SYNTEC TECHNOLOGY CO.,LTD.

Laser Cutting Software User Manual

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中文版Mandarin Version: 雷射切割軟體操作手冊

1 1. Manual Introduction

This manual provides a detailed introduction to the functions of the Laser Cutting software, covering system overview, operational procedures, general functions, and advanced features. This manual is applicable to the **710CA/730CA/FC-C** model. We recommend that you carefully read this manual before using our **710CA/730CA/FC-C** cutting controller. It will help you make the most of the various features of this new generation cutting controller. If you wish to learn about the functions of the new generation **710CA/730CA/FC-C** compatible CADCAM software, please refer to the Syntec ProCAM User Manual.

For your convenience, this manual follows the following conventions:

- Clickable buttons are denoted in **"bold black text within quotation marks"**, for example, **"Confirm"** .
- Input fields are denoted as **<bold black text within brackets>**, such as **<Input value>**.
- Drop-down menus are indicated as **【bold black text enclosed in square brackets】** , such as **【Gas Type】.**

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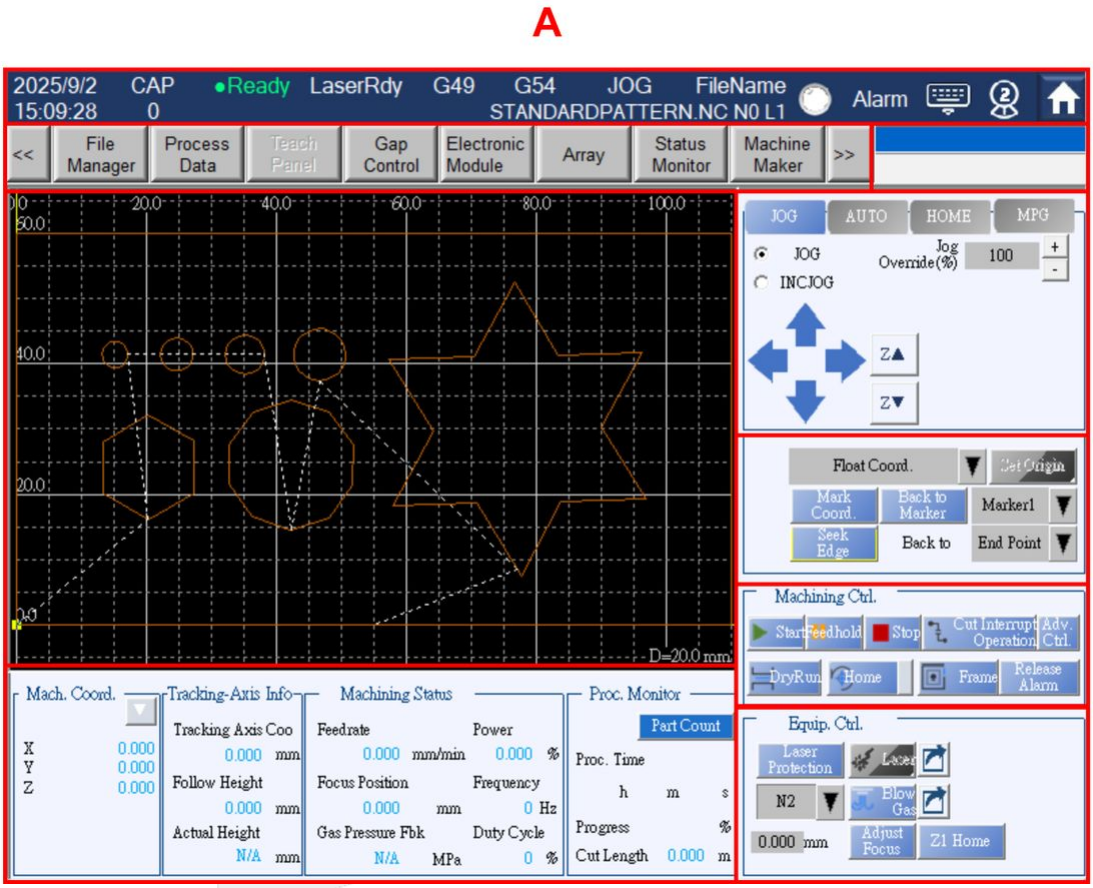
Additionally, due to our company's continuous product updates, with improved and enhanced functionality, we apologize for any discrepancies you may encounter when using this manual. We recommend that you regularly visit the Syntec website to download the latest user manual. Thank you!

2 2. Software Overview

2.1 2.1 Main Screen Introduction

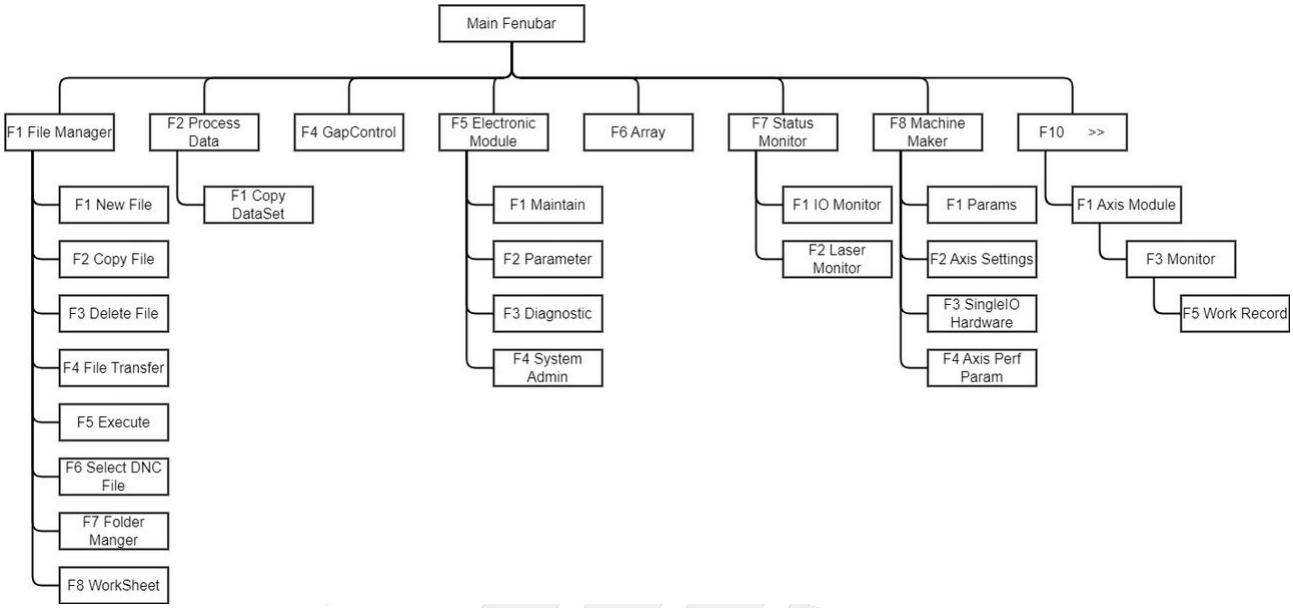


A: Status Bar **B**: Main Screen Feunbar **C**: Input Display Box

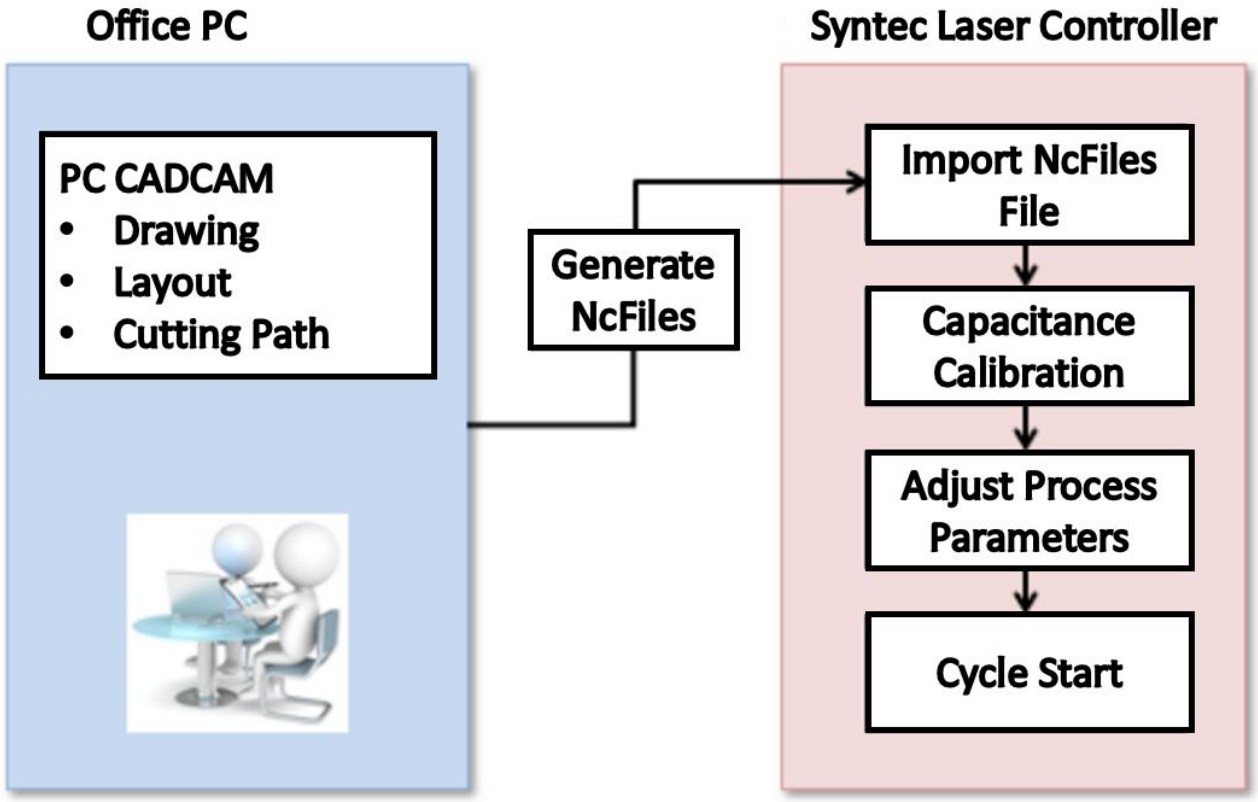
D: Graphic Simulation **E**: Machining Information **F**: Axis Control, Machining Rate, MPG, and Home

G: Coordinate System Setup **H**: Machining Control **I**: Equipment Control

2.2 2.2 Fenubar Tree Diagram



3 3. Operational Procedures Introduction



Operational Steps:

1. Plan the machining path using CADCAM software on the PC and generate the machining file.
    a. Complete drawing, layout, and cutting path planning in CADCAM software.
    b. If using Syntec ProCAM software, Process Data must be set in ProCAM.
    c. Generate NcFiles.
2. Import the machining file into the Syntec Laser Cutting Controller.
    a. On the Main Screen, press F1 to access File Management page.
    b. Press F4 for **"File Transfer"**, and then press F1 for **"File Import"**
    c. Choose NcFiles and press F1 for **"Copy"** to complete the NcFiles import.
    d. Return to the File Management page (press **"ESC"** key twice or press the **"<<"** button on the fenubar twice).
    e. Select a NcFile and press F5 **"Execute"** to assign it as the main program file.
3. Perform Capacitance Calibration Process.
    a. Ensure that the sheet material is correctly placed on the processing table.
    b. On the Main Screen, press F4 to access the Gap Control panel.
    c. Manually adjust the position of the cutting head to be approximately 1 to 5 millimeters away from the surface of the material.
    d. Press **"Normal Calibration"** and follow the on-screen instructions to perform Capacitance Calibration process.
    e. After doing Capacitance Calibration, a popup message will ask if you want to update the calibration data. Press **"Yes"** to complete Capacitance Calibration process.

4. Adjust Process Parameters. (***Note**: If using Syntec ProCAM, skip this step as Process Parameters have already been configured in ProCAM. ProCAM Process Parameters will not be displayed on the controller, and modifications in the Process Data page will have no effect.)
    a. On the Main Screen, press F2 to access the Process Data page.
    b. Set the Processing Material and sheet material thickness.
    c. Configure cutting parameters and piercing processes for all layers used.
5. Prepare for Machining.
    a. Return to the Main Screen.
    b. Conduct a gas blow test.
    c. Perform a laser test.
    d. Adjust focus of the cutting head.
    e. Perform Seek Edge process.
    f. Before actual machining, user can perform a Dry Run to check the cutting path.
    g. Start machining.

4 4. General Function Introduction

4.1 4.1 Main Screen Introduction

Introduction: The Main Screen serves as the primary display interface for the operator. After the completion of the file import, capacitance calibration process, and process data adjustment, the operator is able to execute the necessary actions for laser cutting on the current interface.

4.1.1 4.1.1 Status Bar

a Date and Time: Displays the current date and time.

b Capacitance Value: Displays the current capacitance value measured by the capacitance amplifier.

c Controller Status: Displays the current controller status.

- Ready: Display in green font. If the system is not in Not Ready, Busy, or FeedHold status, it will be in Ready status.
- Not Ready: Display in white font. Appear when an emergency stop is initiated.
- Busy: Appear when the equipment is in operation (except for jogging cutting head). Display in red font if it is processing. Display in orange font if it is manual testing.
- FeedHold: Display in yellow font. Pressing**"Stop"** will revert the system to Ready state.

d Laser Status: Displays the current laser status.

- Appear "Laser Ready" when the laser off. The font color is white.
- Appear "Laser Working" when the laser on. The font color is green.

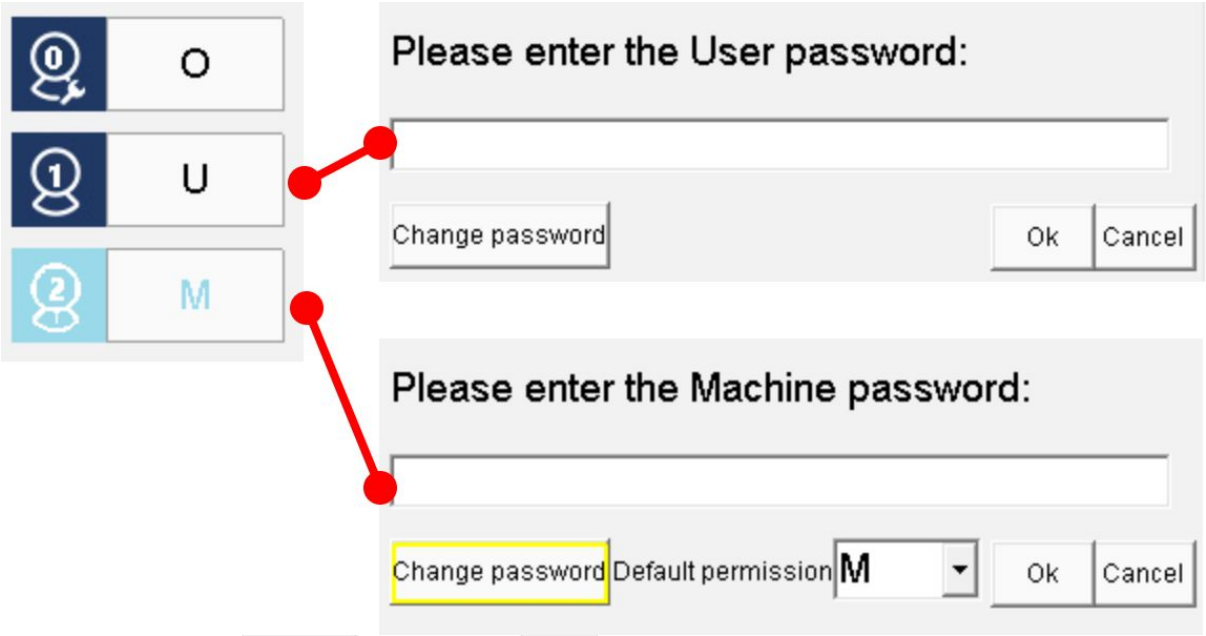
e Program (main program) File Information: Shows the current NcFile name and the current line number.

f Alarm Warning Light: When an alarm is triggered, the warning light starts flashing red.

g Keyboard: When using a touchscreen, clicking  to open the keyboard.

h Current User : Click to switch user permissions, permissions from low to high are as follows

- O(Operator) : Can only use Element Array, Jogging on the Main Screen, Coordinate System Setup (excluding Marking Coordinates), Machining Control, and Laser Protection Switch.
- U(User) : Cannot access the Electronic Module, Machine Maker, and Axis Module. All other functions are accessible.
- M(Machine) : All functions are accessible.



- Click **"O"**to switch directly to Operator.
- Click **"U"**,enter the user password : 666 to switch to User. Provide the option to change the password.
- Click **"M"**,enter the machine password : 520 to switch to Machine. Provide the option to change the password and set startup permissions.
    - To set startup permissions, use the drop-down menu to select startup as O, U, or M. This will apply the selected user permissions at the next startup (if the current permission is already Machine, no password is required; simply click Confirm).

i Main Screen Button: Press  to return to Main Screen.

4.1.2 4.1.2 FenuBar

ESC <<: Go back one step. This key has no effect if you are on the Main Screen.

F1 File Manager: Go to File Manager page.

F2 Process Data: Go to Process Parameters page.

F4 Gap Control: Go to Gap Control panel.

F5 Electronic Module: Go to Electronic Module page.

F6 Array: Go to Array Copy and Rotate page.

F7 Status Monitor: Go to Monitor fenubar.

F8 Machine Maker: Go to Machine Maker fenubar.

F10 >>: Go to Axis Module fenubar.

4.1.3 4.1.3 Input Display Box

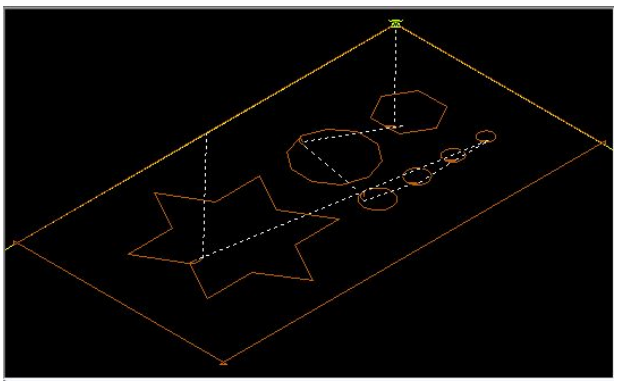
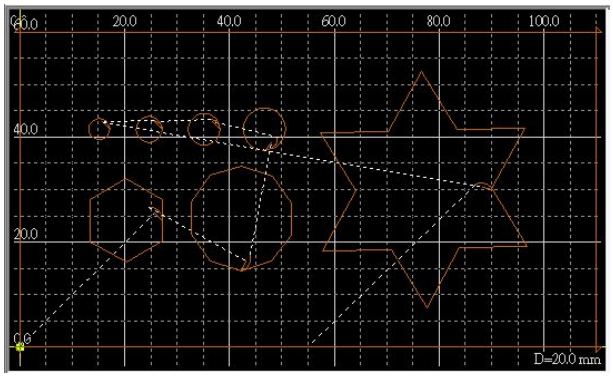
Introduction:

- The blue field displays user input content.
- The white field provides input range information.

4.1.4 4.1.4 Graphic Simulation

Introduction :

- Graphic simulation can use the extended parameter Pr3419 to switch to display in three-dimensional space or different two-dimensional planes or use Pr3424 to adjust the quadrant display direction

XYZ (three-dimensional space)	**XY (two-dimensional planes)**
	

- Display the machining path within the processing area.
- Laser-on paths and frogleap paths are represented by solid lines, while laser-off paths are shown as dashed lines.
- The color of the machining path corresponds to different layers:
  (0, 150, 255)

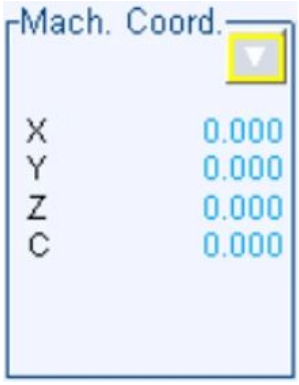
Layers	1	2	3	4	5	6	7	8	9	10
Color(RGB)	(200, 100, 0)	(100, 100, 0)	(200, 200, 0)	(0, 90, 0)	(80, 220, 80)	(0, 200, 200)	(40, 40, 220)	(100, 100, 255)	(255, 100, 255)	(120, 0, 120)
Layers	11	12	13	14	15	16	17	18	19	20
Color(RGB)	(200, 0, 0)	(100, 20, 20)	(0, 255, 0)	(255, 0, 0)	(200, 0, 255)	(128, 255, 255)	(255, 128, 255)	(255, 255, 128)	(128, 255, 128)	(255, 128, 128)
Layers	21	22	23	24	25	26	27	28	29	30

Layers	1	2	3	4	5	6	7	8	9	10
Color(RGB)	(240, 0, 120)	(30, 120, 120)	(150, 150, 150)	(180, 60, 180)	(0, 180, 60)	(90, 180, 210)	(120, 0, 210)	(255, 60, 150)	(60, 255, 150)	

- Layer number 12 is the film burning process layer.

4.1.5 4.1.5 Machining Information

1. Machine Coordinate/Absolute Coordinate



- Introduction:

i. Pressing the upper-right button

enables the user to switch between the display of content in either Machine Coordinate or Absolute Coordinate.

ii. Machine Coordinate: Show the position of the cutting head in machine coordinates.

iii. Absolute Coordinate: Show the position of the cutting head in absolute coordinates (workpiece coordinate system).

iv. If the machine possesses more than six axes. One can access the unshown axis coordinate information by pressing the **"Page Down"** key on the keyboard.

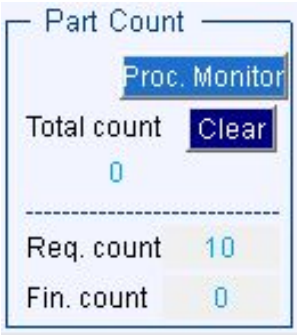
2. Tracking Axis Information

- Introduction:
  i. Axis Coord.: The Track-axis coordinate of the cutting head in machine coordinates.
  ii. Follow Height: The target height for cruise.
  iii. Actual Height: The actual distance between the cutting head and the workpiece. This value will be shown after completing the capacitance calibration process. If the cruise calibration process is not completed, it will show "N/A" instead.

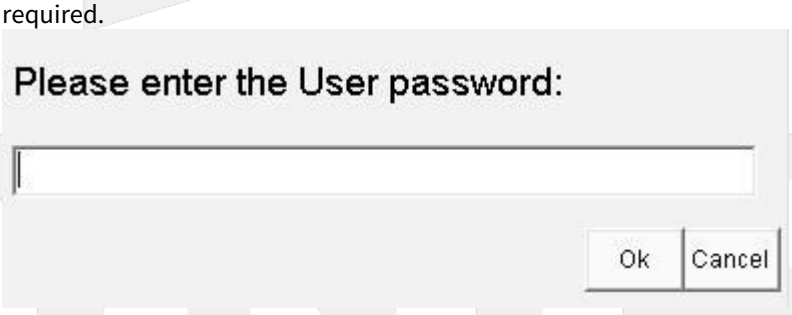
3. Machining Status

- Introduction:
  i. Feedrate: Display the current feedrate.
  ii. Focus Position: Upon completion of the Focus Adjust, the focus position of the cutting head will be displayed. If the cutting head lack automatic focus adjustment, it displays "N/A."
  iii. Gas Pressure Fbk: Show the current feedback pressure of the gas. If the machine doesn't have gas pressure feedback, it displays "N/A."
  iv. Power: Display the current laser power.
  v. Frequency: Display the current laser frequency.
  vi. Duty Cycle: Display the current laser duty cycle.

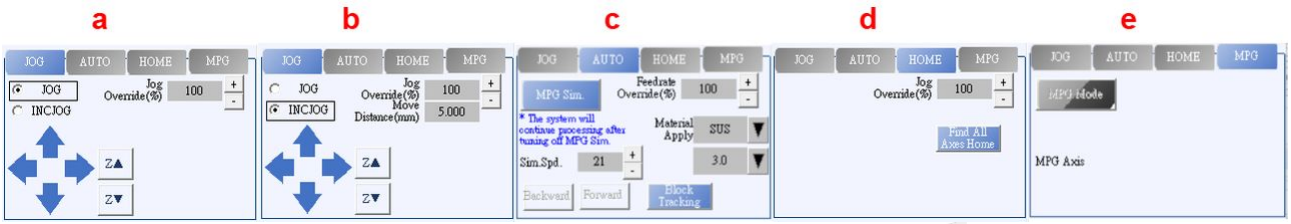
4. Process Monitor/Part Count



- Introduction:
  i. By selecting **"Part Count"** or **"Proc. Monitor"**, you can switch the displayed content.
  ii. Proc. Monitor: Display information such as Processing time, Progress percentage, and Cutting Length. These values will reset to zero if the processing is interrupted and then restart processing.
  iii. Part Count: Display the amount of Total Count, Require Count, and Finish Count. When changing the main program file, the amount of Require Count resets to zero, but the amount of Total Count does not reset to zero.
  iv. **<Req. count>**: Set the amount of part requirements. When the amount of Finish Count equals to the Require Count, a popup message will remind the user that the order requirements have been met.
  v. **"Clear"**: Pressing this button resets the amount of Total Count to zero. User password(666) is required.



4.1.6 4.1.6 Coordinate System Setup and Axis Control



Introduction :

- Set Pr3207 as Percent; each press of "+"or "-"adjusts by 1%
- Set Pr3207 as Level; each press of "+"or "-"adjusts by 10%

a JOG:

- **<Jog Override>**: Set the move rate for continuous jogging. The actual continuous jogging speed is equal to the speed set by the axial performance parameter multiplied by this magnification
- Press the (X+) 、 (X-) 、 (Y+) 、 (Y-) 、 (Z+) 、 (Z-) buttons on the screen to control the cutting head moving direction.
- In jogging mode, pressing an arrow button will move the cutting head in that direction at the setting speed (Jogging speed multiplied by Jog Override percentage). Jogging speed can be set in the Machine Maker Parameters page; see Section 5.1.1 for more details.

b INCJOG:

- **<Jog Override>**: Set the move rate for incremental jogging. The actual incremental jogging speed is equal to the speed set by the axial performance parameter X-Axis jog speed multiplied by this magnification
- **<Move Distance>**: Set the moving distance for incremental jogging.
- Press the (X+) 、 (X-) 、 (Y+) 、 (Y-) 、 (Z+) 、 (Z-) buttons on the screen to control the cutting head moving direction.
- In incremental jogging mode, pressing an arrow button will move the cutting head by the setting distance.

c AUTO:

- **<Feedrate Override>**: Set the cutting override. The cutting speed can be adjusted during processing.
- **<Material Apply>**: Show the currently selected material and thickness. In non-teaching mode, if the file header does not include material or thickness parameters, the selected process data will be applied instead.
- **"Handwheel Simulation"**: Click to enter Handwheel Simulation. After staring the processing, rotate the handwheel to simulate the processing path. Click again to exit Handwheel Simulation.
  - If the physical handwheel is not connected, set Pr2021 to 17577 to enable this function.
    - **【Simulated Speed】**: Enter a number between 1 and 200 or click the +/- buttons to adjust the speed.
    - **"Forward/Backward"**: Simulate handwheel forward rotation (Forward) and reverse rotation (Backward). The Buttons can only be used when Pr2021 is 17577.

  (*Note: The system will continue processing after turning off Handwheel Simulation)

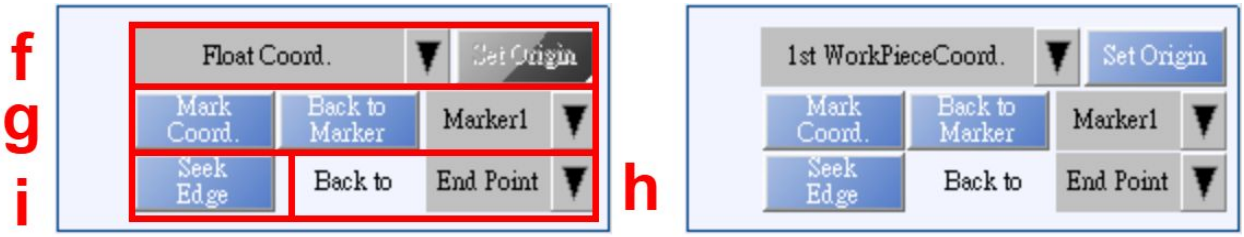
d Home:

- Set the homing speed ratio and press "Find All Axes Home"
  - Absolute/Incremental Encoder Homing Method: The system will always home the following axis first, then synchronize homing of the other axes. Additionally, for absolute homing, each axis must first independently home or set Zero Point in the Machine Maker- Axis Settings before using this function.

(*Note: Ensure the Jogging speed is not too fast and there are no obstacles near the cutting head before jogging.)

e MPG (HandWheel):

- **"Handwheel Mode"**: Click to enter Handwheel Mode. In this mode, turning the handwheel controls the axis movement. Click again to exit Handwheel Mode. Activation conditions:
  - Pr2021 Handwheel Port Setting 20
  - Machine is in Ready State
- Handwheel Axis: Displays the current axis being controlled in Handwheel Mode.



f Set Coordinate System:

- 【**Coordinate System**】: You can choose a coordinate system. There's a floating coordinate system and nine workpiece coordinate systems.
- Select the workpiece coordinate system to use the "Set Origin" function.
  - **"Set Origin"**: When pressed, the current position of the cutting head is set as the origin of the selected coordinate system.

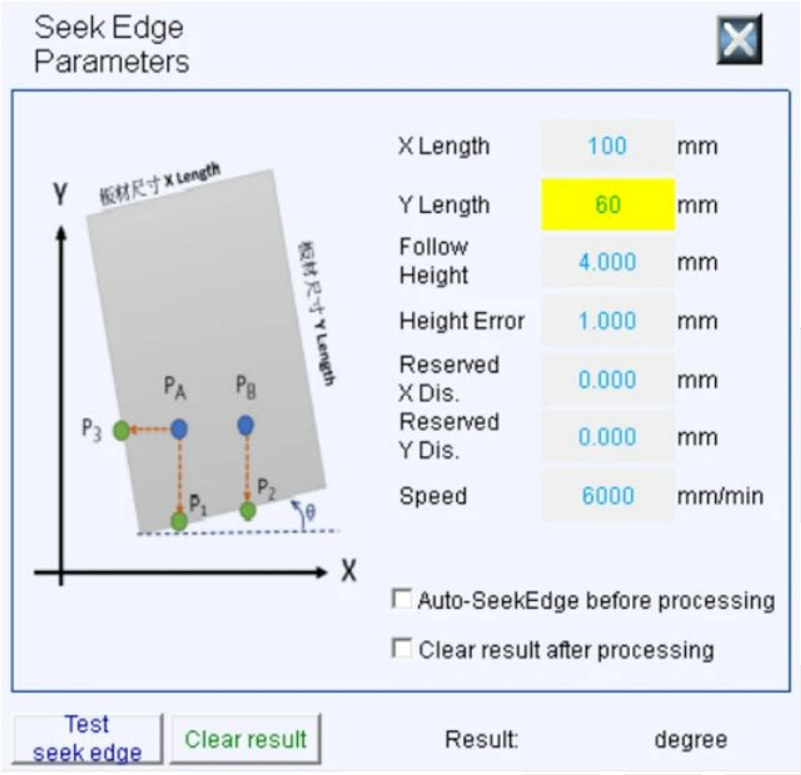
g Set Reference Points:

- "**Mark Coord.**": Pressing this button will set the cutting head current position as the Marker point. The default Marker point is the mechanical origin.
- "**Back to Marker**": Pressing this button allows the cutting head to return to the Marker point.
- 【**Choose Marker Point**】: Choose which Marker point to set or go to. There are 32 reference points can be set.

h Return to Specified Point After Processing:

- 【**Set Point After Processing**】: Choose the position to which the cutting head should return after processing. Options include Program Zero, Start Point, Machine Zero, End Point and Marker Point 1~6. The default is to return to the End Point after processing.

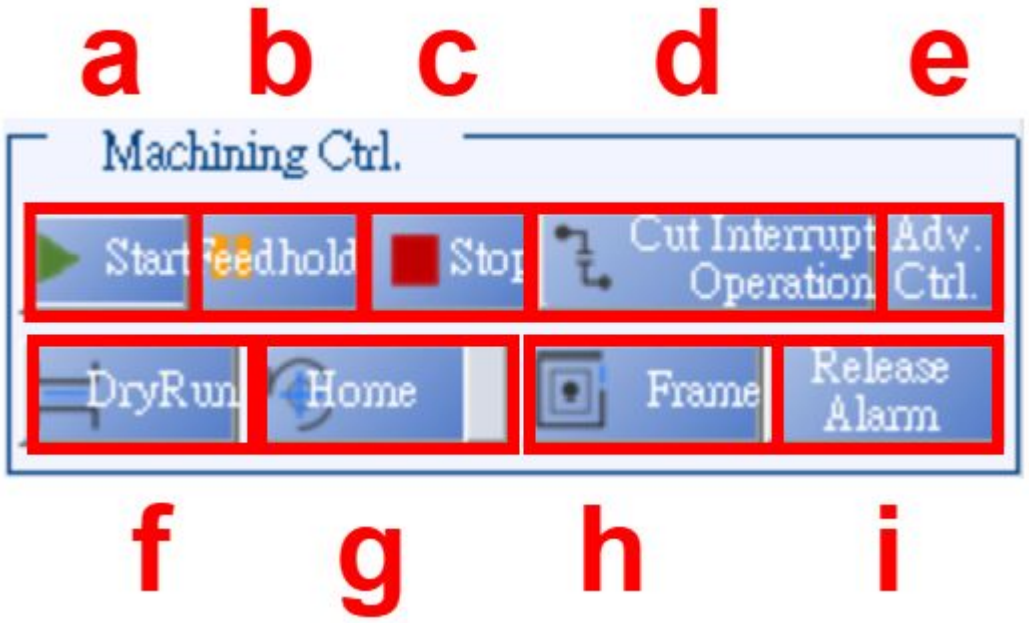
i "**Seek Edge**": Press to open the Seek Edge popup screen (as shown below).



- Seek Edge Parameters introduction:
  - **<X Length>**: Set the size of the sheet in the machine's X direction.
  - **<Y Length>**: Set the size of the sheet in the machine's Y direction.
  - **<Follow Height>**: Set the height of the cutting head during the edge-finding process. This height should not exceed 10 mm.
  - **<Height Error>**: Set the deviation in height at which the edge is considered to be reached during the process of Seek Edge. A smaller value increases the sensitivity.
  - **<Reversed X Distance>**: Set the distance from the sheet at which you want to start processing (relative to the Y-axis).
  - **<Reversed Y Distance>**: Set the distance from the sheet at which you want to start processing (relative to the X-axis).
  - **<Speed>**: Set the speed at which the cutting head moves during the process of Seek Edge.
  - Auto-SeekEdge before processing: If selected, the system will automatically perform edge-finding before starting the cutting process.
  - Clear result after processing: If checked, the system will automatically clear the edge-finding results after the cutting process is completed.
  - **"Test seek edge"**: Press this button to activate the Seek Edge process.
  - "**Clear result**": Press this button to clear the Seek Edge results.
- Process of Seek Edge:
  - Before using the Seek Edge function, ensure that the capacitance calibration process is completed.
  - Confirm that the sheet material has a rectangular geometry.
  - Ensure that there are no gaps or significant obstacles along the path during Seek Edge, and make sure that the sheet material is flat.
  - Set the Seek Edge Parameters.
  - Before starting the process of Seek Edge, move the cutting head to approximately the lower-left corner of the sheet material.
  - Press **"Test seek edge"**, and the machine will begin the process of Seek Edge.

- After the process of Seek Edge is complete, the results will be displayed on the screen, and the cutting head will return to the lower-left corner of the sheet material.

4.1.7 4.1.7 Machining Control

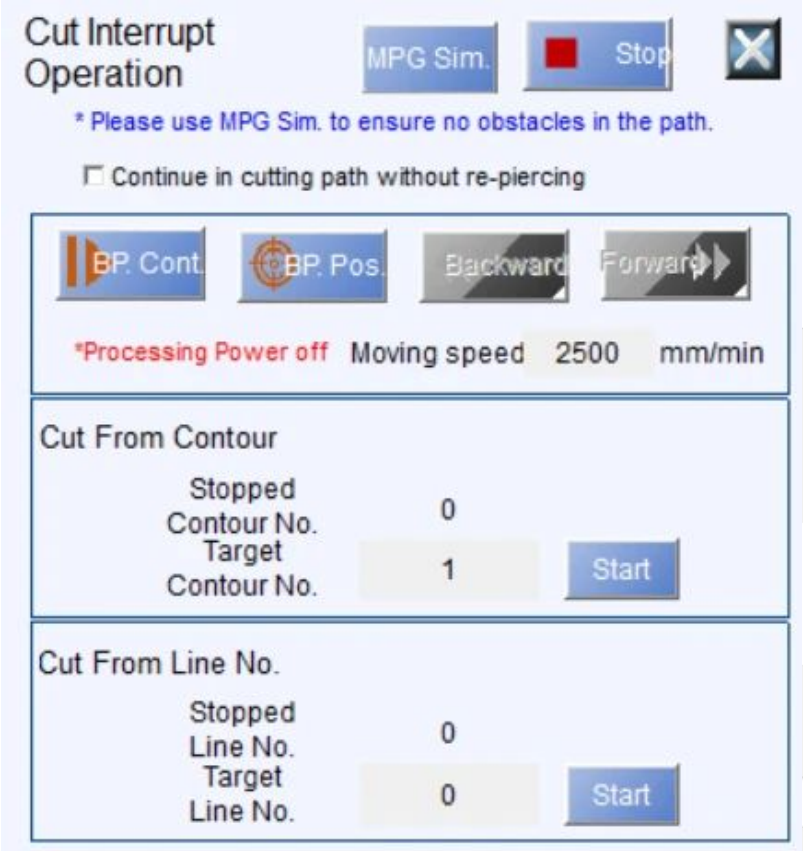


a "**Start**": Press to start the processing. During processing, any modifications to the process data are not allowed.

b **"Feedhold"**: Press to pause the processing, and the Z-axis will return to the mechanical origin. "**Start**" will cahnge to "**Continue**", press "**Continue**" to resume the process. If the axis is moved while in feedhold status, the system will automatically issue a reset.

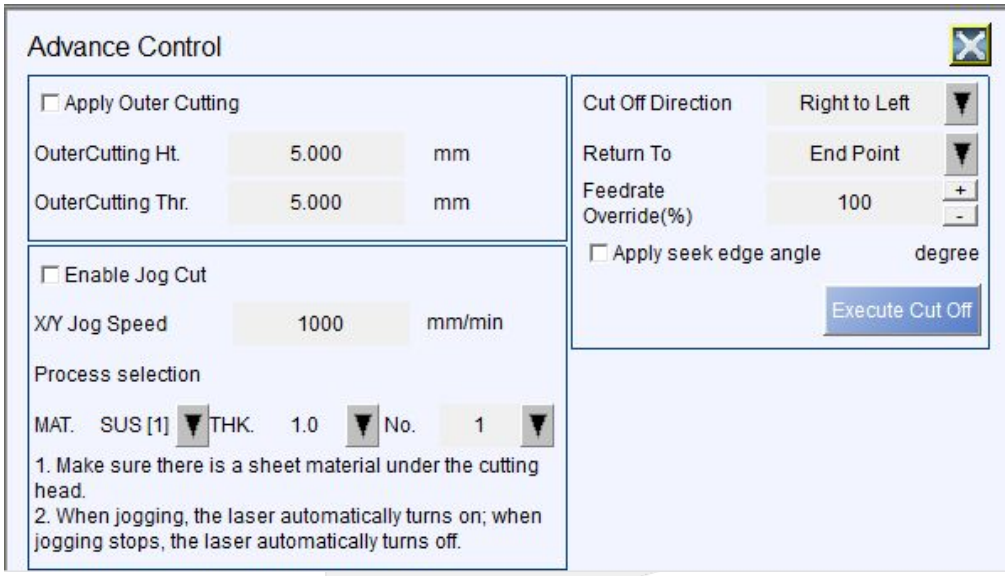
c "**Stop**": Press to interrupt the processing, and the Z-axis will return to the mechanical origin.

d "**Cut Interrupt Operation**": Press to open the Cut Interruption Operation popup screen (as shown below).

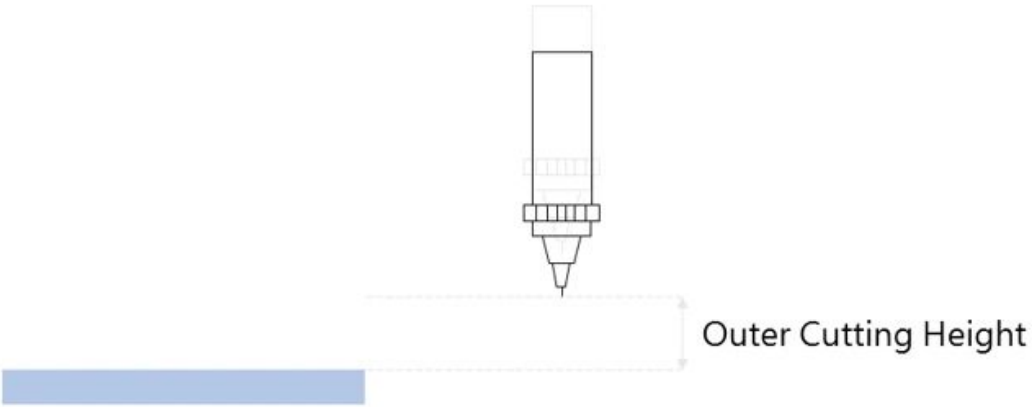


- Introduction:
  - "**Stop**": Press to interrupt the processing, and the Z-axis will return to the mechanical origin.
  - "**BP. Cont.**": Press for the cutting head to return to the processing breaking point and resume processing.
  - "**BP. Pos.**": Press to move the cutting head to the processing breaking point.
  - "**Backward**": When pressed, the cutting head will move backward along the processing path from the breaking point. Please press the "**Break Pos.**" button before using this.
  - "**Forward**": When pressed, the cutting head will move forward along the processing path from the breaking point. Please press the "**Break Pos.**" button before using this.
  - **<Moving Speed>**: Set the speed for forward, backward, and moving to the breakpoint.
  - **<Target Contour No.>**: Input the target contour and press the **"Start"** button to begin processing from the target contour. The first contour is labeled as 1.
  - **<Target Line No.>**: Input the target line no. and press the **"Start"** button to begin processing from the target line no. Line no. starts from 1.
  - Continue in cutting path without re-piercing: Check this box to skip the re-piercing process when executing breaking point resume or cut from line number action.
  - Stopped Contour No. : Displays the contour where processing was interrupted. The first contour is labeled as 1.
  - Stopped Line No. : Displays the line no. where processing was interrupted. Line no. starts from 1.
  - When in teaching mode, Cut From Contour and Cut From Line No. will not be displayed.
  - When a power outage occurs during cutting, power-off resume cutting allows the process to continue after restart.

e "**Advance Control**": Press to open the Advance Control popup screen (as shown below).



- Introduction:
  - Outer Cutting
    - **<Outer Cutting Ht.>**: The cutting height when apply Outer Cutting (as shown below).



    - **<Outer Cutting Thr.>**: When the gap between cutting and plate is less than the setting value, the tracking mode it will change to cruise.
    - Apply Outer Cutting: If selected, enable Outer Cutting function.
  - Jog Cut
    - **Enable Jog Cut:** After checking this box, the next jog movement will perform jog cut according to the process settings. This switch will automatically turn off after a Reset or when the jog cut is completed. To perform jog cut again, you must re-check this box.Support X, Y axis, incremental and continuous jog modes for jog cut.
    - **<X/Y Jog Speed>:** Used to set the jog speed. This jog speed is not affected by the Jog Override(%). The set value is the movement speed during jog cut.
    - **【Process Selection】:** Select the file corresponding to the process parameters for cutting. Example: If the selected process includes piercing, the jog cut will first perform the piercing and then the cutting.
  - Quick Cut Off
    - **【Cut Off Direction】:** Select the cut off direction.
    - **【Return To】:** Specifies the return location after quick cut off.

- **<Feedrate Override>**: Set the cutting override.
- Apply seek edge angle: Specifies whether the seek edge angle is applied during quick cut off.
- **“Execute Cut Off“:** Press to execute quick cut off. The process parameters for quick cut off are based on the currently specified material, thickness, and Layer 1.

f **"DryRun":** Press to perform a dry run along the processing path. The cutting head will move to the origin of Z-axis mechanical before dry running. During the dry run, there is no laser on, or Cruise.

g "**Home**": Press to move the cutting head back to the mechanical origin.

"**Switch RTN Zero/Home**"  : Press to switch between **"RTN Zero"** and "**Home**"
"RTN Zero": Press to move the cutting head back to the absolute origin.

h "**Frame**": Press the button and the cutting head will immediately start moving along rectangular frame of the main program file, assisting in checking the dimensions and position of the workpiece.

i "**Release Alarm**": Press to clear previously excluded alarms.

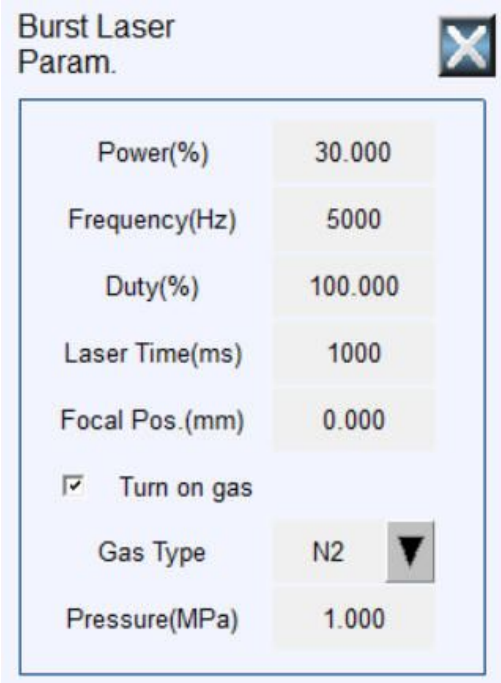
4.1.8 4.1.8 Equipment Control

a "**Laser Protection**": To prevent accidental activation laser.

- When **"Laser Protection"** is not pressed, the **"Laser"** button appears gray and cannot be pressed.
- When **"Laser Protection"** is pressed, the text turns red, the background of the **"Laser"** button becomes blue, and it become clickable.

b "**Laser**": When the laser is off, the text on the button appears white. When the laser is active, the button appears pressed and the text turns green. When the user presses this button, the laser on based on the Burst Laser Parameters.

c Arrow button  at the right of the **"Laser"**: Pressing this button opens the Burst Laser Parameters popup screen, as shown in the figure below. User can set the Burst Laser Parameters here.

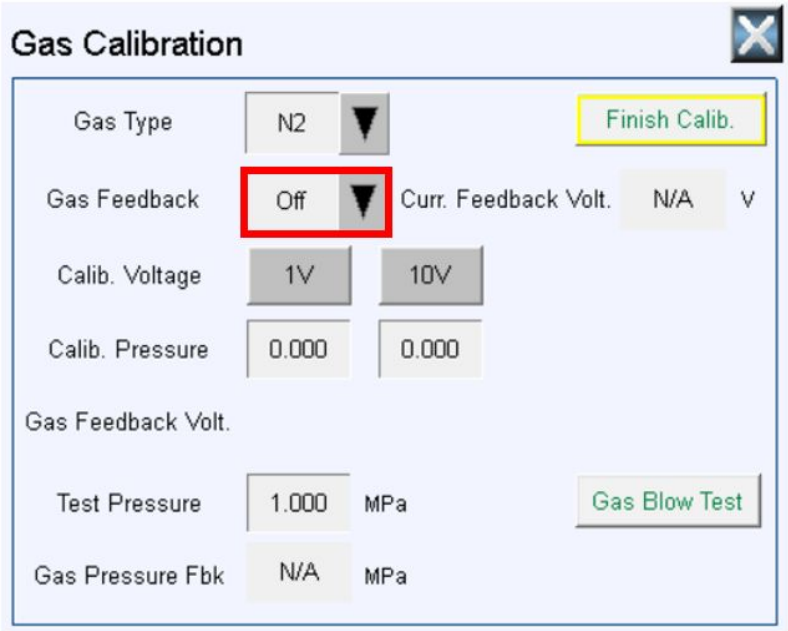


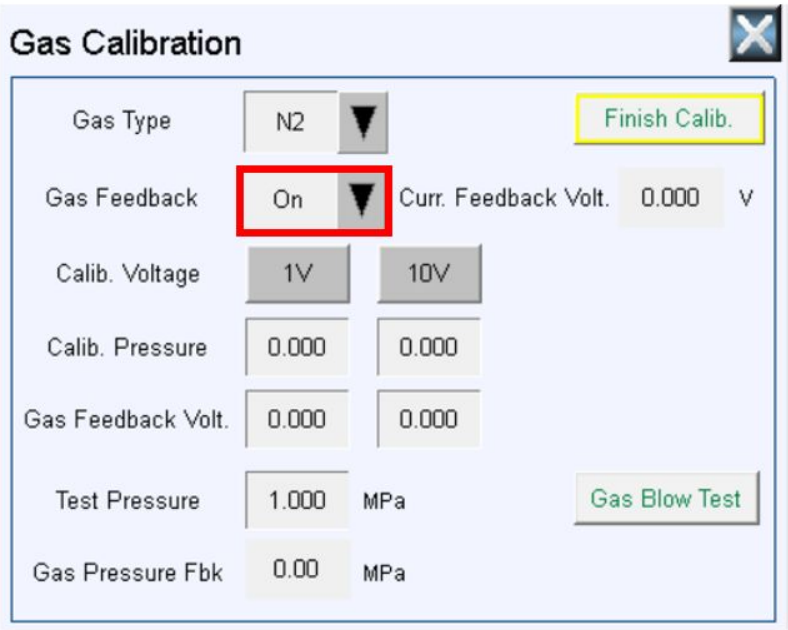
- Burst Laser Parameter introduction:
  - **<Power>**: Set the laser power output percentage for the burst laser test.
  - **<Frequency>**: Set the laser frequency for the burst laser test.
  - **<Duty>**: Set the duty cycle for the burst laser test.
  - **<Laser Time>**: Set the duration of laser on for the burst laser test.
  - **<Focal Pos.>**: Set the focus position of the cutting head during the burst laser test (only applicable to cutting heads with automatic focus adjustment).
  - **"Turn on gas"**: Set whether to turn on gas during burst laser. When "Turn on gas" is activated, the parameters for **Gas Type** and **Gas Pressure** will become visible and configurable.
  - **【Gas Type】**: Select the type of gas. Currently, the system supports the following gas options:
    - Oxygen (O_2)
    - Nitrogen(N_2)
    - Air
  - **<Gas Pressure (MPa)>**: Set the pressure of the gas.The unit of pressure is Megapascal (MPa). Please input the desired gas pressure value in MPa.

d "**Blow Gas**": When pressed, initiates the gas blowing test. User can set the type of gas to be blown below.

e Arrow button  at the right of the **"Blow Gas"**: Pressing this button opens the Gas Calibration popup screen, as shown in the figure below. Users can set Gas Calibration settings here.

- Controller Parameter Pr3406 = 1~3 Calibration Curve Order



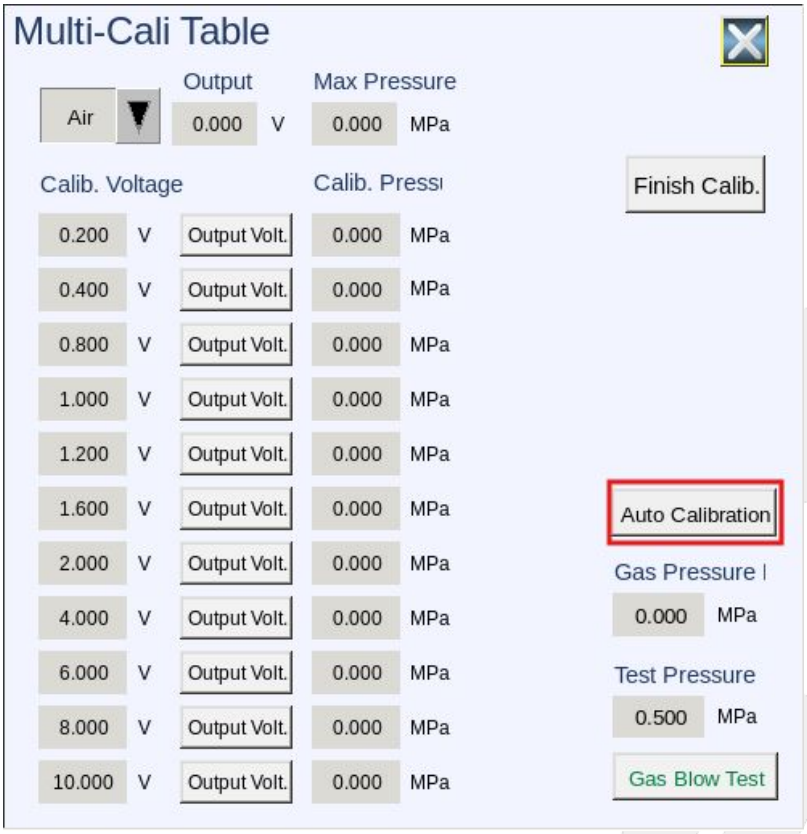


- Based on the selected curve order(Controller Parameter Pr3406 Pressure Calibration Curve Order), the screen will display input box for the desired calibration voltage value and the corresponding input pressure value:
  - For a first-level curve calibration, two input fields will be displayed: one for the pressure corresponding to 1V and one for the pressure corresponding to Controller Parameter Pr3410 (Pr3410=0 for 10V, Pr3410=1 for 5V).
  - For a second-order curve calibration, three input fields will be displayed.
  - For a third-order curve calibration, four input fields will be displayed.
- Gas Calibration Parameters (Machine without Gas Feedback):
  - **【FBK.】**: off
  - Choose **【GasType】**

- Press the **"1V"** button, and the machine will output the selected gas. Input the proportional valve's reading value in the **<Calib. Pressure>** input box located below the voltage button.
- After inputting 1V, press the other calibration voltage buttons, and input the proportional valve's reading value into the corresponding **<Calib. Pressure>** input box.
- Once all voltage values are entered, press the **"Finish Calib"** button to finish the gas calibration.

- Gas Calibration Parameters (Machine with Gas Feedback):
  - **【Gas Feedback】** : on
  - Choose **【GasType】**
  - Press the **"1V"** button, and the machine will output the selected gas. Input the proportional valve's reading value in the **<Calib. Pressure>** input box located below the 1V voltage button, and filled the Current Feedback Voltage value (displayed in the right corner of popup screen) in the **<Gas Feedback Volt.>** input box.
  - After entering the 1V calibration, press the other calibration voltage buttons, and input the proportional valve's reading value and the Current Feedback Voltage value into the **<Calib. Pressure>** and **<Gas Feedback Volt.>** input box, respectively.
  - Sequentially calibrate all voltage values, and press the **"Finish Calib"** button to complete the gas calibration.
- Pressing the **"Gas Blow Test"** button will make the machine release gas according to the current gas type settings and the **<Test Pressure>** setting. Pressing **"Gas Blow Test"** again will stop the gas release.

- Controller Parameter Pr3406 = 4 Multi-point Calibration



- Gas Calibration Parameters (Machine without Gas Feedback):
  - 【**FBK.**】: OFF
  - Choose 【**Gas type**】
  - Set the **<Calib. Voltage>** from top to bottom. After pressing **"Output Volt.",** the machine will output the selected gas. Enter the proportional valve reading into the **<Calib. Press>** field to the right of the Output Voltage button
  - Set the remaining **<Calibration Voltages>** in sequence, entering the proportional valve readings into the corresponding **<Calibration Pressure>** fields.
    - The calibration voltages and pressures must be in ascending order from top to bottom. No zero values are allowed between calibration points. If you do not need to calibrate all 11 points, set all points below the desired voltage and pressure to 0.
  - Set the **<Maximum Pressure>** value to represent the maximum pressure the proportional valve can output. If the desired output pressure exceeds this value, the system will adjust the output voltage according to controller parameter Pr3410. (Pr3410 = 0 is 10V, Pr3410 = 1 is 5V) and output maximum voltage. If this limit is not required, set the maximum pressure to 0.
  - After all voltages have been entered, press **"Finish Calib."** in the upper right corner to complete the gas calibration.
- Gas Calibration Parameters (Machine with Gas Feedback):
  - 【**FBK.**】: ON
  - Choose 【**Gas type**】
  - Set the **<Calib. Voltage>** from top to bottom. After pressing **"Output Volt.",** the machine will output the selected gas. Enter the proportional valve reading into the **<Calib. Press>** field to the right of the Output Voltage button. Enter the feedback voltage displayed in the window into the **<Calib. Fbk>** field to the right of the Calibration Pressure.

- Set the remaining **<Calib. Voltage>** in sequence, enter the proportional valve reading and the current feedback voltage reading in the screen into the **<Calib. Voltage>** field and the **<Calib. Fbk>** field respectively
    - The calibration voltages, pressures and feedback must be in ascending order from top to bottom. No zero values are allowed between calibration points. If you do not need to calibrate all 11 points, set all points below the desired voltages, pressures and feedback to 0.
- Set the **<Maximum Pressure>** value to represent the maximum pressure the proportional valve can output. If the desired output pressure exceeds this value, the system will adjust the output voltage according to controller parameter Pr3410. (Pr3410 = 0 is 10V, Pr3410 = 1 is 5V) and output maximum voltage. If this limit is not required, set the maximum pressure to 0.
- After all voltages have been entered, press **"Finish Calib."** in the upper right corner to complete the gas calibration.

- Pressing the **"Gas Blow Test"** button will make the machine release gas according to the current gas type settings and the **<Test Pressure>** setting. Pressing **"Gas Blow Test"** again will stop the gas release.
- Automatic Air Blow Calibration Procedure (Requires Ospri LCF-A0 Cutting Head)
    i. Set all the calibration voltages to be tested.
    ii. Press **“Auto Calibration.”** The system will automatically test according to the configured calibration voltages and fill the corresponding air pressure into the calibration pressure values.
    iii. After all voltage tests are completed, check whether any voltage or pressure values need adjustment. You may modify them manually or press **“Output Volt.”** to perform a manual test.
    iv. After confirming all values are correct, press **“Finish Calib.”** at the top right to finish the gas calibration.

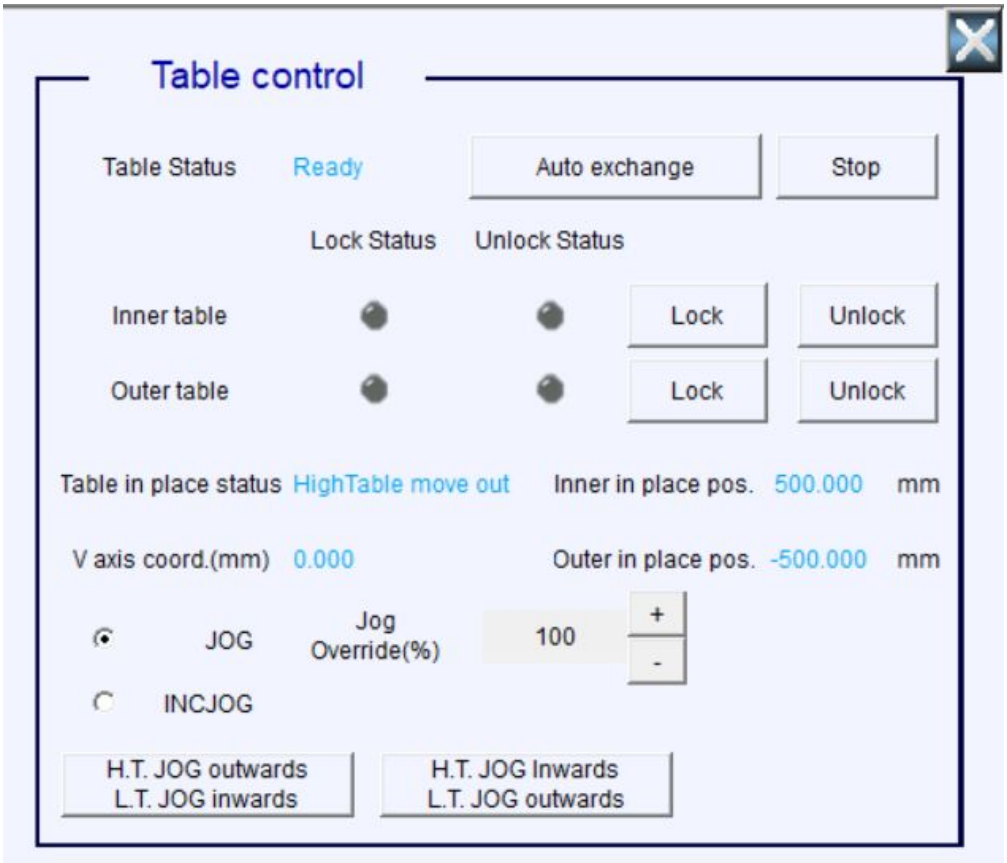
f **【Gas Type】**: Choose the gas for gas blowing test. You can choose from three options: nitrogen, oxygen, and air.

g **"Adjust Focus"**: This function is only applicable to cutting heads equipped with automatic focus adjustment.

- Left **<Input Box>** of **"Focus"**: Enter the target laser focal position in the input box.
- **"Adjust Focus"**: When pressed, the cutting head adjusts laser focal position according to the entered target focal position. Note that you should first finish **"Z1 Home"**.

h "**Z1 Home**": When pressed, the cutting head initiates a search for the home position of the focus axis. This button is only applicable to cutting heads with automatic focus adjustment.

i **"Table"**: Pressing this button will open the "Table control" window, allowing users to monitor the exchange table's status and control its movement.



- **Function Buttons:**
  - **"Auto exchange"**:
    - Prompts for confirmation before starting the exchange.
    - Upon confirmation, the system will execute the exchange process.

      (*Note: Ensure the axis movement path is clear of obstacles and that the negative limits of the high/low exchange tables and the low table origin have been set. Requires confirmation that the current table is in the "Table in place status" before starting.)
  - **"Stop"**: Immediately stops the current exchange operation.
  - **"Lock"/"Unlock"**: Controls the locking and unlocking of the current table.
  - **"Jog (V axis)"**:
    - Controls the exchange axis (V axis) of the high/low exchange table.
    - Selecting "H.T. JOG outwards\nL.T. JOG inwards" moves the V axis in the positive direction; conversely, selecting "H.T. JOG Inwards\nL.T. JOG outwards" moves the V axis in the negative direction.
    - Offers continuous and incremental jogging modes, with adjustable movement increments and distances.
- **Exchange Table Status (Real-time display):**
  - Ready: The exchange table is ready and can independently control locking/unlocking and table jogging.
  - "Auto exchange" Process:
    i. Enable Exchange Table: Lifts the cutting head to the Z-axis origin (no movement if already in position or above the Z-axis origin).
    ii. Table Unlocking: Unlocks the inner and outer tables. If the unlocking time exceeds the set limit, a "Failed to unlock inner/outer table" alarm will be triggered.

iii. Table Moving: Moves the table according to the control mode:
- Use Sensor On: Moving until the sensor detects the "Table in place status" signal. If the expected in-place time is exceeded, a "Exchange Failed" alarm will be triggered.
- Use Sensor Off: Moving to the specified coordinate position. If the movement fails, an "Exchange Failed" alarm will be triggered.

iv. Table Locking: Locks the inner and outer tables. If the locking time exceeds the set limit, a "Failed to lock inner/outer table" alarm will be triggered.

- Inner/Outer Table Lock Status: Displays the status of the inner and outer table locks based on the signal lights.
- "Table in place status" (Primarily based on the high table):
  - "HighTable inner in place"
  - "HighTable outer in place"
  - "HighTable move in"
  - "HighTable move out"
- "V axis coord.(mm)" / Inner/Outer In-place Position: Displays relevant information when "Use Sensor Off" is selected.

4.2 4.2 File Management

4.2.1 4.2.1 Load NcFiles

Path: Main Screen → F1 File Manager → Select NcFiles → F5 Execute

(***Note**: You can only assign NcFiles as the main program file in the Ready state.)

4.2.2 4.2.2 Edit NcFiles

Path: Main Screen → F1 File Manager → Select the NcFiles, and press the **"Enter"** key on the keyboard → Enter the NcFiles editing screen, start edits → F1 Execute

4.2.3 4.2.3 Input NcFiles

Introduction: Users can input NcFiles from external folders (e.g., USB flash drive) into the controller.

Path: Main Screen → F1 File Manager → F4 File Transfer → F1 File Import → Select the folder and the NcFiles to input → F1 Copy

4.2.4 4.2.4 File Output

Introduction: Users can output NcFiles from the controller to external folders (e.g., USB flash drive).

Path: Main Screen → F1 File Manager → F4 File Transfer → F2 File Export → Select the folder and the NcFiles to output → F1 Copy

4.2.5 4.2.5 Delete Files

Path: Main Screen → F1 File Manager → F3 Delete File → Check the files you want to delete → F4 Delete File → F1 Yes

4.2.6 4.2.6 Select DNC File

If the processing file is too large to fit into the controller's memory, you can use this function to load and execute the processing file from an external hard drive.

4.2.7 4.2.7 Folder Manager

This function allows users to edit and manage the contents of the folders. Currently, it supports folder depths up to four levels.

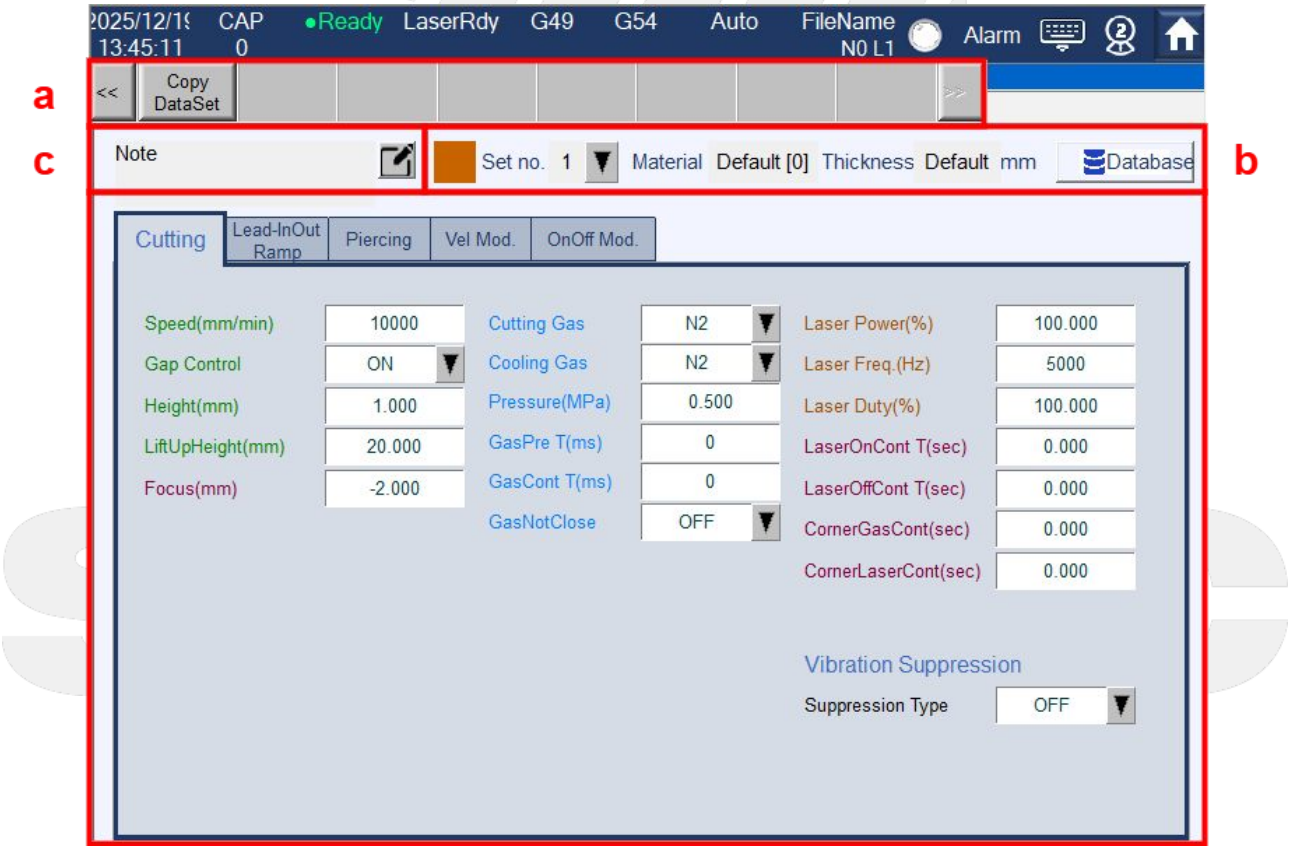
4.2.8 4.2.8 WorkSheet

The work order system provides job dispatch information displayed on the controller page. Operators can compare and modify processing parameters at the machine if there are any discrepancies.

4.3 4.3 Process Data Page

Path: Main Screen → F2 Process Data

(*Hint: The Process Data page can be accessed during the processing, however, it does not allow for modification or input of parameters.)



Introduction:

There is a total of 30 layers, with each layer having the ability to independently adjust cutting parameters and piercing parameters. These parameters include Velocity mode, curve type, laser parameters, air pressure parameters, and follow height.

Steps for Setting Process Parameters (as shown below):

1. Set the material type and material thickness.
2. Select a layer.
3. Set the cutting parameters for that layer.(Include Cutting, Piercing, Vel. Mod, OnOff Mod. etc.)
4. Repeat steps 2,3 until parameters have been configured for all processing layers.

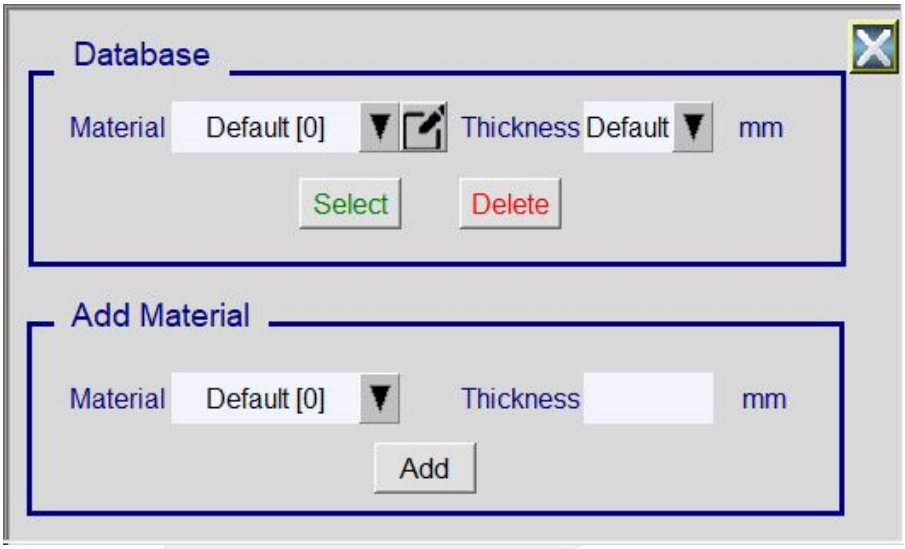
a Copy DataSet

- Introduction:
  Copy the complete process parameters of the current page to the specified layer **【Destination DataSet】**.
  Press **"Save"** to display the "Save Successful" window, then you can click **"Back"** to go back to the Process Data Page.

b Layers and Database Setting

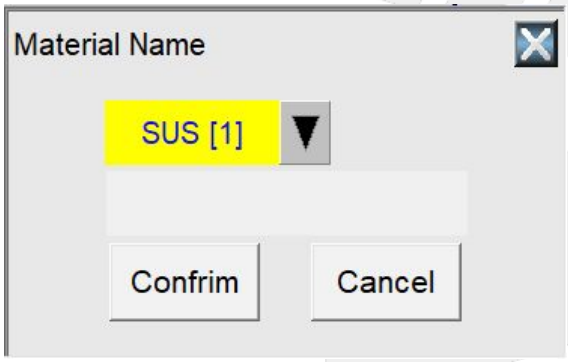
【set no. Layer】 List provides the selection of the Destination DataSet

- **Setting Database**
  Database Setup Step (as shown in the figure):
  a. Press **"Database"** located in the upper right corner of the screen to access the Database page.
  b. If the library does not have any materials available for processing, the user could choose the desired material and specify its thickness, and then click "Add".
  c. If there is existing material data available, the user could select the appropriate material and thickness from the material library and then click "Select".



Custom Database Naming:

- In the Database page, press to open the Custom Database Naming page(as show in the figure).

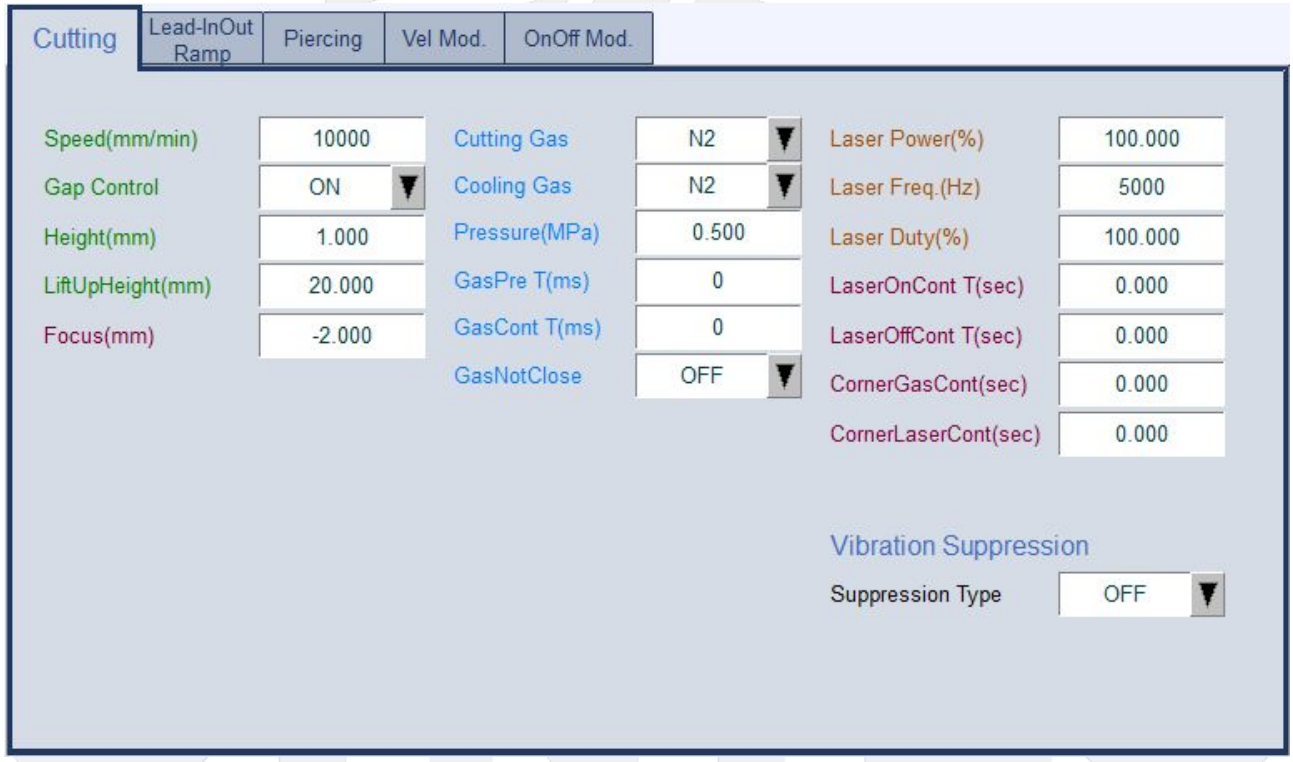


- Steps to customize Database name:
  a. Select the Database name you wish to change.
  b. Enter a custom name string(support Chinese, English, and numeric input).
  c. Press “Confirm“ to complete the modification of the Database name.
  d. Press “Cancel“ or to exit the page.

c Edit Note

- Press to enter the edit note window, where you can add customized notes to individual materials.

4.3.1 **4.3.1 Cutting Parameters Setting**



Introduction(from top to bottom, left to right):

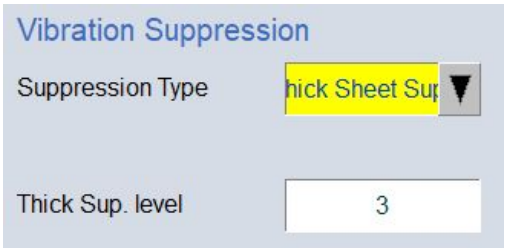
- **<Speed>**: Set the maximum speed during cutting; however, the cutting head will accelerate and decelerate according to the travel parameters at the starting point, end point, and breakpoints.
- **【Gap Control】:**
  - Off: The cutting head will reach the specified height before processing and maintain that height during processing.
  - On: The cutting head will maintain follow mode during processing.

- **<Height>:** The height of the nozzle during cutting, i.e., the target height of the follow mode.
- **<LiftUpHeight>:** Set the lifting height of the cutting head during idle movement between cutting paths.
- **<Focus>:** Set the focal position where the cutting head will automatically adjust the focus during cutting (only applicable to auto-focus cutting heads).
- ----------
- **【Cutting Gas】:**
  - Nitrogen
  - Oxygen
  - Air
- **【Cooling Gas】:**
  - Nitrogen
  - Oxygen
  - Air
- **<Pressure>:** Set the blowing pressure during cutting.
- **<GasPre>:** Set the gas pre-blow time; after the gas starts, it needs to blow for a while to stabilize the pressure and remove dust.
- **<GasCont>:** Set the gas post-blow time; after the gas stops, it blows out residual gas and removes dust.
- **<GasNotClose>:**
  - On: Do not close the gas during idle movement.
  - Off: Close the gas during idle movement (if the movement time between elements is short, the gas can remain on to avoid frequent valve switching, which causes pressure instability).
- ----------
- **< Laser Power >:** Set the laser power output percentage during cutting.
- **< Laser Freq. >:** Set the laser modulation frequency during cutting.
- **< Laser Duty >:** Set the duty cycle of the modulation signal during cutting.
- **< LaserOnCont >:** Set the laser on delay time; this setting ensures sufficient heating at the start of processing by pausing before starting to process.
- **< LaserOffCont >:** Set how long to stay at the end position before turning off the laser.
- **< CornerGasCont >:** Set the time to blow gas while turning a corner; this setting aims to cool the corner.
- **< CornerLaserCont >:** Set the time to keep the laser on while turning a corner; this setting ensures the corner is melted.

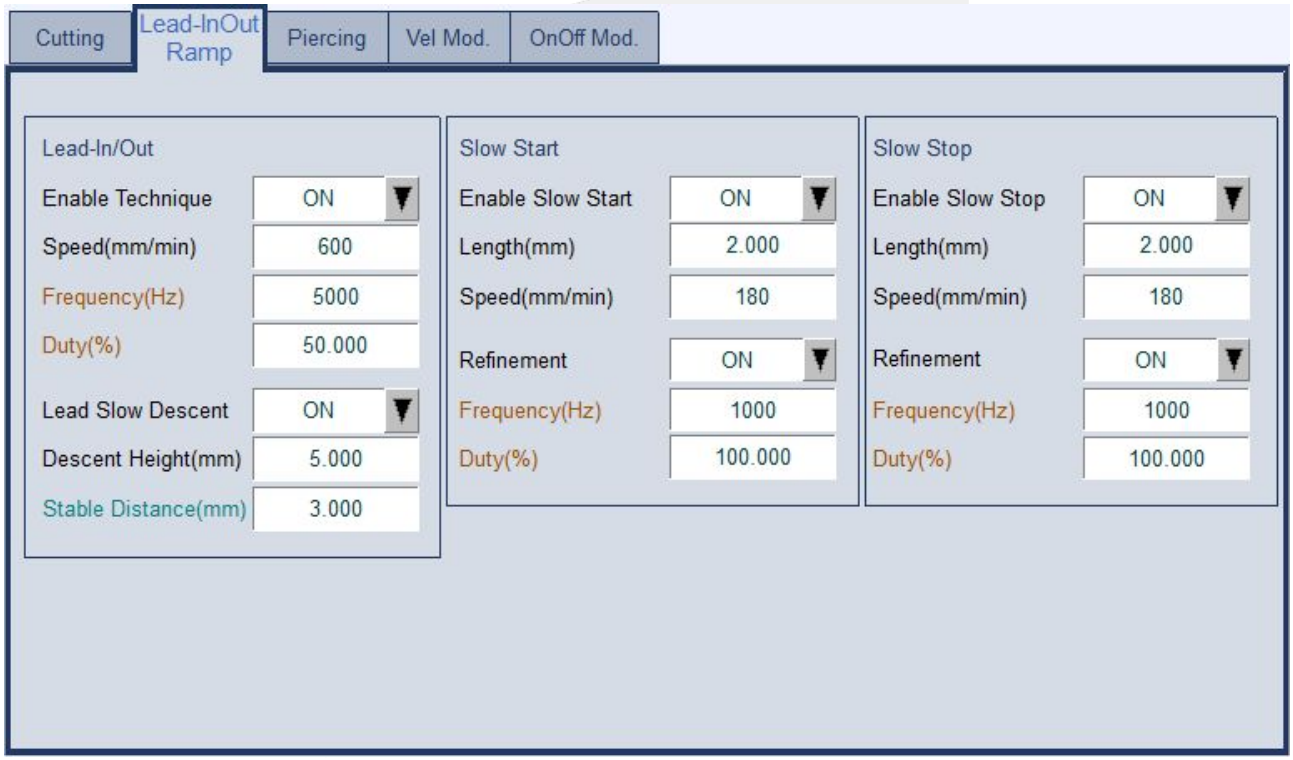
Vibration Suppression

- **【Suppression Type】:**
  - **OFF:** Turn off vibration suppression。
  - **Thin Sheet Suppression:** Turn on Thin-Sheet vibration suppression.
  - **Thick Sheet Suppression:** Turn on Thick-Sheet vibration suppression.
- **Thin-Sheet Suppression time:** Increasing the value enhances the suppression effect, but reduces the tracking performance.

- **Thick-Sheet Suppression Level:** Increasing the value enhances the suppression effect, but decreases the lift-up speed.



4.3.2 **4.3.2 Lead-In/Out Ramp Setting**



Lead-In/Out Introduction

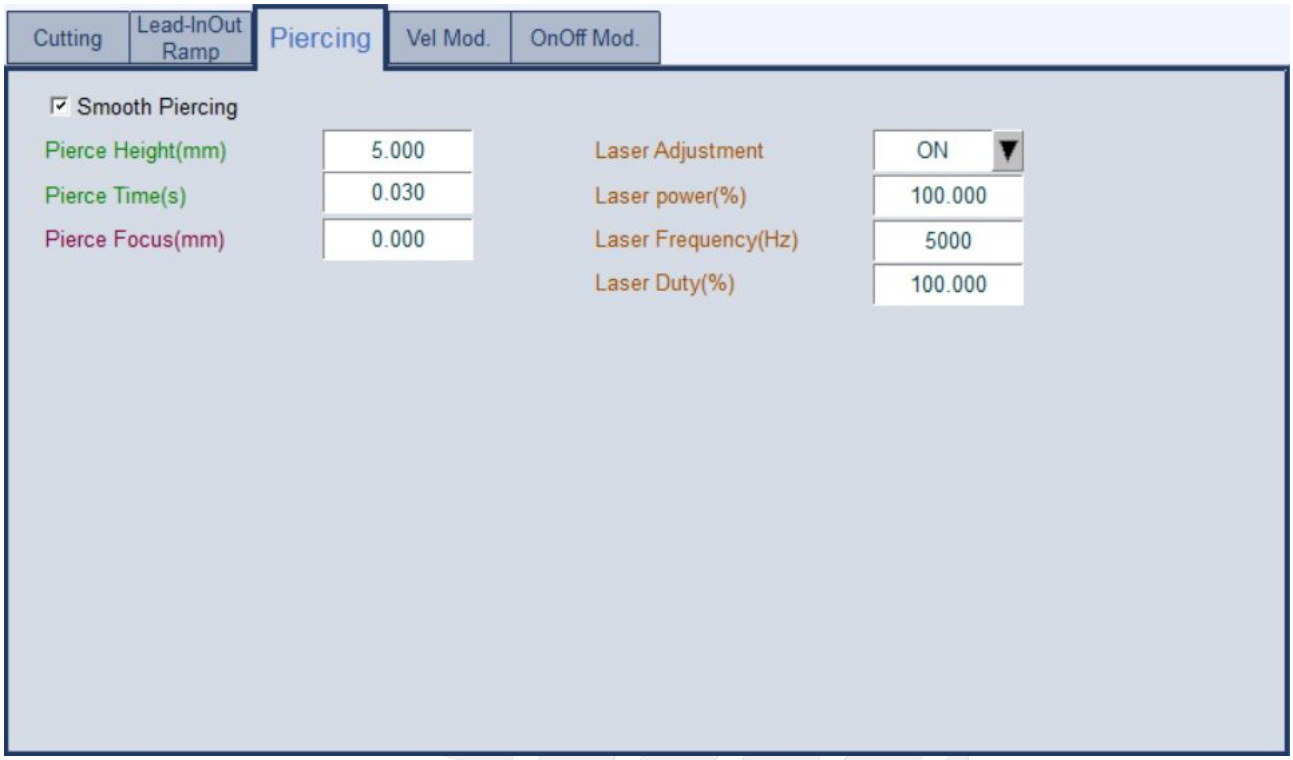
- **【Enable Technique】**： When enabled, the configured speed, frequency, and duty cycle will be used appliedleadline processing, and the Lead Slow Descent function can be activated.
- **<Speed>**: Set the processing speed for the lead-in and lead-out lines.
- **<Frequence >**: Set the laser processing frequency for the lead-in and lead-out lines.
- **<Duty>**: Set the laser processing duty for the lead-in and lead-out lines.
- **【Lead Slow Descent】**： When enabled, the Lead Slow Descent function activates, causing the cutting head to gradually descend from Descent Height to cutting height.
- **<Descent Height >**: The height at which the laser starts firing when using the Lead Slow Descent function.
- **<Stable Distance >**: The distance from the pattern path when reaching the cutting height while using the Lead Slow Descent function.

Slow Start/Stop Introduction

- **【Enable Slow Start/Stop】**： When enabled, the configured speed will be applied during start/stop length.
- **<Length>**: Slow start/stop length.

- **<Speed >**: Slow start/stop speed.
- **【Refinement】**: When enabled, the configured frequency and duty will be applied during start/stop length.
- **<Frequency>**: Slow start/stop frequency.
- **<Duty>**: Slow start/stop duty.

4.3.3 **4.3.3 Piercing Setting**

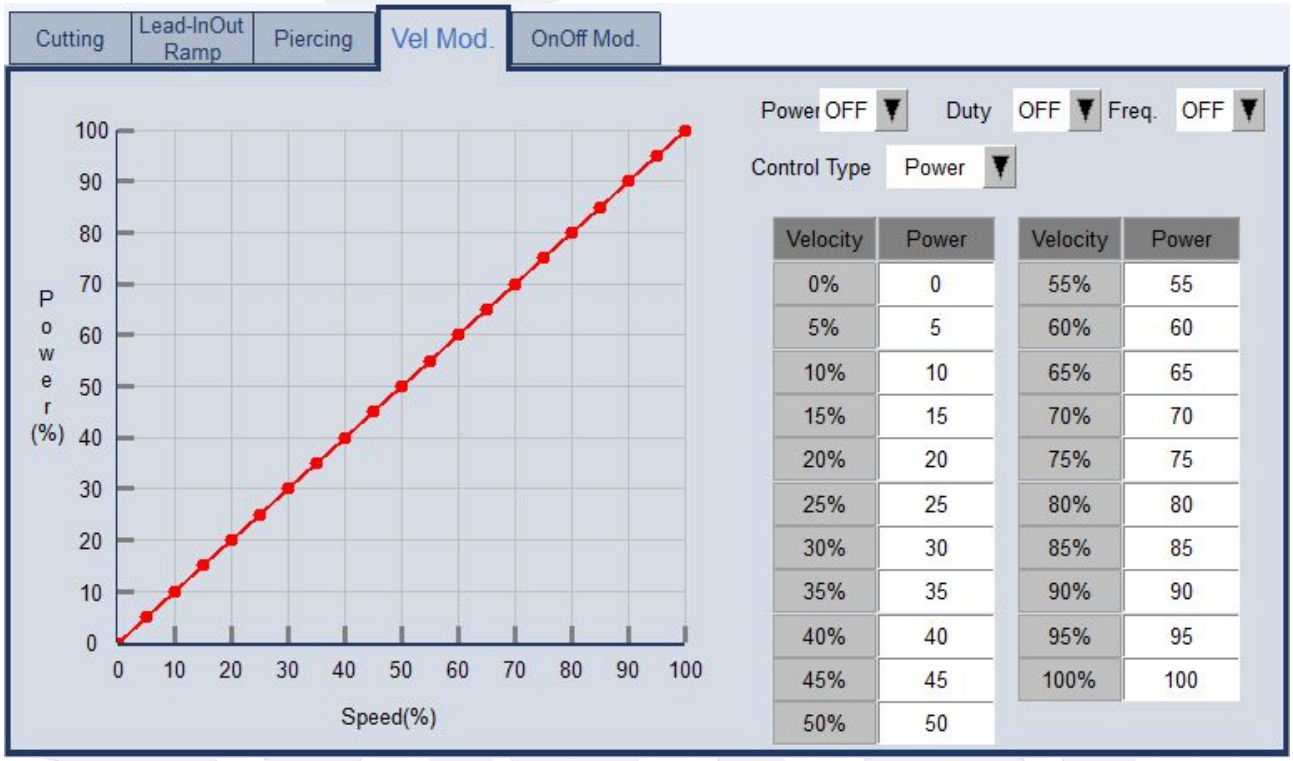


Introduction:

- **「Smooth Piercing」** : After enabling the smooth piercing function, the related piercing parameters will be displayed. Piercing mode will be set to “No Piercing” and the lead-in process will be disable.
  - **<Pierce Height>**: Set the distance between material sheet and cutting head during at the start of smooth piercing process.
  - **<Pierce Time>**: Set the dwell time of the smooth piercing.
  - **<Pierce Focus>**: Set the laser focus position during smooth piercing process.
  - **【Laser Adjustment】**: When enabled, the configured power, frequency and duty will be applied during the smooth piercing process.
    - **<Laser power>**: Set the laser power percentage during the smooth piercing process.
    - **<Laser Frequency>**: Set the laser frequency during the smooth piercing process.
    - **<Laser Duty>**: Set the duty cycle during the smooth piercing process.
- **【Piercing Mode】**: Select the appropriate piercing mode for processing.
  - No Piercing: Start cutting directly.
  - First Stage: Perform the first-stage piercing before cutting.
  - Sec Stage: Perform the second-stage piercing before first-stage piercing and cutting.
  - Third Stage: Perform the third-stage piercing, then second-stage piercing, then first-stage piercing before cutting.
  - Fourth Stage:Perform the fourth-stage piercing, then third stage piercing, then second-stage piercing, then first-stage piercing before cutting.
  - Fifth Stage:Perform the fifth-stage piercing, then fourth-stage piercing, then third stage piercing, then second-stage piercing, then first-stage piercing before cutting.
- **【Piercing Type】**: Choose piercing type with the following options.
  - Segment Pierce: Fire the laser at the upper-level piercing height, stop the laser, move down to the lower-level piercing or cutting height, and resume firing.
  - Stepping Pierce: The laser remains active while descending from the upper to the lower piercing height.”
  - Flash Pierce: Modulate the laser frequency and duty cycle during the set piercing time.

- **<Gradual Speed>**: Set the speed of displacement between different piercing stages in Stepping Pierce.
- **<Height>**: Set the distance between material sheet and cutting head during piercing.
- **<Focus>**: Set the laser focus position during piercing process. This function is only applicable to the cutting head with automatic focus adjustment.
- **<Focus End>**: Specifies the final focus position used during Flash Pierce.
- **【Gas Type】**: Select the type of gas for blowing during processing. Options include nitrogen, oxygen, and air.
- **<Pressure>**: Set the pressure for blowing during piercing.
- **<Laser power>**: Set the laser power percentage during the piercing process.
- **<Laser Frequency>**: Set the laser frequency during piercing process.
- **<Laser Duty>**: Set the duty cycle during piercing process.
- **<LaserContTime>**: Set the dwell time to a specific piercing height before laser output.
- **<GasContTime>**: Set the delay time for turning off the gas after piercing ends. This setting is to facilitate the cooling of the workpiece.

4.3.4 **4.3.4 Velocity Modulation**

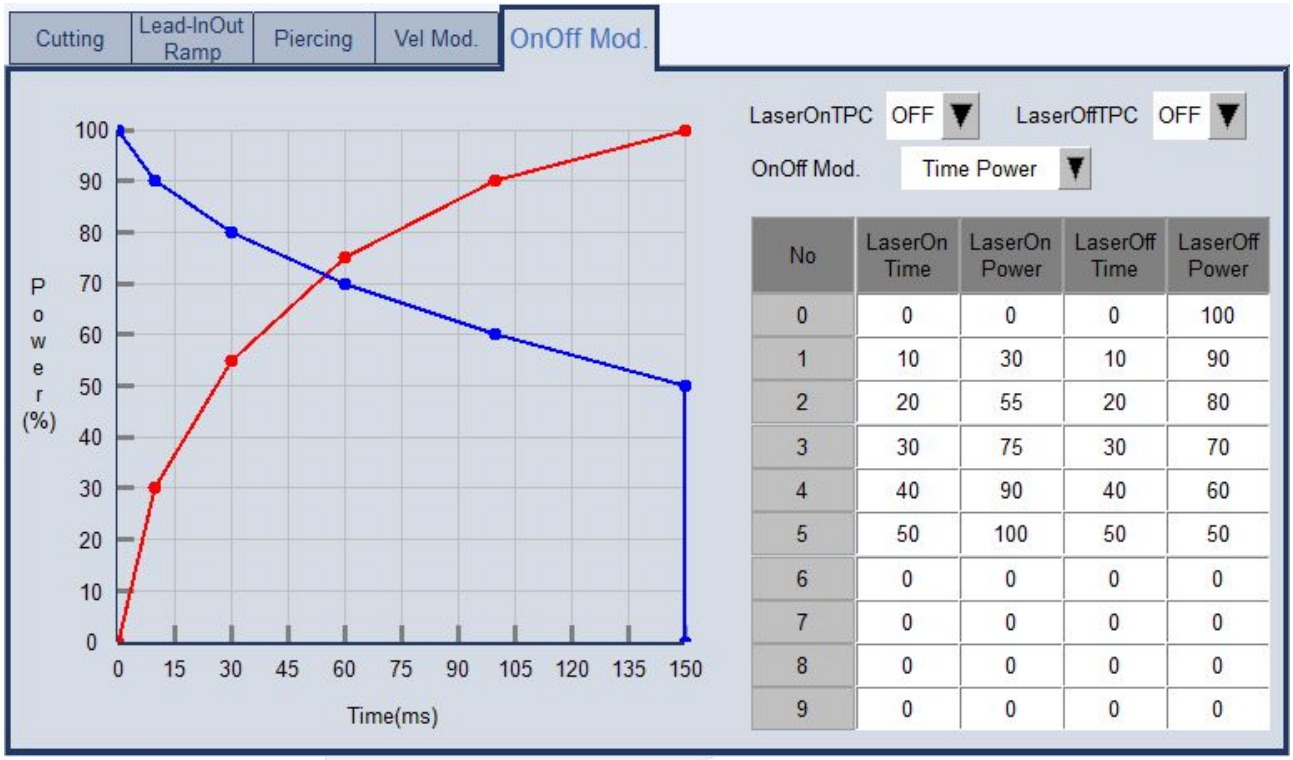


Introduction:

- **【Control Type】**（Clicking it to switch to different speed segments）:
  - Power: Modulating laser power based on processing speed.
  - Duty Cycle: Modulating laser duty cycle based on processing speed.
  - Frequency: Modulating laser frequency based on processing speed.
- **【Power / Duty / Freq.】**:
  - On: The modulation of laser power, duty cycle, or frequency can be activated based on the speed during processing.
  - Off: Do not activate speed modulation during processing.

- Chart: The X-axis represents the processing speed, while the Y-axis represents the chosen modulation type (power, duty cycle, or frequency).
- **<Table>** : The laser power, duty cycle, or frequency can be adjusted at various speed segments, totaling 21 segments in total. By clicking on the left side of the table, users can access various speed segments.

4.3.5 **4.3.5 OnOff Modulation**



No	LaserOn Time	LaserOn Power	LaserOff Time	LaserOff Power
0	0	0	0	100
1	10	30	10	90
2	20	55	20	80
3	30	75	30	70
4	40	90	40	60
5	50	100	50	50
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0

This function is also known as the Laser Modulation function, it primarily works by modulating laser power to avoid a drastic change in laser energy at the start and end points of processing, which can result in poor cutting quality.

Introduction:

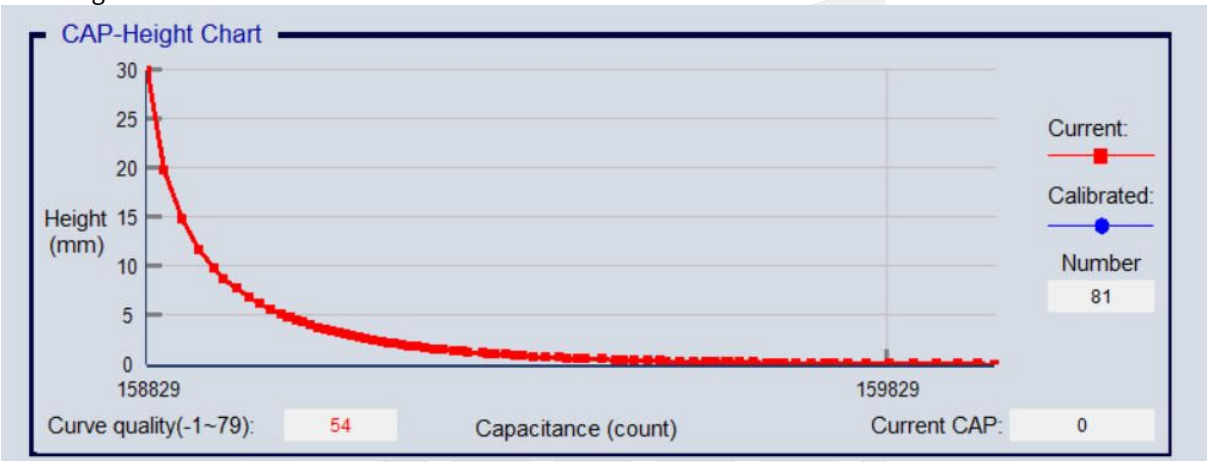
- **【OnOff Mod.】**:
  - TimePower: Laser power exhibits temporal variations at the start and end points of the processing.
  - Dist. Power: Laser power exhibits variations in accordance with the displacement distance at both the start and end points of the processing.
- **【LaserOnTPC】**:
  - On: Laser power modulation occurs at the processing start point based on the laser on modulation settings.
  - Off: There is no laser on modulation at the processing start point.
- **【LaserOffTPC】:**
  - On: Laser power modulation occurs at the processing end point based on the laser off modulation settings.
  - Off: There is no laser off modulation at the processing end point.
- Chart: The X-axis represents either time or distance based on the selected modulation type, and the Y-axis represents laser speed. The red line represents laser on modulation, and the blue line represents laser off modulation.

- **<Table>**: Set the changes in laser power at different speeds/times between processing start and end points. Each time/distance segment in the settings is the difference from the previous segment.

4.4 4.4 Gap Control Panel

Path: Main Screen → F4 Gap Control

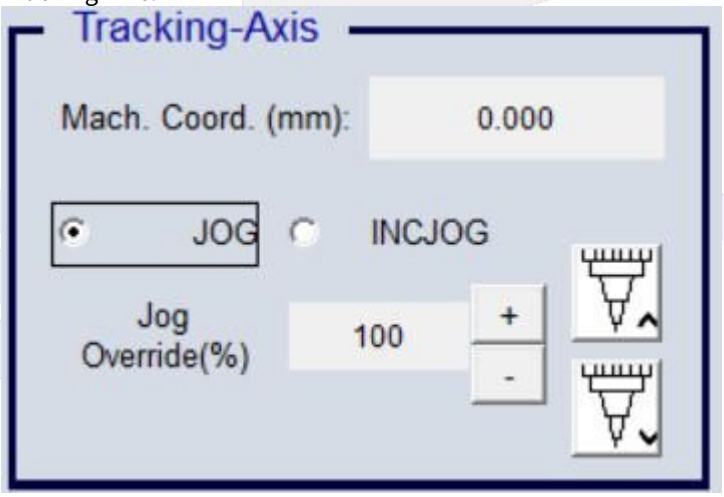
1. CAP-Height Chart:

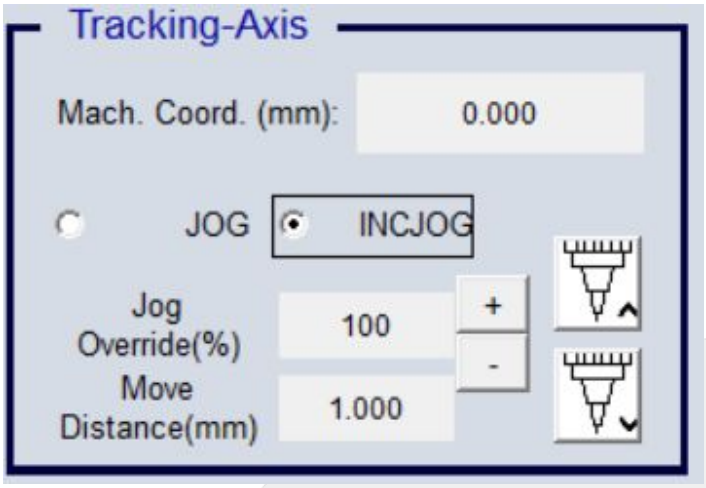


Introduction:

- The current calibration curve and the post-calibration curve are presented in the display. The X-axis denotes the value of capacitance, while the Y-axis represents the height relative to the material.
- The capacitance curve depicted in red represents the current state, whereas the blue curve represents the post-calibration state.
- The number shows the number of calibration points in this table.
- The curve quality index, which is an indicator of the stability of results, generally ranges from approximately 40 to 70 following calibration, with higher values denoting better outcomes.

2. Tracking-Axis:





Introduction:

- Before initiating the calibration process, it is possible to utilize this function in order to relocate the cutting head to a proximity ranging from 1 to 5 millimeters from the sheet metal.
- Mach. Coord.: Display the coordinate of the Tracking-axis in mechanical coordinates.
- JOG/INCJOG:
  - **<Jog Override>**: Set the move rate for continuous/incremental jogging. Press "+" or "-" to adjust by 10%(or 1% if Pr3207 = 1). The actual jogging speed is equal to the speed set by the axial performance parameter (INCJOG : X-Axis jog speed) multiplied by this magnification
  - **<Move Distance>**: Set the moving distance for incremental jogging.
- Press the" button to control the cutting head moving up. Press button to control the cutting head moving down.
  - JOG: Pressing or button to move the cutting head along the Tracking-axis according to the setting speed (Jogging speed multiplied by Jog Override percentage).
  - INCJOG: Pressing or button to move the cutting head along the Tracking-axis according to the setting distance. The actual jogging speed is equal to the speed set by the axial performance parameter multiplied by this magnification

3. Calibration:

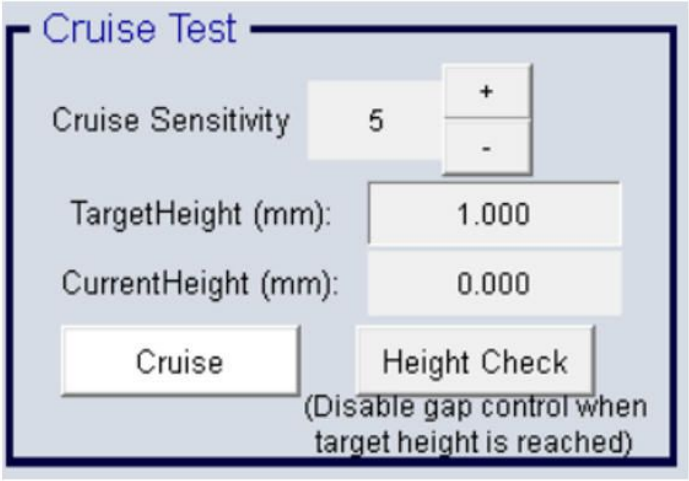
Introduction:

- **"Normal Calibration"**: Press this button to initiate the standard calibration process, and then follow the on-screen instructions to complete Normal Calibration.

- "**Fast Calibration**": Press this button to initiate the Fast Calibration process, and then follow the on-screen instructions to complete Fast Calibration.
- **"Multi-Calibration"**: Multi-Calibration is not available in the sheet cutting function. To use other machine functions, please contact Syntec Technology.
- **"Update Calibration Data"**: After Normal or Fast Calibration, users can press this button to update the calibration data anytime.
- **"Stop Calibration"**: During the calibration process, users can click this button to terminate the process immediately.

Calibration Process Introduction	
Normal Calibration Usage	Fast Calibration Usage
Normal Calibration: It is applicable when working with materials that have not undergone any calibration process.	Fast Calibration: It is applicable when the material being cut is same as the previously calibrated material or when there is a suspicion of a problem with the cutting head height during processing.
Steps: 1. Manually adjust the position of the cutting head to be approximately 1 to 5 millimeters away from the surface of the material. 2. Press **"Normal Calibration"** and follow the on-screen instructions, and keep the machine still during the process. 3. The cutting head will initiate a gradual approach towards the material, establishing contact, and subsequently retract while recording the corresponding capacitance values at different heights. 4. Update the calibration data in order to complete the Normal Calibration process.	Steps: 1. Prior to proceeding, it is imperative to confirm that a Normal Calibration has been conducted and that the material has been appropriately positioned on the cutting table. 2. Press "**Fast Calibration**" and follow the on-screen instructions. 3. The cutting head will initially be positioned approximately 1 millimeter away from the surface of the material. The experimental procedure involves a gradual approach of the sensor towards the material, establishing contact, and subsequently withdrawing while recording the corresponding capacitance values at different heights. 4. Update the calibration data in order to complete the Fast Calibration process.

4. Cruise Test:



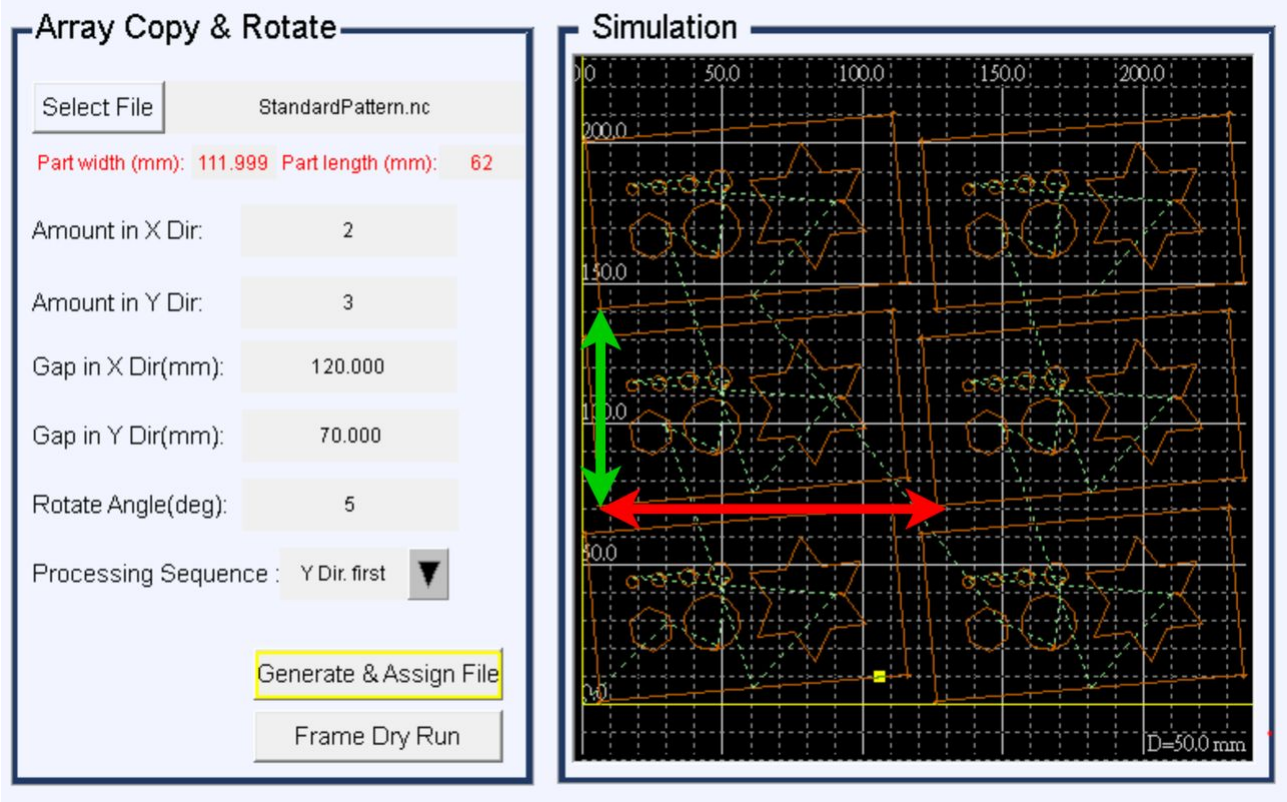
Introduction:

- **<Cruise Sensitivity>**: Enter a number or use the "+" and "-" buttons to adjust sensitivity, with sensitivity values ranging from 1 to 10. Each "+" or "-" button press adjusts the sensitivity by 1. Higher sensitivity values allow the follower to reach the target height faster but may result in reduced stability.
- **<TargetHeight>**: Set the desired height for target tracking.
- CurrentHeight: Display the present distance between the cutting head and the workpiece.
- **"Cruise"**: Pressing this button activates cruise test, using this function to make the current tracking height equal to the target height.
- **"Height Check"**: Pressing this button initiates Height Check process. The purpose of this process is to validate the accuracy of Cruise. Height Check process first makes the current tracking height equal to the target height and then suspends the touch workpiece protection. The touch workpiece protection will remain suspended until the user moves the axis or resets the system.

4.5 4.5 Array Copy and Rotate Page

Path: Main Screen → F6 Array

Introduction: When multiple workpieces with the same shape need to be cut, Array Copy and Rotate can be used to generate the required NcFiles.



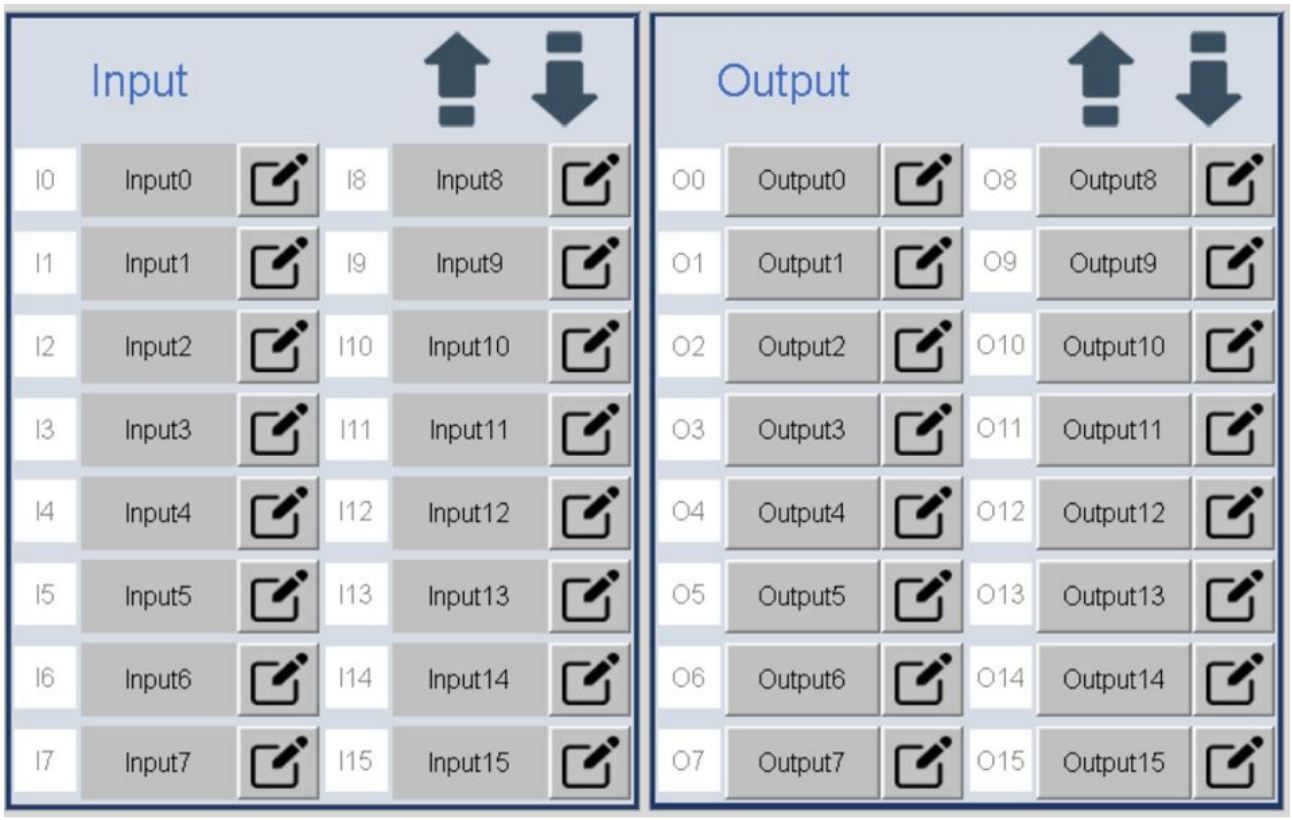
Introduction:

- Part width: Display the width of the selected NcFile in the X direction.
- Part length: Display the length of the selected NcFile in the Y direction.
- **<Amount in X Dir.>**: Set the number of copies to be made in the X direction.
- **<Amount in Y Dir.>**: Set the number of copies to be made in the Y direction.
- **<Gap in X Dir>** : Set the distance between each new workpiece's X-direction origin and the original workpiece's origin, as indicated by the horizontal **red** arrow in the figure.
- **<Gap in Y Dir>** : Set the distance between each new workpiece's Y-direction origin and the original workpiece's origin, as indicated by the vertical **green** arrow in the figure.
- **<Rotate Angle>**: Set the rotation angle of the workpiece.
- **【Processing Sequence】** : Choose X-direction first or Y-direction first.
- "**Generate & Assign File**": After setting the array parameters mentioned above, pressing this button will generate the NcFile using those parameters and load the file.
- **"Frame Dry Run"**: Press to move along the rectangular path of the main program file, assisting in determining the dimensions and position of the workpiece.

4.6 4.6 Status Monitor Panel

4.6.1 4.6.1 I/O Monitor

Path: Main Screen → F7 Status Monitor → F1 I/O Monitor



Introduction:

- I/O monitoring range: 0~511. This provides a total of 512 I/O points that can be monitored.
- Press and to change the page.
- Press to edit the name of the I/O point.
- Pressing O point（e.g. **"Output0"**） can switch its status. If the O point is currently off, pressing it will turn it on, and if it's on, pressing it will turn it off.

4.6.2 4.6.2 Laser Monitor

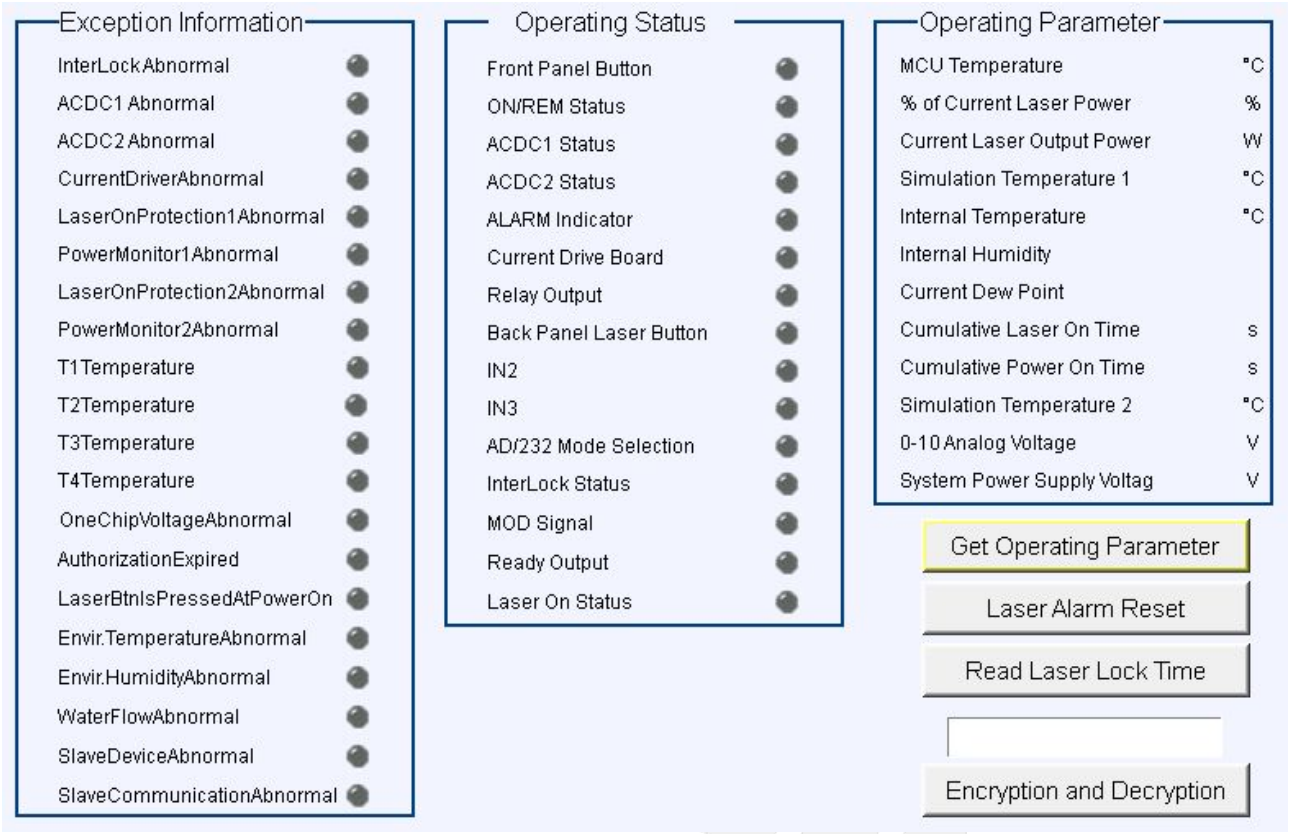
Path: Main Screen → F7 Status Monitor → F2 Laser Monitor

Introduction :

This page will have different screens according to Pr3403(R83) laser source.

(※Note : Laser Monitor only supports 0 : Raycus, 1: Max Photonics, 11: Max G4.8/G5.8, 5: IPG YLM, 51:IPG YLR)

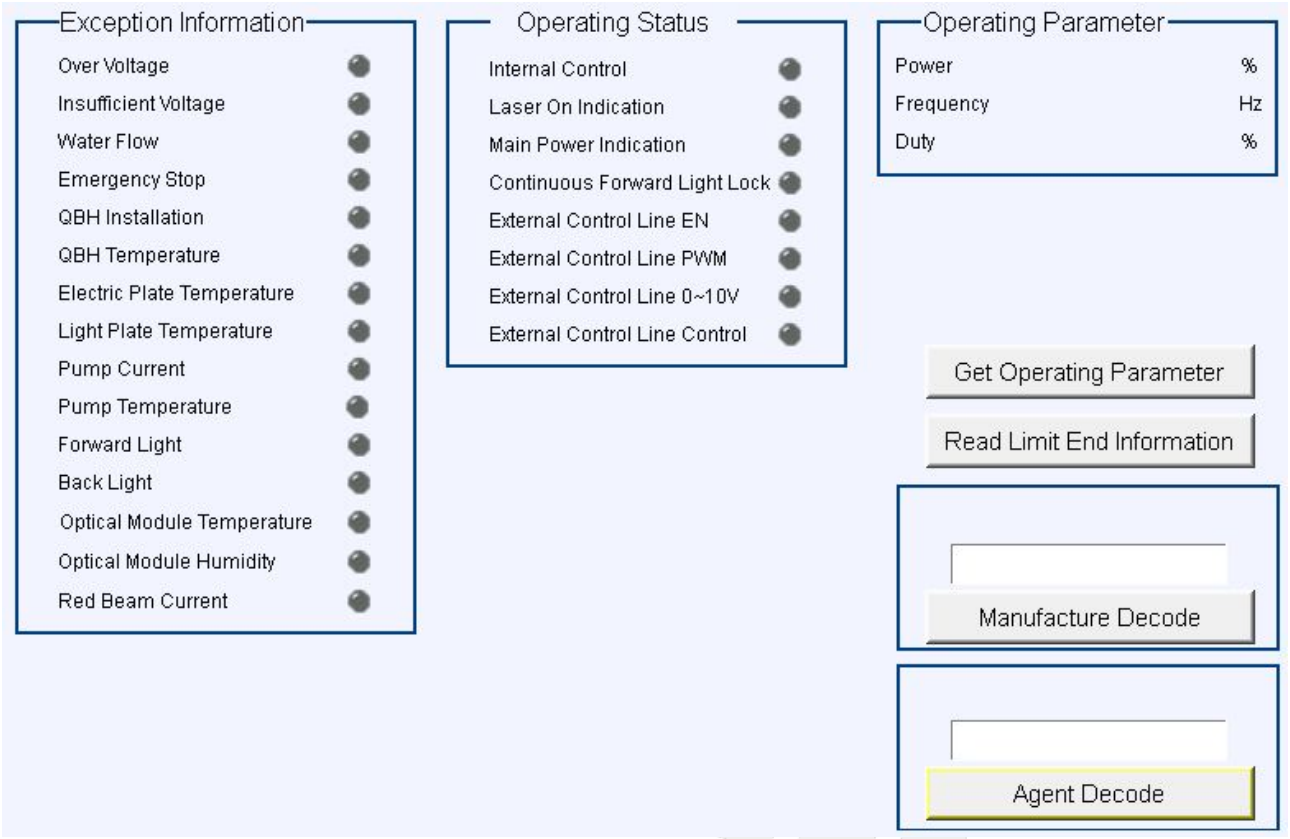
Raycus



Introduction :

1. Exception Information: Red light on the right indicates a laser error.
2. Operating Status: Green light on the right indicates the function is being executed.
3. Press **"Get Operating Parameter"** to update and retrieve laser operation parameters.
4. Press **"Laser Alarm Reset"** to reset laser alarms.
5. **"Read Laser Lock Time"** can read the current laser time and the number of decryption attempts.
6. Enter the password in the **<Encryption and Decryption>** input box, then press "Laser Source Encryption/ Decryption" to perform encryption or decryption on the laser.
7. The bottom of the screen displays the current lockout time, number of failed decryption attempts, and communication status.

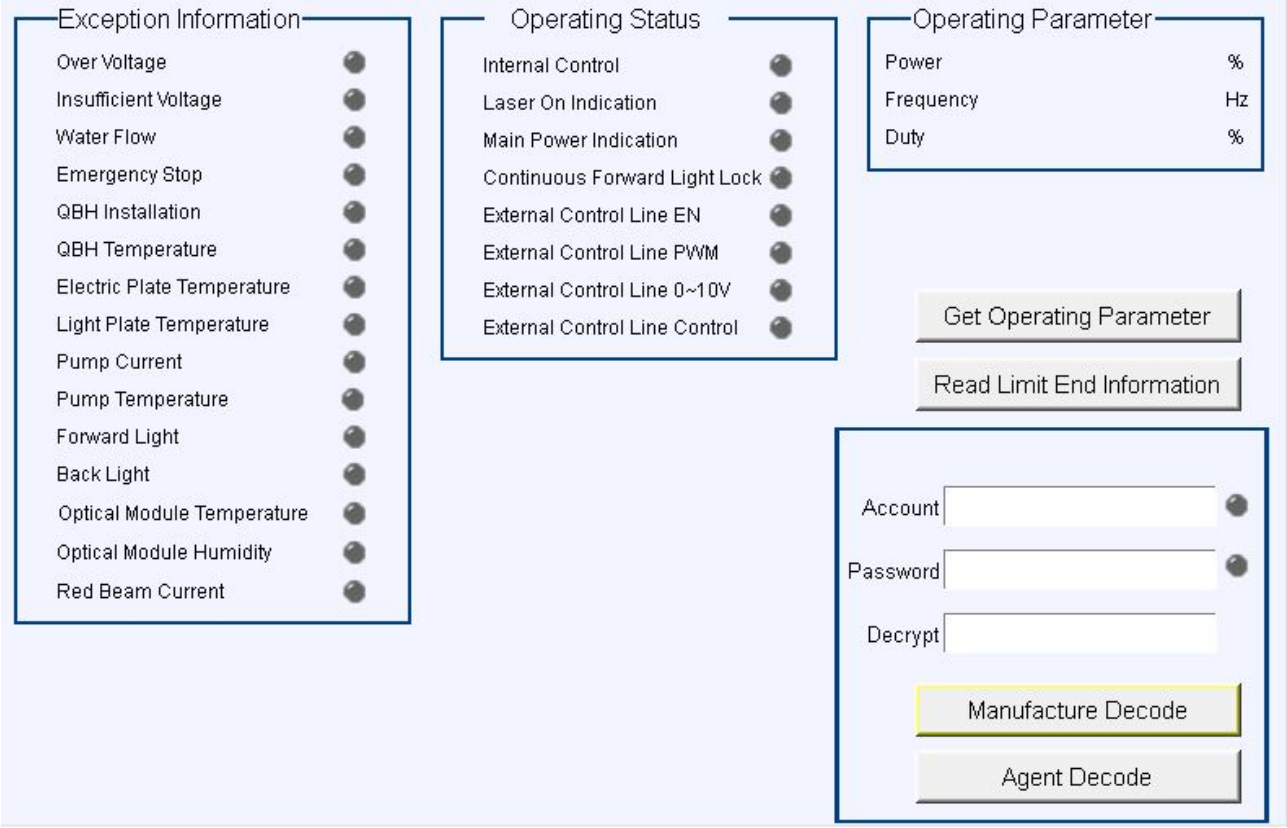
Max Photonics



Introduction :

1. Press **"Get Operating Parameter"** to update the operating parameters, mainly power, frequency, and duty cycle.
2. Press **"Read Limit End Information"** to read the laser expiration information and display it at the bottom of the screen.
3. Press **"Manufacture Decode"** to read the password from the **<Manufacture Decode>** input box and perform manufacturer decryption on the laser.
4. Press **"Agent Decode"** to read the password from the **<Agent Decode>** input box and perform distributor decryption on the laser.
5. In the laser exception information section, the red light on the right indicates a laser error.
6. In the laser operating status section, the green light on the right indicates the function is being executed.
7. The bottom of the screen displays the current decryption expiration status and communication status.

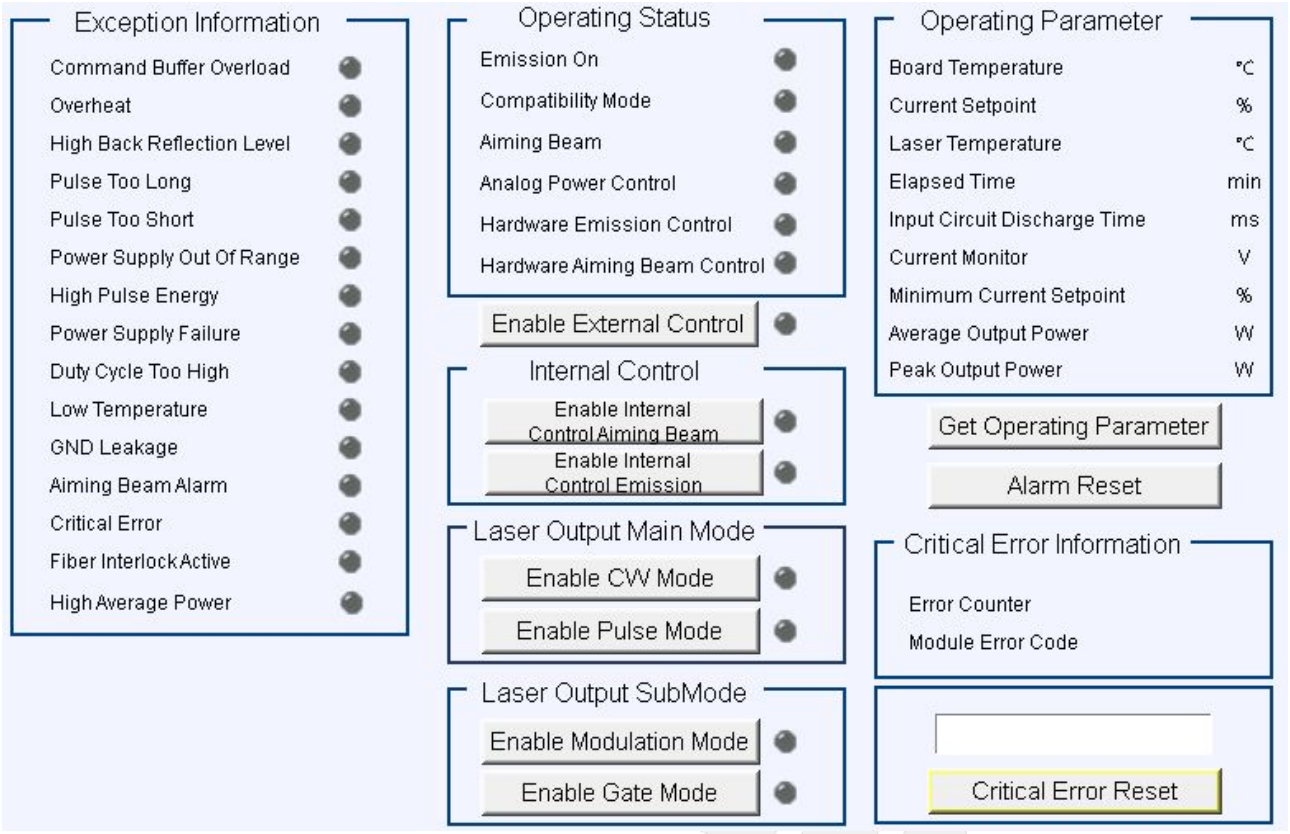
Max-G4.8/G5.8



Introduction :

1. Press **"Get Operating Parameter"** to update the operating parameters, mainly power, frequency, and duty cycle.
2. Press **"Read Limit End Information"** to read the laser expiration information and display it at the bottom of the screen.
3. Press **"Manufacture Decode"** to read the account, password, and decryption code from the **<Manufacture Decode>** input box and perform manufacturer decryption on the laser. These three can be entered separately.
4. If the manufacturer account and password verification are successful, a green light will illuminate on the right ; if there is an error, a red light will illuminate.
5. The laser registration status is displayed to the left of the manufacturer decryption button.
6. In the laser exception information section, the red light on the right indicates a laser error.
7. In the laser operating status section, the green light on the right indicates the function is being executed.
8. The bottom of the screen displays the current decryption expiration status and communication status.

IPG YLM



Introduction :

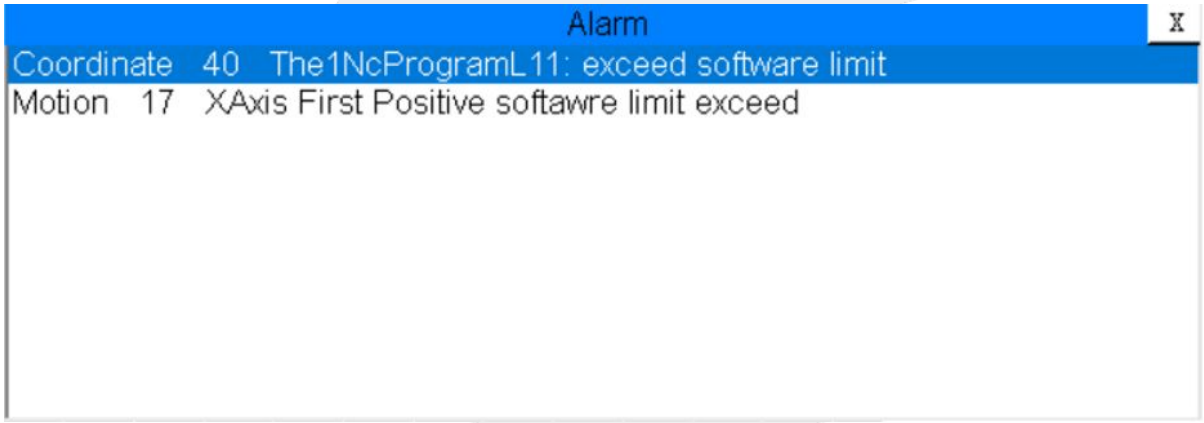
1. Press **"Get Operating parameter"** to update the operating parameters.
2. Press **"Alarm Reset"** to reset the laser errors.
3. Enter the password in the **<Critical Error Reset>** input box, then press **"Critiical Error Reset"** to reset severe laser errors.
4. Press **"Enable External Control"** to turn on external control mode, then press **"Enable External Control"** again to turn it off.
5. Press **"Enable Internal Control Aiming Beam"** to switch red light control to internal control and emit red light; press **"Enable Internal Control Aiming Beam"** again to turn off the red light.
6. Press **"Enable Internal Control Emission"** to switch laser enable control to internal control and enable the laser; press **"Enable Internal Control Emission"** again to disable it.
7. Press **"Enable CW Mode"** or **"Enable Pulse Mode"** to switch the main laser mode.
8. Press **"Enable Modulation Mode"** or **"Enable Gate Mode"** to switch the sub-mode of the laser.
9. In the laser exception information section, the red light on the right indicates a laser error.
10. In the laser operating status section, the green light on the right indicates the function is being executed.
11. The bottom left of the screen displays the current laser mode switching prompt and communication status.
    - Notes:
        i. When a severe error occurs, send the severe error counter, module error code, and laser serial number (SN) to IPG to obtain the critical error reset password, then perform the critical error reset.
        ii. Only QCW products support main mode switching.

4.7 4.7 Alarm Troubleshooting and Alarm Page

4.7.1 4.7.1 Alarm Troubleshooting

Introduction:

- When an alarm occurs, the red alarm  in the upper right corner will flash, and an alarm popup message with the alarm details will appear on the screen, as shown in the image. During this time, you cannot perform machining or load machining files.
- Pressing the **"Esc"** key on the keyboard can close the popup message, but it won't clear the alarm, and the red alarm will continue flashing.
- To troubleshoot the alarm, you need to address all the issues indicated by the alarm details. Once all the alarm conditions have been troubleshooting, the red alarm will stop flashing, and you can continue machining operations.



4.7.2 4.7.2 Alarm Page

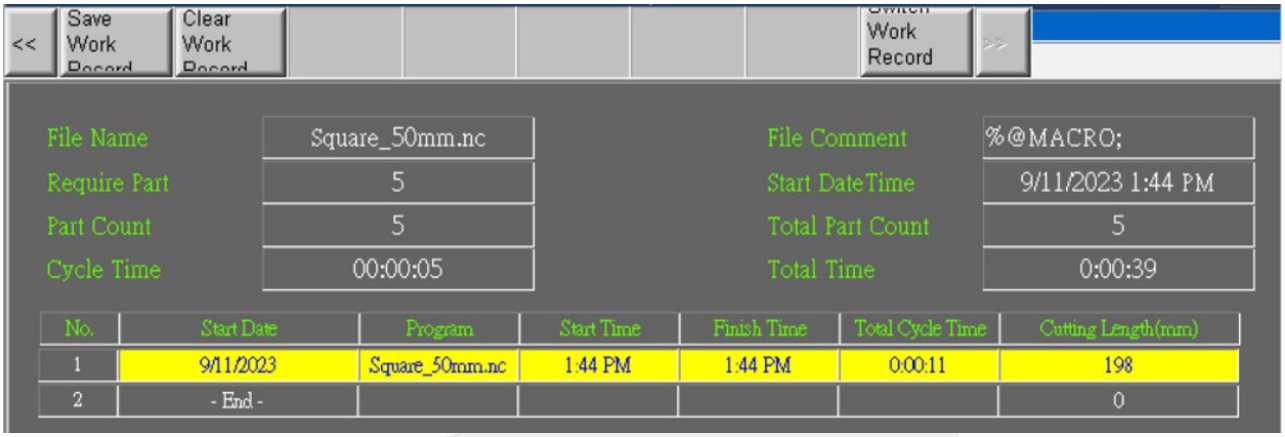
Path: Main Screen → Upper right corner button 

Fenubar Introduction:

- F1 "**Pending Alarm**": Press to display pending alarms.
- F2 "**History Alarm**": Press to display all historical alarms.
- F3 "**Save Alarm**": Press to save the selected alarms to an external folder (can only be done on the Pending Alarm or History Alarm page).
- F4 "**Analyze all**": Press to analyze all historical alarms.
- F5 **"Analyze CNC"**: Press to anlyze cnc alarms.

4.8 4.8 Work Record Page

Path: Main Screen → F10 >> → F1 Axis Module → F3 Monitor → F5 Work Record



Work Record Contents: processing start date, processing program name, processing start time, processing finish time, total cycle time, total cutting length

Generation of Work Record:

- When require count is met: Generate a Work Record when the amount of Finish Count reaches the amount of Require Count.
- When changing main program file: Generate a processing log record when loading a new main program file.

Fenubar Introduction:

- F1 **"Save Work Record"**: Save Work Record to an external folder (e.g., USB flash drive).
- F2 **"Clear Work Record"**: Clear Work Record.

5 5. Advance Function Introduction

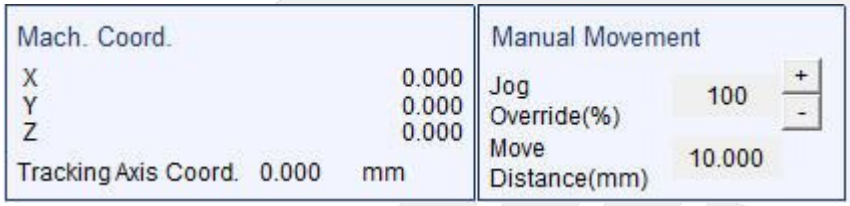
5.1 5.1 Machine Maker

(*Notice: Operators should not make arbitrary changes to this Process Data. Incorrect settings can lead to collisions or render the machine inoperable.**)**

5.1.1 5.1.1 Parameter Setting

Path: Main Screen → F8 Machine Maker →F1 Params

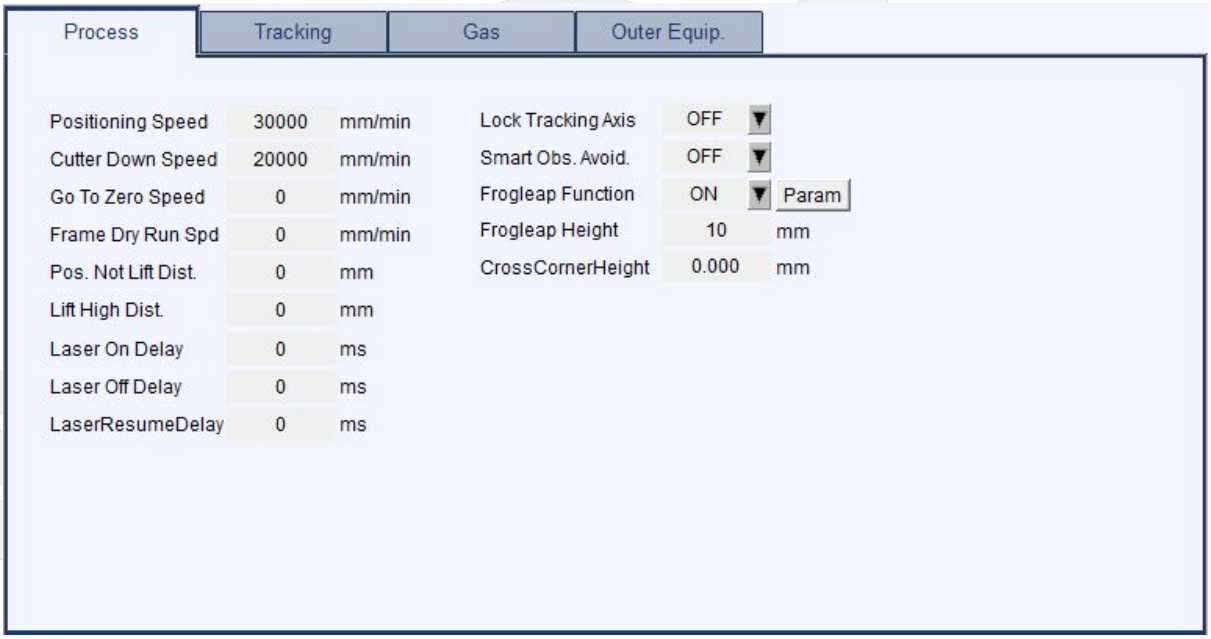
1. Coordinate Information



Introduction:

- **<Jog Override>**: Set the move rate for continuous jogging. Press "+" or "-" to adjust by 10%(or 1% if Pr3207 = 1). The actual jogging speed is equal to the speed set by the axial performance parameter (INCJOG : X-Axis jog speed) multiplied by this magnification
- **<Move distance>**: Set the move distance for incremental jogging.

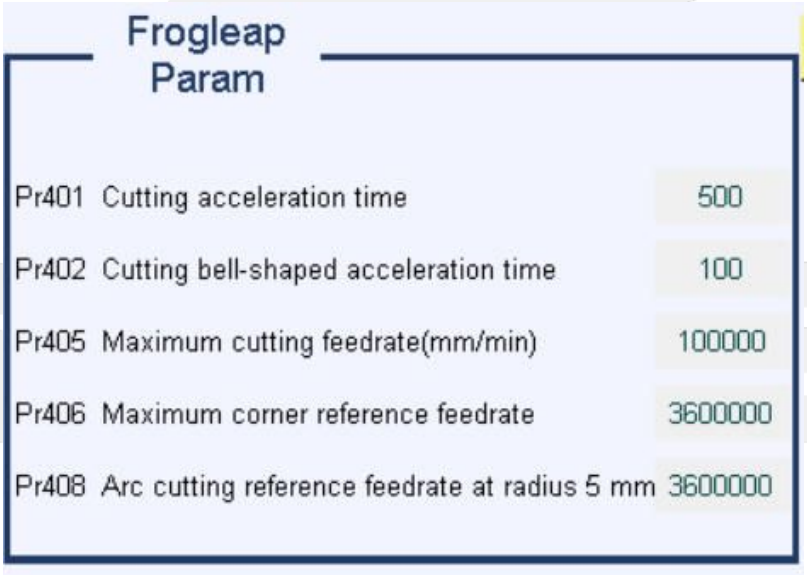
2. Process



Introduction:

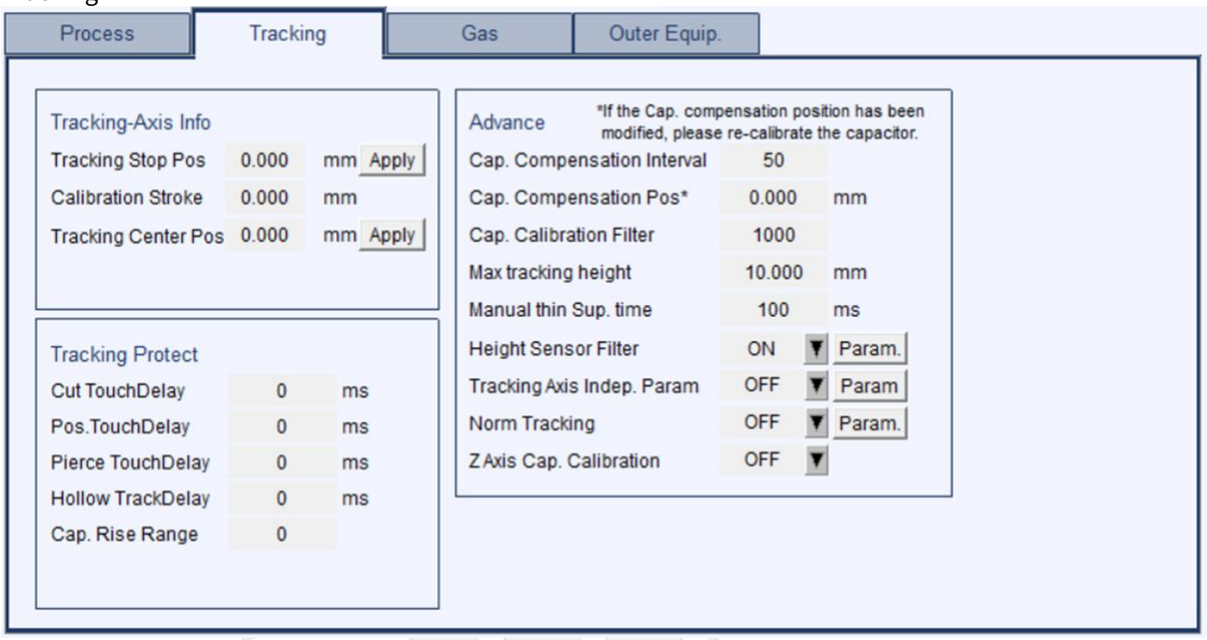
- **<Positioning Speed>**: Set the positioning speed.
- **<Cutter Down Speed>**: Set the speed for lowering and raising the cutter.
- **<Go To Zero Speed>**: Set the speed for returning to the origin.
- **<Frame Dry Run Spd>**: Set the speed for Frame Dry Run.

- 【**Frogleap Function**】:
  - ON: Enable the frogleap function, and the **<Frogleap Height>** will be shown below.
  - OFF: Disable the frogleap function, and the **<Frogleap Height>** will be hidden.
- 【**Smart Obstacle Avoidance**】:
  - ON: If the following axis lifts during Positioning, or if a frog-lift is used, the obstacle avoidance function will be activated.
  - OFF: Obstacle avoidance function disabled.
- **<Frogleap Height>:** Set the initial height for the frogleap. If the initial frogleap height is less than the minimum allowed frogleap height (the highest point of the circumscribed circle of the pipe's outer box), it will default to the minimum allowed frogleap height.
- **<CrossCornerHeight>:** Set the height to lift when crossing a corner. This height determines the maximum height of movement when crossing a corner, extending from the minimum frogleap height. If this setting is lower than the minimum corner lift height (minimum frogleap height + 10mm), the corner lift height will be set to the maximum corner height of the tube plus 10mm to ensure no collision during movement. This parameter is only enabled on tube cutting machines.
- 【**Lock Tracking Axis**】:
  - ON: When enabled, the Tracking-axis movement is disabled for all actions except jogging.
  - OFF: Disable the Tracking-axis locking function.
- **<Pos. Not Lift Dist.>**: If the distance of positioning is less than the specified distance, the Tracking-axis will not lifted during positioning process.
- **<Lift higher Dist.>**: If the positioning distance exceeds the specified distance, the Tracking-axis will first return to the mechanical origin before performing the positioning process.
- **<Laser On Delay>**: Set the compensation time for laser activation during flying cut.
- **<Laser Off Delay>**: Set the compensation time for laser deactivation during flying cut.
- **<LaserResumeDelay>**: Set the laser resume delay. When cutting is resumed after a pause, the laser will remain on for the specified time before motion continues. This parameter ensures a continuous kerf and stable cutting quality after resuming. If piercing is performed upon resuming, this delay is not required. When this parameter is set to 0, the delay will follow the LaserOnCont defined in the Process Data.
- "**Param**": Located to the right of the **<Frogleap Function>**. Press this button to display the popup screen shown below.



Introduction: The Frogleap Parameters can help ensure smoother transitions during frogleap movements around corners. For more detailed information about these parameters, please refer to the CNC Parameter Manual.

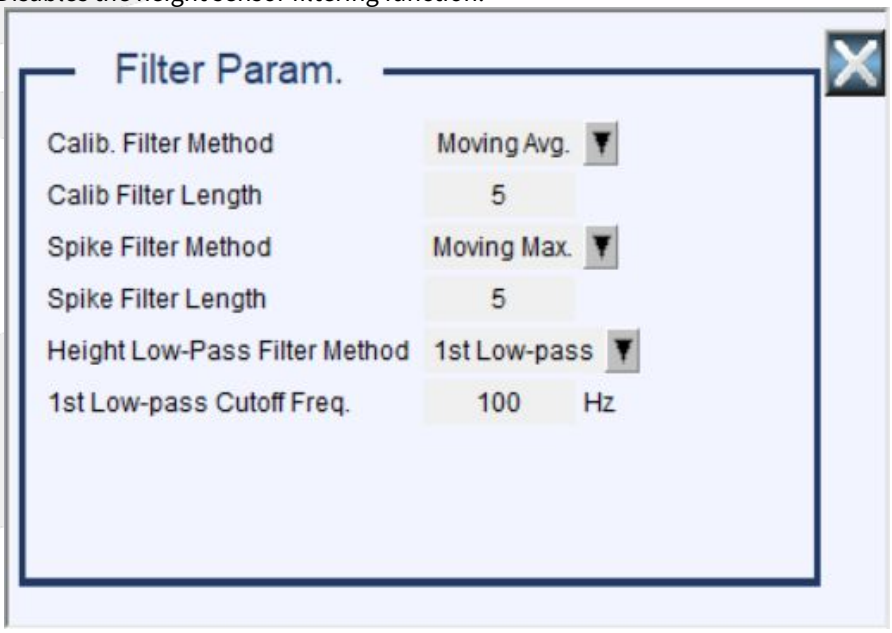
3. Tracking



Introduction:

- Tracking-Axis Info
  - **<Track Stop Pos.>:** Set the stop position of the tracking axis. Once calibration, cruising, or processing is completed, the tracking axis will return to the stop position. However, if an alarm is triggered or a stop happens during the tracking process or processing, and the position of the tracking axis exceeds the stop position, the tracking axis will stay at its current position for safety reasons.
  - **"Apply":** Pressing this button sets the current tracking axis position as the tracking stop position.
  - **<Calibration Stroke>:** Set the tracking calibration stroke. The adjustable range is from 10mm to 30mm.
- Tracking Protect
  - **<CutTouchDelay>**: If the cutter come into contact with the material for longer than the specified milliseconds during the cutting process, an alarm will be triggered, and the processing will be halt. Set to 0 to disable this feature.
  - **<Pos.TouchDelay>**: If the cutter come into contact with the material for longer than the specified milliseconds during the positioning process, an alarm will be triggered, and the processing will be halt. Set to 0 to disable this feature.
  - **<Pierce TouchDelay>**: If the cutter come into contact with the material for longer than the specified milliseconds during the piercing process, an alarm will be triggered, and the processing will be halt. Set to 0 to disable this feature.
  - **<Hollow TrackDelay>**: If the cutter come into the hollow area (exceeds the maximum calibration distance from the soft limit) for longer than the specified milliseconds during the dropping process, an alarm will be triggered, and the processing will be halt. Set to 0 to disable this feature.
  - **<Cap. Rise Range>**: If the capacitance sensor value is non-zero and there is a sudden rise of value when touching the workpiece, this parameter can check the sudden rise of value and regard it as a workpiece contact event.
  - **<LaserObsAvdSpeed>**: Set the Laser Obstacle Avoidance Speed.It will only be displayed when Pr3422 is set to M3 Driver Tracking.

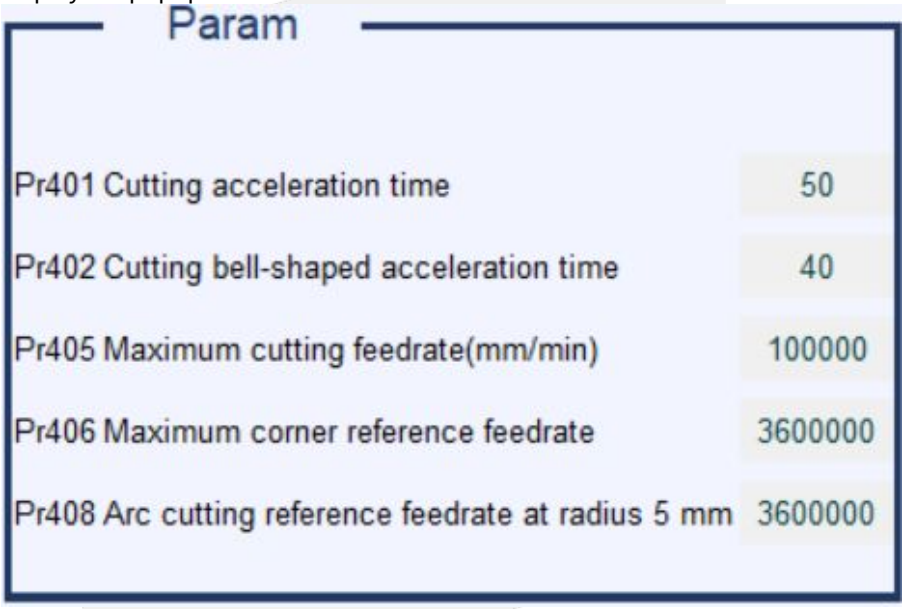
- Advance
  - **<Cap. Compensation Interval>**: For every specified number of contours that have been processed, auto-calibration will be performed.
  - **<Cap. Compensation Pos.>** : Set the position to record cutting head capacitance value; this parameter should be set away from the workpiece. Once the Cap. compensation position has been modified, please re-calibrate the capacitor.
  - **<Max traking height>**: When the follow-cutting height exceeds this height, it will switch to following down to 1mm, then incrementally lifting up to reach the specified height.
  - **<Manual Thin-Sheet Suppression time: >**: Increasing the value enhances the suppression effect, but reduces the tracking performance.
  - **【Tracking Axis Indep. Param】**:
    - ON : Allow the motion range of the tool lifting action of the follower axis to have an independent motion range, which can be set on the right side under "Motion Range."
    - OFF : Ensure that the stroke of the movable axis during the upward knife action is consistent with the original stroke of the movable axis.
  - **【Height Sensor Filter】:**
    - ON: Enables the height sensor filtering function. Parameters can be set on the right side under "Parameter Settings".
    - OFF: Disables the height sensor filtering function.



- **【Calibration Filter Method】:**
  - Moving Average: During follow control calibration, a moving average is applied to filter the height sensor signal.
  - Disable: Disables the calibration filter function.
- **<Calibration Filter Length>:** Sets the window size of the calibration filter. A larger value results in stronger smoothing.
- **【Spike Filter Method】:**
  - Moving Maximum: During tracking control, a moving maximum is applied to filter the height sensor signal.
  - Disable: Disables the spike filter function.
- **<Spike Filter Length>:** Sets the window size of the spike filter. A larger value results in stronger smoothing, but may degrade tracking performance.
  (This method is mainly used to suppress noise caused by spark interference and unstable capacitive signals.)

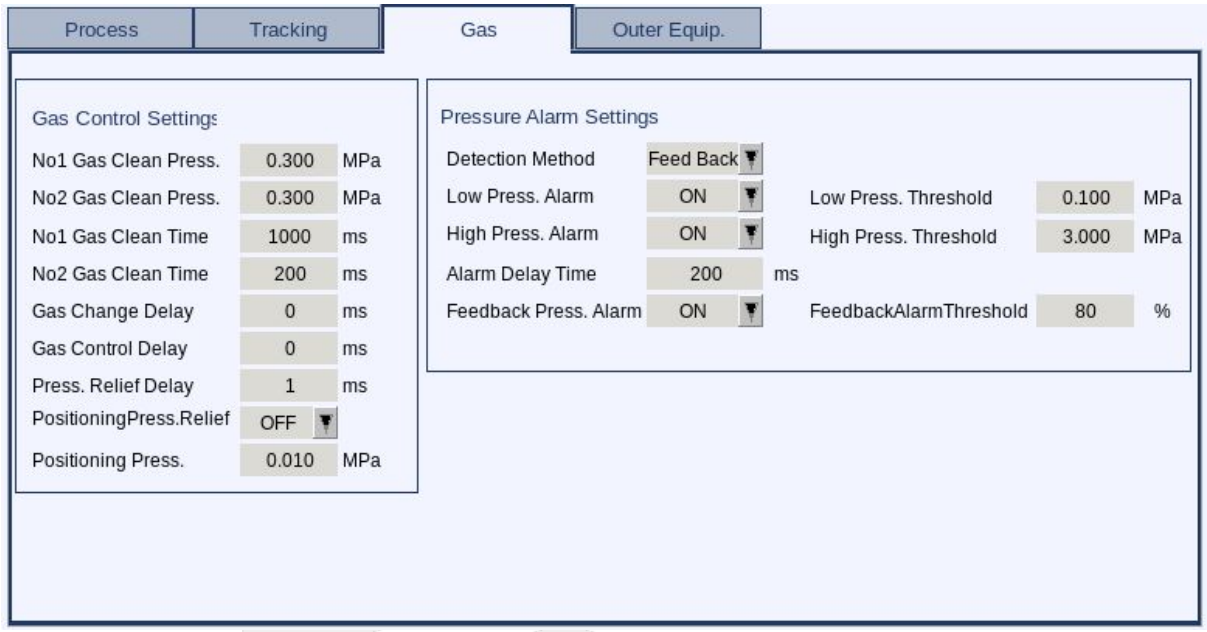
- **【Height Low-Pass Filter Method】：**
  - First-Order Low-Pass Filter: During tracking control, a first-order low-pass filter is applied to the height signal.
  - Second-Order Butterworth Filter: During tracking control, a second-order Butterworth filter is applied to the height signal.
  - Disable: Disables the height low-pass filter function.
- **<First-Order LPF Cutoff Frequency / Second-Order Butterworth Cutoff Frequency>：** Sets the cutoff frequency of the low-pass filter. A lower value results in stronger smoothing, but may degrade follow performance.
  (This method is mainly used to suppress other types of interference, such as electromagnetic noise.)

- **"Param" :** Located to the right of the **【Tracking Axis Indep. Param】**. Press this button to display the popup screen shown below.



  - Introduction: Setting the tracking axis independent param can ensure that the tracking axis does not move too violently, which could lead to overshooting or colliding with the workpiece. For more detailed information about these parameters, please refer to the CNC Parameter Manual.
- <**Cap. Calibration Filter>**: During the capacitance calibrating process, the calibration point will be recorded only when nozzle distance from the workpiece within a certain distance and the capacitance value varies not greater than this value. If the grounding of the machine is poor or the capacitance amplifier is abnormal, this value can be set to avoid abnormalities in the calibration table. If set to 0, the calibration point will be recorded immediately after nozzle detach from the workpiece
- **【Z Axis Cap Calibration】**: Set whether to enable Big Z-axis capacitance calibration. Display conditions: when the tracking axis is not Z Axis. Capacitance calibration is performed by the Z-axis, which moves downward to touch the plate, then upward to record the capacitance change. It then moves the tracking axis to the actual capacitance calibration position, and finally returns to the initial calibration position.

4. Gas Parameters

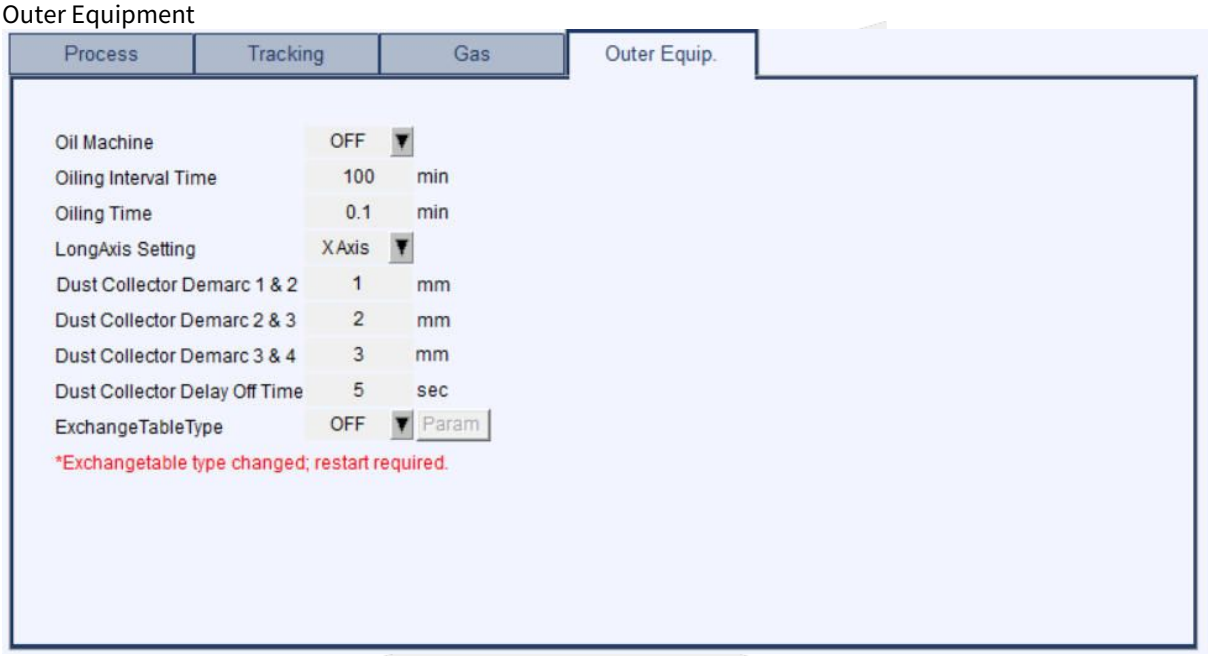


Introduction:

- **<No1 Gas Clean Press.>**: Set the pressure for cleaning the tube with the first gas.
- **<No2 Gas Clean Press.>**: Set the pressure for cleaning the tube with the second gas.
- **<No1 Gas Clean Time>**: Set the duration for cleaning the tube with the first gas.
- **<No2 Gas Clean Time>**: Set the duration for cleaning the tube with the second gas.
- **<Gas Change Delay>**: Set the delay time for switching between gas types. This ensures a proper transition when changing gases.
- **<Gas Control Delay>**: Set the delay time before gas control actions. The delay time for blowing can be adjusted to account for potential delays caused by on-site devices such as gas lines, relays, and proportional valves.
- **<Press. Relief Delay>**: Set the time for gas pressure relief.
- **【Positioning Pressure Relief】**:
  - Enable: Relief the pressure while positioning.
  - Disable: Will not relief the pressure while positioning.
- **<Positioning Press.>**: When the GasNotClose function is active and the Positioning Pressure is not zero, the Positioning Pressure will be applied during positioning.
- **【Detection Method】**:
  - **I Point:** Use I-point signal to detect air pressure.
  - **Pressure Feedback:** Use pressure feedback value to monitor pressure alarms.
- **<Positioning Press.>**:
- **【Low Pressure Alarm】**:
  - **Enable:** Enable low pressure alarm.
  - **Disable:** Do not detect low pressure. Low pressure alarm is disabled.
- **<Low Pressure Threshold>:** Displayed only when pressure feedback is enabled. An alarm will be triggered when the pressure feedback value is **greater than this threshold** and remains so longer than the pressure feedback detection time.
- **【High Pressure Alarm】**:
  - **Enable:** Enable high pressure alarm.
  - **Disable:** Do not detect high pressure. High pressure alarm is disabled.
- **<High Pressure Threshold>:** Displayed only when pressure feedback is enabled. An alarm will be triggered when the pressure feedback value is lower than this threshold and remains so longer than the pressure feedback detection time.

- 【**Alarm Delay Check**】: All pressure alarm conditions must be met for longer than this time before triggering an alarm and stopping processing.
- 【**Pressure Feedback Alarm Detection**】:
  - **Enable:** Displayed only when pressure feedback is enabled. Enable pressure feedback alarm detection.
  - **Disable:** Disable pressure feedback alarm detection.
- **<Pressure Feedback Threshold>:** If the pressure feedback value is lower than this threshold, an **insufficient pressure alarm** will be triggered.

5. Outer Equipment

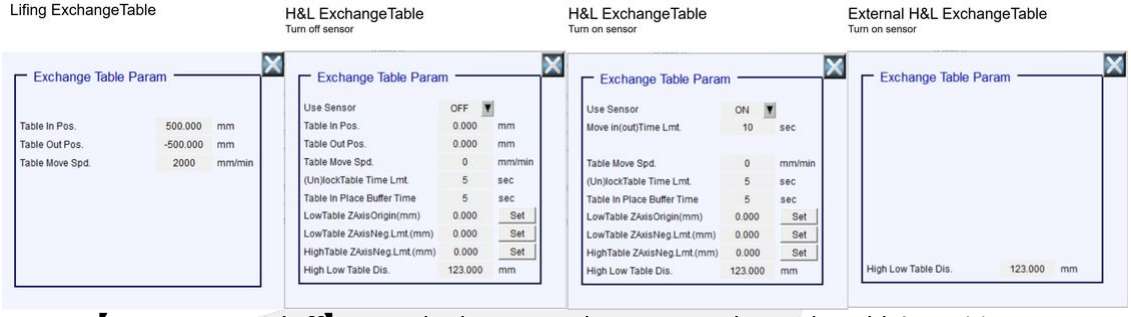


Introduction:

- 【**Oil Machine**】:
  - Enabled: The oil machine is enabled. When transitioning from the non-active state to the active state, it will immediately start to oil continuously according to the set oiling time. After the oiling is completed, it will wait for the specified oiling interval time. When the waiting interval elapses, it starts oiling again.
  - Disabled: Disable oil machine, and the process of oiling will be stopped immediately.
- **<Oiling Time>**: Set the time for oiling.
- **<Oiling Interval Time>**: Set the interval time for oiling.
- 【**LongAxis Setting**】:
  - XAxis: Set the X-axis as the longer axis.
  - YAxis: Set the Y-axis as the longer axis.
- **<Dust Collector Dermac 1 & 2>**: Set the boundary position between the first and second segments of the dust collector.
- **<Dust Collector Dermac 2 & 3>**:Set the boundary position between the second and third segments of the dust collector.
- **<Dust Collector Dermac 3 & 4>**: Set the boundary position between the third and fourth segments of the dust collector.
- **<Dust Collector Cont Time>**: Set the delay time for turning off the dust collector after stopping the processing.
- 【**ExchangeTableType**】**:** Sets the exchange table type. The available options are 0. Close Exchange Table, 1. Lift Exchange Table, and 2. High-Low Exchange Table 3. External High-Low Exchange Table. If the exchange table type is changed, a prompt will appear requiring a restart. Before switching the

exchange table type, a reminder will pop up, and you must ensure that the table is in a ready state before changing the type.

- **"Param":** Sets the parameters related to the exchange table. When the exchange table type is set to "Close," this button cannot be selected.

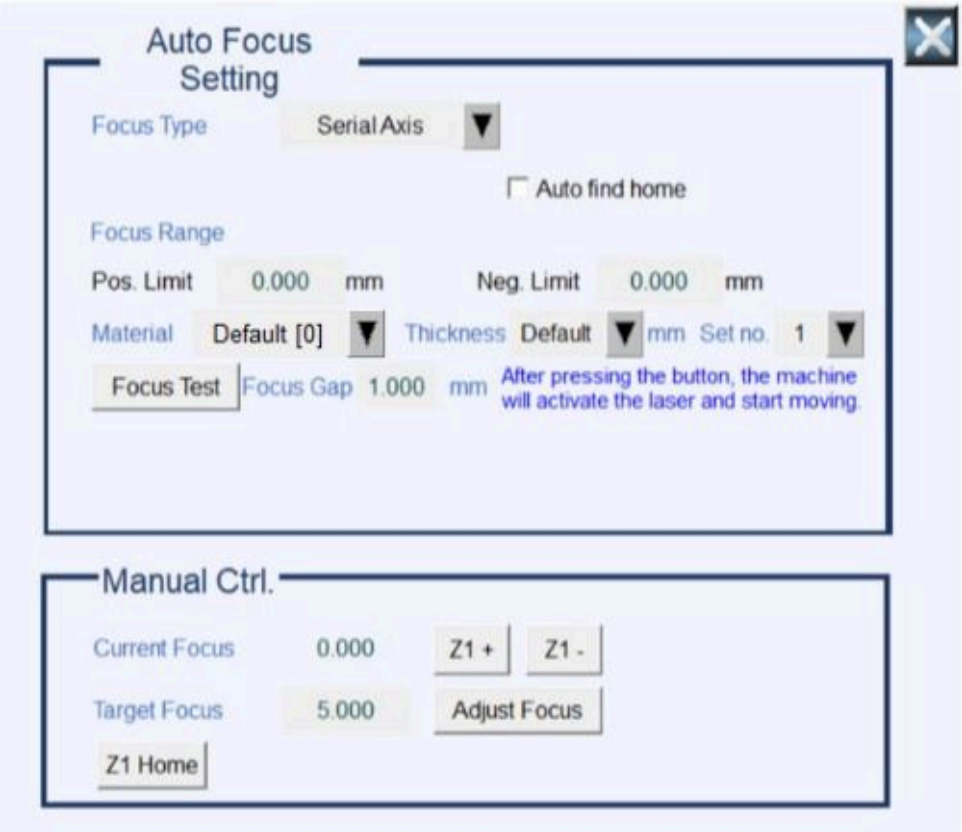


  - 【**Use Sensor On/Off**】: Set whether to use the sensor to detect the table's position.
    - **OFF**: The controller is used to move the table to a specific position.
    - **ON**: The table continues jogging until the sensor detects it is in position, at which point the stepping stops.
  - **<Table in Pos.>**: Sets the position to which the table moves internally.
  - **<Table out Pos.>**: Sets the position to which the table moves externally.
  - **<Table Move Spd.>**: Sets the speed at which the table moves.
  - **<Move in(out) Time Lmt.>**: This option allows setting a time limit for moving the table in and out when the sensor detects that the table is in position. If the table movement exceeds the specified time, an alarm will be triggered.
  - **<(Un)lockTable Time Lmt.>**: Sets the time limit for unlocking or locking the table.
  - **<Table In Place Buffer Time>**: Sets the buffer time after the ExchangeTable is in position. After this buffer time has passed, the next exchange process action will proceed.
  - **<LowTableZAxisOrigin(mm)>**: Sets the program origin coordinates of the Z-axis for the low table in the high-low exchange table.
    - **"Set"**: Press to set the Z-axis program origin coordinates for the low table in the high-low exchange table using the current machine coordinates.
  - **<LowTableZAxis Neg.Lmt.(mm)>**: Sets the negative limit of the Z-axis for the low table in the high-low exchange table.
    - **"Set"**: Press to set the Z-axis negative limit for the low table in the high-low exchange table using the current machine coordinates.
  - **<HighTableZAxis Neg.Lmt.(mm)>**: Sets the negative limit of the Z-axis for the high table in the high-low exchange table.
    - **"Set"**: Press to set the Z-axis negative limit for the high table in the high-low exchange table using the current machine coordinates.
  - **<High Low Table Dis.(mm)>**: Set the distance between the high and low exchange table.

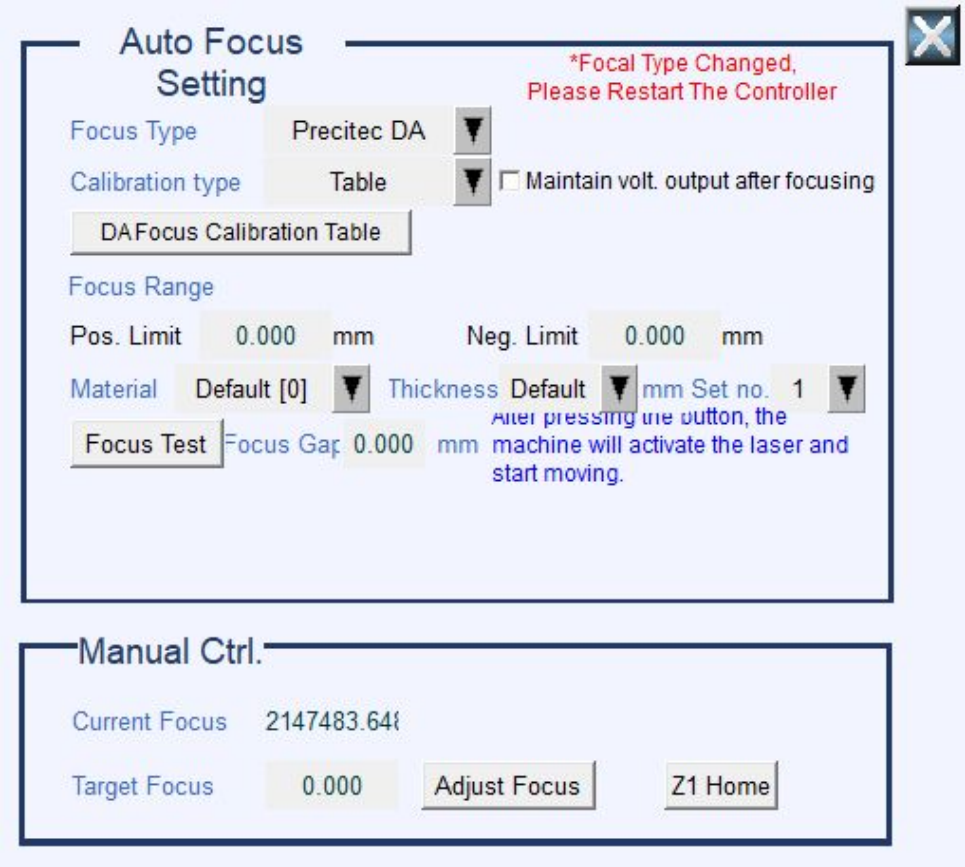
6. Auto Focus Setting
   - In the Machine Maker Parameter Setting page, press **"Auto Focusing Setting"** located in the upper right corner of the screen to access the Auto Focus Setting popup screen.
     - 【**Focus Type**】: Select the type of focusing for the cutting head.
       - Close

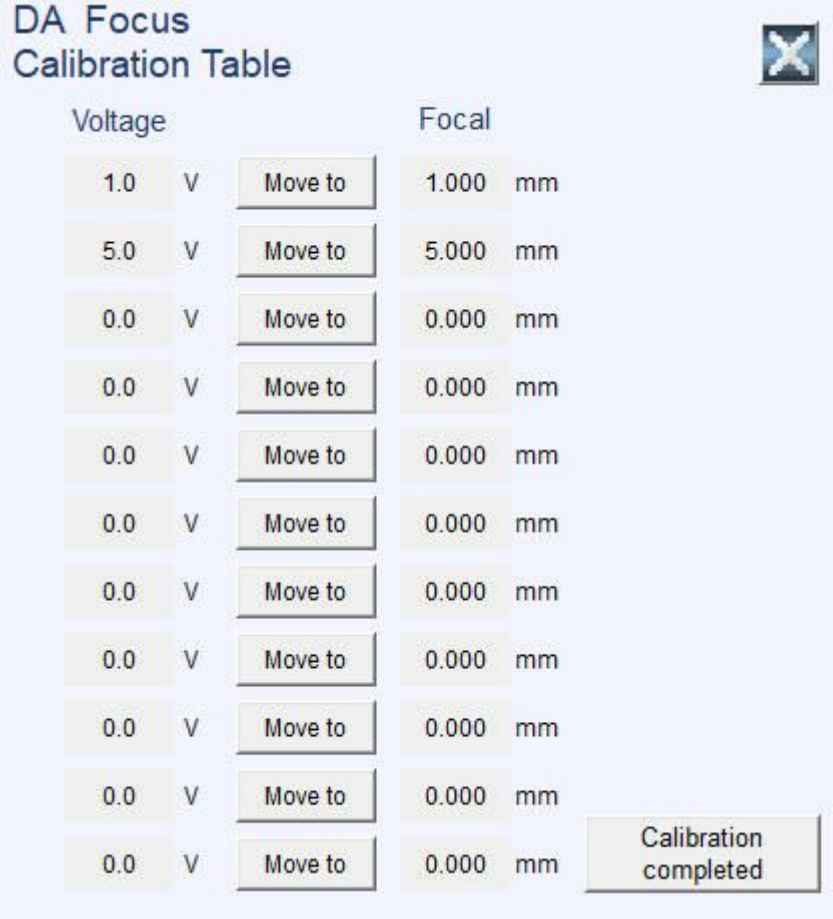

Auto Focus Setting
Focus Type
Close
Manual Ctrl.

- Serial Axis


Auto Focus Setting
Focus Type
Serial Axis
Auto find home
Focus Range
Pos. Limit
0.000
mm
Neg. Limit
0.000
mm
Material
Default [0]
Thickness
Default
mm
Set no.
1
Focus Test
Focus Gap
1.000
mm
After pressing the button, the machine will activate the laser and start moving.
Manual Ctrl.
Current Focus
0.000
Z1 +
Z1 -
Target Focus
5.000
Adjust Focus
Z1 Home

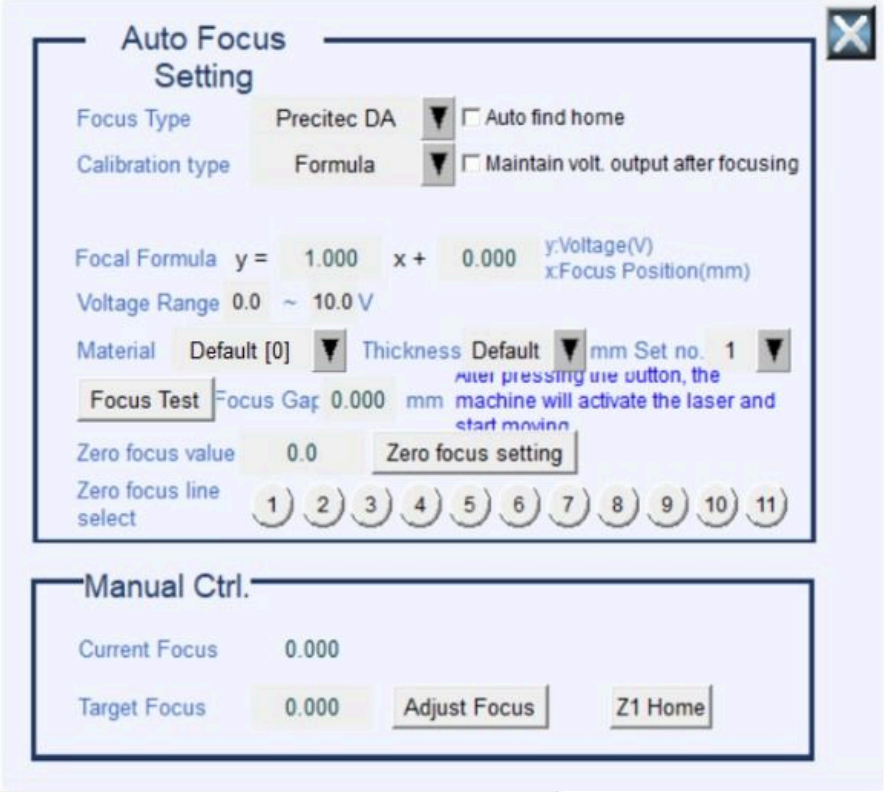
- The focusing process for Serial Axis:
    i. Based on the cutting head specifications, enter the **<Focus Range>** into the input box.
    ii. Press **"Z1 Home"**, and the cutting head will initiate a search for the home position of the focus axis.
    iii. Set the **<Target Focus>**, and press **"Adjust Focus"**. The focus will be adjusted to reach the target position.
    iv. Auto find home: Check this box to enable auto-homing at startup.
- **"Focus Test" :**
    i. Select the 【**Material**】 and 【**Set no.**】 for the focus test.
    ii. Set the **<Focus Gap>**
    iii. Press **"Focus Test".** A popup window will appear, indicating that the machine is about to move.
        - If select OK, the machine will move from a focus position of **<Focus Gap>**x5 to -**<Focus Gap>**x5 in the y-direction at 0.5 mm intervals, cutting 11 lines of 50 mm in the x-direction.
        - If select Cancel, the popup window will close, and no action will be taken.
- Precitec DA/Raytools F100 DA/Ospri DA/Raytools F50 DA





- The focusing process for Precitec DA/Raytools F100 DA/Ospri DA/Raytools F50 DA — Table :
  i. Select【**Table**】as the calibration type.
  ii. Based on the cutting head specifications, enter the **<Focus Range>** into the input box and check the **<Maintain volt. output after focusing>** option.
  iii. Press **"DA Focus Calibration Table".** After entering the **<Voltage>**, press **"Move to"** to automatically focus and display the focal point in **<Focus>**. After completing at least two entries, select **"Calibration Completed"** to close the DA focusing calibration table and save the settings.
  iv. Press **"Z1 Home"**, and the cutting head will initiate a search for the home position of the focus axis.
  v. Set the **<Target Focus>**, and press **"Adjust Focus"**. The focus will be adjusted to reach the target position.
  vi. Auto find home: Check this box to enable auto-homing at startup.
- **"Focus Test" :**
  i. Select the【**Material**】and【**Set no.**】for the focus test.
  ii. Set the **<Focus Gap>**
  iii. Press **"Focus Test".** A popup window will appear, indicating that the machine is about to move.

- If select OK, the machine will move from a focus position of **<Focus Gap>**x5 to -**<Focus Gap>**x5 in the y-direction at 0.5 mm intervals, cutting 11 lines of 50 mm in the x-direction.
- If select Cancel, the popup window will close, and no action will be taken.



The focusing process for Precitec DA/Raytools F100 DA/Ospri DA/Raytools F50 DA — Formula:

i. Select【**Formula**】as the calibration type.
ii. Based on the cutting head specifications, enter the **<Voltage Range>** into the input box and check the **<Maintain volt. output after focusing>** option.
iii. Enter the **<Focal Formula>** into the input box. (y: voltage, x: Focus position; the equation is provided by the laser cutting head manufacturer or supplier.)
iv. Select the【**Material**】and【**Set no.**】for the focus test.
v. Press **"Focus Test".** A popup window will appear, indicating that the machine is about to move.
   - If select OK, the machine will move from a focus position of +2.5 mm to -2.5 mm in the y-direction at 0.5 mm intervals, cutting 11 lines of 50 mm in the x-direction.
   - If select Cancel, the popup window will close, and no action will be taken.
vi. Observe the 11 lines and press the corresponding button for the zero-focus line under "**Zero focus line select**" (For example, if the fifth line is the zero-focus line, press the No. 5 button.)

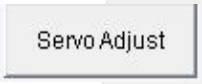
vii. After pressing the button, the corresponding focus position will be filled into the <**Zero focus value**>.
viii. Press "**Zero focus setting**". The system will calculate and refine the Focal Formula based on the Zero focus value, and reset zero focus value.
ix. Prees "**Focus Test**" again and check whether the sixth line is the zero focus one. If yes, the focal adjustment is complete; if not, repeat steps 2 to 7.
x. **"Zero focus value"** can also be entered manually. The system will refine the formula based on the input value.
xi. Set the **<Target Focus>**, and press **"Adjust Focus"**. The focus will be adjusted to reach the target position.

- Normal DA

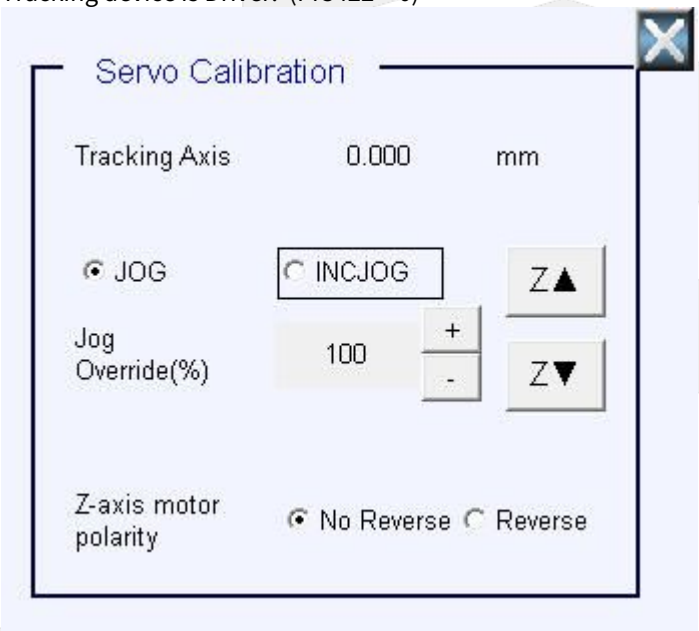
- The focusing process for Normal DA:
  i. Based on the cutting head specifications, enter the **<Voltage Range>** into the input box and check the **<Maintain volt. output after focusing>** option.
  ii. Enter the **<Focal Formula>** into the input box. (y: voltage, x: Focus position; the equation is provided by the laser cutting head manufacturer or supplier.)
  iii. Select the 【**Material**】 and 【**Set no.**】 for the focus test.
  iv. Set the **<Focus Gap>**
  v. Press **"Focus Test".** A popup window will appear, indicating that the machine is about to move.
    - If select OK, the machine will move from a focus position of **<Focus Gap>**x5 to -**<Focus Gap>**x5 in the y-direction at 0.5 mm intervals, cutting 11 lines of 50 mm in the x-direction.

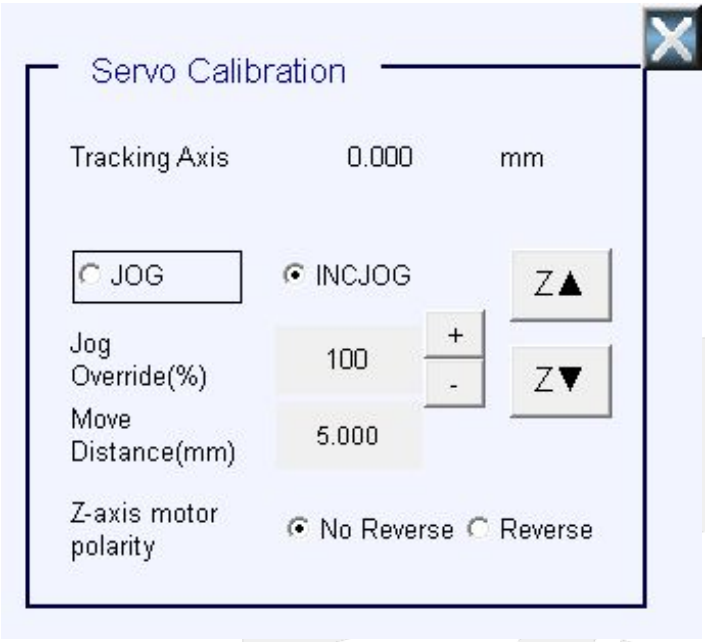
- If select Cancel, the popup window will close, and no action will be taken.

vi. Observe the 11 lines and press the corresponding button for the zero-focus line under "**Zero focus line select**" (For example, if the fifth line is the zero-focus line, press the No. 5 button.)
vii. After pressing the button, the corresponding focus position will be filled into the <**Zero focus value**>.
viii. Press "**Zero focus setting**". The system will calculate and refine the Focal Formula based on the Zero focus value, and reset zero focus value.
ix. Prees "**Focus Test**" again and check whether the sixth line is the zero focus one. If yes, the focal adjustment is complete; if not, repeat steps 2 to 7.
x. **"Zero focus value"** can also be entered manually. The system will refine the formula based on the input value.
xi. Set the **<Target Focus>**, and press **"Adjust Focus"**. The focus will be adjusted to reach the target position.

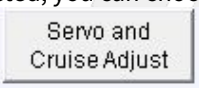
7. Servo Adjust 

Located below the Auto Focus Setting button, it will only be displayed when Tracking device is Driver. (Pr3422 = 0)

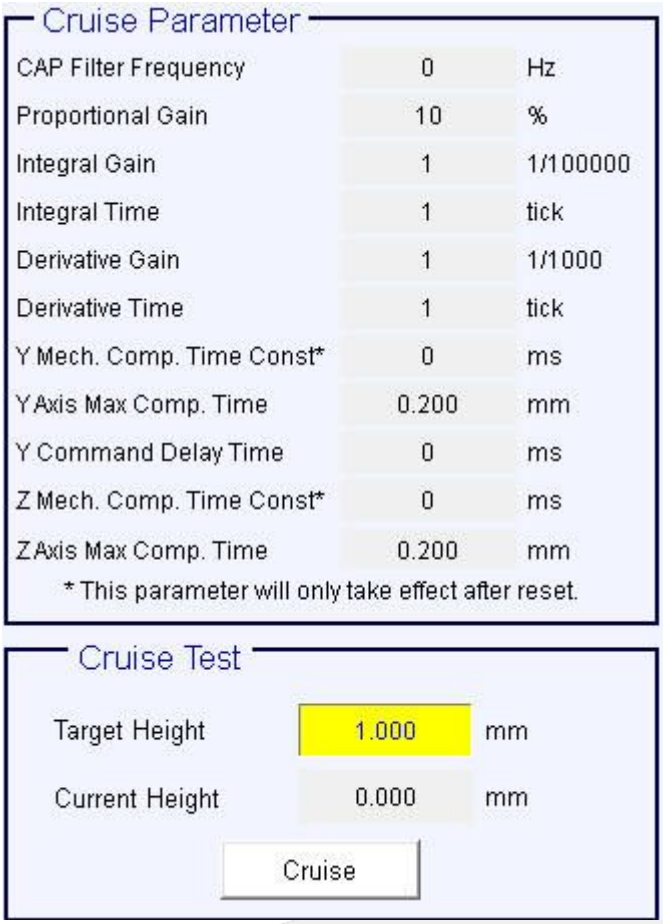




Introduction : This screen allows you to set the Z-axis movement direction to match the expected machine operation on-site. Z▲ moves the cutting head up, and Z▼ moves the cutting head down. If the movement direction is not as expected, you can choose to reverse the Z-axis movement direction.

8. Servo and Cruise Adjust 

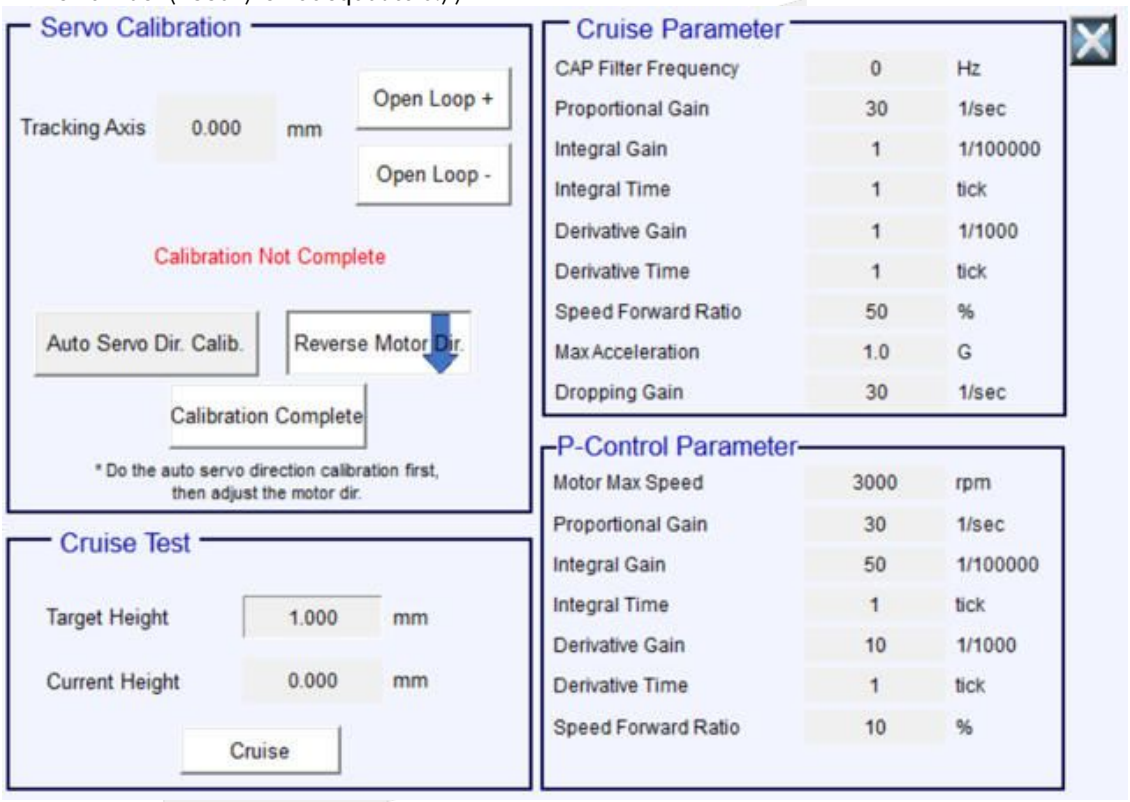
Located below the Auto Focus button, it will only be displayed when Tracking device is FourInOne Controller. (Pr3422 = 1)
(P.S. : FourInOne Controller Tracking is PID Tracking Control)
   - **Position mode control**
     (Tracking Driver Type is Serial (Pr3452 = 0) and tracking Z-Axis number (R5804) is equal to 0.)



- Introduction :
  - **<CAP Filter Frequency>** :
    - Low-pass filter cutoff frequency. Signals above the cutoff frequency will be eliminated.
    - 0: No filtering.
  - **<Proportional Gain>** : Set tracking proportional gain.
  - **<Integral Gain>** : Set tracking integral gain.
  - **<Integral Time>** : Set tracking integral time.
  - **<Derivative Gain>** : Set tracking derivative gain.
  - **<Derivative Time>** : Set tracking derivative time.
  - **<Y Mech. Comp. Time Const*>** : Set Y Mechanism Compensation time constant.
    - The conroller mechanism compensation (backlash, pitch error, and thermal compensation) is output as an exponential curve. This parameter determines the time constant of the exponential curve.
    - The smaller the value, the shorter the compensation correction time required, but it may cause machine vibration. The recommended reference value is 10ms.
    - Parameters take effect after Reset.
  - **<Y Axis Max Comp. Time>** : Range [0~1]. If set to zero, there is no limit.
  - **<Y Command Delay Time>** : The internal preset delay is the servo lag time. Set this parameter to adjust the delay.

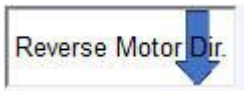
- **<Z Mech. Comp. Time Const*>** : Set the Z-axis mechanism compensation time constant*. The specification are the same as the Y-axis mechanism compensation time constant. Parameters take effect after Reset.
- **<Z Axis Max Comp. Time>** : Range [0~1]. If set to zero, there is no limit.
- **<Target Height>** : Set Tracking Target Height.
- **"Cruise"** : Click to trigger the tracking process, and click again to cancel the tracking.

- **Velocity Mode Control**
  (Tracking driver type is Pulse (Pr3452 = 1). or (Tracking driver type is Serial (Pr3452 = 0) and tracking Z-Axis number (R5804) is not equal to 0.))

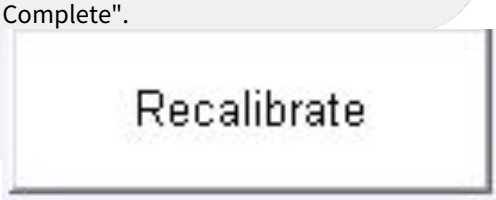


- Servo Calibration Steps:
  1. Move the cutting head to the appropriate height (Reserve 10 mm of moving space at both sides of cutting head. Distance within 50 mm from the workpiece is recommended).
  2. Press **"Auto Servo Dir. Calib."** to start the automatic servo direction calibration.
  3. Once the calibration is complete, there will be three outcomes:
     a. Both the coordinate direction and the direction of motion have been successfully calibrated.
     b. The calibration of the coordinate direction was successful; but the calibration of the motion direction fails. → Please check the connection of the height sensor feedback. Otherwise, check if the cutting head is too far from the workpiece, causing poor signal quality. Then redo the automatic servo direction calibration or directly calibrate the moving direction manually.
     c. Both the coordinate direction and the motion direction calibration fail. → Please check the connection status of the tracking axis, then redo the automatic servo direction calibration. (Step 2.)
  4. **"Open Loop +","Open Loop -"** to confirm the encoder direction is correct. If not, click the **"Reverse Motion Dir."** button.

5. Click **"Calibration Complete"**.
    - Introduction :
        - **"Open Loop +" :** Press to command the Tracking-axis to jog upwards.
        - **"Open Loop -"** : Press to command the Tracking-axis to jog downwards.
        - **"Auto Servo Dir. Calib"** : Press and confirm to start the coordinate and motion direction automatic calibration.
        - **"Reverse Motion Dir."**: Press to reverse the motion direction

          ; the arrow direction will invert. Press again to cancel the reversal.
        - **"Calibration Complete"**: Press to complete servo calibration and lock the servo direction. The text prompt will change to "Calibration Complete".

          To unlock, press again.
        - **<Target Height>**: Set the target tracking height.
        - **"Cruise"**: Press to start the tracking mode process. Press again to cancel tracking mode.
          --- Cruise Parameters
        - **<CAP Filter Frequency>**: Set the low-pass filter cutoff frequency.
            - Signals above this frequency will be filtered out.
            - 0: No filtering
        - **<Proportional Gain>**: Set the follow mode proportional gain.
        - **<Integral Gain>:** Set the follow mode integral gain.
        - **<Integral Time>**: Set the follow mode integral time.
        - **<Derivative Gain>**: Set the follow mode derivative gain.
        - **<Derivative Time>**: Set the follow mode derivative time.
        - **<Speed Forward Ratio>**: Set the velocity feedforward proportion.
        - **<Max. Acceleration>**: Set the maximum acceleration.
        - **<Dropping Gain>:** Set the initial following to target height gain
          --- Position Control Parameters
        - **<Motor Max. Speed>**: Set the motor maximum speed.
        - **<Proportional Gain>**: Set the position proportional gain.
        - **<Integral Gain>**: Set the position integral gain.
        - **<Integral Time>**: Set the position integral time.
        - **<Derivative Gain>**: Set the position derivative gain.
        - **<Derivative Time>**: Set the position derivative time.
        - **<Speed Forward Ratio>**: Set the velocity feedforward proportion.
        - **<Speed Command Unit>**: Set the velocity command unit. This parameter is displayed only if Pr3452 equals 0 and Pr5804 is not equal to 0.

5.1.2 【High Pressure Alarm】

Enable:
Enable high pressure alarm.

Disable:
Do not detect high pressure. High pressure alarm is disabled.

<High Pressure Threshold>:
Displayed only when pressure feedback is enabled.
An alarm will be triggered when the pressure feedback value is **lower than this threshold** and remains so longer than the pressure feedback detection time.

5.1.3 【High Pressure Alarm】

Enable:
Enable high pressure alarm.

Disable:
Do not detect high pressure. High pressure alarm is disabled.

<High Pressure Threshold>:
Displayed only when pressure feedback is enabled.
An alarm will be triggered when the pressure feedback value is **lower than this threshold** and remains so longer than the pressure feedback detection time.

5.1.4 【High Pressure Alarm】

Enable:
Enable high pressure alarm.

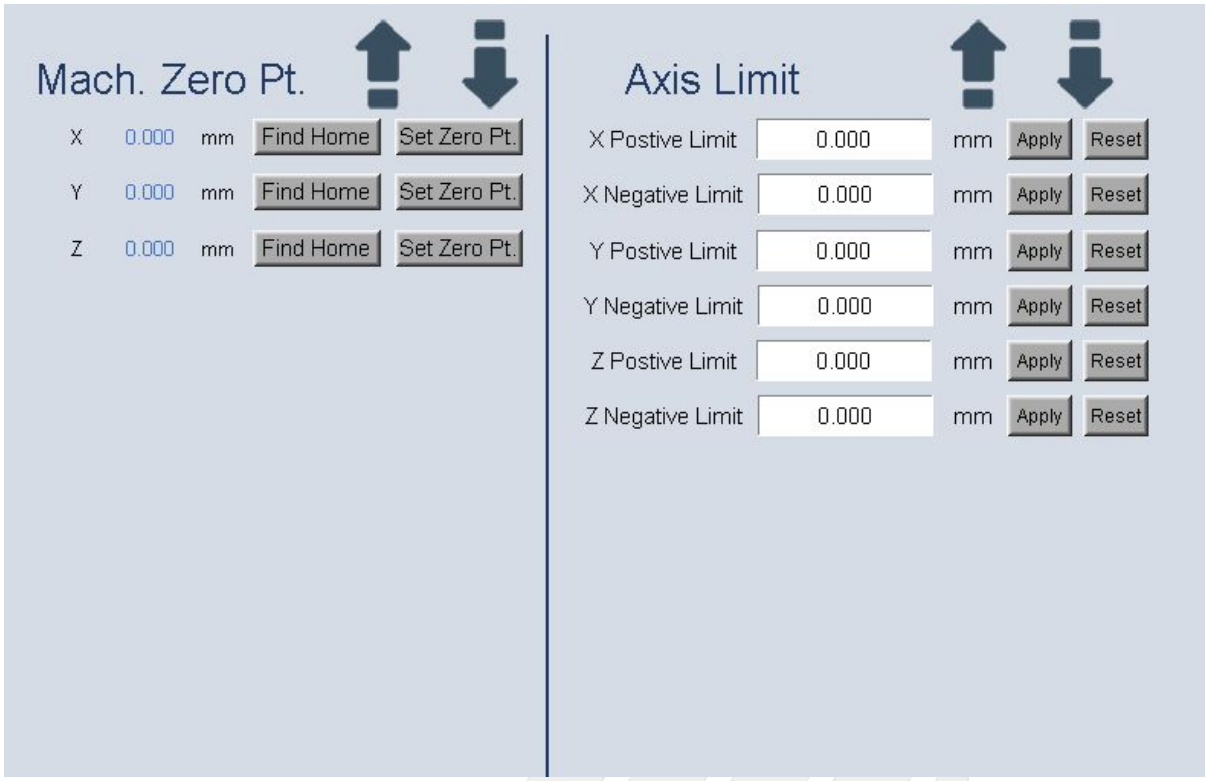
Disable:
Do not detect high pressure. High pressure alarm is disabled.

<High Pressure Threshold>:
Displayed only when pressure feedback is enabled.
An alarm will be triggered when the pressure feedback value is **lower than this threshold** and remains so longer than the pressure feedback detection time.

5.1.5 5.1.2 Axis Settings

Path: Main Screen → F8 Machine Maker → F2 Axis Settings

(*Notice: This page is used to set the mechanical origin points and travel limits for the various axes. Operators should not make arbitrary changes on this page. Incorrect settings can lead to collisions or render the machine inoperable.**)**



Introduction:

- When the cutting head exceeds the axis limit, the machine will stop moving and display an alarm.
- **"Set Mach. Zero Pt."**: Pressing this button will set the current position of the cutting head for the selected axis as the machine's origin for that axis.
- **"Find Home"** : Triggers the target axis to search for the home position.
- **<Axis Limit>**: Specify the limits for the selected axis. It defines the maximum allowable travel distance for that axis. (Settings can only be configured when Pr3428 is equal to 0. (If Pr3428 is equal to 1, the soft limits will be released to their maximum limits.))
- **"Apply**": After entering the axis limit, press the button to set the current position of the cutting head as the limit for the chosen axis. (Settings can only be configured when Pr3428 is equal to 0)
- **"Reset**": Pressing this button will adjust the travel limit to its maximum value, eliminating any pre-established limitations for the chosen axis. (Settings can only be configured when Pr3428 is equal to 0)
    - Steps to set the travel limits for an axis:
        i. First, be careful to set the mechanical origin. It is imperative for the travel limit settings to be in place in order to ensure their effectiveness.
        ii. Click **"Reset"** for desired axis. This action will temporarily adjust the travel limit to either its maximum value or, in the case of a negative limit, its minimum value.
        iii. Carefully jog the cutting head to the desired position in order to set the limit. It is important to acknowledge that currently, there is no software limit protection for the axis. Therefore, it is advised to proceed with caution during this particular step.
        iv. Once the cutting head has been positioned at the desired location, press the **"Apply"** button. This action will set the current position of the cutting head as the limit for the axis that has been selected.

5.1.6 5.1.3 Single IO Point-Hardware

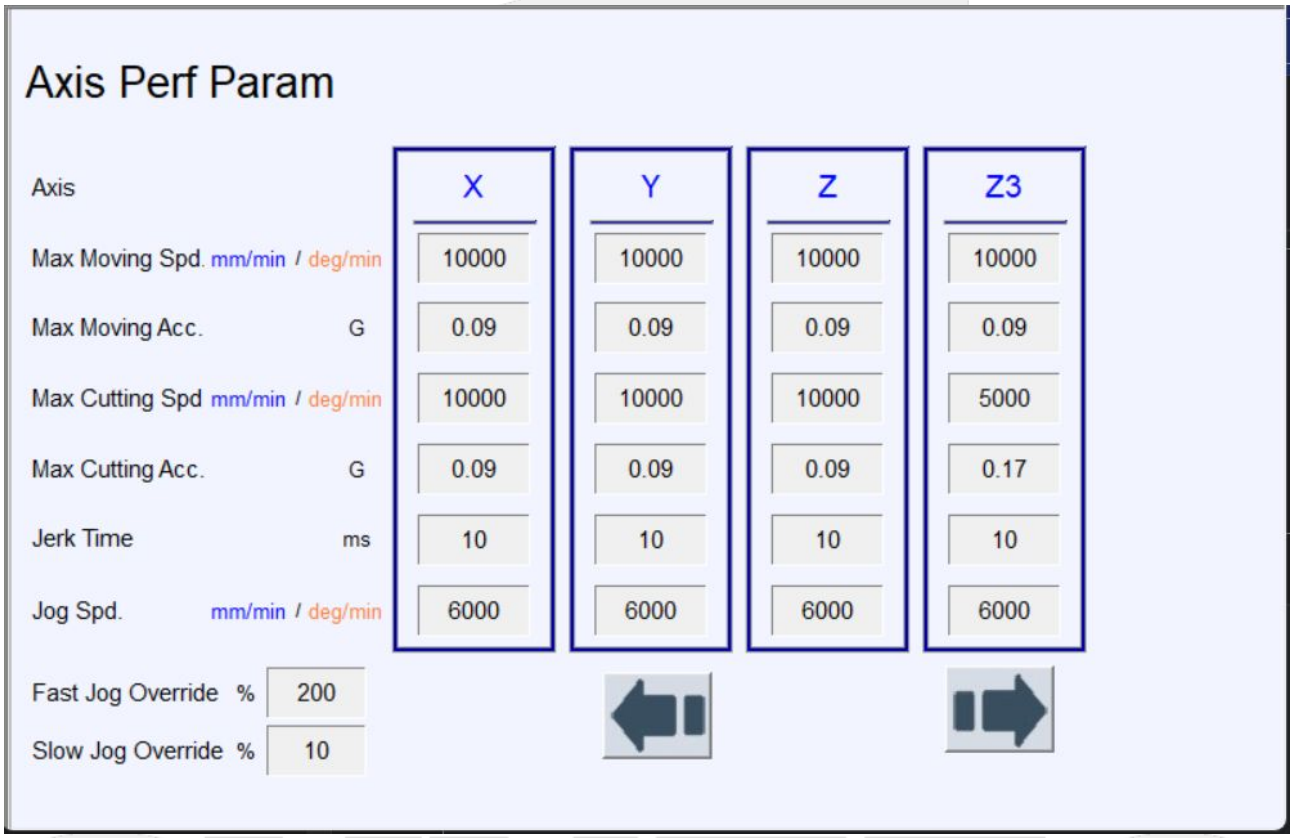
Path: Main Screen → F8 Machine Maker → F3 SingleIO-Hardware

This page determines which hardware I/O points are mapped to the software I/O points for configuration. No changes to the PLC are necessary, providing more flexibility for the user.

For details, please refer to the Single Point IO Setup Instructions.

5.1.7 5.1.4 Axis Performance Parameters

Path: Main Screen → F8 Machine Maker → F4 Axis Perf Param



Introduction:

(*Note: All parameters on this page only take effect after Reset.**)**

- **<Max. Moving Spd>** : Sets the maximum speed limit for rapid traverse.
- **<Max. Moving Acc.>** : Sets the maximum acceleration limit for rapid traverse.
- **<Max. Cutting Spd.>** : Sets the maximum speed limit for cutting.
- **<Max. Cutting Acc.>** : Sets the maximum acceleration limit for cutting.
- **<Jerk Speed>** : Sets the time required to accelerate to 1G.
- **<Jog Spd>** : Sets the jog speed.
- **<Fast Jog Override %>** : Sets the multiplier for rapid jog speed.
- **<Slow Jog Override %>** : Sets the multiplier for slow jog speed.

If the controller is connected to multiple axes and cannot display all on a single screen, press  to switch and view the relevant axes.

5.2 5.2 Controller Parameters

Path: Main Screen → F5 Electronic Module → F2 Parameter

(*Note: Operators should not make arbitrary changes to this page.**)**

Here lists the commonly used Controller Parameters for laser cutting software. If there is a * next to the parameter number, it indicates that the machine must be restarted to apply the setting. If you want to understand Controller Parameters that are not listed here, please refer to the CNC Parameter Manual.

- Commonly used parameters Introduction

Parameter	Introduction
Laser Control Parameters	
Pr3401	Max. voltage output of laser （mV）
Pr3403	Laser Type • 0: Raycus • 1: Max Photonics • 5: IPG YLM • 51: IPG YLR • 7: SwiRoc • 10: YAG
Pr3404*	Communication • 0: M3 • 1: SRI
Speed Parameters	
Pr3407	Default speed of cutter moving down（mm/min）
Pr3408	Shift speed（mm/min）
Pr3409	Frogleap starting height（mm）
Gas control Parameters	

Parameter	Introduction
Pr3406*	Pressure calibration curve order • 1: first order • 2: second order • 3: third order
Pr3410*	The maximum DA output voltage on the controller • 0: 10 V • 1: 5 V
Height Sensing Parameters	
Pr3411*	Height Sensing Device • 0: Capacitance • 1: LVDT • 2: HYD
Pr3412	Height sensor touch workpiece value
Pr3413	Height following tolerance（um）
Pr3414	Height following sensitivity • 1 is Weakest, 10 is Strongest
Axis Over Travel NC/NO	
Pr3415	Axis Over Travel NC/NO • 0: NO • 1: NC
Handwheel MPG	
Pr3416	Handwheel type 0: single 1:binary
Switch platform	
Pr3417	Switch platform inner position（mm）

Parameter	Introduction
Pr3418	Switch platform outer position（mm）
Pr3421	ExchangeTable Type • 0: Disable • 1: Lifting • 2: High&Low
Auto focus function module	
Pr3420	Auto focus function of cutting head • 0: Close • 1: Serial Axis • 2: Precitec DA • 3: Raytools F100 DA • 4: Normal DA • 6: Ospri DA • 7: Raytools F50 DA
Laser parameter unit	
*P3443	Power unit 0: Percent 1: Watt
*P3444	Max. power of laser(W) This parameter only needs to be set when the power unit is in watts (Pr3443=1).
*P3445	0 : Duty cycle 1 : Pulse width

5.3 5.3 Data Backup and Restoration

Introduction: In case of system anomalies, you can use backup files to restore data, or apply machine settings to other machines using backups.

5.3.1 **5.3.1 Data Backup**

Data Backup Steps:

1. On the Main Screen, press F5 for **"Electronic Module"** then press F4 for **"System Admin"** and finally press F2 for **"Backup System"** to access the Data Backup page.
2. Choose the backup file. You can select to back up all files (SB) or partial backup by checking the desired items (MB).
3. Press F1 for **"Next"**.
4. You can add comments.
5. Press F1 and select the external folder to store the backup (e.g., USB flash drive). Press **"OK"** to complete the backup.

5.3.2 5.3.2 Data Restoration

Data Restoration Steps :

1. On the Main Screen, press F5 for **"Electronic Module"** then press F4 for **"System Admin"** and finally press F3 for **"Restore System"** to access the Data Backup page.
2. Choose the folder and select the backup file.
3. Press F1 for **"OK"** to restore the file, then press F1 for **"Next"** and press F1 for **"OK"** in the popup screen to initiate data restoration.
4. A popup message will indicate completion after the restoration.

5.4 5.4 File Import and Export

5.4.1 5.4.1 System Data Import and Export

Introduction: Import system data, commonly used for PLC import/export.

System Data Import Steps:

1. On the Main Screen, press F5 for **"Electronic Module"** then press F4 for **"System Admin"** then press F4 for **"Export/Imp System"** then press F1 for **"System Settings Manager"** and finally press F1 for **"Import"**.
2. Choose the file to import from an external folder (e.g., USB flash drive).
3. Press F1 for **"Next"** to access the Imported File page.
4. Confirm the imported file and press F1 for **"OK"** to proceed with the file import. After the import is complete, a reboot is required to read the imported file.

System Data Export Steps:

1. On the Main Screen, press F5 for **"Electronic Module"** then press F4 for **"System Admin"** then press F4 for **"Export/Imp System"** then press F1 for **"System Settings Manager"** and finally press F2 for **"Export"**.
2. Choose the file to export.
3. Press F1 for **"Next"** and choose the external folder where you want to save the export file (e.g., USB flash drive) and specify the export location.
4. Press F1 for **"OK"** then press F1 for **"OK"** again to complete the file export.

5.4.2 5.4.2 MACRO Import and Export

MACRO Import Steps:

1. On the Main Screen, press F5 for **"Electronic Module"** press F4 for **"System Admin"** press F4 for **"Export/ Imp System"** press F2 for **"MACRO Management"** and finally press F1 for **"Import"**.
2. Choose the MACRO file you want to import from an external folder (e.g., USB flash drive).
3. Press F1 for **"Next"** and a popup message will appear. Press F1 for **"Confirm"** to complete the import of the MACRO file.

MACRO Export Steps:

1. On the Main Screen, press F5 for **"Electronic Module"** press F4 for **"System Admin"** press F4 for **"Export/ Imp System"** press F2 for **"MACRO Management"** and finally press F2 for **"Export"**.
2. Choose the MACRO file you want to export.
3. Press F1 for **"Next"** and a popup message will appear. Press F1 for **"Confirm"** to complete the export of the MACRO file.