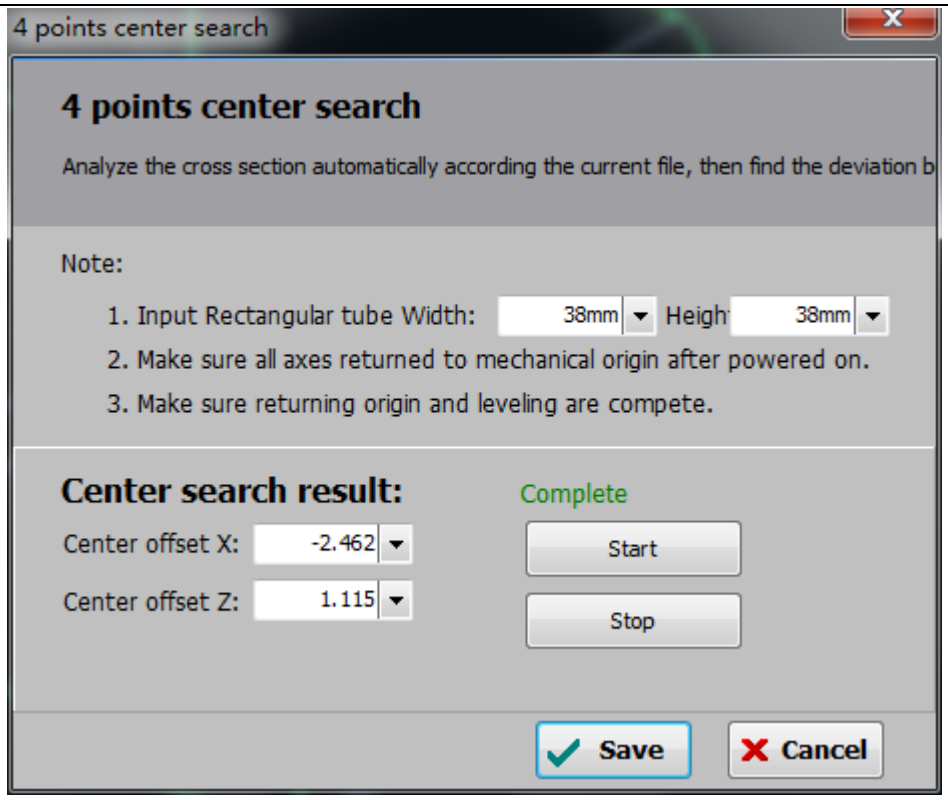


Click into [Turn] page to enable the corner process, for example set the PT FollowH plus as 2 mm, setting up the duty ratio as 40%.

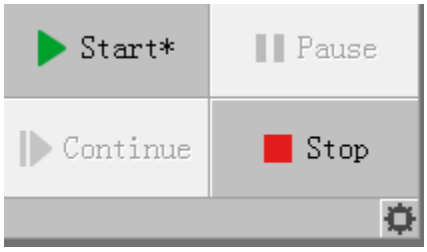


7. Start processing

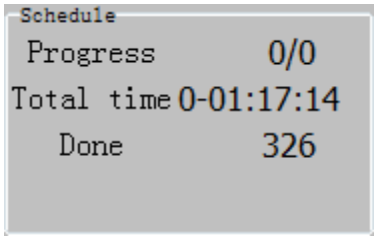
Import the zzx file, to process the square tube / rectangular tube/ round tube / angle steel / channel steel, please click [Auto center] under operation bar first, make sure the actual size of tube material correspond with the size displayed in pop-up window then click Start to execute Auto Center. Click [Save] exit after the operation is completed. Auto Center is not available for oval tube / Obround tube / irregular shaped tube, please adjust the rotary axis in accordance with zzx graphics.



Then click the [Start] button in the operation bar to start processing.

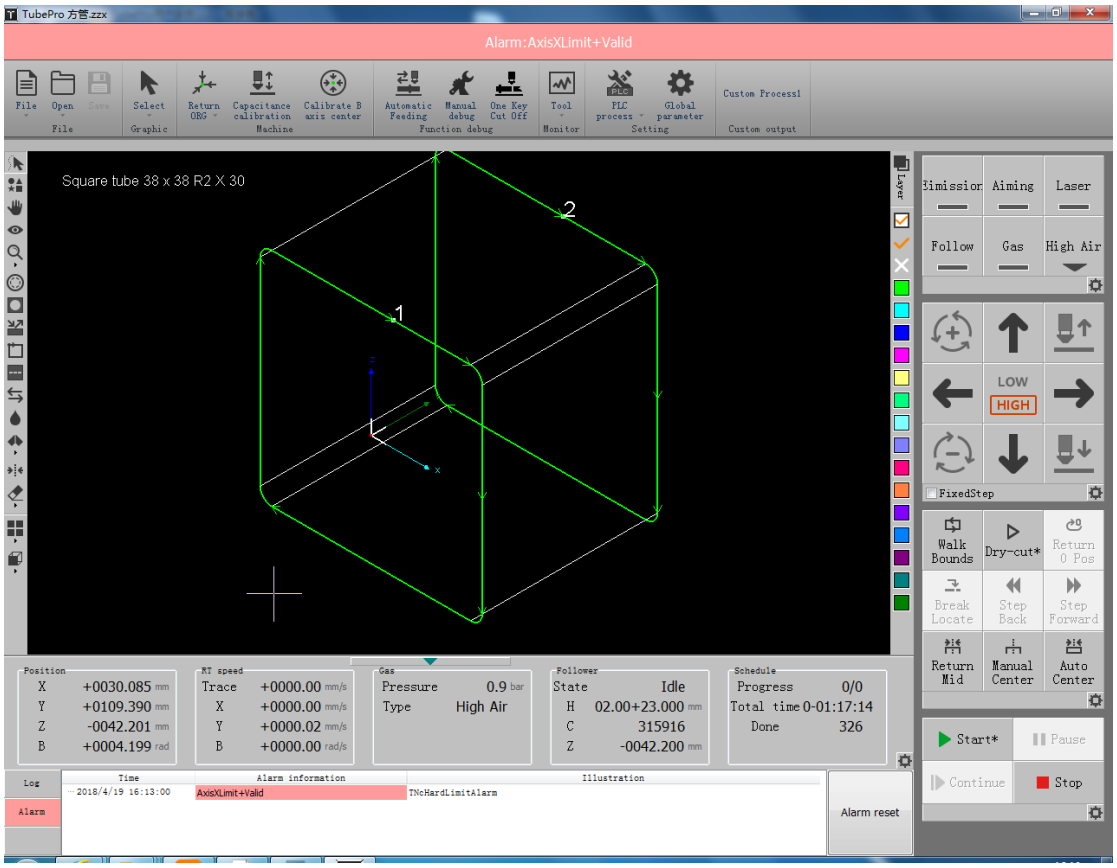


You can see the progress of the parts in the State Bar.

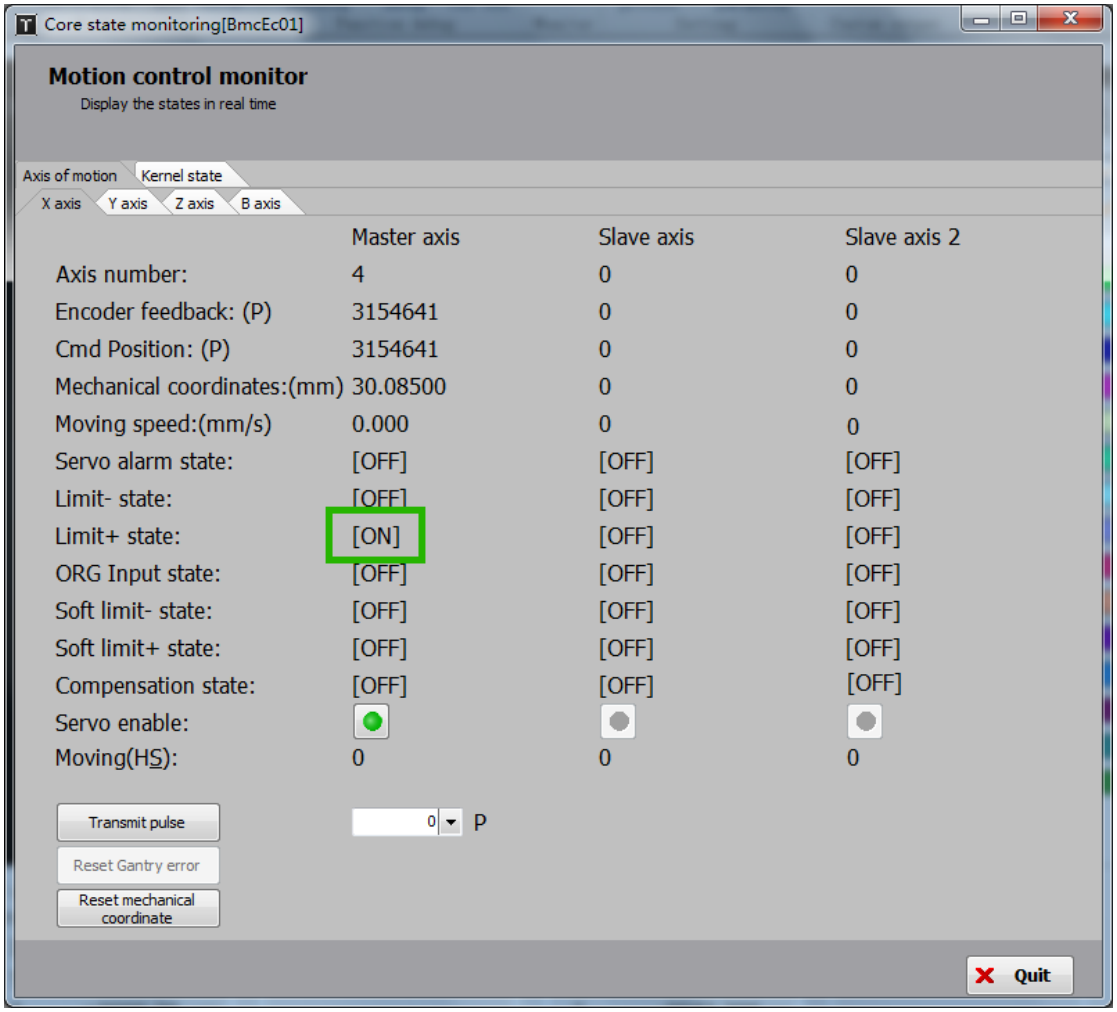


8. Alarms

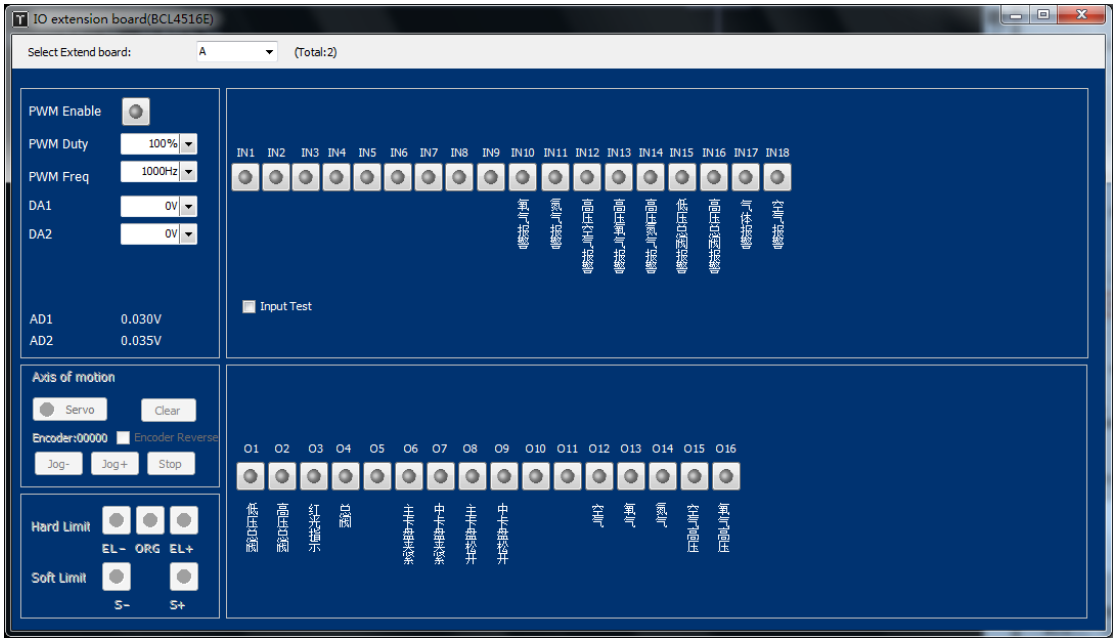
During the operation of the system, alarm or warning will appear in alarm status bar on the top, meanwhile start time of alarms and related information will be displayed at the bottom.



You can check the X axis status by Tool menu - > Motion control monitoring, current Limit+ is on.

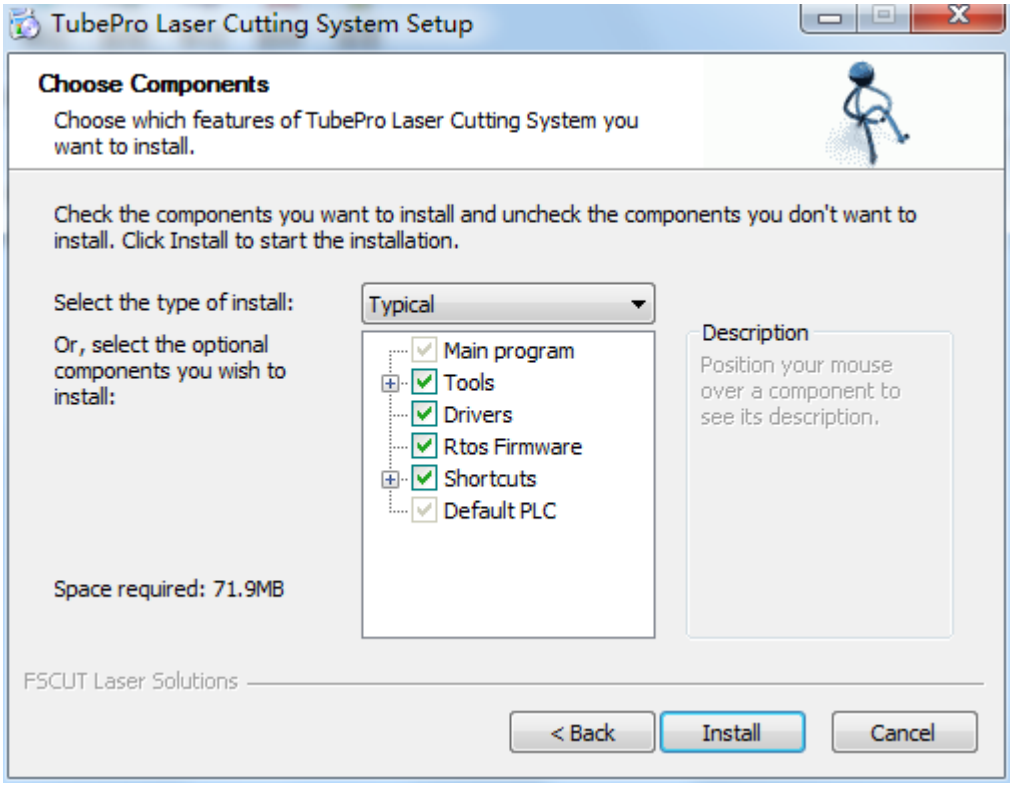


Open the Tool menu ->BCL4516E or other extension board monitors to check the status of the input.



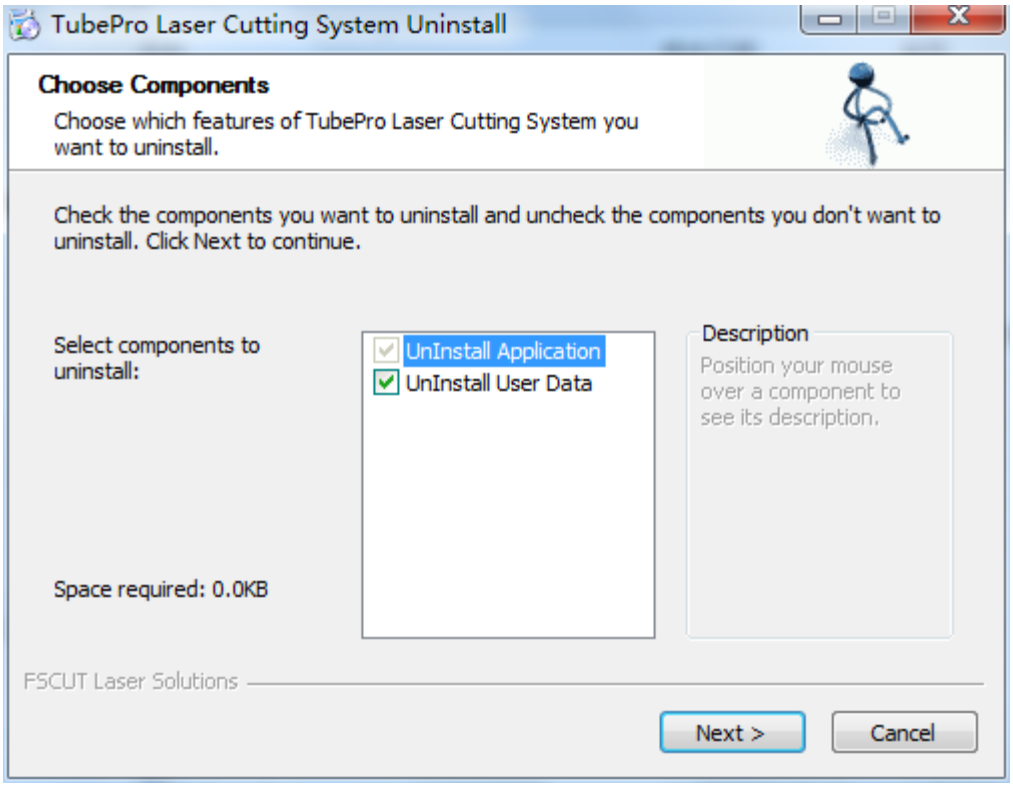
1.6 Software installation and unloading

1. Install software



2. Uninstall software

You can select whether to delete user data on Uninstall software interface. If select delete user data, the mechanical configuration, PLC configuration, and process parameters will be all cleared.

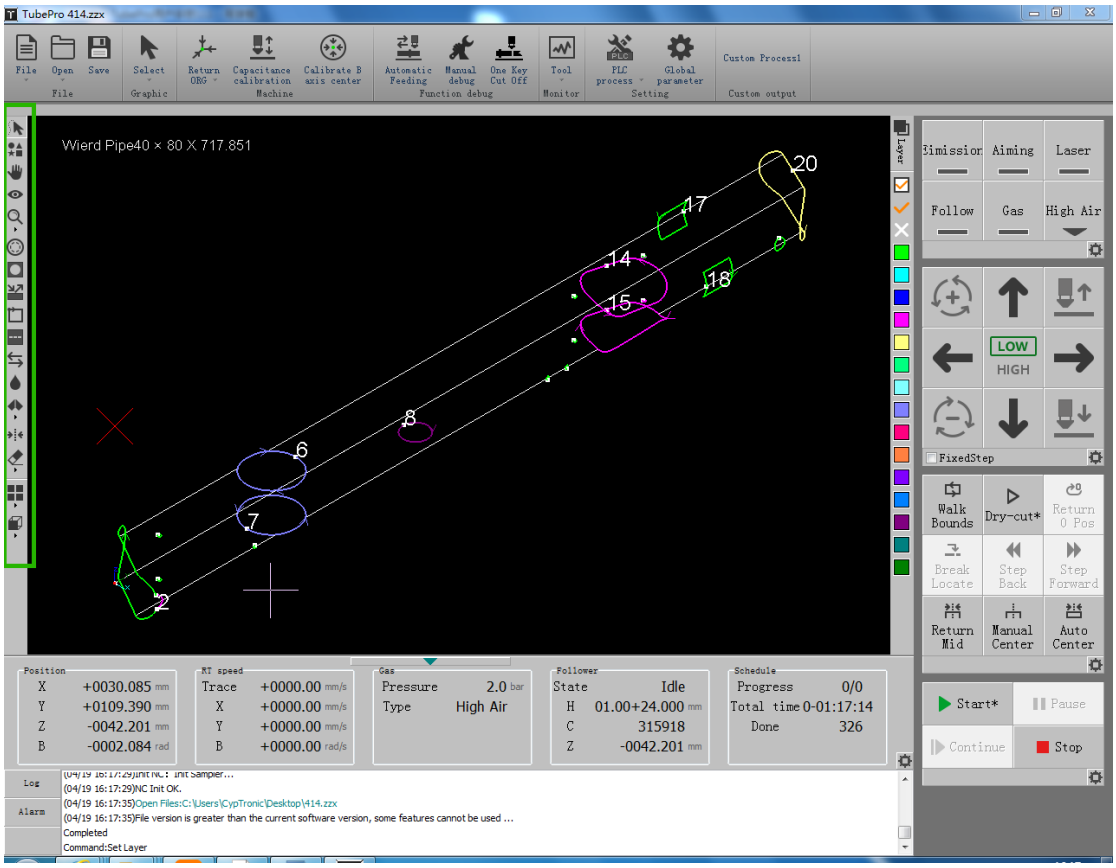


Notice：When unload TubePro, the default is to delete user data. You can directly install over the current version to upgrade the software. Uninstall operation is usually used when user data missing or files damaged, to avoid error caused by calling the incorrect data in overlay installation.

2. TubePro detailed instructions

2.1 Shortcut toolbar

The shortcut toolbar contains the tool button of Select line, Select parts, Drag, 3D view, Zoom, Compensation, InOut, lead-in line, Start point, MicroJoint, Reverse, Cooling point, Weld compensation, Seek center, Clear, Display mode, View selection.



: Select line, to select the specified curve.

: Select parts, to select the specified parts. Click to select all graphics in parts area at one time while the front end face of the shared-edge parts not included.

: Drag, drag the graphics or press Ctrl + mouse wheel to check.

: 3D view, to rotate-view the graphics in 3D. Or you can hold the mouse wheel and drag the mouse to enter the 3D view mode. Hold Shift + mouse wheel and drag the mouse to rotate the graphics around the axis of the tube.

: Zoom, to zoom-view the graphics. You can also scroll mouse wheel to zoom the graphics.

: Weld compensation, to compensate the selected graphic and set the weld width.

: InOut, when choose compensation pattern automatically determined, you can switch compensation mode from internal compensation to external compensation and set weld width; you can also switch lead in line from internal lead-in or external lead-in.

: Lead-in line, to set the path and length of lead in line.

: Start point, set the start position of each process path in the graph.

: Micro Joint, to set the distance and position of the micro-joint.

: Reverse, the moving direction of the machining graphic.

: Cooling point, laser-off and gassing at cooling point. The cooling point delay is configured in the global parameters interface.

: Weld compensation, to set whether to compensate the selected section.

: Seek center, to set the start position in graphic to seek center. Double click to auto-set the position according to distance from B axis center to tube center or by the parts location. You can also set seek center position to a single curve. Select a single curve alone can also set the position in the search.

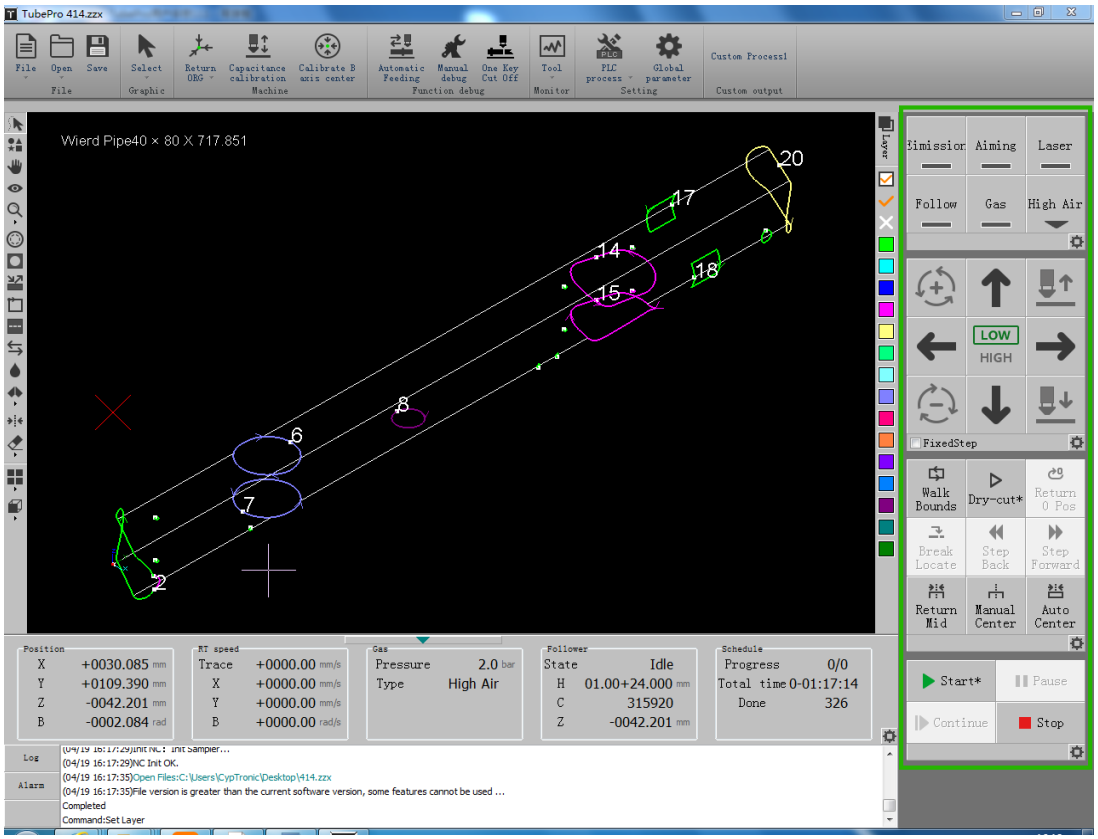
: Clear, you can choose to clear compensation / lead line/ micro-joint / cooling point/ seek center/ clear all.

: Display mode, to select whether display the unclosed graphics / processing order / path origin / trace direction / moving path / moving path / cross section / surface rendering / normal vector.

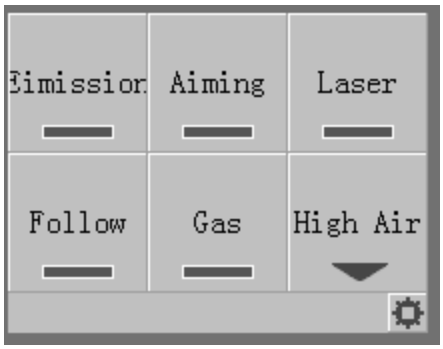
: View selection, to select view mode. You can choose default view / top view / main view / back view / right view / left view / Southwest isometric Survey / Northeast isometric Survey / Southeast isometric Survey / Southeast isometric Survey / Northwest isometric Survey.

2.2 Machining operation bar

As illustrated below on the right bar, the processing operation bar contains emitting operation bar, Jog operation bar and machining operation bar.

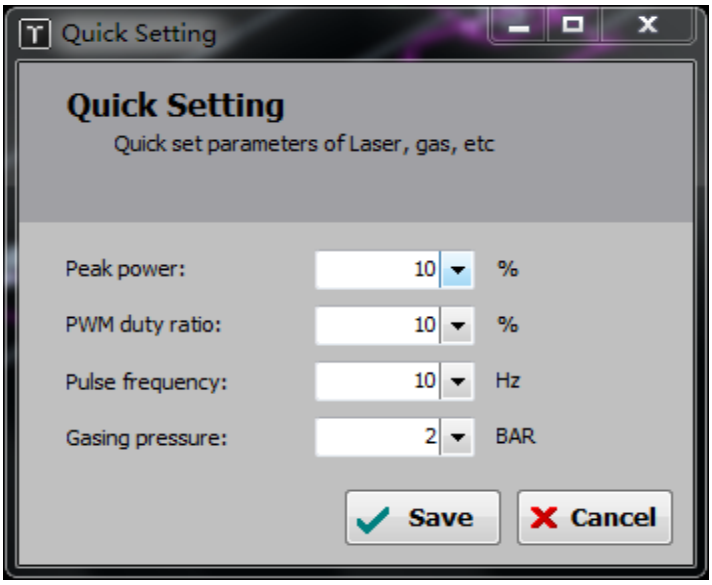


The following are detailed instructions for the four operation bars.



Parameter name	Description
Emission	The shutter of the laser source
Aiming	Red light of laser source

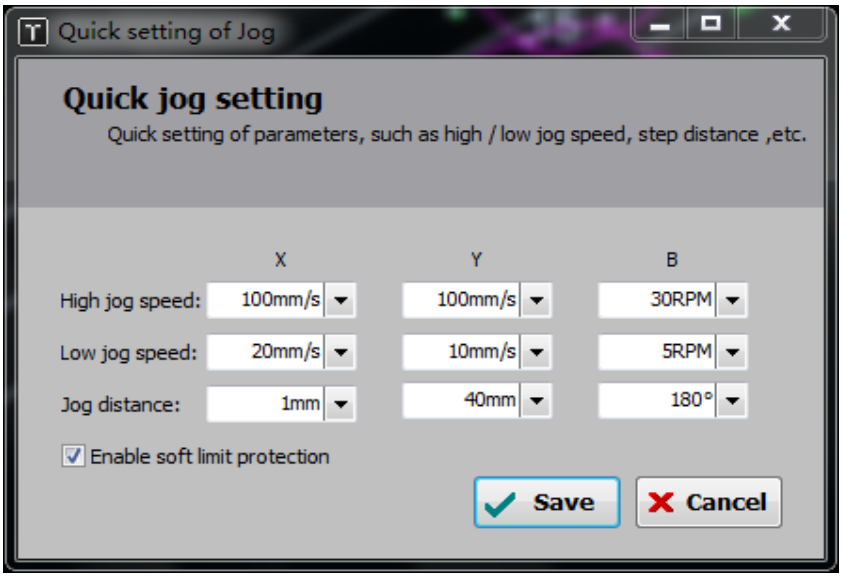
Laser	Burst laser. Left click to burst single beam laser and right click to emit continuous laser beam.
Follow	BCS100 height following.
Gas	Press to emit gas.
Gas selection	Select the available gas.
Quick setting	To set the peak power, PWM duty ratio, pulse frequency and gassing pressure.



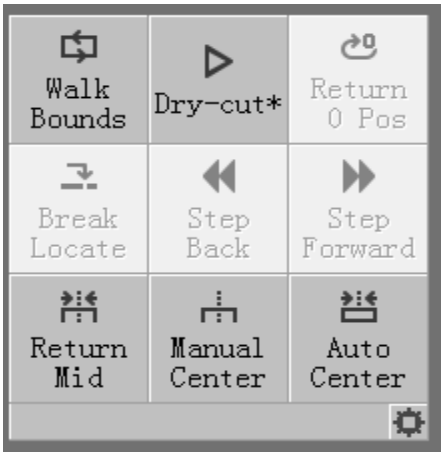
Parameter name	**Description**
Peak power	The peak power of burst laser beam.
PWM duty ratio	The duty ratio of the single laser beam signal
Pulse frequency	The frequency of the single laser beam signal
Gassing pressure	Set the gassing pressure

Parameter name	**Description**

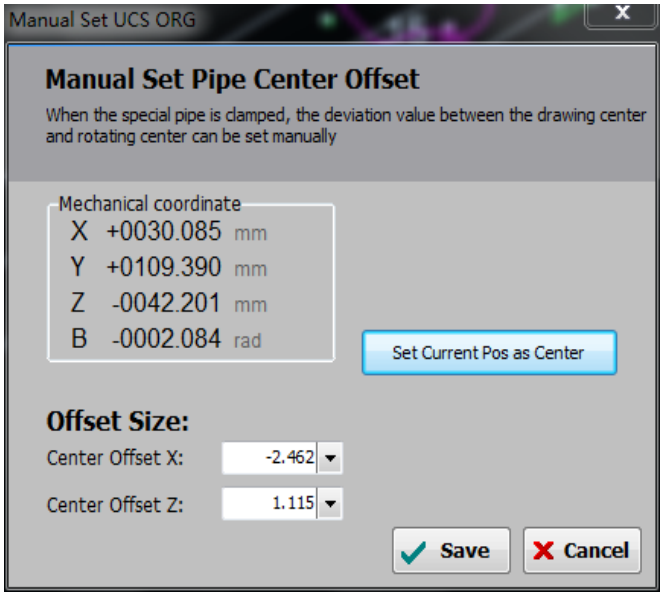
Jog	X/Y/Z/B axis run in Jog/step mode
LOW/HIGH	Set low / high Jog speed or stepping.
Fixed Step	Select the FixedStep, press direction button to specify the axis stepping. Un-check the FixedStep the axis will move in Jog mode.
Quick Jog setting	Set the High Jog speed/ Low Jog speed/Stepping distance/Enable soft limit protection of X/Y/Z/B axis.

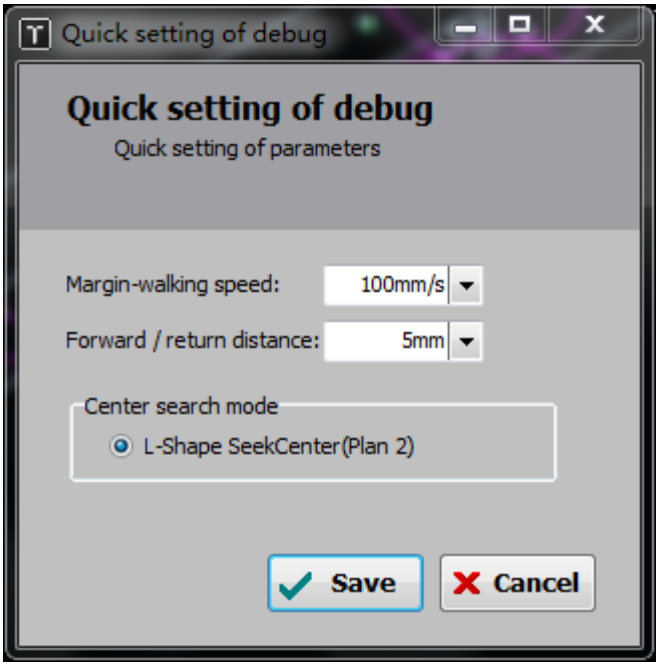


Parameter name	**Description**
High Jog speed	Set high Jog speed/ stepping speed of X/Y/B axis.
Low Jog speed	Set low Jog speed / stepping speed of X/Y/B axis.
Stepping distance	Set distance of low stepping speed of X/Y/B axis.
Enable soft limit protection	Set whether to enable soft limit protection. Soft limit travel range setting is in the platform configuration tool.



Parameter name	**Description**
Walk Bounds	To circle a rectangle border on tool bed according to drawings extent.
Dry cut	The follower moves along the graphics without emission of laser and gas.
Return 0 Position	Move to the zero point of the graphics, of which X, Y, Z, and B axes all involved.
Return Mid	X, B axes move to program 0 point (result from B axis calibration or manual center).
Break Locate	To locate the position where abnormal processing triggered the alarm, and continue the processing.
Step back/ Step forward	Press the button to adjust the processing position after executed Break locate or pause the operation.
Manual center	To set the horizontal position of oval tube/ Obround tube/ irregular shaped tube and the offset of workpiece.
Auto center	This function will measure the offset of rectangle tube/round tube/channel steel/angle steel to guarantee the accuracy of processing path.

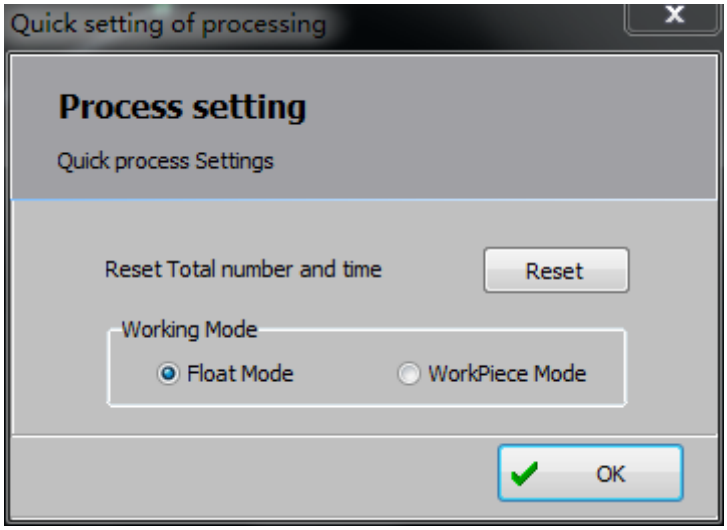




Parameter name	**Description**
Walk-bounds speed(margin walking speed)	Set the speed to circle the border.
Forward and return distance	Set the distance of moving backward and forward. When parts processed undesirably, the function can work with Break locate to locate to the accurate position you want.
Center search mode	To choose the best Seek-center mode according to actual situation of tube material. Four-point seek center is faster than

	5-point mode of which there is an extra leveling tube function used when tube is twisted.

Parameter name	**Description**
Start	Start processing.*： It shows graphic parameter is modified; A： Auto feeding and blanking function is enabled; F: Auto feeding function is enabled. L: Circular processing is enabled; S:The seven-axis pulling function is enabled;
Pause	Suspend the execution of system instructions
Continue	Continue to execute system instructions
Stop	Stop the current system instruction

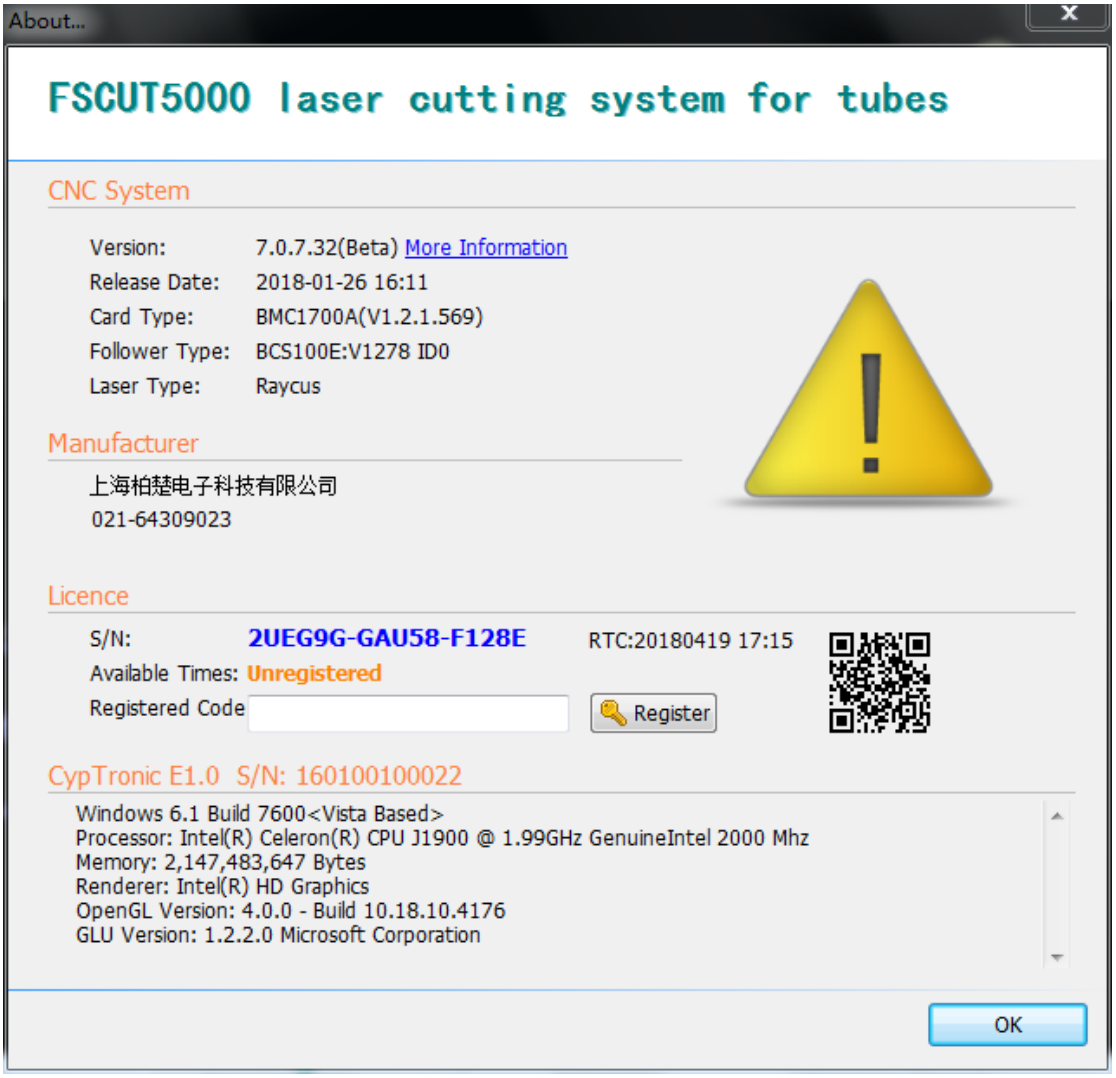


Parameter name	**Description**
Reset total number and time	Clean up the total amount of processed parts and time, clear the history record.

2.3 File menu

1. Version information

You can check the program version, release date, card type, height controller type, laser source type and available time etc.

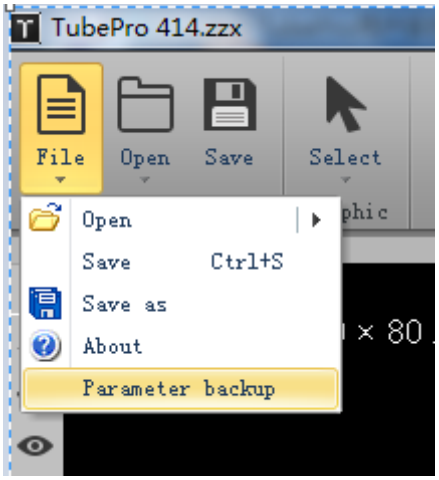


Parameter name	Description
Program version	7.0.6.15 (Beta Edition)
Release date	The program released at 18:53 2017-11-20
Card type	Card type is BMC1700A, support TubePro5000A system
Follower type	BCS100E version is V1278

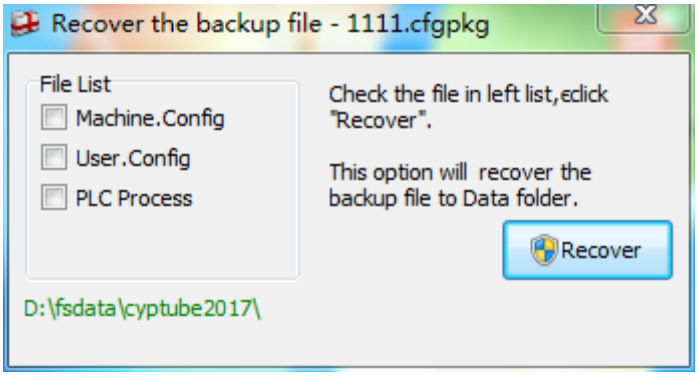
Laser type	IPG/ Raycus and other laser brands
serial number	3NHXXX-XXXXX-XXXXX

2. Parameter backup and restore

The TubePro system provides the parameter backup and restore function through TubePro- file-Parameter backup to generate *.cfgpkg backup file, the file icon is .



Double click the backup file icon will pop-up parameter backup file recovery dialog box, then select the file list to be recovered to finish the recovery.

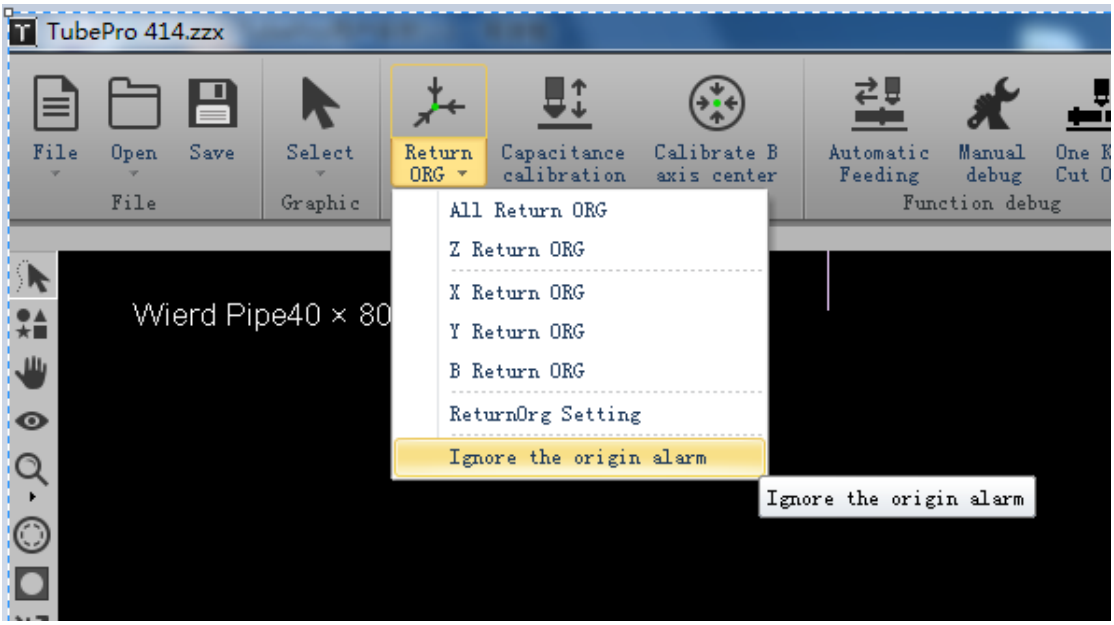


2.4 Capacitance calibration and Return Origin

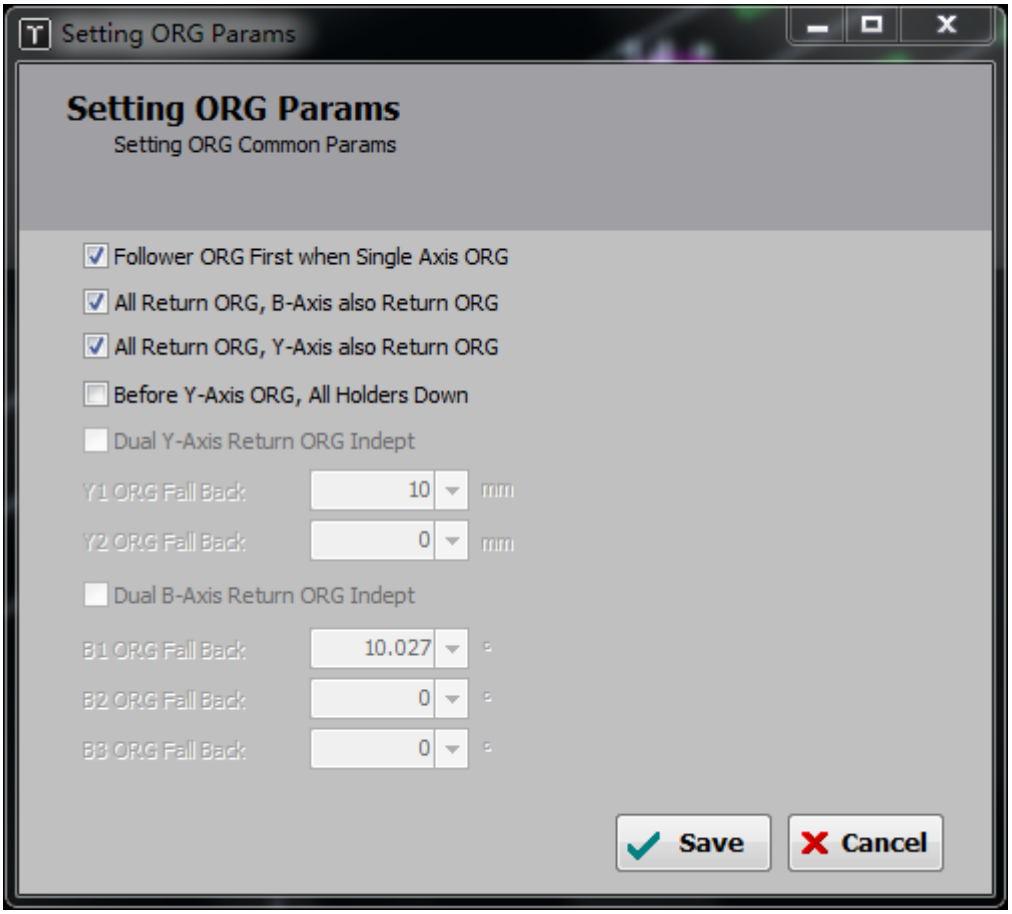
1. Return Origin

Click Return Origin drop-down list there are different options to execute the operation: All Return origin, Z(Z axis) Return origin, X Return origin, Y Return origin, B Return origin, Return Org setting , and Ignore the origin alarm.

Return Origin settings: To set the return ORG process according the different machine model. If there is holder equipped in system, it is recommended to select all holders down before return ORG option. For the independent double-drive axis (non-gantry structure), the install process has to guarantee the synchronization of double-drive. Set the suitable revert distance for each axis after return ORG to achieve the synchronization.



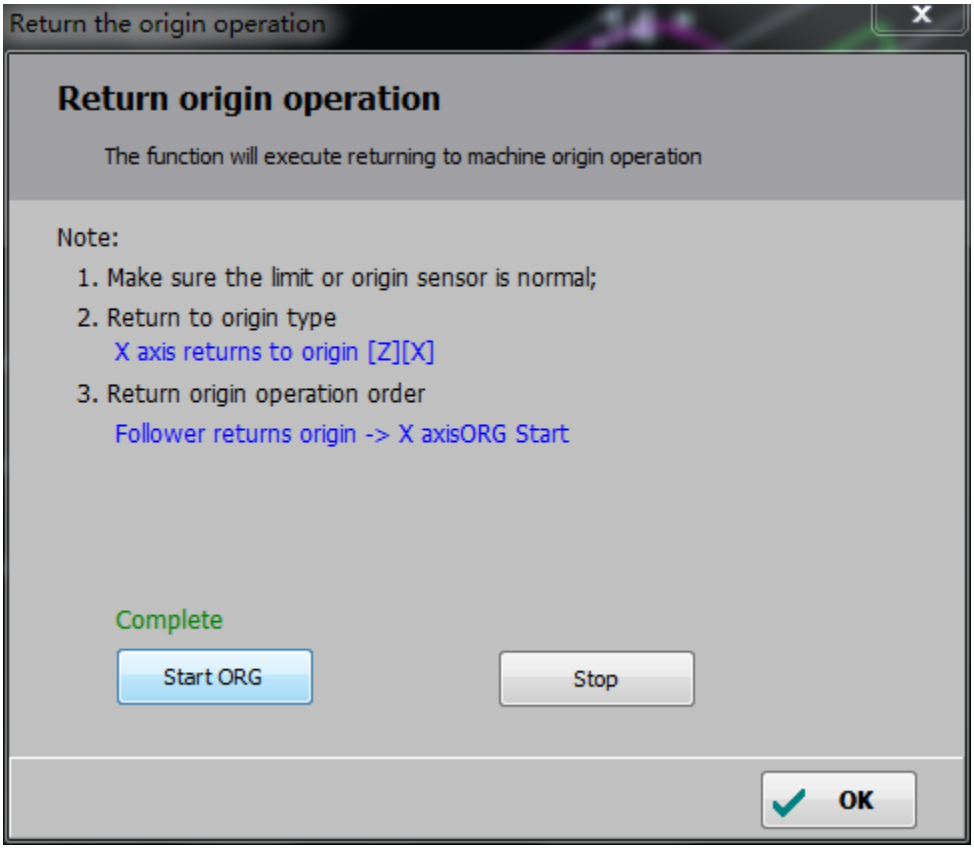
Parameter name	Description
All Return ORG	Execute Z axis (BCS100 height controller) back to the original point, then execute other logical axes return to original point
Z Return ORG	Execute Z axis (BCS100 height controller) back to the original point
X Return ORG	Execute X axis return to original point
Y Return ORG	If set Y axis as Return ORG Indept , Y axis synchronization released and each Y axis will return to original point independently. Otherwise, Y axes synchronously back to the original point
B Return ORG	If set B axis as Return ORG Indept, B axes will return to original point independently and fall back the distance respectively. The relative position of B axis is inconsistent in the whole process. Otherwise, the B axes executes same action in return to ORG the whole time.
Y1/Y2/B1/B2/B3 axis original point	In TubePro5000A system, you can specify an independent axis to return to the original point, then the related logical axis will be decoupled.



Parameter name	Description
Follower ORG first when single axis ORG	For security concern, select the option when execute X axis return ORG, Y axis return ORG or B axis return ORG to let Z axis return ORG first.
All Return ORG, B-axis also Return ORG	Default is not selected. Some machine designed without original point switch, therefore when execute All Return ORG but B axis return ORG is not available, this type of machine is not able to select the option. Some machine designed with 2 original points to double-drive B axis which is also not recommended to select this option.
All Return ORG, Y-axis also Return ORG	Default is not to select. If the user wants Y axis return original point when execute All Return ORG, select this option. It is suggested not to select the option to avoid the situation that tube material falling from chuck when execute All Return ORG.
Before Y-Axis ORG, all Holders Down	Default is to select the option. For security concern, when Y axis is returning to the original point, the holder should be lowering down to prevent collision.
Dual Y-Axis Return	In TubePro 5000A system, select the option when Y1 and Y2 axes need to return to the original point independently. You should

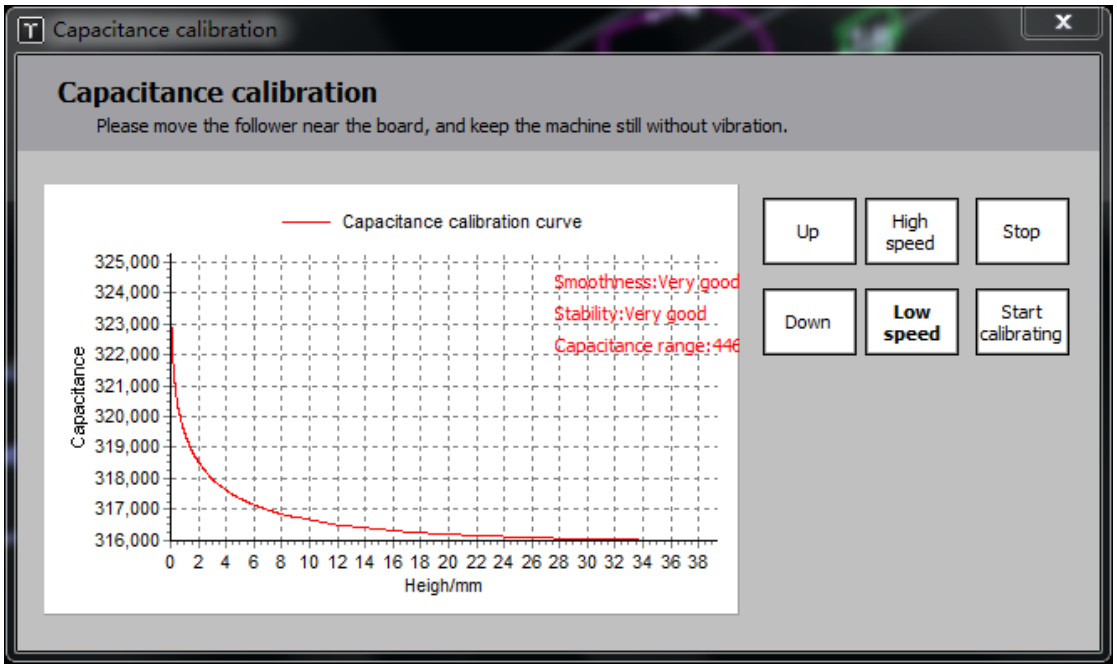
ORG Indept	set return original point switch and limit to Y1 and Y2 axis respectively.
Y1/Y2 ORG Fall Back	In TubePro 5000A if Dual Y-Axis Return ORG Indept function is enabled, you can set fall back distance for both Y axes.
Dual B-Axis Return ORG Indept	For most double-chuck models, if both B1 and B2 axes are set original point switch, for some reason, B1 and B2 axes will move asynchronously, then you have to execute Return ORG to B1 and B2 axes respectively and set fall back distance for both axes. This operation will enable B1 and B2 axes in same angle which is convenient for installation and avoid manual operation for B axes achieving synchronization.
B1/B2/B3 fall back ORG(the retreat distance of axes after reach ORG)	When Dual B-Axis Return ORG Indept function is enabled, you can set fall back distance for B1/B2/B3 axes respectively to let B axes be horizontal or in same angle.

When you click Return ORG, system will prompt the possible path of return ORG to ensure safety.

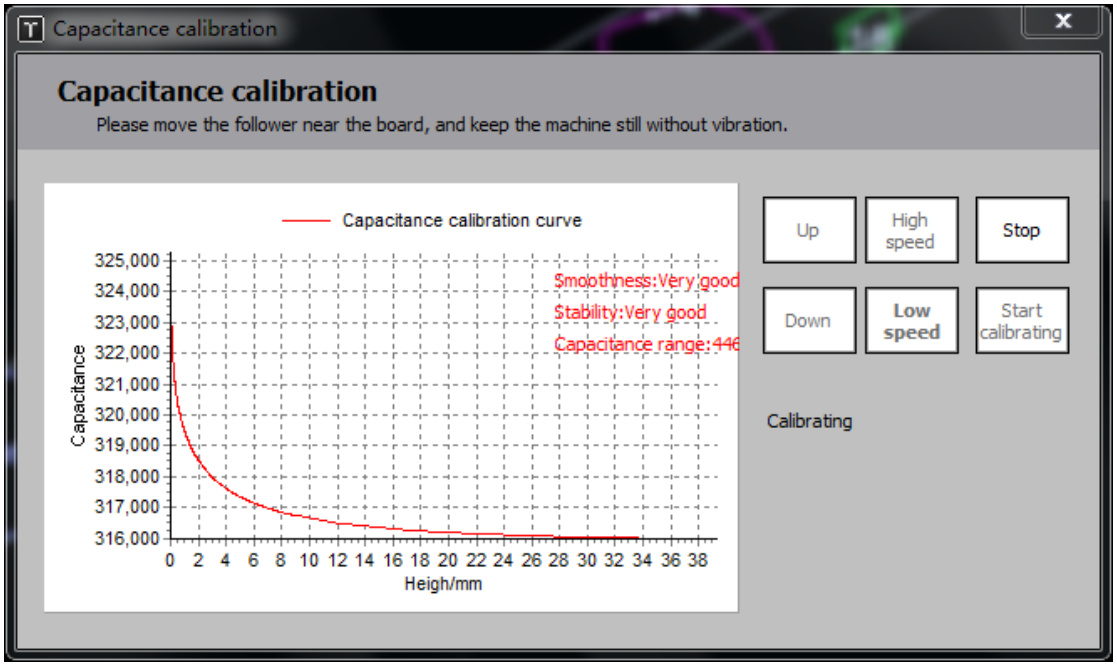


2. Calibrate BCS100 height controller

TubePro 5000A and 5000B adopt BCS100E bus height controller. Before calibrating, we need to Jog the laser nozzle about 2mm above tube material surface, then click [Start calibration] for the operation to complete.



The calibration results show that the smoothness and stability are excellent indicate calibration is successful.

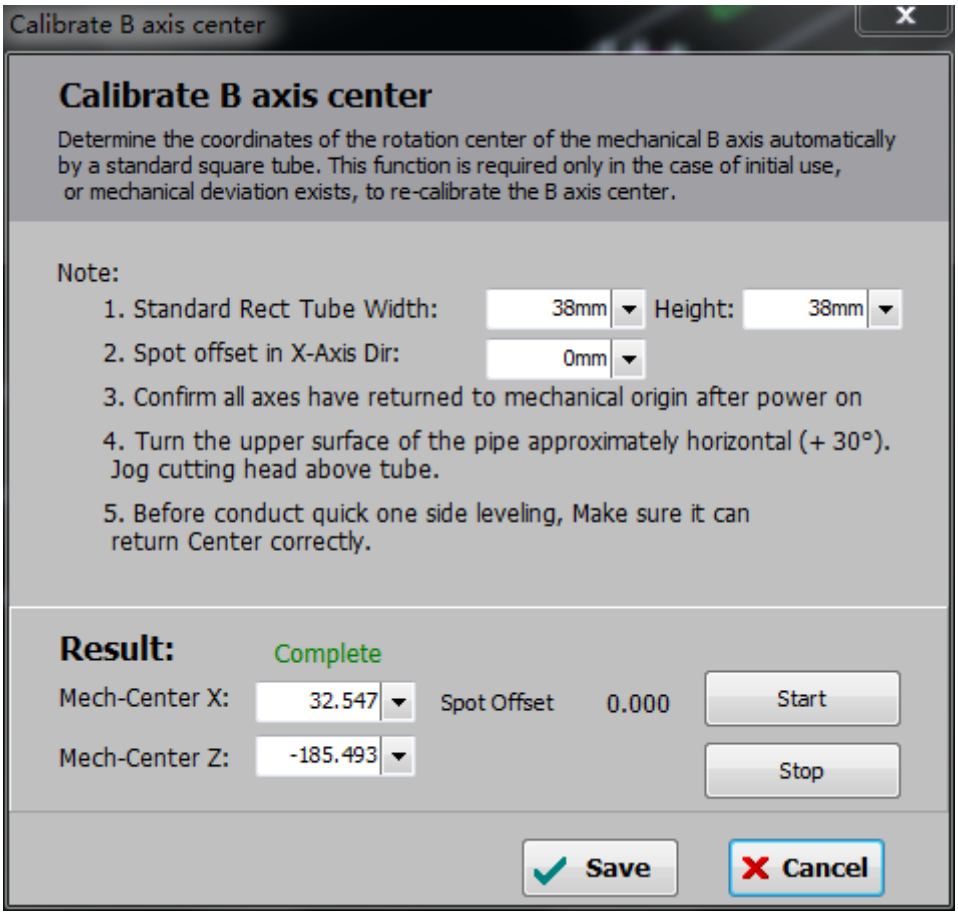


The TubePro5000C system applies BCS100 height controller. Before calibration,

Jog the laser nozzle about 2mm above the tube material, then click Capacitance Calibration to complete the calibration.

3. Calibrate B axis center

There is a rotational coordinates for B axis, calibrate B axis to determine the coordinates of B axis center. It requires a standard rectangular tube without chamfer to calibrate the B axis center, before which make sure X/Z/B axes have completed Return ORG. Then move the nozzle above the standard rectangular tube and input its width and height, click Start to calibrate the center. If there is no alarm triggered shows calibration is complete, click save.



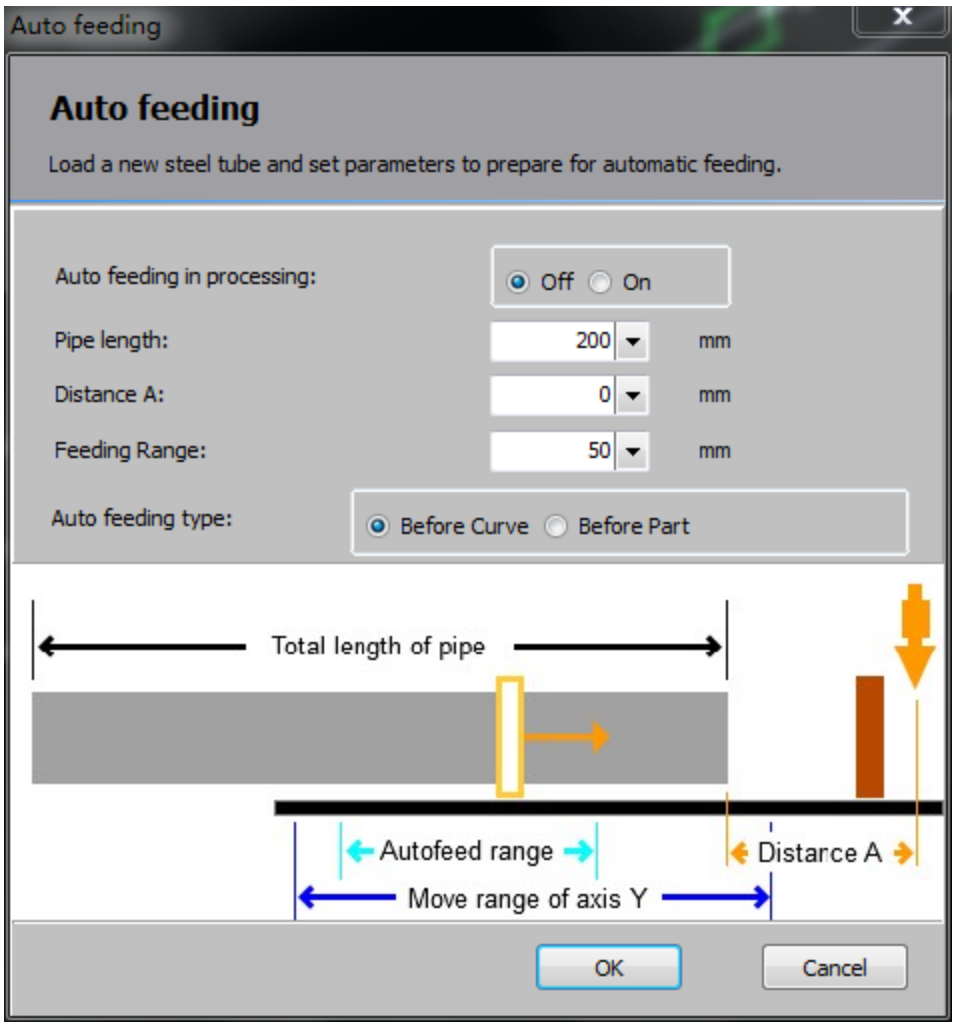
Parameter name	Description
Standard Rec Tube Width/Height	To set the width and height of the standard rectangular tube without chamfer.
Spot Offset	Set the spot offset error of the cutting head. Applications: TubePro takes the nozzle center as the

	benchmark to detect the B axis center. Generally, it's hard to guarantee that the laser spot is right through the center of the nozzle, which lead to offset of cutting counter-hole, you need to divide the offset value by 2 and input in the Spot Offset.
Result	Display the coordinates of the mechanical rotation center.
Save / Cancel	Click Save to record the measurement results as the B axis center.

2.5 Function Setting

1. Auto feeding

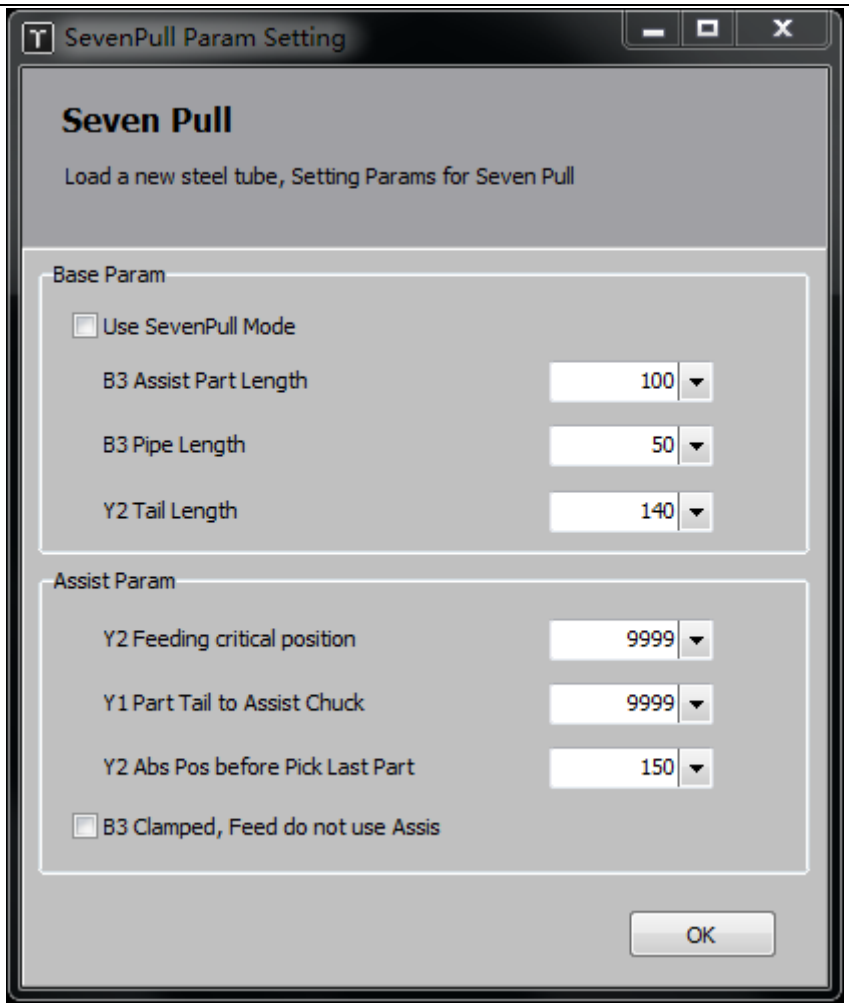
The auto feeding function only supports the tube cutting machine mounted with hollow-structured rear chuck. First to guarantee auto feed function is enabled in the advanced configuration interface in platform config tool.



Parameter name	Description
Auto feeding in processing	This is switch to enable auto feeding function.
Pipe length	Set the total length of steel material to be processed.
Distance A	As distance A shown below. If the steel tube is already under the cutting head after been loaded, set the distance A as 0. If not under the cutting head, set the distance from top side of the tube to cutting head as distance A.
Feeding range	Feeding range of the machine. This travel range can be less than the total travel range of Y axis. It is applied to avoid that the distance between rear chuck and mid-chuck is too long and tube material drops, while it will increase the feeding times.
Auto feeding type	There are 2 ways for auto feeding judgment- before curve and before parts. Before curve means no material will be fed during processing a path and feeding times decrease. While there might be more feeding times process the parts. Before parts means that no feeding in processing a part, which will increase the feeding frequency but guarantee the accuracy.

2. Seven-axis pulling

The seven-axis pulling function only available for TubePro5000A system. First to make sure that the seven-axis pulling have been enabled in the advanced configuration interface of the platform configuration tool. You can set more specified parameters under seven -axis pulling parameter configuration interface.



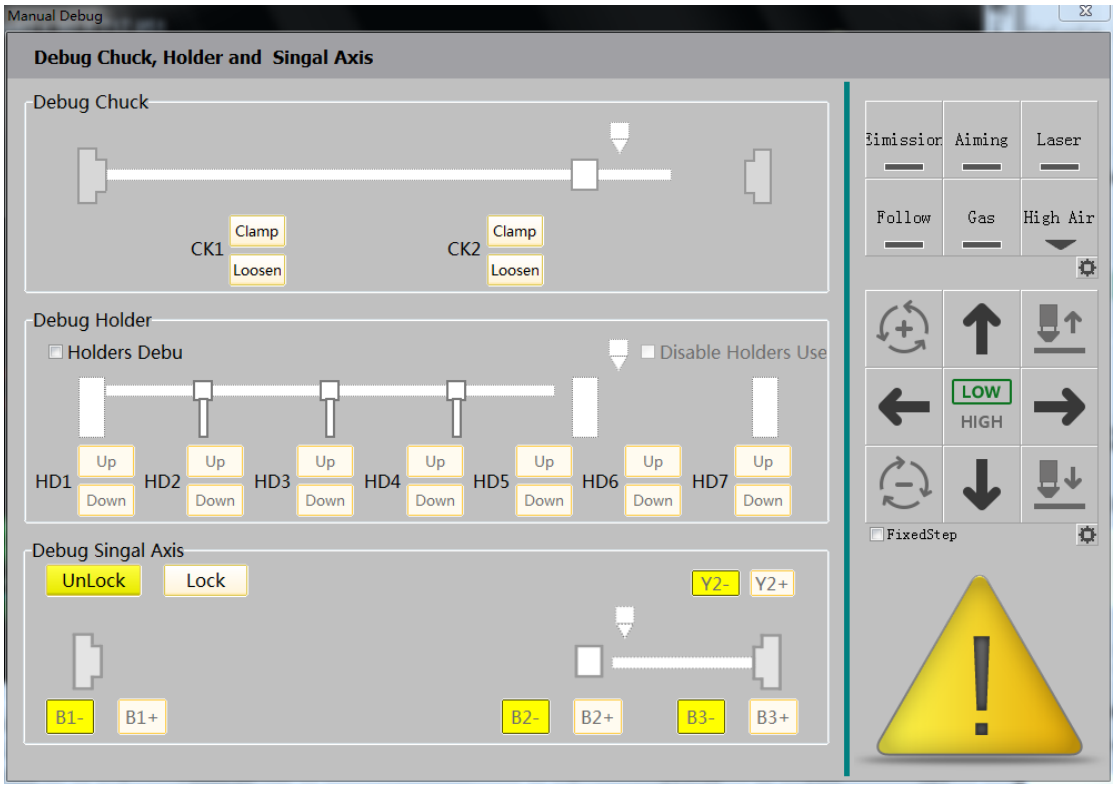
Parameter name	Description
B3 assists part length	Set the minimum part length that requires B3 pulling.
B3 pipe length	The distance from Y2 negative travel range to cutting head. When the front end of the process path is longer than the distance, B3 chuck will
Y2 Tail length	The docking position of the Y2 when B3 is not in use.
Y2 feeding critical position	When next cutting path is to be processed and Y2 coordinate is larger than the critical value, then B3 unclasp and Y2 will move to negative range.
Y1 part tail to assist chuck	The distance from Y1 positive travel range to the central auxiliary chuck.
Y2 Abs Pos before pick last part	When cutting off the last part in the end of the tube, Y2 must move to this position and match up with B axis then execute the unloading action.

3. Manual setting

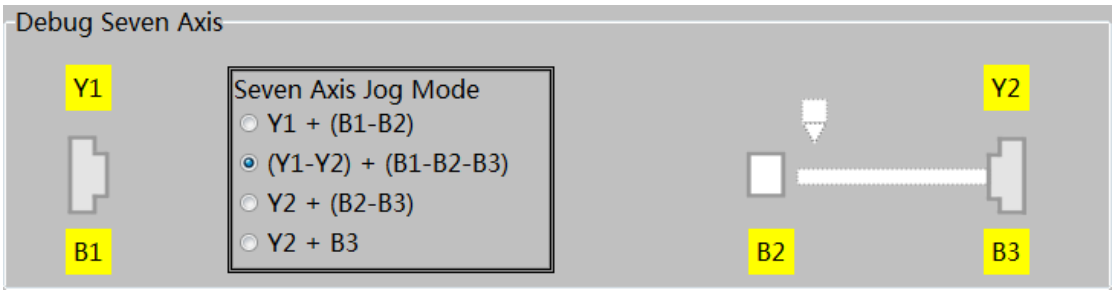
Chuck adjust: When manually test chuck clamp / loosen action, use stopwatch to measure the time required in opening and closing the chuck, then set this time to the chuck in place time in the platform configuration tool. Test the time to see if it's reasonable after the configuration is finished. If the platform configuration tool is equipped with the auxiliary chuck, the manual adjust interface will display the relevant buttons for adjusting functions, otherwise it doesn't display the auxiliary chuck option.

Holder adjust: You can adjust holder up and down within the safety area.

Single drive adjust: Input password 61259023 to unlock TubePro 5000B and 5000C system, Jog control the independent axis to test the synchronization then lock the synchronization. This function is to measure the return distance of B1 and B2 after returning ORG. In the initial installation process, the retreat distance between B1 and B2 is same, but the physical chuck is not synchronized. Unlock B1 and B2, then Jog control B1 or B2 to a horizontal level then lock. Open the [tools]->[motion control monitoring]->[motion axis]->[B axis] to check the radian difference between the mechanical coordinates of B1 and B2 axis, then convert the radian to angular degree(a radian is roughly 57.2974 degree). The angular degree difference is the retreat distance difference of B1 and B2 axis. For example, motion control monitoring shows B1-B2=0.53 rad, 0.53*57.2974≈30.3676°, if the retreat distance of B1 is 40°, then B2 retreat distance is 40 °-30.3676 °≈ 9.6324 °.

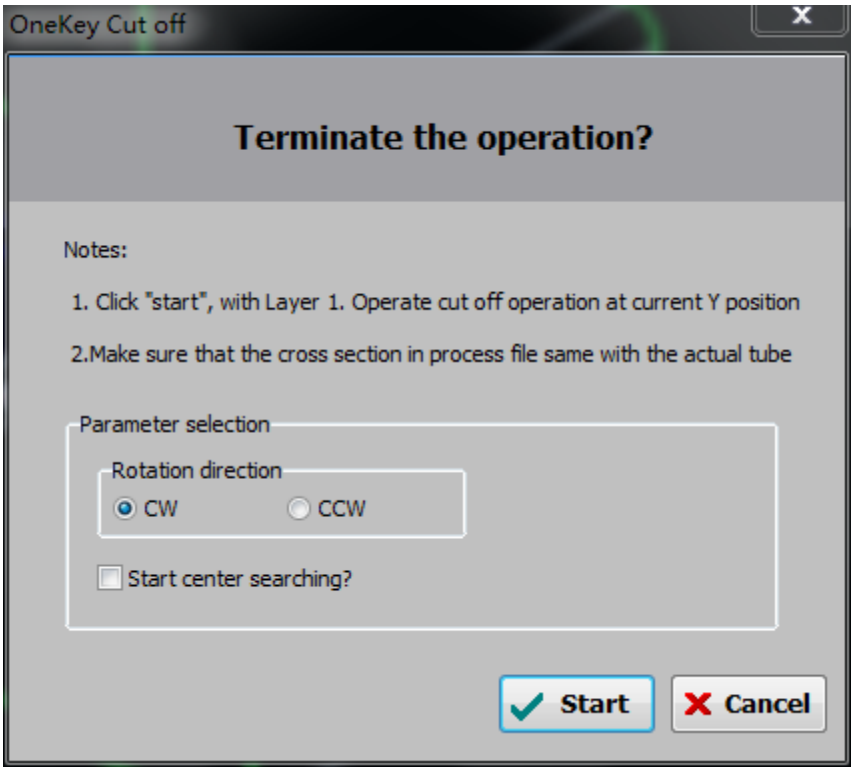


The 4 mode switches in TubePro 5000A seven-axis system is a commonly used operation. Therefore, seven-axis adjusting function replace the single-axis adjusting lock& unlock box, you just need to check the corresponding mode without password. When execute Return Mid and prompts B axes not synchronous, switch to Y2+B3(return mid mode), then redo the return mid.



4. One Key Cut Off

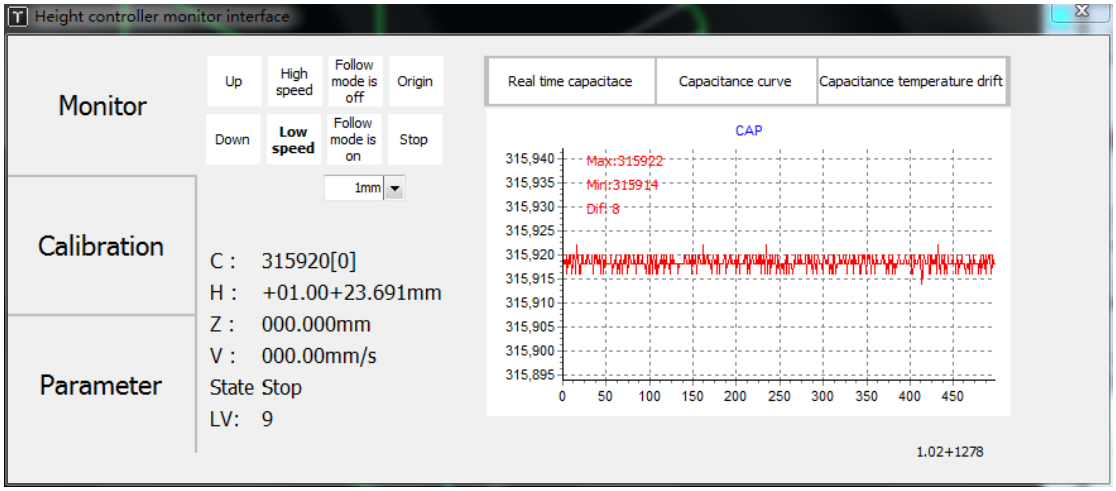
TubePro provides One Key Cut Off function, the system will cut off the material clockwise or counterclockwise at current position. If return mid option is checked, system will execute the return mid action before cutting.

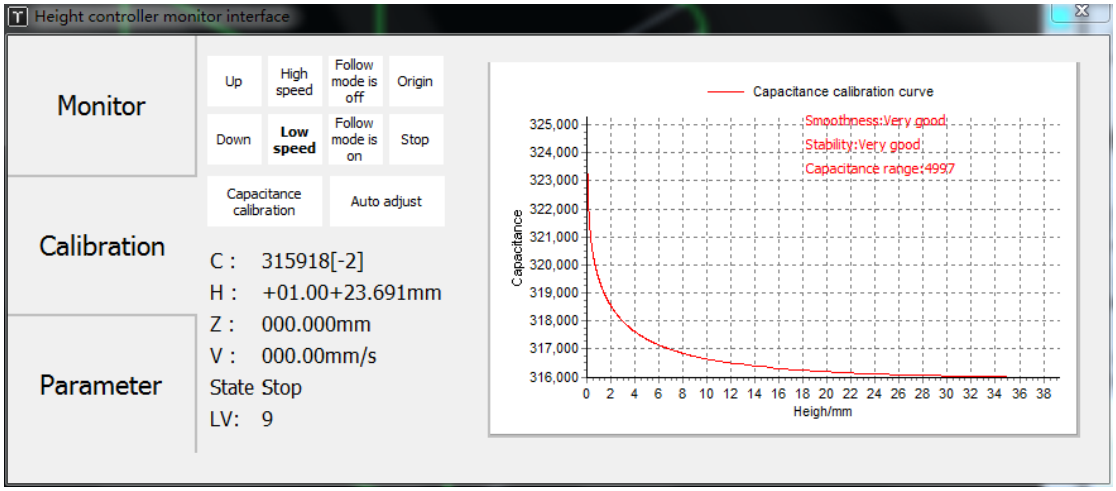


2.6 Monitoring tools

1. Follower monitoring

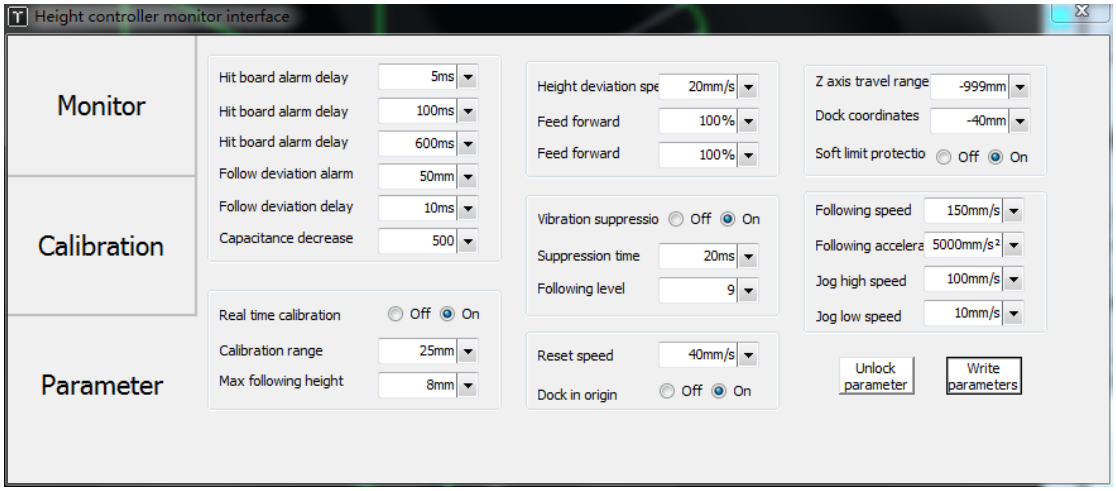
Here is a brief introduction to BCS100E in 5000A and 5000B system. For the configuration of height controller in 5000C system, please refer to <BCS100 Capacitive Height Controller User Manual>.User Manual.





Parameter name	Description
Up / down	Jog Z axis of height controller.
High/low	Choose high Jog speed or low Jog speed.
Follow mode is on/off	Set following on/off. You can set the following height as 1mm for testing.
ORG	Z axis returns to original point.
Stop	BCS100 stops working.
C	BCS100 Capacitance value

H	The distance between the nozzle and sheet metal.
Z	Z axis coordinates
V	Z axis moving speed



Parameter name	**Description**
Hit board alarm delay	When system stops, the follower will lift up automatically and output alarm signal if duration of touching the panel reached the critical value. Set the value as 0, the Tip Touch alarm will not be triggered when system stops.
Hit board alarm delay	In the cutting process, the follower will lift up and output alarm signal for protection when touching the panel (capacitance value as 0) reaches the time limit. Set the value as 0, the Tip Touch alarm will not be triggered in cutting process.
Hit board alarm delay	In the drilling process, the follower will lift up and output alarm signal for protection when touching the panel (capacitance value as 0) reaches the time limit. Increase the value suitably can avoid the false alarm caused by the slag in drilling process. Set the value as 0, the Tip Touch alarm will be disabled when drilling.
Follow deviation alarm	The maximum following tolerance allowable to BCS100.When the cutting head follows in place, if deviation larger than the alarm value caused by follower moving out of the plate or sheet material shaking, the controller will give the alarm.
Follow deviation delay	Set the filter time of deviation alarm Larger value allows longer duration of deviation alarms and stronger ability of filtering the disturbance.
Real-time	The real-time calibration function is opened. The height

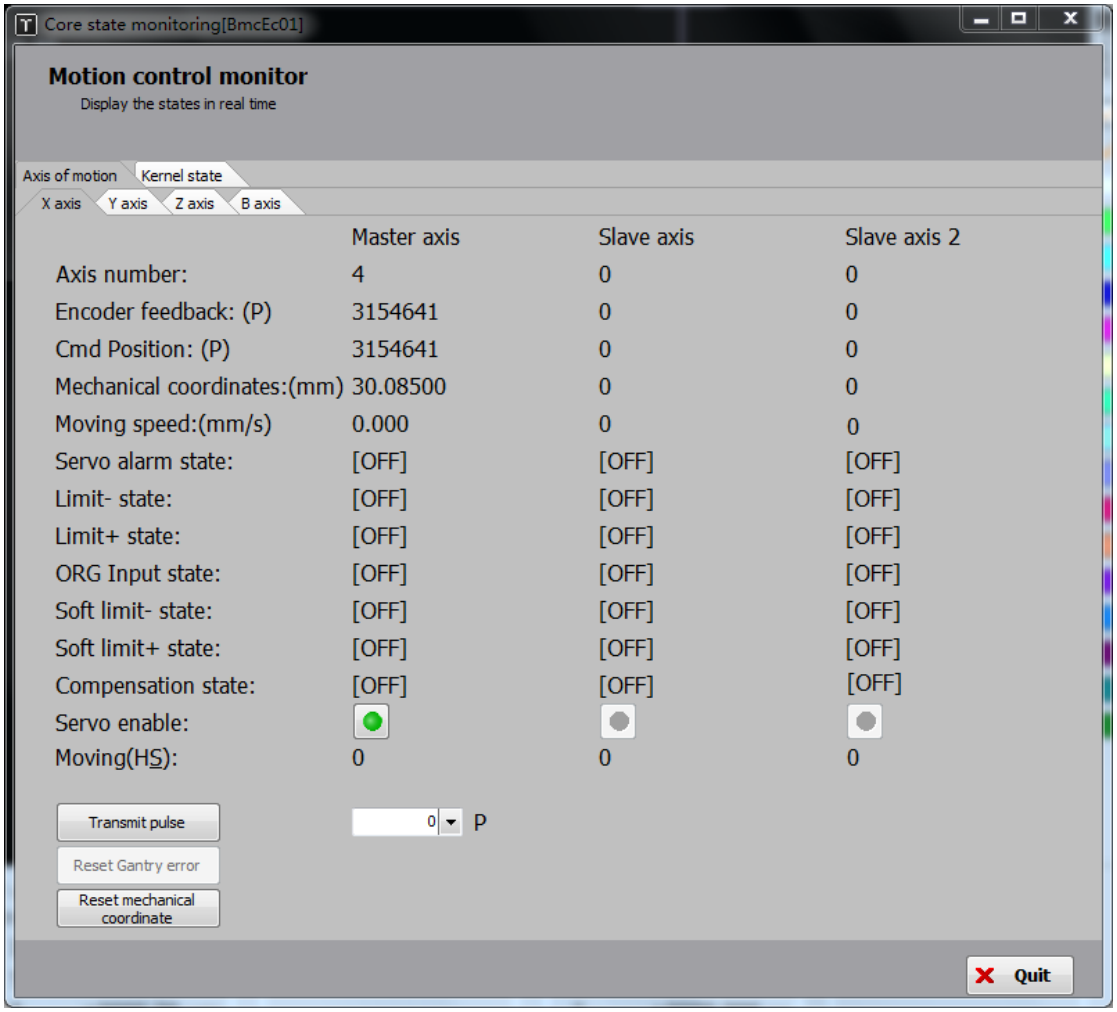
calibration	regulator will calibrate the capacitance of the cutting head automatically after each processing to reduce manual calibration frequency. When using this function, make sure that the docking point at least 30mm above the plate.
Calibration range	The lifting distance of Z axis when return ORG, default is 25mm.
Max following height	The maximum following height allowed.When the height of H is over this height, the regulator follows the 1mm first and then back back (H-1) mm.
Vibration suppression	The vibration suppression function enabledThis function can restrain the vibration caused by air current disturbing the plate with weak rigidity to reduce the waves on cross section.It can suppress the vibration caused by gas and slag.
Suppression time	The parameter presents the ability of the vibration , larger value means better performance in suppress the vibration but it will lower the response speed of height controller.The default value is 20ms, and the recommended range is 5~50ms.
Following level	The follow gain level is from 1~30, the default level 17.Larger level means smaller average following deviation, faster following speed and stronger climbing ability.But if the gain value is too strong, the system will produce self-oscillation.This parameter can be obtained in automatic adjustment interface.
Reset speed	The speed of follower returning to ORG
Dock in origin	Whether to return to the docking coordinates after returning the ORG
Z axis travel range	The travel range of Z axis
Dock coordinate	The docking coordinate of Z axis
Soft limit protection	Set the BCS100 height controller whether to enable the soft limit protection function
Following speed	The following speed of Z axis
Following acceleration	The acceleration of following
High Jog speed	Set the high speed of Jog
Low Jog speed	Set the low speed of Jog

2. Motion control monitor

Motion control monitoring tool, including motion axes monitoring and core state

monitoring.

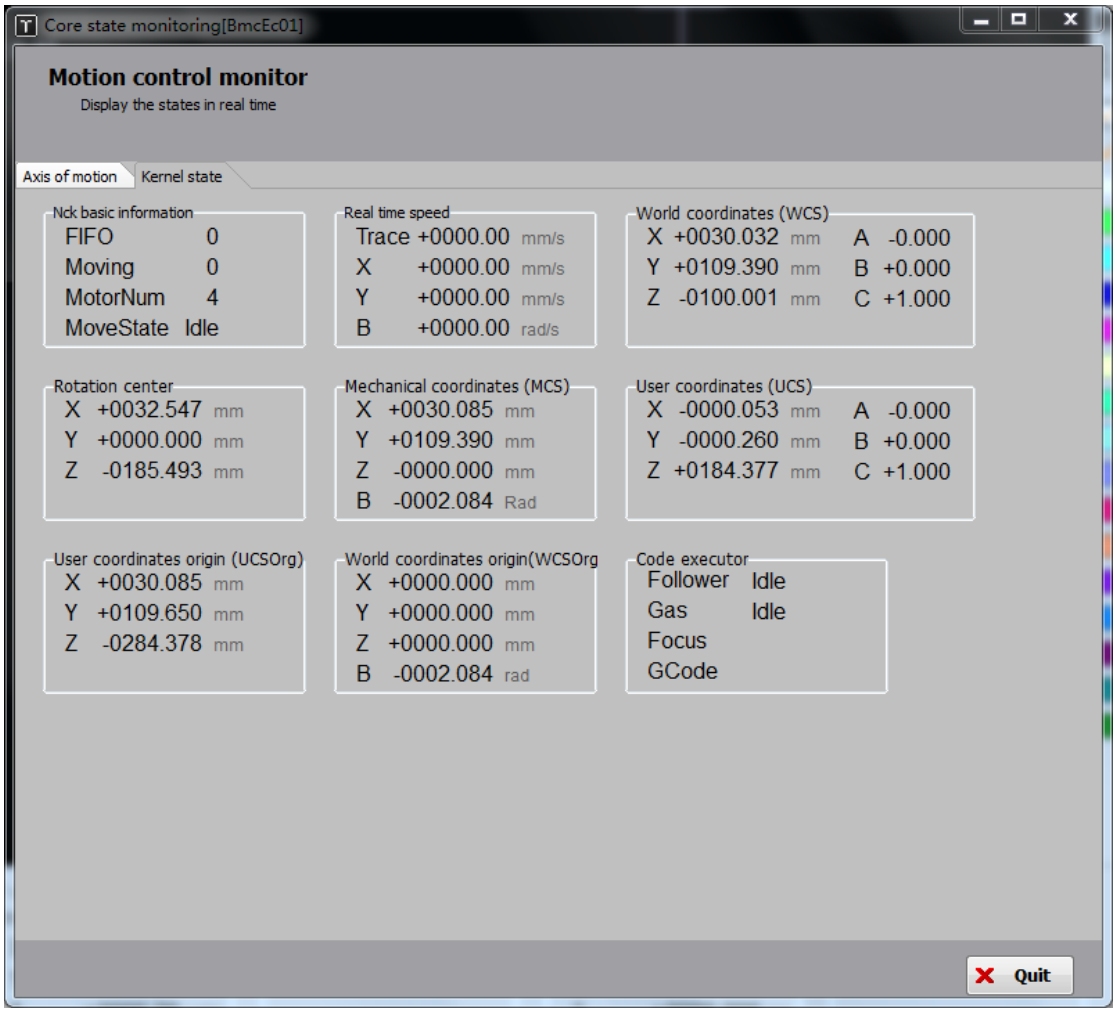
In motion control monitor interface, you can check the enable state, alarm state, hard/soft limit state, ORG input state, compensation state, encoder feedback position and moving speed of each servo axis. It also can send enable and disable servo instructions, send pulses for adjustment, clear the coordinates and clear the double drive alarm.



Parameter name	**Description**
Axis number	Physical axis number
Encoder feedback	The encoder feedback, unit pulse of servo
Cmd position	Instruction position, unit pulse
Mechanical coordinates	The mechanical coordinates, which is the coordinates of system instructions, the unit is mm or the rad.
Moving Speed	The real-time feedback of the current servo speed
Servo alarm state	Current servo alarm state

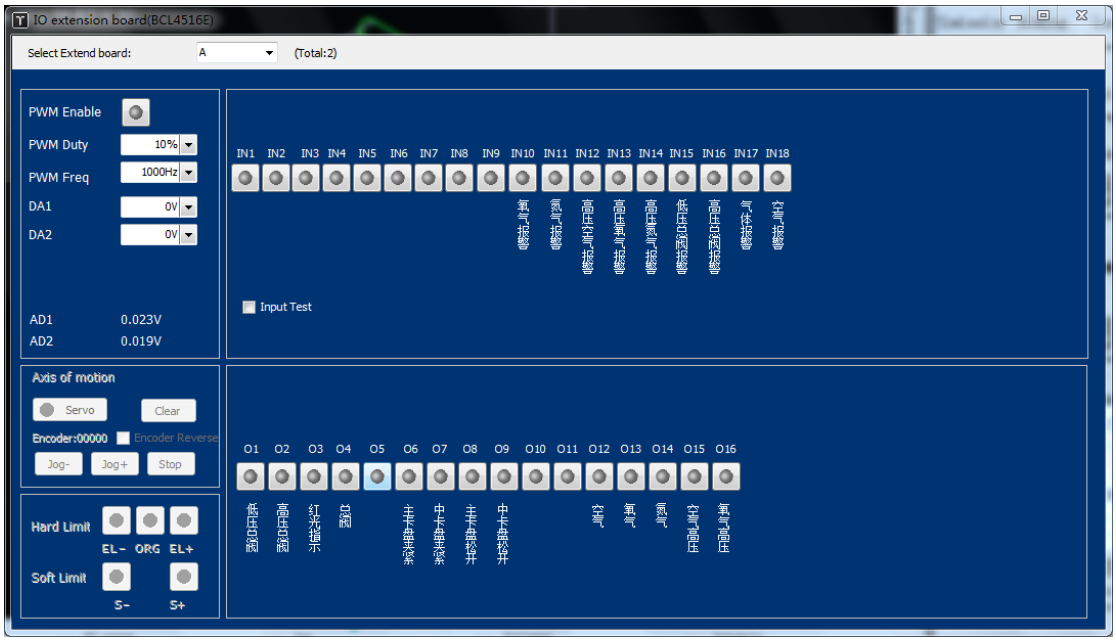
Limit- state	Current hard limit- input state
Limit+ state	Current hard limit+ input state
ORG Input state	Current ORG input state
Soft limit- state	Current soft limit+ input state
Soft limit+ state	Current soft limit+ input state
Servo enable	Click to switch the enable state of servo
Transmit pulse	Generate specified pulse for testing when system stops
Reset gantry error	Clear the double drive error
Reset mechanical coordinate	Set the physical axis coordinates to 0

In the Core state monitoring page, you can check underlying data of kernel state, like mechanical coordinates, User coordinates and G code command information etc., which are complex concept will not be covered in this manual.



3. BCL4516/4516E/2720E monitoring

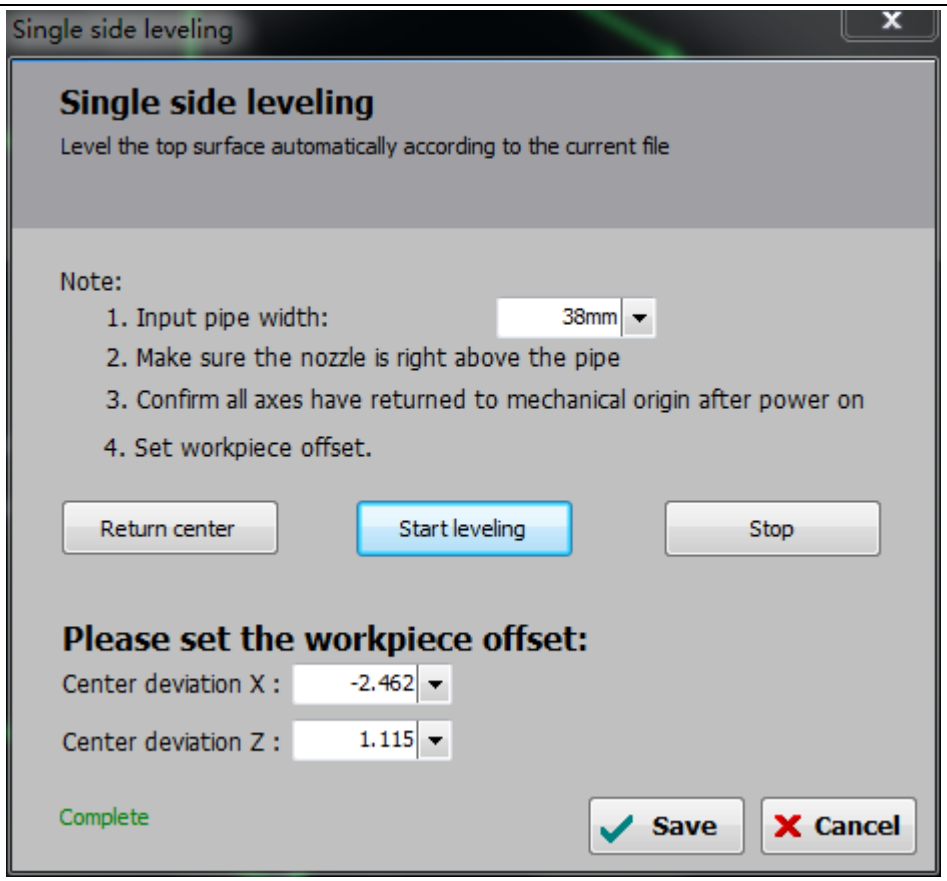
You can switched on / off output, monitor input state, operate simulation test of input on monitoring page. You can adjust and test PWM and DA under extension board monitoring interface and monitoring AD sampling results. If it is BCL4516e monitoring, it's available to Jog test and monitor hard limit of focusing axis.



2.7 Other tools

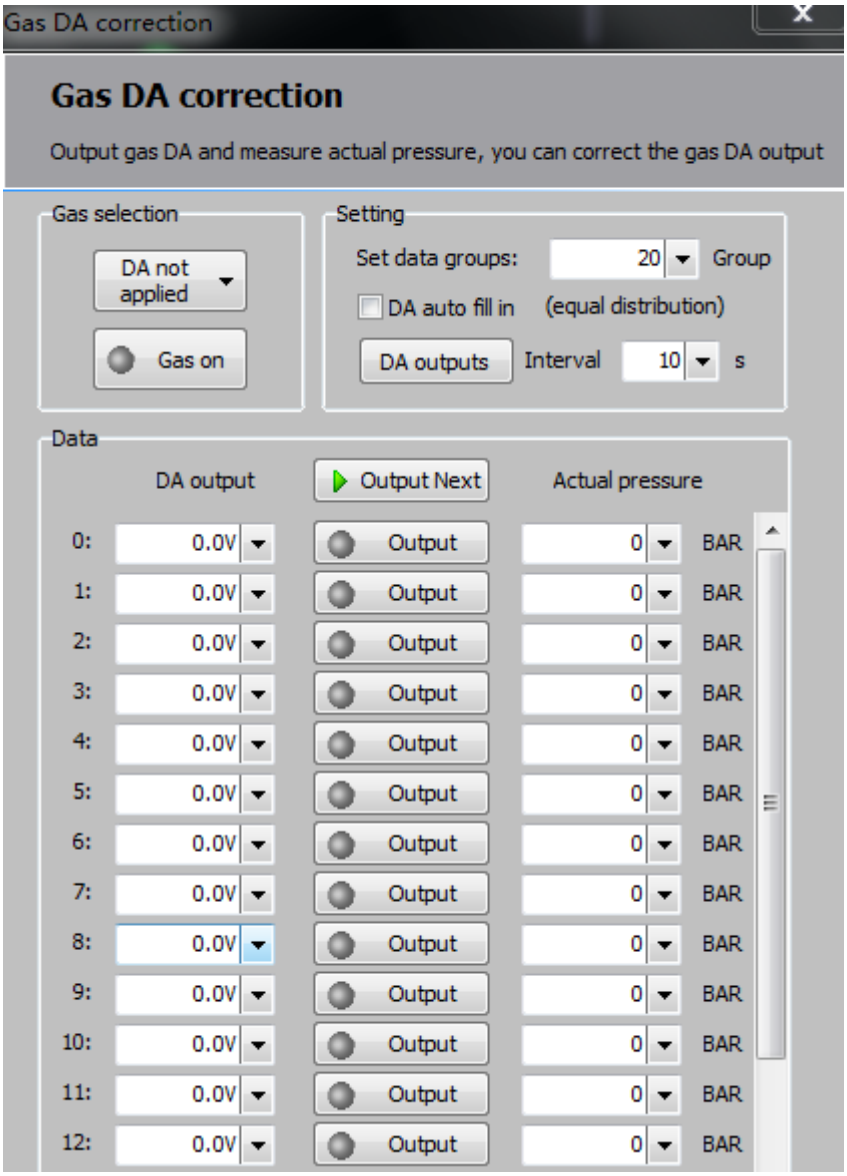
1. Single side leveling

For the special-shaped tube cutting, the common centering method is not applicable. For example, some tube just has one flat surface and others are not. Single side leveling function can level the irregular shaped tube by utilizing the flat side then process the tube material. The function is available for the leveling of common D- type steel.



Parameter name	Description
Standard Rec Tube Width/Height	The width of a rectangular tube
Return Mid	X axis and B axis move to the mechanical calibrated midpoint.
Set the workpiece offset	Set the offset value of the workpiece
Save / Cancel	Save the offset value and leveling position of the applied workpiece

2. Gas DA adjust

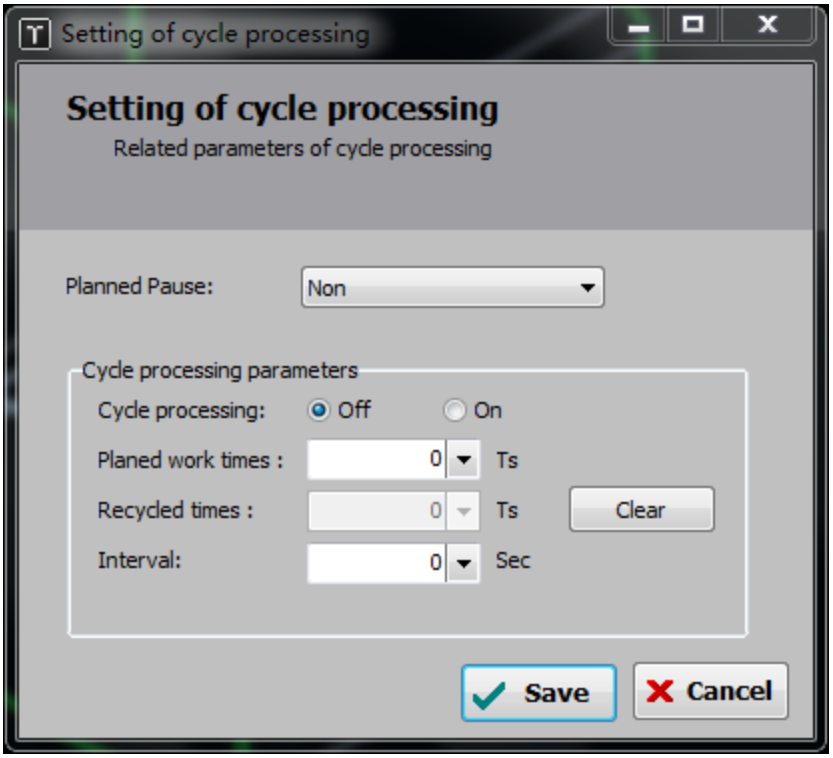


Parameter name	**Description**
Gas selection	Select the gas from current configuration: Air / oxygen / nitrogen
Gas on/off	Gas on/off
Set data groups	Set the number of data linear nodes
DA auto fill in	Auto set the DA distribution value equally spaced.
DA outputs	Output the DA value in the table in sequence
Output next	Manually output the next DA value
DA output	DA output
Actual	Actual pressure

pressure	

3. Cycle processing

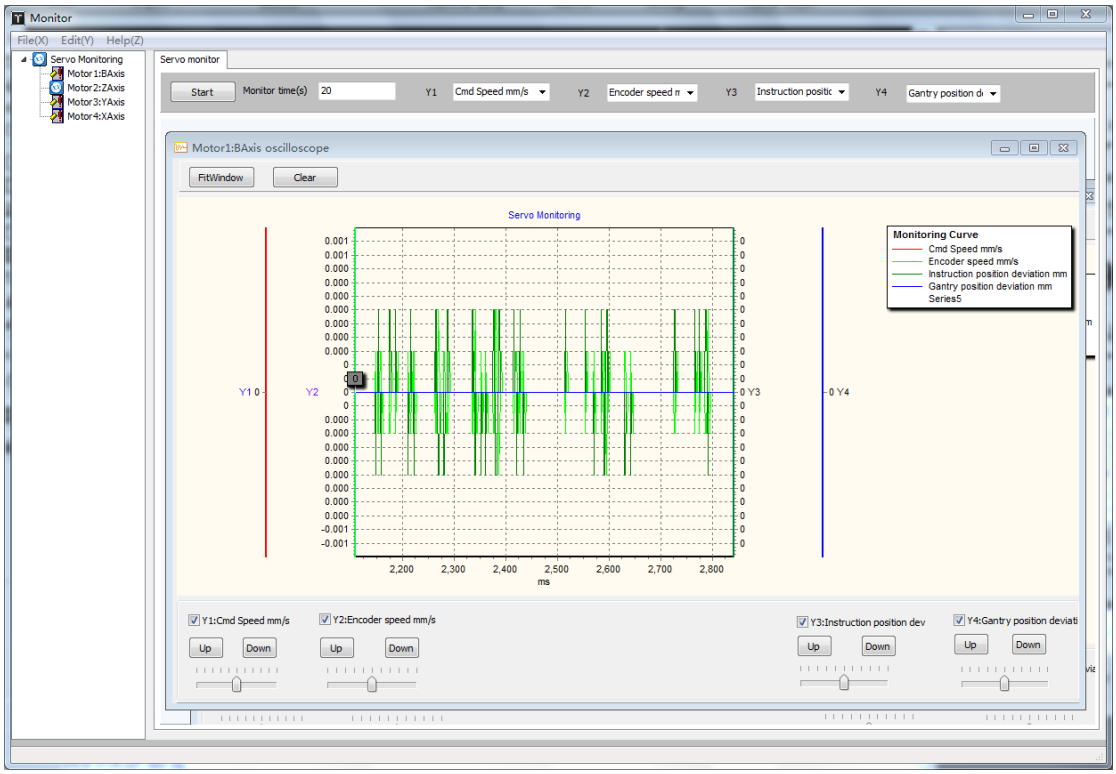
Cycle processing used for exhibition, where it needs to cycle process the graphic without tracing ray; Or assist with auto loading PLC to complete the cycle processing of the whole piece of tube material.



Parameter name	Description
Planned pause	Non Current track (complete the current path and pause) Current parts (complete the process of current parts and pause) Current file (complete the process of current file and pause)
Cycle processing	Cycle processing on Cycle processing off
Planned work times	Recycled times
Interval	The interval time between each cycling process

4. Real time monitoring

Real time monitoring function sampling the command location, command speed, feedback position, feedback speed, torque feedback, instruction deviation and Z axis position. There are four signals (Y1, Y2, Y3, Y4) for monitoring, the time could be 5 seconds~ 20 minutes. The signals will be displayed in each monitoring. The default is to display these four signal curves. Select the (Y1~Y2) check box at the bottom to display the unwanted signals or you can zoom the specified the curves in limits.



You can move mouse wheel to zoom the vertical axis of the curve. Right click to set the time range and drag to zoom view the horizontal axis. Hold the right button and left-drag the mouse to recover the graphic to proper window.

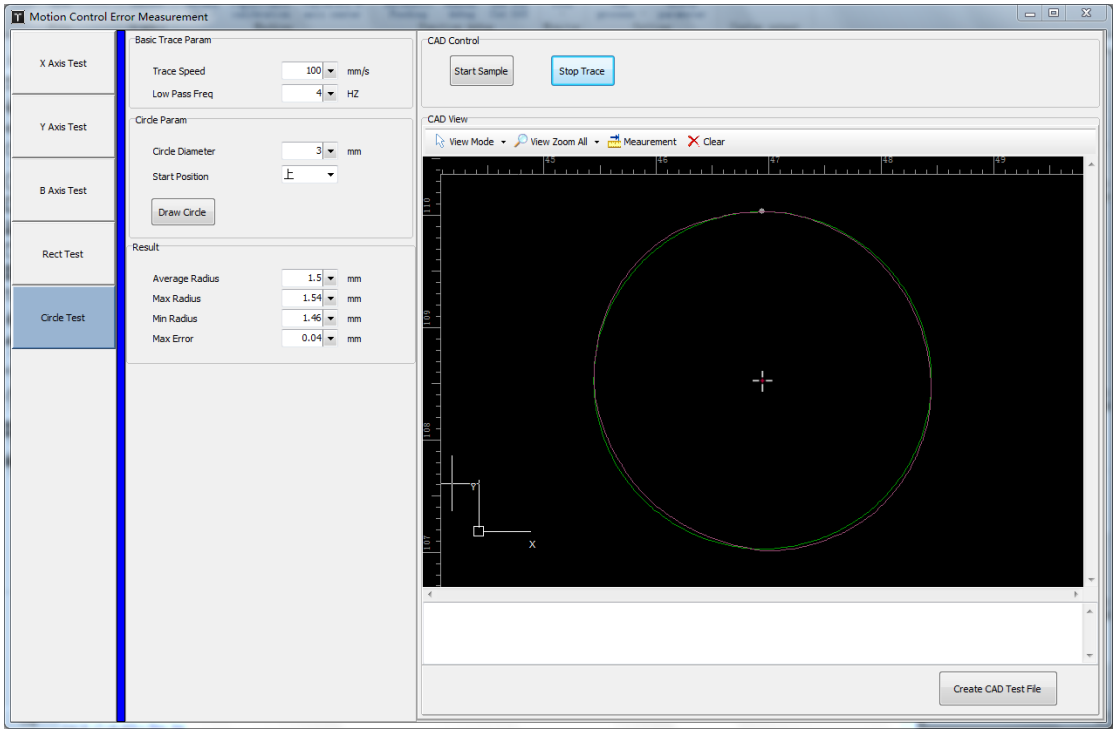
Left-click the mouse to move the graphics.

5. Error measure

The error measure contains single axis test and X-Y co-movement test. This function applied to TubePro5000A and TubePro5000B.

Axis test is mainly used to check if the servo inertia ratio is correct or static torque is normal.

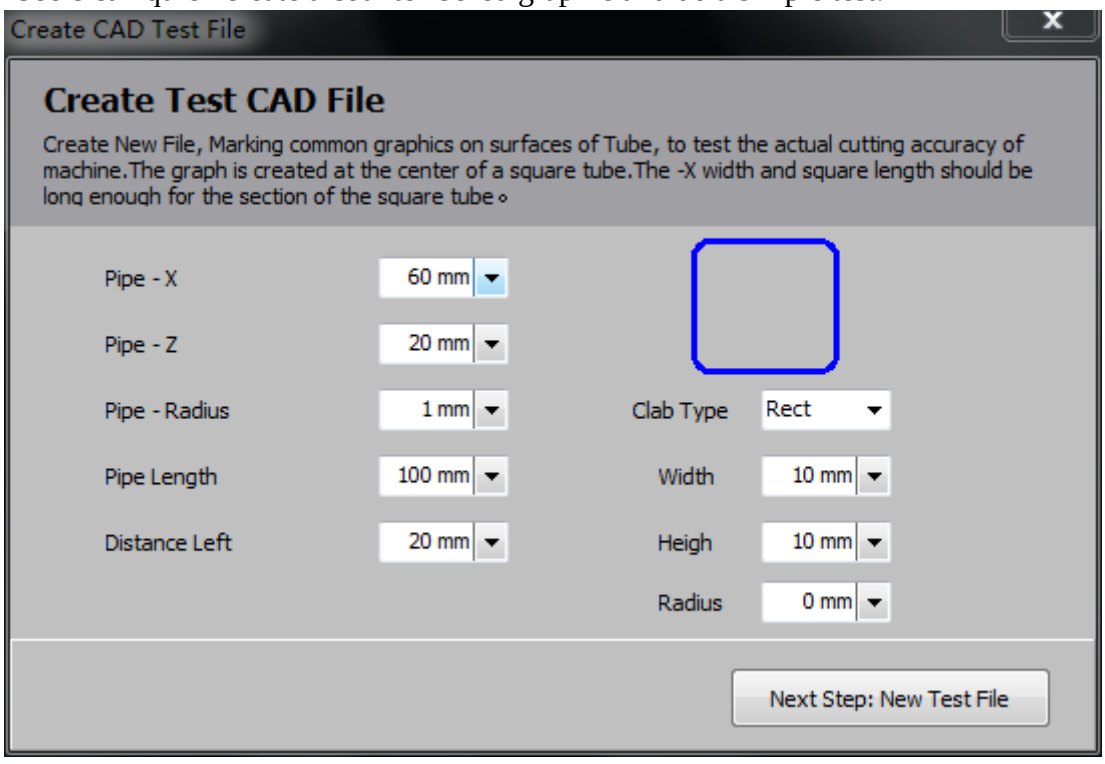
X-Y co-movement test can test the difference value of instruction and encoder feedback when processing rectangle and circle path.



6. Create CAD test File

To facilitate the test cutting, TubePro provides the test tool for creating through holes on rectangle tube and convert to CAD file.

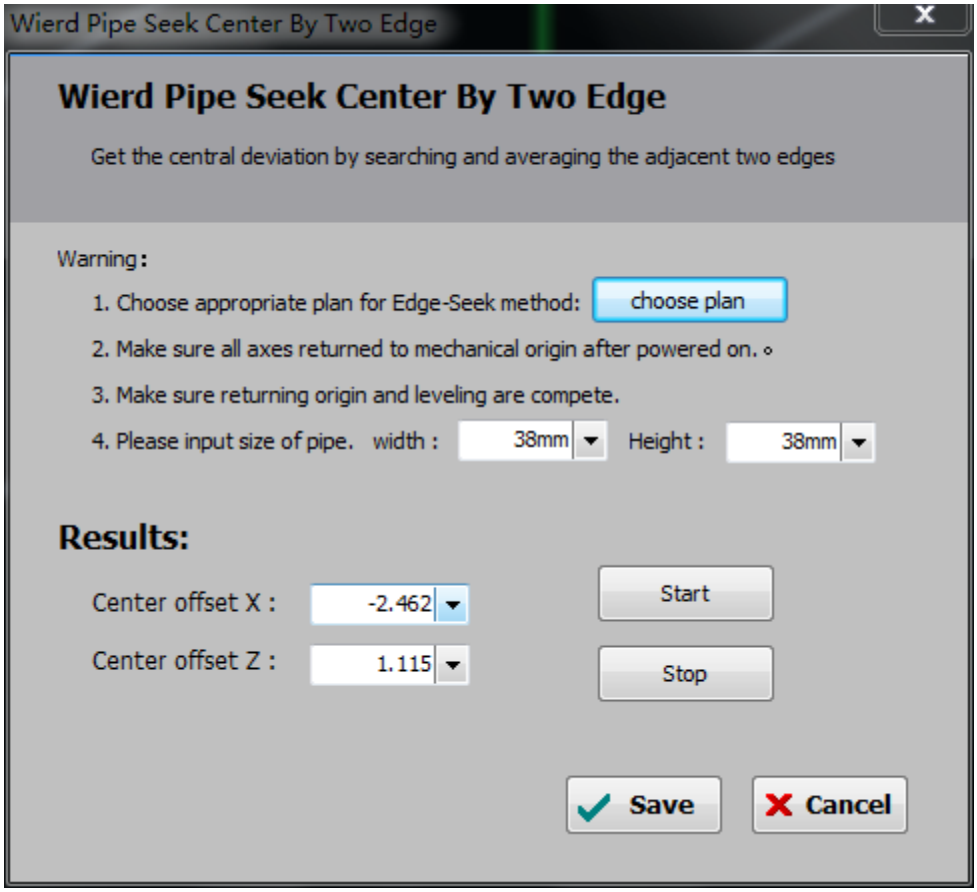
Users can quick create a counter-bored graphic and do a simple test.



Parameter name	Description
Pipe- X	X/Z width, chamfer radius
Pipe length	The length of the graphic
Distance left	The distance from through holes to near end
Clad Type	Choose the counter-bored holes as Circle/ Rect(rectangle) and set radius.

7. Precision Test

You can use the function to measure the workpiece offset for L and C shaped steel or rectangular tube with uneven surface.

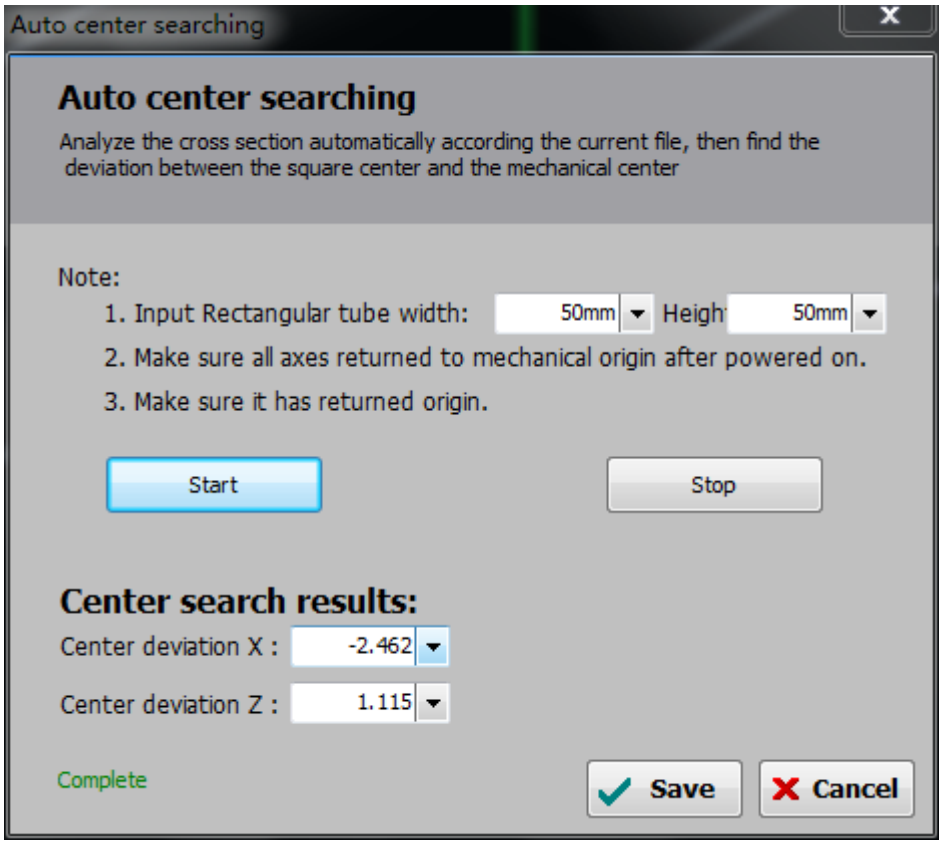


Parameter name	Description
Choose plan	Choose side 1-2 / 2-3 / 3-4/ 1-4 centering option
Standard Rec Tube Width/Height	The width and height of a rectangular tube

Start	Start the centering and seek-edge operation
Results	Display the eccentric value of the workpiece. The eccentric value is equal to the workpiece center coordinates minus the rotation center coordinates value.
Save / Cancel	If centering succeed or manually modify the deviation value, click to save the application or cancel it.

8. Auto center searching (5 points seek center)

Auto center searching is to quick- level the rectangle tube and measure the workpiece deviation.

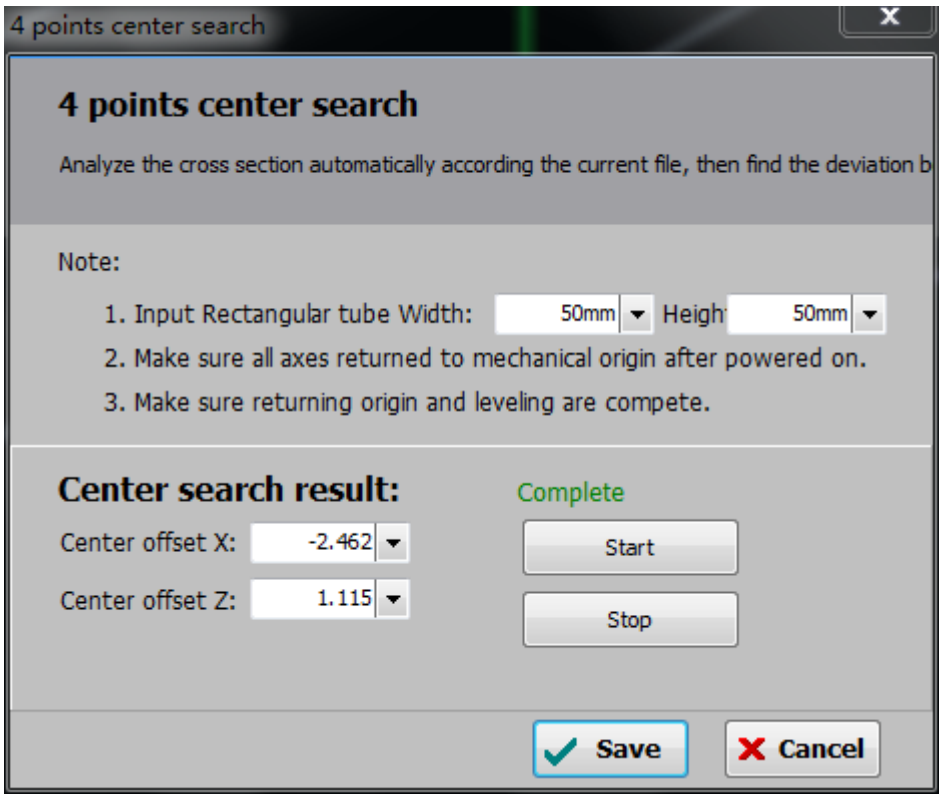


Parameter name	**Description**
Standard Rec Tube Width/Height	The width and height of a rectangular tube
Start	Start the operation of auto center searching
Results	Display the eccentric value of the workpiece. The eccentric value is equal to the workpiece center coordinates minus the

	rotation center coordinates value.
Save / Cancel	If centering succeed or manually modify the deviation value, click to save the application or cancel it.

9. 4 points seek center

4 points seek center is to measure the deviation of rectangle/ round tube.

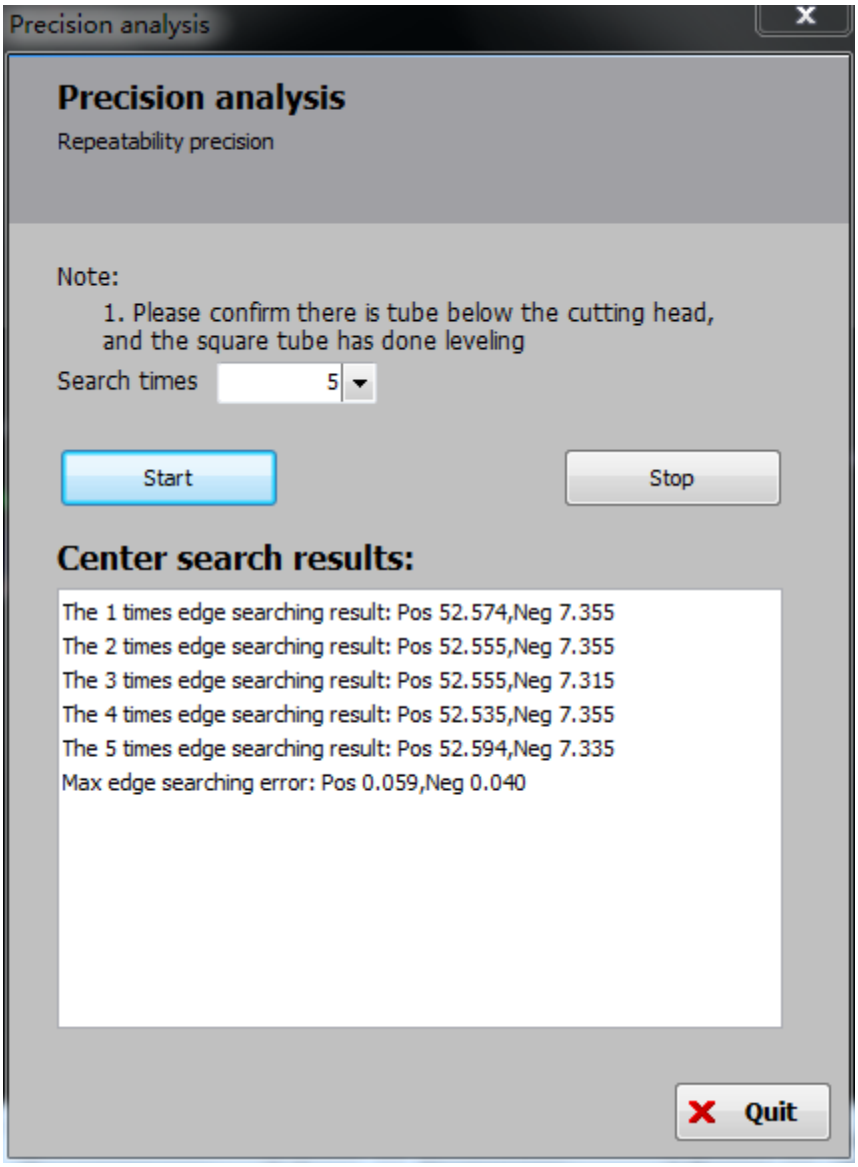


Parameter name	**Description**
Standard Rec Tube Width/Height	The width and height of a rectangular tube
Start	Start the operation of 4 points seek center
Results	Display the eccentric value of the workpiece. The eccentric value is equal to the workpiece center coordinates minus the rotation center coordinates value.
Save / Cancel	If centering succeed or manually modify the deviation value, click to save the application or cancel it.

10. Precision analysis

Test the center search performance to check if the height controller is good in

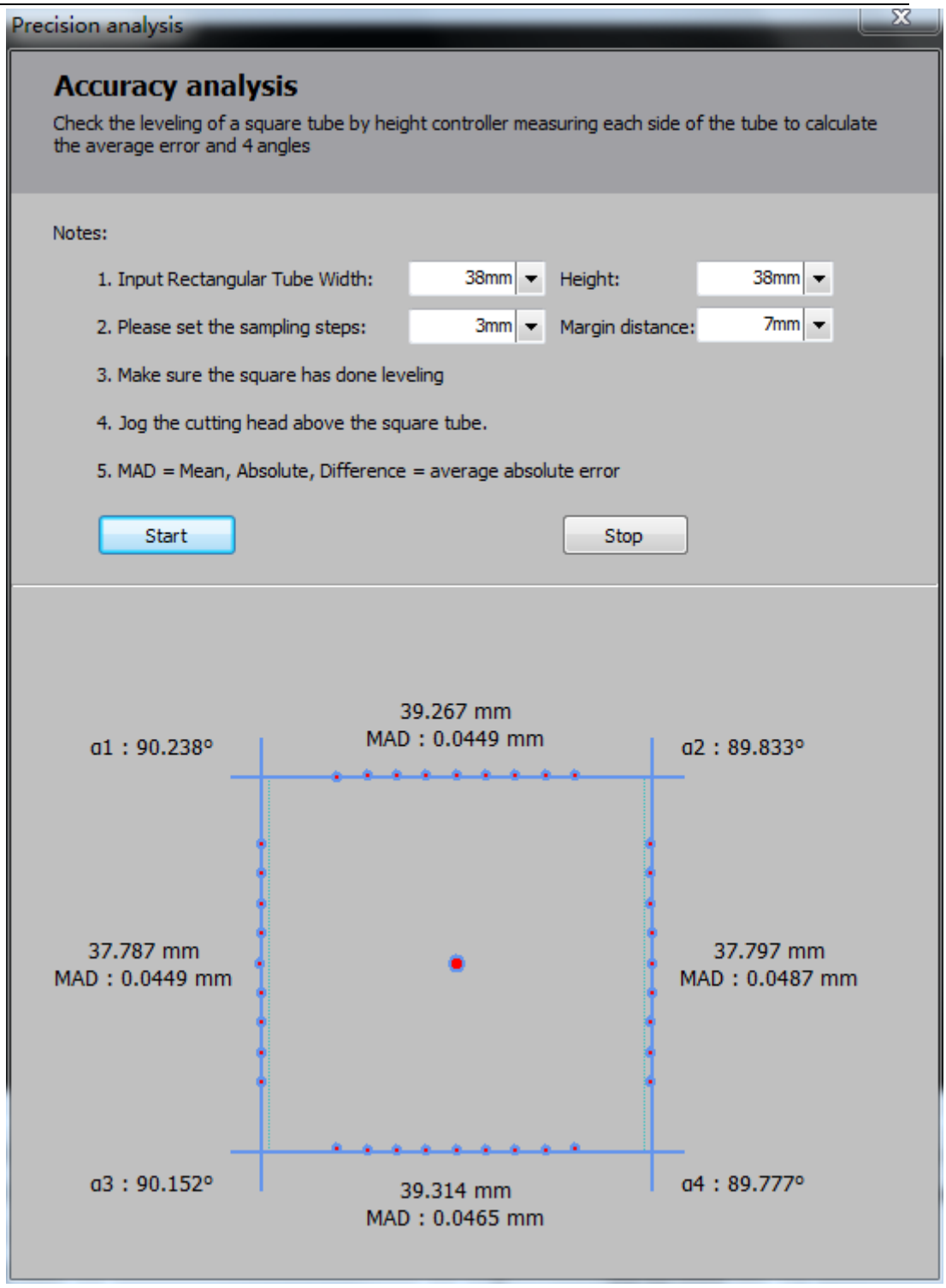
function. The tolerance of 2D nozzle is under 0.08mm, 3D nozzle is under 0.12mm.



Parameter name	Description
Search times	Set the repeat times of searching edge
Start	Start cycle researching edge
Center search results	Display the repetition analysis of seek edge, check the coordinates of both left and right edges of rectangle tube and the tolerance.

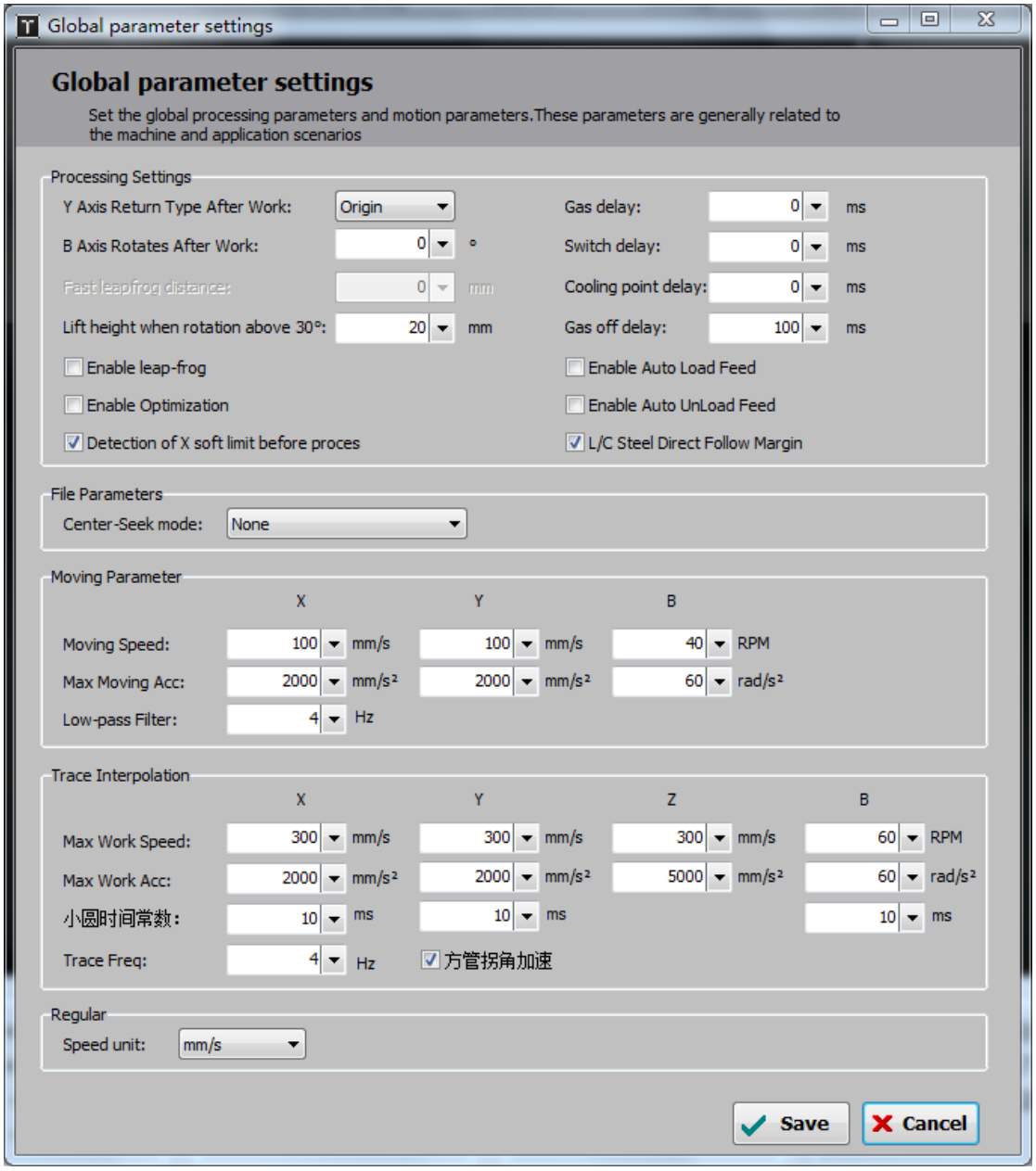
11. Accuracy analysis of square tube section

You can check the shape features of the rectangle tube and the difference of physical tube and ideal tube and if the angle offset larger than 1 degree.



2.8 Global parameter

You can set processing settings, moving parameter, Trace interpolation, Regular unit on the Global parameter interface.



1. Processing settings

Parameter name	Description
Y axis return after work	Remote/Origin/Proximal/end point
B axis rotates after work	It is used for special machine model. It's convenient for clamping the tube material in restricted area, which needs to rotate another 90 degrees after process complete.
Gas delay	The time required for gas reaches after gas channel opened

Switch delay	The tine required for gas reaches after another gas channel opened
Cooling point delay	The time required for cooling
Gas off delay	After process completed delayed to turn off the gas Speed up the interval cutting of short distance to cut the operation of reopen the gas
Fast leapfrog distance	Used for short distance leapfrog at same plane to shorten the leapfrog time
Lift height when rotation above 30 degrees	One of the safety height parameters of Z axis lifting up when switch to process another plane without optimization
Enable leapfrog	Enable the leapfrog function in dry cutting
Enable optimization	Enable the function, height controller will lift up properly according the tube size in graphic.
Detection of X axis soft limit before processing	For large diameter round tube, the cutting process does not need to execute Walk Bounds or check soft limit.
Enable auto load feed	System will execute PLC auto loading instruction then start processing
Enable auto unload feed	When processing finished, system will execute PLC auto unloading instruction then complete the whole process.

2. Moving parameter

Parameter name	**Description**
X/Y/B moving speed	Set the maximum idle moving speed to each axis
X/Y/B Max moving acceleration	Set the maximum acceleration to each axis
X/Y/B Low-pass filter	Set the low pass filtering frequency of the idle moving. This parameter is related to the mechanical performance, and the default is 5Hz.If the cutting error is large, you can try to turn down this parameter

3. Trace interpolation parameters

Parameter name	**Description**
X/Y/Z/B max work speed	Restrict the process speed of single axis

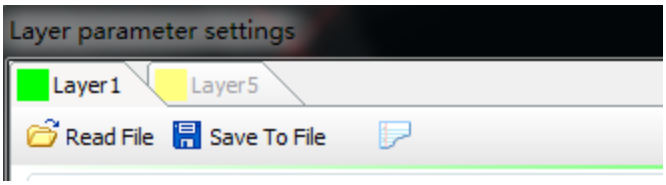
X/Y/Z/B max work acceleration	Restrict acceleration of single axis
Trace frequency	Low pass filter frequency, the default is 5Hz.The lower value means slower speed and higher precision

4. Speed unit

Parameter name	Description
Speed unit	Mm / s, M / s, M / min, in /min, in/ s

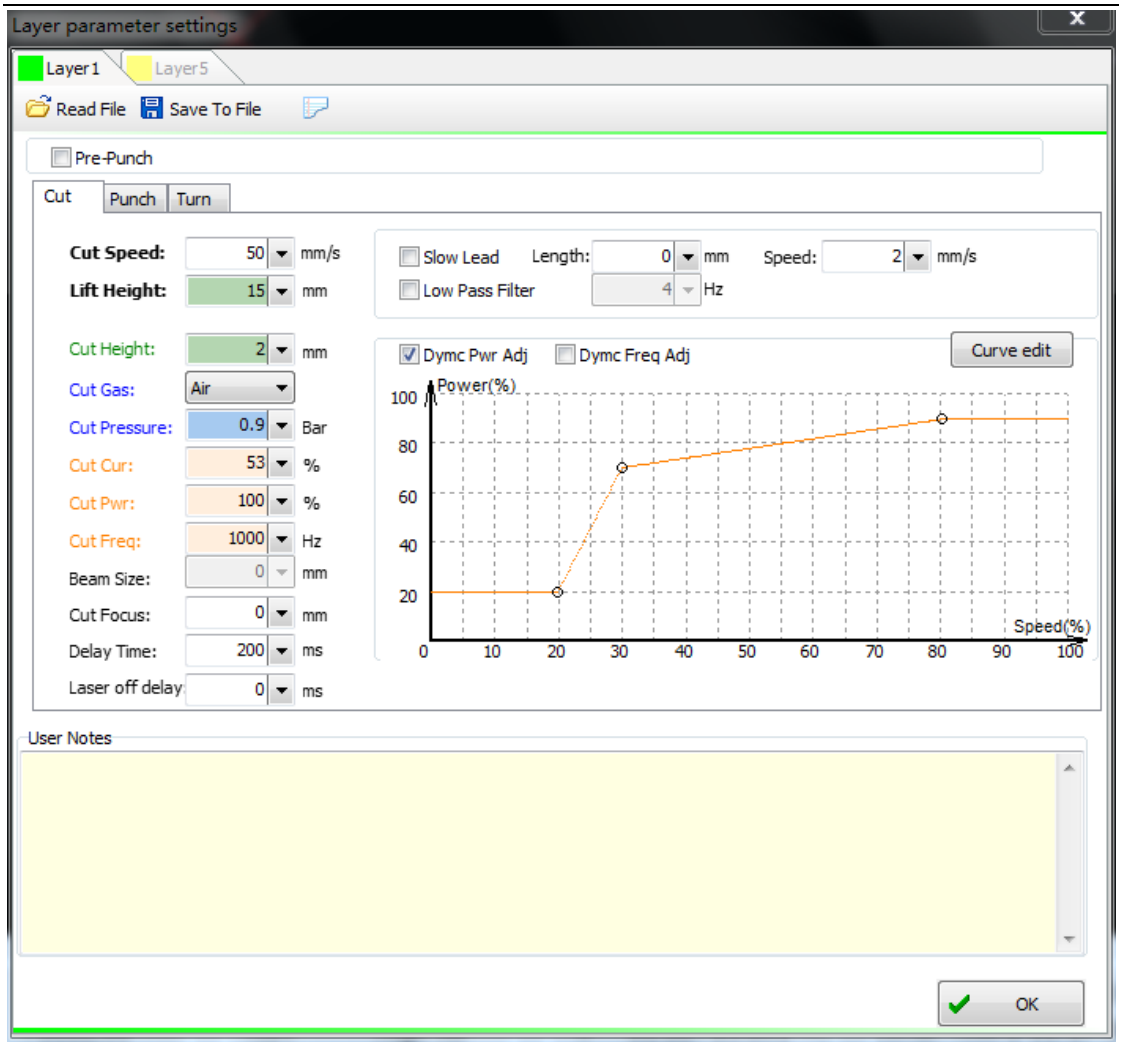
2.9 Layer parameters

If graph has more than one layer, each layer contains a process technique set as required.



1. Layer

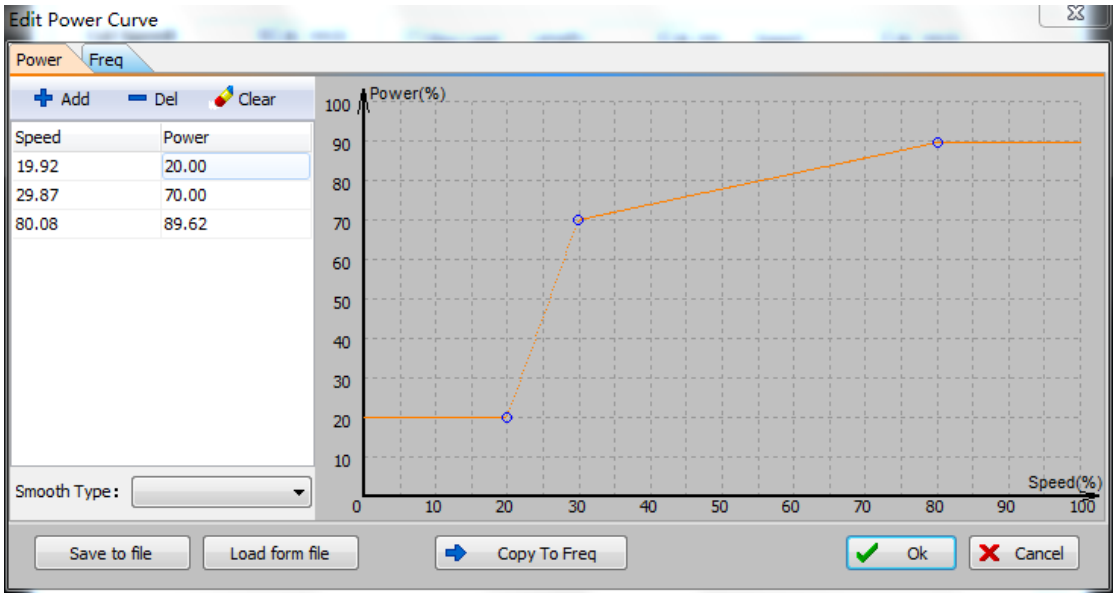
You can set the cut speed, gas pressure, cut power, laser-off delay etc.



Parameter name	Description
Cut speed	The max speed of cutting curve
Lift height	When finish a process path, the height the cutting head will lift to switch to another process path.
Cut height	The following height in cutting
Cut Gas	Air / oxygen / nitrogen for selection in process
Cut pressure	Pressure value
Cut PWR	Set the peak power of the laser source during the cutting process
duty ratio	Setting up the duty cycle of laser source in the cutting process
Cut Freq	Set the pulse frequency of laser source in the cutting process
Beam size	If the focusing axis mounted, you can set laser spot size in cutting process
Cut focus	If the focusing axis mounted, you can set the location of laser focus in cutting process

Delay time	The time from laser turns on to process path starts
Laser-off delay	The time from process path finished to laser turns off
Slow lead length	The lead in path before process path starts
Slow lead speed	Set the speed in lead in stage
Low pass filter	Setting the filter frequency in lead in stage
Dymc Pwr Adj	Set the relation between laser power and path velocity.
Dymc Freq Adj	Set the relation between laser frequency and path velocity.

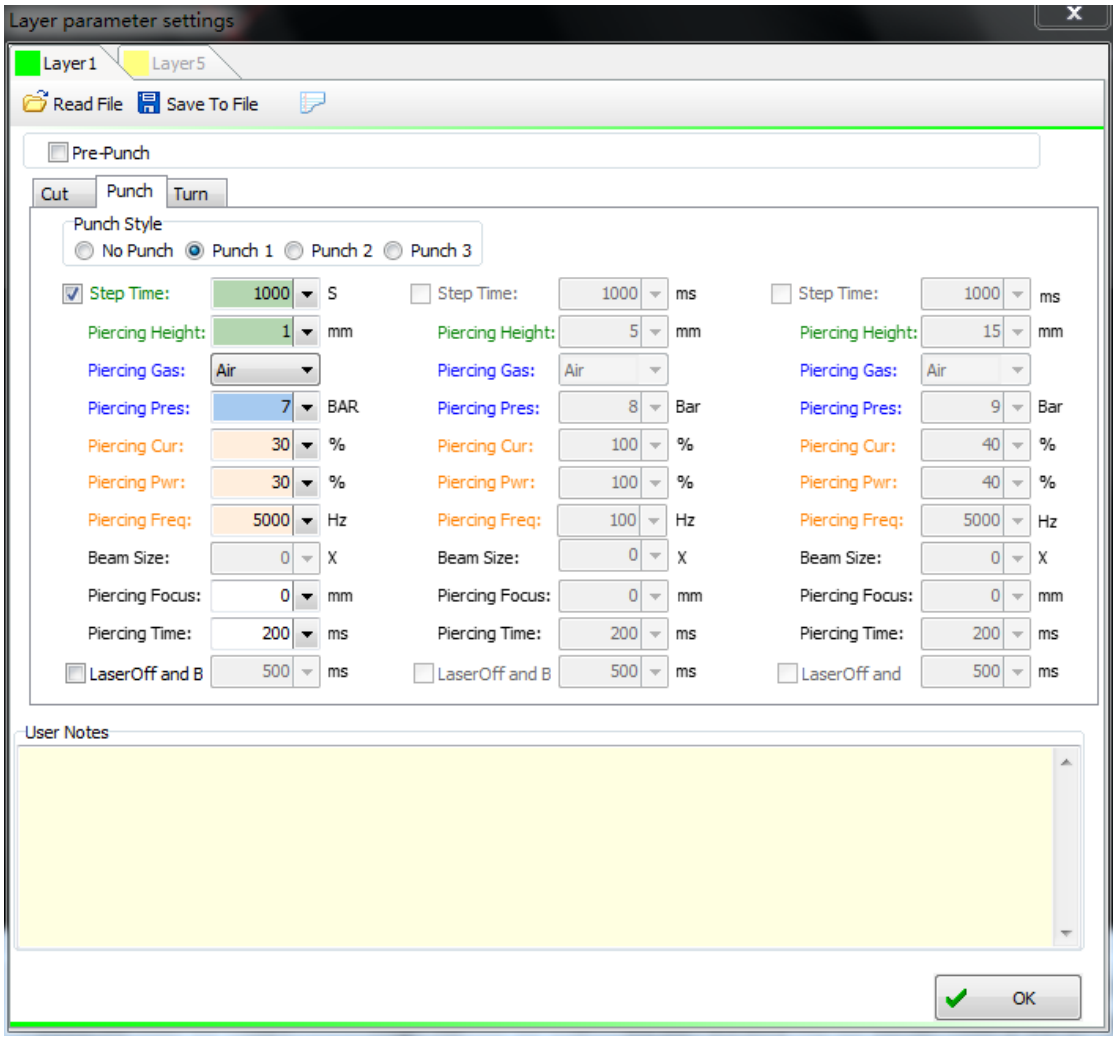
Double click Curve Edit to redact the power curve and frequency curve. Click the left side to add node and choose smooth type: Section / linear / smooth.



Parameter name	Description
Power / frequency	Set the node of Power / frequency curve
Speed	The cutting speed on node
Power	Vertical-coordinate is laser power
Freq	Vertical-coordinate is laser frequency
Smooth Type	Section / linear / smooth, the default is linear

2. Punch parameters

There are No punch/ Punch 1/ Punch 2/ Punch 3 in the option. You can set step time, piercing height, piercing gas, pressure, piercing cur, piercing pwr, frequency etc. You can set beam size and adjust focus if the cutting head supports the focusing function.

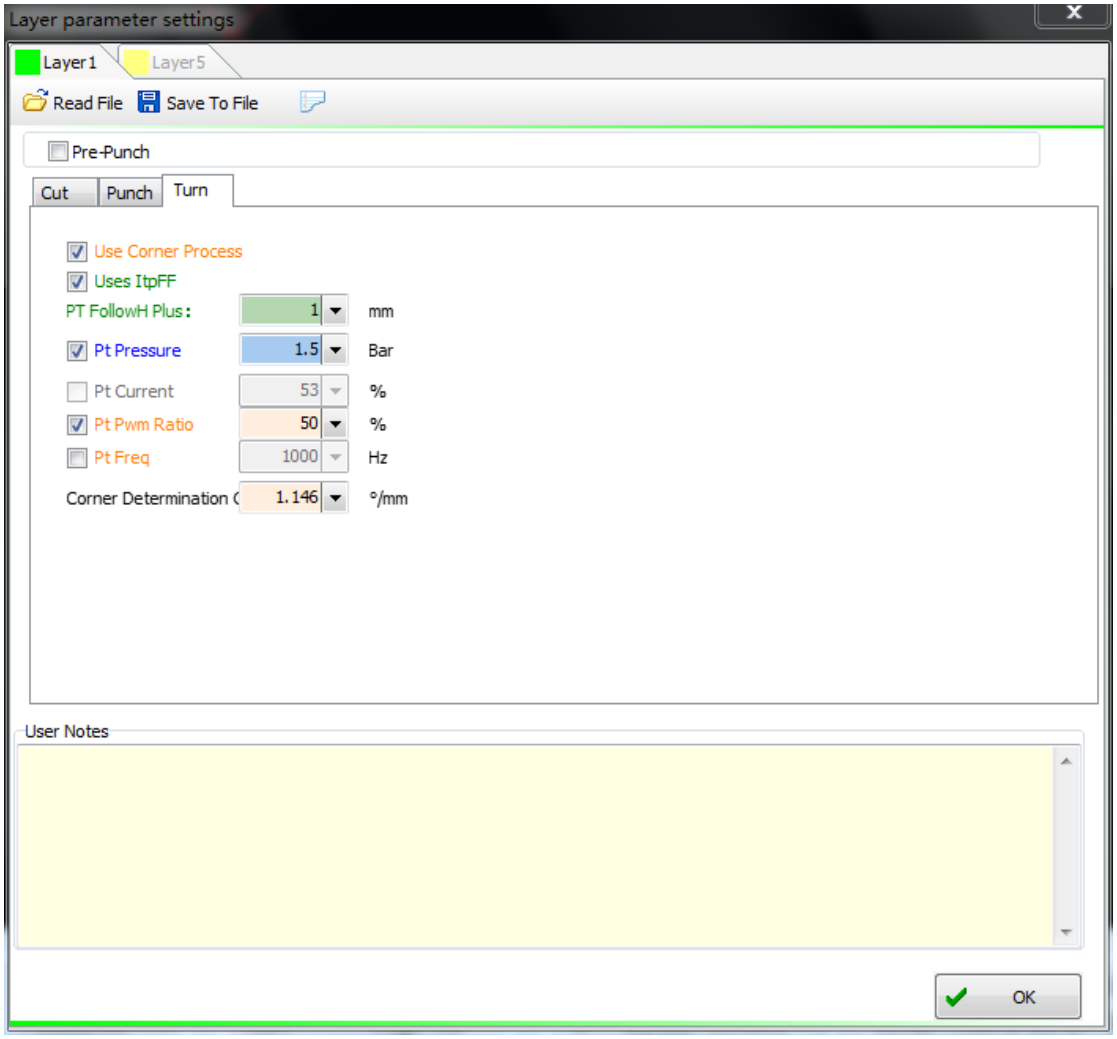


Parameter name	Description
Punch style	Choose the punch style no punch / punch 1 / punch 2 / punch 3 according the thickness and material of sheet metal.
Step time	In Punch 1 / 2/ 3, the time that nozzle slowly steps in.
Cut height	The height of nozzle In piercing process.
Piercing gas	Set the gas type for piercing process
Cut pressure	Set the pressure in piercing process
Cut PWR	Set the peak power of laser in piercing process
duty ratio	Set the laser duty ratio of laser in piercing process.

Cut Freq	Set the laser frequency in piercing process
Beam size	You can set laser beam diameter if the focusing axis mounted
Cut focus	You can set the focusing position if the focusing axis mounted
Piercing time	Piercing time after laser turns on
Laser off and gassing	After piercing complete, turn off the laser and gassing

3. Corner process

This technique will improve the performance of corner process of rectangle tube. You can set pressure, peak power, ratio duty and pulse frequency. Corner process is not available for round tube.5000A and 5000B supports follow-control function, 5000C does not support.



2. Abnormal alarm

3.1 Frequently Asked Questions

1. Leveling or edge searching failed

Please check the pulse equivalent setting of Z/Y/B axes, axis direction and pitch compensation. Make sure the Z axis is calibrated and wiring is solid and reliable. Check if the mid position is in the centering line of the tube, and travel range of X axis is correct in the platform configuration tool.

2. Undesirable piercing precision

For example, when spot offset is not set, the hole heart offset on the four sides of the rectangle tube are +0.60，+0.42，+0.62，+0.74. According to the results of multi group test data, the spot offset is set to - (0.60+0.42+0.62+0.74) /4 = -0.595.

3. Chamfer welded

The corner process is used to adjust the peak power, frequency and duty ratio when processing the corner.

3.2 Abnormal alarm list

Alarm name	Alarm release method	Alarm explanation
Leveling failure, X, Z, B axis might reverse	Manual	Please confirm that the servo direction of the X, Z and B axis is set correctly. Check if the pulse equivalent of the X, Z, and B axis is correct.
Setup error of travel range, edge seeking failure	Manual	Please check the travel range of the X axis.
Incorrect height parameters	Manual	Please check the physical pipe size and the setting value is same. Check the pulse equivalent of the X, Z, and B axis.

Edge seeking failure	Manual	Check X, Z, B axis pulse equivalent, axis direction and pitch compensation. Make sure the Z axis has been calibrated
Holder delay alarm	automatic	Holder inpos signal timeout. Holder might be not in position or incorrect inpos signal
Holder exceeds the position	automatic	The Y shaft exceeds the limit value and holder still not in place. The INPOS time of holder set too large or Y axis moves too fast
Holder alarm	automatic	The holder didn't lower in time
Chuck	automatic	Chuck inpos signal timeout
Excessive following error	automatic	The sudden increase of following height caused by vibration or follower moves out of the board
The follower is too close to the board	automatic	The follower is too close to the board when JOG
Z axis -limit enabled	automatic	Z axis trigger the -limit sensor
Z axis +limit enable	automatic	The Z axis triggers the +limit sensor
Z axis soft -limit enable	automatic	The Z axis exceeds the maximum downward travel range
Z axis soft +limit enable	automatic	The Z axis exceeds the maximum upward travel range
The capacitance is zero	automatic	The cutting head hits the board , BCS100E hardware or capacitance sampling cable not functioning well
Abnormal increase of capacitance	automatic	Cutting head hits the board
Capacitance decrease	automatic	The change of the capacitance caused by the temperature drift.
Capacitance increase	automatic	The change of the capacitance caused by the temperature drift.
Laser alarm	automatic	Gas alarm

Gas alarm: General valve	automatic	Gas alarm
Gas alarm: oxygen	automatic	Gas alarm
Gas alarm: nitrogen	automatic	Gas alarm
Gas alarm: High pressure air	automatic	Gas alarm
Gas alarm: High pressure oxygen	automatic	Gas alarm
Gas alarm: high pressure nitrogen	automatic	Gas alarm
Gas alarm: low pressure	automatic	Gas alarm
Gas alarm: high pressure	automatic	Gas alarm
Z axis servo alarm	automatic	Check whether the driver alerts the alarm.
Excessive following error	automatic	The sudden increase of following height caused by vibration or follower moves out of the board
The follower is too close to the board	automatic	The follower is too close to the board when JOG
Z +limit enable	automatic	Z axis triggers Z +limit sensor
Z axis -limit enable	automatic	Z axis triggers the -limit sensor
Z axis soft +limit enable	automatic	Z axis exceeds the maximum positive travel range
Z axis soft -limit enable	automatic	Z axis exceeds the maximum negative travel range
The capacitance is zero	automatic	The cutting head hits the board , BCS100E hardware or capacitance sampling cable not functioning well
Abnormal increase of capacitance	automatic	Cutting head hits the board
Capacitance decrease	automatic	The change of the capacitance caused by the temperature drift.
Capacitance increase	automatic	The change of the capacitance caused by the temperature drift.
The control card is loose or pulled out	automatic	The control card is loose.

Axis N positive / negative limit enable	automatic	Hard limit is triggered or the hard limit logic is incorrect.
Axis N positive / negative soft limited position enable	automatic	Not within the travel range
Axis N servo alarm	automatic	Servo alarm.
Emergency stop	automatic	Emergency stop button alarm.
Axis N returns ORG abnormally, motion axis remains working	automatic	The servo may not be enabled when return ORG
Failed to capture the switch signal when axis N returns ORG	automatic	The return ORG signal cannot be triggered.
Switch signal keeps enable when axis returns ORG	automatic	The logic of the ORG switch may be incorrect.
The position deviation of axis N double drive is too large	automatic	
User-defined alarm	automatic	The input port alarm
Illegal parameter configuration	Manual	Please close the software and open the platform configuration tool to check whether the parameters are conflicting.
Bus network alarm (please remove the alarm manually)	automatic	Manually dismiss the alarm
Bus network alarm < network line XX is broken >	automatic	The network wire is broken, or the servo power off.
Bus network alarm (RTOS startup problem, system startup failed)	automatic	RTOS startup failure
Bus network alarm (RTOS startup problem, not prepared)	automatic	RTOS startup failure
Bus network alarm (RTOS startup problem, RTOS bin file version is incorrect)	automatic	RTOS startup failure
Bus network alarm (network card opening failed 0x9811000C)	automatic	Bus network alarm

Bus network alarm (license error 0x9811001A)	automatic	Bus network alarm
Bus network alarm (network mismatch)	automatic	Bus network alarm
Bus network alarm (configuration file read failure)	automatic	Bus network alarm
Bus network alarm (cycle instruction loss 0x98110021)	automatic	Bus network alarm
Bus network alarm (station error)	automatic	Bus network alarm
Bus network alarm (frame loss 0x98110025)	automatic	Bus network alarm
Bus network alarm (instruction frame loss 0x98110026)	automatic	Bus network alarm
Bus network alarm (station loss 0x98110027)	automatic	Bus network alarm
Bus network alarm (station is not in the Op mode)	automatic	Bus network alarm
Bus network alarm (station loss 0x9811002B)	automatic	Bus network alarm
Bus network alarm (network wire unconnected)	automatic	Bus network alarm
Bus network alarm (license error 0x98110039)	automatic	Bus network alarm
Bus network alarm (no configuration file is found)	automatic	Bus network alarm
Bus network alarm (change of network link topology)	automatic	Bus network alarm
Bus network alarm (network line cross information error)	automatic	Bus network alarm
Bus network alarm (hardware error)	automatic	Bus network alarm
Bus network alarm (hardware CPU error)	automatic	Bus network alarm
Bus network alarm (DC cycle is incorrect)	automatic	Bus network alarm