该文档是极速PDF编辑器生成，
如果想去掉该提示,请访问并下载：
http://www.jisupdfeditor.com/

CRP-Welding Technology

Instruction Manual

This system supports a variety of process functions. This manual only introduces the welding process of six-joint robot as an example. For other types of robots and process functions, please refer to other manuals for use.

Please refer to other instructions.

CRP-S40, S80 Instruction Manual
CRP-S40 System Hardware Manual
CRP-S80 System Hardware Manual
CRP-S40 PLC Instruction Manual
CRP-S80 PLC Instruction Manual
CRP-S40, S80 Debugging Manual
CRP-S40, S80 Welding Process Instructions
CRP-S40, S80 Palletizing Process Specification
CRP-S40, S80 Visual Function Instructions
CRP-S40, S80 Appointment Process Specification
CRP-S40, S80 Tracking Process Specification

Please ensure that the relevant instructions reach the end user of this product

CRP®

CRP-HJSM-2018-001

Safety Precautions

Before using this system, please be sure to read and master all the instructions and other ancillary information, and then use it after you know all the equipment knowledge, safety knowledge and precautions.

The safety precautions in this instruction can be divided into four categories: "Danger", "Attention", "Compulsion" and "Prohibition".

Sign	Instruction
	The operation is dangerous and may cause death or serious injury.
	Misoperation is dangerous and may cause moderate injury or minor injury accidents and equipment failure.
	Matters that must be observed.
	Prohibited matters.

It should be noted that even the contents recorded in "Attention" will have serious consequences because of different situations. Therefore, any matters needing attention are extremely important. Please strictly abide by them.

Even in some places, even the contents of "Attention" or "Danger" have not been recorded, which is also a matter that users must strictly abide by.

Danger

★ Before operating the robot, press the emergency stop button on the teaching programmer and confirm that the main servo power supply is cut off and the motor is out of power and locked. When the servo power supply is cut off, the servo power indicator button on the teaching programmer is red.

In emergencies, if the robot can not be braked in time, it may cause personal injury or equipment damage accidents



★ When the servo power is turned on after the emergency stop is canceled, the servo power supply is turned on after the accident causing the emergency stop is released.

The robot action caused by misoperation may lead to personal injury accidents.



★ When teaching within the range of robot action, please obey the following principles

keeping wantching the robot from the front .
Strictly abside by the operating procedure
Consider the backup plan if robot move suddenly toward yourself.
Make sure you have shelters in case.
The robot action caused by misoperation may cause personal injury accidents.

★ When doing the following tasks, make sure that no one is in the robot's range of motion and that the operator is in a safe position to operate:

When the robot control cabinet is connected to the power supply.
When operating a robot with a teaching programmer.
Trial run.
Automatic reappearance.
Accidents of personal injury may be caused by inadvertently entering the range of action of the robot or contacting the robot. In addition, in case of abnormality, please press the emergency stop button immediately.



Attention

★ Following items must be confirmed before operating the robot.

Whether the operator has received training in robotic operation or not.
We have enough knowledge of the motion characteristics of robots.
Have a good understanding of the dangers of the robots.
Can't go to work after drinking
No drugs affecting the nervous system and slow reaction were taken.

★ The following items should be checked before the robot teaching device is operated. If there is any abnormality, it should be repaired in time or other necessary measures should be taken.

Whether the robot actions abnormally or not.
Whether the origin is calibrated correctly or not.
Whether the external auxiliary equipment associated with the robot is normal or not.

★ When the teach pendant is used up, it must be put back in place and ensure that it is firmly placed.

If the teach pendant is accidentally placed on the robot, fixture or ground, when the robot moves, the teach pendant may collide with the robot or fixture, causing personal injury or equipment damage.

Prevent the robot from malfunctioning due to accidental fall of the teach pendant, causing personal injury or equipment damage.



Compulsion

Safety Operating Regulations

1、All robot system operators should participate in the training of this system to learn about safety protection measures and the functions of using robots.

2、Before starting the operation of the robot, make sure that there are no abnormal or dangerous conditions around the robot and peripheral equipment.

3、Turn off the power supply or press the emergency shutdown button before entering the operation area, even if the robot is not running.

4、When programming in the robot workspace, set up corresponding guards to ensure that the robot can stop quickly in an emergency.

5、Do not use gloves when teaching and jogging the robot. When jogging the robot, try to use low speed operation. In case of abnormal conditions, the robot can be effectively stopped.

6、The position of emergency stop buttons on the robot controller and peripheral control equipment must be known so that they can be pressed accurately in an emergency.

7、Never think that the program is complete when the robot is in a stopped state. Because at this point the robot is probably waiting for the input signal to keep it moving.

Definitions of common vocabulary in this book

The buttonsand interfaces in this book are displayed as follows:

Robot	The expression in this book
Text key/graphic key	Buttons such as button names and graphics will be indicated by < >. Example: <Enter>
Select	The choice is indicated by [ ]. Example: Select [Y direction]
Interface	The menu in the interface is indicated by [ ]. Example: [Settings]

I.Routine Information

1.1 Applicable standard

Robot system design meets the following requirements:

Standard	Describe
GB 5226.1-2002	Mechanical safety Mechanical safety Mechanical and electrical equipment Part 1: General technical conditions (IEC 60204-1:2000, IDT)
GB 1129l-1997	Safety Code for Industrial Robots (eqv ISO10218:1992)
GB/T 12644-2001	Characteristic Representation of Industrial Robots (eqv ISO 9946:1999)
GB 14048(All parts)	Low Voltage Switchgear and Control Equipment
GB/T 15706.1-1995	Mechanical safety Basic Concepts and Design Principles of Mechanical Safety Part 1: Basic Terminology and Methodology (eqv ISO/TR 12100-1:1992)
GB/T 15706.2-1995	Mechanical safety Basic concepts and design principles of mechanical safety Part 2: Technical principles and specifications (eqv ISO/TR 12100-2:1992)
GB/T 16856-1997	Principles of Mechanical Safety Risk Assessment (eqv PREN 1050:1994)

1.2 Safety Terminology

Use the following signs to record safety precautions. Be sure to read them.

Sign	Instruction
 Danger	The operation is dangerous and may cause death or serious injury.
 Attention	Misoperation is dangerous and may cause moderate injury or minor injury accidents and equipment failure.
 Compulsion	Matters that must be observed.
 Prohibition	Prohibited matters.

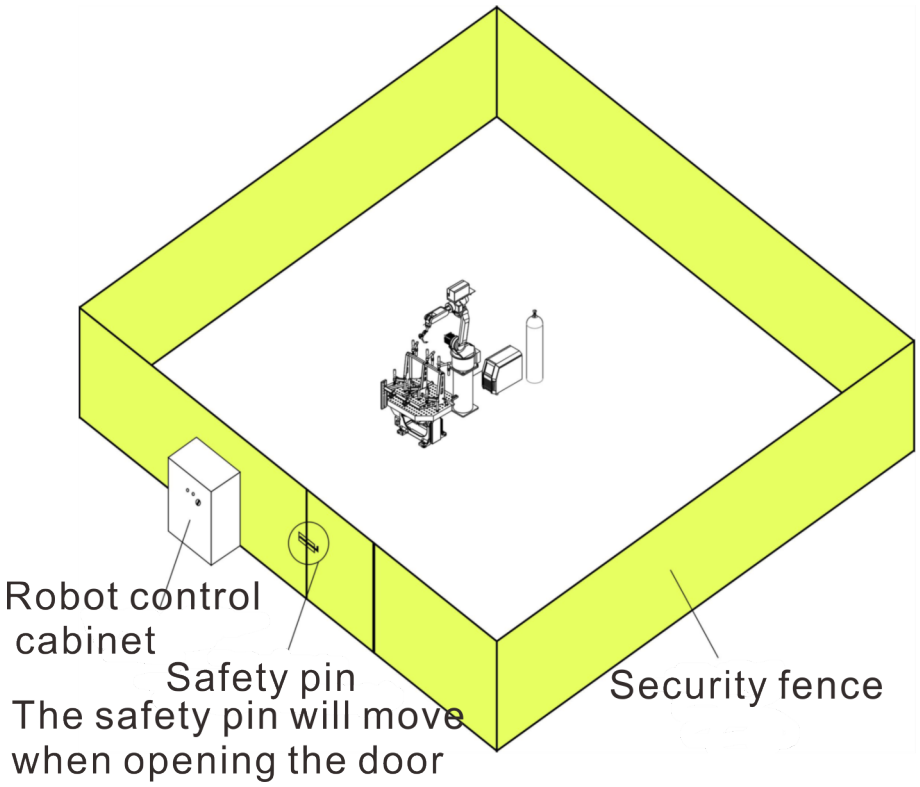
Attention
Even the contents recorded in "Attention" will have serious consequences because of different situations. Therefore, any precautions are extremely important. Please strictly abide by them Even where "Attention" or "Danger" is not marked, it is something that users must strictly observe.

II.Safety-related Instructions

2.1 Danger

1、The operation of the robot controller must designate a dedicated operator, and the operator must undergo safety training and pass the examination before he can be on duty.

2、Safety fence should be set around the range of motion of the robot. The safety fence must be able to effectively prevent the robot from popping out or protruding out of the fence due to errors or arm falling off, material falling off, etc. The safety door on the fence should have a safety pin. Only the safety switch can be opened to enter the fence, and the robot must automatically stop safely after the safety pin is removed.

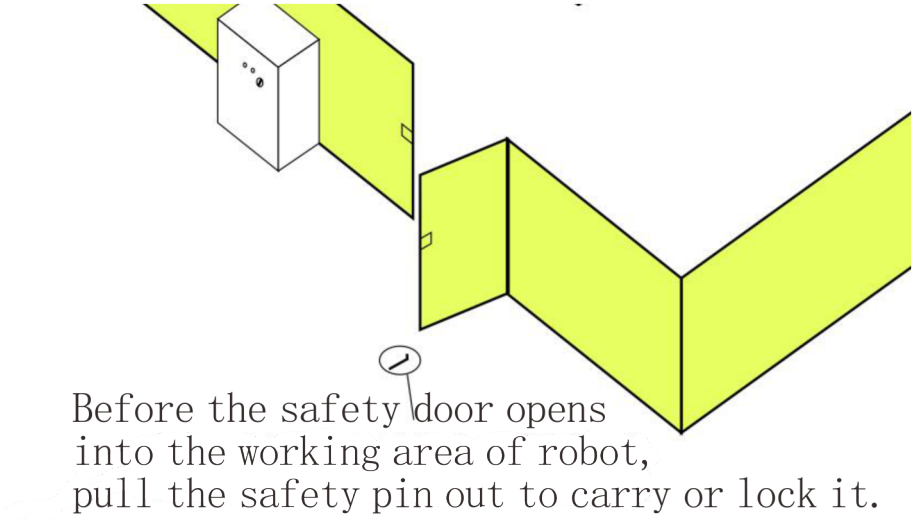


3、Man-machine separation: In the process of robot movement (automatic, manual), no one is allowed to enter the scope of the robot's safety fence.

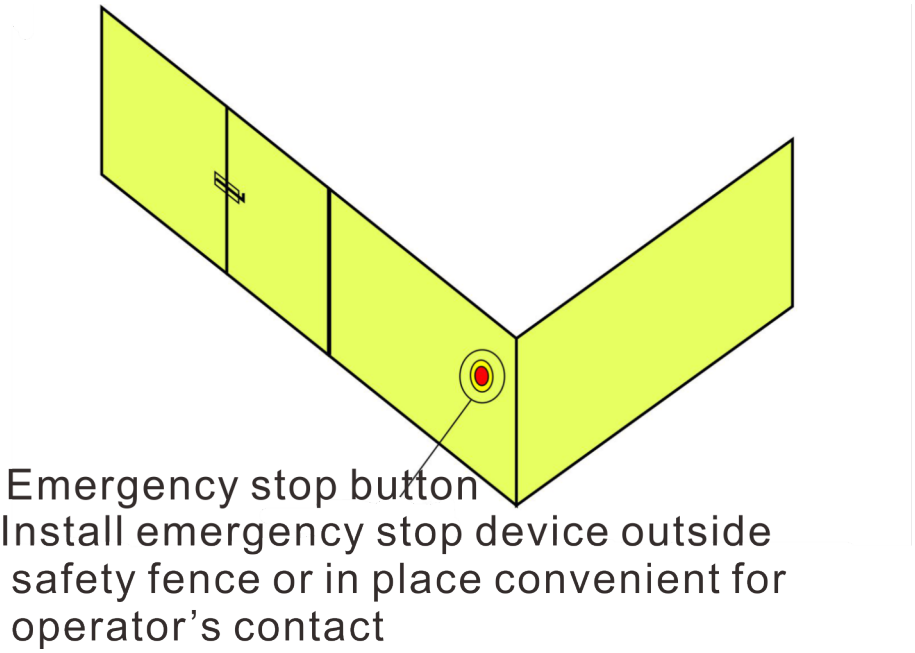
4、If there are several operators working together in the robot application system, it is important that all operators and their associated personnel know that the robot has been enabled before starting the robot.

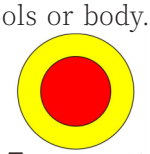
5、When the robot needs to be inspected, the operator should take the safety pin with

him, cut off the power supply of the robot or press the "emergency stop" button to avoid the third party operating the robot.



6、An emergency stop device is provided at the position where the operator is most convenient to contact, ensuring that the operator can perform an "emergency stop" operation quickly and easily when abnormal movement of the robot occurs.



7、Before opening or starting the robot, first confirm the safety conditions and clear the obstacles on the robot's running path, especially to ensure that there is no human activity within the robot's range of motion. Never try to block the movement of the robot with tools or body. Remember to stop the robot immediately, press the "Emergency Stop" button.  。

Emergency
stop button

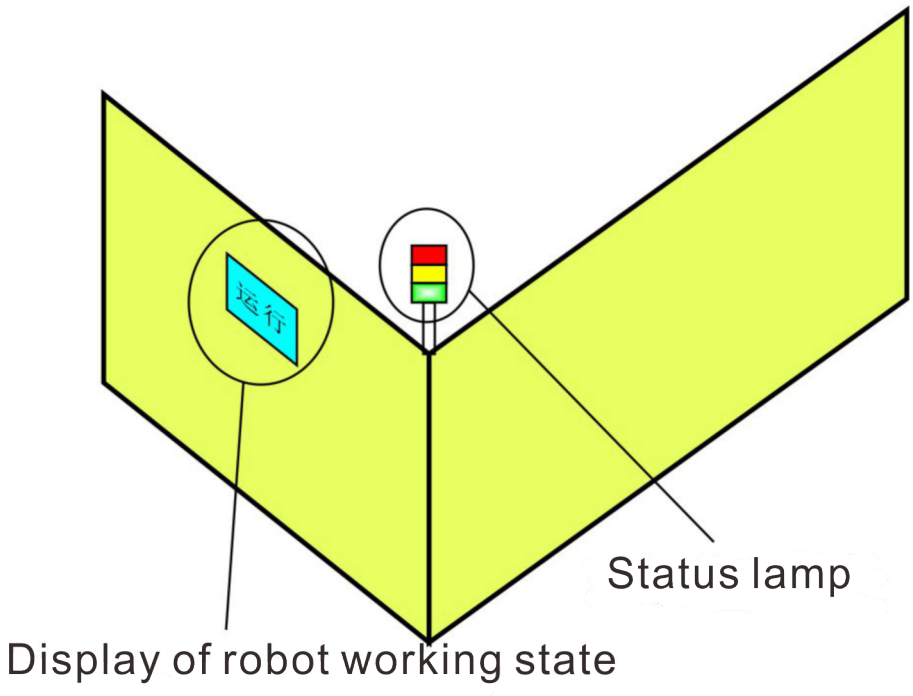
8、Do not operate a robot beyond its rated capacity, including: load, speed, range of

motion, operating environment.

2.2 Attention

1、Safety fence must be strong enough to be fixed and immovable to prevent operators from easily breaking or dismantling the safety fence. Meanwhile, safety fence itself should have no sharp edges and sharp corners and no potential dangerous parts.

2、The outside of the safety fence must clearly indicate what state the robot is currently in (teaching, running, maintenance). In order to prevent people from mishandling robots and peripheral devices through teaching devices, man-machine interfaces, etc.



3、Please mark dangerous areas on the ground with paint, including the range of motion of robots and peripheral equipment. In addition, sufficient safety space is left around and safety protective devices are installed for operators to avoid abnormal operations or emergencies.

4、Before operating the robot, it is necessary to confirm whether the function of the "emergency stop" button is normal. Check the switch, display, signal name and function that all robots must operate.

5. Before operating the robot, it is necessary to confirm whether the origin of the robot is correct and whether the movements of each axis are normal. During the operation, the operator should always look at the robot from the front.

6. In teaching and maintenance operations, safety supervisors must be deployed outside the safety fence. If there is abnormal movement of the robot in the process of teaching or maintenance, the safety supervisor must quickly and easily perform the "emergency stop" operation. In addition, safety supervisors must be those who have completed safety training and passed safety assessment.

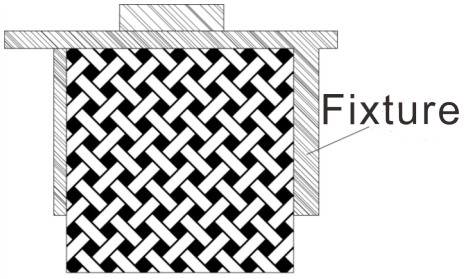
7. When the teaching device is used up, it must be put back to its original place and ensure that it is firmly placed. If the teaching device is improperly placed on the robot, fixture or ground, when the robot moves, the teaching device may collide with the robot or fixture,

thus causing personal injury or equipment damage accident. Prevent the accidental drop of the teaching device from causing the wrong action of the robot, thus causing personal injury or equipment damage accident.

8、If you need to restart the robot after emergency stop, please reset and restart outside the safety fence. At the same time, it confirms that all safety conditions are satisfied and that there is no human or obstacle left in the range of motion and safety fence of the robot.

9、After the robot motion teaching is completed, set the soft limit of the robot to a distance outside the robot's teaching range.

10、When the workpiece is gripped by a pneumatic gripper, electromagnetic method, etc., use a fail-safe system to ensure that the workpiece is not ejected once the drive force of the mechanism is suddenly disconnected.



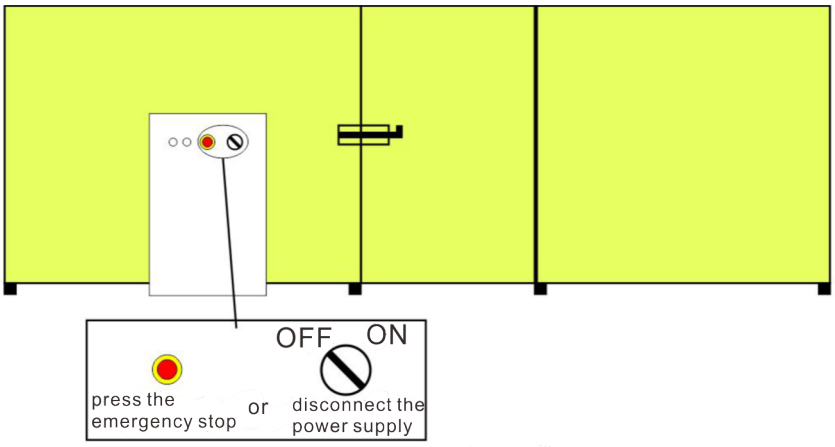
Power-off clamping state

2.3 Compulsion

1、All robot system operators should participate in the training of this system to learn about safety protection measures and the functions of using robots.

2、Before starting to run the robot, make sure there are no abnormal or dangerous conditions around the robot and peripheral equipment.

3、Turn off the power supply or press the emergency shutdown button before entering the operation area, even if the robot is not running.



Press the emergency stop or disconnect the power supply before opening the safety door into the working area of the robot

4、When programming in the robot work area, set the corresponding guard to ensure that the robot can stop quickly in an emergency. Do not use gloves when teaching and jogging the robot. When jogging the robot, try to use low speed operation. In case of abnormal conditions, the robot can be effectively stopped.

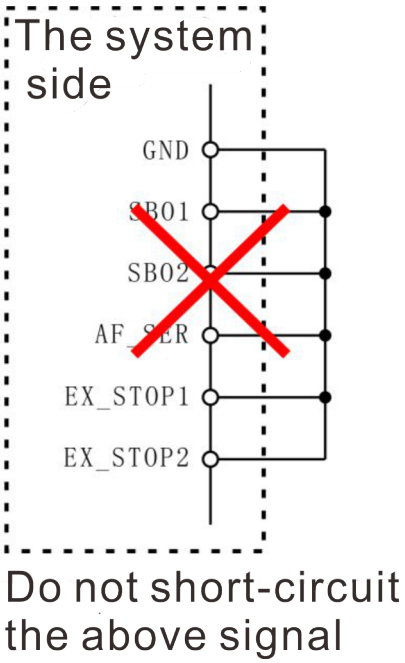
5、The position of emergency stop buttons on the robot controller and peripheral control equipment must be known so that they can be pressed accurately in an emergency.

6、Never think that the program is complete when the robot is in a stopped state. Because at this point the robot is probably waiting for the input signal to keep it moving.

2.4 Prohibition

1、Do not plug or unplug any electrical connectors while the robot is powered on.

2、Do not use any method to short-connect safety devices。



3、It is forbidden to operate and use robots by personnel who have not passed safety training and safety assessment.

4、It is forbidden to work after drinking.。

5、It is forbidden to disassemble or modify any part of the controller. CRP will not bear any responsibility for any equipment and personnel damage caused by unauthorized modification.

CONTENT

I.Routine Information VII

1.1 Applicable standard VII

1.2 Safety Terminology VII

II.Safety-related Instructions.....VIII

2.1 Danger VIII

2.2 Attention X

2.3 Compulsion XI

2.4 Prohibition XII

Chapter 1.Basic Description 1

1.1 Basic Concepts of Coordinates 1

1.1.1 Joint Coordinate System 1

1.1.2 Rectangular Coordinate System 1

1.1.3 Tool Coordinate System.....1

1.1.4 User Coordinate System 1

1.2 Matching with Welding Power Source 2

1.3 Welding instructions 4

Chapter 2.Welding Process Setting Steps 7

2.1 The preparatory work 7

2.1.1 Establishment of user coordinate system 7

2.1.2 Establishing Tool Coordinate System.....10

2.1.2.1 20Point method calibration instructions.....15

2.1.3 Welding Machine Parameter Setting 19

2.1.3.1 Basic parameters: 20

2.1.3.2 Functional options 20

2.1.3.3 Welding current matching settings:.....21

2.1.3.4 Welding Voltage Matching Settings: 22

2.1.3.5 Digital Quantity Control.....23

2.2 Welding process setting..... 35

2.2.1 Setting the basic parameters of welding 35

2.2.2 Setting Welding Swing Arc Parameters.....37

Chapter 3.Examples of Welding Programming.....40

3.1 Example of program..... 40

3.2 Procedural teaching steps..... 40

3.2.1 New file.....41

3.2.2 Program point 1.....43

3.2.3 Program point 2.....44

3.2.4 Program point 3.....45

3.2.5 Arc start and swing 46

3.2.6 Program point 4.....49

3.2.7 Arc end and weave end.....50

3.2.8 Program point 5.....52

3.3 Program commissioning verification 53

3.4 Program reappearance 53

3.4.1 Non-arc operation.....53

3.4.2 Arcing operation.....55

3.5 Welding effect adjustment 56

3.5.1 Adjustment of welding current and voltage.....56

3.5.2 Adjustment of Welding Swing Arc Frequency and Amplitude 56

3.5.3 Adjustment of welding speed is realized by modification degree 57

Chapter 4.Welding related functions 58

4.1 Speed and Rate Adjustment in Welding Process . 58

4.2 Manual wire feeding and withfeedback 58

4.3 Jog wire feeding and wire feedback..... 58

4.4 Gas detection 58

4.5 Simulated welding 58

4.6 Arc break point retention 59

4.7 Welding monitoring 59

4.8 Welding parameter control:..... 59

4.9 Collide detection (AF_SER)..... 60

4.10 Wire feedback 61

4.11 Arc in advance 62

4.12 Restart (lap welding) 63

4.13.Welding Gradient\Jumping (AOUT V I) 63

Chapter5.Cooperative Welding Function 66

5.1 Rotation synergy: 66

5.1.1 <Parameter setting>-<Mechanism parameter>: 66

5.1.2 <Parameter setting>-<Servo parameters>: 66

5.1.3 Collaborative Page Description: 66

5.1.4 Synergism calibration: 73

5.1.5 Compute data: 75

5.1.6 Verification direction: 76

5.1.7 Collaborative use: 77

5.1.8 Collaborative program editing: 77

5.1.9 Examples of procedures: 78

5.2 Straight line coordination: 78

5.2.1 J7 and J8 axis straight line cooperation mode selection 78

5.2.2 Programming examples 79

5.2.3 Example of program: 79

Chapter 6.Fish scale welding function.....80

6.1 Explanation of Fish Scale Welding: 80

6.2 Fish scale welding instruction format: 80

6.3 Fish scale welding instructions: 80

6.4 Fish scale welding work instructions:..... 80

Chapter 7.Welding Search.....83

7.1 Introduction of welding search 83

7.1.1 Matters needing attention of welding search 83

7.1.2 Welding search methods include: 83

7.1.3 The searching type contains: 83

7.1.4 Requirements for Robots before searching: 83

7.2 Hardware Connection and PLC Programming.... 83

7.2.1 Auxiliary Relay Description: 83

7.2.2 Instruction Variables Introduction:.....84

7.2.3 Variable description:.....84

7.3 Process interface introduction 84

7.4 Function detailed explanation 86

7.4.1 Fillet weld 86

7.4.1.1 1D: 86

7.4.1.2 2D: 87

7.4.1.3 3D: 88

7.4.1.4 2D+: 89

7.4.1.5 3D+: 90

7.4.2 Inside and outside diameter 91

7.4.3 Spot 92

7.4.4 Camera 93

7.4.5 Surface.....94

7.4.6 Comprehensive examples.....95

Chapter 8.Explanation of Arc Tracking and Debugging.....99

8.1 Arc Tracking Hardware Connection.....99

8.1.1 Connection Method of Arc Tracker and Ground Wire of Welding Machine.....99

8.1.2 Arc tracker power supply.....99

8.1.3 Arc Tracker Data Line Connection.....99

8.2.Arc tracking parameter setting.....100

8.2.1 Communication settings.....100

8.2.2 Upper and down compensation parameters.....101

8.2.3 Left and Right Compensation Parameters.....102

8.3 Writing Arc Tracking Program.....104

8.3.1 Instruction specification.....104

8.3.2 Programming example.....104

8.4 Notices for Arc Tracking.....104

8.4.1 Applicable Conditions for Arc Tracking.....104

8.4.2 Arc tracking welding conditions:.....104

8.5 About the direction of the arc tracker compensation.....105

Chapter 9.Explanation of Laser Tracking and Debugging.....106

9.1 Laser Tracking Installation Steps.....106

9.1.1 Laser Tracker and Its Components.....106

9.2 Laser tracking host computer interface..... 113

9.2.1 Laser tracking host controller interface.....113

9.2.2 Laser Tracking Probe Interface.....114

9.2.3 Laser Tracking User Operating Software 114

9.3 Adjustment of Laser Tracking Parameters..... 117

9.4 Calibration of Laser Tracker 120

9.4.1 Robot TCP Accuracy Calibration 120

9.4.2 Laser Accuracy Testing 121

9.4.3 Laser safety calibration 121

9.4.3.1 Sensor Installation 121

9.4.3.2 calibration.....123

9.4.4 Laser calibration test 128

9.4.5 Notes for Laser Debugging 129

9.4.5.1 CRNT 129

9.4.5.2 JunnoVision 129

9.5 Introduction to Directives..... 131

9.6 An Example of Laser Tracking Programming..... 131

9.7 Laser Search 135

9.7.1 Laser Search-the starting point.....135

Chapter 1.Basic Description

1.1 Basic Concepts of Coordinates

When performing axis operations on a robot, the following coordinate systems are available:

1.1.1 Joint Coordinate System

Each axis of the robot performs a separate action, called the joint coordinate system.

1.1.2 Rectangular Coordinate System

No matter where the robot is located, it can move parallel along the set X, Y and Z axes.

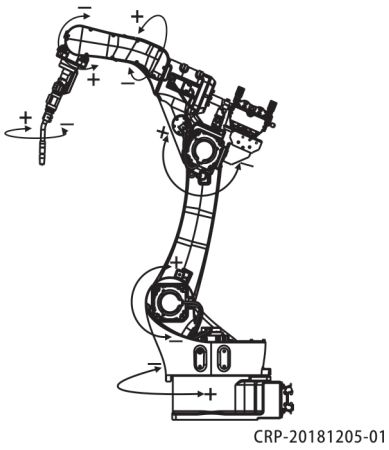
1.1.3 Tool Coordinate System

The tool coordinate system takes the effective direction of the tool held by the robot wrist flange as the Z axis and defines the coordinates at the tip point of the tool.

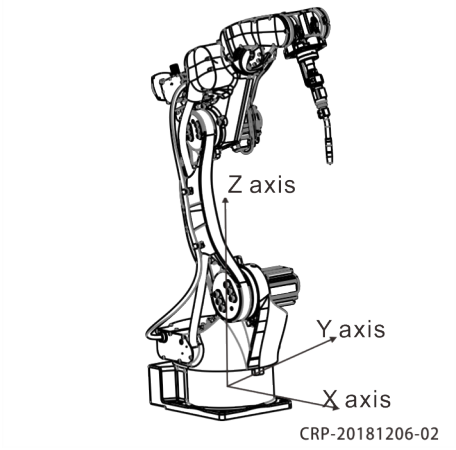
1.1.4 User Coordinate System

The robot moves in parallel along each axis of the specified user coordinate system.

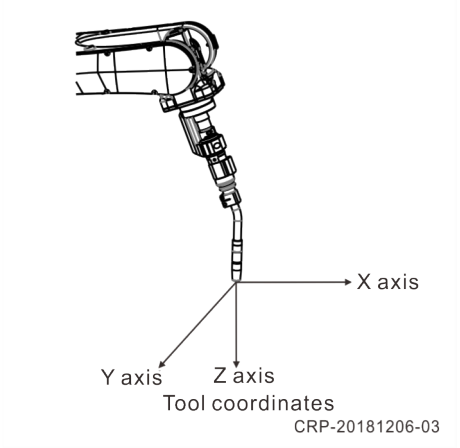
In other coordinate systems other than the joint coordinate system, only the tool pose can be changed without changing the tool tip point (control point) position. This is called the control point invariant action.



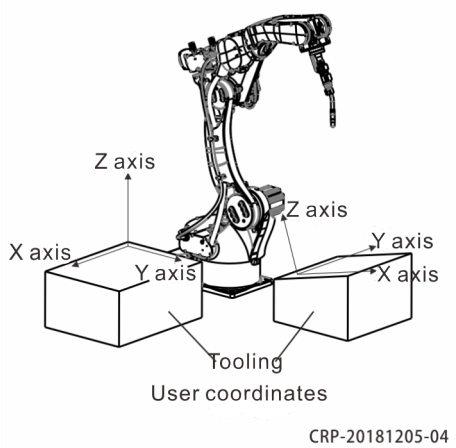
Joint Coordinates



Rectangular Coordinates



Tool Coordinates



User Coordinates

1.2 Matching with Welding Power Source

The CRP system controls the welding power supply through the following signals:

Two 0-10V analogues are used to control the welding current and voltage.

M190 output, control arc starting. M191 and M188 control the wire feeding and unfeeding together.

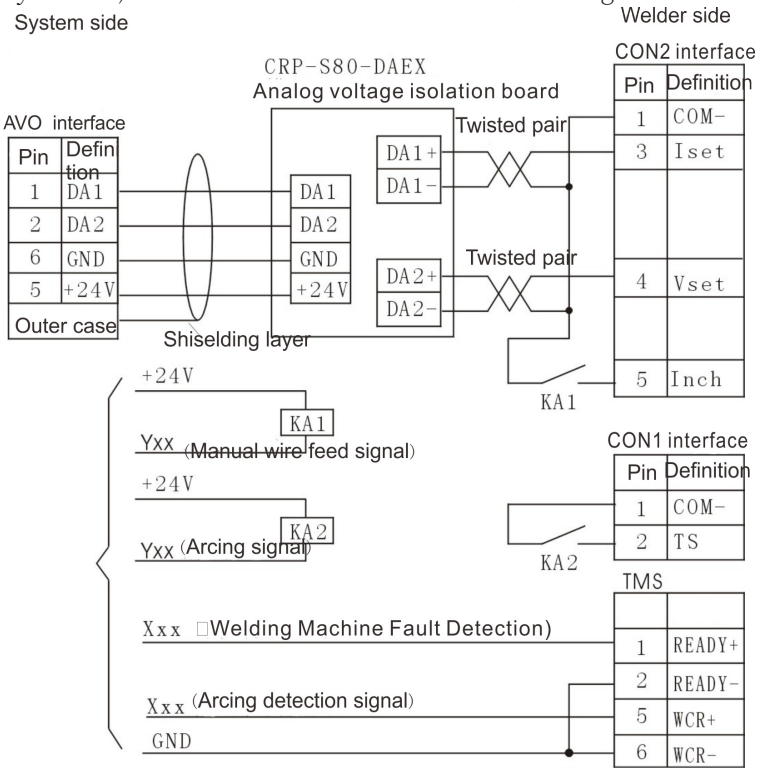
M180 input to detect arc starting success signal. M181 detects whether the welding power supply is faulty.

For the use of logic interface, we need to edit the following PLC ladder diagram in the user’s PLC.

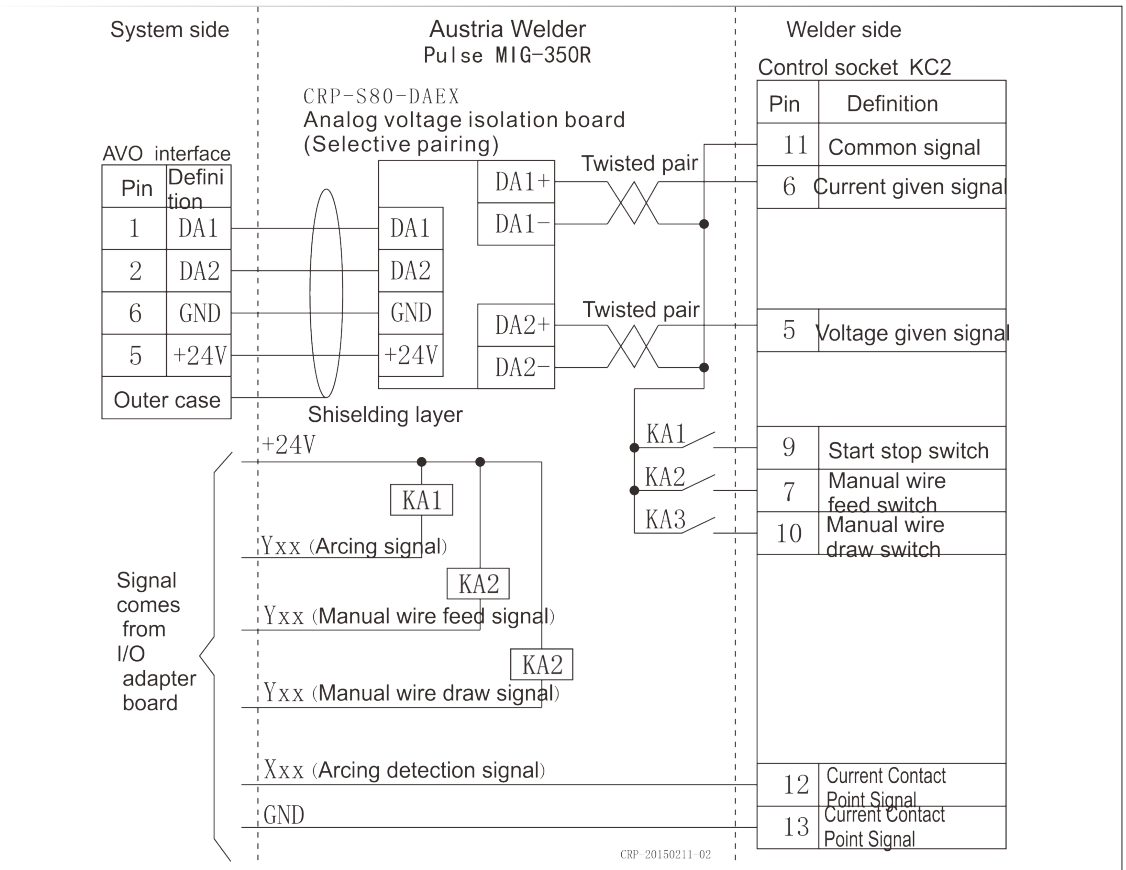


Notes: The input and output ports can be designed according to the field wiring. The meaning of the above PLC is as follows:

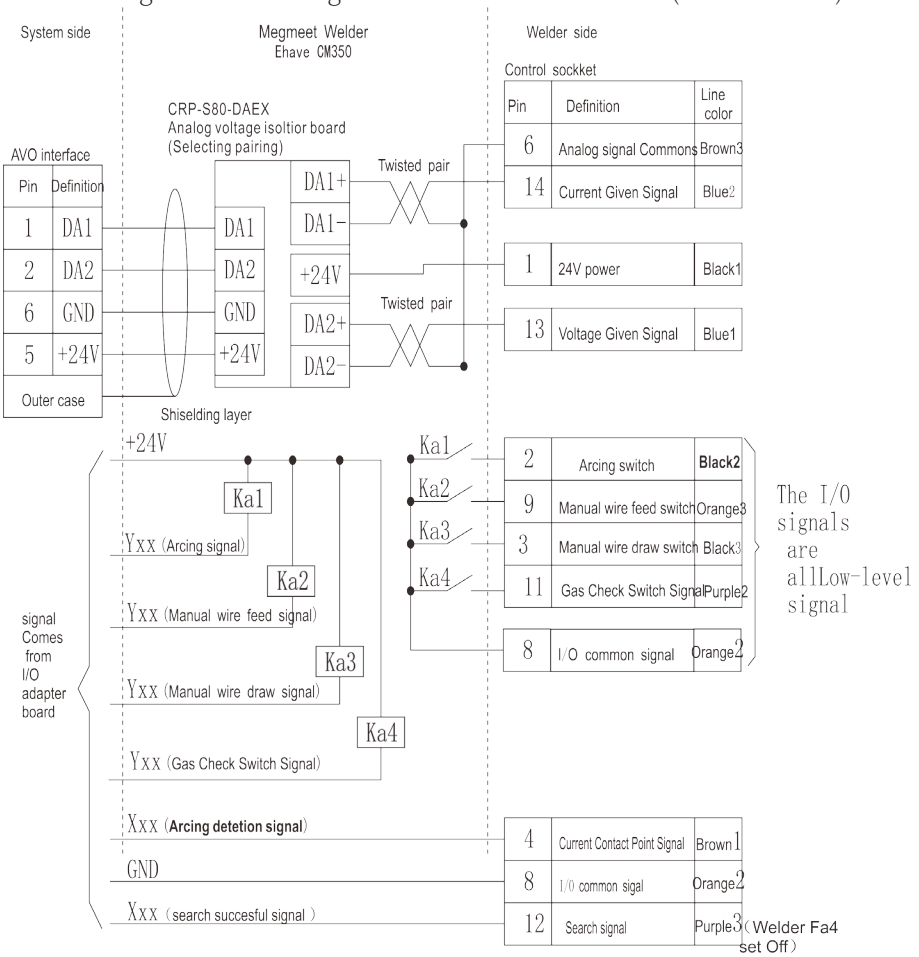
M190(Normally opened)----------Yxx（Arcing control signal）
M191(Normally opened)--M188(Normally Closed)--------Yxx（Manual wire feeding signal）
M191(Normally opened)--M188(Normally opened)------Yxx（Manual wire drawing signal）
Xxx(Normally opened)--------M180（Arc detection signal,arc starting is successful or not）
Xxx(Normally Closed)----------M181（Welding Machine Fault Detection）



Wiring diagram with OTC CPVE-500 (for reference)



Wiring schematic diagram with AOTAI MIG-350R (for reference)



Schematic wiring diagram with MEGMEET Ehave CM350 (for reference)

1.3 Welding instructions

<table>
<tr><td rowspan="5">1.ARC START
【Fast：5 1】</td><td rowspan="5">IInstruction function</td><td colspan="2">Running this instruction, the program will call the pre-set welding parameters to start the arc. Variable number is welding parameter file number, range 0-7.
The two instructions are used in pairs.
The program running speed between ARCSTART and ARCSTARTEND is not controlled by automatic multiplying power. Only MOVL and MOVC instructions can be used between them.
Welding related information can be found in Welding Process Instructions.</td></tr>
<tr><td rowspan="4">Additional items</td><td>#<Variable number></td><td>The variable number is the welding parameter file number that needs to be invoked.</td></tr>
<tr><td>blank
%
MM/S</td><td>Welding speed processing mode.
Blank space: The program runs at 100% speed between arc starting and arc ending, which is not controlled by multiple rate.
%: Set the percentage of program running speed between arc starting and arc ending;
MM/S: The program between arc starting and arc ending is set to run at the set speed. Program instruction speed no longer works.</td></tr>
<tr><td>V I</td><td>Specify welding current and voltage, arc start and arc extinguish are output according to process setting, welding current and voltage change to VI specified value.</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>Example of program</td><td>ARCSTART#(1) 8 MM/S V=20V I=200A
……
ARCEND#(1)</td><td>Call welding parameter file 1, arc starting, welding speed 8MM/S, voltage 20V, current 200A.
Start welding
Arc ending, welding is completed.</td></tr>
</table>

2.(ARC END) 【fast：5 2】	IInstruction function	Running this instruction, the program will call the pre-set welding parameters to extinguish the arc. Variable number is welding parameter file number, range 0-7。 The two instructions are used in pairs. Welding related information can be found in Welding Process Instructions.	
	Additional items	#<Variable number>	The variable number is the welding parameter file number that needs to be invoked.
	Example of program	ARCSTART#(1) 50% …… ARCEND#(1)	Call the welding parameter file 1, start the arc, and the welding program runs according to 50% of the program setting. Start welding Arc ending, welding is completed

3.（WEAVE） 【fast：5 3】 4(WEAVEEND) 【fast：5 4】	IInstruction function	Running this instruction, the program will call the pre-set parameters of the pendulum arc, arc weave. Variable number is file number of swing welding parameters， Range 0-7。 The two instructions are used in pairs. For more information about the weave arc, see Welding Process Instructions.	
	Additional items	#<Variable numbe>	The variable number is the file number of welding parameters using pendulum arc instruction in pairs
	Example of program	Weave #(1) …… Weave end#(1)	Call pendulum arc parameter file 1, arc weave Weave path Weave end

Comprehensive examples of welding:

ARCSTART #(1) 10MM/s V=20V I=200A	Invoke No. 1 welding parameters arcing, speed 10MM/s, welding voltage 20V, welding voltage 200A
WEAVESINE #(1)	Call No.1 pendulum arc parameter
MOVL VL=100MM/S PL=0	Follow the welding track, and the speed shall be 10MM/s as specified by ARCSTART.
WEAVEEND	Weave end
ARCEND #(1)	No.1 Welding Process Arc Extinguishing, End

NOTES
Only MOVL and MOVC instructions can be executed between ARCSTART instructions and ARCSTARTEND instructions, and MOVJ instructions are not allowed.

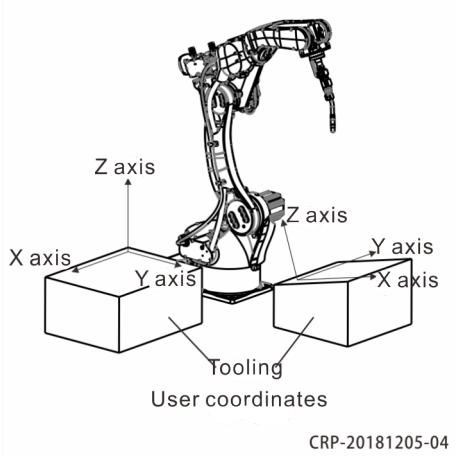
NOTES
The program running speed between ARCSTART instruction and ARCSTARTEND is not controlled by automatic multiplying power. The specific execution speed shall be as follows: ARCSTART#(1) blank: Then run between the arc starting and the end according to the VL speed × 100% given by the program. ARCSTART#(1) 50% : Then run between the starting arc and the end according to the program given VL × 50%. ARCSTART#(1) 8MM/S : Then run at 8MM/S speed between the starting arc and the end. The VL in the program is invalid. ARCSTART is introduced in detail, refer to "Operation Instructions".

Chapter 2.Welding Process Setting Steps

2.1 The preparatory work

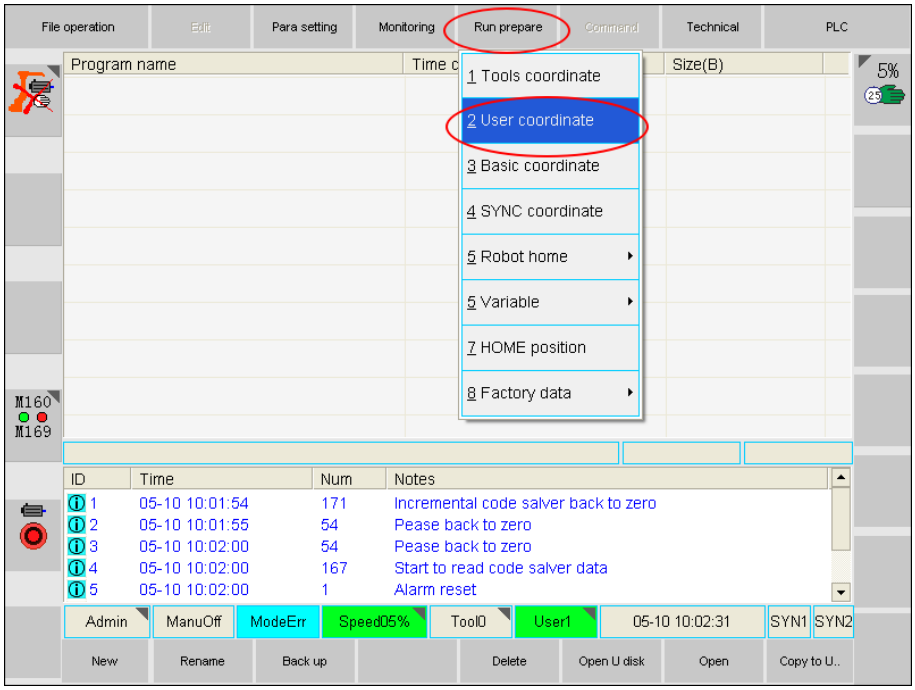
2.1.1 Establishment of user coordinate system

Establish a user coordinate system for easy programming during programming. As shown in the figure below, there are several tooling faces that require several user coordinate systems.

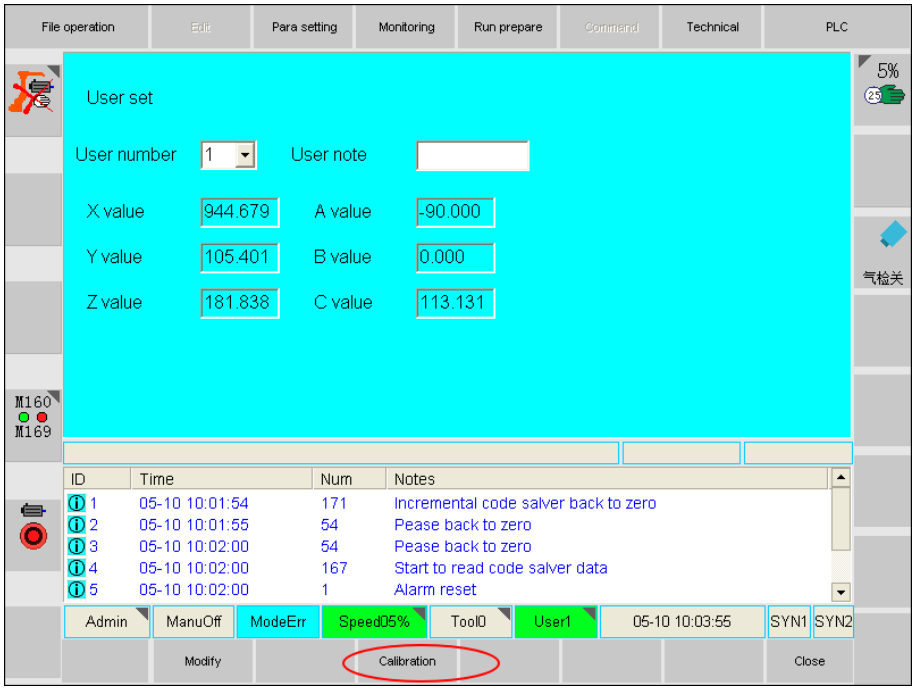


The user coordinate system setting steps are as follows:

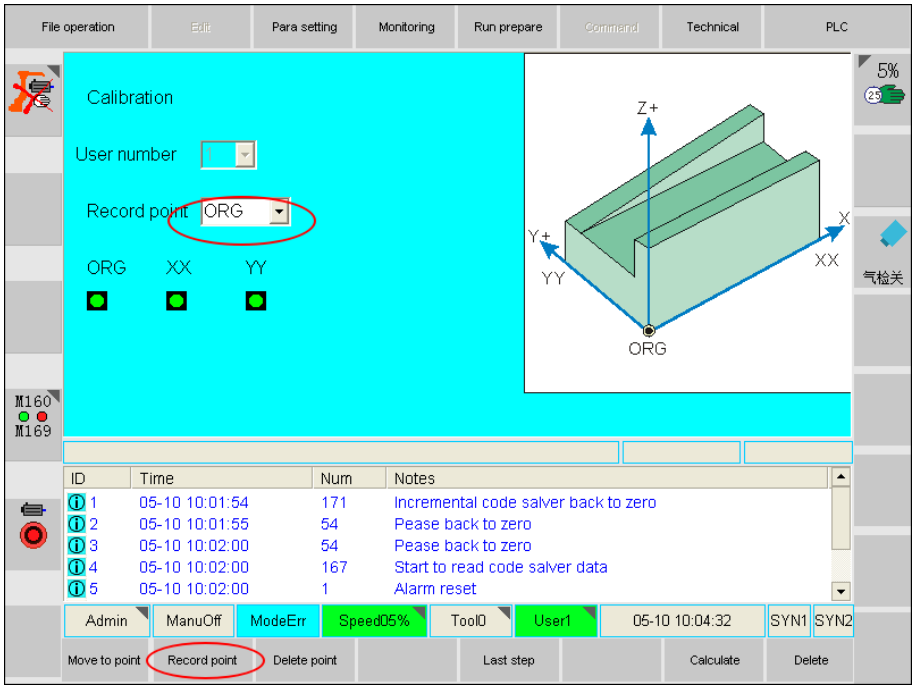
User coordinates are set on the interface of 【Run prepare】 - 【User coordinate 】(as shown below), and one workpiece is set for each workpiece (that is, Workpiece Coordinate System)



【User coordinate system setting interface】

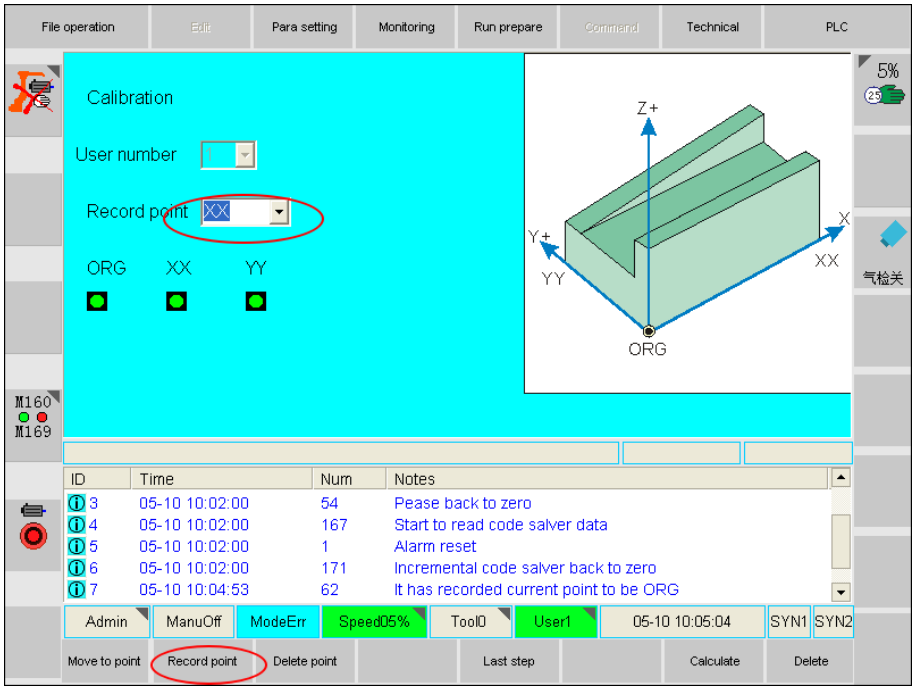


As shown above, after selecting the user coordinate system number, click <Calibration> to enter 【User Coordinate Settings】, as shown below.



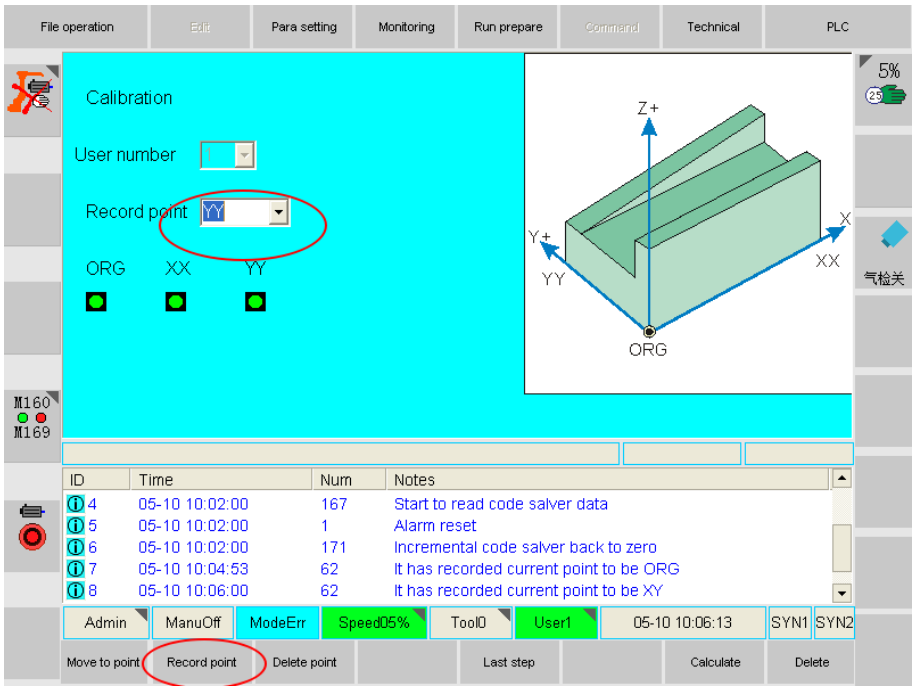
In the interface shown above, first set the origin of the user (workpiece) coordinate system, that is, the robot tip end point (with the welding wire on the welding torch) to the end of a corner of the workpiece. Then press <Record Point> to record the origin of the user (workpiece) coordinates.

Select [XX] to determine the X side, as shown below.

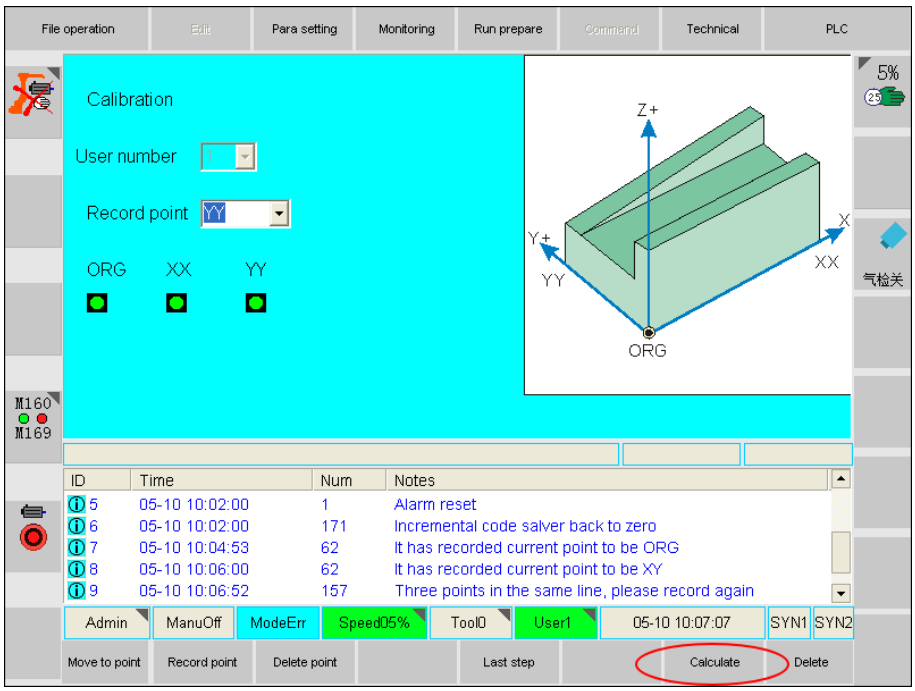


In the above interface, set the X direction of the user (workpiece) coordinate system, that is, the tip of the robot is not pointed to the edge of one side of the workpiece. Then press <Record Point> to record the XX direction of the user (workpiece) coordinates.

Choose [Y Y] to determine the Y side, as shown below.

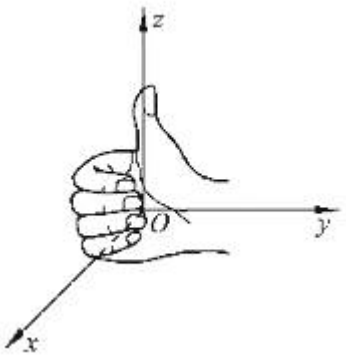


In the above interface, set the Y direction of the user (workpiece) coordinate system, that is, the tip of the robot moves to the edge of the other side of the workpiece. Then press <Record Point> to record the YY direction of the user (workpiece) coordinates.



After determining the origin, XX direction, and YY direction, press <Calculate> in the above figure, the system automatically completes the calculation of the current user (workpiece) coordinates, and determines the coordinate system and direction on the workpiece.

Note: The user coordinate system is established by referring to the right hand helix rule (as shown below), Z is in the direction of thumb which rotates from X to Y. When establishing workpiece coordinates, the positive direction of Z is usually far away from the workpiece. Therefore, it is necessary to consider which one of X and Y directions are respectively considered when establishing workpiece coordinates.



After calculating the user coordinate system, it can switch to the user coordinate system  to verify whether it is the desired user coordinate direction.

After verification, press <Cancel >to exit.

2.1.2 Establishing Tool Coordinate System

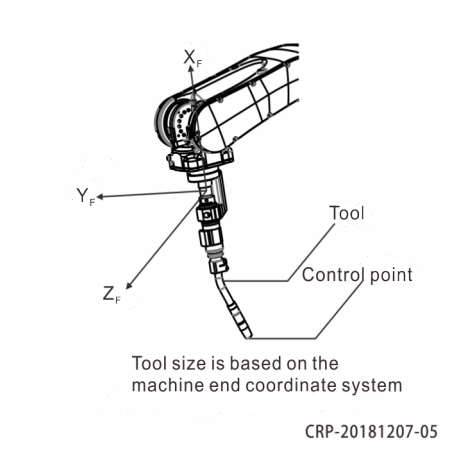
The significance of establishing tool coordinate system is to shift the control point of the robot from the center point of flange to the end point of tool.

In order to enable the robot to carry out correct linear interpolation, arc interpolation

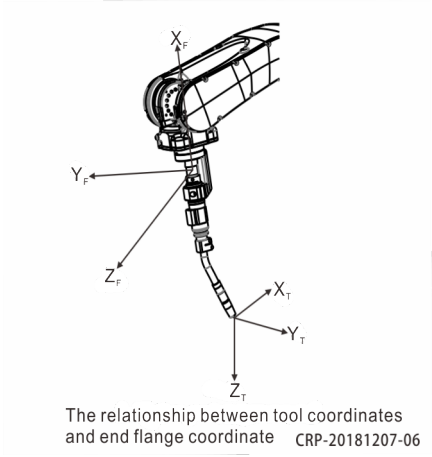
and other interpolation actions after carrying tools, it is necessary to correctly input the size information of welding torch tools and define the position of control points.

Six-point check: Setting up tool coordinates is to automatically calculate the position of tool control points by setting different data at the end of six groups of robots and input them into tool files.

Use the tool to verify the input is the coordinate value of the tool control point in the flange coordinates. As shown below

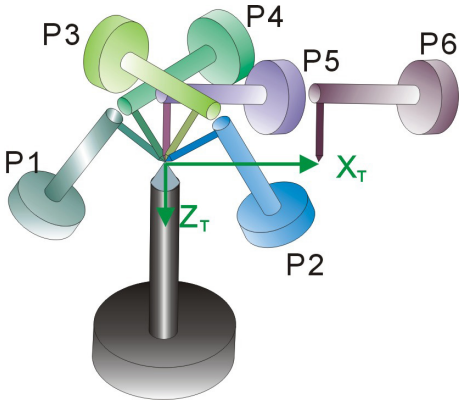


Tool size is based on robot end coordinates



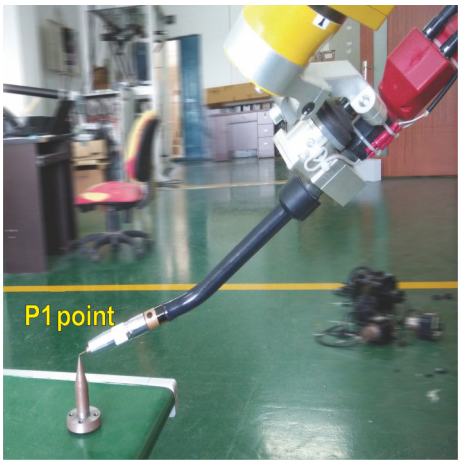
The relationship between tool coordinates and end flange coordinates

For tool calibration, six different gestures should be taught based on control points. According to these six data, the tool size can be calculated automatically,As shown below

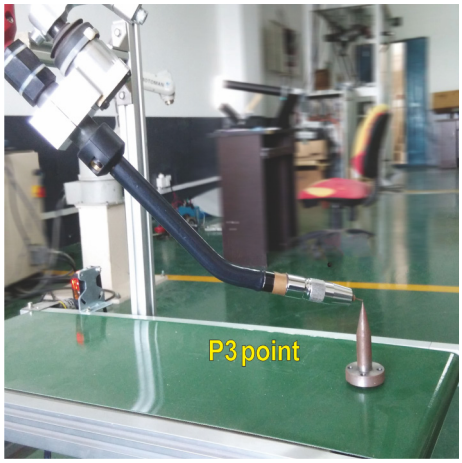


Six-point Check Diagram

The actual six-point calibration diagram is as follows:

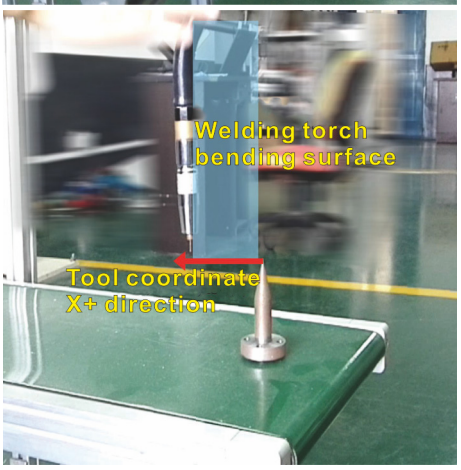








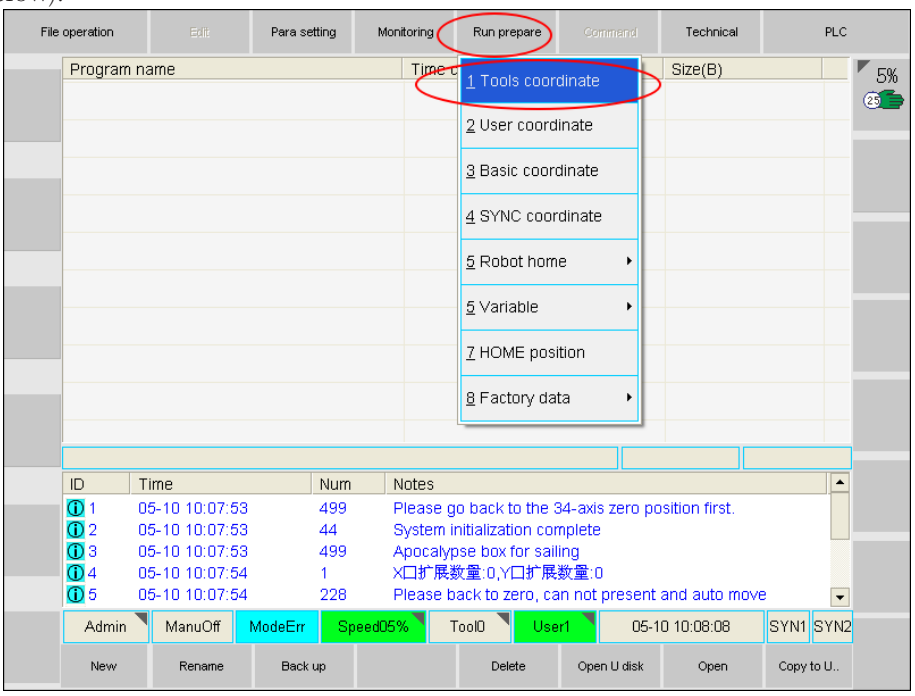




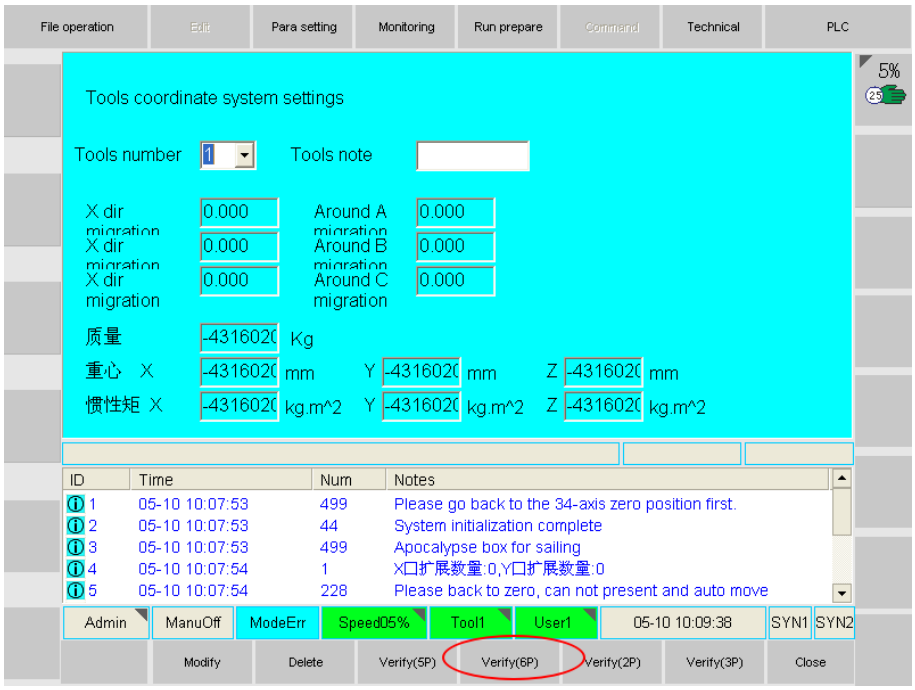
NOTES
As shown in the above figure, the posture change of P1 to P4 point should be as large as possible. At P5 point, the welding wire (the straight part of the end of the welding gun) must be kept in a straight line with the gun calibrator. The P6 point is used to determine the X direction of the tool coordinate. The line connecting point P5 to P6 is the X direction of the tool coordinate.

The steps for setting the tool coordinate system are as follows:

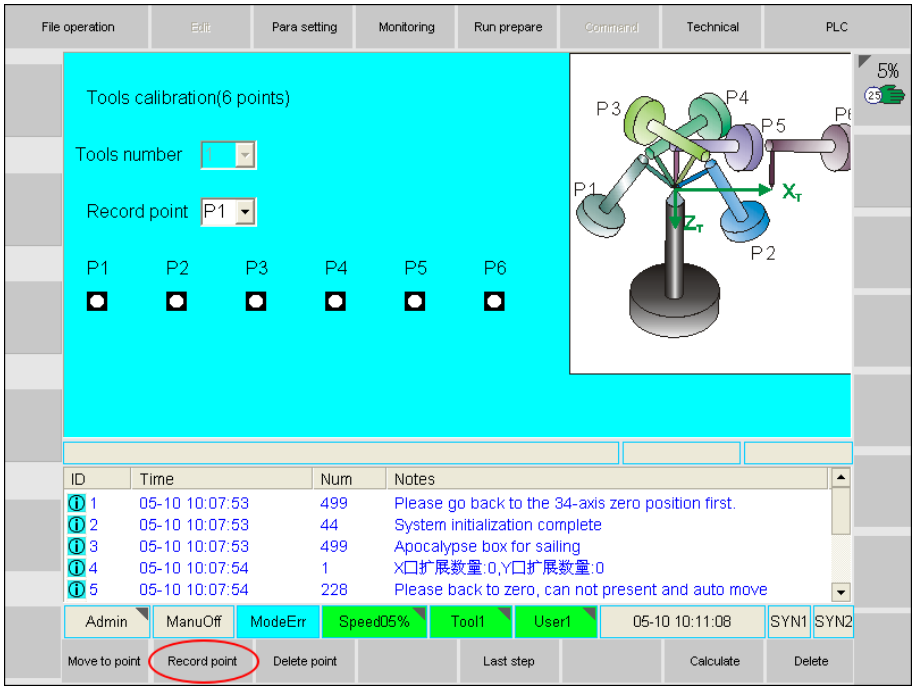
Set the tool coordinate system on the [Run prepare]-[Tools coordinate] interface (as shown below).



【Tools coordinate system settings interface】



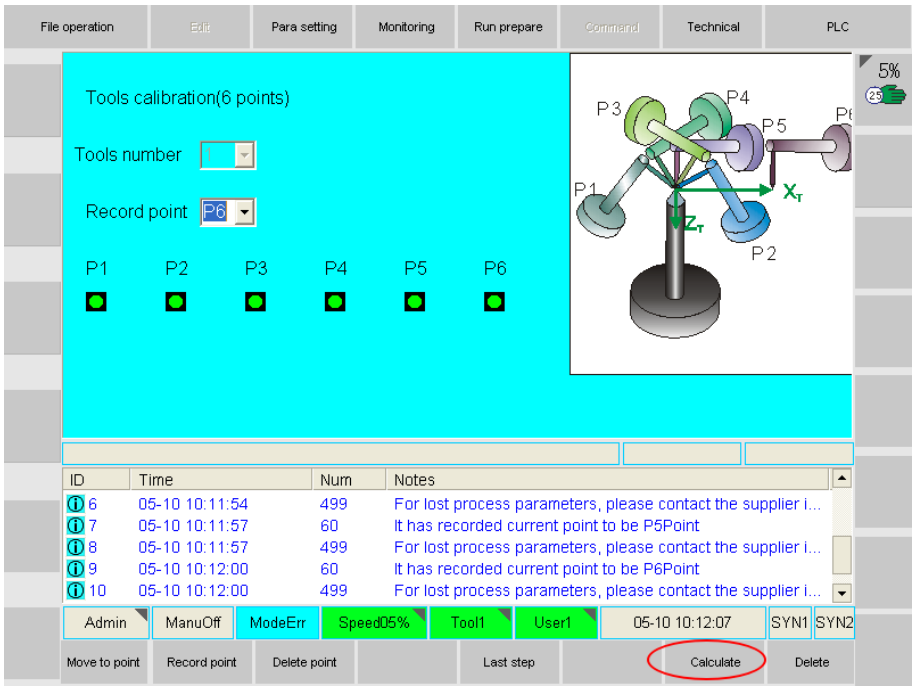
As shown above, select the back point of the tool coordinate system number < Verify(6P) > and enter the tool coordinate system setting interface, as shown below.



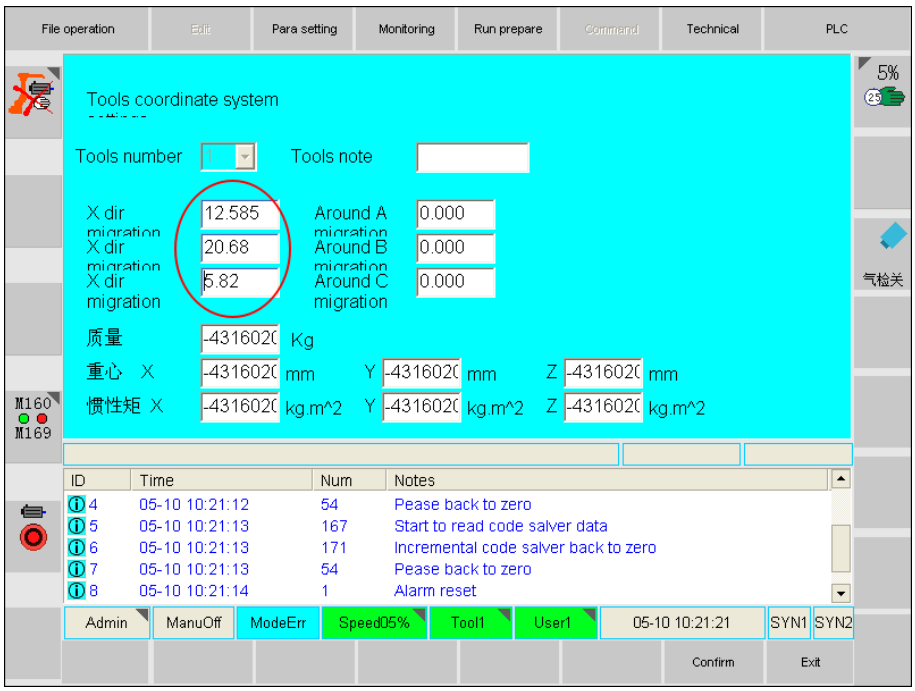
In the above interface, after selecting [Tools number], select the record point number and move the torch tip (wire) to the corresponding position, press <record point>, and the corresponding point indicator will turn green.。

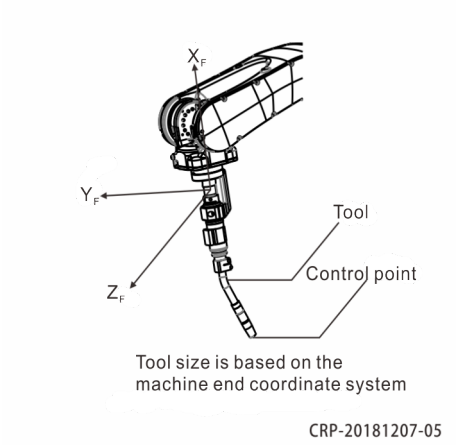
After the P1-P6 recording is completed, all the lights turn green as shown in the figure.

NOTES
As shown in the figure below, the posture change of P1-P4 point should be as large as possible. At P5 point, the welding wire (the straight part of the end of the welding gun) must be kept in a straight line with the calibration device. The P6 point is used to determine the X direction of the tool coordinate. The line connecting P5 and P6 is the X direction of the tool coordinate.



Press <Calculate> on the interface above, the system automatically calculates the coordinates of the tool, determines the coordinate system and direction on the workpiece, press <Delete> on the interface above, and the dimension of the tool tip relative to the flange coordinates at the end of the robot is obtained..

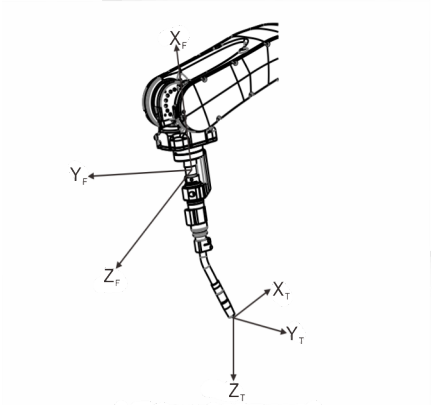




Tool size is based on the machine end coordinate system

CRP-20181207-05

NOTES
The tool size is determined according to the coordinate system shown in the figure above.



The relationship between tool coordinates and end flange coordinate CRP-20181207-06

The tool coordinate system is shown above and is based on Cartesian coordinates of the tool tip.

After calculating the tool coordinate system, it can switch to the tool coordinate system  to verify whether it is the desired tool coordinate direction.

After verification is completed, press the < Exit> key to exit.

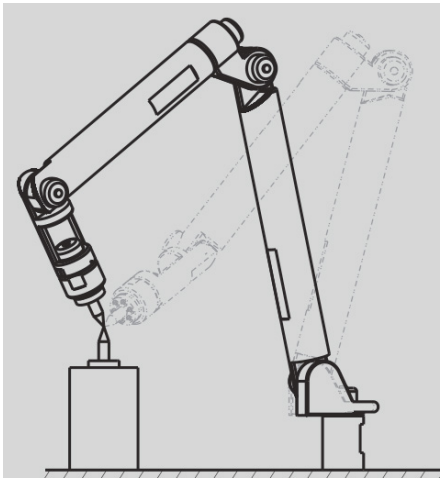
2.1.2.1 20Point method calibration instructions

Prerequisites for calibration: It is necessary to ensure that the relevant mechanical parameters (connecting rod, deceleration ratio, coupling, etc.) of the robot are accurate. The tolerance of each shape and position is controlled in the design range during mechanical assembly.

Calibration steps:

1.Make two single-ended tips (the sharper the better) calibration rods (welding guns with wire can be used, but the welding wire needs to be sharpened), one calibration rod is mounted to the end of the robot, and one is mounted to a fixed position outside the robot perpendicular to the ground.

As shown below:

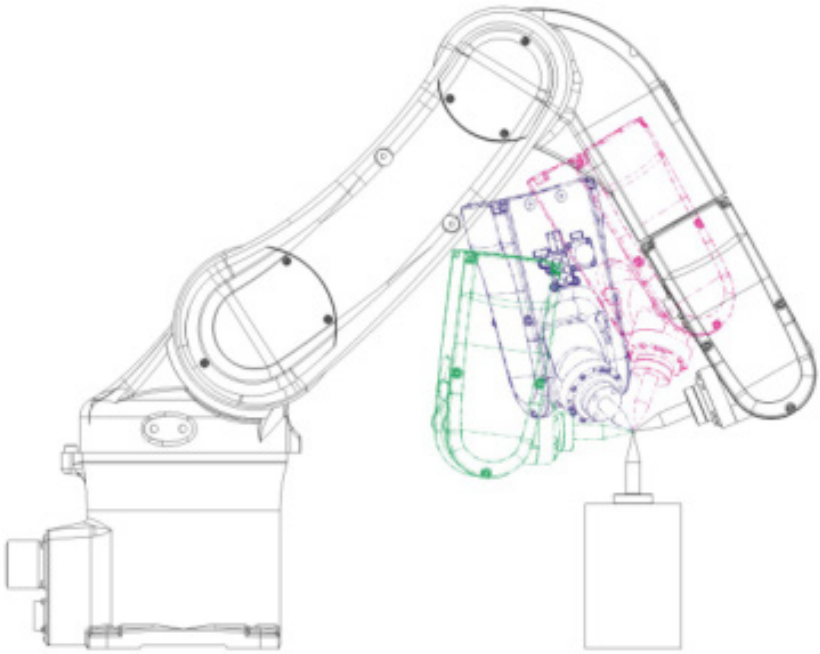


2.When ready, a new program named “TCP + Device Number” is created in the system to facilitate distinguishing and viewing.

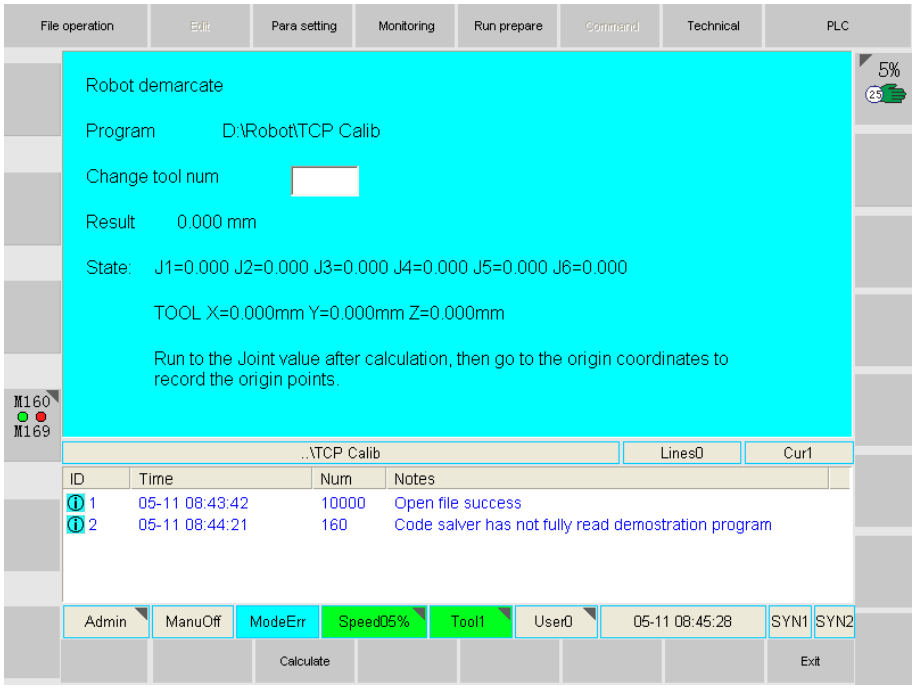
3.Open the program, and then start the robot in the teaching mode to align the body calibration bar tip with the external calibration bar tip (try to align the two tip ends, the more accurate the better). Then record a joint motion commands.As shown below:

```
1   MOVJ VJ=30.0% PL=0 TOOL=1
2   MOVJ VJ=30.0% PL=0 TOOL=1
3   MOVJ VJ=30.0% PL=0 TOOL=1
4   MOVJ VJ=30.0% PL=0 TOOL=1
5   MOVJ VJ=30.0% PL=0 TOOL=1
6   MOVJ VJ=30.0% PL=0 TOOL=1
7   MOVJ VJ=30.0% PL=0 TOOL=1
8   MOVJ VJ=30.0% PL=0 TOOL=1
9   MOVJ VJ=30.0% PL=0 TOOL=1
10  MOVJ VJ=30.0% PL=0 TOOL=1
11  MOVJ VJ=30.0% PL=0 TOOL=1
12  MOVJ VJ=30.0% PL=0 TOOL=1
13  MOVJ VJ=30.0% PL=0 TOOL=1
14  MOVJ VJ=30.0% PL=0 TOOL=1
15  MOVJ VJ=30.0% PL=0 TOOL=1
```

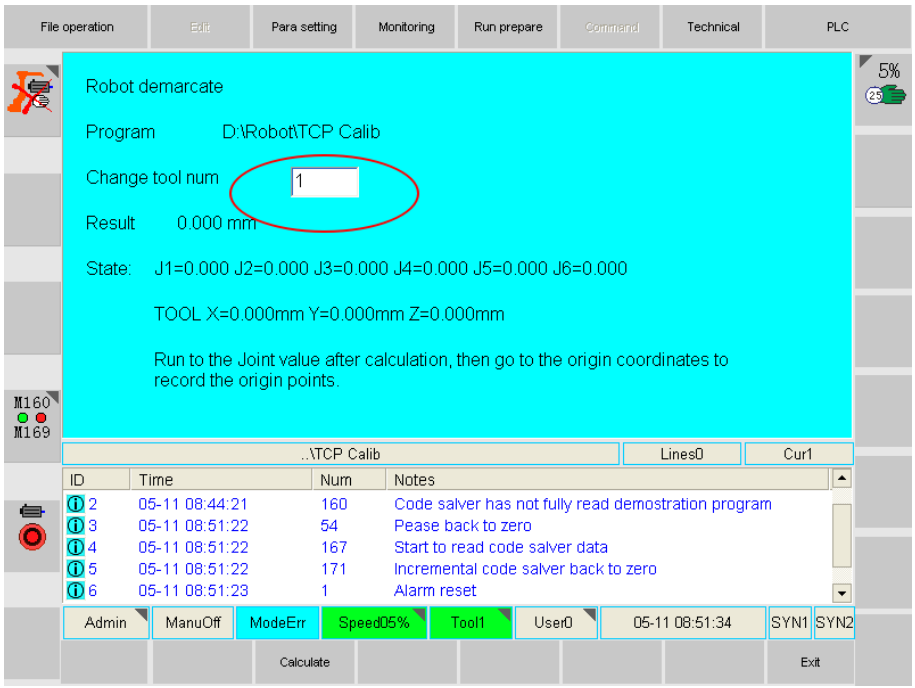
The larger the difference in the posture of the corresponding robot between each command, the better. As shown below



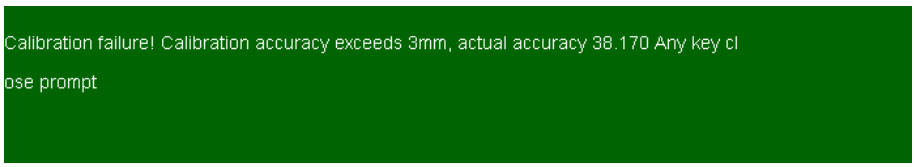
4.After recording 20 points, in any line of the program (except the last blank line), select read in the 【Run prepare】 → <Robot home> -<Robot Calibration>. The following interface appears:



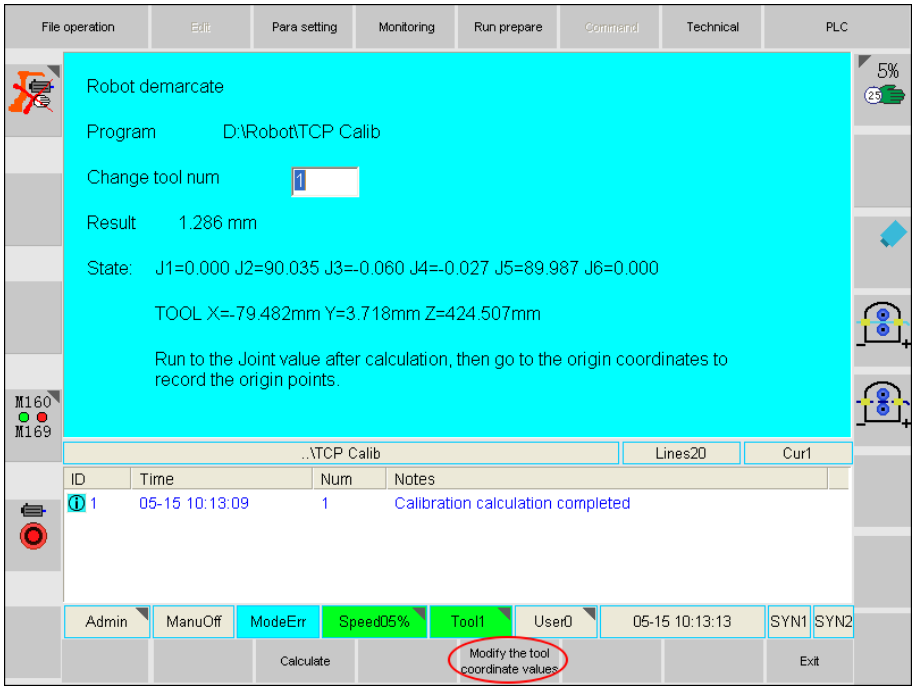
5.In the example above, [Change Tool Number] box, select the tool coordinate number that needs to be set, then click < Calculate > below, and the prompt bar will show that the calculation is in progress, which may take tens of seconds. Please wait patiently.



7.After the calibration is completed, the system will display the calibration results as shown in the figure above. Generally speaking, the calibration value will not exceed 3mm. If it exceeds 3mm, it may be the problem of setting mechanical parameters. It is suggested that the calibration be carried out after checking correctly. Otherwise, the following explanation will appear:



8.After the successful calibration is completed, you can directly import the calculation results into the tool coordinates, click: <Modify the Tool Coordinate values>, then run to the calculated position, and then record the home position as shown below:



The presence 08-16 20:17:44 1 工具坐标系 1 号修改 of A indicates that the calibration results have taken effect. The calibration was successful.。

Then press <Safety Switch>, press <Run to Calculated Position> (If this button does not appear, please change the current permission to manufacturer permission). After trial run to point, click: [Robot home] <Robot home> and then record home position on each axis in turn. The home position recorded are the home position after TCP calibration.

The above accuracy, in principle, is guaranteed in the process of manufacturing robots by the ontology manufacturer. In order to improve and stabilize the accuracy of the robot to a certain extent, it is necessary for the manufacturer to guarantee the design, processing and installation of the robot.

Because the six-axis robot is a series structure, there are many links that affect the final accuracy. If assembled, and then tested, many inadequate links can not be dealt with.

It is like repairing a house, the foundation is not strong, the repair results are not good, and the detection of the problem is not easy to deal with; if the design and construction are guaranteed, the final test will only quantify the better results. If we can guarantee the design and installation of the robot, then our 20-point method will only quantify the good results: What is it?

But if we can not guarantee the design and installation of each link. Robot measurement is troublesome and has more coupling. It is not easy to determine the above parameters independentl

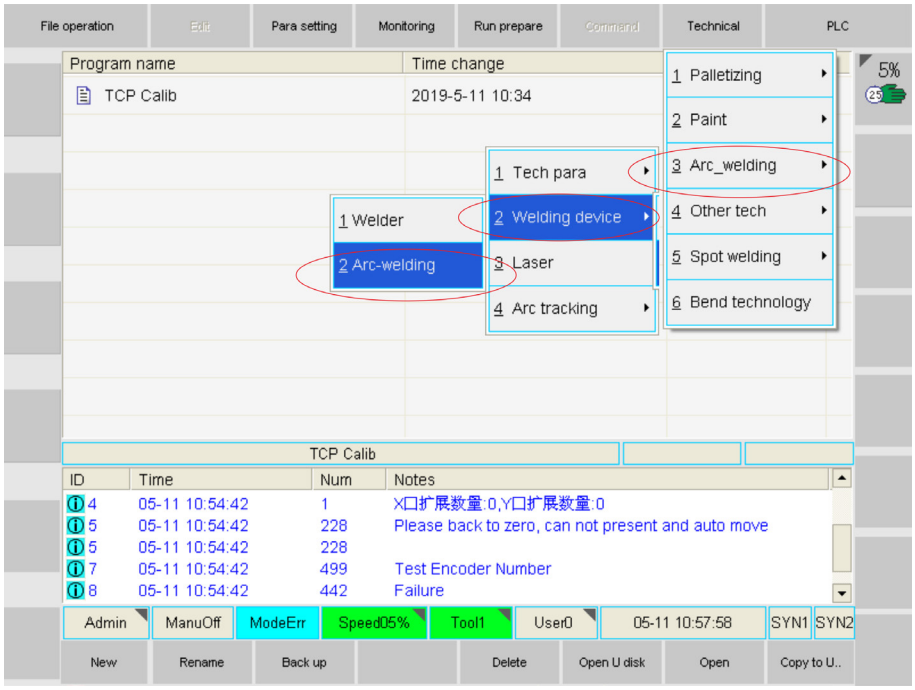
According to the above situation, we have invented a way to use 20 points to blur the home position of the computer robot. It is to transform the influence of each part of the robot

into the influence of home position, so as to improve the accuracy of the robot as much as possible. This explains that the home position effect measured by laser tracker is not good. It is difficult to distinguish between separate analysis because of too many coupling effects.

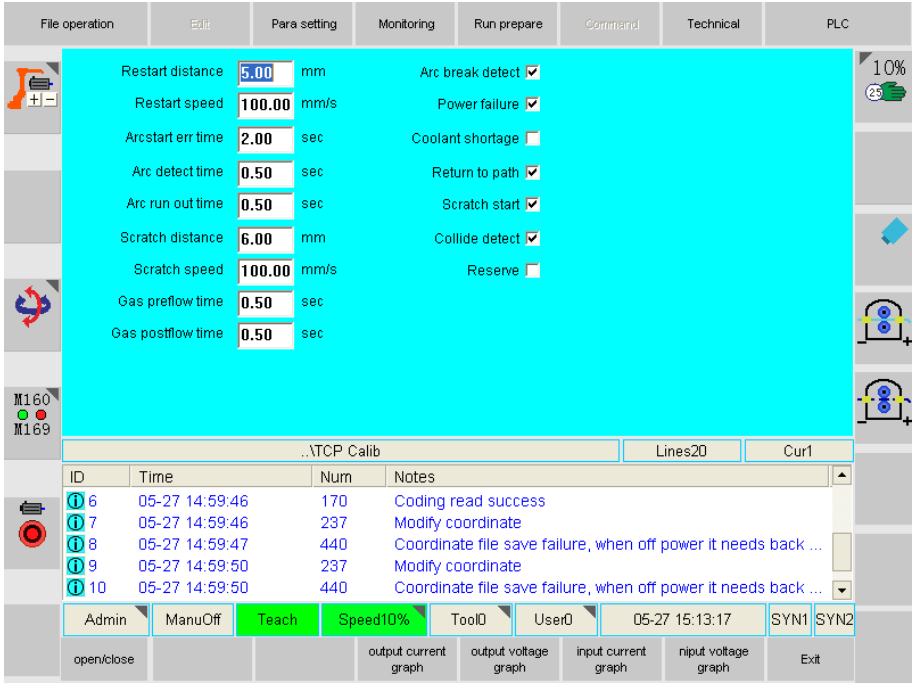
2.1.3 Welding Machine Parameter Setting

This step involves related parameters of welding machine control.

The relevant parameters of the welding machine control are set at the interface of 【Arc welding】-【Welding device】-【Arc welding】 (as shown below).



【Welding device setting interface】as follows:



2.1.3.1 Basic parameters:

Restart distance: used to set the retraction distance of the arc starting again after the first arcing is not successful or the arc is broken.

Restart speed: used to set the speed of return at which the arc starts again after the first arc start is not successful or the arc is broken.

Arcstart err time: It is used to set how long the system will be delay to check after detecting the arc starting.

Arc detection Time: Used to set the duration of successful arcing signal detected by the system, that is, the system must continuously detect the duration of successful arcing signal to consider successful arcing.

Arc run out time: It is used to set the duration of the system to detect the extinction signal (the arc deactivation is cancelled). That is, the system must continuously detect the extinction signal for the duration of the parameter and consider the arc extinction to be successful.

Scratch distance: Used to set the forward moving distance of the arc again when the arc is unsuccessful.

Scratch speed: It is used to set the running speed when the arc restarting is unsuccessful and the arc restarting is successful and the arc breaking point is returned.

Gas preflow time: it is used to set how long to send protective gas in advance when the system prepares for arcing.

Gas postflow time: It is used to set how long the protection gas will be closed after the system is ready to extinguish the arc.

2.1.3.2 Functional options

Arc break detection: Used to set whether there is interruption detection function. When this function is effective, the system will stop the welding action and save the arc breaking point in the middle of welding, and the robot will return to the arc breaking point and run after the arc breaking point is restarted next time.

If it is necessary to revoke the arc breaking point, switch to teaching mode and reset the arc breaking point. Correspond to auxiliary relay M18[illegible].

Power failure: used to set whether there is a detection function of welding machine fault. When the function is valid, the system will stop the welding action if the welding machine fails in the middle of the welding process; if the function is invalid, the abnormal welding power supply will not be detected during the welding process.

Reserve: the system starts, check the option, and the function takes effect after the arcing instruction is run. The corresponding auxiliary relay M181.

Coolant shortage: Used to set whether there is water-cooling anomaly function. When this function is effective, the system will stop welding when abnormal water cooling occurs in the middle of welding.

The effective time is similar to that of welding machine. Corresponding to auxiliary relay M182.

Return to path: Used to set whether there is a restart function. When this function is effective, the system starts arcing again after starting or stopping arc, and operates according to the speed and retreat distance set by basic parameters.。

Scratch start: Used to set whether there is an sratch function. When the function is effective and the arcing fails again, the system operates according to the speed and the backoff distance set by the basic parameters to start the arcing again.

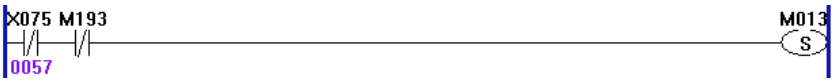
Collide detect: Used to set whether there is anti-collision function. When the function is effective, the anti-collision sensor will stop the welding action and servo power down.

Reserve: After the system is powered on, it takes effect. The collision avoidance detection corresponds to the auxiliary relay M13.

NOTES
For safety, it is strongly recommended that anti-collision sensors be added, and anti-collision detection settings are effective, so that the robot can stop quickly when the end of the robot collides.

Anti-collision relief method:

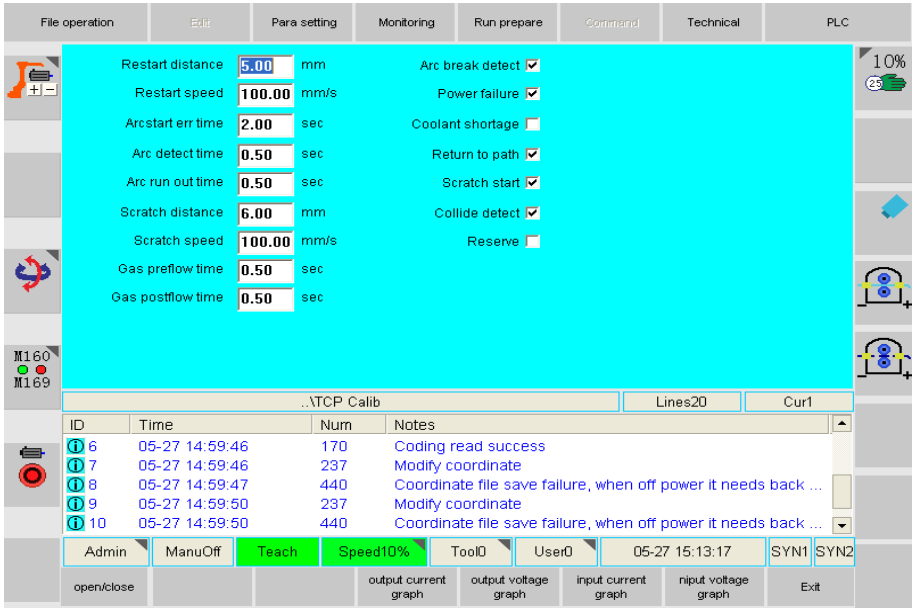
It is necessary to add M193 normal closure in M13 loop of system PLC. The following diagram.



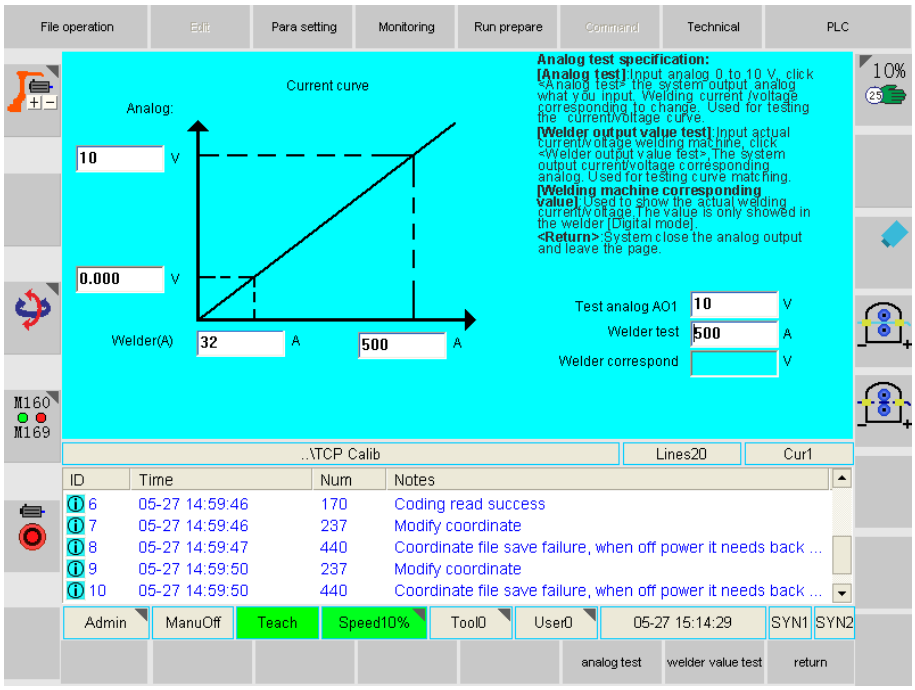
When anti-collision alarm occurs, click the icon of screen coordinate area , the icon disappears, M193 is valid. The M13 circuit in the figure above is disconnected. At this time, the reset alarm  is promptly pressed, the servo  is turned on, and the manual mobile robot is moved to a safe position. After 15 seconds, M193 automatic reset becomes invalid, and the upper loop works normally.

2.1.3.3 Welding current matching settings:

It is used to set the welder welding current controlled by the system when outputting 0-10V analog quantity. Press <Output current graph> on the interface as shown below to enter the setting interface.



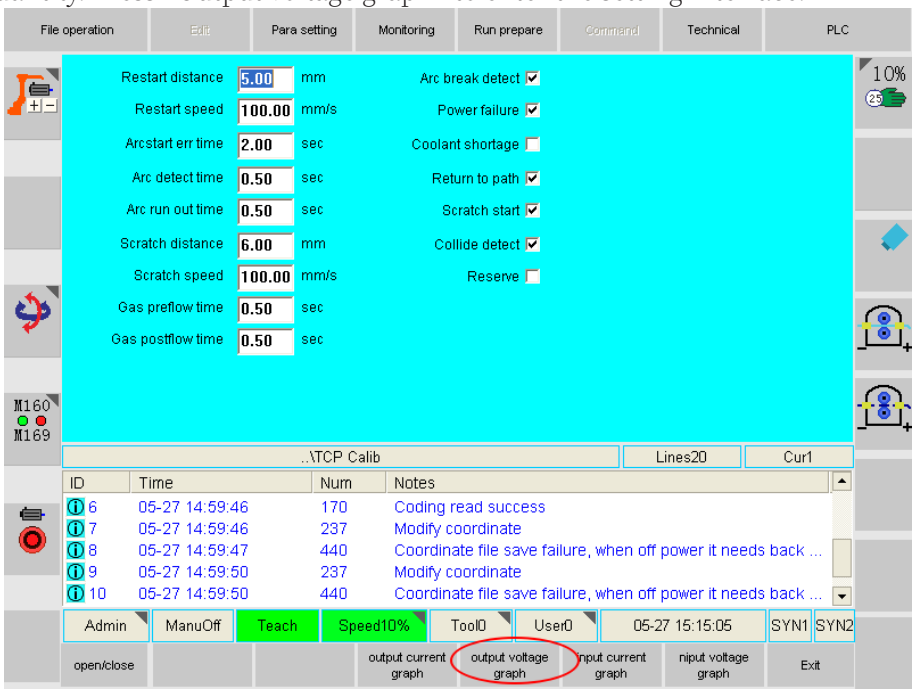
【Welding Current Setting Interface】



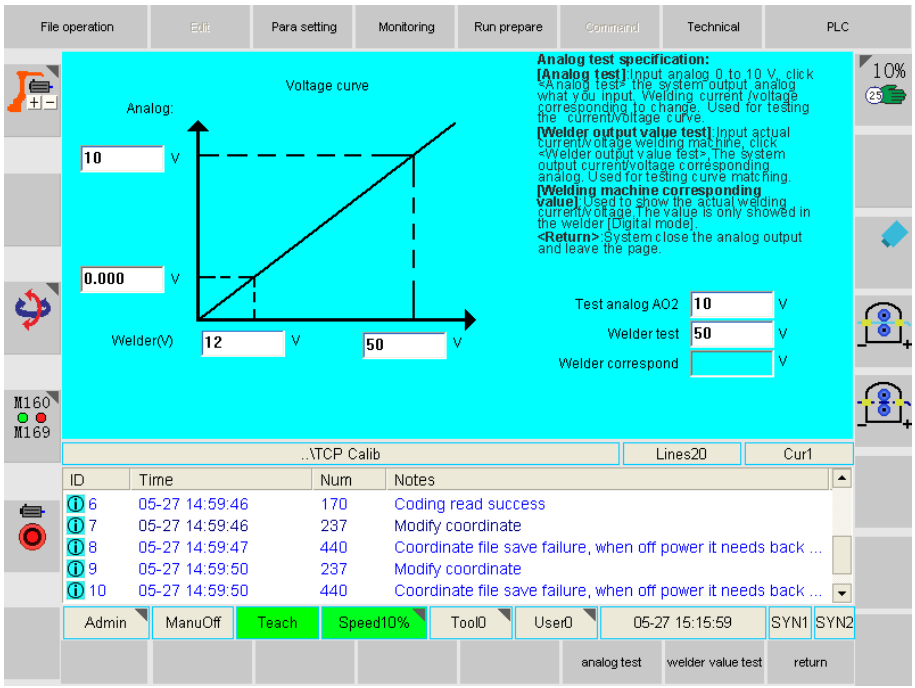
NOTES
To confirm that the output voltage of the system corresponds to the welding current value, we can manually adjust the output voltage of the system from 0V to 10V, observe the changing trend of the current value displayed by the welding machine, and find out the critical voltage value which causes the change and keeps constant. Two pairs of critical voltage values and corresponding current values are recorded and input into the corresponding relationship of the curve.

2.1.3.4 Welding Voltage Matching Settings:

It is used to set the welder welding voltage controlled when the system outputs 0-10V analog quantity. Press <Output voltage graph> to enter the setting interface.



【Voltage Matching Interface】



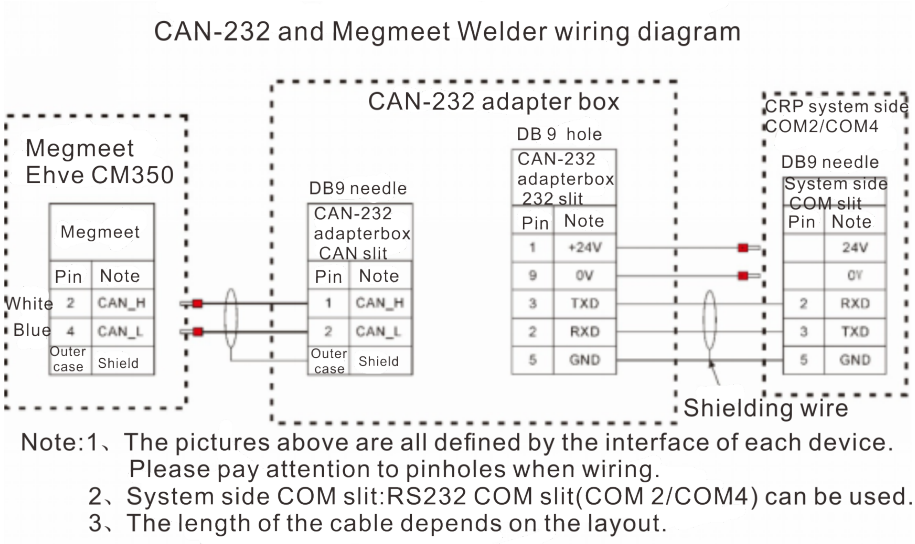
2.1.3.5 Digital Quantity Control

The robot system uses CAN communication mode to exchange current and voltage directly with the welder, start and close arc, feed wire and gas, and search signal. Simple wiring and anti-interference. It can communicate with Megmeet and Austia welding machines in digital quantity.

一.Digital Communication Explanation between Robot System and MEGMEET Welder

1.Communication configuration

Communication wiring is shown as follows:



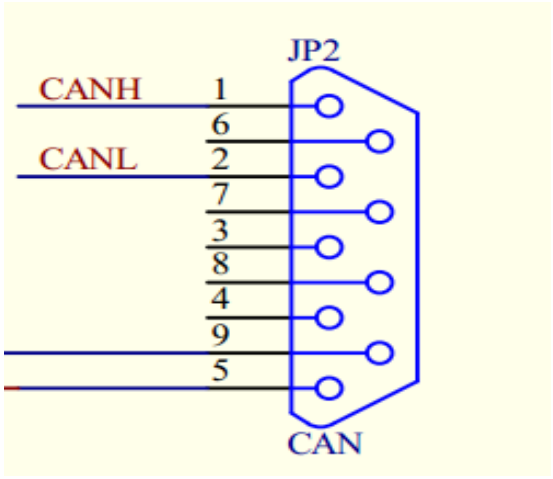
232 Serial Communication Settings

The baud rate of 232 serial port can be selected by dial switch. The optional baud rate is 19200, 57600, 115200 and 23400, totaling four files. Use the dial switch to select one of the baud rates, set the serial port to 8 bits, stop bit 1 bit, no check bit, no flow control. See the table below for details:

Switch2	Switch1	Baud rate	Other settings
OFF--0	OFF--0	19200	Data bits8
OFF--0	ON--1	38400	Stop bit1
ON--1	OFF--0	115200	Check bits (default)
ON--1	ON--1	234000	Flow Control (None)

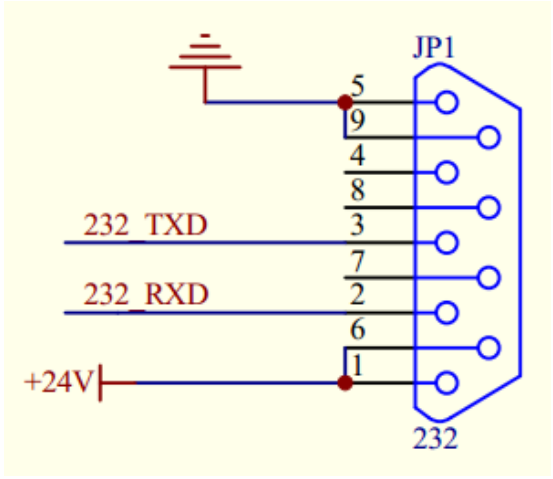
After setting the baud rate of the serial port through the dial switch, the module must be re-energized, and the baud rate set will take effect, otherwise the original baud rate of the serial port will be used for communication. If the CAN communication data is frequent or the CAN baud rate is high, please use the higher serial communication baud rate, and recommend the use of 115200 serial baud rate in use.

2.CAN port wiring



When installing and connecting CAN communication line, please use twisted pair with shielding layer, CANH to connect JP2 - 1, CANL to connect JP2 - 2, shielding line to metal housing of joint reliably. Because 120 ohm terminal resistance is designed on the module circuit board, no additional terminal resistance is needed.

3.232 and power port wiring



According to the above diagram, 232 serial communication uses twisted pair with shield. 232 communication lines are as short as possible. The shield layer must be reliably connected to the metal interface shell.

Description of CAN Communication Module of CRP-S100 (Ecat System)

The S100 host has a CAN-232 communication module, which is connected with COM3. Fixed serial port baud rate is 115200Bps and can not be changed. CAN baud rate supports 100K, 125K, 200K, 250K and 500K. It can be set by instructions to support software filter group settings. The shielded twisted pair is used to connect the module, and the module is equipped with 120 ohm terminal resistance.

4.Welding Machine Parameter Configuration

Slave MAC address

The slave station MAC ID is the MAC ID of the welding machine, default 2. Without repeating with the robot MAC ID, the slave station MAC ID can be set arbitrarily in the range of 1-63 through the internal menu of the welding machine "FA3". When "FA3" is OFF, the default MAC ID 2 is used.

5.Communication Protocol Selection

Enter the internal menu FA9 Select OFF for the simulation: 0: FANUC-MEGMEET communication protocol (digital tube display FAN);

FA7	Current feeding speed switch	BIT	BIT5: S witch。1, ON(current); , OFF（Wire feeding speed）;	OFF （Wire feeding speed）
FA9	Communication Protocol Selection	1	OFF: Analog port 0, FAN: Fanaco-Megmeet(General Edition) 1,FAS: Fanaco-Megmeet(Custom Edition) 2, ABB: ABB-Megmeet 3, YAS: Y askawa-Megmeet 4, KUK: KUKA-Megmeet 5, STA: Megmeet Standard Agreement (Standard) 6, COP: Megmeet Standard Protocol (Full Function)	OFF Analog port control

6.Low voltage search

If there is only low-voltage positioning, the positioning enabler "FA8" should be set to Lo.

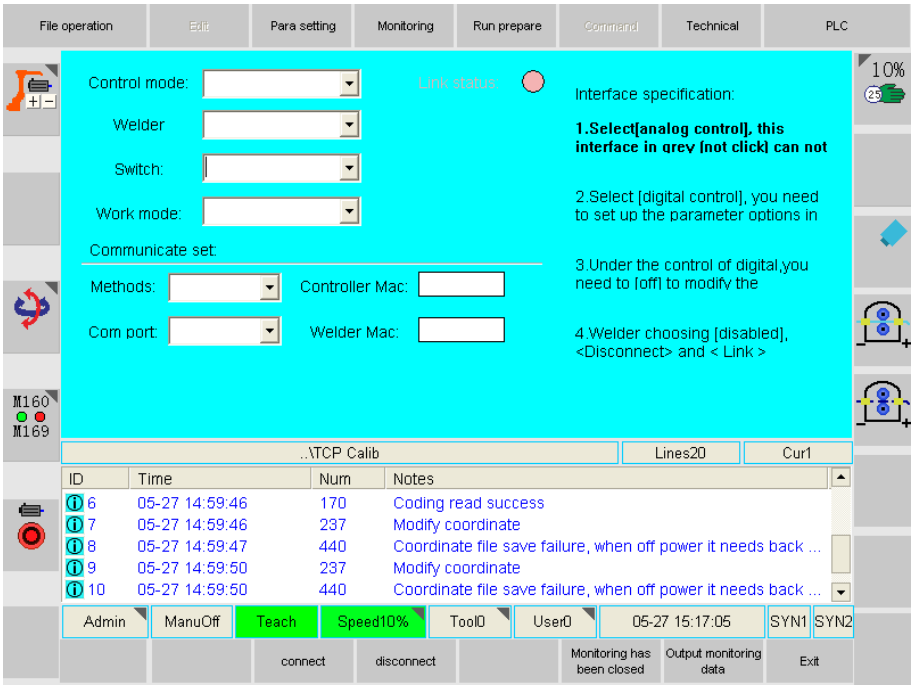
7.Setup process when using the welder to digitize the communication function and upgrade the software for the first time

7.1 Software upgrade

Upgrade the system software version to version 5-7 or later。

7.2 Configuration of welding machine parameters

7.2.1 In the [Technical] menu, select [Arc Welding] and select [Welding Device] to select [Welder] to enter the [Welding Machine Configuration Interface]. As shown below:



The main interface of welding machine configuration has the following settings:

Control mode of welding machine: for selecting control mode of welding machine, “analog control” or “digital control”. When “analog control” is selected, all settings under “welder” and “communicate set” are grey and cannot be set. When “digital mode” is switched to “analog control”, the connection will be automatically disconnected. *1

Welder: Used to select welding machine manufacturer. The current version supports Austria and Megmeet.

Switch: Used to set whether the welding machine is on or off.

Work mode: Used to select the working mode of welding machine. It includes the following five modes: *2

1）DC Unification：

In this mode, other parameters and options can be set freely except that the welding method is locked in DC (pulse and dual-pulse options cannot be selected).

The given parameters sent by the robot are wire feeding speed/current and the corrected values of unified voltage. The default received parameters are wire feeding speed.

The current received can be set by adjusting the FA7 option of the internal menu of the

welding machine.

In this mode, it is impossible to store and invoke, nor to adjust the given current and voltage through the display panel.

2）Pulse Uninfication:

In this mode, other parameters and options can be set freely except that the welding method is locked in pulses and double pulses (DC option can not be selected).

The given parameters sent by the robot are wire feeding speed/current and the corrected values of unified voltage. The default received parameters are wire feeding speed.

The receiving circuit can be set by adjusting the FA7 option of the internal menu of the welding machine.

In this mode, it is impossible to store and invoke, nor to adjust the given current and voltage through the display panel.

3）JOB mode:

In this mode, the stored parameters can only be invoked after the JOB number is sent down by the robot, and the given current/voltage can be adjusted by the JOB current/voltage correction value. The operation of storage and invocation can not be carried out, nor can any parameters be adjusted by the display panel.

4）Near control mode:

In this mode, the given current/wire feeding speed, voltage/unitary correction value can only be adjusted by the display panel, and can be set.

All parameters and options can be stored and invoked at the same time.

After the communication between the robot and the welding machine is established, only in this mode can the storage and calling operations be carried out to save and browse JOB

Parameters;

Before establishing communication, the welding machine defaults to analog interface control. It can also store and invoke JOB parameters by opening close control switch FA1 (ON).

5）Separate mode:

In this mode, all parameters and options can be set freely except for manual selection of unitary and manual selection of dual-pulse process (dual-pulse only has unitary mode).

The given parameters sent by the robot are wire feeding speed/current and voltage, and the default receiving is wire feeding speed. The current received can be set by adjusting the FA7 option of the internal menu of the welding machine.

In this mode, it is impossible to store and invoke, nor to adjust the given current and voltage through the display panel.

Communication mode: Used to select the communication mode between the system and the welding machine. When selecting "welder power supply manufacturer", the "communication mode" will be automatically selected without manual selection.

Communication interface: Used to select the communication interface between the system and the welding machine.

Controller MAC address: used to set the master station MAC address, if no input, the default is 0; the master station MAC address can be set at will, but not greater than 63. *3

Welding machine MAC address: used to set the slave station MAC address, if no input, the default is 0; slave station MAC address should correspond to the welder, and should not be greater than 63. *3

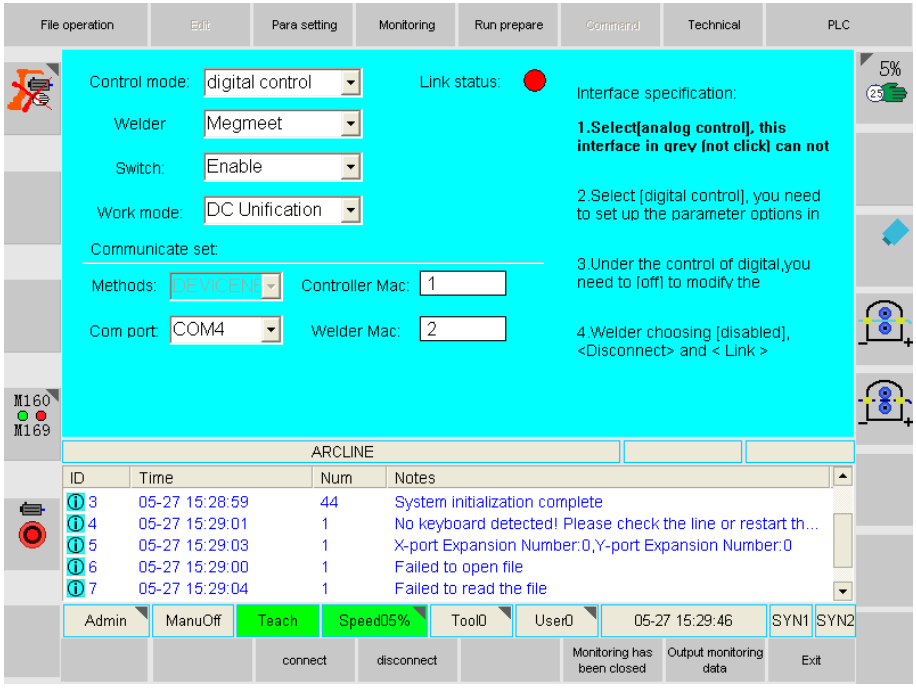
Note:

* 1: When the user does not set the parameter file, the system defaults to analog control mode!

* 2: Different welding machine manufacturers have different working mode options. When switching working mode, you need to reconnect to take effect!

* 3: The MAC address of master station and slave station can't be the same!

7.3 Setting relevant parameters about digital communication



After setting the relevant parameters in the above interface, click the < connection > key, and the system automatically communicates with the welding machine.

Successful connection - Welding machine communication status indicator is green;

Connection failure - Welder communication status indicator is red.

After successful connection, the welding machine communication indicator light is green, click the < disconnect > key, the communication between the system and the welding machine is disconnected, and the welding machine communication indicator light is red. At this time, it is necessary to manually click < connect > to resume communication.

Click the Exit button:

1）. When the mode of control welding machine is [digital control] welding machine selection [enabled], the current connection state is not connected, and the system will automatically establish the connection.

2）. When the mode of control welding machine is [analog control] welding machine is selected [disabled], the current connection state is connected, and the system will automatically disconnect.

8.Fault description

Failure Content	Fault Code Display		Reason	countermeasure
	Left digital tube	Right digital tube		
Start-up self-check	F100	F00	/	/
Welding torch fault	E1	/	When the power supply of the welding torch is opened, the switch of the welding torch closes or the switch of the welding torch is damaged.	Place torch switch in OFF state or replace torch switch
Output terminal loosening (terminal overheating)	E2	1	Left terminal loosening (terminal overheating)	The output terminal is fixed reliably, the cross-section area of the cable is increased, and the appropriate specification of the
	E2	2	Right terminal loosening (terminal overheating)	
Abnormal input power supply	E3	1	Input power supply overvoltage	Check that the input cable is properly connected and check that the input power is normal.
	E3	2	Input power supply undervoltage	
	E3	3	Input power over-frequency	
	E3	4	Input power supply Underfrequency	
	E3	5	Phase imbalance of input power supply	
	E3	6	Input power supply frequency beyond range	

The system has the function of fault detection and protection. When the protection function operates, the alarm status will be displayed when the welding machine parameters are configured, the connection is established and the normal operation is carried out. According to the alarm status, the following solutions can be used to remove the alarm. The following is a list of alarm codes and contents of welder:

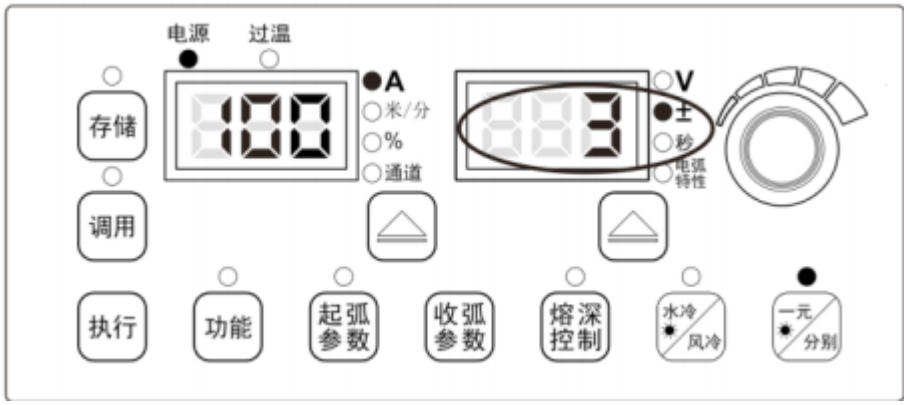
Failure Content	**Fault Code Display**		**Reason**	**countermeasure**
	Left digital tube	**Right digital tube**		
Inductor or diode over temperature	E4	1	Inductance over temperature	Strictly follow the rated load duration range, check whether the welder power vent is blocked, clean the radiator, check whether the fan works normally.
	E4	2	Diode over temperature	
Key error	E5	1-17	Button stuck	Check the corresponding number according to the number in the panel below (see three digital tube display on the right)
Output overcurrent	E6	E6	Output short circuit or excessive current, damage of output diode module	Check whether the output is short-circuited and whether the output diode module is damaged
Communication failure	E7	1	Internal communication failure	Contact after sales
	E7	2		
Output Overvoltage	E8	E8	Input voltage is too high, main transformer is damaged, output wiring is wrong	Check whether the input voltage force is normal, Check whether the main transformer is damaged, check the output wiring.
Primary side overcurrent	E9	E9	main transformer is damaged,damage of output diode module, Main Power Board Damage	Check the main transformer, check the output diode module, check the main power board
Primary side overpressure	E10	E10	Excessive input voltage	Check input voltage
Hall connector is not inserted	E11	E11	Hall connector is not inserted	Check hall connector
Overcurrent of wire feeder motor	E13	E13	Blocking or jamming of welding machine	Check whether the welding wire is blocked or stuck
Valve failure	E14	1	Short circuit or damage of valve	Check whether the valve is short-circuited or damaged
	E14	2	Valve opening or cable disconnection	Check whether the valve is open or the cable is disconnected
Code Disk Opening	E17	E17	Cable loosening or wire feeder stuck	Check whether the control cable is loose or whether the wire feeder is stuck
Robot emergency stop	E18	E18	Robot emergency stop signal error	Check whether the robot communication cables are connected correctly
Robot Communication Fault	E19	/	Communication Fault between Digital Robot and Welder Power Supply	Check communication lines

9.Some skills and precautions in using digital welding machine:

9.1 Unification of Megmeet

The so-called unification of welding refers to the welding opportunity automatically matching the welding voltage according to the given welding current and the corrected value of unified voltage.

The unified setting of Megmeet welder should first open the function on the welder side, Just press the SYNERG./Separate key.Entering the unified mode, the matching voltage and arc length correction can be viewed by right-loop switch key.The right-cycle switch key is switched to the unified voltage correction value " ±".When the indicator light is on or flickering, the automatic matching voltage in the unified mode can be fine-tuned by adjusting the voltage knob on the wire feeder or the panel knob on the power supply of the welding machine, as shown in the figure.



The default value of voltage correction in the unification is 0, ranging from - 30% to + 30%. The current welding voltage relationship is as follows:

Current welding voltage = unified voltage value + (voltage corrected value%) * (unified voltage value)

9.2 Some Parameter Settings of MEGMEET Welder and System

① Arcing time

Arc starting time can be set for both welding machine and system. It is necessary to set the same arcing time for both welding machine and system in order to perform arc starting correctly.

② Preparatory/delayed gas delivery time

The lag time of gas delivery is the same as the time of preparing gas delivery. The lag time of gas delivery is also set according to the time set at the welding machine side.

③ Arc starting time (P17 on welding machine)

This parameter should be consistent with the setting value of the welding machine before it can take effect normally.

④ Arc closing time (P18 on welding machine)

This parameter should be consistent with the setting value of the welding machine before it can take effect normally.

⑤ P02 Slow wire feeding speed

Slow wire feeding speed refers to wire feeding speed before starting arc. Slow wire feeding speed will affect the speed of starting arc. The greater the speed of slow wire feeding, the faster the arcing, and vice versa, but too large setting may cause deflagration blockage of conductive nozzles. The optimum value should be set according to the actual situation.

⑥ P01 reburning time

The reburning time refers to the time when the welding wire will continue to burn at the end of the welding to control the elongation of the rod. However, because the action of our system does not match the welding machine, the parameter will lead to excessive dry elongation after the completion of the procedure, so it is suggested that it should not be opened.

9.3 Some conditions affecting the arcing time are as follows:

① Arc Detection Confirmation Time

This parameter will be maintained in situ for a certain time after successful arcing, and will continue to move after confirming successful arcing, which will directly affect the speed of arcing time. Because of the detection of arc breaking, it is suggested that the user set this parameter to 0.

② Slow wire feeding speed

The description of this parameter is shown on the previous page.

③ Preparatory gas supply time

After setting this parameter, the arc will start after a period of gas supply before arcing, which will also affect the arc-starting tempo of welding.

④ Length of rod extension before welding

The arcing speed is largely affected by the length of the stem at that time. The closer the length of the welding front rod is to the workpiece, the faster the arcing is. This is consistent with the idea of speeding up the slow wire feeding speed. The length of the rod will make the arcing time very different.

9.4 Matters needing attention

In normal welding, please seclect function of 

arc breaking detection . In welding, the robot can make correct alarm and ARC-BREAKING action in the case of wire feeder failure, ground wire loosening, power cut-off, servo disconnection and so on. The following are dangerous actions which may cause safety accidents and losses. Please note that

Dangerous actions:

1 If the arc-break detection function is not selected, if there is such a situation that the ground wire is loose, the wire feeder will be in a state of continuous wire output without any alarm.

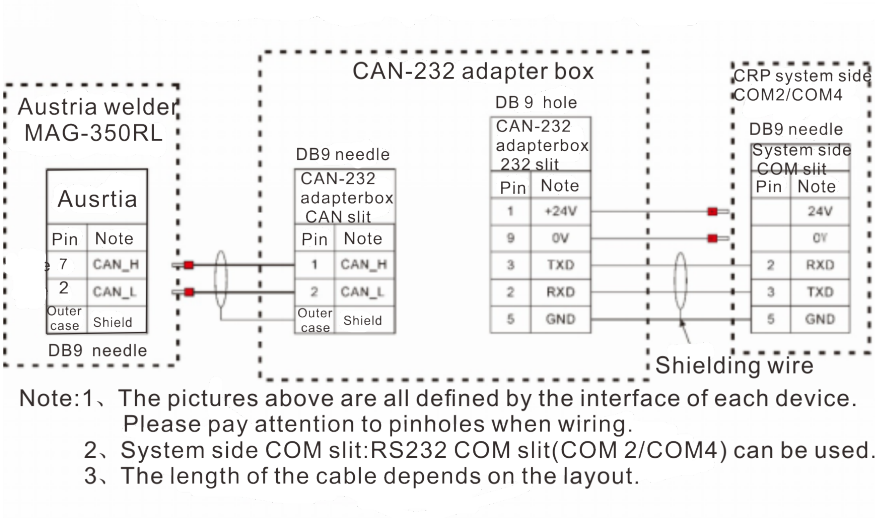
2 If the arc-breaking detection function is not selected, under normal welding, if the welder is powered off, the arc is extinguished, the wire is stuck to the base metal, and the robot is still moving, and the base metal may be pulled away from the original or Causes damage to the wire feeder.

3 Please try to reduce the speed of the test run when teaching the program, so as not to overshoot the wire or damage the workpiece.

二 .Digital Communication Explanation between Robot System and Austria Welding Machine

Communication line configuration

CAN-232 and Austria MAG-350RL/Pulse MIG-500 Welder wiring



Note:1、The pictures above are all defined by the interface of each device.
Please pay attention to pinholes when wiring.
2、System side COM slit:RS232 COM slit(COM 2/COM4) can be used.
3、The length of the cable depends on the layout.

Welding Machine Parameter Configuration

一 .Slave MAC address

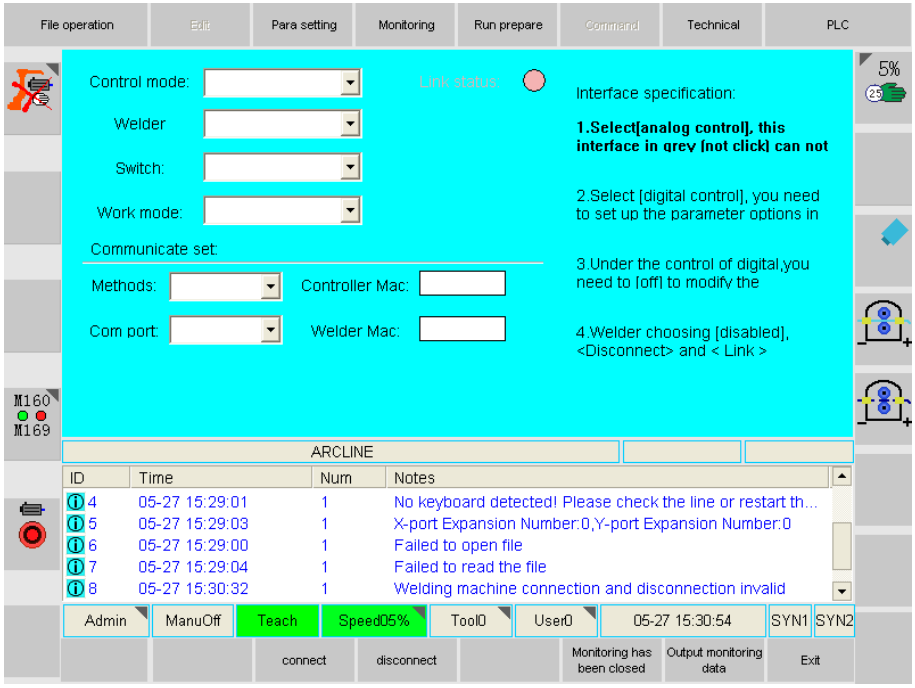
From the station MAC address for the welder MAC address, remove the bottom cover of ATR-CAN interface box, pull out the circuit board, SF2 on the circuit board is an 8-bit dial switch, the switch to ON position represents 1, the reverse direction represents 0. When connecting the CAN interface box to the robot, the address is 129, that is, 1 and 8 are ON. The other address choices are shown in the table below.

b1	b2	b3	b4	b5	b6	b7	b8	address
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	2
1	1	0	0	0	0	0	0	3
…	…	…	…	…	…	…	…	…
1	0	1	1	1	1	1	1	253
0	1	1	1	1	1	1	1	254
1	1	1	1	1	1	1	1	255

Dial switch SF1 1, 2 set to ON.

二 .Configuration of welding machine parameters

1. Select [Arc Welding] under the [Technical] menu and select [Welding Device] to select [Welder] to enter the welding machine configuration interface. As shown below:



The main interface of welding machine matching has the following settings:

· Control mode : for selecting control mode of welding machine, «analog control» or «digital control». When «analog control» is selected, all settings under «welding power supply manufacturer» and «welding machine digital control device» are grey and cannot be set. When «digital mode» is switched to «analog control», the connection will be automatically disconnected. *1

· Welder: Used to select welding machine manufacturer. The current version supports OTAI and MEGMEET.

· Switch: Used to set whether the welding machine is on or off.

· Work mode: Used to select the working mode of welding machine. It includes the following five modes: *2

Unification of Flat Characteristic
Pulse Programming Unification
Flat Characteristic Separation
Pulse Program Separate

Call state

· Communication mode: Used to select the communication mode between the system and the welding machine. When selecting “welder power supply manufacturer”, the “communication mode” will be automatically selected without manual selection.

· Communication interface: Used to select the communication interface between the system and the welding machine.

· Controller MAC address: When choosing welding power source manufacturer as “AOTAI”, this item cannot be input. *3

· Welding machine MAC address: used to set the slave station MAC address, if no input, the default is 0; slave station MAC address should correspond to the welder, and should not be greater than 63. *3

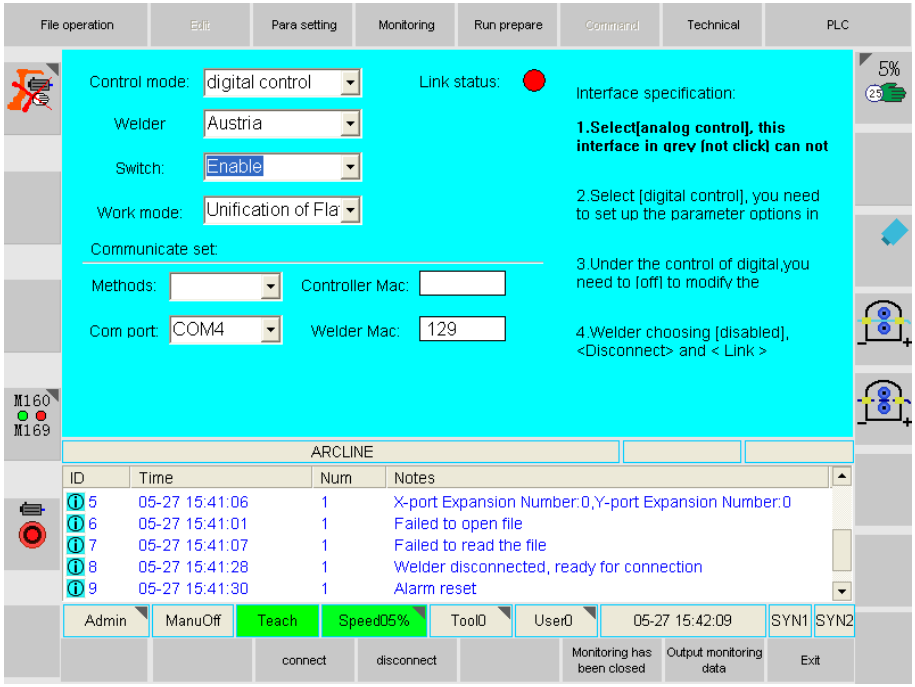
Note:

* 1): When the user does not set the parameter file, the system defaults to analog control mode!

* 2): Different welding machine manufacturers have different working mode options. When switching working mode, you need to reconnect to take effect!

* 3): The MAC address of master station and slave station can't be the same!

2.Set parameters about digital communication.



After setting the relevant parameters in the above interface, click the < connection > key, and the system automatically communicates with the welding machine.

· Successful connection - Welding machine communication status indicator is green;

· Connection failure - Welder communication status indicator is red.

After successful connection, the welding machine communication indicator light is green, click the < disconnect > key, the communication between the system and the welding machine is disconnected, and the welding machine communication indicator light is red. At this time, it is necessary to manually click < connect > to resume communication

Click <Exit>:

1. When the mode of controlling the welding machine is digital control and the welding machine is selected [enabled], the current connection state is not connected, and the system will automatically establish the connection.

2. When the control mode of welding machine is analog control and the current connection state is connected, the system will automatically disconnect.

3. When the welding machine is selected [disabled], the current connection state is not connected, and the system will not automatically connect.

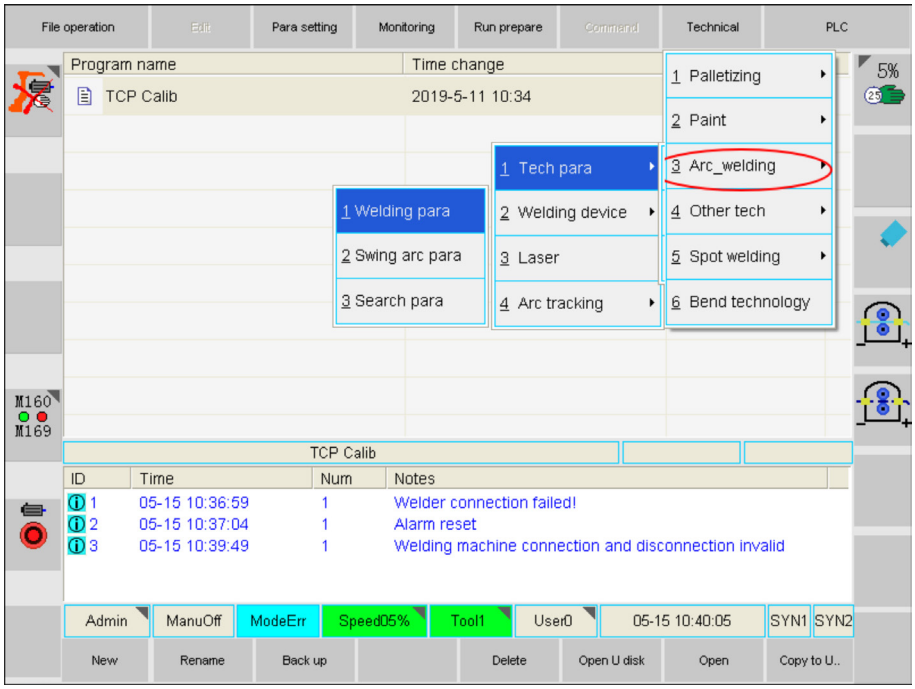
Fault description

The system has the function of fault detection and protection. When the protection function operates, the alarm status will be displayed when the welding machine parameters are configured, the connection is established and the normal operation is carried out. According to the alarm status, the following solutions can be used to remove the alarm.

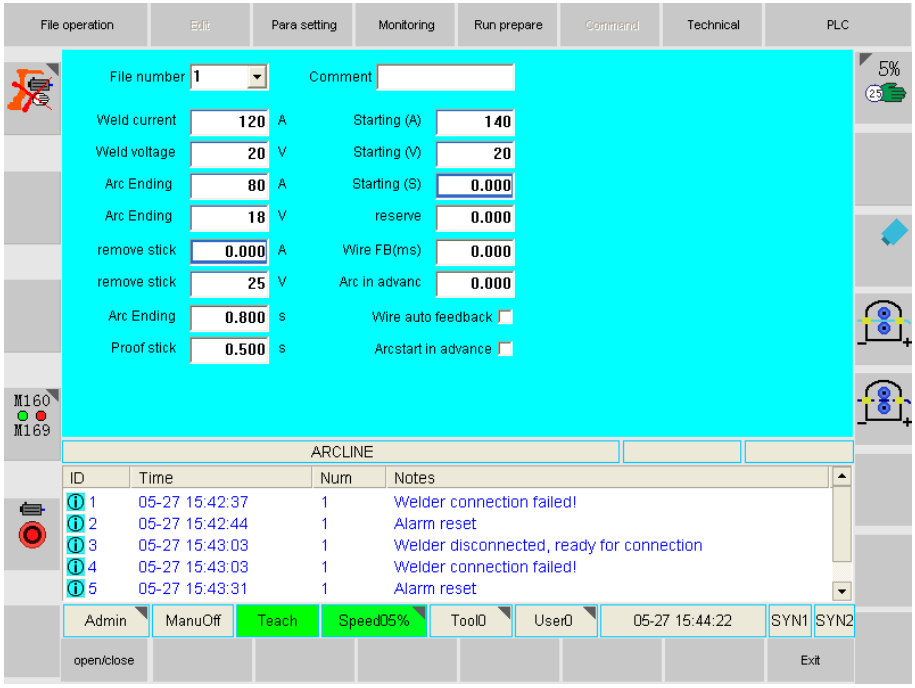
2.2 Welding process setting

2.2.1 Setting the basic parameters of welding

This operation mainly sets welding current and voltage



As shown in the figure above, enter the welding parameter setting interface under [Techinical]-<Arc welding>-<Tech Para>-<Welding para>, as shown below.



In the figure above [File number] select file number [range 0-7], one number corresponds to a set of welding parameters.

Specific parameters are described as follows:

a) The arcing voltage and current are used when arcing is difficult. In order to facilitate arcing, the voltage and current can be adjusted appropriately.

B) The welding voltage and current are the values set at the normal welding time, which are set according to the on-site process.

C) The arc closing voltage and arc closing current are used when the arc closing is not full. Usually, the arc closing current and voltage are smaller than those of welding.

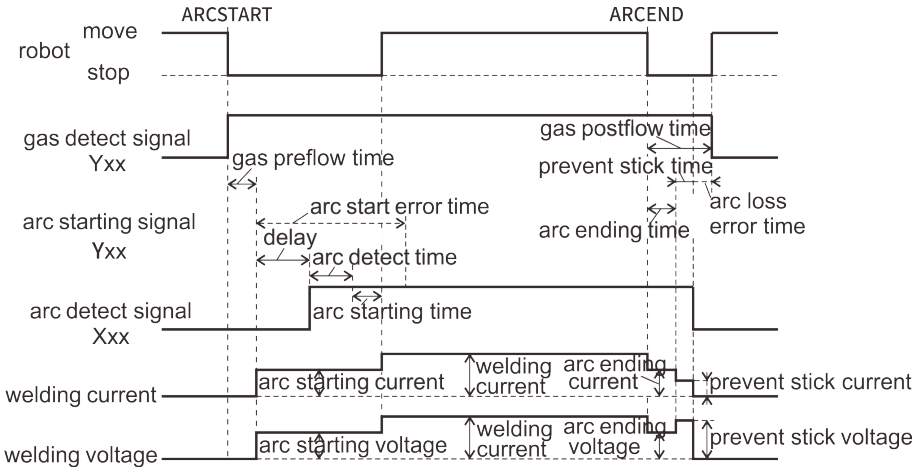
D) The voltage and current of anti-sticking wire are used only when the arc closing point is bonded by welding wire. Usually the current value is 0, and the voltage value is slightly higher than that of welding.

E) Arc starting time, setting arc starting voltage and current holding time, which will make surfacing occur at the beginning of the weld.

F) Arc closing time, setting the holding time of arc closing voltage and current, which will make the end of the weld have surfacing, too small will make the end of the weld have welding pits, so it needs to be set according to the actual situation.

G) Anti-sticking time, setting the holding time of anti-sticking voltage and current.

The sequence diagram of welding control is as follows:



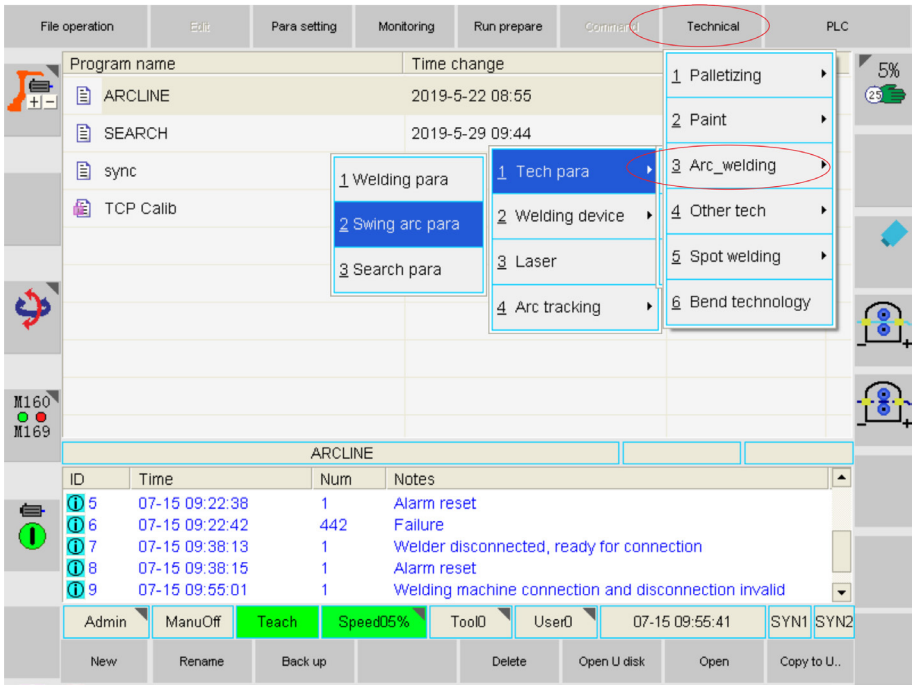
After setting the welding parameters, they are stored in the form of document number. When used, the corresponding parameter number is invoked, and multiple sets of welding parameters can be used in a program.

Example: How to use welding parameters in program

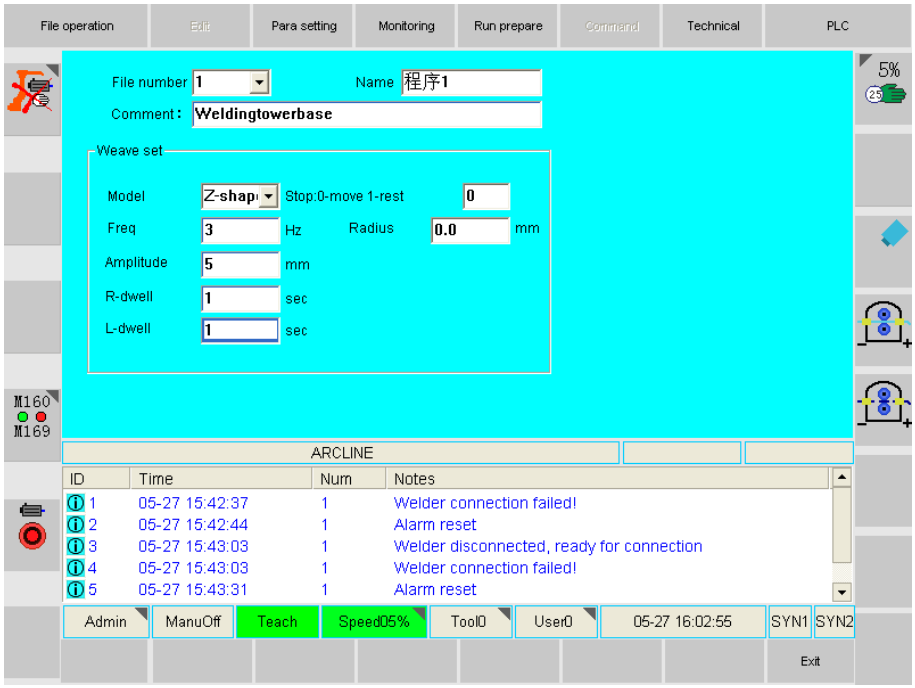
ARCSTART#1	Call No. 1 welding parameters for welding
MOVL VL100=MM/S PL=0	Welding trajectory
ARCEND #1	End of welding process No. 1

2.2.2 Setting Welding Swing Arc Parameters

This operation mainly sets the parameters of swing arc when welding wider seam.



As shown above, enter the welding swing setting interface under [Technical]-<Arc weldig>-<Tech para>-< Swing arc para>, as shown below.



Select the file number [range 0-9] in [File number] in the above figure, and a number corresponds to a set of welding parameters.

In addition, some information about the parameter can be entered in the [Name] and [Comment] fields to facilitate the operator's intuitive understanding of the welding swing.

In the [Weave set] field, enter the [Model] [Frequency] [Amplitude] [R- Dwell] [L- Dwell] value .Then press <Exit>.

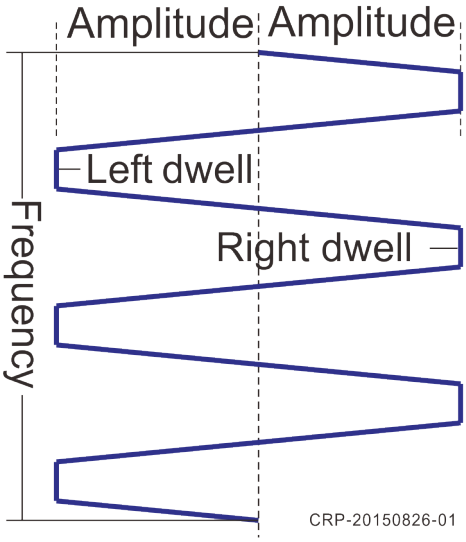
Model : used to set the mode of the swing, such as "Z-shaped pendulum" and "arc pendulum". The following versions of 2018-11-26 only have the "Z-shaped pendulum" function.

Frequency: Set the number of swings per second, in units of HZ.

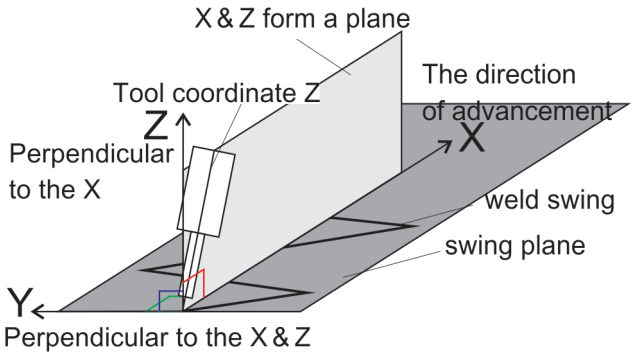
Amplitude: Set the distance of the single side swing, in MM.

L- Dwell : Set the dwell time when the wobble to the left vertex, in S.

R- Dwell : Set the dwell time when the wobble to the right vertex, in S.



Z-shaped pendulum arc schematic diagram



Pendulum-arc coordinate system

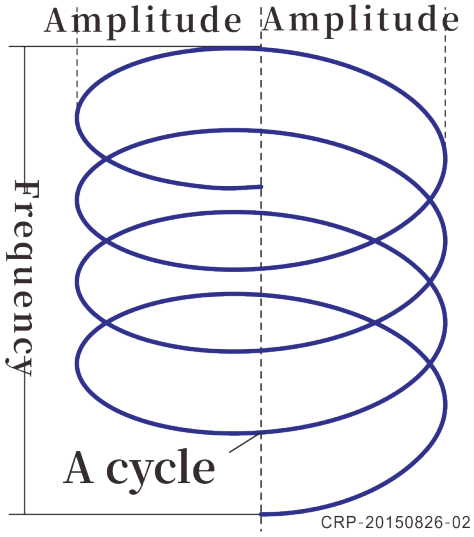
Note: After the setting of the swing parameter is completed, it is stored in the form of a file number. When used, the corresponding parameter number is called, and multiple sets of welding swing parameters can be used in one program.

The pendulum arcs are all based on the swinging arc coordinate system. In the case of an arc, the X direction is the normal direction.

Example: How to use welding parameters in program

ARCSTART#1	Call No. 1 welding parameters for welding
WEAVESINE #1	Call the No. 1 swing parameter
MOVL VL100=MM/S PL=0	Welding trajectory
WEAVEEND	Terminal swing
ARCEND #1	End of welding process No. 1

Circular arc: When the arc is arced, the robot's motion path alternates like a spiral arc. The swinging direction is perpendicular to the forward direction, and the swinging surface is perpendicular to the tool coordinate system Z-axis.

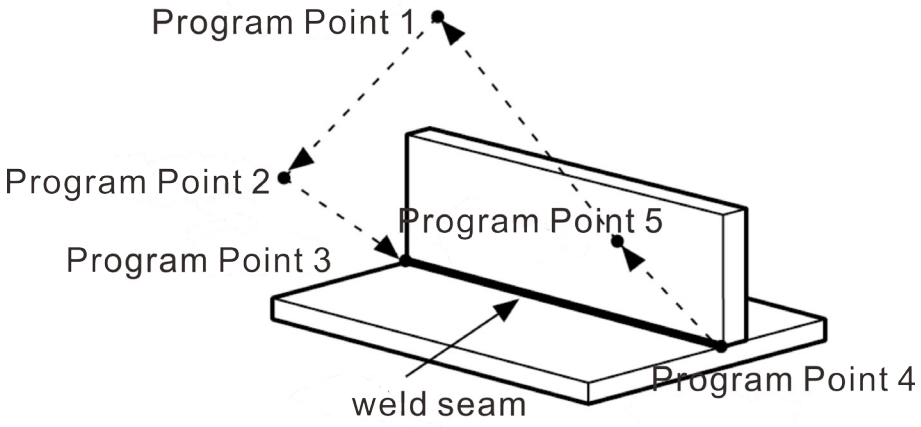


A sketch of the swing arc of a circular arc

Chapter 3.Examples of Welding Programming

After completing the above steps, the welding programming steps can be carried out as follows:

The following figure shows an example of welding workpiece to illustrate the steps of programming.



3.1 Example of program

As shown in the figure, the basic procedure of the workpiece is as follows:

MOVJ VJ=50.0% PL=5	Quickly move to program point 1, waiting point.
MOVJ VJ=50.0% PL=5	Quickly move to program point 2, welding preparation point.
MOVL VL=200 MM/S PL=0	Move to program point 3, welding start point.
ARCSTART#1	Call No. 1 welding parameter to start arc.
WEAVESINE #1	Call No. 1 swing parameter
MOVL VL=50MM/S PL=0	Welding trajectory,Move straight to program point 4.
WEAVEEND	Terminal swing
ARCEND #1	End of welding process No. 1
MOVJ VJ=50.0% PL=3	Quickly move to program point 5, safe point.

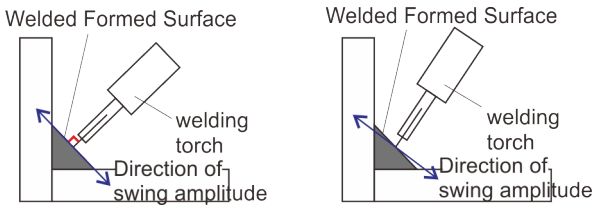
3.2 Procedural teaching steps

Notes:

a. Program point 1 in the standby position should be in a position that does not interfere with the workpiece or fixture.

b. When the program point 5 moves to the program point 1, it is also in a position that does not interfere with the workpiece and the fixture.

c. Teach the program point 3 to the program point 4, that is, when the welding section, the welding wire and the forward X-direction forming surface need to be welded perpendicularly to the forming surface (as shown in the figure below), otherwise the Y-shaped forming surface of the arcing coordinate is not parallel. The arc will be high on one side and low on the other side.



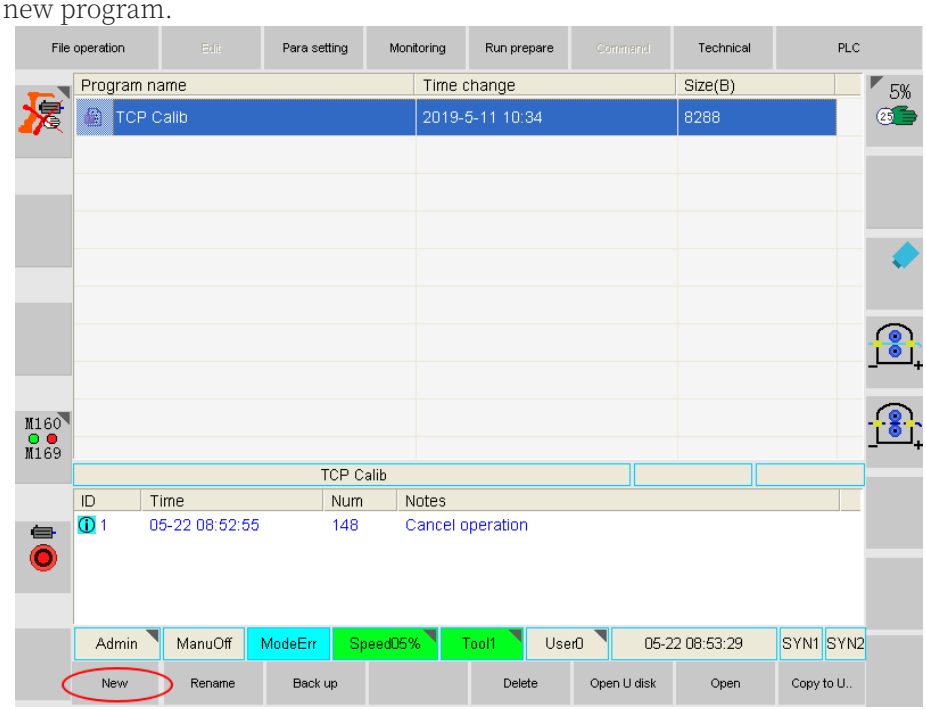
d. The length of the welding wire should be the same as that of the teaching wire. The welding wire is sent out by point motion. Please cut the length of the welding wire (about 10mm).

e. In teaching, when the welding wire bends due to contact with the workpiece, the welding wire is sent out 50-100mm, and the appropriate length is cut to continue teaching.

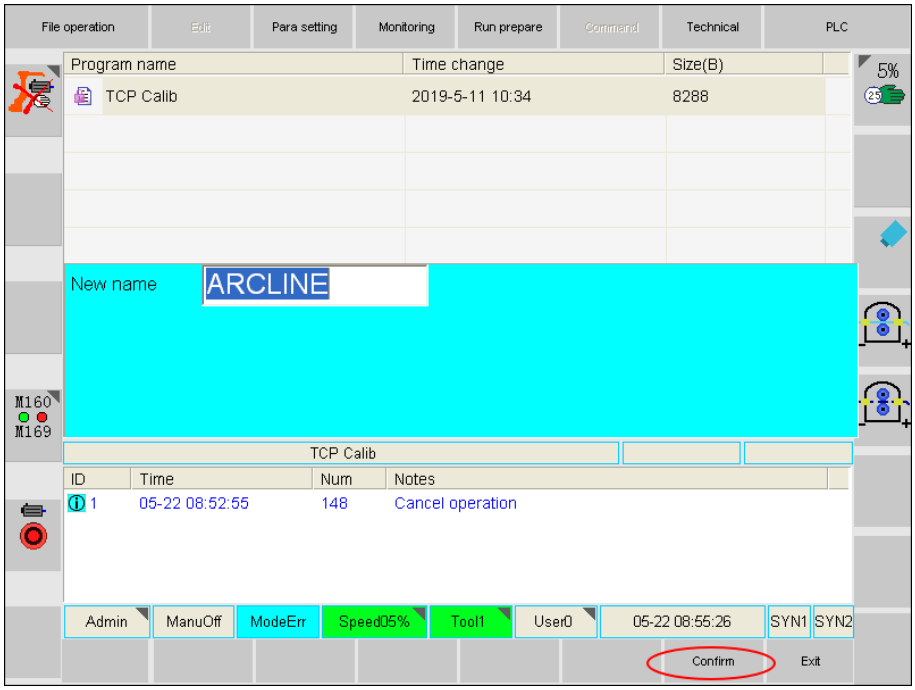
f. After the teaching, please try running with keys to confirm whether the trajectory is correct.

3.2.1 New file

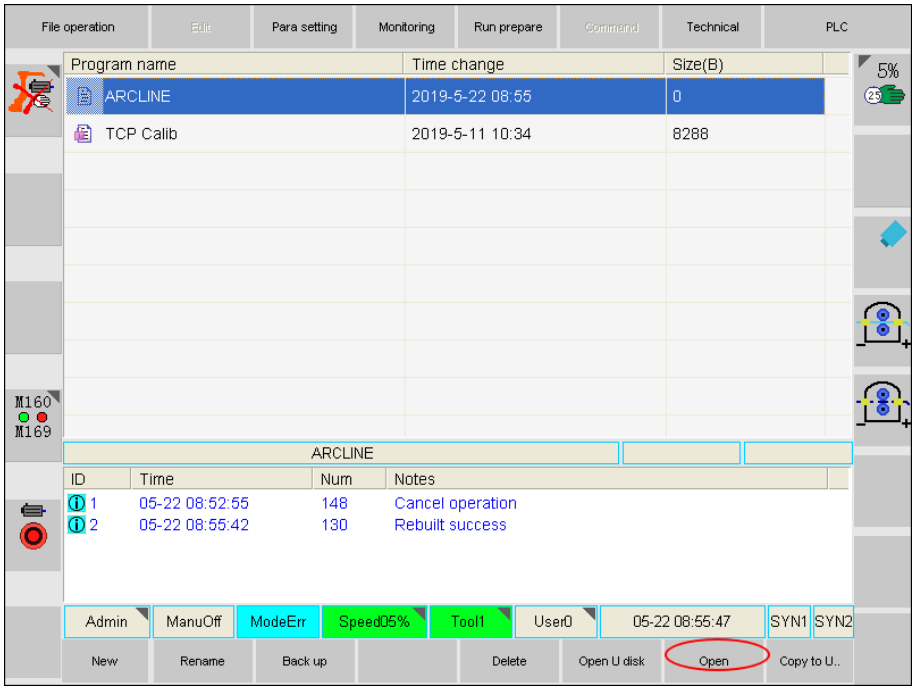
In teach mode. In the main interface (the following interface), click the <New> button to create a new program.



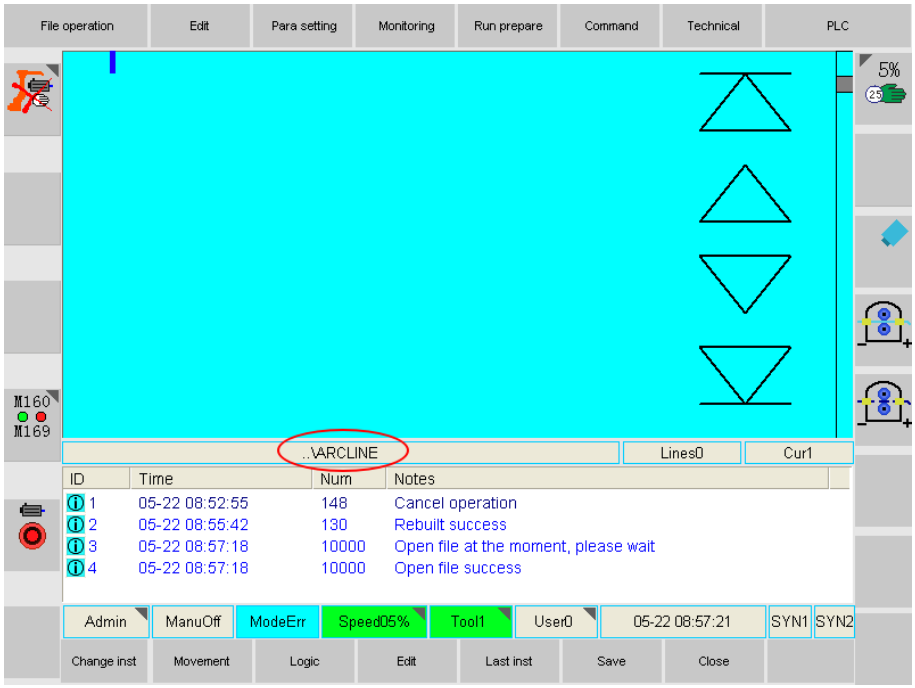
Enter the program name [ARCLINE] at the following interface



At the above point < confirm > button, the program is newly completed and appears in the program list, as shown below.



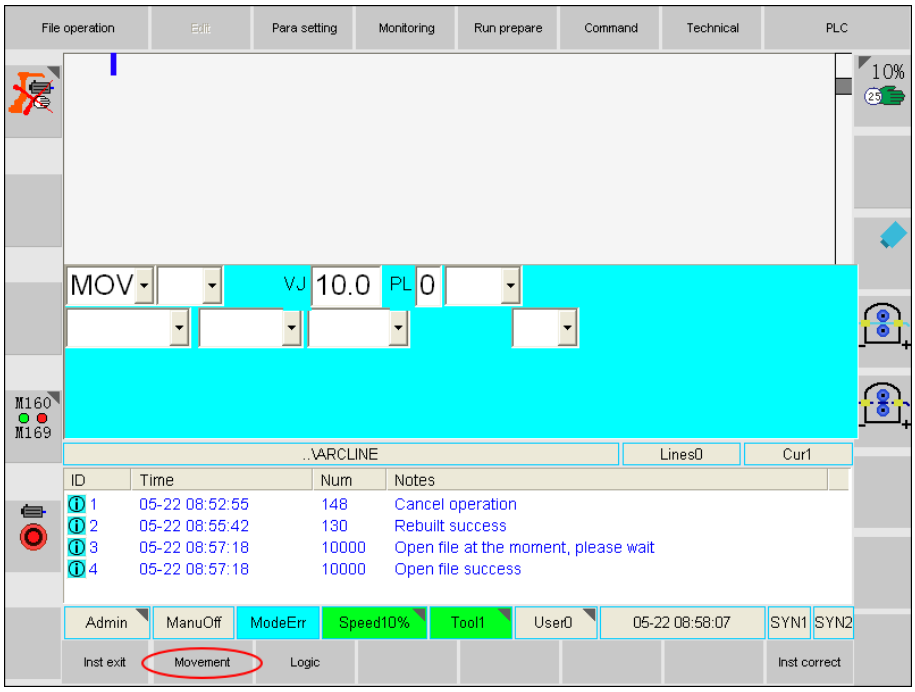
In the above interface, press the < Open > button to enter the program editing interface, as shown below.



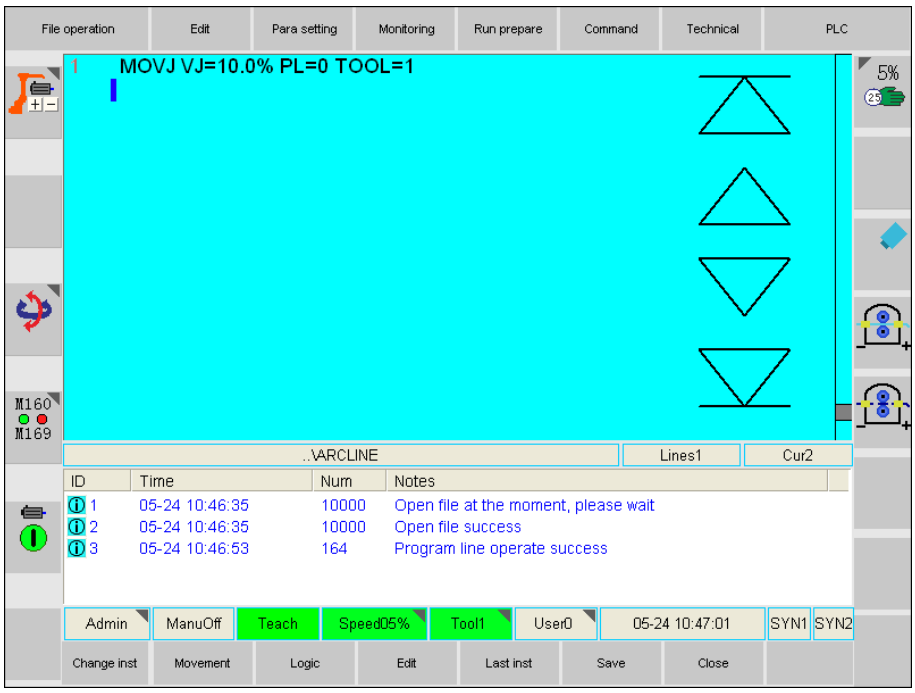
Program Editing Interface

3.2.2 Program point 1

Adjust the manual running speed, coordinate mode of the robot, press the safety switch, run the robot to program point 1, press the < movement > button on the following interface, select [MOVJ] mode, and input the corresponding running speed.

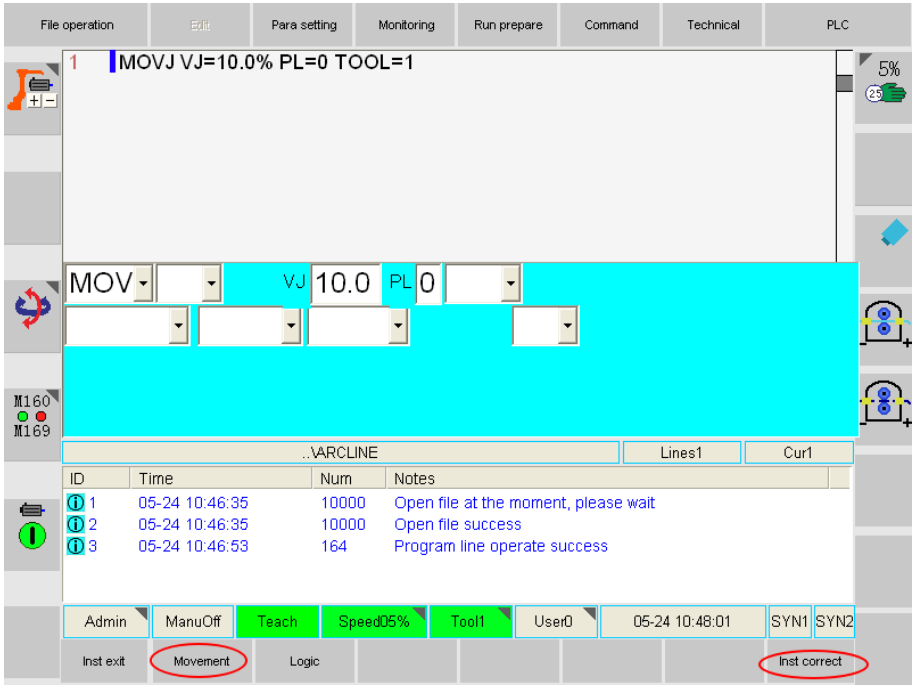


In the interface above, the point < inst correct > button completes the point recording (at this time, the safety switch must be pressed in its effective state). The following diagram.

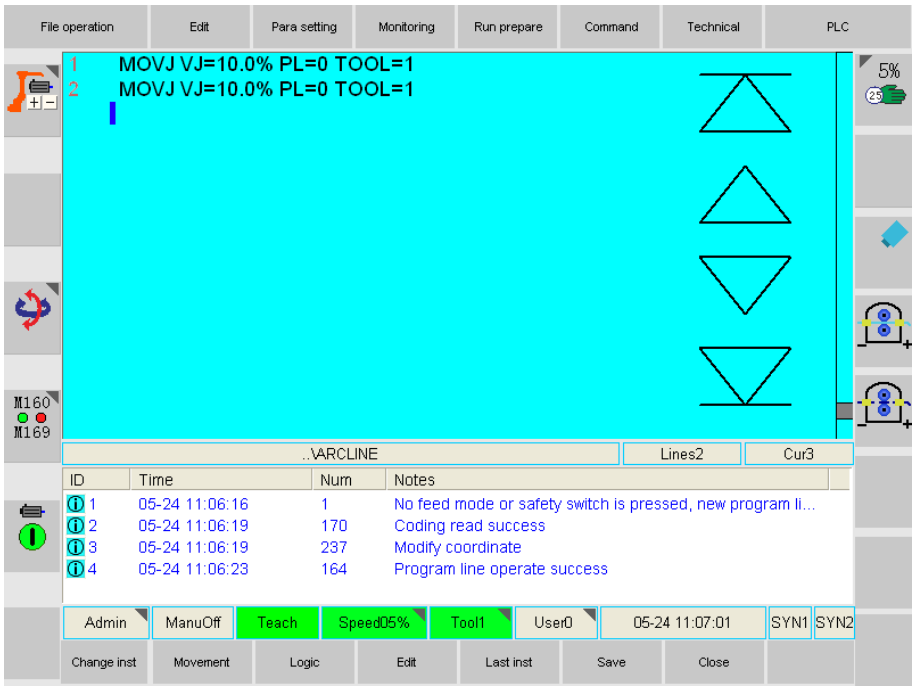


3.2.3 Program point 2

Adjust the manual running speed, coordinate mode of the robot, press the safety switch, run the robot to program point 2, press the < movement> button on the following interface, select the mode of [MOVJ] and input the corresponding running speed.

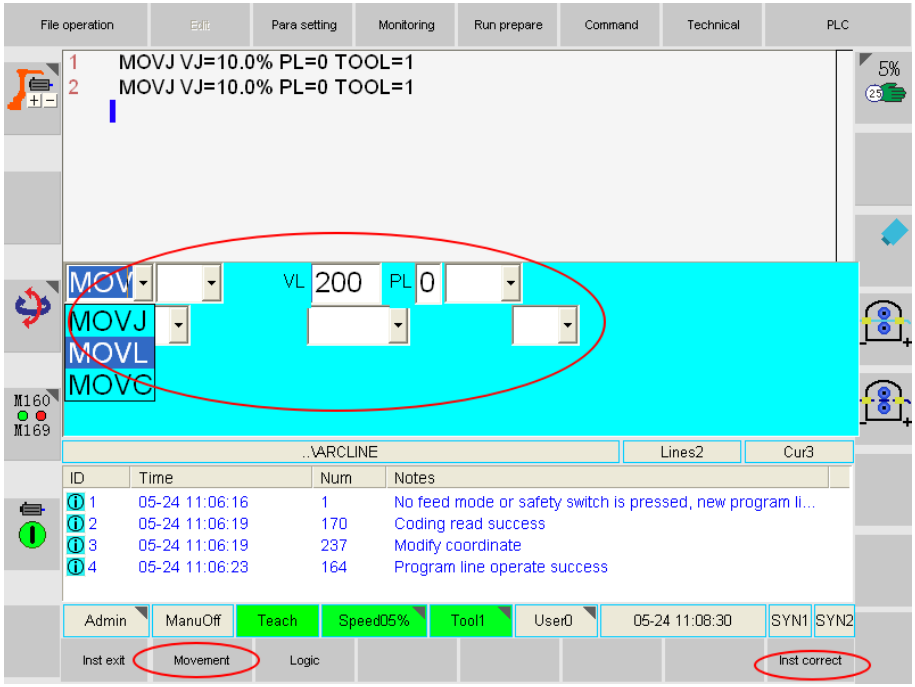


n the above interface, click the <inst correct> button to complete the point recording (in this case, press and hold the safety switch active state). As shown below.

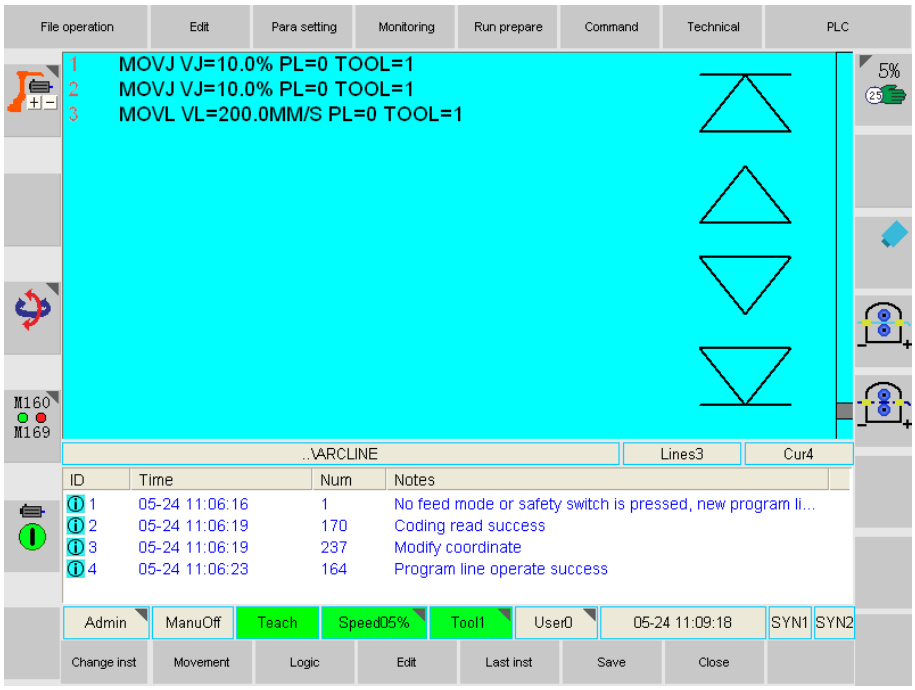


3.2.4 Program point 3

Adjust the manual running speed, the robot in the rectangular coordinate mode  , press the safety switch, run the robot to program point 3, press the < movement > button in the following interface, select the [MOVL] mode, input the corresponding running speed.



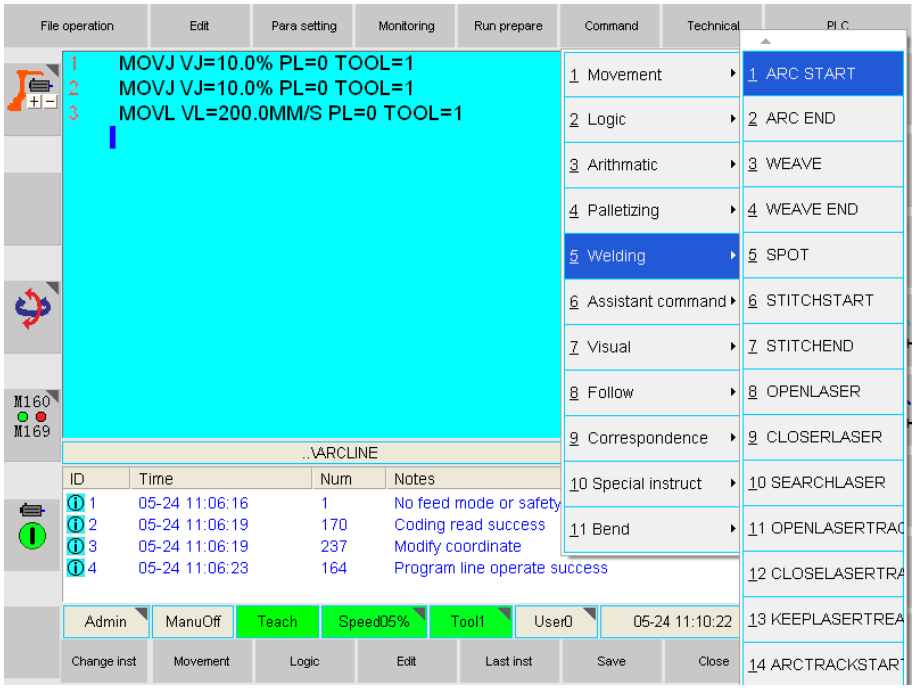
In the above interface, click the <inst correct> button to complete the point recording (in this case, press and hold the safety switch). As shown below.

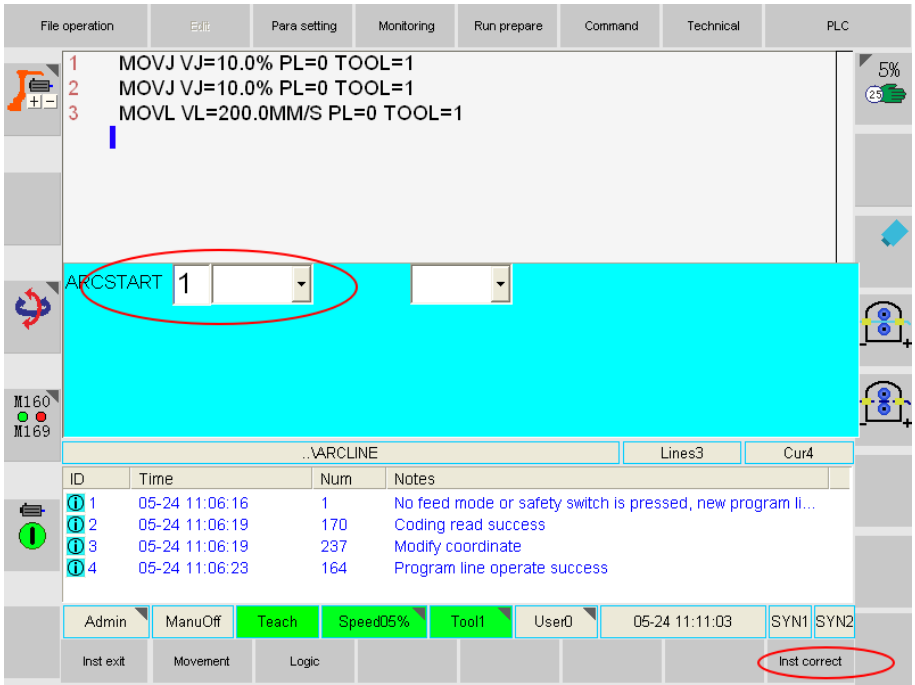


Note: This point is the starting point of welding. In order to ensure the swing function, the welding wire should be vertical to the welding forming surface.

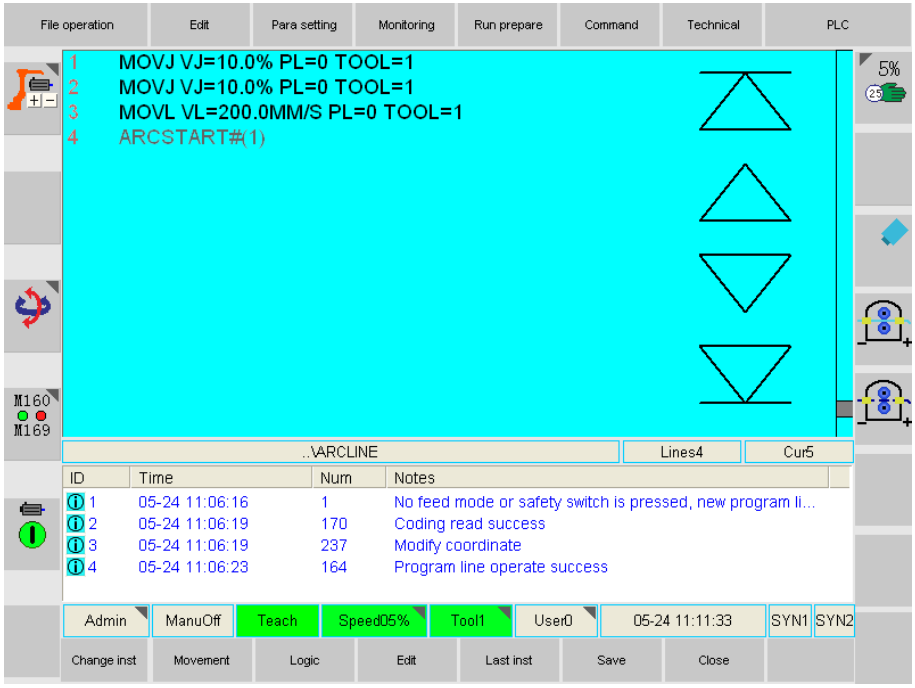
3.2.5 Arc start and swing

After the welding start point is determined, the arcing and swinging arc commands must be input. As shown below, select[Command]- <Welding> -<ARC START>.

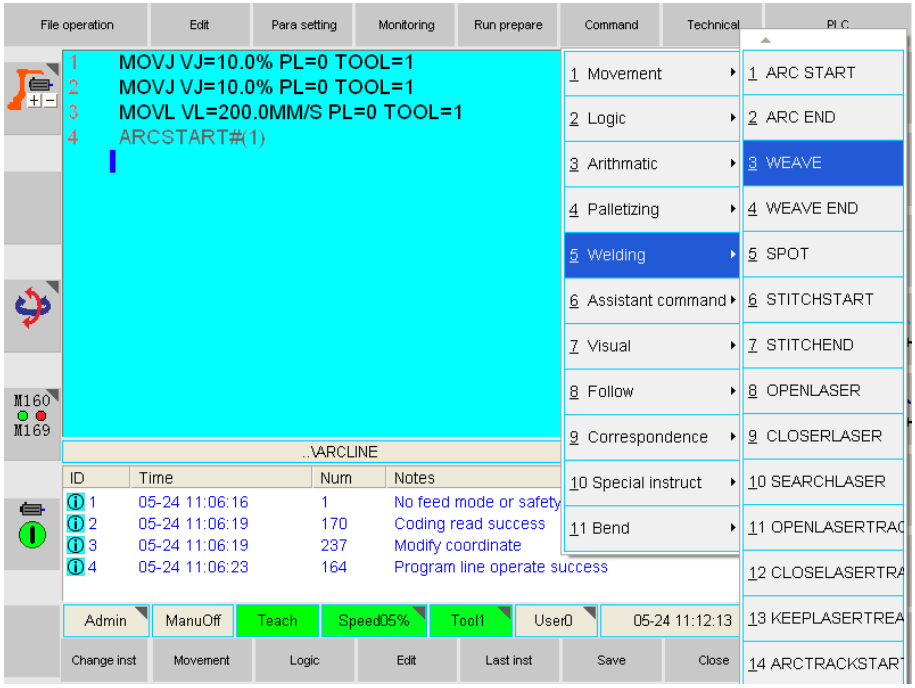


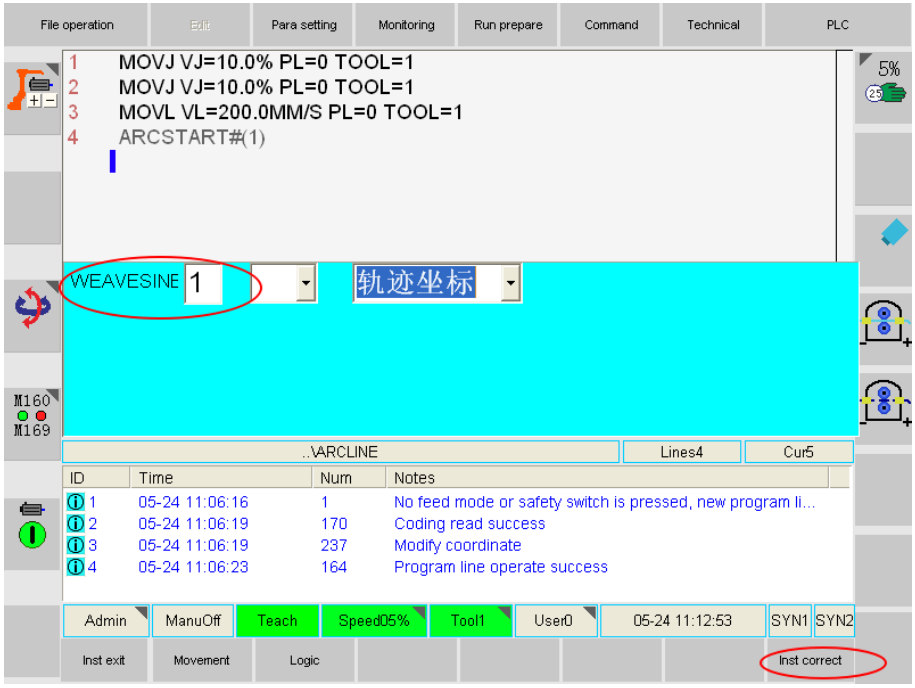


In the figure above, after inputting the file number of welding parameters in the arcing instruction, the arcing instruction is inputted according to the < instruction correct > as shown below.

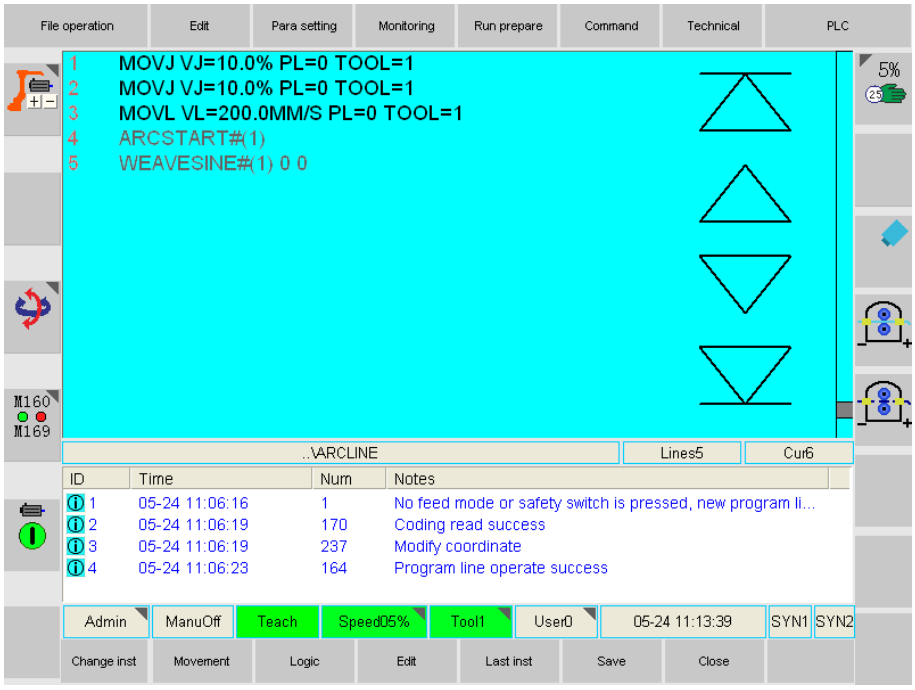


Complete the arcing command input, and then select[Command] -<Welding> - <WEAVE> as shown below.



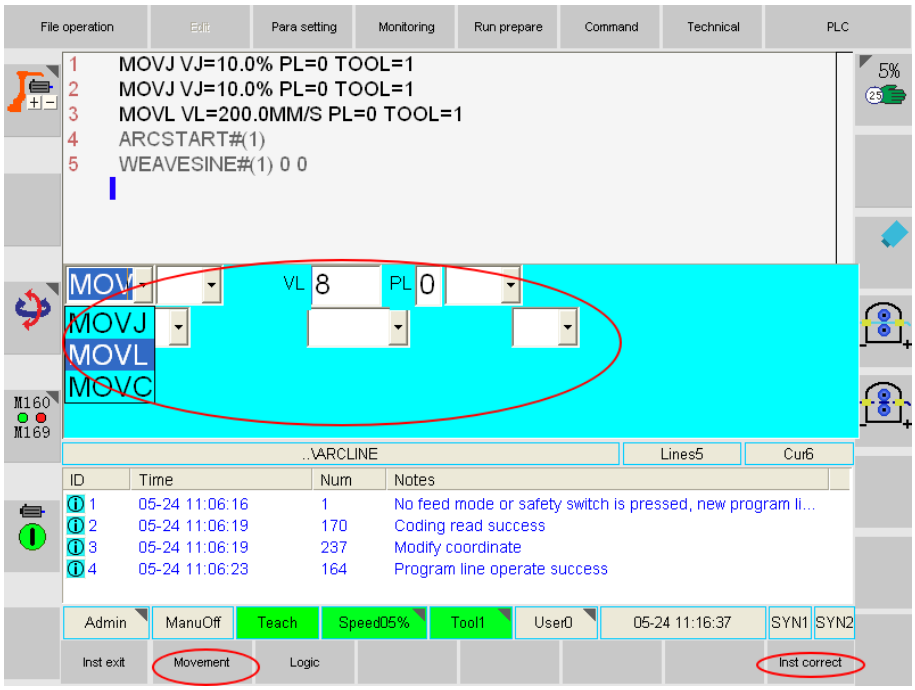


In the above figure, after entering the parameter file number in the pendulum arc command, press <inst Correct> to complete the pendulum arc command input, as shown below.

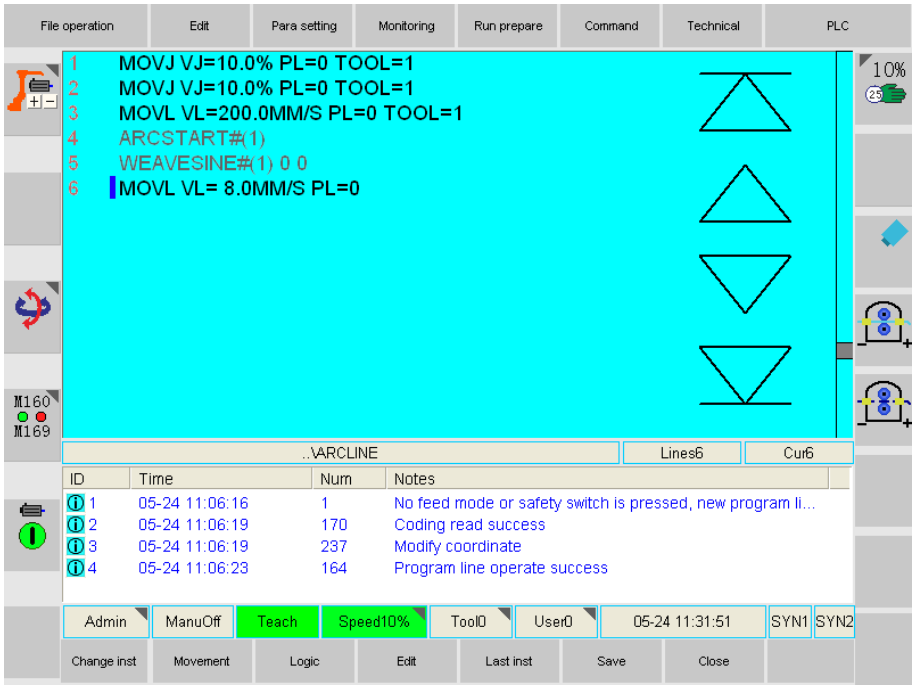


3.2.6 Program point 4

Adjust the manual speed, the robot in the rectangular coordinate mode  , press the safety switch, run the robot to program point 4, press the < movement > button in the following interface, select the [MOVL] mode, input the corresponding speed.



In the above interface, click the <inst correct> button to complete the point recording (in this case, press and hold the safety switch active state). As shown below.

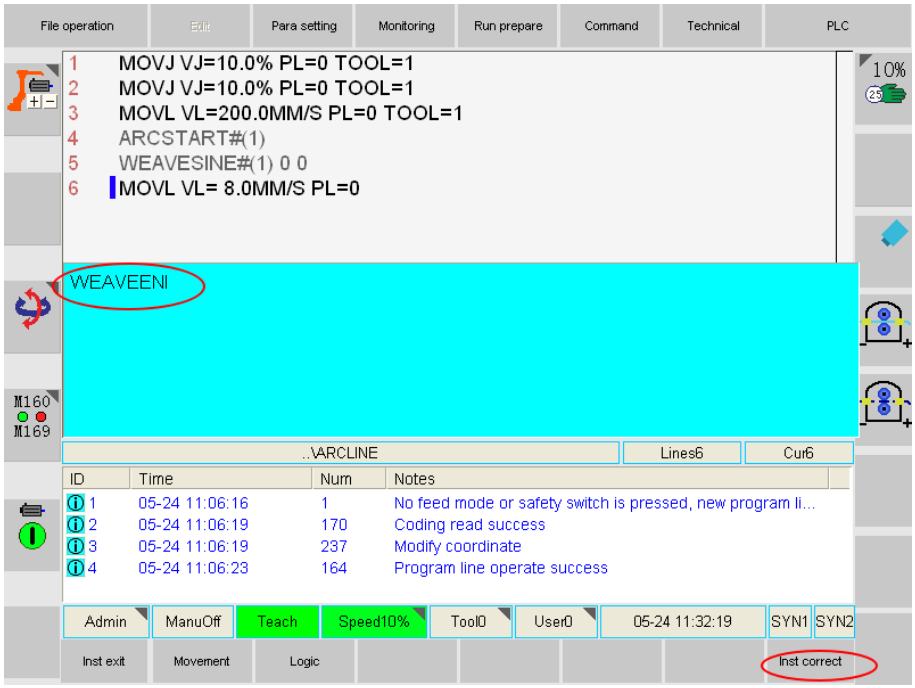


Note: This point is the welding end point. To ensure the swing function, the wire needs to be perpendicular to the welded forming surface.

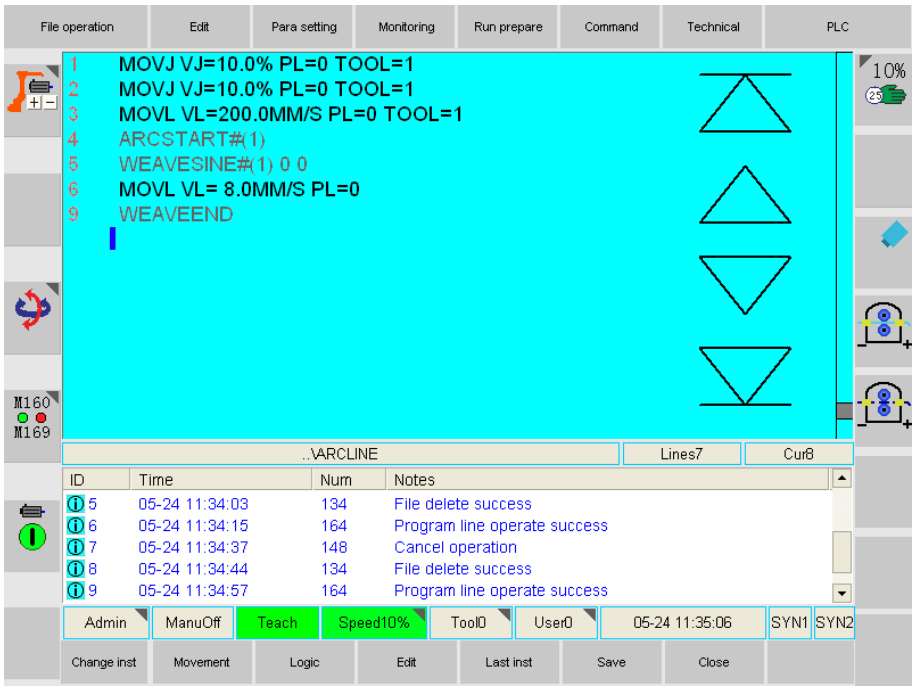
3.2.7 Arc end and weave end

After the welding end point is determined, you need to input the stop swing arc and arc extinguishing command (stop the arc and then extinguish the arc first).

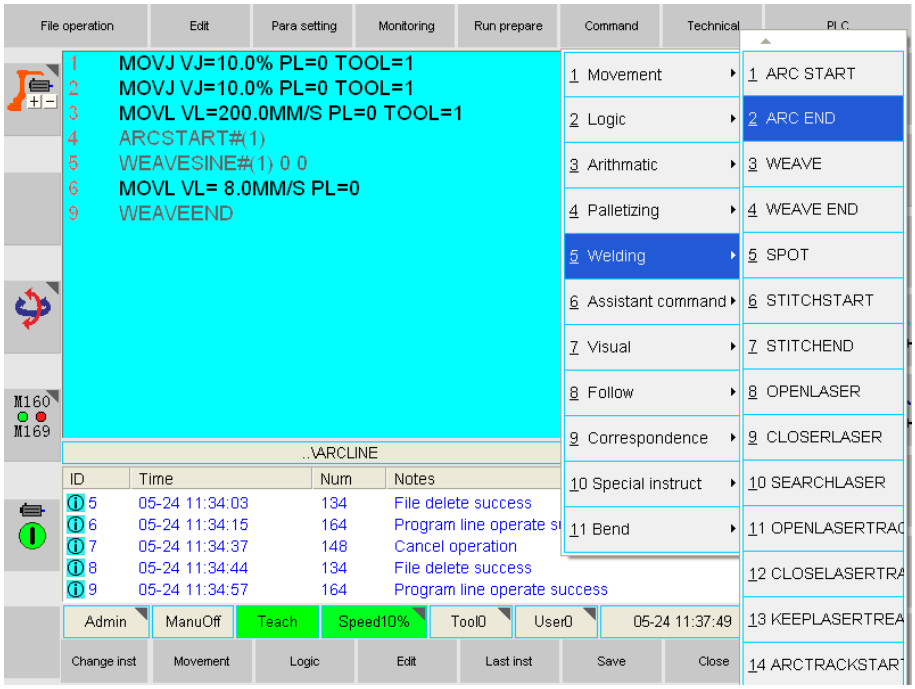
As shown below, select <command>-<Welding> -<WEAVE END>

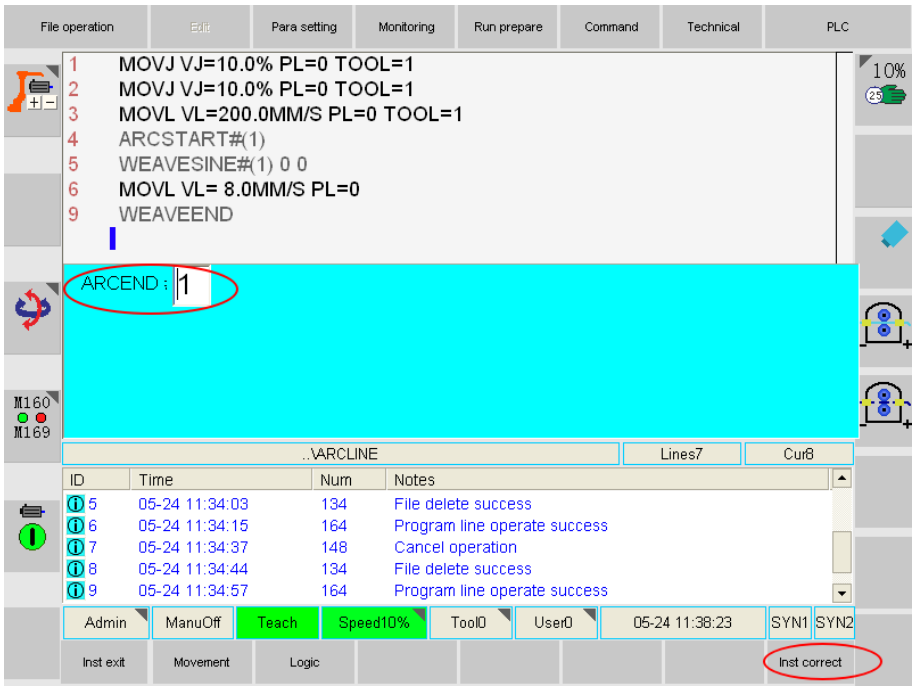


In the above figure, press <Inst correct > to complete the stop swing command input, as shown below.

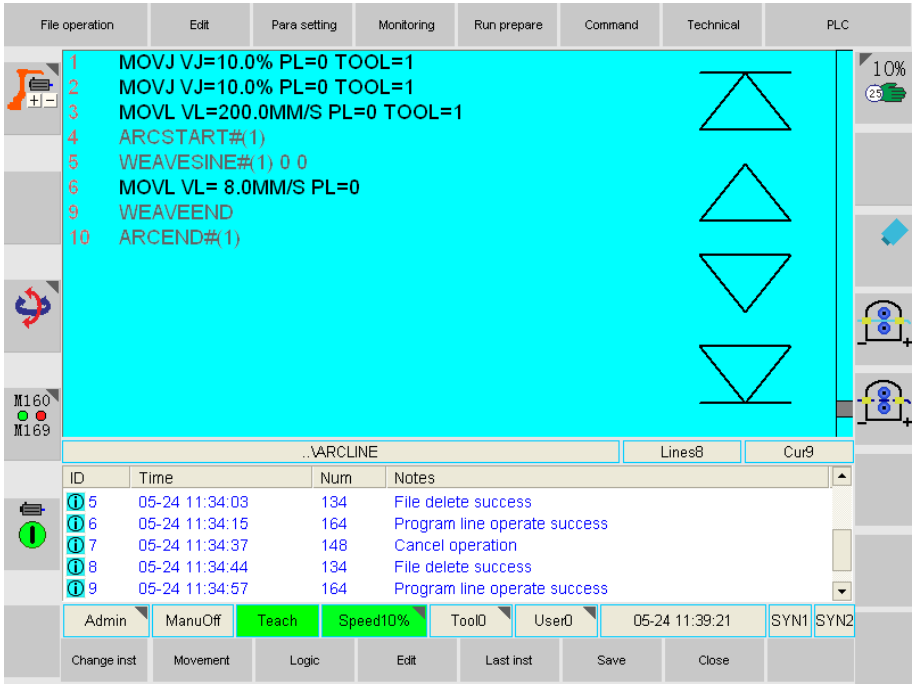


The arc extinguishing command must be input after the stop swing command input is completed. As shown below,Select <command>-<Welding>-<ARC END> .





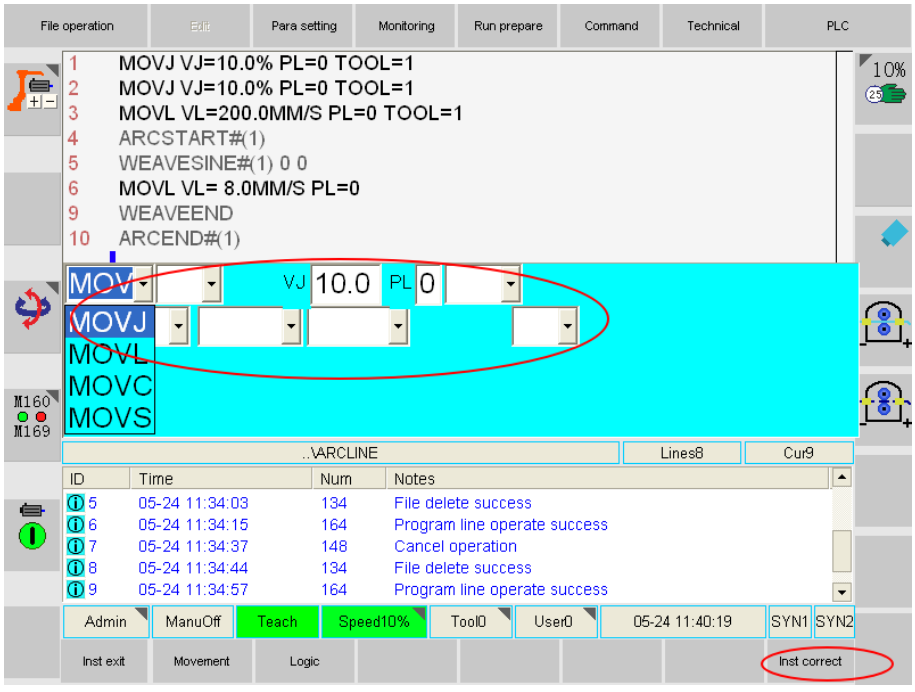
In the figure above, after inputting the file number of welding parameters into the arc extinguishing instruction, press < instruction correct > to complete the input of the start-up and extinguishing instruction, as shown below.



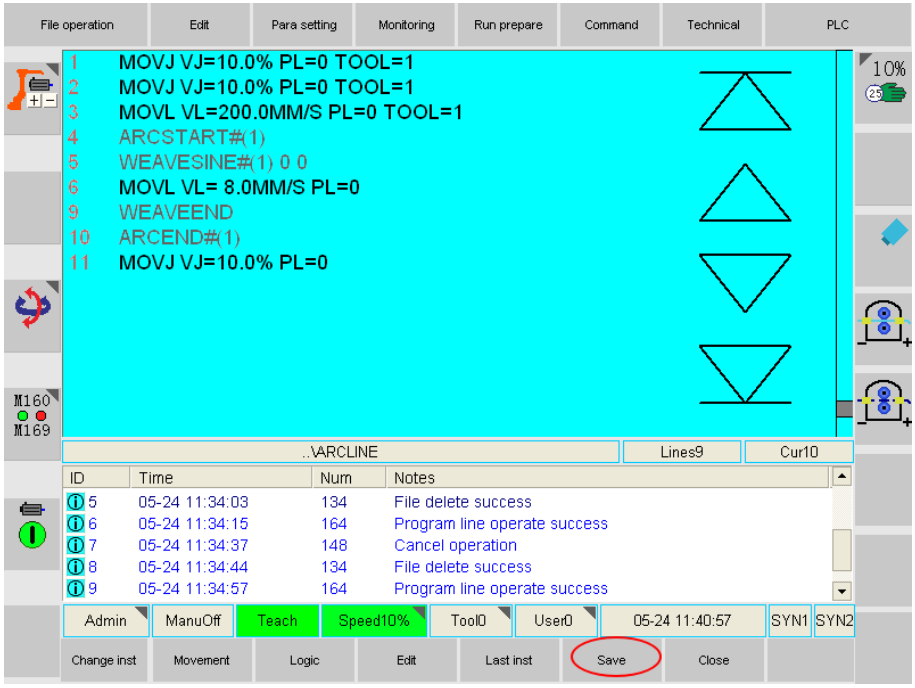
The arc extinguishing instruction input is completed.

3.2.8 Program point 5

Adjust the manual running speed, coordinate mode of the robot, press the safety switch, run the robot to program point 5, press the < movement > button on the following interface, select [MOVJ] mode, and input the corresponding running speed.



In the interface above, the point < instruction correct > button completes the point recording (at this time, the safety switch must be pressed in its effective state). The following diagram.



The program is edited and saved by pressing the < Save > button in the interface above.

3.3 Program commissioning verification

After the program editing is completed, the program should be tested in the teaching mode to verify the correctness of the program trajectory. The operation method is as follows:

In the teaching mode, open the programmed program.

Move the cursor to the corresponding program line.

Press the safety switch and hold the key all the time. The program will run at a low speed at the trial run speed.

NOTES
1. When the execution of the current program segment is completed, the cursor automatically moves to the next line. 2. The arc-starting, arc-extinguishing, swing-arc and stop swing-arc instructions can be tested. 3. Do not perform swing arc action during trial run

3.4 Program reappearance

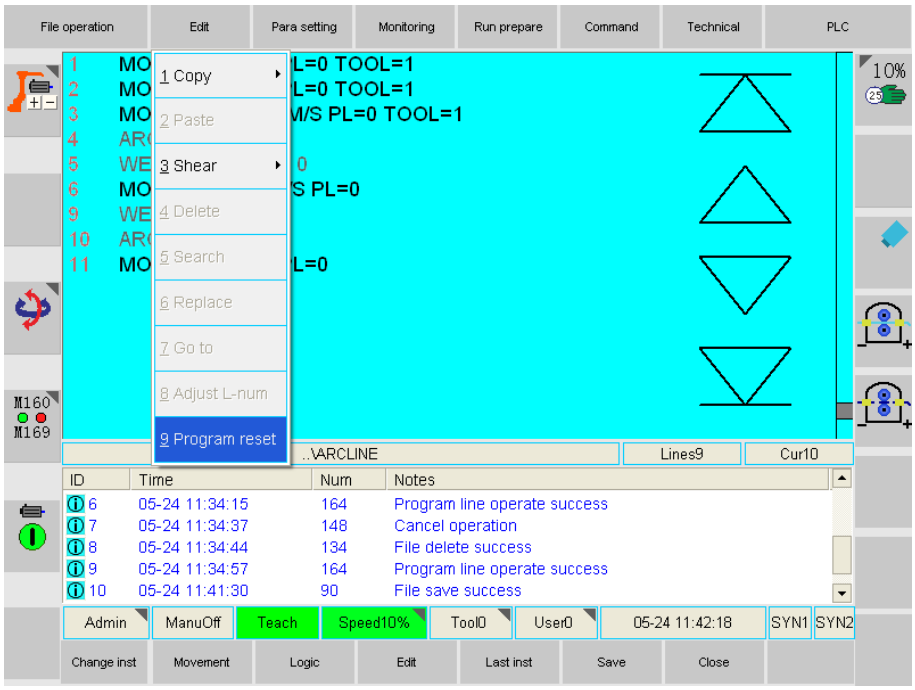
3.4.1 Non-arc operation

After the verification of trajectory operation is completed, the program should be executed automatically without arcing to verify whether the actual welding speed and the swing arc condition are correct.

ATTENTION
Special attention should be paid to the following matters, otherwise life accidents or equipment failures may occur. 1. Before running the program, we must ensure that there are no people around the robot. 2. Before running the program, it is necessary to ensure that there is no interference around the robot. 3. In the process of operation, be ready to press the emergency stop key at any time to ensure that abnormal operation of the machine is terminated quickly.

Open the program in [Teach mode] and move the cursor to the first line.
Switch to [Play Mode].
Adjust [Run Speed] and [Run Mode].
Switch the arcing state to  mode.
Press  this key to start the program

NOTES
1. Stop the program and press this button  . 2. After stopping the program in the middle, if you need to execute the program from the beginning, you need to perform <Program Reset> (as shown below), otherwise the welding program will continue to run from the stop.



3.4.2 Arcing operation

The actual welding speed and swing arc can be verified, and the actual welding operation can be realized.

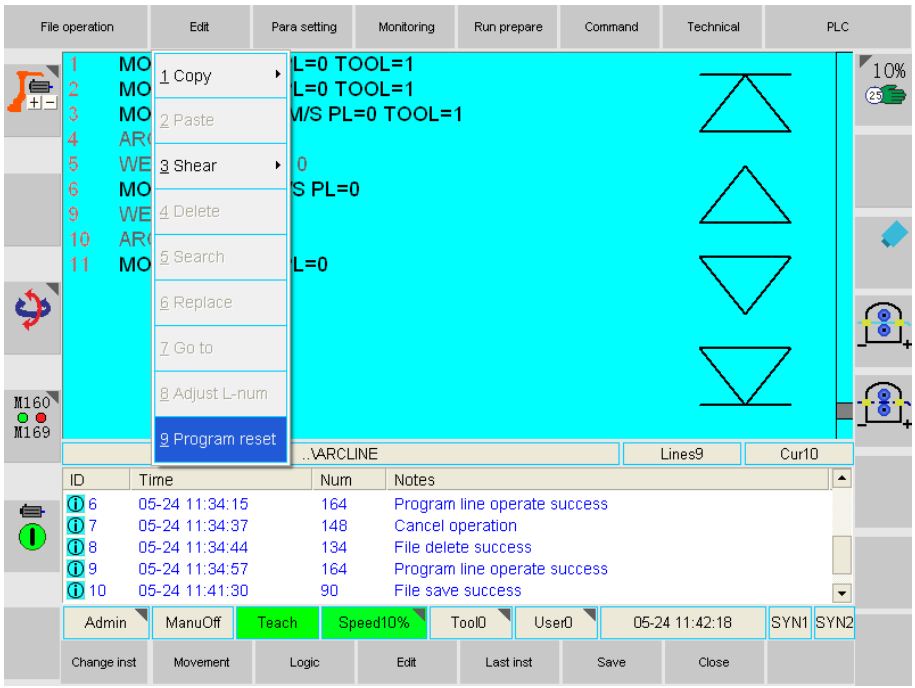
ATTENTION
Special attention should be paid to the following matters, otherwise life accidents or equipment failures may occur. 1. Before running the program, we must ensure that there are no people around the robot. 2. Before running the program, it is necessary to ensure that there is no interference around the robot. 3. In the process of operation, be ready to press the emergency stop key at any time to ensure that abnormal operation of the machine is terminated quickly. 4. Ensure the welding power supply and peripheral equipment run normally before operation.

Open the program under "Teach Mode" and move the cursor to the first line.
Switch to [Play Mode].
Adjust [run speed] and [run mode].

Switch arcing state to this mode  .

Press  this key to start the program

NOTE
1. To stop the program halfway, you need to press this key  . 2. After stopping the procedure in the middle, if the procedure needs to be executed from the beginning, <program reset> (as shown below), or the welding procedure will continue to run from the stop.

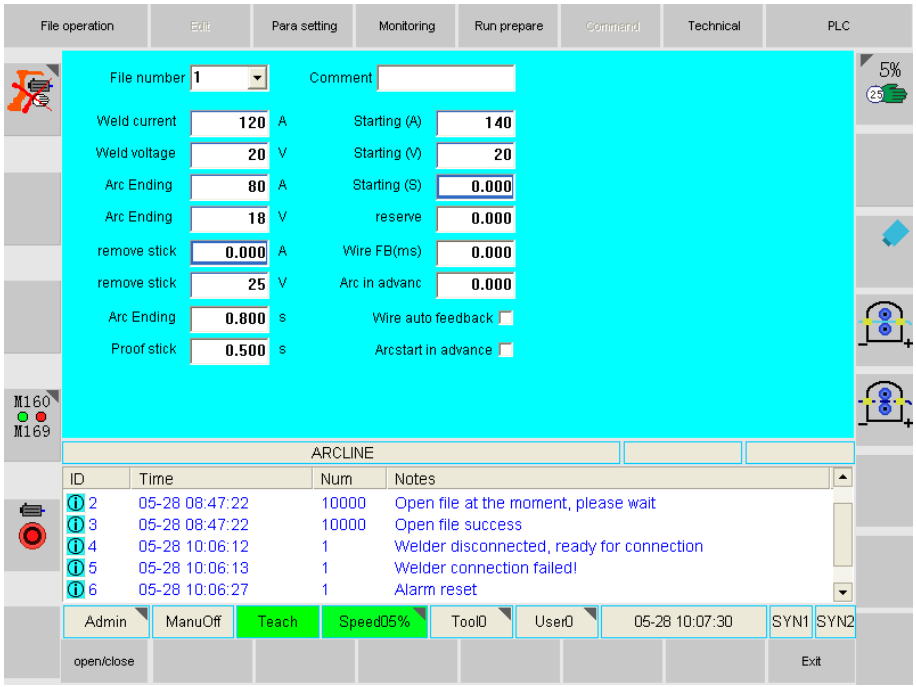


3.5 Welding effect adjustment

After actual welding, the welding parameters can be adjusted according to the welding effect.

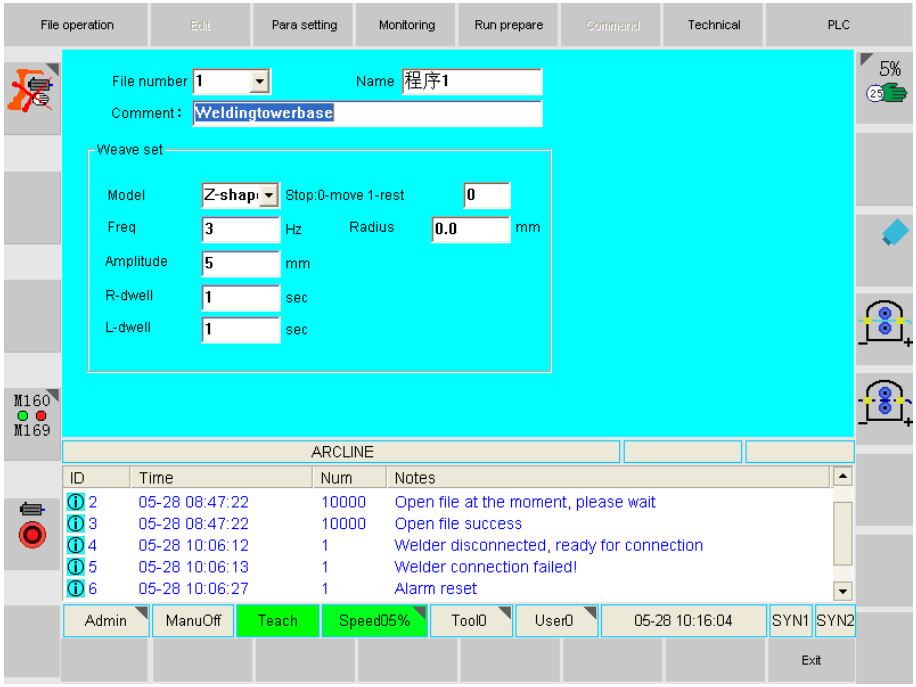
3.5.1 Adjustment of welding current and voltage

Adjust in the corresponding parameter file, as shown below.



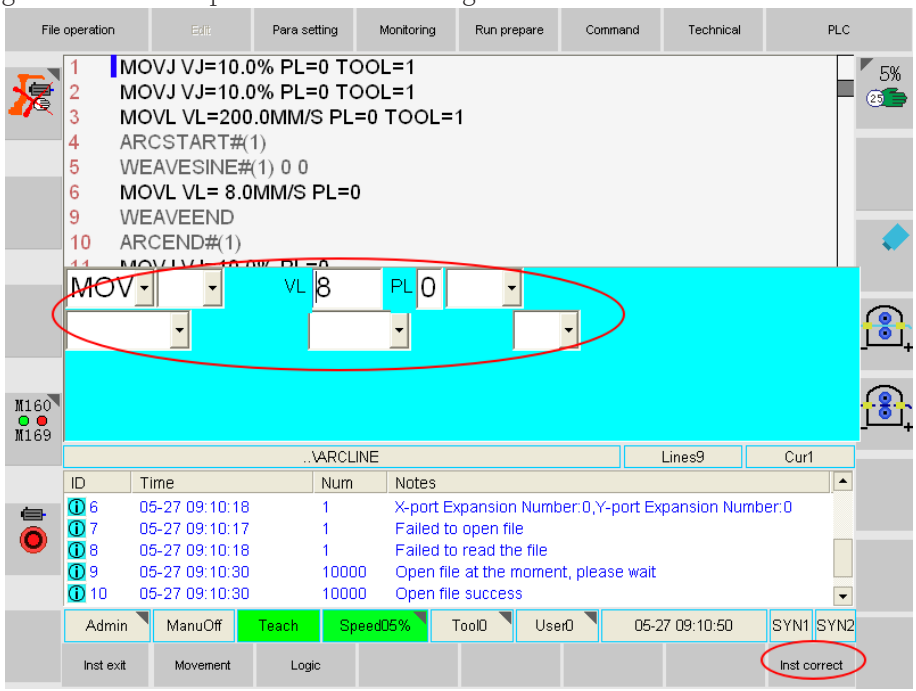
3.5.2 Adjustment of Welding Swing Arc Frequency and Amplitude

Adjust in the corresponding file number, as shown below.



3.5.3 Adjustment of welding speed is realized by modification degree

In the program interface, move the cursor to the corresponding program line and press the Change Instruction to produce the following interface.



After inputting the corresponding speed into the above interface, the speed modification is completed according to < instruction correct >.

NOTES
The safety switch cannot be held down at this time, otherwise the program coordinates will change.

After the adjustment is completed, press this key to start the program and test the running effect.

Appendix:

1. The idea of pendulum arc: The pendulum arc needs two conditions, one is tool coordinate Z direction, which determines the Z direction of pendulum arc. The X direction of the pendulum arc is determined by the direction of the two robots'end. The swing arc is perpendicular to Z direction and the swing direction is perpendicular to X direction, that is, Y direction.

2. Welding process:

The program runs to arcstart

Judging that the welding switch is a switch (no detection of the following direct track, no control of welding)

Delayed Preparatory gas Supply Time to Open gas

Send out arc start signal

When the arc detection time exceeds, the confirmation signal is not received, and the alarm fails to start the arc.

Start detecting arc start success signal (time length: arc detection confirmation time)

Success signal is: start welding action.

After welding

Turn off the arc start signal and start delaying the air supply time at the same time

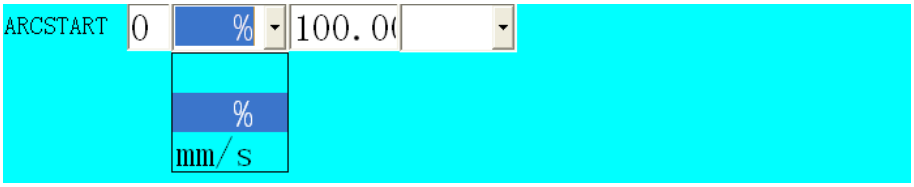
Delayed gas depletion time

The arc extinguishing is over.

Chapter 4.Welding related functions

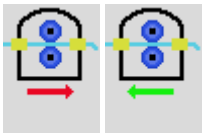
4.1 Speed and Rate Adjustment in Welding Process

Welding process speed: In the welding instruction, the speed of movement instruction can be set between the beginning of welding and the end of welding. The speed can be set to linear speed mm/s and multiple speed. Speed control can facilitate debugging and commissioning process. It runs at the actual speed of the instructions during commissioning and at the speed set by the welding instructions during actual welding.



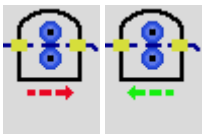
4.2 Manual wire feeding and withfeedback

In the display interface of the robot teaching box, there is a special wire feeding and wire withfeedback button, which can conveniently control the welding machine to feed and wire withfeedback under the manual state, and the speed of wire feeding and wire withfeedback depends on the setting speed of the welding machine. Convenient on-site adjustment of welding wire



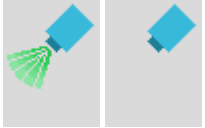
4.3 Jog wire feeding and wire feedback

In the display interface of the robot teaching box, there is a special push button for wire feeding and withfeedback. Under the manual state, wire feeding and withfeedback can be carried out at a fixed time according to the set time of wire feeding and withfeedback. The quantity of wire feeding at each point can be controlled, and the speed of wire feeding is determined by the set speed of the welding machine. It is convenient to adjust welding wire on site.



4.4 Gas detection

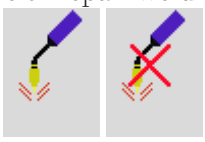
Gas detection: There are special gas inspection keys on the interface of the robot teaching box, which can conveniently inspect the condition of protective gas.



4.5 Simulated welding

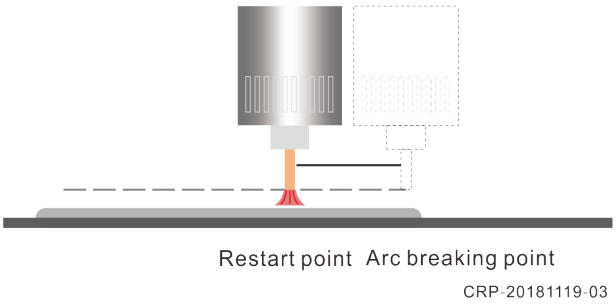
Simulated welding runs according to the actual welding trajectory, but does not start arc,

wire feeding,gas feeding operation. The welding trajectory and speed are the same as the actual welding. Simulated welding has special keys on the interface of robot teaching box. It can be used to check welding procedure or repair welding.



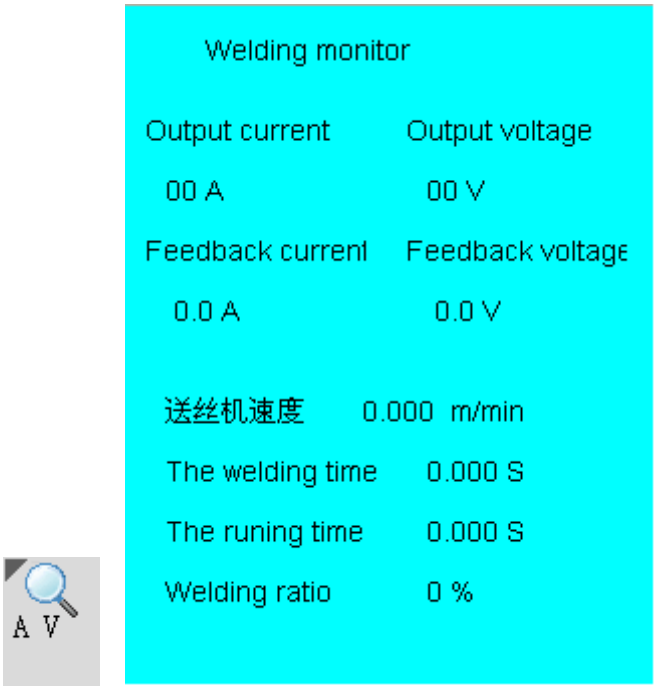
4.6 Arc break point retention

In the process of arc-breaking, the robot will automatically record the position of ARC-BREAKING point. After checking and eliminating the factors of arc-breaking, it will run the program again at the command line of arc-breaking. The robot will automatically run to the ARC-BREAKING point first, and then start the arc again. After program reset or welding reset, the saved arc breaking point will be cleared.



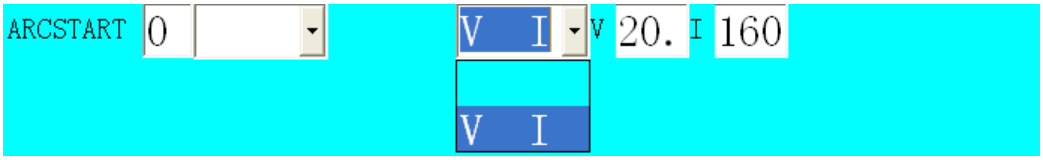
4.7 Welding monitoring

When the robot runs the welding procedure, the welding monitoring can be intuitively viewed: welding current, voltage, welding time, program running time, welding duty ratio and other parameters. It is convenient to analyze and optimize the program.



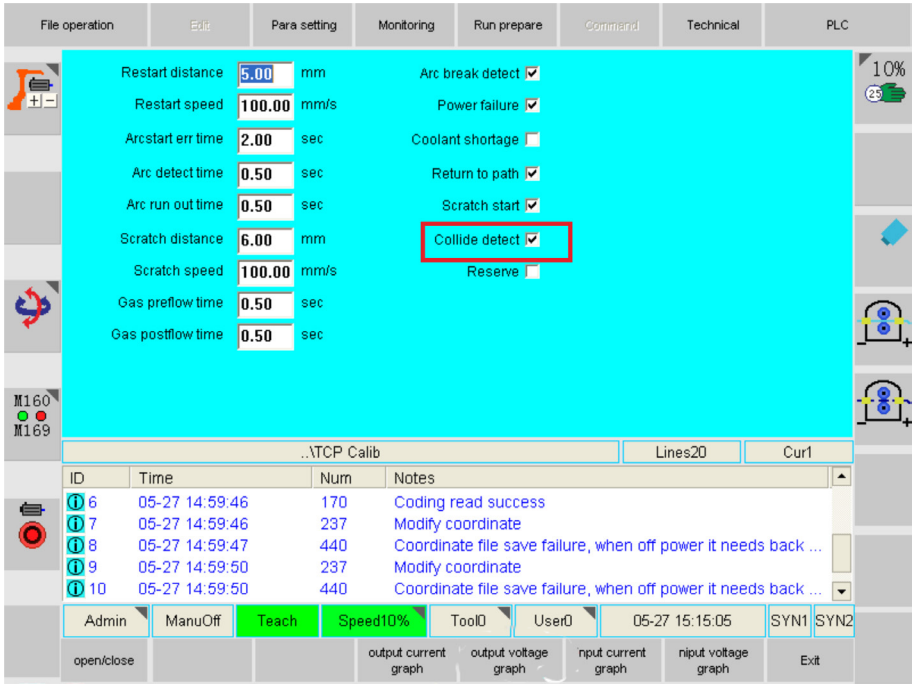
4.8 Welding parameter control:

Welding instructions support welding current and voltage regulation. It is convenient for customers to adjust welding parameters directly in welding procedure.



4.9 Collide detection (AF_SER)

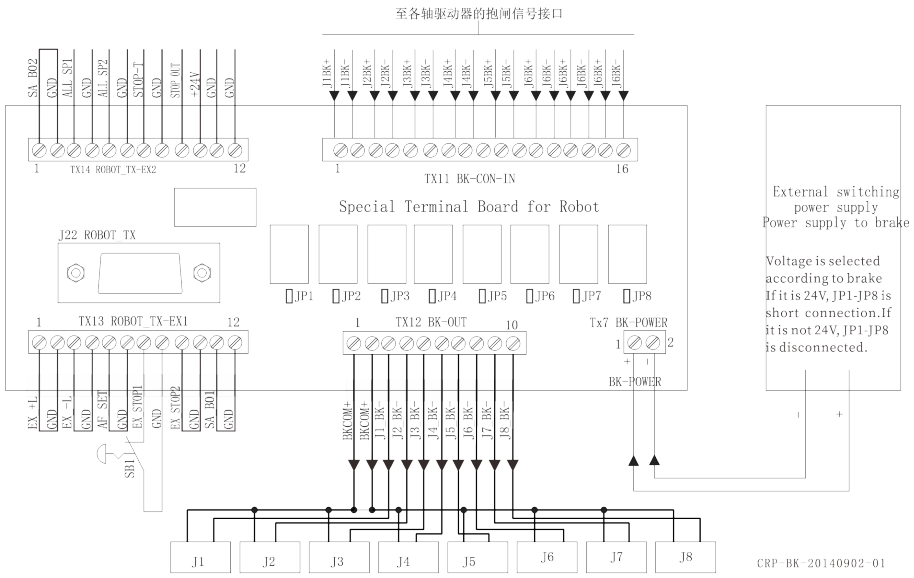
On the special terminal board for robots, there is a set of special [Collide detection] signal interface, which cooperates with the Collide detection switch attached to the welding torch or other fixture. When the welding torch or fixture collides with the workpiece or tooling, the robot can be stopped in time to avoid the damage of the equipment to the greatest extent.



Detection switch

·Collide detection

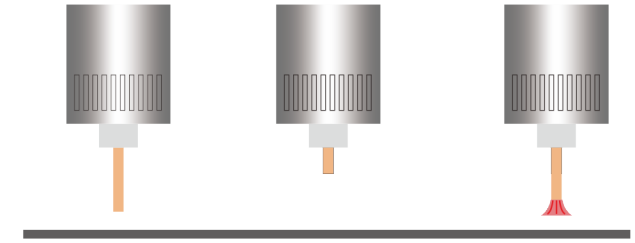
After clicking the check box, open the Collide detection function

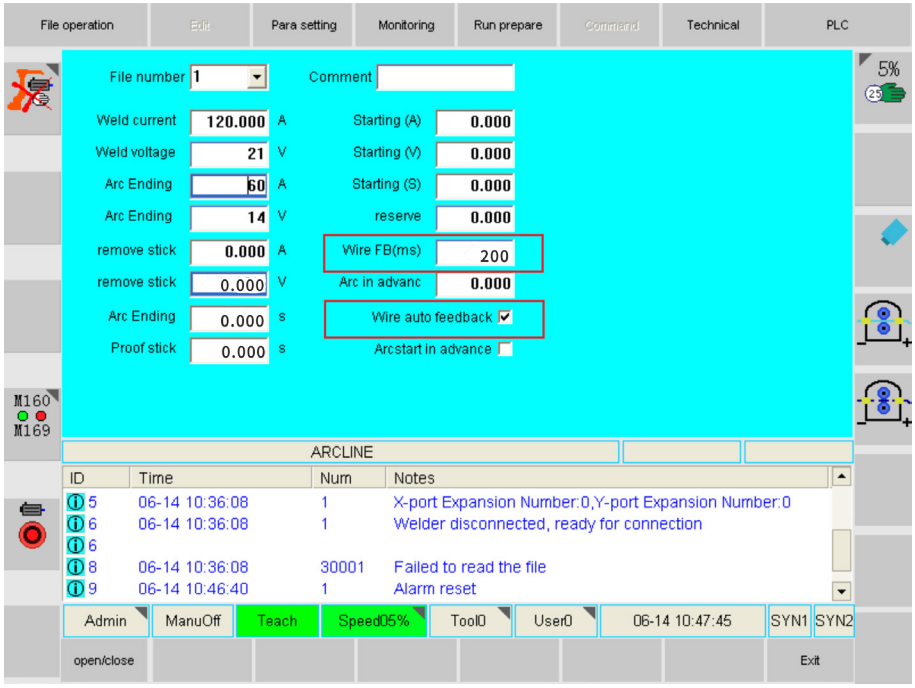


Anti-collision Hardware Interface Location

4.10 Wire feedback

When this function is enabled, the welding wire will automatically retract when the robot moves to the next weld (empty travel) after the completion of one weld, so as to avoid collision with workpiece or fixture and lead to the occurrence of wire bending, so as to realize the smooth arc initiation of subsequent welding.





Wire feedback setting

·Wire FB (ms)

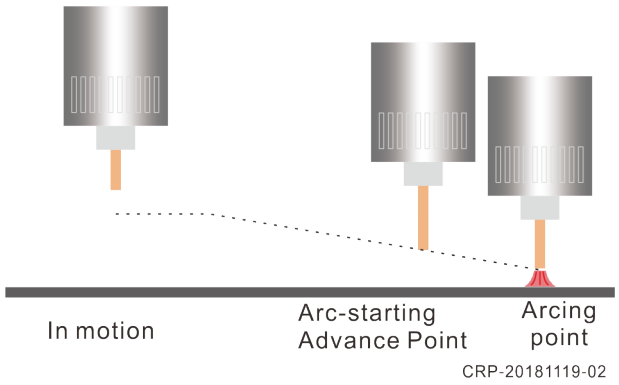
The existing function only supports the unit of ms, and the setting value is the duration of the spinning action.

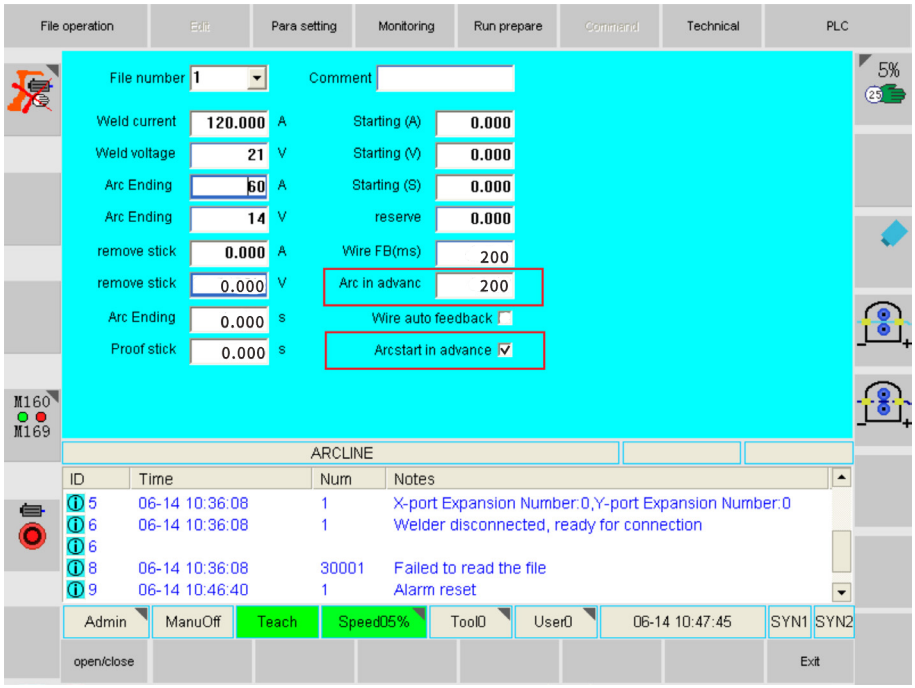
·Wire auto feedback

After the check box is clicked, the welding is completed and the spinning function is turned back.

4.11 Arc in advance

In general, when the robot reaches the starting point of welding, the robot stops and gives arcing instructions. The wire feeder slowly feeds the wire forward until the welding wire touches the base metal and successfully starts the arc. Flying arc initiation means that before the robot reaches the starting point of welding, it starts to execute arc initiation instructions and start slow wire feeding. When the robot reaches the starting point of welding, the welding wire and the base metal touch successfully to start arc. So the welding rhythm can be shortened.





Arcstart in advance setting

· Arc in advance time MS

Set the value of how long to start arc preparation before the start of welding. Arc is

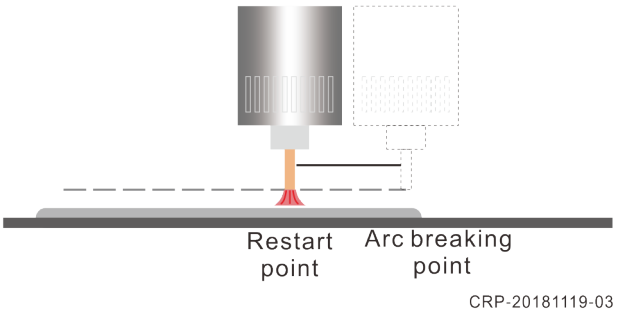
started directly when the welding position is reached.

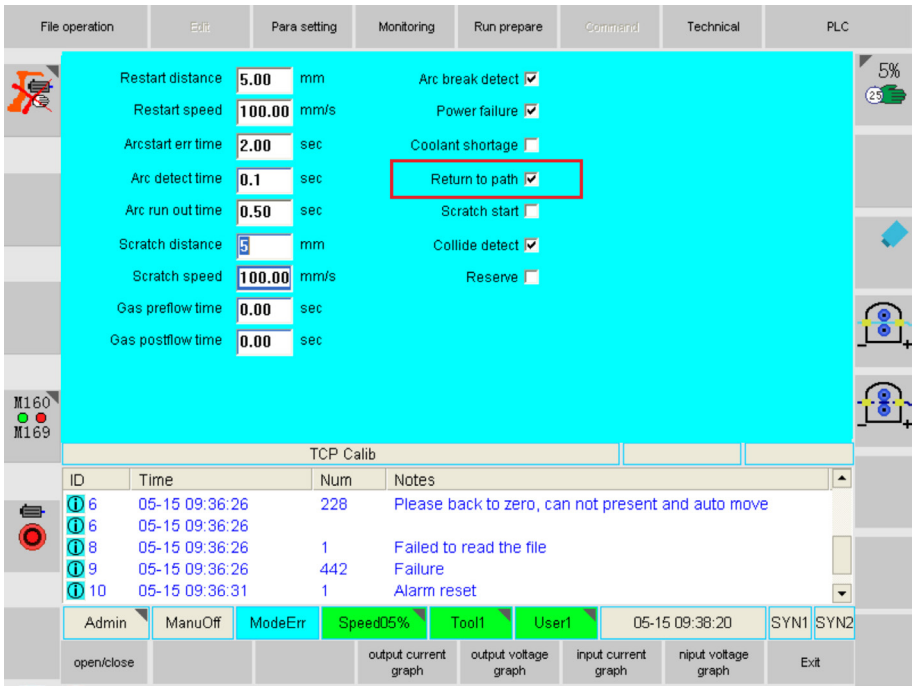
· Arc in advance

After clicking the check box, turn on the Flight Arc function

4.12 Restart (lap welding)

When this function is enabled, arc breaking or welding suspension occurs during the welding process. When it needs to be re-welded, the robot will automatically retreat a certain distance along the welding forward direction, and overlap with the previous arc stopping points to avoid bad results. This function is suitable for girth welding or welding of products with sealing requirements.





Rerurn to path switch

·Rerurn to path switch

After clicking on the check box, turn on the restart action function

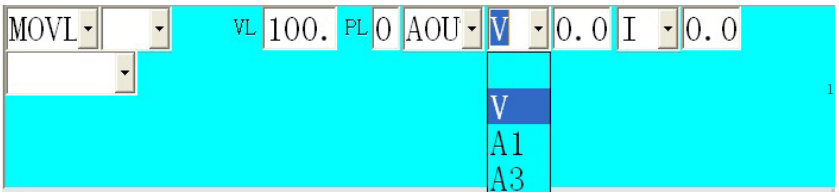
4.13.Welding Gradient\Jumping (AOUT V I)

Gradient function can be applied to welding occasions requiring gradient welding current and voltage.

During the execution of welding action, the current and voltage parameters of the welding machine can be controlled to increase or decrease gradually, and the gradual change process is linear.

Examples of AOUT usage:

This additional item is used to output the specified analog value in the course or end position of the robot.



1) V I analog output:

V I analog output can only be used in the middle of welding instructions. When the command is not between the welding instructions, the system executes the command line, the system alarms, and prompts: no welding state, can not use AOUT to change the welding current and voltage in motion.

V corresponds to welding voltage and I corresponds to welding current. When this instruction is executed from the starting point to the end point, the analog voltage changes linearly from the welding voltage to the specified voltage.

Examples of procedures:

The welding current 200A corresponds to 4.95V, the welding voltage 20V to 4.95V, the welding current 400A to 9.95V, and the welding current 40V to 9.95V.

ARCSTART#（0）

MOVL VL=500MM/S PL=0 AOUT V=40.0 I=400.0A

ARCEND#（0）

Program Description: When the program is executed to the first line, A1A2 first outputs arcing voltage; at the end of the first line instruction, A1A2 analog output 4.95V (welding current and voltage). From line 2 to the end of the execution, the A1 A2 analog varies linearly from 4.95V to 9.95V. When the third line is executed, the voltage becomes the arc-extinguishing voltage.

It can be used in situations where welding current and voltage need to be changed.

2）A1 A2 analog output:

When this instruction is used between welding instructions, it will not take effect. The output of the system is set according to the welding process.

When not between welding instructions, the system executes until the end of this instruction line and then outputs A1 A2 corresponding analog. Abbreviated as Point-to-Point Output.

3）A3 A4 analog output:

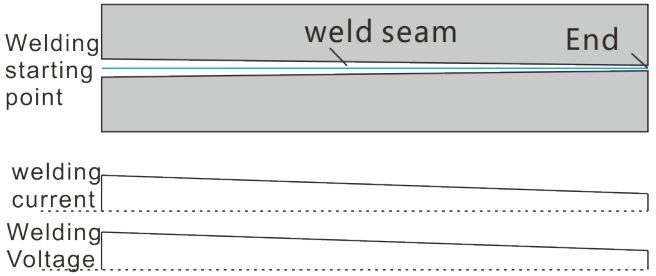
Whether between welding instructions or not, when the system executes this command line, the robot changes linearly from the starting point to the end point, and the A3 A4 analogue changes linearly from the starting point to the specified value of the end point command. Linear output for short.

Examples of procedures:

MOVJ VJ=30% PL=0 ； A point A3=0 A4=0

MOVL VL=500MM/S PL=0 AOUT A3=10.0 A4=10.0 ； B point

Program description: The robot moves from point A to point B, and the analog value of A3 A4 changes linearly from 0 V to 10 V.

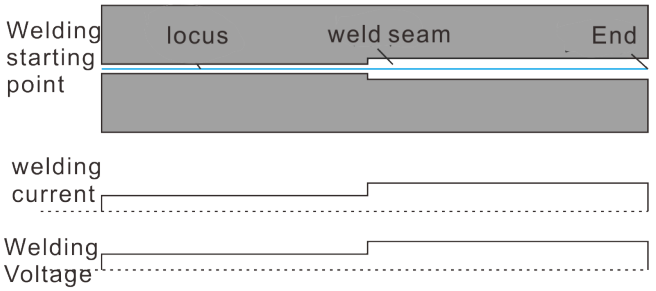


CRP-20181116-01

```
1    MOVJ VJ=100.0% PL=0
2    ARCSTART#(0) V= 20.00V I= 160.00A
3    MOVL VL=10.0MM/S PL=0 AOUT V=23.0 I=220.0
```

The jump function can be applied to complex weld welding, where different welding parameters are needed for each segment.

During the execution of welding action, the current and voltage parameters of welding machine can be controlled to jump up or down, and the jump process can be completed instantaneously.



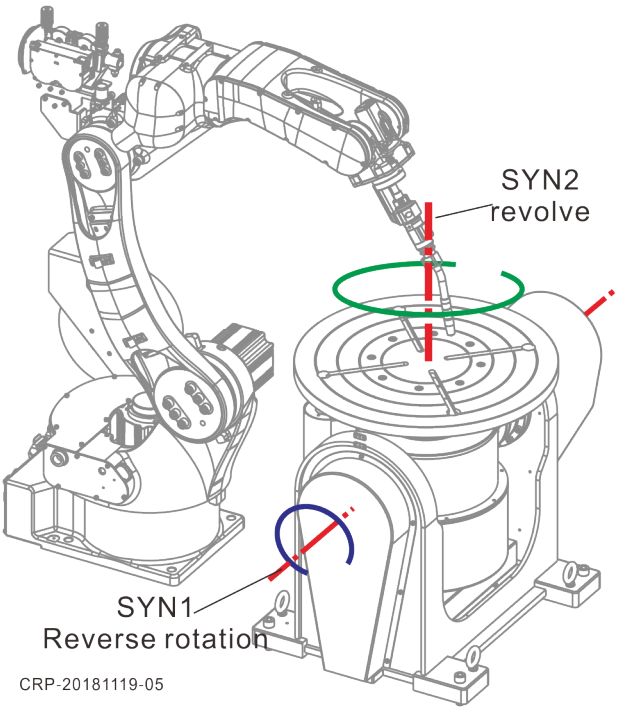
CRP-20181117-01

```
1    MOVJ VJ=100.0% PL=0
2    ARCSTART#(0) V= 20.00V I= 160.00A
3    MOVL VL=10.0MM/S PL=0
7    ARCSTART#(0) V= 23.00V I= 220.00A
6    MOVL VL=10.0MM/S PL=0
4    ARCEND#(0)
```

Chapter5.Cooperative Welding Function

5.1 Rotation synergy:

The external axis is a rotating shaft, and one or two additional rotating shafts can be externally mounted. The rotating shaft can be rotated and rotated, and the 7-axis and 8-axis is combined with the body 6 axis to perform interpolation motion. That is, during the movement of the external rotating shaft, the end of the robot can still maintain linear or circular interpolation motion. Applicable to applications where the robot's attitude coverage is insufficient, but continuous operation is required, such as: intersecting wire welding, full-face round welding, etc.



5.1.1 <Parameter setting>-<Mechanism parameter>:

28 additional axle: 0 closes additional axle; 1 opens additional axle (touch screen display does not need to set this parameter).

5.1.2 <Parameter setting>-<Servo parameters>:

55) 7-axis drive type: when set to a non-home parameter, the shaft acts as an additional shaft.

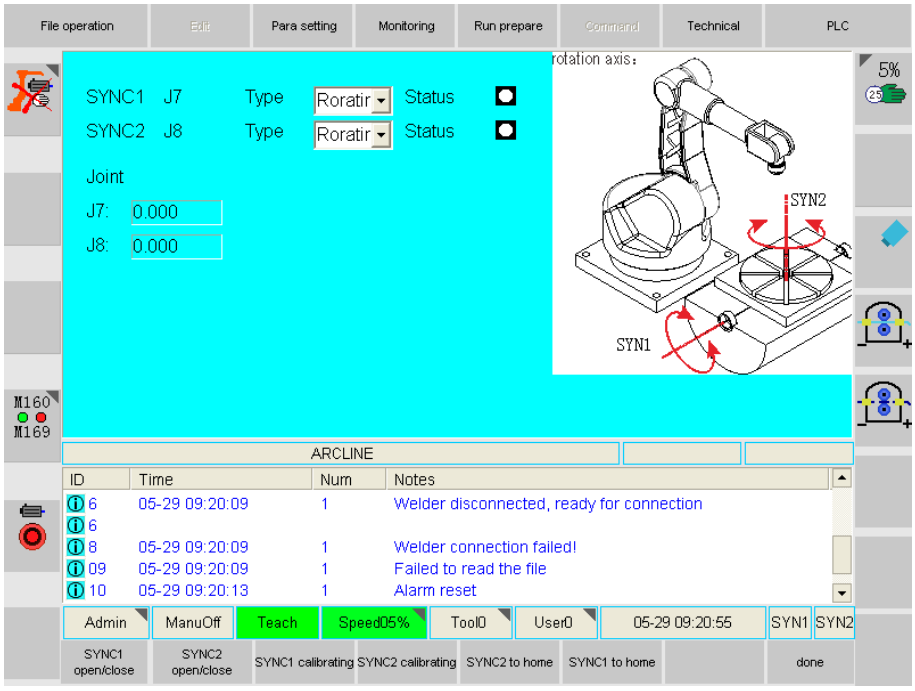
56) 8-axis drive type: when set to a non-home parameter, the shaft acts as an additional shaft.

Other relevant 7-axis and 8-axis parameters are set according to the actual situation.

5.1.3 Collaborative Page Description:

The calibration interface is divided into three interfaces: synergy 1, 2 switch interface, synergy 1 calibration interface, and synergy 2 calibration interface.

Click <Run Prepare>-<SYNC Coordination>-to pop up the synergy 1, 2 switch interface, as follows:



Interface Content Description:

[SYNC 1] J7 :

Represents the J7 axis used in collaboration with axis 1.

[SYNC 2] J8 :

Represents the J8 axis used in collaboration with 2 axes.

[Type] Rorating :

Represents that the current axis is a rotating axis.

[SYNC open/close] status:

When the switch state corresponds to the axle calibration state indicator ⬤, The switch state cannot be switched.Represents the opening (⬤) or closing (⬤) of the current axis coordinated state. Click on <Synergy 1 on/off> and <Synergy 2 on/off> to switch on or off the corresponding axis synergy state. This indicator has the same function as the corresponding axis calibration interface.

Description: When the switch state corresponds to the axis calibration state indicator ⬤, the switch state can not be switched.

[Joint]:

Represents the joint coordinate values of J7 and J8 axes for easy observation of the position of additional axes.

<SYNC 1 open/close>

Click this button to switch on and off coordinated with axis 1.

The function of this switch is the same as that of Synergetic Switching/Switching in Synergy 1 calibration interface.

The cooperative switching/switching in the cooperative setting of the additional axis is effective only in the teaching mode, and the manual action of the additional axis is effective. When the reproduction runs, it runs according to the additional instructions of the program

line (COORD, COORD1, COORD2).

<SYNC 2 open/close>

Click this button to switch on and off coordinated with axis 1

The function of this switch is the same as that of Synergy 2 Calibration interface.

The cooperative switching/switching in the cooperative setting of the additional axis is effective only in the teaching mode, and the manual action of the additional axis is effective. When the reproduction runs, it runs according to the additional instructions of the program line (COORD, COORD1, COORD2).

<SYNC 1 Calibrating>:

Click this button to open the coordinated 1-axis calibration interface

<SYNC 2 Calibrating>:

Click this button to open the coordinated 2-axis calibration interface

<SYNC 1 to home>:

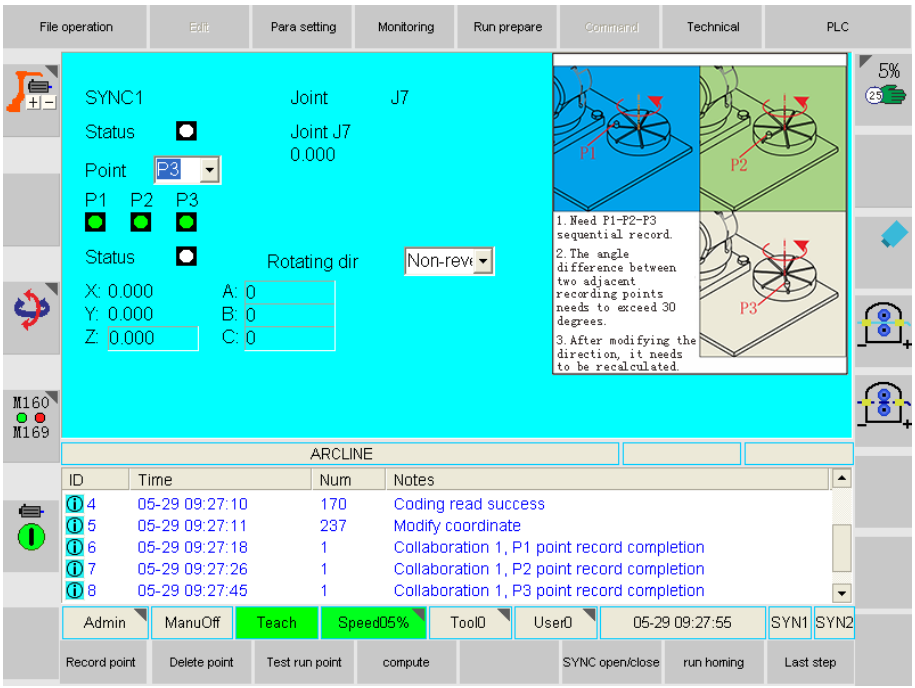
Press the safety switch, then press the button continuously, coordinate with the 1 axis corresponding to the J7 axis back to home. Release the button halfway and the robot stops running. This switch has the same function as the <running zero> in the coordinated 1-axis calibration

<SYNC 2 to home>:

Press the safety switch, then press the button continuously, coordinate with the 1 axis corresponding to the J7 axis back to home. Release the button halfway and the robot stops running. This switch has the same function as the <Run to Zero> in the coordinated 2-axis calibration interface.

<done>:

Click this button to exit the additional axis collaborative settings interface.



In the coordinated 1-axis and 2-axis switch interface, click the button of <coordinated 1-axis calibration> to open the coordinated 1-axis calibration interface, as shown in the figure above:

Interface Content Description:

[SYNC 1]:

Represents the current coordinated 1-axis calibration interface.

[Joints: J7]:

Represents the J7 axis used in collaboration with axis 1.

[Status]:

Represents Represents the status of the current axis calibration. When P1-P2-P3 points are calibrated and click < Compute >, the indicator becomes this , indicating that the axis calibration is completed.

Explanation: When the recordings of points P1, P2 and P3 are incorrect, this indicator will be changed to this one after clicking <calculation>.

[Joint J7]:

Represents the joint coordinates of J7 axis, which is convenient for observing the position of additional axis.

[Point]:

It is used to select the calibration points that need to be recorded. Using cursor keys, P1, P2 and P3 can be selected.

Explain:

1. When calibrating, it is necessary to strictly follow the sequence of P1-P2-P3.

2. At the same time, the angle difference between P1-P2 and P2-P3 needs to be greater than 30 degrees, otherwise it can not be calculated. The greater the angle difference, the higher the accuracy.

[P1 P2 P3] indicator:

Used to indicate the recording status of a point, when a point is recorded, the indicator below that point becomes like this .

[Status]:

Represents the opening ( ) or closing ( ) of the current axis coordinated state. Click < Synergy on/off > to switch on or off the synergy state. The function of this indicator lamp is the same as that of the [cooperative on/off] indicator lamp in the "coordinated 1-axis and 2-axis switch interface".

Description: When the switch corresponds to the axle calibration status indicator lamp ( ), the switch status can not be switched.

[Rotating direction]:

For switching the rotation direction of the cooperative axis, after each switching of the rotation direction, it is necessary to re-click the < calculation > button to calculate.

[X Y Z A B C]Calibration data:

Represents the calibrated data of the current axis. This data is for reference only and has no practical significance.

<Record point>:

Click on this button to record the data of the current position of the robot and the additional axis into the point selected by the [calibration point], and change the corresponding indicator from ( ) to ( ).

<Delete point>:

Click this button to clear the data of the selected point. At the same time, the corresponding indicator lamp changed from ( ) to ( ).

<Test run point>:

Click on this button, the robot and the additional axis move to the selected calibration point position.

<Compute>:

When the records of P1, P2 and P3 are completed, click this button to calculate the calibration data, and the indicator lamp changes to the calibration state. At the same time, the calibration data of [X Y Z A B C] shows the data.

<SYNC open/close>:

When the calibration point status indicator becomes ( ), click this button to turn on the synergistic state, and then the [synergistic on/off] indicator becomes ( ). Change (SYN1) to (SYN1) in the status bar. The function of this switch is the same as that of <Synergy 2 on/off> in "Synergy 1 and 2 axes switch interface".

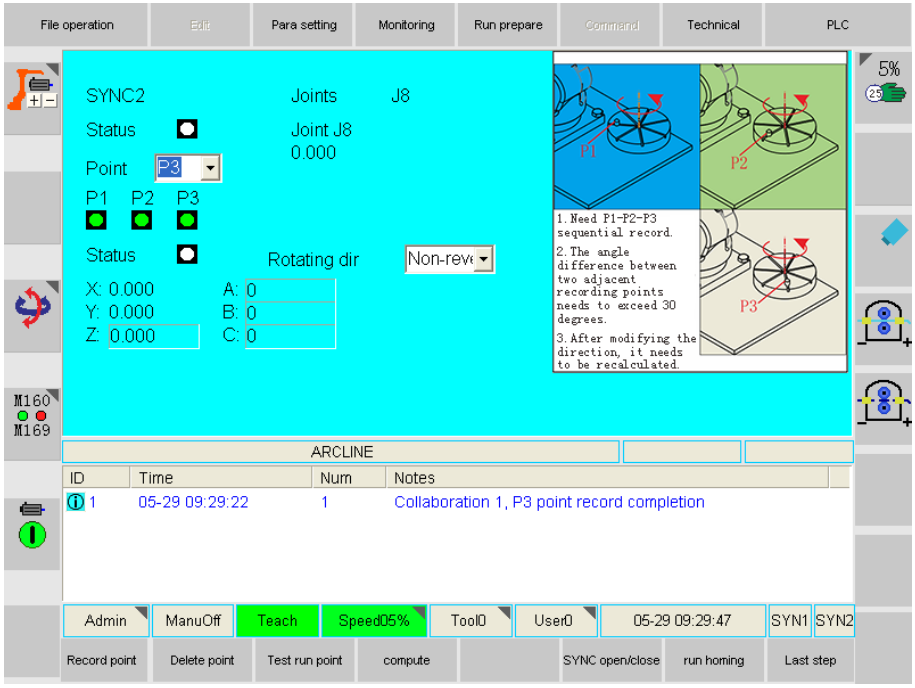
<Run homing>:

Press the safety switch, then press the button continuously, coordinate with the 1 axis corresponding to the J7 axis back to home. Release the button halfway and the robot stops running. The function of this switch is the same as that of <Synergy 1 runs to zero> in the interface of Synergy 1 and 2 axes switch.

<Last step>:

Click on this button and return to the coordinated 1 and 2 axis switch interface.

In the coordinated 1-2 axis switch interface, click the button of <coordinated 2-axis calibration> and open the coordinated 2-axis calibration interface, as shown in the following figure:



Interface Content Description:

[SYNC 2]:

Represents the current coordinated 1-axis calibration interface.

[Jionts: J8]:

epresents the J7 axis used in collaboration with axis 1.

[Status]:

Represents the status of the current axis calibration. When the P1-P2-P3 point is recorded, click < Compute > and the indicator changes to indicate that the axis calibration is completed

Description: When the recordings of points P1, P2 and P3 are incorrect, the indicator will change to ( ) after clicking < calculation >.

[Joint J8]:

Represents the joint coordinates of J7 axis, which is convenient for observing the position of additional axis.

[Calibration point]:

It is used to select the calibration points that need to be recorded. Using cursor keys, P1, P2 and P3 can be selected.

Explain:

1. When calibrating, it is necessary to strictly follow the sequence of P1-P2-P3.

2. At the same time, the angle difference between P1-P2 and P2-P3 needs to be greater than 30 degrees, otherwise it can not be calculated. The greater the angle difference, the higher the accuracy.

[P1 P2 P3] indicator:

Used to indicate the recording status of each point, when a point is recorded, the indicator below the point changes to ( ).

[SYNC open/close]:

Represents the opening ( ) or closing ( ) of the current axis coordinated state. Click < Synergy on/off > to switch on or off the synergy state. The function of this indicator lamp is the same as that of the [cooperative on/off] indicator lamp in the "coordinated 1-axis and 2-axis switch interface".

Description: When the switch corresponds to the axle calibration status indicator lamp ( ), the switch status can not be switched.

[Rotating direction]:

For switching the rotation direction of the cooperative axis, after each switching of the rotation direction, it is necessary to re-click the < calculation > button to calculate.

[X Y Z A B C] Calibration data:

Indicates the calibrated data of the current axis. This data is for reference only and has no practical significance.

[Record point:]

Click on this button to record the data of the current position of the robot and the additional axis into the point selected by the [calibration point], and change the corresponding indicator from ( ) to ( ).

<Delete Point>

Click this button to clear the data of the selected point. At the same time, the corresponding indicator lamp changed from ( ) to ( ).

<Test run point>:

Click on this button, the robot and the additional axis move to the point selected by the [calibration point], where the data will be recorded.

<Compute>:

When the records of P1, P2 and P3 are completed, click this button to calculate the calibration data, [calibration status] indicator becomes ( ), and [X Y Z A B C] calibration data shows the data.

<SYNC open/close>:

When the calibration point status indicator changes to ( ), click this button to open the collaborative state, and then the [collaborative on/off] indicator becomes ( ). Change (SYN2) to (SYN2) in the status bar. The function of this switch is the same as that of <Synergy 2 on/off> in "Synergy 1 and 2 axes switch interface"

<Run homing>:

Press the safety switch, then press the button continuously, coordinate with the 1 axis corresponding to the J7 axis back to home. Release the button halfway and the robot stops running. The function of this switch is the same as that of <Synergy 1 runs to zero> in the

interface of Synergy 1 and 2 axes switch.

<Last step>:

Click on this button and return to the coordinated 1 and 2 axis switch interface.

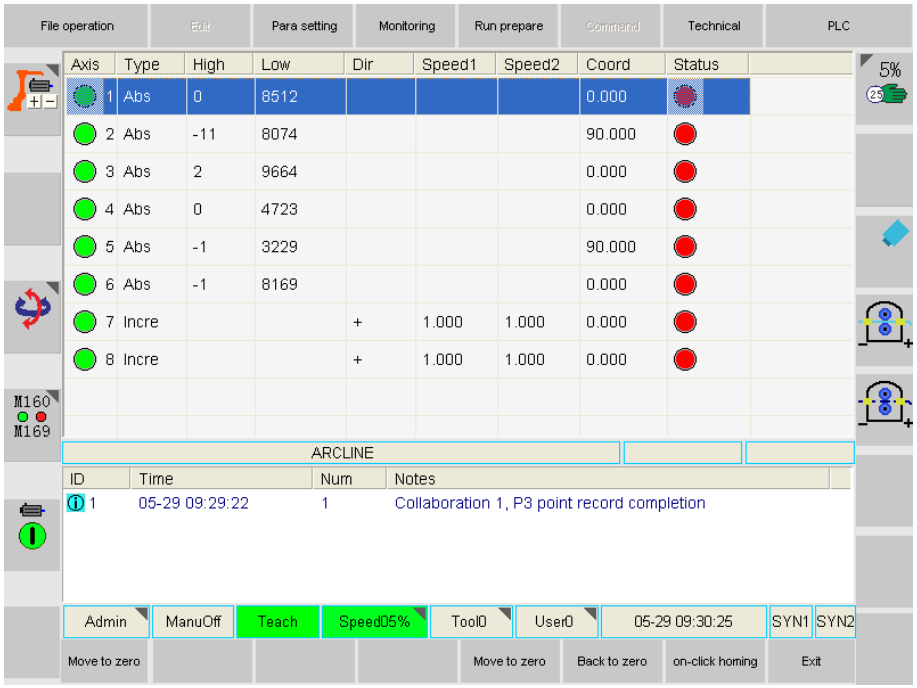
5.1.4 Synergism calibration:

When two additional coordinated axes are used, the coordinated 1 axis must be the J7 axis and the coordinated 2 axis must be the J8 axis. When only one additional coordinated axis is used, the coordinated axis 1 must be the J7 rotation axis

The calibration steps are described below according to the distance between two cooperative additional axes:

Back to home:

Click <Run Prepare>-<Robot home> to pop up the home setting interface as follows:



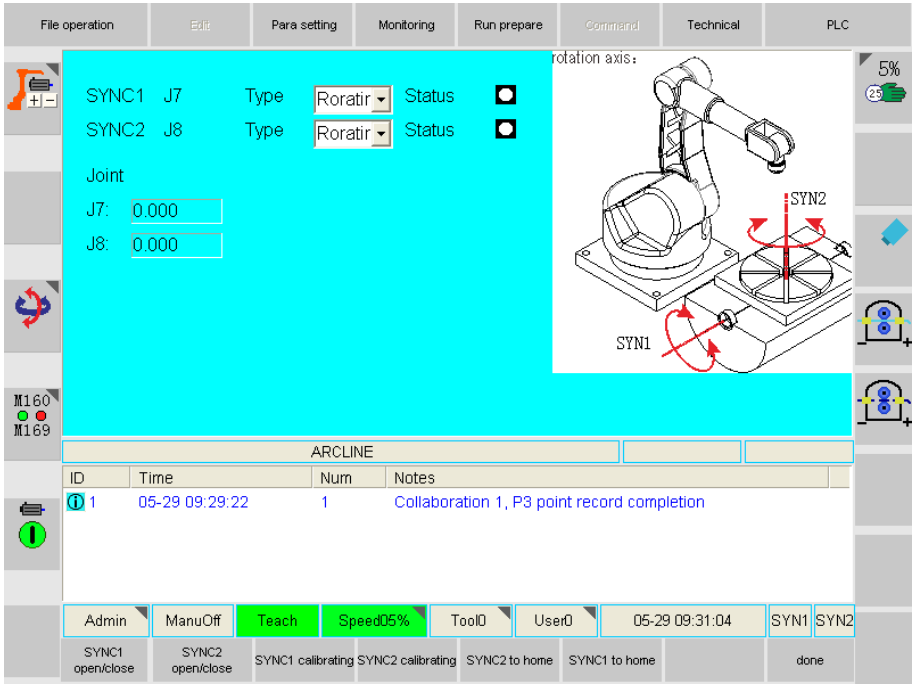
Press and hold the safety switch and hold down <Move to Zero> to return each axis to home, including the external additional axis.

Select tool coordinate number:

Click <Run Prepare>-<Tools Coordinate >, select a reasonable tool coordinate number in the tool selection interface that pops up, and click <Close>. Refer to the System Operation Manual for the specific operation of the tool coordinates.

Enter the Additional Axis Cooperative Setting Interface:

Click <Run Prepare>-<SYNC Coordinate>to pop up the synergy 1, 2 switch interface, as follows:

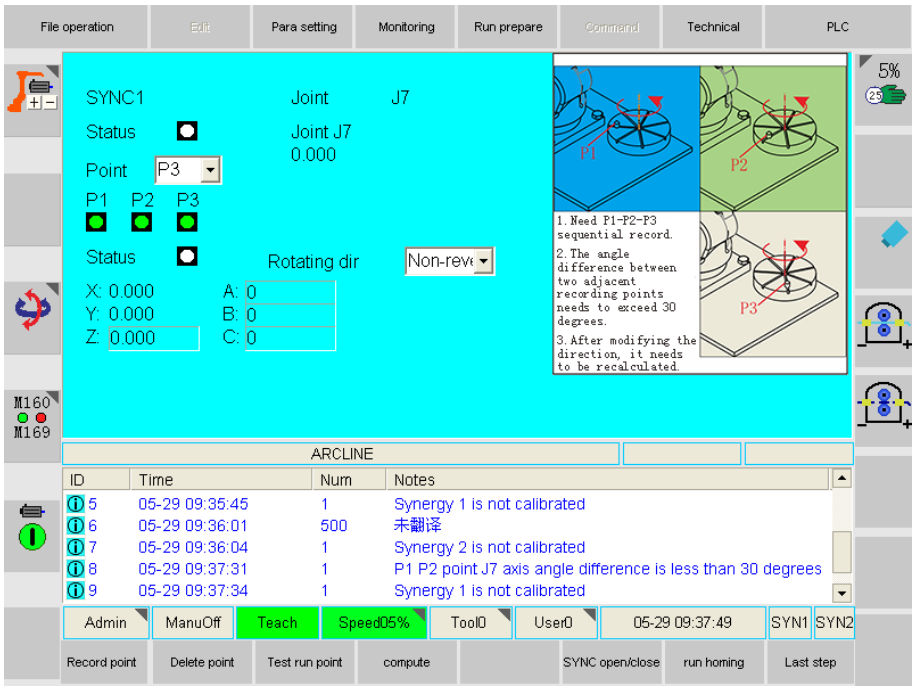


Verify that the J7 and J8 axes below [joint] are 0.

If it is not 0, you can press the safety switch, and then continue to press <SYNC 1 to zero> to run the synergy 1 axis to home; press the safety switch again, and then press <SYNC 2 to zero> to run the 2 axis to home. Observing the joint coordinate data in the interface, when the coordinates of J7 and J8 axes become home, it means that both axes return to home.

Enter【SYNC 1 Calibration Interface】:

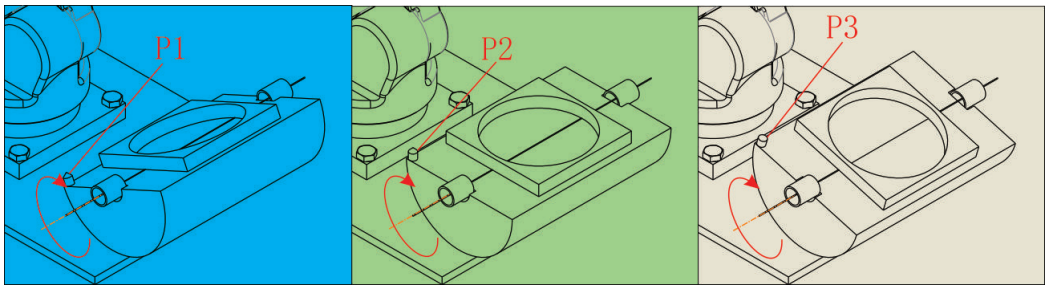
Click the <SYNC 1 Calibrating> button to bring up the SYNC 1 Calibration Interface as follows:



Move the cursor to [Point] and select the P1 point.

Record point P1:

Select a reference point on the coordinated 1-axis: J7-axis reversal positioner. As follows:



The record at point P1 was completed.Rotate the J7 axis to position P1 at the first point. Click on the XYZ mobile robot to make the end of the robot tool coincide with the reference point of the positioner. Click < Record the Current Point > and the light below point P1 changes to ( ). The record at point P1 was completed.

Record point P2:

Rotate the J7 axis to point P2 at the second point. Click on the XYZ mobile robot to make the end of the robot tool coincide with the reference point of the positioner. Click < Record Current Point > and the light below point P2 changes to ( ). P2 point record completed

Record point P3:

Rotate the J7 axis to point 3. Click on the XYZ mobile robot to make the end of the robot tool coincide with the reference point of the positioner. Click < Record Current Point > and the indicator light below point P3 changes to . The record of point P3 is completed.

SYNC 1 Calibration Note:

The calibration points must be strictly calibrated in the order of P1-P2-P3.

The angles of P1-P2 and P2-P3 are greater than 30 degrees, and those of P1-P3 are greater than 60 degrees. The greater the angle difference between the two points, the higher the accuracy.

In the process of moving and recording P1, P2 and P3 points, the attitude of the robot should be consistent. That is to say, the attitude of the tool should be adjusted before the point of P1 is recorded, and during the movement and recording of P1, P2 and P3, the attitude can not be changed any more.

In the process of calibrating points P1, P2 and P3, the coordinate system can use any coordinate system except joint coordinates.

If the reference point of calibration is on the coordinated 2-axis, the coordinated 2-axis can not be acted on when the coordinated 1-axis is calibrated.

5.1.5 Compute data:

Click on the <compute > button, after the calculation of calibration data is completed, [Status] indicator becomes ( ), at the same time, [XYZABC] below will display the calibrated data.

If the calculation is wrong, it will be prompted in the information prompt area, please follow the prompt information processing.

5.1.6 Verification direction:

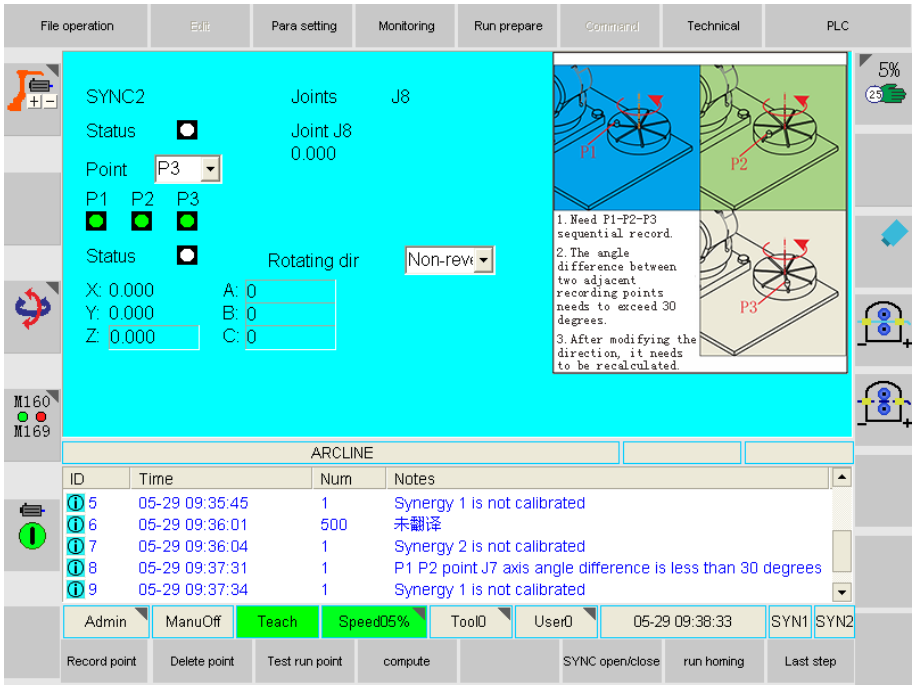
Click <SYNC open/close>, and the [SYNC open/close>] indicator will change to ( ), and the status bar will change from (SYN1) to (SYN1). At this point the robot and the additional axis 1: J7 axis are in a coordinated state.

Low-speed mobile J7 axis, observe the robot tool end and J7 axis movement direction is consistent, if consistent, then coordinated with 1 calibration.

If the direction is opposite, modify the direction of rotation of the coordinated axis and click < Compute >. Moving the J7 axis at a low speed, we observe whether the moving direction of the end of the robot tool is the same as that of the J7 axis. If the direction is the same, we will complete the calibration with 1.

Enter【SYNC 2 calibration interface】

Click <Last step> to return to the [SYNC open/close interface], click <SYNC 1 to home>, and the synergy 1 will run to home. Then click <SYNC 2 Calibrating> to enter the [SYNC 2 Calibration Interface]. as follows:



Move the cursor to [Point] and select point P1.

Complete coordinated 2-axis calibration:

Repeat 5) - 9) steps to complete the coordinated 2-axis calibration.

SYNC 2 calibration Note:

When coordinate 2 is calibrated, coordinate 1 axis must run to home, otherwise P1, P2 and P3 points can not be recorded.

The calibration points must be recorded strictly in the order of P1-P2-P3.

The angles of P1-P2 and P2-P3 are greater than 30 degrees, and those of P1-P3 are greater than 60 degrees. The greater the angle difference between the two points, the higher the accuracy.

In the process of moving and recording P1, P2 and P3 points, the attitude of the robot should be consistent. That is to say, the attitude of the tool should be adjusted before the point of P1 is recorded, and during the movement and recording of P1, P2 and P3, the attitude can not be changed any more.

In the process of calibrating points P1, P2 and P3, the coordinate system can use any coordinate system except joint coordinates.

When calibrating synergy 2, synergy 1 axis cannot be acted.

5.1.7 Collaborative use:

At present, the system can only use J7 and J8 axis interface as the cooperative additional axis.

The type of synergistic additional axis can only select the rotation axis.

When using a collaborative additional axis, the interface can only use J7. Just calibrate the J7 axis.

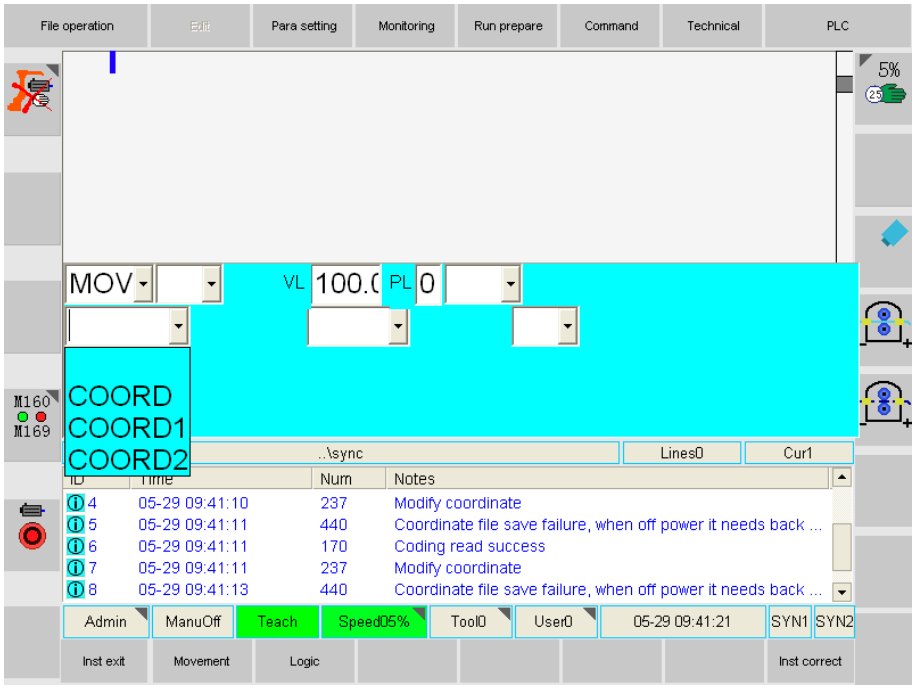
When two cooperative additional axes are used, the J7 axle can only be a Flip axis and the J8 axle can only be a revolving axle

In the teach mode, enter the interface of [SYNC coordinate]. Open SYNC 1 and SYNC 2. When the manual action cooperates with 1 or 2, the robot tool will cooperate with the additional axis action. The additional axes of the action robot do not move.

In the play mode, as long as the working program lines have COORD, COORD1, COORD2 additions, the current line program runs in a cooperative manner. It has nothing to do with the cooperative switching state of the additional axis cooperative setting interface.

5.1.8 Collaborative program editing:

The programming command line is as follows:



Explain:

COORD means that all external axes participate in cooperative motion; COORD1 means that only one axis is involved in cooperative motion; COORD2 means that only two axes are involved in cooperative motion.

When the instruction line has COORD, COORD1, COORD2 additions, the instruction line runs in a cooperative manner.

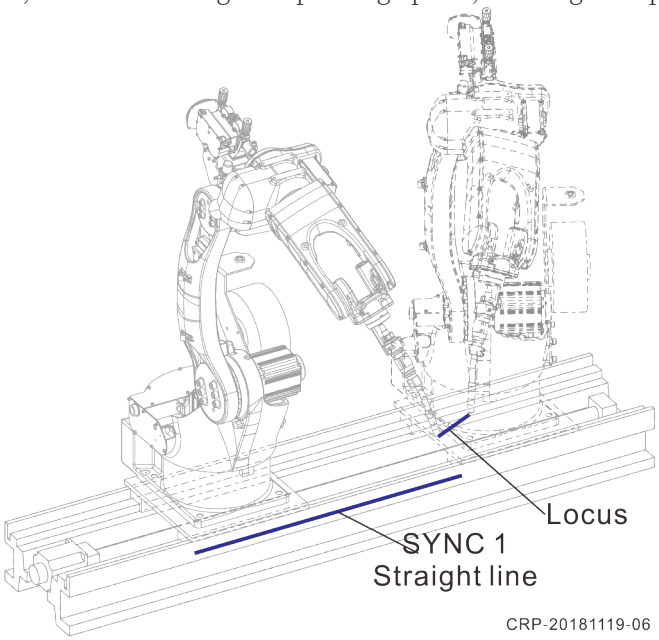
COORD only for MOVL, the MOVC instruction effective, invalid for MOVJ (plus not work). User coordinates will not be available after using the COORD add-on.

5.1.9 Examples of procedures:

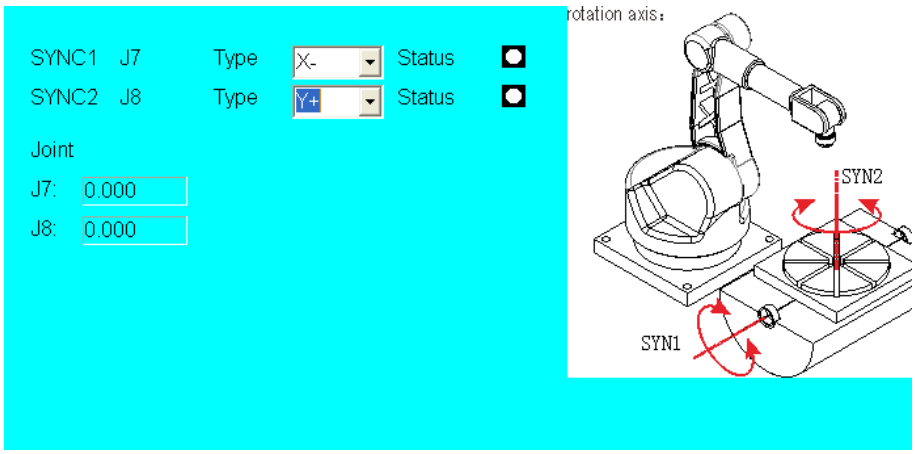
MOVJ VJ=50% PL=9 TOOL=2	Joints move to the starting point
ARCSTART#(0)	Arcing
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVC VL=100MM/S PL=9 TOOL=2 POINT=2 COORD	Arc Moving Cooperative Work
MOVC VL=100MM/S PL=9 TOOL=2 POINT=3 COORD	Arc Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
ARCEND#(0)	Arc breaking
MOVJ VJ=50% PL=9 TOOL=2 COORD	Joint movement leaving

5.2 Straight line coordination:

The exterior axis is a straight line axis, which can be attached to any direction or two directions coinciding with the geodetic coordinates X, Y and Z of the robot. The exterior axis and the six axes of the body together constitute 7/8 axes for interpolation. That is to say, the exterior linear axis can still maintain linear or circular interpolation motion at the end of the robot. It is suitable for applications where robotic arm is not fully developed, but needs continuous operation, such as welding of super-large parts, welding of super-long welds, etc.



5.2.1 J7 and J8 axis straight line cooperation mode selection

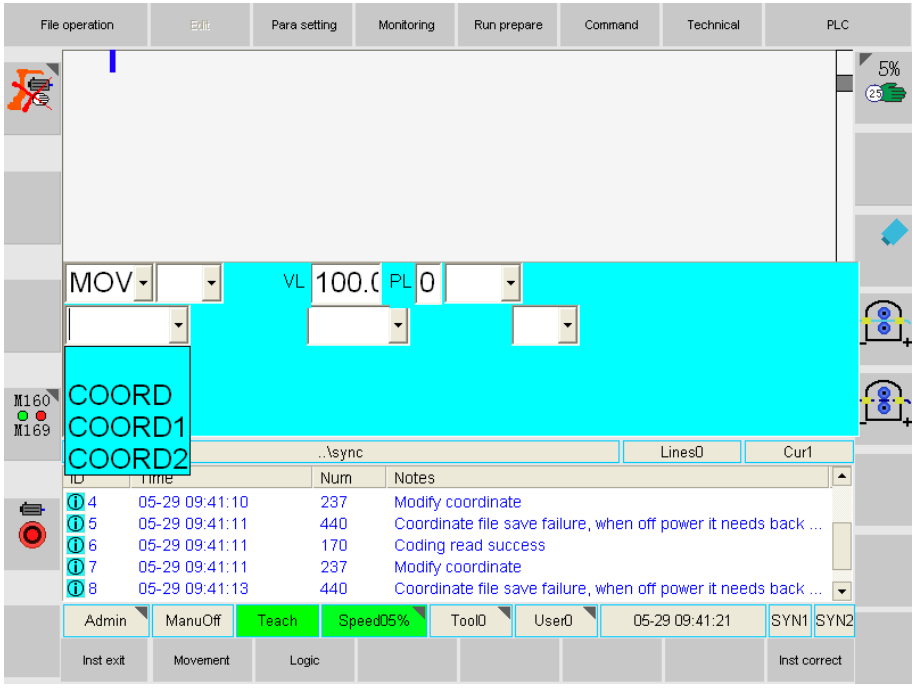


It only needs to be set up to coordinate the straight axis. Which axis of the straight axis coincides with the geodetic coordinates of the robot?

The linear axis does not need to be calibrated, only the deceleration ratio servo parameters of the linear axis need to be set to ensure that the system moves 1 mm along the linear axis.

5.2.2 Programming examples

The programming instruction line is as follows:



Explain:

COORD means that all external axes participate in cooperative motion; COORD1 means that only one axis is involved in cooperative motion; COORD2 means that only two axes are involved in cooperative motion.

When the instruction line has COORD, COORD1, COORD2 additions, the instruction line runs in a cooperative manner.

COORD only for MOVL, the MOVC instruction effective, invalid for MOVJ (plus not work).

After using the COORD add-on, the user coordinate system will not be available.

5.2.3 Example of program:

MOVJ VJ=50% PL=9 TOOL=2	Joints move to the starting point
ARCSTART#(0)	Arcing
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVC VL=100MM/S PL=9 TOOL=2 POINT=2 COORD	Arc Moving Cooperative Work
MOVC VL=100MM/S PL=9 TOOL=2 POINT=3 COORD	Arc Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
MOVL VL=100MM/S PL=9 TOOL=2 COORD	Linear Moving Cooperative Work
ARCEND#(0)	Arc breaking
MOVJ VJ=50% PL=9 TOOL=2 COORD	Joint movement leaving

Chapter 6.Fish scale welding function

6.1 Explanation of Fish Scale Welding:

Fish scales need to set the arcing detection confirmation time to 0. No arcing signal is confirmed.

Arc detection confirmation time, set to 0, can speed up the welding rate.

The detection time of arc extinguishing exhaustion is set to more than 0.5 seconds. If the arc extinguishing is unsuccessful, the alarm will be given. If you always call the police, set the time to a large extent.

Welding interruption arc detection is not selected. Does not detect the broken arc.

6.2 Fish scale welding instruction format:

STITCHSTART	T	Spot welding time	MS	L2	Empty distance	MM
	L1	Welding distance	MM			
STITCH END	Instructions for the end of fish scale welding					

6.3 Fish scale welding instructions:

STITCHSTART: Fish Scale Directive

T: Spot welding time, unit(MS), range:

L1: Welding distance, unit(MM), range:

L: Empty distance, unit(MM), range:

STITCHEND Instructions for the end of fish scale welding。

The fish scale welding command does not itself move the robot and can only be used in combination with the motion command MOVL MOVC in the welding command (ARCSTART). The fish scale function is invalid when combined with MOVJ. This instruction cannot be used in other processes.

6.4 Fish scale welding work instructions:

Example 1:

1 ARCSTART 0 : Arcing

2 STITCHSTART T 300MS L2 3MM : Fish scale welding start, spot welding 300 ms, 3 mm interval

3 MOVL VL=10MS/S PL=0 : Welding Locus and Fish Scale Welding Function Intervention.

4 STITCHEND : End of Fish Scale Welding Function

5 ARCEND 0 : Arc extinguishing

Work process:

After the first line is run, the system starts the arc according to the arcing process parameters, outputs the M190 signal, and then judges that M180 is valid according to the arcing confirmation time. Execute the second line of the program after it is valid.

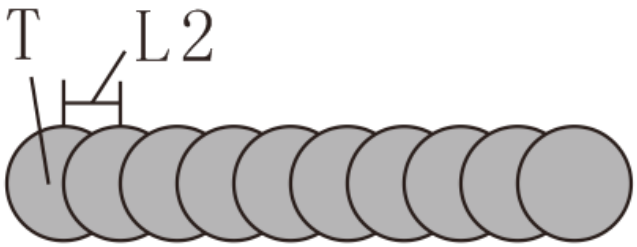
After the second line is executed. The system loads the relevant parameters in the fish scale instruction, such as T L2, etc.

The program runs to line 3. After system delay T time, M180 is invalid according to

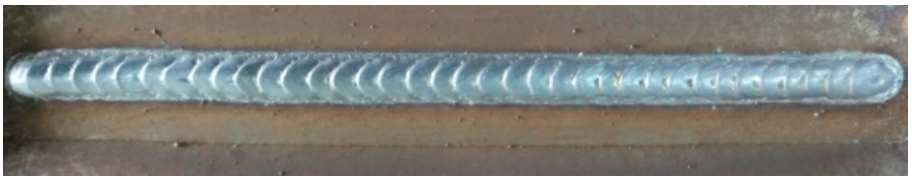
arc extinguishing detection time. When M180 is invalid, the robot moves L2 length. Then according to the arcing requirements, the arcing time is delayed by T, and then the invalid M180 and the L2 length of the robot motion are judged. So (arc starting, delay T, arc extinguishing, empty walk L2) cycle until the third line of instruction is executed to the end.

Line 4, turn off fish scale function Then normal exercise.

Line 5 instruction, arc extinguishing.



The following figure shows the actual welding effect when the spot welding time is set to 200 ms and the interval is 3 mm.



Example 2:

1 ARCSTART 0 : Arcing

2 STITCHSTART L1 10MM L2 20MM : Fish scale welding start,

3 MOVL VL=100MM/s PL=0 : Welding Locus and Fish Scale Welding Function Intervention.

4 STITCHEND : End of Fish Scale Welding Function

5 ARCEND 0 : Arc extinguishing

Working process:

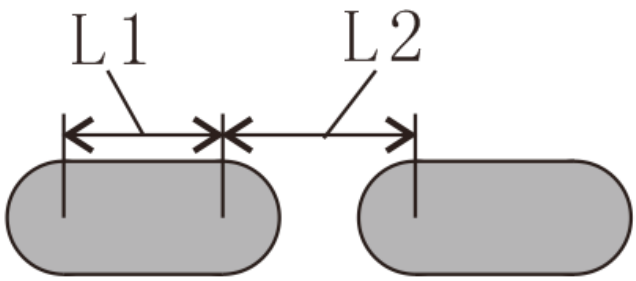
After the first line of operation, the system starts arcing according to the arcing process parameters, outputs M190 signal, and then judges M180 validity according to the arcing confirmation time. Execute the second line of procedure after it is valid.

After the second line is executed. The system loads the relevant parameters in the fish scale instruction, such as L1 L2, etc.

The program runs to line 3. The system controls the welding L1 length of the robot and judges M180 invalid according to the arc extinguishing detection time. When M180 is invalid, the robot moves L2 length. Then according to the arcing requirements, the arcing motion L1 length after the arcing, and then judge that the M180 arc extinguishing is invalid, the robot motion L2 length. So (arcing, welding L1, arc extinguishing, empty walk L2) cycle until the third line of instruction is executed to the end.

Line 4, turn off fish scale function. Then normal exercise.

Line 5 instruction, arc extinguishing.

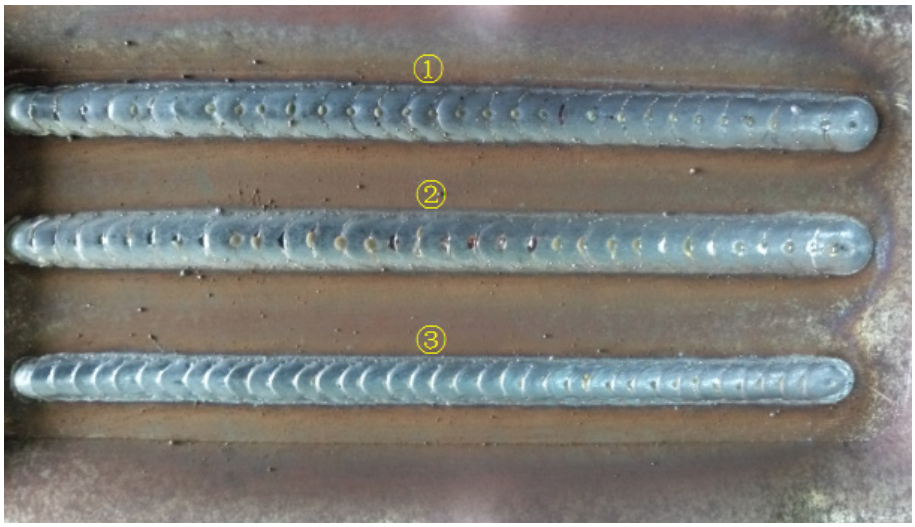


For example, the following figure shows the effect when the welding distance is set to 4 mm and 10 mm.



Note: Fish scale welding refers to the function of intermittent welding in the welding zone, which can save the trouble of teaching at each welding point.

In actual welding, the expected effect may not be achieved. At this time, the welding parameters need to be adjusted according to the actual situation, as follows:



The welding current and voltage of weld seam ① is 125A 17.7V, the overall effect is general, but the stereoscopic effect is not strong.

The welding current and voltage of weld seam ② are 125A 18.4V, and the stereo induction is worse than that of figure 1. This is due to the high voltage.

The welding current and voltage of weld seam ③ are 125A 17.7V. Compared with figure 1, the dry elongation speed is increased, the distance between solder joints is shortened by 0.5mm, and the overall effect is better.

Generally speaking, welding voltage affects the weld width, the larger the voltage, the wider the weld; welding current affects the penetration, the larger the current, the deeper the penetration; wire feeding speed / welding time will positively affect the welding effect. The faster wire feeding speed, the longer welding time, the larger the current and voltage, and vice versa.

Chapter 7.Welding Search

7.1 Introduction of welding search

In the search mode, the workpiece is grounded and low voltage electricity is supplied through the nozzle or welding wire. When the robot moves along the trajectory, when the nozzle or welding wire contacts the workpiece, the level is pulled down, and the contact signal is generated. The robot stops moving and records the position data when it contacts the workpiece. The path is corrected by the deviation between the current position and the position set by the program, so that the real target position can be obtained.

7.1.1 Matters needing attention of welding search

Workpiece surface shall be free of rust, oxide, paint or other insulating coating

Wire shearing must be carried out before search to ensure that the elongation of the welding rod is the same.

When using water-cooled welding torch, distilled water or other non-conductive cooling liquid is recommended. Impure water (such as salt mineral water) can reduce the sensitivity or voltage of position finding.

The order of searching points should not be confused (e.g. 3D+, first three points in any direction of change in x.y.z form a surface, then two points in another direction form a line, and then one point in the last direction).

7.1.2 Welding search methods include:

Simple, V-port, fillet weld, inside and outside diameter, camera, point and surface.

7.1.3 The searching type contains:

3D + rotation, 2D + rotation, 2D, 1D + 1 rotation, 1D + 2 rotation, 1D. See 5 Functional Explanation for details.

7.1.4 Requirements for Robots before searching:

A. Robot accuracy. The accuracy of the robot is as high as possible. The higher the positioning accuracy of the robot, the better the positioning accuracy.

B. Check the tool coordinate system. The higher the accuracy of TCP, the better the accuracy. It is suggested to use our company’s 20-point calibration method. The smaller the calibration error, the better. If the error is greater than 2.00, the accuracy can not be guaranteed. Tool coordinates need to be taken in the positioning process.

C. Searching speed. The faster the speed is, the more easily the welding wire will be deformed and the greater the error will be. The slower the speed, the smaller the error and the lower the efficiency. The IO signal of this system needs 20MS time to confirm the signal. Example: 5MM/S speed, 20MS time corresponding error 0.1MM.

D. Searching action. The instruction line can only use MOVL. It needs to specify a bit-finding preparation point and then define a bit-finding start point. The straight line from the preparation point to the starting point is the welding locating direction

7.2 Hardware Connection and PLC Programming

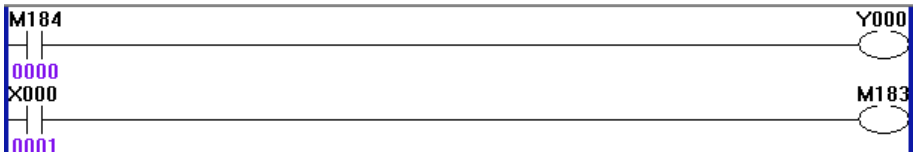
7.2.1 Auxiliary Relay Description:

M184: Search enabler, switching status, output. The following PLC corresponds to Y00

M183: Search detection signal, detection of searching contact point, input. The following

PLC corresponds to X00

PLC edits as follows:



Hardware connection:

Welding simulation mode. Y00 needs to be connected to the position finding switch signal of the welder.

Welding search detection signal is connected to X00.

7.2.2 Instruction Variables Introduction:

SEARCHSTART [1] Call the No.1 process of search.

SEARCHEND Search end.

MOVL (OP*) Search preparation point

MOVL SEARCH NP[1] (OP*) Search start point, Search start instructions, Search start from the point , Direction is from the search preparation point to the search starting point . (When running to this instruction, search start.Instruction end,then undo search;OP* Optional: When there are multiple search together,Need to bring the upper nested offset motion.If not, it runs according to the original program.)

COUNTOFFSET (Fillet weld) (2D+Selection) (Reference OP*) NP1 NP2 NP3 (Save OP1) Calculating offset。(Reference OP*): Recalculation with offset

OFFSETSTART OP[1] Start offset

OFFSETEND End offset

7.2.3 Variable description:

VP variable: Location reference position variable. After the flag is opened, the corresponding data will be overwritten and modified, and the machine will be shut down and saved. Scope: 0-499.

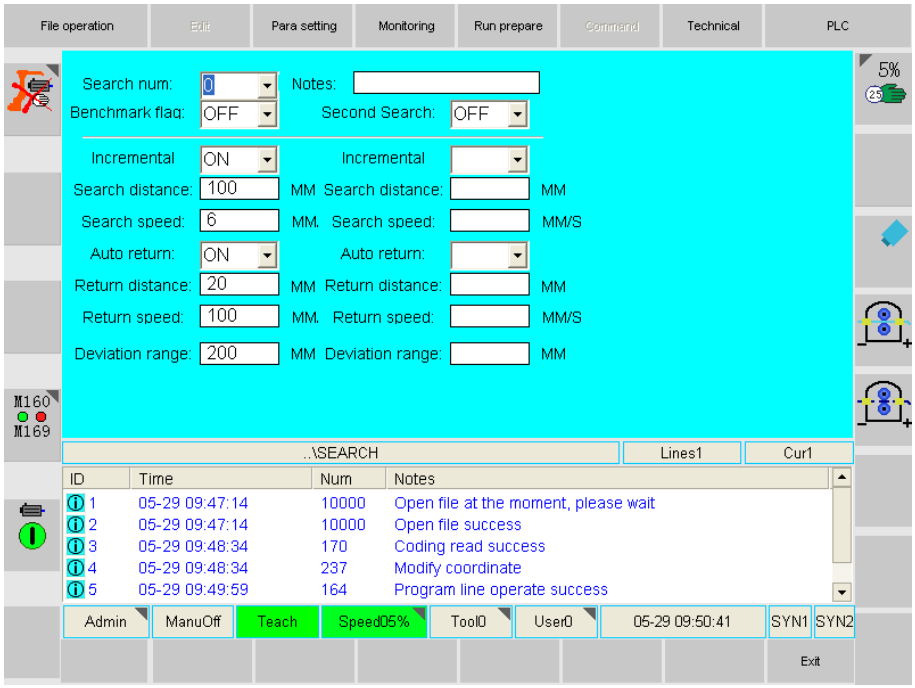
NP variable: position variable. Similar to GP variable. Used to record locating contact point position, shutdown and save. Scope 0-449.

OP variable: bias variable. Save the offset calculated by location finding for program offset, can be modified, shutdown and save. Scope 0-449.

7.3 Process interface introduction

Open path: [Technical] -< Arc welding >-<Tech para>-<Search para>

The figure below also increases the range of search offset



Search Number.: 0-15, set the process number of the SEARCHTART call.

Notes: Customers can add annotation information for easy identification.

Benchmark flag: The process number in the program corresponding to the reference location of the search point to write data to the switch. When turned on, the location is stored in the VP variable as the reference data. After closing, the benchmark data is protected and no longer written. (If the flag is not off, but the workpiece moves relative to the reference position, the data will be written into the VP variable again after this positioning, causing the reference data of the previous VP variable to be overwritten, and the later program will be meaningless, so it is necessary to rewrite the trajectory part of the program.)

Incremental : ON/OFF. When set to ON, the offset of the next searching point will be brought into the previous point, which can reduce the deviation too large, so as to avoid the situation of missing location, and improve the efficiency of location. Set to OFF, will strictly go to the searching point , and then start to search. Incremental positioning is used for translation and rotation is not used as much as possible.

Search distance: The distance from the searching point to the direction of the tool, beyond which the system will alarm.

Search speed: The speed at which the workpiece moves from the searching point , the smaller the searching speed, the higher the precision. (The system IO signal takes 20MS time to confirm the signal. Example: 5MM/S speed, 20MS time corresponding error 0.1MM.)

Auto return: ON/OFF. Set to ON, the robot will return along the previous motion path with reference to the distance and speed of automatic return after locating contact with the workpiece. Set to OFF, do not return.

Return distance: Set the auto-return distance. When the distance exceeds the starting point of the search, the robot's motion ends at the starting point of the search and is not running.

Return Speed: Set the Return Speed when the welding wire or nozzle touches the workpiece.

7.4 Function detailed explanation

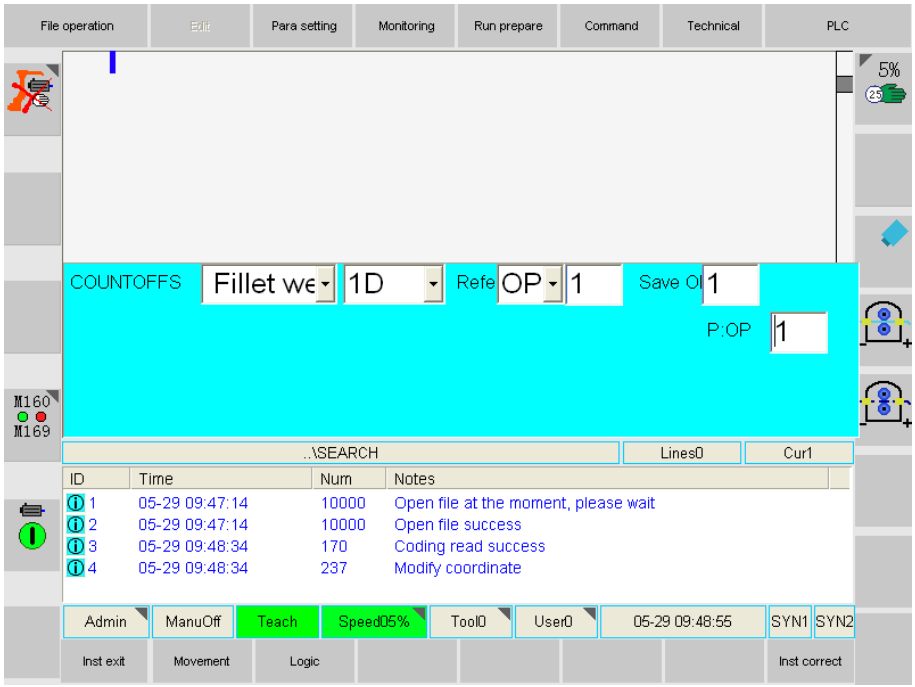
7.4.1 Fillet weld

7.4.1.1 1D:

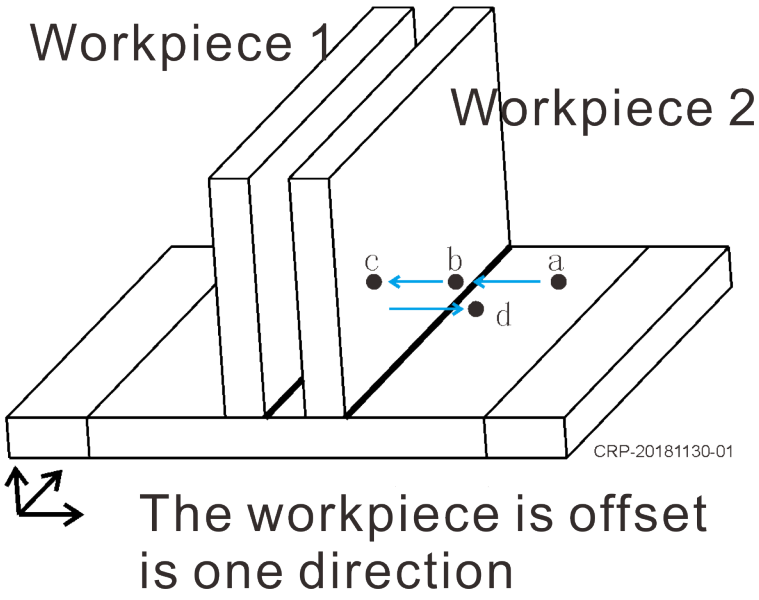
Conditions of Use:

The workpiece moves in only one direction, and the search direction must move in the direction of movement.

Instruction description:



Examples of procedures:



Note:

The flag should be opened when searching the reference position.when search the 1D,2D and 3D,the Incremental searching can be turned on.

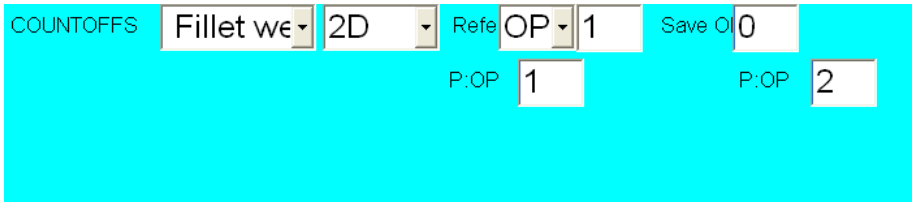
```
SEARCHSTART 0                                    //Search start
MOVL VL=100  PL=0  TOOL=1                        //a point
MOVL VL=100  PL=0  TOOL=1 SEARCH NP1 //Point B finds point C and returns point D automatically. Save NP1
SEARCHEND                                        //Search end
COUNTOFFSET 角焊缝 1D 输出 OP1 NP1               //Computation, save OP1
OFFSETSTART OP[1]//Start offset OP1
MOVL VL=100  PL=0  TOOL=1                        //Migration data section
……                                               //Migration data section
OFFSETEND                                        //offset end
```

7.4.1.2 2D:

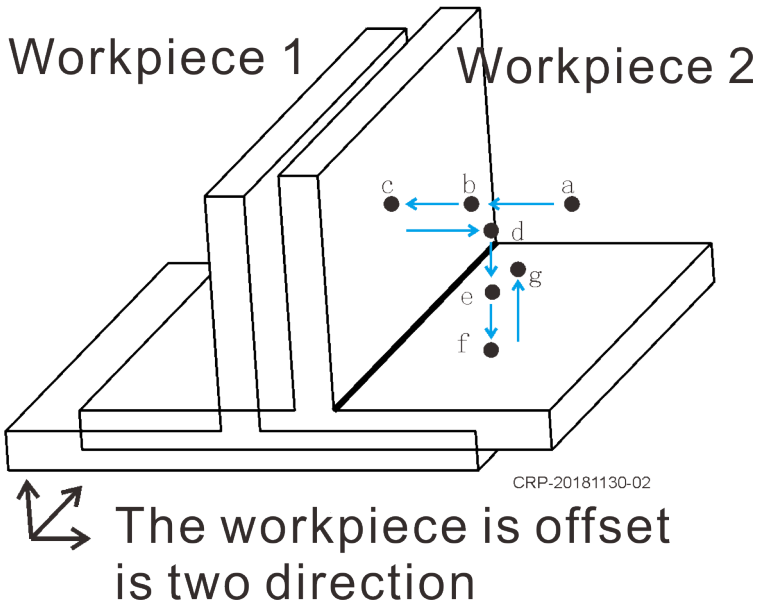
Conditions of Use:

Translation on any two planes of XYZ on the workpiece coordinate, similar to 1D, 1 point in each of the changed directions

Instruction description:



Program example:



Note:

The flag should be opened when searching the reference position. Incremental locations can be opened when locating 1D, 2D and 3D.

```
SEARCHSTART 0                                    //Search start
MOVL VL=100  PL=0  TOOL=1                        //a point
```

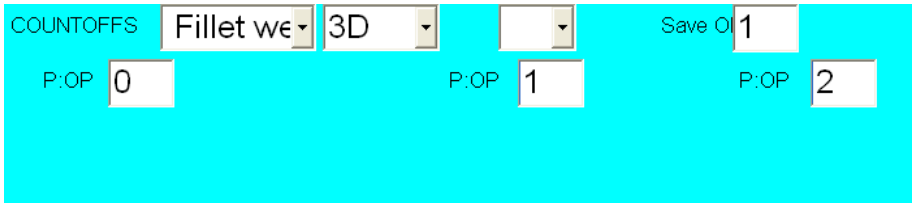
MOVL VL=100 PL=0 TOOL=1 SEARCH NP0 //B-point finding c-point, automatically returning d-point, data saving NP0
MOVL VL=100 PL=0 TOOL=1 //e point
MOVL VL=100 PL=0 TOOL=1 SEARCH NP1 //Find G-point at f-point, return H-point automatically, save NP1 data
SEARCHEND //Search end
COUNTOFFSET 角焊缝 2D 输出 OP1 NP0 NP1 //Computation, save OP1.
OFFSETSTART OP[1] //Start offset OP1
MOVL VL=100 PL=0 TOOL=1
……
OFFSETEND //offset end

7.4.1.3 3D:

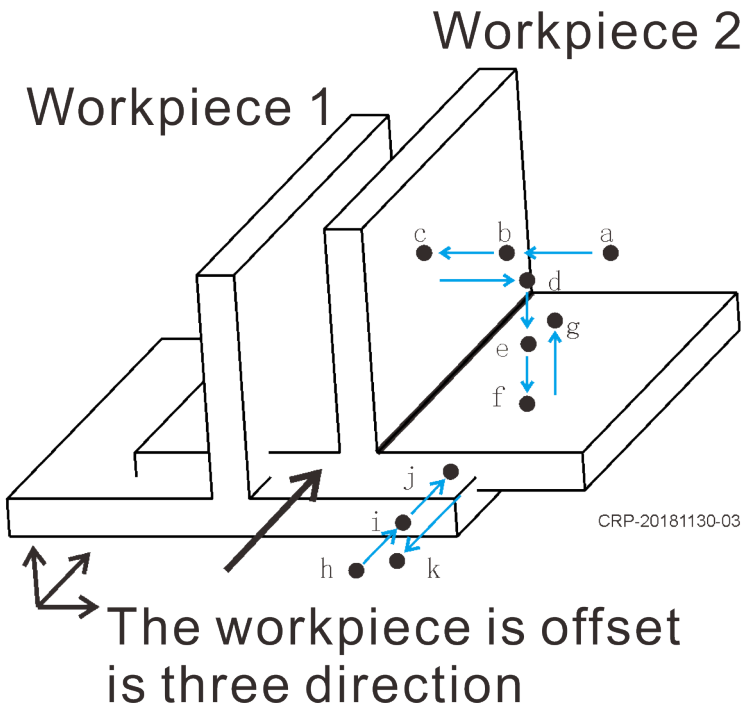
Conditions of use:

In the workpiece coordinates, XYZ is translated on any three planes, which is similar to 2D, and one point is found in each of the three directions of change.

Instruction description:



Examples of procedures:



Note:

The flag should be opened when locating the reference position. Incremental locations can be opened when locating 1D, 2D and 3D.

SEARCHSTART 0 //Search start
MOVL VL=100 PL=0 TOOL=1 //a point

MOVL VL=100 PL=0 TOOL=1 SEARCH NP0 //B-point finding c-point, automatically returning d-point, data saving NP0

MOVL VL=100 PL=0 TOOL=1 //e point

MOVL VL=100 PL=0 TOOL=1 SEARCH NP1 //Find G-point at f-point, return H-point automatically, save NP1 data

MOVL VL=100 PL=0 TOOL=1 //e point

MOVL VL=100 PL=0 TOOL=1 SEARCH NP2 //F-Point finding g-point, automatically returning to h point, save NP2 data

SEARCHEND //Search end

COUNTOFFSET 角焊缝 3D 输出 OP1 NP0 NP1 NP2 //Data calculation. Put it in OP1.

OFFSETSTART OP[1] //Start offset OP1

MOVL VL=100 PL=0 TOOL=1

…… //Offset data part

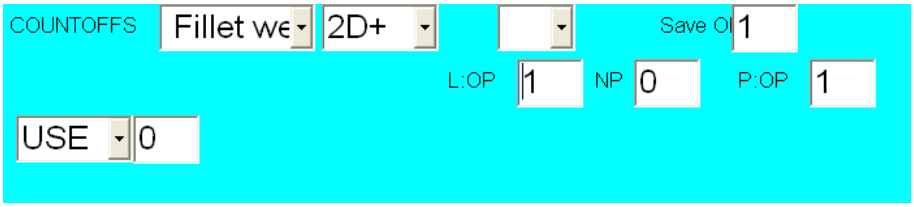
OFFSETEND //offset end

7.4.1.4 2D+:

Conditions of Use:

Rotate around any X, Y, Z axis (or Z axis of geodetic coordinates) on the workpiece and move in any two directions.

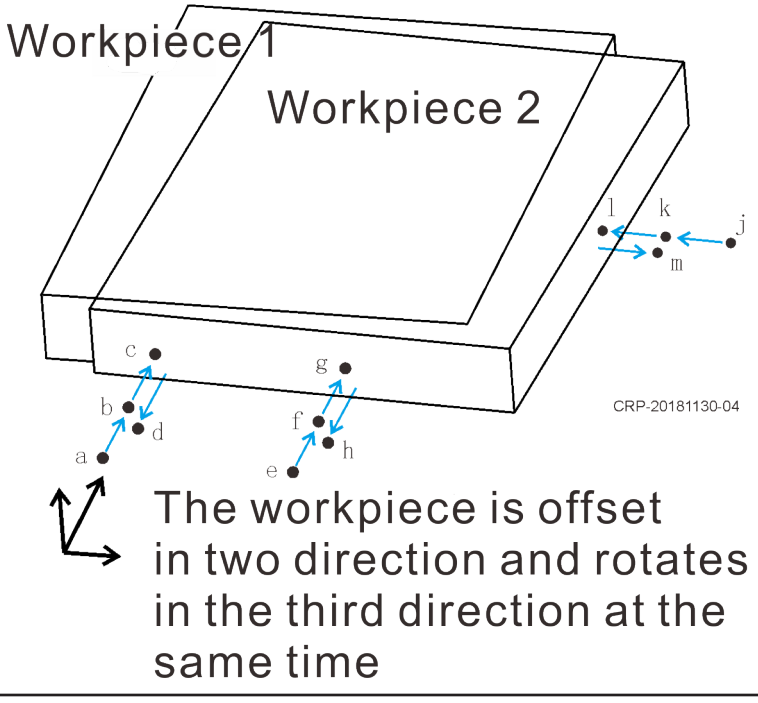
Instruction description:



Explain:

Find two points in one direction and determine the line; find one point in the other direction, and the line and point correspond to the point and line of the product in turn.

In USE user coordinate system, the specified direction of rotation is to rotate around the Z axis of user coordinates. If it is not set, then it can be used by rotating around the Z axis of the earth.



Examples of procedures:

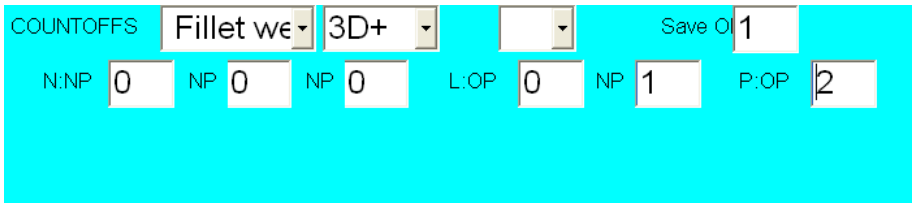
```
SEARCHSTART 1                          //Search start
MOVL VL=100  PL=0  TOOL=1              //a point
MOVL VL=100  PL=0  TOOL=1  SEARCH NP0  //B-point finding c-point, automatically returning d-point, data saving NP0
MOVL VL=100  PL=0  TOOL=1              //e point
MOVL VL=100  PL=0  TOOL=1  SEARCH NP1  //Find G-point at f-point, return H-point automatically, save NP1 data
MOVL VL=100  PL=0  TOOL=1              //j point
MOVL VL=100  PL=0  TOOL=1  SEARCH NP2  //K-point finding l-point, automatically returning m-point, data saving NP2
SEARCHEND                              //Search end
COUNTOFFSET 角焊缝 2D+ 旋转 NP0 NP1 NP2 OP1  //Data calculation. Put it in OP1.
OFFSETSTART OP[1]                      //Start offset OP1
MOVL VL=100  PL=0  TOOL=1
……                                     //Migration data section
OFFSETEND                              //offset end
```

7.4.1.5 3D+:

Conditions of Use:

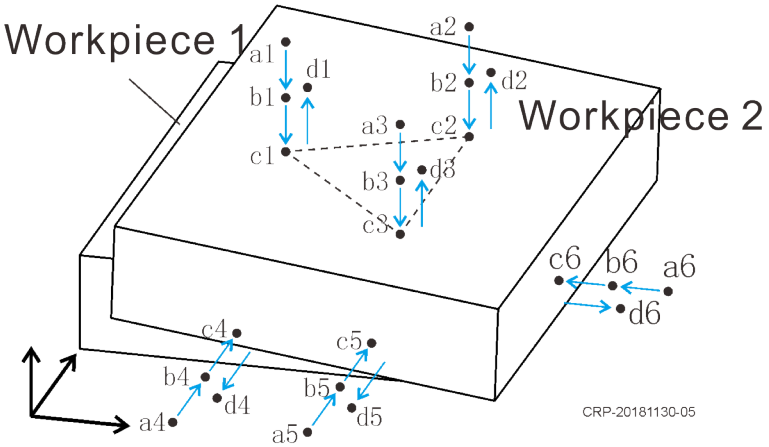
Arbitrary rotation or translation around X, Y, Z

Instruction description:



Description: Find three points in one direction and determine the surface; Find two points in the other direction and determine the line; Find one point in the last direction to locate. The actual locating surface, line and point should correspond to the surface, line and point in the computational instruction COUNTOFFSET in turn.

Examples of procedures:



The workpiece is offset is three direction

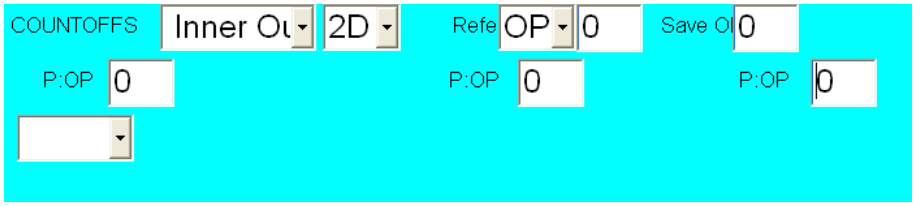
```
SEARCHSTART 1                 //Search start
MOVL VL PL                    //a1 point
MOVL VL PL SEARCH NP0         //Point B1 searches for point c1, automatically returns point d1, and saves NP0
MOVL VL PL                    //a2 point
MOVL VL PL SEARCH NP1         //Point B2 searches for point c2, automatically returns point d2, and saves NP1
MOVL VL PL                    //a3 point
MOVL VL PL SEARCH NP2         //B3 searches for C3 points, automatically returns D3 points, and saves NP2 data
MOVL VL PL                    //a4 point
MOVL VL PL SEARCH NP3         //B4 searches C4 points, automatically returns D4 points, and saves NP3 data
MOVL VL PL                    //a5 point
MOVL VL PL SEARCH NP4         //B5 searches C5 points, automatically returns D5 points, and saves NP4 data
MOVL VL PL                    //a6 point
MOVL VL PL SEARCH NP5         //B6 searches for C6 points, automatically returns D6 points, and saves NP5 data
SEARCHEND                     //Search end
COUNTOFFSET 角焊缝 3D+ 旋转 NP5 NP4 NP3 NP2 NP1 NP0 OP1     //Data calculation. Put it in OP1.
OFFSETSTART OP[1]             //Start offset OP1
……                            //Offset data part
OFFSETEND                     //Offset  end
```

7.4.2 Inside and outside diameter

Conditions of Use:

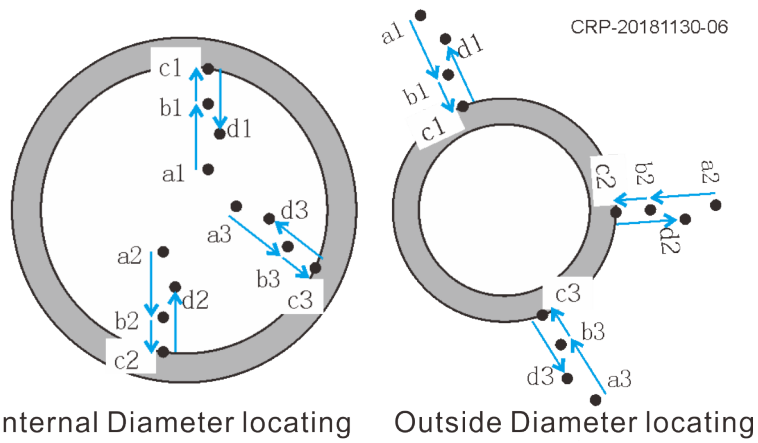
Shift in any two directions (X, Y directions of user coordinates or geodetic coordinates)

Instruction description:



Note: Any 3 points on a circle

Examples of procedures:



Internal Diameter locating Outside Diameter locating

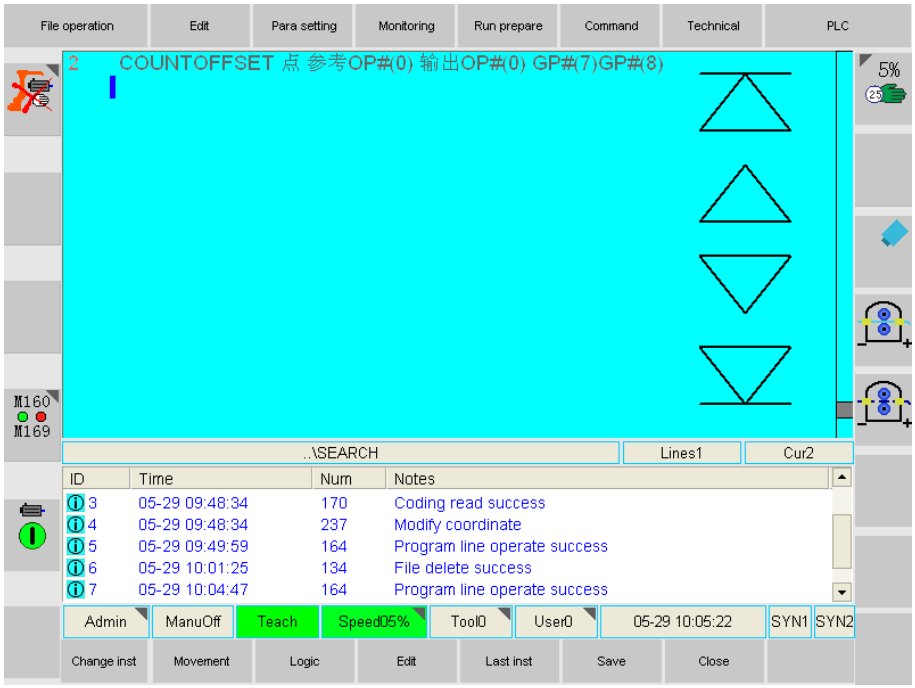
```
SEARCHSTART 1                    //Search start
MOVL VL PL                       //a1 point
MOVL VL PL SEARCH NP0            //Point B1 searches for point C1 and automatically returns to point d1. Save NP0
MOVL VL PL                       //a2 point
MOVL VL PL SEARCH NP1            //Point B2 searches for point C2 and automatically returns to point d2. Save NP1
MOVL VL PL                       //a3 point
MOVL VL PL SEARCH NP2            //Point B3 searches for point C3 and automatically returns to point d3. Save NP2
SEARCHEND                        //Search end
COUNTOFFSET 内外径 NP0 NP1 NO2 OP1   //Computation, data storage OP1
OFFSETSTART OP[1]                //Start offset OP1
……                               //Partial migration data
OFFSETEND                        //Offset end
```

7.4.3 Spot

Conditions of Use:

The search point must be the same point (only the translation x, y, z is calculated), used when the object only moves without rotation.

Instruction description:

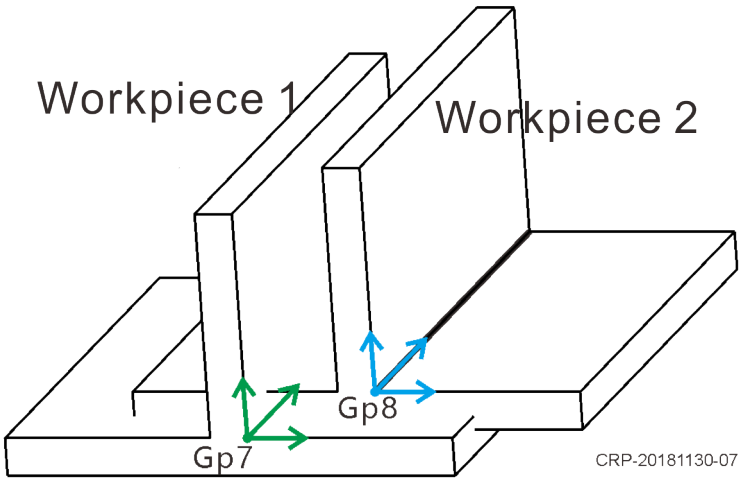


Explain:

1. Two GP points with only position change and no attitude change

2. Save OP as output OP, base GP as original GP location, and reference GP as new GP location. This is orderly.

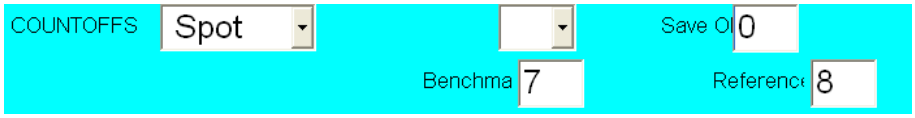
3. It is strongly recommended to add a preparatory point before migration to prevent the current position mutation (position unchanged, attitude change) from causing overspeed.



Position migration
between two GP variables

Examples of procedures:

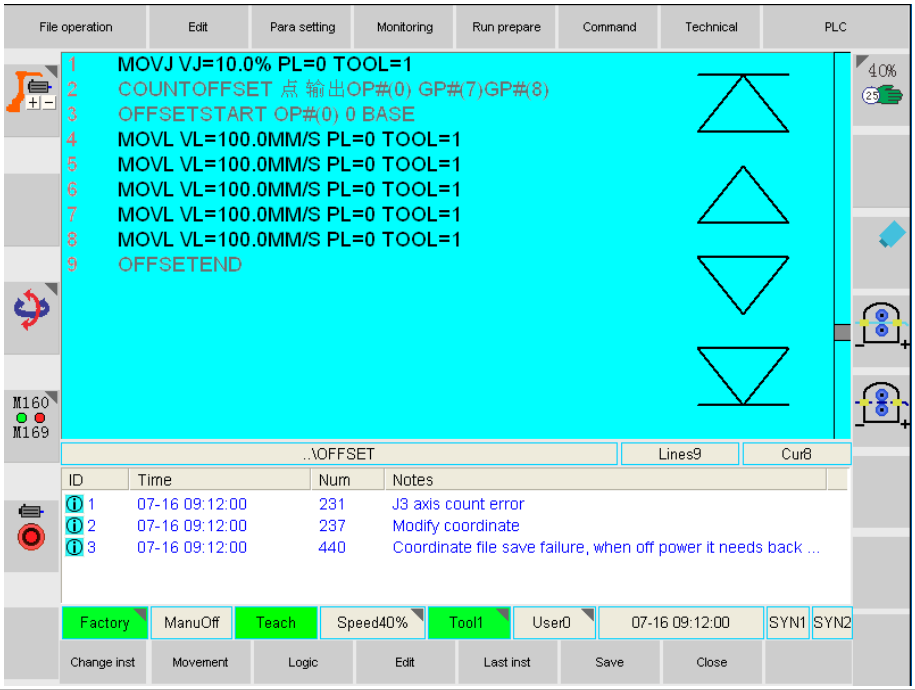
COUNTOFFSET 点 输出 OP0 GP8 GP7	//Computation, data storage OP1
OFFSETSTART OP[0]	//Start offset OP1
……	//Partial migration data
OFFSETSTARTEND	//Offset end



7.4.4 Camera

Conditions of Use:

Camera calibration should be accurate. When assigning reference data, the data should correspond to the reference trajectory. The photographic point must be the same point on the workpiece. The attitude offset of X, Y, Z must be calculated. After the trajectory offset, the attitude of each point is consistent with the attitude change of the workpiece. It is used in the case of arbitrary rotation or translation of the object.



Explain:

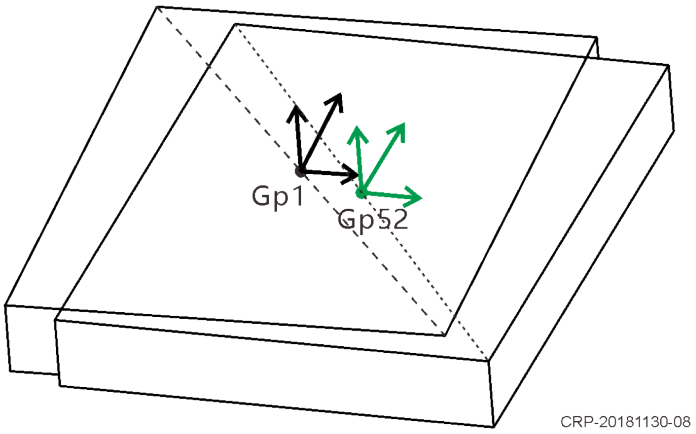
The blank box behind the camera is the reference OP option.

Benchmark: The original position is also the value when editing the initial trajectory.

Reference: The changed position.

The difference between the change value and the reference value is calculated and saved to OP1.

Examples of procedures:



Position and angle offset of first camera data and second camera data

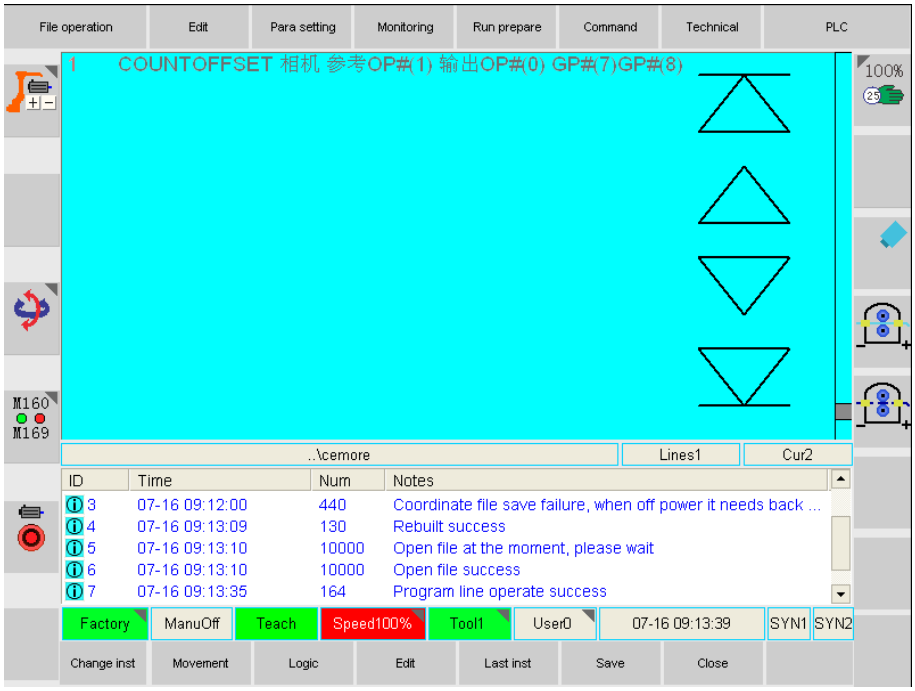
```
RUNVISON#(0)                    //No.0 Technology for Operating Vision
*1                              //Signs of Jump*1
TRIGGERVISON#(0)                //Trigger once, if timing trigger is used, it can be canceled, only to judge whether there is a buffer
TIME 200                        //delayed 200MS
JUMP *1 IF GI50<=0.000          //If the visual buffer has no data, the jump is triggered again
GETVISONDATA#(0)                //The data obtained from the visual buffer are placed in GP52 and GP53.JUMP *2 IF GI0>0  //Judgment of visual benchmark data signs, jump
SET GP1 GP52                    //Assign visual baseline data to GP1
SET GI0 1                       //Position visual reference data markers.
*2                              //Jump sign*2
COUNTOFFSET 相机 参考 OP1 GP1 GP52      //Calculate camera offset data and store OP1
OFFSETSTART OP[1]               //Start offset OP1
……                              //Migration data section
OFFSETEND                       //Offset end
```

7.4.5 Surface

Conditions of Use:

For the rotation of coordinate system, the position and attitude deviation is calculated and compensated by changing coordinate system and reference coordinate system. The three points in the coordinate system must be the corresponding points on the workpiece in turn. They should be used where the object rotates or moves arbitrarily.

Instruction description:

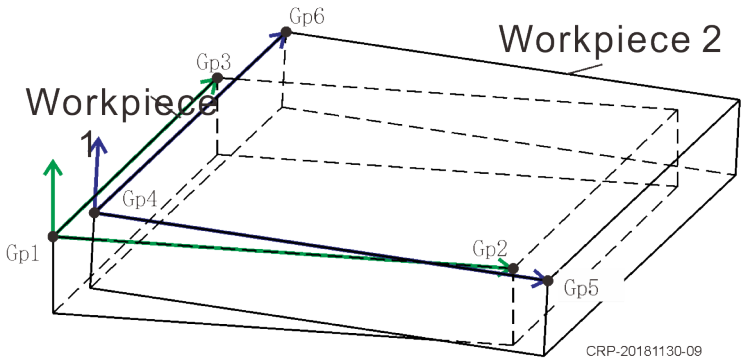


Benchmark: Three points in the benchmark coordinate system, ORG, X, Y

The latter three points are three points in the variable coordinate system, ORG, X and Y.

Reference and change coordinate systems ORG, X, Y must correspond one by one. And the position on the workpiece should be the same.

Examples of procedures:



Migration and rotation between planes of GP point combination

```
COUNTOFFSET 面 参考 OP1 GP1 GP2 GP3 GP4 GP5 GP6      //Computation, data storage OP1
OFFSETSTART OP[1]                                    //Start offset OP1
……                                                   //Partial migration data
OFFSETEND                                            //Offset end
```

7.4.6 Comprehensive examples

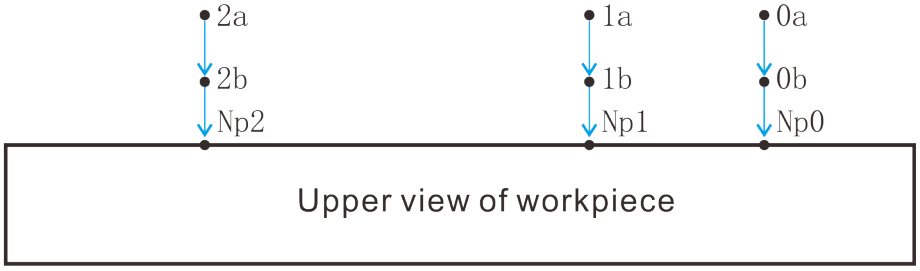
Overall offset plus local offset

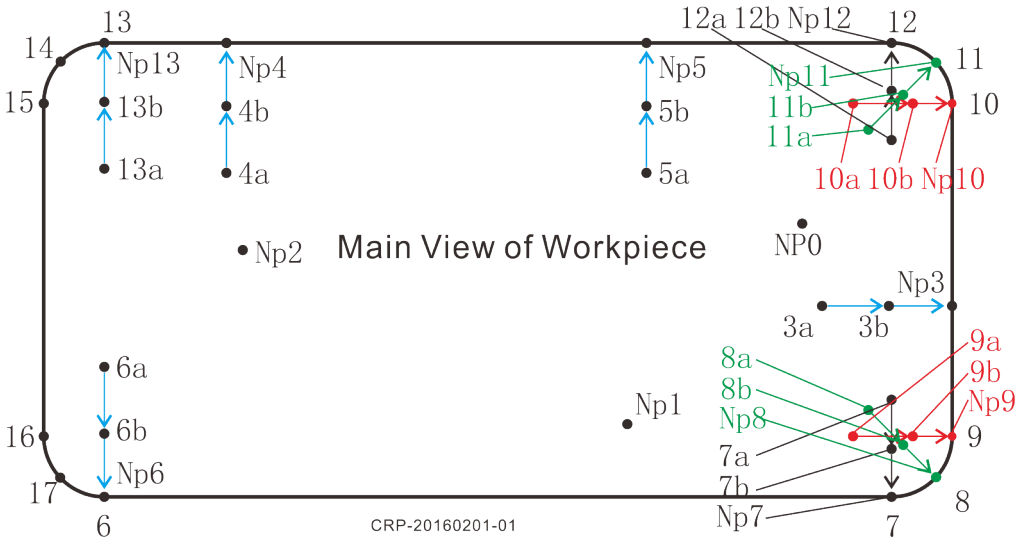
Look for the overall offset first, then bring the overall offset into the local offset to find the local offset.

Example: To achieve the idea, first find the overall offset, and then locate the local 1D

offset based on the overall offset. When the program is executed, the overall offset is first introduced, and then the 1D offset is brought in the local locating point to realize the overall offset plus the local offset.

In the following, it is assumed that there will be local deformation at points 6-13, and these points are locally located.





Examples of procedures:

```
MOVJ VJ=31.0 PL=0                    //Move to the ready position
SEARCHSTART#(0)                      //Search start, call 0 Location Processing Parameters
MOVL VL=500.0 PL=0                   //Move to 0A Preparatory Position
MOVL VL=500.0 PL=0 SEARCH NP#(0)     //To 0b starting point, search to NP0, automatic return
MOVL VL=500.0 PL=0                   //To 1a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(1)     //To 1b starting point, search to NP1, automatic return
MOVL VL=500.0 PL=0                   //To 2a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(2)     //To 2b starting point, search to NP2, automatic return
MOVL VL=500.0 PL=0                   //Spatial Auxiliary Location
MOVL VL=500.0 PL=0                   //To 3a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(3)     //To 3b starting point, search to NP3, automatic return
MOVL VL=500.0 PL=0                   //Spatial Auxiliary Location
MOVL VL=500.0 PL=0                   //Spatial Auxiliary Location
MOVL VL=500.0 PL=0                   //To 4a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(4)     //To 4b starting point, search to NP4,
```

automatic return
MOVL VL=500.0 PL=0 //Spatial Auxiliary Location
MOVL VL=500.0 PL=0 //To 5a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(5) //To 5b starting point, search to NP5, automatic return
MOVL VL=500.0 PL=0 //Leave the workpiece
SEARCHEND //Search end
COUNTOFFSET 角焊缝 3D+ OP0 NP0 NP1 NP2 NP4 NP5 NP3 //Full 角 焊 缝 , 3D+, calculation deviation save OP0, reference NP3 point, reference NP4 NP5 line, reference NP0 NP1 NP2 plane
SEARCHSTART#(0) //Search start, Invoking No.0 Location-finding Process Parameters
MOVJ VJ=31.0 PL=0 //Spatial Auxiliary Location
OFFSETSTART OP#(0) //The migration of OP0 data begins, and the following program moves to the end of OFFSETEND as a whole.
MOVL VL=500.0 PL=0 //To 6a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(6) //To 6b starting point, search to NP6, automatic return
MOVL VL=500.0 PL=0 //Spatial Auxiliary Location
MOVL VL=500.0 PL=0 //To 7a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(7) //To 7b starting point, search to NP7, automatic return
MOVL VL=500.0 PL=0 //To 8a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(8) //To 8b starting point, search to NP8, automatic return
MOVL VL=500.0 PL=0 //To 9a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(9) //To 9b starting point, search to NP9, automatic return
MOVL VL=500.0 PL=0 //To 10a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(10) //To 10b starting point, search to NP10, automatic return
MOVL VL=500.0 PL=0 //To 11a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(11) //To 11b starting point, search to NP11, automatic return
MOVL VL=500.0 PL=0 //To 12a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(12) //To 12b starting point, search to NP12, automatic return
MOVL VL=500.0 PL=0 //To 13a Prepare Position
MOVL VL=500.0 PL=0 SEARCH NP#(13) //To 13b starting point, search to NP13, automatic return
OFFSETEND //Overall offset end
SEARCHEND
COUNTOFFSET 角 焊 缝 1D OP0 OP13 NP13 //Fillet weld 1D, bring in OP0, calculate deviation save OP13, refer to NP13 point
COUNTOFFSET 角 焊 缝 1D OP0 OP12 NP12 //Fillet weld 1D, bring in OP0, calculate deviation save OP13, refer to NP12 point
COUNTOFFSET 角 焊 缝 1D OP0 OP11 NP11 //Fillet weld 1D, bring in OP0, calculate deviation save OP13, refer to NP11point
COUNTOFFSET 角 焊 缝 1D OP0 OP10 NP10 //Fillet weld 1D, bring in OP0, calculate deviation save OP13, refer to NP10 point
COUNTOFFSET 角 焊 缝 1D OP0 OP9 NP9 //Fillet weld 1D, bring in OP10, calculate

deviation save OP9, refer to NP9 point
COUNTOFFSET 角 焊 缝 1D OP0 OP8 NP8 //Fillet weld 1D, bring in OP10, calculate deviation save OP8, refer to NP8 point
COUNTOFFSET 角 焊 缝 1D OP0 OP7 NP7 //Fillet weld 1D, bring in OP10, calculate deviation save OP7 refer to NP7 point
COUNTOFFSET 角 焊 缝 1D OP0 OP6 NP6 //Fillet weld 1D, bring in OP10, calculate deviation save OP6, refer to NP6 point
MOVJ VJ=31.0 PL=0 //Spatial Auxiliary Location
OFFSETSTART OP#(0) //The migration of OP0 data begins, and the following program moves to the end of OFFSETEND as a whole.
ARCSTART #(0) 10MM/S //Welding Start, Process No. 0, Speed 10MM/S
MOVL VL=100.0 PL=0 OFFSET OP#(6) //Bring in OP6 local offset and move to 6 point
MOVL VL=100.0 PL=9 OFFSET OP#(7) //Bring in OP7 local offset and move to 7 point
MOVC VL=100.0 PL=9 POINT=2 OFFSET OP#(8) //Bring in OP8 local offset and move to 8 point
MOVC VL=100.0 PL=9 POINT=3 OFFSET OP#(9) //Bring in OP9 local offset and move to 9 point
MOVL VL=100.0 PL=9 OFFSET OP#(10) //Bring in OP10 local offset and move to 10 point
MOVC VL=100.0 PL=9 POINT=2 OFFSET OP#(11) //Bring in OP11 local offset and move to 11 point
MOVC VL=100.0 PL=9 POINT=3 OFFSET OP#(12) //Bring in OP12 local offset and move to 12 point
MOVL VL=100.0 PL=9 OFFSET OP#(13) //Bring in OP13 local offset and move to 13 point
MOVC VL=100.0 PL=9 POINT=2 //No local offset, move to 14 points
MOVC VL=100.0 PL=9 POINT=3 //No local offset, move to 15 points
MOVL VL=100.0 PL=9 //No local offset, move to 16 points
MOVC VL=100.0 PL=9 POINT=2 //No local offset, move to 17 points
MOVC VL=100.0 PL=9 POINT=3 OFFSET OP#(6) //Bring in OP6 local offset and move to 6 point
MOVL VL=100.0 PL=9 //Leave the workpiece
ARCEND //The welding is over.
OFFSETEND //Offset end。

Chapter 8.Explanation of Arc Tracking and Debugging

8.1 Arc Tracking Hardware Connection

8.1.1 Connection Method of Arc Tracker and Ground Wire of Welding Machine

As shown in the figure below, the ground wire of the welder moves from the welder end through the arc tracker to the system end, and finally connects to the welding tooling or workpiece

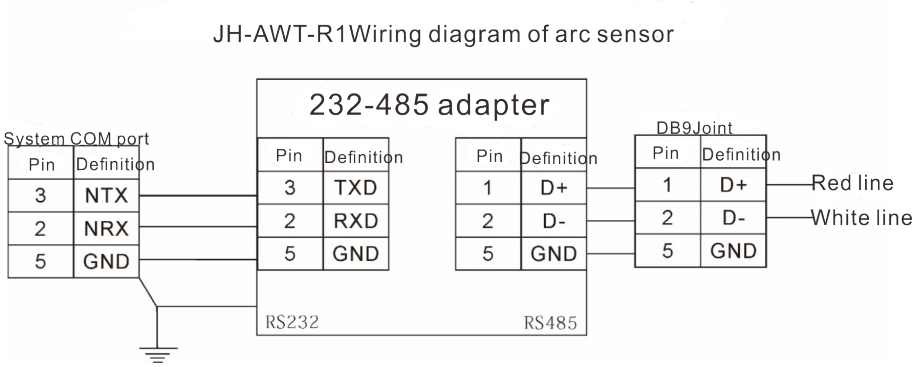


8.1.2 Arc tracker power supply

The arc tracker is powered by conventional 220V power supply.

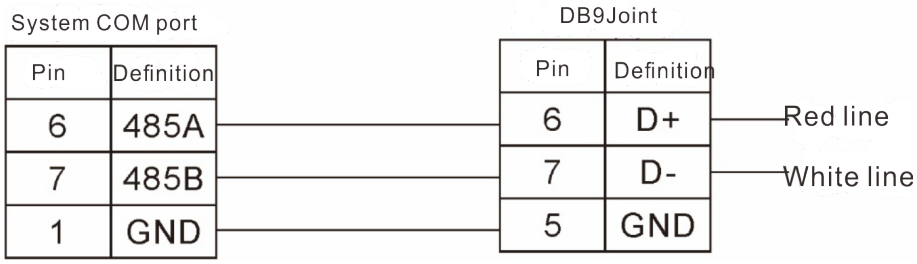
8.1.3 Arc Tracker Data Line Connection

As shown in the figure below, the end of the S80 pulse system is 232 interface (COM2 or COM4). Through 232 to 485 adapter, the signal is converted to 485 signal, and then the data signal line of the arc tracker is connected through DB head.



Connection Diagram of S80 Cabinet 232-485

As shown in the figure below, the S100 bus system has 485 interfaces (COM1), which can be directly connected to the data signal line of the arc tracker.

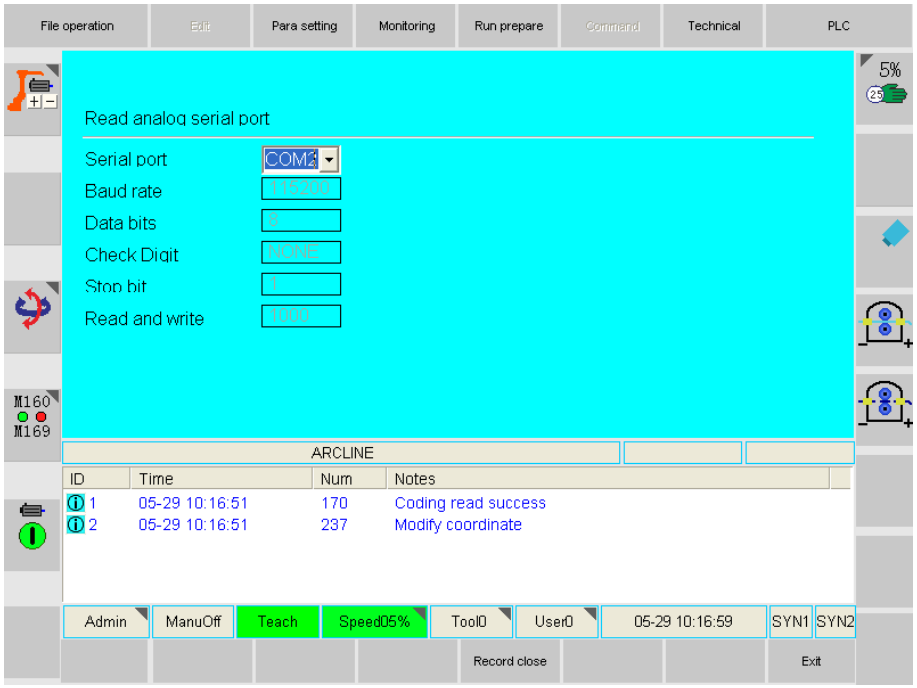


Connection Diagram of S100 Cabinet 485

8.2.Arc tracking parameter setting

8.2.1 Communication settings

In the system interface: [Technical] → <Arc welding > → <Arc tracking> → <communication set>



· Select the corresponding COM port

Selection of COM1 for S100 Bus System

Selection of COM2 or COM4 for S80 Pulse System

Selection of COM1 for CRX8 integrated electrical cabinet

· Communication parameters

Fixed baud rate set to 115200Data bits fixed to 8

Check bits are fixed to NONE

Stop Bit Fixed Set to 1

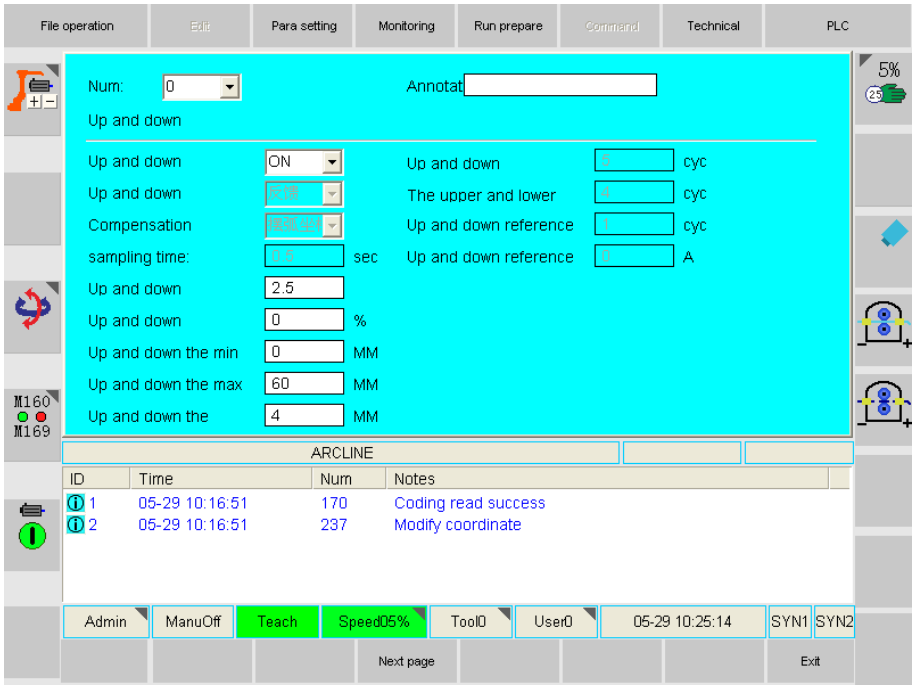
Read and write timeouts are fixed to 1000

· Background record

Need to be set to “ Record Open”

8.2.2 Upper and down compensation parameters

Set the compensation parameters in [Technical] → <Arc Welding> → <Arc Tracking →→ <Para Settings>:



Number

File Number Called by ARCTRACKSTRAT Instruction in Program

Annotat

Customer customization, for label, annotation

Up and down compensation function

When ON is selected, the upper and lower compensation function is turned on, and the upper and lower compensation parameters can be set.

When OFF is selected, the upper and lower compensation functions are closed, and the upper and lower compensation parameters are not set.

Up and down reference current setting

The default setting is "Feedback"

Compensation coordinate system

The default setting is "Tool coordinates"

Sampling time

The default setting is "0.5"

Up and down compensation sensitivity

When arc tracking is used to compensate the weld seam, the fluctuation is compensated along Z direction of the pendulum arc coordinate system. If overshoot occurs, the sensitivity is lowered, and if lag occurs, the sensitivity is increased.

Initial Recommended Value of Upper and Lower Compensation Sensitivity "2.5"

· Up and down compensation offset

This parameter is a standby parameter. Set it to "0" when using it.

Up and down the minimum compensation

The minimum offset of arc tracking compensation is set when the welding seam is compensated. The offset collected by arc tracker is less than the offset set by this parameter and will not be compensated.

Initial Recommended Value of Upper and Lower Minimum Compensation "0"

Up and down the cumulative maximum compensation

When arc tracking is used to compensate the welding seam, the maximum amount of compensation accumulated after each compensation is set. When the total compensation exceeds the set value of this parameter, it will not be compensated by incremental calculation.

Initial Recommended Value "60" of Upper and Lower Cumulative Maximum Compensation

Up and down the maximum compensation at every turn

Set the maximum offset of each compensation when arc tracking is used to compensate the weld seam. When the single deviation value collected by the arc tracker is larger than the set value of this parameter, no compensation will be made

Initial Recommended Value "4" for Maximum Compensation of Upper and Lower Quantities

Up and down compensation start counting

This parameter is an internal parameter and need not be changed when used.

· The upper and lower reference sampling start counting

This parameter is an internal parameter and need not be changed when used.

Up and down reference sampling count

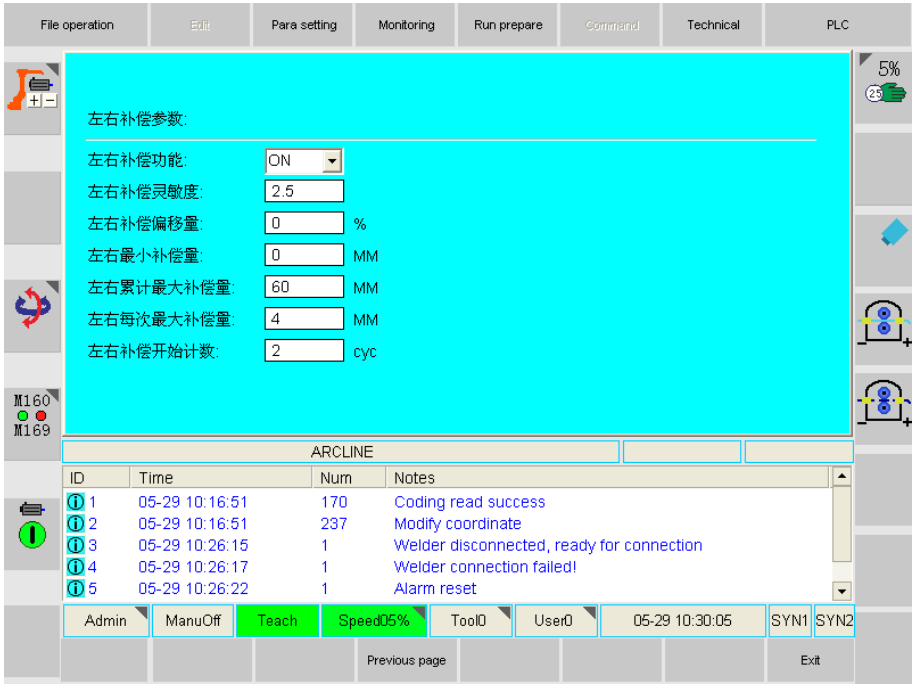
This parameter is an internal parameter and need not be changed when used.

· Up and down reference current constant data

This parameter is an internal parameter and need not be changed when used.

8.2.3 Left and Right Compensation Parameters

In: [Technical] → <Arc Welding > → <Arc Tracking> → → <Para Settings>, click <Next page> after the upper and lower compensation settings are completed.



· Left and Right Compensation Function

When ON is selected, the left and right compensation function is turned on, and the left and right compensation parameters can be set.

When OFF is selected, the left and right compensation function is closed and the left and right compensation parameters are not set.

· Left and Right Compensation Sensitivity

When arc tracking is used to compensate the weld seam, the fluctuation is compensated along the Y direction of the pendulum arc coordinate system. If overshoot occurs, the sensitivity is lowered, and if lag occurs, the sensitivity is increased.

Initial Recommended Value of Upper and Lower Compensation Sensitivity "3.5"

· Left and Right Compensation Offset

This parameter is a standby parameter. Set it to “0” when using it.

· Left and Right Minimum Compensation

The minimum offset of arc tracking compensation is set when the welding seam is compensated. The offset collected by arc tracker is less than the offset set by this parameter and will not be compensated.

The initial recommended value of left and right minimum compensation is “0”

· Maximum cumulative compensation of left and right

When arc tracking is used to compensate the welding seam, the maximum amount of compensation accumulated after each compensation is set. When the total compensation exceeds the set value of this parameter, it will not be compensated by incremental calculation.

The initial recommended value of left and right cumulative maximum compensation is “60”

· Maximum compensation at left and right

Set the maximum offset of each compensation when arc tracking is used to compensate the weld seam. When the single deviation value collected by the arc tracker is larger than the

set value of this parameter, no compensation will be made.

The initial recommended value “4” for each maximum compensation

· Left and Right Compensation Start Counting

When setting arc tracking to compensate the weld seam, the arc swing period should be compensated.

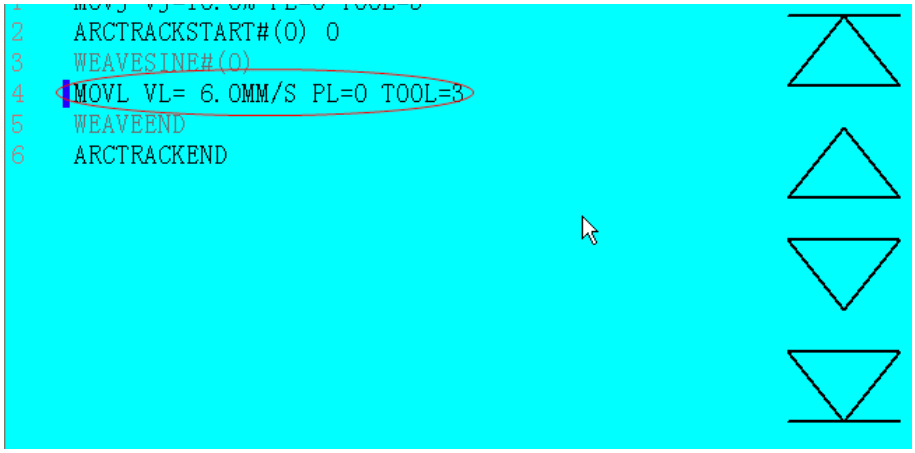
Left and Right Compensation Start Counting Initial Recommended Value “2”

8.3 Writing Arc Tracking Program

8.3.1 Instruction specification

·ARCTRACKSTART#(0) 0 - Arc Tracking Start
·ARCTRACKEND - End of arc tracking

8.3.2 Programming example



8.4 Notices for Arc Tracking

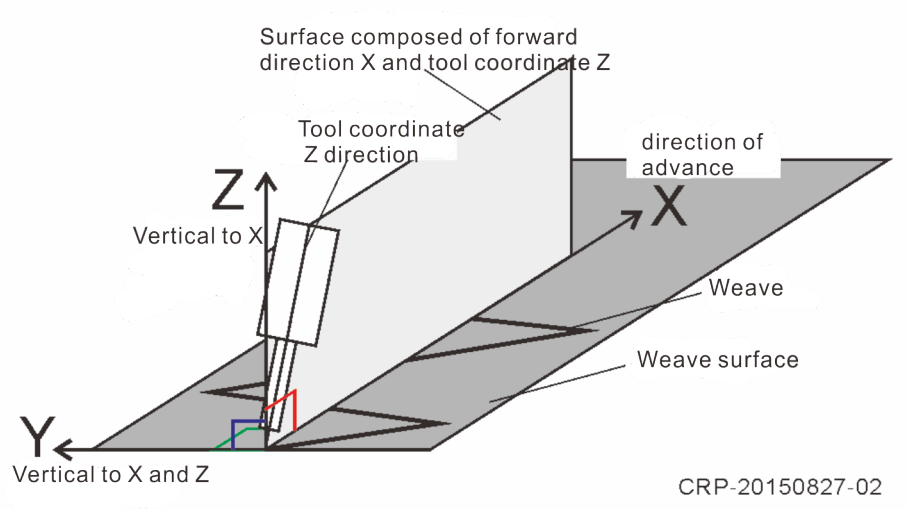
8.4.1 Applicable Conditions for Arc Tracking

Protective gases: CO2 and MAG
Wire diameter: 1.0~1.2
Welding rod elongation: 15mm~20mm
Welding Length and Thickness: More than 6mm
Slot angle: less than 90 degrees

8.4.2 Arc tracking welding conditions:

Welding current: over 200A
Welding speed: below 8mm/s
Minimum welding length: 70mm
Swing welding range: 3-5 mm
Pendulum Welding Frequency: 2~4HZ
Pendulum Welding Type: Z Pendulum

8.5 About the direction of the arc tracker compensation



The figure shows the pendulum arc coordinate system of CRP system.

Firstly, the calibration tool coordinate system is required. When programming, the corresponding tool coordinate system is also substituted for programming, as shown below.

```
1    MOVJ VJ=10.0% PL=0 TOOL=20
2    MOVJ VJ=10.0% PL=0 TOOL=20
3    ARCTRACKSTART#(0)
4    ARCSTART#(0) V= 10.00V I= 50.00A
5    WEAVESINE#(0)
6    MOVL VL=10.0MM/S PL=0 TOOL=20
7    ARCEND#(0)
8    ARCTRACKEND
9    MOVJ VJ=10.0% PL=0 TOOL=20
```

It needs to be clear that the pendulum-arc coordinate system is based on the tool coordinate system, so the offset of compensation is also compensated to the pendulum-arc coordinate system, which is related to the tool coordinate system. Please check the tool coordinate system before using it.

Chapter 9.Explanation of Laser Tracking and Debugging

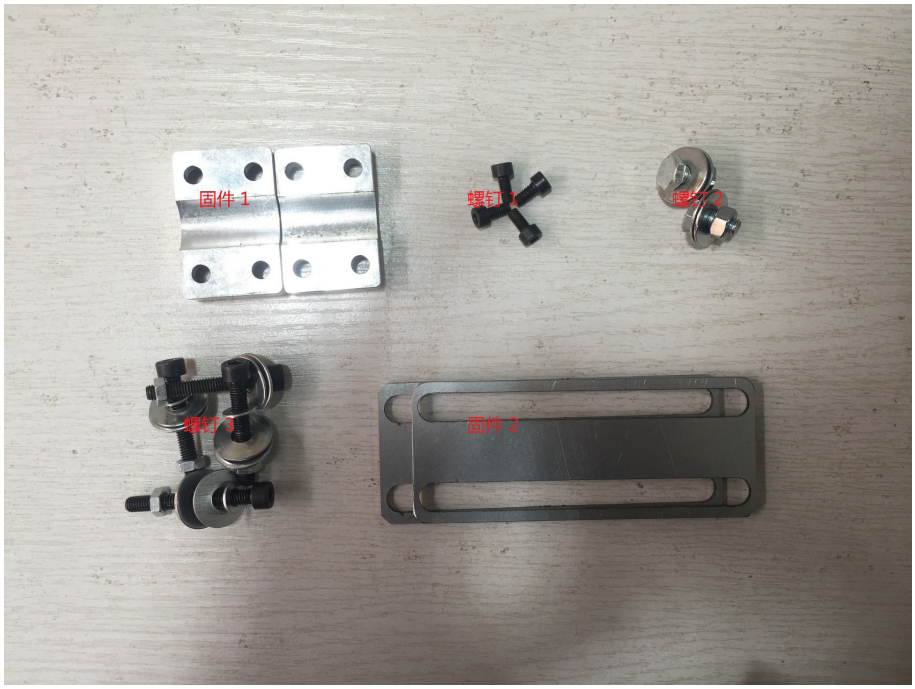
9.1 Laser Tracking Installation Steps

9.1.1 Laser Tracker and Its Components

The main components used in the installation process are as follows



1. Laser Instrument 2, Net Line 3, Main Power Line 4, Laser Instrument Power Line 5, Laser Instrument Control Line 6, Laser Instrument Communication Line

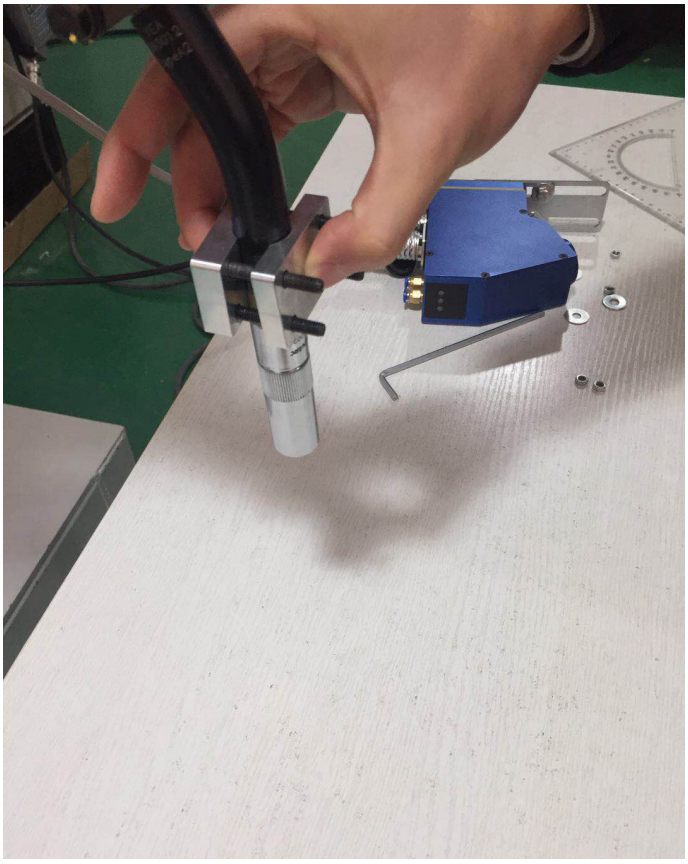


Firstly, fixing camera clamp (firmware 2) is installed with screw 1 and screw 2, as shown below.

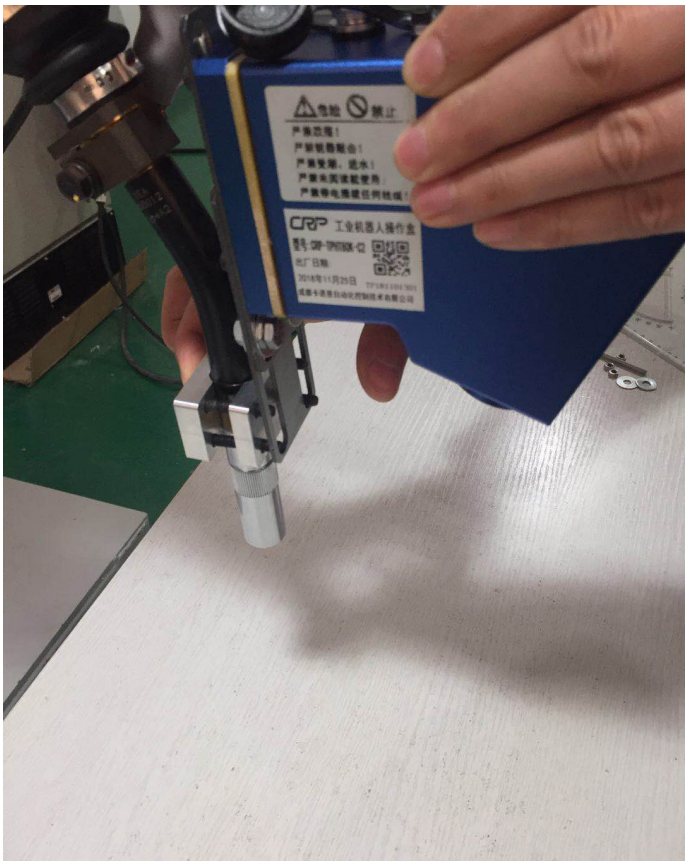




Next install firmware 1 with screw 3, as shown below

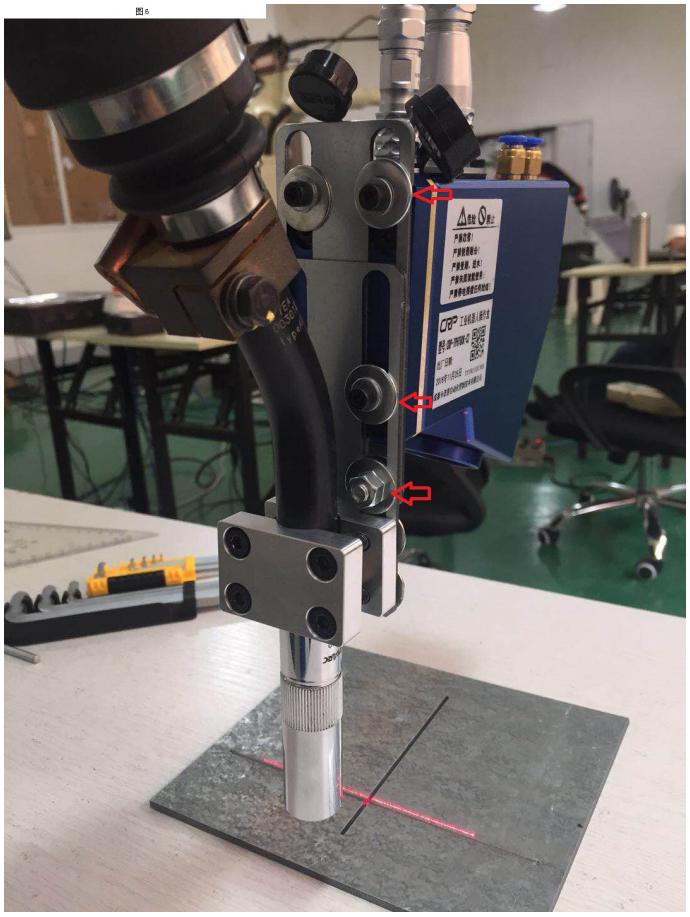


Then the mounted camera bracket and firmware 1 are spliced together, as shown below.





After the camera is installed, the No. 1 and No. 2 screw can be used to adjust the vertical height of the camera and the workpiece. as shown below.

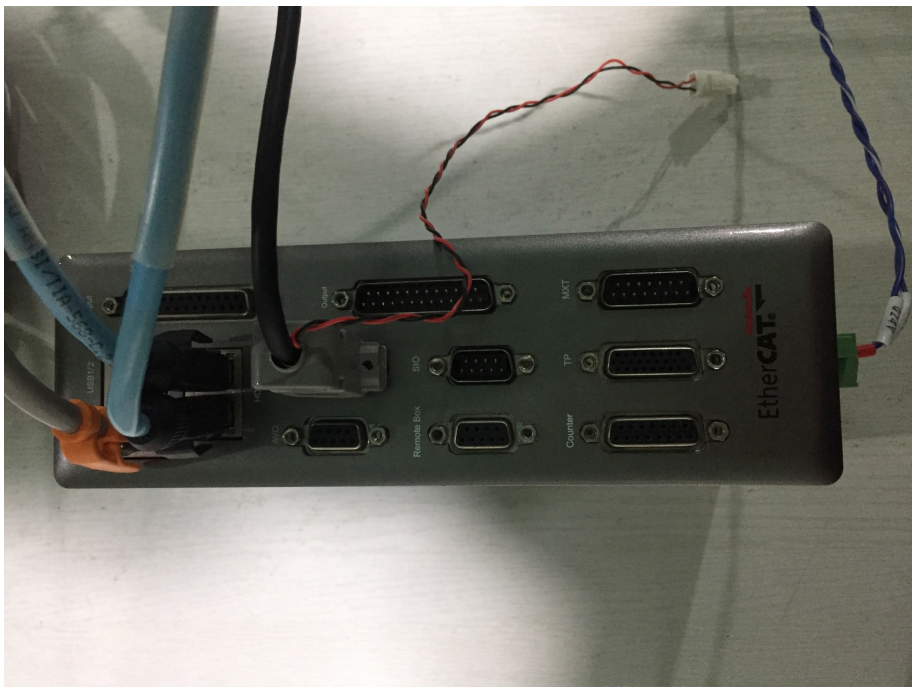


Connect the control line and communication line to the laser instrument. Note that red dots and red dots must be inserted correspondingly when inserting. as shown below.

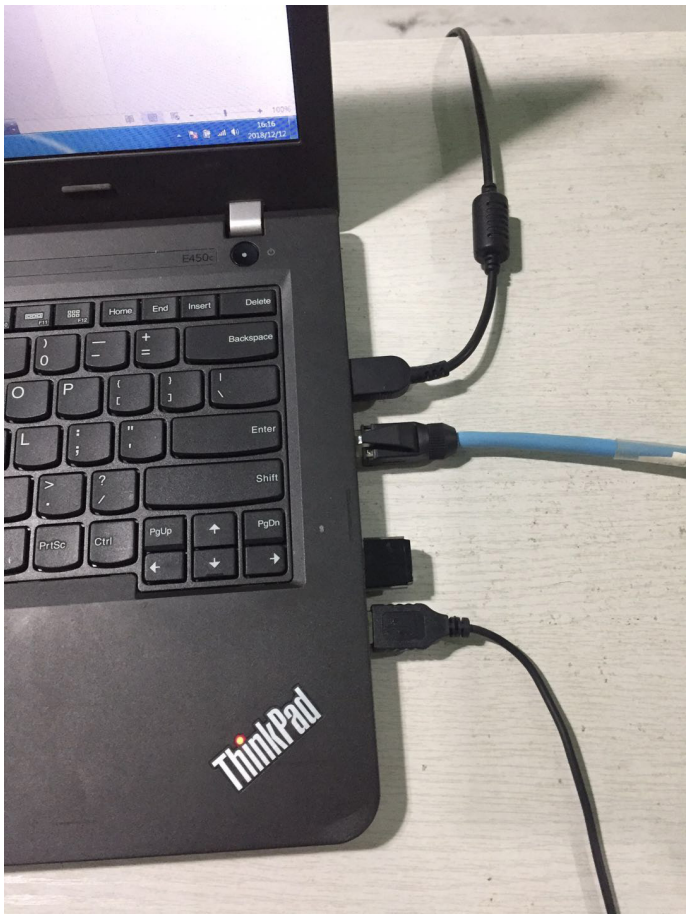




Then the laser instrument is connected with the host computer, as shown below, the laser instrument control line is connected with CAN/COM, the laser instrument communication line is connected with LAN 3, the computer network line is connected with the host LAN 1 port, and the system controller is connected with LAN 2 port.



Communication lines with computers, as shown below



Connect to the system controller, as shown below.



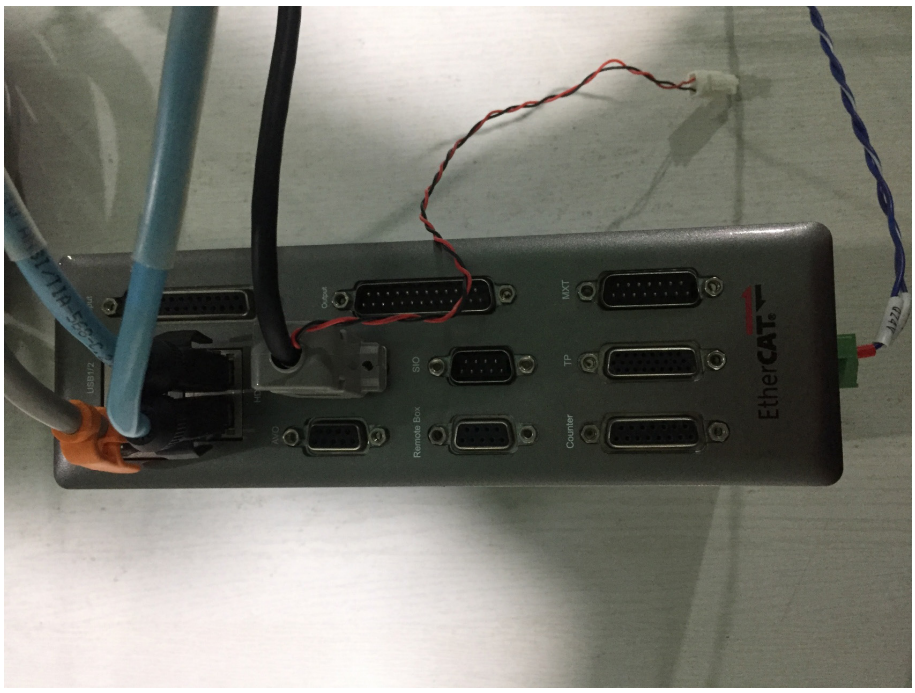
Finally, the fixed position of the adapter is adjusted so that the direction of the laser line is parallel to the front section of the welding torch. as shown below.





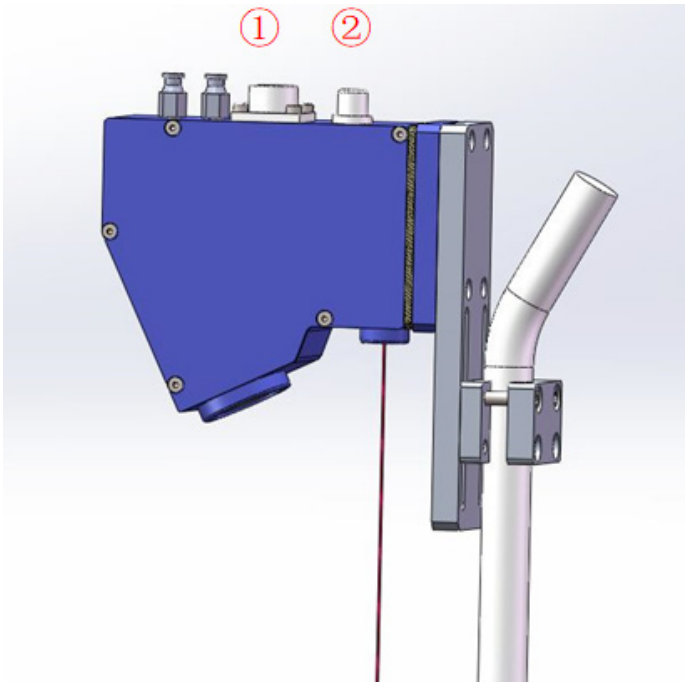
9.2 Laser tracking host computer interface

9.2.1 Laser tracking host controller interface



LAN3: Probe Communication Interface (RJ45)
LAN2: Robot Communication Interface (RJ45)
Robot communication interface socket information:
IP address: 192.168.10.20
Port number: 23463
LAN1: User Operating Interface Communication Interface (RJ45)
User Operational Control Interface Communication Interface Socket Information:
IP address: 192.168.15.18
Port number: 43276
CAN/COM: Probe Control Series Interface (DB9)

9.2.2 Laser Tracking Probe Interface



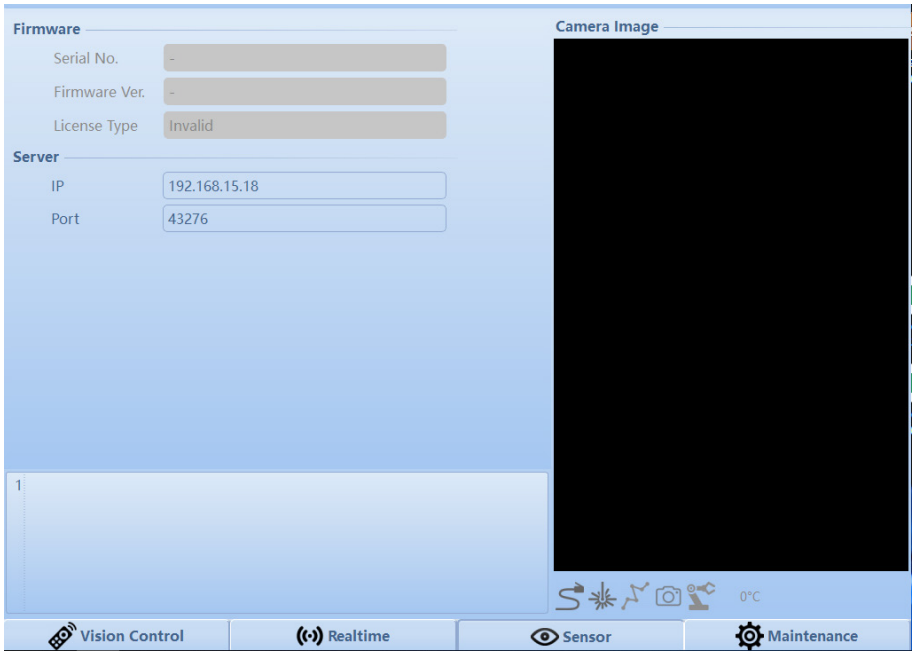
1: Probe Communication Interface
2: Probe Control and Power Interface

9.2.3 Laser Tracking User Operating Software

Running User Operating Software.Common_ui.exe

名称	修改日期	类型	大小
api-ms-win-crt-multibyte-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	26 KB
api-ms-win-crt-private-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	72 KB
api-ms-win-crt-process-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	19 KB
api-ms-win-crt-runtime-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	23 KB
api-ms-win-crt-stdio-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	24 KB
api-ms-win-crt-string-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	24 KB
api-ms-win-crt-time-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	21 KB
api-ms-win-crt-utility-l1-1-0.dll	2018/4/19 23:56	应用程序扩展	19 KB
Common_ui.exe	2019/3/26 14:23	应用程序	841 KB
Common_ui.ini	2019/4/4 17:05	配置设置	1 KB
concrt140.dll	2019/2/16 9:03	应用程序扩展	244 KB

connections setting up



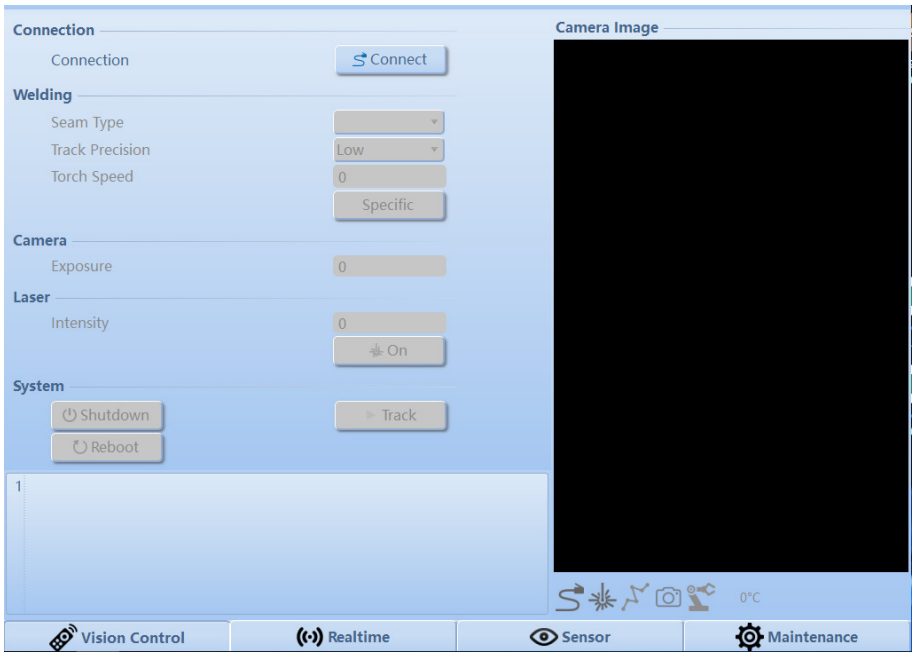
·IP

192.168.15.18

·Port

43276

Sensor control



· Connection

Connect to the sensor

· Weld type

Select the weld types that need to be identified, such as butt joint, corner joint, lap joint, etc.

· Track precision

Low precision: When the camera processes the image, it will lose some details of the

image. It has filtering effect and is suitable for fillet weld.

Medium Precision: The camera has slightly higher ability of recognizing details than low precision when processing images. The filtering effect is moderate. It is suitable for docking and overlapping welds.

High Precision: The camera has the highest ability to recognize the details of the weld seam when processing images. It can capture more and finer welds. The disadvantage is that it is prone to jump and has poor filtering effect. It is suitable for very fine and flat butt welds.

· Exposure

Normally,Normally set not more than 80 ,the more reflective the workpiece is, the shorter the exposure time is. When a very thick laser beam appears on the image, it proves that the exposure time is very long. The longer the exposure time, the greater the interference of arc light on camera imaging.

· Laser intensity

The more reflective the laser intensity of the workpiece should be smaller, the maximum setting is 100. When the laser beam on the image is thicker, the laser intensity should be reduced.

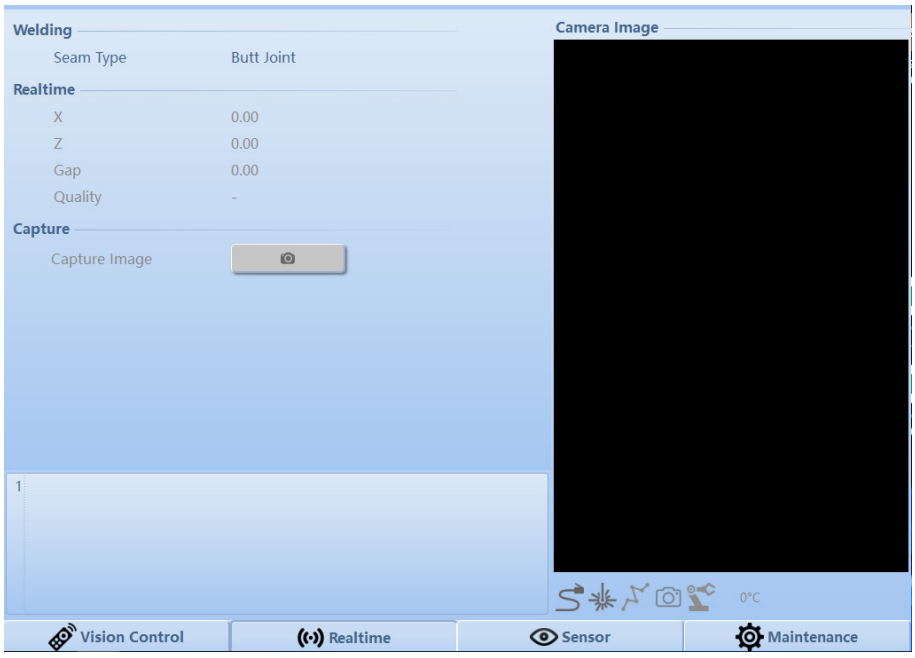
· On

Turn on the laser and you can see the picture of weld detection at the right interface.

· Track

Turn on laser tracking, and you can see the picture of seam detection on the right interface, as well as the seam position detected by laser tracker.

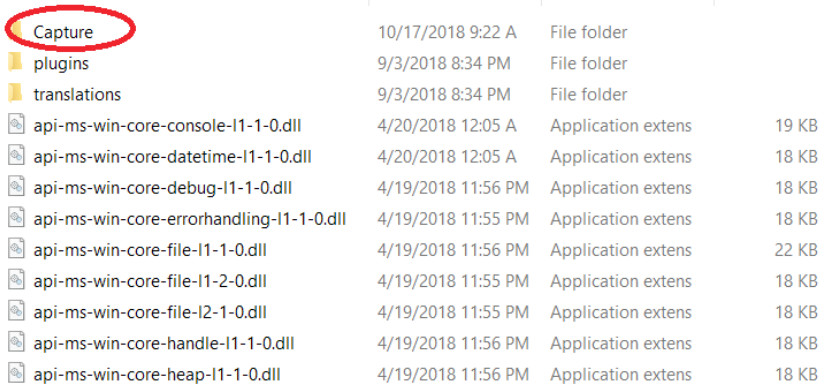
Tracking State and Sample Collection



· Capture Image

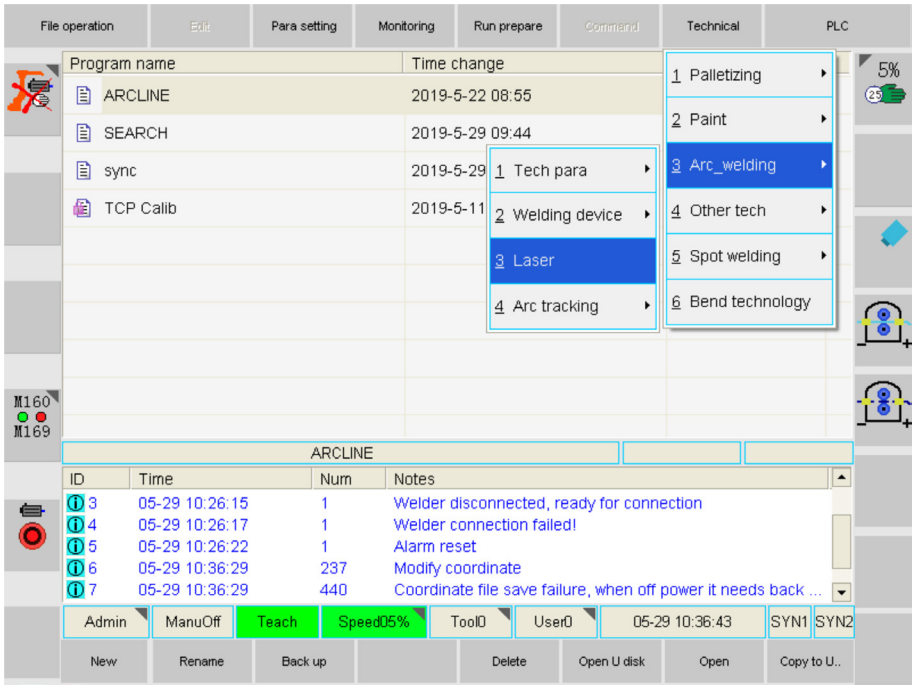
Acquisition of static images captured by laser tracker

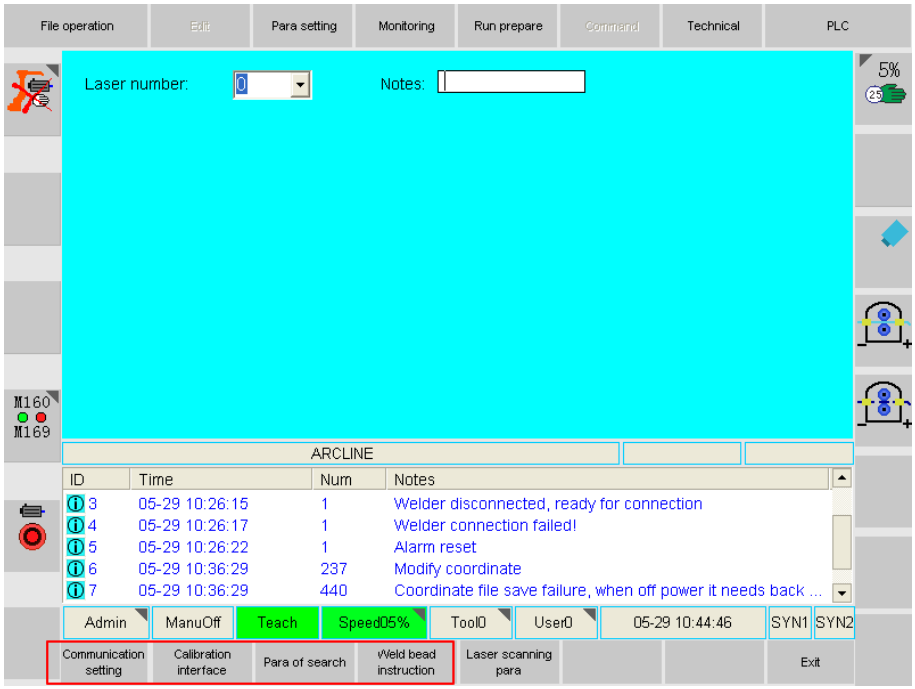
Sample images are saved in the Capture Catalog of the currently running folder:



9.3 Adjustment of Laser Tracking Parameters

1. In the CRP system: enter [Technical] → <Arc welding> → <laser >, as shown below

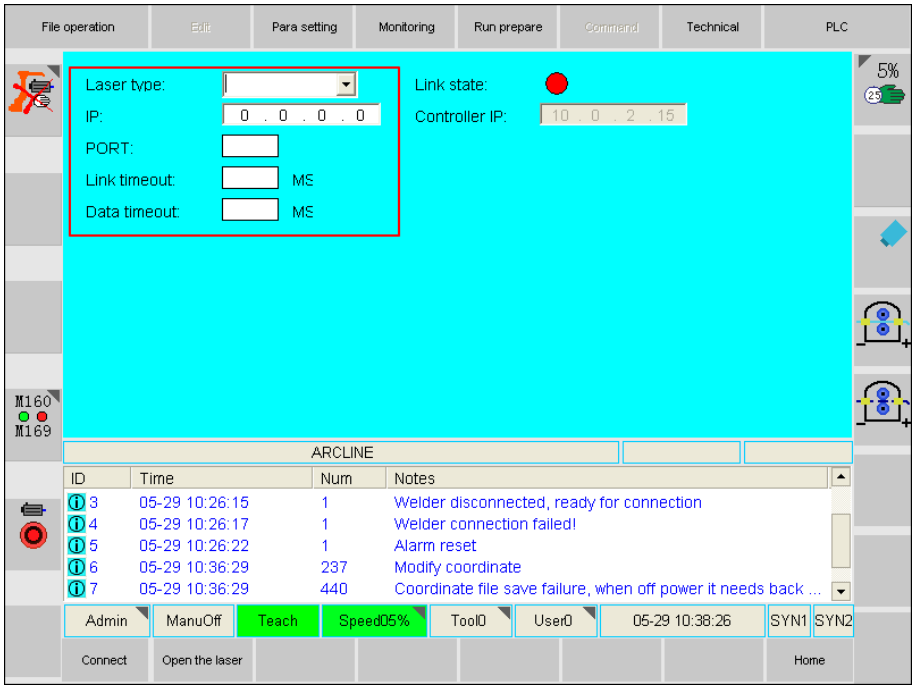




· Laser number

Represents the different laser tracking process, the lower left corner of several parameters may be different, for OPENLASER () to turn on laser commands, other commands can not be used. (Different from the laser process invoked in SEARCHLASER() and OPENLASERTRACK()).

2. Enter the communication setting, as shown below



· Laser type

Choose JunnoVision and CRNT

·IP

The IP address is the IP address of the laser tracker.

JunnoVision: 192.168.10.##

CRNT: 192.168.0.##

·PORT

The port number is the laser tracker port number.

JunnoVision port number: 23463

CRNT Port Number: 43002

·Link timeout

Generally set to 1S, the connection fails beyond this time

·Date timeout

It means that the system will report errors if communication fails to receive and receive data within a period of time.

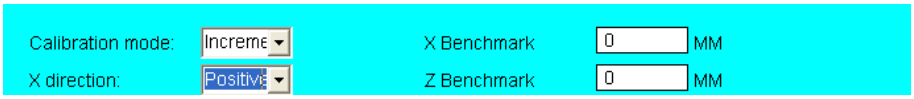
·Connect button

Click on this button and the system will connect to the laser tracker. When the connection is successful, the red state light in the upper right corner will turn green.

·Open the laser button

It can be used to test whether the laser connection is successful. After the connection is successful, clicking on the open laser button will trigger the laser tracker to turn on the laser, and clicking again will turn off the laser.

3. Enter the calibration interface, as shown below



· calibration mode

Incremental or absolutely options are available

· X and Z Direction

It is used to determine whether the direction of tracking is correct or not. If the direction is reversed in real-time tracking, the direction can be changed by this parameter.

· Front distance

Refers to the horizontal distance between the laser wire and the end of the welding wire. The general setting value is 2-3 mm larger than the actual value.

· Search sensitivity

When setting the sensitivity of search, the bigger the setting value is, the bigger the compensation value is, and the bigger the jitter is. If the jitter is large or overshoot, the parameter will be reduced, and if there is a lag phenomenon, the parameter will be increased.

· Search for X and Z axis ratios

It refers to the ratio of deviation value of X-Z axis, which is set to 1 in JunnoVision absolutely mode and 0.01 in CRNT absolutely mode.

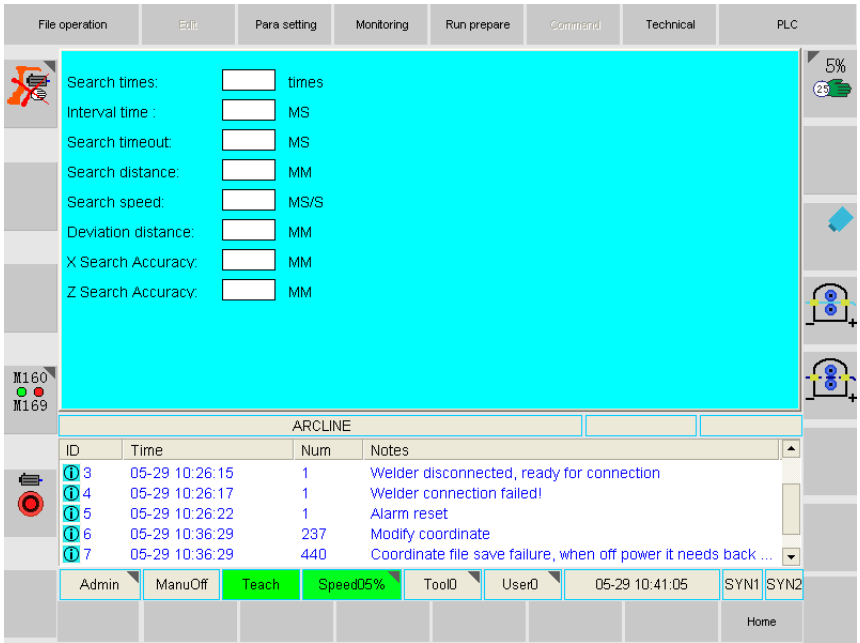
· Real-time tracking sensitivity

When setting the sensitivity of tracking, the bigger the setting value, the bigger the compensation value and the bigger the jitter. If the jitter is large or overshoot, the parameter will be reduced, and if there is a lag phenomenon, the parameter will be increased.

· Real-time tracking of X and Z axis ratios

It refers to the ratio of deviation value of X-Z axis, which is set to 1 in average macro absolute mode and 0.01 in imaginary absolute mode.

4. Enter the search para of search, as shown below



· Search times

Refers to the number of seam searches in SEARCH. If the number of seam searches exceeds the set number, the system will alarm.

· Search interval time

Refers to the interval in the number of searches.

· Search timeout

No welds were found during the search, and the alarm will be given after a period of time.

· Search distance

It is used to search the distance of weld seam in incremental mode. If the distance exceeds the parameter setting value, it will alarm.

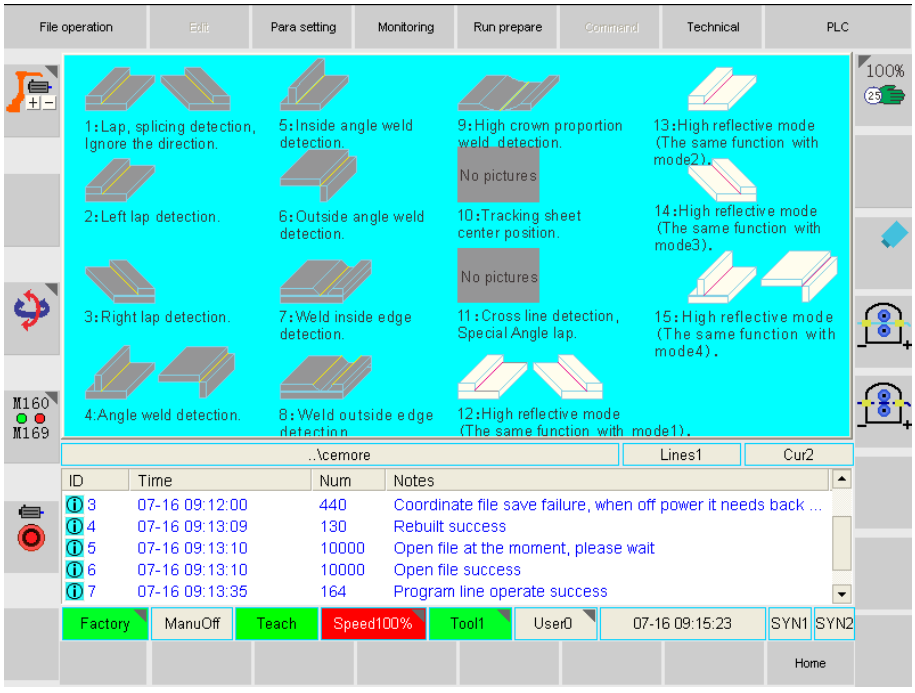
· Search speed

It refers to the speed at which the robot moves to the target point when it finds the weld in absolute mode.

· Search for Excess Deviation Distance

It is used to search the deviation range of weld seam in incremental mode. If the actual distance is larger than the setting value, the alarm will be given.

5. Weld description: This description corresponds to laser tracking, as shown below.



9.4 Calibration of Laser Tracker

9.4.1 Robot TCP Accuracy Calibration

The accuracy of TCP should be within 2 after 20-point calibration.

If one attitude is used for calibration and another attitude is used for calibration, TCP will affect it. If the attitude is always used for calibration, the accuracy of TCP will not affect much. In the program example, the test results of the effect of TCP accuracy on the actual

effect with different attitude can be used as a reference.

9.4.2 Laser Accuracy Testing

When connecting with the CRNT laser, the search X ratio, search Z ratio, trace X ratio and trace Z ratio parameters of the calibration interface need to be set to 0.01.

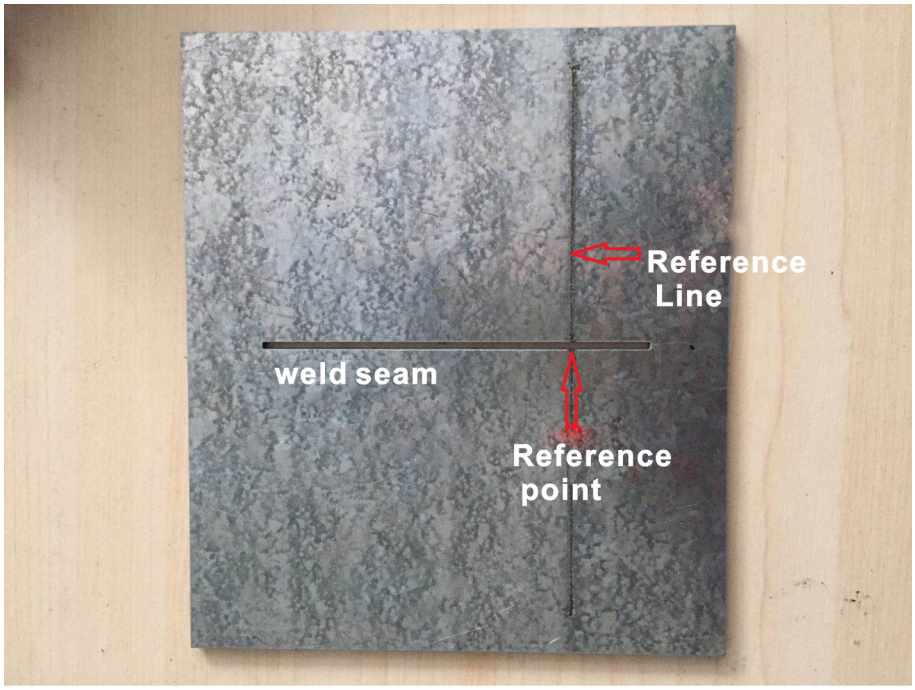
After the laser is installed, the laser tracking calibration interface is observed, the robot point position is recorded, the robot point moves 1 mm, and the data change corresponding to the laser tracking calibration interface is 1 mm. In theory, the laser data will change as much distance as the robot moves in YZ direction.

Laser is installed well, keeping the calibration board parallel to the laser line, observing the laser tracking calibration interface, moving the robot, so that the laser moves alone in one direction (X or Z). The data feedback from the laser also changes in only one direction, and the value is the same as the position of the robot.

9.4.3 Laser safety calibration

9.4.3.1 Sensor Installation

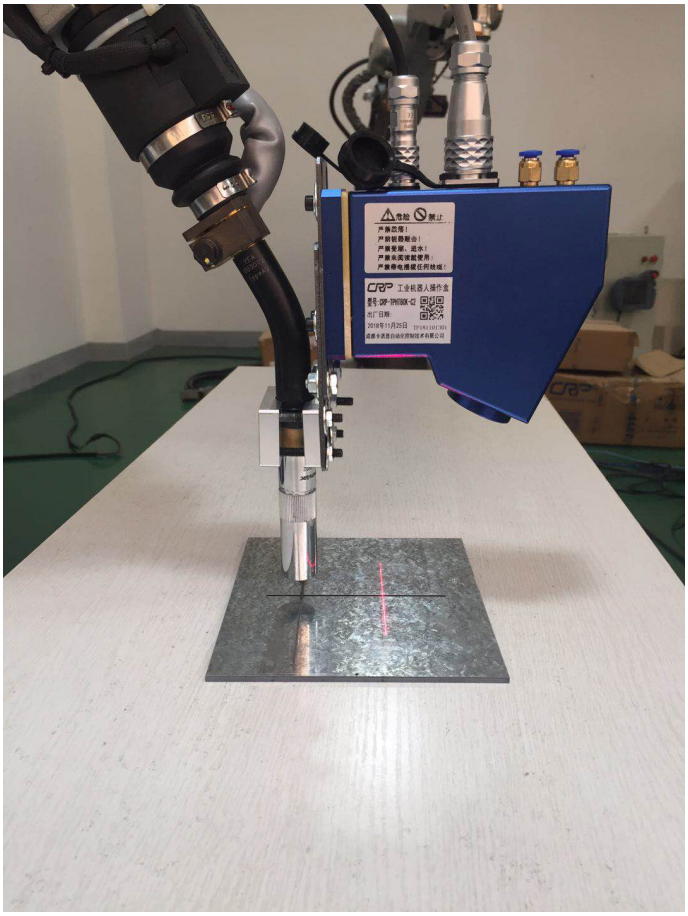
1. The calibration board of the laser weld tracker is shown in the following figure. There is a weld and “reference line” on the calibration board. The intersection point of the weld center line and the reference line is defined as “reference point”. The calibration plate is fixed on the horizontal worktable to prevent the calibration plate from moving during the calibration process.

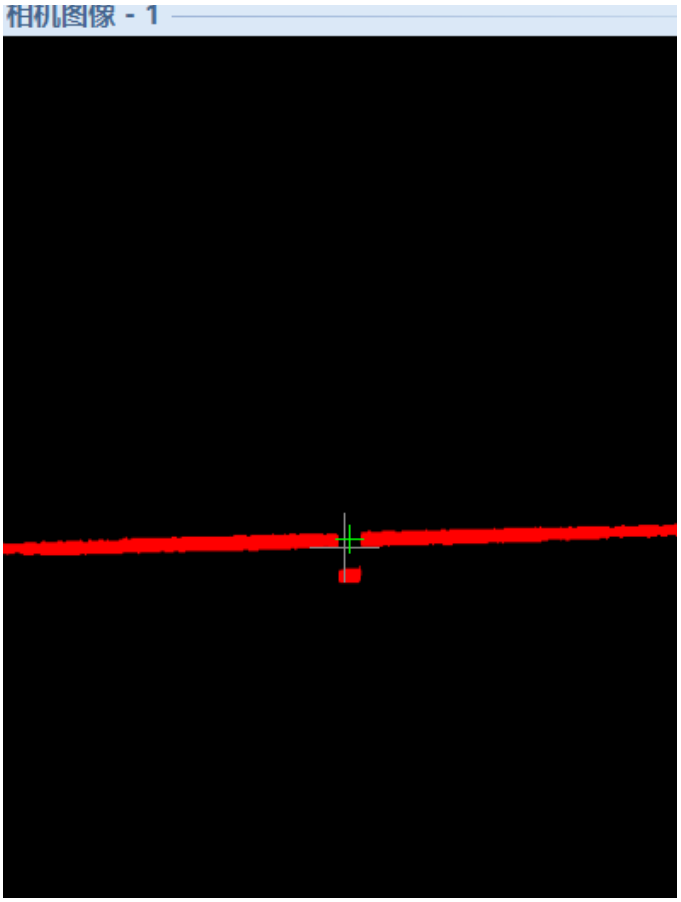


The 20-point method is used to precisely calibrate the TCP parameters of the welding torch. If it has been calibrated, this step can be skipped and the number of the calibrated tool can be selected on the teaching device.

2. As shown in the figure below, adjusting the robot’s posture (revolving around A and B) makes the axis of the welding torch perpendicular to the calibration plate. Move the welding wire tips into the weld seam, adjust the position and posture of the tracker installed on the welding torch, make the laser line perpendicular to the center line of the weld, and the length

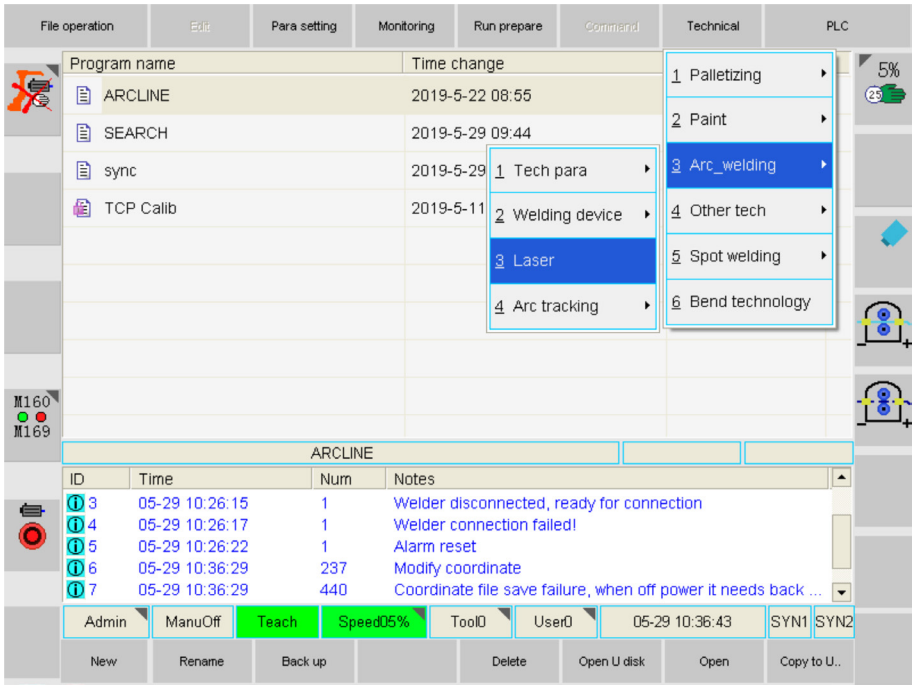
of the laser line on both sides of the weld is approximately equal. At the same time, adjust the installation position up and down, so that the laser line in the vision is near the transverse axis of the camera.

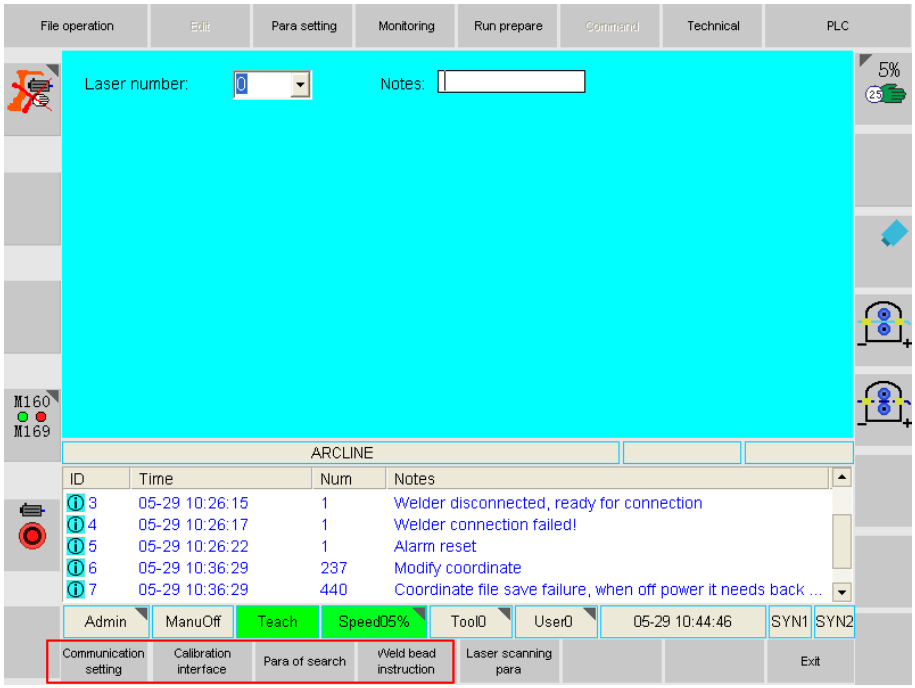


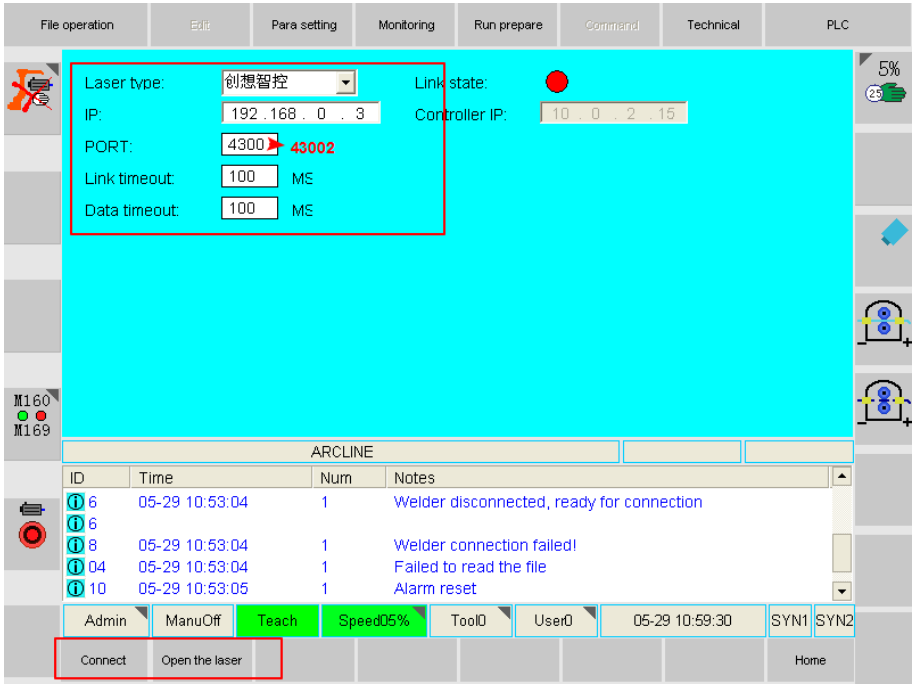


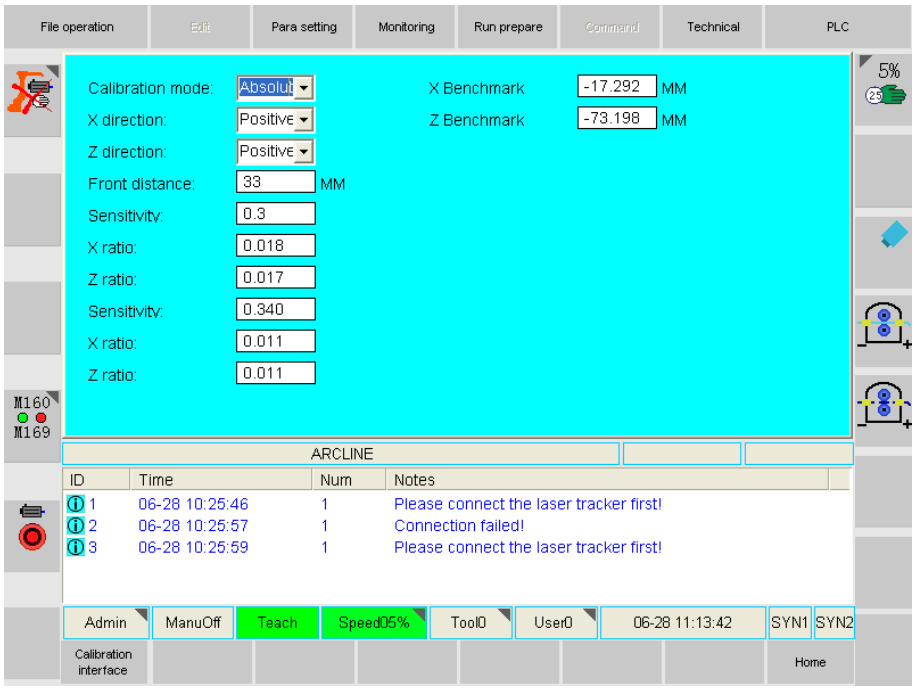
9.4.3.2 calibration

1. Connect the robot to the laser tracker and turn on the laser, then enter the calibration interface as shown in the figure below.





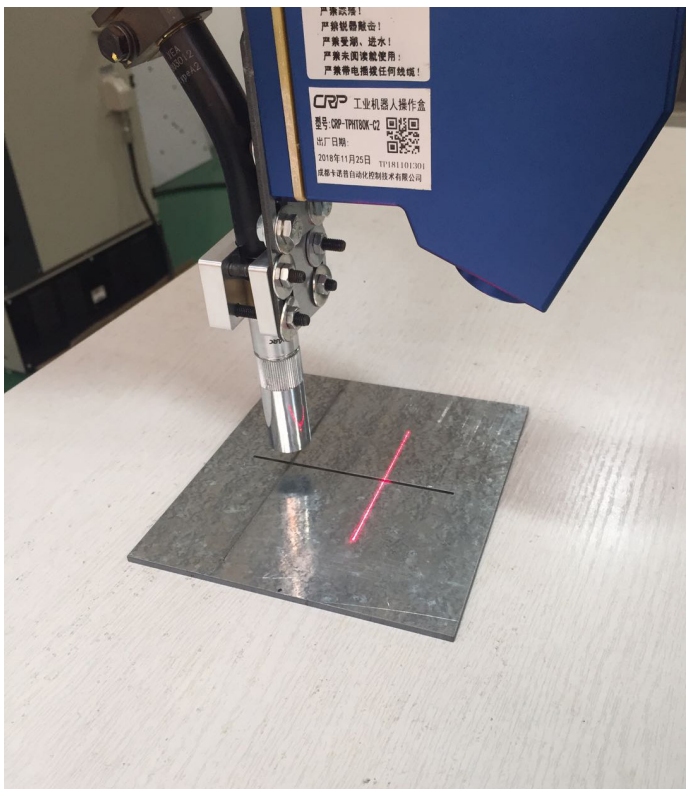

File operation
Edit
Para setting
Monitoring
Run prepare
Command
Technical
PLC
Laser type:
创想智控
Link state:
IP:
192 .168 . 0 . 3
Controller IP:
10 . 0 . 2 . 15
PORT:
4300
43002
Link timeout:
100
MS
Data timeout:
100
MS
5%
M160
M169
ARCLINE
ID
Time
Num
Notes
6
05-29 10:53:04
1
Welder disconnected, ready for connection
6
8
05-29 10:53:04
1
Welder connection failed!
04
05-29 10:53:04
1
Failed to read the file
10
05-29 10:53:05
1
Alarm reset
Admin
ManuOff
Teach
Speed05%
Tool0
User0
05-29 10:59:30
SYN1
SYN2
Connect
Open the laser
Home

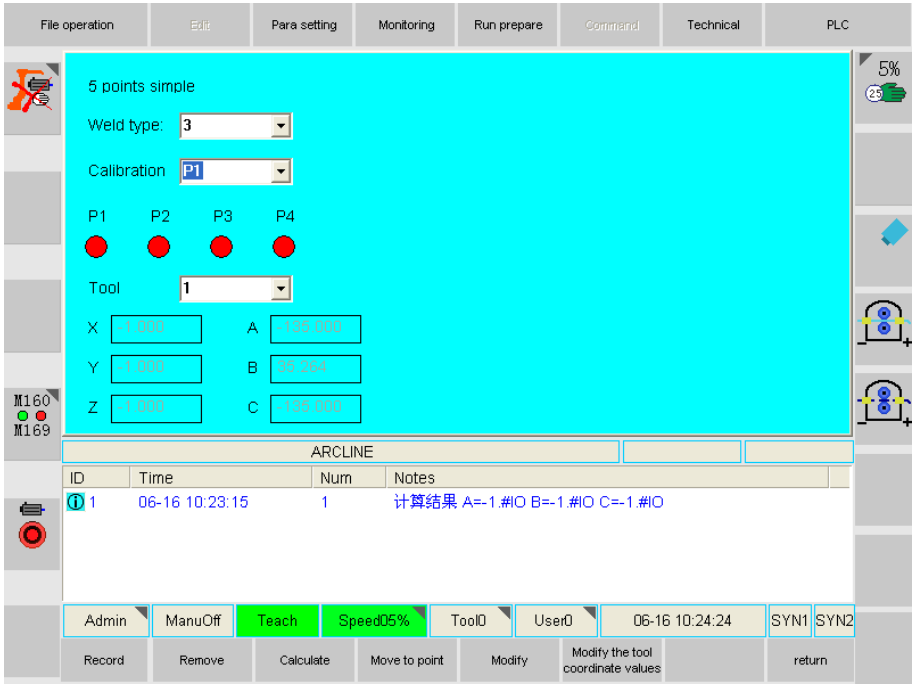

File operation
Edit
Para setting
Monitoring
Run prepare
Command
Technical
PLC
Calibration mode:
Absolut
X Benchmark
-17.292
MM
X direction:
Positive
Z Benchmark
-73.198
MM
Z direction:
Positive
Front distance:
33
MM
Sensitivity:
0.3
X ratio:
0.018
Z ratio:
0.017
Sensitivity:
0.340
X ratio:
0.011
Z ratio:
0.011
5%
M160
M169
ARCLINE
ID
Time
Num
Notes
1
06-28 10:25:46
1
Please connect the laser tracker first!
2
06-28 10:25:57
1
Connection failed!
3
06-28 10:25:59
1
Please connect the laser tracker first!
Admin
ManuOff
Teach
Speed05%
Tool0
User0
06-28 11:13:42
SYN1
SYN2
Calibration interface
Home

2. As shown in the figure below, adjusting the posture around C makes the laser line coincide with the reference line (the laser line must coincide with the reference line precisely, otherwise the calibration accuracy will be affected).

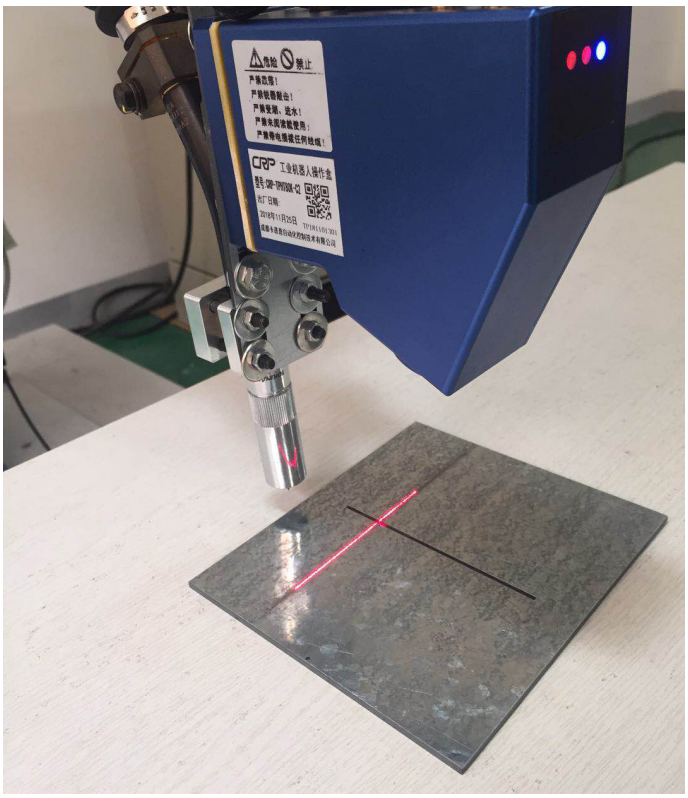


3. As shown in the figure below, without changing the posture of the robot, it moves only along the X, Y and Z directions, so that the welding wire tips coincide with the “reference points” (the welding wire tips are located in the center of the weld and pass through the reference lines). Click on the Robot Instructor to record point P1.

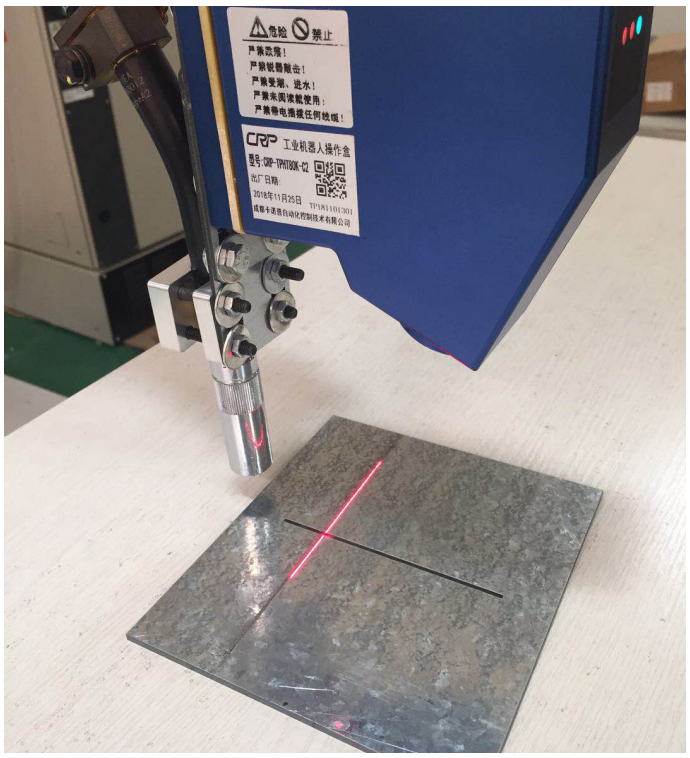




4. As shown in the figure below, without changing the posture of the robot, it moves only along the X, Y and Z directions, making the laser line coincide with the reference line, and the length of the laser line on the left side is much longer than that on the right side. The record is P2.



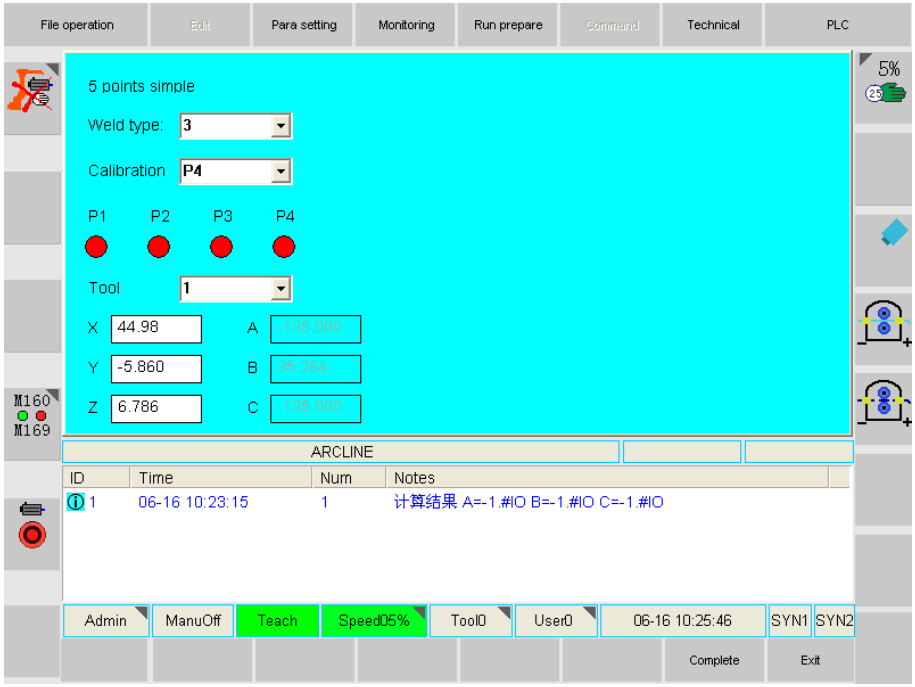
5. As shown in the figure below, without changing the attitude of the robot, it only moves along the X, Y and Z directions to make the laser line coincide with the reference line, and the length of the laser line on the right side is much longer than that on the left side. Recorded at point P3.



6. In the following figure, without changing the posture of the robot, move about 20 mm along the Z direction of the robot and X and Y directions, so that the laser line coincides with the reference line, and the length of the laser line on the left is equal to the length of the laser line on the right. The record is P4.



7. From P1 to P4, 4 points are recorded and calculated by clicking to get the relationship between tools and cameras.

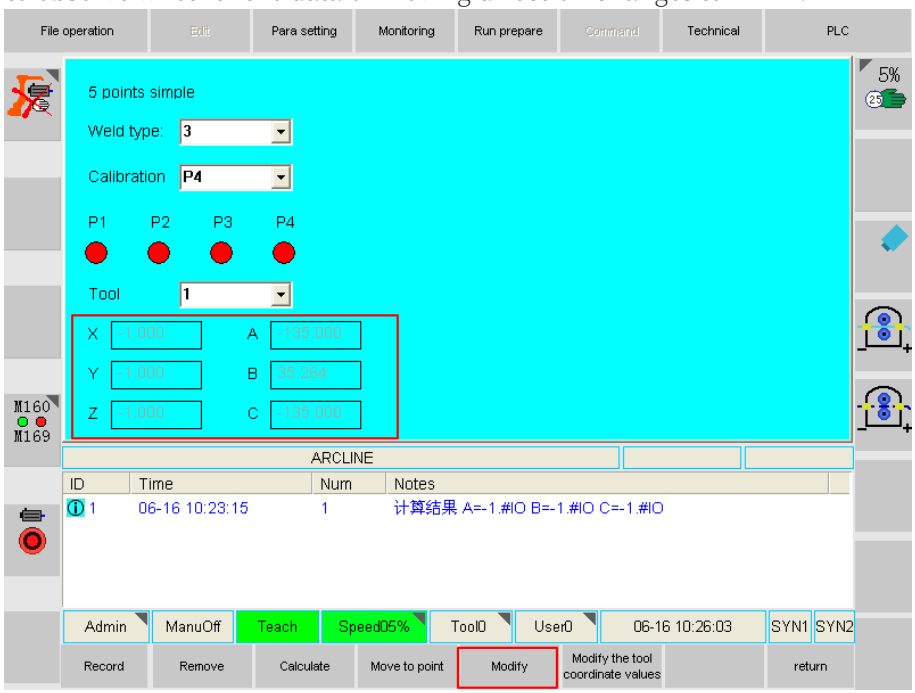


8. Click to modify the tool coordinate value, and automatically fill the calculated tool coordinate ABC into the selected tool coordinate system.

9.4.4 Laser calibration test

Direction relation, the direction of calibrated tool coordinates, when the tool coordinates are moved manually, X + is perpendicular to the laser line, the direction is that the welding torch tip is towards the laser line, and Z + is away from the calibration plate.

In proportional relation, the robot moves 1 mm in YZ direction, and the feedback data of the laser tracker changes 1 mm. The feedback data can be observed at the laser tracking and calibration interface. It can also record P points in the calibration interface, observe the laser position of the information prompt bar, and judge the change of feedback data. Every time P-point is recorded, the data information of laser feedback is printed out. First P-point is recorded, then 1 mm is recorded in one direction for mobile robot, and then P-point is recorded to observe whether the data of moving direction changes to 1 mm.



Calibration relationship compensation, the results of calibration are displayed in the calibration interface, and laser search can be programmed. If the location of laser search is different from the actual location, and the difference is fixed, the calibration relationship compensation can be carried out. Calibration relationship compensation in the calibration interface, Click to modify, you can modify the XYZ value in the input box, generally only modify XYZ, do not need to modify ABC. The X direction is the direction from the tip of the torch to the laser beam, and the Y direction is parallel to the laser beam.

9.4.5 Notes for Laser Debugging

9.4.5.1 CRNT

· Incremental and absolutely switching: Select incremental or absolute in the calibration interface of the teaching box.

· Incremental tool coordinate system X direction is parallel to laser beam, Y direction is perpendicular to laser beam, Z + direction is downward; absolute tool coordinate system X direction is perpendicular to laser beam, Y direction is parallel to laser beam, Z + direction is upward. When incremental and absolute switching, it is necessary to switch to the corresponding tool coordinate system.

· Laser parameters: absolutely, AX2 axis adjusted to automatic tracking, incremental, AX2 adjusted to manual tracking.

· Laser home position can be calibrated at any position in incremental mode. Home position can not be calibrated after calibration in absolutely mode.

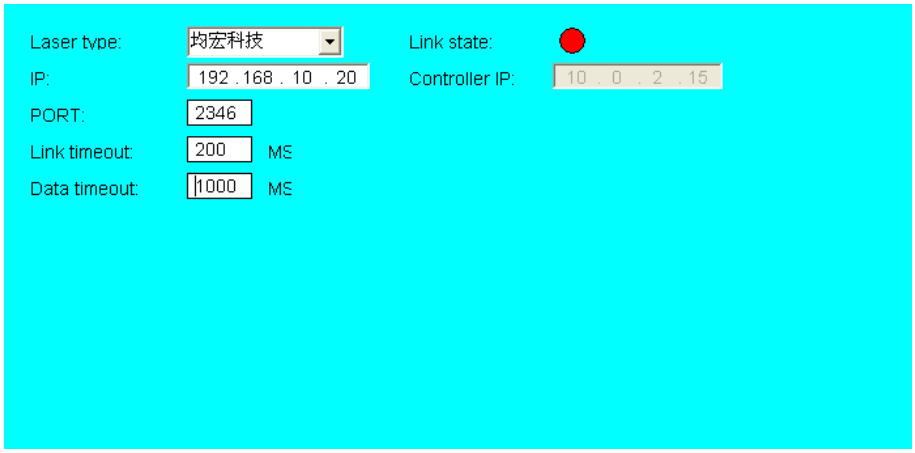
· The search ratio and real-time tracking ratio in the calibration interface of the teaching box are both 0.01.

· Front distance: In incremental mode, it can be adjusted by itself. In absolutely mode, fixed to 16.

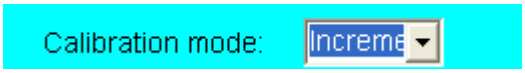
· Incremental tracking, the relationship between the robot and the laser, is determined by the direction of the reference and coordinate system. Absolute tracking, the relationship between the robot and the laser is determined by the calibration relationship.

·OPENLASER#(0) 0 refers to turning on Laser Tracking Process No. 0
·SEARCHLASER#(1) 1 refers to calling the laser No. 1 parameter
·OPENLASERTRACK#(2) 2 refers to calling the laser No. 2 parameter

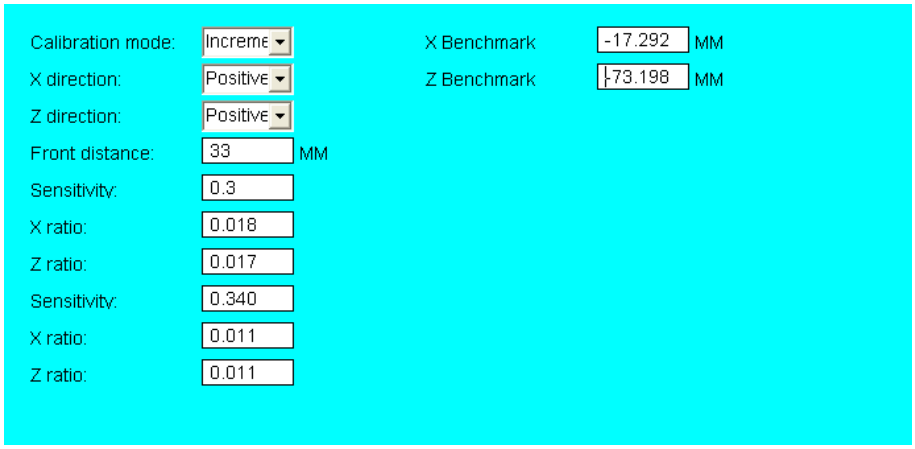
9.4.5.2 JunnoVision



· Incremental and absolutely switching: Select incremental or absolutely in the calibration interface of the Teach Pendant.

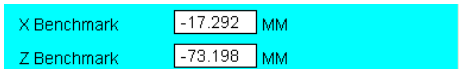


· Incremental tool coordinate system X direction is parallel to laser beam, Y direction is perpendicular to laser beam, Z + direction is downward; absolute tool coordinate system X direction is perpendicular to laser beam, Y direction is parallel to laser beam, Z + direction is upward. When incremental and absolute switching, it is necessary to switch to the corresponding tool coordinate system. If the direction is not right in incremental tracking, the direction parameters of the calibration interface can be adjusted and the direction can be changed.



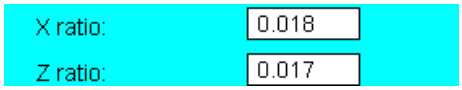
· In incremental mode, the datum point needs to be set in the X benchmark and Z benchmark in the calibration interface. After the robot is adjusted to the starting welding position, the welding wire is aligned with the weld, and the Y and Z values searched by the laser are obtained.

· In absolutely mode, there is no need to set a benchmark point.



· In incremental mode, the search proportion of the calibration interface of the Teach Pendant is the data used for the feedback of the fuzzy laser. Multiply the data received by the following proportion, if the search overshoot is serious, then reduce the proportion.

· In absolutely mode, the X ratio and Z ratio is 1.



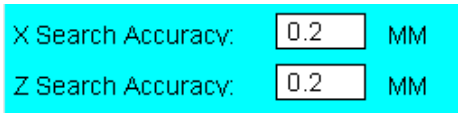
· The search sensitivity and real-time tracking sensitivity adjustment principle in the Teach Pendant calibration interface: the sensitivity is increased when the clock is not kept, and the sensitivity is reduced when the overshoot is adjusted.'



· In incremental mode, adjust the search accuracy in the teaching box search parameter interface, the search accuracy can be adjusted appropriately, the search accuracy adjustment principle: similar to the positioning error, when the data fed back by the laser is less than the

set value, the robot thinks that the search is in place. , proceed to the next step.

· In absolutely mode, there is no need to set search accuracy. When the point is found, the position is not accurate, the search accuracy can be set to compensate, X compensates the direction of the laser beam, and Z compensates the direction of the torch.



· When calibrating the point, record the P point, trigger the laser tracker to track, then send the coordinates to the camera, the camera returns X/Y/Z, X is the X coordinate of the robot, Y/Z is the camera value, after the recording is completed, the tracking is turned off.

·OPENLASER#(0) 0 refers to turning on Laser Tracking Process No. 0
·SEARCHLASER#(1) 1 refers to the type of weld that calls laser No. 1
·OPENLASERTRACK#(2) 2 refers to the type of weld that calls laser No. 2

9.5 Introduction to Directives

OPENLASER#（0）·Turn on the laser
0 represents the invoked laser tracking process number;
When the command is run, the laser is controlled to turn on and ready to run.
CLOSELASER·Turn off the laser
When the command is run, the laser is controlled to turn off the laser.
SEARCHLASER#（0） 0·Laser Search
0 represents the invoked laser tracker parameter number (CRNT), the invoked laser tracker weld type (Junnovision)

0 or 1 represents whether to select GP points, 0 represents not to select GP points, after searching for the target directly run in place. 1 represents the number saved to GP after searching for the target. When saving, only XYZ is saved, but ABC is not saved. The attitude of the target point is based on the reference point.

When the command is run, the laser search action or the search save point action are executed.

OPENLASERTRACK#（0）·Turn on Laser Tracking

0 represents the invoked laser tracker parameter number (CRNT), the invoked laser tracker weld type (Junnovision)

When the command is run, the laser is controlled to enter a continuous search state. The data feedback from the laser is pushed into the buffer, and the data searched before the buffer is taken out for operation.

CLOSELASERTRACK·Turn off laser tracking
When the command is run, the laser is controlled to stop searching.
KEEPLASERTRACK·Keep Laser Tracking

In incremental mode, when the end of the weld is tracked, the laser can not find the weld, so it keeps the last searched data and completes the pre-distance. This function takes effect automatically without writing this instruction in the program.

9.6 An Example of Laser Tracking Programming

Absolute Laser Search (arrival point) (CRNT)

Testing weld seam
Splicing, weld width 1.8

Test program

CHANGETOOL#(11) //Change tool coordinate system
OPENLASER#(0) //Turn on the laser
TIME T=500
SEARCHLASER#(1) 0 //Search laser, 1 represents the parameter number of the laser tracker invoked; 0 represents not selecting GP points, after searching for the target, run directly in place.
CLOSELASERTRACK //Turn off laser tracking
CLOSERLASER //Turn off the laser

When the normal calibration is completed, the welding torch is nearly vertical to the workpiece surface and the laser beam is nearly vertical to the workpiece surface, the test program can accurately find the weld seam when the Y/Z direction is offset, and guide the robot to let the torch tip go to the center of the weld seam.

When the welding torch is not perpendicular to the workpiece surface, the laser beam is not perpendicular to the workpiece surface, and the A/B posture is changed, the position searched by the test program and the position guided by the robot are deviated. There are three main aspects that affect the accuracy, TCP accuracy, laser accuracy and calibration accuracy.

Absolute Laser Search (Storage Point) (CRNT)

Testing weld seam

Lap arc weld, weld height difference 2mm

Test program

CHANGETOOL#(11) //Change tool coordinate system
OPENLASER#(0) //Turn on the laser
TIME T=500
SEARCHLASER#(2) 1 1 //Search Laser, 2 represents the parameter number of the laser tracker invoked; 1 represents the selection of GP points, and the latter 1 represents the number saved to GP after searching for the target. When saving, only XYZ is saved, but ABC is not saved. The posture of the target point is based on the reference point.
MOVL VL=100MM/S GP#01 PL=0 //Running to the point searched by the laser
CLOSELASERTRACK //Turn off laser tracking
CLOSERLASER //Turn off the laser

When searching for overlap weld, the torch is nearly perpendicular to the workpiece surface and the laser beam is nearly perpendicular to the workpiece surface, but not perpendicular to the tangent of the weld, the position found in XY direction is accurate, the height found in Z direction is deviated, and the deviation range is 1-3 mm.

The angle between the torch and the workpiece surface is about 45 degrees. When the laser beam seeks the spot, it is nearly perpendicular to the workpiece surface. When it is perpendicular to the weld tangent, X/Y/Z has errors. It is verified that the error of XY direction is influenced by TCP accuracy.

Absolute Laser Tracking（CRNT）

CHANGETOOL#(11) //Change tool coordinate system
OPENLASER#(0) //Turn on the laser, 0
TIME T=500
SEARCHLASER#(4) 0 //Search Laser, 4 represents the parameter number of the laser

tracker invoked; 0 represents not selecting GP points and running directly after searching for the target.OPENLASERTRACK#(4) 0 //Start laser tracking

MOVL VL=10MM/S PL=0 //Originally planned path

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Absolute Laser Search (arrival point)（Junnovision）

Testing weld seam

Splicing, weld width 1.8

Test program

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser

TIME T=500

SEARCHLASER#(0) 0 //Search Laser, The first 0 represents the weld type of the laser tracker invoked (according to actual selection); the second 0 represents the non-selection of GP points and the direct operation of the target after searching.

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Absolute Laser Search (Storage Point)（Junnovision）

Testing weld seam

Lap arc weld, weld height difference 2mm

Test program

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser

TIME T=500

SEARCHLASER#(2) 1 1 //Search Laser, 2 represents the weld type of the laser tracker invoked (according to actual selection); 1 represents the selection of GP points, and the latter 1 represents the number saved to GP after searching for the target. When saving, only XYZ is saved, but ABC is not saved. The posrture of the target point is based on the reference point.

MOVL VL=100MM/S GP#01 PL=0 //Running to the point searched by the laser

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Absolutely Laser Tracking（Junnovision）

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser, 0

TIME T=500

SEARCHLASER#(2) 0 //Search Laser, 2 represents the weld type of the laser tracker invoked (according to the actual selection); 0 represents the non-selection of GP points and the direct operation in place after the target is searched.

OPENLASERTRACK#(2) 0//Start laser tracking, 2 represents the weld type of the invoked laser tracker.

MOVL VL=10MM/S PL=0 //Originally planned path

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Cooperative Tracking of Linear Weld with External Rotation on Absolute Laser Band(均宏)

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser, 0

TIME T=500

SEARCHLASER#(2) 0 //Search Laser, 2 represents the weld type of the laser tracker invoked (according to the actual selection); 0 represents the non-selection of GP points and the direct operation in place after the target is searched.

OPENLASERTRACK#(2) 0//Start laser tracking, 2 represents the weld type of the invoked laser tracker.

MOVL VL=10MM/S PL=0 TOOL=11 COORD1 //Original Path of Linear Weld with External Shaft Synergy

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Cooperative tracking of arc weld with external rotation on absolute laser strip (Junnovision)

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser, 0

TIME T=500

SEARCHLASER#(2) 0 //Search Laser, 2 represents the weld type of the laser tracker invoked (according to the actual selection); 0 represents the non-selection of GP points and the direct operation in place after the target is searched.

OPENLASERTRACK#(2) 0 //Start laser tracking, 2 represents the weld type of the invoked laser tracker.

MOVC VL=10MM/S PL=0 TOOL=11 POINT=1 COORD1 //Origin Path Point 1 of Circular Arc Weld with Outer Shaft Synergy

MOVC VL=10MM/S PL=0 TOOL=11 POINT=2 COORD1 //Origin Path Point 2 of Circular Arc Weld with Outer Shaft Synergy

MOVC VL=10MM/S PL=0 TOOL=11 POINT=3 COORD1 //Origin Path Point 3 of Circular Arc Weld with Outer Shaft SynergyCLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Absolutely Laser Fixed-point Tracking, External Axis Motion is not Robot Control

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser of No. 0 process,Incremental mode and parameters are set in process parameters

TIME T=500

SEARCHLASER#(0) 0 //Search Laser, The first 0 represents the weld type of the laser tracker invoked (according to actual selection); the second 0 represents the non-selection of GP points and the direct operation of the target after searching.

OPENLASERTRACK#(2) 1 //Start laser tracking, 2 represents the weld type of the invoked laser tracker. 1 represents the fixed-point tracking selection, and the robot enters the fixed-point tracking state.

(M229=ON End of Tracking) // External control of weld movement, external judgment of the completion of the movement, input conditions positioning M229

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

Absolutely Laser Fixed-point Tracking, External Axis Motion Controlled by Robot

CHANGETOOL#(11) //Change tool coordinate system

OPENLASER#(0) //Turn on the laser of No. 0 process,Incremental mode and parameters are set in process parameters

TIME T=500

SEARCHLASER#(0) 0 //Search Laser, The first 0 represents the weld type of the laser tracker invoked (according to actual selection); the second 0 represents the non-selection of GP points and the direct operation of the target after searching.

OPENLASERTRACK#(2) 0 //Start laser tracking, 2 represents the weld type of the invoked laser tracker.

MOVJ VJ=10% PL=0 TOOL=11//Robot Controls External Axis Movement

CLOSELASERTRACK //Turn off laser tracking

CLOSERLASER //Turn off the laser

9.7 Laser Search

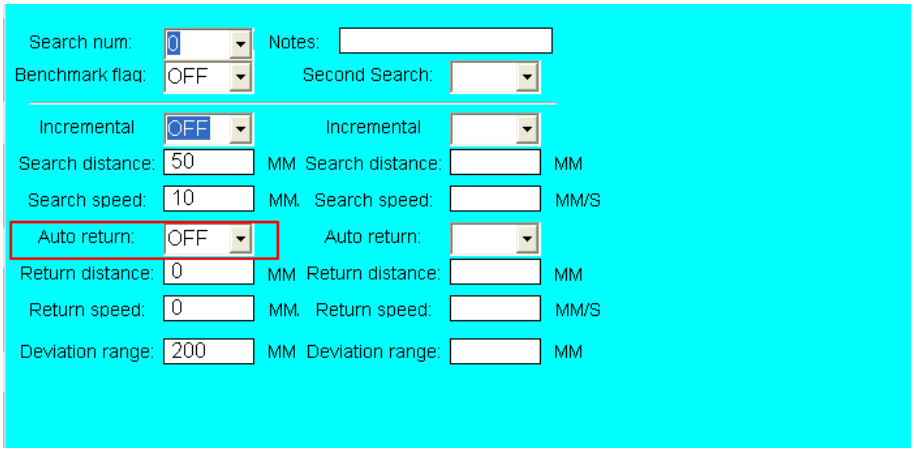
9.7.1 Laser Search-the starting point

With laser tracker as the medium, the robot runs on the search path with laser. When the laser finds the required seam position, the feedback signal is sent to the robot. The robot uses the feedback signal of laser to find the welding position.

The function of locating the starting point is suitable for the situation where the deviation of the welding starting point and the subsequent trajectory are tracked by arc or laser.

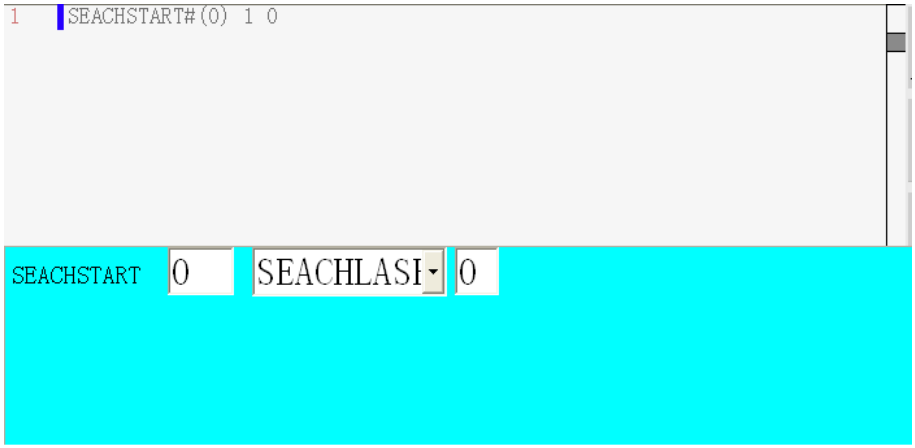
Laser Location Parameter Setting

As shown in the following figure,



Instructions for Laser search

As shown in the figure below, add SEARCHLASER to the options after the conventional bit-finding instructions



Examples of search

CHANGETOOL#(11) //Change tool coordinate system
OPENLASER#(0) //Turn on the laser, 0
TIME T=500
SEARCHSTART#(0) 1 0 //Laser search start
MOVL VL=10MM/S PL=0 TOOL=11
MOVL VL=10MM/S PL=0 TOOL=11 SECH NP#(0)
SEARCHEND
SEARCHLASER#(2) 0 //Search Laser, 2 represents the weld type of the laser tracker invoked (according to the actual selection); 0 represents the non-selection of GP points and the direct operation in place after the target is searched.
OPENLASERTRACK#(2) 0//Start laser tracking, 2 represents the weld type of the invoked laser tracker.
MOVL VL=10MM/S PL=0 TOOL=11//Originally planned path
CLOSELASERTRACK //Turn off laser tracking
CLOSERLASER //Turn off the laser

该文档是极速PDF编辑器生成，
如果想去掉该提示,请访问并下载：
http://www.jisupdfeditor.com/

Thank you very much for choosing our products!

The relevant manuals of this system should be properly kept for reference when necessary.

If the equipment needs to be handed over, please forward the relevant information to the other party!

The keys, functions and options not specified in the relevant manuals of this system are deemed to be unavailable. Do not use them!

Revision Notes:

Modification of PLC Ladder Diagram and Explanation from September 26, 2014 Add Austria wiring instructions and welding diagram on February 11, 2015 2019-2-17 Revised to Welding Process Instructions

Troysupply.com