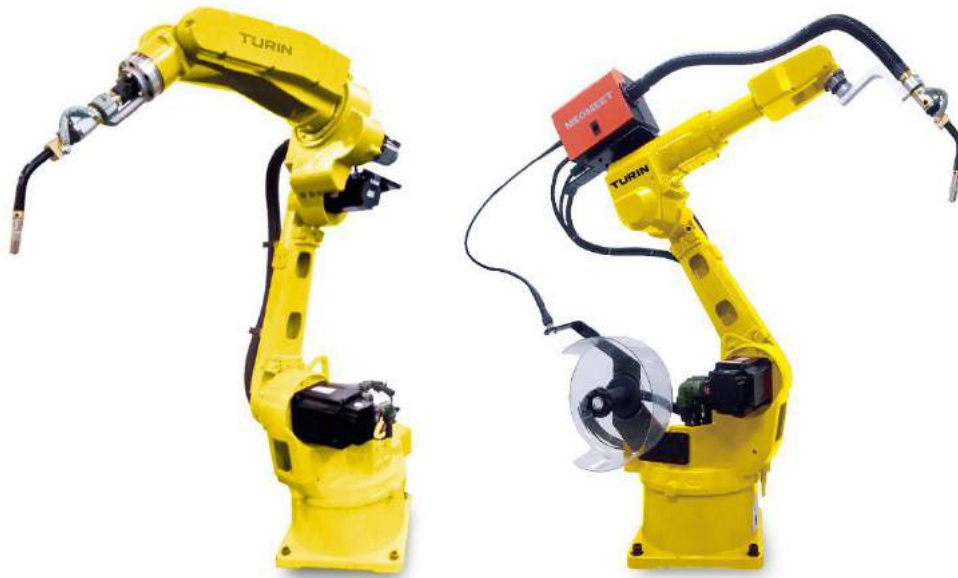**WELDING ROBOTICS**

TURIN arc welding robot Training Manual

ROBOT VINTAGE Co.,Ltd.

www.turinthailand.com

Version: TRW-V4

Statement

This manual gives a comprehensive description of the composition and operation of the arc welding robot. Please be sure to operate the robot on the basis of careful reading and full understanding.

- The diagrams in the maintenance manual, in order to explain the details, remove the cover or safety cover for drawing, when operating such parts, it is necessary to restore the cover or safety cover according to the regulations, and then operate according to the requirements of the manual.
- The drawings and photos in the manual are representative examples, which may be different from the products purchased.
- Sometimes the instruction manual is modified appropriately due to product improvement, specification change, and the convenience of the instruction itself.

TURIN

Contents

I.System safety

Because the robot system is complex and dangerous, during the practice, any operation of the robot must pay attention to safety. No matter when entering the working range of the robot, serious injury may be caused. Only trained and certified personnel can enter the area.

The following safety rules must be observed:

➢ In case of fire, please use carbon dioxide fire extinguisher.

➢ The emergency stop switch shall not be short circuited.

➢ When the robot is in automatic mode, no one is allowed to enter the area where it moves.

➢ In any case, do not use the original starting disk of the robot, use the copy disk.

➢ When the robot stops, there should be no objects on the fixture, and the machine must be empty.

➢ In case of accident or abnormal operation, e-stop can be used to stop the robot.

➢ In the automatic state, even if the running speed of the robot is very low, its momentum is still very large, so when programming, testing and maintenance work, the robot must be placed in the manual mode.

➢ The pressure in the air circuit system can reach 0.6mp, and the air source shall be cut off for any relevant maintenance.

➢ Debug the robot in manual mode, and release the enable in time if the mobile robot is not needed.

➢ When the debugging personnel enter the robot working area, they must take the teaching device with them to prevent others from misoperation.

➢ Switch off the main power supply and air supply of the robot in advance when receiving the power outage notice.

➢ After power failure, turn off the main power switch of the robot in advance before calling, and remove the workpiece on the fixture in time.

➢ The maintenance personnel must keep the key of the robot. Unauthorized personnel are forbidden to enter the robot software system in manual mode and read or modify the program and parameters at will.

TURIN

II.Robot installation requirements

➢ The robot has been adjusted before leaving the factory. Please do not change the data that has been set up at will. If adjustment is really necessary, it shall be operated by qualified professionals or in accordance with the instruction manual.

➢ During the installation of the lifting robot, it must be carried out by qualified professionals under the command of professionals, and the lifting appliances must be safe and reliable. The lifting operation must comply with the lifting safety regulations. A level meter must be used on the mounting base to keep the upper plane of the base level.

➢ After the installation or maintenance of the robot, the tools, workpieces and sundries must be carefully checked and cleaned in time to prevent accidents.

➢ After installation, it is forbidden to open the power distribution box or operation box to operate the machine, so as to avoid the electric shock caused by the dust entering the electrical components and the operator accidentally touching the live components.

III.Robot components

Arc welding robot system is a robot welding workstation including welding device, which is generally composed of robot body, control system, positioner, welding system and safety protection equipment.

3.1 Robot body introduction

In the process of arc welding, it is required that the welding gun moves in strict accordance with the track of the welding seams and continuously fills the welding wire. The movement track of the welding torch nozzle, the gesture of the welding torch and the welding relues all require precise control. Therefore, in the process of robot motion, the stability of speed and the accuracy of trajectory are very important and must well met indexes. There are six axes on the body of arc welding robot, which can reach the designated position with high position accuracy and the best path
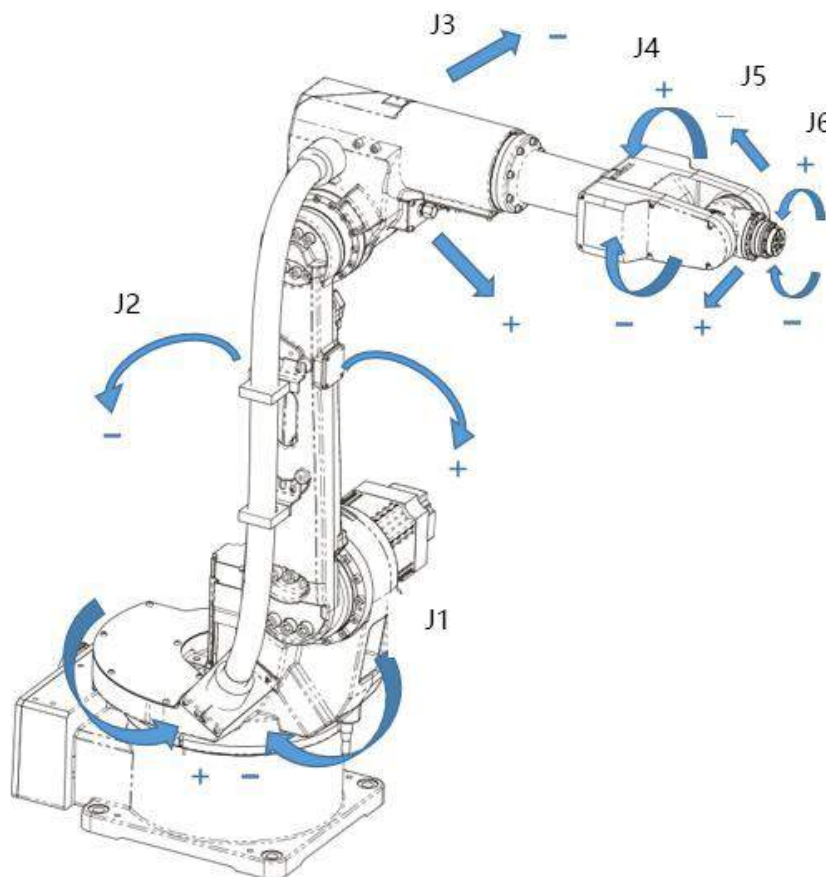
3.1.1 TKB1400 robot body and motion diagram of each axis
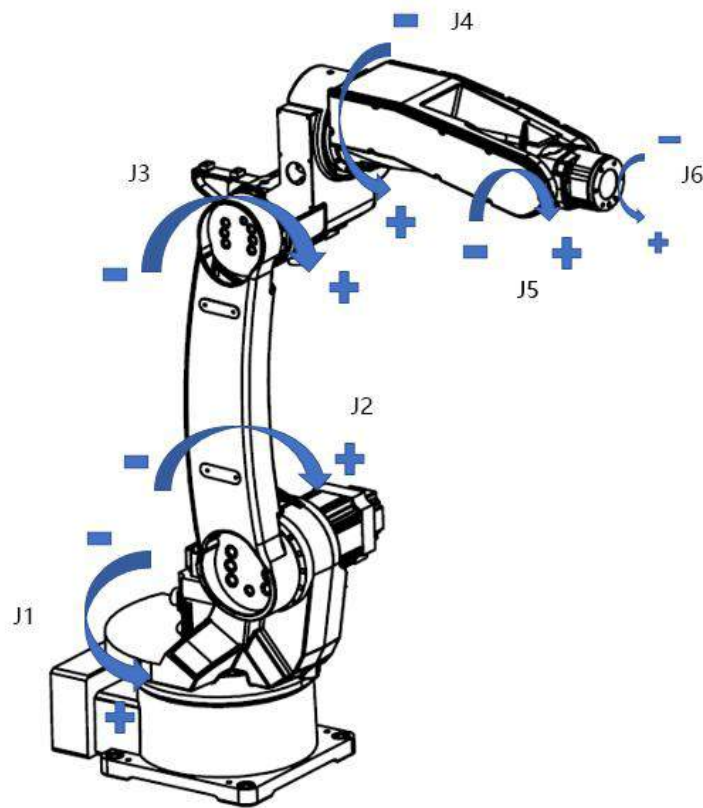
3.1.2 TKB1520 robot body and motion diagram of each axis

3.2 Teaching Pendant

3.2.1Appearance of teaching pedant

The teaching device is a personal computer interaction device. Through it, the operator can operate the robot movement, complete the teaching programming, realize the system setting, fault diagnosis and so on. The front includes the emergency stop switch, touch screen display and touch buttons. The enable switch is on the right side of the teaching device, which is convenient for the operator to hold during operation
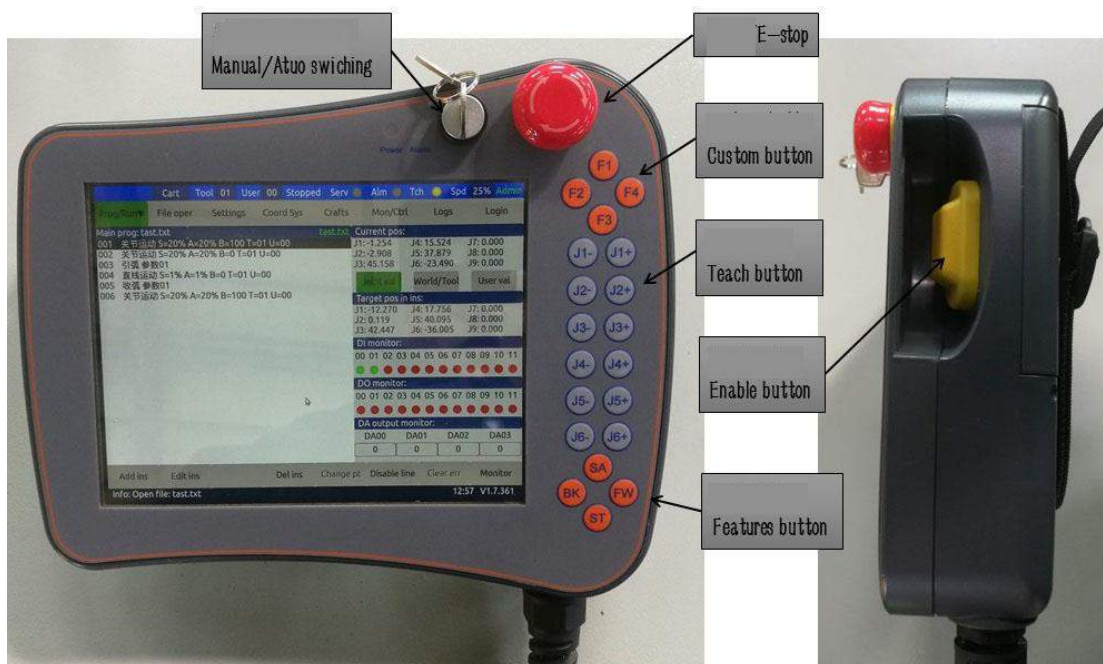
3.2.1 Appearance of teaching device

3.2.2 Key function description

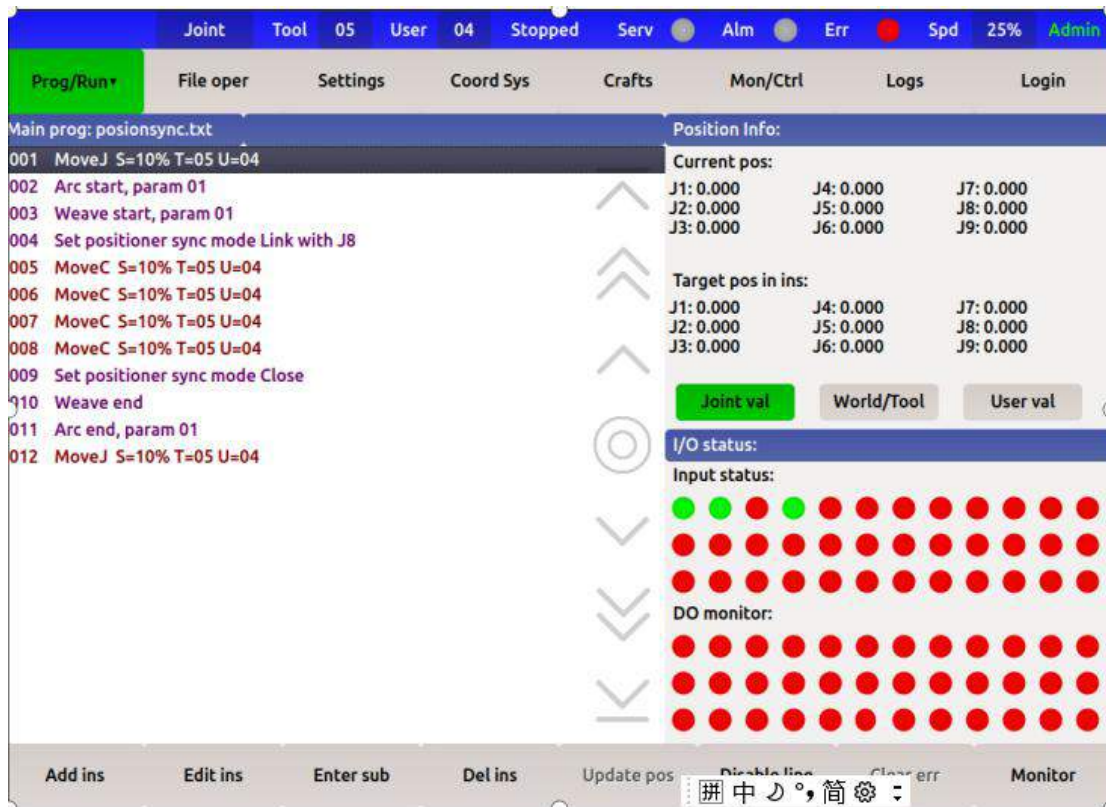| Key	Definition
F1	Wire inspection (can check whether the wire feeder is feeding, can adjust the length of welding wire)
F2	Check the air (check whether there is protective air, whether the solenoid valve works, and adjust the wire feeding flow through the air supply solenoid valve)
F3	Wire withdrawal. (check whether the wire feeder is rewiring and adjust the length of welding wire)
F4	Remove anti-collision (when the anti-collision is turned on, the anti-collision alarm can be released when the welding gun touches the workpiece) 1-4. For details on how to define its functions, see the section "key settings" in the manual。
J1-	The joint moves in the negative direction or in the negative direction of the x-axis
J1+	The joint moves in a positive direction or X-axis
J2-	Joint moves in two negative directions or in Y-axis negative direction
J2+	The joint moves in the two-way positive direction or in the y-axis positive direction
J3-	The joint moves in three negative directions or in z-axis negative direction
J3+	The joint moves in the three-way positive direction or the z-axis positive direction
J4-	The joint moves in four negative directions or RX negative directions

J4+	The joint moves in four directions or RX directions
J5-	Joint movement in five negative directions or in ry negative directions
J5+	The joint moves in five directions or ry directions
J6-	Joint movement in six negative directions or RZ negative directions
J6+	The joint moves in six directions or RZ directions
SA	Start button, automatic (playback) mode to start the program; Manual (Teaching) mode to start the single step operation
BK	Return to zero button, press and hold the robot joint movement to zero position, release and stop the movement
ST	Stop button, automatic (reproduction) mode stop program execution
FW	Clear drive alarm button

3.2.3 Touch screen interface layout

The display adopts 8-inch 1024 * 768 LCD, and the touch screen adopts resistance touch screen. The screen is divided into the following sections.

➢ The top line, from left to right, is: coordinate system selection during manual operation, tool coordinate selection, user coordinate selection; then the operation status, servo status, alarm status, teaching status and other information; the right side is manual operation speed selection.

➢ The second line is the main menu, including eight main menu selections

➢ The middle right side is the joint real-time coordinate display value and command position value from top to bottom, and the lower half is the IO state real-time display

➢ At the bottom is the operation key area under each menu

➢ The bottom is the real-time status and alarm information display column

| Joint | Tool | 05 | User | 04 | Stopped | Serv ● | Alm ● | Err ● | Spd | 25% | Admin |

| Prog/Run▾ | File oper | Settings | Coord Sys | Crafts | Mon/Ctrl | Logs | Login |

Main prog: posionsync.txt

```
001   MoveJ  S=10% T=05 U=04
002   Arc start, param 01
003   Weave start, param 01
004   Set positioner sync mode Link with J8
005   MoveC  S=10% T=05 U=04
006   MoveC  S=10% T=05 U=04
007   MoveC  S=10% T=05 U=04
008   MoveC  S=10% T=05 U=04
009   Set positioner sync mode Close
010   Weave end
011   Arc end, param 01
012   MoveJ  S=10% T=05 U=04
```

Position Info:

Current pos:
J1: 0.000   J4: 0.000   J7: 0.000
J2: 0.000   J5: 0.000   J8: 0.000
J3: 0.000   J6: 0.000   J9: 0.000

Target pos in ins:
J1: 0.000   J4: 0.000   J7: 0.000
J2: 0.000   J5: 0.000   J8: 0.000
J3: 0.000   J6: 0.000   J9: 0.000

| Joint val | World/Tool | User val |

I/O status:

Input status:

DO monitor:

| Add ins | Edit ins | Enter sub | Del ins | Update pos | Disable line | Clear err | Monitor |

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3.2.3 touch screen page layout

3.3 Control cabinet

3.3.1Appearance of control cabinet

The front panel of the robot control cabinet is equipped with power switch, emergency stop switch, door lock and power indicator light of the control cabinet. The teaching indicator is hung above the door of the control cabinet, and the side of the control cabinet is equipped with interconnection cable interface.

3.3.1 Control cabinet.

TURIN

3.3.2Introduction to button / indicator

3.3.2 Control cabinet button / indicator light

➢ Power indicator

This light indicates that the industrial robot control cabinet is connected to 220V power supply.

➢ Emergency stop

When the button is pressed, the power and electricity of servo drive and motor are immediately cut off. If the robot is moving, it will stop moving immediately, and there is no deceleration process when it stops; rotating or pulling the button can release the emergency stop. If the robot is running, please first press the teaching device pause button, do not directly turn off the power or press the emergency stop during the robot movement, so as to avoid impact damage to the machinery.

➢ Power switch

Power on switch of industrial robot

➢ External interface (side)

The control cabinet provides VGA and USB ports, or 485 or 232 interfaces as required by customers.

TURIN

IV Teaching on startup

4.1 Boot up

➢ First, check whether the equipment starts normally, and check the gas, welding wire and welding gun

➢ Switch on the welding machine → turn on the robot control cabinet → turn on the power supply of other equipment.

➢ Robot teaching device display → enter the system → click "login and logout" → click "operator login" → input password "33333333" → click "confirm"

➢ Click "file operation" → select the program folder to be run → open → click the first line 001 of the command (if the program command before shutdown is still running after startup, this step is unnecessary)

➢ Turn the key to online mode and press the button "Sa" on the teaching pendant or the green button on the control cabinet

➢ If there is a button box, the button box can be operated. Pay attention to the start button corresponding to the station to be welded

➢ If the key is in (online mode) before shutdown and the workpiece to be welded remains unchanged, press the start button directly after startup

4.2 Manual teaching

Press the "enable button" with the right hand (half of the key range, the lower part of the display will display "enable on") → select the operation mode (joint, right angle, tool) → generally select "right angle" → adjust the teaching speed (the upper right corner of the display, generally select 5%, fine-tuning select 1%)

V Introduction to arc welding package

Robot arc welding package consists of robot body, controller, teaching device, power transformer, welding power supply, wire feeder and welding gun.

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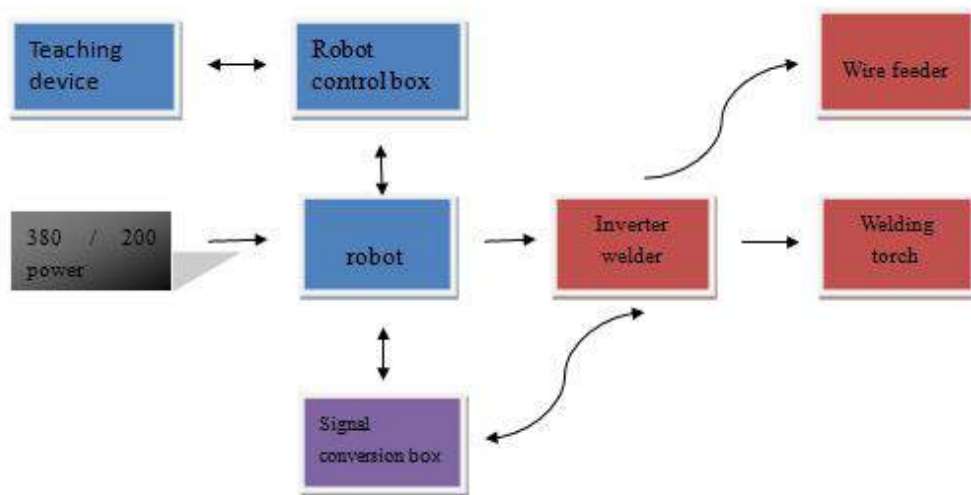
VI Introduction of welding positioner

Positioner is an important part of arc welding robot system. Its function is to translate or rotate the parts to the best welding position. Generally, the positioner is used to clamp and locate the workpiece through the fixture. The load capacity and movement mode of the positioner can be selected according to the characteristics of the workpiece to be welded.

Specific functions of positioner:

➢ Improve the accessibility of welds

➢ It can make the weld in the best position of flat welding

➢ Can improve welding or cutting speed

➢ Two sets of workbenches can be used to improve efficiency

➢ Protect the operator from radiation and splashing

➢ Reduce repetitive positioning of robot
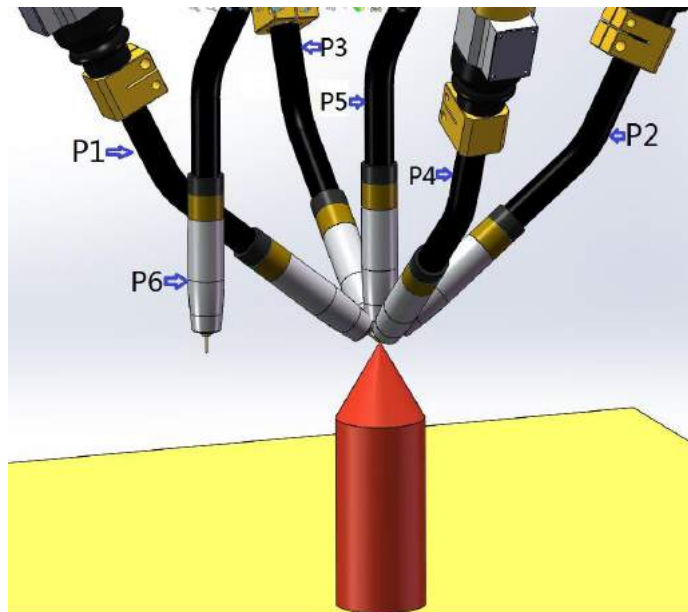
➢ Friendly human-machine interface

VII Robot coordinate system

7.1Tool coordinate system
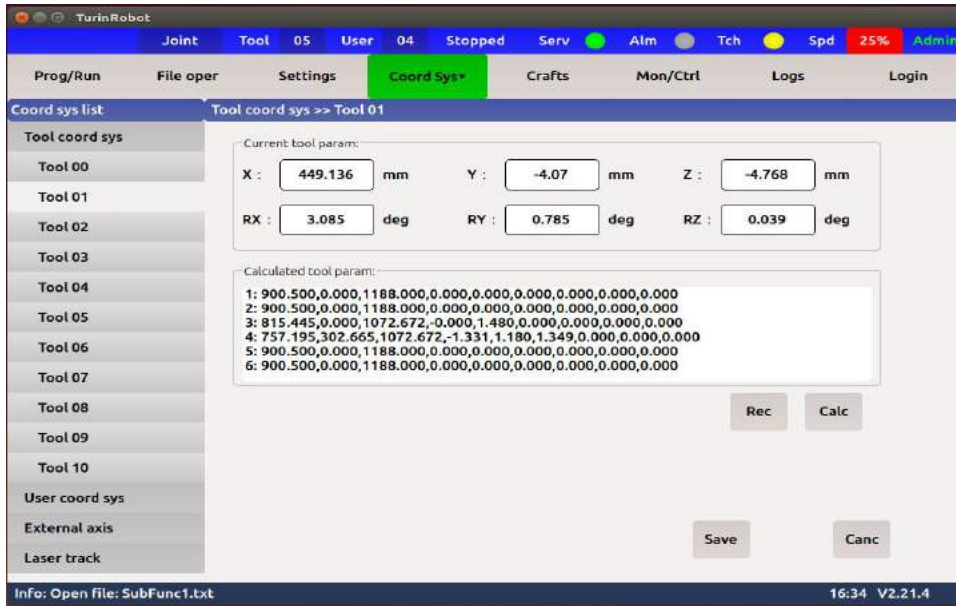
7.1.1 Tool coordinates

For tool calibration, 6 different postures need to be taught based on the control point. According to these six data, the tool size is calculated automatically. After taking a point, click the corresponding "record point" button. Take points as follows:

7.1.2 Tool coordinate calibration

Note: as shown in the figure above, the attitude change of point 1-p4 should be as large as possible. In point

P5, the welding wire (the straight part at the end of the welding gun) must be kept in a straight line with the calibration rod. Point P6 is used to determine the X direction of the tool coordinate, that is, the line between point P5 and P6 is the X direction of the tool coordinate.

Note: for tool coordinate calibration, the fixed plane of the industrial robot should have the same levelness as the plane where the gun calibrator is placed!

7.2 Establish user coordinate system

The user coordinate system is established to facilitate the programming during teaching and programming. As shown in the figure below, several user coordinate systems need to be set for several tooling surfaces.
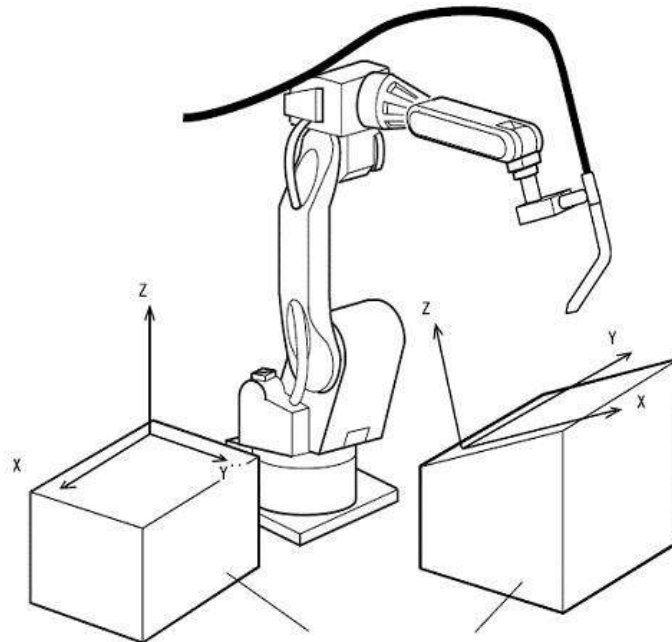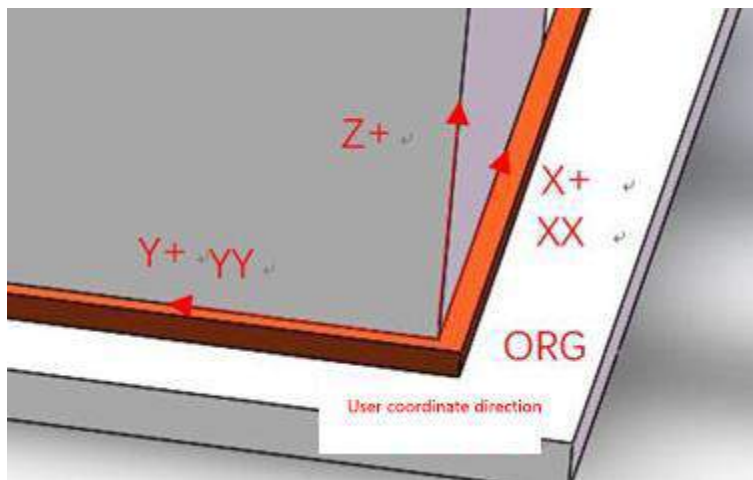

7.2.1 User coordinate calibration

The steps for setting up the user coordinate system are as follows：

Set user coordinate system in user coordinate system setting interface of coordinate system (as shown below)

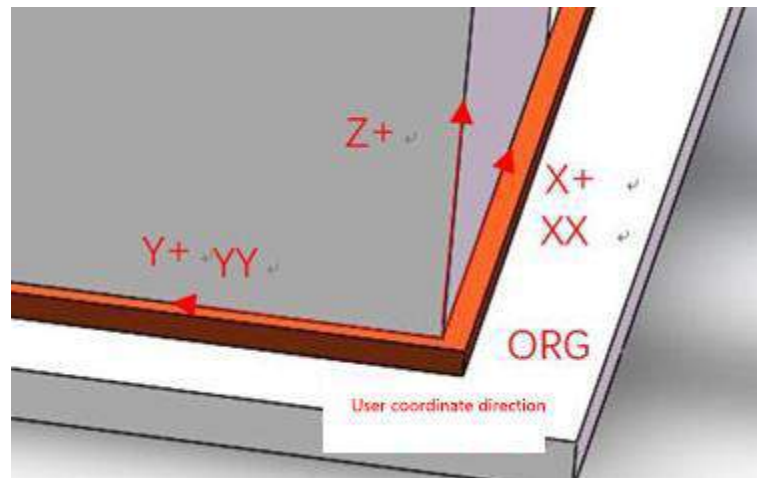7.2.2 User coordinate calibration interface

7.2.3 User coordinate calibration diagram

In the above interface, first set the origin of the user (workpiece) coordinate system, that is, the robot's non end point (with the welding wire on the welding gun) goes to the end of an angle of the workpiece. Then press "record point 1" to record the origin of user (workpiece) coordinate.
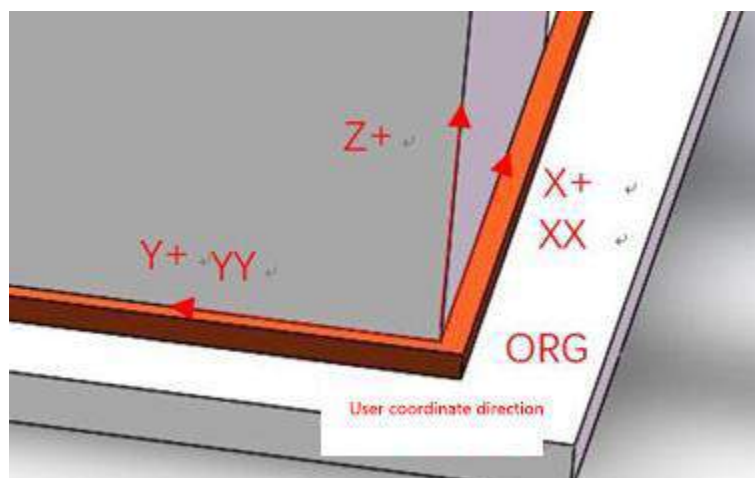
Select "XX direction" to determine x side, as shown below.

7.2.4 User coordinate calibration diagram

In the interface above, set the X direction of the user (workpiece) coordinate system, that is, the robot's non tip point goes to the edge of one side of the workpiece. Then press "record point 2" to record the XX direction of user (workpiece) coordinate.

Select "YY direction" to determine y side, as shown below.

7.2.5 User coordinate calibration diagram

In the interface above, set the Y direction of the user (workpiece) coordinate system, that is, the robot's non tip point goes to the edge of the other side of the workpiece. Then press "record point 3" to record the YY direction of user (workpiece) coordinate.

After confirming the origin, XX direction and YY direction, press the "calculate" key in the figure above, the system will automatically complete the calculation of the user (workpiece) coordinate, and determine the coordinate system and direction on the workpiece, so as to facilitate the coordinate setting during stacking.
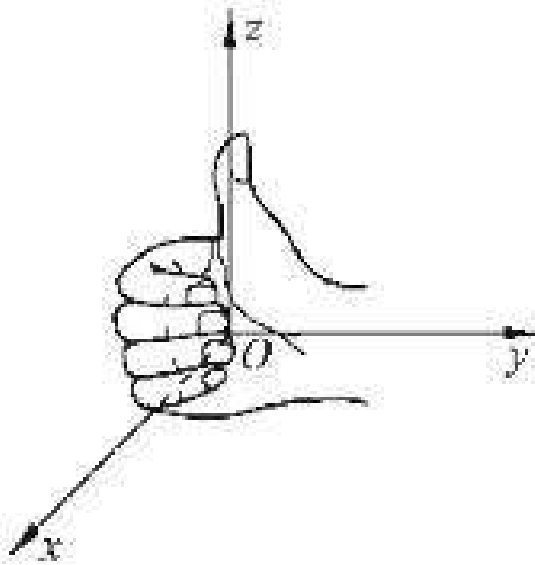
7.2.6 Right hand spiral method

Note: the user's coordinate system is established by referring to the right hand spiral rule (as shown in the above figure). The positive direction of Z is in the thumb direction of X-Y rotation. When establishing the workpiece coordinate, the positive direction of Z is usually far away from the workpiece. Therefore, when establishing the workpiece coordinate, it is necessary to consider which user coordinate system is the edge of X and Y direction respectively, and then switch to the user system to verify whether it is the desired workpiece coordinate direction. After verification, press cancel to exit.

VIII.Robot and welding machine configuration

The robot and welding machine can be controlled by analog communication and digital communication. The digital communication includes DeviceNet, can and other buses. The arc striking and arc stopping, wire inspection and gas detection of welding machine are controlled by robot control system. Welding system includes welding gun, wire feeder, positive and negative electrode ground wire, etc. Welding consumables such as welding wire and conductive nozzle shall be equipped separately.

IX.welding instructions

9.1 Condition of arc welding

➢ Arc welding conditions are defined in advance. The arc welding instruction in the procedure specifies the arc welding condition number, which shall be executed according to the arc welding condition number.
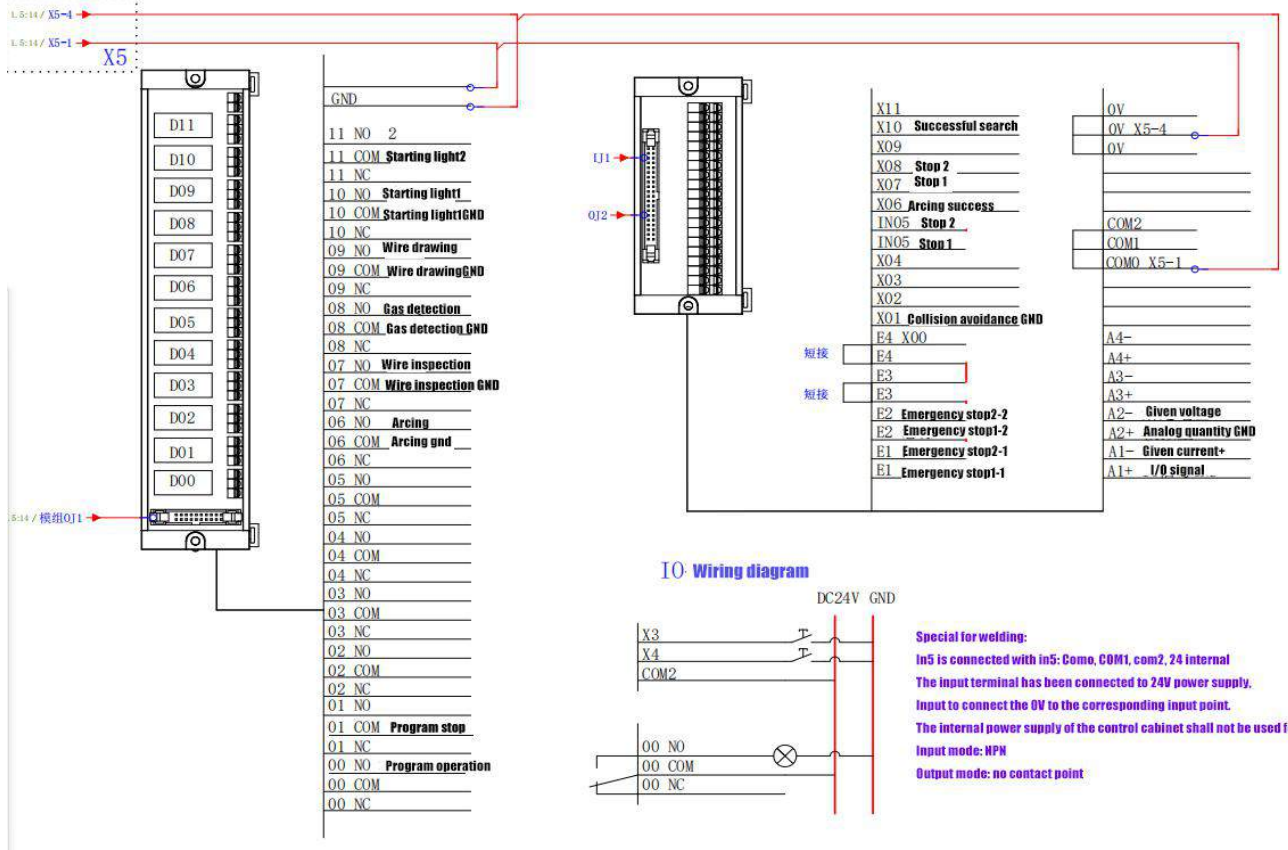
➢ Command value voltage

The voltage command value specifies the command value (V) of the welding voltage.

➢ Command value current or command value welding (wire feeding) speed

➢ Current command value specifies the command value (a) of welding current.

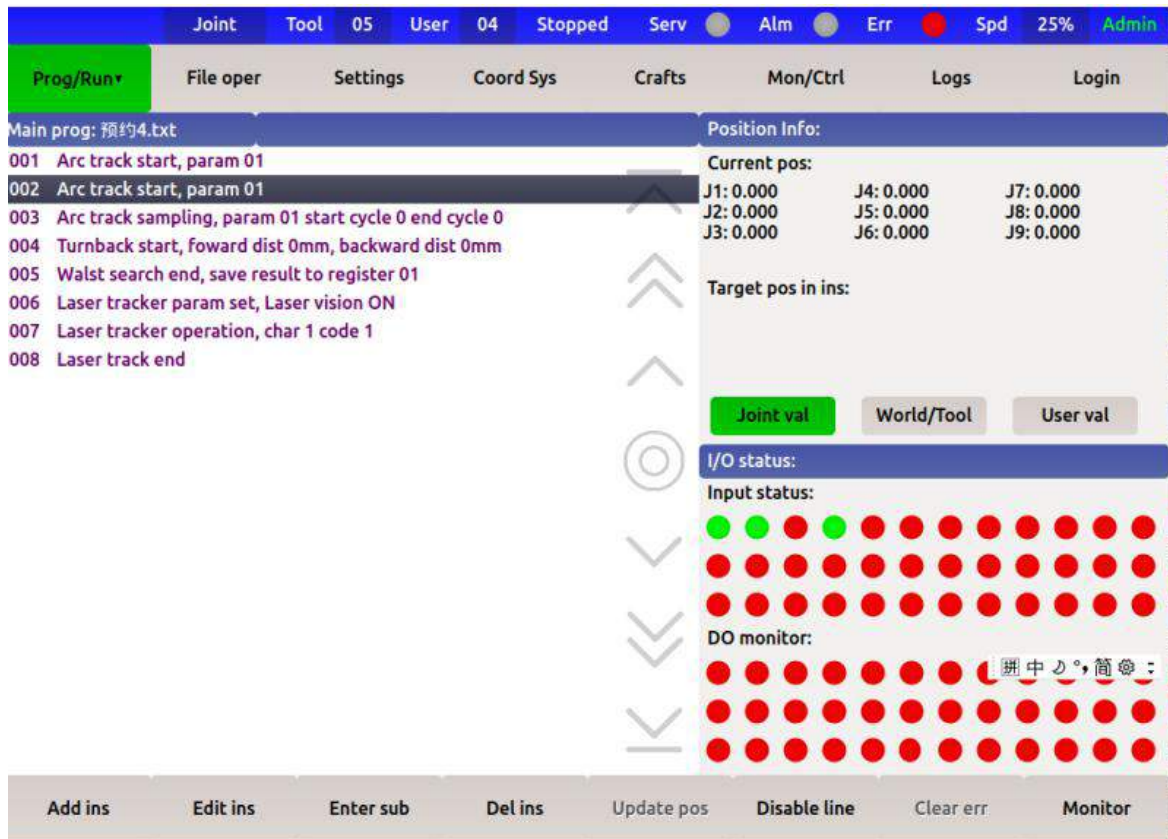➢ The wire feeding speed command value specifies the wire feeding speed (M / sec).

9.2 Switch input and output

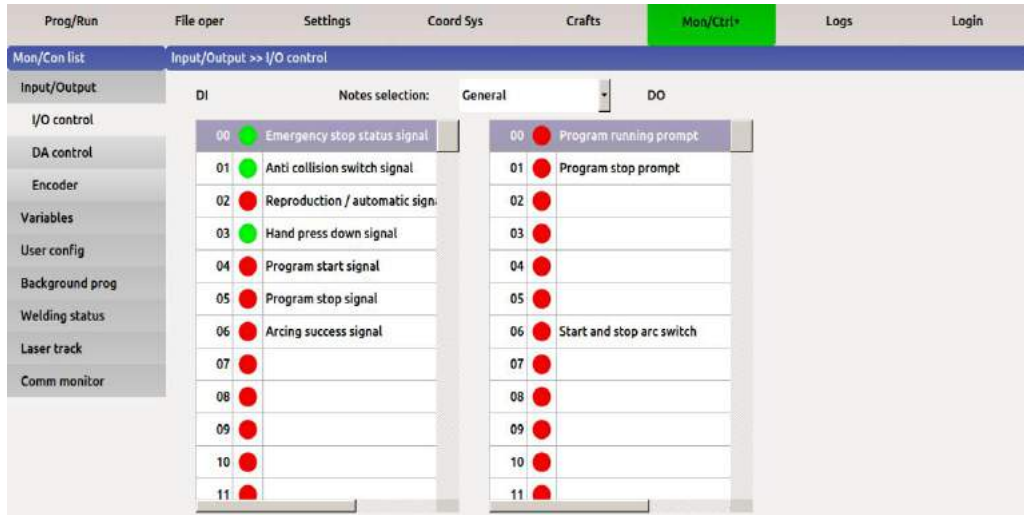In the I / O input / output screen, you can perform the following operations：

➢ Confirm the status of welding input signal and welding output signal (on / off)

➢ Simulation input output and forced output of signal

➢ Welding I / O is carried out automatically when selecting the welding device. Generally, it is not necessary to change the type and number of welding input and output signals.

➢ The output signals of welding I / O include arc strike signal (I / O output 06), wire detection signal (I / O output 07), gas detection signal (I / O output 08), wire withdrawal signal (I / O output 09), etc. the input signals of I / O include arc strike success signal (I / O input 06), etc. If the switching signal of welding power supply needs to be active, it needs to be connected to the switching power supply of robot control cabinet (see the specification of welding power supply for the specific wiring definitio
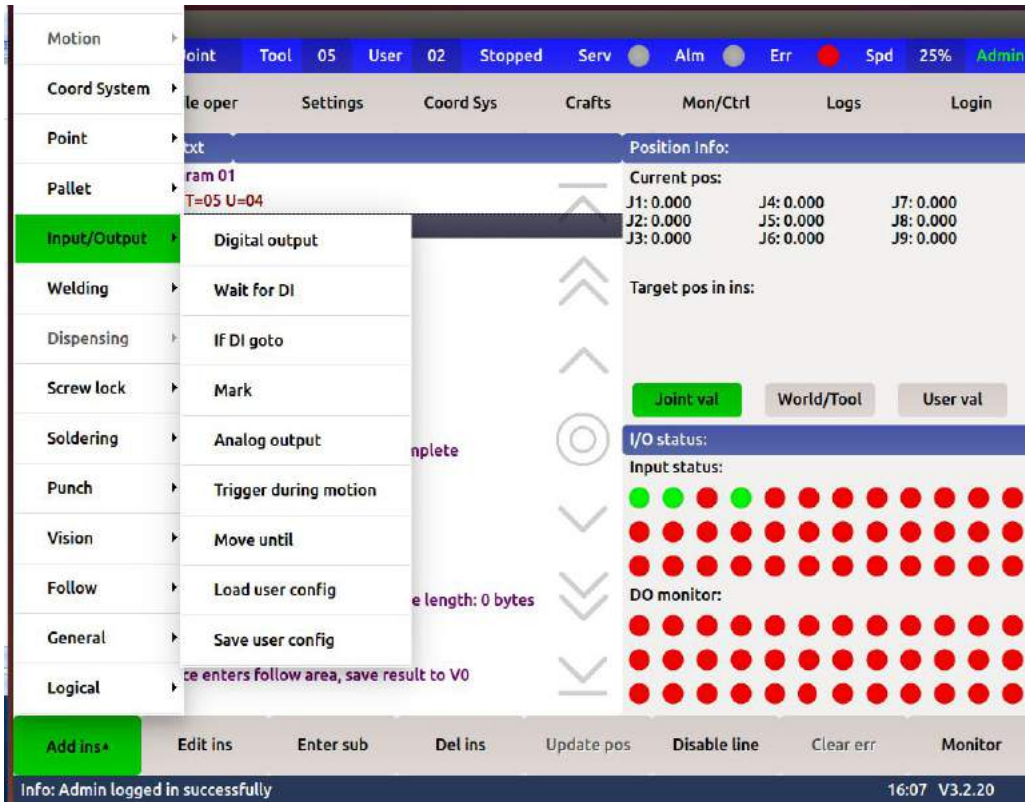
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IO Wiring diagram

Left connector (D00–D11):
D11, D10, D09, D08, D07, D06, D05, D04, D03, D02, D01, D00

GND

11 NO 2
11 COM Starting light2
11 NC
10 NO Starting light1
10 COM Starting light1GND
10 NC
09 NO Wire drawing
09 COM Wire drawingGND
09 NC
08 NO Gas detection
08 COM Gas detection GND
08 NC
07 NO Wire inspection
07 COM Wire inspection GND
07 NC
06 NO Arcing
06 COM Arcing gnd
06 NC
05 NO
05 COM
05 NC
04 NO
04 COM
04 NC
03 NO
03 COM
03 NC
02 NO
02 COM
02 NC
01 NO
01 COM Program stop
01 NC
00 NO Program operation
00 COM
00 NC

模组OJ1

IJ1
OJ2

X11
X10 Successful search
X09
X08 Stop 2
X07 Stop 1
X06 Arcing success
IN05 Stop 2
IN05 Stop 1
X04
X03
X02
X01 Collision avoidance GND
E4 X00
E4
E3
E3
E2 Emergency stop2-2
E2 Emergency stop1-2
E1 Emergency stop2-1
E1 Emergency stop1-1

短接
短接

OV
OV X5-4
OV

COM2
COM1
COMO X5-1

A4−
A4+
A3−
A3+
A2− Given voltage
A2+ Analog quantity GND
A1− Given current+
A1+ I/O signal

DC24V GND

X3
X4
COM2

00 NO
00 COM
00 NC

Special for welding:
In5 is connected with in5: Como, COM1, com2, 24 internal
The input terminal has been connected to 24V power supply.
Input to connect the 0V to the corresponding input point.
The internal power supply of the control cabinet shall not be used for the output.
Input mode: NPN
Output mode: no contact point

9.2.1 Welding machine and control cabinet wiring

Interface screenshot:

Joint | Tool 05 | User 04 | Stopped | Serv | Alm | Err | Spd 25% | Admin

Prog/Run▾ | File oper | Settings | Coord Sys | Crafts | Mon/Ctrl | Logs | Login

Main prog: 预约4.txt

001 Arc track start, param 01
002 Arc track start, param 01
003 Arc track sampling, param 01 start cycle 0 end cycle 0
004 Turnback start, foward dist 0mm, backward dist 0mm
005 Walst search end, save result to register 01
006 Laser tracker param set, Laser vision ON
007 Laser tracker operation, char 1 code 1
008 Laser track end

Position Info:

Current pos:
J1: 0.000   J4: 0.000   J7: 0.000
J2: 0.000   J5: 0.000   J8: 0.000
J3: 0.000   J6: 0.000   J9: 0.000

Target pos in ins:

Joint val | World/Tool | User val

I/O status:
Input status:

DO monitor:

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Add ins | Edit ins | Enter sub | Del ins | Update pos | Disable line | Clear err | Monitor

9.2.2 I / O input and output monitoring

21

9.2.3 I/O input and output

9.2.4 I/O instruction

9.3 Analog output

The number of analog input and output signals that can be used is two channels. DA1 corresponds to the welding current control of the welding power supply, DA2 corresponds to the welding voltage control of the welding power supply. It can be manually filled in the output of numerical detection analog quantity
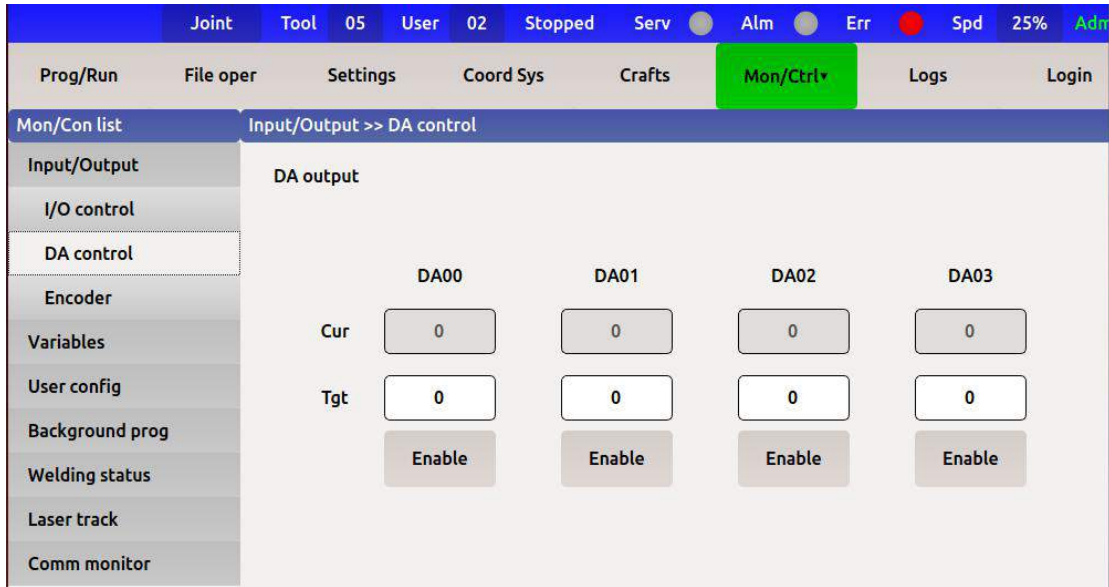
9.3.1 Analog output
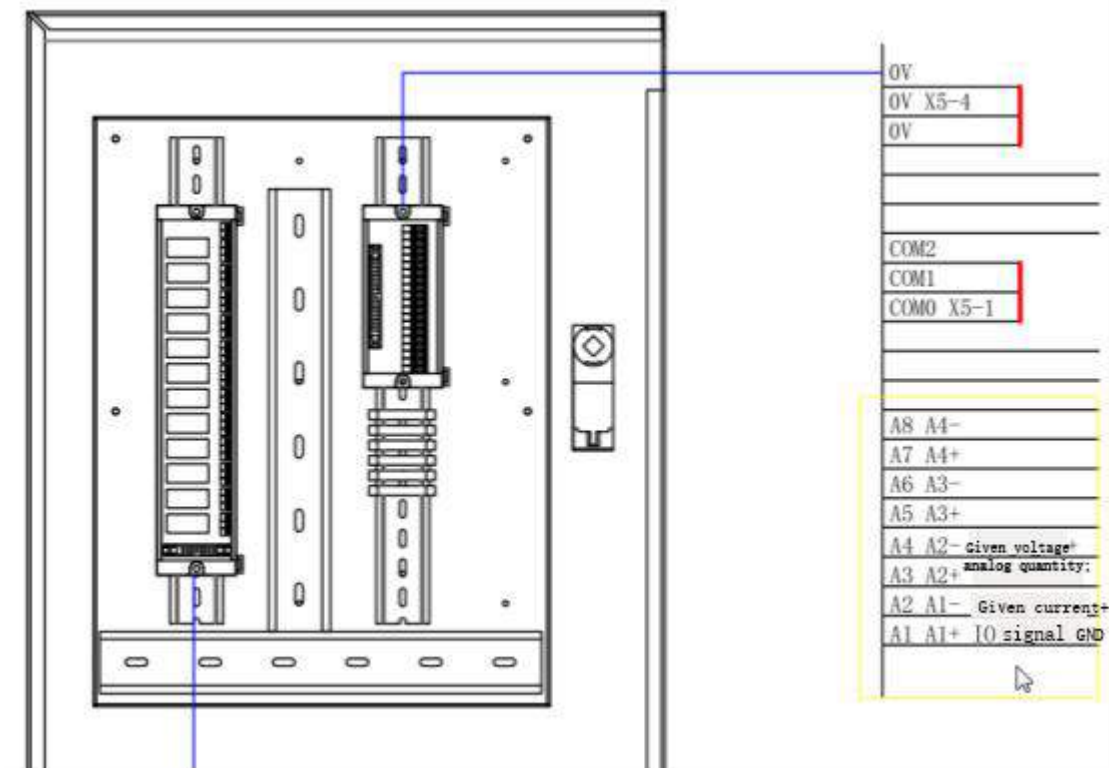
9.3.2 Analog output wiring

9.4Welding process settings

Before the robot control system can control the welding machine, it needs to make corresponding settings according to the basic characteristics of the welding machine and the connection circuit between the welding machine and the control cabinet.

In the main menu, select **Craft** and then select **welding** to set welding process parameters. Any modification can take effect only after clicking save. Including: basic setting, arc striking (welding) and arc striking, arc swinging setting, voltage matching table and current matching table, etc.

Basic settings: including welding trial run and anti-collision detection.

Welding trial run: after the verification of track run, it is necessary to run the program automatically without arc striking to verify whether the actual speed of welding and arc swing are correct.

Pay special attention to the following items, otherwise life accident or equipment failure may occur:

  1、Make sure there are no people around the robot before running the program.

  2、Before running the program, make sure that there is no interference around the robot.

Anti collision detection: selective detection with anti-collision welding gun. If the welding gun collides and the anti-collision sensor acts, the system will give an alarm. The detection function can be cancelled and the alarm can be released. At this time, the robot can be operated. After the welding gun leaves the collision point, check the anti-collision detection, and the anti-collision detection function can be used continuously.
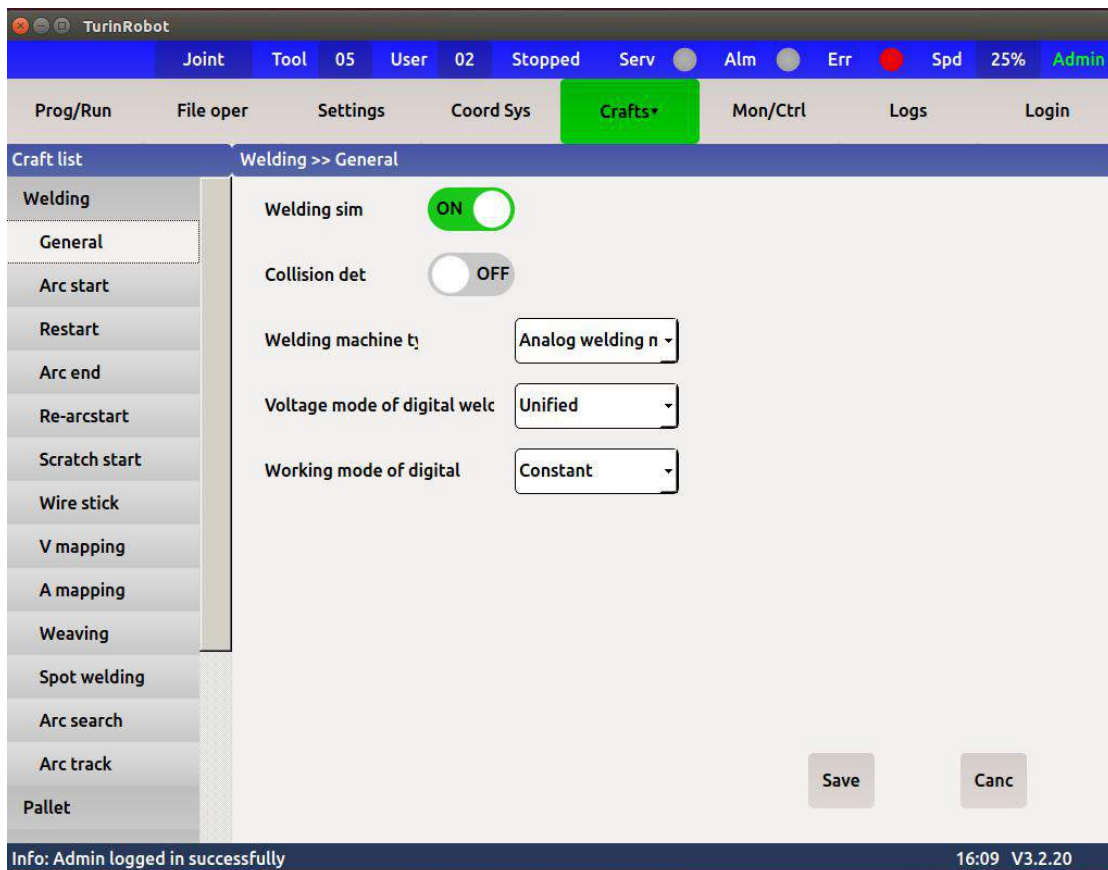

9.4.1 Global settings

Arc start: it can set the arc striking time, arc striking current voltage, welding current voltage, arc striking current voltage and arc striking time. In the figure "parameter selection" (range 01-09), a number corresponds to a group of welding parameters.

Note:

 a) **arc start V and start C** are used when it is difficult to strike an arc, and they are used for convenience.

b)**Voltage and Current** are the values set during normal welding, which are based on the field work Art settings.

c)**Arc start time:** set the holding time of arc striking voltage and current. After receiving the arc striking signal, the welding power supply feeds back the successful arc striking signal. If the arc striking has not been carried out beyond this time, an alarm of arc striking failure will appear.
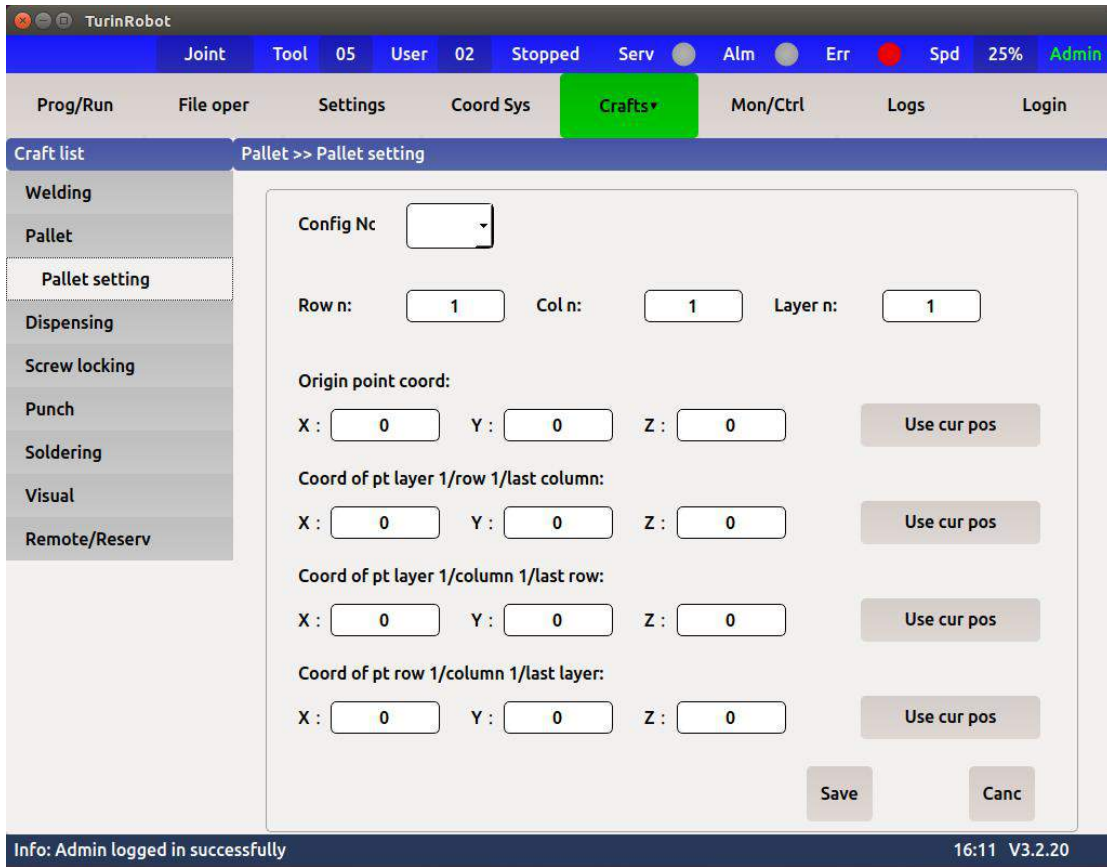
9.4.2 Arcing setting

Restart: in the welding process, arc striking can be performed again in case of arc breaking. Nine sets of parameters (01-09) can be set, and notes can be given, with selection mode, restart times, overlapping times of welding gun, speed of returning to arc breaking point, voltage and current moving to arc striking point,and whether to use re arc striking and scraping arc striking can be selected.
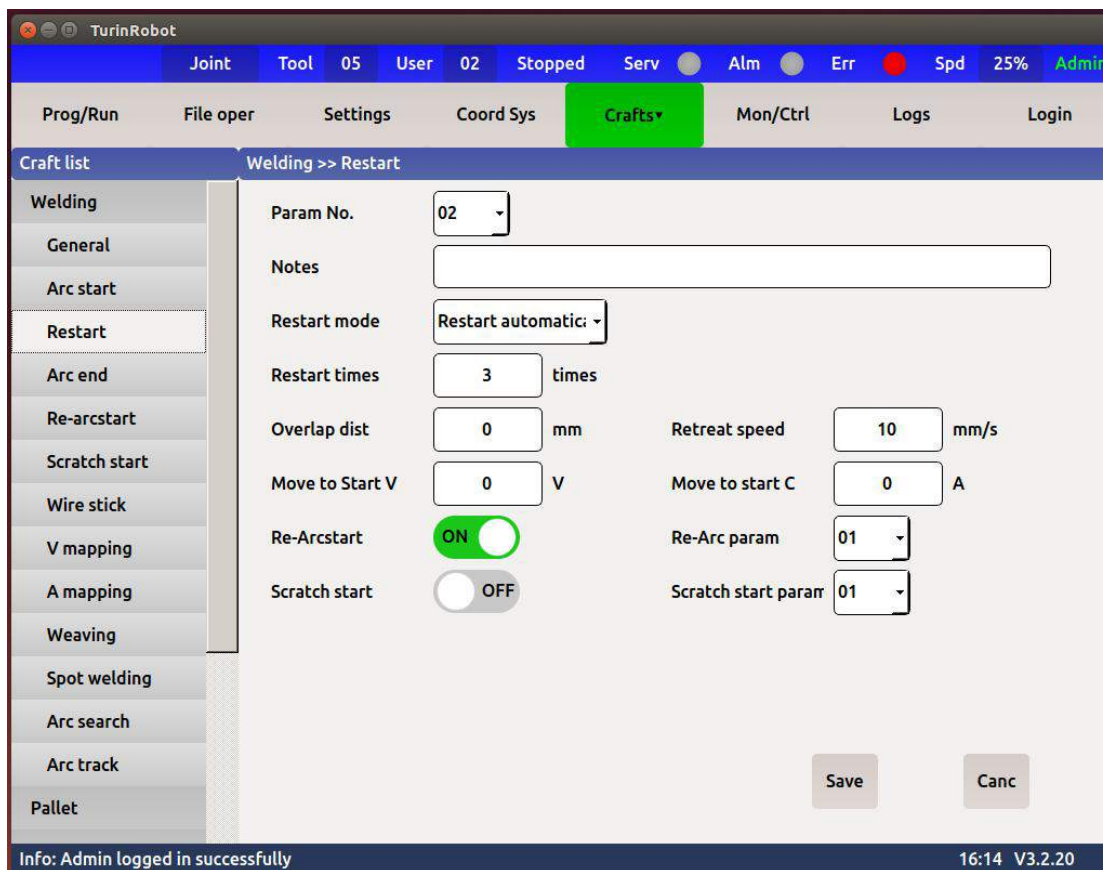
9.4.3 Restart settings

Arc end: at the end of welding, adjust the arc stopping parameters, which are generally used for workpieces with high weld quality requirements, and will also affect the next arc striking. Generally, the arc stopping current and voltage will be smaller than the value at the time of welding. Nine sets of parameters (01-09) can be set and comments can be given. The arc stopping time is set as the holding time of arc stopping voltage and current. If the value is too small, there will be weld crater at the end of the weld. The reflow time affects the remaining length of welding wire at the end of welding. The longer the time is, the shorter the remaining welding wire is. In addition, the reflow voltage and current can be set. In order to avoid wire sticking, it is optional to enable wire sticking detection.

9.4.4 Setting of arcing parameters

Scratch start: if the arc striking fails at the beginning of welding, it will return to the starting point for re arc striking. Nine groups of parameters (01-09) can be set and comments can be given. The number of restart times can be set. If the welding wire is too long, the return time can be set. If the arc striking point cannot meet the arc striking conditions, the welding gun can be moved forward for a certain distance.
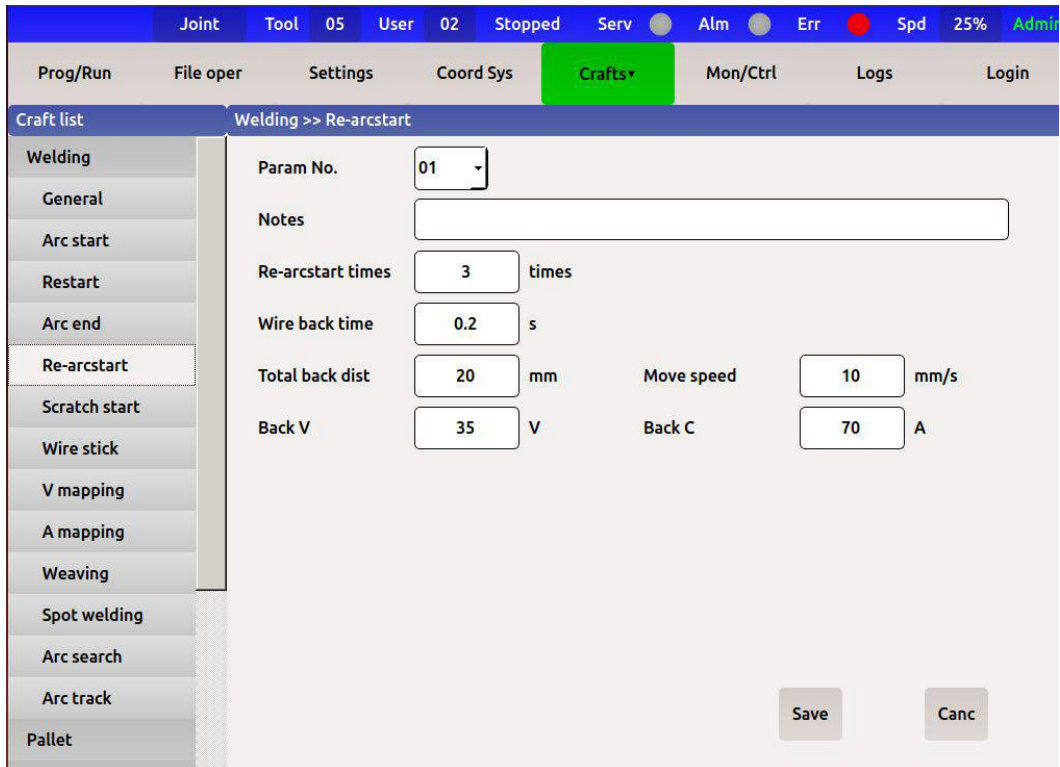

9.4.5 Setting of re striking parameters

TURIN

Scratch start: with the use of restart arc striking, when the welding wire scraps the workpiece, the probability of arc striking is increased. Nine sets of parameters (01-09) can be set and comments can be given. The moving distance, moving speed, arcing voltage and current can be given.
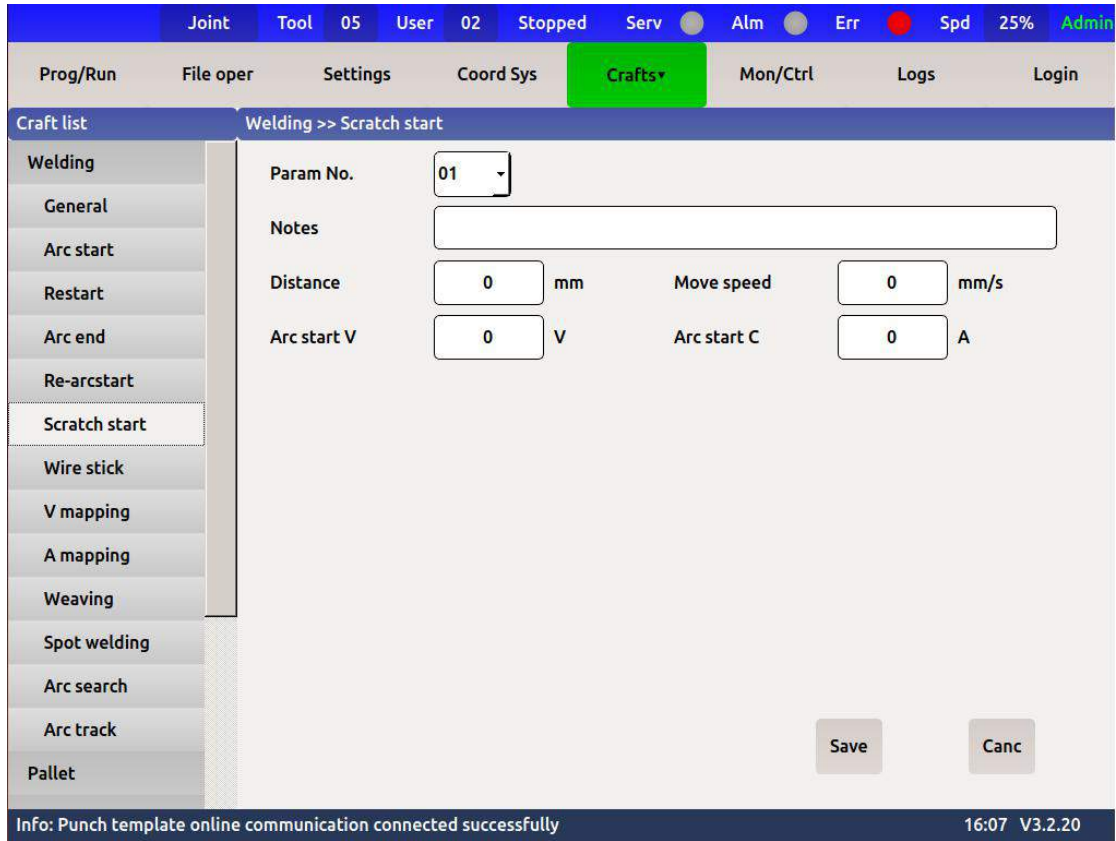
9.4.6 Parameter setting of arc striking by scraping

Wire stick: during welding and arc stopping, the welding wire may stick to the weld. It is necessary to burn off the welding wire, that is to remove the wire sticking. Nine sets of parameters (01-09) can be set and comments can be given. It can set the detection time of wire sticking, whether to enable wire sticking or not, the number of times to remove, the voltage and current at each time to remove, and the number of times to remove.
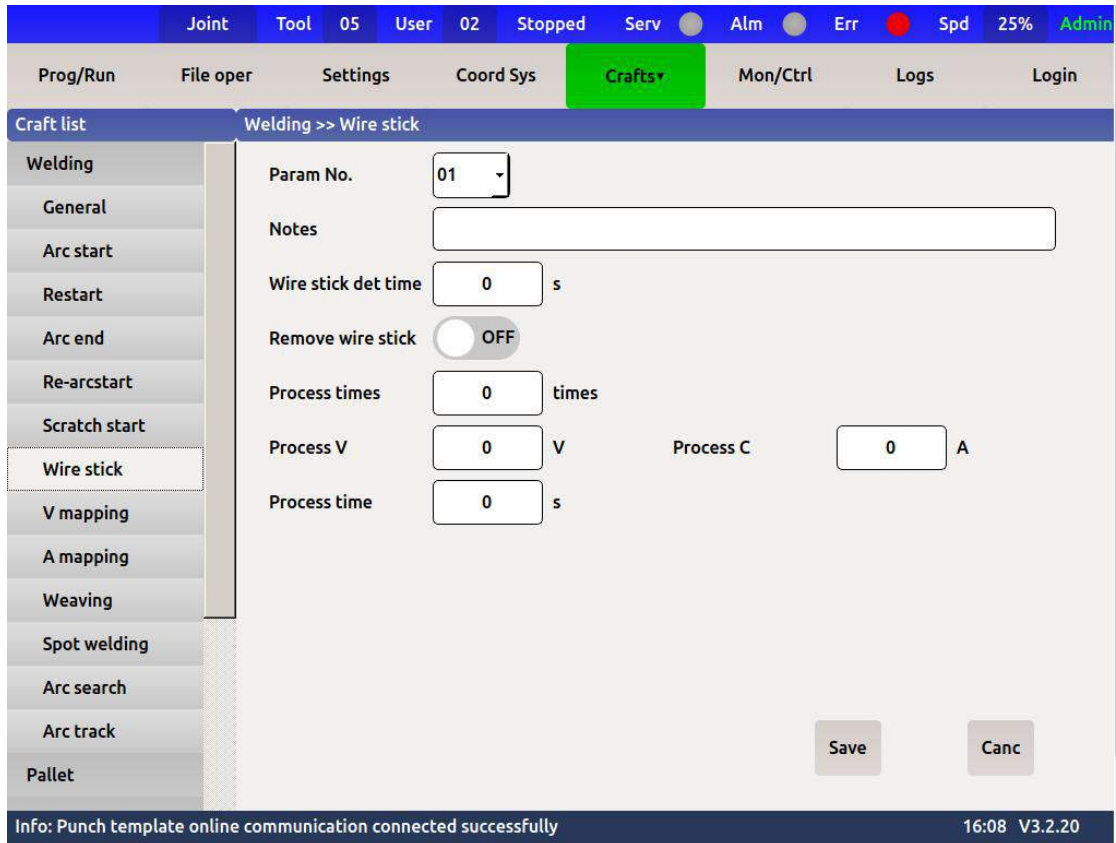
9.4.7 Wire sticking parameter setting

A and V mapping table: matching table of welding machine voltage and current: that is, the two analog voltages (0-10V) output by the controller are matched with the voltage and current displayed on the welding machine, so that the voltage value required by the controller can be calculated according to the operating voltage and current of the welding machine during welding. Click effective to make the controller output the corresponding voltage value. At this time, fill in the voltage or current value displayed on the welding machine, and click save after inputting all 20 gears。

Joint	Tool	05	User	02	Stopped	Serv ●	Alm ●	Err ●	Spd	25%	Admin

Prog/Run	File oper	Settings	Coord Sys	Crafts▾	Mon/Ctrl	Logs	Login

Craft list | **Welding >> V mapping**

	No.	Output	Oper	Machine	No.	Output	Oper	Machine
Welding								
General	V 01	0.5	Enb	0.4	V 11	5.5	Enb	5.8
Arc start	V 02	1	Enb	0.9	V 12	6	Enb	5.8
Restart	V 03	1.5	Enb	1.4	V 13	6.5	Enb	6.3
Arc end	V 04	2	Enb	1.9	V 14	7	Enb	6.8
Re-arcstart	V 05	2.5	Enb	2.4	V 15	7.5	Enb	7.3
Scratch start	V 06	3	Enb	2.9	V 16	8	Enb	7.8
Wire stick	V 07	3.5	Enb	3.3	V 17	8.5	Enb	8.2
V mapping	V 08	4	Enb	3.8	V 18	9	Enb	8.7
A mapping	V 09	4.5	Enb	4.3	V 19	9.5	Enb	9.2
Weaving	V 10	5	Enb	4.8	V 20	10	Enb	9.6
Spot welding								
Arc search						Save		Canc
Arc track								
Pallet								

Info: Punch template online communication connected successfully   16:08 V3.2.20

9.4.8 Voltage matching table

Joint	Tool	05	User	02	Stopped	Serv ●	Alm ●	Err ●	Spd	25%	Admin

Prog/Run	File oper	Settings	Coord Sys	Crafts▾	Mon/Ctrl	Logs	Login

Craft list | **Welding >> V mapping**

	No.	Output	Oper	Machine	No.	Output	Oper	Machine
Welding								
General	V 01	0.5	Enb	0.4	V 11	5.5	Enb	5.8
Arc start	V 02	1	Enb	0.9	V 12	6	Enb	5.8
Restart	V 03	1.5	Enb	1.4	V 13	6.5	Enb	6.3
Arc end	V 04	2	Enb	1.9	V 14	7	Enb	6.8
Re-arcstart	V 05	2.5	Enb	2.4	V 15	7.5	Enb	7.3
Scratch start	V 06	3	Enb	2.9	V 16	8	Enb	7.8
Wire stick	V 07	3.5	Enb	3.3	V 17	8.5	Enb	8.2
V mapping	V 08	4	Enb	3.8	V 18	9	Enb	8.7
A mapping	V 09	4.5	Enb	4.3	V 19	9.5	Enb	9.2
Weaving	V 10	5	Enb	4.8	V 20	10	Enb	9.6
Spot welding								
Arc search						Save		Canc
Arc track								
Pallet								

Info: Punch template online communication connected successfully   16:08 V3.2.20

9.4.9 Ammeter

Weaving: during the welding process, the robot can swing the welding gun, realize special welding process requirements, and optimize the weld forming, as shown in the following figure:
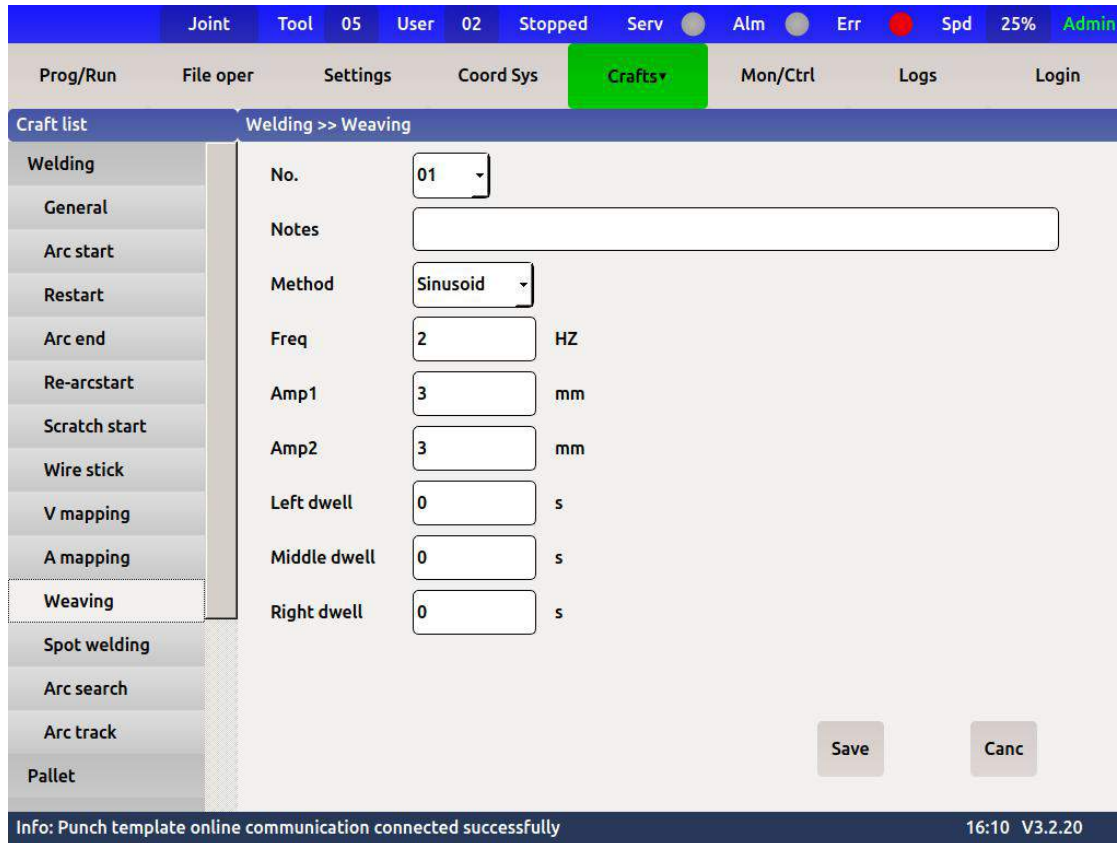
9.4.10 Arc setting

Enter the values of "swing mode", "swing frequency", "swing amplitude", "left dwell time" and "right dwell time" in the "swing arc setting" column, and press save to exit.

➢ **Method:** used to set the swing mode, such as "sine swing".
➢ **Freq:** set the number of swings per second.
➢ **Swing amplitude:** set the single swing distance.
➢ **Left dwell:** set the dwell time when swinging to the left vertex
➢ **Right dwell**: set the dwell time when swinging to the right vertex

Note: after the swing parameter is set, it is stored in the form of document number. When it is used, it is good to call the corresponding parameter number. Multiple groups of welding swing parameters can be used in a program.

Spot welding: spot welding in straight line or curve motion. Nine sets of parameters (01-09) can be set and comments can be given. Arc striking conditions use arc striking parameters, arc striking conditions use arc striking parameters, set dwell time, forward movement specific and movingspeed.
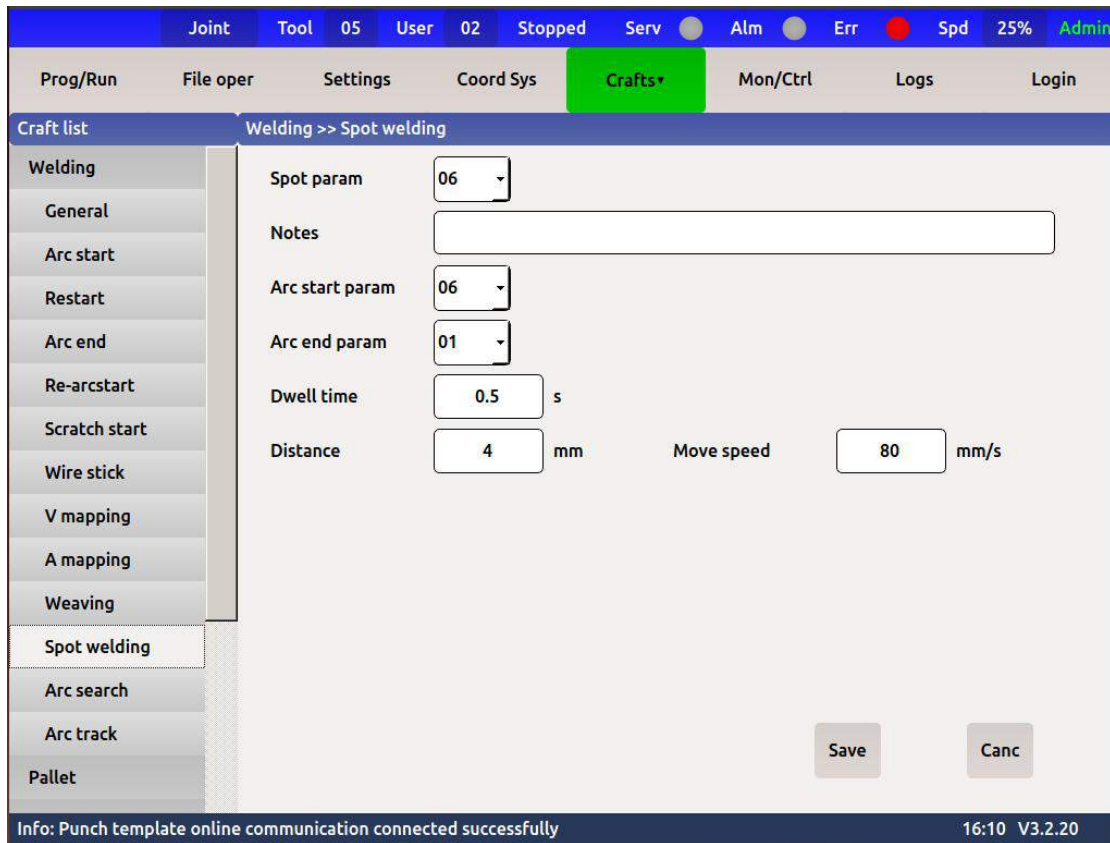
9.4.11 Spot welding settings

Arc search: robot and welding machine with position finding signal realize position finding detection, which can correct the deviation of welding track caused by workpiece weld. Nine sets of parameters (01-09) can be set and comments can be given. In the position seeking mode, the system energizes the nozzle or welding wire with low voltage, and the workpiece is grounded. In the process of robot moving along the searching track, once the nozzle or welding wire contacts with the workpiece, it will generate a contact signal, and the robot stops moving. The deviation between the current position and the program set position is used to correct the path, so as to get the real target position. There must be no rust, oxide layer, paint or other insulating coating on the surface of the workpiece. Before positioning, the gun must be cleaned and the wire must be cut. When using the water-cooled welding gun, distilled water or other non-conductive coolant is recommended. Impure water (such as salty mineral water) will reduce the sensitivity of location finding or the voltage of location finding.

9.4.12 Location setting

X. Program instruction

10.1Welding procedure instruction

Arc command is a command to indicate to robot when and how to conduct arc welding. The arc welding is carried out during the execution of the action command shown between the arc welding start command and the arc welding end command.

Arc striking: multiple arc striking methods can be selected for welding arc striking, as shown in the following figure, which is set as "arc striking parameter 1".

The arc striking command can be used in combination with the arc striking command by setting the parameters of the arc striking and the parameters of the arc striking through the program setting interface to the "welding process".
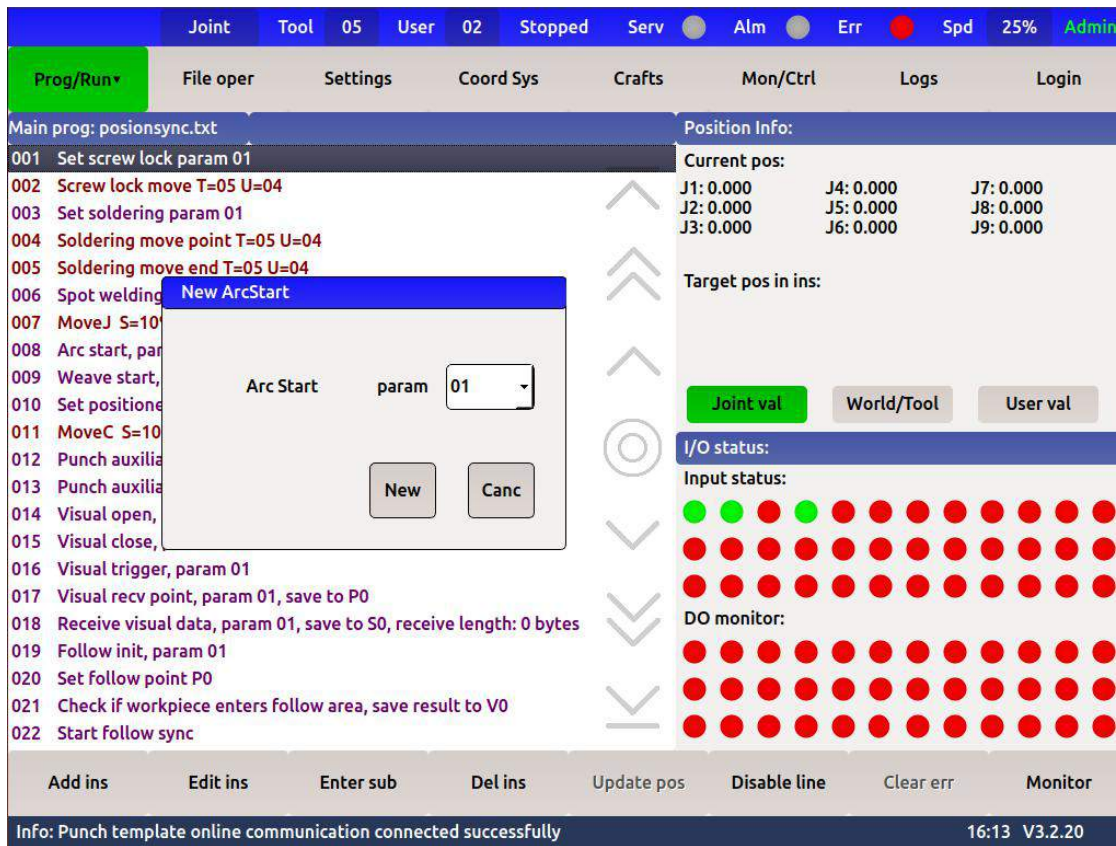
10.1.1 Arcing instruction

Arc stop: select this command to stop the welding machine.
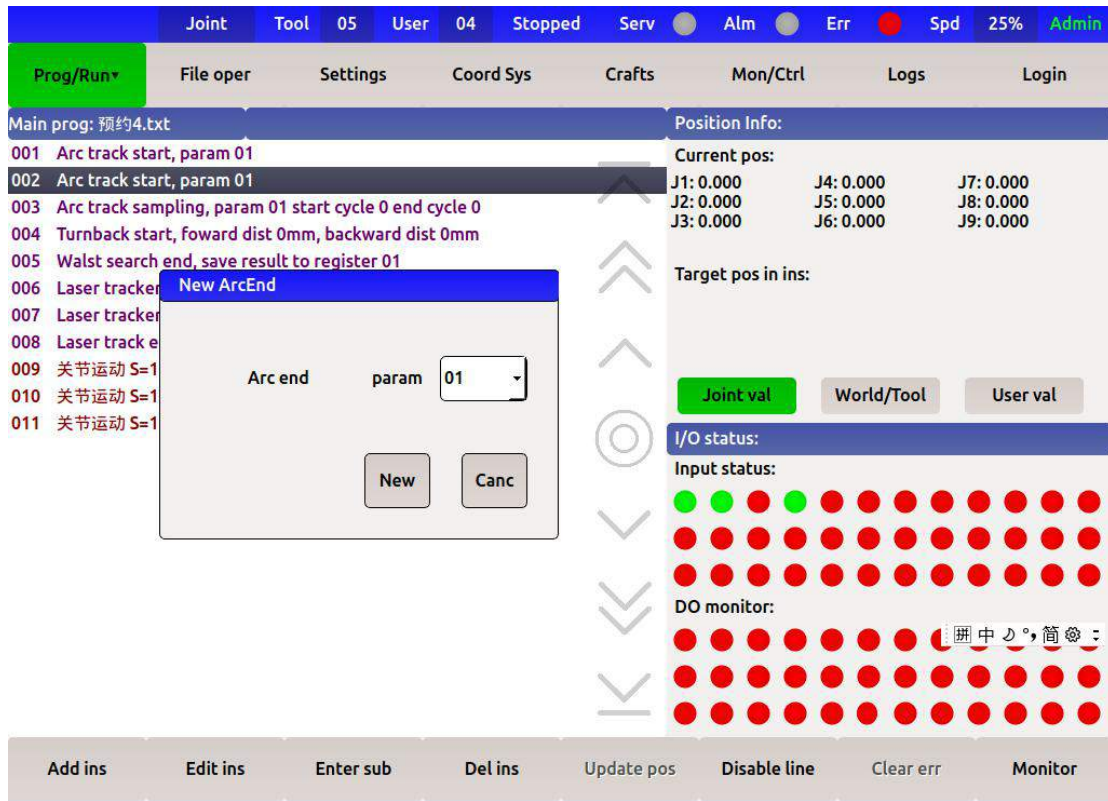
10.1.2 Arc suppression instruction

Welding instruction definition:

➢ Arc starting point: the movement instruction in front of the arc starting instruction is the arc starting point (point-1)

➢ Arc starting safety point: the command in front of the arc starting point is the arc starting safety point (point-2)

➢ Arc stopping point: the movement command before arc stopping is arc stopping point (point-3)

➢ Arc stopping safety point: the command after the arc stopping instruction is the arc stopping safety point (point-4)

Welding example: angle welding is the most common welding method, with high requirements for the angle of welding gun,as picture:
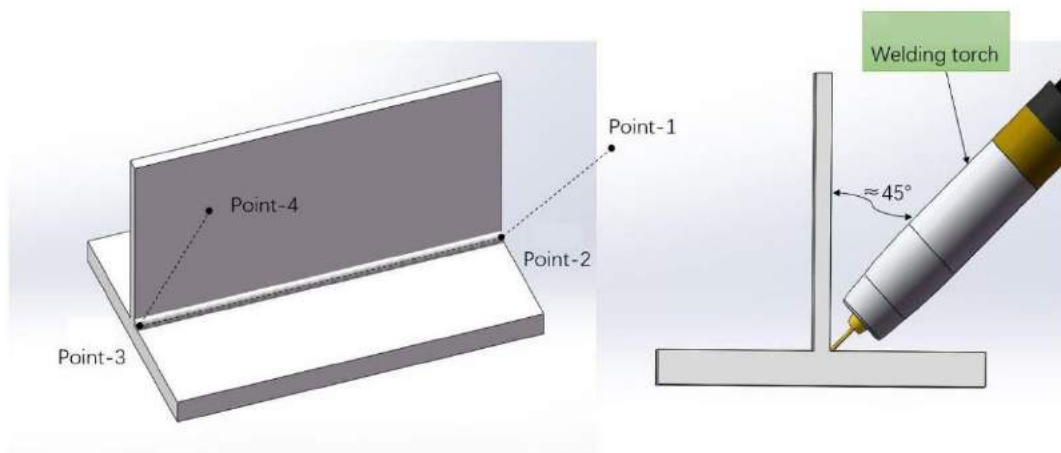
10.1.3 Fillet weld

10.2 Welding speed command

The welding speed command can set the welding speed in the welding conditions. Welding voltage, current and speed can be managed together as welding conditions. The robot can operate according to the specified welding speed, which should be set according to its weld forming. As shown in the figure below, in the online mode, when the overall operation is at 100%, the speed 1 is 1% of 1000mm / s, which is 10 mm/s.

10.2.1 Linear speed command

Follow these rules:

➢ Joint motion or linear motion is used in the command to move to the start of arc welding.
➢ In the movement towards the end of welding, joint movement mode cannot be used.
➢ Adjust the direction of welding gun to an appropriate angle when facing the welding workpiece.
➢ Use appropriate welding conditions.

10.3 Motion command mode

The motion command is the trajectory of the robot between the execution teaching points. Robots generally support three types of motion: joint motion, linear motion, arc motion, etc. The robot welding can be realized by adding the command of arc striking and arc striking to the corresponding position. Generally, robots can realize straight line welding, arc welding, full circle welding and single point welding. Other auxiliary functions are arc welding.
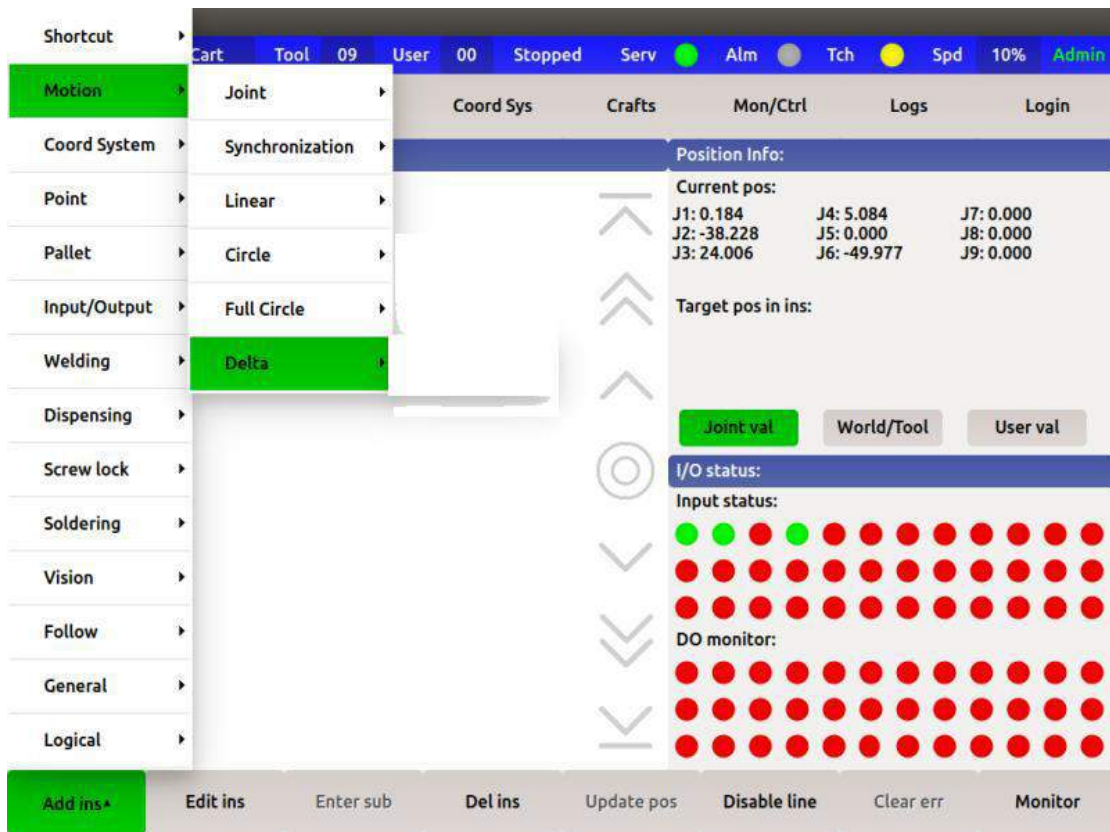
10.3.1 Motion command
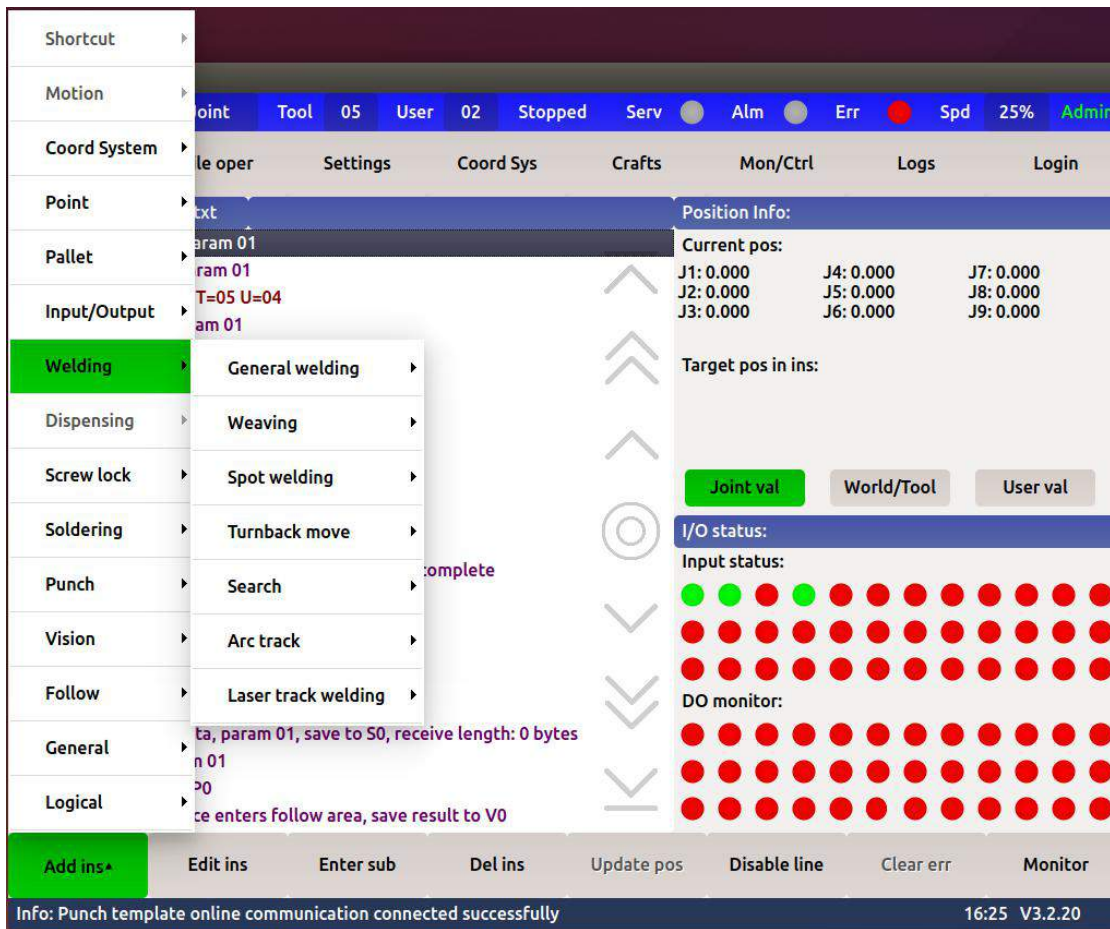
10.3.2 Welding instruction

Straight line welding instruction: the diagram shows the programming of single straight line welding

instruction. When it is necessary to weld multiple continuous straight lines, the starting point of the second straight line is the ending point of the first straight line. The second straight-line motion needs to be smoothed.
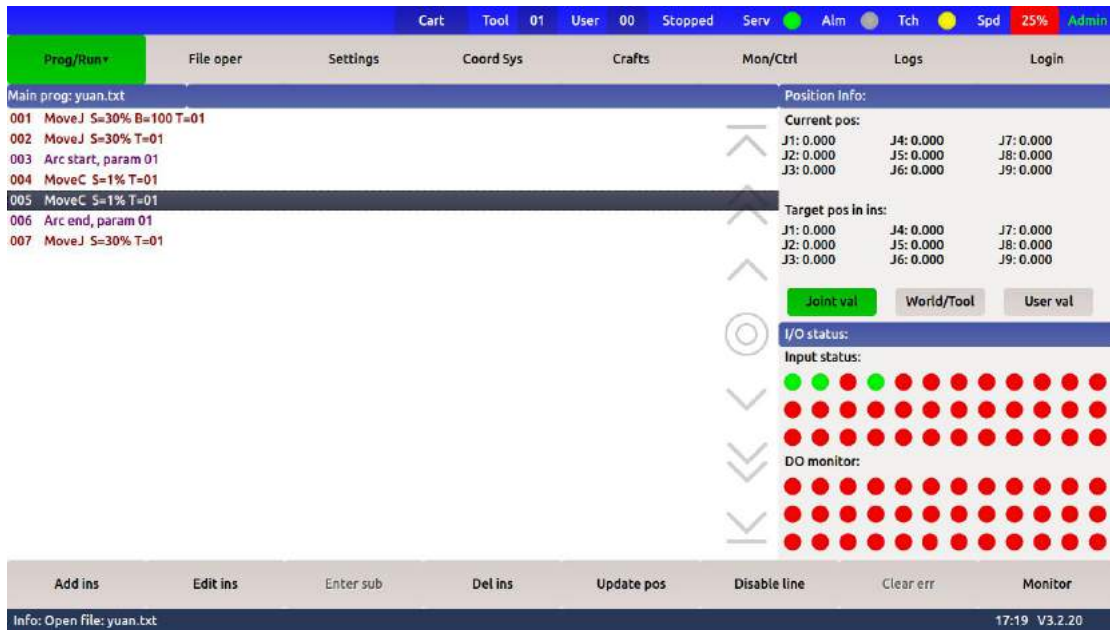

10.3.3 Linear welding motion command

Arc welding command: the starting point of arc is the arc striking point (line or joint command), the middle point of arc (also known as arc auxiliary point) is the first arc motion command after the arc striking command, and the ending point of arc is the second arc motion. When it is necessary to weld multiple continuous arcs, the end point of the first arc is the starting point of the second arc.


10.3.4 Arc welding motion command

Circular welding instruction: the welding circle can be regarded as welding multi-section arc, at least two sections arc. Take a circle divided into two arcs as an example: the starting point of the circle is the starting point of the arc, the middle point of the first arc (also known as the auxiliary point of the circle) is the first arc movement instruction after the arc striking instruction, the ending point of the arc is the second arc movement, the starting point of the second arc is the ending point of the first arc, the middle point of the arc is the third arc movement instruction, and the ending point of the circle is the fourth arc movement instruction Instructions.

10.3.4 Arc welding motion command

Circular welding instruction: the welding circle can be regarded as welding multi-section arc, at least two sections arc. Take a circle divided into two arcs as an example: the starting point of the circle is the starting point of the arc, the middle point of the first arc (also known as the auxiliary point of the circle) is the first arc movement instruction after the arc striking instruction, the ending point of the arc is the second arc movement, the starting point of the second arc is the ending point of the first arc, the middle point of the arc is the third arc movement instruction, and the ending point of the circle is the fourth arc movement instruction Instructions.

10.3.5 Circular welding motion command

Arc swing welding instruction: there are start and end of arc swing in arc swing welding. The start of arc swing is added after the command of arc striking, and the parameters of arc swing can be selected. In the corresponding process, the setting parameters of arc swing are 01-09. The end of the arc is added before the arc is stopped. Swing arc welding can be used in line welding and arc welding.

Note: when the arc swinging function is to be realized, the welding wire shall be perpendicular to the welding forming surface.
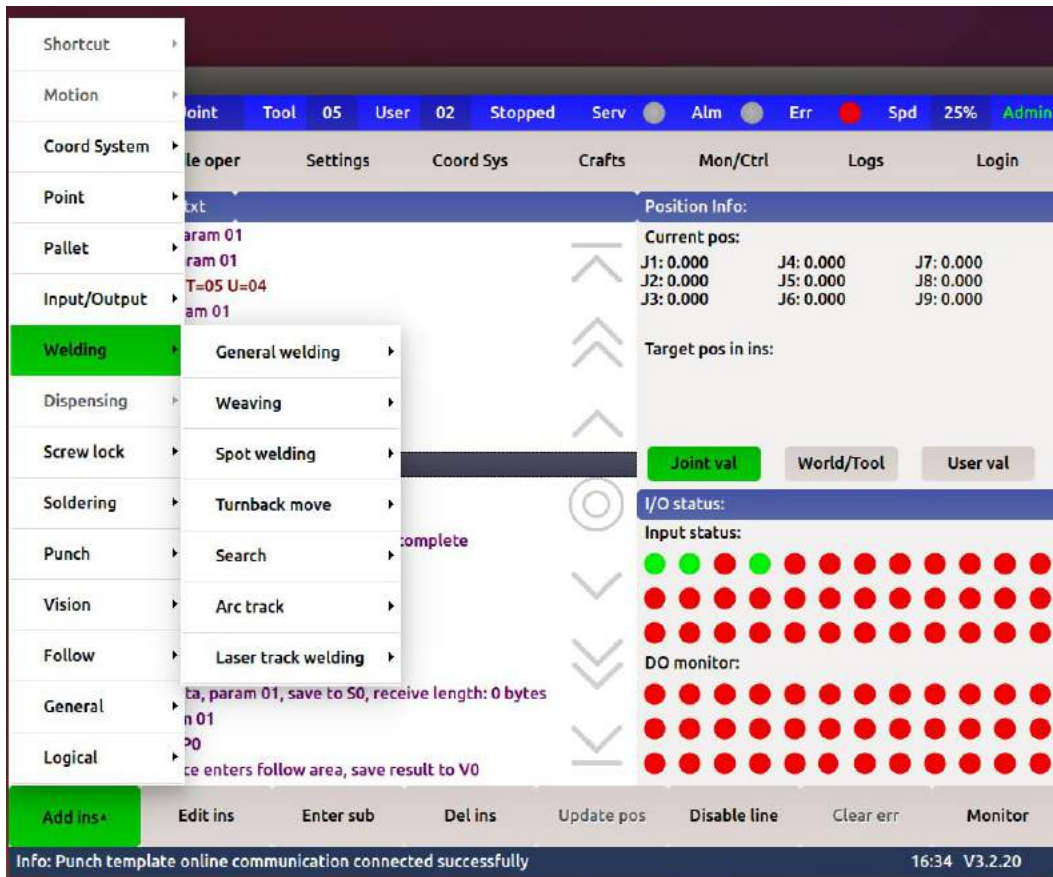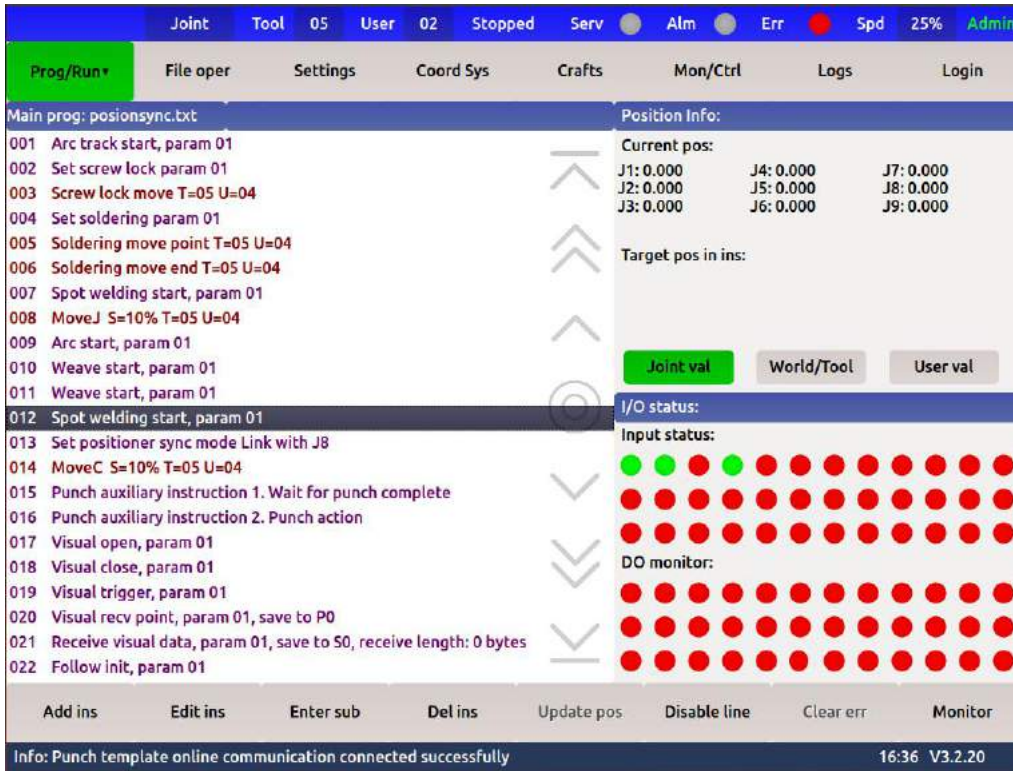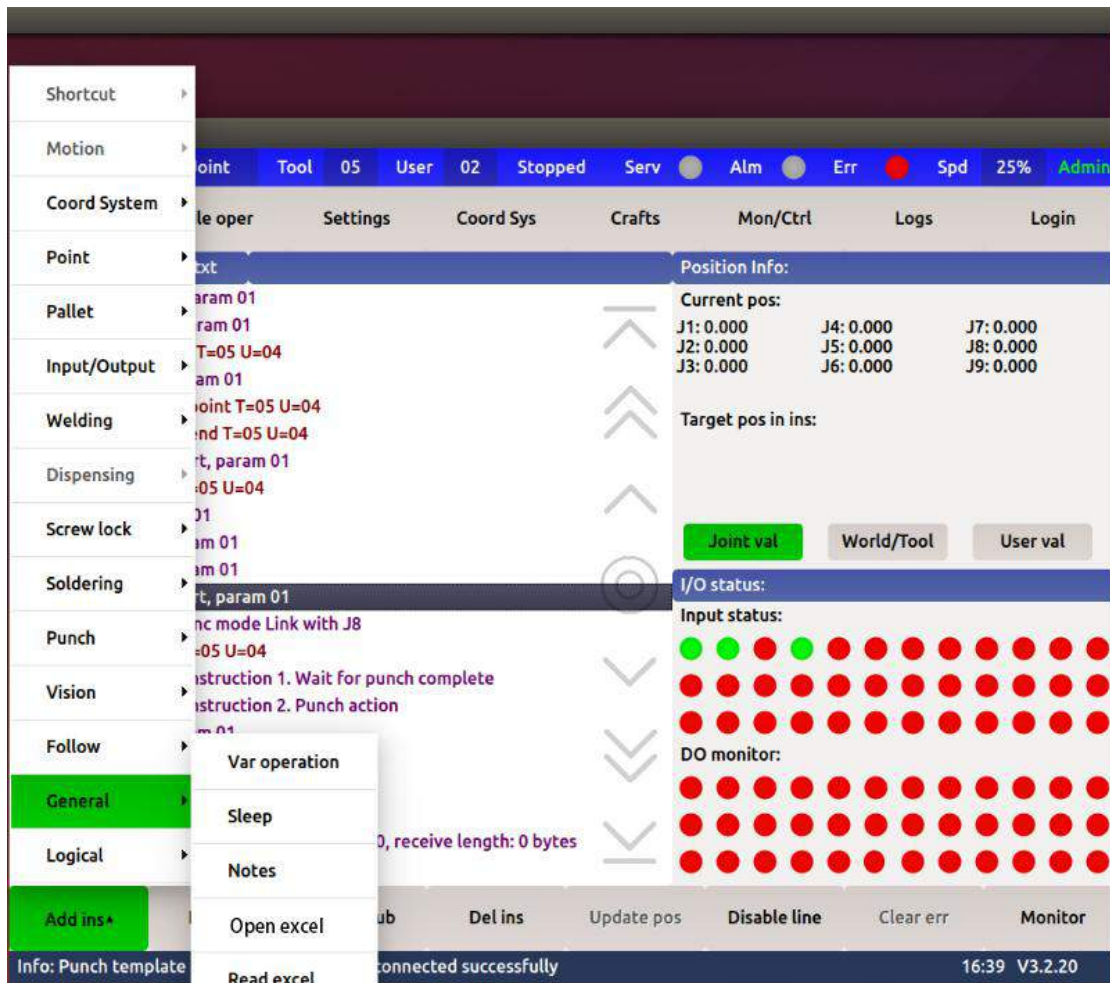
10.3.6 Arc swinging instruction
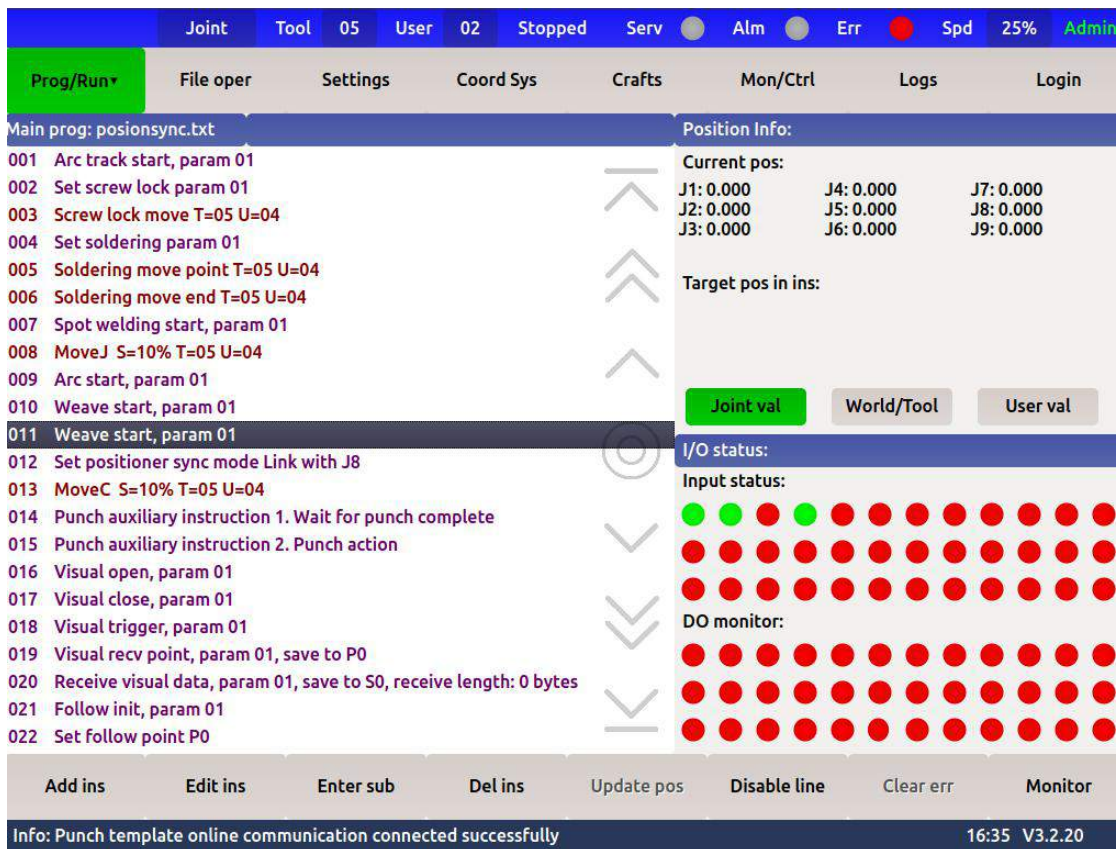
10.3.7 Motion command of arc linear welding

Single point welding instruction: single point welding can be realized only by adding delay time between arc striking and arc stopping, or by using spot welding procedure, and the size of welding point is set according
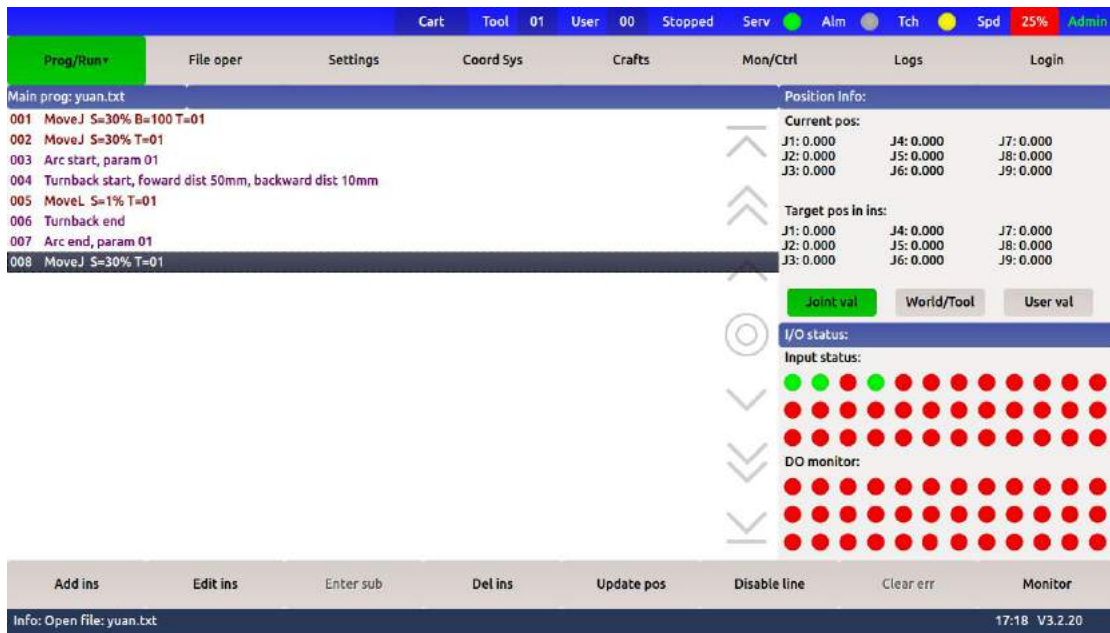
to the required process.
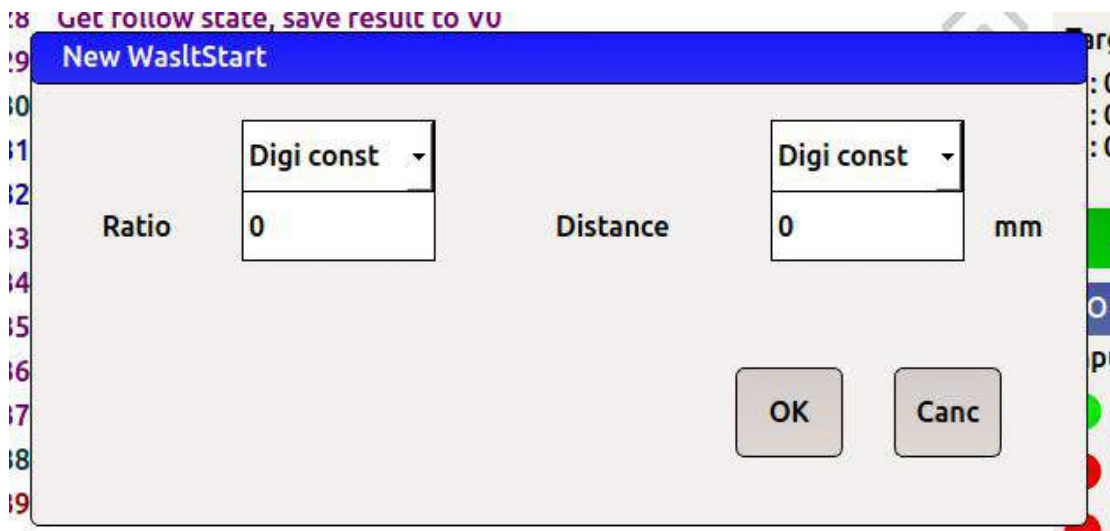

10.3.8 Spot welding instruction

10.3.9 Delay instruction

TURIN

Turn back welding instruction: turn back welding starts and ends. Turn back start is added after arc striking command, and forward and backward distance can be set.
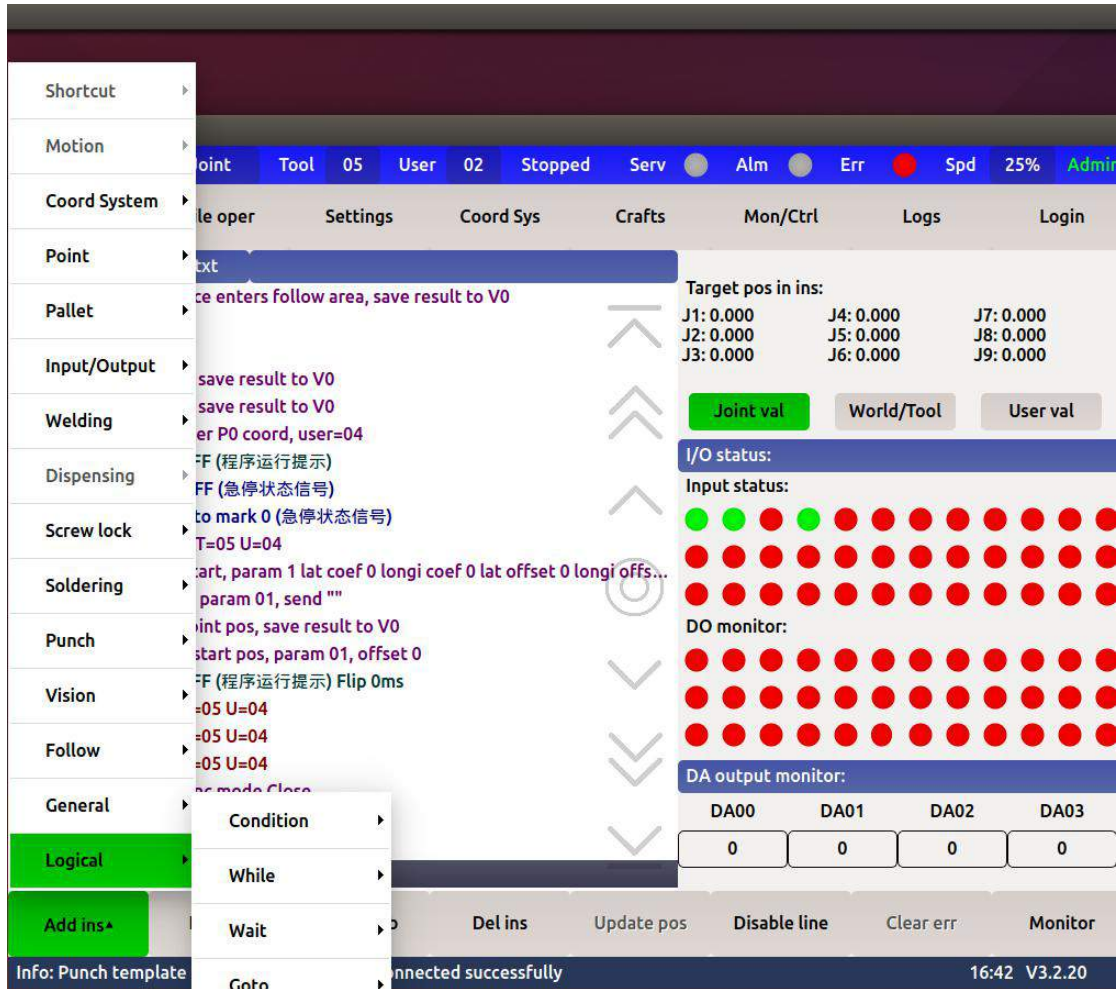

10.3.10   Turn back welding instruction
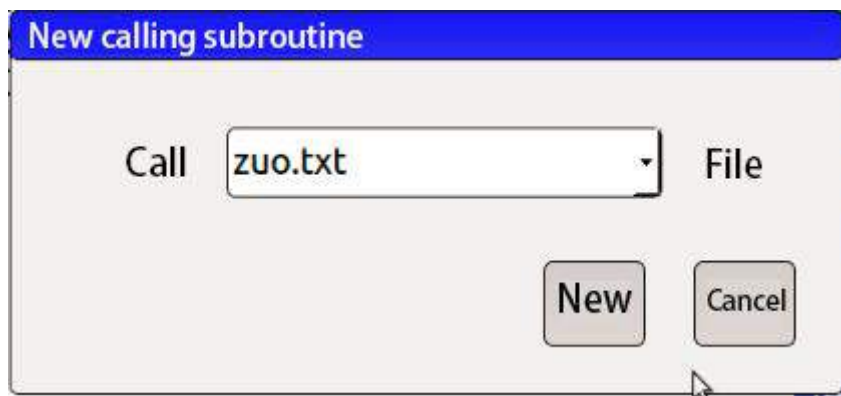

10.3.11 Turn back welding instruction
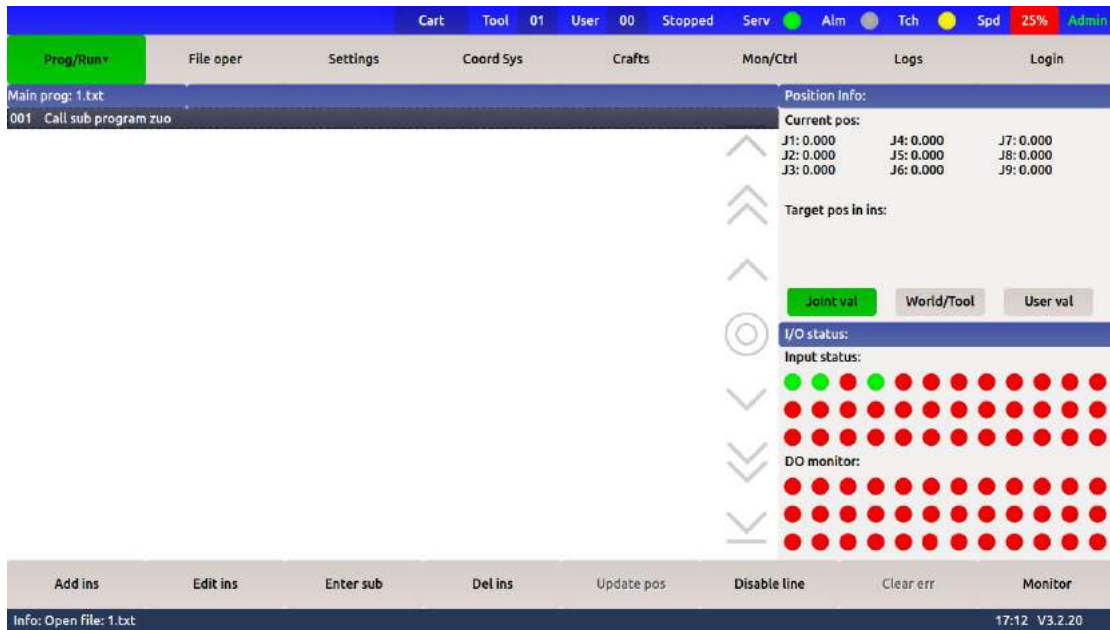
XI.Other functions

11.0 Subprogram Call

Open the program or create a new blank program file, and then add the call subroutine command in the program. In the program command, you can select the name of the program file to call, and add the program end command in the last line of the subroutine.

11.0.1　Program call

11.0.2 Program call file selection

11.0.3   Blank file program call

11.1 Instruction editor

Editing instructions include editing, editing, and modifying parameters in the selected row. Both copy and cut can select the number of rows or the range of rows. Paste to paste into the current file click the next line of the current line or another file. Delete to select the current row or row number range.

Calibration: the correction instruction is to correct the number of lines from the first point to the last point to be corrected after the welding gun collides or the workpiece moves, and then click the correction instruction

after manually teaching to the correct position. Click the confirmation to complete the correction, but the correction instruction is only valid for the straight line movement and arc movement instruction, and is invalid for the joint movement.