

# lnc robot

## Welding instruction manual

2019/12/02

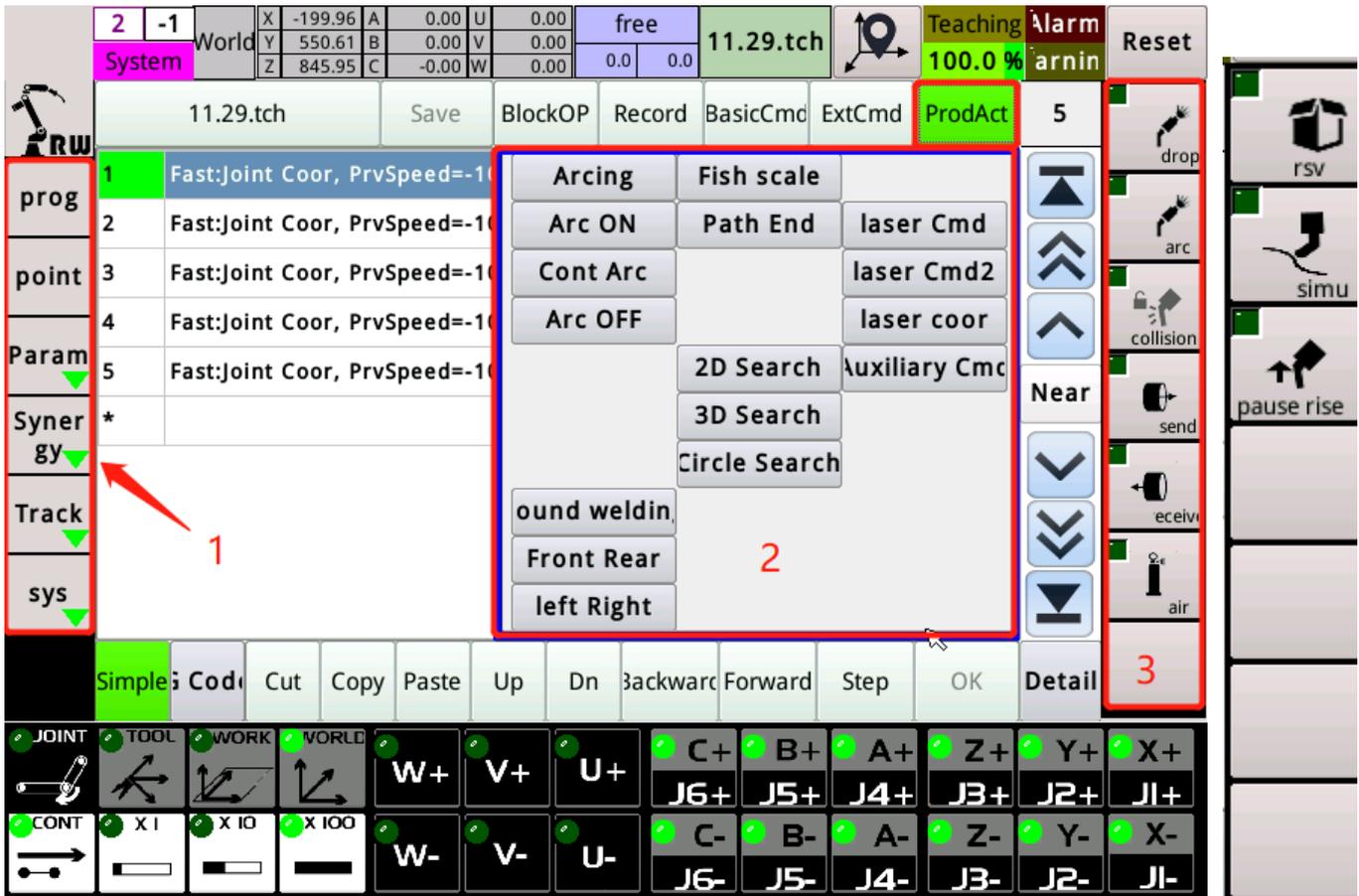


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# 1 Introduction to welding interface



## 1.1 page enter button

Parameters: Welding parameter debugging page.

Collaboration: Collaborative calibration page.

Tracking: Laser welding seam tracking setting and calibration page.

## 1.2 Welding related program page

The welding-related program instructions are in the application process page.

## 1.3 Shortcut Button

Some push-button switches commonly used during welding operations.

# 2 Introduction of welding parameters

## 2.1 Arc welding

### 2.1.1 Arc welding—welding arc timing

The screenshot displays the 'Welding arc' control interface. At the top, there are status indicators for 'Ready' (100.0%) and 'Alarm' (Alarm). Below this, the 'Welding arc' menu is active, showing 'Param set', 'Check set', and 'Break arc Set' options. The 'Arc' parameter is set to 0. The 'Feature list' table is as follows:

Feature	Value
Weld V	10.000
Weld I	180.000
Arc V	20.000
Arc I	160.000
Heat V	0.000
Heat I	0.000
ArcOff V	20.000
ArcOff I	160.000
SW V	0.000
SW I	0.000

The 'Timing' table shows the following values:

Parameter	Value	Unit
ArcTime	200	ms
Heating Time	0	ms
ArcOffTime	200	ms
SW_Time	0	ms

The waveform diagram at the bottom right shows the sequence of events: arc, heat, weld, arcoff, and sw. Red annotations highlight the 'features table' button and the 'Click to enter new page' instruction.

**G**roup number: Each group can set the welding current and voltage parameters, etc. After the setting is completed, when the arc start command is called in the program, different group numbers are set according to different current and voltage requirements.

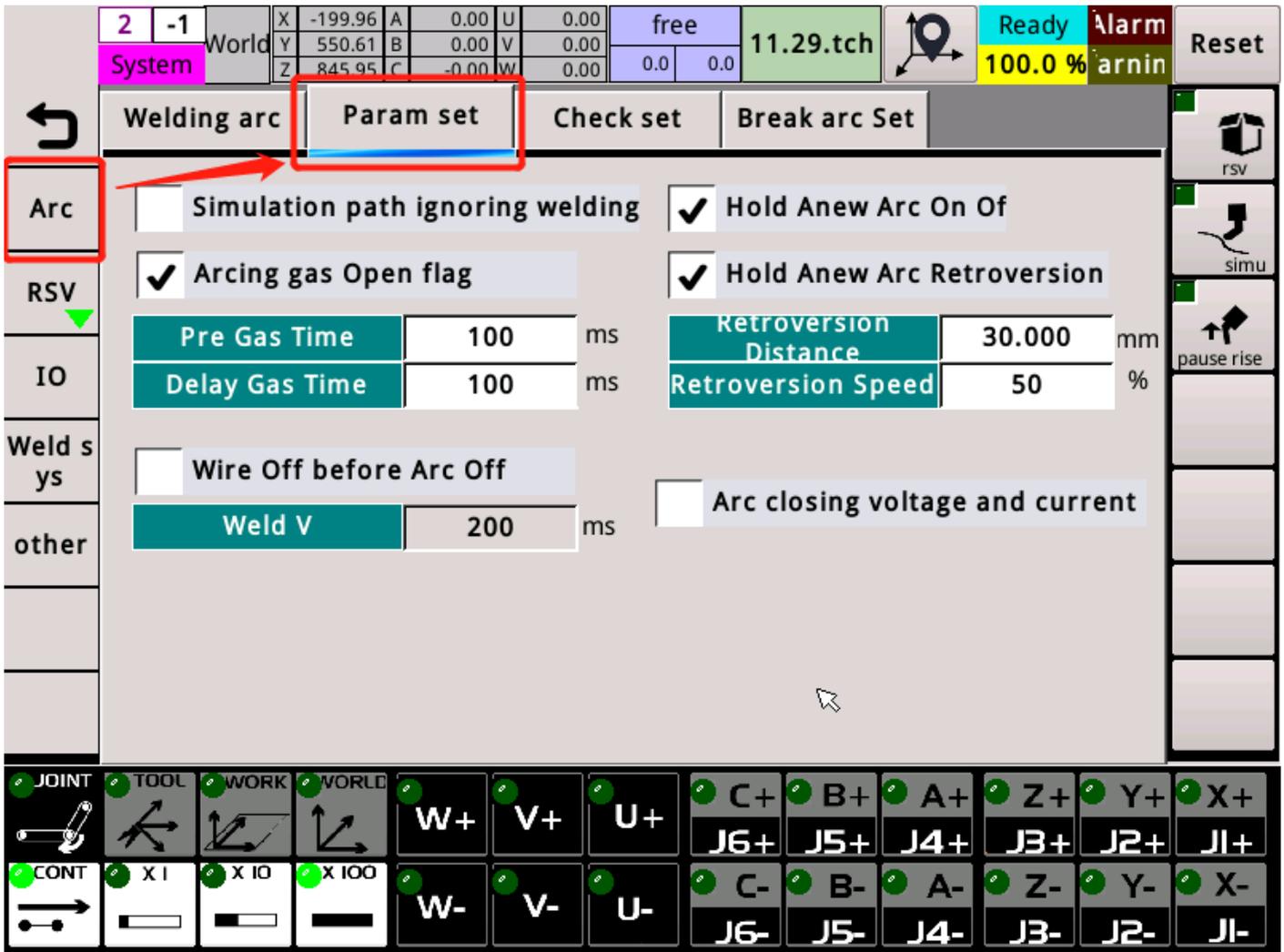
**W**elding characteristics table: Different welding machine characteristic

curve tables are different, and there will be one yuan and a difference. When using, this item must be checked, and the characteristic table number to be used is filled in the characteristic table number on the right. (Uncheck, you cannot fill in the value)

**Arc starting, arc closing, heating, anti-stick wire:** After ticking, parameters such as current voltage value and time can be set (selectable ticking is used, arc starting and arc ending are more commonly used)

**Characteristics table:** Click to enter the characteristics table page (for details, please refer to the chapter on welding characteristics table debugging method)

### **2.1.2 Arc welding-parameter setting**



**I**gnore arc welding on simulated paths: When the program is run automatically, if there are welding instructions such as arc starting and arc closing in the program, ignoring these instructions will not actually weld, only the path will be run dry.

**A**rc Start Gas Flag: After ticking this item, you can set the time to advance gas and delay gas during welding.

**A**rc closing and wire removal: After ticking this item, you can set the time of wire winding at the end of welding.

**P**ause, restart, and close arc: After ticking, turn on the pause and restart, and close arc function. After turning on, when the program is

paused during the welding process, press the start button again, and the robot will return to the set path along the original path according to the set back speed. Back off the distance and restart welding.

**P**ause restart arc rewind: Set the retraction distance and retraction speed (based on welding speed) as a percentage.

**A**rc closing voltage and current hold data: When this option is checked, the welding machine panel will display the current and voltage values at the time of arc closing when the arc is closed.

### 2.1.3 Arc Welding-Detection Settings

The screenshot displays the 'Arc Welding-Detection Settings' interface. At the top, a status bar shows coordinates (X: -199.96, Y: 550.61, Z: 845.95) and other parameters like 'free', '11.29.tch', 'Teaching 100.0%', and 'Alarm'. Below this, there are four tabs: 'Welding arc', 'Param set', 'Check set' (highlighted with a red box), and 'Break arc Set'. On the left side, a vertical menu has 'Arc' highlighted with a red box. A red arrow points from 'Arc' to the 'Arc On interrupt detection' checkbox. The main area contains several settings:

- Arc On interrupt detection
- ArcOn wait for signal to continue
- ArcOn detection T: 1500 ms
- ArcOff detection T: 1500 ms
- ArcOff wait for signal to continue
- Weding interrupt detection
- Weding detection T: 3000 ms
- Check unmoved arc close
- Unmove detection T: 2000 ms

At the bottom, there is a toolbar with buttons for JOINT, TOOL, WORK, and WORLD, along with directional keys (W+, V+, U+, C+, B+, A+, Z+, Y+, X+, J6+, J5+, J4+, J3+, J2+, J1+, W-, V-, U-, C-, B-, A-, Z-, Y-, X-, J6-, J5-, J4-, J3-, J2-, J1-).

**A**rc detection time: the time from when the controller sends out the arcing signal to the system receiving the arcing success from the welding machine! If the system does not receive the arcing success within this time, the system will issue an arcing failure alarm!

**A**rc detection time: The time when the controller disconnects the arc start signal after the controller issues the arc end command! If the arc start success signal persists, the system triggers the arc end failure!

**W**elding interruption detection time: After the arc start is successful, the system does not issue an arc end command during this period, but due to external reasons, the arc start success signal is disconnected for more than the set time, the system will trigger the signal detection error during welding!

**A**rc start waiting for welding signal to continue: After arc start failure, continue to wait for welding signal before acting!

**A**rc closing waiting for welding signal to continue: After arc failure, continue to wait for welding signal before acting!

#### **2.1.4 Arc Welding–Arc Break Setting**

The screenshot shows the 'Break arc Set' menu in a CNC control system. The top status bar displays coordinates (X: -199.96, Y: 550.61, Z: 845.95) and system information (free, 11.29.tch, Teaching 100.0%, Alarm). The main menu has three sections: 'Arc', 'RSV', and 'IO'. The 'Arc' section has a checked box for 'interrupt weding again' (with a red note 'need Weding interrupt detection'). The 'RSV' section has a checked box for 'up funtion'. The 'IO' section has a checked box for 'Arc breaking restart arc retreat'. Below these are 'Weld s ys' (with 'up and Wire Off') and 'other' (with 'Selective filling'). To the right is a table of parameters:

Z coor rising dista	Alram	3
Wire Off Time		1000
Anew delaytime		1000
TOOL Z COOR RISING distance		30.000
TOOL COOR RISING speed		600
Retroversion Distance		30.000
Retroversion Speed		30
Wire Off time		200

Red annotations include: 'If you want to use this function, must be checked' pointing to the 'Arc' section; 'can pull down, there are three kinds of arc-break peocessing mechanism to choose' pointing to the 'Alram' dropdown; and 'Selective filling' in red text near the 'other' section.

This page can be set during the welding process, the system handles the arc breaking mechanism after the arc breaking due to some occasional external factors (clogging, poor line contact, interference, etc.).

Currently there are 3 processing methods.

Welding interrupted arc restart arc: To activate the arc restart mechanism, this item must be checked.

Lifting function: After ticking this item, you can set the lifting distance mm and speed mm / min of the tool coordinate Z on the right.

Rollback function: After this check, you can set the distance mm and the welding speed percentage after the arc break on the right.

Rewind after lifting: After this item is checked, you can set the number of seconds for rewinding.

- 1、 Alarm: After the arc is broken, the system directly pops up an alarm pop-up box to prompt the alarm. At this time, the program can only be restarted after resetting.
- 2、 Auto-restart: You can set the number of restarts and restart delay time. After the arc is interrupted, the robot will perform a lifting in the z direction of the tool, and then descend and retreat to the set distance (if the lifting and retract functions are not checked, there is no The above action), try to start the arc again, and after this cycle is reached the set number of arc starts, an alarm will be prompted.
- 3、 Exclude start connection: This action is similar to automatic arc restart, the difference is that after the arc break is raised, the system will prompt a warning at this time, the program is in a paused state. After investigating the cause of the arc break, after pressing the start button, the robot will lower and back. Try to restart the arc.

Note: After the arc is interrupted, when the system prompts a red warning, only the reset will clear the alarm, and the program will also end at this time. You can only manually start from the beginning or start from this. When the yellow pause is prompted, the program is currently paused. After finishing the cause of arc break, do not press reset or end, just press

the start button to continue welding.

## 2.2 Appointment

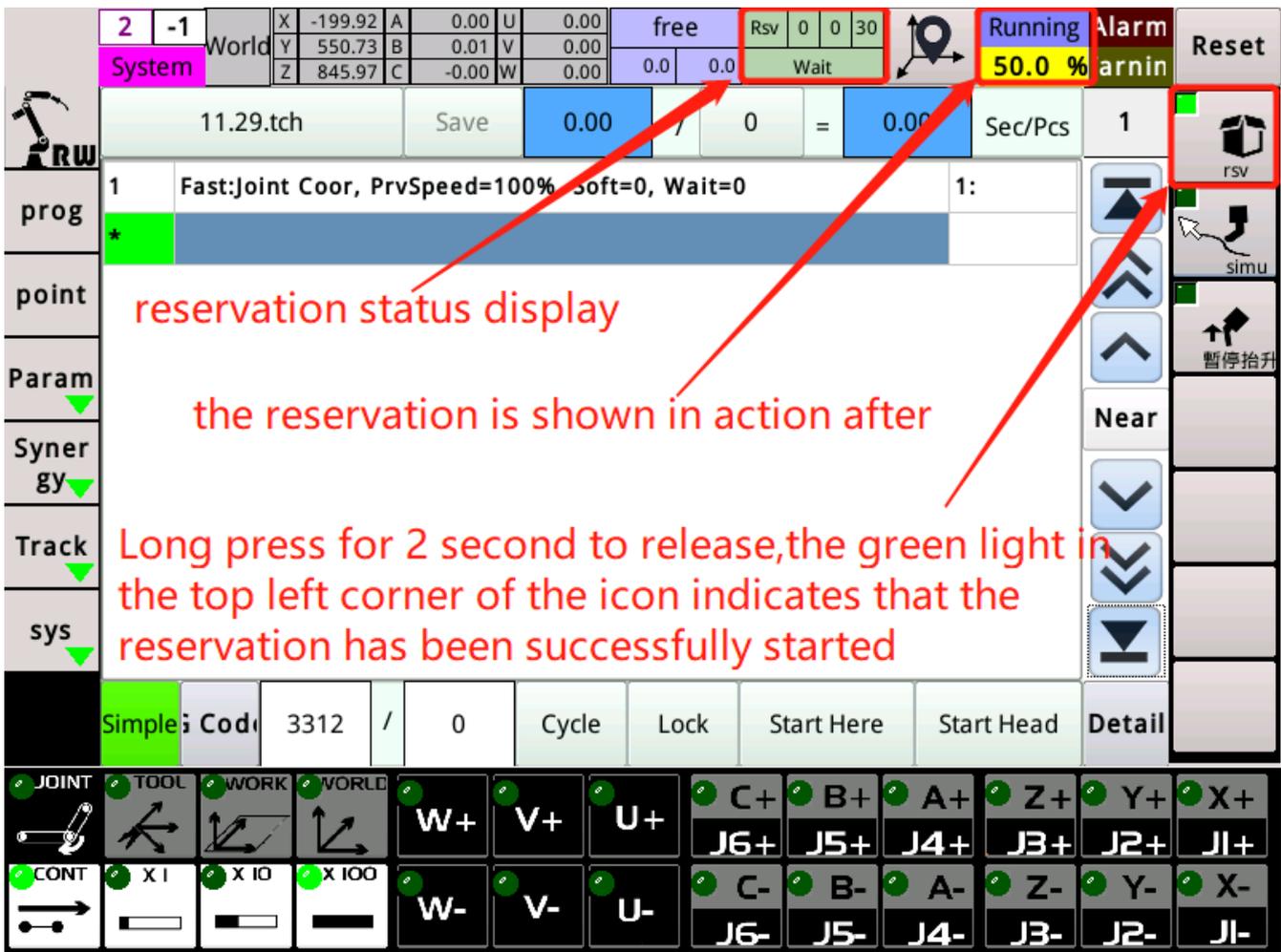
### 2.2.1 Appointment–Appointment Schedule

click poison switch to appointment

select the program you want to make an... appoinement with

1.select the program to be reserved from the program list

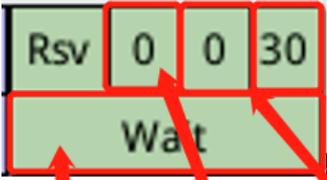
2.click the open button



reservation status display

the reservation is shown in action after

Long press for 2 second to release, the green light in the top left corner of the icon indicates that the reservation has been successfully started



total number of reservation programs

waiting for the scheduled program list

current booking list number

the status of the reservation or the name of the program currently being executed by the reservation

## 2.2.2 Appointment-Appointment Setting

**Reservation set** Do not check if there is no clear

**RSV Set**

Reservation start sec	1000	ms
Reservation cancel sec	1000	ms
Reservation times prog	<input type="checkbox"/>	
current number of times	30	
Number of arrivals	5	
Program name	IN_0.tch	

can set the upper limit of the number of gun clearance program execution

click here to select the cleaning procedure, method with the appointment scheduling

clear gun program

**Number of seconds to start the appointment box:** When making an appointment, long press the start button on the appointment box to meet the set number of startup seconds before the appointment can be successfully scheduled. It is recommended to set 1 to 2 seconds to prevent workers from accidentally touching it.

**Reservation Box Cancellation Seconds:** When an appointment is made to a program, but this program has not been executed, you can press and hold the start button to cancel the appointment of this program.

## How to use appointments

- 1、 Make a reservation procedure to be used.
- 2、 In the appointment schedule, add the program to be scheduled to the list.
- 3、 Set the relevant parameters of the appointment.
- 4、 Switch the Teach Pendant to automatic mode, press and hold the start appointment button on the right for about 2 seconds to loosen, and the light on the button turns green to indicate that the startup appointment was successful.
- 5、 Press and hold the appointment box start button corresponding to the program you want to run to start the appointment program.
- 6、 While the appointment program is being executed, you can press and hold the start button of the other appointment box to make a reservation for that program. After the currently running appointment program ends, it will directly execute the program just reserved.  
(Only one program can be queued. (If you make a reservation for a queued program, go to another program, it will cut in, and cancel the program you just reserved)
- 7、 The pause button on the appointment box can pause the appointment procedure, and then press the start button to continue the procedure.

## **2.3 Welding**

### **2.3.1 Welding io-point i**

The system has planned the functions commonly used for welding and their corresponding soft numbers. When using them, you only need to set them in io and write the soft numbers corresponding to the functions in accordance with the hard numbers of the actual wiring.

name	oftwar	ardwar	name	oftwar	ardwar
Arc Single	2000	no use			
Welding Single	2000	no use			
Collision I	2002	20			
Search I	70	no use			

Welde and Arc are same I

check here

welding related input I point function and corresponding soft number

go quickly to the IO settings page

JOINT TOOL WORK WORLD

W+ V+ U+ C+ B+ A+ Z+ Y+ X+

J6+ J5+ J4+ J3+ J2+ J1+

W- V- U- C- B- A- Z- Y- X-

J6- J5- J4- J3- J2- J1-

name	oftwar	ardwar	name	oftwar	ardwar
RsvBox Single1	730	5	RsvBox Single11	740	no use
RsvBox Single2	731	6	RsvBox Single12	741	no use
RsvBox Single3	732	7	RsvBox Single13	742	no use
RsvBox Single4	733	8	RsvBox Single14	743	no use
RsvBox Single5	734	9	RsvBox Single15	744	no use
RsvBox Single6	735	10	RsvBox Single16	745	no use
RsvBox Single7	736	11	RsvBox Single17	746	no use
RsvBox Single8	737	no use	RsvBox Single18	747	no use
RsvBox Single9	738	no use	RsvBox Single19	748	no use
RsvBox Single10	739	no use	RsvBox Single20	749	no use
Rsv Hold single	53	18			

same as above

start and pause buttons for the reservation box

### 2.3.2 Welding io-o point

2 -1 World X -199.90 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % arnin Reset

System World Y 550.79 B 0.01 V 0.00 Z 845.99 C -0.00 W 0.00

AOI

name	oftwar	ardwar
Arc	2000	8
Air	2001	9
Send	2002	10
Revice	2003	no use
Search	2004	no use

welding related output point function and corresponding soft number

Setting fresh

drop arc collision send receive air

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X1 X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

2 -1 World X -199.90 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % arnin Reset

System World Y 550.79 B 0.01 V 0.00 Z 845.99 C -0.00 W 0.00

AOI

name	oftwar	ardwar	name	oftwar	ardwar
RsvBox light1	730	17	RsvBox light11	740	no use
RsvBox light2	731	18	RsvBox light12	741	no use
RsvBox light3	732	no use	RsvBox light13	742	no use
RsvBox light4	733	no use	RsvBox light14	743	no use
RsvBox light5	734	no use	RsvBox light15	744	no use
RsvBox light6	735	no use	RsvBox light16	745	no use
RsvBox light7	736	no use	RsvBox light17	746	no use
RsvBox light8	737	no use	RsvBox light18	747	no use
RsvBox light9	738	no use	RsvBox light19	748	no use
RsvBox light10	739	no use	RsvBox light20	749	no use
RsbFuntion	2010	no use			

reservation output indicator light

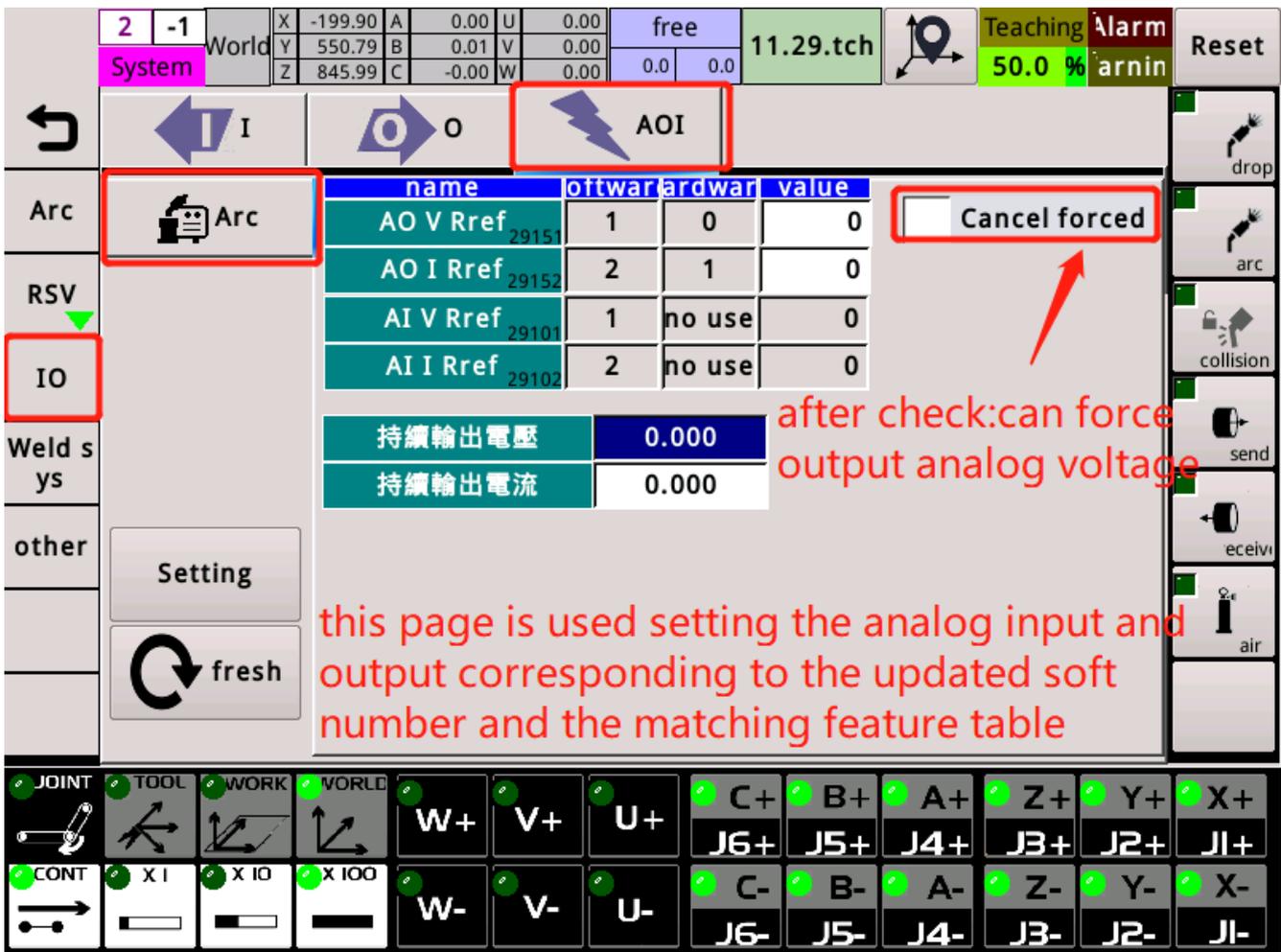
Setting fresh

drop arc collision send receive air

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X1 X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

### 2.3.3 Welding io-aoi



This page is used to set the analog current and voltage and the corresponding soft number. This page is needed to match the characteristic table. (For details, please refer to Chapter 5 Matching Table of Characteristic Table)

## 2.4 Welding device

2 -1 World X -199.90 A 0.00 U 0.00 free 11.29.tch Teaching Alarm Reset  
System Y 550.79 B 0.01 V 0.00 0.0 0.0 50.0 % arnin

World Z 845.99 C -0.00 W 0.00

Welding Sys

Arc

RSV v mode

IO

Welding Sys

other

Reset 0 0  
Close 0

Debug Mode

select CAN communication to display the status of the communication

drop down to select analog communication or megmet CAN

drop

arc

collision

send

receive

air

JOINT TOOL WORK WORLD

W+ V+ U+ C+ B+ A+ Z+ Y+ X+

J6+ J5+ J4+ J3+ J2+ J1+

CONT X I X IO X IOO

W- V- U- C- B- A- Z- Y- X-

J6- J5- J4- J3- J2- J1-

## 2.5 Other

### 2.5.1 Others-Others 1

The screenshot shows the 'other' settings menu in a CNC control system. The 'collision avoidance function' is checked. The 'collision mechanism' is set to 'alarm'. The 'Inspection T' is 50 ms and 'Remove Collision T' is 10000 ms. A red arrow points from the 'collision mechanism' dropdown to the 'collision' button on the right. A red text box explains that if the welding gun is stuck, clicking the collision relief button and moving it out slowly in teaching mode is required.

if the welding gun is stuck and cannot be recovered, click the collision relief button then move the welding gun out slowly in teaching mode

External anti-collision function: Set the processing mechanism when the welding gun collides, inspection time and alarm release time.

Welding gun collision release alarm time: When the welding gun collides, sometimes the welding gun cannot be reset, causing the system to keep alarming and unable to operate the machine to move away. In teaching mode, click the collision release button, the alarm will be temporarily shielded during this time, Remove the welding torch manually.

Lock rate in teach mode: The speed is fixed at the set value during teach

mode operation.

**Lock rate in automatic mode:** When running the program in automatic mode, the speed is fixed at the set value.

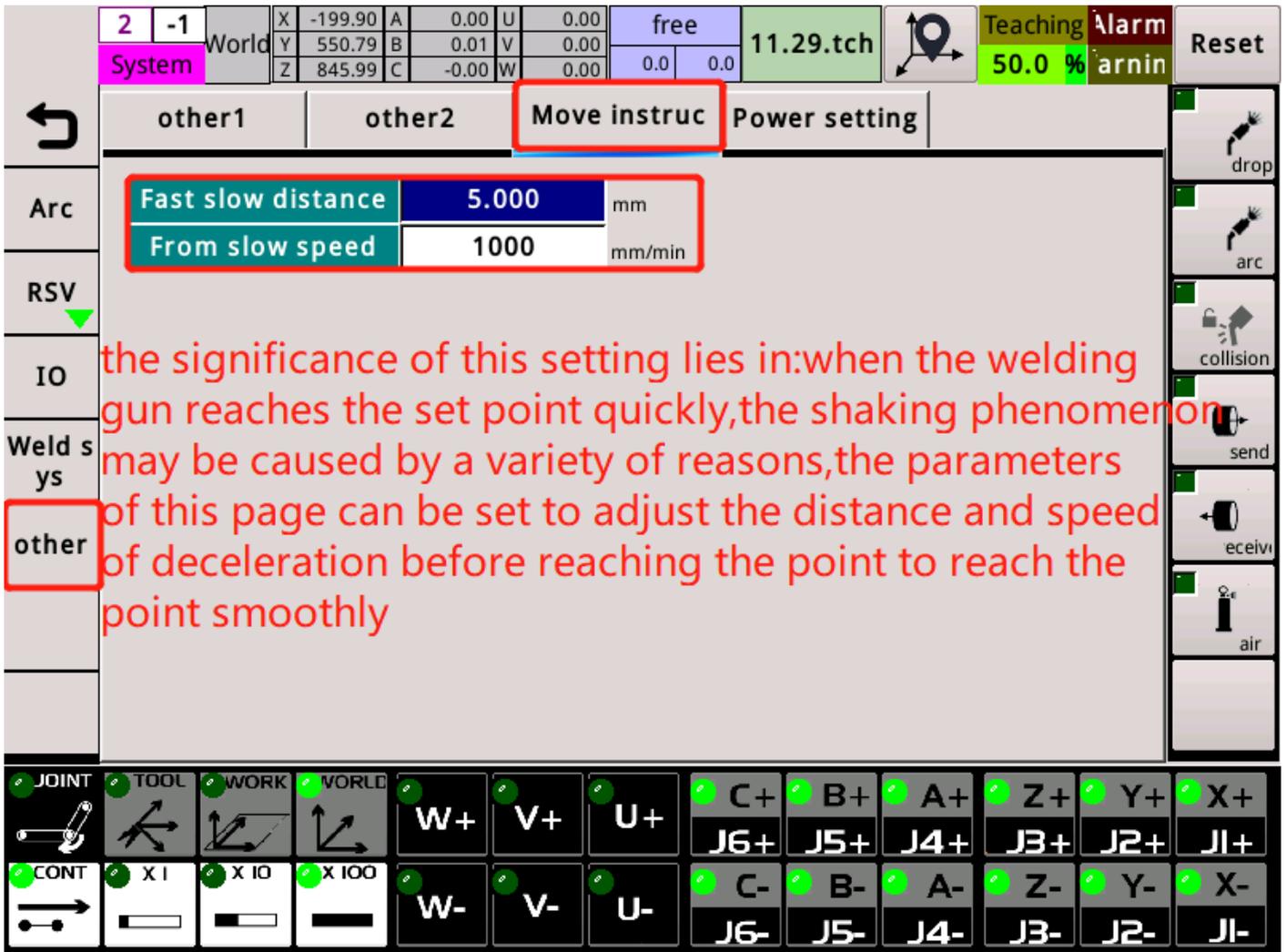
**Lock rate under welding path:** When the automatic mode is running, the welding path is fixed at the set value.

**Check the start and end commands of the program:** When it is running automatically, it will first check if there are any start and end commands in the program. If not, it will alarm.

**This process detects the arc start command:** When this is started, it will check whether the subsequent program has an arc start command. If not, it will give an alarm.

**Display inspection seconds:** Shows how long the alarm release time and inspection time on the left are.

## **2.5.2 Others—move instructions**



Because this fast instruction operation mode is used in some cases and not in most cases, the application process of programming instructions on the program page—move instructions—fast instructions (including slow distance). You can follow the figure below Go find this instruction.

2 -1 World X -199.89 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % arnin Reset

System World Y 550.84 B 0.02 V 0.00 Z 846.00 C -0.00 W 0.00 0.0 0.0

11.29.tch Save BlockOP Record BasicCmd ExtCmd ProdAct 1

1 move instructions:fast slow

Arcing Fish scale  
 Arc ON Path End laser Cmd  
 Cont Arc laser Cmd2  
 Arc OFF laser door  
 2D Search ve instructio  
 3D Search Auxiliary Cmd  
 Circle Search

ound weldin  
 Front Rear  
 left Right

Simple; Code Cut Copy Paste Up Dn Backward Forward Step OK Detail

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+  
 CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

2 -1 World X -199.89 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % arnin Reset

System World Y 550.84 B 0.02 V 0.00 Z 846.00 C -0.00 W 0.00 0.0 0.0

11.29.tch Save BlockOP Record BasicCmd ExtCmd ProdAct 1

1 move instructions:fast slow d

Joint ( fast slow distance

	Set Value	Cur Value
J1	19.945	19.945
J2	22.758	22.758
J3	-31.703	-31.703
J4	0.000	0.000
J5	-81.033	-81.033
J6	-19.946	-19.946

Get Cur Goto 0 Speed /s

Simple; Code Cut Copy Paste Up Dn Backward Forward Step OK Detail

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+  
 CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

## 2.5.3 Others–Suspended Lift

The screenshot displays the CNC control interface for the 'Others–Suspended Lift' function. The top status bar shows the following information:

2	-1	World	X	-199.89	A	0.00	U	0.00	free	11.29.tch	Ready	Alarm	Reset
System			Y	550.84	B	0.02	V	0.00	0.0	0.0	50.0 %	arnin	
			Z	846.00	C	-0.00	W	0.00					

The main menu includes 'other1', 'other2', 'Move instruc', and 'Power setting'. The 'Power setting' menu is expanded, showing the following parameters:

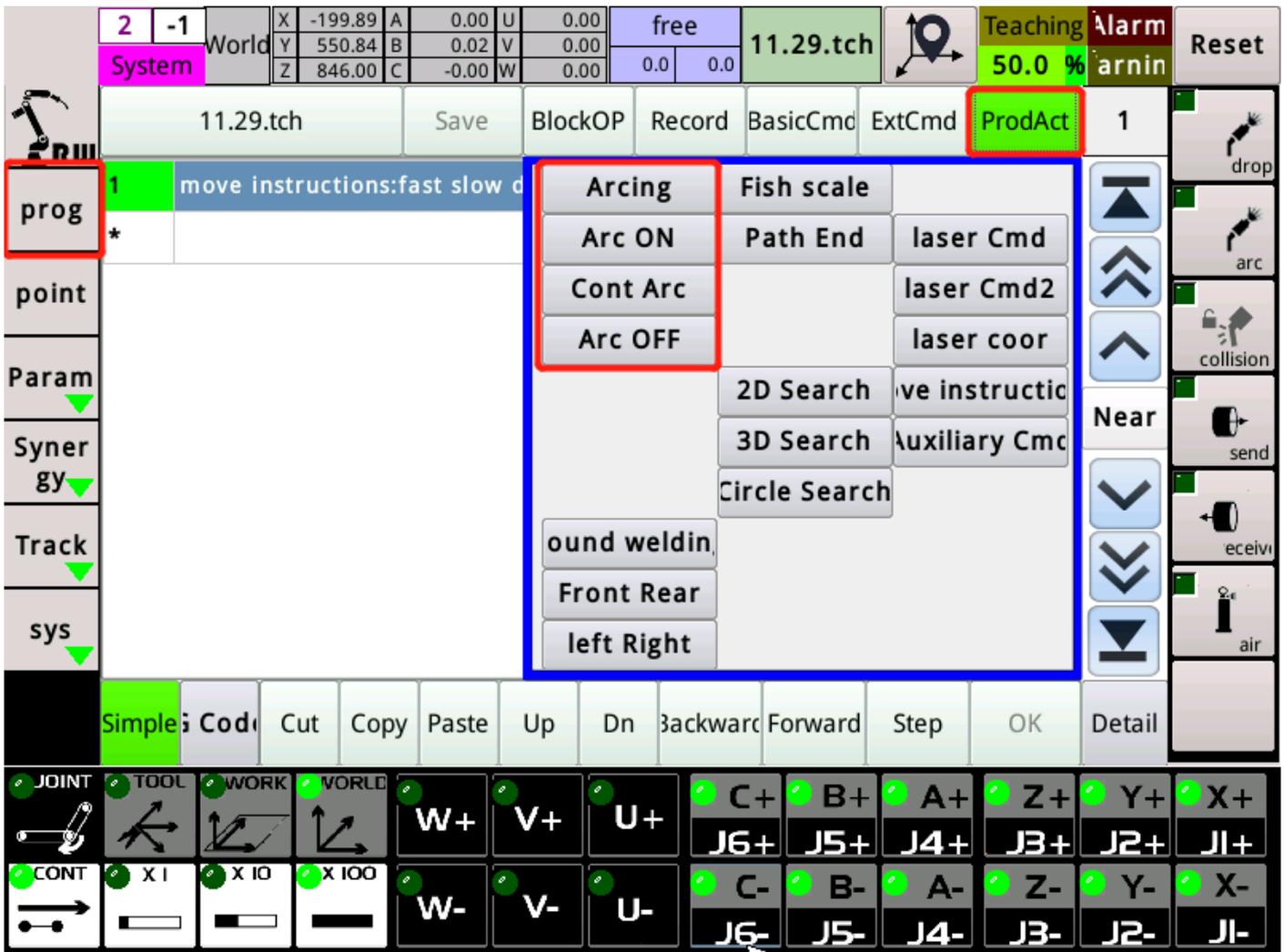
Restart delay time	100	det
TOOL Z COOR rising distance	50.000	mm
TOOL Z COOR rising speed	600	mm/mi
Arc break restart fallback distance	20.000	mm
recent rewind speed	30	%
Wire back time	0	ms

The 'other' button in the left sidebar is highlighted with a red box. The bottom control panel includes buttons for JOINT, TOOL, WORK, WORLD, W+, V+, U+, C+, B+, A+, Z+, Y+, X+, J6+, J5+, J4+, J3+, J2+, J1+, CONT, X I, X IO, X IOO, W-, V-, U-, C-, B-, A-, Z-, Y-, X-, J6-, J5-, J4-, J3-, J2-, J1-.

This function is used to pause when welding is halfway during the welding process. When observing the welding effect, first set the parameters on this page (for the meaning of the parameters, refer to the parameters on the arc welding–arc setting page). Pressing the pause and raise button on the right will pause the program, then lift and back. After pressing again, the welding gun will come down to continue welding.

# 3 Welding instructions and program examples

## 3.1 Arc start instruction



Arc starting:  , added at the arc starting point, outputting an arc starting signal to the welding machine, and can set the welding arc number (corresponds to the group number in the parameter page-arc welding page-arc welding sequence page)





### 3.3 Oscillation welding and fish scale welding

The screenshot shows a robotic control interface with a program editor. The program is named '11.29.tch' and is in 'ProdAct' mode. The program steps are as follows:

Step	Command
1	Fast:Joint Coor, PrvSpeed=10
2	Line:World Coor, PrvSpeed=1
3	Arcing:spot welding, 1, 1500,
4	Line:World Coor, PrvSpeed=1
5	Line:World Coor, PrvSpeed=1
6	Arcing:spot welding, 1, 1500,
7	Fast:Joint Coor, PrvSpeed=10

The 'Arcing' menu is open, showing options for 'Fish scale' (highlighted in red), 'Arc ON', 'Cont Arc', 'Arc OFF', '2D Search', '3D Search', and 'Circle Search'. The 'Oscillation welding' menu is also open, showing options for 'Front Rear' and 'left Right' (both highlighted in red). The interface includes various status indicators, a coordinate system display, and a control panel with directional keys and joint movement buttons.

Coordinate system:Path

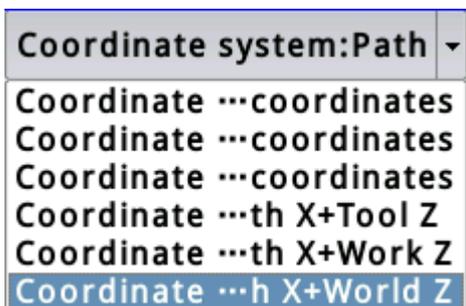
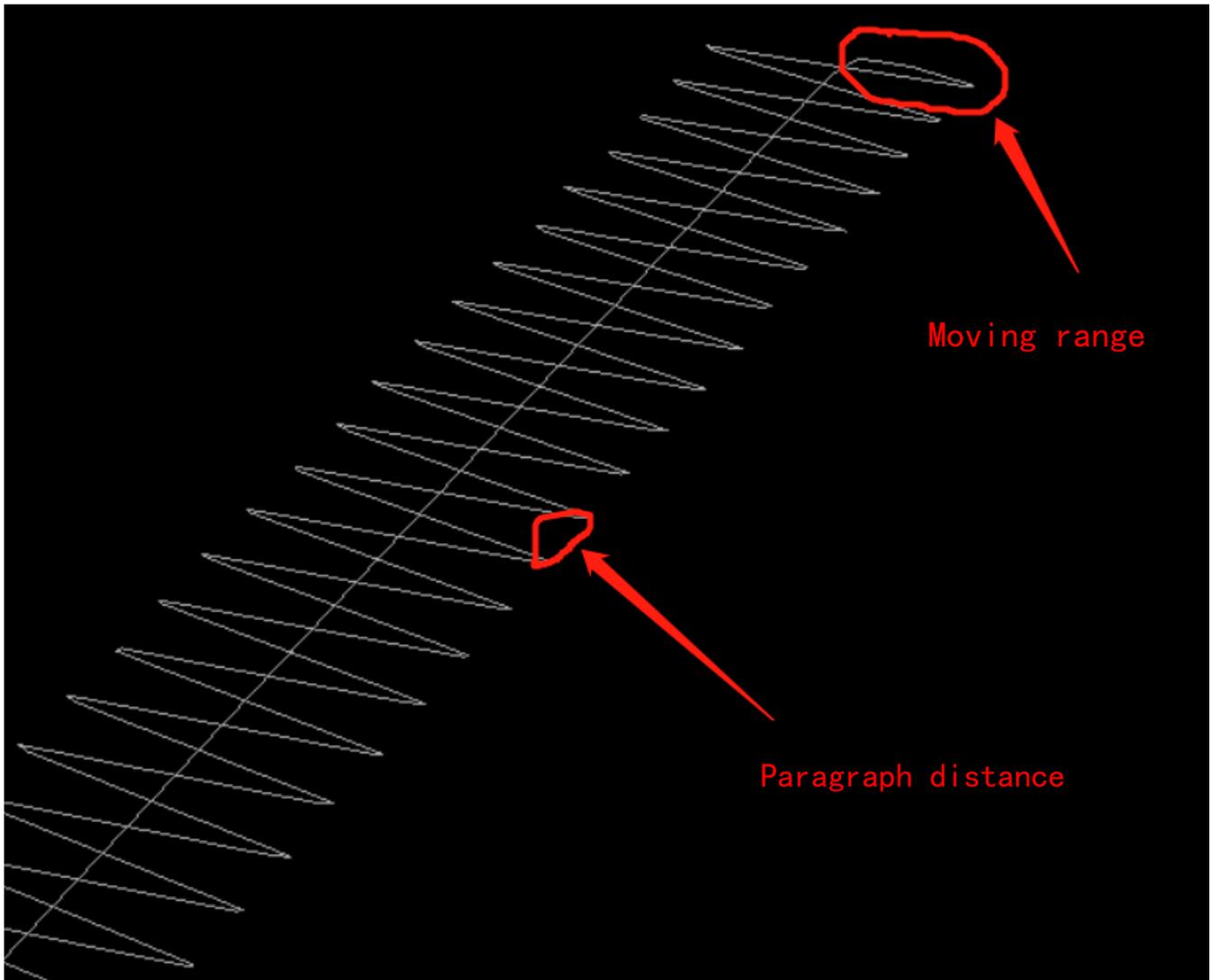
Moving range	5	mm
Moving distance	3	mm
Speed		mm/s
Corner Delay	100	ms

**Range of movement:** the amplitude of the left and right swing during swing welding.

**Paragraph distance:** the period or frequency of the swing during swing welding.

**Corner delay:** the dwell time from swing welding to the corner.

The speed of the swing welding does not need to be set. The speed is determined by the speed of the straight line in the swing welding path.

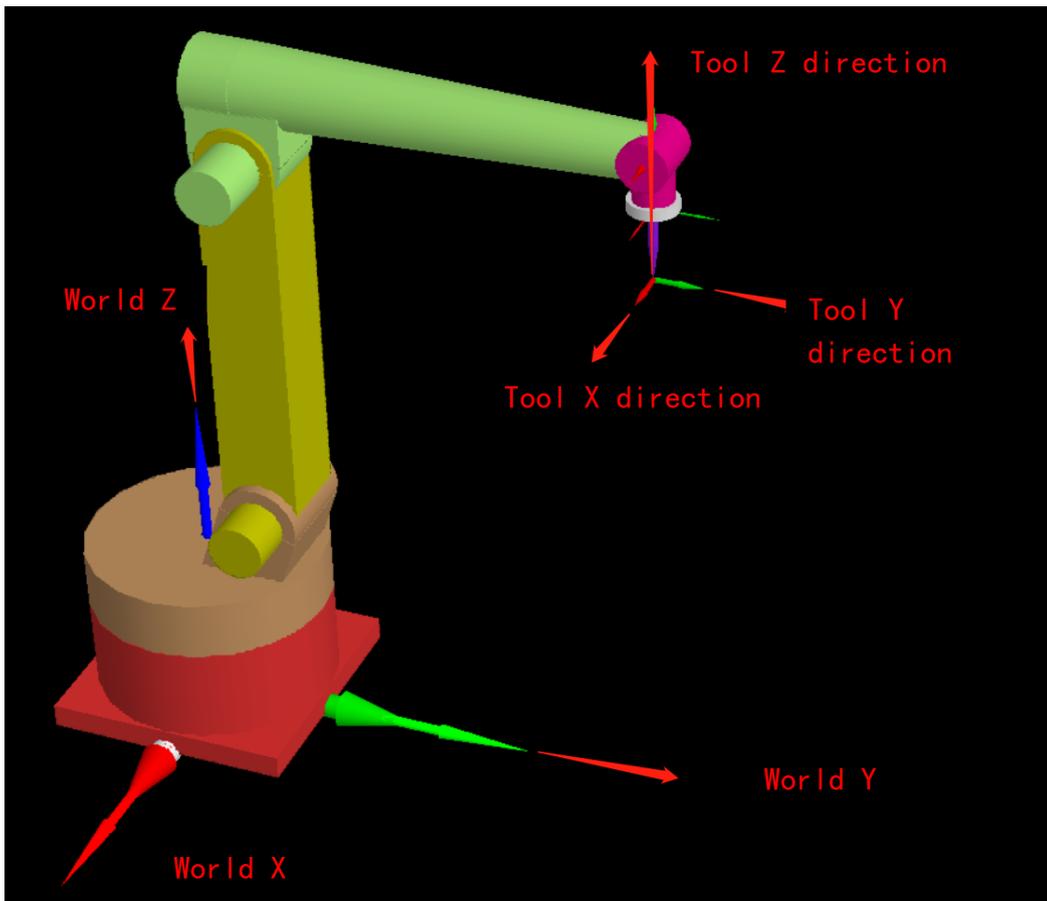


Changing coordinate system: There are 6 ways of changing, two of which are path x + tool z and path x + world z. To understand these six changing coordinate systems, you need to understand three coordinate systems (world coordinate system, working coordinate). What are the meanings of `` system and tool coordinate system ''? I am proficient in mastering 6 kinds of changing attitudes and can quickly teach the ideal welding effect in

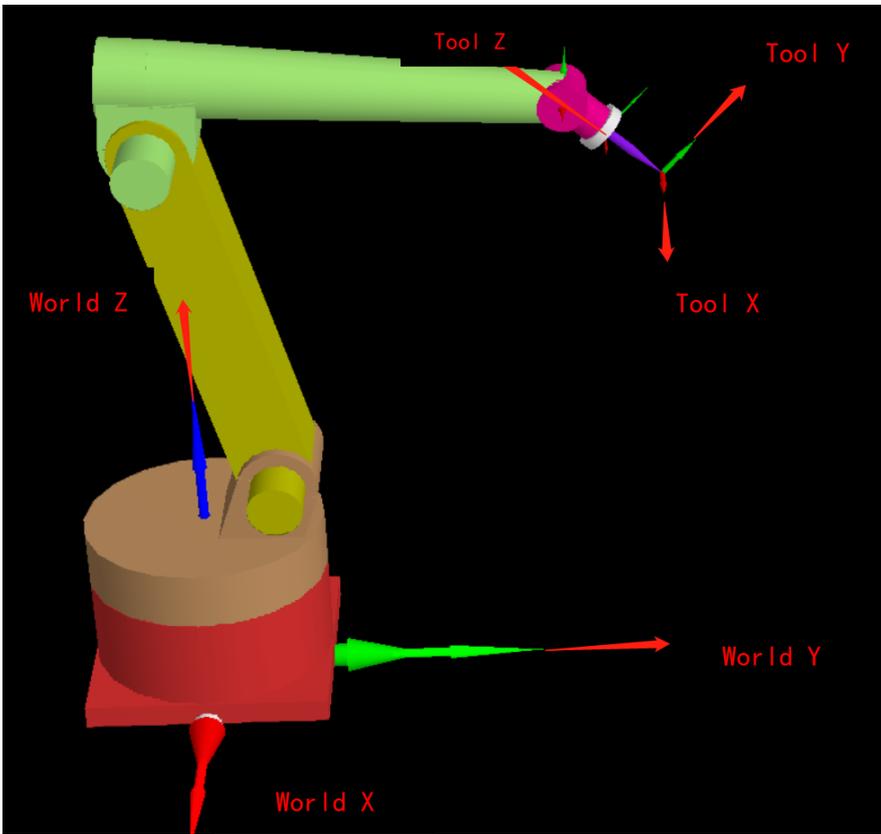
programming. The following focuses on the path  $x + \text{world } z$  and the path  $x + \text{tool } z$ .

First understand the tool coordinates and world coordinate directions.

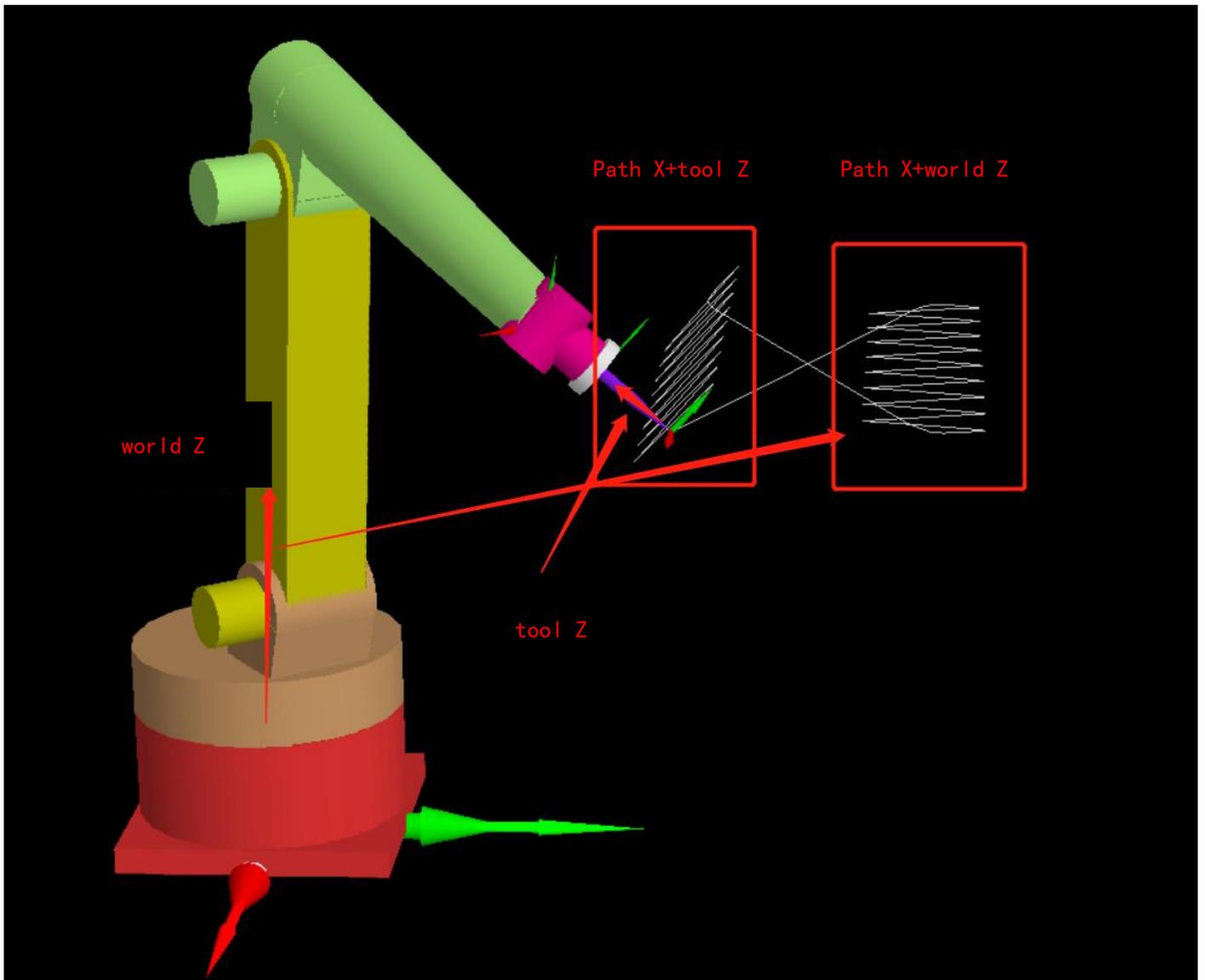
When at the calibration point, the coordinate directions are as follows:



Coordinate direction after changing attitude:



Let's compare the effects of the two paths in this attitude:



Therefore, it can be seen that these two swing welding methods are based on the taught trajectory to swing left and right, and the angle of swing is perpendicular to the z direction of the selected coordinate system.

### 3.4 Oscillation Programming Example

2	-1	World	X	-199.89	A	0.00	U	0.00	free	11.29.tch	Teaching	Alarm	Reset
System			Y	550.84	B	0.02	V	0.00	0.0	0.0	50.0 %	arnin	
			Z	846.00	C	-0.00	W	0.00					

11.29.tch	Save	BlockOP	Record	BasicCmd	ExtCmd	ProdAct	8
-----------	------	---------	--------	----------	--------	---------	---

prog	1	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0	1:
point	2	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0	2:
Param	3	Arc ON:Arc ON, 1, _ _ _ _ _ _ _ _	4:
Synergy	4	left Right:Coordinate system:Path X+World Z, 5, 3, _ 5, _ _ _ _	5:
Track	5	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0	6:
sys	6	Arc OFF:Arc OFF, _ _ _ _ _ _ _ _	7:
	7	Path End:Path End, _ _ _ _ _ _ _ _	8:
	8	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0	6:

Simple	Code	Cut	Copy	Paste	Up	Dn	Backward	Forward	Step	OK	Detail
--------	------	-----	------	-------	----	----	----------	---------	------	----	--------

JOINT	TOOL	WORK	WORLD	W+	V+	U+	C+	B+	A+	Z+	Y+	X+
							J6+	J5+	J4+	J3+	J2+	J1+
CONT	X I	X IO	X IOO	W-	V-	U-	C-	B-	A-	Z-	Y-	X-
							J6-	J5-	J4-	J3-	J2-	J1-

go to welding spot  
arc on  
plus swing welding process  
arc off  
swing and weld to arc spot  
turn off swing welding, otherwise the following line will continue to swing welding

### 3.5 Fish Welding

Fish scale_0			Fish scale_1		
Arc num	1		Arc num	1	
Weld T	500	ms	Weld T	500	ms
Moving distance	3	mm	Arc Count	20	
Speed	100	mm/s	Speed	100	mm/s
Delay T		ms	Delay T		ms

Welding arc number: The group number of the current and voltage called during welding.

Welding time: the time of spot welding during fish scale welding.

Paragraph distance: the distance between every two spot welding points (equivalent to the period or frequency)

Arcing times: how many spot weldings this welding path has in total (not commonly used, generally using paragraph distance)

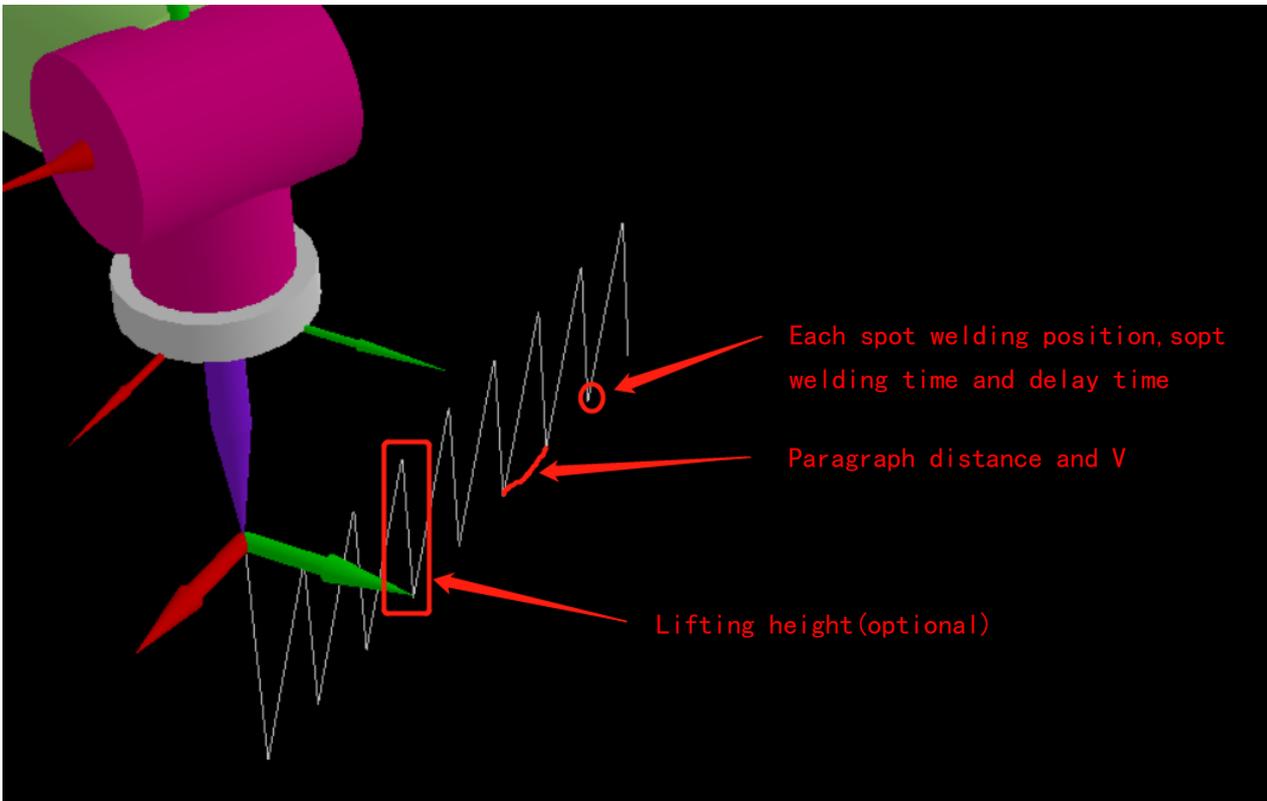
Speed: The speed of moving between every two spot welding spots.

Delay time: when reaching each welding point, how long will it delay before starting arc welding (not commonly used)

Tool lifting height: after each spot welding point is welded, the distance lifted in the tool z direction, and then straight to the next spot welding point (not commonly used).

### 3.6 Fish Scale Welding Procedure Example

2	-1	World	X	-199.89	A	0.00	U	0.00	free	11.29.tch	Teaching	Alarm	Reset	
System			Y	550.84	B	0.02	V	0.00	0.0	0.0	50.0 %	Alarm		
			Z	846.00	C	-0.00	W	0.00						
		11.29.tch		Save	BlockOP	Record	BasicCmd	ExtCmd	ProdAct	6				
prog	1	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0									1:			
point	2	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0									2:			
Param	3	Fish scale:Fish scale_0, 1, 500, 20, 100, _ _ _ _									3:			
Synergy	4	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0									4:			
Track	5	Path End:Path End, _ _ _ _ _									5:			
sys	6	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0									6:			
	*													
		turn on fish process,since the arc-starting instruction is included,there is no need to add arc-starting and arc-closing in the program												
		Simple	Code	Cut	Copy	Paste	Up	Dn	Backward	Forward	Step	OK	Detail	
		JOINT	TOOL	WORK	WORLD	W+	V+	U+	C+	B+	A+	Z+	Y+	X+
		CONT	X I	X IO	X IOO	W-	V-	U-	C-	B-	A-	Z-	Y-	X-
						J6+	J5+	J4+	J3+	J2+	J1+			
						J6-	J5-	J4-	J3-	J2-	J1-			



### 3.7 Coordinated swing welding

Coordinated swing welding: used with additional axes. When the additional shaft is rotated, the end of the robot is fixed at one point for swing welding.

The screenshot shows a robotic control interface. At the top, there's a status bar with coordinates (X: -199.89, Y: 550.84, Z: 846.00) and program name '11.29.tch'. The 'ExtCmd' button is highlighted in green. The central menu has 'CoSwing' highlighted in a red box. Below the menu is a keyboard with various function keys like JOINT, TOOL, WORK, and WORLD. The right sidebar contains status indicators for 'drop', 'arc', 'collision', 'send', 'receive', and 'air'.

Swing with U			
Swing with U	SwingType	1	0Circ/1Line
Swing with V	Swing Tool X	3.000	mm
Swing with W	Swing Tool Y		mm
U To Near Co-located angle	Swing Tool Z		mm
V To Near Co-located angle	Rotate Ang	360.000	deg
W To Near Co-located angle	Rotate Radius	100.000	mm
U Set Zero	Section Dist	3.000	mm
V Set Zero	Speed	600	mm/min
W Set Zero			

Swing method: Let 0 be the circle swing welding, and let 1 be the back and forth straight swing welding.

Swing vector tool x / y / z: The distance to swing in three directions of the tool coordinate system xyz. (Adjust according to the actual situation)

Turning radius: The radius of the workpiece to be welded.

Rotation angle: the rotation angle of the rotation axis during cooperative swing welding.

Paragraph distance: The same as the paragraph distance of swing welding described above.

Speed: The speed of welding. (The system will calculate the distance moved during welding according to the rotation radius and rotation angle)

Program example:

2	-1	World	X	-199.89	A	0.00	U	0.00	free	11.29.tch	Teaching	Alarm	Reset
System			Y	550.84	B	0.02	V	0.00	0.0	0.0	50.0 %	arnin	
			Z	846.00	C	-0.00	W	0.00					

prog	1	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0	1:
point	2	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0	2:
Param	3	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0	8:
Syner	4	Arc ON:Arc ON, 1, _ _ _ _ _ _ _ _ _ _ arc on	9:
gy	5	CoSwing:Swing with U, 1, 3, _ _ _ 360, 100, 3, 600 coor swing	
Track	6	Arc OFF:Arc OFF, _ _ _ _ _ _ _ _ _ _ arc off	9:
sys	7	Line:World Coor, PrvSpeed=120000, Soft=0, Wait=0	6:
	8	Fast:Joint Coor, PrvSpeed=100%, Soft=0, Wait=0	6:

JOINT	TOOL	WORK	WORLE	W+	V+	U+	C+	B+	A+	Z+	Y+	X+
							J6+	J5+	J4+	J3+	J2+	J1+
CONT	X I	X IO	X IOO	W-	V-	U-	C-	B-	A-	Z-	Y-	X-
							J6-	J5-	J4-	J3-	J2-	J1-

# 4 Matching of welding characteristic curve table

## 4.1 Introduction to the feature table interface

The screenshot shows the main control interface with the 'Welding arc' tab selected. A 'features table' is highlighted with a red box and an arrow pointing to the 'Arc' row. The table lists various parameters for different arc types. A waveform graph on the right shows the relationship between voltage (V) and current (A) for different arc types.

Feature	Value	Unit
Feature list	1	
Weld V	10.000	V
Weld I	180.000	A
Arc V	20.000	V
Arc I	160.000	A
Heat V	0.000	V
Heat I	0.000	A
ArcOff V	20.000	V
ArcOff I	160.000	A
SW V	0.000	V
SW I	0.000	A

Waveform graph parameters:

- ArcTime: 200 ms
- Heating Time: 0 ms
- ArcOffTime: 200 ms
- SW\_Time: 0 ms

The screenshot shows the 'OutputTest' window, which displays a graph of 'Weld I' (actual current) versus 'analog voltage'. The graph shows a dashed line representing the relationship. The 'features table' is also visible in the bottom right corner.

Graph parameters:

- Weld I: 400.000 A
- analog voltage: 30.000 V
- Output V: 20.000 V
- Output I: 120.000 A

**Test output:** This function is used to check whether the matching welding characteristic curve table is accurate. The specific operation is as follows:

- 1) Select the number of the welding characteristics table you want to test above
- 2) Tick the property sheet
- 3) Enter the actual desired current and voltage
- 4) Press and hold the output icon below, and the system will output the corresponding analog voltage to the welding side according to the input current voltage value and characteristic table, and the welding machine panel will output the actual current voltage according to the received analog voltage. Compare the value entered on the system with the actual value displayed on the welding machine panel to determine whether the welding characteristic table is accurate. If the output icon is loosened, the system will not output the analog voltage.
- 5) If the arc start output is checked, when the output icon is held down, in addition to the analog voltage output, the arc start signal will also be output, and the welder will start the arc.

**Advanced characteristic table:** Click this button to enter the advanced characteristic table page. This page can subdivide the characteristic table, and the current and voltage are more accurate when used.

2 -1 World X -199.89 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % 50.0 % Alarm Reset

System

R108000~ 1000 R108000~ 100

CM350 1 actual V -> analog V actual A -> analog A

Arc CM500FB 2 0.000 0.000 30.000 0.000

RSV 3 18.000 8.000 400.000 8.000

IO 4 0.000 0.000 0.000 0.000

Weld s ys 5 0.000 0.000 0.000 0.000

other 6 0.000 0.000 0.000 0.000

7 0.000 0.000 0.000 0.000

8 0.000 0.000 0.000 0.000

9 0.000 0.000 0.000 0.000

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

advanced properties page

### 4.2 Welding characteristics table matching method

1. Enter the welding io page, aoi page.

2 -1 World X -199.89 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % 50.0 % Alarm Reset

System

I O AOI

Arc Arc

name	soft	hard	value
AO V Rref <sub>29151</sub>	1	0	0
AO I Rref <sub>29152</sub>	2	1	0
AI V Rref <sub>29101</sub>	1	no use	0
AI I Rref <sub>29102</sub>	2	no use	0

持續輸出電壓 0.000

持續輸出電流 0.000

Setting fresh

check here

Cancel forced

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

## 2. Input the analog voltage to match the current and voltage

The screenshot shows a CNC control interface with various status indicators at the top, including 'Teaching Alarm' at 50.0% and 'Alarm' in 'arnin' mode. The main display area is titled 'AOI' and contains a table of AO parameters:

name	softwar	ardwar	value
AO V Rref <sub>29151</sub>	1	0	2000
AO I Rref <sub>29152</sub>	2	1	9600
AI V Rref <sub>29101</sub>	1	no use	0
AI I Rref <sub>29102</sub>	2	no use	0

Below the table, there are two rows of Chinese text:

持續輸出電壓	0.000
持續輸出電流	0.000

Red arrows point from the 'AO V Rref' and 'AO I Rref' values to the text '2V' and '9.6V' respectively. A red note at the bottom of the interface reads: 'Here, input the analog current and voltage, and record the actual current and voltage corresponding to the welding panel'.

## 4.3 Welding mode selection

### 4.3.1 Unary

If you set one yuan, first set the welder to unary mode, and then record the upper and lower limits of the analog voltage and the actual current and voltage. Note: You need to set the upper limit for the model of the welder.

Lower limit value: The actual current voltage value corresponding to the analog voltage is recorded.

Upper limit: For example, the upper limit of the current of the welding machine is 400a. At this time, the 10v analog voltage welding machine displays 400a, and the 8v welding machine also displays 400a. Then, the 8v analog voltage should record the actual current of 400a at this time. The

characteristic table is relatively accurate.

The screenshot shows a CNC control interface with a 'Welding arc' menu. A 'Param set' window is open, displaying a characteristic table for 'Weld I' (name: CM350). The table plots current (I) on the x-axis and voltage (V) on the y-axis. The x-axis ranges from 0.000 to 10.000 A, and the y-axis ranges from 0.000 to 9.600 V. A dashed line represents the characteristic curve. Red boxes highlight the values 400.000 A and 30.000 A on the x-axis, and 0.000 V and 8.000 V on the y-axis. Red arrows point to these values with the text 'the upper and lower limmits match'. To the right, an 'OutputTest' window shows 'features' checked, 'O output' unchecked, and 'Output' parameters: V = 20.000, I = 120.000.

When used, the voltage is filled with a reference intermediate voltage, and the current is filled according to actual needs.

The screenshot shows the same CNC control interface, but with the 'Param set' window displaying a 'Feature list' table. The table lists various parameters and their values:

Feature list	0
Weld V	9.000
Weld I	200.000
Arc V	9.000
Arc I	180.000
Heat V	0.000
Heat I	0.000
ArcOff V	9.000
ArcOff I	180.000
SW V	0.000
SW I	0.000

Below the table, a timing diagram shows the sequence of events: 'arc', 'heat', 'weld', 'arcoff', and 'sw'. Red arrows indicate the duration of each event. The 'ArcTime' parameter is set to 200 ms, 'Heating Time' to 0 ms, 'ArcOffTime' to 200 ms, and 'SW\_Time' to 0 ms.

### 4.3.2 respectively

The separate mode is to subdivide the welding characteristic table by setting several sets of analog voltages and actual current voltages to make the current and voltage values more accurate during welding.

2		-1		World		X	-199.89	A	0.00	U	0.00	free	11.29.tch		Teaching Alarm	Reset	
System				Y	550.84	B	0.02	V	0.00	0.0		0.0		50.0 %	arnin		
R108000~ 1000				R108100~ 100													
		CM350		1		actual V -> analog V		actual A -> analog V									
Arc			CM500FB		2	12.000	0.000	30.000	0.000								
RSV					3	15.300	1.000	75.000	1.000								
IO					4	18.600	2.000	122.000	2.000								
Weld sys					5	21.899	3.000	170.000	3.000								
					6	25.199	4.000	217.000	4.000								
other					7	28.500	5.000	264.000	5.000								
					8	31.800	6.000	311.000	6.000								
					9	35.200	7.000	359.000	7.000								
						38.500	8.000	406.000	8.000								
						41.799	9.000	454.000	9.000								
						45.000	10.000	500.000	10.000								
						0.000	0.000	0.000	0.000								

JOINT	TOOL	WORK	WORLD	W+	V+	U+	C+	B+	A+	Z+	Y+	X+
							J6+	J5+	J4+	J3+	J2+	J1+
CONT	X I	X IO	X 100	W-	V-	U-	C-	B-	A-	Z-	Y-	X-
							J6-	J5-	J4-	J3-	J2-	J1-

When using, fill in the current and voltage according to actual needs.

The screenshot displays a CNC welding control interface with the following components:

- Top Status Bar:** Shows coordinates (X: -199.89, Y: 550.84, Z: 846.00), tool (11), mode (Manua), and system status (Teaching 50.0%, Alarm arnin).
- Navigation:** Buttons for 'Welding arc', 'Param set', 'Check set', and 'Break arc Set'.
- Parameter Table:**

Feature list	Value	Unit
Weld V	15.000	V
Weld I	120.000	A
Arc V	15.000	V
Arc I	100.000	A
Heat V	0.000	V
Heat I	0.000	A
ArcOff V	15.000	V
ArcOff I	110.000	A
SW V	0.000	V
SW I	0.000	A
- Timing Diagram:** A graph showing the sequence of events: arc, heat, weld, arcoff, and sw. Red arrows indicate the duration of each phase.
- IO and Control Panel:** Includes checkboxes for 'features table', 'Arc', 'Heating', and 'Arc Off', along with a 'features table' icon. The bottom panel contains directional keys (W+, V+, U+, C+, B+, A+, Z+, Y+, X+ and their negative counterparts) and joint/tool/work/world selection buttons.

After setting the welding characteristic table, in the welding io page, the cancellation force is written to cancel. When using, which group of welding characteristic table is called, the unary and separate mode of welding must also be selected correctly.

# 5 Tool calibration and origin calibration

## 5.1 Tool Calibration

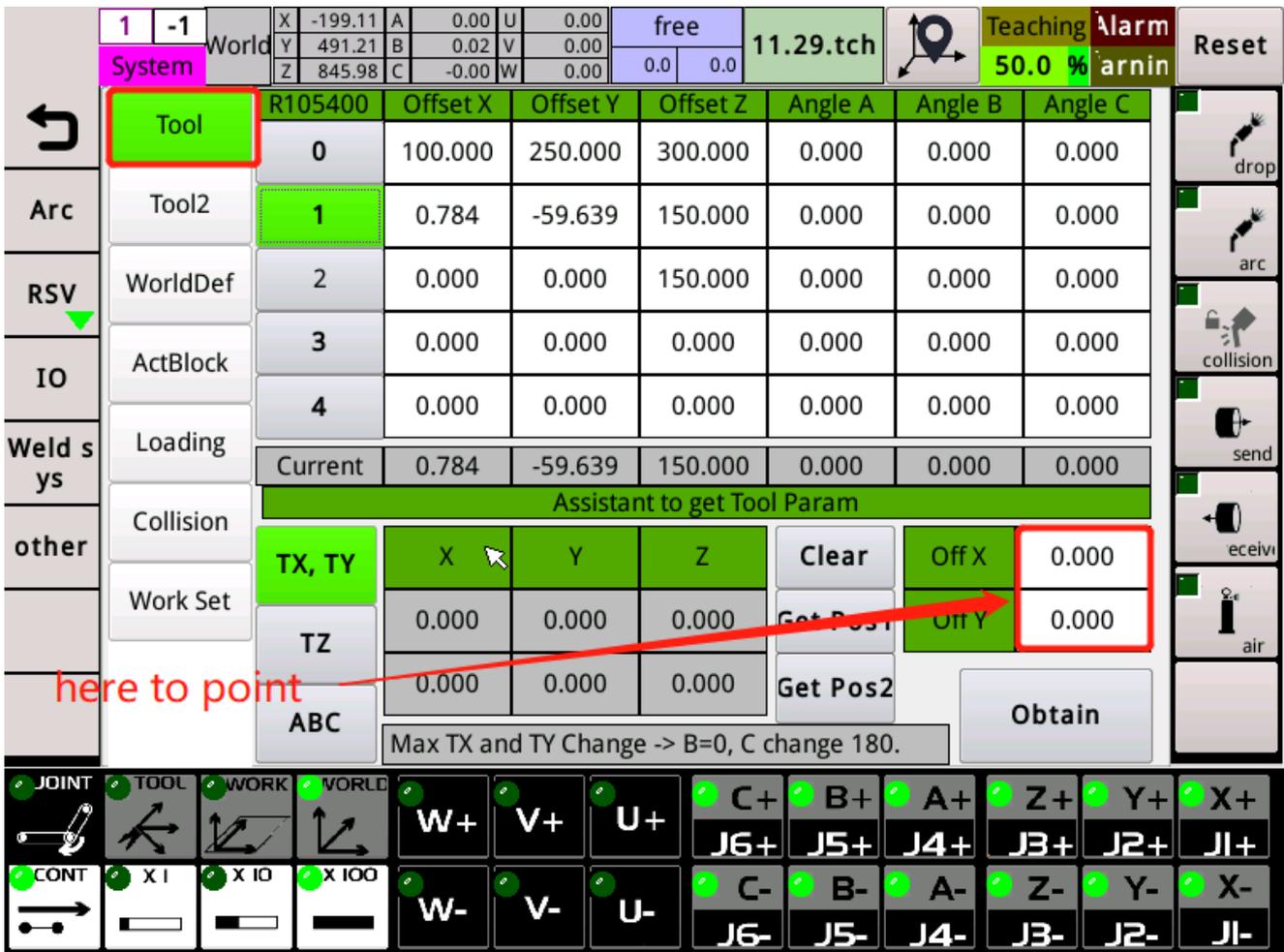
The screenshot displays a CNC control HMI interface. At the top, a status bar shows '2 -1 World' and a table of coordinates:

X	-199.89	A	0.00	U	0.00
Y	550.84	B	0.02	V	0.00
Z	846.00	C	-0.00	W	0.00

Other status indicators include 'free', '11.29.tch', 'Teaching 50.0%', 'Alarm arnin', and 'Reset'. The main menu is titled 'V09.03 191224 0-7288-1-9-9' and contains the following options:

- MchLock
- Servo
- Reboot
- Authorize
- Record
- Coor
- Safe Pos
- Recipe
- Install** (highlighted with a red box)
- Transfer
- Network
- Language
- Option
- IO Set
- Comm
- Resource
- Tuning
- Limit
- Calibrate
- CaliFix
- Hardware
- GearRatio
- ServoParam
- MainBody

On the left side of the menu, there are fields for 'Now Level 4', 'Log Out', 'Password', 'New Pwd', 'Confirm', and 'Change', along with a 'Default HMI Select' button. At the bottom, a control panel features icons for JOINT, TOOL, WORK, and WORLD, along with directional keys (W+, V+, U+, W-, V-, U-) and axis keys (C+, B+, A+, Z+, Y+, X+, J6+, J5+, J4+, J3+, J2+, J1+, C-, B-, A-, Z-, Y-, X-, J6-, J5-, J4-, J3-, J2-, J1-).



The coordinates of the robot represent the spatial position and attitude of the tip point of the end tool, but the tool will be out of the robot installed, so there must be parameters to be used to specify the position and direction of the end tool tip, called tool parameters.

The system provides four sets of tool parameters, and each set of parameters contains six items, including offset X, offset Y and offset Z. The relative position between the tool tip and the flange surface is described. Angle A, Angle B and Angle C describe the direction of the tip.

1. click on the tool number 0~14 for calibration, example **1**.
2. Click on the items to be corrected **TX, TY**, press on **Clear**.
3. The robot moves to approximately the right of the pose, while

externally mounting a cusp, after alignment according to **Get Pos1**.

- 4、 The external cusp doesn't move, the world coordinates turn C about 90 or 180 degrees, and then XYZ moves so that the tool cusp is aligned

with the external cusp, press on **Get Pos2**.

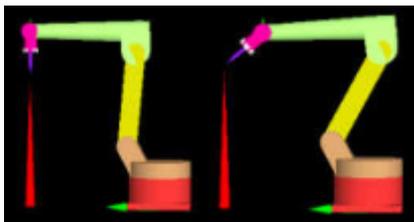
- 5、 Press on **Obtain**, **Off X** 0.000, **Off Y** 0.000, will be values.

- 6、 Click to the numbers of **Off X** 0.000, **Off Y** 0.000, you can add the error to the tool parameters.

- 7、 Click on the items to be corrected **TZ**, press on **Clear**.

- 8、 The robot in the two positions as shown on the right, after pointing to the sharp point, press respectively **Get Pos1** and **Get Pos2**.

- 9、 Press on **Obtain**, **Off Z** 0.000 will be values.



- 10、 Click to the number of **Off Z** 0.000, you can add the error to the tool parameters.

- 11、 If the direction of the tool tip is not parallel to the axis of the sixth axis, and the tool Angle needs to be set, please first set the tool Angle A, Angle B and Angle C to 0.

- 12、 Click on the items to be corrected **ABC**.

- 13、 Rotate the direction of the tool tip so that the tool is aligned with the direction of the world coordinates.
- 14、 Press on **Obtain**, the system will automatically substitute the values of Angle A, Angle B and Angle C.

## 5.2 Origin (tcp) correction

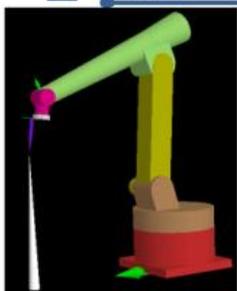


# Origin correction step

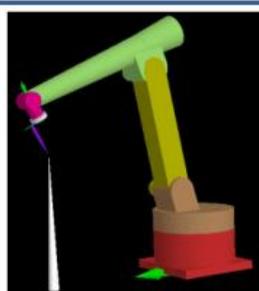
1. Press "clear" to clear the original school information
2. Take any 8~10 points with big attitude change and press "take" after alignment.
3. Select J2~J5, TX, TY and TZ as the items to be calculated, and then calculate the deviations and "maximum errors".
4. If the value of "maximum error" is greater than 2, the system may have the wrong deceleration ratio or the wrong size of the mechanism. The results are also meaningless, skipping the next steps.
5. Click on the error field in order to bring the error value into the system
6. The pressure release stop allows the change value to take effect



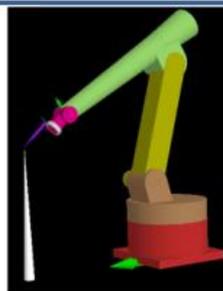
## 建議的原點校正姿態



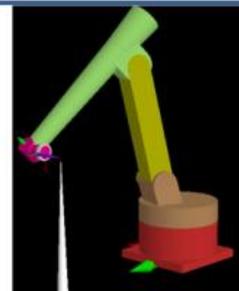
(1)  $J5 < 0$



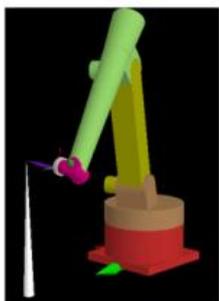
(2)  $J5 < 0$  (1)+B



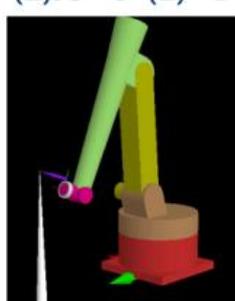
(3)  $J5 < 0$  (1)-B



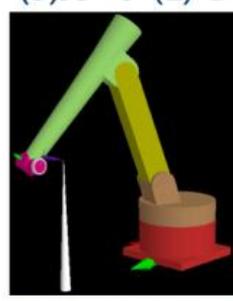
(4)  $J5 < 0$  (1)+A



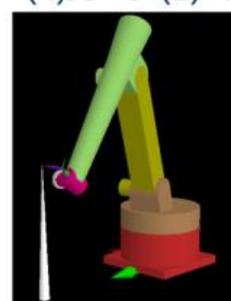
(5)  $J5 < 0$  (1)-A



(6)  $J5 > 0$



(7)  $J5 > 0$  (6)+A



(8)  $J5 > 0$  (6)-A

# 6 Calibration and use of external cooperative axes

## 6.1 Collaborative calibration

### 6.1.1 Architecture of External Coordinated Axis

Outer co-axial axis takes into account six axial possibilities

21.WorkCoorX
22.WorkCoorY
23.WorkCoorZ
24.WorkCoorA
25.WorkCoorB
26.WorkCoorC

You can choose up to three of them to combine to build an external collaborative axis

Axis Setting		
	Usage	AxisID
U	25	7
V	26	8
W	0	0

The external coordinate axis is set on a base coordinate in space, and if there is (use 21, 22, 23) movement, it first moves according to the corresponding axial coordinate, and then sequentially moves a (use 24 around the z axis) ) Rotation, rotate b (use 25 around the x-axis) and c (use 26 around the z-axis). The position and attitude after the final movement and rotation are the origin of the working coordinate system.

Before the actual operation, the main key is to find the base

coordinates and the size of the mechanism between the abc axes. This is also the main item that must be corrected.

Base Pos			
X	100.044	A	0.000
Y	885.175	B	0.005
Z	592.185	C	0.019
Dimension			
		BX	-101.590
		BY	11.138
		BZ	108.927

Because the external coordinated axis calibration is performed through the robot's sharp point, the origin of the robot must be calibrated before the calibration, to ensure that the robot's sharp point is trustworthy, so that the corrected coordinated axis information will be available. trust.

### 6.1.2 External coordinated axis correction method

After the purpose is selected according to the actual mechanism, there will be a maximum of three rotation axis calibrations. The order of calibration is b information (c information (a information) ). The three tabs will be enabled according to the selected axis.

### Rotation calibration

The rotation calibration is based on a point marked on the rotary table as the basis for alignment. When the rotation axis is rotated to three different angles, the pointed point of the robot is used to align

the marked point and obtain its coordinate value. As a basis for calculating the rotated coordinate system.

Note that the three points  $p_0$ ,  $p_1$ , and  $p_2$  must conform to the counterclockwise (ccw) rotation order (the right-hand rule, looking from the position of the thumb to the rotation surface), so that the system will not calculate the wrong direction.

<b>RotateCali</b>				B Info		C Info		A Info		Parameter	
U		V		Clear							
CCW	P0	P1	P2	ObtainPos							
X	0.000	0.000	0.000	X	0.000						
Y	0.000	0.000	0.000	Y	0.000						
Z	0.000	0.000	0.000	Z	0.000						
R	0.000	0.000	0.000	A	0.000						
Get P0		Get P1		Get P2		B	0.000				
To P0		To P1		To P2		C	0.000				

### Information calibration

First on the rotation calibration page, select the additional axis (uvw) corresponding to b, and then take three points in the counterclockwise rotation direction



Current Cooperate		G54	G56P0	G56P1	G56P2	G56P3	G56P4	G56P5	
G56P0	Axis Setting		RotateCali		B Info	C Info	A Info	Parameter	
	Usage	AxisID	U	V	Clear				
G56P1	U	25	7	ObtainPos					
G56P2	V	26	8	CCW	P0	P1	P2	X	
G56P3	W	0	0	X	-199.111	-124.091	-199.098	X	
G56P4	21.WorkCoorX		Get P0				Get P1		Y
	22.WorkCoorY		To P0				To P1		Y
	23.WorkCoorZ		Get P2				To P2		Z
	24.WorkCoorA		To P0				To P1		Z
G56P5	25.WorkCoorB		To P0				To P1		A
	26.WorkCoorC		To P0				To P1		A
								B	
								C	

Then switch to the b information page, and press the `` take calibration ' ' key to bring in the result of the just rotated calibration. If the external collaboration includes c, this information will also be brought into the base coordinate b of the c information page for subsequent bc For conversion.

目前協同組			G54	G56P0	G56P1	G56P2	G56P3	G56P4	G56P5	G56P6
G56P0			軸設定		旋轉標定		B資訊	C資訊	A資訊	儲存參數
			用途	軸號						
G56P1	U	25	7							
G56P2	V	26	8							
G56P3	W	0	9							
G56P4	21.WorkCoorX									
G56P5	22.WorkCoorY									
G56P5	23.WorkCoorZ									
G56P5	24.WorkCoorA									
G56P6	25.WorkCoorB									
G56P6	26.WorkCoorC									
				旋轉面 B						
				X	-520.254					
				Y	1014.940					
				Z	188.635					
				A	2.768					
				B	94.736					
				C	-0.057					
				取標定						

### c information calibration

First turn the b axis to 0 degrees, cut to the c information page, and take three points in the counterclockwise rotation direction. The three points should preferably span 180 degrees to reduce errors.



目前協同組			G54	G56P0	G56P1	G56P2	G56P3	G56P4	G56P5	G56P6	
G56P0			軸設定		旋轉標定		B資訊	C資訊	A資訊	儲存參數	
			用途	軸號							
G56P1	U	25	7								
G56P2	V	26	8								
G56P3	W	0	9								
G56P4	21.WorkCoorX										
G56P5	22.WorkCoorY										
G56P5	23.WorkCoorZ										
G56P5	24.WorkCoorA										
G56P6	25.WorkCoorB										
G56P6	26.WorkCoorC										
				取點	取點	取點	轉換BC旋轉面				
				大約-90	大約0	大約90	底座標B				
				X	-639.879	-488.759	-747.033	X	-520.254		
				Y	740.152	1014.202	1204.628	Y	1014.940		
				Z	295.009	295.026	295.040	Z	188.635		
				R	-77.500	3.749	87.499	A	0.000		
							機構尺寸				
							BX	-206.051			
							BY	-39.700			
							BZ	106.392			
				原點偏移				套用BC轉換			
				C	5.216						

After taking three points, press `` Convert bc rotation plane '', the system will re-correct the direction of the base coordinate b according to the z-axis direction of the c rotation plane, and calculate the origin offset of the c rotation plane (the The position of the sharp point is the 0-degree position) and the relative size relationship between the b-axis and the c-axis.

目前協同組		G54	G56P0	G56P1	G56P2	G56P3	G56P4	G56P5	G56P6
G56P0		軸設定		旋轉標定	B資訊	C資訊	A資訊	儲存參數	
		用途	軸號	基底座標					
G56P1	U	25	7	X	-520.254	A	0.000		
G56P2	V	26	8	Y	1014.940	B	0.004		
G56P3	W	0	9	Z	188.635	C	2.773		
				機構尺寸					
G56P4	21.WorkCoorX			BX	-206.051				
G56P5	22.WorkCoorY			BY	-39.700				
G56P6	23.WorkCoorZ			BZ	106.392				
	24.WorkCoorA								
	25.WorkCoorB								
	26.WorkCoorC								

### 6.1.3 Calibration method when single external axis cooperates

1 -1 World X -199.10 A 0.00 U 0.00 free 11.29.tch Teaching Alarm 50.0 % arnin Reset

System World Y 516.23 B 0.02 V 0.00 0.0 0.0

Z 820.98 C -0.00 W 0.00

Current Cooperate G54 G56P0 G56P1 G56P2 G56P3 G56P4 G56P5

Cooperate G56P0 Axis Setting RotateCali B Info C Info A Info Parameter

Cross Block G56P1 Usage AxisID U 26 7

G56P2 V 0 0

G56P3 W 0 0

G56P4 21.WorkCoorX

G56P5 22.WorkCoorY

23.WorkCoorZ

24.WorkCoorA

25.WorkCoorB

26.WorkCoorC

U

Clear

CCW	P0	P1	P2	ObtainPos
X	0.000	0.000	0.000	X -21474.836
Y	0.000	0.000	0.000	Y -21474.836
Z	0.000	0.000	0.000	Z -21474.836
R	0.000	0.000	0.000	A 0.000
				B 90.000
				C 0.000

Get P0 Get P1 Get P2

To P0 To P1 To P2

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

1 -1 World X -199.10 A 0.00 U 0.00 free 11.29.tch NotReady Alarm 50.0 % arnin Reset

System World Y 516.23 B 0.02 V 0.00 0.0 0.0

Z 820.98 C -0.00 W 0.00

Current Cooperate G54 G56P0 G56P1 G56P2 G56P3 G56P4 G56P5

Cooperate G56P0 Axis Setting RotateCali B Info C Info A Info Parameter

Cross Block G56P1 Usage AxisID U 26 7

G56P2 V 0 0

G56P3 W 0 0

G56P4 21.WorkCoorX

G56P5 22.WorkCoorY

23.WorkCoorZ

24.WorkCoorA

25.WorkCoorB

26.WorkCoorC

Base Pos

X	100.044	A	0.000
Y	885.175	B	0.005
Z	592.185	C	0.019

Dimension

GetObtain

JOINT TOOL WORK WORLD W+ V+ U+ C+ B+ A+ Z+ Y+ X+ J6+ J5+ J4+ J3+ J2+ J1+

CONT X I X IO X IOO W- V- U- C- B- A- Z- Y- X- J6- J5- J4- J3- J2- J1-

- 1) Single external shaft use set 26
- 2) Select the coordinate system as g56 p0
- 3) Take 3 points on the rotation calibration page, refer to the coordinated calibration method for the two external axes above
- 4) On the storage parameter page, click on the calibration

## 6.2 Using collaborative functions

Current Cooperate		G54	G56P0	G56P1	G56P2	G56P3	G56P4	G56P5
G56P0	<b>Axis Setting</b>		RotateCali	B Info	C Info	A Info	<b>Parameter</b>	
		Usage	AxisID	<b>Base Pos</b>				
G56P1	U	25	7	X	100.044	A	0.000	
G56P2	V	26	8	Y	885.175	B	0.005	
G56P3	W	0	0	Z	592.185	C	0.019	
G56P4	21.WorkCoorX			<b>Dimension</b>				
G56P5	22.WorkCoorY			BX		-101.590		
	23.WorkCoorZ			BY		11.138		
	24.WorkCoorA			BZ		108.927		
	25.WorkCoorB							
	26.WorkCoorC							

Click on the current collaboration group as g56p0. When operating in working coordinates, you can achieve cooperative action.

If you need to switch the coordinate system during the automatic operation, you also need to issue the g56p0 instruction.

Note: there will be synergistic effects only when working coordinates

### 6.2.1 Program example

The screenshot shows a CNC control interface with a program editor. The program is named '11.29.tch' and contains the following instructions:

Line	Instruction	Parameter
1	Fast:Joint Coor, PrvSpeed=10	maker_macro_g 56
2	Line:World Coor, PrvSpeed=1	Set Add Axis Coor(P:Set).
3	Call G:G=56 (Set Add Axis Co)	Param A(#1)
4	Line:Work Coor, PrvSpeed=12	Param B(#2)
5	Line:Work Coor, PrvSpeed=12	Param C(#3)
6	Line:Work Coor, PrvSpeed=1	Param D(#4)
7	Fast:Joint Coor, PrvSpeed=10	Param P(#16) 0
8	Line:World Coor, PrvSpeed=1	Param L(#12)

Red annotations in the image point to the instruction 'Call G:G=56 (Set Add Axis Co)' with the text 'call coordinate system' and to the 'Line:Work Coor' instructions with the text 'the points need to be recorded in the working coordinate system'.

The interface also shows a status bar at the top with 'Teaching 50.0 %' and 'Alarm' indicators, and a bottom panel with various control buttons like 'JOINT', 'TOOL', 'WORK', 'WORLD', and axis movement keys (W+, V+, U+, etc.).

# 7 Instructions for welding seam tracking and positioning

## 7.1 Laser tracking

### 7.1.1 Tracking Setting Page Introduction

1. The option to adjust the laser parameters will only appear when the operation level is adjusted to the machine factory and above.

The screenshot displays the CNC control interface. At the top, a status bar shows the current program (1), system (-1), and world coordinates (X: -199.09, Y: 516.25, Z: 820.98). The interface is divided into several sections:

- Left Panel:** A vertical menu with options: prog, point, Param, Synergy, **Track** (highlighted in red), and sys.
- Center:** A 3D model of a robotic cell with various components and a mouse cursor.
- Right Panel:** A vertical menu with options: drop, arc, collision, send, receive, and air.
- Bottom Panel:** A grid of control buttons for JOINT, TOOL, WORK, and WORLD, along with directional keys (W+, V+, U+, C+, B+, A+, Z+, Y+, X+, W-, V-, U-, C-, B-, A-, Z-, Y-, X-).

A red arrow points to the 'Track' option in the left panel, with the text "adjust laser parameters" written below it.

2. Tracking settings page



跟踪器其他资讯			
激光器使能	<input checked="" type="checkbox"/>	10	切换
启动跟踪器		255	设定
关闭跟踪器		10	设定
寻找跟踪焊缝		0	设定
焊道样式		0	0 设定

This part is the command sent to the laser by the system.

Laser enable: Click the "Switch" button to switch the laser on and off. When the digital display is 10 and the green light is on, the laser is successfully turned on.

Start tracker and close tracker: Click the "Settings" button at the back. Control the tracker on and off. The status shown in the figure

indicates that the tracker was successfully opened.

**Finding weld seam tracking:** After clicking the "Set" button at the back, this parameter will have a continuously accumulated count, indicating that the system will successfully receive the weld seam data. When it is not turned on, the tracker can scan the weld seam in time. Edge will not receive any data!

**Weld Bead Style:** This parameter is used to manually find the weld seam. According to different welds on the workpiece, the system control tracker switches to the corresponding weld seam parameters to ensure that accurate data can be scanned. Enter the corresponding number in the digital input field , Click the setting button at the back. The number in the number field becomes the number to be switched, indicating that the setting is successful.

搜索状态	0
左右偏差值	0
高度偏差值	0

This part is the data sent by the laser to the

1. The laser is successfully enabled 2. The tracker is turned on 3. The tracking weld is turned on

The system will successfully receive the data given by the tracker if the above three conditions are met !!!

Search status: When the laser does not scan the weld or receives data, the digital display box will display the number "0"; when the weld is scanned, the number "255" will be displayed.

Left and right deviation value: The searched weld position is based on the left and right values of the origin of the tracker coordinate system.

Height deviation value: The searched weld position is based on the value of the height above and below the origin of the tracker coordinate system.

跟踪器位置资讯	
搜索状态	0
区域X	0.00
区域Y	0.00
区域Z	0.00
世界X	-81.01
世界Y	1120.63
世界Z	1300.30

 跟踪点 常时转换

Tracking point is always switched: Click this button, the left light is on to indicate that it is successfully turned on. At this time, if a weld is scanned, there will be a value in the red box. The meaning of this

value is that the weld scanned by the laser at this time The position of the point is the coordinates of the robot's world x / y / z.

One of the functions of this function: After calibration with the laser, you can verify whether the calibration result is accurate.

Verification method: first scan a weld point with a laser, mark this point, and record the world x / y / z value displayed in the red frame at this time; then move the tcp point of the robot to the marked point and record At this time, the robot's world xyz coordinate value is compared; the closer the two sets of coordinate values are, the closer the value is, the more accurate the calibration is.

偏移坐标R		乘数
有	23988	
XR	23989	0.100
YR	0	0.000
ZR	23990	-0.100
AR	0	0.000
BR	0	0.000
CR	0	0.000

搜索状态	0
左右偏差值	0
高度偏差值	0

Please enter the same value as the box!

Offset coordinate r: indicates that the offset value read by the tracker is stored in the corresponding r value register of the system.

Multiplier: The left and right height deviation value in the box on the right, multiplied by the value in the multiplier, which is the actual

distance. (Here the multiplier is set according to the idea)

**Can verify the accuracy of the data given to the system when the laser scans the weld !!!**

Verification method: first let the laser scan to a welding point and record the deviation value at the time. Subtract the deviation value and multiply it by the multiplier to see if it is equal to the fixed distance of the movement. If it is not equal, please adjust the parameters of the camera to ensure that the weld point scanned is stable and effective.

坐标系	
X	0.00
Y	0.00
Z	0.00
A	0.00
B	0.00
C	0.00

The meaning of this coordinate coefficient value: After the tracker is installed, the relative position and attitude of its reference position and the robot's tcp point.

### 7.1.2 Preparation before use

- 1、 Tool preparation: one switch and two shielded network cables.

- 2、 One end of a network cable is plugged into the switch, and the other end is plugged into the Ethernet port on the system side. The same applies to the camera side.
- 3、 Ask relevant personnel to install the camera and adjust the corresponding parameters on the camera side.
- 4、 After doing the above work, you can debug the relevant parameters on the system side!

### 7.1.3 Communication and calibration

#### 1. Set up communication



- 1) Turn on communication
- 2) Select the corresponding camera brand
- 3) Set the IP to 192.168.19.3 and the port number Port to 502. At the same time, set the IP and port number of the camera to the same as on the

system.

- 4) Then restart the system and tracker.
- 5) After restarting, go to this page again and observe that the number box on the right of the online reset has been continuously accumulating, and the connection is successfully displayed below the number.
- 6) At this point, you need to check whether the real connection is successful:

The screenshot displays the LNC control interface. At the top, it shows system information including 'LNC 0 -1', '世界' (World), and coordinates for X, Y, Z, A, B, C, U, V, W. The status is '闲置' (Idle) with '5.7.2.tch' and '示教中 100.0%' (Teaching 100.0%). A '警告' (Warning) icon is present. The main area is titled '跟踪点 常时转换' (Tracking Point Constant Conversion). It features a table for coordinate systems and a '跟踪器其他资讯' (Tracker Other Information) section. The '跟踪器其他资讯' section includes '激光器使能' (Laser Enable) with a green indicator and '10' value, '启动跟踪器' (Start Tracker) with '255' value, and '关闭跟踪器' (Close Tracker) with '10' value. Red arrows point to the '切换' (Switch) and '设定' (Set) buttons next to these values. A red box highlights these buttons. Below the table, a red text annotation reads '点击1、2后，此状态表示连接成功' (After clicking 1, 2, this state indicates successful connection). The bottom of the interface shows various control buttons for JOINT, TOOL, WORK, and WORLD, along with axis movement controls (C+, B+, A+, Z+, Y+, X+, J6+, J5+, J4+, J3+, J2+, J1+, C-, B-, A-, Z-, Y-, X-, J6-, J5-, J4-, J3-, J2-, J1-).

## 2. Parameter setting

Refer to the following figure for the parameter setting !!!

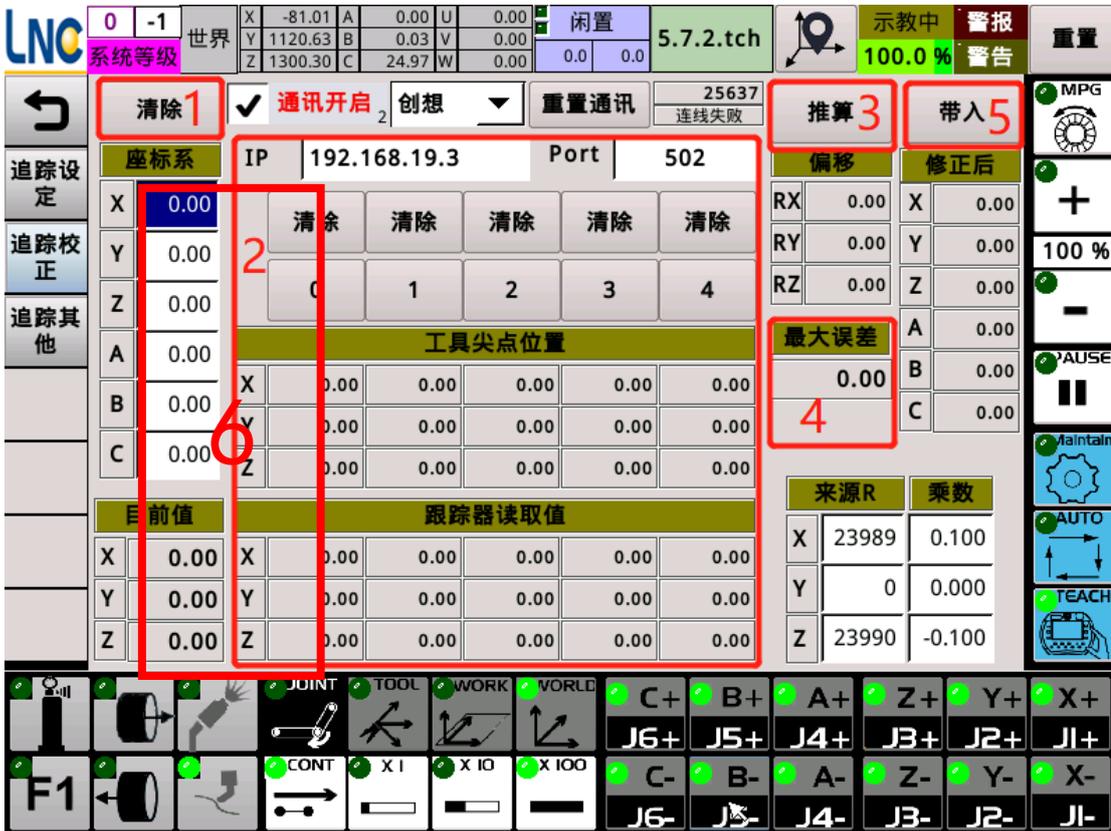


Refer to Chapter 2 to set related parameters and open related buttons !!!

After the communication and parameter settings are completed, please verify it according to the second chapter. The left and right and height deviation values given by the tracker to the camera are equal to the actual distance !!!

### 7.1.4 Laser Calibration

Significance of calibration: The welding point scanned by the laser can be directly converted to the world coordinates on the system side. Before calibration, tool calibration and origin calibration are needed! (For tool calibration and origin calibration, please refer to Chapter 5)



- 1) Click Clear first to clear the previously calibrated data.
- 2) Take 5 calibration points. When taking these 5 points, please pay attention: when taking the points, ensure that the laser can scan the stable and effective welding point.

Point 1: Take a workpiece, take a point on its welding seam, mark it; move the robot, align the robot's sharp point to the marked point, and ensure that the laser can scan the welding seam, and wait for the left and right and height deviation values to stabilize After that, click the button "0", at this time, the coordinates of the tool tip and the tracker reading value will be recorded.

Point 2--4: The mobile robot enables the laser to scan to the marked point, and the robot's sharp points are located at the upper left, lower left, upper right, and lower right of the marked point. When the

deviation value stabilizes, click the 1-4 button to record the coordinate value. .

- 3) Click the "Calculate" button, the maximum error will be calculated; and the coordinate value of "corrected" will appear numerically.
- 4) The maximum error is within 1 to meet the requirements.
- 5) After the error meets the requirements, click the "Bring In" button to bring the "corrected" coordinate value into the 6th "Coordinate System".

The method of checking the calibration results is mentioned above and will be mentioned below.

### **7.1.5 Program Introduction**



- 激光开启
- 激光关闭
- 样式切换
- 取点N
- 到点N
- 两点直线
- 三点圆弧
- 登入原点点位
- 比对原点点位并偏移
- 取消偏移

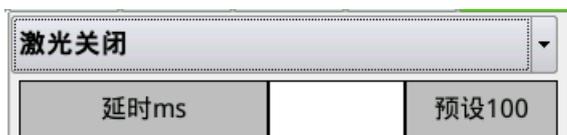
Laser command:

- 启动跟踪器(到达后)
- 关闭跟踪器(移动前)
- 探测轨迹
- 直线跟踪
- 圆弧跟踪中点
- 圆弧跟踪
- 取点
- 姿态登入(最多10个)

Laser coordinates:



: Turn on the laser and tracker. You can set the delay time after turning on, the preset is 100ms.



: Turn off the laser and tracker. You can set the delay time after turning off, the preset is 100ms.

样式切换		
样式参数		

: Set different parameter styles of the weld in advance according to the laser side, and call the weld style according to the weld before scanning.

取点N		
点号码		

: Record the positions of the welds scanned by the laser, and fill in the corresponding numbers, up to 100 groups.

到点N		
点号码		
速度		mm/s

: The point recorded before reaching, and set the arrival speed at the same time.

两点直线		
点位1	3	mm/s
点位2	4	mm/s
姿态1	1	mm/s
姿态2	2	mm/s
速度	20	mm/s

: Move linearly from point 1 to point

2. The number behind the point corresponds to the number of the point.

Attitude is the same. There are up to 10 groups of attitudes, which will be described below. Attitude 1 corresponds to the attitude of point 1.

There is no representative point. The attitude of bit 1 is the attitude at the time of taking points. Please ignore the following units and display

errors!

三点圆弧		
点位1		mm/s
点位2		mm/s
点位3		mm/s
姿态1		mm/s
姿态2		mm/s
姿态3		mm/s
速度		mm/s
垮度		(预设0)

: Points 1, 2, and 3 function as

circular arcs. The order is equivalent to straight lines, midpoints, and 3d arcs. The attitude is the same as above. The span is preset to 0, which is a circular arc formed by three points. When the degree is set, it indicates the angle that this arc can move.

**Start the tracker (on arrival):** After reaching the specified position, turn on the laser first, and then turn on the tracker.

**Turn off the tracker (before moving):** turn off the tracker, then turn off the laser, and then move to the specified position.

**Detection trajectory:** Move from the robot's current position to this point. During the movement, if the laser detects a weld, it will go to the weld point at a speed 3 times the current command; if no weld is detected up to this point, it will Prompt alarm cannot find weld.

**Straight-line tracking:** switch to tracking bead mode, and then detect if there is still a bead signal at regular intervals, if any, convert its

detected position to world coordinates, and then calculate the distance from the target point, Compare it with the distance from the target point that was detected last time. If it becomes larger, it means that it has started to move away from the target point. When the bead signal cannot be checked or it starts to move away from the target point, end the tracking trajectory, if not, Move to the converted world coordinates.

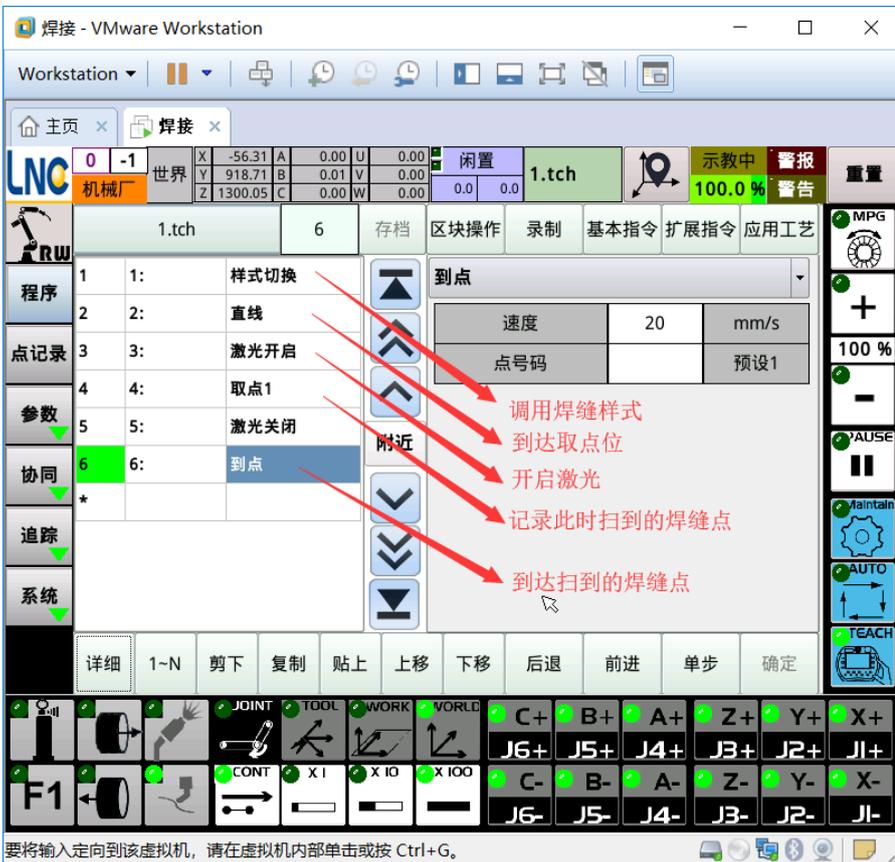
**Arc tracking midpoint:** When detecting the arc trajectory in real time, take any point in this arc to record the position and attitude.

**Arc tracking:** When detecting the arc trajectory in real time, go to the end position and attitude of the arc.

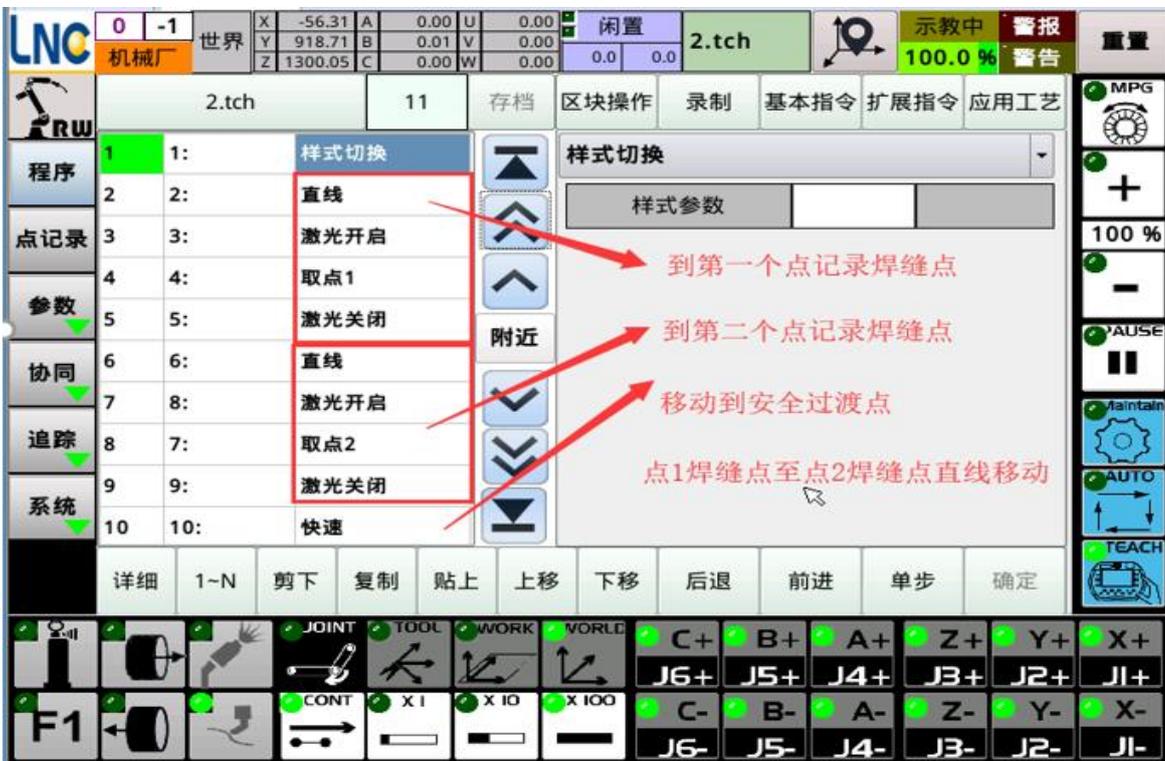
**Attitude login (up to 10 points):** When performing two-point straight line or three-point arc, you can call the abc coordinate value of this instruction to its corresponding attitude. In the program, it will not run to the position of this instruction, it will only call its abc coordinates.

### **7.1.6 Laser Program Example**

**Example 1:** Calibration result verification procedure. When taking point 1, the weld spot scanned by the laser is marked. The closer the position to the point is, the more accurate the calibration is.



Example 2: Two-point positioning. Take two points respectively, record the welds scanned, and then move in a straight line with two points.





Example 3: Two-point positioning (attitude setting). Move linearly with the attitude of the attitude registration point, but will not move to the attitude registration point!

1	1:	样式切换
2	2:	直线
3	3:	激光开启
4	4:	取点1
5	5:	激光关闭
6	6:	直线
7	7:	激光开启
8	8:	取点2
9	9:	激光关闭
10	10:	快速

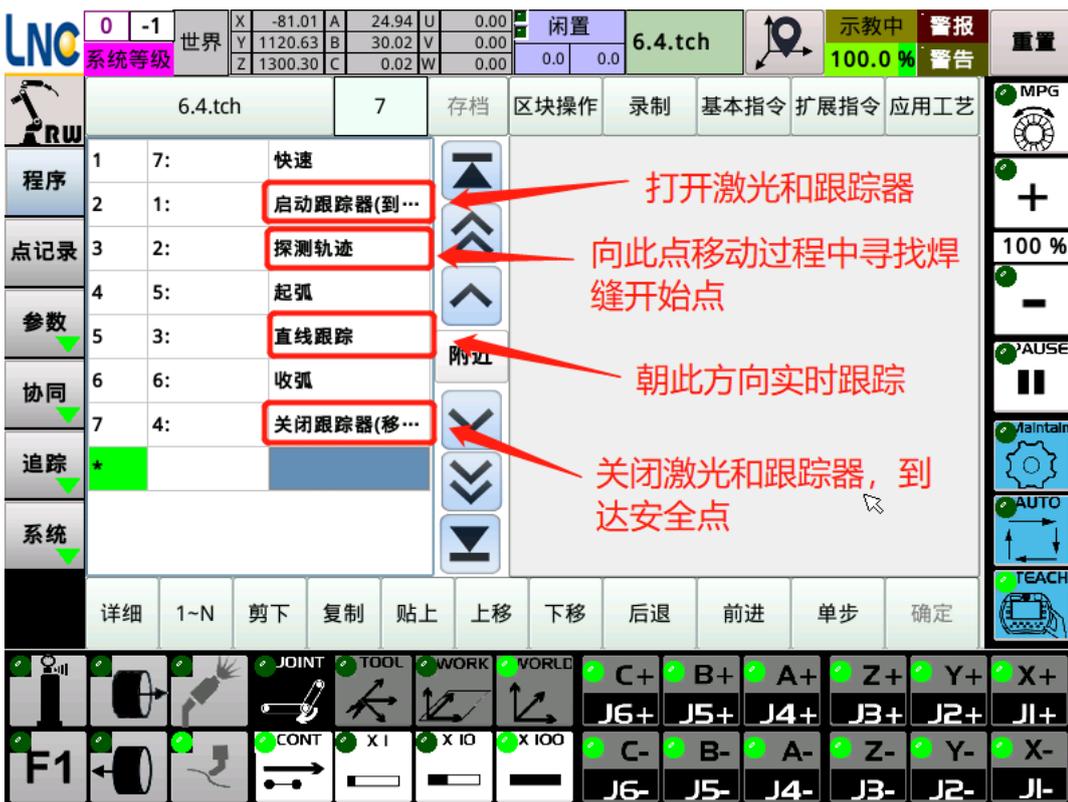
7	7:	激光开启		世界座 ▾	姿态登入1 ▾	0	
8	8:	取点2			设定值	目前值	
9	9:	激光关闭		X	-56.287	-56.287	
10	10:	快速		Y	918.757	918.757	
11	11:	姿态登入1		Z	1300.057	1300.057	
12	12:	到点		A	45.280	45.280	
13	13:	起弧		B	12.139	12.139	
14	14:	两点直线		C	-36.042	-36.042	
15	15:	收弧					
*				带入目前	到	速度	/s

Example 4: Three-point arc: Take three points as the starting point, midpoint, and end point of an arc to form an arc.

1	1:	样式切换
2	2:	直线
3	3:	激光开启
4	4:	取点1
5	5:	激光关闭
6	6:	直线
7	7:	激光开启
8	8:	取点2
9	9:	激光关闭
10	10:	直线



Example 5: Real-time tracking with fixed attitude.



Example 6: Real-time tracking with variable attitude.

LNC 0 -1 世界 X -81.01 A 24.94 U 0.00 闲置 6.4.tch 示教中 警报 重置  
系统等级 Y 1120.63 B 30.02 V 0.00 0.0 0.0 100.0% 警告

程序	1	7:	快速	附近 跟踪的终点位置 变姿态路径中任意一点
点记录	2	1:	启动跟踪器(到...	
参数	3	2:	探测轨迹	
协同	4	5:	起弧	
追踪	5	7:	圆弧跟踪中点	
系统	6	8:	圆弧跟踪	
	7	6:	收弧	
	8	4:	关闭跟踪器(移...	

详细 1~N 剪下 复制 贴上 上移 下移 后退 前进 单步 确定

							C+	B+	A+	Z+	Y+	X+
							J6+	J5+	J4+	J3+	J2+	J1+
F1			CONT	X1	X10	X100	C-	B-	A-	Z-	Y-	X-
							J6-	J5-	J4-	J3-	J2-	J1-

## 7.1.7 Introduction to Flip Laser Tracking with External Axis



Instructions:

- 1、 It is recommended to perform tool calibration and origin calibration before installation to ensure that the TCP accuracy of the robot is within the controllable range, and then flip the robot upside down. If it is done after flipping up due to TCP, The operation will be troublesome, so it is recommended to do the calibration before flipping.
- 2、 After flipping, set the robot to flip on the system. Because the direction of the world coordinates will change after the robot is flipped, you need to set the flip, so that the direction of the world coordinates after flip It is the same as the formal dress, it is easier to teach, and it won't take long for the direction to change.  
The steps are as follows:
  - 1) Enter the installation application page
  - 2) Go to the world definition page



3) Set the correct use of additional axes

Use 11: additional axis coordinated with world coordinate x axis

Use 12: additional axis coordinated with world coordinate y-axis

As shown in the figure above, at the position of the calibration point of the robot, the direction of the gantry travel is consistent with the world coordinate x direction, then the purpose of the gantry axis is set to 11. The direction of the additional axis on the gantry beam is consistent with the world coordinate y direction. The purpose is 12.

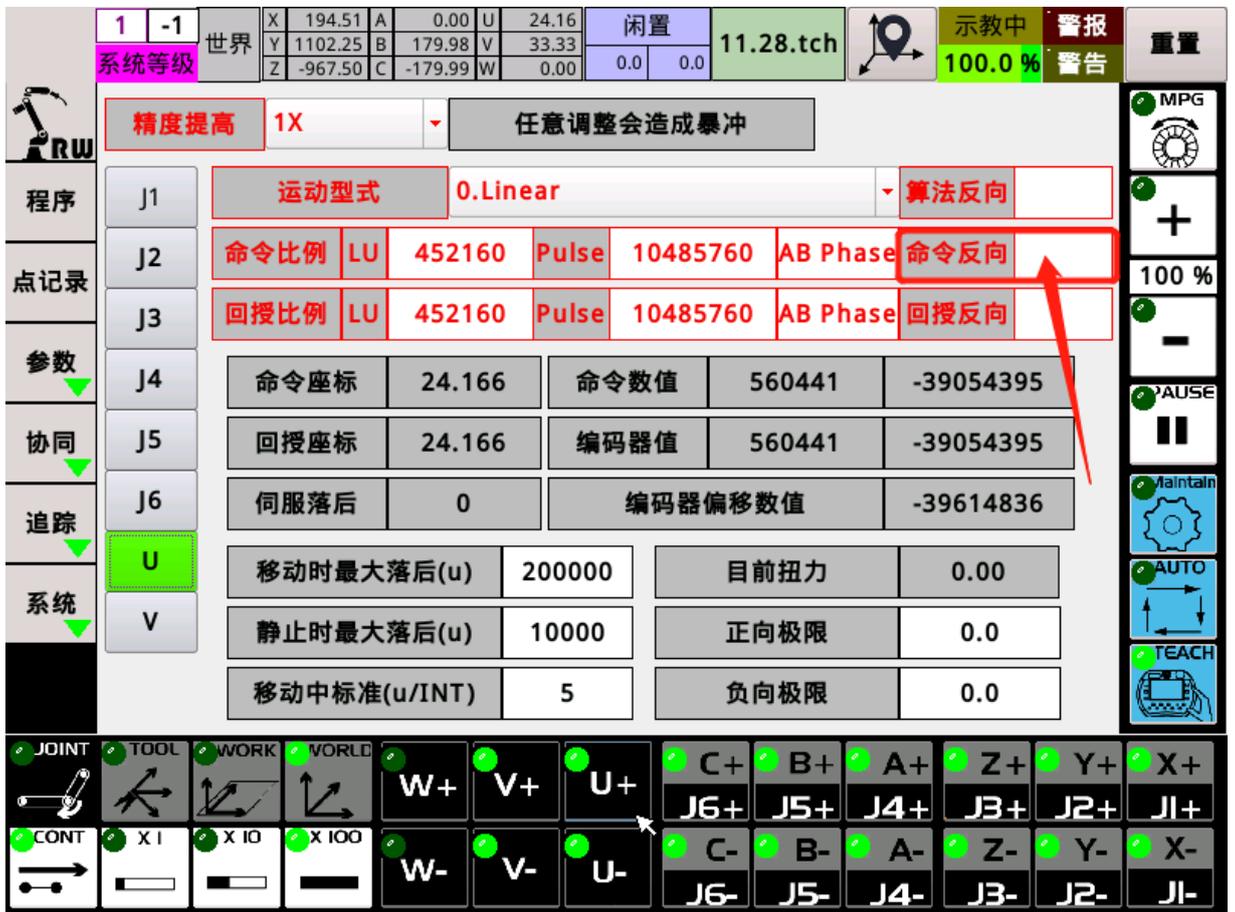
轴清单	轴号	脉冲	绝对值	型号	绝对值
1	Pulse	1	0	No	
2	Pulse	2	0	No	
3	Pulse	3	0	No	
4	Pulse	4	0	No	
5	Pulse	5	0	No	
6	Pulse	6	0	No	
7	Pulse	7	0	No	
8	Pulse	8	0	No	
9	Pulse	0	0	No	

用途	轴号	参数号
7	11	
8	12	
9	0	

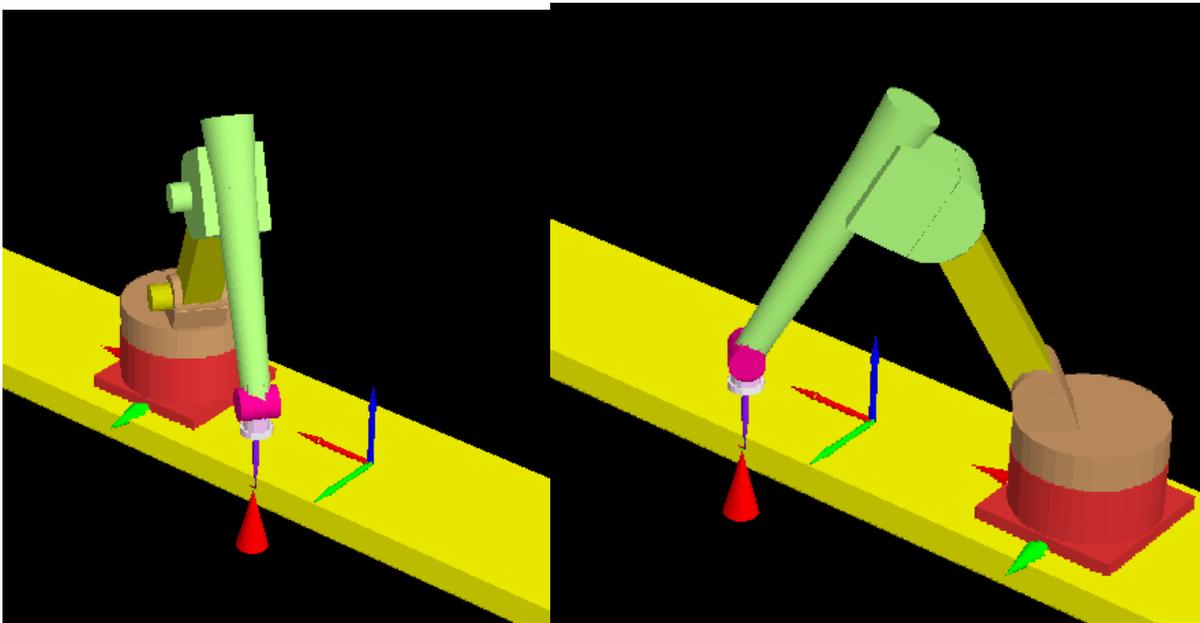
4) Set the rotation direction of the additional axis

Consistent with the world coordinate direction, it also includes the direction of rotation must be consistent. It is necessary to verify that the direction of travel of the additional axis is consistent with the direction of the world coordinate. For example: the gantry axis moves in the positive direction. It is the same direction, that means correct, otherwise you need to reverse the axis command. Invert the command reverse parameter and restart to take effect.



### 5) Verify synergy

Take a fixed point, align the robot tcp (torch tip) with the fixed point, then switch the coordinates to world coordinates, move the u / v axis of the robot, and observe whether the two pointed points are always together. If in Together, it means that the coordination is very accurate. If there are more movements, the more the two sharp points deviate, it means that the synergy effect is not working, and a collaborative correction is required. The correction method is as follows:



机型	33	30	坐标系	-1	0	X	100	警告					
清除	J1	-49.968	J126	-28.015	J1	0.00	TX	0.00	CnX	0.00			
	J2	-28.013	J16	-0.002	J2	0.00	TY	0.00	CnY	0.00			
	J3	-33.070	J23	-61.083	J3	0.00	TZ	0.00	CnZ	0.00			
	J12	-77.981	J235	-89.998	J4	0.00	L12	0.00	L5X	0.00			
0	1	2	3	4	5	6	J5	0.00	L23	0.00	L5Y	0.00	
7	8	9	10	11	12	13	J6	0.00	L34a	0.00	L5Z	0.00	
14	15	16	17	18	19	清除	U	0.00	L34	0.00	L6X	0.00	
取点坐标				相对坐标				V	0.00		0.00	L6Y	0.00
J1	-49.97	X	-8.01	X		0.00	W	0.00		0.00	L6Z	0.00	
J2	-28.01	Y	600.52	Y		0.00				0.00			
J3	-33.07	Z	209.82	Z		0.00				0.00			
J4	0.00	A	0.00										
J5	-28.91	B	0.00										
J6	49.97	C	-0.00										
U	-722.88												
V	0.00												
W	0.00												
		取点		到			推算			0.00		0.00	
										最大误差		0.00	

As shown in the figure, take a sharp point and fix it. Move the additional axis parallel to the world coordinate x, then adjust the world coordinate xyz, align the tip of the welding torch with the sharp point. Then adjust the origin page and take the point 0. Then move the additional

axis Move in the opposite direction, adjust the world coordinate xyz, and then align the tip of the welding gun with the sharp point, take point 1. Then the point is calculated, and the error is within 3, which can be brought into use and the emergency stop takes effect.

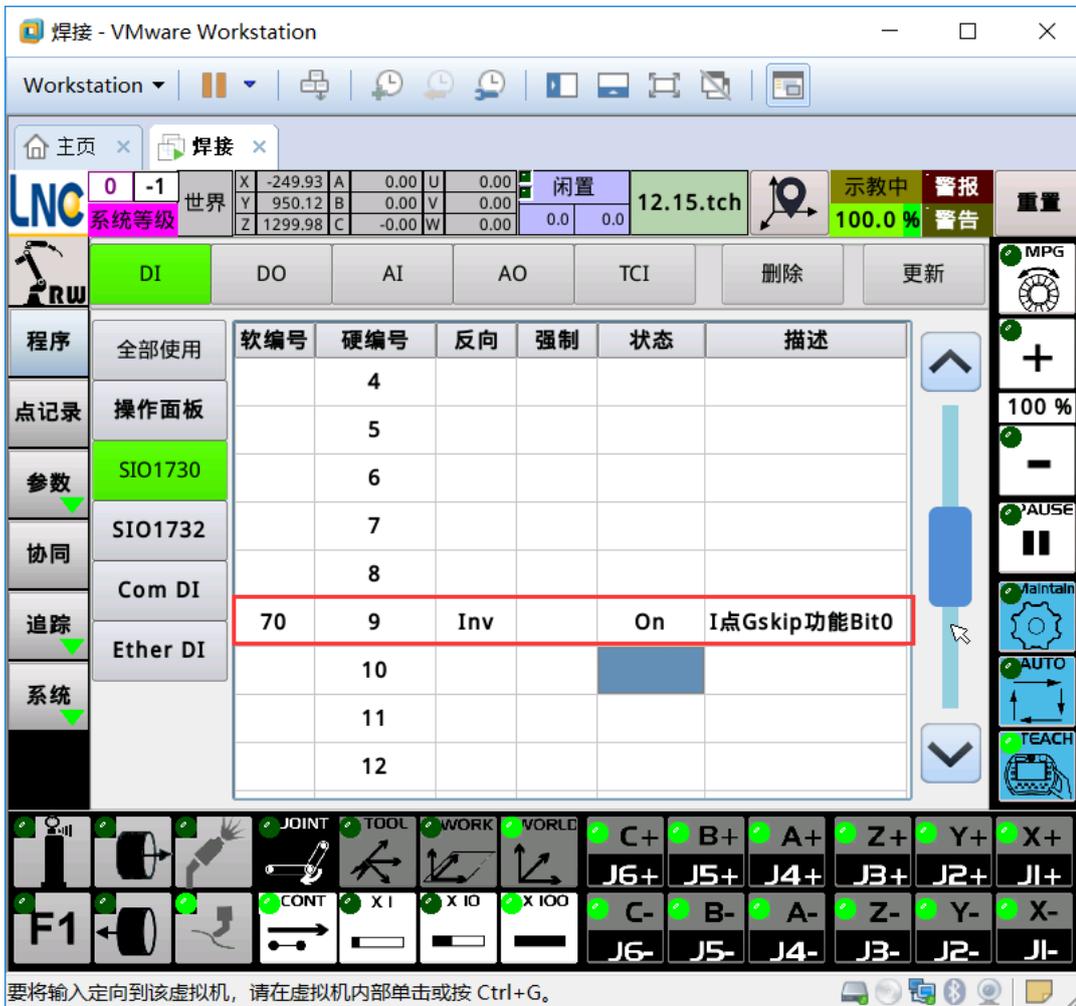
Then verify the synergy effect again. If it is not correct, correct it again. After many corrections, there is no major improvement. You must find the cause from other channels.

- 6) The rest of the operation is the same as normal laser tracking programming.

## **7.2 Contact positioning**

### **7.2.1 Preparatory work before contact positioning**

A signal output point is required on the welding machine. Generally, the welding machine monitors the change in the current value of the welding wire to the surface of the workpiece. Connect this output point on the welding machine to the input point on the system i / o board. In the settings, fill in the corresponding soft numbers as follows:



Make sure that the signal is off when it is not in contact with the workpiece, and it will turn on when it is in contact. The tester is a welding machine of the Model 350 Megmeet, you need to reverse this i point signal.

## 7.2.2 Bit Instruction Introduction

There are currently three types of positioning instructions, namely planar positioning, spatial positioning, and circular positioning, which will be introduced one by one below.

焊接 - VMware Workstation

Workstation | [Pause] | [Print] | [Refresh] | [Fullscreen] | [Screenshot] | [Save]

主页 | 焊接

LNC	0	-1	世界	X	-249.93	A	0.00	U	0.00	闲置	PMXW.tch	示教中	警报	重置
系统等级				Y	950.12	B	0.00	V	0.00	0.0	0.0	100.0 %	警告	
				Z	1299.98	C	-0.00	W	0.00					

PMXW.tch | 14 | 存档 | 区块操作 | 录制 | 基本指令 | 扩展指令 | 应用工艺

程序	1	1:	坐标系	焊枪输出	圆弧焊	平面寻位	激光指令
点记录	2	2:	快速	起弧	前後擺焊	空間尋位	輔助指令
参数	3	3:	I點尋找P1(與...	延續起弧	左右擺焊	圓形尋位	
协同	4	4:	快速	收弧	魚鱗焊		
追踪	5	5:	I點尋找P2(與...		路徑結束		
系统	6	6:	快速				
	7	7:	快速				
	8	8:	I點尋找P3				
	9	9:	快速				
	10	10:	尋位平面偏移				

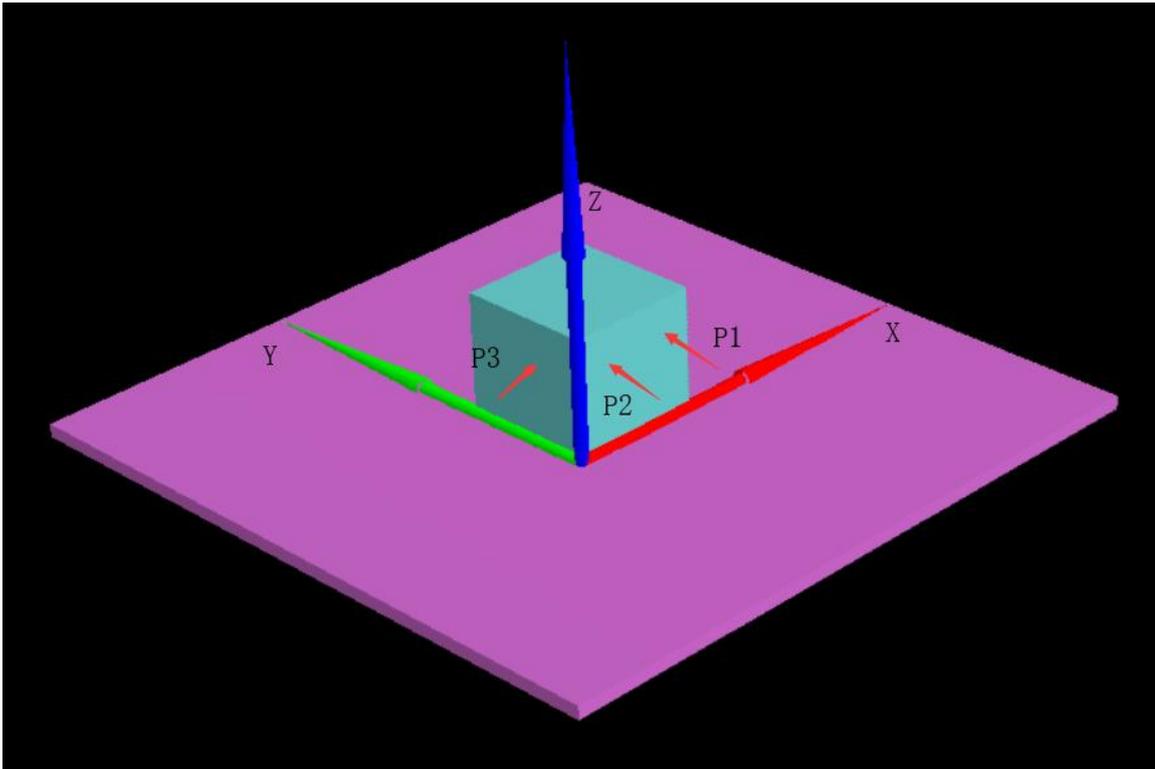
MPG | + | 100 % | - | PAUSE | Maintain | AUTO | TEACH

详细 | 1~N | 剪下 | 复制 | 贴上 | 上移 | 下移 | 后退 | 前进 | 单步 | 确定

JOINT	TOOL	WORK	WORLD	C+	B+	A+	Z+	Y+	X+
				J6+	J5+	J4+	J3+	J2+	J1+
CONT	X I	X IO	X IOO	C-	B-	A-	Z-	Y-	X-
				J6-	J5-	J4-	J3-	J2-	J1-

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G.

# Plane positioning



- I點尋找P1(與P2同方向)
- I點尋找P2(與P1同方向)
- I點尋找P3
- 激光尋找P1(與P2同方向)
- 激光尋找P2(與P1同方向)
- 激光尋找P3
- 尋位平面偏移
- 取消尋位偏移

I點尋找P1(與P2同方向)

方向與最大位移X		mm
方向與最大位移Y	300	mm
方向與最大位移Z		mm

尋點速度	10	mm/s
------	----	------

尋位平面偏移

交點工作座標X		mm
交點工作座標Y		mm

1	1:	座標系
2	2:	快速
3	3:	I點尋找P1(與...
4	4:	快速
5	5:	I點尋找P2(與...
6	6:	快速
7	7:	快速
8	8:	I點尋找P3
9	9:	快速
10	10:	尋位平面偏移

6	6:	快速
7	7:	快速
8	8:	I點尋找P3
9	9:	快速
10	10:	尋位平面偏移
11	11:	直线
12	12:	直线
13	13:	直线
14	14:	直线
*		

In order to better understand the principle, here we build a model and explain it with a program example.

(1) First, you need to establish a working coordinate system, and the working coordinate system is shown in the above figure (the direction is indicated). When programming, we need to call this coordinate system in the first step, and the subsequent points are recorded using the working coordinate system. .

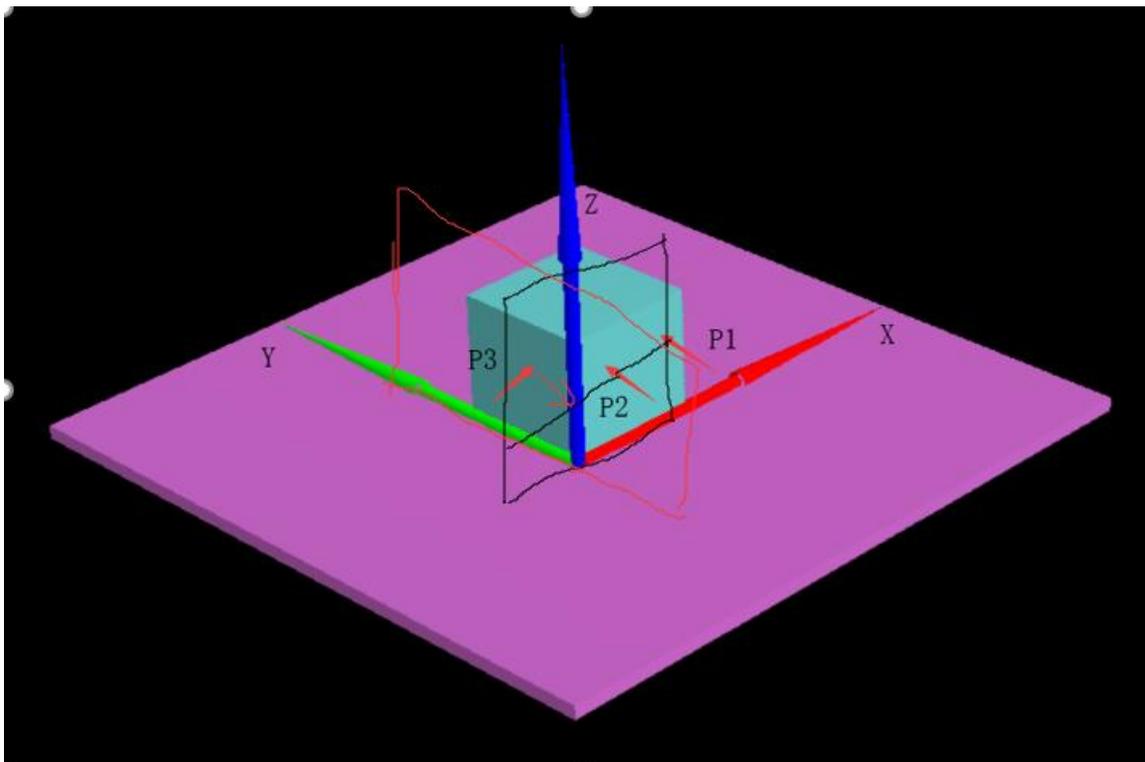
(2) After that, 3 points need to be taken, p1, p2, and p3. The direction and position of the three points are shown in the figure above.

Maximum displacement in the direction: refers to the point of the fast instruction in the program, which moves linearly in a certain direction, and the speed is the speed of the seek point. Note: This displacement direction has positive and negative.

When the welding torch touches the surface of the workpiece, an i-point signal is triggered. At this time, the welding torch returns to the previous fast point by the original path and continues to execute

the next instruction.

After finding 3 points, these 3 points will determine a coordinate system. Because it is a plane positioning, the two points p1 and p2 will form a plane (black plane) parallel to the z axis, and the point p3 is perpendicular to this plane To form a plane (red plane) that is also parallel to the z-axis.



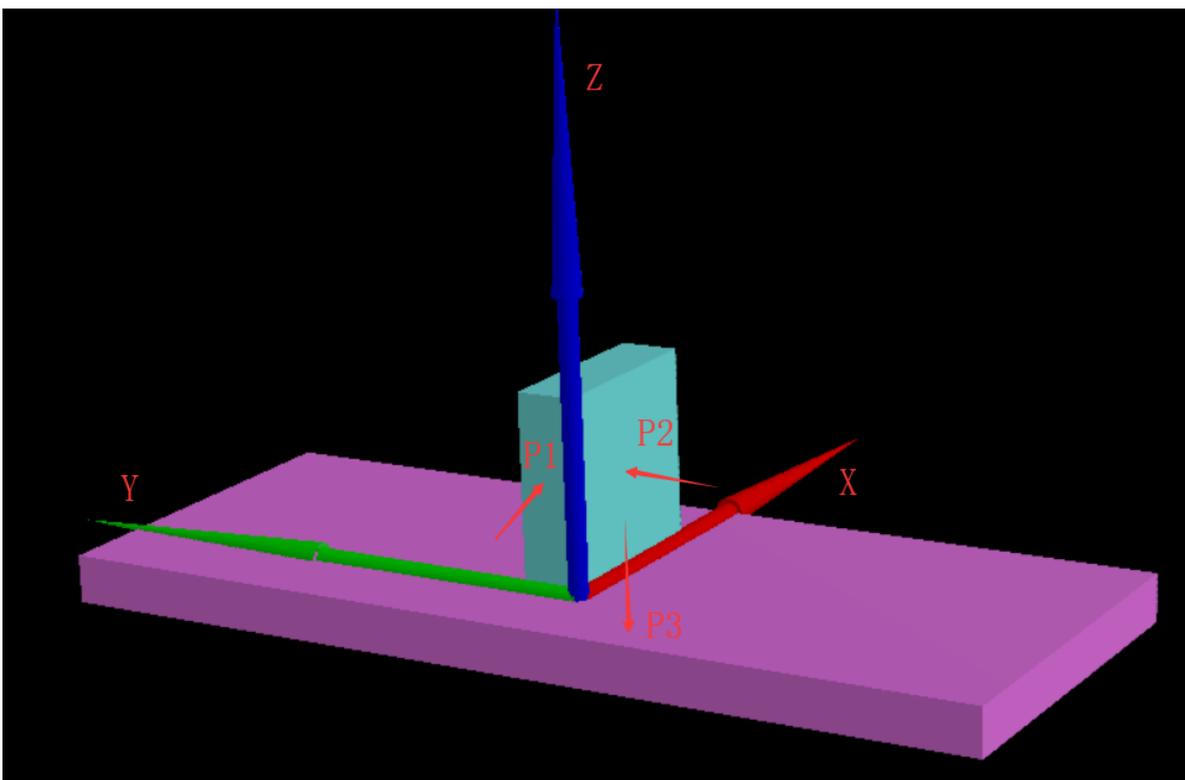
The origin of the working coordinate system found at this time is located on the intersection of the two planes.

- (3) After the three points are determined, the coordinate system must be shifted. The principle is the same as the working coordinate system. The purpose is to shift the originally established working coordinate system to the working coordinate system after positioning. The path that was originally established on the working coordinate system can continue to run the same effect after the workpiece is offset.

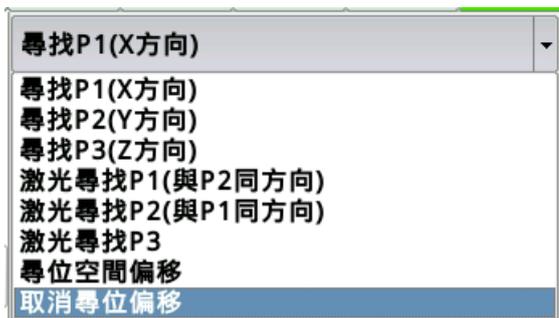
**I**ntersection working coordinates: Refers to the origin of the working coordinate system determined by the three points taken, an offset from the x or y direction of the original working coordinate system origin. Measure the offset value and fill it in. In order to ensure the positioning accuracy, when taking the point, make sure that the origin of the offset is on the same side as the origin of the original coordinate system.

- (4) After the positioning plane is offset, write a normal machining path.
- (5) If the next command does not need to use the offset coordinate system, please use the cancel plane offset command.

### 7.2.3 Spatial and circular positioning

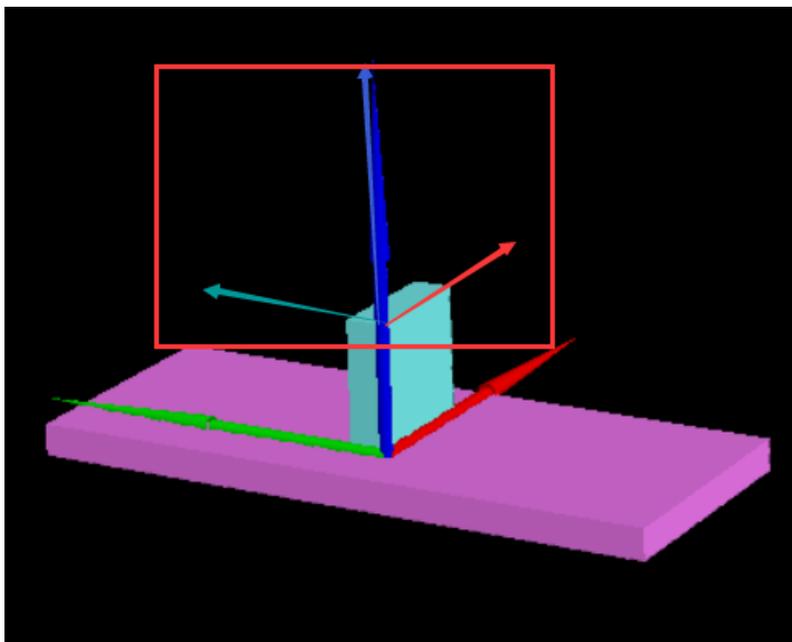


1	1:	坐标系	5	5:	尋找P2(Y方向)
2	2:	快速	6	6:	快速
3	3:	尋找P1(X方向)	7	7:	尋找P3(Z方向)
4	4:	快速	8	8:	快速
5	5:	尋找P2(Y方向)	9	9:	尋位空間偏移
6	6:	快速	10	10:	直线
7	7:	尋找P3(Z方向)	11	11:	直线
8	8:	快速	12	12:	直线
9	9:	尋位空間偏移	13	13:	直线
10	10:	直线	*		



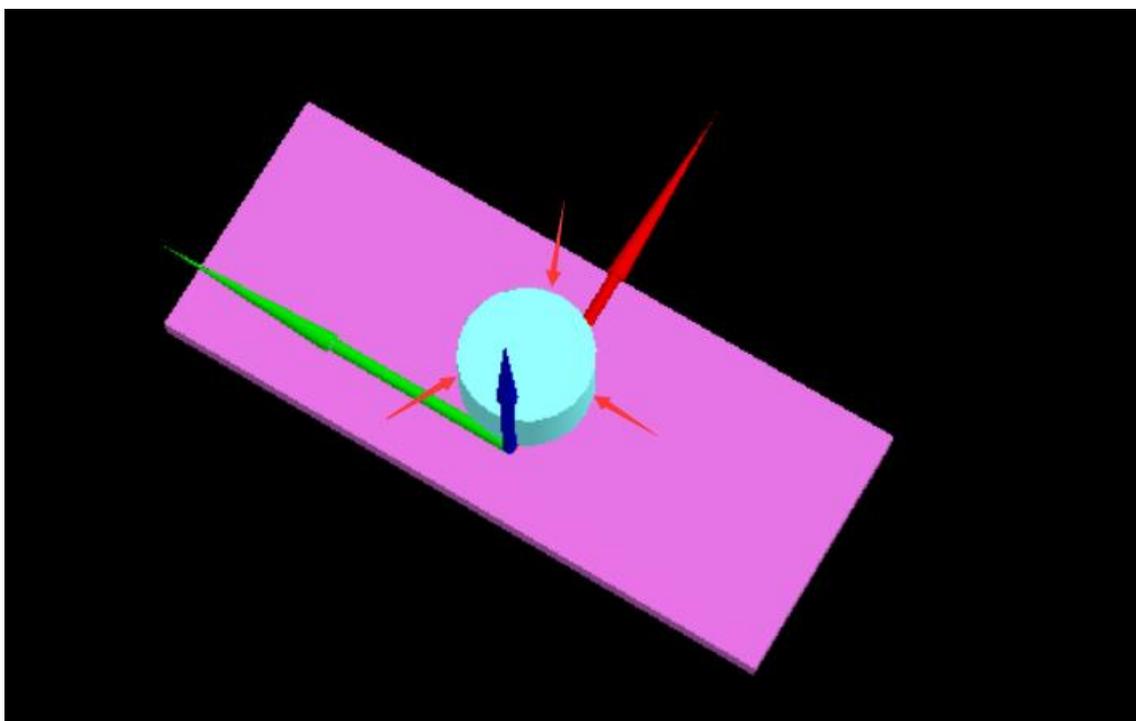
The principles of spatial positioning and circular positioning are the same. Both seek three points to determine an offset of the coordinate system.

The above picture is an example. After finding points in three directions of xyz, you can determine that the position of an intersection point of the three planes is on the same side as the working coordinate system. In this case, you do not need to fill in any offsets to find the space offset instruction. Sometimes the coordinate system selected is not convenient to take, as shown in the figure below:



空间偏移计算		
交点工作坐标X		mm
交点工作坐标Y		mm
交点工作坐标Z	200	mm

At this time, because the intersection of the three points taken is on the bottom plane, you need to fill in the working coordinate offset value of the intersection of z here.



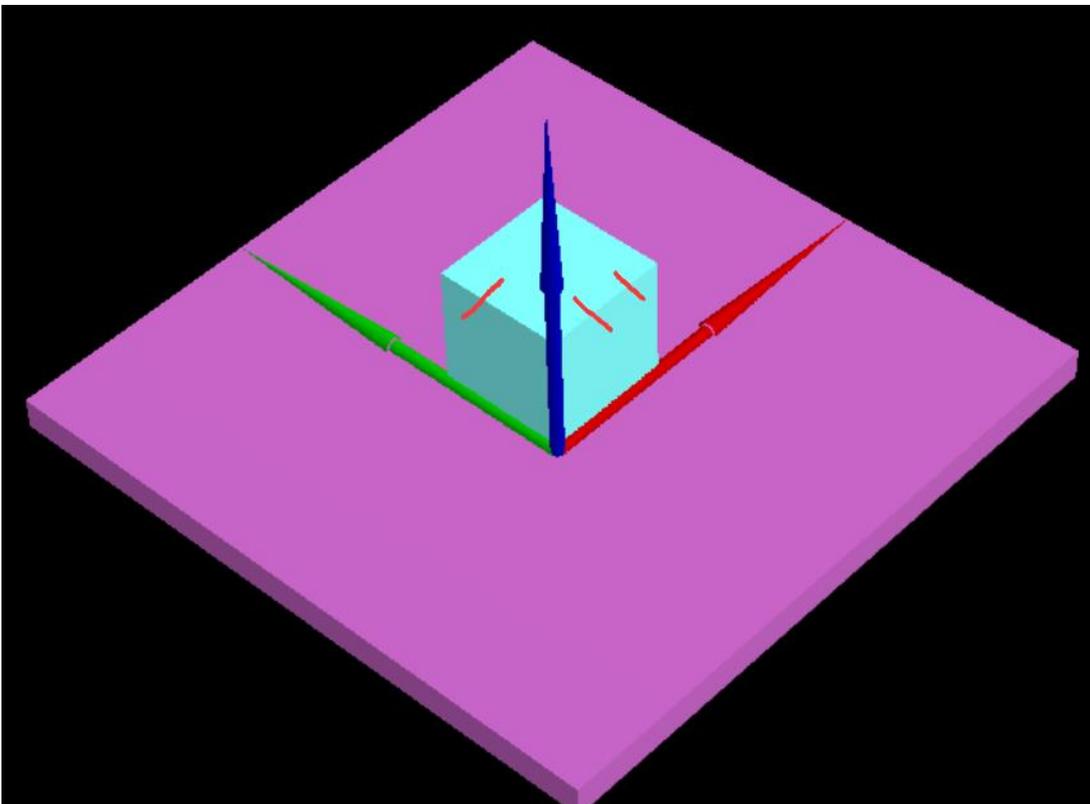
平面圆心计算		
圆心工作坐标X		mm
圆心工作坐标Y		mm

The difference of circular positioning is that the three points determine a circle, and the working coordinate intersection point is the center of the circle. Therefore, when setting the working coordinate offset of the intersection point, the offset value is the cylindrical center to the selected working coordinate. An offset in the xy direction of the origin.

## 7.3 Laser positioning

### 7.3.1 Laser Positioning Introduction

Laser positioning is the same as contact positioning. The only difference is that the three points taken by the laser are the points that can be scanned to the weld.



### 7.3.2 Laser positioning program example



This function is a three-point plane positioning, which is limited to use when the workpiece needs two adjacent right-angled edges. Based on this, an improvement has been made to calculate the accurate offset by finding four points. The method is as follows:

激光开启
激光关闭
样式切换
取点N
到点N
两点直线
三点圆弧
登入原点点位
比对原点点位并偏移
取消偏移

登入原点点位		
直线1点位1号码	1	
直线1点位2号码	2	
直线2点位1号码	3	
直线2点位2号码	4	

比对原点点位并偏移		
直线1点位1号码	1	
直线1点位2号码	2	
直线2点位1号码	3	
直线2点位2号码	4	

This method requires writing two programs.

The first program: find four points by laser. These four points are the same as the three-point plane positioning principle, except that at three points, the side that takes one point becomes two points.

The second program: also find four points by laser, the order of finding points is the same as the first program, and compare the four points with the four points of the first program to calculate the offset.

When using, run the first program first, record the four reference points, and only need to run it once; then run the second program all as the processing program.

Example: first program

5.7.1.tch 5 存档 区块操作 录制 基本指令 扩展指令 应用工艺

1	1:	取点N	点1
2	2:	取点N	点2
3	3:	取点N	点3
4	4:	取点N	点4
5	5:	登入原点点位	

直线1点位1号码	1
直线1点位2号码	2
直线2点位1号码	3
直线2点位2号码	4

登入原点点位

记录这四个点位

The second program:

5.7.2.tch 9 存档 区块操作 录制 基本指令 扩展指令 应用工艺

1	1:	取点N	点5
2	2:	取点N	点6
3	3:	取点N	点7
4	4:	取点N	点8
5	5:	比对原点点位...	
6	6:	直线	
7	7:	直线	
8	8:	直线	
9	9:	取消偏移	

直线1点位1号码	5
直线1点位2号码	6
直线2点位1号码	7
直线2点位2号码	8

比对原点点位并偏移

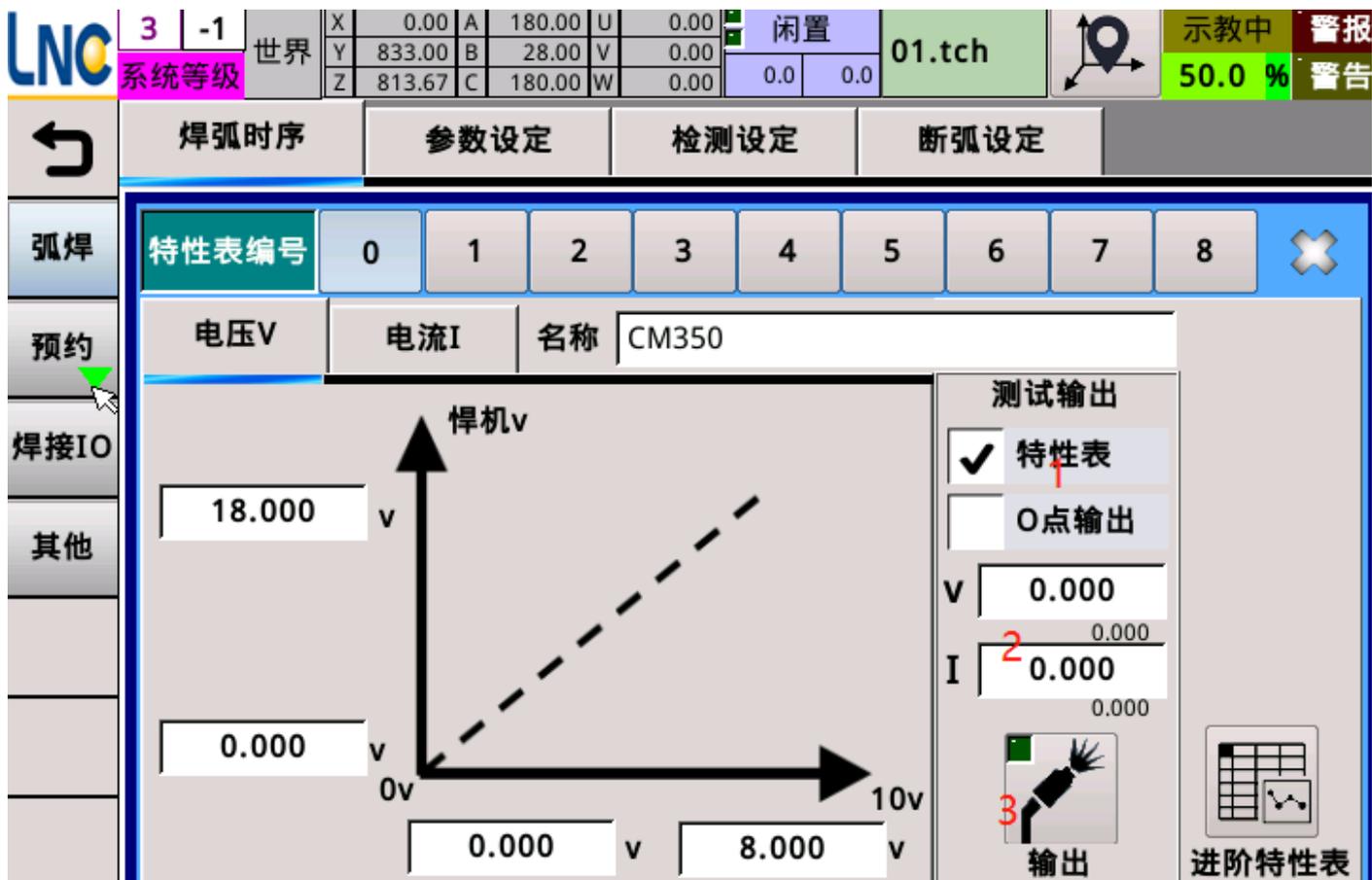
将此四点记录与第一个程序的四个点对比推算偏移

最后取消偏移, 否则工作坐标系不会变回

# 8 Appendix

## 8.1 Characteristic table test

According to the matching of the welding characteristic curve table in Chapter 5, after setting the voltage and current corresponding to the characteristic table, follow the step 123 in the picture, check the characteristic table, enter the actual voltage value after  $v$ , and see if the welder panel display is the same. The actual current value depends on whether the display of the welding machine panel is the same; if they are different, you need to test the matching characteristics table yourself or consult the welding machine manufacturer.



## 8.2 Characteristics table

### 8.2.1 McGmrite models and Otto 350

焊机型号	输出电压曲线	输出电流曲线	基准电压
麦格米特CM350AR	0~8V	0~8V	9V
	0V~18V	30~400A	
麦格米特CM500AR	0~10V	0~10V	9V
	0~18V	30A~500A	
麦格米特PM400F	0~8.8V	1.1V~7.3V	
	0~30V	60A~400A	
麦格米特PM500	0~10V	0~10V	
	0~18V	30A~500A	
奥太350	0~10	0~10V	110V
	50V~150	0~500A	

备注：特殊情况要以实际情况为准，设置电流电压与焊机实际值要相符！

0 | -1  
 系统等级

X 366.59 A -179.99 U 0.00  
 Y 888.34 B 29.98 V 0.00  
 Z 818.74 C 179.99 W 0.00

闲置  
 12.2.1.tch  
 0.0 0.0

准备完成 报警  
 100.0 % 警告

重置

电弧时序

参数设定

检测设定

断弧设定

特性表编号	0	1	2	3	4	5	6	7	8
电压V									
电流I									
名称									

测试输出

特性表

起弧输出

V | 0.000

I | 0.000

输出

进阶特性表

JOINT TOOL WORK WORLD  
 F1

C+ B+ A+ Z+ Y+ X+  
 J6+ J5+ J4+ J3+ J2+ J1+  
 C- B- A- Z- Y- X-  
 J6- J5- J4- J3- J2- J1-

0 -1 世界 X 366.59 A -179.99 U 0.00 闲置 12.2.1.tch 准备完成 警报 重置  
 系统等级 Y 888.34 B 29.98 V 0.00 0.0 0.0 100.0 % 警告

电弧时序 参数设定 检测设定 断弧设定

弧焊 特性表编号 0 1 2 3 4 5 6 7 8

电压V 电流I 名称

0.000 焊机I

0.000 A

0.000 A

0v 10v

0.000 v 0.000 v

测试输出  
 特性表  
 起弧输出  
 V 0.000  
 I 0.000

输出 进阶特性表

MPG  
 +  
 100 %  
 -  
 PAUSE  
 Maintain  
 AUTO  
 TEACH

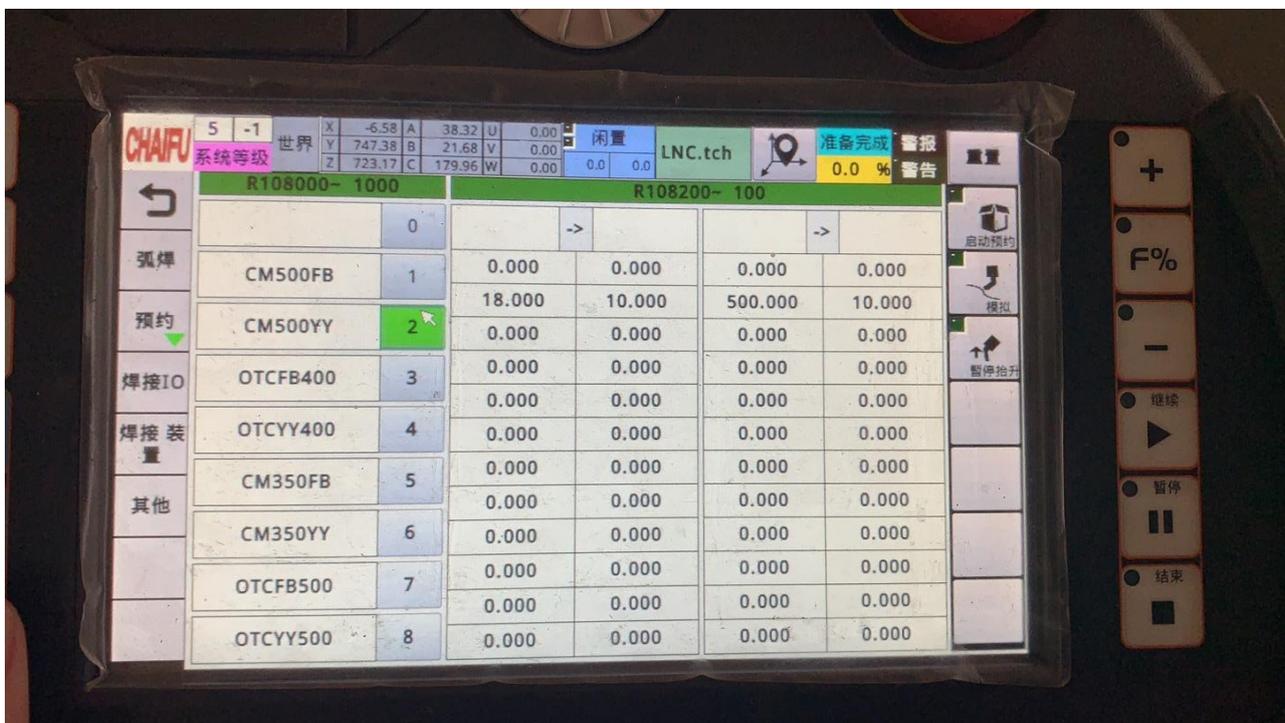
JOINT TOOL WORK WORLD  
 C+ B+ A+ Z+ Y+ X+  
 J6+ J5+ J4+ J3+ J2+ J1+  
 F1 CONT X I X IO X IOO  
 C- B- A- Z- Y- X-  
 J6- J5- J4- J3- J2- J1-

CHAIFU 5 -1 世界 X -6.58 A 38.32 U 0.00 闲置 LNC.tch 准备完成 警报 重置  
 系统等级 Y 747.38 B 21.68 V 0.00 0.0 0.0 0.0 % 警告  
 Z 723.17 C 179.96 W 0.00

R108000- 1000 R108600- 100

特性表编号	名称	电压V	电流I	电压V	电流I
0					
1	CM500FB	0.000	0.000	30.000	0.000
2	CM500YY	18.000	8.000	398.000	7.800
3	OTCFB400	0.000	0.000	0.000	0.000
4	OTCY400	0.000	0.000	0.000	0.000
5	CM350FB	0.000	0.000	0.000	0.000
6	CM350YY	0.000	0.000	0.000	0.000
7	OTCFB500	0.000	0.000	0.000	0.000
8	OTCY500	0.000	0.000	0.000	0.000

启动预约  
 模拟  
 暂停抬升  
 继续  
 暂停  
 结束

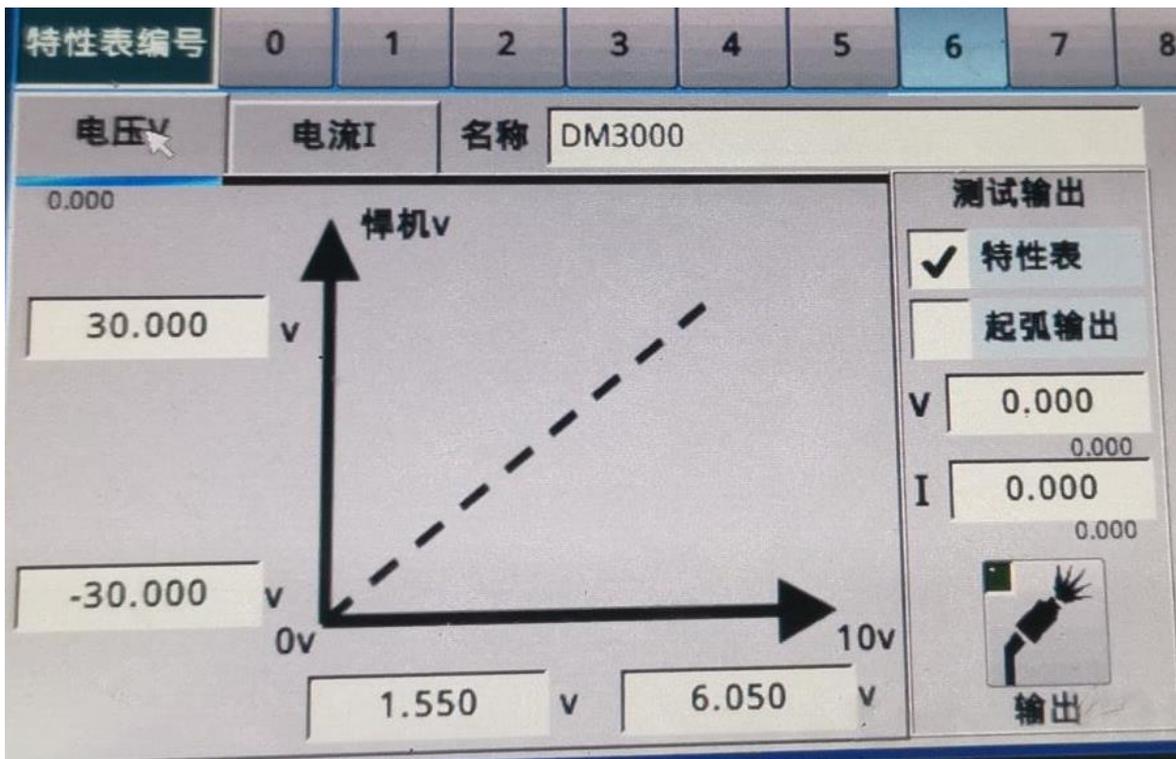


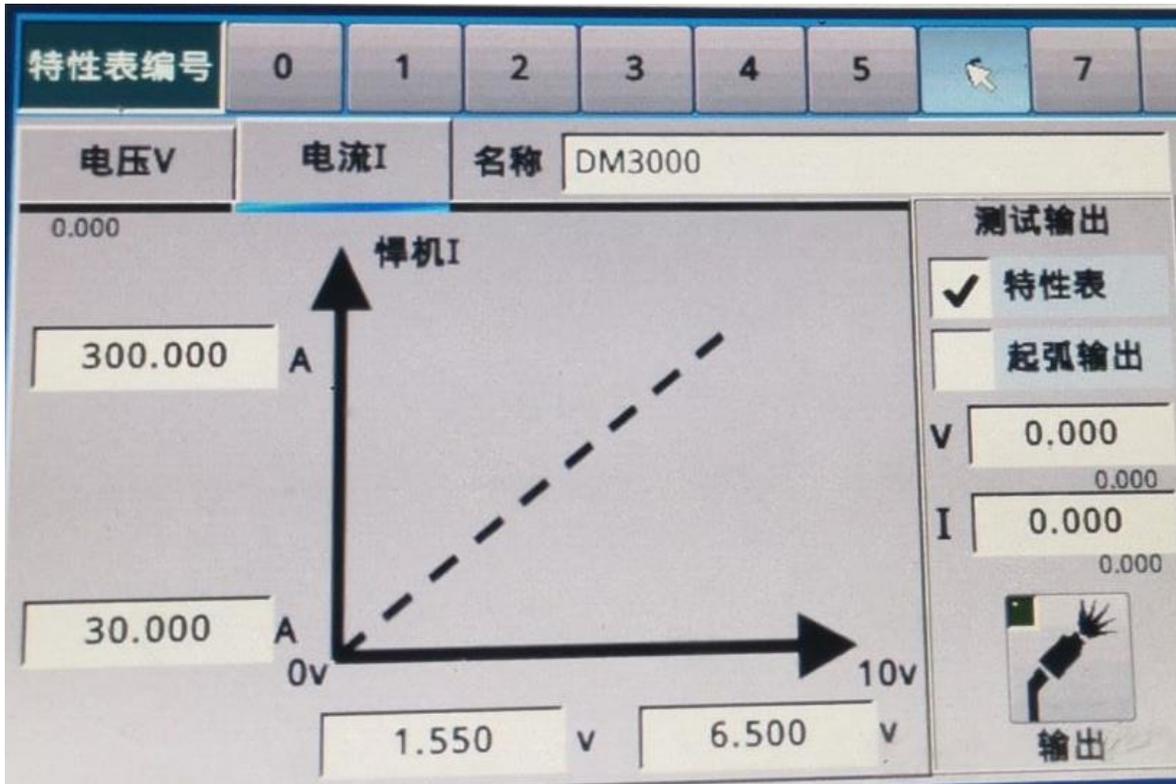
CHAIFU 5 -1 世界 X -6.58 A 38.32 U 0.00 闲置 LNC.tch 准备完成 0.0 % 警告

系统等级 Y 747.38 B 21.68 V 0.00 Z 723.17 C 179.96 W 0.00 0.0 0.0

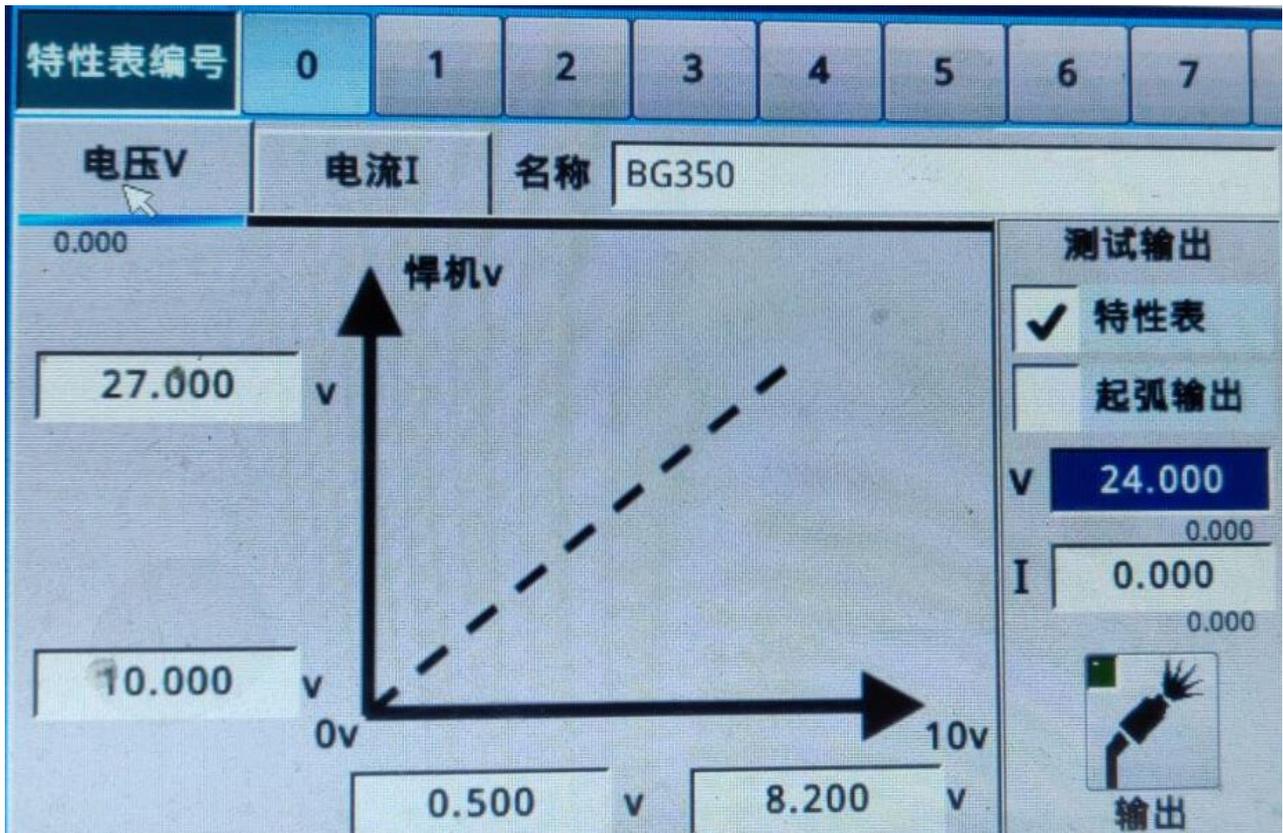
R108000~ 1000		R108100~ 100			
弧焊	0		->		->
CM500FB	1	12.000	0.000	30.000	0.000
CM500YY	2	15.300	1.000	75.000	1.000
OTCFB400	3	18.600	2.000	122.000	2.000
OTCFB400	3	21.899	3.000	170.000	3.000
OTCFB400	3	25.200	4.000	217.000	4.000
OTCFB400	3	28.500	3.000	264.000	5.000
OTCFB400	3	31.798	6.000	311.000	6.000
OTCFB400	3	35.200	7.000	359.000	7.000
OTCFB400	3	38.500	8.000	406.000	8.000
OTCFB400	3	41.798	9.000	454.000	9.000
OTCFB400	3	45.000	10.000	500.000	10.000
OTCFB400	3	0.000	0.000	0.000	0.000

### 8.2.2 Magmite dm3000

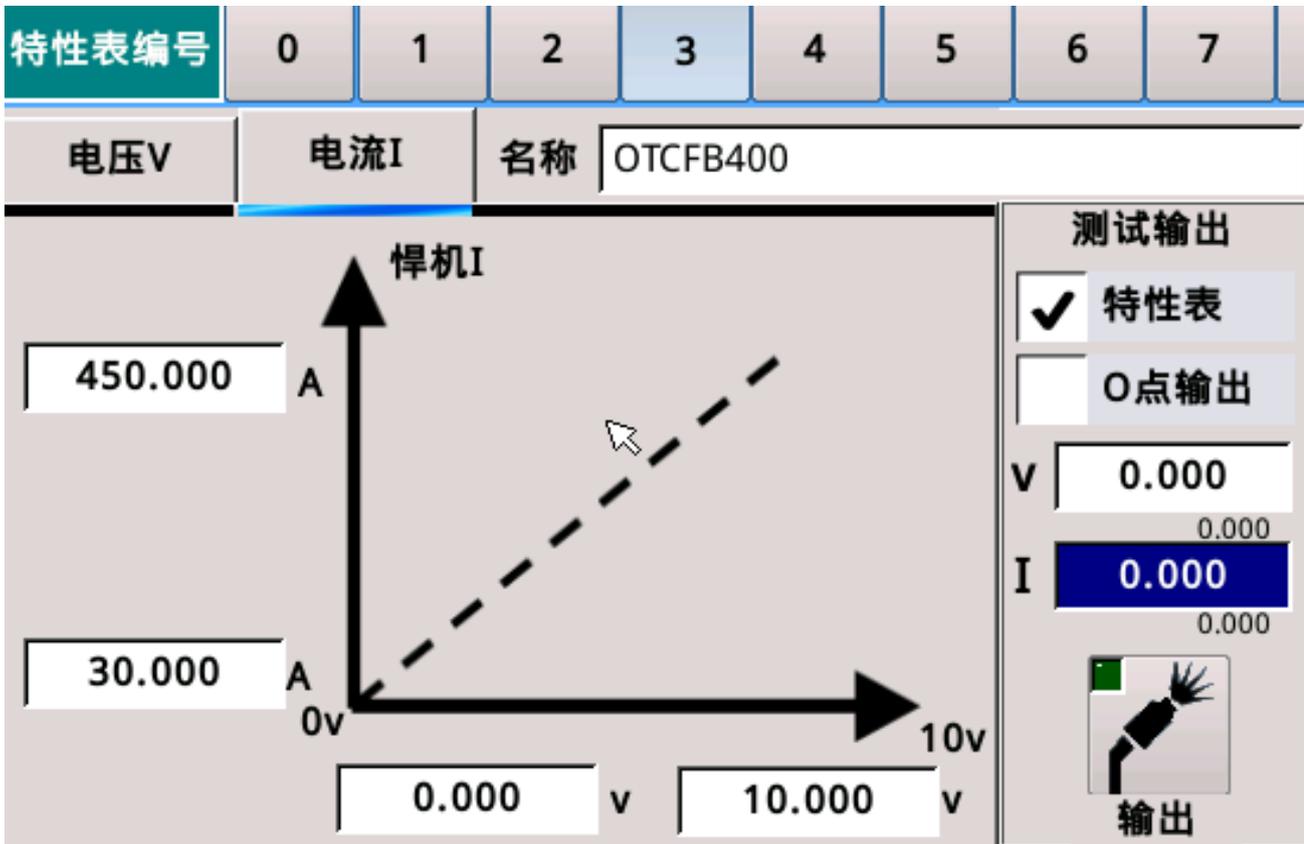




### 8.2.3 Must High 350







CHAIFU 5 -1 世界 X -6.58 A 38.32 U 0.00 闲置 LNC.tch 准备完成 警告 0.0 % 警告

系统等级 Y 747.38 B 21.68 V 0.00 0.0 0.0 Z 723.17 C 179.96 W 0.00

	R108000~ 1000		R108300~ 100		
弧焊	0	->		->	
预约	1		12.000	0.000	30.000 0.000
焊接IO	2		15.500	1.000	73.000 1.000
焊接装置	3		18.899	2.000	117.000 2.000
其他	4		22.299	3.000	160.000 3.000
	5		25.700	4.000	204.000 4.000
	6		29.200	5.000	247.000 5.000
	7		32.599	6.000	291.000 6.000
	8		36.099	7.000	334.000 7.000
	9		39.500	8.000	378.000 8.000
	10		42.900	9.000	422.000 9.000
	11		45.000	10.000	450.000 10.000
	12		0.000	0.000	0.000 0.000

CHAIFU 5 -1 世界 X -6.58 A 38.32 U 0.00 闲置 LNC.tch 准备完成 警告 0.0 % 警告

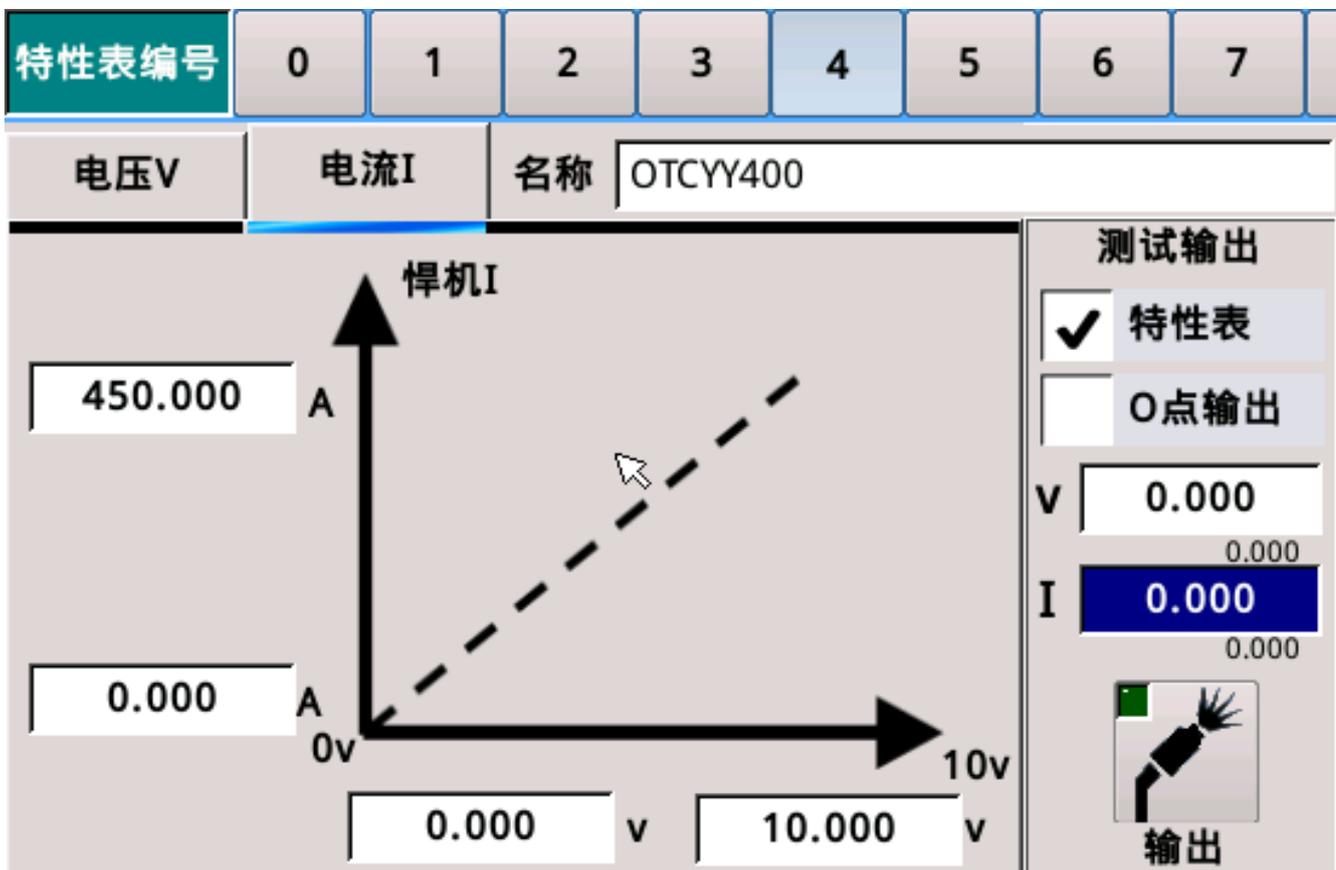
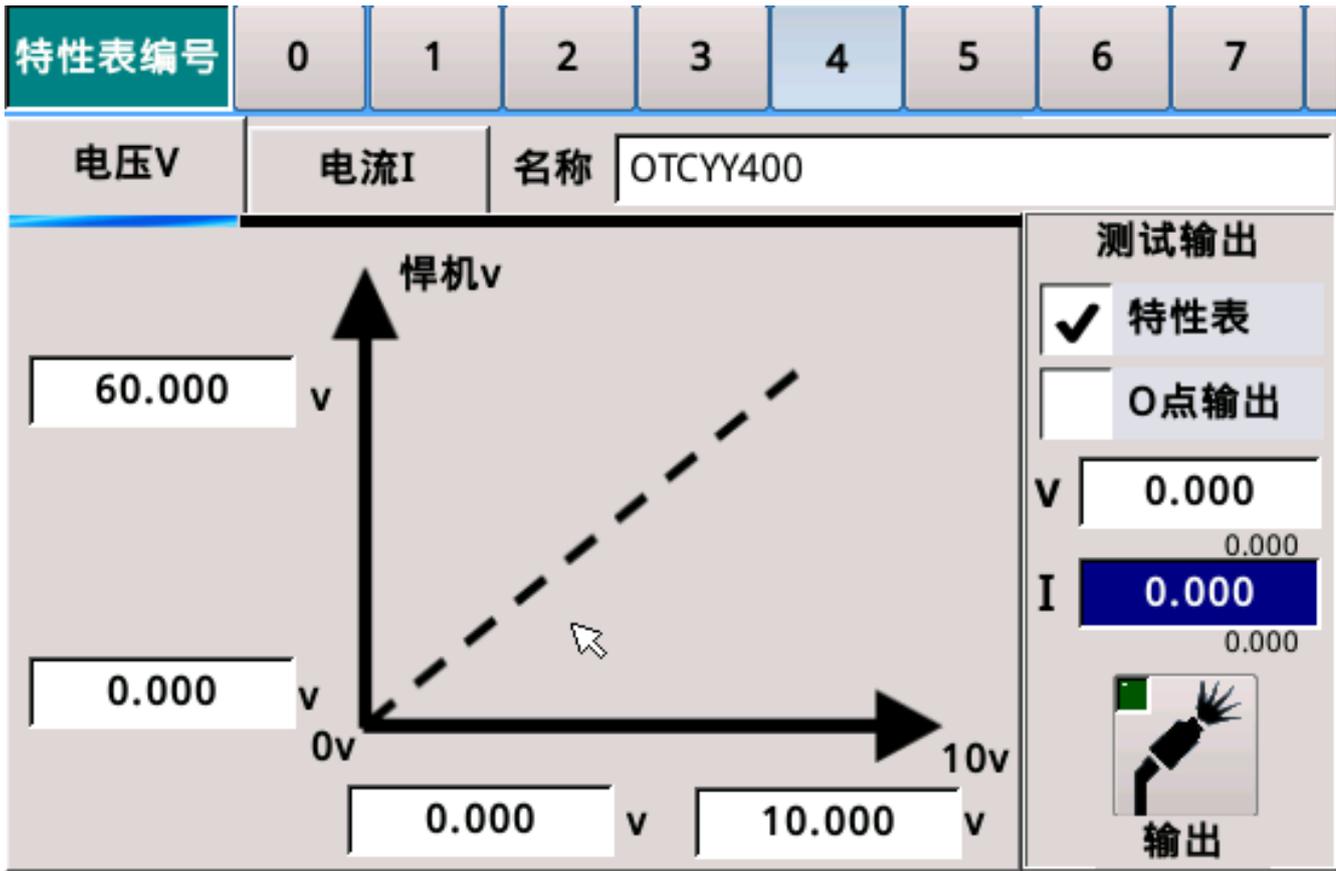
系统等级 Y 747.38 B 21.68 V 0.00 0.0 0.0 Z 723.17 C 179.96 W 0.00

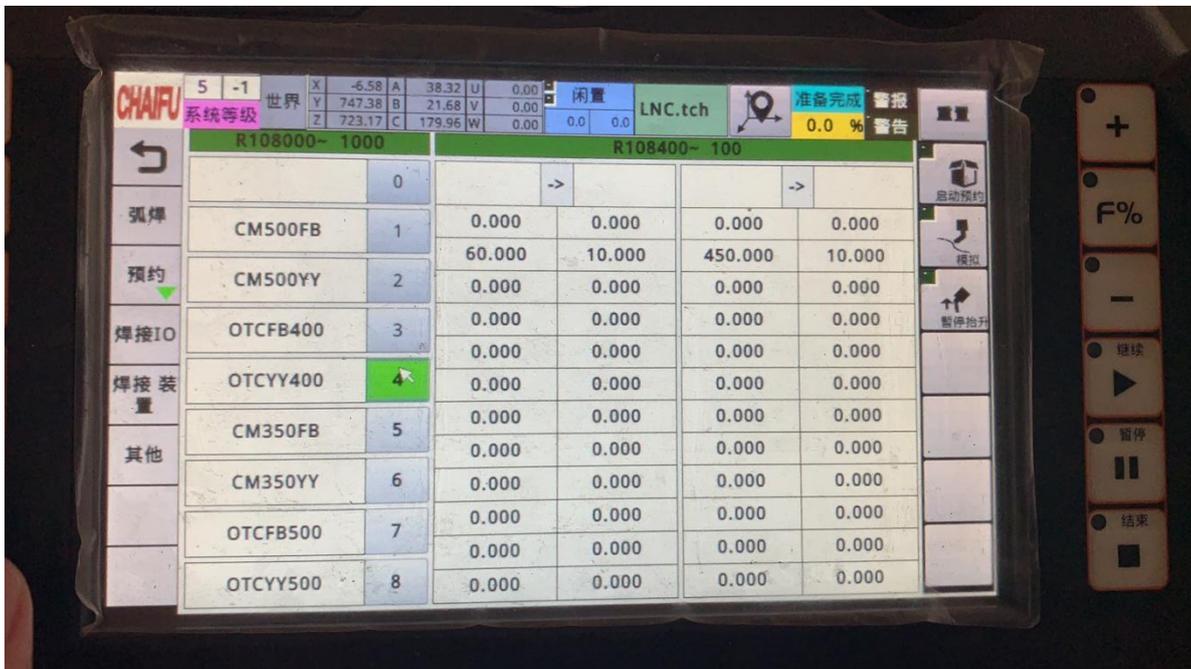
启动预约 模拟 暂停抬升

继续 暂停 结束

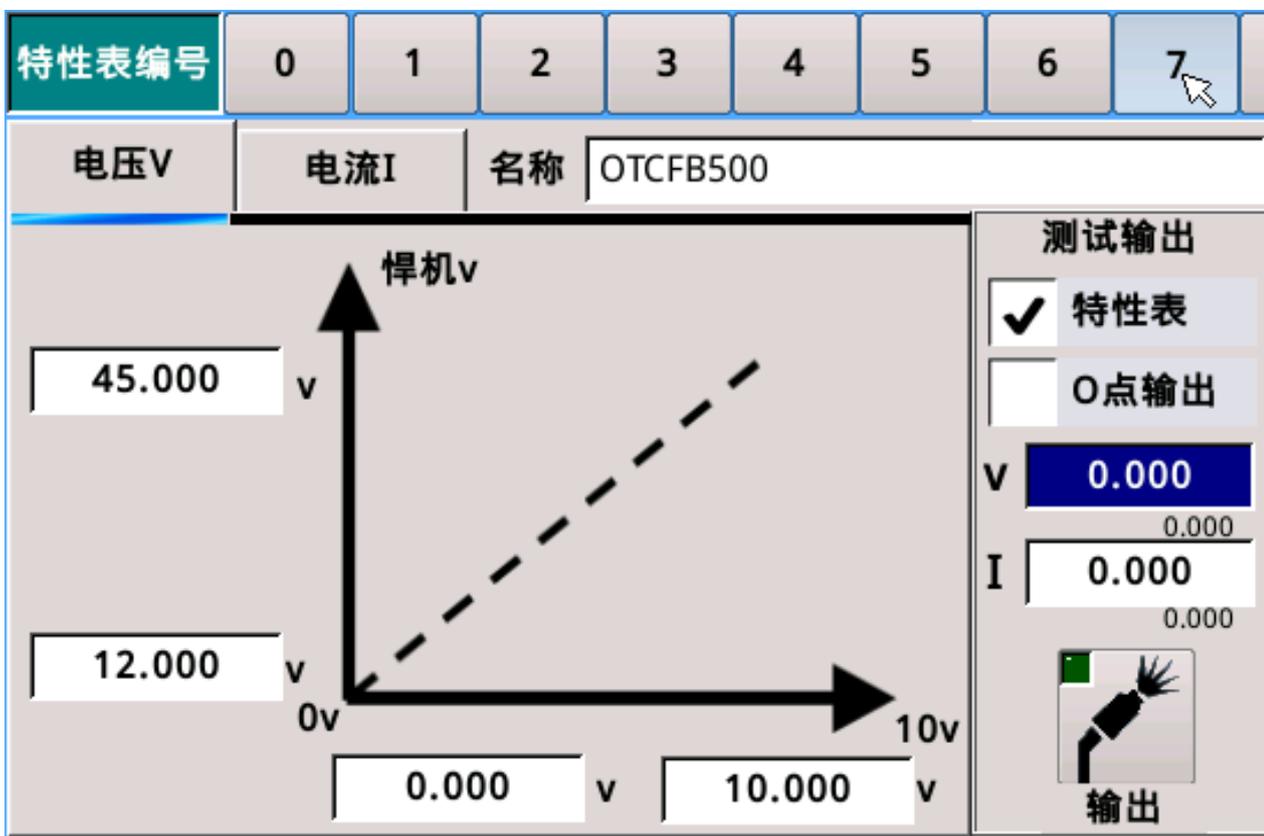
手轮 连续 XI X10 X100

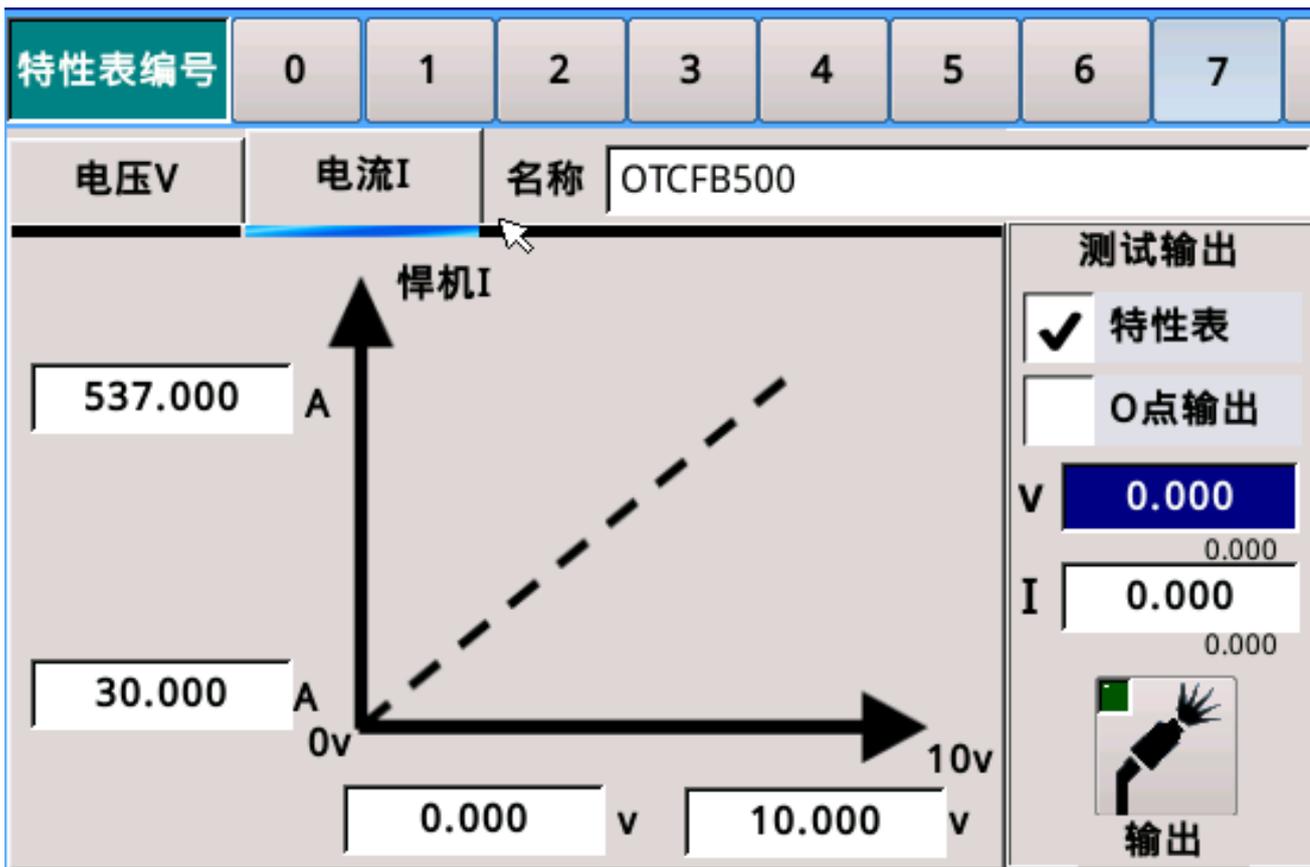
(2) OTCYY400





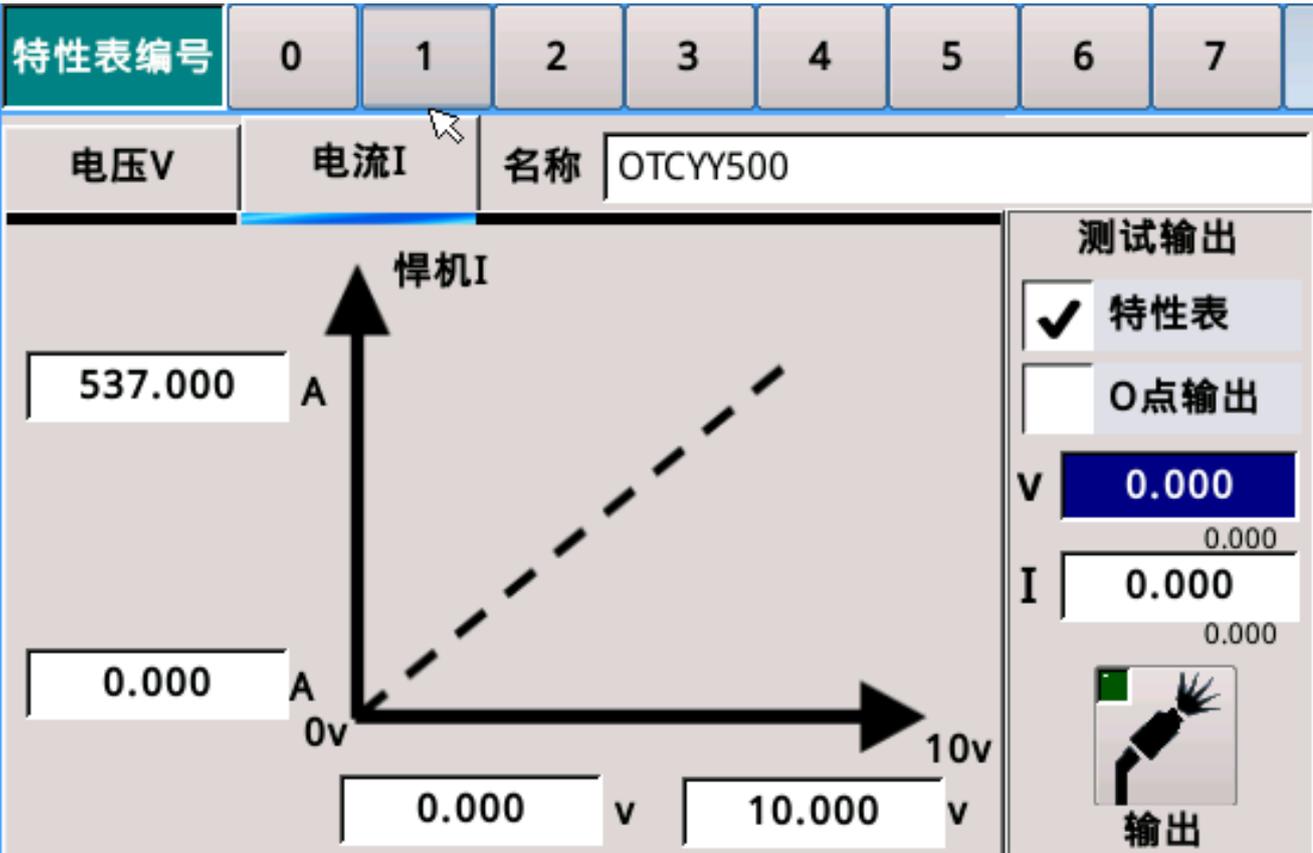
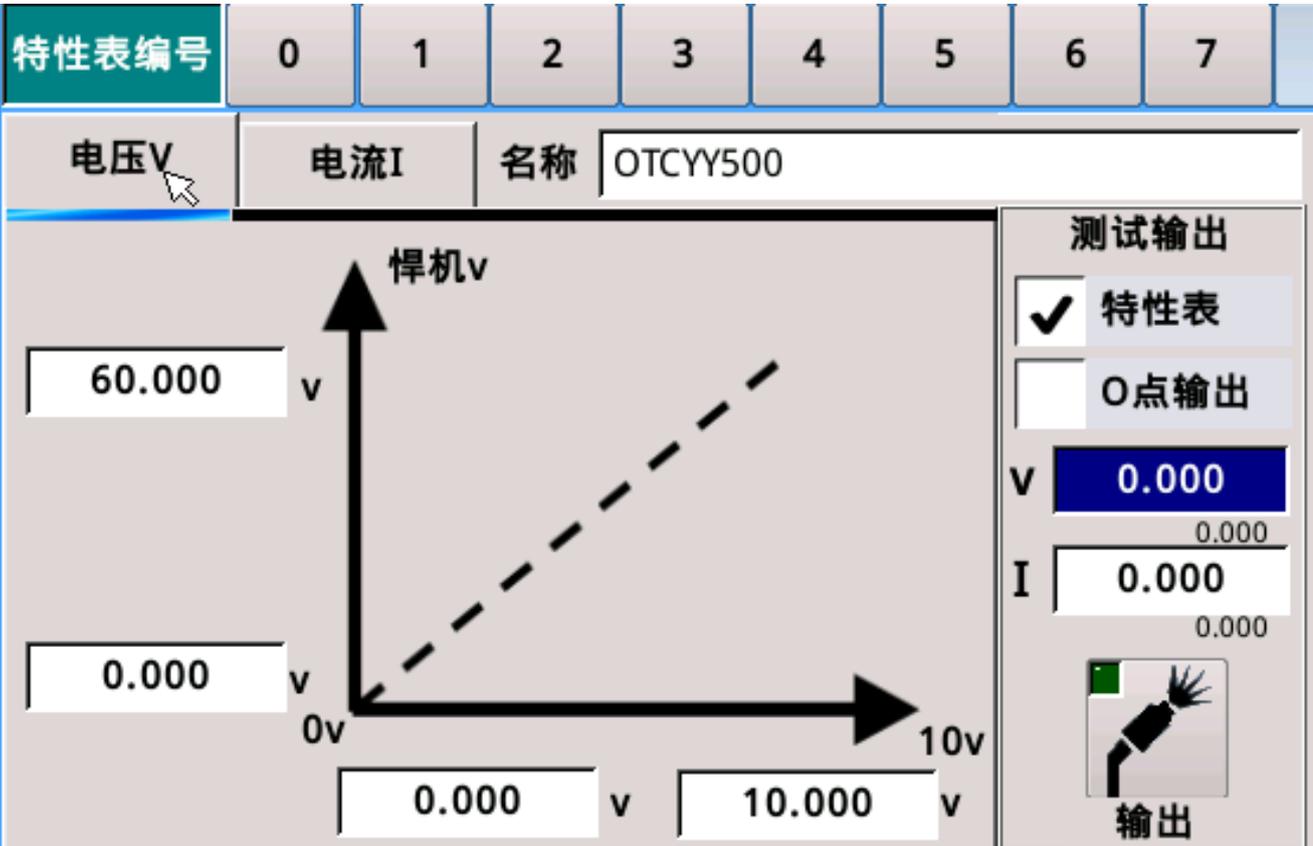
(3) OTCFB500

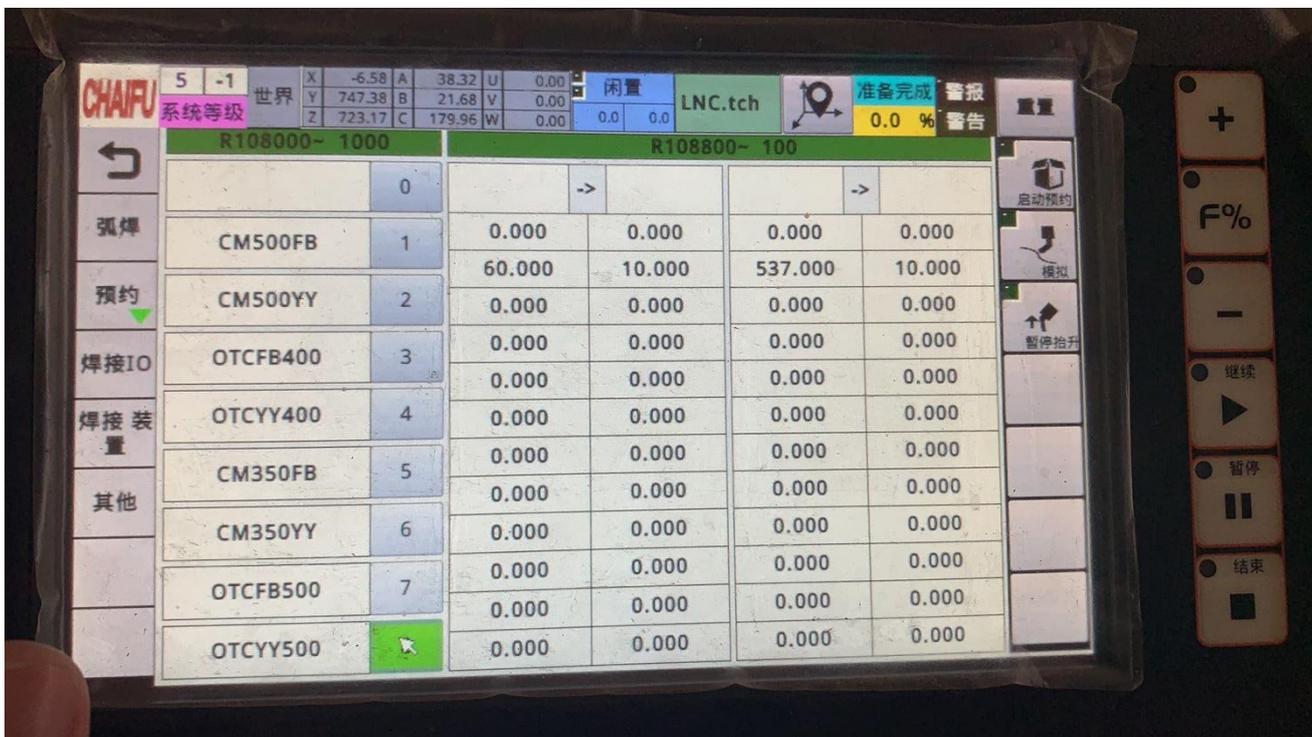




CHAIFU		5	-1	世界	X	-6.58	A	38.32	U	0.00	闲置	LNC.tch	准备完成	警告	重置
系统等级		Y	747.38	B	21.68	V	0.00	0.0	0.0	0.0	0.0	0.0	0.0 %	警告	
		Z	723.17	C	179.96	W	0.00								
		R108000~ 1000				R108700~ 100									
弧焊		0													
	CM500FB	1	12.000	0.000	30.000	0.000									
预约	CM500YY	2	15.199	1.000	74.000	1.000									
焊接IO	OTCFB400	3	19.000	2.000	126.000	2.000									
焊接装置	OTCFB400	3	22.000	3.000	177.000	3.000									
	OTCYY400	4	26.600	4.000	229.000	4.000									
其他	CM350FB	5	30.399	5.000	280.000	5.000									
	CM350YY	6	34.200	6.000	331.000	6.000									
	OTCFB500	7	38.000	7.000	383.000	7.000									
	OTCFB500	7	41.799	8.000	435.000	8.000									
	OTCFB500	7	45.500	9.000	486.000	9.000									
	OTCFB500	7	49.200	10.000	537.000	10.000									
	OTCYY500	8	0.000	0.000	0.000	0.000									

(4) OTCYY500





Note: The characteristics table of each welding machine is different. Here are some of the ones that Baoyuan has adapted to the field so far. The appendix is for reference only. The actual use is set according to the description in Chapter 5.