Welding Cobot Operation Manual

Contents

Chapter I Foreword

1.1 Thanks

Thank you for purchasing and using our product. This is the new generation intelligent industrial lightweight six-joint cobot developed by our company.

1.2 Nameplate

You can find information about the robot's model and other details on the robot arm body.

You can find information about the control cabinet, including its model and other details, on the control cabinet itself.

1.3 How to use the manual

This manual describes the hardware composition of the CoolRobo collaborative robot and the operation of its teaching control system. It is designed to help users understand and master the functions, technical specifications, installation, and operation of the CoolRobo collaborative robot.

This manual is intended for customers, sales engineers, installation and debugging engineers, technical support personnel, and others.

The manual includes methods on how to protect users and prevent damage to the machine. Users are required to read all relevant descriptions in the manual and be fully familiar with the safety precautions.

Throughout this manual, we strive to describe various situations; however, due to the numerous possibilities, it is impossible to document every situation where an action is unnecessary or prohibited.

1.4 Copyright and Trademark Statement

1.5 Manual Disclaimer

Before using this product, please carefully read the user manual and relevant technical documents published online to understand the information provided. Ensure that you use the robot only after gaining a full understanding of the robot and its related knowledge. We recommend using this manual under the guidance of professionals. All safety-related information contained in this manual should not be considered as a guarantee from the manufacturer. Even if you follow this manual and related instructions, potential harm or loss may still occur during use.

1.6 Common Terms

1.6.1 Robot

The operational machine is automated, programmable for repetitive tasks, versatile, and capable of programming three or more axes. It can be either stationary or mobile and is employed in industrial automation.

1.6.2 Maximum Working Space

The maximum workspace refers to the space that the robot's moving parts can traverse, including the space covered during the movement of the end effector and the workpiece.

1.6.3 Precision

Deviation between the commanded distance and the actual achieved distance, averaged over both position and orientation.

1.6.4 Repeatability

Consistency in achieved distance after repeated movements of the same commanded distance in the same direction.

1.6.5 Trajectory Accuracy

The maximum trajectory deviation along position and orientation obtained during a given path.

1.6.6 Trajectory Repeatability

Consistency in achieving the same trajectory after the robot repeats the same commanded path for n times is referred to as Trajectory Repeatability.

1.6.7 Tool Center Point，TCP

A point established for a specific purpose with reference to the mechanical interface coordinate system. (Refer to GB/T 12643-2013, Definition 4.9)

1.6.8 Payload

It refers to all the loads mounted on the flange of the robot.

1.6.9 Protective Stop

A form of operational interruption that allows motion to cease in an orderly manner for safety reasons, maintaining program logic for potential restart.

1.6.10 Singular Point

The situation where two or more axes of a robot become aligned, resulting in uncertain motion and velocity, is known as a "singular point."

1.7 Revision history

Number	Version	Data	Description
1	V1.0	20240619	For the new welding process package (V1.2.X and above)
2	V1.1	20240708	Add Create welding template, add template lock function, add template parameter upload/issue function, add swing parameter, improve multi-layer and multi-pass process template (V1.3.X and above)

Chapter II Safety Information

2.1 Announcement

- Ensure that the robot arm and the tool/end-effector are properly and securely fastened in place with bolts. Make sure that the robot arm has sufficient space to move freely.
- Ensure that safety measures and/or robot safety configuration parameters defined in the risk assessment are established to protect programmers, operators, and onlookers when operating the robot.
- Avoid wearing loose clothing or jewelry when operating the robot. Ensure that long hair is tied back when operating the robot.
- Do not use the robot if it is damaged, for example, when joint caps are loose, damaged, or removed.
- Do not insert fingers into the control box.
- Do not connect any safety devices to the standard IO interface. Only use the safety IO interface.
- Ensure correct installation settings (e.g., robot installation angle, weight in TCP, TCP offset, safety configuration.
- The use of the teach pendant drag-and-teach function during installation is only allowed after a risk assessment.
- The tool/end-effector and obstacles must not have sharp corners.
- Ensure that people's heads and faces are kept out of the reachable range of the robot being operated or about to be operated.
- Be cautious of the robot's movement when using the teach pendant.
- If the risk assessment has identified it, do not enter the robot's safety zone or touch the robot while the system is in operation.
- Connecting different mechanisms may increase or introduce new dangers. Always conduct a comprehensive risk assessment for the entire installation.
- Do not modify the robot, as alterations may pose unpredictable risks. Robot reassembly should follow the latest version of all relevant service manuals.
- Ensure that robot users are aware of the emergency stop button's location and are instructed to activate it in emergency or abnormal situations.
- The robot and control box generate heat during operation. Do not touch the robot while it is running or has just stopped. You can cool the robot by shutting it down and waiting for an hour.
- When the robot is connected or working with mechanisms that can damage the robot, it is strongly recommended to individually test all functions and robot programs.
- Do not expose the robot to environments such as magnetic fields, combustion, explosion hazards, radio interference, liquids, etc., as this may damage the robot.
- During equipment operation, because the robotic arm may appear to be stationary while waiting for a start signal, it should still be considered in motion. Do not approach the robotic arm.

2.1.1 Universal Welding Safety

This product is welding equipment and should comply with the safety protection standards of welding equipment.

1 A special fire area should be divided, and safety signs should be posted and fire-fighting equipment should be equipped.

2 It is forbidden to place flammable and explosive materials around the equipment to avoid potential safety hazards.

3 The operator should pay attention to avoid high temperature and weld fumes caused by welding.

Safety Signs	Description
	This sign indicates a potentially dangerous situation that, if not avoided, could result in injury to personnel or serious damage to equipment.
	This sign indicates a potentially dangerous electrical situation that, if not avoided, could result in injury to personnel or serious damage to equipment.
	This sign indicates a hot surface that may cause a hazard and could cause injury if not avoided.
	This sign indicates that the area is a fireable area.
	This sign indicates that you need to wear appropriate goggles to prevent eye damage when welding.
	This sign indicates that a suitable mask must be worn during welding work.

2.1.2 Laser Safety

① The laser matched with this product emits laser radiation with a wavelength of 1080nm or around 1080nm when working, which is invisible light, and the laser classification is subject to the laser manufacturer.

② High-power lasers should not be treated as ordinary light sources, and the light outlet of the laser welding head should be avoided from facing people or flammable and explosive materials.

③ Direct or indirect exposure to such light levels can cause damage to the eyes or skin. Although this radiation is not visible, the beam can cause irreversible damage to the retina or cornea. When the laser is running, the relevant personnel should wear the corresponding band laser protective glasses that meet the standards.

④ High-power laser will electrolyze the gas and produce ionizing radiation, so relevant personnel should pay attention to protection.

Safety Signs	Description
	Laser radiation Protect eyes and skin from direct or scattered radiation This product is a Class 4 laser product
	Laser window Avoid exposure to laser radiation coming out of this window
	Watch out for laser
	Beware of ionizing radiation

2.2 Limitation of Liability

Any safety information contained in this manual should not be construed as a guarantee for our robots. Many aspects are not exhaustively described, and it is still possible to cause harm or damage.

We are committed to continually improving the reliability and performance of our products, and therefore, reserve the right to upgrade products without prior notice. The company is not

responsible for any errors or omissions in this manual and retains the final interpretation rights of this manual.

2.3 Emergency Stop

Referring to the IEC 60204-1, emergency stops are divided into three categories, namely stop category 0 (Cat.0), stop category 1 (Cat.1) and stop category 2 (Cat.2). Among them, stop category 0 is an uncontrollable stop, stop category 1 and stop category 2 are controllable stops.

Cat.0	Uncontrolled shutdown, which stops the robot by immediately cutting power to the actuator.
Cat.1	In controlled shutdown, the actuator actively brakes but does not ensure that the robot stops on the motion trajectory. After the robot stops, cut off the power supply.
Cat.2	In controlled shutdown, the actuator actively brakes and ensures that the robot stops on its motion trajectory. After the robot stops, the power supply is not cut off.

According to IEC 60204-1 and ISO 13850, emergency equipment is not a safety guard. They are supplementary protective measures and are not intended to prevent injury.

When an emergency occurs, press the emergency stop button to immediately stop all movements of the robot and lock it. Emergency shutdown cannot be used as a risk reduction measure. However, it can be regarded as a secondary protection device and is only used in critical situations.

If you need to stop the robot movement under normal circumstances, please use other methods. After risk assessment, if an emergency stop button needs to be installed, the emergency stop button must comply with the requirements of IEC-60947-5-5.

When the emergency stop button is pressed, the robot system will cut off the power supply of the robot, and the brake device between the joints of the robot will automatically lock the joints. However, under the action of gravity, the slight movement of the robot body is a normal phenomenon, but it may also cause the risk of clamping injury or collision with the human body.

2.4 Emergency Stop Recovery

The emergency stop button will be locked after being pressed. You need to rotate the button according to the mark on the button to unlock it. After the lock is unlocked, the alarm can be cleared through the control software, then powered on and enabled to recover from the emergency state.

2.5 Storage、Use and Shipping Conditions

- The ambient temperature should be between 0 and 45° C during storage and operation;
- Places with low humidity and relatively dry conditions. Relative humidity between 10% and 90%, no condensation;
- Places with less dust, dust, oil fume and water;
- Inflammables and corrosive liquids and gases are not allowed in the working area;

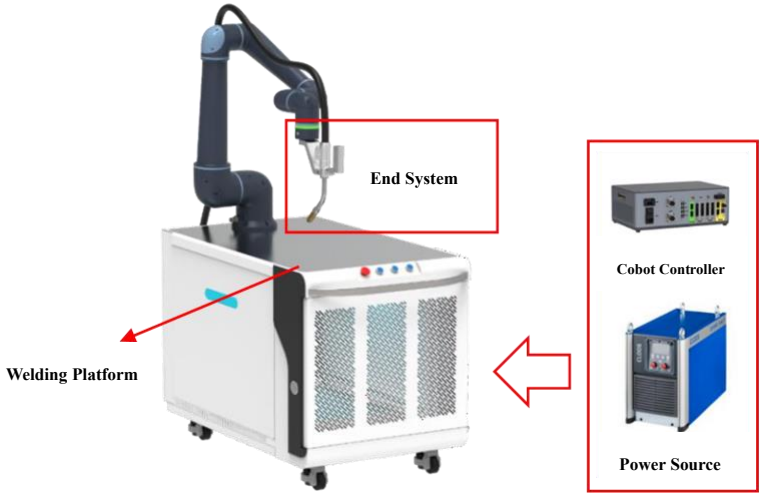
- Places with small vibration or impact energy on the electrical control cabinet (vibration below 0.5G);
- There should be no large electrical noise sources nearby (such as gas shielded welding TIG equipment, etc.);
- There is no potential danger of collision with mobile equipment (such as AGV);
- The control box should be installed outside the robot’ s action range (outside the safety fence);
- The control box must be at least 100mm away from the wall to keep the heat dissipation channel clear.

Chapter III Installation and Commissioning

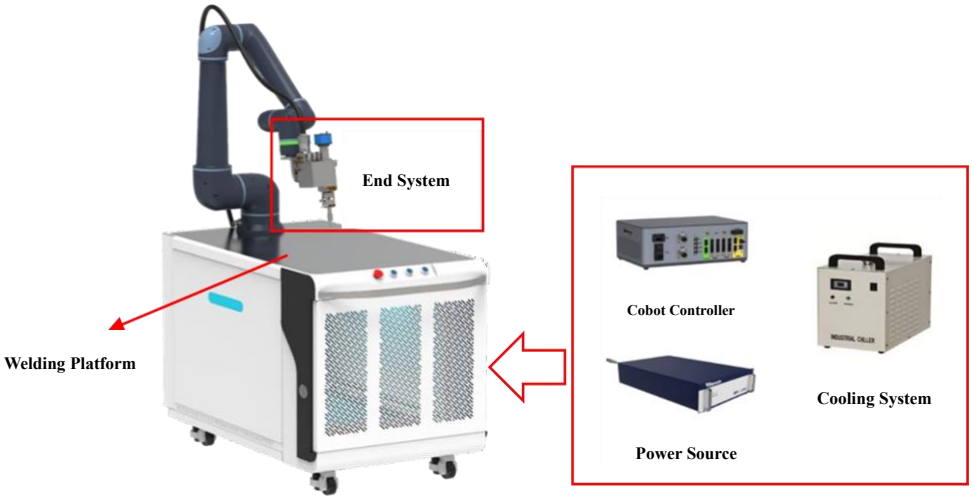
3.1 Installation

3.1.1 Quick Installation Connections

Estun codroid intelligent welding workstation is mainly composed of robot system, welding system, end effector system, cooling system and welding platform. Refer to the model of the circuit breaker on the nameplate of the equipment, and connect and energize the welding equipment in the workstation.



Pic 3-1a Welding Workstation（Arc Welding）



Pic 3-1b Welding Workstation（Laser Welding）

3.1.2 Robot Installation

As shown in Figure 3-2, use four M8 bolts with at least grade 8.8 strength and four 8.5mm mounting holes on the base to install the robot arm. Tighten the bolts to 20Nm torque. Use the two

reserved pin holes to accurately position the robot arm. Install the robot on a solid, vibration-free surface that is strong enough to withstand at least 10 times the full torsional force of the base joints and at least 5 times the weight of the robot arm. If the robot is installed on a linear axis or a movable platform, the acceleration of the mounting base should be very low, because high acceleration will cause the robot to falsely report a collision and stop running. For details on the installation dimensions of the robot base, see Chapter 3.

Pic 3-2 Installation

3.1.3 Bracket Installation

Use four M6 bolts of at least 8.8 strength to install the weldgun (laser weldgun) bracket, the following size bolts are recommended.

Type	Bolt
Weldgun Bracket	M6×15mm
Laser Weldgun Bracket	M6×15mm

3.2 Weldgun Bracket

3.2.1 Arc welding workstation

The 5-pin plug and 3-pin plug are used to access the welding workstation to supply power to the welding equipment and robot, and the power demand is detailed in the nameplate information.

3.2.2 Laser welding workstation

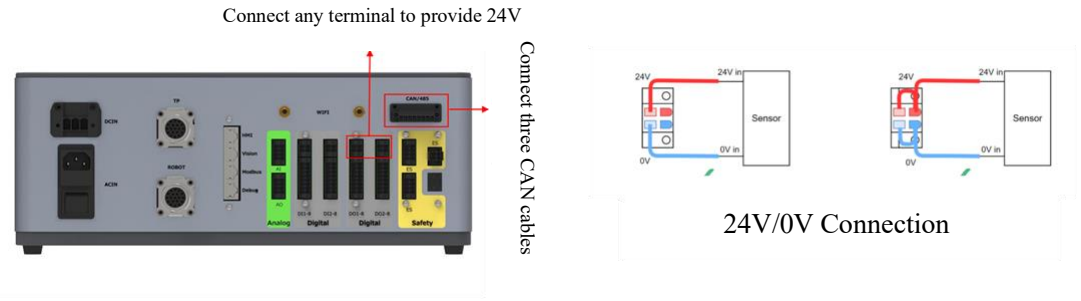
The 3-pin plug is used to connect to the welding workstation to supply power to the welding equipment and robots, and the power demand is detailed in the nameplate information.

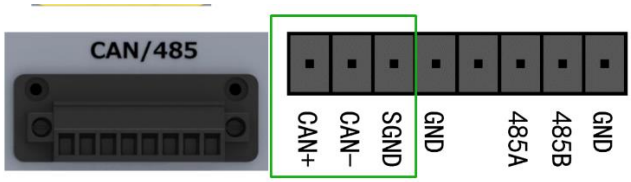
3.3 Power Source Communication

3.3.1 CLOOS Power Source Communication

Prepare one CAN-Bus (Shipped with the case)，One end of the Harting connector is connected to the X70 connector of the welder，One end of the loose wire with a label is connected to the robot controller，Connect pins with the following field labels to the terminals under the figure。

Number	Define	Controller
1	CANL1	CAN-
2	CANH1	CAN+
14	ground robot	SGND
8	24V robot	24V
11	0V robot	0V

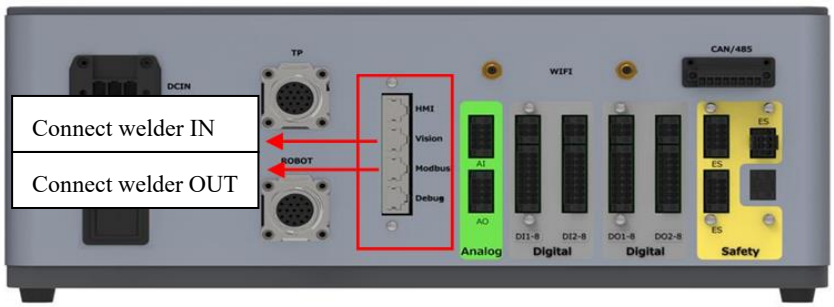




CAN+/CAN-/GND Connection

3.3.2 ESTUN Power Source Communication

Prepare two network cables and connect them to each other as shown in the following figure.



3.4 Prepare for Power-up

- Ensure that the workstation is firmly seated;
- Ensure that the control cabinet is properly connected;
- Ensure that the welding machine cable connection (positive and negative cables), laser welding does not have positive and negative cables;
- Ensure that the control cabinet is properly connected with the robot cable;
- Make sure the welding gun/processing head is firmly fixed and the cable connection is secure;
- Make sure the E-STOP button is in the released state;
- Ensure that there are no people or equipment within the robot's range of motion.

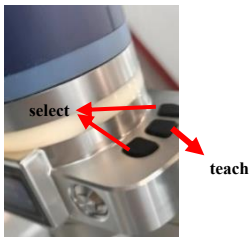
3.5 Power On and Off

- Release the emergency stop button on the electrical cabinet of the workstation.
- Click the "Total Power" button on the electrical cabinet.
- Nudge the circuit breaker inside the electrical cabinet.
- Click the button on the front panel of the robot control cabinet until the button light is green, then wait a few moments.
- Nudge the power switch of the welding equipment.

Chapter IV Welding package

4.1 End Flange

The buttons are shown in the figure, including two "Select" buttons and one "Teach" buttons



- Select: according to the programmer's own ideas to write the program, in the "template programming" mode does not take effect
- Teach: You can record the current point and generate instructions that match the screen. If there is no welding program in the interface, click the button to enter the programming process.

The existing instructions include: Add Seam、MovJ、MovL Arc On、MovLW、MovCW、MovCW Arc Off、MovLW Arc Off、Multi-Pass Point of Reference (POR)。

4.2 Interface

Weld: Main interface of welding programming

APPS: Store welding related process parameters

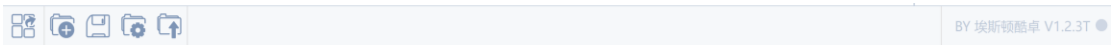
ROBOT: JOG ROBOT（according joint/world/tool coord）

SETTING: setting robot parameter

RECORD: You can download logs for troubleshooting

USER: User management allows you to create and delete users with lower management rights

admin: Current user, click to switch account



 : Navigation Key

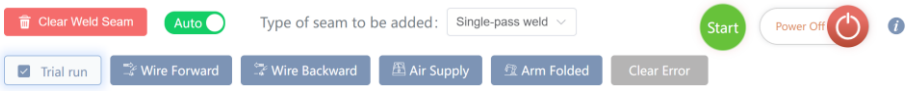
 : Add Program

 : Save Program

 : Program Management

 : Upload Program

: Click “ ◯ ” to exit the service



Delete: Delete the current welding program

Manual/Auto: Switch Manual/Auto

Type: Switch single pass welding/multi-pass welding

Start: Run program

Power On/Power Off: Switch Power On/Power Off

Dry Run: Complete the running of the track without welding

Wire + / Wire -: The communication power source can complete the action of wire feeding and wire withdrawal

Gas: The communication power source can complete the action of gas supply

Home: Robot back to Home point

Reset: When the welder alarm, you can use this button to clear the welder error

4.3 Process Template

The process template includes single-pass welding, multi-pass process template and welding template.

4.3.1 Single-pass Welding

Click "+ Add" next to "Process Template List" below to create a new process template.

i. CLOOS Welder Process Template

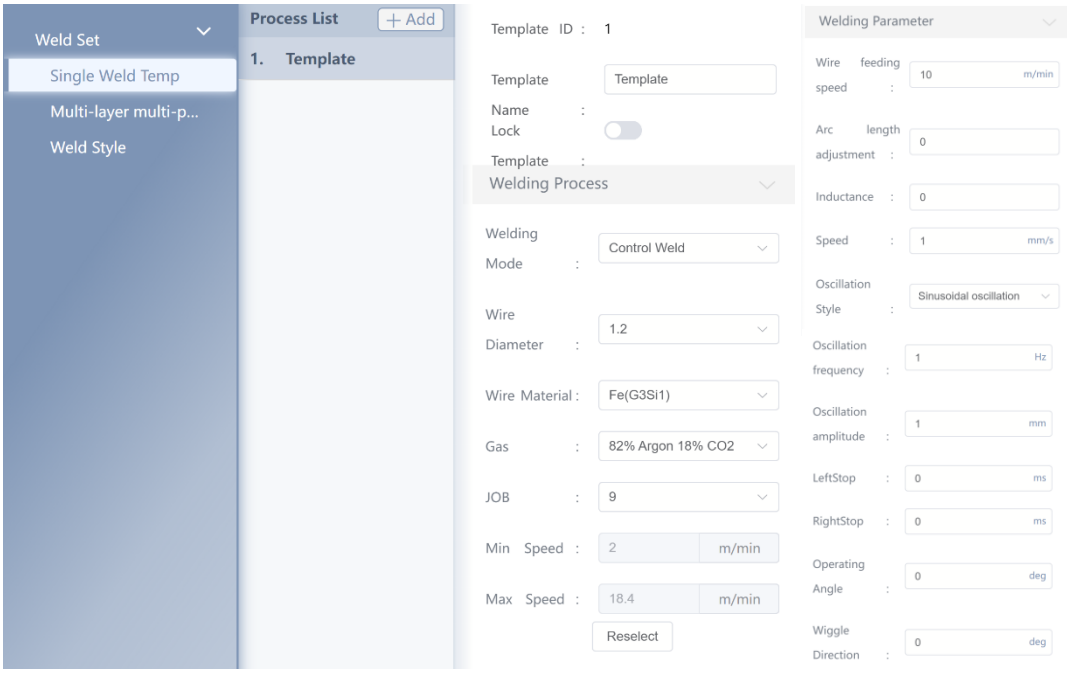
ID: A serial number is automatically generated when you create a new template.

Title: Name the new template.

Lock: The template can be locked and cannot be modified in the calling interface while in the calling state.

Welding Process-Welding Mode①: The welding modes in the process curve of CLOOS welding machine are selected as: Control Weld (DC welding), Fine Weld (low splash welding), Rapid Weld (deep penetration welding), Speed Weld (high speed pulse welding) and Vari Weld (pulse welding).

Welding Process-Wire Diameter①: The diameter of welding wire in the process curve of CLOOS welding machine is selected as φ0.8, φ1.0, φ1.2 and φ1.6 respectively.



Welding Process-Wire Material[①]: Select the welding wire material in the process curve of CLOOS welding machine, respectively: AlMg2,7Mn, AlMg4,5Mn, AlMg5, AlSi5, CrNi 1.4316, CrNi 1.4370, CrNi 1.4462, Fe(G3Si1), Fe-basis, Fe-Met, Fe-RUT.

Welding Process-Gas[①]: Select the gases in the process curve of CLOOS welding machine as follows: 100%Argon、100%CO_2、48%Argon 50%He 2%CO_2、70%Argon 30%He、82%Argon 18%CO_2、82%Argon 18%CO_3、90%Argon 10%CO_2、91%Argon 4%O_2 5%CO_2、92%Argon 8%CO_2、97.5%Argon 2.5%CO_2、97.5%Argon 2.5%CO_3、98%Argon 2%CO_2。

Note: ① The above welding machine process curves are based on the actual welding machine, the type of process curve depends on the model of the welding machine, and the corresponding curve is selected according to the actual welding conditions.

Welding Process-JOB: Combined with the selected process curve, a JOB number is automatically generated for sending to the welder.

Welding Process- Min WFS: The minimum wire feed speed can be set according to the process curve.

Welding Process- Max WFS: The maximum wire feed speed can be set according to the process curve.

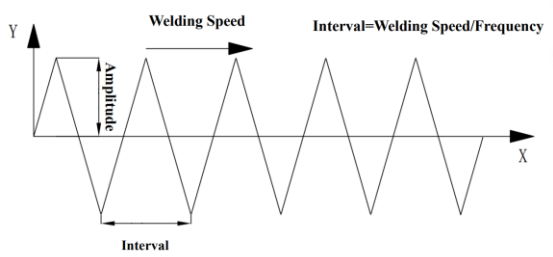
Welding Parameter-WFS: The wire feed speed is used to match the welding current during the welding process.

Welding Parameter-Arc Length Adjust: Used to adjust arc length, the "0" welding current is precisely located in the process curve; When the value of "-" decreases, the arc becomes longer. The arc becomes shorter when the + value increases.

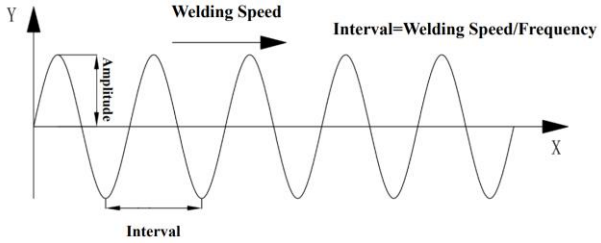
Welding Parameter-AC Dyn: Used to adjust arc length during welding, the "0" welding current is precisely located in the process curve; "-" arc becomes softer and wider; The "+" arc is getting harder and thinner.

Welding Parameter-Speed: The actual speed of the robot in the welding process.

Welding Parameter-Weave Type: Can be switched weave type, divided into triangular weaving, sine weaving.



Weave Type: triangular weaving



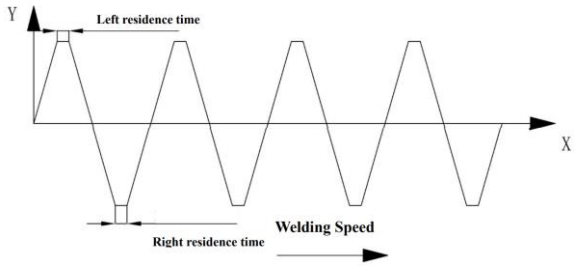
Weave Type: sine weaving

Welding Parameter-Frequency: The number of cycles the robot weaving in 1 second.

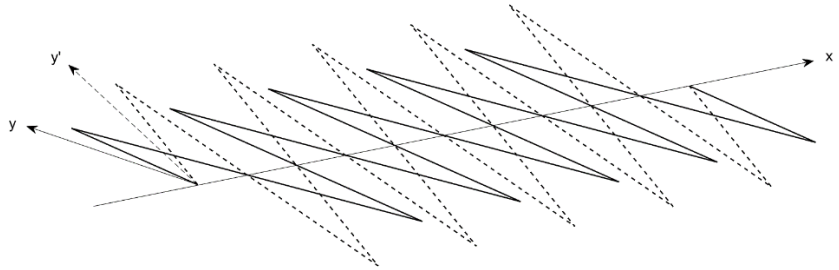
Welding Parameter-Amplitude: The maximum distance the robot weaving to the left/right.

Welding Parameter-Left residence time: The stay time when the robot weaving to the left end point, where the stay is the stay in the direction of the weaving.

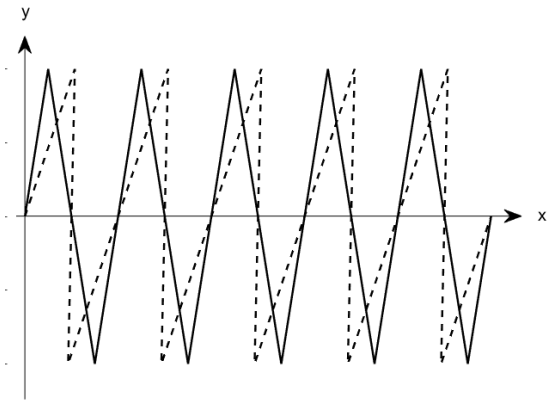
Welding Parameter-Right residence time: The stay time when the robot weaving to the right end point, where the stay is the stay in the direction of the weaving.



Work Angle: The weaving plane can be rotated around the welding direction, following the right helix rule, and the legend is 10° work Angle.



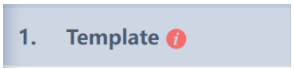
Weaving Direction: The tilt of the weaving direction in the weaving plane can be adjusted. The weaving direction cannot be negative, and the legend is 10° weaving direction.



The rest of the function keys in the process template

- Empty Temp: Clear all templates in the current robot.
- Upload Temp: New templates can be imported from other robot controllers.
- Delete Temp: Delete the current template.
- Copy Temp: Copy the current template content.
- Send-PARM: Communicating with the welding machine wire feed speed (or welding current) arc length adjustment and other parameters sent to the welding machine for users to check.
- Export Temp: The template can be exported to mobile for transfer.

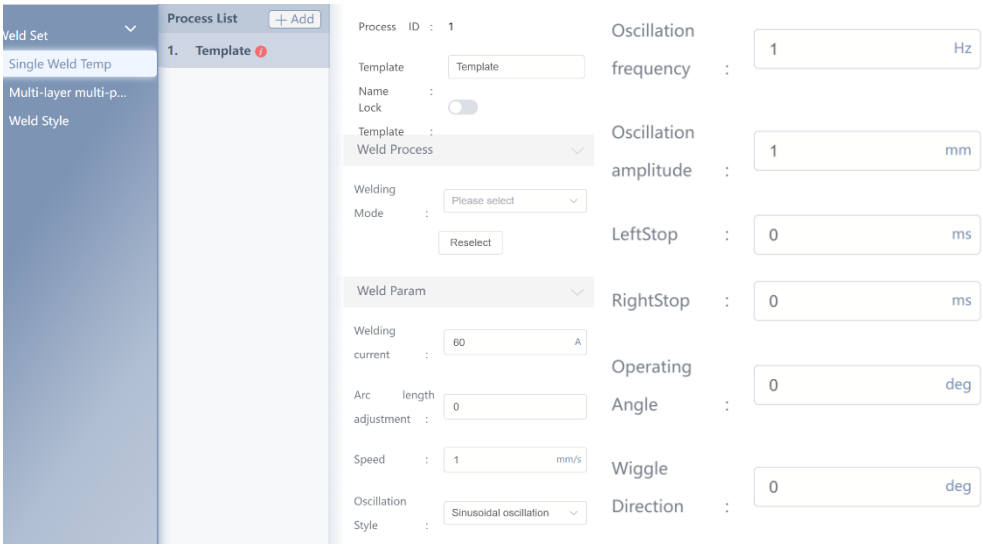
The process template list shows the example below the figure, indicating that the parameters in the template are incomplete and can be called only after the complete parameters.



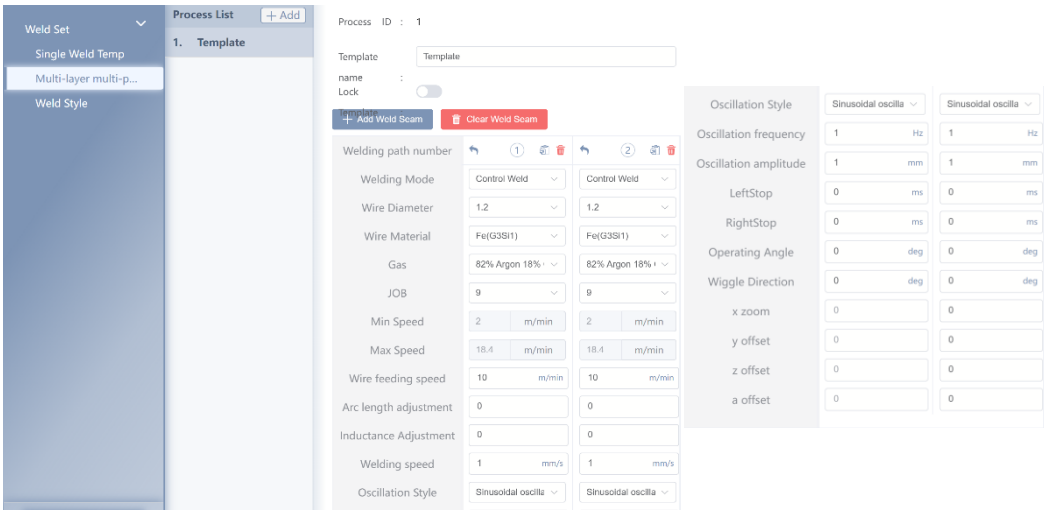
ii. ESTUN Welder Process Template

Taking the EC 500iP welder as an example, unlike the CLOOS welder process template, the welder can only select welding modes, respectively, DC Welding、Pulse Welding、Call、Deep Penetration and Speed-Pulse Welding.Other parameters such as wire diameter, material and

shielding gas must be selected on the welder panel. In addition, the robot can control welding parameters such as welding current and arc length adjustment.



4.3.2 Multi-pass Process Template



As shown in the figure above, each parameter in the multi-pass can be set independently, among which X scaling, Y offset, Z offset and a offset are unique parameters of the multi-pass and are set to offset the base pass. The specific setting method is as follows.

X scaling: The weld length of subsequent pass can be shortened or extended.

Y offset: In the process of compiling multi-channel templates, the generated offset value in the Y direction is calculated.

Z offset: In the process of compiling multi-channel templates, the generated offset value in the Z direction is calculated.

a offset: In the process of compiling multi-channel templates, the generated offset value in the a direction is calculated.

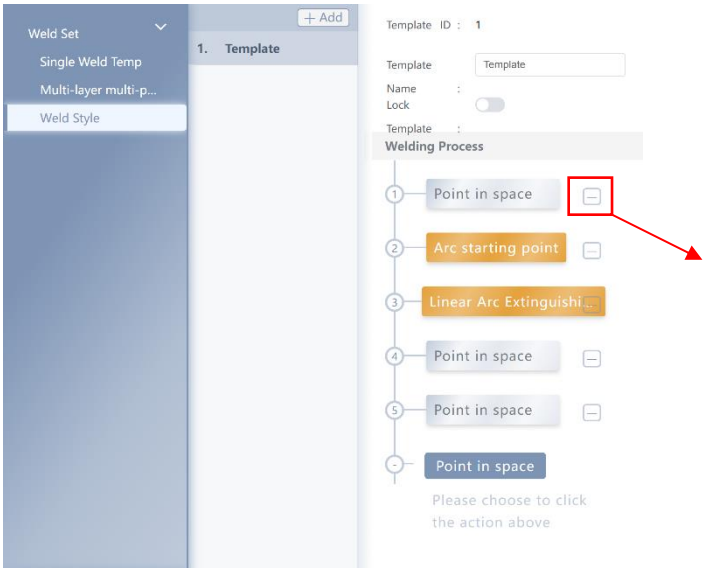
4.3.3 Welding Template

Select process template-welding template and click Add, according to the actual working conditions, free to choose the point program. This template is used to select welding templates in template programming.

The template can be locked. That is, the template cannot be modified when it is locked.

Delete: The instructions in the template can be deleted.

Note: Only one weld seam is allowed in the welding template, that is, a pair of arc on and arc off points.



4.4 Setup

In the setup interface, there are two tabs: welding machine and arc tracking.

4.4.1 Welding Machine

Welder Brand: Two brands can be switched between Cloos and Estun

Cloos: QINEO StarT 406 Premium、QINEO StarT 502 Premium、QINEO NexT 452 Premium、QINEO NexT 602 Premium、A500Na、A500FG。

Communication Mode: CAN

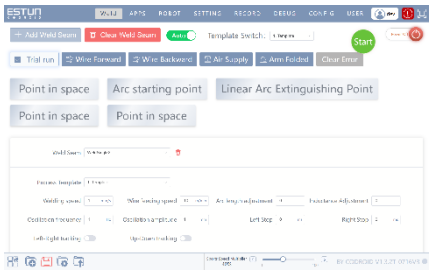
Estun: EC 350S、EC 350iL、EC 500iP。

Communication Mode: EtherCAT

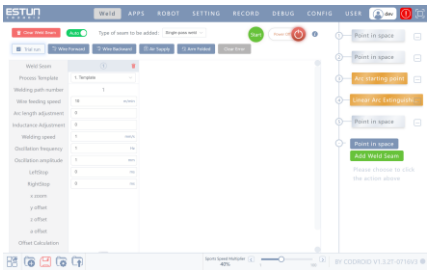
Programming Mode: Divided into template programming and flexible programming.

- Template Programming: Fixed template program for users to choose, through the end of the small screen to guide the user to complete the programming content.

- Flexible Programming: According to the actual working condition, the user can choose the motion instruction independently in the end small screen, so as to complete the writing of the program.



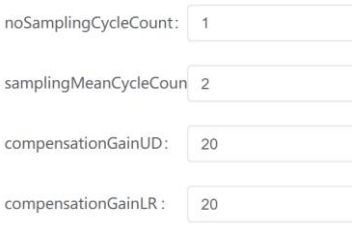
Programming Mode-Template Programming



Programming Mode-Flexible Programming

Parameter Mode: Divided into local control (that is, robot control welder parameters), welder control (welding parameters set by the weder)

4.4.2 Arc Tracking



The adjustment parameters are shown in the figure above:

- noSamplingCycleCount: The welding current has no reference value when the welding arc starts, and several cycles should be ignored.
- SamplingMeanCycleCount: The number of periods to start sampling after welding begins..
- compensationGainUD: The amount of compensation in the up and down direction, usually the greater the sensitivity, the more compensation.
- compensationGainLR: The amount of compensation in the left and right direction, usually the greater the sensitivity, the more compensation.

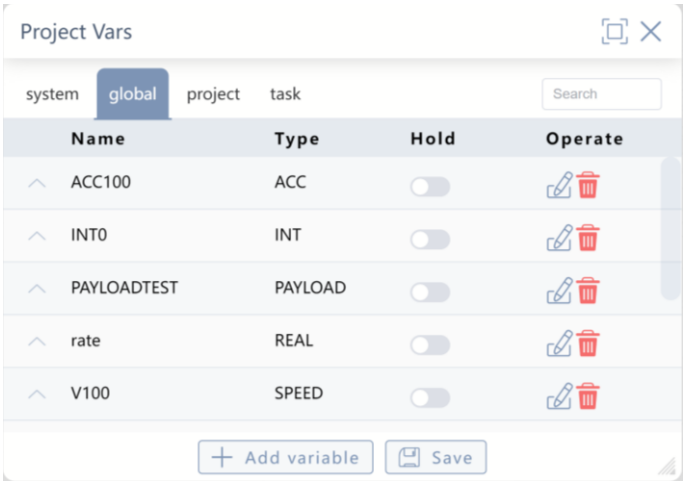
Chapter V Operation

5.1Tool Coord

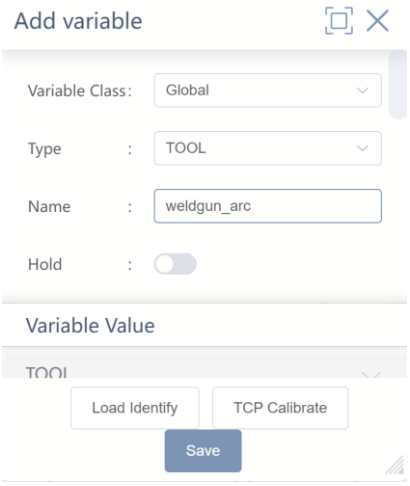
Click on Interface Robot Control and select Project Vars. The tool coord is established according to the actual end.

5.1.1 Setting Tool Coord

1、Open Project Vars and click add variable.

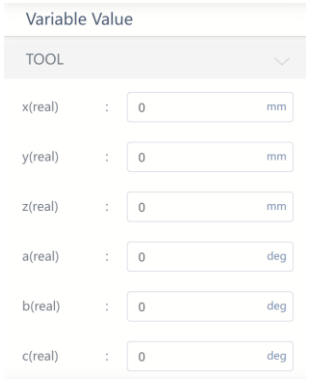


2、Select global, Type-TOOL, Take any variable name you want (weldgun_arc).

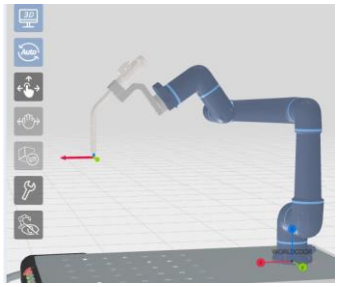


3、Manually enter the mass and center of mass to ensure normal dragging.

4、Click calibration, select the four-point calibration method, follow the steps to complete the calibration, or you can directly enter the value in the variable value.



5、Select one-point calibration method and mark the direction of the tool. TCP direction should be defined as +Z direction for the tool straight up and +X direction for the welding torch straight forward, as shown in the following figure.



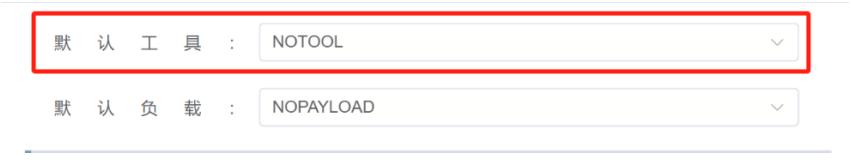
Tool coord variables set parameters in detail

Parameter	Data Type	Meaning
Tool	X（real）	The displacement offset of TCP relative to the flange coordinates in the X direction, in mm.
	Y（real）	The displacement offset of TCP relative to the flange coordinates in the Y direction, in mm.
	Z（real）	The displacement offset of TCP relative to the flange coordinates in the Z direction, in mm.
	A（real）	The Euler angle of TCP relative to the X-axis of the flange coordinates, in deg.
	B（real）	The Euler angle of TCP relative to the Y-axis of the flange coordinates, in deg.
	C（real）	The Euler angle of TCP relative to the Z-axis of the flange coordinates, in deg.

Dyn （LoadDyn）	M	The mass information of the tool, which is used to calculate the full model of robot dynamics.
Pos	MX（real）	The offset of the center of gravity C of the installed Tool or clamped load in the X direction of the coordinate system O Tool XYZ, in mm.
	MY（real）	The offset of the center of gravity C of the installed Tool or clamped load in the Y direction of the coordinate system O Tool XYZ, in mm.
	MZ（real）	The offset of the center of gravity C of the installed Tool or clamped load in the Z direction of the coordinate system O Tool XYZ, in mm.
Tensor	lxx（real）	The moment of inertia of the installed tool or the clamped load rotating in the X direction at the center of gravity, in kg·mm 2.
	lyy（real）	The moment of inertia of the installed tool or the clamped load rotating in the Y direction at the center of gravity, in kg·mm 2.
	lzz（real）	The moment of inertia of the installed tool or the clamped load rotating in the Z direction at the center of gravity, in kg·mm 2.
	lxy（real）	The moment of inertia of the installed tool or the clamped load rotating in the XY direction at the center of gravity, in kg·mm 2.
	lxz（real）	The moment of inertia of the installed tool or the clamped load rotating in the XZ direction at the center of gravity, in kg·mm 2.
	lyz（real）	The moment of inertia of the installed tool or the clamped load rotating in the YZ direction at the center of gravity, in kg·mm 2.

5.1.2 Switch Tool Coord

In Setup - Machine, you also need to change the default tool to the tool coord of the actual application and save it



5.2 Arc-weld Programming

5.2.1 Template Programming

Template programming can choose straight weld, circular weld (single circular) or custom weld template

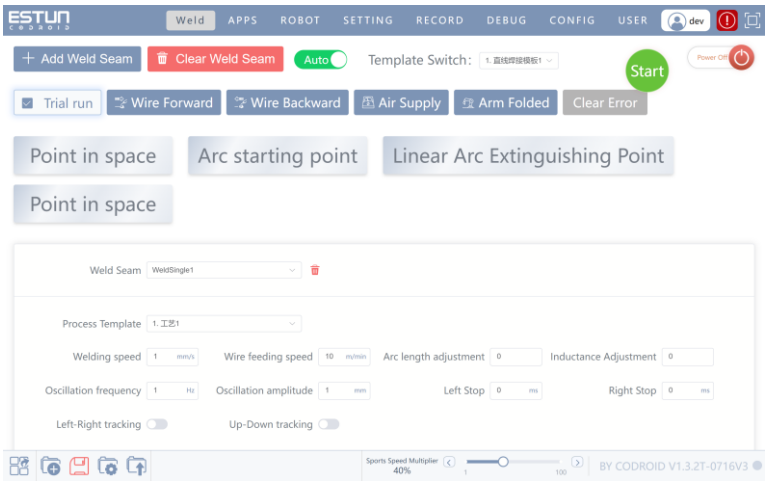
i. Straight Weld

1、 Clear Weld Seam.

2、 Switch template to select straight weld.

3、 Add Weld Seam.

4、 Display the interface under the figure.



5、 Drag the robot and use the end button to record the four points successively until the record is completed.

6、 If you need to add the weld again, click Add the weld again and repeat step 5.

7、 After the completion of programming, confirm whether the process template of each weld is correct.

8、 If you want to run the program without arc welding, you need to check the screen " Dry Run ".

9、 Click to start.

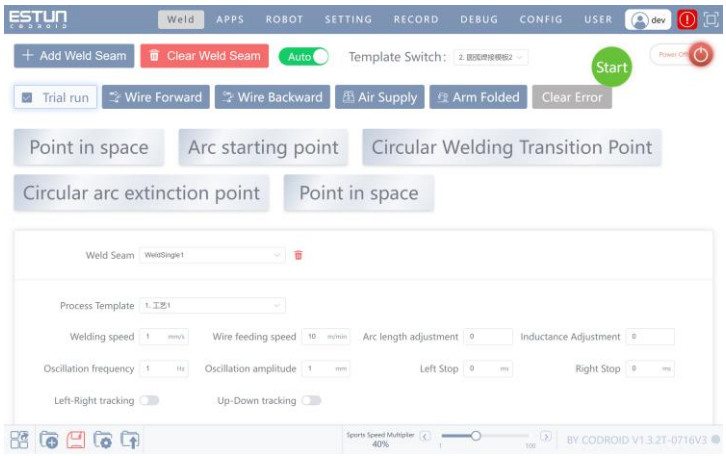
ii. Circular Weld

1、 Clear Weld Seam.

2、 Switch template to select straight weld.

3、 Add Weld Seam.

4、 Display the interface under the figure.



5、 Drag the robot and use the end button to record the five points successively until the record is completed.

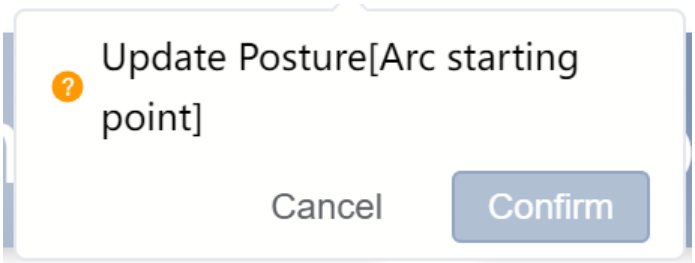
6、 If you need to add the weld again, click Add the weld again and repeat step 5.

7、 After the completion of programming, confirm whether the process template of each weld is correct.

8、 If you want to run the program without arc welding, you need to check the screen " Dry Run ".

9、 Click to start.

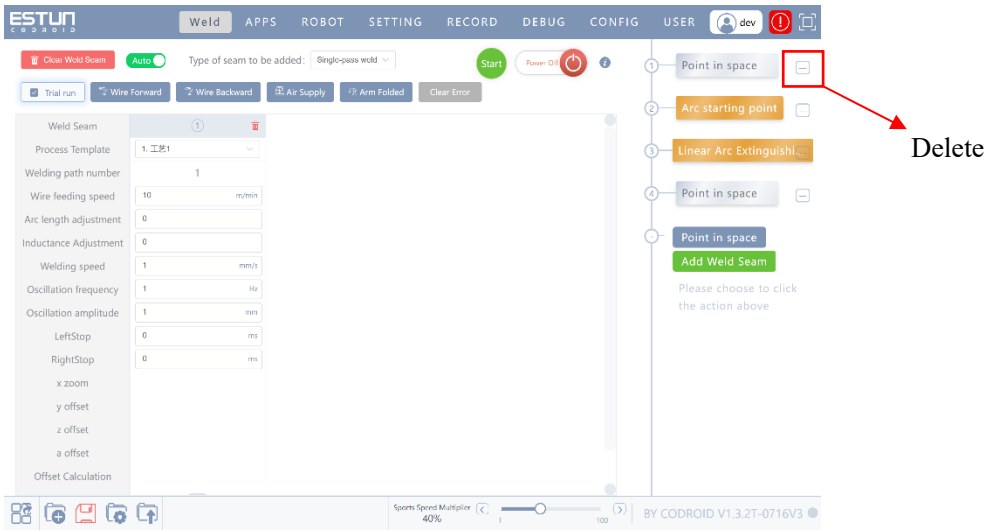
Note: ① In the process of programming, if you want to update the point, you can drag the robot to the position you want to teach, click the wrong point, It prompt whether to update the point, click confirm.



② The points must be complete before the program can be run.

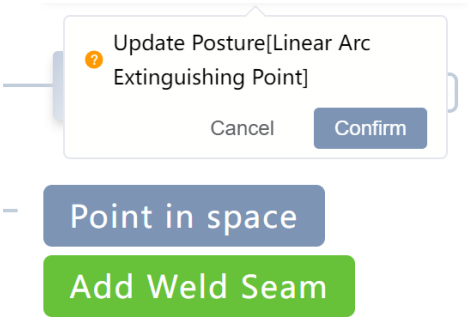
5.2.2 Flexible Programming

i. Single weld seam



According to the actual working conditions, the motion instructions can be customized, and the programming of combination welds such as straight line, straight line plus circular can be realized.

Note: ① In the process of programming, if you want to update the point, you can drag the robot to the position you want to teach, click the wrong point, prompt whether to update the point, click confirm.



② If you record wrong instructions during the programming process, click the "-" button on the right side of the instruction. If you clear the points except "space point", all the following instructions will be cleared.

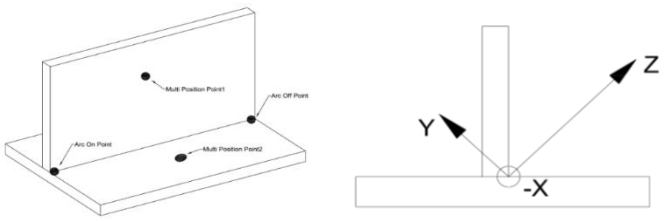
③ In the process of using flexible programming, only after the completion of a set of arc instructions, the subsequent addition of welds, starting and other operations can be carried out.

④ Click the corresponding weld number, you can view the program of the weld, you can update the point position, you can also insert a new space point between the two welds.

ii. Multi-pass weld

Theory: The welding teaching path is taken as the X-axis of the multi-pass offset coord, and the angular bisector direction of the two planes composed of two reference points and welding arc points is taken as the Z-axis. As a multi-pass offset coordinate system, it is used to calculate the offset value of the subsequent pass compared with the first pass.

At the beginning of the teaching procedure, add two multi-pass reference points, for example: the reference points of the weld are on the two plates, and the butt weld is also on the inside groove.



Note: The reference points must be on both sides of the teaching weld. TCP as close as possible to the location you want to teach; The welding direction must be consistent.

i. Create multi-pass templates

1、 Choose flexible programming method

2、 Teach the first weld and complete the welding

3、 Click the blue "+" sign next to "main process" to generate the second welding parameter.

4、 Teach the robot to the second weld position (can avoid welding start position).

5、 Click "Calculate Channel 2" to generate the offset value.

6、 Click the Start button to complete the welding of the second weld.

7、 Repeat steps 2-5 until the production and welding of multi-pass templates are completed.

Note: In the next parameter generated in step 2, " √ " indicates that only this weld is welded, and it will be automatically canceled after the welding is finished.

ii. Create multi-pass program

1、 Select flexible programming method.

2、 Teach the first weld program.

3、 Select the appropriate welding template in the process template.

If you currently have the multi- -pass template you need, just select the multi- pass welding template you want to use after completing the programming, you can click to start the welding work.

The template only records the offset value in a coordinate system, so as long as the offset coordinate system is consistent, you can weld any workpiece. For example: after linear welding as a template due to circular/tube welding or combination weld, but be sure to ensure that the offset coordinate system is consistent.

5.3 Laser Welding Programming

Laser welding interface details please see our general version of the robot manual, the following is the laser welding program template, for reference only.

2. Move to welding start point (P1) by linear motion

3. Digital signal DO [laser]=1 (Trigger the laser to turn on the light) a)

4. waiting 500ms b)

5. Move to welding end point (P1) by linear motion

6. Digital signal DO [laser]=0 (Trigger the laser to turn off the light) a)

7. waiting 500ms b)

Note:

a) The address depends on the actual access port number. For details, see the robot manual.

b) The waiting time depends on the light out and light off delay time.

Laser welding head with weaving function, the robot does not need to weaving.

The program includes a section of weld teaching, if you need to add transition points during the welding process, add "MovL" command to the required position, and select "RELATIVE" transition type, the transition value depends on the situation.

When teaching the circular trajectory, replace "MovL" to MovC and add two points.

When teaching the full circle track, replace "MovL" to MovCircle and add two points.

Note:

1. Laser welding is non-contact welding, that is, there is no need to arc after the welding wire and the workpiece, and do not open the laser signal in the non-welding area when teaching the robot or writing the laser program.

2. Before welding, it is necessary to confirm whether the protective gas is sufficient, and do not weld in the case of insufficient protective gas.