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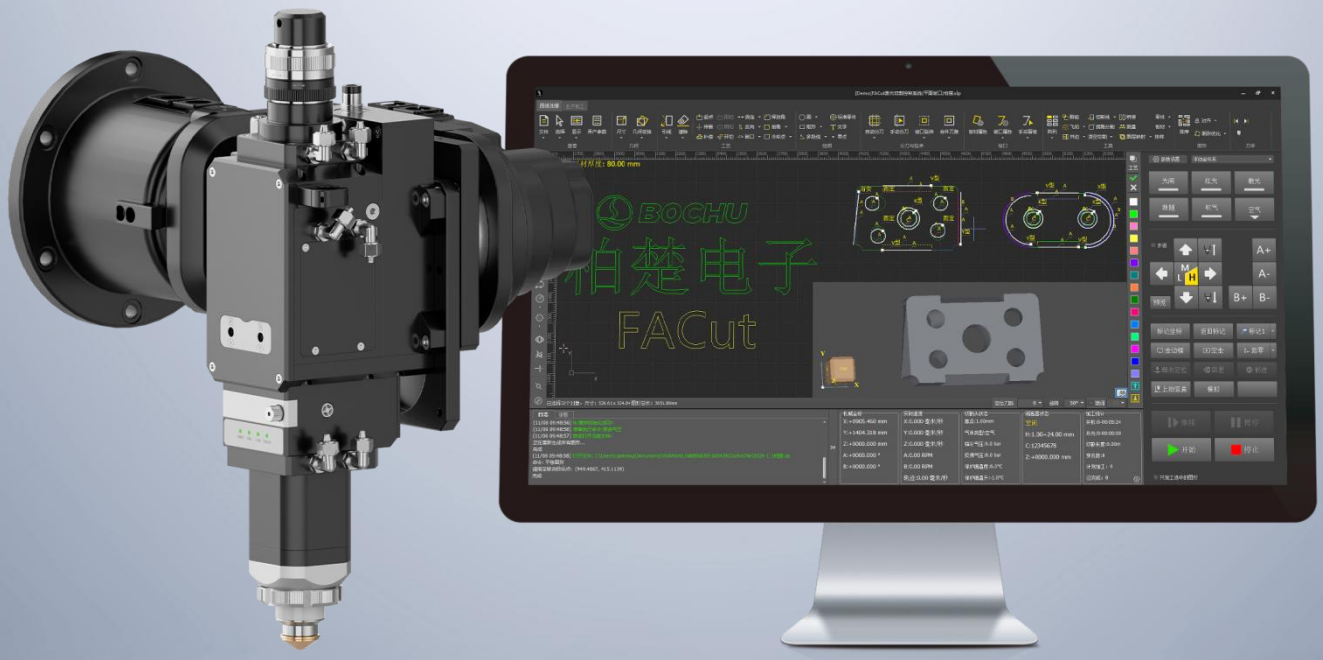


FACut Plane Bevel Laser Cutting Control User Manual

System: 9100

Software version: 1.13.2406.2

Document version: V1.1.0

www.bochu.com

Foreword

Thank you for using FACut Plane Bevel Cutting Control Software!

BOCHU FACut Plane Bevel Cutting Control Software (hereinafter referred to as FACut) is a dedicated control software for plane bevel laser cutting, featuring high precision and high efficiency. The main functions include ***Vision Calibration***, ***Swing Correction***, ***Custom PLC***, parameter settings, simulation, and accurate control for laser cutting.

FACut must be used with the HypTronic3 CNC host to perform actual cutting operations. When running on a computer other than the HypTronic3 CNC host, it will enter demo mode.

Please note that this user manual is only used as the operation instruction of the main program of FACut software. Please refer to other manuals or contact us for other tools and software installed with FACut software.

This manual is based on FACut version 1.13.2406.2. We apologize for the fact that the FACut you are using may differ in some respects from what is stated in this manual due to the continuous updating of software functions. Contents of this manual are subject to change without prior notice.

Some of the independent feature descriptions linked are currently only available in Chinese. English versions are being progressively developed and will be updated in due course. If you require immediate access to specific documentation, please contact technical support.

For any questions or suggestions during usage, please contact us through the information provided.

Convention Symbol Explanation

Notice: Supplementary or explanatory information for the use of this product.

Caution: If not operated as specified, it may result in minor physical injury or equipment damage.

Warning: If not operated as specified, it may lead to death or serious physical injury.

Danger: If not operated as specified, it will cause death or serious physical injury.

Safety Statement

The machine tool operation and laser cutting quality have something to do with the material being cut, the laser used, the gas used, the pressure and the parameters you set. Please set the parameters

according to your cutting process requirements!

Improper parameter setting and operation may lead to poor cutting effects, damage to the cutting head or other machine components, and even personal injury. FACut-H has tried its best to provide various protection measures. Laser equipment manufacturers and end users are supposed to abide by operating procedures to avoid injury accidents as possible as they can.

The company shall not be held responsible for any direct, indirect, incidental, and/or consequential losses or liabilities resulting from improper use of this user manual or the product.

Revision History

Version No.	Date	Description
V1.0.0	2023/10/18	The first English edition for FACut 1.6.2210.1.
V1.1.0	2025/06/30	Updated to BOCHU's latest documentation templates. Updated according to the feature set of FACut 1.13.2406.2.

Contents

Chapter 1 Quick Start

1.1 **Feature Highlights**

- Supports importing 2D drawings in formats such as *.slp, *.lxds, *.nrp2, *.lxd, *.dxf, *.g, *.nc, *.gen, *.txt, and *.dwg.
- Automatically optimizes imported files (e.g., *.dxf), including ***Delete Duplicates***, ***Join Nearest Lines***, ***Delete Invisible***, ***Automatic Identify Inner/Outer Contour***, etc.
- Supports various bevel types such as V, Y, X, and K. After importing drawings by outer contour and confirming plate thickness, the bevel property can be flexibly configured for each part.
- Establishes a 3D mathematical model for the rotary mechanism and applies advanced algorithms. With a vision sampling device, the system performs high-precision sampling and analysis to reduce machining errors caused by structural accuracy or installation deviations.
- Provides compensation mechanisms for plate deformation by performing pre-sampling to quantify deformation, ensuring machining accuracy across various materials and conditions.
- Supports normal vector following to eliminate dimensional deviations caused by different nozzles and cutting angles.
- Supports local editing and optimization of drawings to improve production efficiency.
- Offers built-in automatic nesting and co-edge bevel cutting for bevel applications.
- Supports ***Auto Split*** and ***Manual Break*** that allows flexible part property editing without altering the original drawing geometry.
- Supports both vertical and tilted piercing modes.
- Supports the editing of technique marks, allowing detailed control of special processing scenarios such as corners.
- Supports the editing of power curves and setting related parameters such as smooth start, smooth end, corner swing, etc.
- Offers two corner motion strategies: ***Direct Corner Transition*** and ***Normal-based Optimization***, balancing cutting stability and quality.

- Supports high-speed capacitive edge finding.
- Provides breakpoint memory for forward and backward tracing.
- Allows positioning to any point during stop or pause, and supports resuming processing from an arbitrary location.
- Enhanced PLC editing capabilities, supporting script-based logic and process control.
- Programmable I/O ports with configurable alarm and pre-alarm inputs.

1.2 Acquire and Install

FACut is pre-installed in HypTronic3 by default and can be used directly upon startup.

The HypTronic host PC supports one-click system restore, allowing for quick reset to factory default settings in case of system issues.

You can also contact the supplier or technical support for the system install package. It will be much more convenient for subsequent upgrades and restoration.

1.3 Quick Start

In this section, you'll see how a debugged machine works normally with FACut.

Before processing, make sure the system has completed operations including ***Return Origin***, ***Capacitance Calibration***, ***Vision Calibration***, and ***Swing Correction***. Ensure that the A/B axes are properly calibrated without significant offset. If not, perform the necessary initial setup steps such as ***Return Origin*** and other calibrations.

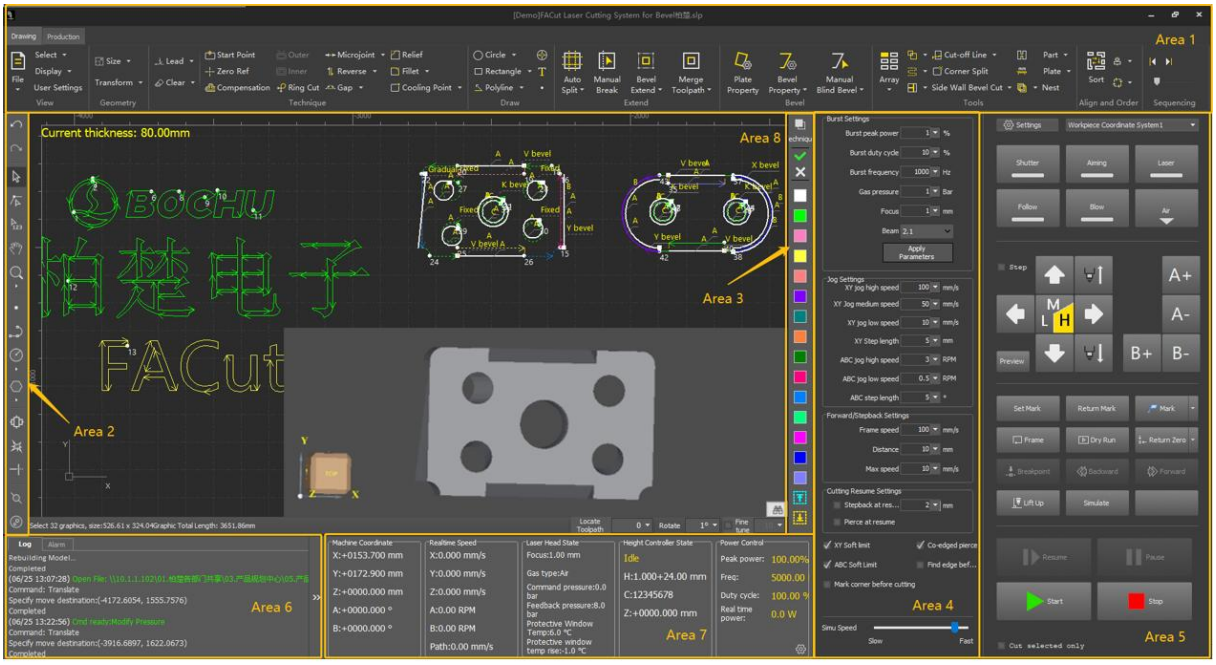


Figure 1-1 Interface overview

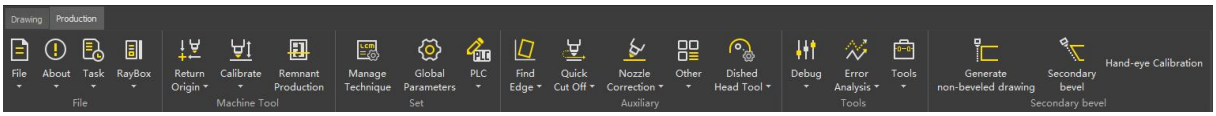


Figure 1-2 Interface overview (continued)

Before starting the operation, it is recommended that you familiarize yourself with the software interface. In the figures above, each region is marked with a yellow box and labeled with a number for reference.

- Area 1: Drawing Toolbar

  Starting from version 2024C, FACut separates the toolbar into two sections: ***Drawing*** and ***Production***. The drawing toolbar contains nine major functional zones: ***View***, ***Geometry***, ***Technique***, ***Draw***, ***Extend***, ***Bevel***, ***Tools***, ***Align and Order***, and ***Sequencing***. Detailed functions will be covered in later chapters.

- Area 2: Left-side Drawing Tools

  This toolbar provides a comprehensive set of drawing tools, including ***Explode***, ***Clip***, ***Technique Mark***, and ***Dished Head***, among others.

- Area 3: Technique Settings Panel

  After selecting a specific path, click on the colored squares to assign different layers. Click the ***Technique*** button at the top for advanced technique parameter settings.

- Area 4:Parameter Settings Panel

  This section allows for parameter adjustments such as burst settings and jog settings. You can open or hide it by clicking the ***Settings*** button in the top-left corner of Area 5.

- Area 5: Processing Control Panel

  This area enables operations such as turning the ***Shutter*** and ***Aiming*** on/off, jogging or stepping the cutting head, performing ***Frame***, ***Dry Run***, ***Simulate***, ***Lift Up***, etc. You can ***Start*** machining from this panel.

- Area 6: Log & Alarm Panel

  Every operation and machine change is displayed here. The log helps identify the reasons for any failures and can be exported to technical support for troubleshooting.

- Area 7: Status Monitoring Panel

  Click the gear-shaped icon in the lower-right corner of this section to adjust the five modules displayed on the interface, making it easier to monitor machine movement and processing conditions.

- Area 8: CAD View

  The main drawing is displayed here. When a shape is selected, its bevel properties are shown in the top-left corner of this area. Click the telescope icon in the bottom right for a 3D preview. This area also supports ***Locate Toolpath***, ***Rotate***, and ***Fine Tune*** at the bottom.

- Area 9: Production Toolbar

  As shown in Figure 1-2, this panel includes sections such as ***File***, ***Machine Tool***, ***Set***, ***Auxiliary***, and ***Tools***. If the secondary bevel function is enabled in FAConfig, the related settings will also appear here.

1.3.1 Processing Flow

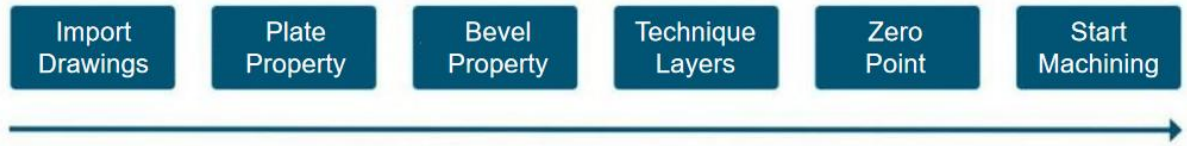


Figure 1-3 FACut simple processing flow

1.3.2 Import Drawings

Click ***File*** → ***Open File***, you can choose ***Open File***, ***Import DXF***, or ***Import SLP***. After selecting an option, a file selection dialog will appear. The right panel of the dialog provides a preview of the machining geometry and its dimensions.

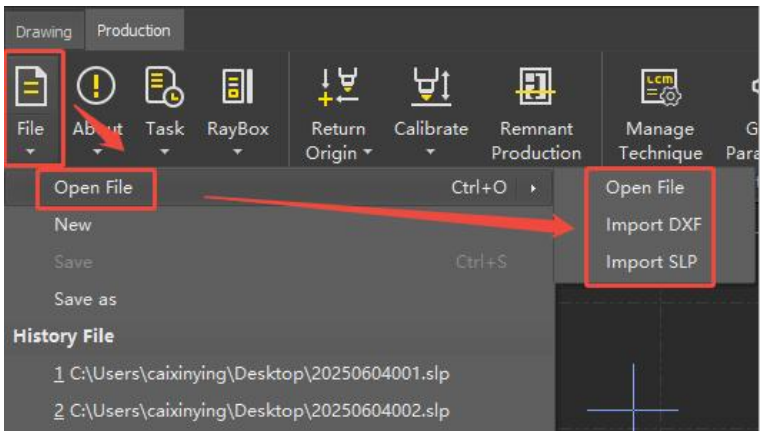


Figure 1-4 Import drawings

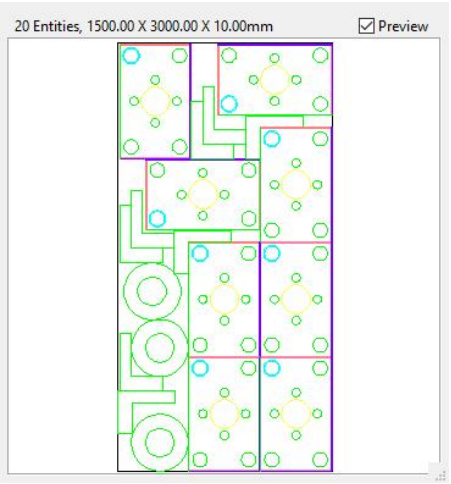


Figure 1-5 Drawing selection and preview

1.3.3 Plate Property and Bevel Property

Click ***Plate Property*** and ***Bevel Property*** to set relevant parameters.

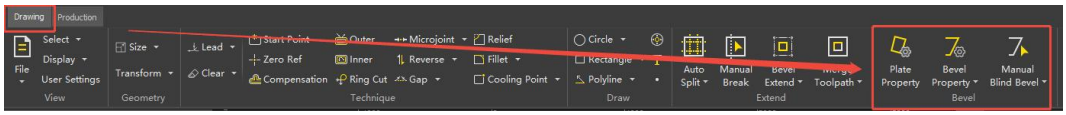


Figure 1-6 ***Plate Property*** and ***Bevel Property***

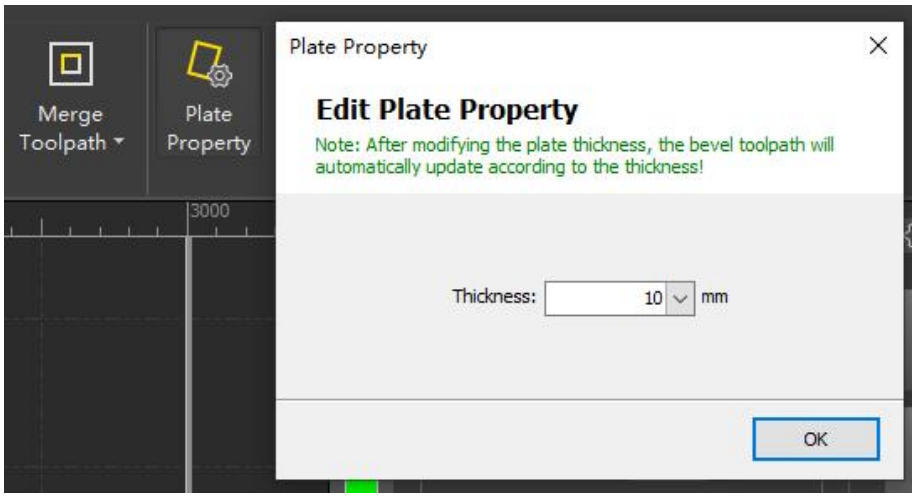


Figure 1-7 Edit ***Plate Property***

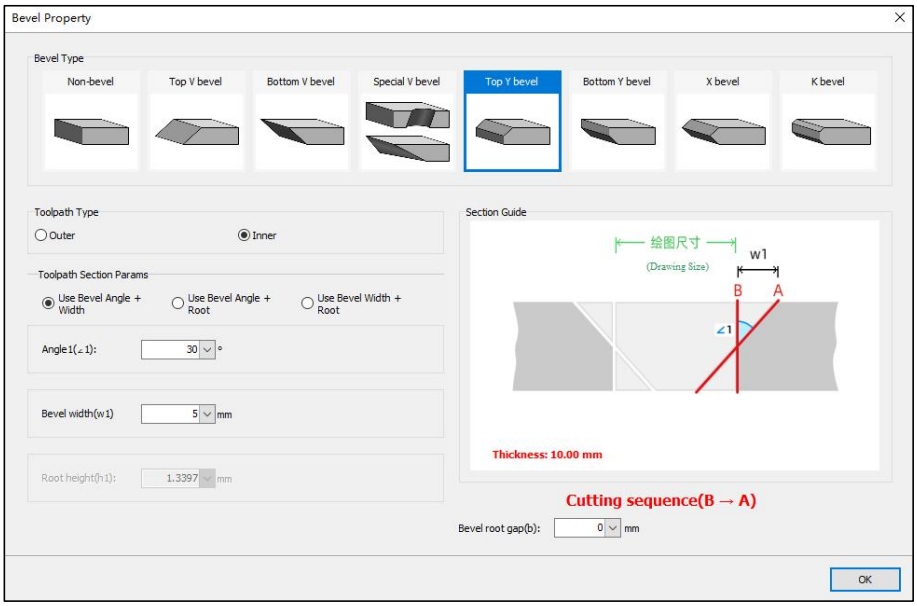


Figure 1-8 Set ***Bevel Property***

After adding bevels, select the part and click the telescope icon in the lower right corner of the CAD view to preview the 3D model of the beveled part.

During preview:

- Hold and drag the left mouse button to pan the model.
- Scroll the mouse wheel to zoom in or out.

- Hold and drag the mouse wheel to rotate the model.
- Click anywhere in the drawing area to exit preview mode.

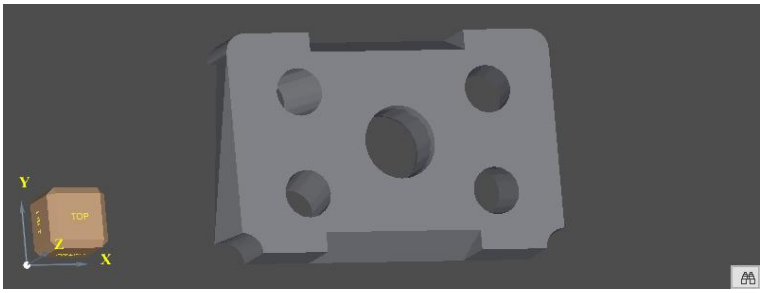


Figure 1-9 3D model preview

Notice: This preview is available for individual parts only.

1.3.4 Technique Layers

Select a part or toolpath and use the technique setting panel on the right to assign the appropriate layer. For compound bevels, you can either assign multiple toolpaths on a single layer or one toolpath per layer.

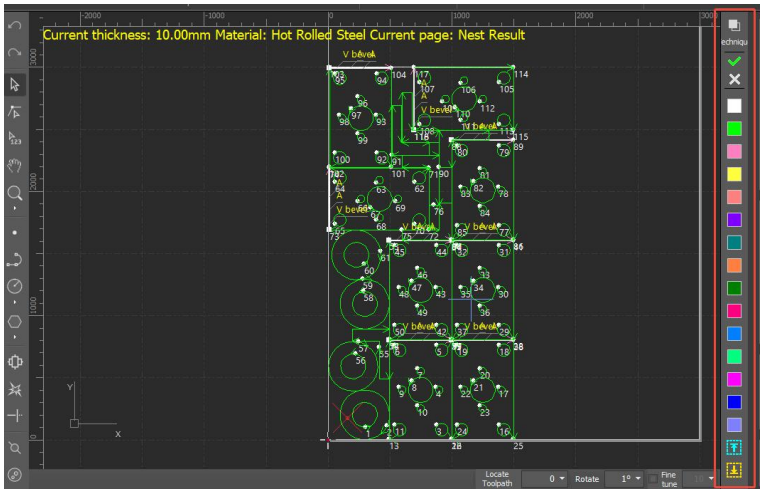


Figure 1-10 Technique layer setting

In ***Technique*** setting, you can either directly import parameters from the technique library or configure specific technique parameters for piercing, cutting, etc.

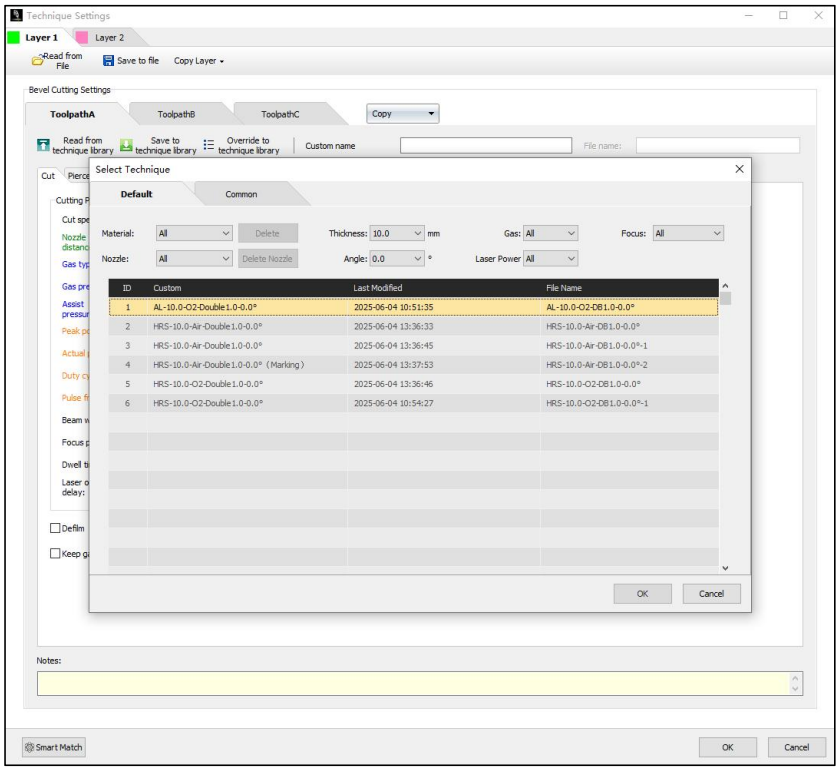


Figure 1-11 Read from technique library

Notice: In FACut, technique library parameters are stored based on ***Toolpath***, not ***Layer***.

1.3.5 Auxiliary Functions

The following list describes the auxiliary functions needed before and after actual cutting:

- Capacitive Find Edge: Before cutting, the system locates the edge of the plate to determine its tilt and adjusts the orientation of the geometry accordingly. This ensures parallel alignment between the part and the plate, improving material utilization and reducing the need for manual alignment.
- Capacitance Calibration: When following fails, an alarm is triggered, or the nozzle is replaced, the ***Capacitance Calibration*** module allows quick one-click calibration on the designated calibration plate.
- Detect Cutting: For bevel toolpaths, the system runs the toolpath once in following mode at a preset speed to collect data and compensate for plate deformation. If ***Realtime Plate Detection*** is enabled in global settings, this pre-run step can be skipped when processing fixed-pose bevel toolpaths.

1.3.6 Zero Point

Use the top-right area of the processing control panel to configure the ***Floating Coordinate System*** or ***Workpiece Coordinate System***. You can also use the drop-down menu next to ***Return Zero*** to access previously used zero points.

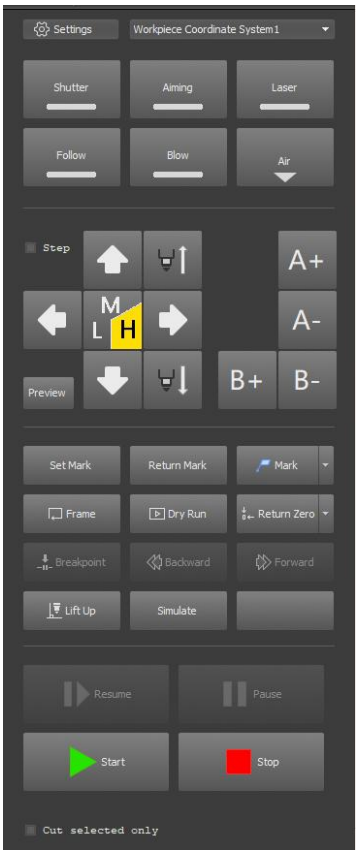


Figure 1-12 Processing control panel

1.3.7 Machining

Before machining, please confirm that the equipment is normal without alarm, and the drawings, techniques, zero points and auxiliary functions to be processed are correct. Also, you can reconfirm whether the drawings are within the boundary of the plate through ***Frame***, and observe the cutting sequence by ***Simulate***.

If there is obvious inclination of the whole plate or the area to be processed, you can enable ***Detect Cutting*** in ***Global Parameter***, and then click ***Start*** in the processing control panel to start processing.

Chapter 2 Graphic Operations

2.1 **Viewing Graphics**

2.1.1 Drawing File

FACut supports operations such as ***Open File***, ***New***, ***Save***, and ***Save As*** for drawing files. It also supports importing *.dxf and *.slp files. Additionally, the ***File*** drop-down menu provides quick access to recently opened files.

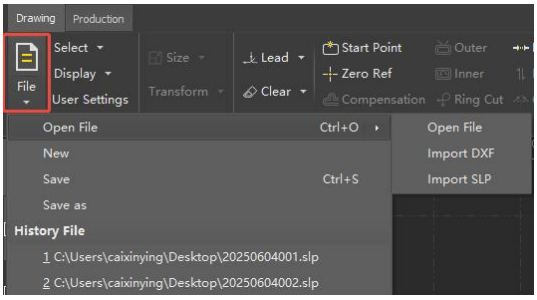


Figure 2-1 File

- Open File: Replaces the current file with the selected one and opens it directly.
- Import File: The imported drawing appears in a floating state following the cursor. Its reference point aligns with the preset snapping point in the software. Click anywhere in the interface to place the drawing into the current file without affecting existing content.

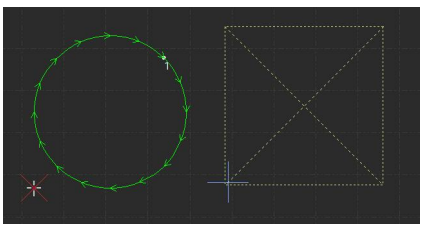


Figure 2-2 Import file - floating state

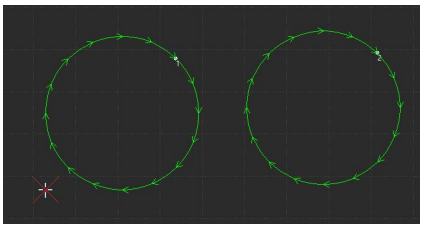


Figure 2-3 Import file - completed

2.1.2 Selecting Graphics

FACut provides various operations for selecting graphics. The most basic is ***click selection***, where single clicking a shape selects it directly. A more common method is ***box selection***, where dragging the mouse forms a semi-transparent box to select shapes.

There are two types of box selection:

- Left to right drag: Displays a solid blue rectangle. Only graphics fully enclosed in the rectangle will be selected.
- Right to left drag: Displays a dashed cyan rectangle. Any graphic that is partially or fully enclosed will be selected.

The diagram below illustrates both methods. In the left image (left to right), only B and C are selected. In the right image (right to left), A, B, C, and D are all selected. Flexible use of these two methods can improve selection efficiency. Flexible use of these two methods can improve selection efficiency.

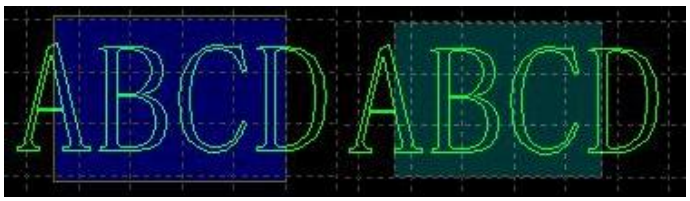


Figure 2-4 Box Selection Illustration

Regardless of whether ***click selection*** or ***box selection*** is used, holding the ***Shift*** key while selecting allows you to add new graphics without deselecting the current ones.

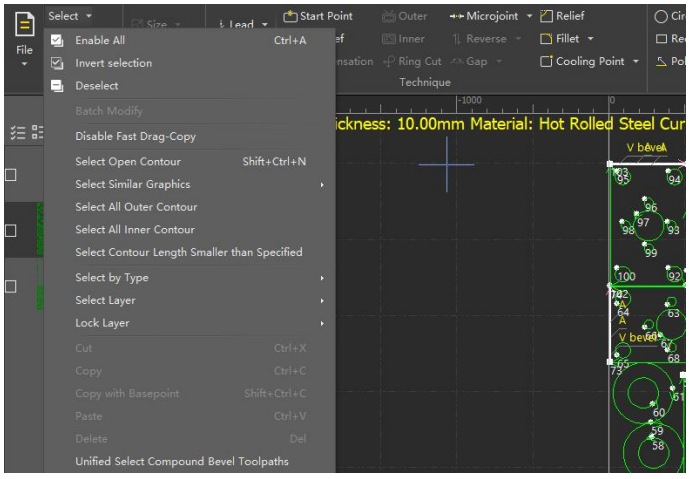


Figure 2-5 Select

In addition to the basic operations above, FACut also provides advanced selection options under ***Drawing → View → Select***, including:

- Basic Operations: ***Enable All***, ***Invert Selection***, ***Copy***, ***Paste***, ***Cut***, ***Delete***, ***Deselect***, and ***Copy with Basepoint***.
  - Deselect: Can also be done by clicking on a blank area of the drawing.
  - Copy with Basepoint: Allows you to define a reference point. When pasting, the shape will maintain the same relative position to the mouse as the basepoint has to the original geometry.
- Graphic Operations: ***Select Open Contour***, ***Select Similar Contour***, ***Select All Outer/Inner Contour***, ***Select Contour Length Smaller than Specified***, and ***Select by Type***.
  - Select Similar Contour: Supports filtering by layer or angle and selects all shapes that match the criteria.
  - Select by Type: Allows selecting all polylines, circles, or Bezier curves.
- Layer Operations: ***Select Layer*** and ***Lock Layer***.
  - Select Layer: Selects all graphics on the same layer.
  - Lock Layer: The background layer is locked by default. You can also lock marking or other layers as needed. Locked layers cannot be selected.
- Disable Fast Drag-Copy: Disables the operations such as drag, copy, or rotate the graphics. This will prevent the malposition of nested graphics.
- Unified Select Compound Bevel Toolpaths: For compound bevels, selecting one toolpath automatically selects all associated toolpaths.

- Batch Modify: Select a single graphic and click ***Batch Modify*** in the ***Select*** drop-down menu to open the ***Batch Modify*** window, where the modifications made to the very graphic will be applied to other similar ones. Supported operations include geometric transformation, applying part techniques, setting cutting techniques, beveling, sequencing, etc. Assigning layers and applying modifications to all nesting results are also supported.

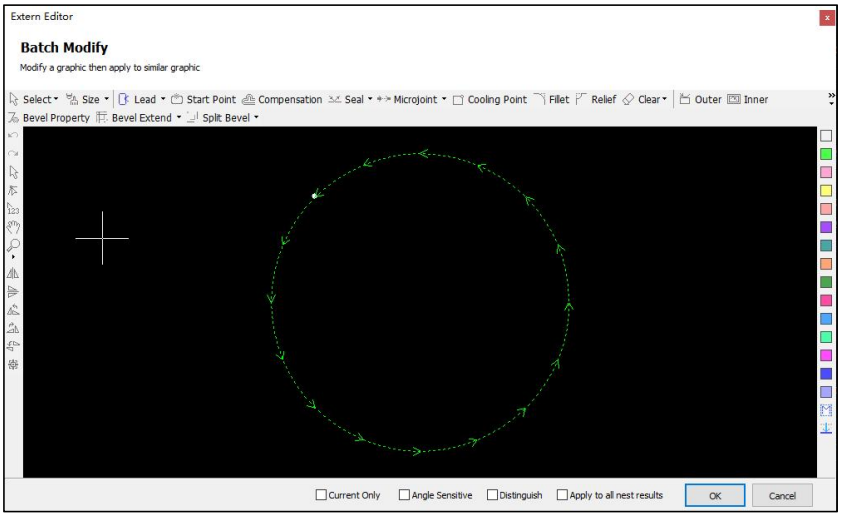


Figure 2-6 Batch Modify

2.1.3 Displaying Graphics

FACut offers a variety of display options under ***Drawing → View → Display***.

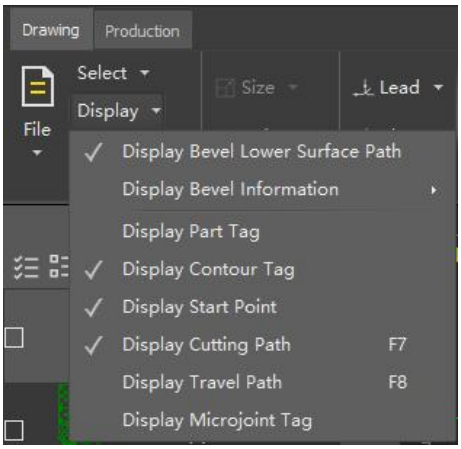


Figure 2-7 ***Display*** drop-down menu

Display features include:

- Display Bevel Lower Surface Path: Displays the bottom bevel paths as solid white lines.
- Display Bevel Information:
  - Display Bevel Type: For example, ***X bevel*** is shown in yellow text for X bevels.
  - Display Bevel Parameters: For example, ***X top 15° bottom 30°*** indicates bevel type and angles in yellow text.

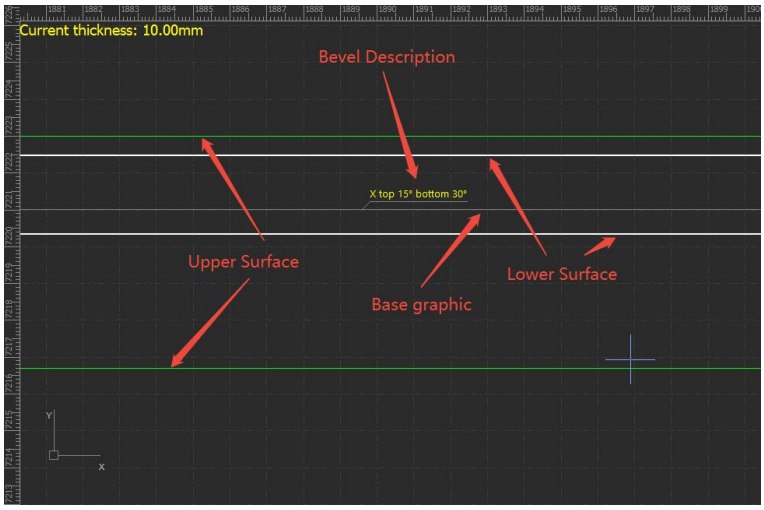


Figure 2-8 Bevel Display

- Custom Bevel Parameters: Opens the ***Custom Bevel Parameters Display*** window where you can define what information to show for each bevel type. Refer to the ***Parameter List*** and

preview diagrams to configure the ***Custom Information***.

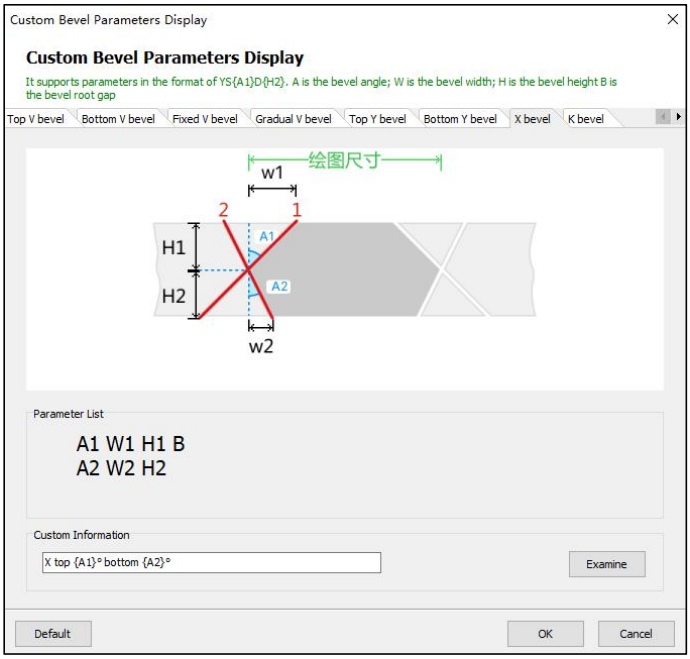


Figure 2-9 Custom bevel parameters display

- Display Part Number: Displays one serial number for each group if graphics are grouped.
- Display Contour Number: Displays a unique number for each shape within a group.
- Display Start Point: Displays as small white circles.
- Display Cutting Path: Displays as green arrows.
- Display Travel Path: Displays as yellow dashed arrows.
- Display MicroJoint Tag: Displays as small white box outlines, indicating where the path is intentionally interrupted.

2.2 User Settings

FACut allows configuring automatic optimization and drawing board parameters according to their personal usage habits.

When ***Auto Optimize*** settings are enabled, imported *.dxf and other external files will be automatically optimized based on the configured settings, including: ***Delete Invisible***, ***Delete Duplicates***, ***Join Nearest Lines***, and ***Auto Smooth***. ***Auto Sort***, ***Import Unit***, and ***Layer Mapping*** are also supported.

Notice: If ***Auto map layers in DXF file*** is not enabled, graphics imported with default layer settings will be automatically assigned to Layer 10.

Configuring ***Drawing*** parameters helps improve drawing efficiency. For example, FACut provides various auto attach features during drawing, such as attach to grid points, key points of graphics, or graphic boundaries. You can also enable ***Object Capture***, and the ***Capture Distance*** can also be defined.

You can also adjust ***Universal***, ***Nest***, ***Report***, and other settings based on ***Using Habit***, including settings such as remembering ***Find Edge Settings***, toolpath deformation and overlap checks.

When importing *.gen or *.nc0 files, you can also define parameters for ***Layer Mapping***, ***Auto Compensate***, and ***Drawing Rotation***.

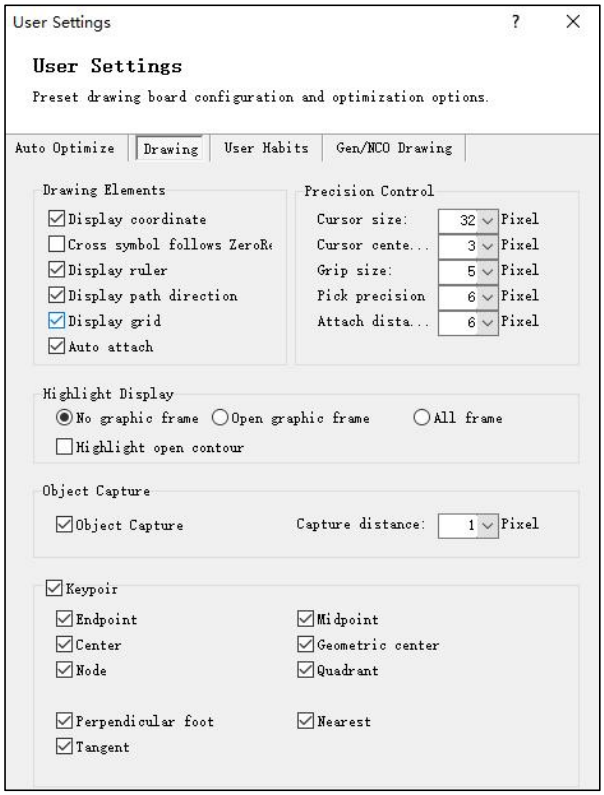


Figure 2-10 User settings

2.3 Geometry

2.3.1 Size

FACut offers seven quick dimension adjustment tools and supports dynamic zooming with specified base and reference length, accessible via the ***Size*** drop-down menu. Click ***Size*** or ***Modify Size*** in the drop-down menu to adjust the dimensions of the selected graphics.

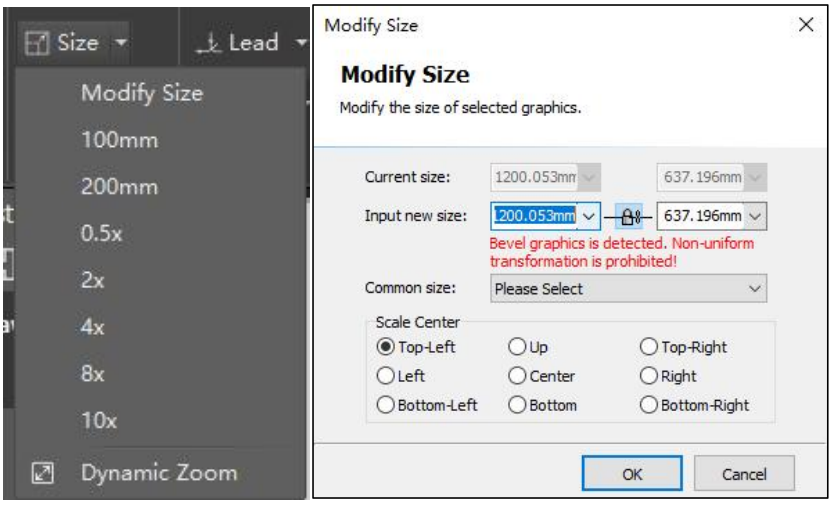


Figure 2-11 Modify size

When the lock icon appears as shown below, the width and height are scaled proportionally based on the original aspect ratio.

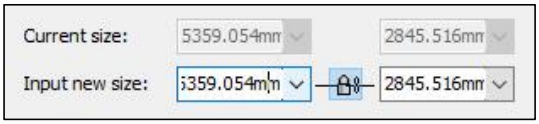


Figure 2-12 Lock uniform transformation

To set width and height independently, click the icon to unlock the proportions.

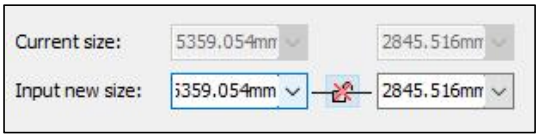


Figure 2-13 Unlock uniform transformation

Scale Center defines the alignment between the new and original graphics. For example, ***Top-Left*** indicate the graph in new scale at the top left of the original one.

Notice: Non-uniform transformation of bevel graphics is prohibited in FACut, as it may cause toolpath errors after bevel properties are set.

2.3.2 Geometry

Transform provides rich geometric transformation tools such as ***Translate***, ***Flip***, ***Rotate*** etc.

To use a transformation:

Step 1 Select the desired geometry.

Step 2 Choose the corresponding function in the ***Transform*** drop-down.

Step 3 Follow the prompts in the log & alarm panel.

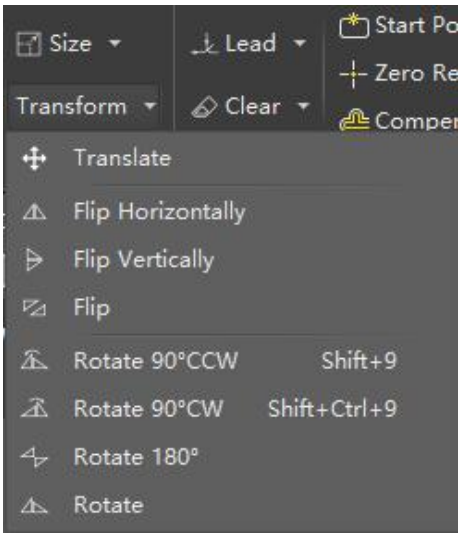


Figure 2-14 Geometry

Locate at the bottom-right corner of the CAD panel:

- Locate Toolpath: Enter a toolpath number to zoom into and locate the corresponding path directly.
- Rotate: After inputting a desired angle, select the geometry and press ***A/D*** to rotate counterclockwise/clockwise by the specified angle, or ***W/S*** to rotate in 90° increments.
- Fine Tune: Enable the checkbox next to ***Fine Tune***, enter a distance, select the geometry, and use arrow keys to move the graphic incrementally. Hold ***Ctrl*** + arrow keys to duplicate the selected geometry at the specified distance.

2.4 Drawing Graphics

2.4.1 Basic Drawing Tools

The quick-access toolbar on the left supports common shapes like isolated points, polylines, circle (full circle, three-point arc, sweep arc, and elliptical arc), and polygon (rectangle, rounded rectangle, polygon, and star). The top drawing toolbar provides more options including: circle (with option to ***Replace Circle with Dot***), standard part, rectangle (including obround and rounded rectangle, text, polyline (including polygon and star), and isolated point.

2.4.2 Text

FACut supports both text insertion and curve conversion: Click the text icon in the toolbar, then click on the CAD panel to insert text. The text will be selected automatically.

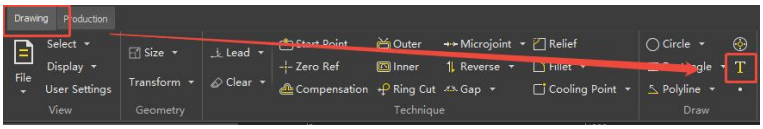


Figure 2-15 Text

When text is selected, the ***Text*** tab appears, where content, font, size, and style can be adjusted. As shown in the figure below:

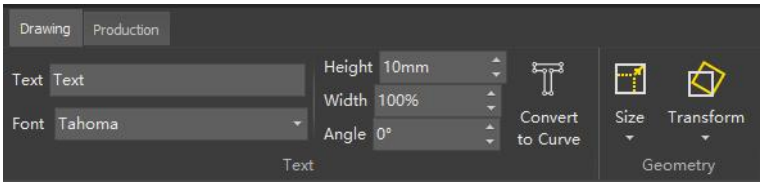


Figure 2-16 Text parameter settings

Click ***Convert to curve***, and you will see:

- Converts the text to vector shapes, making it independent from font files. Ensures consistent appearance across devices, even if the font is not installed.
- Prevents accidental changes to font, size, or style, preserving design integrity.

2.4.3 Standard Parts

FACut supports quick drawing of standard parts. Click the ***Standard Parts*** icon to open the standard parts library.

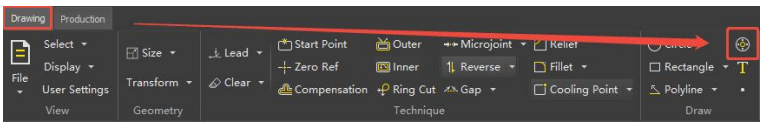


Figure 2-17 Standard parts

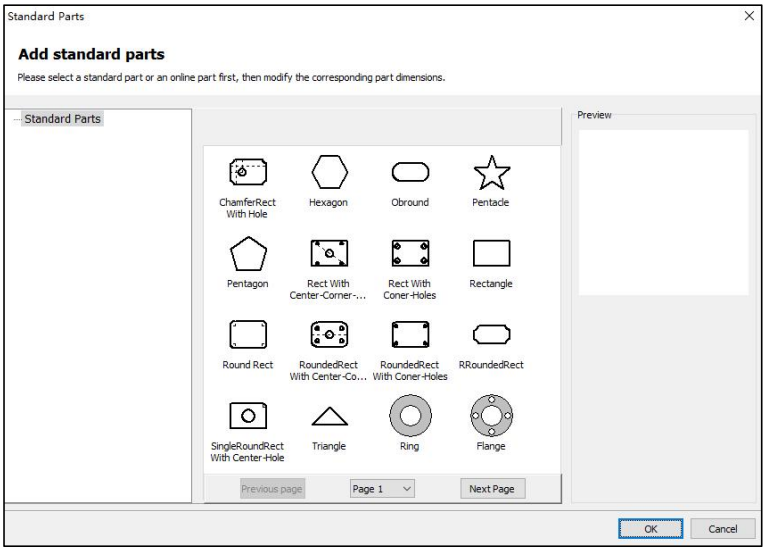


Figure 2-18 Standard parts library

Select the part shape then set the parameters. After selecting a part type, set the corresponding parameters in the secondary panel.

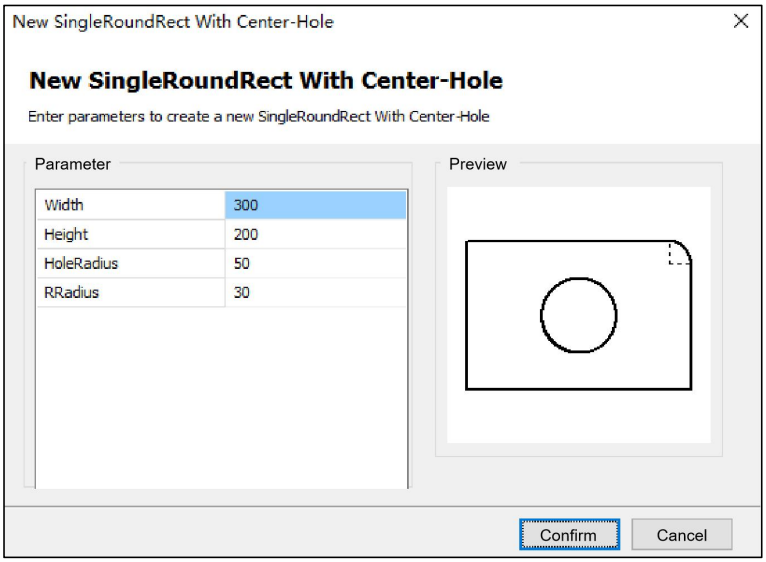


Figure 2-19 Standard parts parameter settings

2.4.4 Measure

FACut provides measuring tools for measuring the distance between two points.

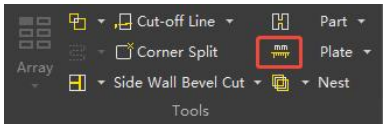


Figure 2-20 Measure icon

Click the measure icon and select a point on the drawing board then click another point, the log panel will show a position message between these 2 points.

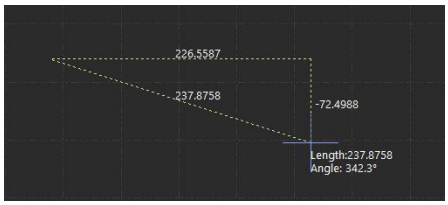


Figure 2-21 Measure

Right-click or press ***ESC*** to exit the measuring status.

2.4.5 Graphic Optimize

Imported graphics are automatically optimized by FACut. The behavior is defined in ***User Settings*** → ***Auto Optimization***.

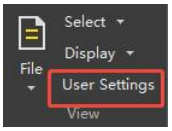


Figure 2-22 User settings

For manual optimization, use ***Graphic Optimize*** in the toolbar. Supported operations include ***Join Nearest Lines*** and ***Delete Invisible***.

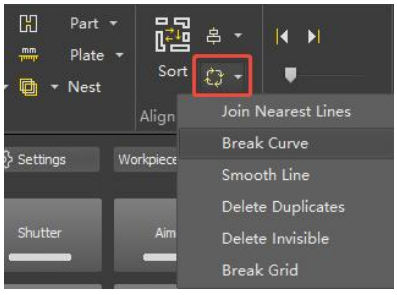


Figure 2-23 Graphic optimize

Notice: Graphic optimization applies to base drawings only and is different from ***Split***.

2.4.6 Align

FACut allows quick alignment of graphics. Select the target geometry, choose a desired alignment method from the ***Align*** drop-down, and multiple objects can be aligned simultaneously.

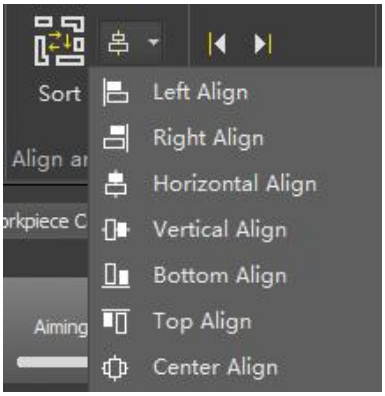


Figure 2-24 Align

2.4.7 Dished Head

FACut supports hole processing on dished (non-planar) surfaces, including head vertical holes, normal holes, and projection normal holes. Currently, this function requires a pre-drawn 2D top-view drawing.

Select the geometry where a dished head hole needs to be configured. Click ***Dished Head*** at the bottom of the left toolbar to enter the dished head editing interface. Guide elements such as longitude, latitude, and annotations will be automatically identified as non-cutting layers. Click ***Clear Mark*** to remove these auxiliary elements.

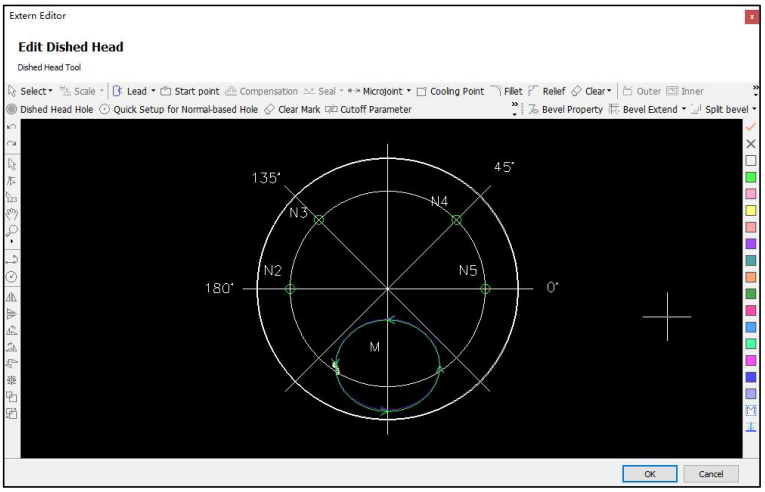


Figure 2-25 Dished head editing

Select the desired closed curve to be defined as a dished head hole. Click ***Dished Head Hole***. In the popup window, refer to the diagram and drawing labels to select the hole type, hole phase angle, and the spherical section angle. Click ***OK***, and a hole label will appear next to the corresponding curve in the editing window.

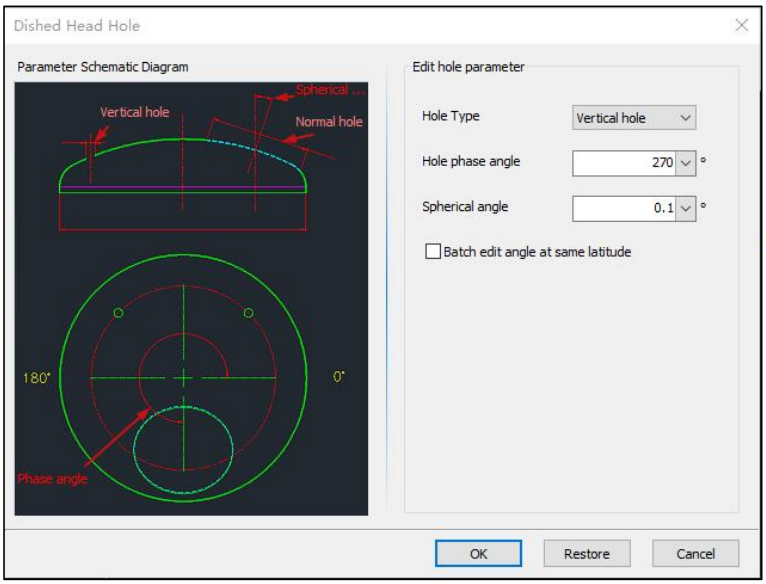


Figure 2-26 Dished Head Hole

If ***Batch edit the spherical section angle of dished head at the same latitude*** is checked, all circles located along the same latitude line will automatically share the same spherical section angle—saving repetitive operations.

Notice:

1. When setting normal holes, the 2D top-view must be replaced with a normal-view drawing.

2. If the dished surface is planar, projection normal hole can be used without converting the drawing from top-view to normal-view.

3. The starting point of each dished hole must lie on the central axis of the geometry.

4. Avoid clicking ***Clear Mark*** before completing the hole settings, as this may remove necessary reference lines.

5. Bevels can be added to dished holes. You can either adding bevels to the original graphics first, then assign dished hole attributes, or defining all dished holes first, then apply bevels. After a graphic has been assigned a dished hole property, it becomes grouped. You must ungroup it before applying bevels.

2.5 Bevel Settings

2.5.1 Bevel Property

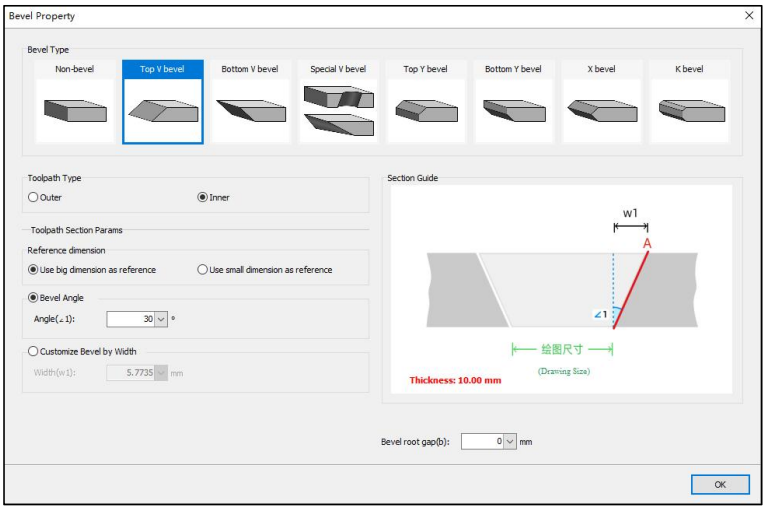


Figure 2-27 V bevel parameters

Select the graphics to be featured by bevel, click ***Bevel Property*** and set relevant parameters to add required bevels.

Before setting bevel parameters, confirm the toolpath type (inner or outer) of the part. Then determine the top/bottom bevels based on the reference diagram (the shaded area indicates the retained part of the workpiece).

For standard V bevels, set ***Angle ∠1*** and ***Reference Dimension***. Alternatively, you can ***Customize bevel by width***. The relationship between V bevel geometry and cross-section diagrams is illustrated below. ***Drawing Size*** refers to the size of the selected shape. Big/Small part size refers to the workpiece size for external cuts and to the sheet size for internal cuts.

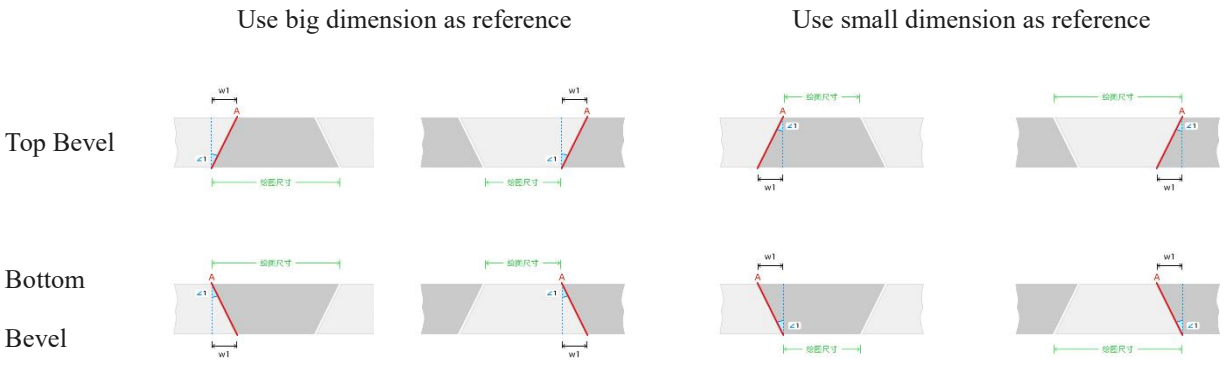


Figure 2-28 V bevel parameter and cross-section diagram

If the parts need to be intersected and welded with round or square tubes, please select ***Fixed V Bevel*** and set ***Bevel Angle*** and ***Phase Angle*** respectively in ***Special V Bevel***; if you need to process gradual bevel, please select ***Gradual V Bevel*** in ***Special V Bevel*** and set ***Start Angle*** and ***End Angle*** respectively.

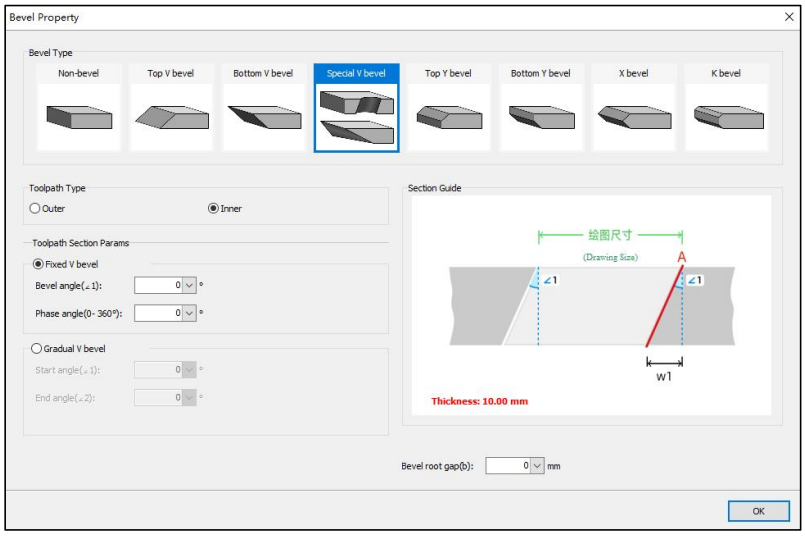


Figure 2-29 Fixed V bevel parameter

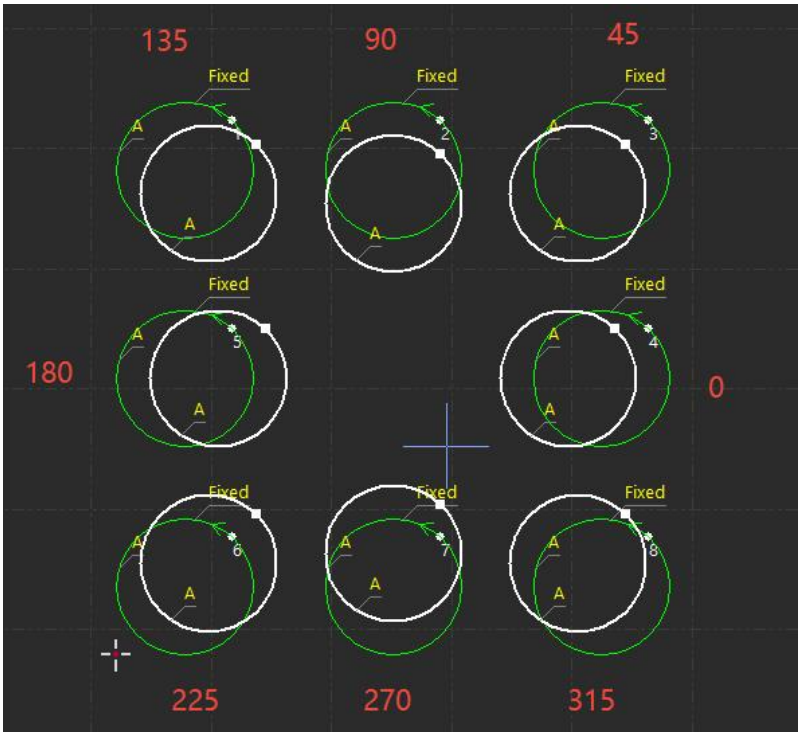


Figure 2-30 Fixed V bevel

The diagram shows how the top and bottom surfaces align relative to the phase angle.

Notice: Gradual bevel is for open toolpath only!

For Y bevel, three ***Toolpath Section Params*** combinations are supported: ***Use Bevel Angle + Width***, ***Use Bevel Angle + Land***, and ***Use Bevel Width + Land***. Depending on the selected combination, corresponding input fields will become available. Fill in the required values and click ***OK***.

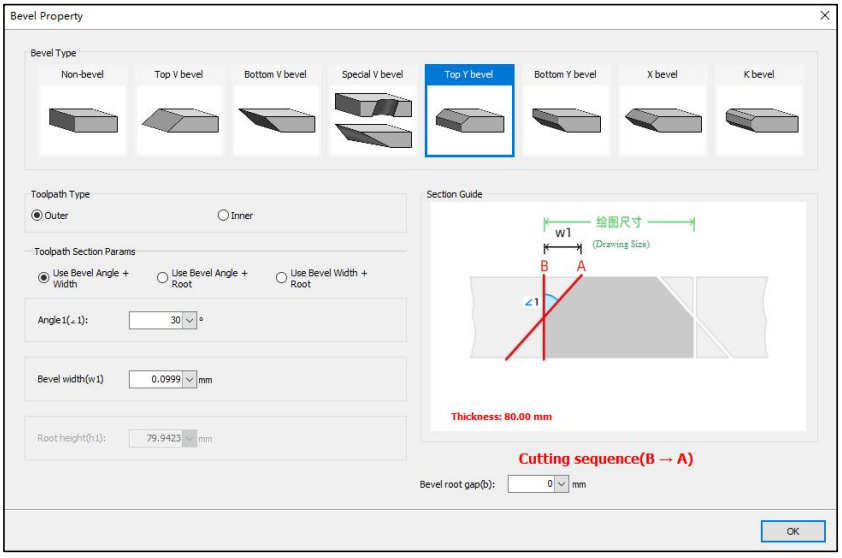


Figure 2-31 Y bevel parameters

For X bevel, three toolbath section param combinations are supported: ***Use Bevel Angle + Width***, ***Use Bevel Angle + Height***, and ***Use Bevel Width + Height***. Depending on the selected combination, corresponding input fields will become available. Fill in the required values and click ***OK***.

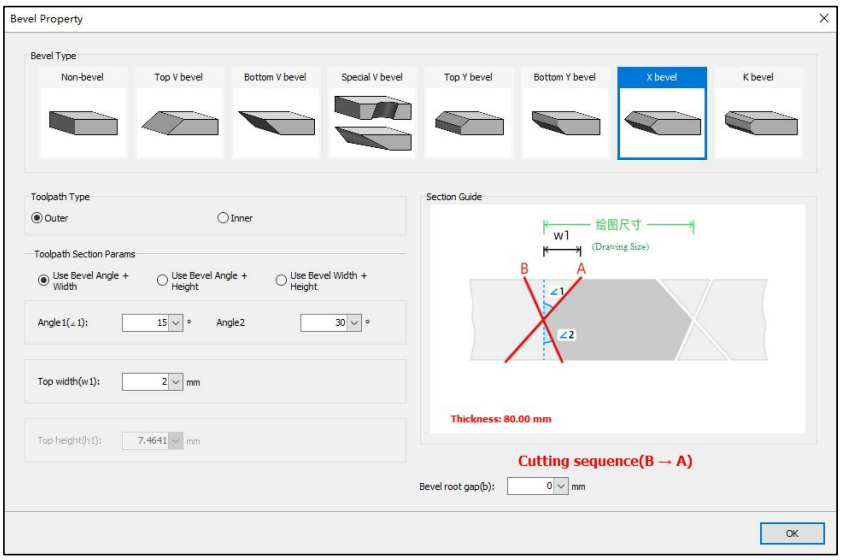


Figure 2-32 X bevel parameters

For K bevel, three toolbath section param combinations are supported: ***Use Bevel Angle + Width***, ***Use Bevel Angle + Height***, and ***Use Bevel Width + Height***. Depending on the selected combination, corresponding input fields will become available. FACut will automatically calculate the land height for K bevels. Enter the parameters as required and click ***OK***.

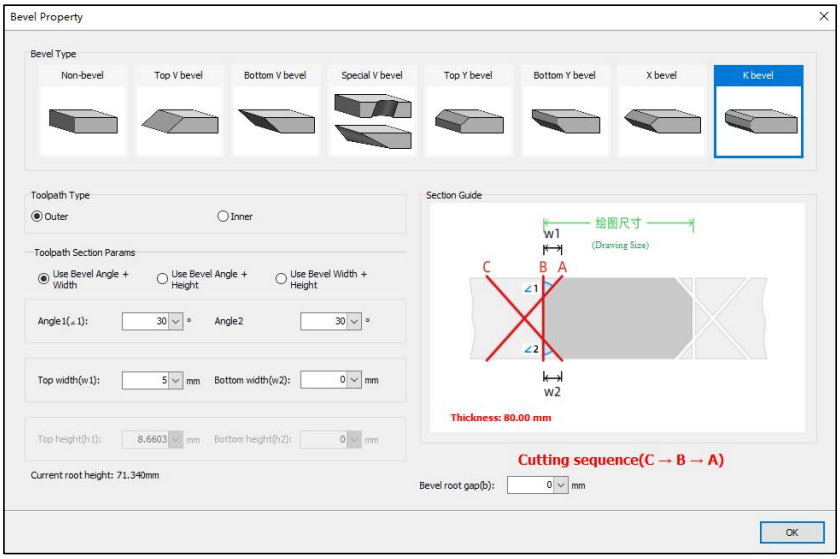


Figure 2-33 K bevel parameters

To improve weld penetration strength, FACut allows defining a ***Bevel Root Gap***. This ensures full contact between the molten weld and the workpiece, enabling full-penetration welding. This setting is located below the bevel cross-section diagram. Use this setting based on your process requirements.

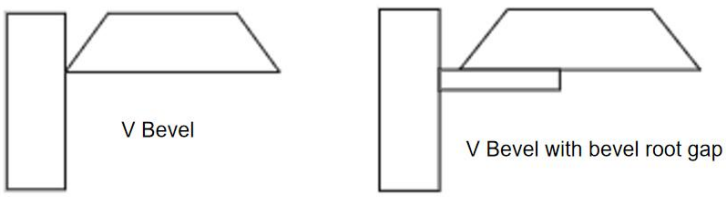


Figure 2-34 Diagram

If a specific cut order is needed, Y, X, and K bevels support ***Reverse Toolpath***. This setting is also located below the bevel cross-section diagram, and the cutting sequence is shown in red text. When enabled, the cut sequence will update accordingly and display in bold red text on the right. Use this setting based on your process requirements.

2.5.2 Create Special Bevel

FACut supports creating special bevels such as top-round bottom-square frustum, which is characterized by two curves with different shapes on the upper and lower surface. It is necessary to select two straight cutting path to-be-beveled before adding special bevel, then click ***Create Special Bevel*** in the drop-down menu of ***Bevel Property*** to enter its modification interface.

Once inside, the top and bottom cut paths will be assigned automatically. You can also click ***Switch upper and lower surfaces*** to modify.

If the path directions are inconsistent, a prompt will appear showing ***Upper and lower surface line directions are inconsistent***. Select a curve and click ***Reverse*** to fix.

Click ***Edit normal vector*** and set the ***Normal vector density*** to visualize corresponding points between top and bottom surfaces.

FACut can simulate the cutting process to verify if the bevel angle exceeds machine limits. If exceeded, an error ***Mechanical motion range exceeds soft limit*** will be triggered. In this case, reposition the start points so their connecting line points to the geometry's center, as shown below:

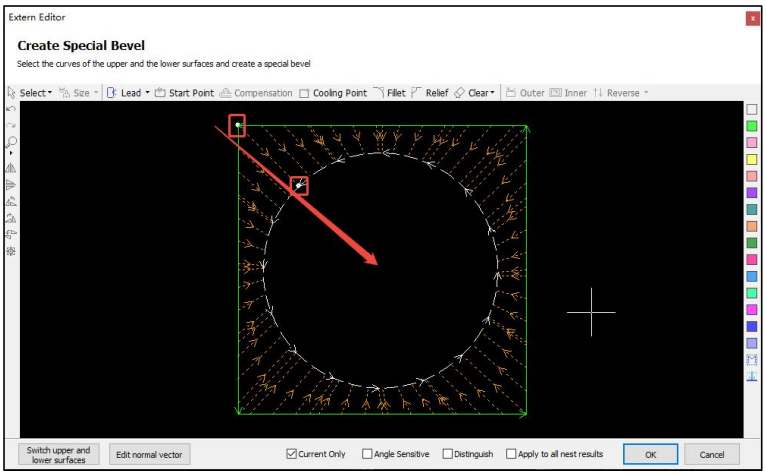


Figure 2-35 Special bevel normal vector

To apply a special bevel to multiple shape pairs, uncheck ***Current Only***. If only the angle varies, enable ***Angle Sensitive*** for batch processing. Layer-specific settings can be achieved by enable ***Distinguish Layer***, and special bevel can ***Apply to all nest results***.

To modify an existing special bevel, select the shape and click ***Create Special Bevel*** again to re-enter the edit interface. To revert it to its original geometry, click ***Reset Special Bevel*** in the drop-down menu.

Notice: To create a sample top-round bottom-square frustum, you can draw a 100×100 square, then draw a similar-sized circle inside. Select both and use ***Center Align***. After entering the bevel interface, align path directions, and make sure start points face the same way.

2.5.3 Set Blind Bevel

FACut's blind bevel feature enables parametric configuration of multiple adjacent straight/beveled segments on a single contour. This allows the machine to start cutting bevel at any position along the path. The system will automatically generate transition lines between adjacent bevel and straight segments.

Select the desired contour, then go to ***Drawing → Bevel → Bevel Property***, and choose ***Set Blind Bevel*** from the drop-down menu to open the blind bevel setting window.

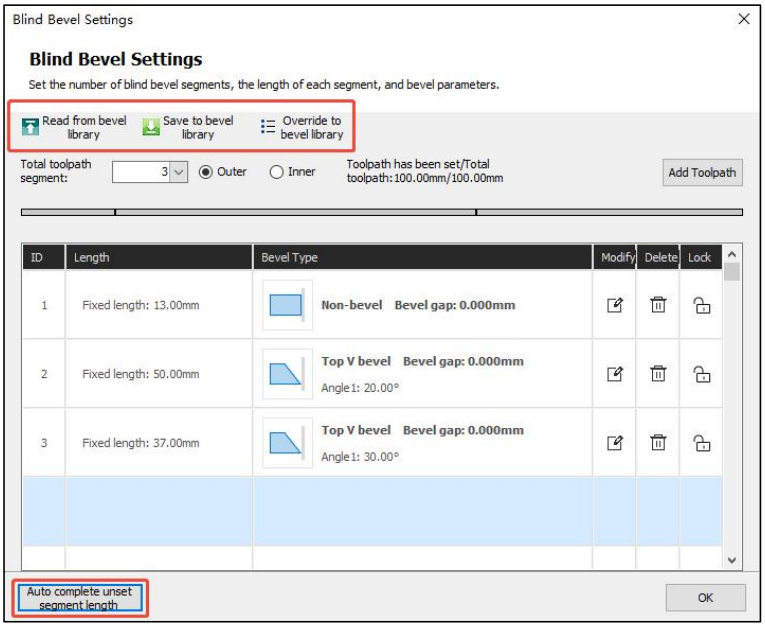


Figure 2-36 Blind Bevel Settings

You can define the ***Total toolpath segment***, and configure the bevel type for each segment in the table below. Click ***Add Toolpath*** to insert a new segment (length defaults to 0) at the end of the current segment group. When only one unconfigured segment remains, click ***Auto complete unset segment length*** to automatically assign the remaining length to fill the entire contour.

Currently, blind bevel only supports straight cuts and V bevels, with optional root gap for V bevels. You can apply the same blind bevel configuration to multiple segments of identical length. When a segment is locked, it turns gray and both its length and bevel attributes become non-editable.

Segments are ordered from start to end of the contour. To reverse the segment order, select ***Reverse***

Blind Bevel Toolpath from the ***Bevel Proverty*** drop-down.

FACut allows saving frequently used blind bevel settings:

- Save to bevel library: Save current blind bevel settings (name and thickness required). Saved parameters include: thickness, total length, number of segments, segment lengths, and bevel parameters per segment.
- Override to bevel library: Overrides the currently set blind bevel parameter to an existing parameter in the bevel library. Name and thickness remain unchanged; all other parameters are replaced.
- Read from bevel library: Select a set of parameters and click ***Read Parameters***, current blind bevel parameters will be refreshed to the selected parameters.

Click ***Insert to the end*** to append the selected parameter set to the current list. If the total length differs from the current contour, each segment length is scaled proportionally. For locked segments, the total length remain unchanged. When inserted to the end, all inserted segment lengths remain unchanged, regardless of lock status.

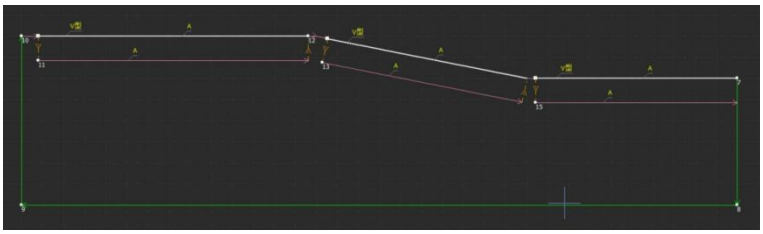


Figure 2-37 Manual blind bevel

FACut also supports manually creating blind bevel transition lines.

Workflow:

Step 1 Apply standard bevels to each segment of the contour. For full-penetration welds, remember to set root gap.

Step 2 Navigate to ***Drawing → Bevel → Manual Blind Bevel*** (or select ***Manual Set Blind Bevel*** from dropdown).

Step 3 Click on two adjacent segments, and a transition line will be automatically generated between their start and end points.

Step 4 Right-click or press ***Esc*** to exit manual blind bevel mode after finishing.

If you wish to remove blind bevels:

Step 1 Using ***Reset Toolpath*** will reset all bevels on the part, including non-blind bevels.

Step 2 Instead, use ***Manual Clear Blind Bevel*** from the ***Manual Blind Bevel*** drop-down.

Step 3 Click on the desired contour to revert the entire blind bevel segment to a straight cut.

Notice:

1. When manually creating blind bevels, follow the contour direction when selecting segments.
2. To remove a blind bevel, you must select and reset the entire blind bevel path in one go.
3. Manual blind bevel can only be applied to paths without ***Bevel Extend***.
4. For one path cutting contours, do not manually add a blind bevel transition line after splitting/breaking the tool path and setting the bevel separately.

2.5.4 Toolpath Split

Using a closed rectangle as an example, if a bevel is applied directly to the entire part, all toolpaths are treated as a single cut completed in one pierce, and the corners are processed using pre-adjusted normal vector transitions.

When one path cutting bevels do not provide sufficient process stability or when higher cutting quality is required, use the ***Drawing → Extend*** toolbar to apply either ***Auto Split*** or ***Manual Break***. ***Auto Split*** automatically adds split points at corner nodes of the part. ***Manual Break*** allows manually add split points along continuous toolpaths.

Please note that the original graphics remains intact after split/break and exhibits the following characteristics:

- Drag operation is only validated for whole part.
- Different bevel properties and layer can be set for different cutting paths.
- Attributes of a single toolpath are determined with respect to the entire part geometry.
- For corners with large angles, one path cutting may suffice to meet tolerance and quality requirements. Considering this, FACut also supports custom ***Auto Split Params***.

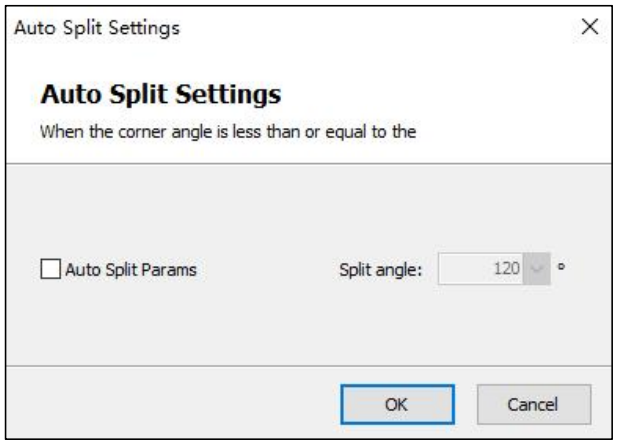


Figure 2-38 Auto split params setting

- Open the ***Auto Split*** drop-down and select ***Auto Split Params***, then the ***Auto Split Params Setting*** window will pop up.
- Check ***Enable Auto Break Params*** and set the split angle. When the corner is less than or equal to the split angle, the graphic will be automatically split, otherwise, it remains one path cutting.

The concave angle is not split.

- This feature is disabled by default, and supports parameter memory (default threshold: 120°).

➢ If previously split toolpaths need to be recombined, use ***Merge Toolpath*** of the ***Extend*** toolbar. Hold ***Shift*** to select multiple toolpaths. To restore the geometry to its original state, use ***Reset Toolpath*** from the ***Merge Toolpath*** drop-down. This will also reset any added techniques, layers, and features associated with the geometry.

2.5.5 Bevel Extend

After a bevel is applied, the resulting toolpath is generally closed to ensure part integrity. However, in some complex cases or after compensation adjustments, the cutting path may become non-closed.

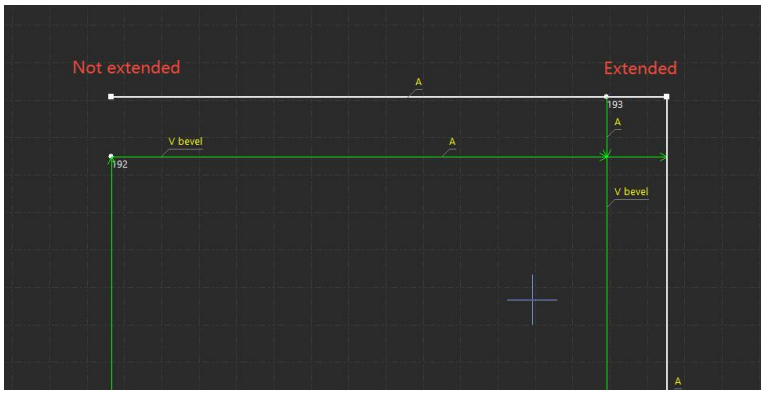


Figure 2-39 Bevel extend

To address this, select the two unconnected toolpath ends, then click ***Bevel Extend*** in the ***Extend*** toolbar to restore path continuity. The ***Bevel Extension*** drop-down offers the following modes:

➢ Manual Extend: Select specific edges to extend.

➢ Auto Extend: Automatically extends all bevels in the selected geometry.

➢ General Extend: Automatically extends all eligible bevels in the current view.

To remove previously applied bevel extensions, select the geometry and click ***Cancel Bevel Extend*** from the drop-down.

Additionally, enable ***Auto Extend After Compensation*** to automatically re-extend corner edges after bevel compensation is applied.

Chapter 3 Technique Settings

This section introduces the technique settings available in FACut. Since most parameters are directly related to factors such as material properties, laser source, and gas pressure, please configure these parameters according to your actual processing requirements. All parameters mentioned in this section—including those shown in images—are for demonstration purposes only and should not be considered as process recommendations.

Caution: Improper or incorrect parameter settings may degrade cutting quality or even damage the machine. Proceed with caution.

3.1 Leadline

3.1.1 Identify Inner/Outer Contour

When importing external files (e.g., *.dxf), FACut will automatically distinguish between inner and outer contours. If any edits are made to the path that change the contour relationship, click ***Sort*** (any sorting method will re-analyze the contours), or click the drop-down arrow next to ***Lead***, and select ***Identify Inner/Outer Contour***.

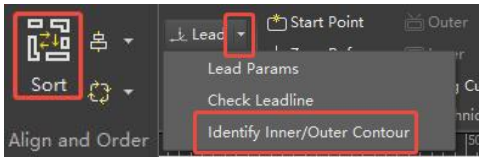


Figure 3-1 ***Sort*** and ***Identify Inner/Outer Contour***

FACut distinguishes contours based on containment relationships: The outermost closed shape is treated as an outer contour (outside cut). The next enclosed shape becomes an inner contour (inside cut), and so on, alternating layer by layer. Open contours cannot be recognized as valid layers.

When adding leadlines, leadlines for outer contour starts from outside, while from inside for inner contour. To manually define cutting direction: select the geometry, then click ***Outer*** or ***Inner*** accordingly.

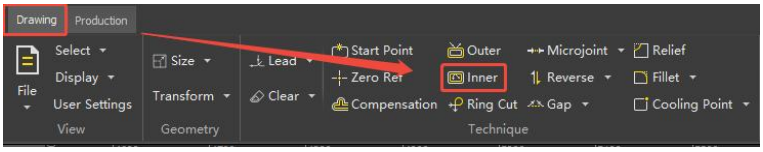


Figure 3-2 Inner

3.1.2 Auto Leadline

Select the graphic to be set leadline, and click ***Lead*** in the top toolbar. In the pop-up window, configure the following parameters:

Figure 3-3 Lead

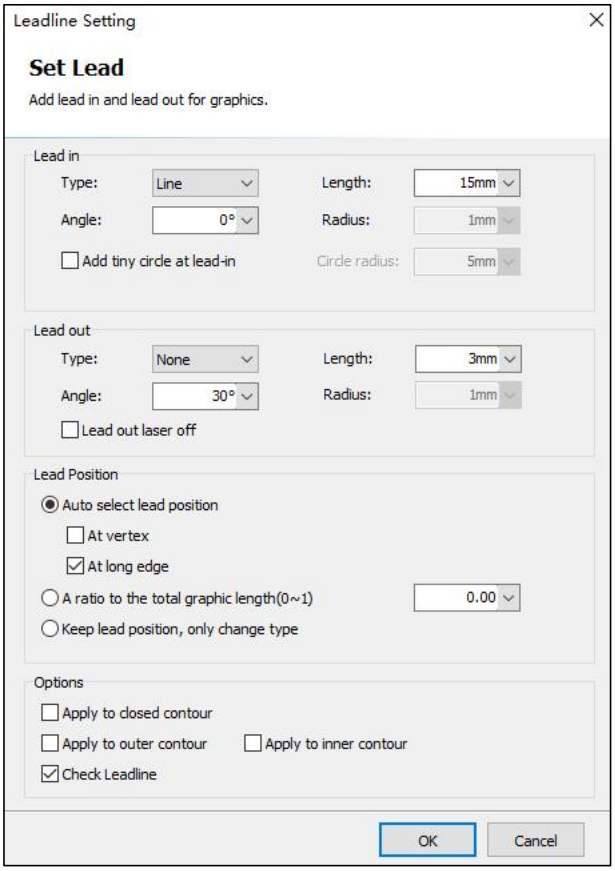


Figure 3-4 Leadline setting

The supported lead type include ***Arc***, ***Line***, and ***Arc + Line***. The supported parameters include ***Type***, ***Angle***, ***Length***, and ***Radius***. You can also add small hole at leadline start point.

Notice: FACut will automatically choose an appropriate lead-in position based on preferred part tip or preferred long edge, as previously defined. Any existing lead-in settings on the geometry (position/type) will be overwritten. If a fixed lead-in position is required, select options such as ***A ratio to the total graphic length(0~1)*** or ***Keep lead position, only change type***.

3.1.3 Manual Leadline

Click ***Start Point*** to change the lead-in line manually. Click a point on the graphic to change the lead-in location, while keeping the angle and length unchanged.

Figure 3-5 Start point

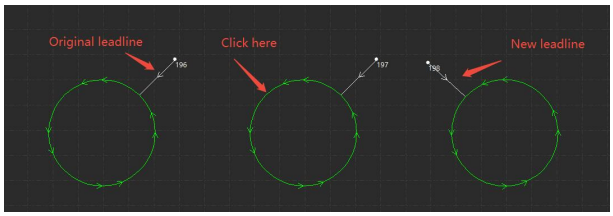


Figure 3-6 Change lead-in line position

Click point A outside the part, then click point B on the contour. FACut will draw a straight-line lead-in from A to B.

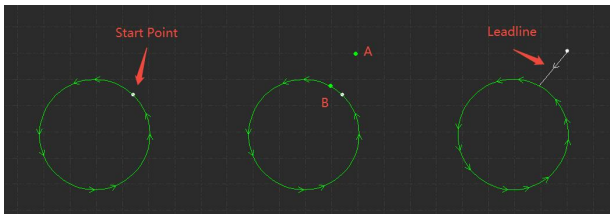


Figure 3-7 Manual leadline

3.1.4 Check Leadline

Click ***Lead*** drop-down menu and select ***Check Leadline***. This function will examine all leadline and automatically shorten overly long leads to prevent interference or crossover with other parts. Click ***Identify Inner/Outer Contour*** to re-determine leadline positions based on current inner/outer contours.

Notice: In certain toolpath split scenarios, toolpaths are designed to intentionally intersect (interfere). Such interference may be normal and expected.

3.2 Kerf Compensation

To apply kerf compensation, select the desired geometry and click ***Compensation*** on the toolbar. After configuring the compensation parameters in the pop-up window, click ***OK*** to apply.

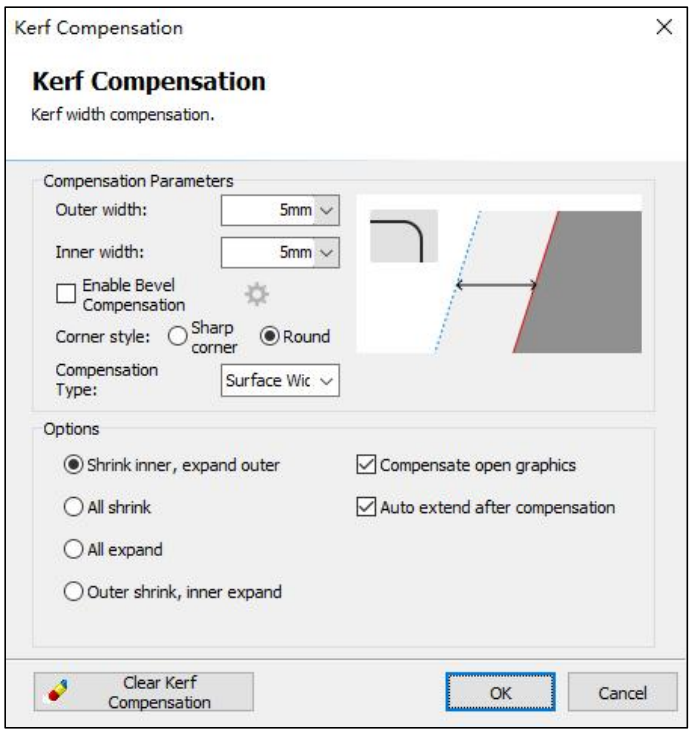


Figure 3-8 Compensation parameter

The kerf width should be measured based on actual cutting results. After compensation, the new toolpath will be displayed in green on the CAD panel and used during cutting. The original geometry will not be cut—it is only shown for reference.

The kerf compensation can be manually set as ***All shrink*** or ***All expand***. Or, it can be automatically determined based on the cut type: ***Inner shrink, expand outer***/***Outer shrink, inner expand***. You can also choose the corner transition type between fillet and sharp corners, as shown in the figure below:

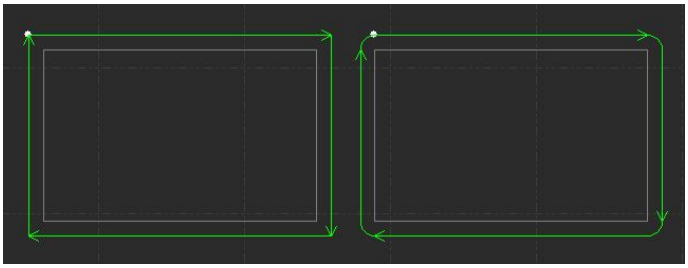


Figure 3-9 Kerf compensation corner

In the image, white cutting path is the original one and green is the compensated. It can be seen that

the compensation on both sides of the vertical line can ensure that the side of cutting path coincides with the original trajectory, but the corner needs transition. Fillet transitions typically ensure smoother paths and better alignment with original edges, especially at corners.

FACut supports two ***Compensation Type***:

- Kerf Width: Compensation width is measured along the laser beam direction.
- Surface Width: Compensation width is measured along the surface of the sheet.

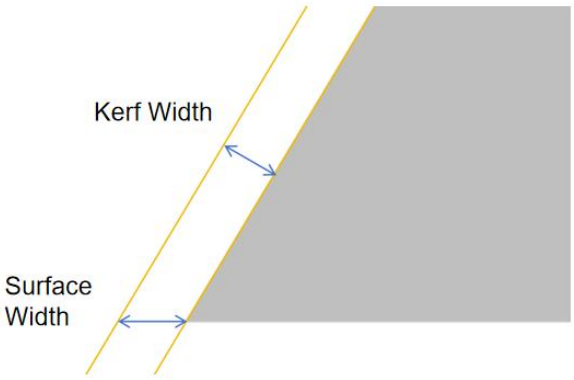


Figure 3-10 Compensation type

To cancel ***Compensation***, please select the figures first, then navigate to the drop-down menu of ***Clear*** and click ***Clear Compensation***; Or directly click the ***Clear Compensation*** in the compensation setting window.

3.2.1 Bevel Compensation

Check ***Enable Bevel Compensation*** in the compensation window, click the right gear icon to configure compensation values based on bevel type, angle, etc. Bevel compensation parameters can be saved and read as independent files, and the system automatically detects overlapping angle ranges.

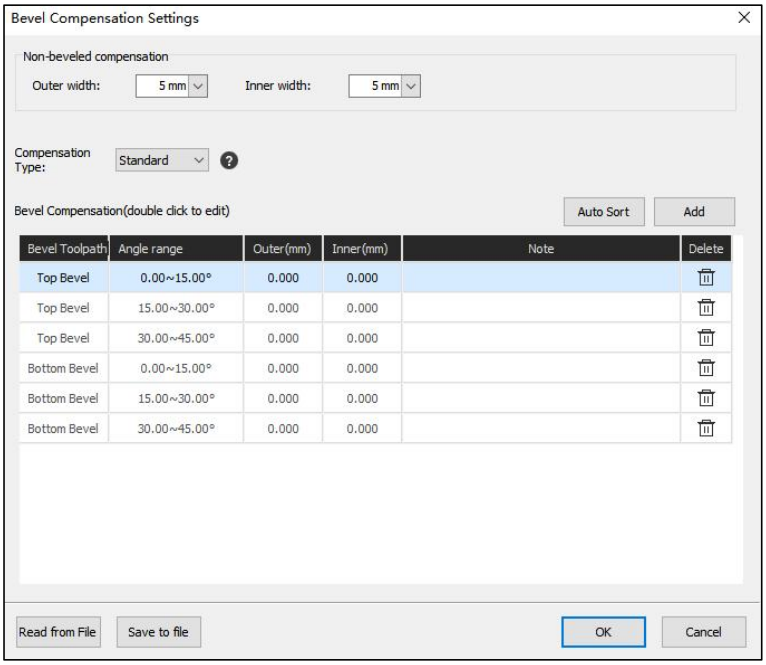


Figure 3-11 Bevel compensation settings

Two compensation modes are available:

- Standard: Matches values based on top/bottom bevel and angle range, regardless of bevel type.
- Fine: Further distinguishes bevel types (V/Y/X/K), matches values using bevel type, top/bottom, and angle range.

This interface also supports setting straight-cut compensation. For undefined angles in the table, default straight-cut parameters will be applied.

3.3 Ring Cut

Click ***Ring Cut*** on the toolbar after selecting the geometry to improve sharp corner cutting performance.

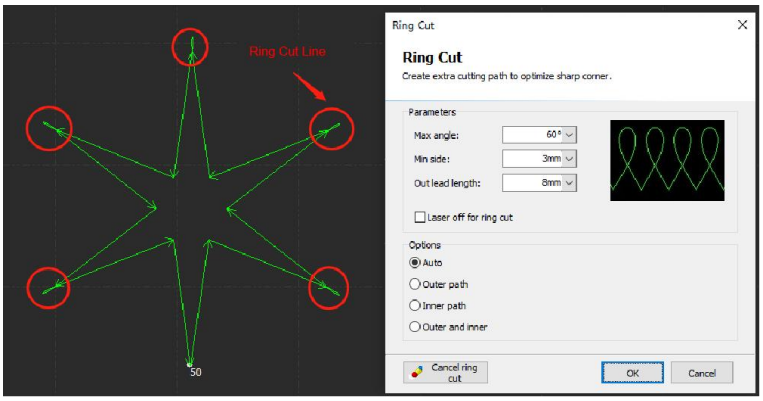


Figure 3-12 Ring cut

3.4 Microjoint

Microjoint insert uncut segments along the path to prevent part lifting after cutting. The laser turns off at the microjoints. Visually, a micro joint appears as a gap, optionally with a white frame if ***Display Microjoint Tag*** is enabled.

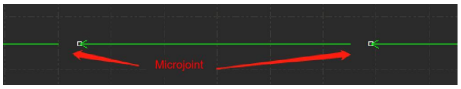


Figure 3-13 Microjoint

Click ***Microjoint*** and then click the desired position on the contour to insert. You can continue adding multiple joints until pressing ***ESC*** or switching tools. Microjoints can be added even after compensation.

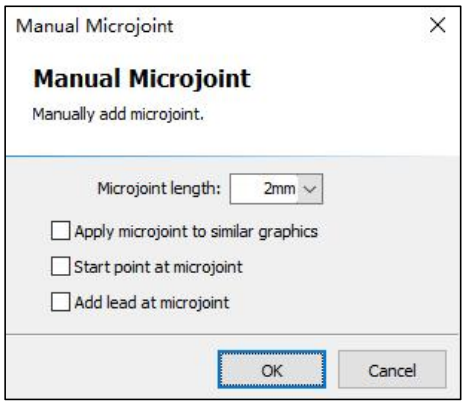


Figure 3-14 Manual microjoint

When adding microjoints manually on graphics for the first time after clicking ***Microjoint***, it is necessary to set ***Microjoint Length*** in the pop-up window, and you can also ***Apply microjoint to similar graphics***, ***Change start point to microjoint***, and ***Add lead at microjoint***. In addition, you can also modify microjoint length by clicking ***Modify Microjoint*** in its drop-down menu, and the value will be validated on the microjoints added later.

Moreover, it is possible to apply ***Auto Microjoint***. Click ***Auto MicroJoint*** in the drop-down menu, set the parameters in the pop-up dialog, and then click ***OK*** to get it started. There are two patterns of adding microjoint: by total number or by interval. For example, you can choose to add 10 microjoints to each figure, or add microjoint to part geometry every 100 mm interval.

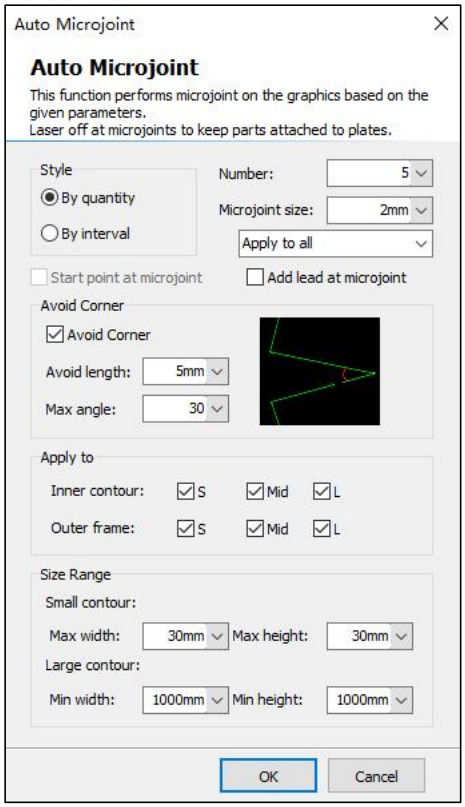


Figure 3-15 Auto microjoint

3.5 Gap

These four options ***Seal***, ***Gap***, ***Over-Cut***, and ***Multi-Cut*** are integrated in the drop-down menu of ***Gap***. Select graphic and click the target function.

A closed shape by default is sealed, which means the start and end point converge at a same point; ***Gap*** means the start and end point doesn't join together with a gap in between, while ***Over-Cut*** is to add an extra path at end point. ***Multi-Cut*** means repeating cut along the same pass for target times.

Click ***Gap***/***Over-Cut*** tab to pop up the ***Gap/Over-Cut Settings***, and click ***Multi-Cut*** to pop up the cutting counts settings. The setting of ***Gap/Over-Cut*** size is only valid for those to-be-set later, not the ones have been set before.

3.6 Relief/Fillet

Click ***Relief*** to create a release notch for bending process.

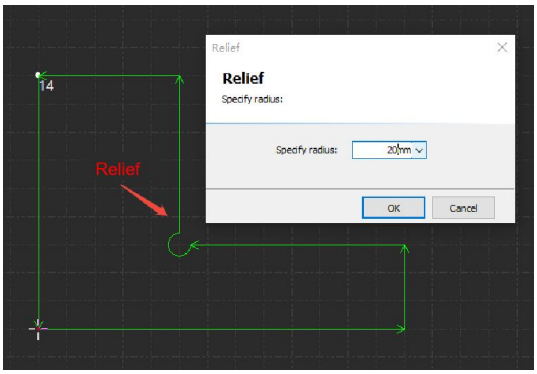


Figure 3-16 Release

Click ***Fillet*** to open the fillet setting dialog. Select type and size, then click target corners to apply.

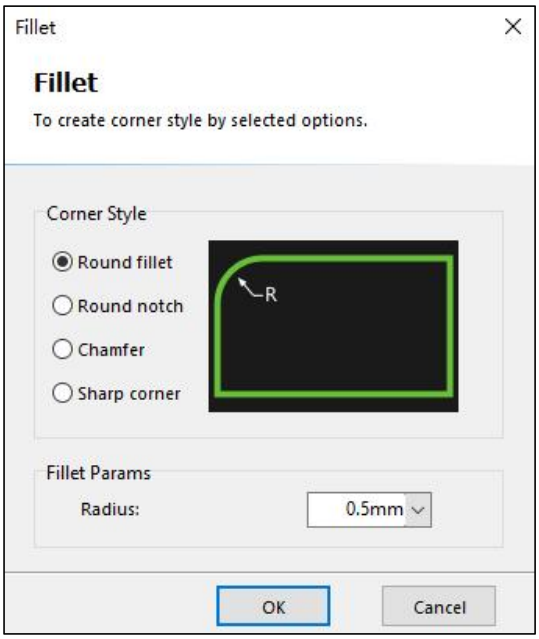


Figure 3-17 Fillet

Use ***Fillet All*** in the drop-down menu of ***Fillet*** to auto-apply chamfer to all eligible corners in selected contours.

3.7 Cooling Point

Click ***Cooling Point*** in the top toolbar and click desired positions on the contour. During cutting, the laser will pause at these points, stop firing, and delay while blowing air, then resume the cutting. The delay can be set in ***Global Parameter*** → ***Gas Parameter*** → ***Cooling Delay***. Cooling points are displayed on the CAD panel as solid white dots, as shown below:

Figure 3-18 Cooling point

Multiple cooling points can be inserted continuously. Still available after micro joint or compensation.

FACut also supports ***Auto Cooling Point***. Click ***Auto Cooling Point*** in the drop-down menu, set the parameters in the pop-up dialog, and click ***OK*** to apply. Cooling points can be automatically added at lead-in points and sharp corners. If added at the end of a lead-in, the cooling point becomes part of the lead-in, not an independent cooling point. It will move or be deleted along with the start point and cannot be removed using the ***Clear Cooling Point*** function.

To delete cooling points, you can hold ***Shift*** and click them. If you want to delete all cooling points, select the graphic, and select ***Clear Cooling Point*** in the drop-down of ***Clear*** to delete all cooling points already set.

Cooling points are commonly used in corner processing. They help by pausing the cut and activating air blowing to cool the area, which prevents corner burning.

3.8 Technique Mark

Click ***Technique Mark*** in the lower left toolbar.

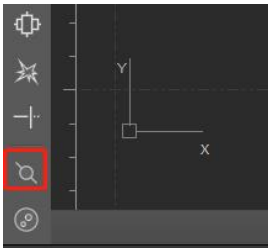


Figure 3-19 Technique mark

In the ***Add Technique Mark*** dialog that appears, configure the mark ID, the effective segment of the technique, and relevant parameters. Click ***OK***, then click the desired position on the path where you want to apply a specific technique. A technique mark point will be added.

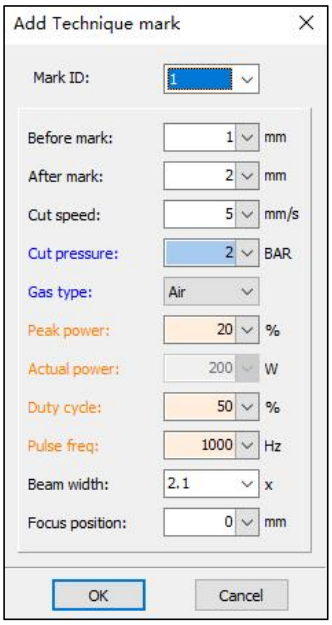


Figure 3-20 Add technique mark

It will be displayed as a yellow point in drawing board, labeled with their ID as shown below:

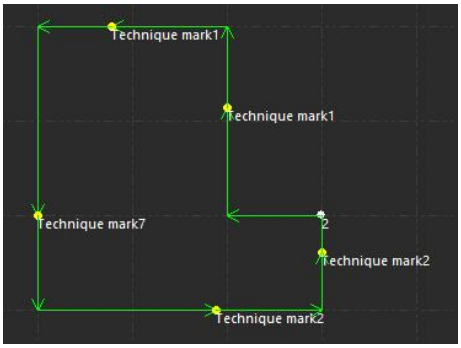


Figure 3-21 Technique mark

During processing, the system will apply the corresponding technique settings within the path segment defined by the technique marks.

FACut supports adding up to nine different types of technique marks.

- To modify a technique associated with a mark point, select its ID in the ***Add Technique Mark*** dialog and update the parameters.
- To delete a technique mark point, enter the technique mark setting mode, hold ***Shift***, and click the point to remove it.

3.9 Technique Settings

FACut provides 17 layers in total, among which layer 0 is the unprocessed layer. Each of the remaining layers can be configured independently with technique parameters such as cutting speed, laser power, gas pressure, nozzle distance, etc.

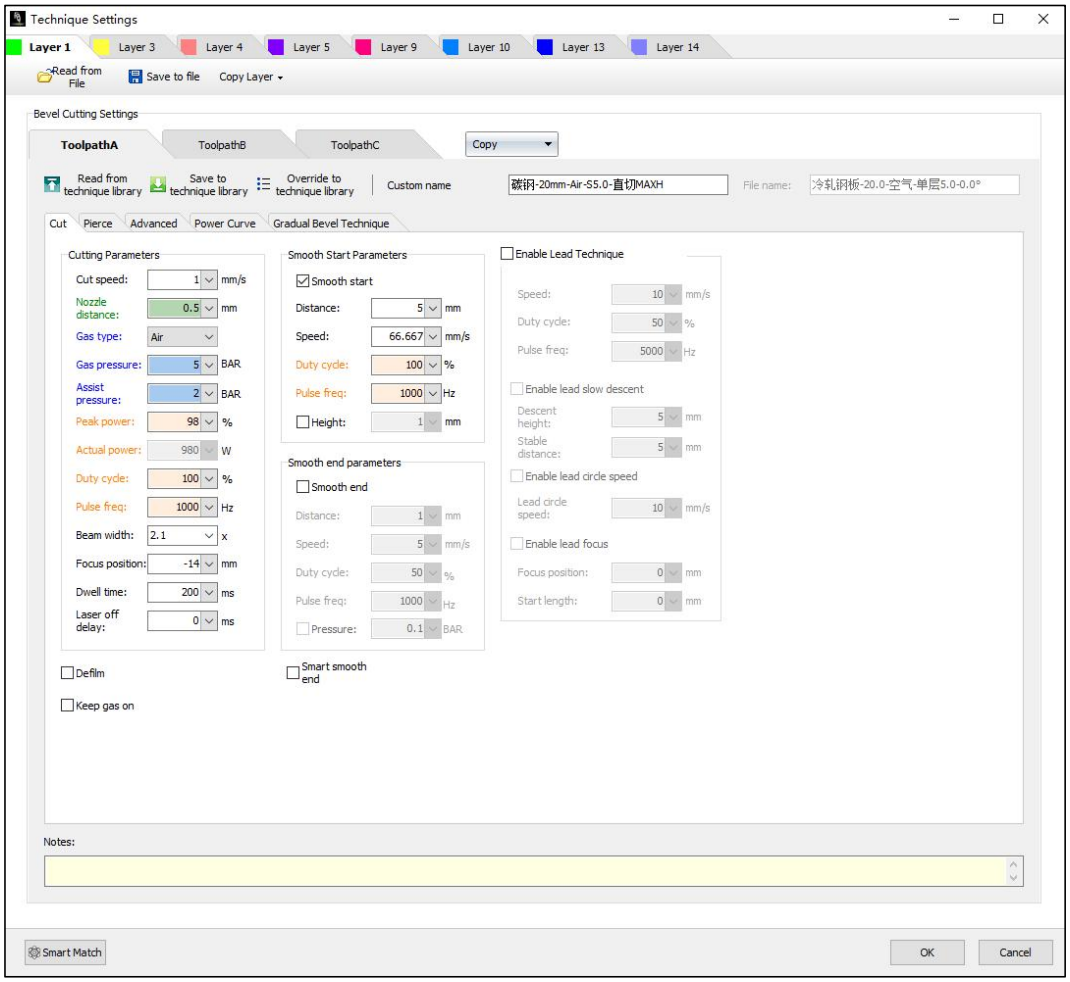


Figure 3-22 Technique settings

Click ***Technique*** on the right to open the ***Technique Settings*** window, almost all parameters during the cutting process are included. Click each layer to set the corresponding technique independently. Each layer corresponds to specific toolpaths, and different bevel toolpaths within the same layer can also be configured individually.

Notice: Although toolpaths A, B, and C under the same layer appear in the same color, their technique parameters are independent. When composite bevels (Y, X, K) are applied to a geometry, the cutting, piercing, and power curve parameters for toolpaths A, B, and C must be set separately in the technique setting interface.

If one toolpath shares the same technique parameters with another or only needs minor adjustments, you can use the ***Copy*** function to quickly duplicate parameters. The logic is ***Copy from Toolpath A/B/C***. For example, to copy parameters from toolpath A to toolpath C, go to toolpath C's settings interface and click ***Copy → Copy from Toolpath A***.

Otherwise, if you set the technique parameters for other layers, it is possible to copy the parameters from one toolpath of other layers. You can also copy technique parameters across layers. For example, to copy toolpath A's parameters from layer 1 to layer 2, go to toolpath A under layer 2, click ***Copy***, then select ***Copy from Layer 1 → Copy from Toolpath A*** in the drop-down menu.

You can also click ***Copy Layer*** to batch-copy all layer parameters from another layer.

3.9.1 Cutting & Piercing Parameters

Table 3-1 Cutting Parameters

Name	Description
Cut Speed	Sets the target speed of actual cutting. Actual speed may be lower due to acceleration/deceleration at the start, end, and corners of the path.
Nozzle Distance	Sets the height of the cutting head from the plate during cutting.
Gas Type	Sets the type of assist gas used in cutting.
Gas Pressure	Sets the air pressure of assist gas during cutting, used with a proportional valve or multivalve.
Assist Pressure:	Sets the gas pressure for the assist gas when using high-speed following nozzle.
Peak Power	Sets peak power of fiber laser. Peak power determines the maximum cutting power that the machine can achieve. If a 3000 W machine sets peak current at 80%, the maximum cutting power will be 3000 W * 80% = 2400 W.
Duty Cycle	Sets the PWM duty cycle used in machining.
Pulse Freq	Sets the carrier frequency of the PWM modulation signal, which represents the number of laser emissions per second.
Beam Width	A default parameter for cutting head, no need to make modifications.
Focus Position	The distance between the focus and the nozzle tip of the cutting head.
Dwell	Delay time for burning the plate through to ensure complete cutting.
Laser Off Delay	A delay before turning off the laser to ensure the cutting path is fully completed.

Name	Description
Defilm Cutting	If enabled, the ***Defilm Parameters*** tab will appear in the technique settings interface. Before actual cutting, the cutting head will remove the film in the vertical state according to the preset parameters. This applies only to layers where defilm cutting is enabled.
Laser On Parameters	Allows the use of specific parameters for the initial segment of the cutting path and supports setting lead-in height.
Laser Off Parameters	Allows the use of specific parameters for the final segment of the cutting path and supports setting lead-out gas pressure.
Smart Laser Off	If enabled, burrs at the end of the cutting path for closed shapes can be avoided. Only applicable when using a BLT cutting head and cannot be enabled simultaneously with lead-out parameters.
Lead Technique	Sets the starting speed, duty cycle and pulse frequency separately when cutting leadlines.
Lead Slow Descent	After activating the laser at lead-in height, the head gradually descends while cutting. The stable distance refers to the distance from the start point to the point where the head reaches the processing height.
Lead Circle Speed	If a lead circle is added, this sets its cutting speed.
Lead Focus	Adjusts focus during lead-in cutting. Starts with the lead-in focus and transitions to the processing focus after the ***Start length***.

Table 3-2 Piercing Parameters

Name	Description
Segment Pierce	Suitable for all plates, stable and simple.
Incremental Pierce	The cutting head gradually moves from high to low during piercing, reducing burrs and improving lead-in quality.
Flash Pierce	Suitable for Carbon Steel cutting with Oxygen. For plates thicker than 12 mm, it is recommended to use along with ***Segment Pierce***.
Smooth Pierce	Laser turns on during following, and cutting starts once the head reaches position.
Tilted Pierce	Before bevel path cutting begins, the head swings to cutting position and pierces.
Pre-Pierce	Execute Pre-pierce at the start point before actual cutting.

3.9.2 Advanced Parameters

Table 3-3 Advanced Parameters

Name	Description
Speed Constraints	Constraint max swing speed at coincident points during the piercing and machining process.
Vibration Suppression	It is used to suppress the vibration when cutting thick plates. It is recommended to enable the ***Adaptive Algorithm***.
Interpolation Follow Feedforward	When enabled, accelerates the height controller's response speed, helping to avoid collisions on uneven materials. Cannot be used simultaneously with vibration suppression.
Short travel no lift	Available only for the ***First Layer*** (i.e., marking layer). When enabled, allows movement between two marking paths without lifting if the distance is shorter than the no-lift distance.
Use external device marking	When enabled, adds an External Device Marking layer where users can set cutting speed, dwell time, laser-off delay, and short distance no-lift parameters.
Adjust Microjoint	When enabled, all microjoints on the layer will be adjusted to the specified length, calculated from the tail end of the original micro joint.
Smooth Microjoint	When enabled, all micro joints on the layer become seamless. During cutting, the system will follow the set duty ratio, speed, focus, and pressure. Root Ratio = 100% - Duty Ratio.
Deslag Parameter	Performs slag removal after piercing to avoid burrs affecting cutting quality.

3.9.3 Real-time Power/Frequency Adjustment (Power Curve)

Enables real-time adjustment of laser power (PWM duty ratio) and frequency according to user-defined curves. This is particularly effective for improving corner cutting quality.

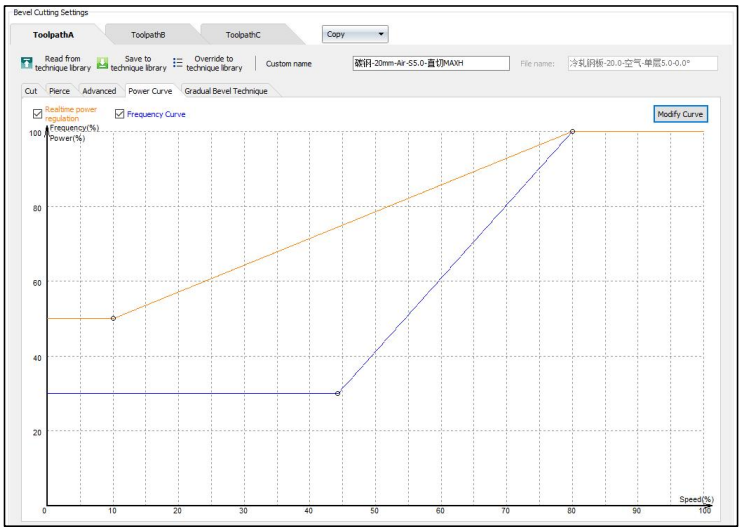


Figure 3-23 Power curve

Notice: Real-time frequency and power should be enabled simultaneously.

3.9.4 Gradual Bevel Technique

The gradual bevel technique uses a similar interface to the real-time power/frequency adjustment. By defining curves for bevel angle versus power, frequency, pressure, and focus, the technique allows real-time adjustment during cutting. Only the parameters with checked curves will be applied.

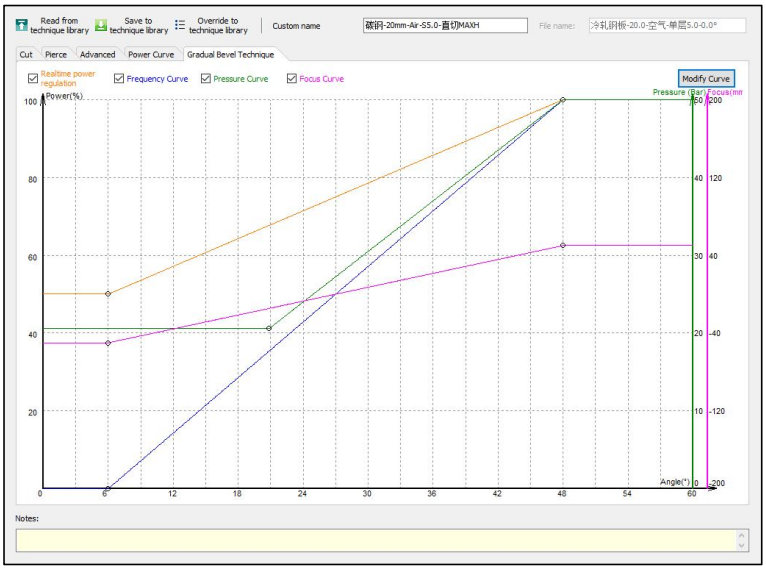


Figure 3-24 Gradual bevel technique

The curve can be edited via the ***Edit Curve*** interface by adding, deleting, or adjusting nodes (dragging or inputting coordinates directly). FACut supports saving and reading gradual bevel technique curves in *.lcm file format. The saved file contains only the currently edited curve. When loading a file, the gradient bevel technique will overwrite only the current toolpath.

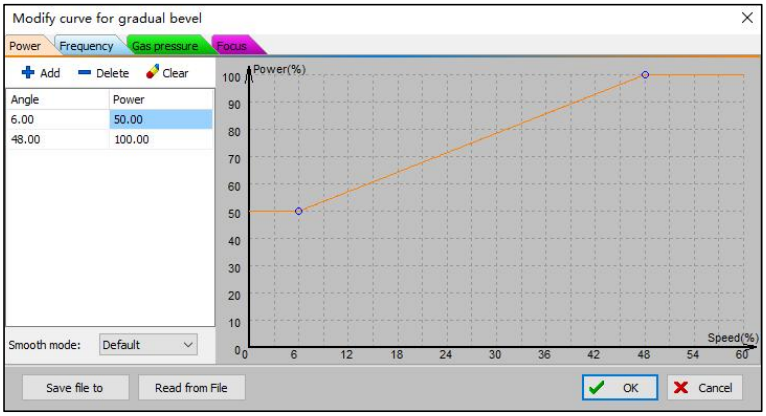


Figure 3-25 Gradual bevel technique curve adjustment

3.9.5 Save and Read Technique

There are two ways to save and read FACut technique parameters: save to/read from technique library or from files. The former saves parameters by toolpath. Suitable for saving techniques after debugging on the machine for future production use. The latter saves parameters by layer. Suitable for backing up techniques as files or transferring them to other machines.

- Save to Technique Library/Read from Technique Library

Click ***Save to Technique Library*** to open the ***Save Technique*** window, where you can set material type, thickness, nozzle name, nozzle diameter, gas type, and angle for the process. A file name will be generated based on these parameters. Notice: This file name is used within the technique library and differs from the file name when saving to a file. After saving, the technique can be viewed in the technique library. A Custom name can also be set for easier retrieval and application.

FACut provides several predefined material types, and users can click + on the right to add custom materials. Nozzle names and abbreviations must be manually defined, you can do this by clicking + to add custom nozzles. The default cutting angle is 0° (straight cut), but users can add custom angles using +. Click ***OK*** to save current parameters as a technique, or **-** to remove the newly added parameters.

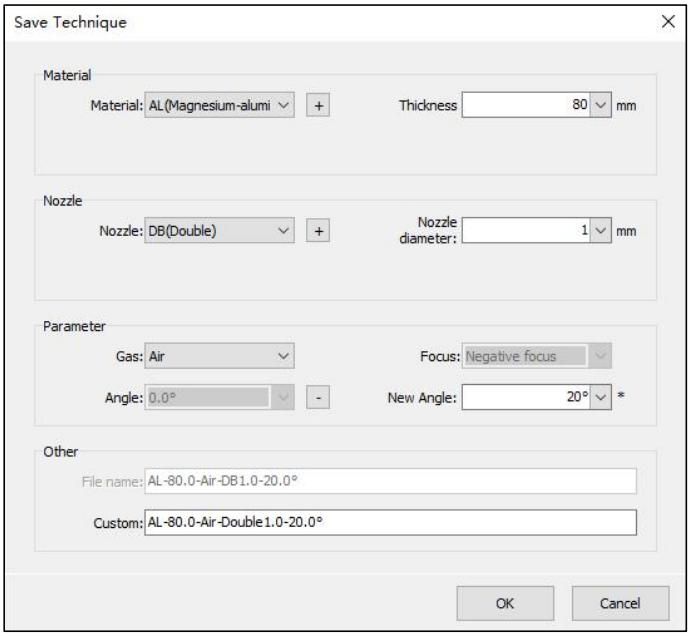


Figure 3-26 Save technique

Click ***Read from Technique Library*** to select a saved toolpath technique and override the current one; you can also click ***Override to Technique Library*** to overwrite the preset technique in the library with the current one(the file name remains unchanged).

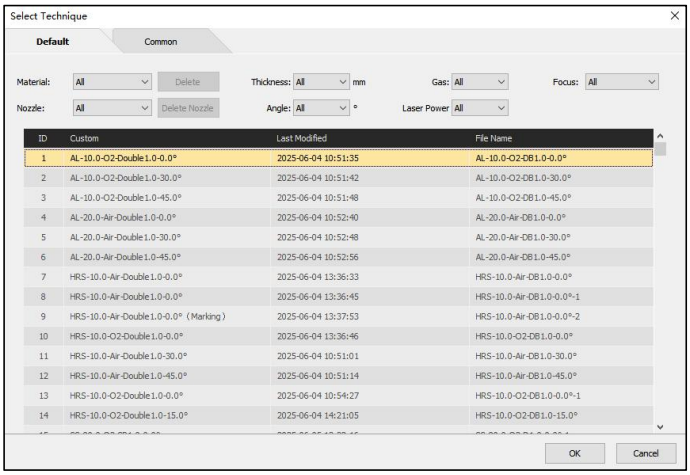


Figure 3-27 Read from technique library

- Read from/Save to file

Click Save to File to save the current Layer Parameters as a material library file (*. lcm). To load a saved process, click ***Read from file*** and select the required material library file. This will overwrite all toolpath technique parameters and user-defined names for the current layer.

3.10 Manage Technique

Click ***Production → Manage Technique*** on the top toolbar to manage the technique that has been saved in the technique library and delete materials and nozzles without corresponding technique parameters. You can sort the techniques by material, thickness, gas type, nozzle type, bevel angle, and laser power.

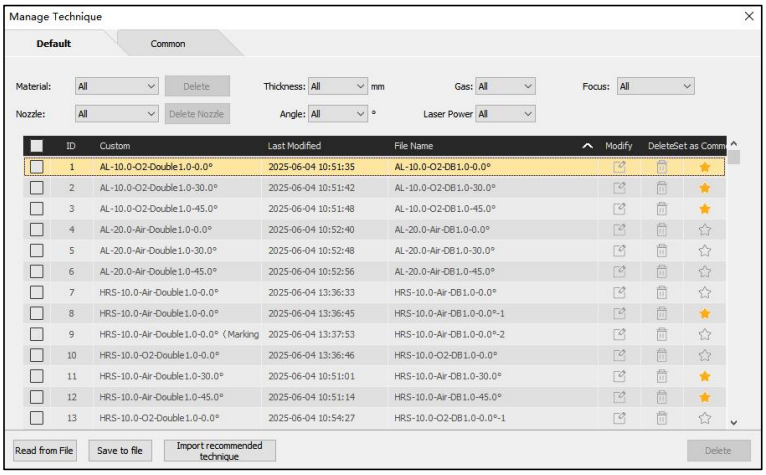


Figure 3-28 Manage technique

Click the icon under ***Modify*** to modify the technique parameters and user-defined name of the toolpath, which is similar to the technique settings window; Click the icon under ***Delete*** to delete the saved technique; Click the icon under ***Set as Common*** to add designated technique to the ***Common*** page, and click it again to cancel.

When using BLT cutting heads, ***Import recommended technique*** is available.

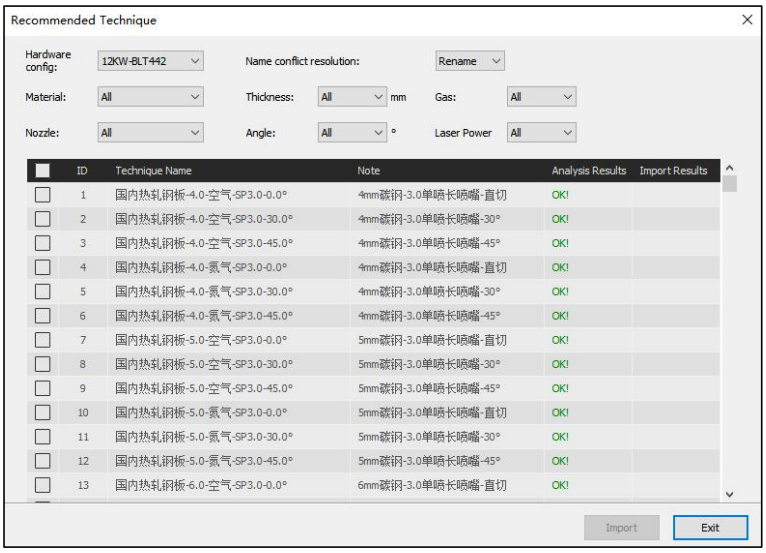


Figure 3-29 Recommended technique

If you want to back up the toolpath techniques in the technique library as files, select the technique to be saved, and click ***Save to file*** to save the selected technique as a Material Library File (*. fam). Click ***Read from File*** to load a saved technique, then click ***Select*** in the pop-up window, open the *.fam file, and select the technique to be imported. If the name of the to-be-imported technique file is the same as that of a preexisting one, choose an appropriate handling method and click ***Import*** to complete the process.

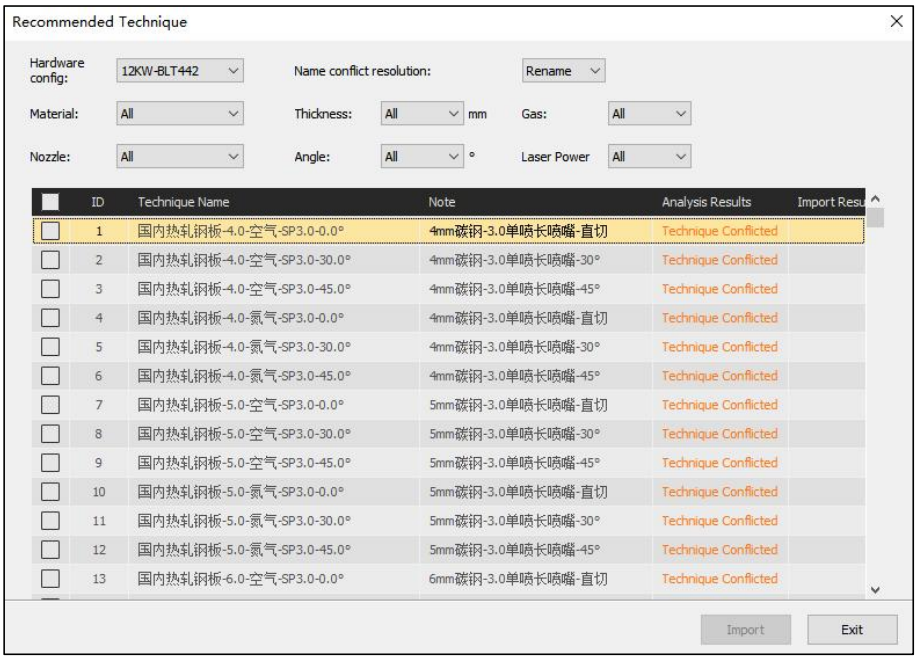


Figure 3-30 Import technique

Chapter 4 Tools

This section introduces the tools provided by FACut during the drawing processing stage. Please configure them according to actual processing requirements. All parameters mentioned in this section, including those shown in images, are for demonstration purposes only and should not be considered as guidance values.

4.1 Array

Array refers to the duplication and arrangement of one or more shapes into a grid based on specified row and column offset or interval. This function helps create layouts of multiple identical or similar workpieces, enabling batch processing and improving production efficiency. FACut supports generating ***Rectangular Array*** and ***Polar Array***.

4.1.1 Rectangular Array

Select the shapes to be arrayed and click ***Array*** or ***Rectangular Array*** in the drop-down menu to open the parameter settings interface:

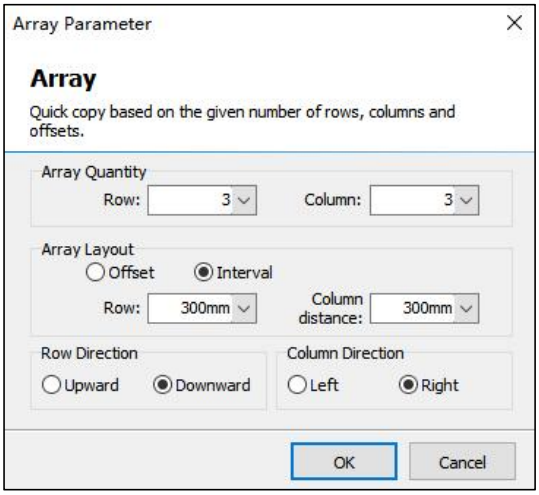


Figure 4-1 Rectangular array parameters

When ***Array Layout*** is set to ***Offset***, row/column spacing refers to the distance between the same reference point of the shapes. When set to ***Interval***, it refers to the distance between the closest edges in horizontal/vertical directions.

After configuring row and column counts, spacing, and direction, the selected shapes can be quickly

duplicated into an array.

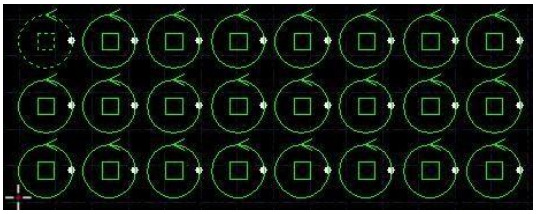


Figure 4-2 Rectangular array

4.1.2 Polar Array

Select the shapes to be arrayed and click ***Polar Array*** in the drop-down menu of ***Array*** to open the parameter settings interface:

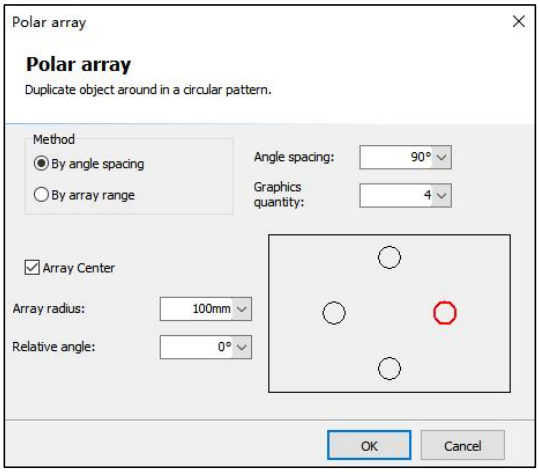


Figure 4-3 Polar array parameters

You can configure the array either by ***Angle Spacing*** or by ***Array Range***. In ***Angle Spacing*** mode, the ***Number*** of shapes must not exceed the maximum number allowed within 360° based on the specified angle spacing by entering ***Degree***. Otherwise, the array will be generated according to the actual maximum number. In ***Array Range*** mode, the system calculates angle spacing based on the set total ***Range*** and ***Number*** of shapes.

You must also set the ***Array Center***. When ***Array Center*** is checked, a preview of the array will be shown. ***Array Radius*** is the distance from the shape center to the array center. ***Relative Angle*** defines the relative angle of the shape's position in the array. If the ***Array Center*** remains unchecked, after clicking ***OK*** to exit the interface, you need to manually specify the center of the array in the CAD view, and the FACut will automatically generate a circular array upon a single click.

4.2 Fly Cut

When the shapes are regular (e.g., rectangles, full circles, polygons) and arranged in a certain pattern, fly cut can link straight segments in the same direction into a continuous cut path. This improves cutting speed and reduces time.

Before fly cut, it is recommended to sort the graphics to optimize the path of fly cut and save travel time.

Click ***Fly Cut*** or ***Linear Fly Cut*** in the drop-down menu to enter the parameters setting page of linear fly cut.

- Start position: Defines the cutting start location.
- Tolerance: Maximum offset allowed between arrayed shapes.
- Max smooth joint: Maximum spacing allowed for smooth connections between turns.

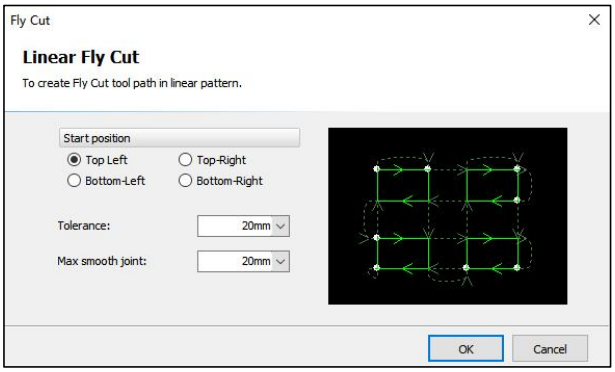


Figure 4-4 Linear fly cut

When all arrayed shapes are circles, clicking ***Fly Cut*** will open the ***Circular Fly Cut*** settings, or you can choose it from the drop-down.

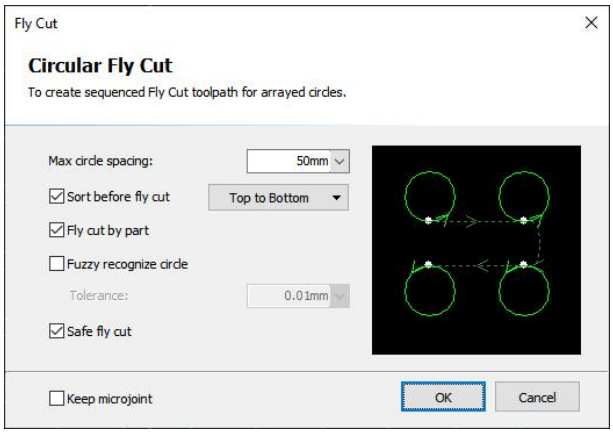


Figure 4-5 Circular fly cut

- Max circle spacing: Maximum distance allowed between two circles to form a fly cut path. If the distance between two circles is greater than the set value, fly cut setting will fail.
- Sort before fly cut: Sorts all selected shapes before fly cut.
- Fly cut by part: Sorts and fly-cuts shapes within each part individually.

When both are checked, the machine will fly cut each part internally by sorting rules before cutting by part.

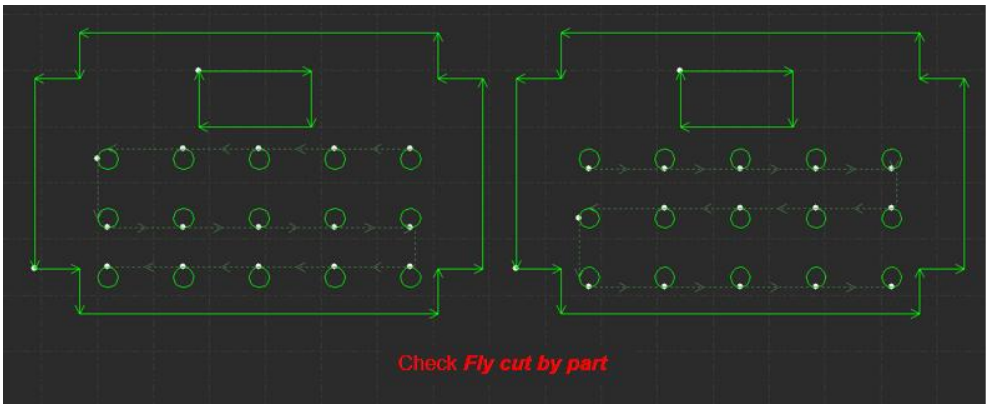


Figure 4-6 Fly cut by part

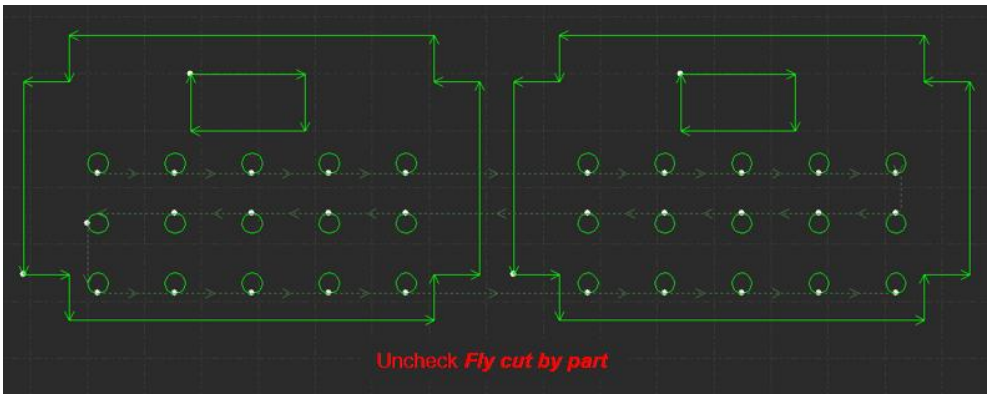


Figure 4-7 Fly cut not by part

Safe fly cut: Avoids holes and small inner shapes during fly cutting (minimum supported: > 0.5 mm diameter circles).

You can configure ***Fly cut overcut*** through ***Global Parameter → Motion Control Params → Path Interpolation Parameter*** to ensure part separation after cutting.

4.3 Co-edge

Co-edge is to merge the common edge of multiple parts into one, capable to reduce actual cutting length and parts gap for better processing efficiency and plate utilization rate. FACut supports creating parallelogram straight-cut co-edge arrays and V/Y/X/K bevel co-edge arrays.

4.3.1 Manual Co-edge

FACut supports auto attach for co-edge in both horizontal and vertical direction. Move a part close to another with which it may share an edge. FACut will attempt to automatically snap them together and display a prompt.

When dragging two or more parts simultaneously, FACut will snap them into position if possible, enabling quick layout adjustments. In addition to manually dragging parts together, you can also create a set of co-edgeable parts by generating a rectangular array. Currently, only rectangular arrays support co-edge. To achieve co-edge, the part spacing must be set to 0.

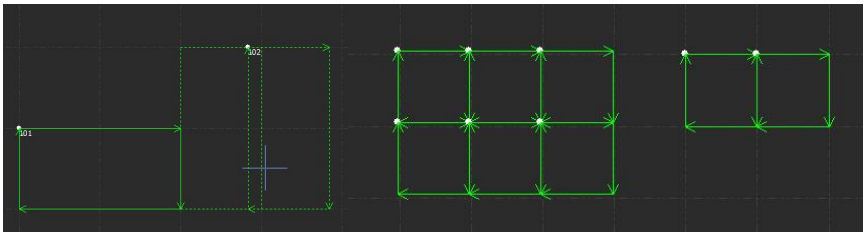


Figure 4-8 Manual co-edge

Select two or more graphics, click ***Co-edge***, then FACut will try to merge the selected parts. If selected parts are recognized as an array, the ***Rectangular Co-edge*** dialog will appear. Set the co-edge pattern and click ***OK*** to generate a co-edge layout. Once co-edged, the participating parts are grouped into a co-edge group.

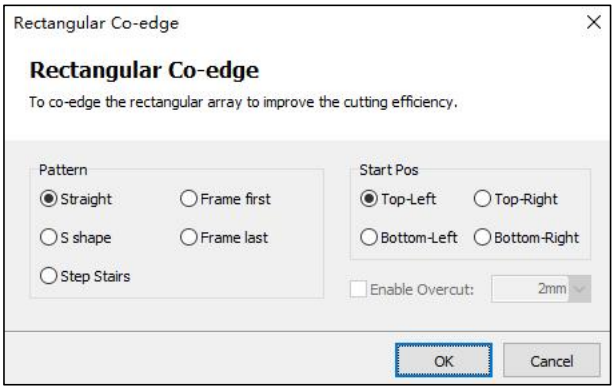


Figure 4-9 Rectangular co-edge

Notice:If any part in the group contains internal geometry (e.g., holes), group the part and all its inner geometry before applying co-edge. Otherwise, the relationship between internal geometry and the co-edge group will become invalid, which may cause issues in processing order or inner/outer profile recognition.

4.3.2 Bevel Co-edged Array

Draw a rectangle, or a parallelogram with polyline, choose ***Auto Split*** or ***Manual Break***. After splitting, you can apply bevel properties on these separate lines.

Select the parallelogram intended for co-edged arraying, click ***Bevel Co-edged Array*** in the drop-down menu of ***Co-edge***, in which you can set array quantity, row direction, not co-edged parts interval (used when full co-edge is not possible). Click ***OK*** to generate the bevel co-edge array.

If the graphic selected cannot be co-edged, there will be a notification of failed operation in the log&alarm interface.

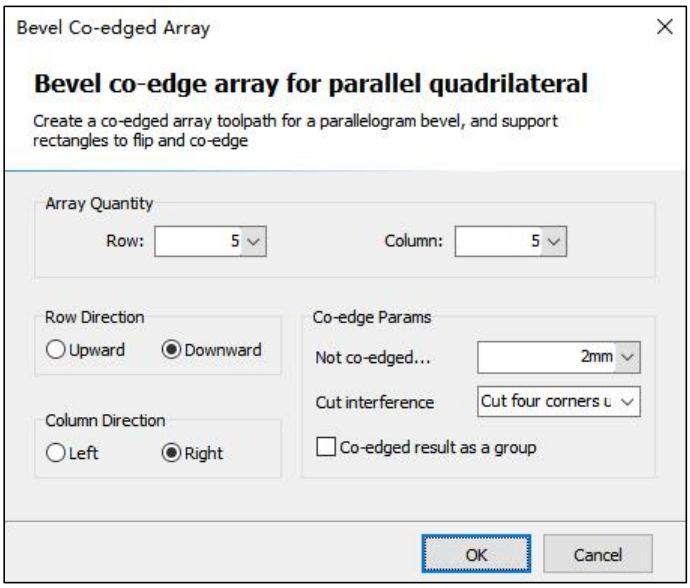


Figure 4-10 Bevel co-edge array

FACut supports flipped co-edge for V bevels and full co-edge for symmetric X/K bevels. If a row/column cannot be fully co-edged, FACut will insert a pseudo co-edge based on the not co-edged parts interval.

The diagrams below illustrate flipped/full bevel co-edge array and partial pseudo co-edge array.

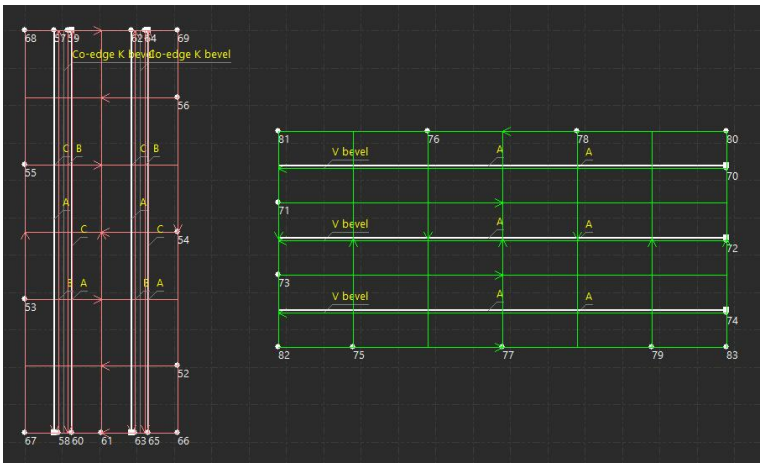


Figure 4-11 Bevel co-edged array

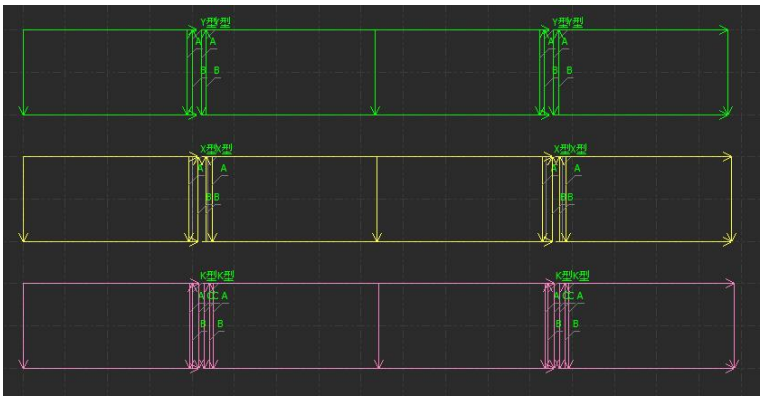


Figure 4-12 Bevel co-edged pseudo array

FACut now supports bevel co-edged array for parts with bevels on adjacent edges. After setting the array parameters and clicking ***OK***, an additional dialog—***Set remove size when interference is found in Bevel Co-edged Array***—will appear. By setting a radius, the system will automatically create chamfers in the interference zones to prevent collision between co-edged bevel toolpaths during cutting.

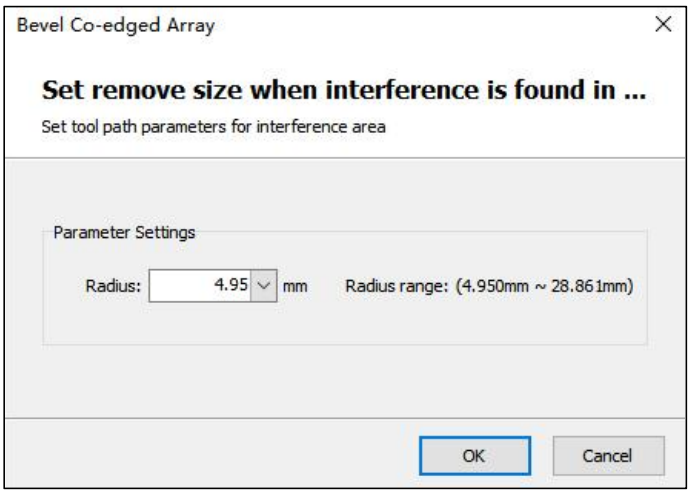


Figure 4-13 Set remove size when interference is found in bevel co-edged array

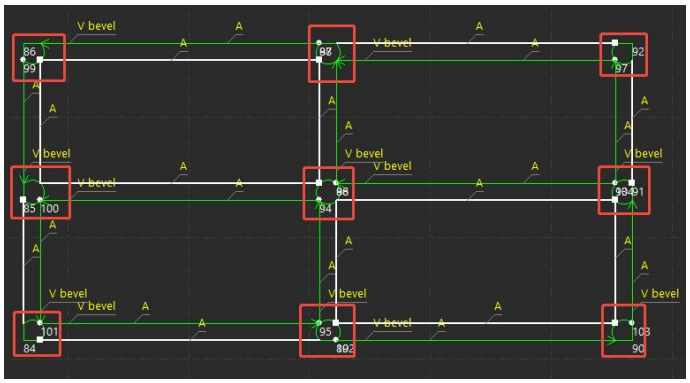


Figure 4-14 Diagram of chamfers

4.4 Cut-off Line

When cutting off remnant material or beveling along the plate edge, starting directly from the edge may lead to nozzle collisions. You can solve this problem by setting the trajectory as a cut-off line.

Select the trajectory to be set as cut-off line (ensure its length matches the edge to be trimmed), click ***Cut-off Line*** to set the cut-off line parameters in the pop-up window, and configure the cut-off line parameters in the pop-up dialog. After clicking ***OK***, a blade-shaped icon will appear at the path's start point in the CAD panel, indicating the cut-off line has been set successfully.

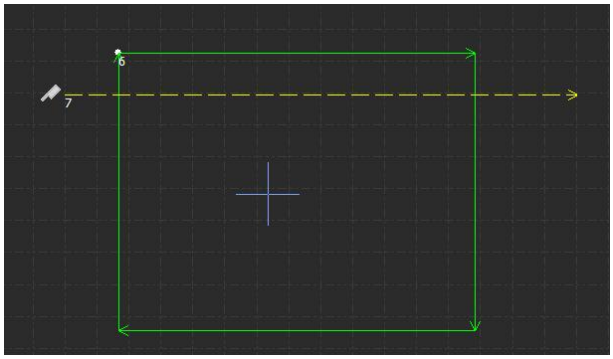


Figure 4-15 Cut-off line mark

You can set the out-plate method of the cut-off line as either ***Fixed Height*** or ***Only follow upward***. The latter helps reduce the risk of nozzle collion during lift-off.

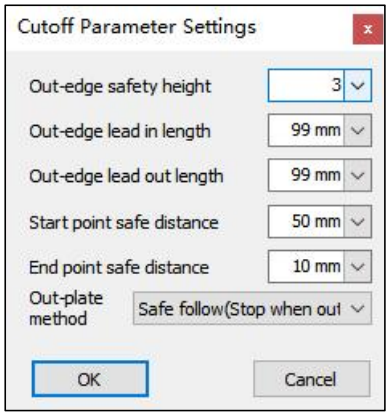


Figure 4-16 Cutoff parameter settings

If you need to cancel the cut-off line, select specific trajectory and choose ***Cancel Cut-off line*** in the drop-down menu of Cutoff Line.

Every time you open FACut, there will be a pop-up window of ***Cutoff Parameter Settings*** only when the cut-off line is set for the first time. After that, if you need to modify the cutoff settings, click the drop-down arrow and then click ***Cutoff Parameter Settings***.

FACut supports bevel cut-off lines and side wall bevel cutoff from the edge of the plate, eliminating the need to flip the plate. The following example demonstrates how to perform side wall bevel cutoff using a C path of a K bevel.

Step 1 Find Edge

The accuracy of side wall bevel cutoff depends on the ***Find Edge*** accuracy. Before setting cut-off line, it is necessary to execute ***Find Edge*** and confirm whether the ***Find Edge*** result is accurate by ***Frame*** and ***Dry Run***. You should also set the appropriate margin for ***Find Edge*** to ensure that the zero point (cut-off start point) aligns with the plate corner.

Step 2 Set Bevel

Draws a straight line with its ***Bevel Property*** set as K bevel. Set the required angle and root height, and modify the cutting sequence to C→ B→A to prevent prevent slag buildup. If the tool order is not modified in ***Bevel Property***, it can be realized by ***Manual Sort***. After the bevel setting is completed, set toolpath B to layer 0.

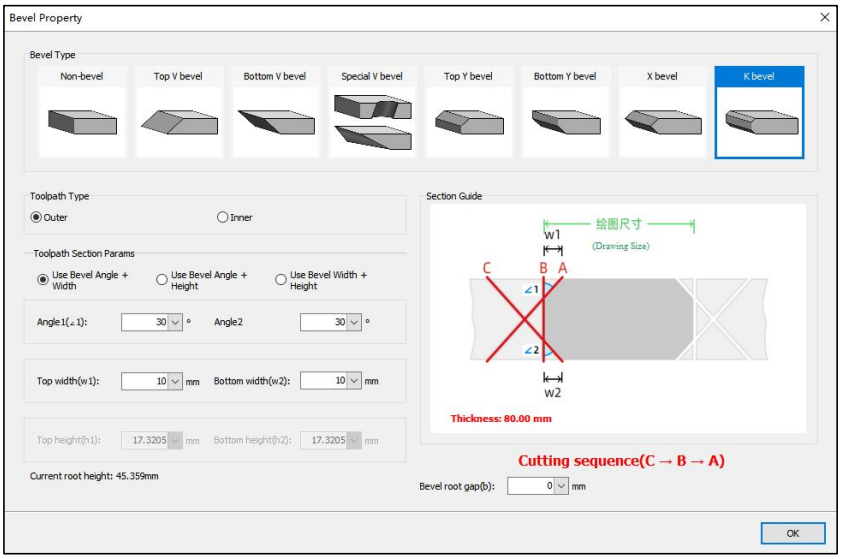


Figure 4-17 Set bevel

Step 3 Set Cut-off Line

Go to ***Cut-off Line → Cut-off Line Settings***, configure cut-off parameters, ***Follow shrink dis*** (the distance to move inward before detecting), and ***Outward distance of safe lift*** (distance to extend outward before lifting). Select toolpath A, click ***Cut-off Line*** to define it as a normal cut-off line. Select the toolpath C, and in the drop-down menu, click ***Side Wall Bevel Cutoff***. A special icon will appear at the toolpath C-path's start point, indicating the side wall bevel cutoff line is set. Once the side wall bevel

cut-off line is defined, the system will automatically calculate the zero ref. Please confirm that the zero ref lies on the plate edge.

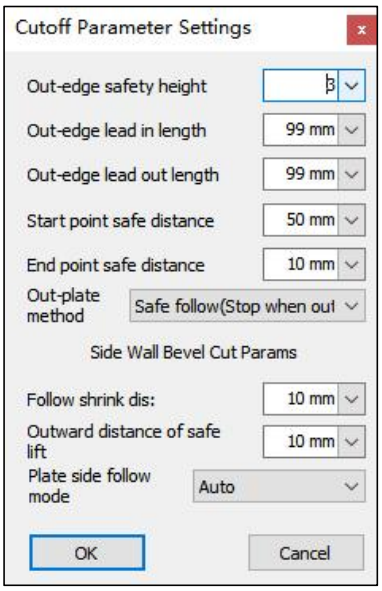


Figure 4-18 Set cut-off line

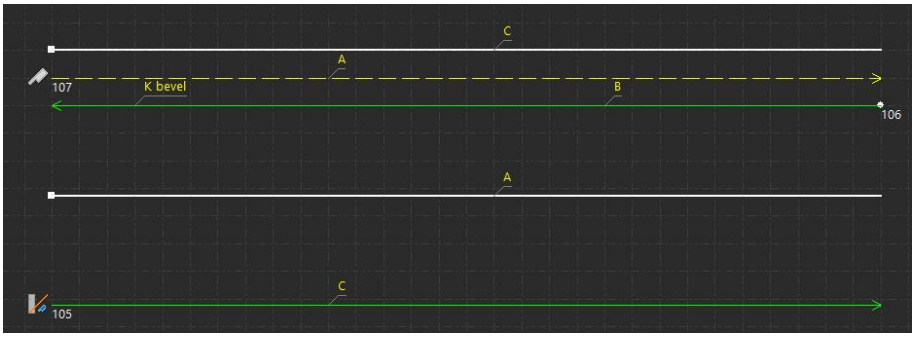


Figure 4-19 Cut-off line

Notice:

1. The default technique layer for a cut-off line is ***Last Layer***. After setting the cut-off line, ensure appropriate cut-off technique parameters are configured.

2. FACut supports any shape for straight cut-off lines, but only straight lines are supported for bevel cut-off lines.

3. ***Detect Cutting*** must be enabled in ***Global Parameter*** before using side wall bevel cutoff line.

4.5 Corner Split

This function is designed for the transition between straight cuts and bevel cuts, and must be used in conjunction with ***Normal-Based Optimization***.

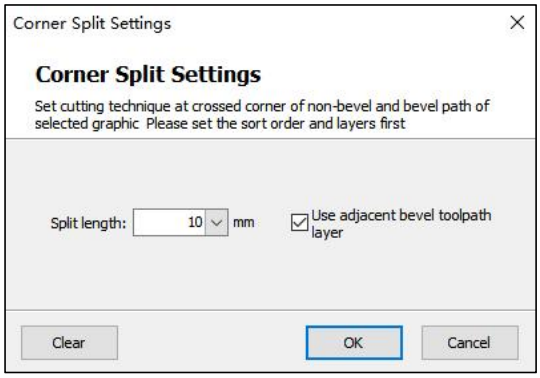


Figure 4-20 Corner split setting

Under normal circumstances, after enabling ***Normal-Based Optimization***, the cutting head will begin tilting at the start point of the straight edge preceding the bevel edge. By the time it reaches the bevel edge, the cutting head will have adjusted to the required cutting angle. As shown in Figure 4-21, the cutting head has already started tilting (highlighted in red).

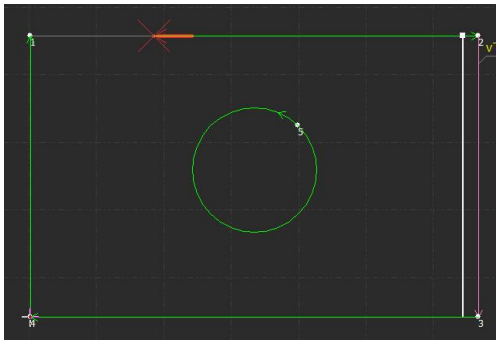


Figure 4-21 Before corner split

After a corner split point is set, the cutting head will maintain a straight cutting posture between the start point of the preceding straight edge and the corner segmentation point, as shown in figure 4-22.

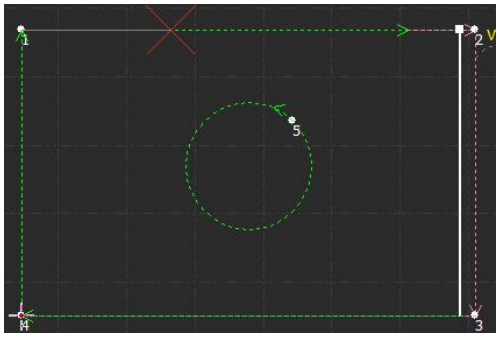


Figure 4-22 After corner split - before the split point

Once the cutting head reaches the segmentation point, it begins tilting and will reach the required bevel cutting angle precisely when it enters the bevel edge, as shown in figure 4-23. This helps maintain the cutting quality of the straight section to some extent.

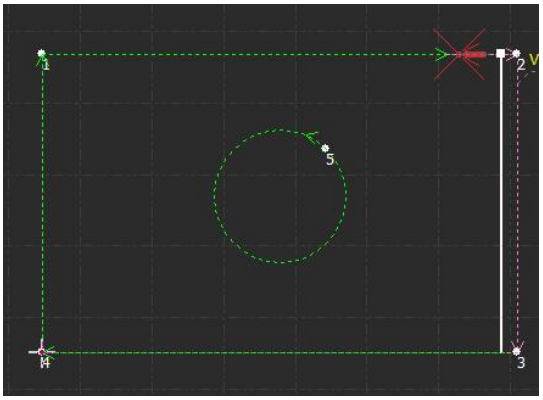


Figure 4-23 After corner split - after the split point

During corner segmentation, it is supported to use the adjacent bevel technique layer to cut the straight edge segment where the cutting head tilts. To enable this, check ***Use adjacent bevel toolpath layer***. As shown above, the toolpath layer after the segmentation point matches the bevel layer.

4.6 Bridge

When a part consists of multiple subparts that you don't want to fall apart after cutting, you can use ***Bridge*** to connect them. This feature also reduces the number of piercing operations. By using ***Bridge*** for multiple times, you can achieve a continuous ***One-Pass*** cut effect across all geometries.

To bridge two geometries, click ***Bridge***, set the ***Bridge Width*** in the pop-up window, and then draw a straight line across the screen. All geometries intersected by the line will be bridged in pairs. As shown in the figure below:

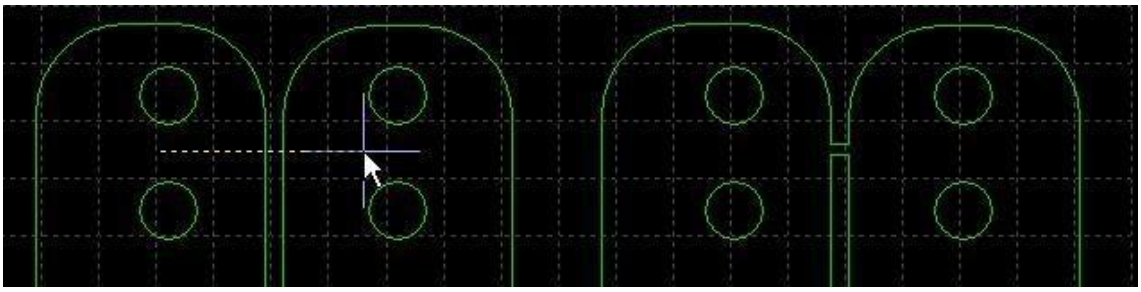


Figure 4-24 Bridge

Notice: After bridging, the graphics become a single entity. Since the cutting of any individual part won't be completed until the full one-pass cut is done, pay attention to potential changes in heat distribution caused by this setup.

4.7 Layer Mapping

Layer Mapping is used to quickly and consistently apply technique parameter settings across multi-layer drawings. With one-click mapping, users can automatically assign predefined technique parameters—such as for cutting or marking—to corresponding layers, adapting to different processing requirements and improving efficiency in technique configuration.

Currently, FACut supports two types of layer mapping: ***DXF Layer Mapping*** and ***Bevel Layer Mapping***.

- DXF Layer Mapping: To use this function, you must assign distinct layers during the drawing process. After importing the drawing, click ***Layer Mapping*** or select ***DXF Layer Mapping*** from its drop-down menu.

The interface will list the detected layer names and quantities. You can assign a corresponding technique to each layer using the drop-down menus. In the lower-left corner of the interface, there is also

a checkbox for ***Enable Bevel Layer Mapping***, but this only supports mapping by bevel type, not bevel angle.

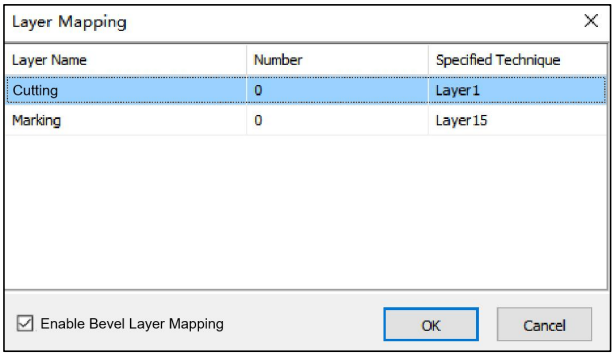


Figure 4-25 DXF layer mapping

- Bevel Layer Mapping: FACut offers a dedicated bevel layer mapping tool for quickly assigning techniques layers based on bevel drawing attributes. This function supports differentiation by bevel type and angle, and allows the assignment of corresponding layer techniques. Its features include sorting, adding new mapping rules, duplicate mapping check, and saving and reading the mapping rules as files. Two mapping modes are available:
  - Standard: Does not differentiate bevel types; matches layer numbers based on top/bottom bevel and angle range.
  - Fine: Further distinguishes bevel types (V/Y/X/K...), matches values using bevel type, top/bottom, and angle range.

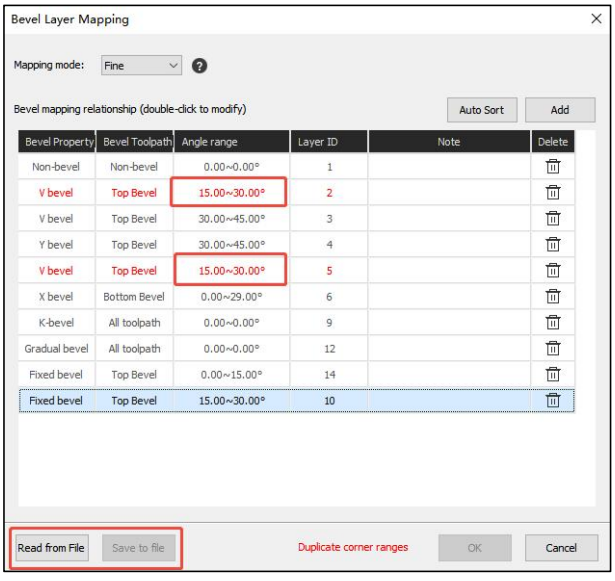


Figure 4-26 Bevel layer mapping

For details about layer mapping, please refer to FACut - Layer Mapping.

4.8 Nest

It is used to nest the designated parts reasonably on the plate with the highest utilization rate. FACut supports one-click nesting. To perform this operation, click ***Drawing*** → ***Tools*** → ***Nest***. Additionally, FACut provides several optimization parameters for fine-tuning, such as ***Parts Gap*** and ***Plate Margin***.

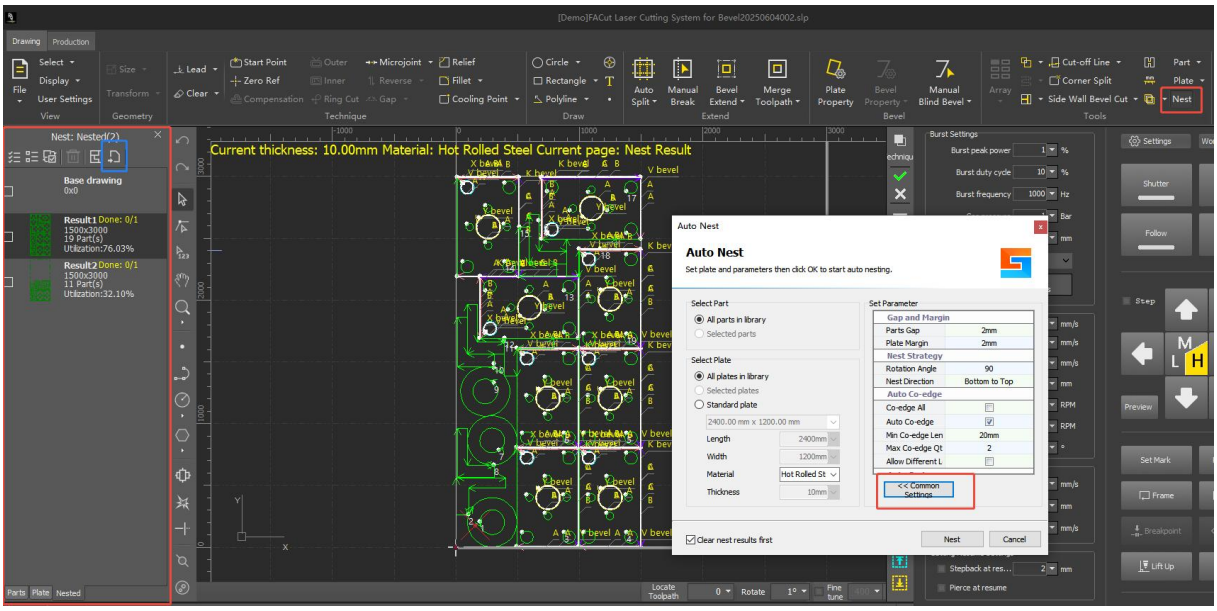


Figure 4-27 Nest

After initiating the nesting function, a sidebar appears on the left, displaying the part library, plate library, and nesting result. If accidentally closed, you can reopen the part library by clicking ***Part*** in the toolbar, or reopen the plate library by clicking ***Plate***.

The Part Library displays all parts to be nested as thumbnails. Users can add parts by right-clicking a selected graphic or using the sidebar's right-click menu to import parts. Right-click on the left sidebar to select ***Import Standard Parts***, ***Delete All Parts***, and ***Save Unnested Parts***.

Plate library shows available plate types and quantities. Plates can be added by right-clicking selected geometry or importing from standard plate options. The right-click menu also allows ***Delete All Plates*** or save the plates as files.

The ***Nested*** column will display the nesting results after ***Auto Nest***, and plates that have been processed or modified will be marked accordingly in the thumbnail. To return to the original base drawing after nesting, click ***Go to Base Drawing*** (blue box).

Part of the parameters of ***Auto Nest*** are described as follows.

- Click ***Common Settings*** in the bottom-right of the ***Auto Nest*** window to switch to simplified parameter mode. Key options include:
  - Parts Gap: Minimum distance allowed between parts.
  - Plate Margin: Space reserved around the plate border during nesting.
- Detail Settings
  - Rotation Angle: Defines allowable rotation angles for parts during nesting. Options include ***90°***, ***180°***, ***Free***, or ***Forbid Rotate***.
  - Nest Direction: Controls the directional sequence of part arrangement.
  - Auto Co-edge: Enables auto co-edge detection during nesting. If ***Co-edge All*** is checked, other co-edge parameters become unavailable.
  - Auto Sort: Where you can enable ***Forbid In-part Sort***.

Right-click on the nesting result and click ***Generate Report*** to generate nesting report, including the total cutting length, total travel length, processing time, pricing and other information of all nesting results. Before it, you can click ***Report Information*** to set the report name, pricing method and other text information on the report.

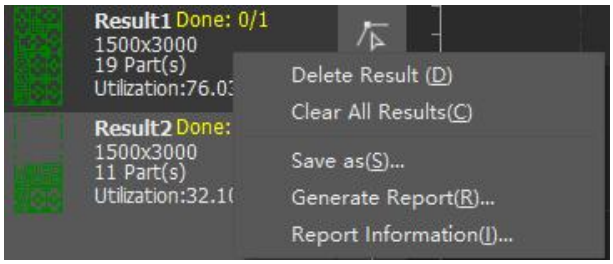


Figure 4-28 Nest report

4.9 Sort

FACut supports flexible cutting order management through the ***Sort*** function and offers various auto-sort parameters.

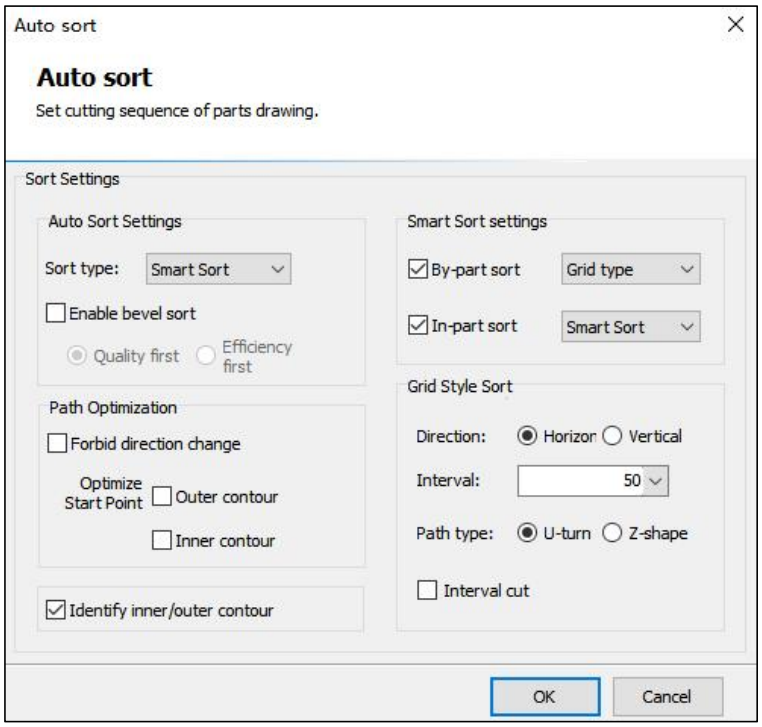


Figure 4-29 Auto Sort

When the ***Sort type*** is set to ***Smart Sort***, the panel on the right will display ***Smart Sort settings***. If ***By-part sort*** is set to ***Grid type***, a ***Grid Style Sort*** panel will appear in the bottom-right.

FACut also allows ***Enable Bevel Sort***, a unique feature.

- If ***Quality First*** is selected, the sorting follows the principle:"Bottom bevel first, then top bevel; straight cuts before bevel cuts."
- If ***Efficiency First*** is selected, the sorting is optimized for maximum efficiency.

For detailed bevel sorting instructions, refer to the FACut - Enable Bevel Sort.

Chapter 5 Machining control

FACut integrates CAD and CAM functions, and all operations including editing files and setting cutting parameters can be done in the office or on your own computer. Then you can open the file on the machine for processing directly.

5.1 Coordinate System

During the design phase, the ***Model Coordinate System*** is used, which is independent of the machine tool. Its origin (zero point) is shown in the red box below.

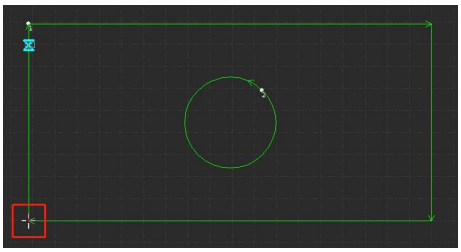


Figure 5-1 Zero point

During actual machining, a different coordinate system associated with the machine's operational state is used. The relationship between the two coordinate systems is illustrated below.

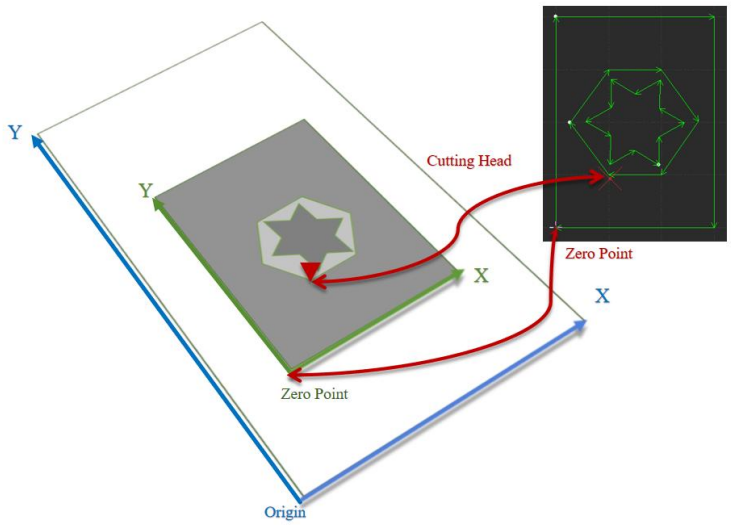


Figure 5-2 Coordinate system mapping

Click ***Preview*** in console will display the cutting head position correspond with graphic.

5.1.1 Machine Coordinates

The machine coordinate system is uniquely determined by the machine structure and machine parameters. The coordinate system established by clicking ***Return Origin*** is consistent at all times. When the machine is installed for the first time or the mechanical coordinate system deviates due to abnormal reasons, you can click ***Return Origin*** on the top toolbar to reset the machine coordinate system.

Regardless of the machine structure, the coordinate system definition in FACut is consistent.

- Facing the machine from the front:
  - Cutting head moving to the right → Positive X direction
  - Cutting head moving backward → Positive Y direction
- Viewed from the positive direction of the X/Y axis:
  - A/B axes rotating clockwise → Positive direction
  - Counterclockwise → Negative direction

Thus, the bottom-left corner of the workpiece represents the minimum coordinates, and the top-right corner the maximum coordinates.

5.1.2 Program Coordinates

Since machine coordinate is consistent, FACut also adopts program coordinates for flexible production.

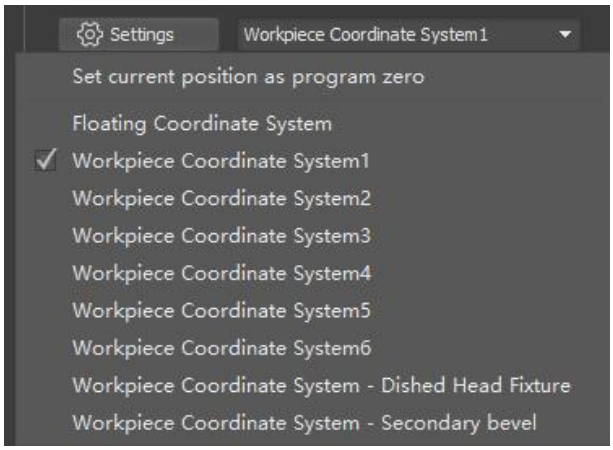


Figure 5-3 Select coordinate system

All program coordinates in FACut share same coordinate direction with machine coordinate—only

the zero point differs. Program coordinates can be divided into ***Floating Coordinate System*** and ***Workpiece Coordinate System***.

The program coordinate system options are available at the top of the machining control panel, including ***Floating Coordinate System*** and six ***Workpiece Coordinate System***s (1 to 6)

Floating coordinate system is typically used for temporary or trial operations, where "machining starts from the current cutting head position." Whenever the user clicks ***Frame***, ***Dry Run***, or ***Start***, the system automatically sets the current cutting head position as the zero point.

When the ***Workpiece Coordinate System*** 1 ~ 6 is selected, its zero point is manually set by the user through ***Set Current Position as Zero Point***. Once saved, it won't be changed until you modify it manually. These coordinate systems are suitable for batch production, with zero-point positions often defined by fixed fixtures—ensuring that every job runs from the same physical location.

5.1.3 Return Zero under Abnormal Situations

- If only external devices such as the laser or gas system malfunction and machining is interrupted, but the coordinate system remains intact: you can directly click ***Return Zero*** to return to the zero point.
- If accidents like power down or servo alarm occur and deviate from the machine coordinate system, it is recommended to click ***Return Origin*** to reset the machine coordinate, and then click ***Return Zero*** to find the zero point.
- If the production is interrupted due to unexpected circumstances, but the machining is started by misoperation, and you still want to find the zero point of the last processing, it is possible to locate ***Memory Zero*** to get back to the last zero point. You're allowed to select ***Memory Zero*** in the drop-down icon next to ***Return Zero*** on the console, and then click a specific one to set it as current zero point.

5.2 Machining Control

Machining Control is on the right side of the software and contains the following operation bars, ***Burst***, ***Jogging***, ***Debugging***, and ***Machining***. The control parameters for these functions can be modified in the parameter settings. The functions of each of these four operation bars are described in detail below.

5.2.1 Bursting

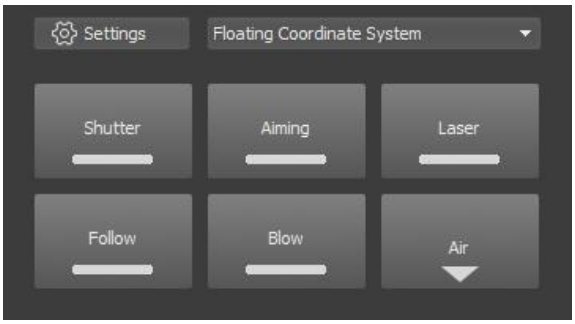


Figure 5-4 Bursting

- Shutter: Controls the laser shutter (on/off).
- Aiming: Controls the laser red light (on/off).
- Laser: With ***Shutter*** on, left-click for a single burst, and right-click for continuous shooting.
- Follow: Controls the following (on/off）.
- Blow: Controls the gas (on/off).
- Gas: Select the blowing gas type.

5.2.2 Jogging

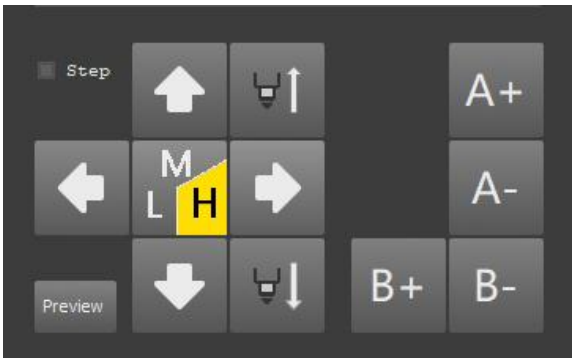


Figure 5-5 Jogging

- Jog Panel: Jog and step controls for X/Y/Z/A/B axes.
- L/M/H: Set low/medium/high-speed jog or step mode.
- Step: If enabled, the cutting head will move by steps of designated distance, or it will move by jogging.

5.2.3 Debugging

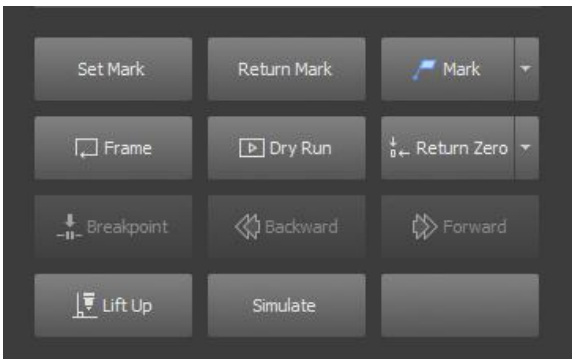


Figure 5-6 Debugging

- Set Mark: Record current X and Y coordinates of the cutting head, saved in the drop-down arrow of ***Mark*** on the right.
- Return mark: The cutting head will lift up and then return to X and Y coordinates corresponding to designated mark.
- Mark: There are 6 mark points listed in it, you're allowed to click the drop-down arrow on the right to switch the mark points or rename them by ***Edit***.
- Frame: The cutting head will move a rectangle surrounding the to-be-processed graphics.

- Dry Run: The cutting head moves along the graphics without emission laser emission, following, or gas blowing.
- Return Zero: The machine tool moves to the zero point of the graphic. Clicking the drop-down arrow on the right allows returning to history zero point.
- Breakpoint: If there are abnormal conditions during actual machining, which lead to machining suspension by triggering alarm, you can locate to the break point and then start machining;
- Back/ Forward: You can adjust the position of machining point by ***Backward***/***Forward*** option.
- Lift Up: In the ***Stop*** state, the Z axis will lift up, and the A and B axes will return origin without changing the nozzle's position in the horizontal plane.
- Simulate: This process can be done independently, during which the machining sequence and procedure can be checked.

5.2.4 Machining

Figure 5-7 Machining

- Start: Start machining.
- Pause: Pause current machining.
- Resume: Resume suspended machining. Pierce action will be executed if there is pierce technique preset for the graphics.
- Stop: Stop current machining..
- Cut selected only: Only selected graphics will be processed if this option is enabled. It will not start machining if no graphics are selected.

5.2.5 Parameters

The ***Parameters Settings*** panel is on the left of the machining control, where you can modify settings for ***Burst***, ***Jog***, ***Cutting***, and so on.

➢ Burst Settings

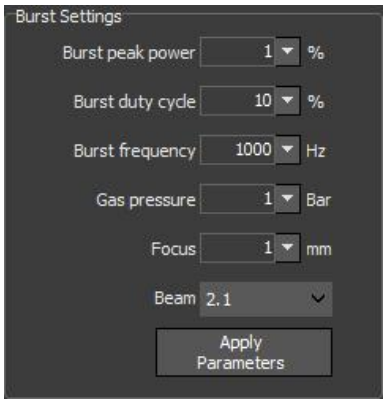


Figure 5-8 Burst settings

- Burst peak power: Peak power of burst laser.
- Burst duty cycle: The duty cycle of burst laser signal.
- Burst frequency: The frequency of burst laser signal.
- Gas pressure: Gas pressure when bursting.
- Focus: Focus position when bursting.
- Apply Parameters: Write in the parameter by this option after changing ***Focus*** and ***Beam***.

➢ Jog Settings

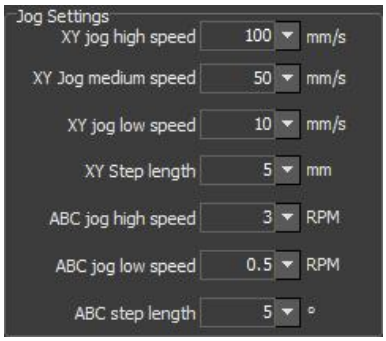


Figure 5-9 Jog settings

- XY jog high speed: X/Y Jog/Step speed when it is in ***H*** status.
- XY jog medium speed: X/Y Jog/Step speed when it is in ***M*** status.

- XY jog low speed: X/Y Jog/Step speed when it is in ***L*** status.
- XY Step length: Step distance of X/Y when the ***Step*** option is checked.
- ABC jog high speed: A/B/C Jog/Step speed when it is in ***H*** status.
- ABC low speed: A/B/C Jog/Step speed when it is in ***L*** status.
- ABC step length: Step angle of A/B/C when the ***Step*** option is checked.

➢ Forward/Stepback Settings:

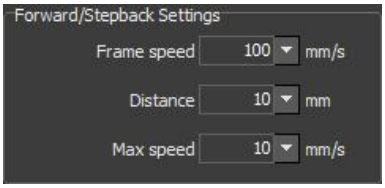


Figure 5-10 Forward/stepback settings

- Frame speed: Sets the ***Frame*** speed.
- Distance: Sets the ***Forward*** and ***Stepback*** distance. In a ***Pause*** state, the ***Forward*** and ***Stepback*** can be used to locate to the desired position.
- Max speed: Sets max speed for ***Forward***/***Backward***.

➢ Cutting Resume Settings:

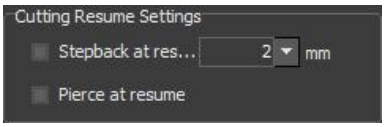


Figure 5-11 Cutting resume settings

- Stepback at resume: If checked, the cutting head will move backward for specific distance when you click ***Resume***.
- Pierce at resume: If checked, the cutting head will pierce before actual cutting when you click Resume.

➢ Other Options:

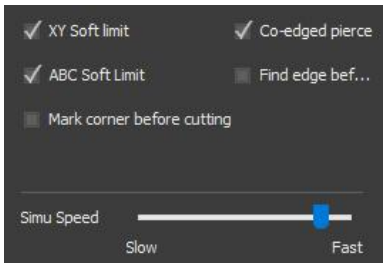


Figure 5-12 Other options

- XY Soft limit: If checked, soft limit for XY axes will be enabled.
- Co-edged pierce: If checked, pierce at each co-edged toolpath of straight cut.
- ABC Soft Limit: If checked, soft limit for ABC axes will be enabled.
- Find edge before production: Find edge automatically before actual cutting.
- Mark corner before cutting: If checked, the machine will mark corners before actual processing to ensure all to-be-cut graphics are exactly within plate, avoiding the risk caused by operator observing the framing by walking on the plate.
- Simu Speed: Simulation speed can be changed.

Chapter 6 Cutting File

6.1 **About**

6.1.1 About Interface

The about interface provides detailed system information including the program's version number, release date, control card type, height controller type, laser type and license expiration, etc.

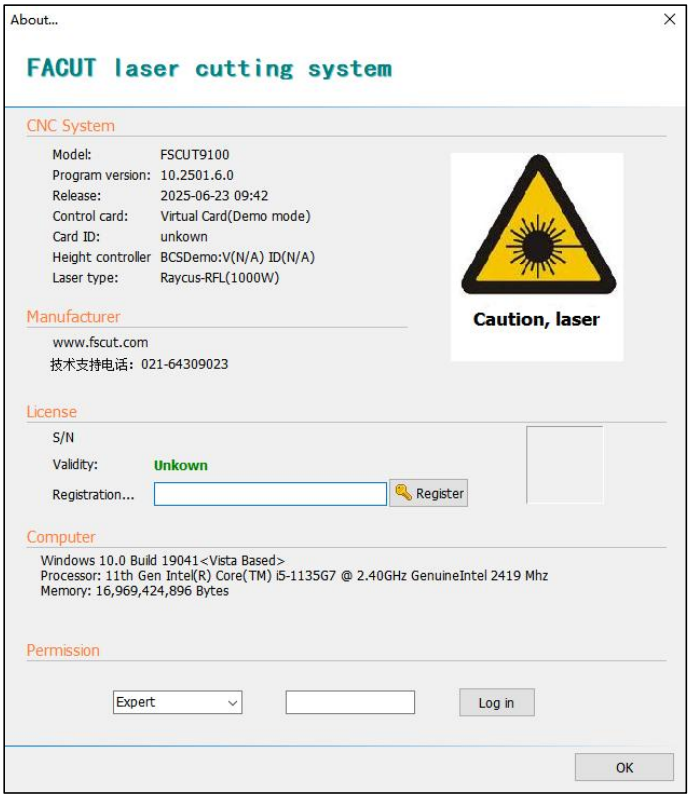


Figure 6-1 About

6.1.2 Parameter Backup

FACut offers parameter backup and restoration functionality. Click ***About → Parameter Backup*** to generate a backup file (*.cfgpkg) at the specified path. Double-click the backup file or open it through the platform configuration tool (FACutConfig), and the parameter restoration dialog will pop up. Select the file list to restore and click ***Restore*** to restore the machine parameters.

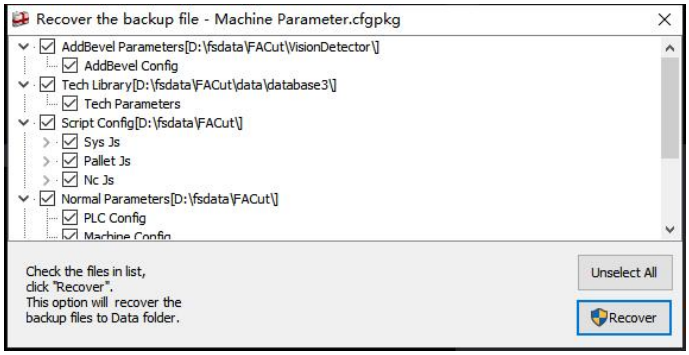


Figure 6-2 Parameter restore

6.1.3 Save Troubleshoot File

This function saves the current drawing, logs, alarms, and other information as a compressed file, making it easier to collect and send all information upon a machine failure.

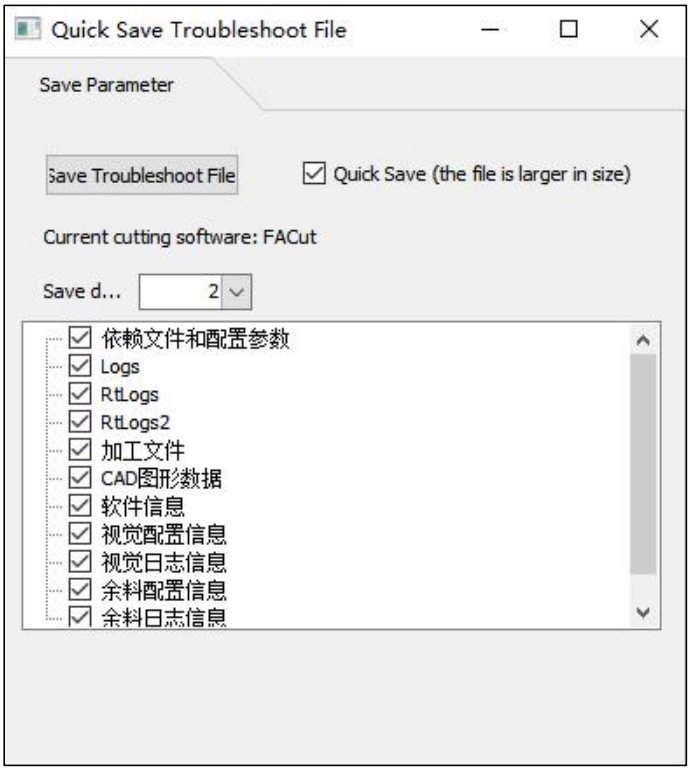


Figure 6-3 Save troubleshoot file

It supports selecting only the modules related to the fault and customizing the number of days of information to save. After clicking ***Save Troubleshoot File***, the file save window will pop up, allowing you to specify the location to save the fault information package.

If a fault occurs and you cannot click ***Save Troubleshoot File*** within the software, you can also select by ***Windows Start Menu → FACut → Fault Information Packaging Tool***. Both methods serve the same function.

6.1.4 NC Log

This module displays motion-related information from the machine and allows you to ***Save*** the current NC log or ***Open*** existing NC log files.

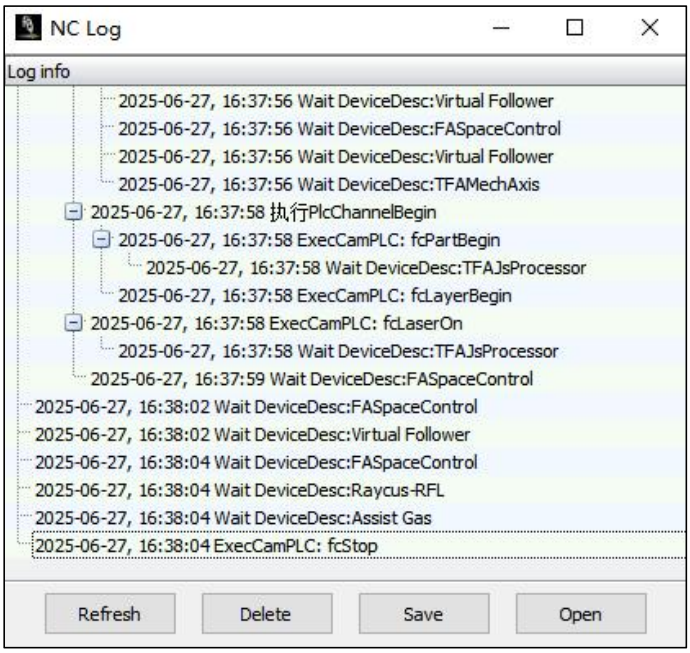


Figure 6-4 NC log

6.1.5 Maintenance

In FACutConfig, you can configure scheduled maintenance tasks in the corresponding module. If the software is launched during a scheduled maintenance window, the system will issue a warning or alarm notification.

In the ***Maintenance*** window, the operator must enter ***Maintainer*** and ***Maintenance Remarks***, then click ***Start Maintain*** to dismiss the alert. The window also allows you to view the status of each maintenance item and filter maintenance records by various conditions.

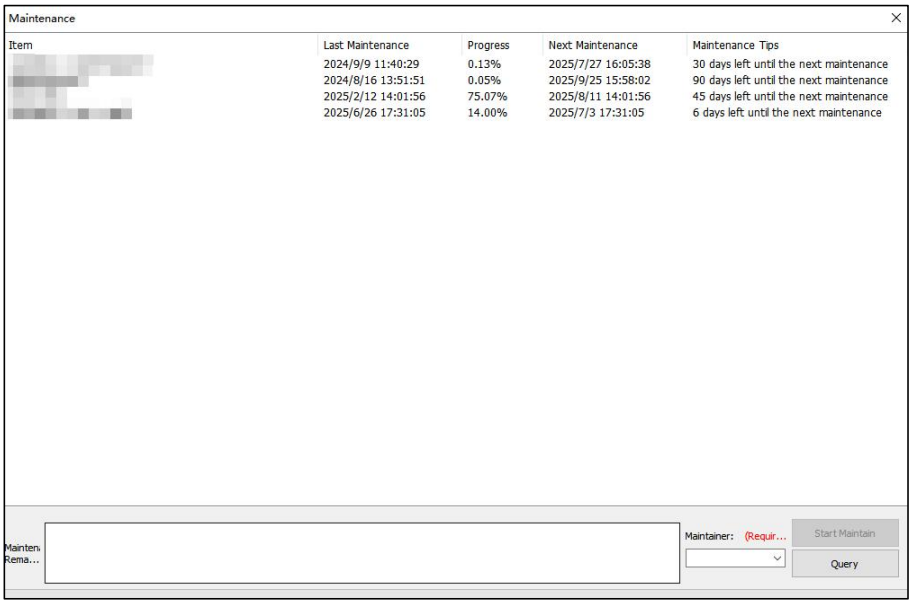


Figure 6-5 Maintenance

6.2 Task

Click the ***Task*** drop-down menu to load a cutting task or save the current cutting task. The task file (*. fj) from FACut is capable to save the drawings and breakpoint information. When the processing is interrupted unexpectedly, the current task can be saved and loaded when the production is resumed. On the premise that the plate has no relative motion to the machine, the processing can be resumed from the breakpoint.

6.3 RayBox

FACut supports ***RayBox*** usage, which can be used for operations such as importing drawing tasks and remote control.

Chapter 7 Mechanical Settings

7.1 Return Origin

When the machine is installed for the first time or the mechanical coordinate system deviates due to abnormal reasons, you can click ***Return Origin*** on the top toolbar to reset the machine coordinate system.

FACut supports single-axis return origin, selected-axis return origin, and full-axis return origin operations.

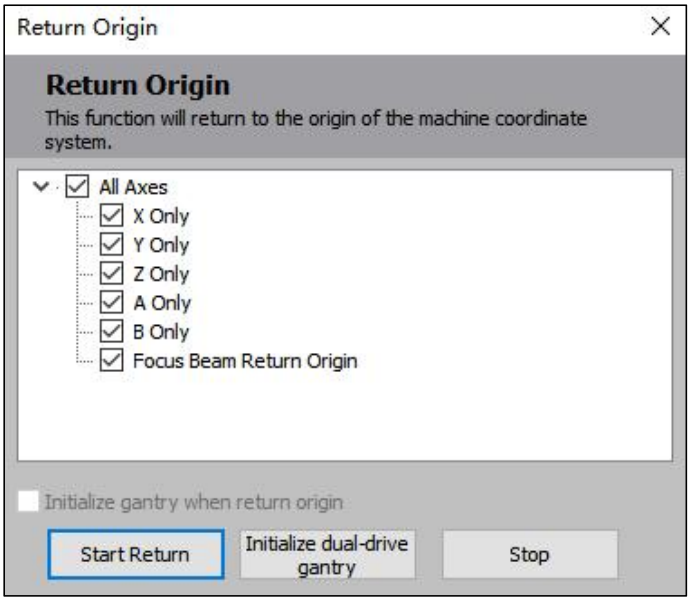


Figure 7-1 Return origin

When the option ***Use Z Phase Signal*** is enabled in FACutConfig, the ***Return Origin*** interface will display options related to ***Initialize gantry when return origin*** and ***Initialize dual-drive gantry*** (available in the ***Expert*** mode).

7.2 Calibrate

Capacitance calibration and pressure calibration help ensure optimal cutting performance by stabilizing height control and gas delivery during processing.

7.2.1 Capacitance Calibration

Ensure that the nozzle is tightly secured and the cutting head is above a plate surface. Jog to lower the cutting head close to the plate, then click ***Start Calibrate***. Once calibration is complete, confirm that both smoothness and stability indicators display ***Excellent***.

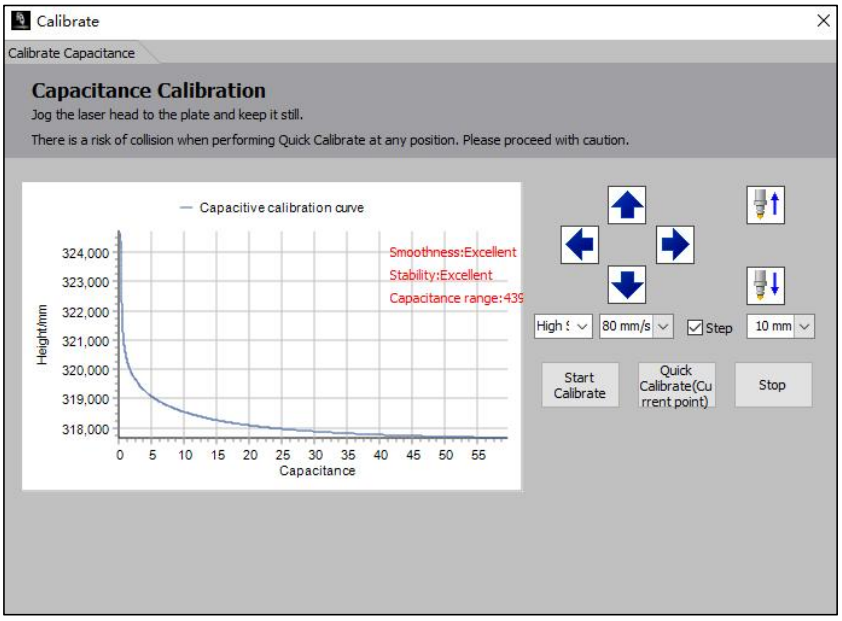


Figure 7-2 Capacitance calibration

After a successful calibration, you can move the cutting head to any location on the plate and click ***Quick Calibrate (Current point)*** to perform a localized calibration.

Caution: The capacitance calibration needs to be re-executed after the nozzle is replaced or a capacitance alarm occurs.

7.2.2 Pressure Calibration

Select nozzle and gas type and calibrate the gas pressure.

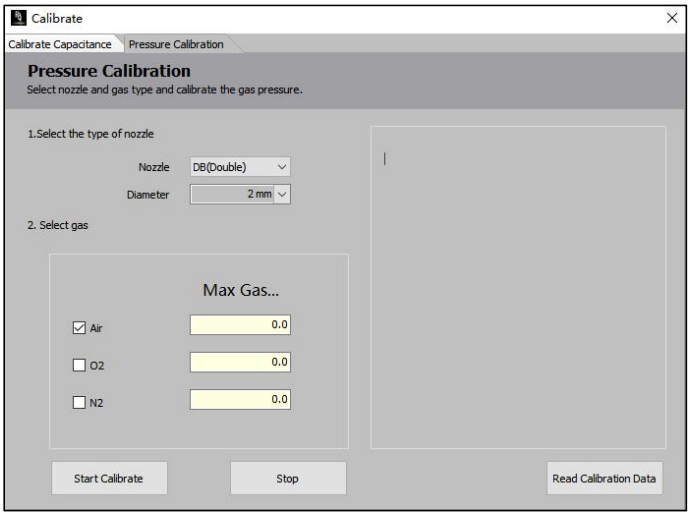


Figure 7-3 Pressure calibration

Caution: When nozzles of different diameters are used, re-executed ***Pressure Calibration***.

7.2.3 Quick Calibrate (fixed)

Before using quick calibration, capacitance calibration must be completed.

You can jog the cutting head within the interface to read its current coordinates, or manually set a fixed point. After moving the head, click ***Return Fixed Point*** to move it back to the defined position. Click ***Fixed Point*** to perform a one-click capacitance calibration at that location.

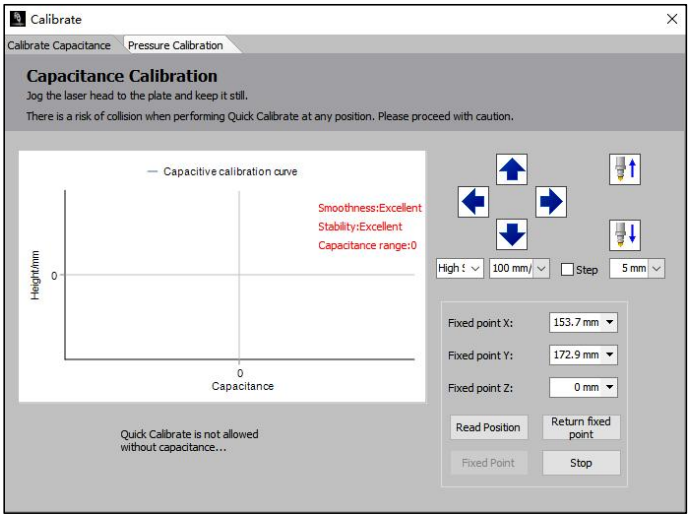


Figure 7-4 Quick calibrate (fixed)

Chapter 8 Software Settings

8.1 **Global Parameter**

Global Parameter defines machine-wide settings such as acceleration and general machining options.

8.1.1 Cutting Params

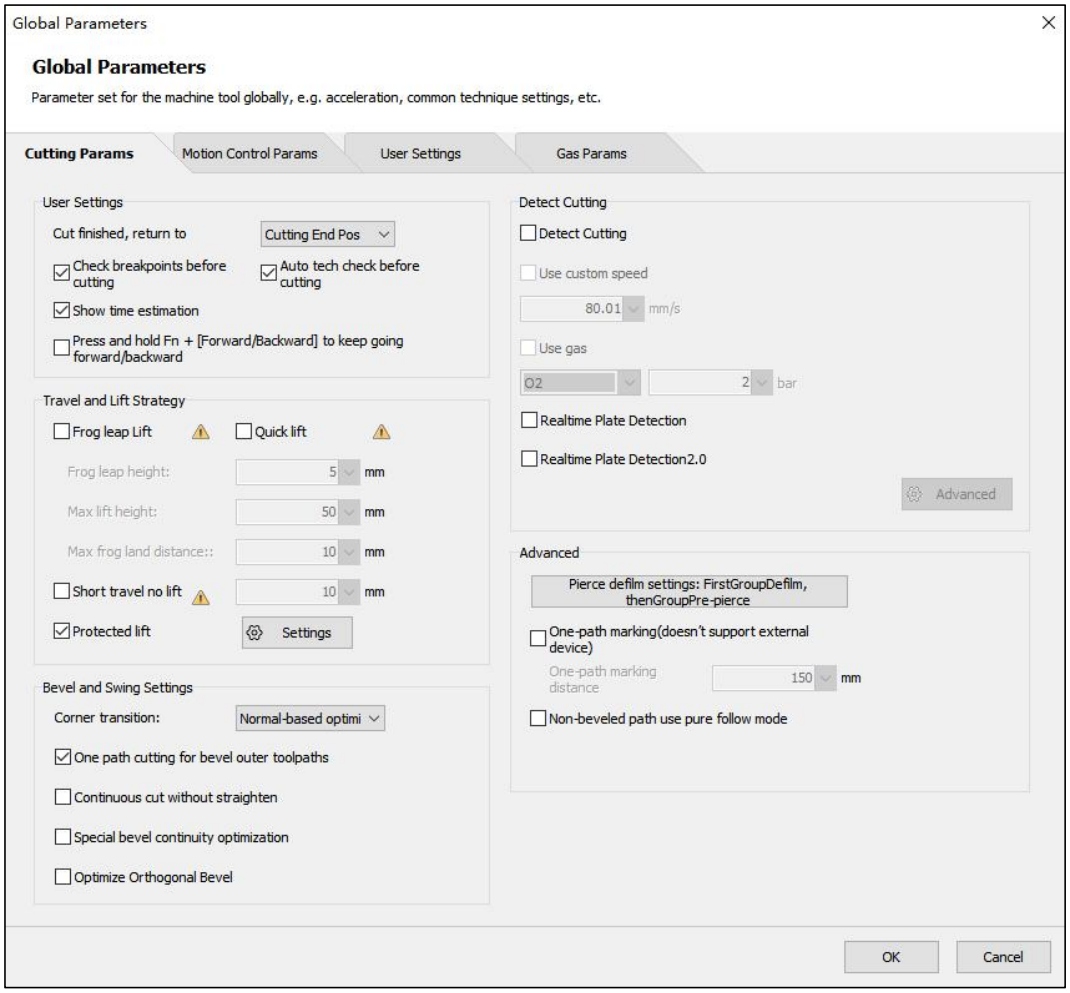


Figure 8-1 Cutting parameters

Details of the explanation of each parameter can be found in the following table:

Table 8-1 Cutting Params: User Settings

Name	Description
Cut finished, return to	Selection includes ***User Zero Point/Cutting End Pos/Marks***.
Check breakpoints before cutting	If enabled, the system checks for breakpoints before restart cutting after a stop.
Auto tech check before cutting	If enabled, the system checks graphic techniques before each machining session.
Show time estimation	If enabled, the estimated completion time will be displayed in the upper-left corner of the CAD panel during machining.
Press and hold ***Fn*** + ***Forward/Backward*** to keep going forward/backward	If enabled, holding ***Fn*** + ***Forward/Backward*** on the WKB wireless remoter will move the cutting head continuously along the original path.

Table 8-2 Cutting Params: Travel and Lift Strategy

Name	Description
Frog leap lift	If enabled, the cutting head lifts as frog leap during travel.
Frog leap height	Lift to the set height before executing frog leap.
Max lift height	Max lift height of frog leap.
Max frog land distance	The distance at which frog land begins.
Short travel no lift	If enabled, the head skips lifting when the next segment is within a specified short distance.
Protected lift	Enables anti-collision logic during all lifting motions. See FACut - Protected Lift.

Table 8-3 Cutting Params: Bevel and Swing Settings

Name	Description
Corner transition	Selection includes ***Direct Corner Transition/Normal-based Optimization***.
One path cutting for bevel outer toolpaths	When enabled, continuous cutting for connected bevel contours.

Name	Description
Continuous cut without straighten	Enables efficiency boost by minimizing swing-back motions between tilted piercing segments.
Special bevel continuity optimization	Optimizes corners further when ***Optimize Orthogonal Bevel*** is enabled.
Optimize Orthogonal Bevel	Improves continuity when cutting rounded rectangle V/Y/X/K bevels.

Table 8-4 Cutting Params: Detect Cutting

Name	Description
Detect Cutting	Pre-runs the path to compensate for plate deformation, improving accuracy.
Use custom speed	Sets the speed of the detection, recommended to be limited to 80 mm/s or lower.
Use gas	Sets gas type and pressure for detection.
Realtime Plate Detection	When enabled, the detection before cutting is omitted for fixed-stance bevels, while still maintaining compensation effect.
Sampling precision	Located in ***Advanced***: Controls sampling density. ***Precision first*** = tighter tracking; ***Stability first*** = sparse tracking. ***Stability first*** prevents untimely Z-axis following response due to over-sampling when the plate deformation is large.
Detect Height	Located in ***Advanced***: Sets head height (1 ~ 5 mm) during detection.
Vibration Suppression	Sets the parameters for ***Vibration Suppress*** during the detection, and higher ***Sample Filtering Lv*** improves the suppression effect.
Compensate bevel degree by plate detection	Detect Cutting fits a new plate surface by collecting the plate capacitance where the machining track locates. If enabled, the calculated normal vector of the surface is also compensated in the processing commands.

Table 8-5 Cutting Params: Advanced

Name	Description
Pierce defilm settings	Set the cutting sequence and grouping sequence of pierce and defilm.
One-path marking	Enables one-pass marking (ineffective with external devices). Supports max stroke distance.
Non-beveled path use pure follow mode	Enables pure follow mode (same as HypCut) for height controller during straight cuts rather than interpolated follow.

8.1.2 Motion Control Params

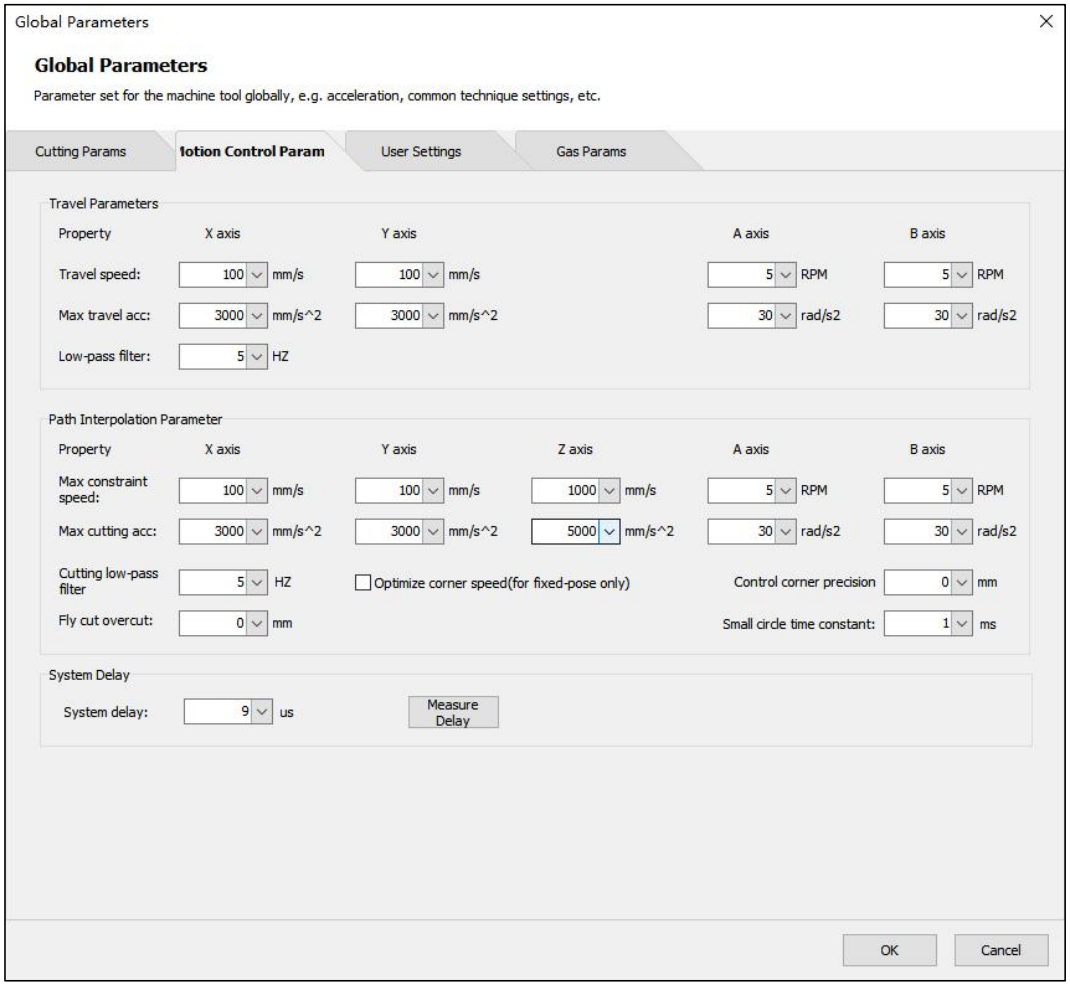


Figure 8-2 Motion control parameters

Details of the explanation of each parameter can be found in the following table:

Table 8-6 Motion Control Params: Travel Parameters

Name	Description
X/Y/A/B Travel speed	Set max travel speed for the X/Y/A/B axis.
X/Y/A/B Max travel acc	Set max travel acceleration for the X/Y/A/B axis.
Low-pass filter	Set the travel low pass filtering frequency. This parameter is related to the mechanical performance, and the default is 5 Hz.

Table 8-7 Motion Control Params: Path Interpolation Parameter

Name	Description
X/Y/Z/A/B Max constraint speed	Limit the speed of single-axis machining.
X/Y/Z/A/B Max cutting acc	Limit the acceleration of single-axis machining.
X/Y/Z/A/B cutting low-pass filter	The low-pass filtering frequency for machining, and the default is 5 Hz. The better the performance of the machine, the higher acceleration and lower pass filtering allowed.
Optimize Corner Speed	When checked, it optimizes the speed reduction when machining rounded corners (for straight cuts only).
Control corner precision	Determines corner rounding fidelity. Lower values = sharper corners but slower. The value can be adjusted to make a trade-off between corner cutting speed and accuracy. This parameter is currently valid for straight cuts only.
Fly cut overcut	Defines early laser-on and late laser-off distances to ensure part drop-off.
Small circle time constant	Minimum time for small arc cuts. Higher values = better precision, slower speed.

Table 8-8 Motion Control Params: System Delay

Name	Description
System delay	The current system delay is measured by ***Measure Delay*** to to adjust laser-on/off timing during fly-cutting.
Measure delay	Uses EtherCAT bus to calculate and compensate for latency, ensuring multi-axis sync and cut accuracy.

8.1.3 User settings

Figure 8-3 User settings

Details of the explanation of each parameter can be found in the following table:

Table 8-9 User Settings: Common

Name	Description
Speed unit	You can change the speed unit in ***Global Parameter***. Optional: mm/s, m/s, m/min, mm/min, in/min, in/s.
Language	FACut supports both simplified Chinese and English. Add other language packages to the installation directory, then the corresponding language will be available. Restart the software to complete the language change.

8.1.4 Gas Params

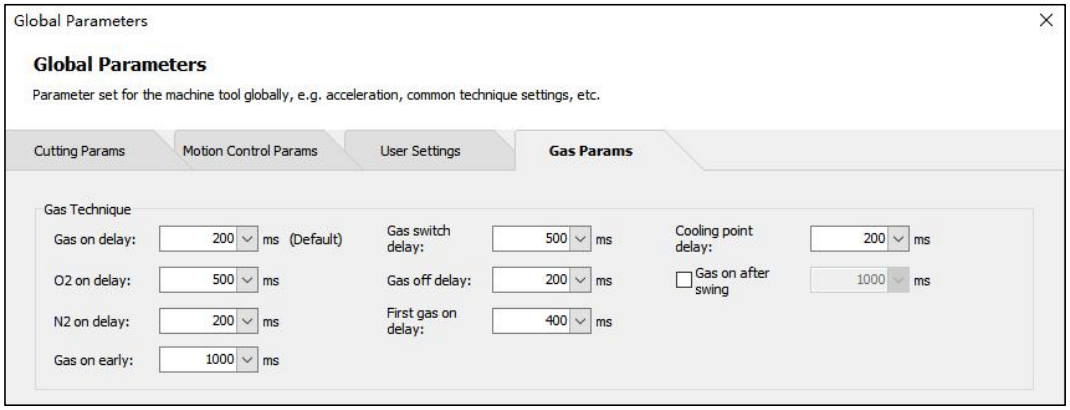


Figure 8-4 Gas parameters

Details of the explanation of each parameter can be found in the following table:

Table 8-10 Gas Parameters

Name	Description
Gas/O2/N2 on delay	Delay required to stabilize gas pressure after opening the gas circuit.
Gas switch delay	Time required to purge the previous gas before stabilizing the new gas at the cutting head.
Cooling delay	Duration of gas cooling at cooling points.
Gas off delay	Delay before shutting off the gas after cutting, reducing unnecessary gas activation for short-distance movements.
First gas on delay	Delay before the first gas blow at the start of processing.
Gas on after swing	When the cutting head stops rotating, it will turn off the laser and blow according to the set time.

8.2 PLC

FACut supports setting up PLCs for alarm handling and production processes, including custom PLC processes.

Figure 8-5 Manage PLC

After configuring a custom process in the PLC module, click the drop-down menu to select and execute the desired custom PLC.

Chapter 9 Auxiliary

9.1 **Find Edge**

FACut supports several find-edge methods, such as ***Auto Find Edge***, ***2-point Find Edge***, ***Manual Find Edge***, and ***Circle Center***. Click the ***Find Edge*** drop-down under the ***Production*** toolbar to choose the most suitable method based on actual conditions to determine the plate placement. The edge finding result will be displayed in the upper-right corner of the CAD panel.

9.1.1 Auto Find Edge

Click ***Find Edge*** on the top toolbar to enter ***Auto Find Edge*** interface, as shown in the figure:

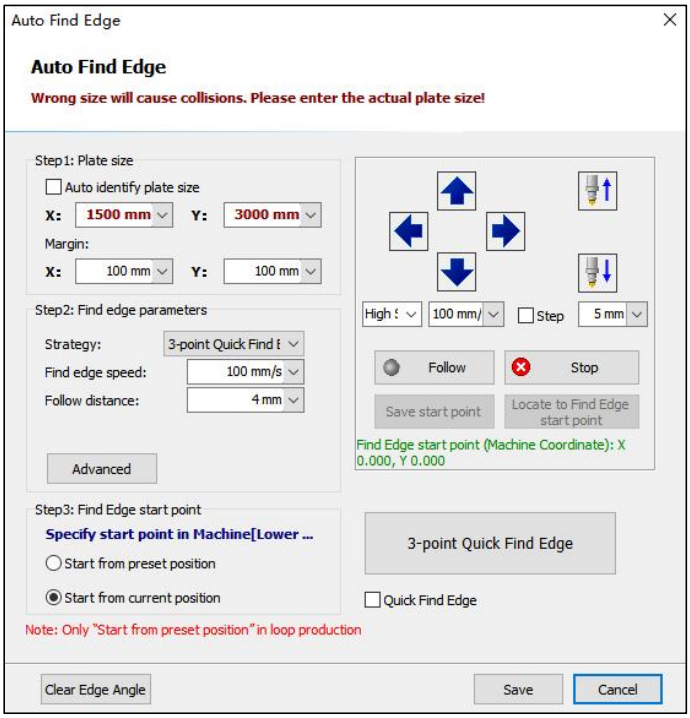


Figure 9-1 Auto find edge

- Auto identify plate size: When checked, the system automatically identifies the plate size, using the maximum drawing size by default. If unchecked, you should enter the actual plate size manually.

  Caution: Ensure manually entered values are slightly smaller than the actual plate size to avoid nozzle crashes caused by mismatches.

- Margin: The edge detection point is typically set outside the plate. A positive value shifts the point

inward (into the plate); a negative value shifts it outward (beyond the plate). Setting an margin helps prevent cutting head vibration due to capacitance fluctuations near the edge. If edge margin has already been configured in the nesting stage, set this value to 0.

- Strategy: You can select between ***3-point Quick Find Edge*** and ***6-point Slat-Avoid Find Edge***; Among them, 6-point slat -avoid find edge is suitable for thin plates to avoid the interference caused by rack tips. ***Advanced*** settings allow adjusting the spacing between the two probe points on the same edge.

Notice: Find edge parameters will affect the accuracy of edge-finding, so it is suggested to use the initial values: Find edge speed 100 mm/s; Find edge follow height 4 mm. For improved accuracy on long sides, increase the spacing between probe points.

- Start from preset position: Each edge find starts from a user-defined fixed point. You can jog the cutting head to the desired start point and save it. Ensure this point is inside the plate.
- Start from current position: Starts from wherever the cutting head currently is. Make sure the cutting head is above the plate before starting.

If the ***Find edge before production*** option is enabled in parameter settings, the system performs a capacitance edge finding before dry-run or machining based on the graphic zero point. In this case, select ***Start from preset position*** and ensure the starting point is properly configured.

Caution: Before edge finding, please ***Return Origin*** to reset machine coordinates and ensure that the cutting head is capable of following properly. The inclination angle of the plate should not exceed 10 degrees.

9.1.2 2-Point Find Edge

This is a simplified strategy within automatic edge finding, shown as a separate option because it does not set the program zero point. Hence, it is not applicable for ***Find edge before production***. Its parameters are identical to ***Auto find edge***, except that the point selection strategy only supports ***2-point Quick Find Edge***.

9.1.3 Manual Find Edge

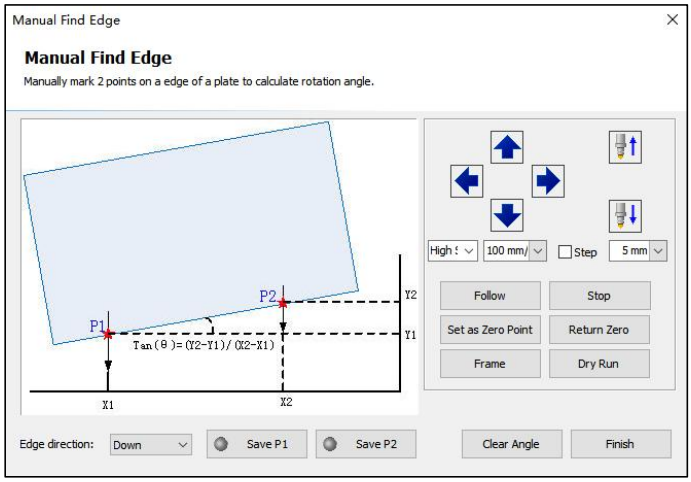


Figure 9-2 Manual find edge

Manually move the cutting head to the edge of the plate, and record the coordinates of two different points on each edge of the plate respectively, and the system will automatically calculate the tilt angle of the plate. The longer the distance between two points is, the more precise the angle calculated is.

9.1.4 Circle Center

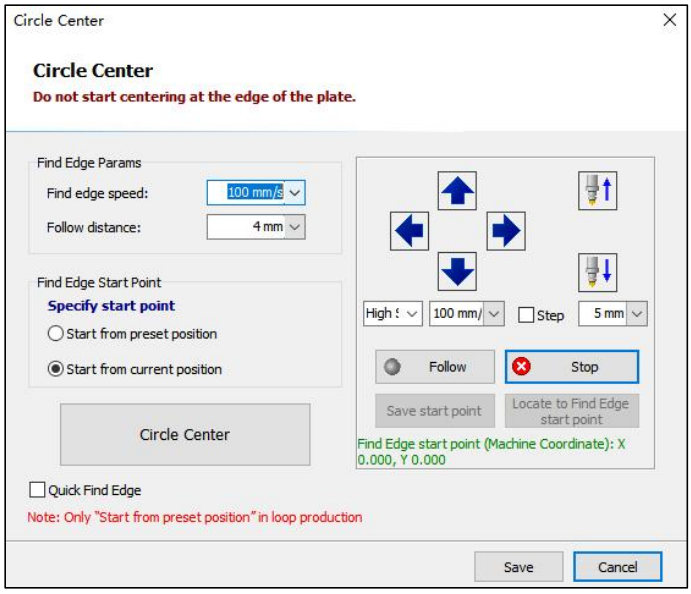


Figure 9-3 Circle center

This method is used exclusively for circular plates. After centering, the program zero point is placed at the center of the circular plate. Thus, ensure the zero ref of the drawing is set to ***Center***.

Caution: Before starting, make sure the cutting head is above a circular plate.

9.2 Quick Cut Off

9.2.1 Quick Cut Off

Click ***Quick Cut Off*** from the Production toolbar or from its drop-down menu to enter the ***Quick Cut Off*** interface. This function is mainly used for quickly cutting off remnant materials along the X or Y axis. The interface is as shown in the figure:

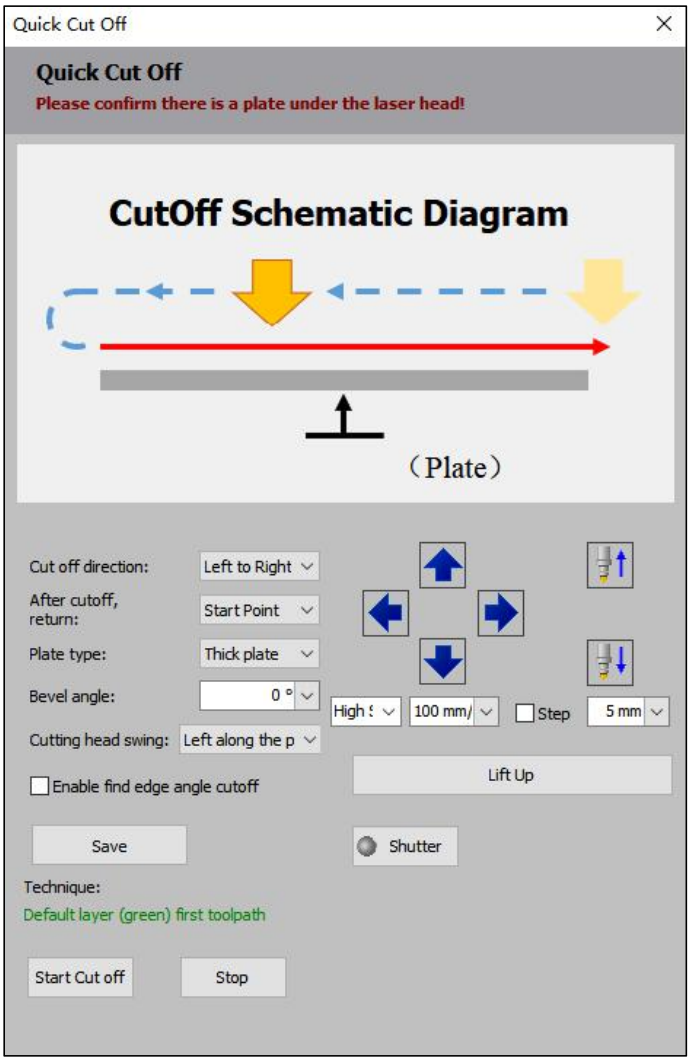


Figure 9-4 Quick cut off

- Cut off direction: Select cutting starting point and cutting direction in four options listed.
- After cutoff, return: Choose to return to ***Start Point*** or stay at ***End Point*** after cut off.
- Plate type: Select a specific plate type according to actual situation.
- Bevel angle: FACut supports beveled quick cut off. Set the bevel angle to perform cutting.

- Cutting head swing: Choose tilt direction of the cutting head during the cutting.
- Enable find edge angle cut off: When enabled, the cutting direction is adjusted based on edge-finding results.

Notice: The default cutting technique for quick cut off is the layer 1 (green).

9.2.2 Cut Off Guiding

Supports flexible definition of cutoff lines by selecting points, helping save material more efficiently.

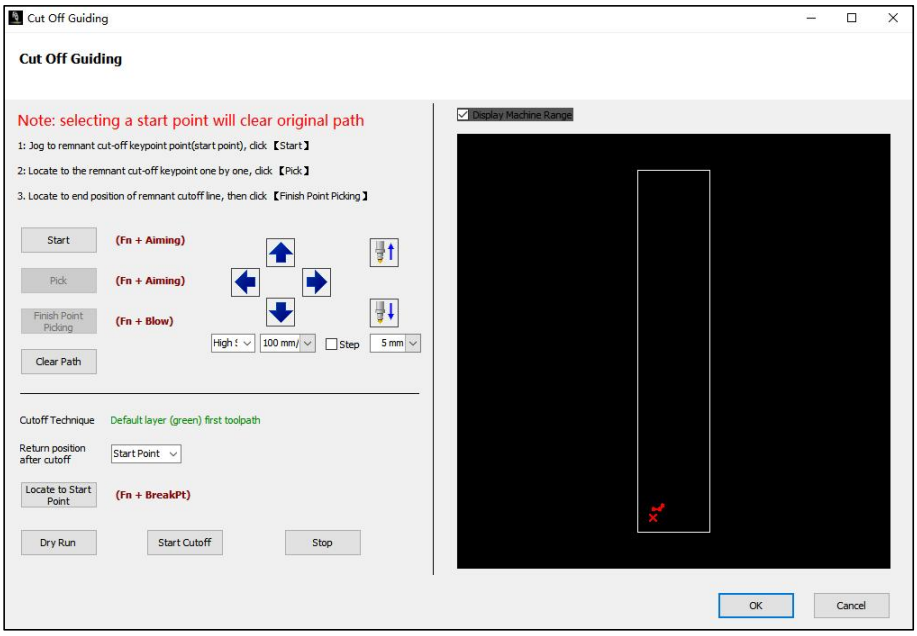


Figure 9-5 Cut off guiding

9.3 Nozzle Correction

The swing length and zero focus of the cutting head will be changed after replacing the nozzle of different lengths. Therefore, nozzle parameters should be adjusted accordingly after each nozzle replacement.

Upon opening the nozzle parameter adjustment interface, the ***Select nozzle*** defaults to the last selected one. You can click the drop-down arrow to switch nozzles or click the + icon to enter the nozzle abbreviation and name to add a new one. The **-** button allows you to remove the currently selected nozzle from the nozzle library. Click ***Confirm*** at the top of the interface to write the ***Current swing length*** and ***Current focus offset*** of the selected nozzle into the current values.

Notice: Each time swing length or focus offset is written, both the current values and the selected nozzle's stored values will be updated. The actual processing is based on the ***Current swing length*** and ***Current focus offset***.

9.3.1 Swing Correction

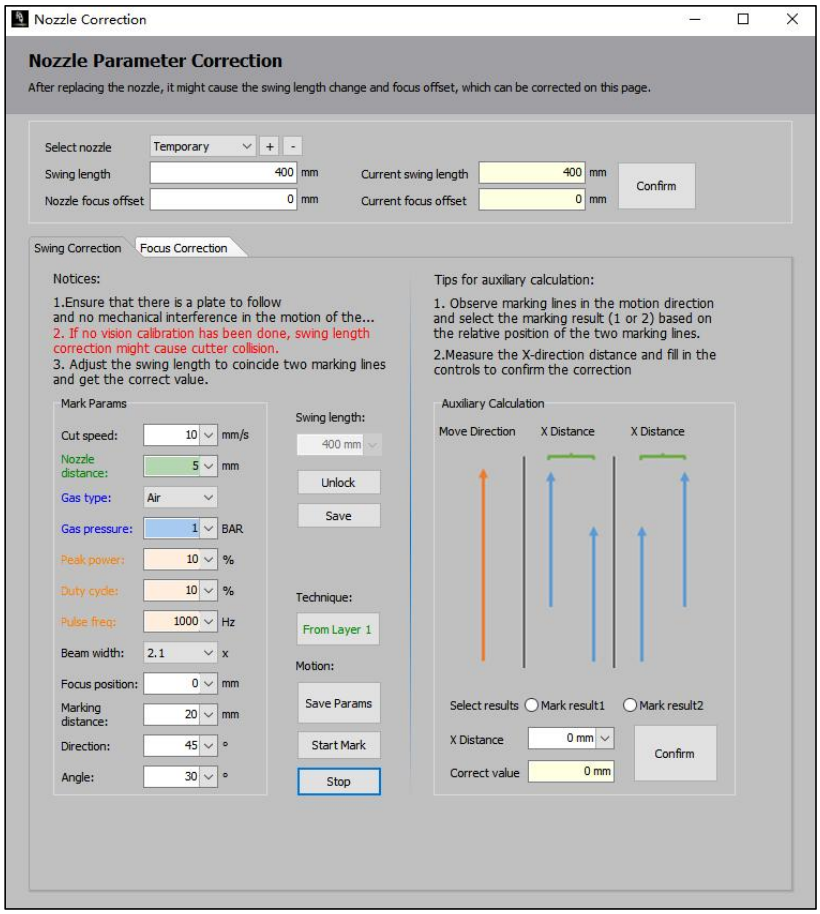


Figure 9-6 Swing correction

Swing Correction must be performed after ***Vision Calibration***. Ensure there is material under the cutting head, sufficient axis travel, and no mechanical interference.

After setting the technique for marking, click ***Start Mark***, the cutting head will tilt to the set angle, and cut two marking lines along the set direction. Observe the marking lines along the cutting head motion direction, measure the ***X Distance*** between them, and enter the results in ***Mark result 1*** or ***Mark result 2*** according to the relative position of the marking lines. Click ***Confirm*** to write the data to the current swing length.

In addition, you can click ***Unlock*** to enter the ***Swing length*** directly and click ***Save*** to set it as the current swing length.

Notice: After marking parameters are modified, if you use WKB to ***Start*** marking, click ***Save Params*** first to ensure the updated process parameters take effect.

9.3.2 Focus Correction

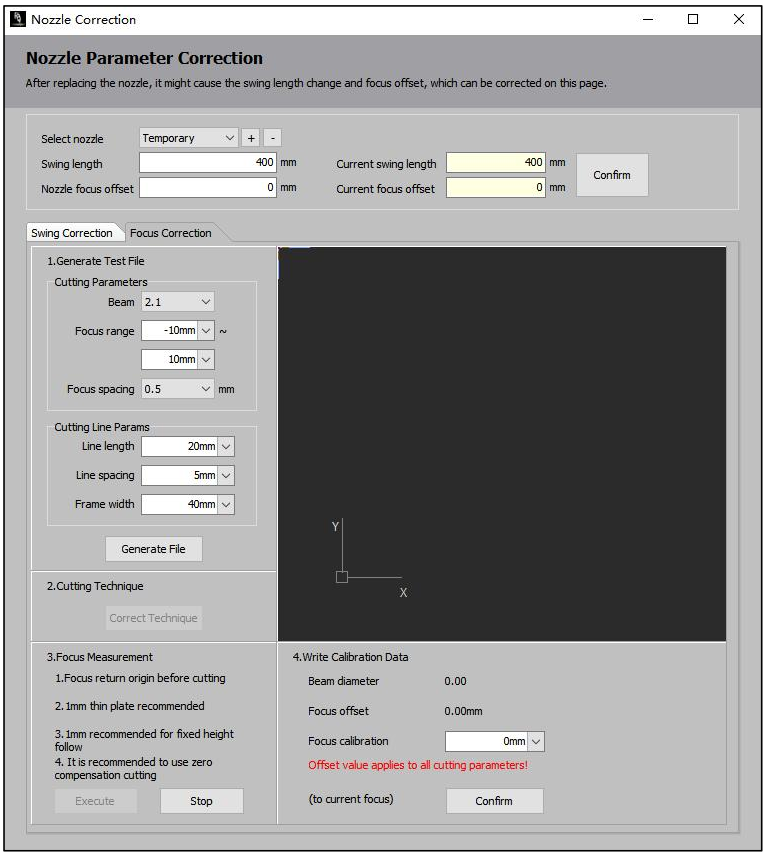


Figure 9-7 Focus correction

The focus testing allows measuring the actual focal position under the current conditions and writing

the corresponding calibration value.

Step 1 Adjust focus range and spacing. A smaller spacing improves accuracy. Repeat testing if needed. Keep default values for marking line parameters.

Step 2 Click ***Generate File*** and ***Correct Technique***, enter the marking technique in the pop-up window, save the settings, and then click ***Execute***.

Step 3 Observe the finished workpiece and check the focus value on the right corresponding to the thinnest line. For example, the focus on the right corresponding to the thinnest horizontal line in the following figure is -1, which indicates that the zero focus is at -1. Enter -1 to the ***Focus calibration*** box, and click ***Confirm*** to write the focus offset into the current value.

Figure 9-8 Zero focus

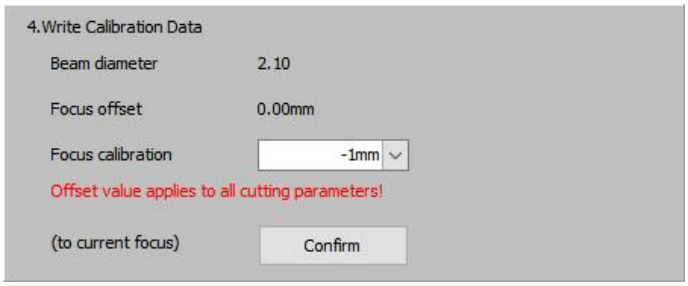


Figure 9-9 Focus calibration

Notice:

1. Focus should return origin before cutting.

2. A 1 mm thick stainless steel plate is recommended.

3. Suggested following height: 1 mm.

4. Use zero focus offset in cutting.

5. Pay attention to the positive and negative directions of the feeler gauge to avoid incorrect input of positive and negative values.

9.4 **Other**

9.4.1 Tape Shot

Tape shot is mainly used to detect whether the lens/windows in the cutting head is contaminated.

Step 1 Lay the photo paper flat on a 200 × 300 mm plate and secure its four corners with masking tape to keep it smooth.

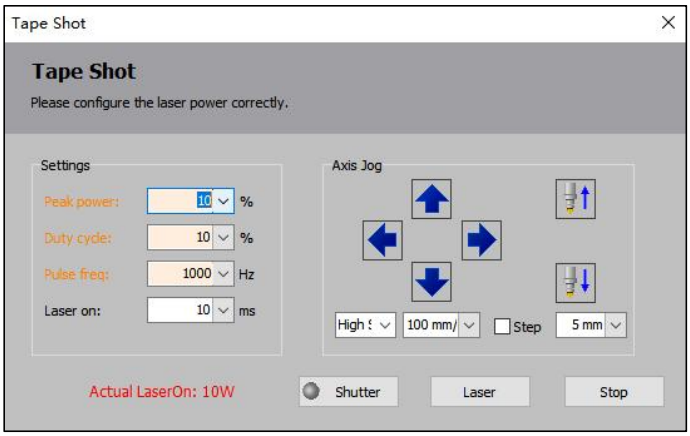
Step 2 Place the plate with photo paper in the hopper.

Step 3 Turn on the aiming red light, move the cutting head or fine-tune the paper's position to ensure the red light is centered on the photographic paper. Ensure the cutting head is positioned in the middle of the rack to prevent the beam from being obstructed.

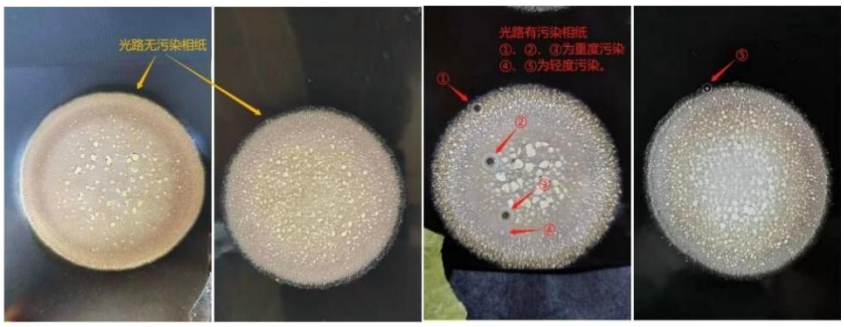
Step 4 Replace the nozzle with a single-layer nozzle larger than 3.0 mm in diameter and set the focus to zero focus. Select ***Tape Shot*** in the drop-down list of ***Other***, and enter the following parameters:

- Peak power: Around 10,000 W (for lasers below 10,000 W, input the maximum power)
- Duty cycle: 100%
- Pulse freq: 5000 Hz
- Laser On: 25 ms

Activate the laser to perform the test.



Step 5 After the test, evaluate the paper for abnormalities to determine potential contamination or optical misalignment.



9.4.2 Stations Management

FACut supports multi-task processing. You can configure either ***1-Pallet - N Station*** or ***1-Pallet - 1 Station*** with pallet changer to manage automated part cutting and material handling across multiple workstations.

For details, refer to FACut - Multi-task.

9.4.3 Mark Corner

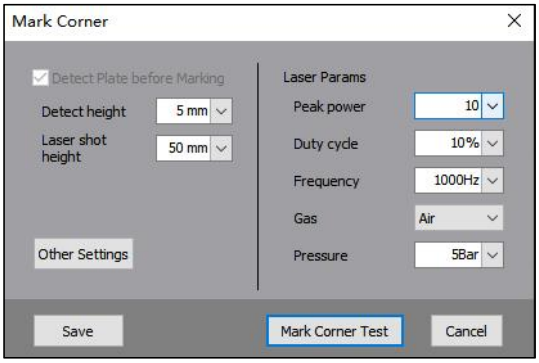


Figure 9-10 Mark corner

Mark Corner, similar to ***Frame***, both can be used to determine whether the to-be-machined figure is within the plate. It will activate laser on the four corners of the figure frame and make four L-shaped corner marks on the plate. Click ***Mark Corner Test*** will perform the mark corner action.

9.4.4 Clean Nozzle

After enabling Nozzle Cleaning under ***FACutConfig → Planar NC System → Advanced Config***, the ***Clean Nozzle*** function will appear under ***Other*** in the FACut ***Production*** toolbar. This function needs nozzle to work with brush and open gas to to clean up the metal slag inside the nozzle.

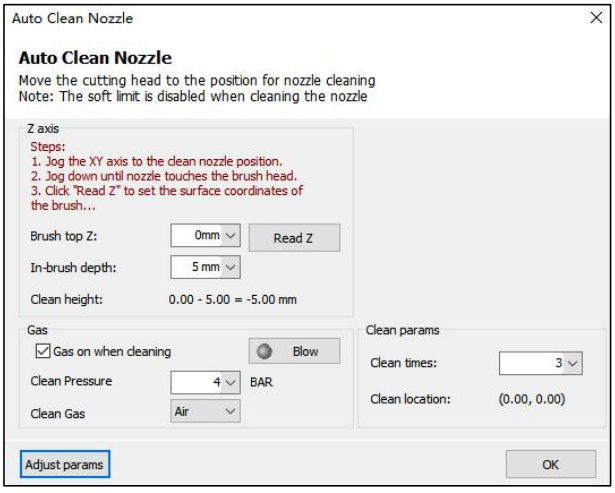


Figure 9-11 Automatic clean nozzle

You can configure basic parameters in the ***Clean Nozzle*** window, and click ***Adjust Params*** to open the advanced settings interface, where you can configure motion parameters for the nozzle cleaning process. There are three kinds of ***Clean path***: ***Line***, ***Circle*** and ***Wavy line***. In the preview diagram, the green dot represents the starting point while the red dot represents the ending point. Ensure all movement

paths stay within the machine's travel limits.

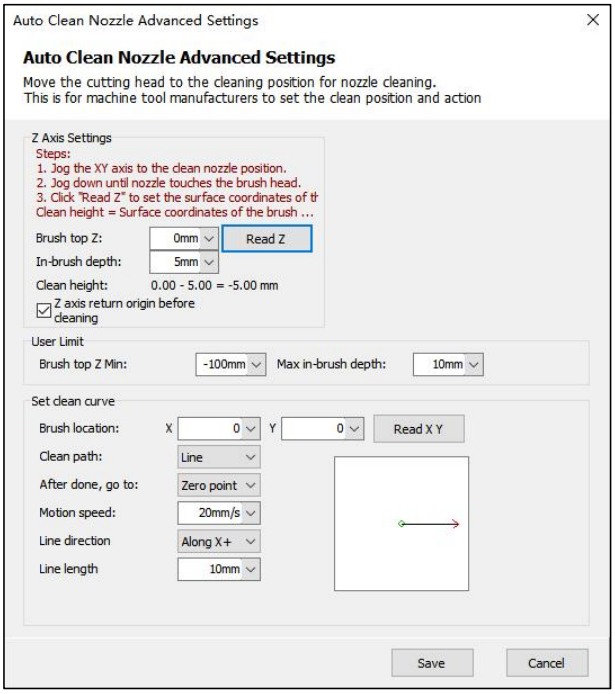


Figure 9-12 Auto clean nozzle advanced settings

9.4.5 Border Contour

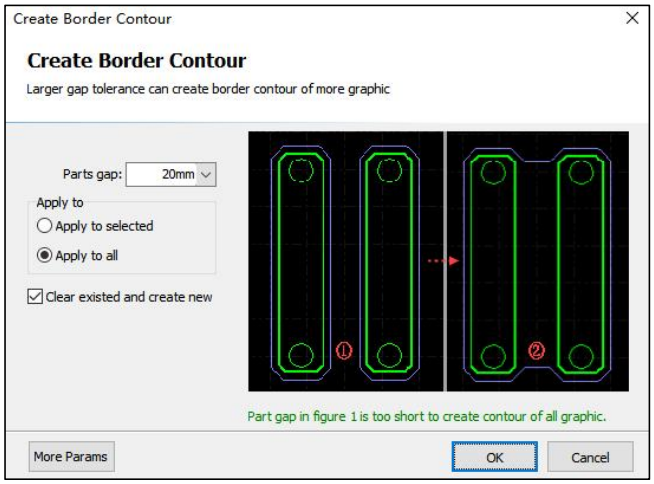


Figure 9-13 Border contour

The ***Border Contour*** function generates one or more boundary lines around the maximum outer contour of a part. The function include creating and clearing the border contour.

- Create Border Contour: Creates border contours based on the parts. The larger the part spacing, the larger the area covered by the border contour.
- Clear Border Contour: Deletes all existing border contours from the current drawing.

Chapter 10 Tools

10.1 **Debug**

10.1.1 IO Board

In the IO board monitoring interface, select the board number to be tested in the top-left to perform operations such as toggling output ports on/off, monitoring input port status, simulating input tests, debugging PWM and DA signals, and monitoring AD sampling results.

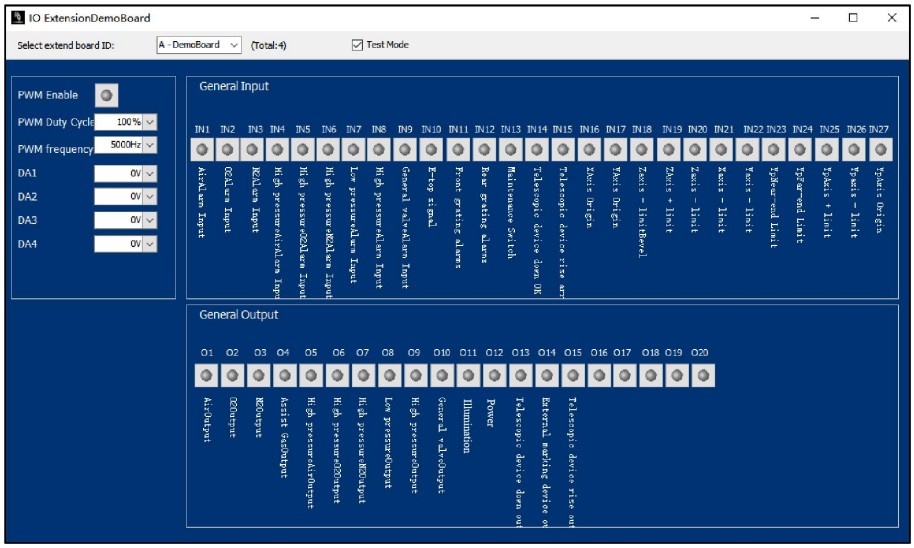


Figure 10-1 IO board

After checking ***Test Mode***, you can manually test the input and output ports without being affected by the real-time refreshing thread.

10.1.2 Height Controller Monitor

The monitoring page displays real-time capacitance, capacitance curves, and capacitance temperature drift of the height controller.

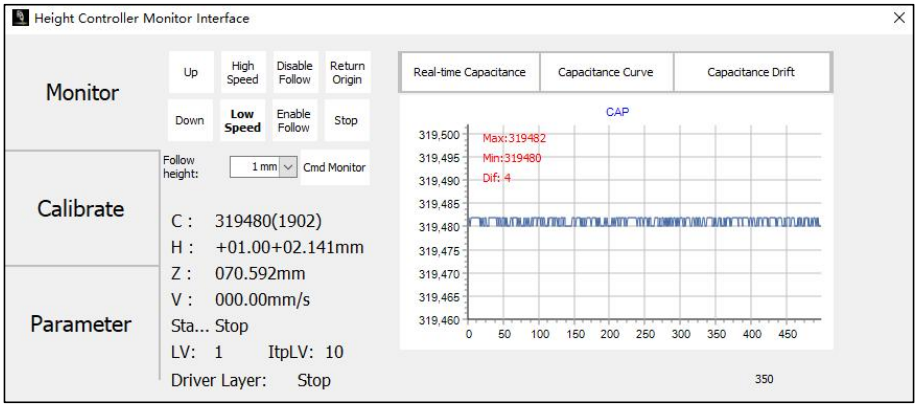


Figure 10-2 Height controller monitor interface

On the ***Calibrate*** page, you're allowed to finish capacitance calibration, and adjust follow parameters and interpolation level.

Step 1 Ensure that the nozzle is tightly secured and the cutting head is above a plate surface. Jog to lower the cutting head close to the plate, then click ***Capacitance Calibration***. Once calibration is complete, confirm that both smoothness and stability indicators display ***Excellent***.

Step 2 After calibration, perform ***Auto Adjust*** and ***Interpolated Auto Adjust*** to optimize the ***Follow Level (LV)*** and ***Interpolated Follow Level (ItpLV)***.

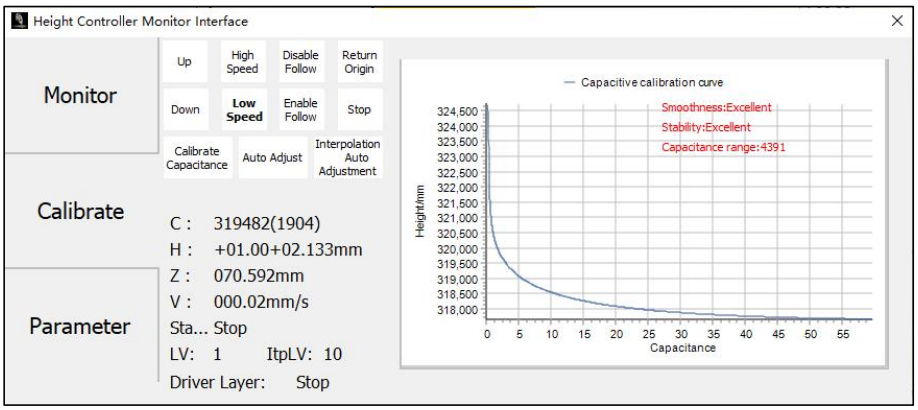


Figure 10-3 Height controller calibration

The ***Parameters*** page is used to adjust the parameters of the height controller. Click ***Unlock Parameter*** to modify the parameters and click ***Write Parameter*** to save the changes and make them effective.

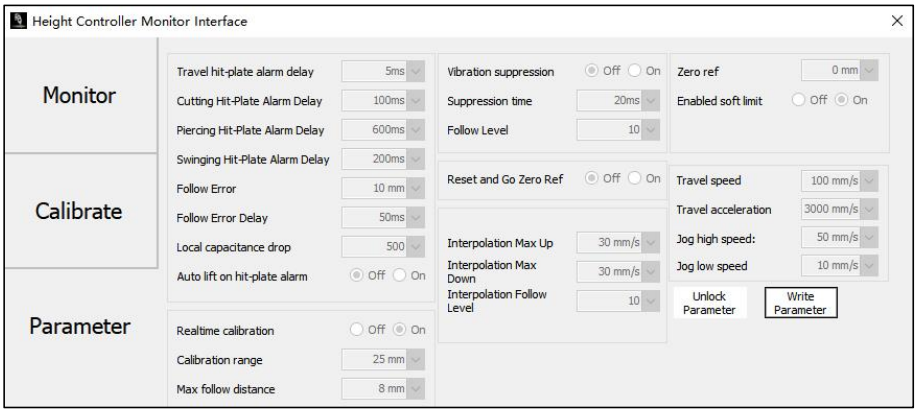


Figure 10-4 Height controller parameter

The parameters are described in the following table:

Table 10-1 Height Controller Parameter

Name	Description
Travel/Cutting/Piercing Hit-Plate Alarm Delay	When the system stops or in a state of travel/cutting/piercing, if a collision persists longer than the set value, the Z-axis retracts and alarms. A value of 0 disables this alarm.
Follow Error	Maximum allowable following error. After the cutting head follows in place, once the following error exceeds the limit as the cutting head moves out of the plate boundary or the plate vibration, a follow error alarm will be triggered.
Follow Error Delay	This value determines how long follow-up errors can occur before triggering the alarm. The larger the value, the longer the system allows for follow errors, and the better the ability to filter out interference.
Local Capacitance Drop	An alarm will be triggered when the local capacitance decreases beyond the set value.
Auto Lift on Hit-Plate Alarm	If on, the cutting head will lift up automatically once there is a hit-plate alarm. If disabled, the cutting head will remain in place after the alarm is triggered.
Realtime Calibration	Enabling this function helps avoid issues caused by temperature drift, which can affect cutting quality.
Calibration Range	Sampling range of Capacitance Calibration.
Max Follow Distance	Max follow height allowed by the height controller. If the follower is above

Name	Description
	this height and ***Follow*** is triggered, the height controller will lower to the plate surface and then move upwards to the ***Max Follow Distance***.
Vibration Suppression	It is capable of suppressing the vibration caused by the cutting airflow on the plate with weak structural rigidity so as to reduce the cross-section wavy lines. It is also effective in suppressing vibrations caused by gas and slags.
Suppression Time	This parameter sets the strength of the vibration suppression function. A higher value will result in more noticeable vibration suppression but may reduce the responsiveness of the height controller. The default value is 20 ms, and the recommended range is 5 ~ 50 ms.
Follow Level	The following gain level is from 1 ~ 30, with a default value of 17. A higher level brings less average error and quicker follow motion, also stronger follow capability on the tilted plate. However, self-oscillation will be caused by a too-high follow level. You can automatically acquire a proper level by ***Auto Adjust***.
Reset and Go Zero Ref	Whether to go to Zero Ref of the Z-axis after ***Return Origin***.
Zero Ref	Zero reference for Z-axis.
Enable Soft Limit	Whether to enable soft limit protection for the height controller.
Travel Speed	Height controller travel speed.
Travel Acceleration	The height controller travels acceleration.
Jog High Speed	Set the jogging speed for high-speed movement.
Jog Low Speed	Set the jogging speed for low-speed movement.
Interpolation Max Up/Down	Under the interpolation algorithm, the following algorithm affects the response speed of distance.
Interpolation Follow Level	The higher the interpolation follow level, the more sensitive the following algorithm will be to capacitance. This results in better follow accuracy.

10.1.3 Motion Control Kernel Monitor

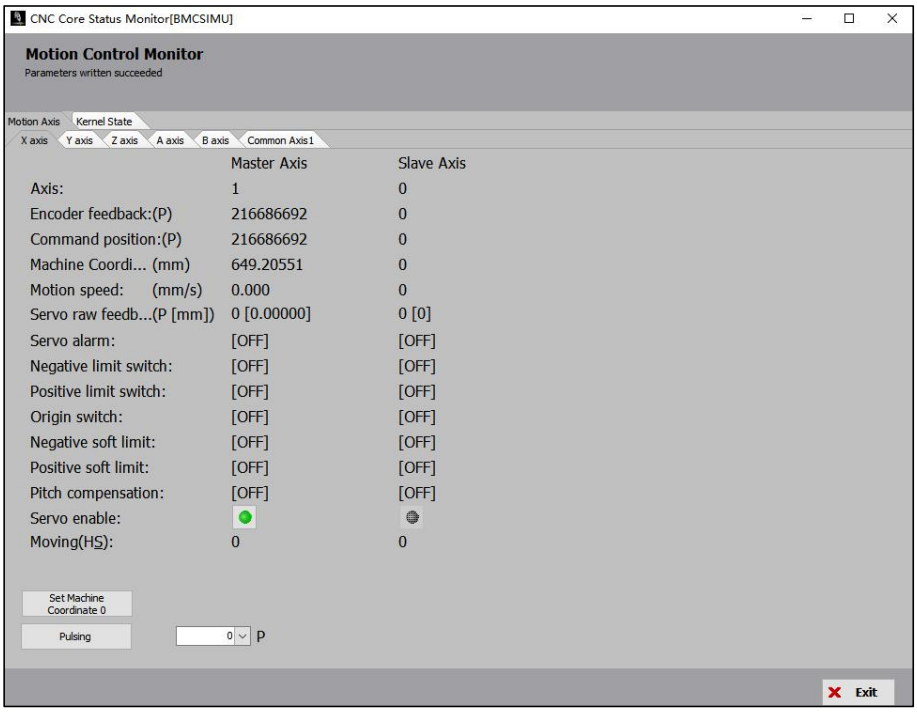


Figure 10-5 Motion control kernel monitor - motion axis

Motion control monitoring tool, including motion axes monitoring and kernel status monitoring.

Table 10-2 Motion Control Monitoring Parameters

Name	Description
Axis	The configured physical axis number.
Encoder Feedback	The encoder feedback value of servo, in Pulse.
Command Position	The command position, in Pulse.
Machine Coordinates	The system command position, in mm or rad.
Motion Speed	Real-time feedback speed of current servo.
Servo Raw Feedback	Record the feedback position of the servo motor.
Servo Alarm	Current servo alarm.
Negative/Positive Limit Switch	Current negative/positive hard limit input state.
Origin Switch	Current origin signal input state.
Negative/Positive Soft Limit	Current negative/positive soft limit input state.
Pitch Compensation	Check whether ***Pitch Compensation*** is enabled, only available for the X and Y axes.
Servo Enable	The servo enables status. Clicking to turn the servo enable on or off.

Name	Description
Pulsing	In the system stop state, allows sending specified pulses for testing purposes.
Set Current Position as Origin	This option is only available for A and B axes. You're allowed to set the current position as the origin for the A or B axis.
Clear Multi-turn Encoder Alarm	It is capable of clearing the A/B axis alarm of Yaskawa A810 (absolute encoder), this option only appears on the page of the corresponding axis when the alarm exists.
Set Machine Coordinate 0	Reset X/Y/Z mechanical coordinates to 0.

On the motion axis monitoring page, you can check the servo enable state, alarm state, hard/soft limit state, origin switch state, pitch compensation state, physical axis commanded position, feedback position, mechanical coordinates, and motion speed for each servo axis. You can also enabling/disabling the servo, sending test pulses, clearing coordinates, and clearing dual-drive alarms.

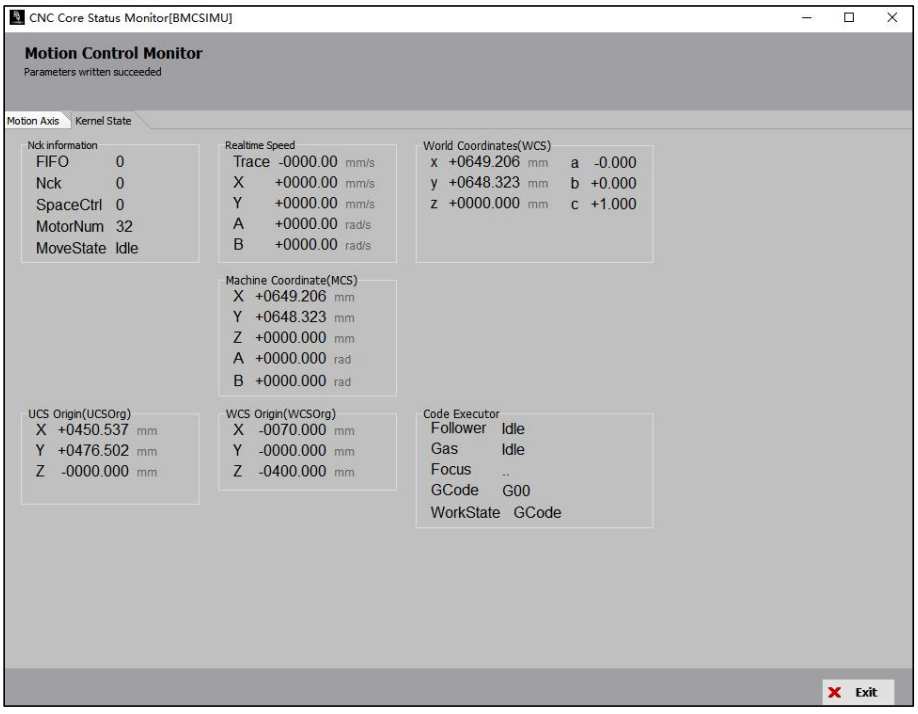


Figure 10-6 Motion control kernel monitor - kernel state

On the kernel state monitoring page, more in-depth kernel-level information is available, such as mechanical coordinates, program/user coordinates, buffer count, and G-code instruction data. Due to the complexity of these concepts, detailed explanations are omitted here.

10.1.4 Vision Calibration

Vision calibration is a key feature of FACut bevel cutting software. It uses camera-based detection to automatically correct the simulated parameters of the swing axis and cutting head, ensuring high cutting accuracy.

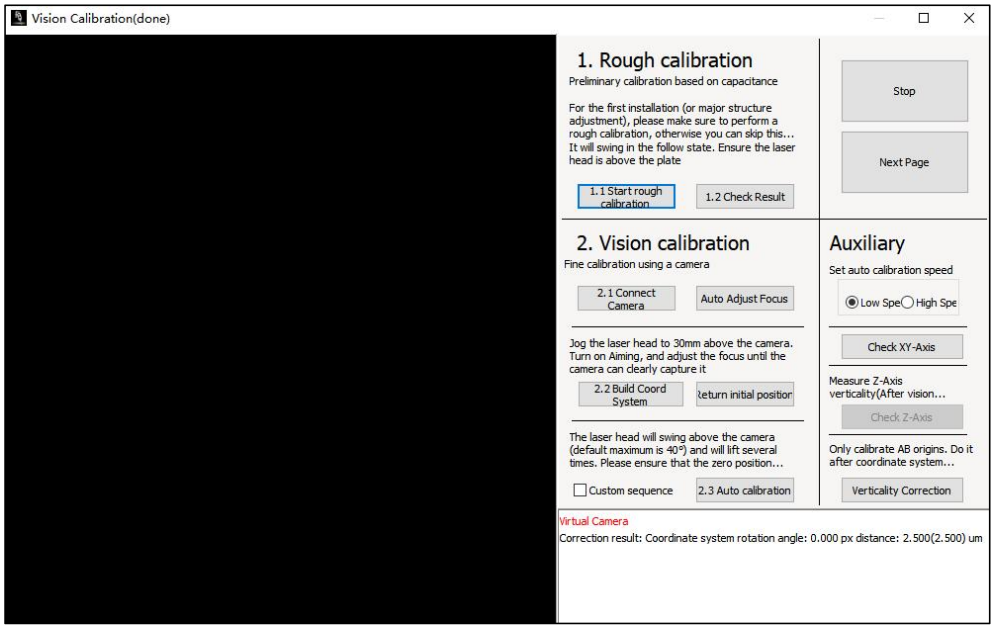


Figure 10-7 Vision calibration

For details, refer to FACut - Vision Calibration.

10.1.5 Vision Calibration Parameter Read/Write

When both FACut and FACut-H are installed on the same device and the mechanical structure remains unchanged, previously saved vision calibration data can be reused after switching between the software.

For example, when using FACut-H on a device for the first time, you can reuse the vision calibration data previously generated with FACut.

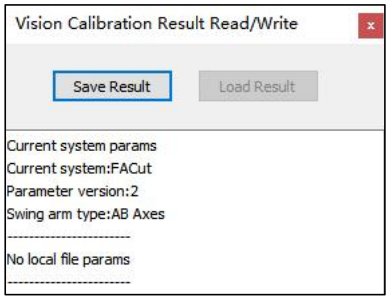


Figure 10-8 Vision calibration results read/write

Warning:

1. If the cutting head experiences a collision, you must re-execute vision calibration.

2. Even with identical mechanical parameters, do NOT reuse vision calibration results from other machines via the ***Vision Calibration Parameter Read/Write*** feature.

10.1.6 Capacitance Zero Point Calibration

This function allows for quick correction of axis zero points, assuming vision calibration and swing arm length compensation have been properly completed. Ensure axis initialization is completed with correct zero axis before performing zero point calibration.

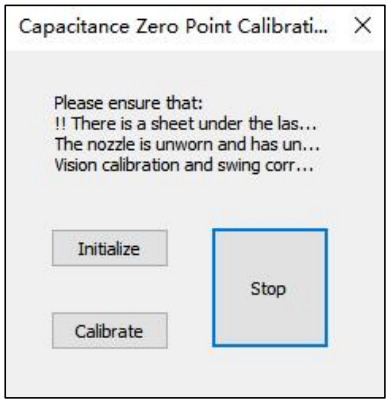


Figure 10-9 Capacitance zero point calibration

10.2 Error Analysis

10.2.1 Measure Error

Error measurement is used to compare actual multi-axis motion trajectories with the commanded paths, assisting in tuning axis response behavior. There are three types of test trajectories: ***XY Axis Circle Test***, ***Draft Circle Test(A axis, B axis and AB axes)***, and ***Bevel Line Mark***, as shown in the figure:

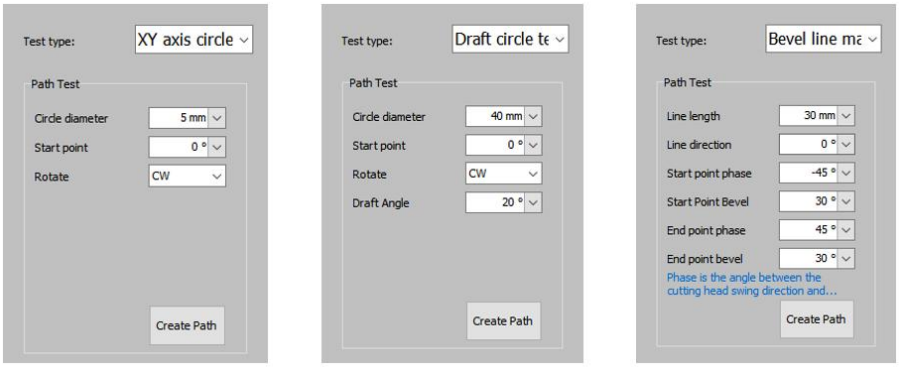


Figure 10-10 Measure error

- Circle Test Parameters:
  - Start point: 0° at the right, 90° at the top, based on polar coordinates.
  - Draft Angle: When the angle is positive, the cutting head deviates to the left along the track; when the angle is negative, the cutting head deviates to the right.

⚠ Notice: The left/right deviation of the cutting head refers to the rotation of the cutting head arm while the nozzle position remains unchanged.

- Bevel Line Mark Params:
  - Line direction: From left to right is 0 degree, from bottom to top is 90 degrees, defined by polar coordinates.
  - Start/end point bevel: The swing angle at the start and end point.
  - Start/end point phase: When the phase is 0 degree, it will swing along a straight line; if the phase is 90 degrees, it will rotate 90 degrees counterclockwise in line direction and then start swinging.

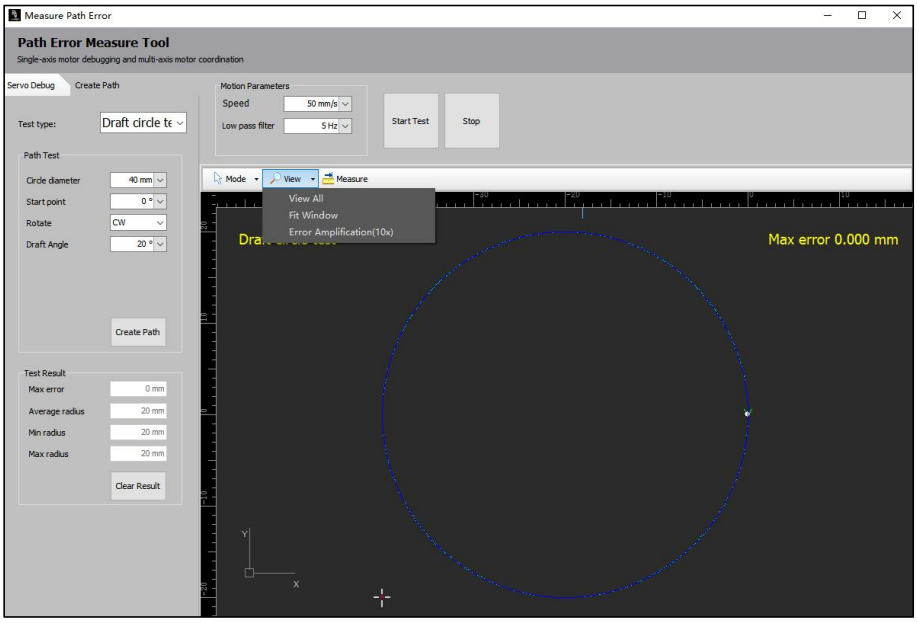


Figure 10-11 Measure error

The typical workflow is to run XY axis circle test → A axis draft circle test → B axis draft circle test→ AB draft circle test. After finishing the settings, click ***Create Path*** to generate a green command path in the test interface. Click ***Start Test***, and each axis will execute ***Dry Run*** according to the commands to generate a blue feedback path.

If there is a noticeable discrepancy between the commanded trajectory and feedback trajectory in certain quadrants of the circle, switch to the ***Servo Debug*** interface and click ***Measure Delay*** to measure the system delay of the X/Y/Z/A/B axes, typically adjusting based on the Z-axis. You can make the servo delay of each axis consistent through manual or automatic adjustment:

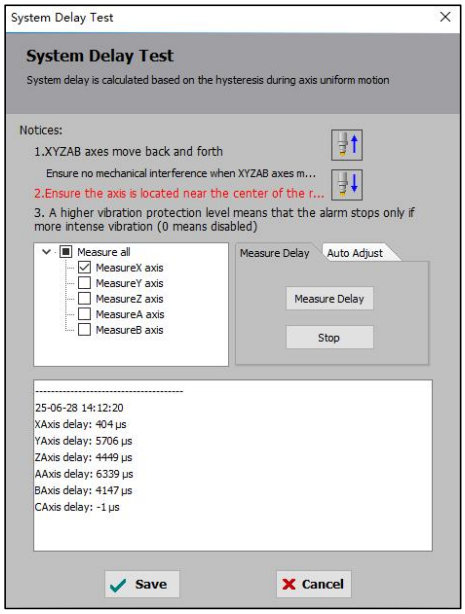


Figure 10-12 Measure delay

- Manual Adjust: If the X/Y/A/B delay is too small, increase the delay (e.g., decrease tracking gain for Yaskawa, increase filter time for Hiwin, decrease rigidity for Mitsubishi). Conversely, reduce the delay to make the delays of each axis approximately the same (usually, axis delays should not exceed 5000 μs).
- Auto Adjust: In the ***Measure Delay*** interface, click ***Auto Adjust***, set the target delay time and vibration protection level (usually default 4), and click ***Delay Adjustment***. The system will automatically adjust each axis' delay to the target value.

Once the servo delays of all axes are consistent, the commanded and feedback trajectories should largely overlap. The result of the A/B axis draft circle test should be controlled within 0.05 mm, and the result of the draft circle test should be controlled within 0.07 mm.

If there is still a large error in the extraction circle after adjusting the servo delay, click ***Error Amplification(10x)*** in the ***View*** drop-down menu to enlarge the tested trajectory by 10 times and observe the source of error. At this point, the error typically appears as:

- The feedback trajectory is generally contracted compared to the commanded trajectory.
- There is an obvious inflexion point.

The below shows the corresponding solutions:

- Path shrinkage is due to excessive overall servo delay, it is necessary to reduce the delay of each axis within the mechanic design allowance.

Inflexion point is often related to friction, you can try to add friction compensation to the corresponding axis.

10.2.2 Trajectory Capture

This feature monitors commanded and feedback trajectories of processed parts to help troubleshoot issues. You can toggle curve visibility as needed. During processing, raw trajectory is shown first, followed by commanded and feedback curves after execution.

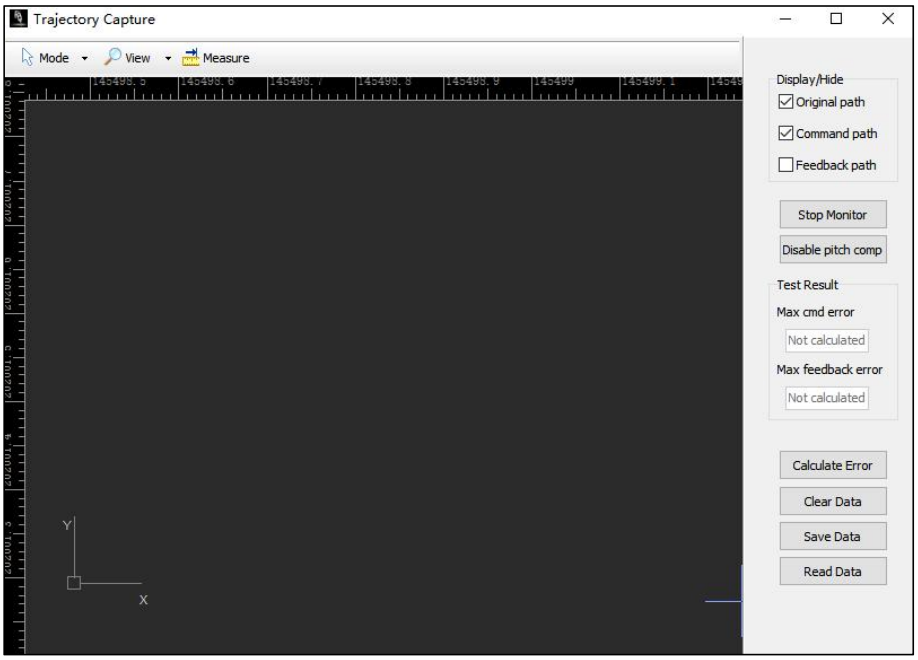


Figure 10-13 Trajectory capture

10.2.3 Swing Precision Calibration

This function verifies the accuracy of the swing model determined by vision calibration and swing correction.

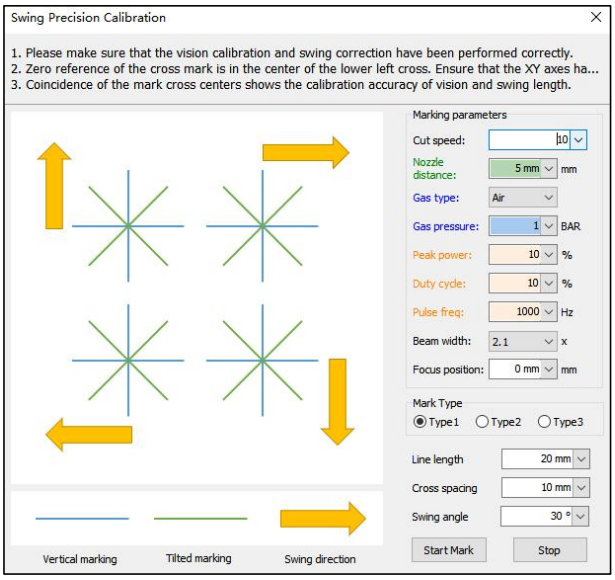


Figure 10-14 Swing precision calibration

Set appropriate marking parameters and click ***Start Mark***. Observe whether the center of the vertical marking cross aligns with the center of the tilted marking cross.

If there is a significant deviation, it indicates a large error in the swing model. In this case, check for issues in the machine's mechanical structure, vision calibration, and swing correction.

10.3 **Tools**

10.3.1 Real-time Curve Monitoring

Real-time monitoring can accurately sample the command position, command speed, feedback position, feedback speed, feedback torque, command position deviation, dual-drive position error, buffer number and height controller position. You can select any four of the above to monitor for at least 5 seconds, at most 20 minutes to check their signals and draw corresponding curves.

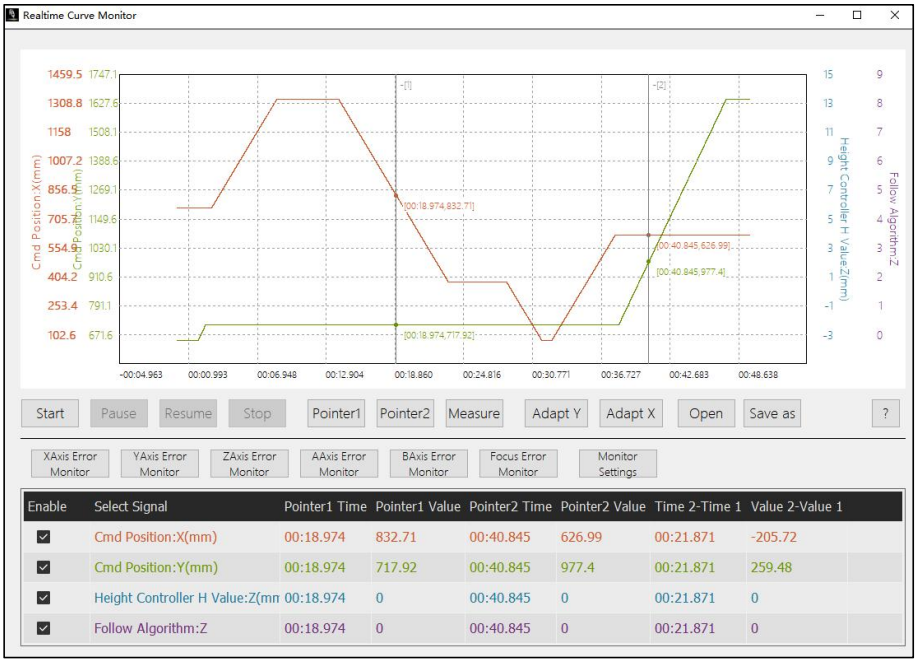


Figure 10-15 Real-time curve monitoring

By default, there will be four signal curves shown, which can be selected as needed by clicking ***Select Signal*** at the bottom.

Check the box under ***Enable*** to turn on or off specific signal monitors or only monitor specified curves in the designated span.

You can zoom in or out the vertical axis by scrolling the mouse wheel, and check the horizontal axis by right-clicking the specified span and dragging it to the right. Hold down the right mouse button and drag towards the left can restore the curves to the appropriate window.

Hold down the left mouse button to translate the curves. Click the left mouse button to display all curves in the position designated by the mouse with a white label, and click the right mouse button to display all curves in the position designated by the mouse with a black label.

10.3.2 BLT Cutting Head Diagnosis

The interface provides information and debugging functions related to the BLT series cutting heads. It helps to monitor the sensor parameters as well as the focus velocity curve and also allows performing jog testing for the focus motor.

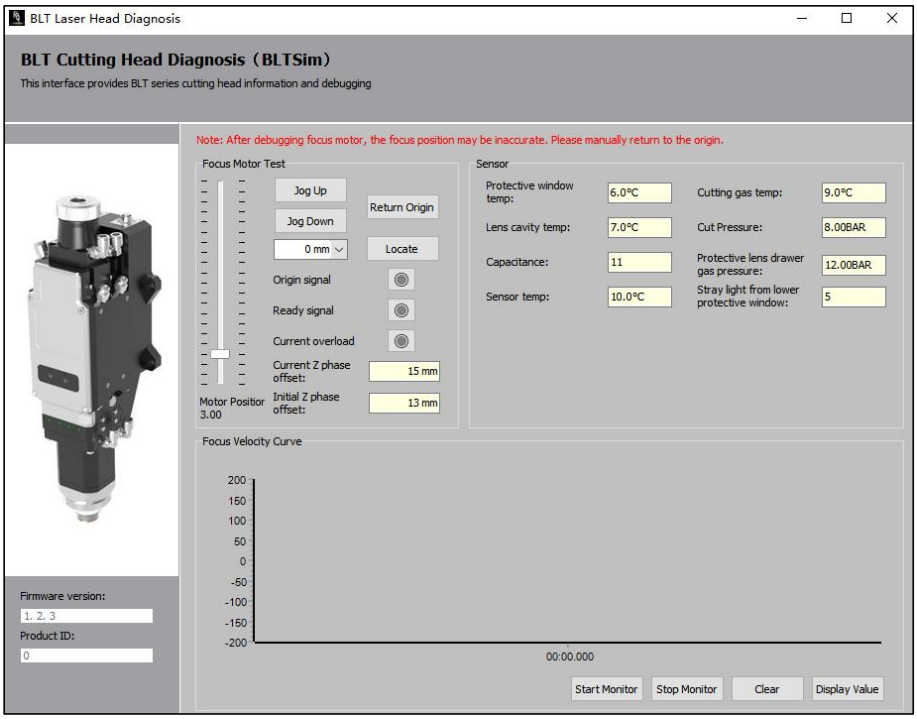


Figure 10-16 BLT cutting head diagnosis

10.3.3 External Device Marking Calibration

When checked ***Use external device marking*** on the ***Advanced Config*** page of FACutConfig and correctly configured the marking output, there will be a ***External device marking calibration*** option in the drop-down menu of ***Tools***. The purpose of this calibration is to determine the relative position between the marking device and the cutting head nozzle.

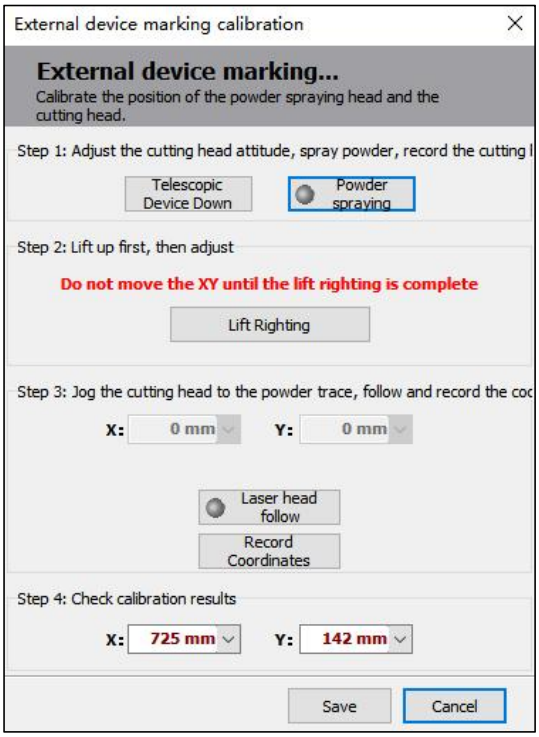


Figure 10-17 External device marking calibration

Calibration steps:

Step 1 Adjust the installation position of the marking device to avoid interference during swing cutting. Typically ensures no collision occurs when cutting a 45° draft circle.

Step 2 Adjust the cutting head pose to place the marking device at the correct height. Click ***Powder Spraying*** and jog the cutting head while observing the marking trace to adjust the position. After an appropriate marking track is achieved, click the ***Powder Spraying*** button again to stop the output. Only when ***Powder Spraying*** is active will the system record the current swing pose and XY coordinates.

Step 3 Click on ***Lift Up*** to return the cutting head to the vertical position. Do not move XY axes during this process.

Step 4 Jog the cutting head to the end of the powder trace (where the powder device previously locates),

click ***Follow***, and fine-tune the position with the aiming red light until it aligns with the powder endpoint. Click ***Save*** to exit the calibration interface. If there's still position deviation after actual marking, re-enter the calibration interface to manually edit and save the calibration result.

Once calibration is complete, assign the marking path to the ***First layer***. In the technique settings interface, there will be a option named ***Use external device marking***. When enabled, there will be a new layer named ***External Device Marking***, and the cutting head will maintain fixed height and posture as it does for calibration during this operation.

When marking with external device, supported parameters in the corresponding layer are as follows:

- Cut speed: Corresponds to powder spraying speed.
- Dwell time: Delay before spraying to allow gas mixing.
- Laser off delay: Delay after spraying to prevent residue during travel.

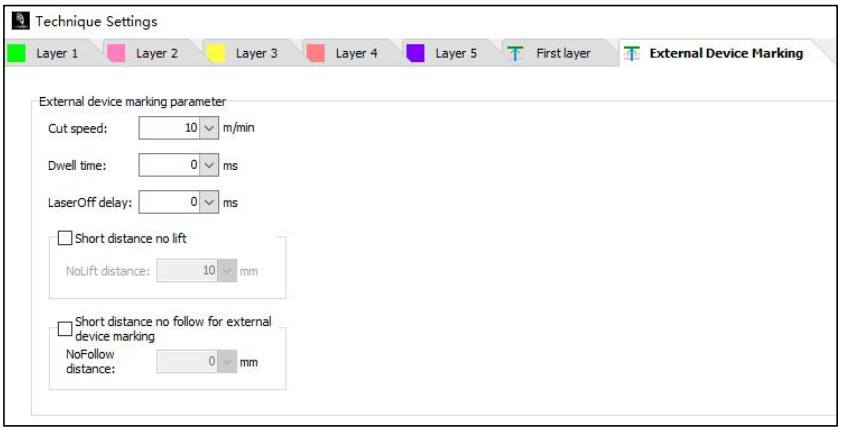


Figure 10-18 Technique settings for external device marking layer

Besides, if ***Short travel no lift*** and ***Short travel no follow for external device marking*** are enabled, with the corresponding distances set, then the cutting head will stay at the height it finishes cutting and travel to the next start point within the set distance.

Notice:

1. When both no lift and no follow for short distances are enabled, the cutting head will maintain its height during travel. Risk of head collision increases if the sheet surface is uneven.

2. To enable the ***Short travel no follow for external device marking*** option, go to ***FACutconfig → Planar NC System → Advanced Config → Use external device marking***, and uncheck ***Enable telescopic device***.

10.3.4 Common Axis Debug

After setting common axes in FACutConfig, it can be tested in this interface by jogging and observing motion behavior.

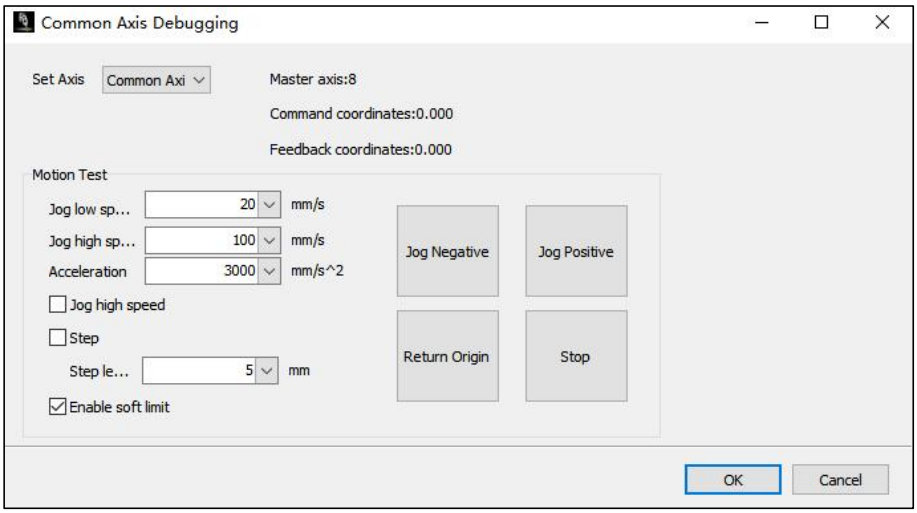


Figure 10-19 Common axis debug

10.3.5 Yp Debug

Once the Yp follow-up axis is configured, this interface enables debugging and motion verification for the Yp axis.

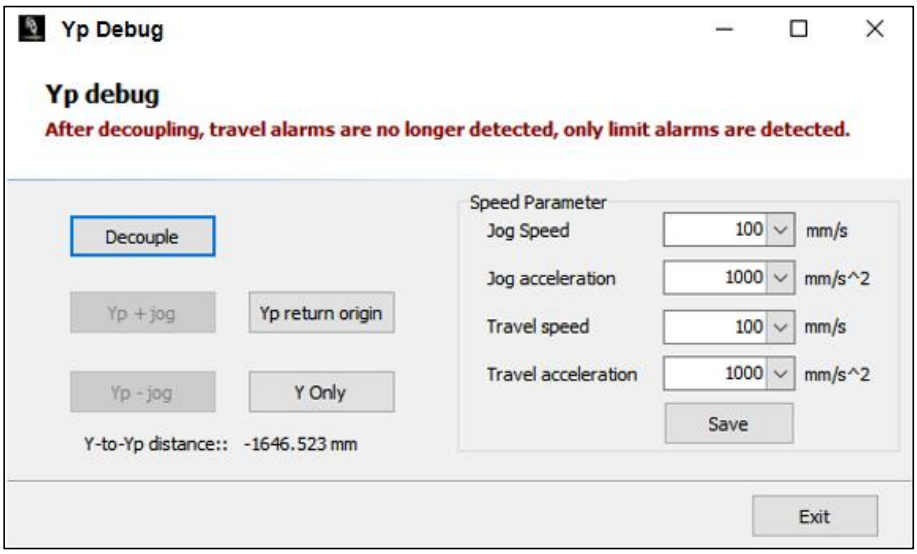


Figure 10-20 Yp debug

For a detailed explanation of the Yp follow-up axis, refer to FACut - Moving Enclosure.

10.3.6 Manual Centering

FACut supports manual centering of circular plates by selecting three or more edge points on the plate to construct a circle model and locate the center point accordingly.

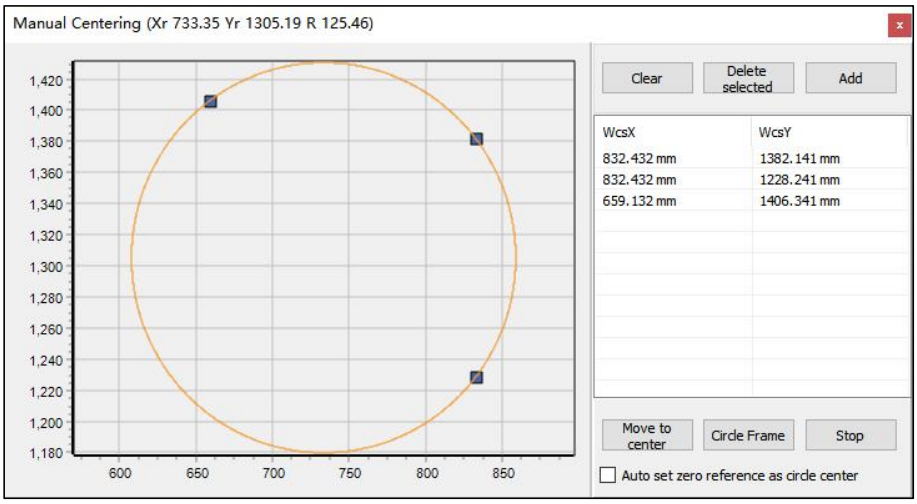


Figure 10-21 Manual centering

10.3.7 Cycle Production

It can be used for loop machining of selected drawings, also for cutting demonstration in exhibitions with laser off. You can add, delete, enable, and disable drawings in ***Cycle Production Settings***, and set the processing times and delay time after each processing. When the drawing for cycle production is enabled and all settings are saved, the ***Start*** tab in the machining operation zone will change to ***Start L***, and the ***Dry Run*** button in the debugging operation zone will change to ***Dry Run L***, which means the current processing is in cycle production status.

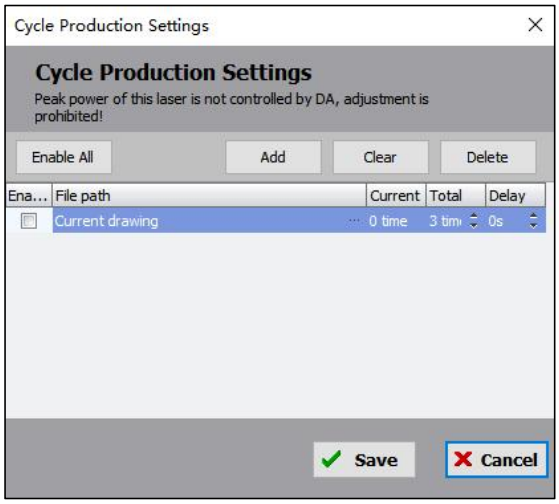


Figure 10-22 Cycle production settings

10.3.8 Cycle PLC

This function allows setting up long-duration, high-intensity loop test parameters to verify system reliability and stability under continuous load.

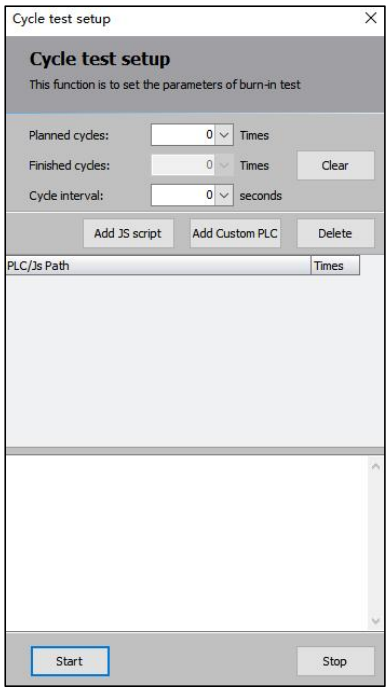


Figure 10-23 Cycle test setup

10.3.9 Dry Run Settings

Set the dry run parameters. In bevel cutting, the Z-axis may move up and down due to cutting head swing and corner transitions. Enabling Z-axis moves in dry runs improves simulation accuracy for bevel cutting paths.

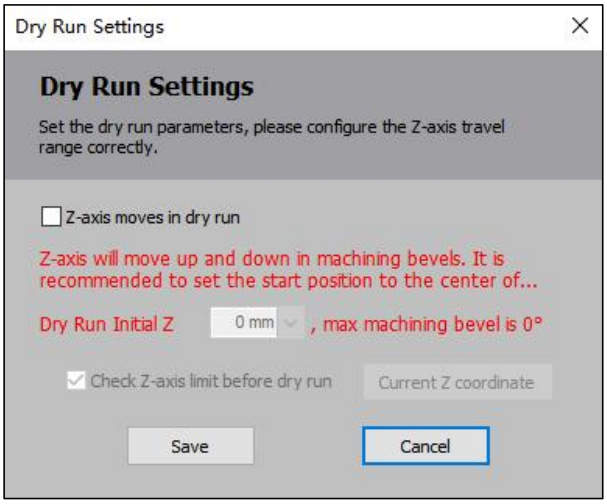


Figure 10-24 Dry run settings

10.3.10 Time Estimation

This tool estimates the total processing time for a complete job, as well as the time required for individual processing actions. It requires an accurate input of the plate surface's corresponding Z-axis position.

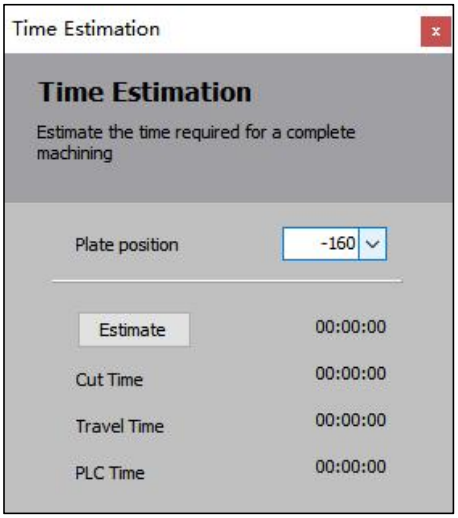


Figure 10-25 Time estimation

10.3.11 Bevel Size Calculator

It can calculate bevel parameters according to section type and section parameters. After selecting the toolpath type(inner or outer), enter any 4 of these 5 parameters, and the rest constrained parameter will be automatically calculated.

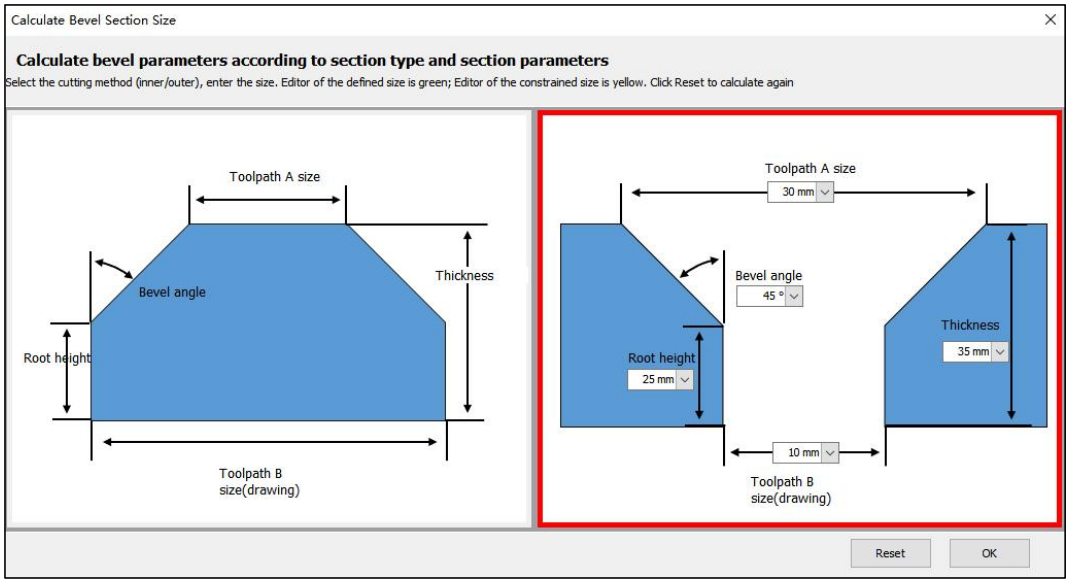


Figure 10-26 Bevel size calculator

10.3.12 Laser Adjustment

This function assists in fine-tuning the XY installation accuracy using a laser interferometer, improving overall processing stability and laser alignment precision.

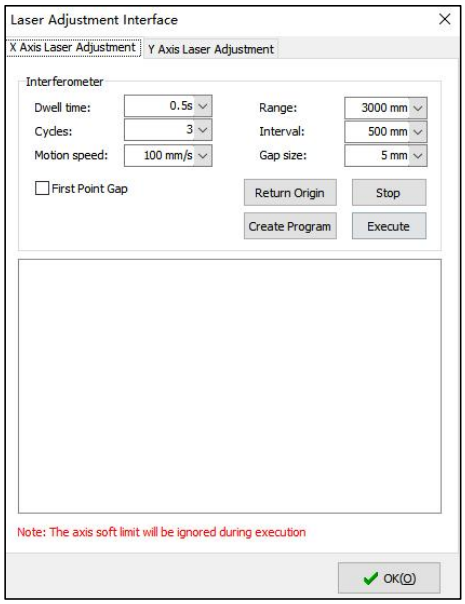


Figure 10-27 Laser adjustment

10.3.13 Calibrate Fixture

Used to calibrate fixtures for dished head processing. By marking the actual installed position of the fixture on the machine, it ensures alignment between the part and the programmed cutting path. Jog the cutting head to locate four edge points of the fixture. The system uses these points as reference coordinates to determine the fixture's actual position.

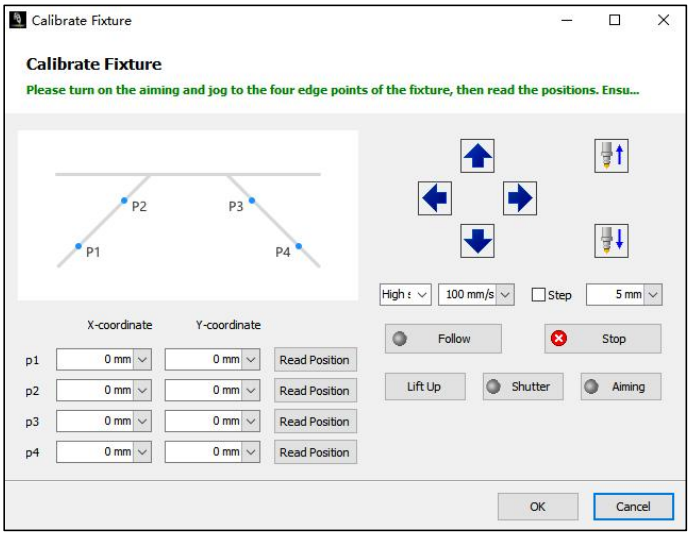


Figure 10-28 Calibrate fixture

10.3.14 Dished Head Zero Reference

Due to the curved surface of dished heads, the actual reference point during installation may differ from the drawing's coordinate system. By inputting the the dished head radius, the system calculates a corresponding zero reference for the current part, ensuring fixture alignment with the processing path.

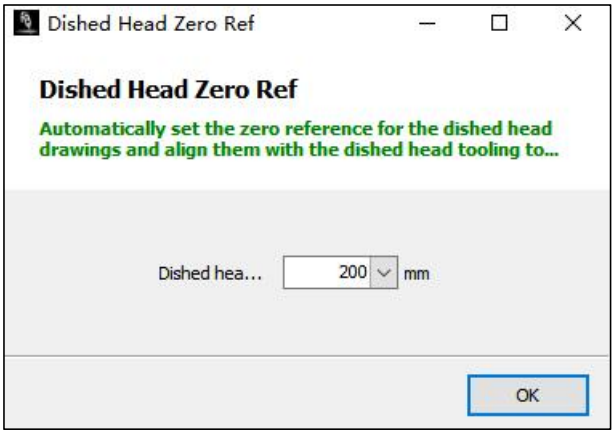


Figure 10-29 Dished head zero ref

Chapter 11 Main Interface Status Bar

Click the gear icon at the bottom right corner of the main interface status bar to access the following two sub-menus.

11.1 Set Modules

This function allows you to configure which modules are shown in the status bar. As the status bar only supports five modules being displayed at a time, only the top five in the list will appear. To rearrange, select a module and use the ***Up*** or ***Down*** buttons, then click ***Save*** to apply the changes.

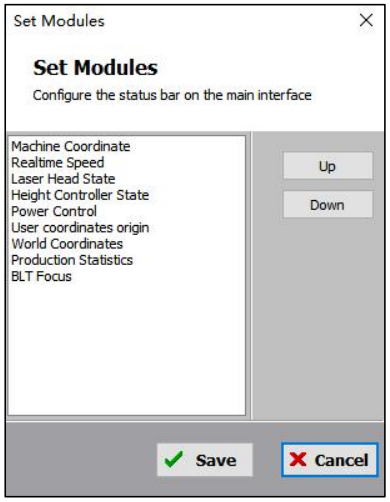


Figure 11-1 Set modules

11.2 Production Count

This tool allows you to set a planned number of parts for processing. It automatically tracks the number of completed parts and provides options for actions to take once the target is reached.

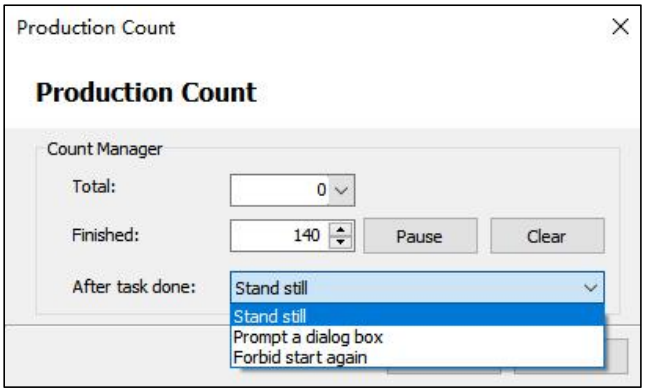


Figure 11-2 Production count

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