BOCHU

CypWeld

Intelligent Welding Control Software

User Manual

V2.0

Software Version: C110.20

Welcome

Thank you for using BOCHU CypWeld intelligent welding control software!
"CypWeld Intelligent Welding Control Software" (hereinafter referred to as "CypWeld") is a set of control software for intelligent welding, which is developed for "FSWELD Intelligent Welding Control System" and has the functions of TCP calibration/zero calibration of mechanical arm, initial positioning of workpiece, weld kerf extraction, weld kerf editing, batch weld kerf generation, path planning, simulation, weld kerf location, arc tracking, continuous fillet welding, multi-layer and multi-pass welding, bracket parametric modeling, multi-panel control and so forth. The main functions include importing workpiece model, selecting welding edge, updating welding posture/locating posture, process setting, path planning and other operations.
Please note that CypWeld must be used in conjunction with the industrial computer and license of BOCHU to carry out actual processing control. When CypWeld software runs on an unauthorized industrial computer or other computers, it will enter the DEMO mode, and you can only use other functions except processing control normally.
This user manual is only used as the operating instruction of the main program of CypWeld. For other software or drivers installed with CypWeld, please refer to other manuals or contact us.
This user manual is based on CypWeld-C110.20 version. Due to the continuous update of the version, the CypWeld you used may be different from the statement in this manual in some aspects.
If you have any questions or suggestions during the use, please feel free to contact us!

The operation of the robot/external axis and the final welding result are directly related to the welding material, welding machine, gases used, gas pressure, and the parameters you set. Please set all parameters carefully and diligently according to your welding process requirements.

Improper parameter settings and operation can lead to a decrease in welding quality, damage to the welding gun or other components, and even personal injury. The FSWELD intelligent welding control system has made every effort to provide various protective measures. Equipment manufacturers and end users should follow the operating procedures as much as possible to avoid accidents and ensure safety.

contents

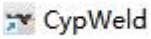
I.Quick Start

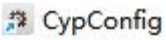
1.1 Supported Models

The BOCHU Intelligent Welding System has three product versions, each supporting different machine types. Before using the software, please check whether the hardware of the purchased system is compatible with the current machine model. If not, the CypWeld software will enter demonstration mode, where only simulated operations can be performed, and the actual control of the equipment will not be possible.

Intelligent Welding System	Supported Machine Types
2800L	Standalone workstation, 7-axis ground rail, 7-axis cantilever; requires CAD model import
2800M	All types of workstations; requires CAD model import
3800	All types of workstations; does not require CAD model import

1.2 Software Icons

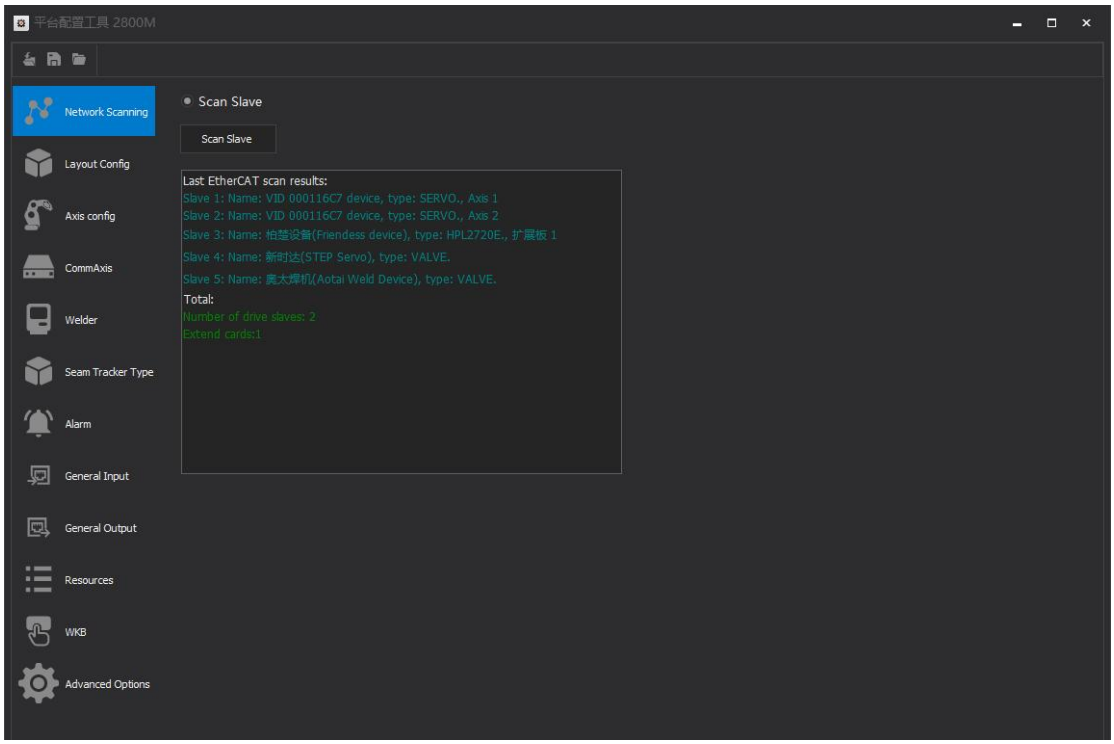
Main Software: 

Platform configuration tool: 

1.3 Machine Settings

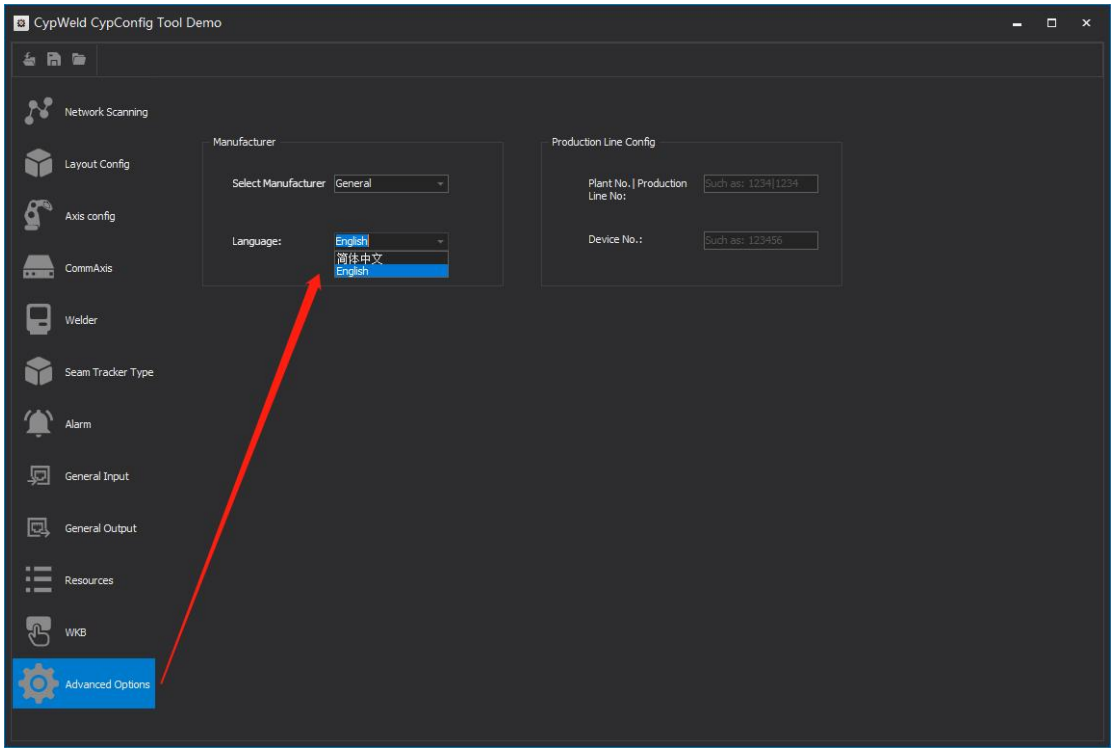
Scan Slave

All slaves connected to the EtherCAT bus are scanned automatically.



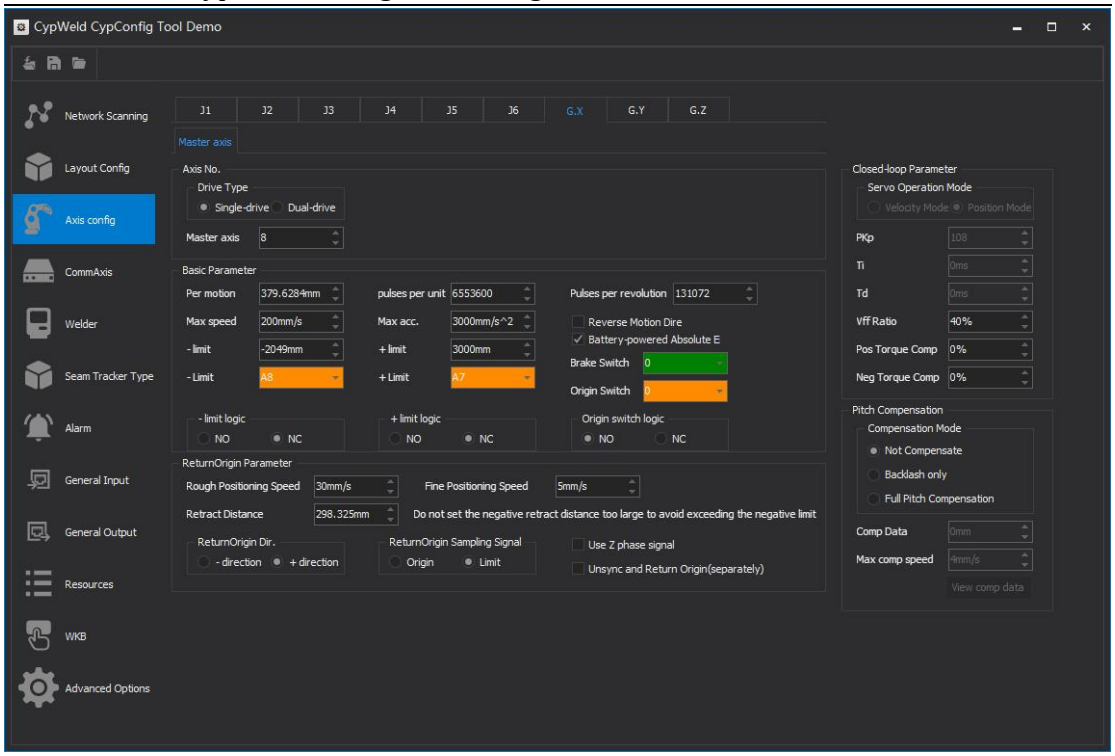
Language Settings

Currently supports Simplified Chinese and English.

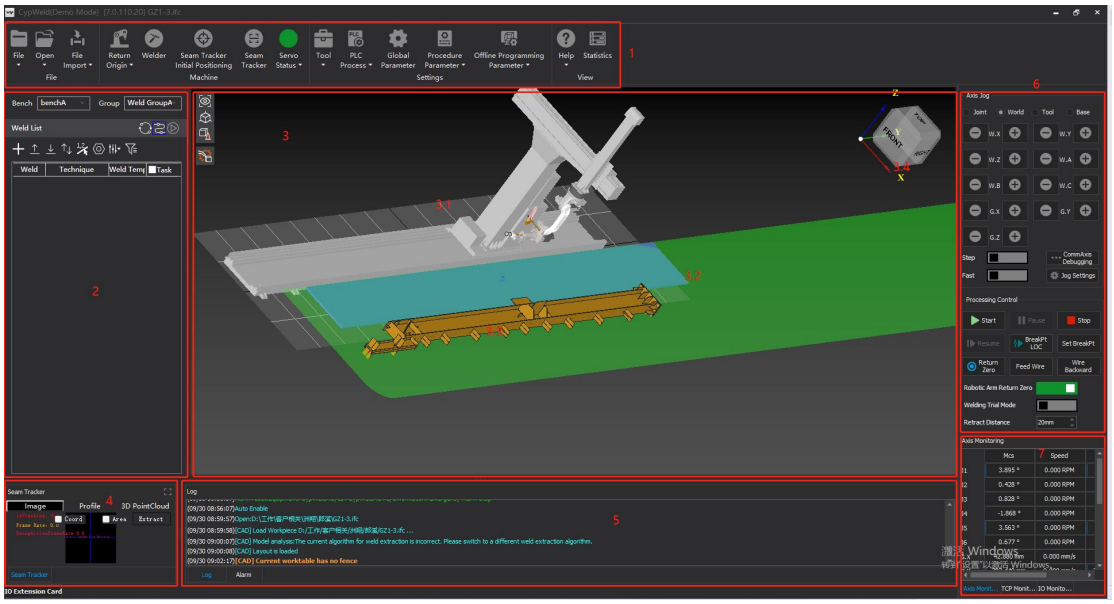


Axis Configuration

Configure the correct axis numbers and parameters for the drive. For parameter settings, refer to the drive's user manual or the BOCHU Intelligent Welding System "Installation Manual."



1.4 Software Main Interface



1. Toolbar

The toolbar lists the commonly used functions of the software, including import and export, parameter settings, procedure library, calibration tools, enable buttons, and more.

2. Weld settings

Used for setting and modifying the weld seams that need to be welded. It also provides functions for processing emulation, path planning, weld seam sorting, and station selection.

3. Digital twin

The digital twin interface in CypWeld is modeled in proportion to the physical object. The

movements in the physical space are fed back to this interface in real time, allowing users to intuitively reflect collision planning, positional movement, and welding posture in the physical object while operating on the PC.

- 3.1 Main hardware devices, including robotic arms, external axes, etc., need to contact BOCHU staff in advance for software modeling.
- 3.2 The green area represents the optimal working range of the robotic arm calculated automatically by the software.
- 3.3 The yellow component represent the imported workpiece model.
- 3.4 The top-right corner provides a view-switching control.

4. Seam tracker

Allows control of the visual camera and adjustment of visual parameters. The camera display interface provides real-time viewing of the current image.

5. Log

Records the current processing, user operations, and error/warning messages.

6. Controler

Allows jog control of the robotic arm and external axes, offering four coordinate systems: World, Joint, Tool, and Base. It also provides control over the processing state, allowing users to start, pause, resume, or stop processing. Additionally, it controls whether the welder arcs during processing.

7. Axis monitoring

Used to view the current coordinates, speed, and acceleration of each axis.

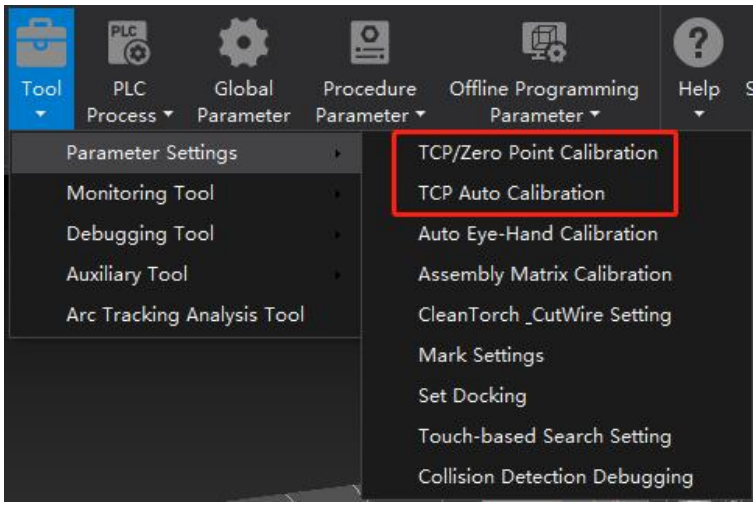
II.Parameter Settings

For detailed operational steps of the calibration process mentioned below, please consult BOCHU staff for instructional videos. This manual is for reference only.

2.1 TCP Calibration

Supports both manual and automatic calibration.

Entry:



For manual calibration, please follow the prompts on the interfaces. You need to prepare a BOCHU calibration cone beforehand.

- Point the robotic arm's TCP (Tool Center Point) as vertically as possible toward the tip of the cone and record the vertical position coordinates.
- Then jog the robotic arm to adjust to four different postures, using the TCP to point to the tip of the cone each time, and record the coordinates.
- Click the "TCP" button at the bottom to perform calibration, ensuring that the calibration error is within 2 mm.
- Add more robotic arm posture coordinates to reduce calibration error. Multiple points also support calibration of the robotic arm's zero point.
- Save the calibration results and set the current welding wire length to complete the calibration.

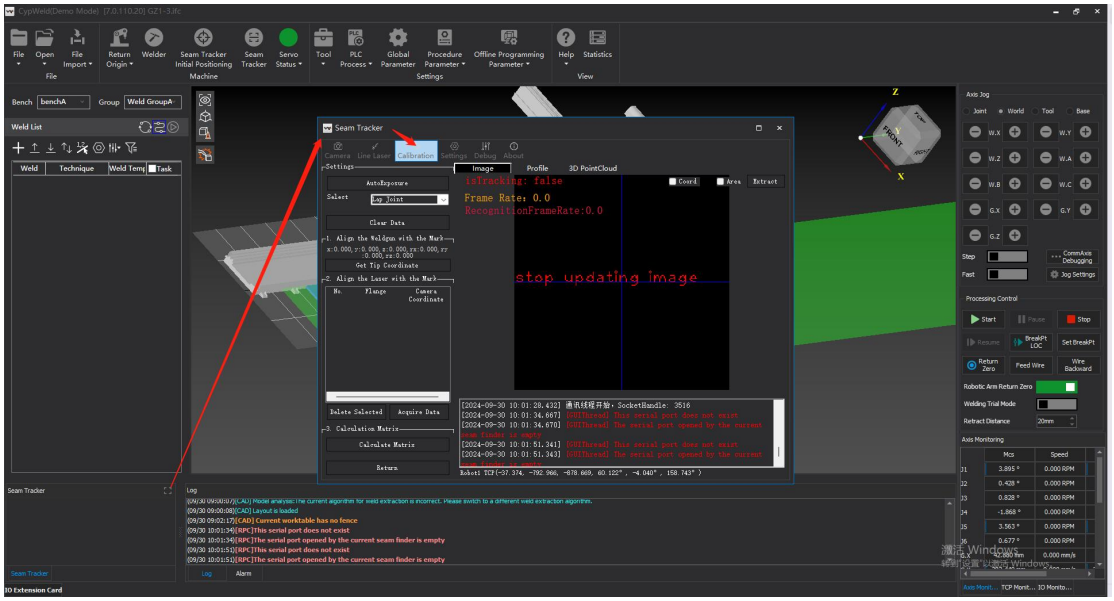
Please consult BOCHU staff before using automatic calibration to confirm whether the welding machine supports the automatic calibration feature. Prepare a steel plate in advance and turn on the welding machine.

- Position the TCP as vertically as possible, pointing to the center of the plate, maintaining a distance of 1–2 mm from the plate.
- Start auto calibration.

2.2 Hand-eye Calibration

For the first installation, please use manual hand-eye calibration; subsequent calibrations can utilize automatic hand-eye calibration.

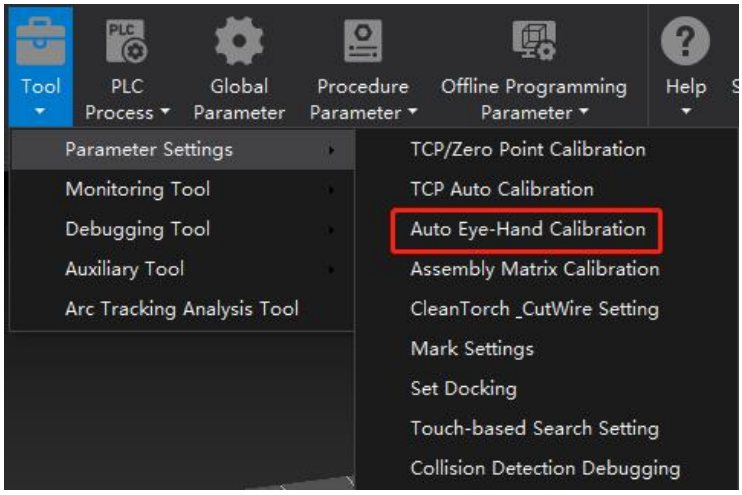
Manual Hand-Eye Calibration Entry:



Before calibration, keep the lower surface of the camera parallel to the ground. Prepare calibration sample templates in advance; options include a triangular prism or a step piece. Before hand-eye calibration, please make sure the TCP calibration error of the robotic arm is within 2mm. The BCW600P camera has two viewing distances: near and far. Please calibrate for each separately.

- Point the TCP (Tool Center Point) of the robotic arm at the marked point on the stepped piece or the apex of the triangular prism, and record the coordinates.
- Jog the robotic arm incrementally so that the camera can display the coordinates of six different calibration pieces, and record each one separately. During this process, please ensure that the robotic arm only performs translational movements without changing its posture.
- Click "Calibrate" and check the calibration error in the seam tracker log. For near viewing distance, ensure the error is within 1 mm; for far viewing distance, within 10 mm.

Automatic Hand-Eye Calibration Entry:



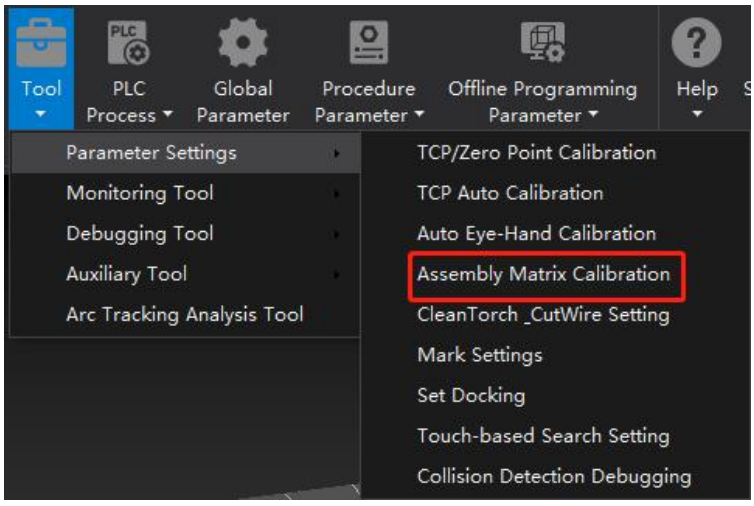
Please prepare the triangular prism for calibration in advance, and ensure that the bottom surface of the camera is essentially parallel to the ground before calibration.

- Point the robotic arm's TCP to the tip of the prism and start auto calibration.

2.3 Assembly Matrix Calibration

It is used to calibrate the assembly matrix of extended axes (ground rail, cantilever, or gantry), as well as calibration of the external axis's gear ratio.

Entry:

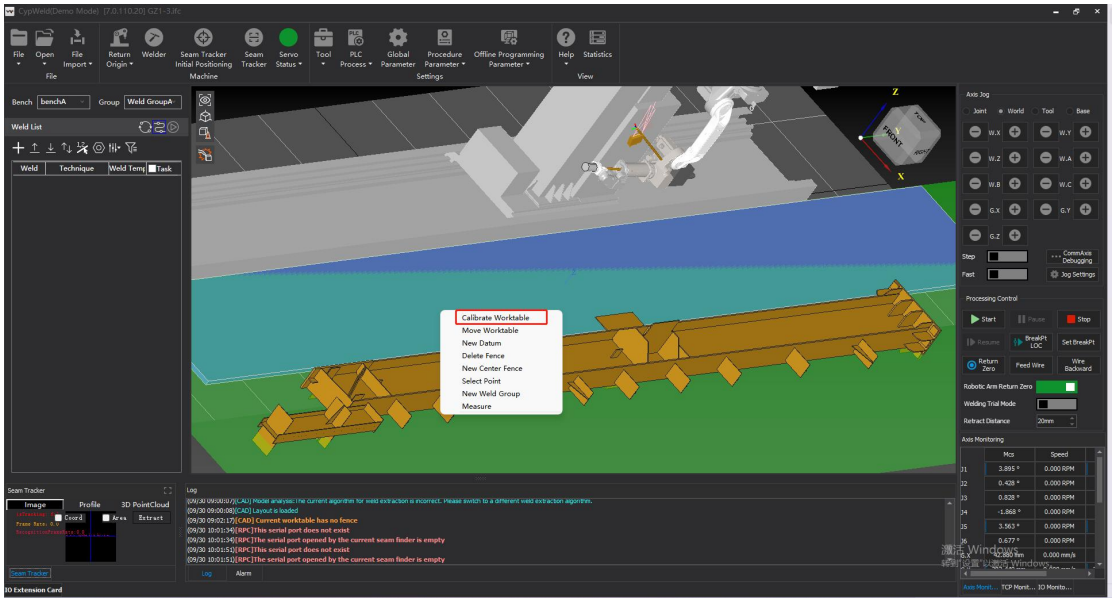


Before calibration, ensure that the TCP calibration error of the robotic arm is within 2mm. Place a marker at a fixed position, which can be a cone or a triangular prism. Point the TCP to the marker and record the coordinates. Move the external axis by more than 100 mm, point the TCP to the marker again, and record the coordinates to complete the calibration.

2.4 Worktable/Positioner Calibration

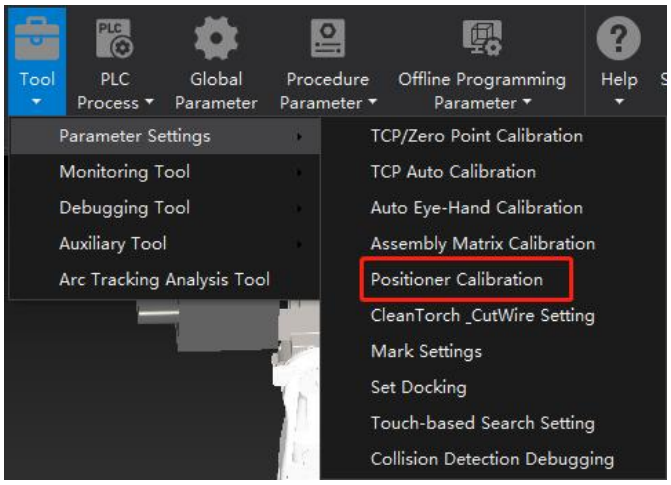
Please note that the stationary worktable is calibrated in a different way from the single-axis/double-axis positioner. If the current machine model is equipped with more than one positioner, please calibrate them separately. Before calibration, ensure that the TCP calibration error of the robotic arm is within 2mm.

Worktable Calibration Entry: Right-click on the worktable



By default, a fixed worktable is a complete plane. Use the robotic arm's TCP to touch three different positions on the worktable surface and record the coordinates; the three points should be as far apart as possible. For ground rail with jig, please ensure that the three marker positions are on the same horizontal plane.

Positioner Calibration Entry:



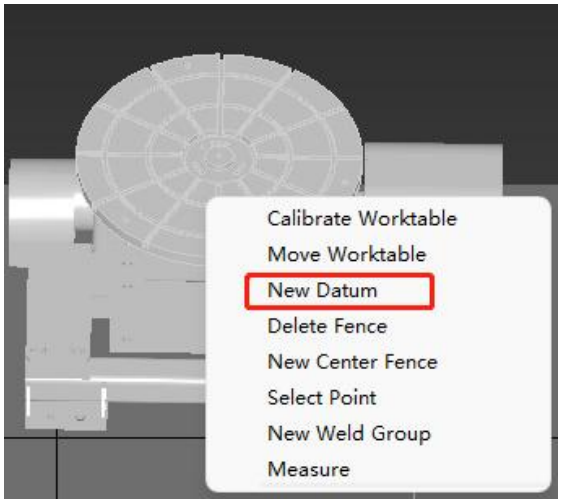
The software will automatically recognize the current scene and display different calibration interfaces based on whether it's a fixed worktable, single-axis positioner, or double-axis positioner.

For positioner calibration, please determine a marking point on the positioner, or fix a marker (such as cone) on it. Rotate the positioner to the angles recommended in the calibration interface, use the robotic arm's TCP to touch the marker point, record 10 sets of coordinates, and perform calibration calculations. The calibration result evaluation will be displayed at the bottom of the interface.

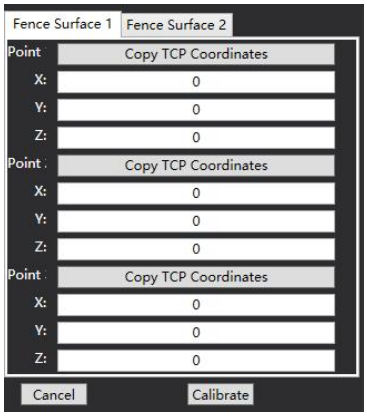
2.5 Fence Calibration

Two fence surfaces can be calibrated to make it easier for workpieces to dock.

Entry: Right-click on the worktable.

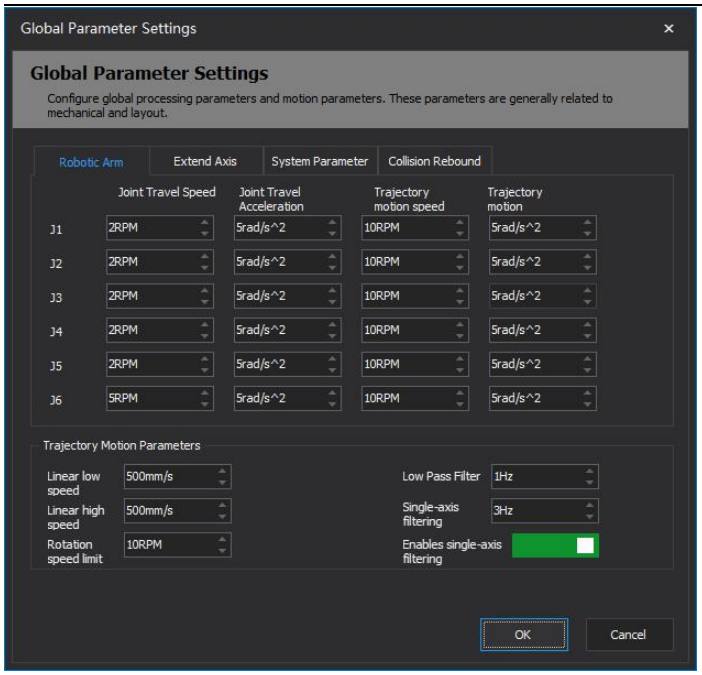


Move the TCP to three different positions on the fence surface, ensuring a significant height difference in the Z-direction, and record the coordinates. The fence needs to calibrate two mutually perpendicular fence surfaces.

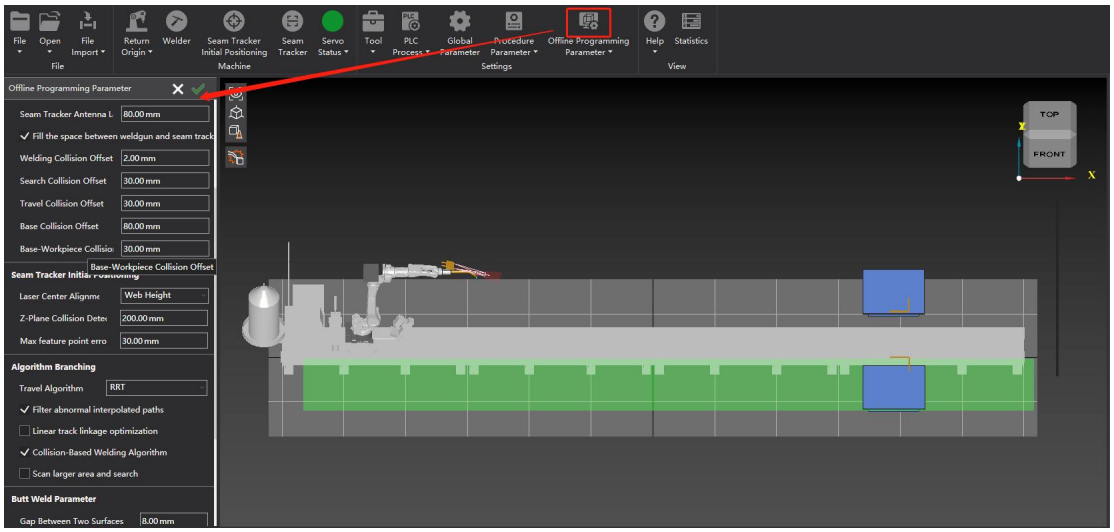


2.6 Other Parameter Settings

Set the movement speed of the Robotic Arm and Extend Axis under Global Parameter Settings:



Set parameters such as collision offset and movement planning under Offline Programming Parameter.

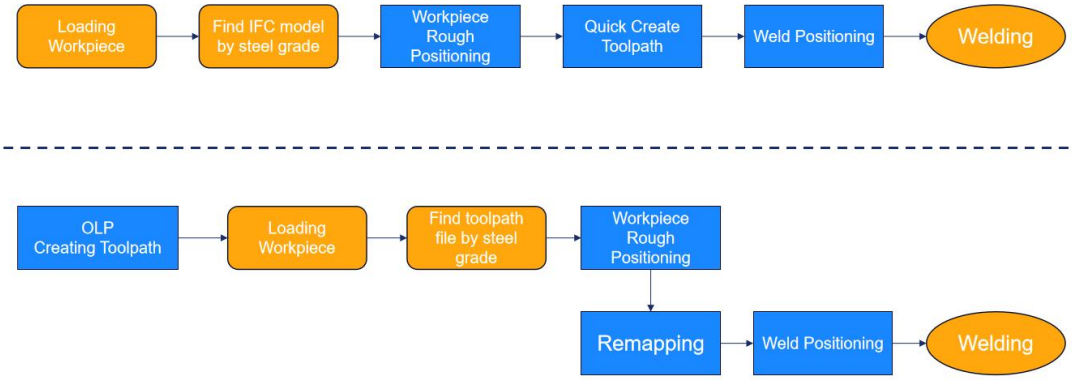


III.Processing Flow

3.1 FSWELD2800 Processing Flow

Supports two processing workflows:

- On-site processing, workers operate the software to perform pre-processing setup, including initial positioning of the workpiece, weld seam editing, process settings, and path planning
- Offline programming is done by professional engineers, who then send the edited processing drawings to the site, where workers remap the settings and start processing.

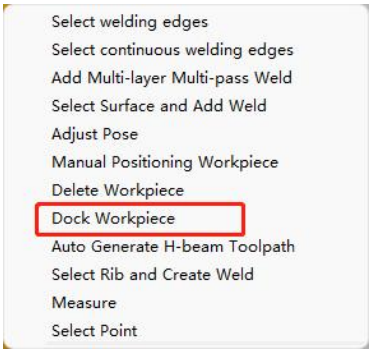


3.1.1 Initial positioning

In this process, a physical workpiece is matched with the imported position shown on the software interface. Supports fence initial positioning, manual three-point initial positioning, and automatic initial positioning.

Fence Initial Positioning:

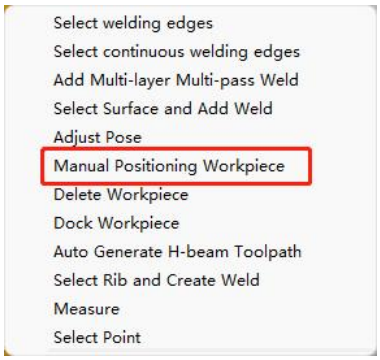
This requires that the fence surfaces be calibrated beforehand. Right-click on the workpiece and select Dock Workpiece. Then select two different and perpendicular surfaces on the workpiece as docking surfaces.



Manual Three-Point Initial Positioning:

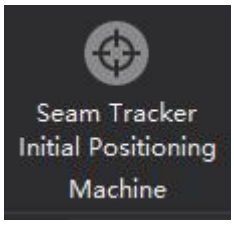
Right-click on the workpiece and select Manual Positioning Workpiece. Select a point on the workpiece model and move the TCP to the corresponding position on the physical workpiece.

Record the coordinates, and repeat the process three times, calibrating three different corresponding points. The right-side interface will display whether the selected three points meet the requirements, which should be as far apart as possible and not on the same horizontal plane.



Auto initial positioning:

Entry: Toolbar at the top.

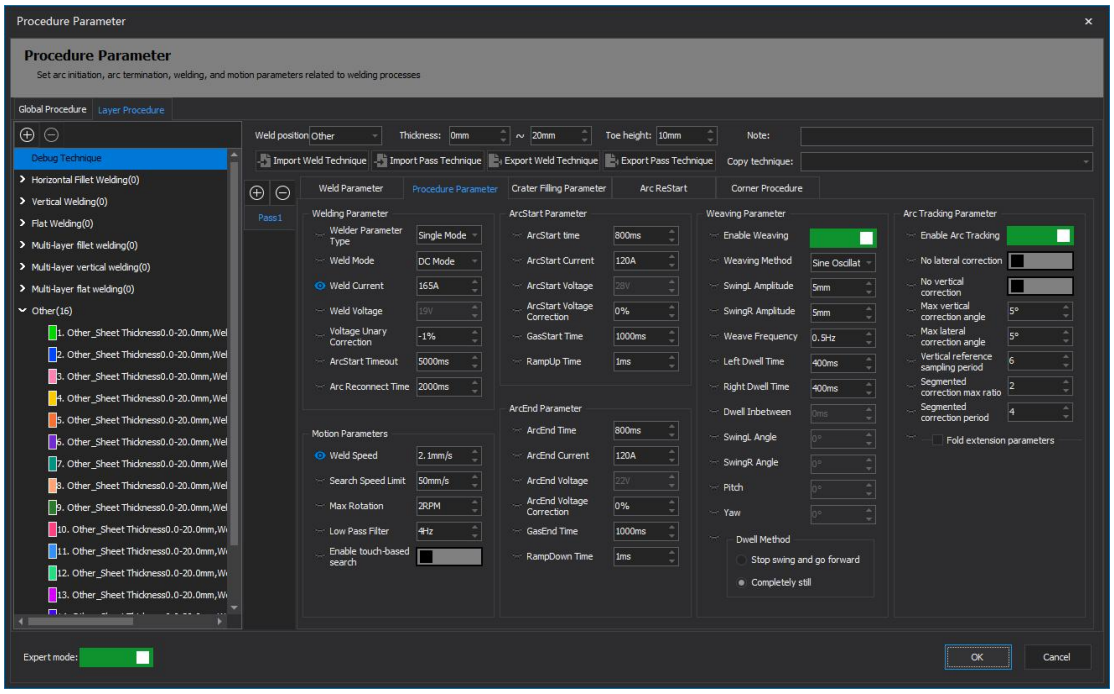


Move the TCP to a position about one fist away from the workpiece edge, and regard the bounding box of the entire workpiece as a cuboid. Then move the TCP to the outer side of one corner of the bottom rectangle, at a height above the workpiece. Let the seam tracker lens roughly overlook the workpiece, and record the coordinates after ensuring no collision will occur during robotic arm translation.

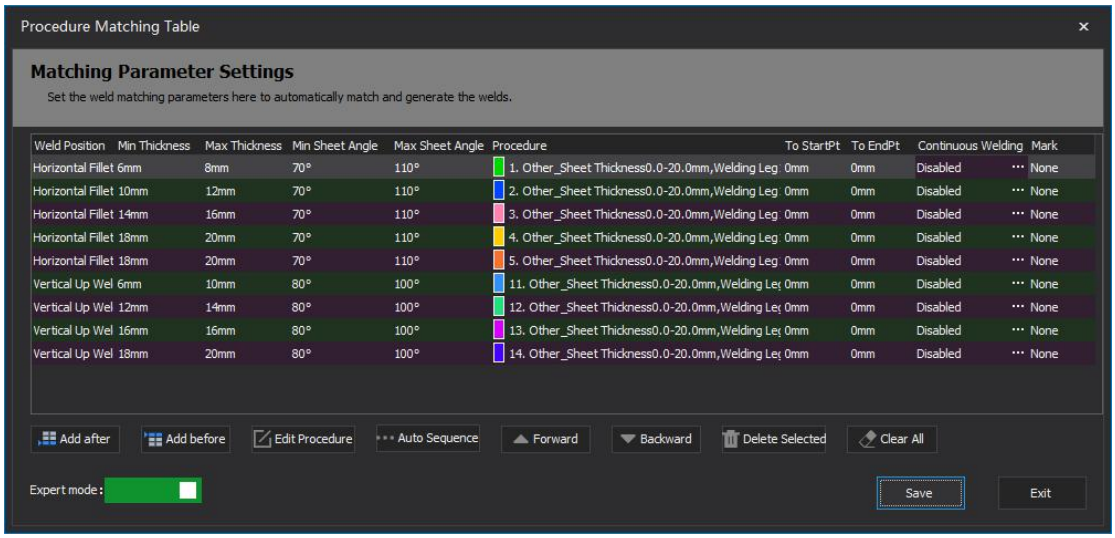
Depending on the general shape and placement of the workpiece, select the scanning mode and seam tracker movement direction which will ensure full coverage of the entire workpiece during seam tracker translation. Click on Calibration, and after the robotic arm completes the scanning motion, the initial positioning results will be displayed on the interface.

3.1.2 Procedure setting

Before editing the weld seam, it is necessary to set up the procedure parameters required for processing. The CypWeld software comes pre-installed with basic process packages, which users must adjust according to the actual processing requirements.



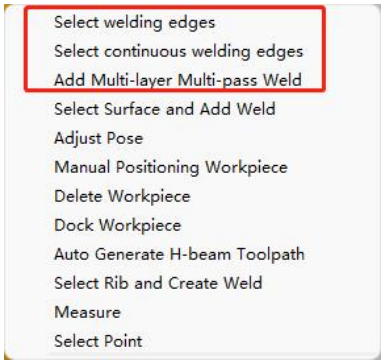
Set the process match table according to the actual requirements, such as plate thickness range, welding position, and bevel angle.



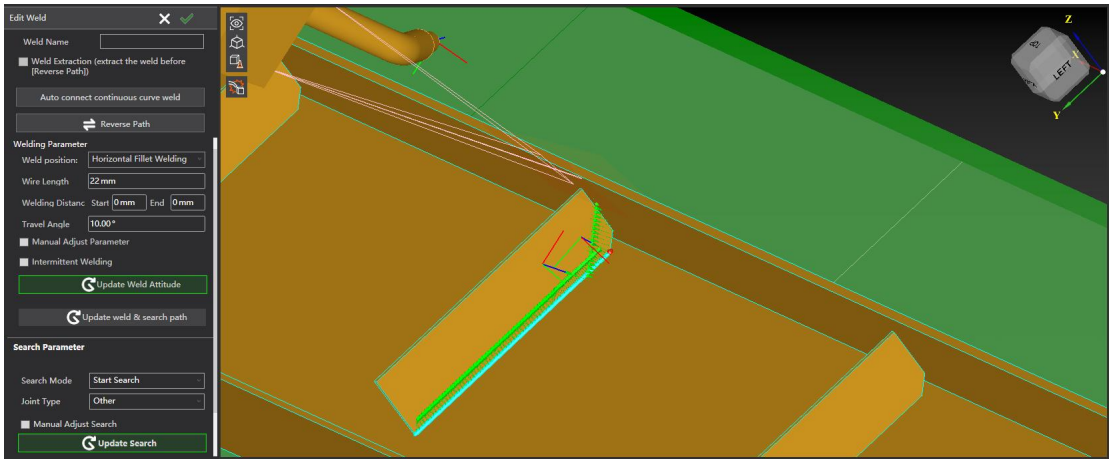
3.1.3 Weld generation

Manual Editing:

Right-click the workpiece to select weld (continuous welding/multi-layer multi-pass welding).

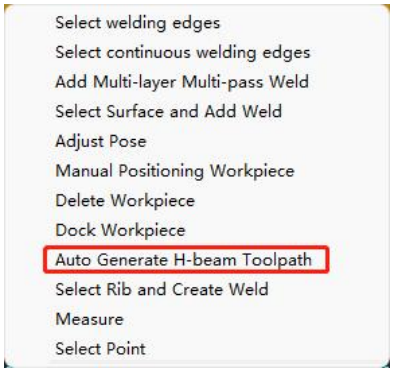


Click Synchronization to update Weld & Search Attitude, and the software will automatically calculate the optimal welding path. The manual adjustment of the welding position parameters is also allowed.



Auto generation:

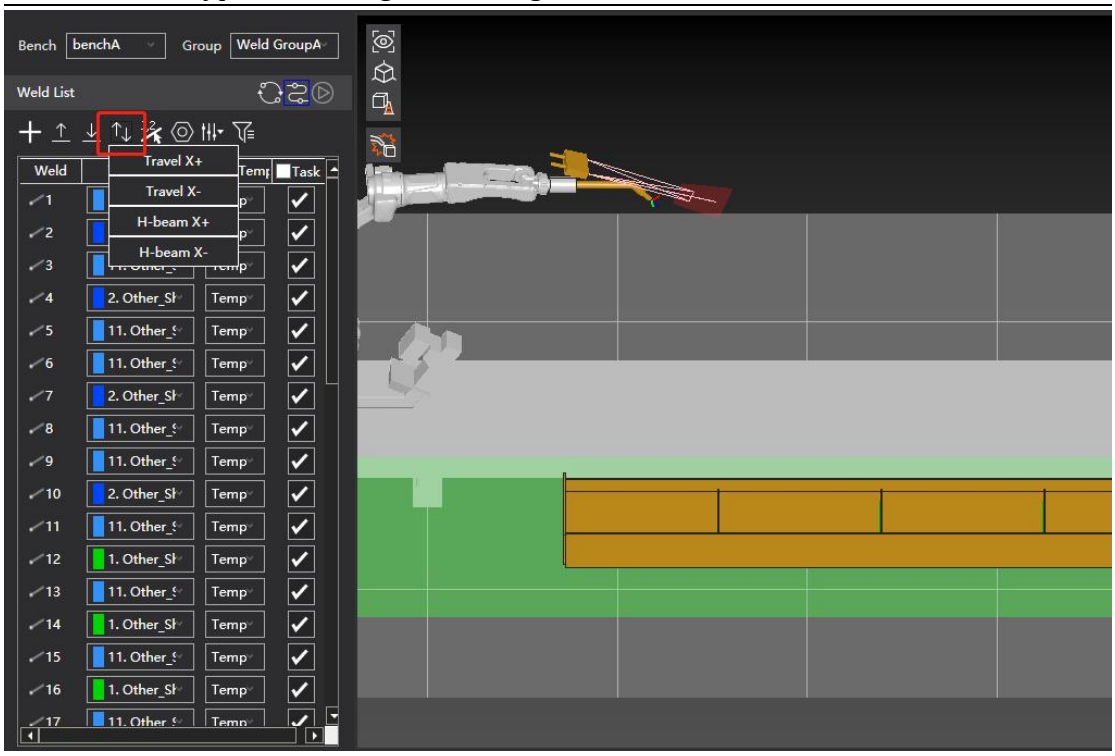
Right-click the workpiece: Select Auto Generate H-beam Toolpath.



The software will automatically generate welds on both sides of each rib of the H-beam.

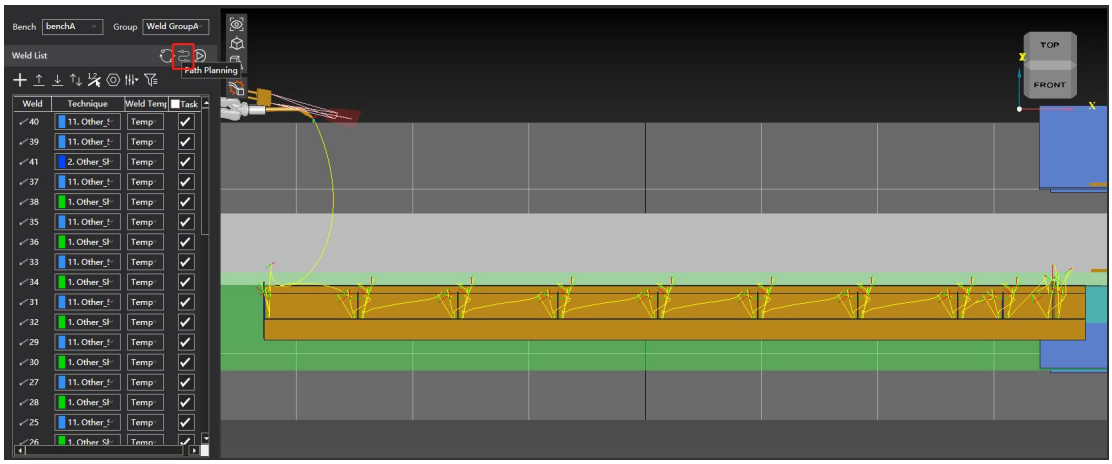
3.1.4 Weld sorting

By default, the weld seam sequence follows the direction of the ground rail, minimizing thermal deformation while ensuring the shortest idle movement.



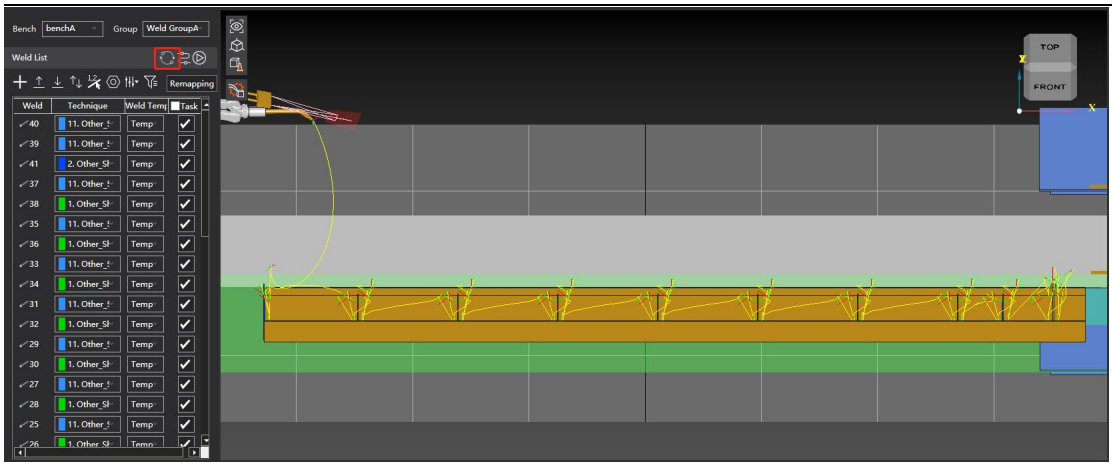
3.1.5 Path planning

The entire welding paths are planned and represented on the model with continuous colored curves.



3.1.6 Remapping

When the processing workflow involves engineers editing drawings and sending them to the site for processing, the remapping function can be used to quickly adjust the original processing path to match the current one after initial positioning. After recalibrating parameters such as TCP, hand-eye coordination, and zero points, the remapping function can also be used for quick adjustments.



3.1.7 Processing control

The main common functions include start, pause, resume, and stop.

BreakPt LOC/Set BreakPt: When a running procedure is stopped or interrupted unexpectedly, the software will memorize the breakpoint. As long as the workpiece model, weld seam information, and path planning are not modified, the software will automatically resume from the point where processing was halted. You can also manually set a breakpoint, using the current TCP position as the starting point for the next processing session.

Welding Trial Mode: When enabled, the welding machine will not ignite the arc during the processing.

3.2 FSWELD3800 Drawing-free Processing Flow

Please confirm in advance that the hardware and equipment used are compatible with the FSWELD3800 system, or the relevant features will not be available. Users can configure the FSWELD3800 system to process without drawings through its point cloud reconstruction feature, making it suitable for workpieces assembled from horizontal and vertical plates.

(Currently, the software interface is only available in Chinese; an English version will be released in future updates.)

Entry for point cloud reconstruction feature:

First, set the robotic arm's posture during scanning to ensure that there is no collision along the track and that the camera's field of view is unobstructed. After the scan is completed, the system will enter the point cloud reconstruction interface.

On the left side of the interface, the scanned point cloud is displayed, and on the right side is the reconstructed model. Once the reconstructed model is saved to a local file, it will be

automatically pushed to the processing interface.