Operation manual of welding process system

WELD_V2.4.0

Contents of this series of instructions: Operation Manual of welding process system.

Foreword

This series of instructions introduces the characteristics, system composition, system commands of each part and its use, operation steps, user programming methods and examples, etc., which is the basic instruction manual for users to quickly learn and use the teaching pendant. The update and upgrade of the manual are authorized and implemented by Foshan Huashu Robot Co., Ltd. Without the company's authorization or written permission, any unit or individual has no right to modify or correct the content of this manual, and the company is not responsible for this. Customer loss.

In the instruction manual of the programming of the teaching device (Hspad), we will try our best to describe various events related to the operation of the teaching device. Due to space limitations and product development positioning, it is impossible and impossible for all of the teaching device not to do or Events that cannot be done are described in detail. Therefore, events that are not specifically described in this specification can be considered as "impossible" or "not allowed" events.

We have checked the content of the printed matter for consistency with the described hardware and software content, and we do not rule out inconsistencies, but we regularly proofread the printed matter and make necessary changes in later editions. The copyright of this manual belongs to Foshan Huashu Robot Co., Ltd., any unit or individual publishing or copying is illegal, and our company will pursue its legal responsibility.

Content

Version history

edition	category	explain	Release time
V2.0.1.200411	establish	Welding system adaptation 1.6 control system;	2020.04.13
V2.0.2.200508	update	1. Add instruction a; 2. Add welding parameter curve setting page; 3. Add one key recording point function; 4. Add a weld to use multiple groups of process parameters; 5. Optimize the process package interface; 6. Non channel functions and interfaces are cancelled.	2020.05.09
V2.0.3.200515	update	1. Add the function of online modification of points; 2. The external mode is reconstructed; 3. It solves the problem that the robot will move for a short period after the arc striking fails; 4. Solve the problem that the drive power on speed is inconsistent with the system startup speed, resulting in unsuccessful system startup and yellow network.	2020.05.16
V2.1.0.200609	update	1. Add swing welding function; 2. Add batch editing, attribute copying and other functions; 3. Package ACC, Dec to welding channel to simplify parameter debugging.	2020.06.10
V2.2.0.200819	update	1. Add channel number function for arc starting and arc stopping command; 2. When inserting arc starting, welding channel	2020.08.20

		and arc stopping commands, you can choose to set welding voltage and welding current; 3. Add the linkage function of robot positioner; 4. Increase the output statistics function; 5. Increase the left and right residence time function of swing welding; 6. Add adaptive integrated drive; 7. Add boundary singular error reporting prompt; 8. If the welding is started after the arc failure is optimized, the robot will walk a short distance; 9. Optimize external mode configuration and use functions; 10. The optimizer does not display the internal code of macro instructions; 11. Solve the problems of sudden change of arc trajectory acceleration and algorithm error.	
V2.2.0.201029	update	1. Add speed-up function of welding program speed parameter and "welding speed-up instruction"; 2. Optimize the inching wire feeding function, and add the touch screen "wire feeding +" and "wire feeding -" buttons to realize the inching wire feeding function under the enable state of manual mode; 3. Solve the problem of "sudden acceleration, algorithm error" when the startup l command returns to the origin and the attitude changes greatly;	2020.10.30

		4. Solve the problem of inconsistent length of inching wire feeding.	
V2.2.0.201205	update	1. The system model parameters are accelerated, and the encapsulation attribute of the acceleration instruction is increased by L_ VEL、L_ ACC、L_ Dec and CNT, speed up instruction "standard": J_ VEL=100 , J_ ACC=100，J_ DEC=100，L_ VEL=1800，L_ ACC=75，L_ DEC=75，CNT=40；“ High speed ": J_ VEL=200，J_ ACC=200，J_ DEC=200，L_ VEL=2400，L_ ACC=100，L_ DEC=100，CNT=40； 2. The program editing interface is sinicized, and all instructions are updated to Chinese instructions to realize full Chinese instruction programming; 3. Optimize the operation of the teaching pendant program editing interface and cancel the slider function; 4.Welding speed up version lde-x6 servo drive parameter HSSs_ AllAxle_ JH605_ 20201208_ HS update release.	2020.12.09
V2.3.0.210122-1-007	update	1. Match the version of 1.6.6 control system; 2. Add online editing function; 3. Add fish scale welding function; 4. Suitable for 16 input / 16 output hio-18xx series IO; 5. When the external mode is loaded, the content of the main.prg program is not	2021.03.15

		displayed, and the content of the first program configured is displayed; 6. Optimize single step debugging function; 7. When creating a new PRG program, you cannot create a new main.prg file to avoid conflict with the external running default program; 8. Fix the abnormal problem of arc pause and fallback trajectory; 9.Fixed the problem of skip point not welding when using multiple fish scale welding instructions.	
V2.3.0.210122-2-001	iteration	1. Add external start, add reference point signal judgment, and give an alarm if the robot is not started at the safe point; 2. Fix the syntax error problem that the program cannot be loaded after the addition / deletion instruction in the program exits editing in the online editing mode; 3. Reduce the delay time of reservation start-up, and solve the problem that the reservation start-up time fed back from the welding site is too long; 4. Fix the problem that the external mode program cannot be started after running and pausing; 5. Repair the switchable mode in the start editing state. When switching mode in the start editing state, prompt the user to exit the editing	2021.03.26

		mode first; 6. Fix the disorder of the modified program after the external mode is switched to the manual mode, modify and distribute the program according to the currently displayed program.	
V2.3.0.210122-2-003	iteration	1. According to the site requirements, the maximum number of additional safety reference points is 8; 2. Repair the problem that the belt positioner uses swing welding and the positioner returns to zero automatically; 3. Repair the problem that rexay I / O is suitable for OTC and meggitt welding machines and the continuous wire feeding speed is constant; 4.Repair the problem of wire feeding function failure in rexay I / O adaptive OTC and megmit welding machine.	2021.04.09
V2.3.0.210122-3-000	iteration	1. Optimize common welding bus timeout and other problems to reduce the probability of abnormal alarm of various buses; 2. Optimize the model parameters to solve the problem of too fast attitude change in the teaching program in manual mode [the TCP default moving speed (vtran) is reduced from 2400 to 2000, and the TCP default rotation speed (vrot) is reduced from 360 to 120]; 3.Solve the problem that the motion trajectory of linear swing welding is disordered near the critical position of angle.	2021.04.22

V2.3.0210525-1-001	iteration	1. The settings of gun cleaning station, arc striking times and welding current / wire feeding speed are cancelled in the configuration of process package system. The functions of arc detection switch, arc detection time, reference point switch, wire sticking detection switch and wire sticking detection time are added; 2. Add the function of continuous forward and continuous backward operation of the program; 3. Add the judgment function of welding pause point; 4. Repair the situation that the robot does not stop after clicking the "move to point" button for many times and releasing it; 5.Fix the disorder of program track after clicking jump of new instruction.	2021.05.26

1 Introduction

Huashu type III control system is a new control system independently developed by Huashu robot Co. Ltd.

1.1Target Group

This manual is mainly aimed at users who use Huashu industrial robots, and requires users to have basic knowledge of industrial robots.

1.2 Icon Description

	Information: provide more information for operation.
	Warning: warn about potential loss that may occur.
	Danger: inform the potential danger.

1.3 Terms

TCP: Tool Center Point

2 Upgrade Procedure of Welding Process System

2.1 Upgrade though Teaching Device

1.Copy the files for upgrade to a USB flash disk, and plug it into the teaching devic e. Enter the ES explorer, select udisk after clicking the quick navigation button in upper-l eft corner to enter the US flash disk, and then click to install the software named HSPad 3-1.6.3XXXXXX-WELD.APK in the upgrade folder “Teaching Device” (as illustrated in Fi

gure 2-1).

Figure 2-1 Install HSPad software

2.Open the HSPad software after its successful installation; enter into the interface of Process package management through finding in sequence Configuration- Teach Pendant Configuration- Process package management in the navigator, and click Install Craft package in the lower corner (as illustrated in Figure 2-2), that is when a dialog box pops up from which enter into the folder “Teaching Device”, select HS3_VX.X.X.XXXXXX_HJ.apk (as illustrated in Figure 2-3), click “Sure” and wait for completion of installation. Restarting as notified after installation is completed means successful installation of HSPad.

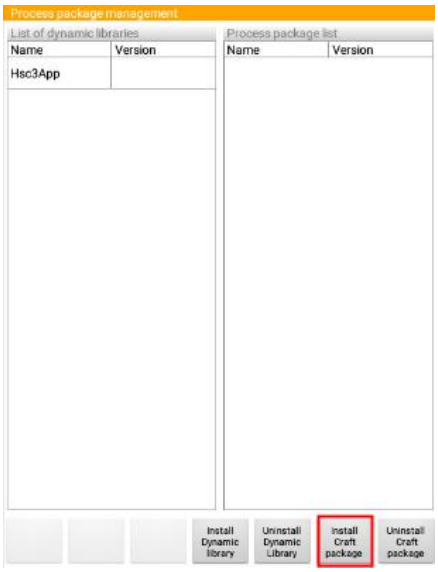
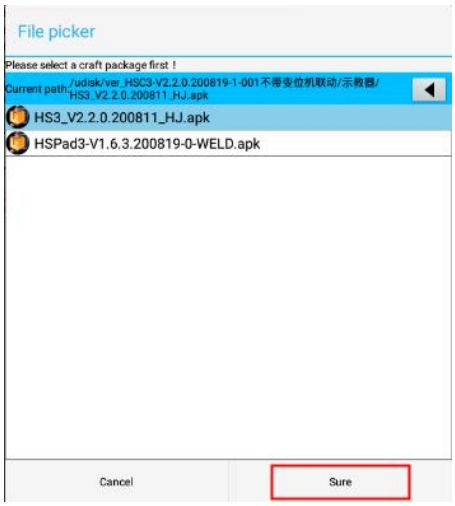
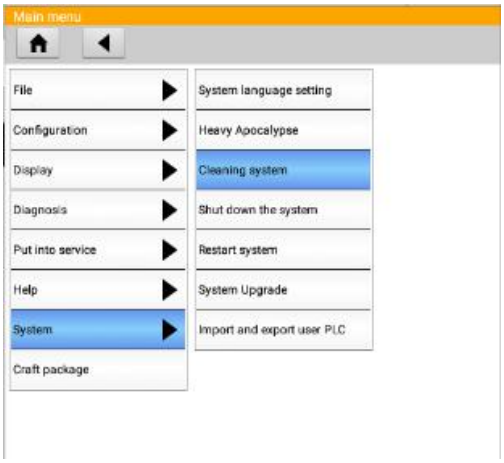


Figure 2-2 Install craft package



Figuare 2-3 Install craft package

3.On the premise of successful installation of HSPad, enter the software and click buttons in sequence “Menu”-“System”-“Cleaning system” (as illustrated in Figure 2-4), and then click Sure when a dialog box that says “Are you sure about cleaning the system?” arises. Cleaning the system will release controller’s storage space from pre-occupied junks (including remaining upgrade package files, system backup files, etc. Hence it is necessary to clean the system).



Figuare 2-4 Clean the system

4.This step shall only be executed when the system is to upgrade from the versions of 2.0.2, 2.0.3 or 2.1.0 to version 2.2.0, while step 5 shall be executed if it is the first time for the system to be upgraded or to upgrade directly from version 2.0.1 to 2.2.0.

After plugging the USB flash disk into the teaching device, find and decompress the compressed file named ver_HSC3-V2.2.0.XXXXXX under “System Folder” of the upgrade package, and then copy the file Hsc3Upgrade.tar.gz into a folder without a Chinese folder name.

After that, start HSPad app and straight-forwardly click buttons “Menu”-“System”-“System upgrade”. With the directory of USB disk displayed, select to enter the ungrade package list and send the upgrade file named Hsc3Upgrade.tar.gz (with a suffix .tar.gz) by clicking “Send update

package" (as illustrated in Figuare 2-5). After successfully sending the upgrade file, click "Sure" and restart the controller after powering off (check whether the zero point is correct or not). Then the system upgrade is completed.

Note: There shall be no file under a Chinese name in the upgrade path, or the upgrading fails.

5.This step shall only be executed when it is the first time for the system to be upgraded or to upgrade directly from version 2.0.1 to 2.2.0, and if the system is to upgrade from the versions of 2.0.2, 2.0.3 or 2.1.0 to version 2.2.0, step 4 shall be executed.

With USB flash disk plugged into the teaching device, decompress ver_HSC3-lib4plugin under folder "System" and copy the file Hsc3Upgrade.tar.gz in the decompressed folder of Hsc3Upgrade_out to anther folder without a Chinese name. Decompress the package ver_HSC3-V2.2.0.XXXXXX under "System Folder" and then copy the Hsc3Upgrade.tar.gz in it also to a folder named in language other than Chinese.

Then start HSPad, directly click buttons of "Menu"-"System"-"System upgrade". Displaying the directory of USB flash disk and select to enter the ungrade package list and send the upgrade file named Hsc3Upgrade.tar.gz (with a suffix .tar.gz) under Hsc3Upgrade_out by clicking "Send update package". After successfully sending the upgrade file, click "Sure" and restart the controller after powering off.

Repeat the procedure of clicking "Menu"-"System"-"System upgrade" after a successful restart. Displaying the directory of USB flash disk, select to enter the ungrade package list and send the file named Hsc3Upgrade.tar.gz (with a suffix .tar.gz) under folder ver_HSC3-V2.2.0.XXXXXX by clicking "Send update package" (as illustrated in Figuare 2-5). After successfully sending the upgrade file, click "Sure" and restart the controller after powering off (check whether the zero point is correct or not). Then the system upgrading is completed.

Note: There shall be no file under a Chinese name in the upgrade path, or the upgrading fails

Figure 2-5 Select upgrade file

6.If it is the first time to upgrade the system and directly to Version 2.2.0, there is no need to execute this step. If it is to upgrade from versions of 2.0.1, 2.0.2, 2.0.3 and 2.1.0 to version 2.2.0, file config under ftp://10.10.56.214/usr/codesys/hsc3_app/plugins/WeldPackage-1.0-SNAPSHOT/ of the controller shall be transferred to its parent directory, and then transfer configAUTHCODE_9 and configTOTALTIME_9 to the folder where config was copied. The concrete steps are as follows.

When executing this step, please take photos of the data of welding channel and pendulum channel interfaces in the process parameters of the craft package in case of loss of process data.

Steps of entering ftp though teaching device are as follows:

(1) Click ES file explorer from the main application interface of the teaching device and select FTP (as illustrated in Figure 2-6) under Network provided in the Fast Access.

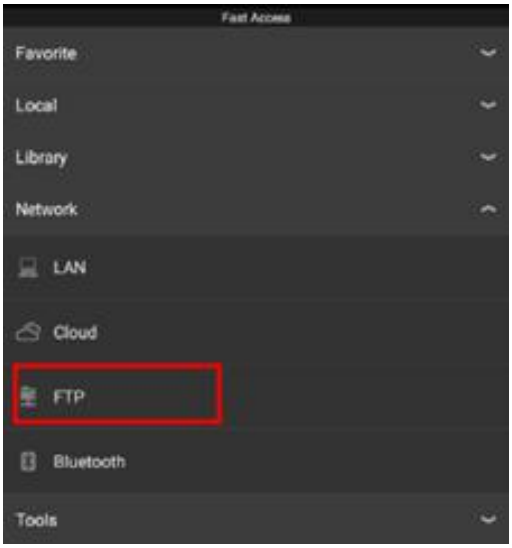


Figure 2-5 Select FTP server

(2) After entering the interface of FTP, click to establish a new FTP server where 10.10.56.214 shall be filled in following Server, root after Username and 111111 after Password, and thereafter click “OK”, as illustrated in Figure 2-7.

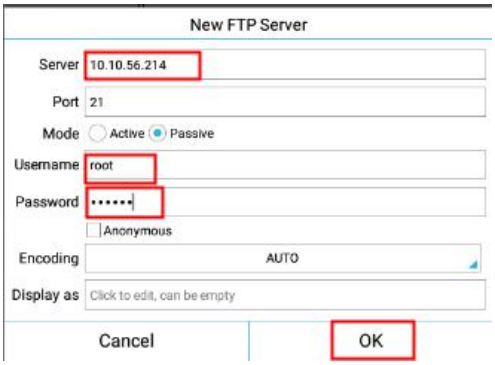


Figure 2-7 Establish a new FTP server

（3）If you upgrade from 2.0.1, 2.0.2, 2.0.3 and 2.1.0 to 2.3.0, click 10.10.56.214/usr/codesys/hsc3_ In the app / plugins / weldpackage-1.0-snapshot / directory, set config and a

uthcode_ 9、configTOTALTIME_ 9. Select the file and click the copy button (as shown in Figure 2-8). After copying, return to the upper level directory (i.e. 10.10.56.214 / usr / CoDeSys / hsc3)_ Click the paste button under app / plugins / (as shown in Figure 2-9). After copying, long press wavechannel.xml and weldchannel.xml in config and click the delete button (as shown in Figure 2-10). After deletion, restart the controller to complete the upgrade.

Note: please take photos to back up the channel data before deleting

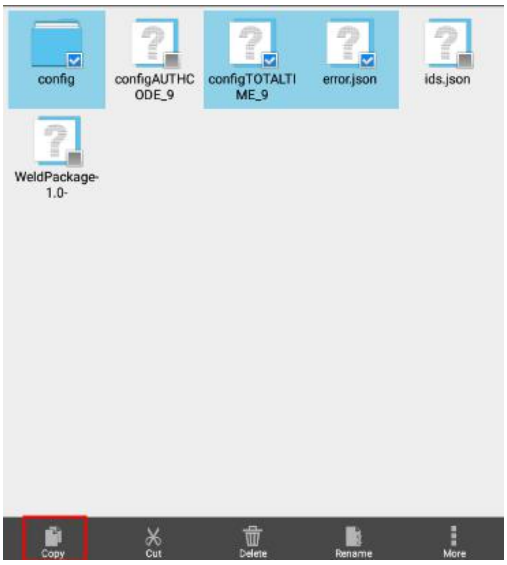


Figure 2-8 Copy the files

Figure 2-9 Paste the files

Figure 2-10 Delete the files

（4）When upgrading from version 2.2.0 to version 2.3.0, you need to delete the modfconfig.xml file in the config folder, and restart the controller after deletion (as shown in Figure 2-11).

Figure 2-11 files to be deleted when upgrading from version 2.2.0 to version 2.3.0

(5) When upgrading from version 2.3.0 to version 2.4.0, you need to delete the wavechannel.xml file in the config folder, and restart the controller after deletion (as shown in Figure 2-12).

Note: please take photos to back up the channel data before deleting.

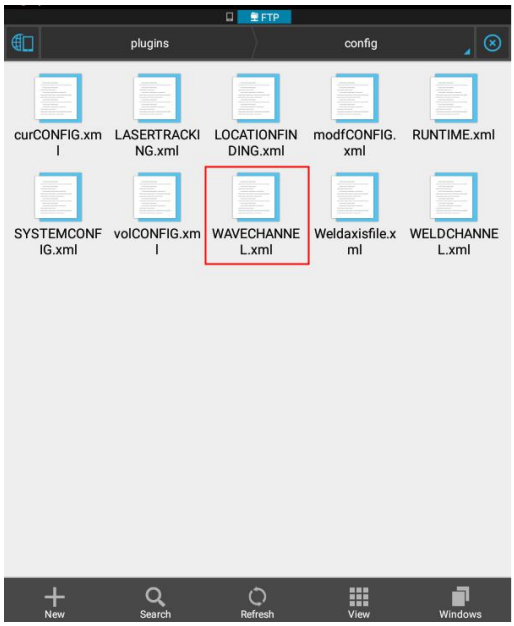


Figure 2-12 files to be deleted when upgrading from version 2.3.0 to version 2.4.0

2.2 Upgrade though CA

1.Copy the files for upgrade to a USB flash disk, and plug it into the teaching device. Enter the ES explorer, select “udisk” after clicking the quick navigation button in upper-left corner to enter into the US flash disk, and then click to install the software named HSPad3-1.6.3XXXXXX-WELD.APK in the upgrade folder Teaching Device (as illustrated in Figure 2-13)

Figure 2-13 Install HSPad

2.Start the HSPad software after its successful installation; enter into the interface of Process package management by clicking buttons following the sequence of Configuration- Teach Pendant Configuration- Process package management in the navigator, and click Install Craft package in the lower right corner (as illustrated in Figure 2-14), that is when a dialog box pops up from which enter into the folder “Teaching Device”, select HS3_VX.X.X.XXXXXX_HJ.apk (as illustrated in Figure 2-15), click Sure and wait for completion of installation. Restarting as notified after

installation is completed means successful installation of HSPad.

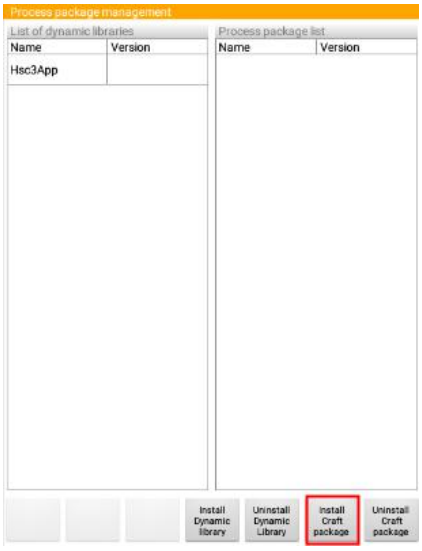


Figure 2-14 Install craft package

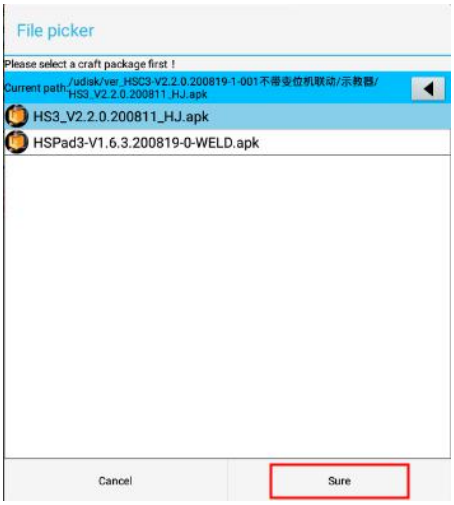


Figure 2-15 Install craft package

3.Connect the cable of the controller to the computer and start software ControlAssist ant_win.exe. Click the New button in the lower-left corner and type in 10.10.56.214 follo wing IP in the dialog box and 23234 after Port, and finally click the OK button (as illust rated in Figure 2-16).

Figure 2-16 Connect the controller

4.Select the newly established controller and click Connect (as illustrated in Figure 2-17). When the Status displays Prepared, the controller then is successfully connected.

Figure 2-17 Connect the contoller

5.After successful connection, change the terminal interface to the directory interface, type in lib.clearDisk() and press Enter to clean the system (as illustrated in Figure 2-18).

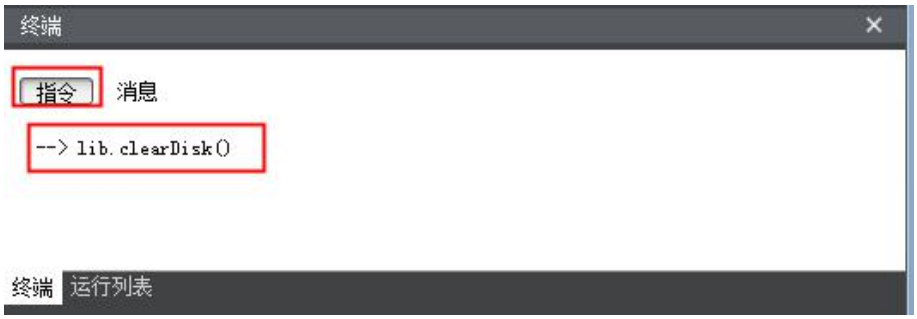


Figure 2-18 Directive of cleaning the system

6.This step shall only be executed when the system is to upgrade from the versions of 2.0.2, 2.0.3 or 2.1.0 to version 2.2.0, while step 7 shall be executed if it is the first time for the system to be upgraded and directly to 2.2.0 or to upgrade from version 2.0.1 to 2.2.0.

First, decompress the file ver_HSC3-V2.2.0.XXXXXX under “System”, the folder

containing the upgrade files. Second, right click the newly created controller in the monitoring interface of the controller and select Upgrade (as illustrated in Figure 2-19), then click the upgrade file Hsc3Upgrade.tar.gz (with the suffix of .tar.gz) (as illustrated in Figure 2-20) from the list appreared thereafter. Click the Upgrade button and wait to restart the controller after the controller has finished the remaining steps before restart. After all the aforementioned steps, the upgrade shall be completed.

Note: There shall be no file under a Chinese name in the upgrade path, or the upgrading fails

7.This step shall only be executed when it is the first time for the system to be upgraded or to upgrade directly from version 2.0.1 to 2.2.0, and if the system is to upgrade from the versions of 2.0.2, 2.0.3 or 2.1.0 to version 2.2.0, step 6 shall be executed.

First, decompress ver_HSC3-V2.2.0.XXXXXX and ver_HSC3-lib4plugin under folder “System” and copy the decompressed files to anther folder without a Chinese name.

Second, right click the newly created controller in the monitoring interface of the controller and select Upgrade from the list (as illustrated in Figure 2-19) that appears, then select the upgrade file Hsc3Upgrade.tar.gz (with the suffix of .tar.gz) under folder ver_HSC3-lib4plugin followed thereafter. Click the Upgrade button and wait to restart the controller after the controller has finished the remaining steps before restart.

When it is successfully restarted, right click again the newly created controller in the monitoring interface of the controller and select Upgrade from the list (as illustrated in Figure 2-17) that appears. There follows a dialog asking for upgrade, select the upgrade file Hsc3Upgrade.tar.gz (with the suffix of .tar.gz) (as illustrated in Figure 2-20) under folder ver_HSC3-V2.2.0.XXXXXX. Click the Upgrade button and wait to restart the controller after the controller has finished the remaining steps before restart, which allows the successful upgrade.

Note: There shall be no file under a Chinese name in the upgrade path, or the upgrading fails

Figure 2-19 Upgrade the system

Figure 2-20 Select the system upgrade file

8.There is no need to process this step if it is the first time to upgrade the system and directly to version 2.2.0. While if it is to upgrade from 2.0.1, 2.0.2, 2.0.3, 2.1.0 to 2.2.0, the file config under the directory of ftp://10.10.56.214/usr/codesys/hsc3_app/plugins/WeldPackage-1.0-SNAPSHOT/ shall be transferred to to its parent foler usr/codesys/hsc3_app/plugins, and configAUTHCODE_9 and configTOTALTIME_9 be copied into the parent folder plugins following the steps below.

When executing this step, please take photos of the data of welding channel and pendulum channel interfaces in the process parameters of the craft package in case of loss of process data.

Steps to enter ftp through computer are as follows:

（1）Enter “Computer”, input ftp://10.10.56.214 and press Enter to connect to the directory of the controller as illustrate in Figure 2-21

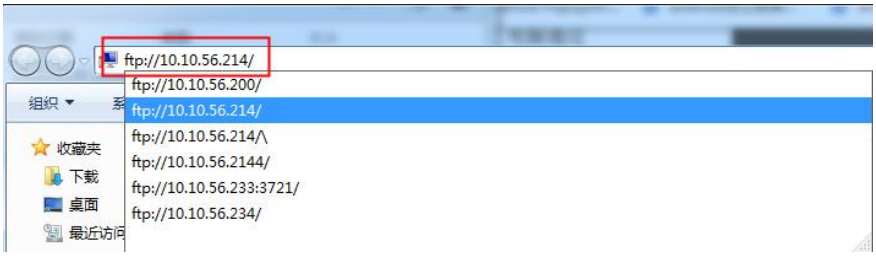


Figure 2-21 Connect FTP server

（2）Right click the mouse in the blank space and select “Login” upon entrance into the directory of the controller files after acquisition of access permission. Enter the username and password to login to the directory of the controller, as displayed in Figure 2-22 below.

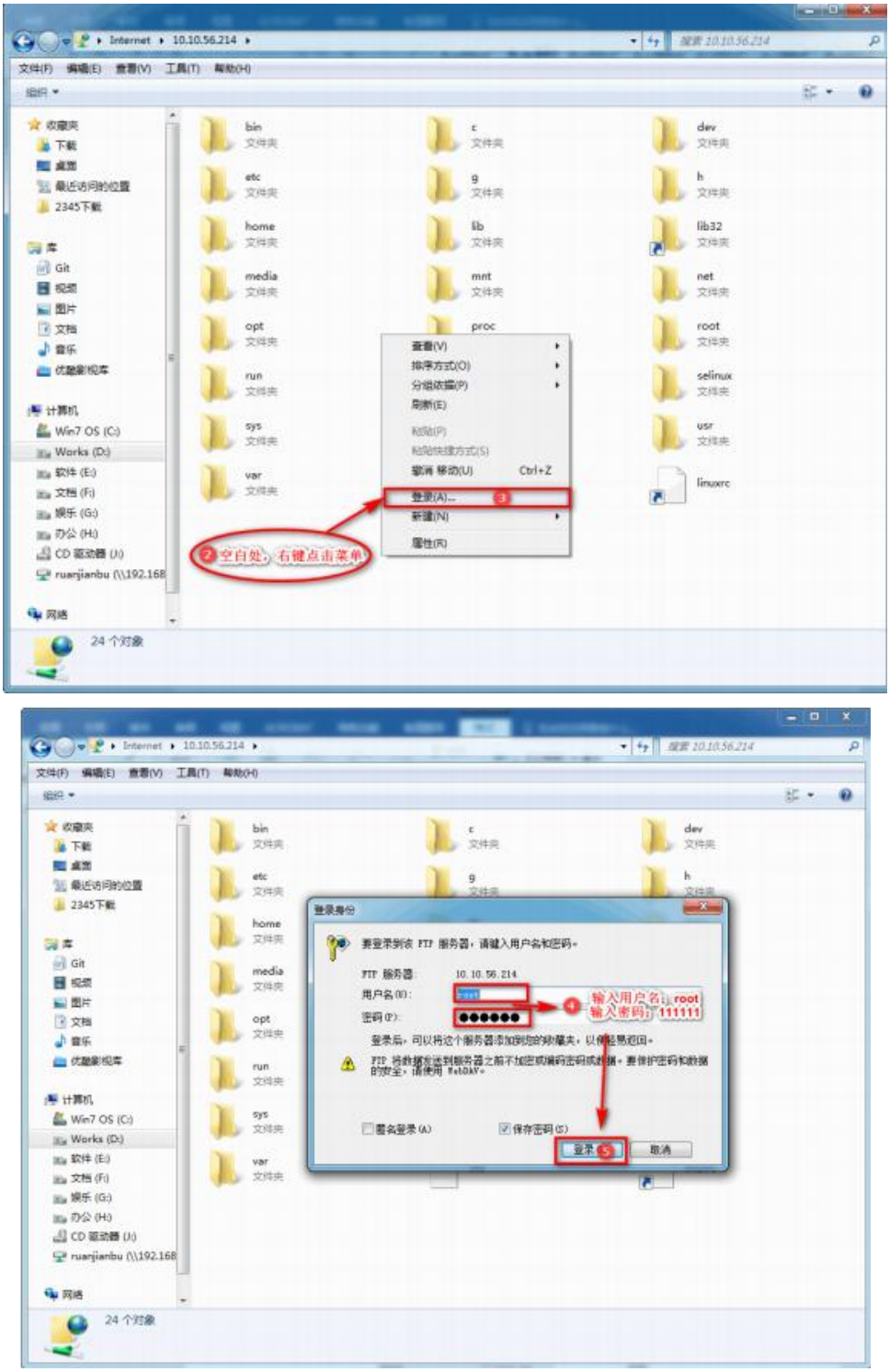


Figure 2-22 Login to FTP server

（3）Copy the file config under ftp://10.10.56.214/usr/codesys/hsc3_app/plugins/WeldPackage-1.0-SNAPSHOT/ to its parent folder (i.e. 10.10.56.214/usr/codesys/hsc3_app/plugins/), and then copy the files configAUTHCODE_9 and configTOTALTIME_9 (as illustrated in Figure 2-23) to the plugins, their parent foler. Restart the controller after deleting WAVECHANNE.xml and WELDCHANNEL.xml (as illustrated in Figure 2-24) under config, after which the controller shall be upgraded.

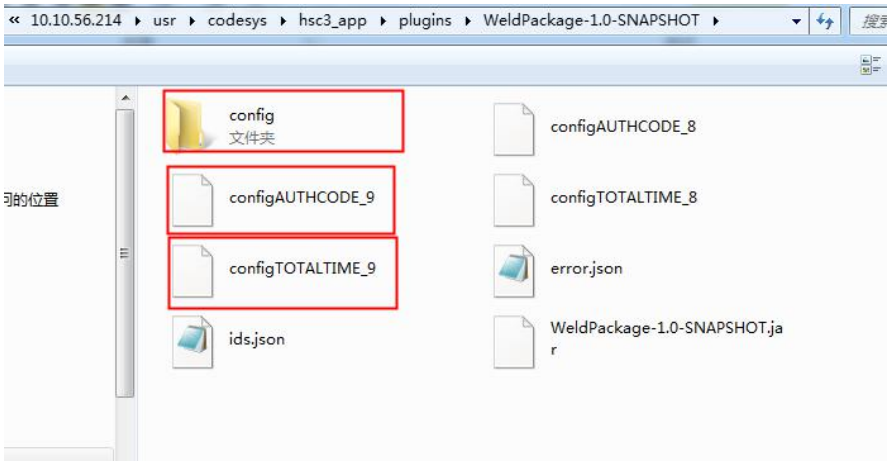


Figure 2-23 Copy the files

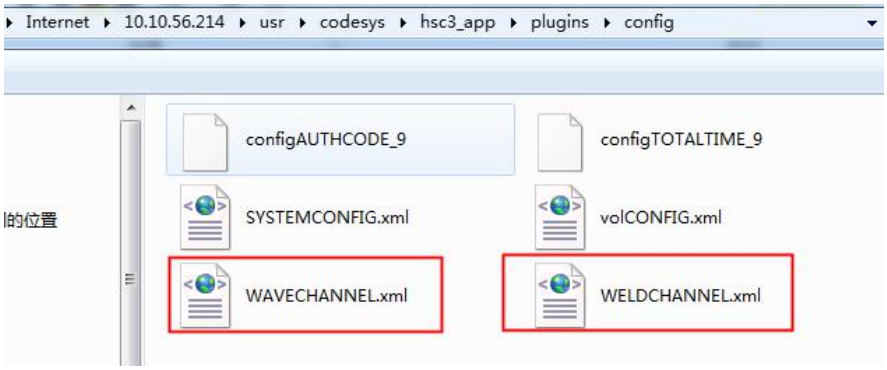


Figure 2-24 Delete the files

（4）When upgrading from version 2.2.0 to version 2.3.0, you need to delete the modfconfig.xml file in the config folder, and restart the controller after deletion (as shown in Figure 2-25).

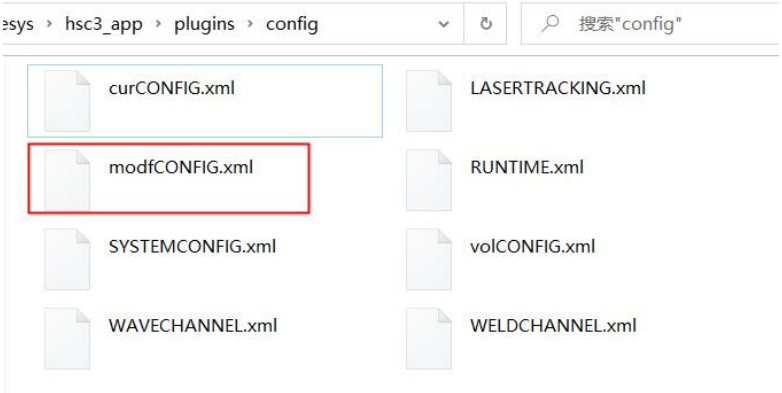


Figure 2-25 files to be deleted when upgrading from version 2.2.0 to version 2.3.0

（5）When upgrading from version 2.3.0 to version 2.4.0, you need to delete the wavechannel.xml file in the config folder, and restart the controller after deletion (as shown in Figure 2-26).

Note: please take photos to back up the channel data before deleting.

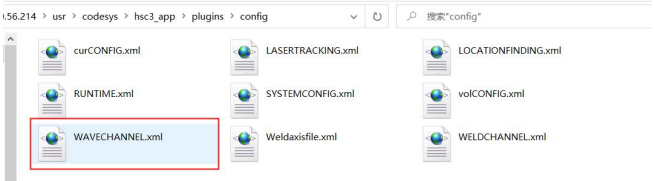


Figure 2-26 files to be deleted when upgrading from version 2.3.0 to version 2.4.0

3 Huashu Type III Control Syste Introduction

Huashu Ⅲ industrial robot control system is a control system independently developed by Huashu Robot Co., Ltd., which has the characteristics of high speed and high precision. Its programming language is simple and easy to understand. Through Huashu Ⅲ teach pendant, fast programming can be realized in real time. Regulation to meet most industrial needs.

3.1 System composition

The composition of Huashu industrial robot system mainly includes the following four parts:

- Mechanical arm
- Connect the cables
- Electronic control system
- HSpad Teach Pendant

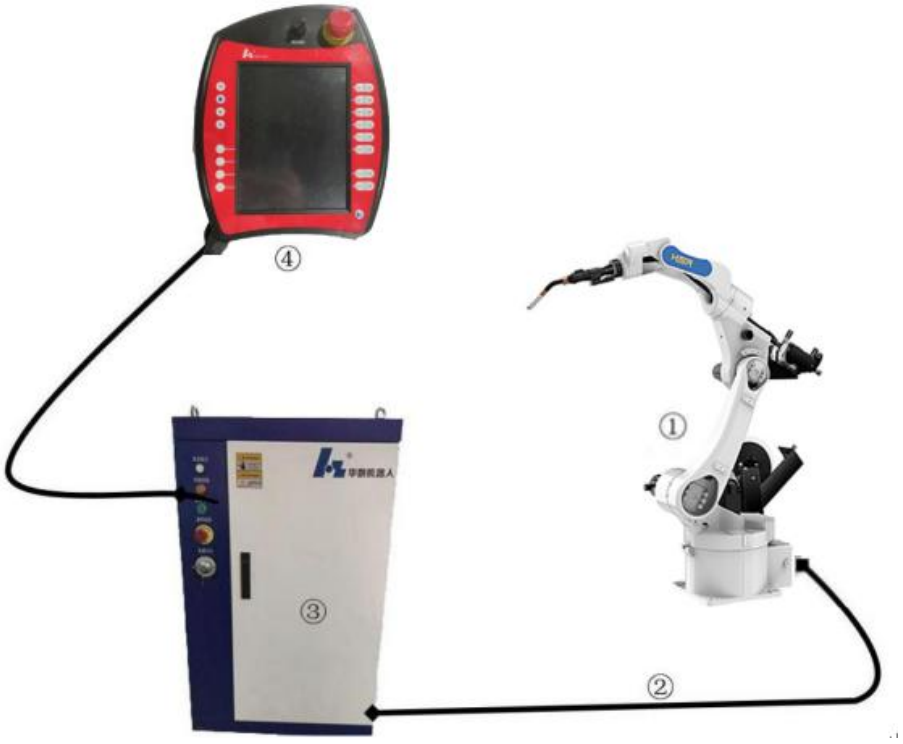


Figure3-1 HSpad and Huashu robot connection diagram

3.2 Huashu Type Ⅲ Teaching Software

The teaching software of Huashu III control system mainly includes

- Huashu Robot Teachware HSC3-HSpad

4 Safe

4.1 Cautions

1. Huashu robot users must operate the robot while ensuring their own safety.
2. Make sure the robot is stable and the base is stable.
3. The user of Huashu Robot must operate the robot according to the compliant operation, and illegal operation is strictly prohibited.
4. Before using Huashu Robot, make sure the surrounding environment will not affect the robot.
5. Huashu Robot Co., Ltd. is not responsible for the safety of robot use.
6. Huashu Robot Co., Ltd. reminds users that when using Huashu industrial robots, they must use safety equipment and must abide by the safety provisions.
7. Huashu Robot can move a great distance at a high speed.
8. Never turn your back to the robot.

	When there's a power failure of Huashu robots, please recharge it after a complete discharge.

4.2 Where robots cannot be used

1. Burning conditions
2. Explosive conditions
3. Radio inference conditions
4. In water or other liquids
5. In delivery of a person or animal
6. Clinging

7. Other non-applicable conditions

4.3 Safety Operation Instructions

4.3.1 Teaching and Manual Control Robot

1. Jog Huashu robot at a lower speed ratio.
2. Take the motion tendency into consideration before pressing the operation button.
3. Verify the motion trail in advance for Huashu robots, and make sure this trail will not be interfered.
4. Keep the surrounding areas of Huashu robots clean, and of no oil, water or other impurities.

4.3.2 Production Motion

1. Must know all the tasks the robot will perform according to the program before operation.
2. Must know the position and status of all switches, sensors and control signals that may affect robot's motion.
3. Must know the position of "Emergency Stop" button in the robot controller and peripheral control equipment and prepare to use in emergency.
4. Never regard the no-motion of robot as the completion of program, because in this condition, the robot can be waiting for new input signal to move.

5 Hua Shu type III teaching device

5.1 Front

Figure 5-1 Hpad front

Item Number	Explanation
1	Used to turn up key switch to connect the controller. The status can be switched only with the key in. Switch run mode by connecting the controller.
2	Emergency Stop. Stop the robot in an emergency.
3	Jog button. Used to move the robot manually.
4	Buttons to set the regulating variable of the program. To regulate automatic operation ratio.
5	Buttons to set the manual regulating variable. To regulate manual operation speed.
6	Menu. Switch between menu and the file navigator.
7	Pause. Pause the running program.

8	Stop. Stop the running program.
9	Reserve.
10	Start. Press to start operation after program has been loaded successfully.
11	Modifier.

5.2 Back

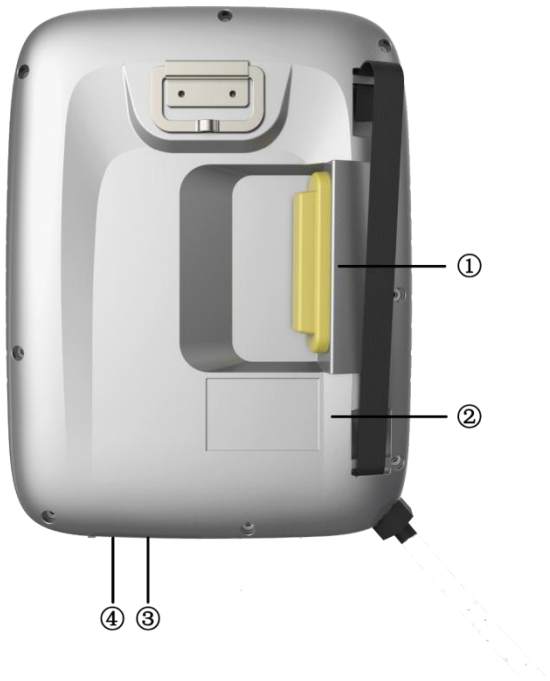


Figure 5-2 Hpad back

Item Number	Explanation
1	Debugging interface.
2	Three-stage safety switch. 3 positions of safety switch: ①Up ②Middle ③Below

	Make sure the switch is in middle position in manual mode T1 or manual mode T2, so that the robot can move. The safety switch won't work in the automatic run mode.
3	Slot for Hpad-201 touch screen handwriting pen.
4	USB Flash drive interface. This interface is used for archive or recover, etc.
5	Thermo-vent.
6	Position for Hpad-201 mode label sticker.

5.3 Hpad Operation Interface

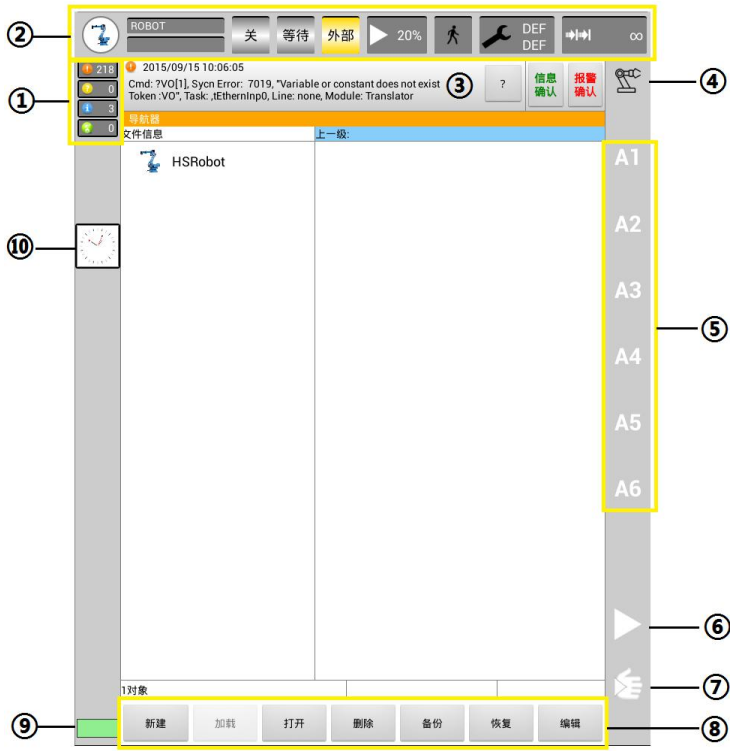


Figure5-3 Hpad-201 operation interface

Item Number	Explanation
1	Message counter. Message counter displays types and amounts of messages waiting to be processed. Touch message counter to display the detail.

2	Status bar.
3	Message window. By default, only the latest message will be displayed. Touch the message window to display message list. The message list displays all the messages waiting for processing. Press Confirm to confirm message. Confirm confirms all messages excluding error message. Alarm confirms all error messages. "?" displays details about current message.
4	Frame state. Touch this icon to display all frames and select.
5	Jog indication. Select shaft-related operation and shaft numbers (A1, A2, etc.) will be displayed here. Select the Cartesian operation and the direction of frame (X, Y, Z, A, B, C) will be displayed here. Touch to display the window for motion system group selection. Select the group and the corresponding name in the group will be displayed.
6	Auto ratio trimming icon.
7	Manual ratio trimming icon.
8	Operation menu bar. Relevant operations for program files.
9	Network State. Color red suggests link error, so please check the network. Color yellow suggests successful link but uncompleted controller initialization, so the robot can't be controlled to move. Color green suggests successful network initialization and Hpad-201 is properly connected to the controller. The robot can be controlled to move.

10	Clock. Displays the time. Touch the Clock, and the system time and the current system uptime will be displayed in digital form.

5.3.1 Status Bar

The status bar displays the set status of industrial robot. In most cases, touching the icon will open a window and you can modify the settings there.

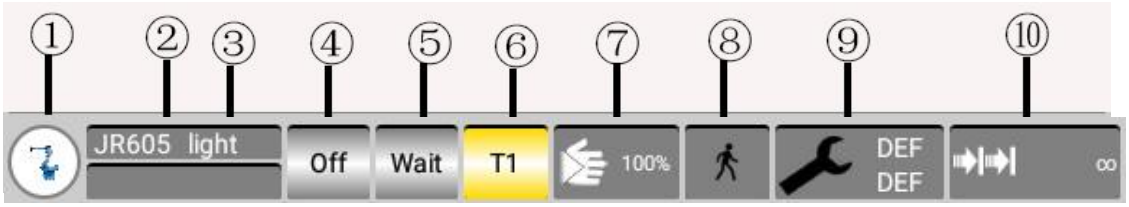


Figure 5-4 Hpad-201 status bar

Item Number	Explanation
1	Menu. Same function as the Menu button.
2	Robot Name. Displays the name of the current robot.
3	Loading Program Name. Display name of the current loading program after loading.
4	Enable state. "Open" in green suggests the enable is opened. "Close" in red suggests the enable is closed. Touch to open the enable settings window, touch Open/Stop to set the enable state in automatic mode. The Window displays the status of safety switch.
5	Program Running Status. Display the running status of current program in automatic operation.
6	Display Run Mode.

	Mode can be set as manual mode, automatic mode, or external mode by key switch.
7	Display Ratio Trimming. Display the ratio trimming value of current mode when there's a mode change. Touch to open the Settings window, can trim with the plus/minus icon by 1% per unit, or drag the slider to trim.
8	Display Program Run Method State. In automatic run mode, only continuous running is available. In manual mode T1 or manual mode T2, single-step running and continuous running are available. Touch to open the Settings window, and then select continuous/single-step running method in manual mode T1 or manual mode T2.
9	Display Activation of Base Frame/Tools. Touch to open the window, and then select the proper tool and base frame and set them correspondingly.
10	Incremental Mode. Touch to open window in manual mode T1 or manual mode T2, and choose the proper incremental mode.

5.3.2 Call the Main Menu

Steps Click Main Menu icon or press Main Menu button to open the Main Menu window.

Re-click to close Main Menu.

Instructions Properties of Main Menu Window:

- Main menu is displayed in the left column.
- Click one menu item to display its sub-menus (for example:Configuration).
- The main menu column may be hidden when there are many sub-menus

and the latest tertiary menu will be displayed.

- Click Home in the upper left to close all sub-menus and display main menu only.
- The lower area displays the last selected menu item (up to 6), which serves as a shortcut menu. So these menus can be slected directly without closing the sub-menus in advance.
- Click the red cross in the left to close the window.

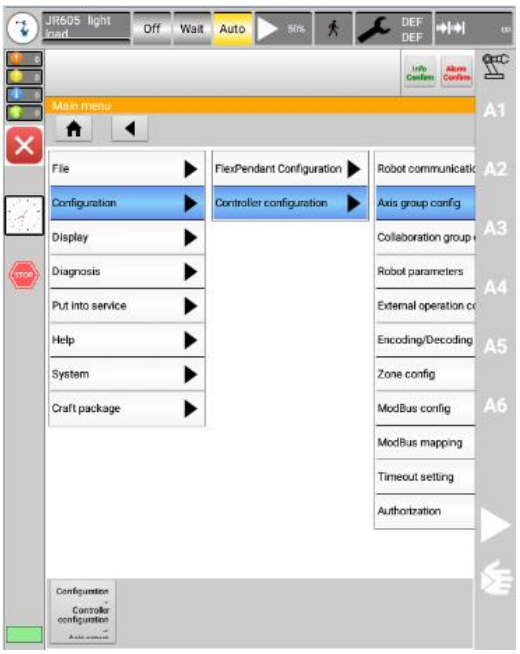


Figure 5-5 Hpad-201 Main Menu

6 Settings page

6.1 Communication connection

Description Establishes a communication connection with the controller.

Steps:

1. Select "User Group" in the "Configuration-Teach Pendant Configuration" menu and log in to the "super" user (switch to super user and above permissions)

2. In the menu bar "Configuration-Controller Configuration", select "Robot Communication Configuration" in the submenu

3. After entering the IP and port corresponding to the controller, "Save" operation

4. Re-enlightenment device (click "System-Re-enlightenment device" in the menu bar or

slide the app to close it and open the "HSC3-HSpad" app manually

Figure 6-1 Robot communication configuration

6.2 Rights Management

Explanation In the 1.6 version, there are 4 user groups, which are Normal, Super, Debug, and Final. The specific user permissions are as follows. This page is not allowed to use this function, "√" is editable / usable). In the HSpad system software, different users have different permissions.

There are the following user groups:

- **Normal user:**
  Operator user group, which is the default user group.
- **Super users:**
  Super privilege user group, this user group has more access to system functions than the default ordinary user. This user is protected by a password.
- **Debug user:**
  Debugger user group, this user group has the right to use most of the system functions of the HSpad system. This user is protected by a password.
- **Final users:**
  The final authority user group, this user has all the use rights of the Hspad system.

[Remark] The default password is "hspad".

The default user group will be selected on new startup.

A menu	Secondary	Three-level	user group

	menu	menu	Normal	Super	Debug	Final
File management	Backup restore settings	——	You can only choose to set it as the root directory / default path of the u disk, you cannot edit the custom path	√	√	√
	Lock password settings	——			√	√
	Get register file	——	View	√	√	√
	Log file management	——	View	√	√	√
File operations	New	——		√	√	√
	load	——	√	√	√	√
	turn on	——	√	√	√	√
	save	——		√	√	√
	delete	——		√	√	√
	Backup	——		√	√	√
	restore	——		√	√	√
	Multiple choice	——		√	√	√
	Rename	——		√	√	√
	locking	——			√	√
	Turn on / off instructions	——	√	√	√	√

	On / off state	——	√	√	√	√
	Release wait	——	√	√	√	√
	optimization	——	√	√	√	√
Configuration	Teach Pendant Configuration	user group	√	√	√	√
		Alternate button configuration	View	√	√	√
		Process package management	View	√	√	√
	Controller configuration	Robot communication configuration	View	√	√	√
		Axis group configuration	View	View	View	√
		Robot parameters	View	View	View	√
		External operation configuration	View	View	√	√
		Encoding / decoding configuration	View	View	√	√
		Zone configurati	View		√	√

		on				
		Modbus configuration		√	√	√
		Modbus mapping		√	√	√
		Timeout setting	√	√	√	√
		Authorization	View	√	√	√
display	Input / output	Digital input / output	View	√	√	√
		Analog input / output	√	√	√	√
	Actual location	——	√	√	√	√
	Variable list	——	View	√	√	√
	Modbus display	——		√	√	√
diagnosis	Run log	display		√	√	√
		Configuration			√	√
put into service	measuring	User tool calibration	View	√	√	√
		User workpiece calibration	View	√	√	√
	Adjustment	calibration	View	View	√	√
	Software limit switch	——	View	View	√	√
	Current limit switch	——	View	View	√	√

help	information	——			√	√
system	Alarm language	——			√	√
	Heavy Apocalypse	——			√	√
	Cleaning system	——			√	√
	Shut down the system	——			√	√
	Restart system	——			√	√
	System Upgrade	——	View	View	√	√
	Import and export user plc	——	√	√	√	√
Interface buttons	Start / pause button	——	√	√	√	√
	Mode switch	——		√	√	√
	Tool workpiece switching	——		√	√	√
	Program single step / continuous	——		√	√	√
	Manual continuous / step	——		√	√	√
	Modify	——		√	√	√
	Manual coordinate system	——		√	√	√

	Back button	——	√	√	√	√
Craft package	——	——		√	√	√

Steps

1. Select "Configuration → Teach Pendant Configuration → User Group" in the main menu. The current user group will be displayed.

2. If you want to switch to the default user group, click Standard. (If you are already in the default user group, you cannot use the standard.) To switch to another user group: Select the desired user group. Press log in.

3. Super user, Debug user and Super user need to enter the password to log in, and enter the password to log in to confirm.

4. Change password: If you need to change the password of a user, select the user and press the "Password .." button.

5. After entering the original password and the new password in the password modification interface, click the ok button to complete the password modification.

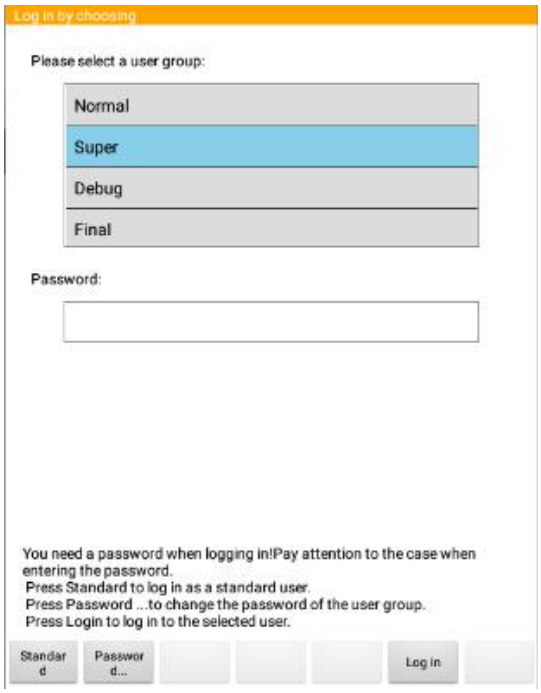


Figure 6-2 User login interface

6.3 Backup button

	The auxiliary keys can only be used in manual T1, T2, and automatic modes, and cannot be used in external mode.The permissions are set to Super and above.

Explain The teach pendant provides 4 auxiliary keys on the left for user-defined key operations.After the output command.

There are 3 types of configuration, io type, craft package, no configuration

io type: Shortcut key for operating the output io value (after pressing, the io value is inverted according to the current state)

Craft package: Open the craft package interface shortcut key

No configuration: disable the spare button function

Steps

1. Under Super permission, select Configuration → Teach Pendant Configuration → Spare Button Settings option to enter the spare button configuration interface.
2. Select the serial number and click the "Modify" button.
3. Click to select the "Feature Type" drop-down box option (eg: select io type).
4. Enter the io index number in the "do index" input box.
5. Select "on / off" in the drop-down box.
6. Click the "OK" button to complete the configuration.

Figure 6-3 Backup button configuration

	io type: Press the corresponding configuration auxiliary button to set the io value to on or off. Technology package: If the teaching software has a technology package installed, press the corresponding configuration assist button to quickly open the technology package interface (shortcut to open the technology package)

6.4 Axis group configuration

	The axis group configuration must not be set by non-debuggers. Make sure that the models match during configuration. After the setting is complete, check whether the zero point and limit are correct. Set the permission to Final. (Do not operate at will, you need to backup system parameters first) Load classification: light load, medium load, full load

Explain the use of axis group configuration, model switching, and load settings

Steps

1. Under Final authority, select menu bar → configuration → controller configuration → axis group configuration to enter the axis group configuration interface.
2. Click the "Edit" button.
3. Select the "Model" drop-down box option and select the robot model.
4. Click the "Confirm" button. (Note: When switching models, the load will also switch at the same time, and the load will be switched by the load option below)
5. Click the "Modify" button. (You can switch the load for the robot separately, the speed of the robot is different for different loads)
6. Select the "Load" drop-down box option and select the load level;
7. Click the "OK" button
8. Restart the system to complete the setup.

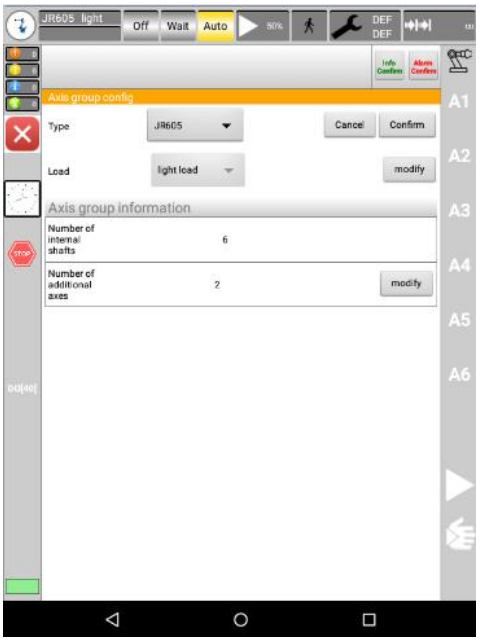


Figure 6-4 Axis group configuration

	Note: When changing the load level, there is no need to switch models again, only steps 1, 6 ~ 8 can be used. The function of setting the number of additional axes is reserved.

6.5 Robot parameters

Explanation Robot parameters are used to view the system parameters in detail

Steps:

1. Select "menu bar → configuration → controller configuration → robot parameters" to enter the robot parameter interface.
2. Click the option drop-down box option to display the details of the selected axis parameter.

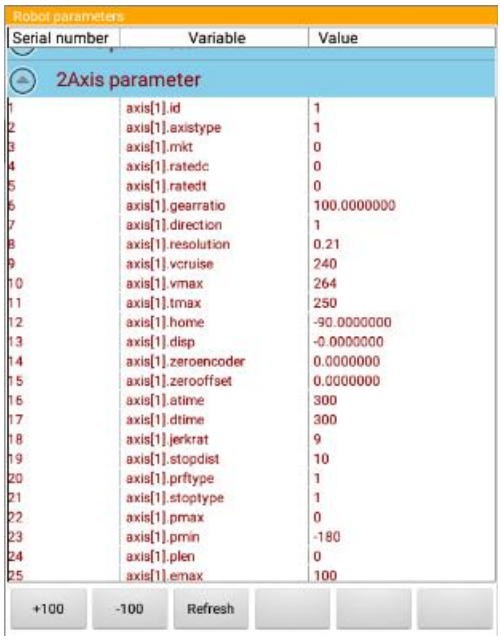


Figure 6-5 Robot parameters

6.6 Encoding / Decoding Configuration

Description

The encoding function is to map the R register to the output of the IO. The IO sequence is set according to the value of R. This process is binary encoding. The corresponding IO sequence value is encoded by the value of R, such as DO [1] -DO [4] and R [1] association, where R [1] = 3 (binary 0011b), then DO [1] = 1, DO [2] = 1, and the remaining DOs are all 0; the decoding function is to map the input of IO to R Register, external input corresponding signal, the controller will decode this signal to R register,

for example, DI [1] -DI [4] is mapped to R [2], external input DI [2] = 1, corresponding 2) = 2 (binary 0010b).

Steps

1. Select Configuration → Controller Configuration → Encoding / Decoding Configuration button in the main menu.
2. Click to select encoding settings or decoding settings
3. Click the "Add" button to enter the setting interface
4. After the setting is completed, click the "OK" button to complete the setting.

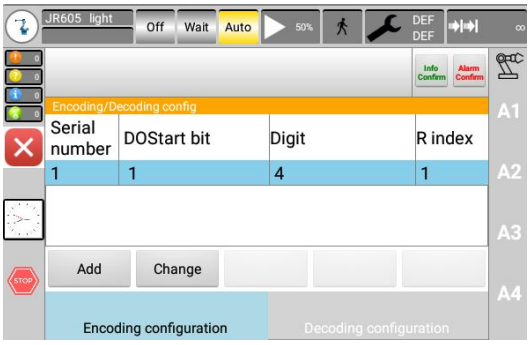


Figure 65-6 Encoding / decoding configuration

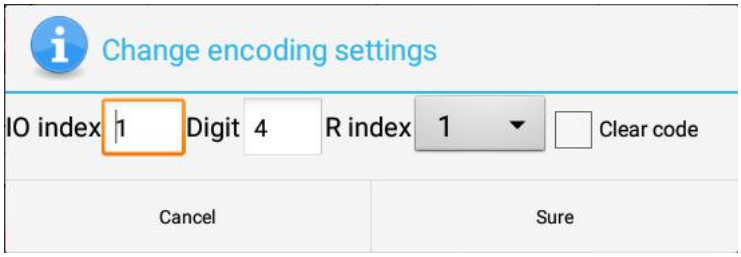


Figure 6-7 Encoding / decoding change configuration

	Example: The code r [0] = 42, which is associated with do [0 ~ 6], the decimal 42 to binary is 01010100, and the corresponding value of do [0 ~ 6] is also 010101. If the output above do [6] is associated Signals, such as do [7 ~ 10] are also 0 Decoding is the opposite.Convert the associated binary di signal to decimal to get a value to the specified r register.For example, di [0 ~ 6] = 010101 is associated, r [1] is bound, and after decoding, r [1] = 42

6.7 Zero Calibration

Description The axis zero point must be calibrated before the robot runs.

The robot can only perform Cartesian movement after zero-point calibration, and the robot must be moved to a safe position. The robot's mechanical position and encoder position will be coordinated during the zero-point

calibration process. To this end, the robot must be placed in a defined Mechanical position, which is the zero calibration position. Then, the encoder return value of each axis is stored. The calibration positions of all robots are similar, but not exactly the same. The exact position will also be between different robots of the same robot model. Different.

The calibration function is updated to internal and external axis calibration and absolute zero point saving. The difference between the two calibration methods is that after the zero point is calibrated by internal and external axis calibration, a non-zero position is accidentally calibrated to zero when debugging (the zero position is When the calibration position is calculated after calculation of the compensation amount by the bolt and professional equipment), it needs to re-zero calibration; while saving the zero by absolute zero does not need to re-zero calibration, just click to restore the zero.

	The robot must be calibrated before it is put into operation, otherwise it cannot run normally

The robot must be calibrated in the following situations

Happening	Note
When the robot is in operation	Must be calibrated, otherwise it will not work
After the robot sends a collision, the encoder value is lost	Must be calibrated, otherwise it will not work
When replacing the motor or encoder	Must be calibrated, otherwise it will not work

[Remarks] Zero calibration operation requires Final user authority

Internal axis calibration procedure

Steps

1. Click "Menu → Startup → Adjustment → Calibration".
2. Move the robot to the mechanical origin.
3. After each axis moves to the mechanical origin, click each option in the list to pop up the input box, enter the correct data and click OK.
4. After inputting the data of each axis, click to save the calibration data, save the data, and take effect immediately.The success of the save can be verified by the current actual

position data.

External axis calibration procedure

1. Click "Menu → Startup → Adjustment → Calibration".

2.Move the robot's external axis to the mechanical origin.

3. Click the [Add Additional Axis] button.

4.After the external axis moves to the mechanical origin, click each option in the list, and the input box pops up.Enter the correct data and click OK.

5.After inputting the data of each axis, click the [Save] button to save the data and take effect immediately. The success of the save can be verified by the current position data.

	If the calibration is unsuccessful, please check whether the network connection is successful; It can also support single-axis calibration (after calibration, the current actual position will become the set calibration value, which is generally a fixed position and fixed calibration value)

Operation steps for saving absolute zero point

1. Click "Menu → Startup → Adjustment → Calibration".

2.Move the robot to the mechanical origin.

3.After each axis moves to the mechanical origin, click each option in the list to pop up the input box, enter the correct data and click OK.

4.After inputting the data of each axis, click the [Calibration] button to save the data and take effect immediately. The success of the save can be verified by the current position data and encoder value data.

Restore zero point save operation steps

1. Click "Menu → Startup → Adjustment → Calibration"

2.Click each option in the list, and the input box will pop up.Enter the correct data (the same data as the calibration) and click OK.

3.After inputting the data of each axis, click the [Resume] button to take effect immediately. Whether the restoration is successful can pass the motion zero check.

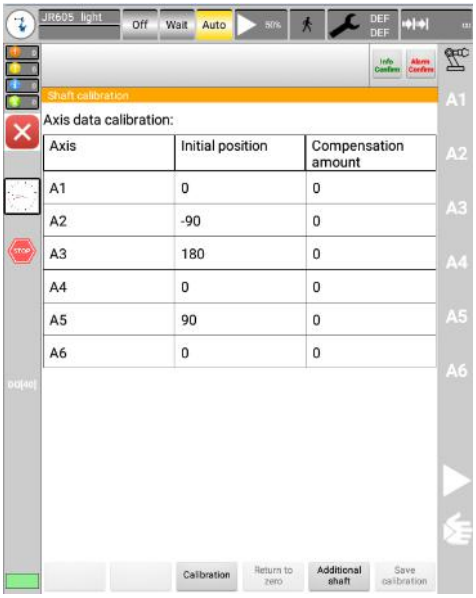


Figure 6-8 Zero calibration

	Note: 1.The mechanical zero position of different models is not exactly the same, and the calibration value is not the same.You can consult the relevant technical personnel, and the calibration is also performed at the non-zero position.The calibration value is also different. 2.After zero point calibration is completed, the system needs to be restarted to prevent zero point loss caused by system upgrade without restarting after calibration.

6.8 Soft limit

Explain By setting the soft limit switch, you can limit the axis range of all robots and positioning axes.

The software limit switch is used for robot protection.After setting,it can ensure that the robot runs within the setting range.

The software limit switch is set when the industrial robot is running. According to the field environment, the corresponding limit settings are set for each axis in turn, and the unit of the axis data is radian.

Note: When setting the limit information, the value of the negative limit must be smaller than the value of the positive limit.

	The limit switch must be enabled for the robot to be put into operation and the corresponding axis data must be set, otherwise loss may be caused. The limit is based on the movement range derived from the calibration zero of the robot, and the calibrated zero is a precondition.

[Note] Final user rights are required to set the limit

Steps

1. Click the menu option, and then click "Commissioning → Soft Limit Switch"

2. Select an axis, edit the limit data in the table, and click Limit Enable [On / Off] to enable or disable the limit.

3. After setting the software limit information for all axes, click the [Save] button, and the setting will take effect immediately.

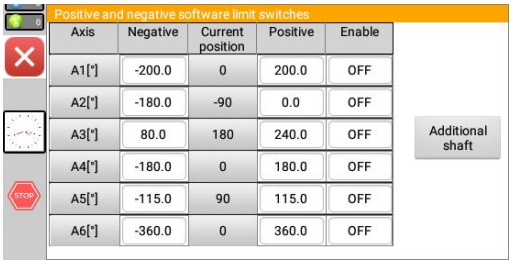


Figure 6-9 Soft limit setting

6.9 Current limit

Explain Note By setting the current limit switch, the current range of each axis can be limited in amps.When an axis reaches or exceeds the set current limit value, it will alarm and stop for protection.

Steps

1. Click the menu bar option, and then click "Startup → Current Limit Switch" to enter the current limit setting interface.

2. Select an axis, edit the limit data in the table, and click Limit Enable [On / Off] to enable or disable the limit.

3. After setting the software limit information for all axes, click the [Save] button, and the setting will take effect immediately.

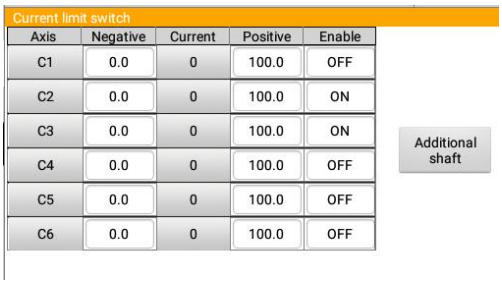


Figure 6-10 Current limit setting

6.10 Zone Configuration

Explain The type of description area includes, interference zone, security zone, shared zone, and invalid zone.

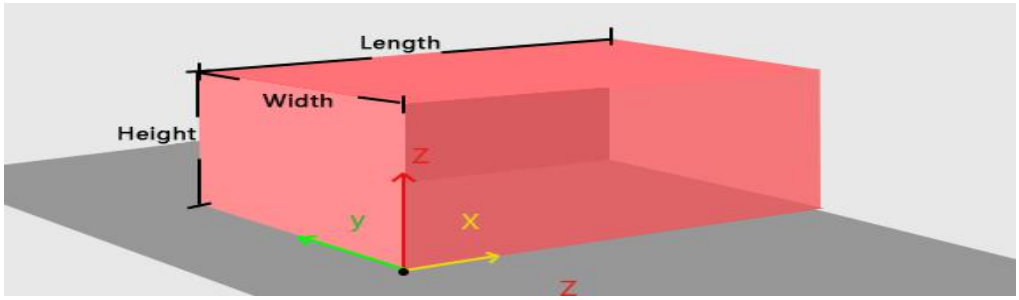
[Area configuration contains the following parameters]

Area refers to a spatial range and has the following characteristics:

(1) Origin. A reference point of the area relative to a user coordinate system.

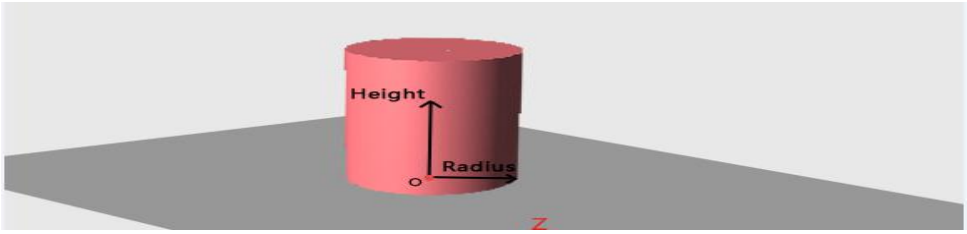
(2) Shape: The area is usually a solid based on the origin, and its shape can be box-shaped and column-shaped.

A. Box, with length, width, and height.



Box shape

B. Cylinder, with bottom radius and height.



Cylindrical

(3) Extension value (Offset), the allowable error when judging inside / outside of the area. (The current system version cannot accurately stop at the edge of the extension value, and the stopping distance varies according to the movement position and speed)

	Note: The expansion value can also be understood as the area wall thickness, the safety zone is equivalent to increasing the wall thickness inward, and the interference / shared area is equivalent to increasing outward. In practical applications, the expansion value should be larger than the theoretical value, increasing safety

(4) Each area is equipped with an external output signal (digital signal, see the external operation configuration for the area signal configuration), which is used to indicate whether the position of the robot is inside / outside of the area, and whether the external output signal can be reversed.

After the zone parameter is configured successfully, the external output signal will have corresponding output according to the signal inversion, regardless of the zone type.

Signal inversion = true (open state), output outside the zone = ON, and vice versa within the zone;

Signal inversion = false (closed state), enter the area, the area output = ON, and vice versa outside the area;

(5) The processing mode can be processed according to the relationship between the robot position and the area (inside / outside) (different types of areas have specific definitions). The processing modes include:

A. Ignore.

B. Error Stop.

C. Warning Stop.

(6) Workpiece selection, which can be selected according to the workpiece calibration to determine the xyz direction of the area

Block area: refers to the area where the robot cannot enter or stay.

Features: It is normal for the robot to be outside the area, and it will alarm and stop when it is in the area

Features: In manual mode (jog, jog, space motion) / auto mode (t1, t2, auto, external), the system reports an error and stops in the area. If the robot alarms in the area, the area type needs to be switched to the invalid area. Then move the robot outside the area before the robot can perform subsequent movements.

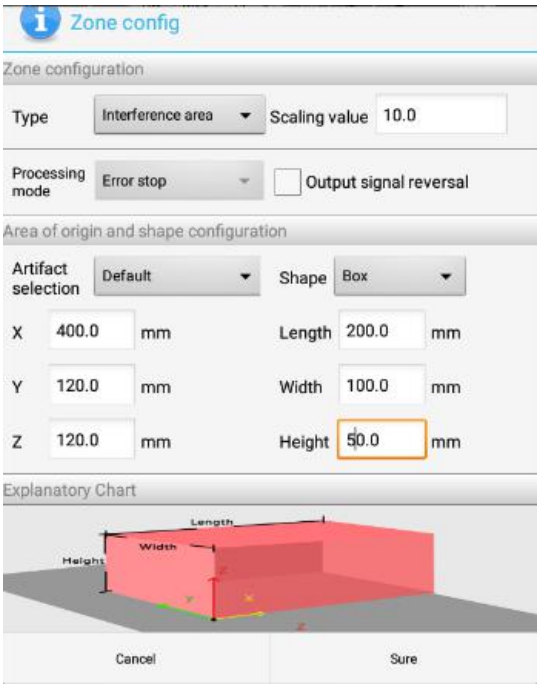


Figure 6-11 Zone configuration settings-1

Work Area: The area where the robot is not allowed to leave

Features: In manual mode (jog, inching, space motion) / automatic mode (t1, t2, auto,

external), it is normal for the robot to be in the area, and it will report an error and stop when the robot is outside the area. Switch the area type to the invalid area, and then move the robot into the area before the robot can perform subsequent movements.

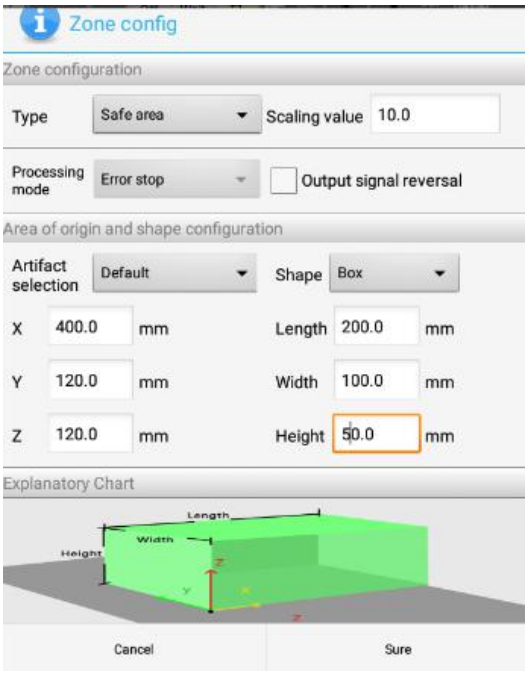


Figure 6-11 Zone configuration settings-2

Share Area: It refers to the area that can control whether it has the characteristics of the interference area, and can choose to enter the processing mode of this area.

Each shared area is configured with an external input signal (digital signal) to enable the shared area.

a. In the enabled state, it is normal for the robot position to be outside the area; when entering the area, it responds according to the configured processing mode.

b. In the non-enabled state, the shared area has no effect.

Features: In manual mode (jog, inching, space motion) / auto mode (t1, t2, auto, external), it is normal for the robot to be outside the area, and it will report an error and stop in the area. If the robot reports an alarm in the area, The area type is switched to the invalid area or the non-processing mode is selected, and the robot is moved outside the area before the robot can perform subsequent movements.

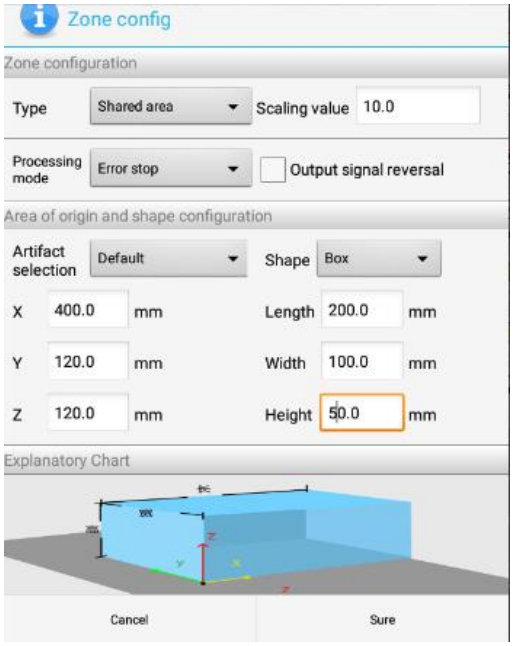


Figure 5-11 Zone configuration settings -3

Invalid area: It refers to the area where the current setting is invalid.Only the output signal detection is performed on the area, and no error or shutdown is performed on the area.

	Example: Suppose the robot is at a certain position, and an area is to be generated at this position. The actual position of the xyz coordinate is {600, -100, 100}. An interference zone is generated at the current position of the robot. Set the length to 200, the width to 100, and the height to 50. , The telescopic value is 5, the range of a box-shaped area generated at this position is (the default is generated in the positive direction, if the workpiece coordinates are called, the direction of xyz is determined) X=[595,805] Y=[-105,50]] Z=[95,155] Remarks: The interference area / shared area is xyz, all enter into the xyz area, and the safe area is xyz. Any area outside the area is a super area.

6.11 Authorization

	Using the controller requires authorization.

Description

Added a license function to the new version of the controller software, increasing the trial time limit

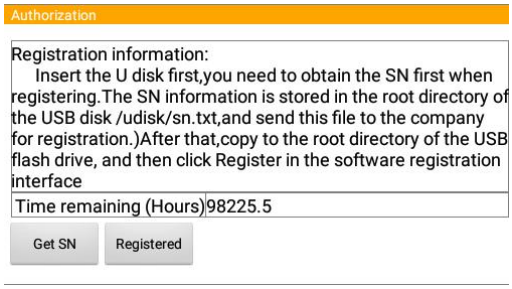


Figure 6-12 Authorization

Steps 1. Select Configuration-> Controller Configuration-> Authorization in the main menu.

2. Insert the USB disk and click to get SN. At this time, a file named sn.txt isgenerated in the USB disk. This document needs to be sent to our company for registration.

3. Put the registration file genAuthCode on the USB flash drive, insert the USB flash drive, and click Register to complete the registration.

6.12 Timeout setting

Description The timeout setting is to prevent the robot program from waiting indefinitely. By setting a time, it is used in conjunction with the WAIT timeout instruction. During the execution of the program, when the WAIT instruction is run (except for the value of WAIT TIME =, WAIT TIME has no timeout function). When the unsatisfaction is in the blocked state, after the waiting time exceeds the set time, it will jump to the corresponding program line to continue execution. The time unit is milliseconds (ms). If it is not set, the timeout time defaults to 10s.

Steps

1. Open the menu and click "Configuration → Controller Configuration → Timeout Setting"

2. Check the time edit box and edit the time

3. After setting, click the [Set] button for the setting to take effect immediately.

Figure 6-13 Timeout setting

	In addition to the timeout setting, when the wait instruction is executed and it is in a blocked state, you can also cancel the wait by clicking the

	menu "More → Release Wait". After clicking the "Release Wait" button, the pointer will move to the next line, but the robot does not Execute the program in the next line, and adjust the corresponding io output of the robot at the same time (equivalent to the pause state at this time). You need to click the "Start" button again to run the program. If there is no instruction in the next line, you will return to The first line of the program.

6.13 Process Package Management

Description The process package management is divided into two parts, one is the installation and uninstallation of the process package, and the other is the installation and uninstallation of the dynamic library.

Installation process steps

1. Open the menu and click "Configuration → Teach Pendant Configuration → Process Package Management"

2. Click the [Install Process Package] button to pop up the USB disk file selector

3. Select the appropriate file, click OK, and wait for the successful installation of the craft package to indicate that the installation was successful.

Steps to uninstall technology package:

1. Open the menu and click "Configuration → Teach Pendant Configuration → Process Package Management"

2. Select the technology package to be uninstalled in the technology package list. After selecting it, click the [Uninstall Technology Package] button, follow the prompts, and the information about the technology package in the row of the technology package list is deleted after successful uninstallation.

Steps for installing dynamic libraries

1. Open the menu and click "Configuration → Teach Pendant Configuration → Process Package Management"

2. Click the [Install Dynamic Library] button to pop up the USB disk file selector

3. Select the appropriate file, click OK, and wait for the successful installation of the dynamic library to indicate that the installation was successful.

Steps to uninstall dynamic library:

1. Open the menu and click "Configuration → Teach Pendant Configuration → Process Package Management"

2. Select the dynamic library to be uninstalled in the dynamic library list. After selecting it, click the [Uninstall Dynamic Library] button and follow the prompts. The dynamic library information in the row of the dynamic library list will be deleted after successful uninstallation.

Figure 6-14 Process package management

	After the technology package is installed, you can enter the related technology package configuration interface in the first-level menu "Process Package", which requires a USB flash drive.

6.14 Register Description and IO Description Functions Associated with Program Lines

Description After opening the function of register description and io description and program line, you can see the contents of the user record on the register list and io list on the teach pendant program interface.If you close this function, it will not

display.

Steps

1. Open the program and click "More → Open Instructions" in turn. After opening, you can see the corresponding instructions in the program.

The procedure is as follows after opening the instructions:

J JR[1:HOME] // JR[1] 's description in the register list is home

R[2] = R [1: TIMES] -1 // R[2] is not specified in the register list, r [1] is described in the register list as "times"

DO [0: grab] =ON // DO [0] 's description in the io list is "grab"

2. Open the program and click "More → Close Instructions" in turn. You cannot see the description after closing.

The procedure is as follows after closing the instructions:

J JR

R[2]=R[1]-1

DO[0]=ON

	The description content cannot be changed in the program line.If the register index / io index / description content is changed, the corresponding description content is also changed in real time.

6.15 IO status display

Description Note After the IO status association display function is turned on, the corresponding io status can be seen on the teach pendant program interface. When this function is turned off, it is not displayed. It is similar to the register description and io description and program line association functions.

Steps

1. Open the program, click "More → Open Status" in turn, and you can see the corresponding io status in the program after opening.

The following example shows the procedure after turning on:

DO[1:ON]=OFF // do [1] current state is on, running this instruction will adjust to off

DO[2:OFF]=DI[1:ON] // di [1] current state is on, do [2] current state is off, running this instruction will adjust do [2] state to off

2.Open the program, click "more → closed state" in turn, you can't see the io state

after closing.

DO[1]=OFF

DO[2]=DI[1]

	① When one of the programs is opened and closed, when the next program is opened, the status display of the program is the same as the previous program, that is, all programs affected by the button operation of the previous program. The default is closed (including Restart after power failure). While loading the program. ② When there is an io instruction at the same time, it is performed in the order of displaying the status first, and then displaying the instructions. ③ When the io status changes, it needs to be updated simultaneously.

7 Manual operation

7.1 Action mode

There are two action modes in manual mode: incremental and continuous.

7.1.1 Continuous

Steps

1. Select the coordinate system of "Run key" in manual mode

2. Set the manual override.

The following names are displayed next to the run keys:

A1--A6: corresponding to the axis number marked on the robot;

X、Y、Z: for linear movement along the axis of the selected coordinate system;

A、B、C: for rotating motion along the axis of the selected coordinate system.

3. Press and hold the safety switch, and the enable is now on.

4. Press the positive or negative running key to make the robot move in the positive or negative direction.

	The position of the robot during movement can be displayed by the following methods: Select Main menu → Display → Actual position. For the first time, the Cartesian coordinate position is displayed by default. If the axis coordinate is displayed, click the Cartesian button on the right to switch.

7.1.2 Incremental

Description The incremental manual operation mode allows the robot to move a defined distance, such as 10 mm or 3 °.

Then the robot stops by itself, or a custom jog distance of 0 ~ 10 ° / 0 ~ 100mm.

Application:

1.Point positioning with equal distance

2. Move a defined distance from a location

3. Use the meter to adjust

The following options are available

Set up	Description
continuous	Incremental manual movement is turned off.
100mm/10°	1 increment = 100 mm or 10 °
10mm/3°	1 increment = 10 mm or 3 °
1mm/1°	1 increment = 1 mm or 1 °
0.1mm/0.005°	1 increment = 0.1mm or 0.005 °

mm: for Cartesian motion

Degree: suitable for axis-related motion

	If the robot's motion is interrupted, such as by releasing the safety switch, it will be in the next action The interrupted increment will not continue, but a new increment will be started from the current position.

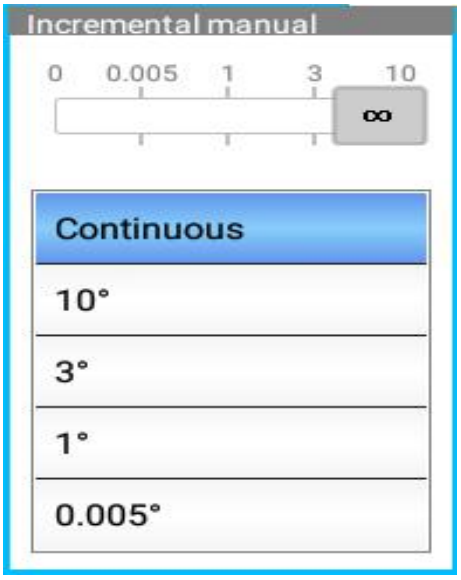


Figure 7-1 Incremental manual movement

7.2 Manual override

Description Note that the magnification is the speed of the robot at runtime. It is expressed as a percentage.

Steps

1. Touch the magnification adjustment status icon to open the magnification adjustment window. Press the corresponding button or drag the magnification to be adjusted.

2. The desired manual override can be set via the positive and negative keys or through the screen adjuster.

Positive and negative keys: can be set in 100%, 75%, 50%, 30%, 10%, 3%, 1% steps

Regulator: Can be set in 1% steps.

[Remark] Only manual override can be adjusted in manual mode; only automatic override can be adjusted in automatic mode.

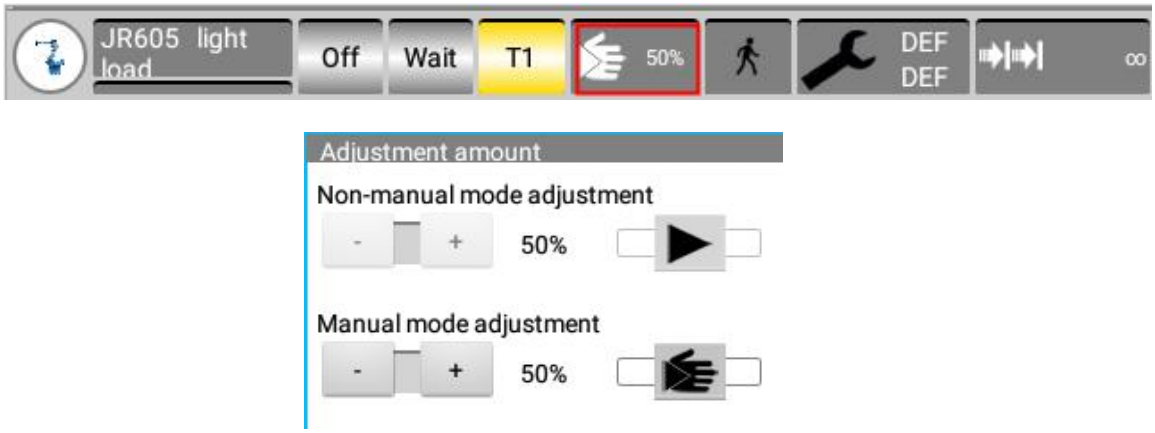


Figure 7-2 Manual override display and adjustment

7.3 Tool selection and workpiece selection

Description Note Up to 16 tool coordinate systems and 16 workpiece coordinate systems can be stored in the robot control system.

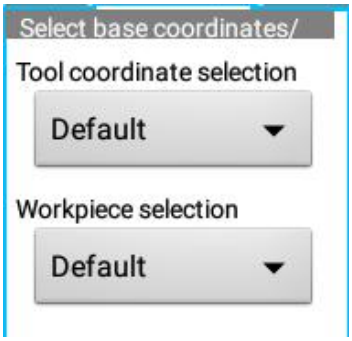


Figure 7-3 Tool workpiece coordinate system

Steps

1. Touch the tool and workpiece coordinate status icons to open the "Active Tool / Workpiece Coordinates" window.

2. Select the required tool and the required workpiece coordinates.

Remarks:

Before loading the program, the current actual position is displayed by the user's selected tool workpiece as the standard. After the loading program (not running) is successful, the tool workpiece coordinate system display is the default, regardless of the non-default tool workpiece coordinate system selected before loading. Run After the program, the tool workpiece coordinate system is displayed according to the tool workpiece coordinate system called in the program.If there is no call, the default tool workpiece coordinate system is used and displayed. When the program is uninstalled, it is restored to the tool workpiece number called before loading.

	The currently used tool workpiece coordinate system shown above is the standard and displays the current actual position.

7.4 Display actual position

Steps

1. Select Main Menu Display → Actual Position. The Cartesian actual position will be displayed.

2. Click Axis Correlation to display the actual position related to the axis.

3. Click on Cartesian to show the actual Cartesian position again.

Description

Cartesian actual location:

Display the current position (x, y, z) and direction (a, b, c) of tcp.

Axis related actual position:

The current positions of axes a1 to a6 are displayed. If there are additional axes, the positions of the additional axes are also displayed.While the robot is running, the actual position of each axis is updated in real time.

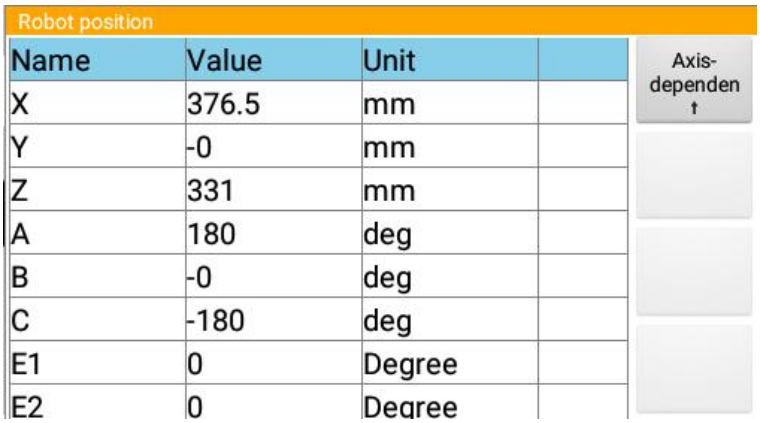


Figure 7-4 Cartesian actual position

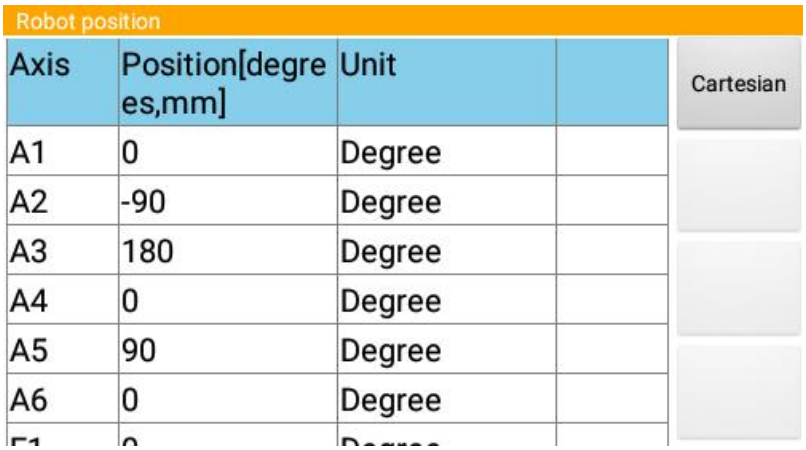


Figure 7-5 Actual joint position

7.5 Move to the point

Huashu type III control system provides the function of moving to the point. Select the jr / lr variable in the main menu display → variable list, click "change", enter the target coordinates, press the safety switch, click "joint to point" or "straight line" To the point, you can run the robot to the target point. If it is a program editing interface, select the motion instruction line, press the safety switch, and click "joint to point" or "line to point" to achieve this function.

[Remarks]

The arc command does not support the motion to point function.

	Note: The Cartesian coordinate lr has different morphological positions. It is not manual to "get the coordinates". The coordinates entered manually need to be confirmed, and the morphological positions will be generated before moving to the point correctly.

8 Automatic operation

Steps

1. Select the mode you want to run: t1 / t2 / auto mode
2. Select the program to be run in the navigator interface and click "Load"
3. In t1 / t2 mode, press the safety switch, do not release it during the running of the program; in automatic mode, click the enable button on the upper left of the screen to turn on the enable.
4. Adjust the speed override to a suitable value.
5. After the program on the teach pendant is in the "ready" state, click the physical operation button on the left side of the teach pendant to start the program.)
6. While the program is running, click the corresponding physical button to pause and stop the program.

[Remarks]

1. Switching mode is not allowed during program running
2. Editing a program is not allowed during program loading / runtime

9 Emergency stop

The emergency stop switch is used to stop the robot motion in an emergency. It is located at the upper right of the teach pendant (red button).

Steps

1. In an emergency, take a picture of the emergency stop button on the top right of the teach pendant
2. Turn the emergency stop button clockwise to release the emergency stop switch
3. In the teach pendant status display window, click "Alarm Acknowledge" to clear the emergency stop error.

10 Dual code control

Description Dual-code joint control is used to run the program in virtual iterative mode, optimize the optimal motion trajectory speed, and add motion parameters to the motion instruction.

Steps

1. Click the cursor to select the program to be optimized. (Note: It is recommended to keep the original program and copy another program before optimizing).

2. Click the "More-Optimize" button in the lower corner. After a period of time, the program color will be displayed in green after the program optimization is completed.

	Note: The process of program optimization is virtual execution, which may not be enabled; The optimization program only optimizes motion instructions (straight and circular); After optimization, new motion parameters will be inserted into the program. If you need to retain, you can copy and retain one more program before optimizing; The flag of the successful optimization program is displayed in green. If the program is repaired, the original logo color will be restored, which can be optimized multiple times; Among them, the optimized program is not an absolute ideal speed trajectory, which can be used as a reference and a secondary modification and debugging; Operation is not allowed during optimization.

11 Jump function

Description In manual mode, the program supports jump running.If the program pointer jumps to the selected line and then runs, the program will execute from the selected line.

Steps

1、 In manual mode, load a program and enable it manually

2、 Select any line of instructions in the program and click the "Run" button. The run pointer of the program running interface jumps to the selected line

3、 Click the "Run" button again, the program will execute the current instruction. If the current operation mode is single-step operation, after the execution of this line of instructions, the run pointer points to the next line of instructions; if the current operation mode is continuous operation, the current instruction is completed After that, the program will continue to execute until the program is completed.

	The jump function can be used in conjunction with the back function.Only the motion instructions are executed when backing up, and other instructions are ignored and not executed.

12 Craft package

Description The process package is an extension module of the teaching pendant, which mainly simplifies the process flow, parameter data operation and calculation, etc., and the corresponding process package needs to be installed.

Steps

1.Click the "Tech Package" button in the first-level menu bar to enter the process package selection interface. (Options will only be displayed if a process package is installed)

2. Click the technology package name option to successfully enter the technology package interface.

12.1 Welding process package

12.1.1 Main Interface of Welding Process Package

Open the menu of teaching device: Process Package ——> Welding Process Package, then the main interface of welding process package is open, as show in Figure12.1:

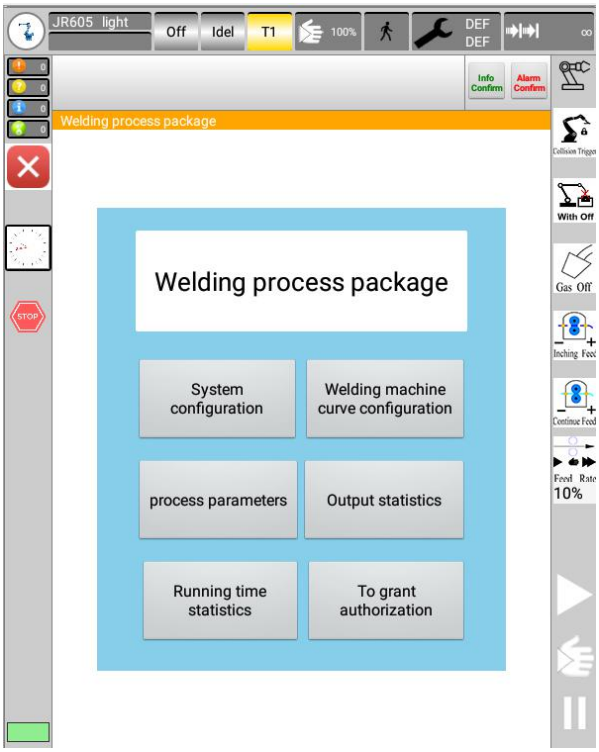


Figure 12.1 interface of welding process package

System Configuration: it mainly sets the model of welding machine, numbers of channels and brand of clear gun station, etc.

Curve Parameter Setting: it sets the mapping curve of current and voltage.

Process parameters: set the process parameters of welding channel (a total of 10 groups of process parameters can be set), including welding machine working mode, arc starting / ending voltage / current, welding voltage / current, welding speed, etc.

Output statistics: count the running times of the specified program, that is, the production quantity of the specified products.

Authorization: this is the authorization interface of process package; the welding process package is available only after authorization!

12.1.2 Configuration of Welding System

Open the selection menu of teaching device: Process Package—>Welding Process Package—>System Configuration; as shown in the below Figure 12.2:

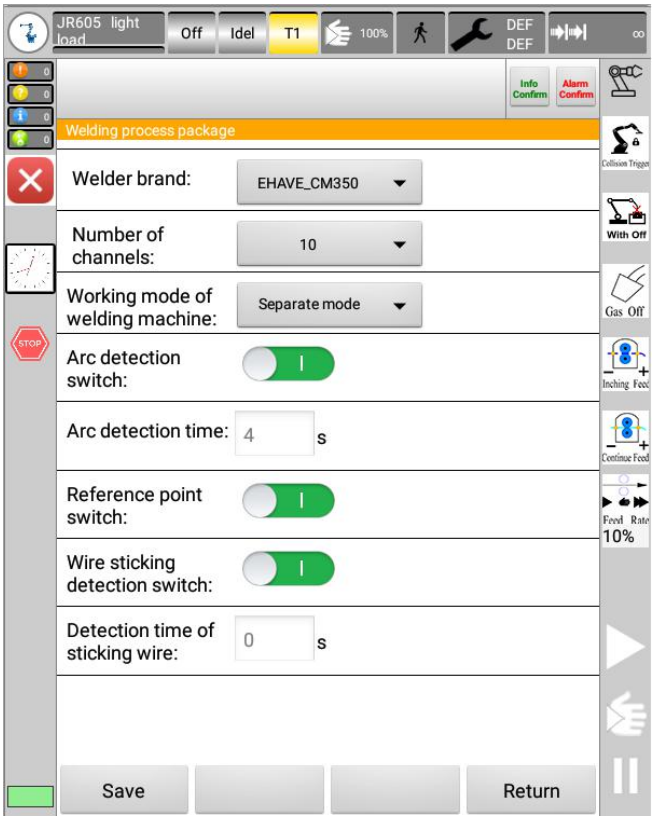


Figure12.2welding system configuration

The interface presents four configuration items in the welding system configuration (as shown in Figure 12.2):

(1)Welding machine brand: any brand of welding machine can be configured. Brands currently available include OTC, AOTAI, Megmeet, Fronius, etc..

(2)Channel numbers: this can save process parameters of up to a total of 10 channels, which can be arbitrarily called in the procedure.

(3) Clear gun station: TBi has been configured.

(4) Arc detection switch: the arc detection function can be turned on or off. This function is turned on by default.

(5) Arc detection time: set the arc detection time, the range is 0 ~ 10s, and the default is 4S.

(6) Reference point switch: it can turn on or off the reference point judgment function during external mode startup. After the operation is changed, it takes effect after clicking the Save button in configuration - controller configuration - operation configuration - program configuration according to the prompt. This function is turned on by default.

（7）Wire sticking detection switch: the wire sticking detection function can be turned on or off. This function is on by default.

（8）Wire sticking detection time: set the arc detection time, the range is 0 ~ 1s, and the default is 0.3s.

(9)Gas flow detection threshold: set the gas flow with a switch next to it. When it is turned on, it will judge whether there is still gas in the actual welding process. If there is no gas, the arc will fail and the welding will be stopped. The range is 0.1 ~ 30L / min.

Note: in the system configuration, the welder brand, number of channels, welding working mode, arc detection switch, reference point switch and wire sticking detection switch will take effect immediately after modification. The arc detection time and wire sticking detection time will take effect after clicking "save configuration". After modification, if you do not click the "save configuration" button, restart the system to restore the previous settings, After modification, click "save configuration" to restart the system, and the last configuration shall prevail.

12.1.3Curve Parameter Setting

12.1.3.1 Welding Voltage Curve Parameter Configuration

Different brands of welding machines display different curves. Enter into the interface of welding curve configuration, after a click at “Voltage” below, the input and output voltage curve can be set just as Figure 12.3 displays:

The concrete operation steps are:

(1)Directly input the minimum and maximum voltage values if they are known, or follow steps 2 to 5 to test out the voltage curve.

(2)Input voltage value (scope: 0 to 10. 0 as the start and increasing gragually to carry out the test is advisable.) at the right side of analog quantity AO1 and click “Take effect”.

(3)Observe the welder voltage displayed for whether it is the minimum value or not. If so, change value of AO1 and repeat step 2 till the minimum voltage value of the welder voltage appears to be defferent when the value of AO1 shall be put down to the output voltage input box.

(4)Input voltage value (scope: 0 to 10. 10 as the start and decrease gragually to carry out the test.) at the right side of analog quantity AO1 and click “Take effect”.

(5)Repeat step 3 and 4 till the maximum value of the welder votage changes when the value of AO1 shall be put down to output voltage input box.

(6)To verify whether the output voltage value curve is right, input the welder voltage value to be tested following Welding value test and observe if the deviation of the voltage value and input value (theoretical value) displayed in the interface is within the allowed range (the maximum deviation value equals 1% of the full scale voltage value). Where the value of deviation turns out to be over the range, repeat step 1 to 5 so as to reset configuration.

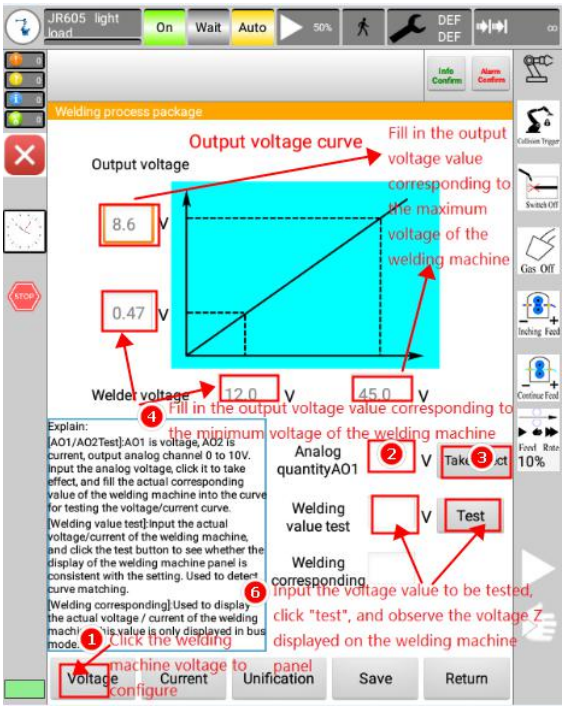


Figure 12.3 Curve Parameter Setting

12.1.3.2 Welding current curve configuration

Refer to 11.1.3.1 Welding Voltage Curve Parameter Confuguration

12.1.3.3 Centralized curve parameter configuration

Analog quantity communication welder shall be set to centralized mode in the welding machine interface before carrying out settings following steps specified in 11.1.3.0 Welding Voltage Curve Parameter Confuguration.

12.1.4 Process Parameter

Enter the welding process package's parameter setting interface displayed hereunder in Figure 12.4, which is mainly divided into function areas of Message Box, Selection Menu, Content Area and Button Operation.

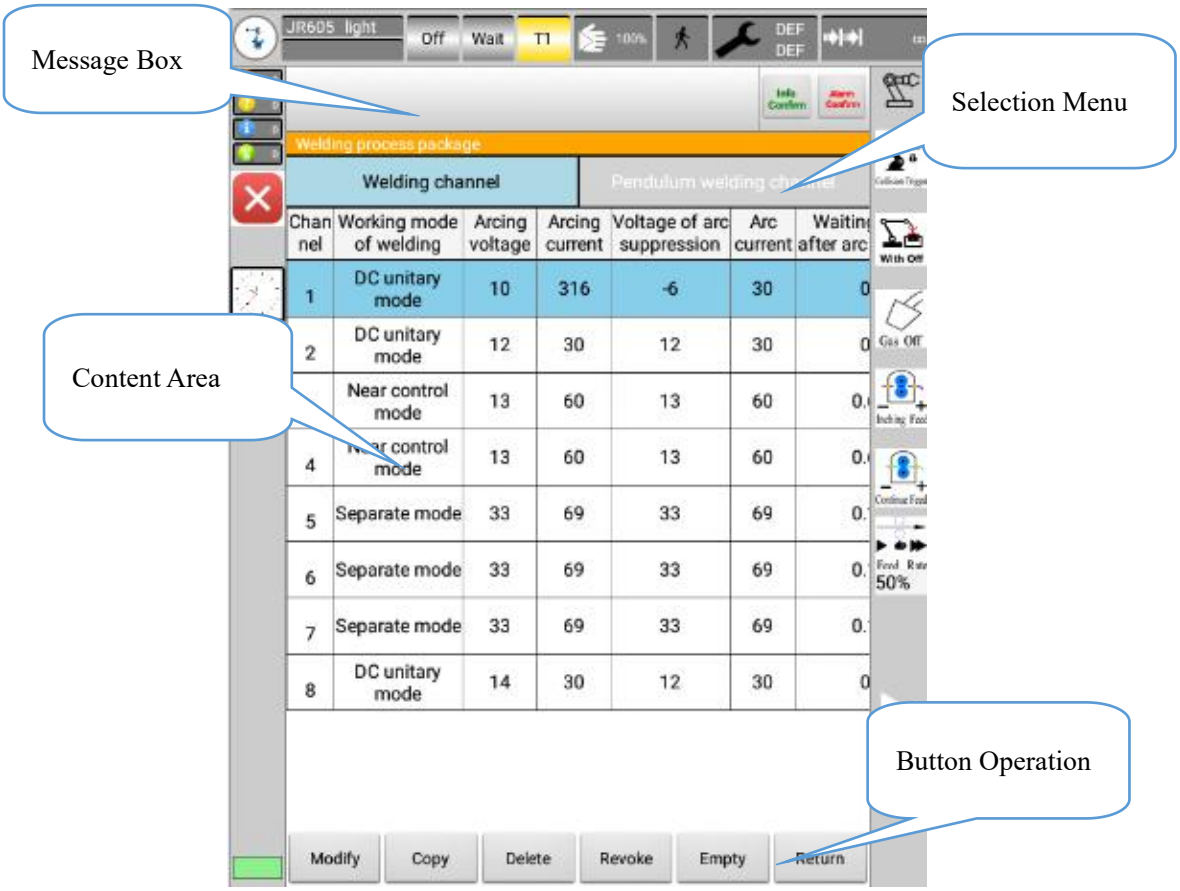


Figure 12.4 Process parameter setting interface

(1)Message Box displays feedbacks of setting including whether the parameter setting or deletion of channels is successful or not.

(3)Selection Menu provides different setting interfaces, containing welding channel and pendulum welding channel. Welding channel consists of process parameters such as channel number, working mode of welding machine, arcing voltage, arcing current, voltage of arc suppression, arc current, waiting time after arc striking, end weld time, welding voltage, welding current, robot magnification, welding speed, ect.

(4)Content Area exhibits welding information.

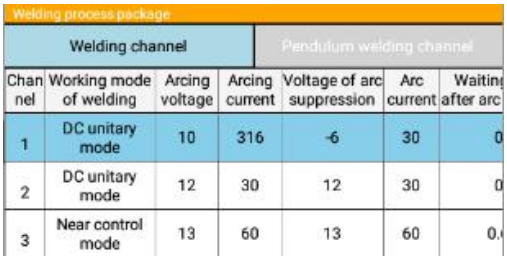
(5)Button Operation area includes function buttons such as Modify, Copy, Delete, Revoke and Empty.

12.1.4.1Welding Channel

Welding Channel stores data of the set welding parameters, with multiple channels for

configuration, 10 utmost, available for the system to invoke.

Open the selection menu of the teaching device and select in sequence: Process package—> Welding process package—> Process parameters—> Welding channel. Parameters settable in the welding channel mainly include 12 items: working mode of welding machine, arcing voltage, arcing current, voltage of arc suppression, arc current, waiting time after arc striking, end weld time, welding voltage, welding current, robot magnification, robot's speed and withdrawal time, as inllustrated in Figure 12.5.


Welding process package

Welding channel | Pendulum welding channel

Channel	Working mode of welding	Arcing voltage	Arcing current	Voltage of arc suppression	Arc current	Waiting after arc
1	DC unitary mode	10	316	-6	30	0
2	DC unitary mode	12	30	12	30	0
3	Near control mode	13	60	13	60	0.

Figure 12.5 Process parameters of welding channel

Channel number: numbers of the process parameter groups (1 to 10)

Working mode of welding machine: There are 8 types of working modes in general, 2 for analog quantity welder as separate and centralized.

Arching voltage: voltage in the arching stage

Arching current: current in the arching stage

Voltage of arc suppression: voltage in the arc suppression stage

Arc current: current in the arc suppression stage

Waiting time after arc striking: residence time of robot at the starting weld after successful arching

End weild time: residence time of the robot at the last weld

Welding votage: voltage in the welding stage

Welding current: current in the welding stage

Robot magnification: operation speed of the robot in the welding stage, 100% by default

Welding speed: operation speed of the robot in the welding stage

Withdrawal time: withdrawal time of welding wires

12.1.4.1.1 Modify

Steps to modify the welding channel

(1)Select the line to be modified;

(2)Click “Modify” below the channel list, and there appears the Welding channel modification dialog box as in Figure 12.6 below;

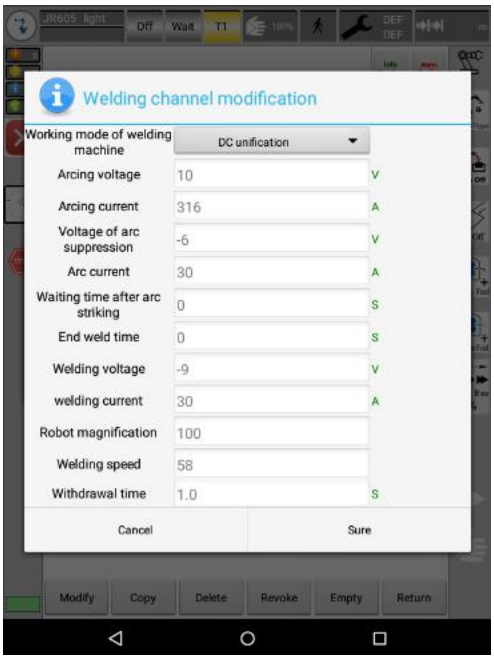


Figure 12.6 Welding channel modification dialog

Modify the default parameters displayed herein, working mode of welding machine of which is optional while others require input of value to be modified.

(3)Click “Sure” to complete modification.

12.1.4.1.2 Copy

Steps of channel replication

(1)Click “Copy” below the channel list, there will appear Channel replication dialog box as in Figure 12.7 Channel replication;

Figure 12.7 Channel replication

(2)The Original channel number and Target channel number are displayed in the Channel replication dialog box. Type in the copied line number in the input box after the Original channel number and the line number to which the copied shall be pasted after the Target channel number;

(3)Click “Sure” to execute the operation;

12.1.4.1.3Delete

(1)Select the line to be deleted;

(2)Click “Delete” below the channel list;

(3)There pops up a prompt box that says “Confirm to delete data?” as shown in Figure 12.8, click “Sure” to execute operation of deletion;

Figure 12.8 Prompt box for deleting the channel

12.1.4.1.4 Revoke

Revoke is to cancel the previous operation of modification, replication or deletion, which is only effective for the latest operation. Click Rovoke and take effect immediately.

12.1.4.1.5 Empty

Empty serves to wipe out all data of all channels.

Steps to empty channels:

(1)Click “Empty” below the channel list, there pops up a dialog box as follows

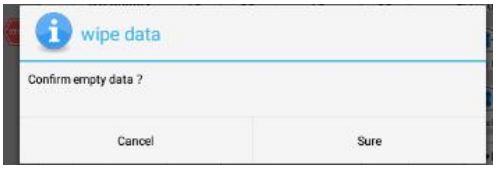


Figure 12.9 Prompt box of whether to empty channels

(2)Click “Sure” to execute operation of emptying channels;

12.1.4.1Pendulum Welding Channel

Pendulum Welding Channel stores data of the set welding parameters, with multiple channels for configuration, 10 utmost, available for the system to invoke.

Open the selection menu of the teaching device and select in sequence: Process package—> Welding process package—> Process Parameters—> Pendulum welding channel. The Pendulum welding channel consists of 7 parameters naming swing shape, swing frequency, amptitude of swing, swing plane, stay or not, left dwelling time and right dwelling time, as displayed in Figure 12.10;

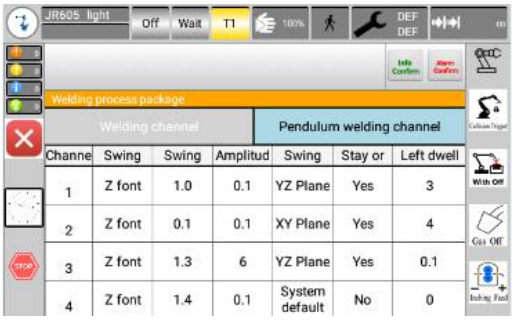


Figure 12.10

For operations of the pendulum welding channel please refer to the relevant content in the welding channel section.

Note: When the swing speed divided by frequency equals 2.5 or more, the outcome at 2.5 will be the best. Before using the pendulum channel, please calibrate the tool coordinates by referring to 18 Tool/workmarking

Reference list of pendulum channel parameters

No.	Posture change or not between start weld and end weld	Maximum speed of swinging (mm/s)	Maximum ACC of swinging	Maximum DEC of swinging	CNT
1	Yes	60	600	600	100
2		40	1,500	1,500	100
3		30	3,000	3,000	100
4	No	60	600	600	100

5		30	1,500	1,500	100
6		20	3,000	3,000	100

表格内容描述：

Descriptions on the content of the table:

No. 1, when there is no posture change between the start and end weld with the maximum speed within 60mm/s, the maximum ACC and DEC can both be set to 600 whlie working without problems.

No. 2, when there is no posture change between the start and end weld with the maximum speed within 40mm/s, the maximum ACC and DEC can both be set to 1,500 whlie working without problems.

No. 3, when there is no posture change between the start and end weld with the maximum speed within 30mm/s, the maximum ACC and DEC can both be set to 3,000 whlie working without problems.

No. 4, when there is posture change between the start and end weld with the maximum speed within 60mm/s, the maximum ACC and DEC can both be set to 600 whlie working without problems.

No. 5, when there is posture change between the start and end weld with the maximum speed within 30mm/s, the maximum ACC and DEC can both be set to 1,500 whlie working without problems.

No. 6, when there is posture change between the start and end weld with the maximum speed within 20mm/s, the maximum ACC and DEC can both be set to 3,000 whlie working without problems.

12.1.5 Output Statistics

Open the selection menu of teaching device, select in sequence: Process package—> Welding process package—> Output statistics, as displayed in Figure 12.11 below:

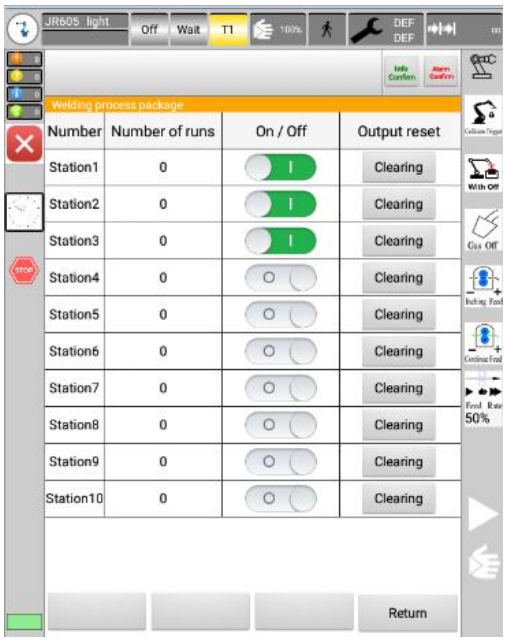


Figure 12.11 Function of output statistics

1.After adding the output statistics to the programme (Green light stands for on and gray for off), switch to turn on at the current station and the number of runs and output of such station will be recorded.

2.Click Clearing, there will appear a prompt box asking whether it is confirmed to reset the output. Clicking Sure will reset the output of current station.

12.1.6 Running time statistics

Open the teaching pendant selection menu: process package - > welding process package - > running time statistics; As shown in Figure 12.12 below:

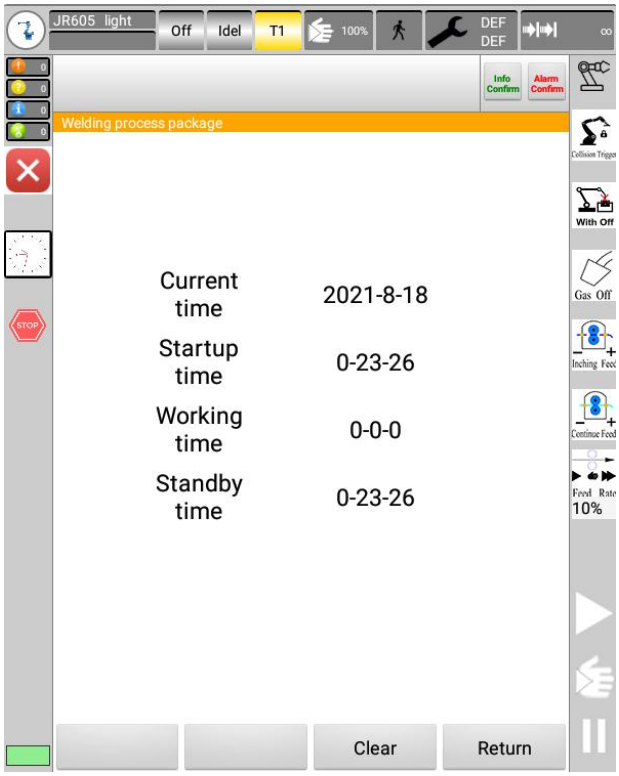


Figure 12.12 running time statistics function

1. Click the reset button to pop up a prompt dialog box, ask to confirm the reset time, and click the OK button to reset the current time.

12.1.7 Process system authorization

Note: welding process package requires separate authorization.

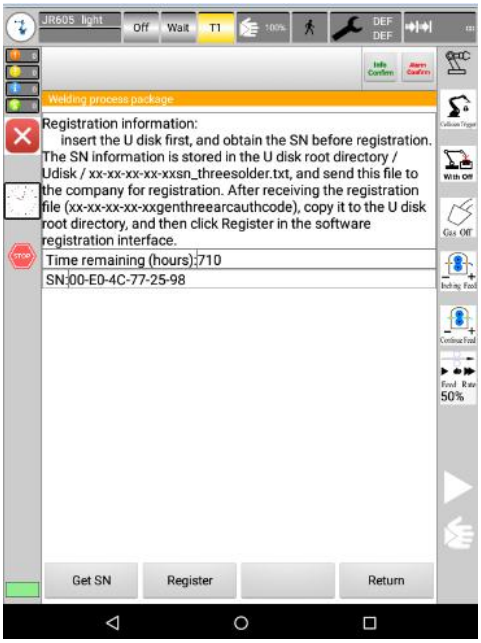


Figure 12.13 authorization

Steps:

(1) Select Configuration in main menu—>Process Package—>Welding Process Packae —>Authorization

(2 Insert U disk, click Obtain SN, and a document named XX-XX-XX-XX-XX-XXsn_threesolder is generated in the U disk, send this document to our company for registration, and XX is the system SN.)

(3) Put registration document XX-XX-XX-XX-XX-XXgenThreeArcAuthcode in the U disk, insert U disk, click register to complete registration.

12.1.8 Welding Instruction

Welding Instruction in the menu of the Editor interface of the programme lies in Instruction-> Welding instruction as illustrated in Figure 12.14.

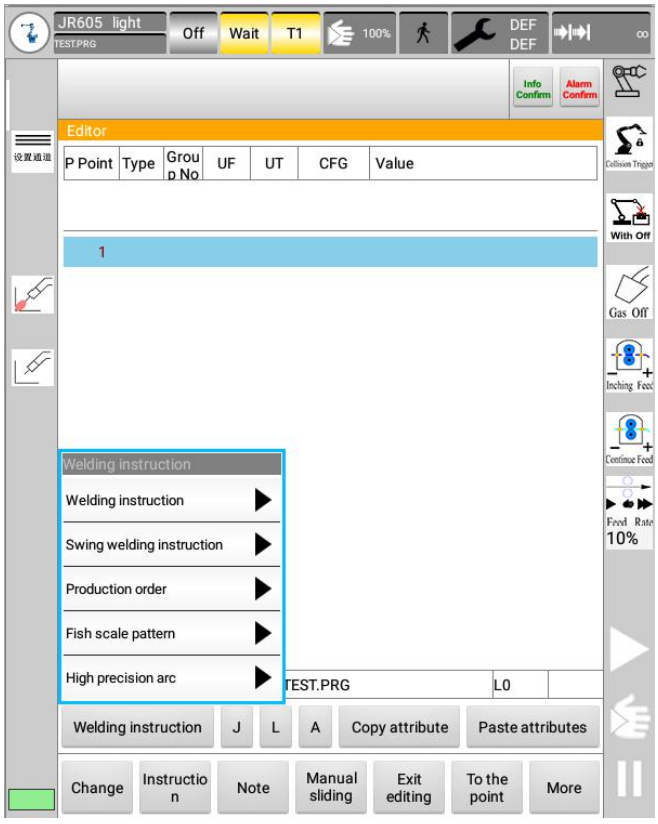


Figure 12.14 Welding instruction

Welding instruction consists of 6 directives:

(1)ARC_ON

Description: directive for arc striking

Application location: be put after arcing point.

Display form:

(2)ARC_OFF

Discription: directive for acr withdrawal

Application location: be put after the withdraw point

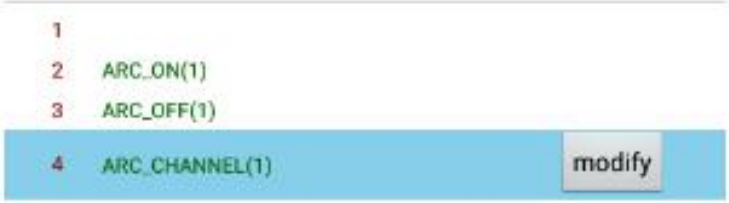
Display form:

(3)ARC_CHANNEL

Description: to set channel

Application location: be put before the effective point for the channel;

Display form:

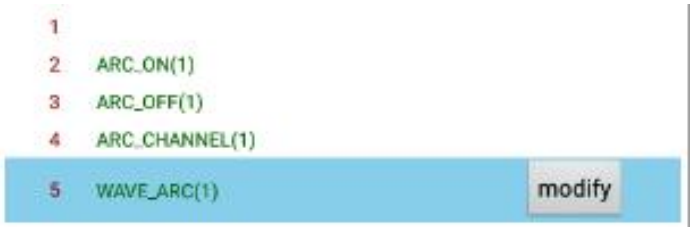


(4)WAVE_ARC

Description: to set the pendulum channel

Application location: be put after the ARC_ON instruction;

Disply form:

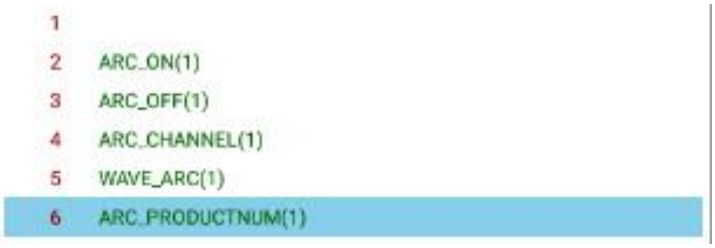


(5)ARC_PRODUCTNUM

Discription: directive for counting the output

Application location: be put at the end of the programme;

Display form:

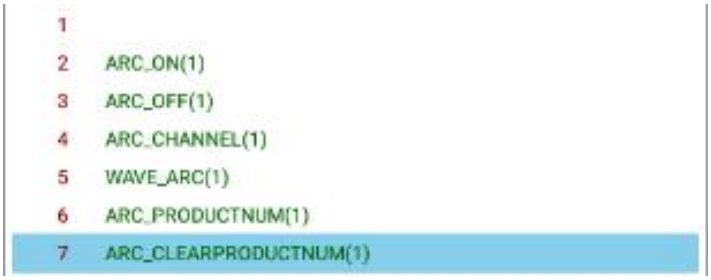


(6)ARC_CLEARPRODUCTNUM

Description: directive for clearance of outcome

Application location: put into any directive line of the programme;

Display form:

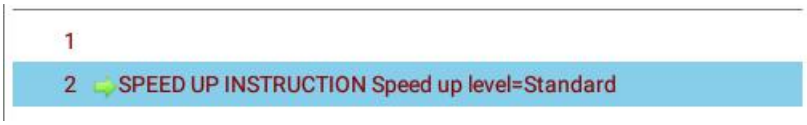


（7）SPEED_UP_INSTRUCTION

Description: improve the running speed of the robot

Use position: placed on any instruction line of the program;

Display form:



（8）FISH_SCALE_PATTEN

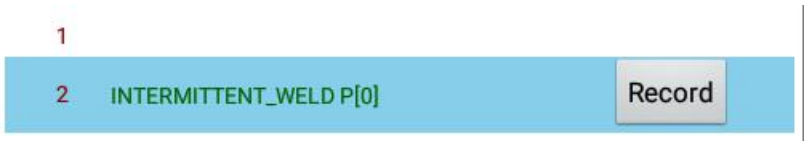
Description: realize "skip" welding

Use position: after the arc striking command;

Constraint: after fish scale welding, do not pause during fish scale welding, otherwise the welding quality will be affected.

Display form:

（4） High precision arc



Description: realize high-precision arc welding

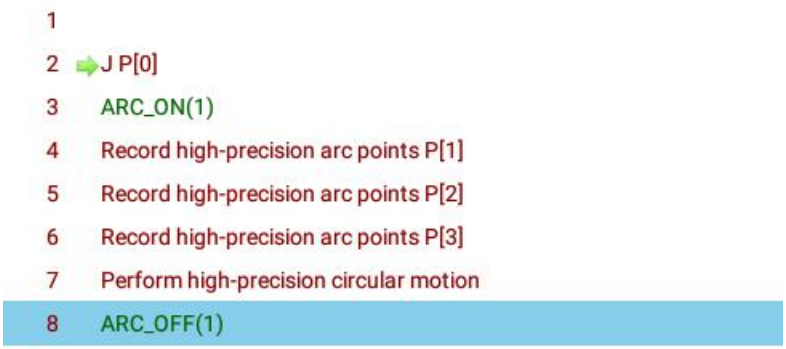
Use position: after the arc striking command

Constraints: 1. When recording high-precision arc points, at least 3 points shall be recorded. The high-precision arc point command must be recorded before executing the high-precision arc motion command.

2. Before using high-precision circular motion command, the CNT of the previous system command (line, joint, circular arc) must be 0.

Tip: if there is dwell time during actual welding arc starting, which affects the welding process quality, the arc starting command can be placed before the execution of high-precision arc motion command.

Display form:



（5） Arc swing welding

Description: realize arc swing welding

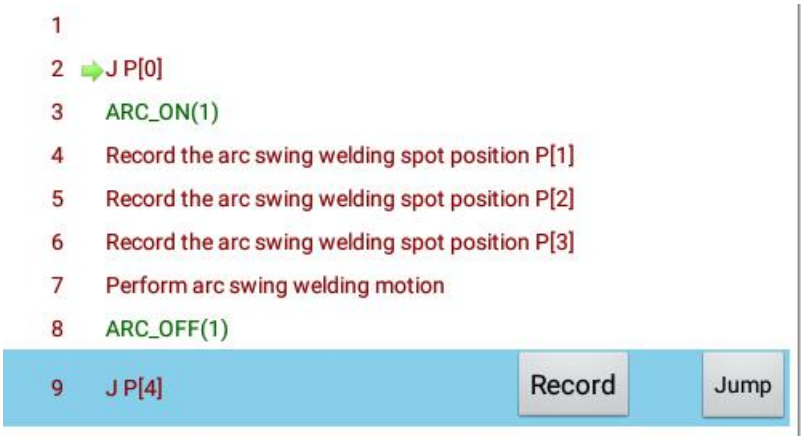
Use position: after the arc striking command

Constraints: 1. At least 3 points shall be recorded when recording the arc swing welding point position. The command to record the arc swing welding point position must be before executing the arc swing welding motion command. The dwell time of arc swing welding is invalid.

2. The CNT of the system command (line, joint, arc) before using the arc swing welding motion command must be 0.

Tip: if there is a dwell time during actual welding arc starting, which affects the welding process quality, the arc starting command can be placed before the arc swing welding motion command is executed.

Display form:



(6) Arc fish scale welding

Description: realize arc "jumping" welding

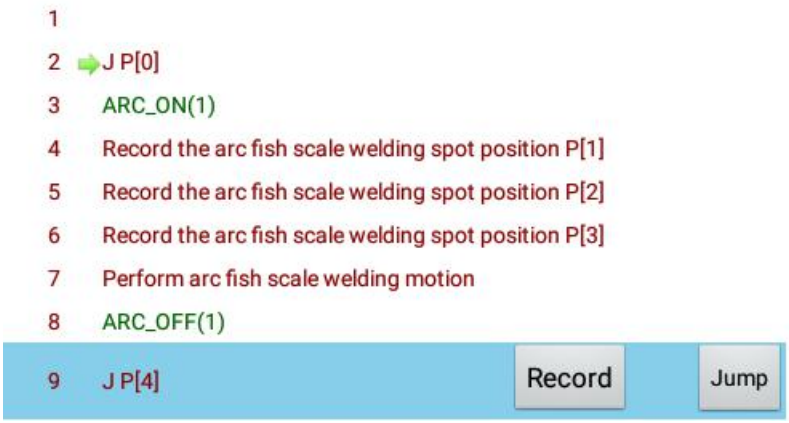
Use position: after the arc striking command

Constraints: 1. At least 3 points shall be recorded when recording the arc fish scale welding point position. The command to record the arc fish scale welding point position must be before executing the arc swing welding motion command.

2. The CNT of the system command (line, joint, arc) before using the arc fish scale welding motion command must be 0.

Tip: if there is a dwell time during actual welding arc starting, which affects the welding process quality, the arc starting command can be placed before the arc fish scale welding motion command is executed.

Display form:



12.1.8 Programming Teaching

12.1.8.1 Welding procedure

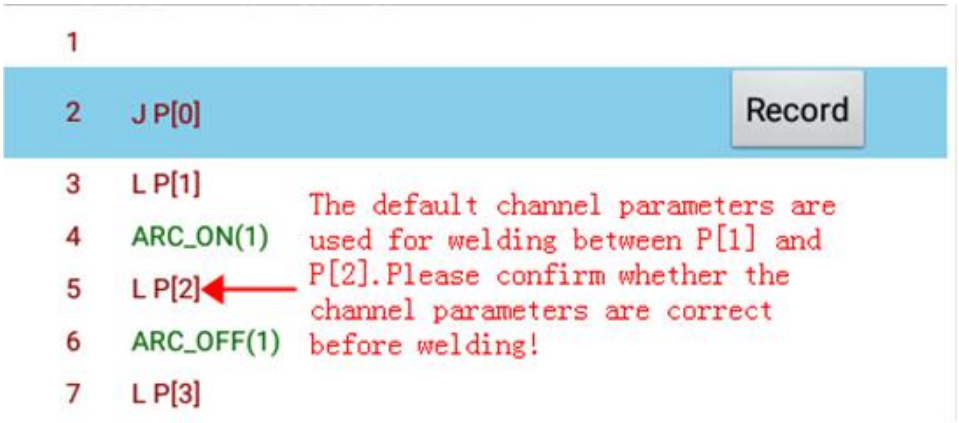
The actual welding operations of a welding project are performed through programming of the teaching device.

12.1.8.2 Example for application of welding instructions

12.1.8.2.1Application of welding instructions

(1)Application method for one weld joint with only one group of process parameters

```
J P[0]
JP [0]
L P[1]                  'Arching point
ARC_ON(1)               'Directive for arc striking which will invoke welding channel (1) by default
L P[2]                  'End weld (extinguish point)
ARC_OFF(1)              'Directive for arc withdrawal
L P[3]                  'Transition point
```



Remark: ARC_ON will invoke parameters of a welding channel to perform welding. Please confirm the accuracy of the parameters of the welding channel before operation!

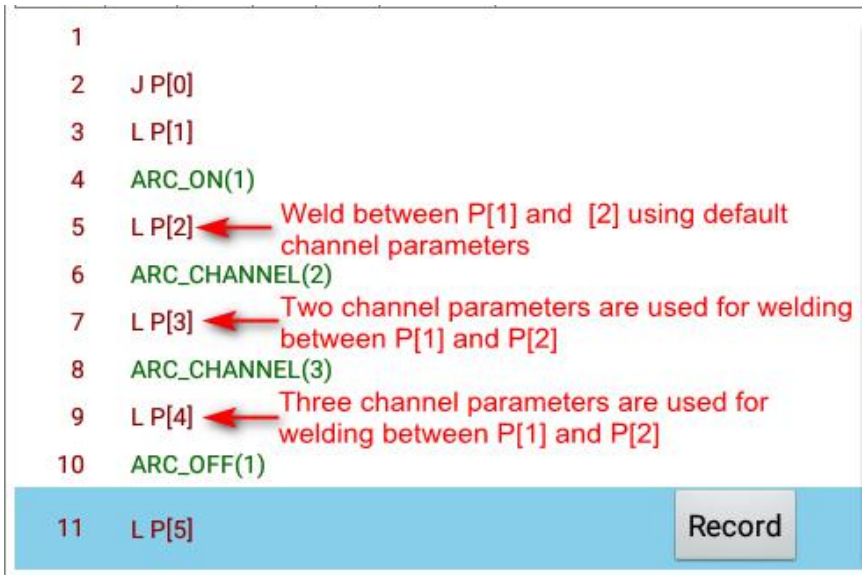
(2)Application method of one weld joint with multiple groups of process parameters

```
L P[1]                  'Arching point
ARC_ON(1)               'Directive for arc striking which will invoke welding channel (1) by default
L P[2]                  'End weld of the first section
ARC_CHANNEL(2)          'Invoke a channel
L P[3]                  'End weld of the second section
ARC_CHANNEL(3)          'Invoke a channel
```

L P[4] ‘End weld of the third section, extinguish point

ARC_OFF(1) ‘Directive for arc withdrawal

L P[5] ‘Transition point



ARC_CHANNEL and ARC_OFF may be modified after insertion as Figure 12.16 displays.

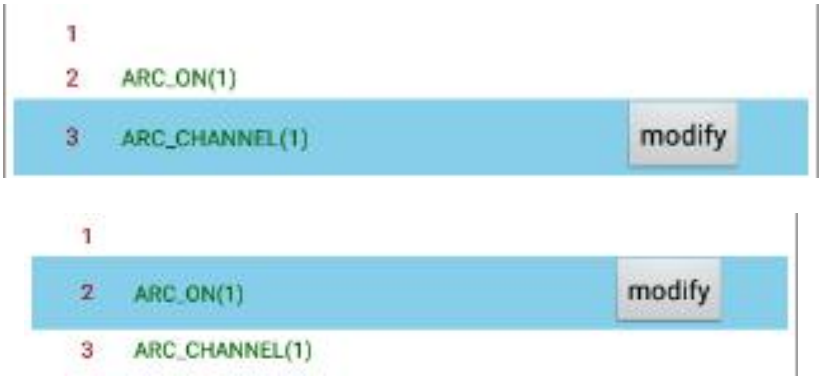


Figure 12.16 Modify the channel

After selecting the directive line to be modified, a button says modify will show up. Click modify, there will come a dialog box as illustrated in Figure 12.17.

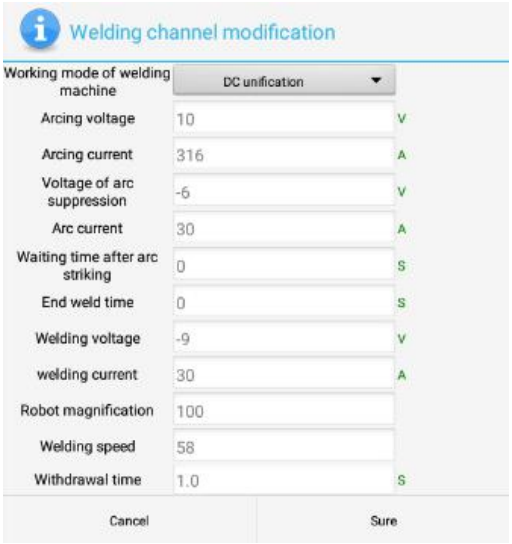


Figure 12.17 Modify the channel

Click Sure to make effective the parameters after modification. Channel number can also be changed, by selecting the line and clicking modify, what is displayed in Figure 12.17 will show up.

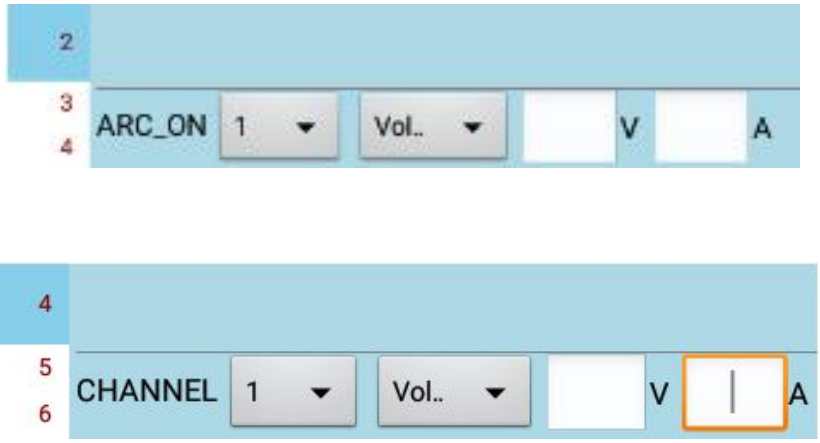


Figure 12.18 Change the channel number, voltage value and current value

As illustrated in Figure 12.18, it is allowed to select the channel number to be changed. If the voltage and current are selected, the modification box will appear, and after alteration, the altered value will be prevailing. If No is selected, the voltage and current value will be subject to the value set before. Selecting and clicking Sure shall complete modification of channel number, voltage and current value.

(3)Application of WAVE_ARC

J P[0]

J P[0]

L P(1) ‘Arcing point

ARC_ON(1) ‘Directive for arc striking, invoking welding channel (1) by default

WAVE_ARC(1) ‘Invoke parameters of pendulum channel (1)

WL P[2]VEL=10 VROT=10 CNT=100 ACC=500 DEC=500 ‘The first weld joint end,

ARC_CHANNEL(2) ‘Invoke a welding channel

WL P[2] VEL=10 VROT=10 CNT=100 ACC=500 DEC=500 ‘The second weld joint end

ACR_CHANNEL(3) ‘Invoke a welding channel

L P[4] ‘The third weld joint end, extinguish point

ARC_OFF ‘Directive for arc withdrawal

L P[5] ‘Transition point

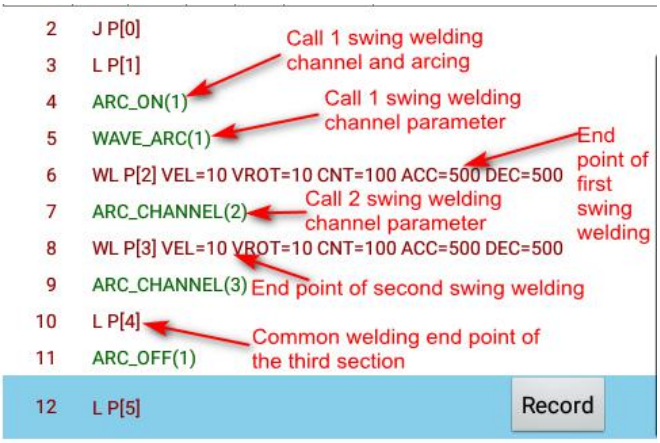


Figure 12.19

As illustrated in Figure 12.19, where VEL, VROT, ACC and DEC have been set in the WL Pendulum mobile directive, the welding shall be conducted subject to the speed set in the welding channel. However, if set otherwise in the directive line, the new speed will be executed as the welding speed.

（4）Application of ARC_PRODUCTNUM

J P[0]

J P[0]

L P[1] ‘Normally edited programme

ARC_PRODUCTNUM(1) ‘Instruction for counting the output

Figure 12.20

As illustrated in Figure 12.19, when ARC_PRODUCTNUM occurs in the programme, the number of runs and output of the product of the current station will be recorded and displayed in the statistics interface of the process package.

(5) Application of ARC_CLEARPRODUCTNUM

```
J P[0]
L P[1]                          'Normally edited programme
ARC_CLEARPRODUCTNUM(1)  'Directive for wiping out the outcome
```

Figure 12.21

As displayed in Figure 12.21, where ARC_CLEARPRODUCTNUM is adopted in the programme, the output of the current station will be wiped out.

（6）Use of speed up command

```
ACCSPEED SPEEDLEVEL = Standard          'ACCSPEED
J P[0]                                  'Normal editing program
L P[1]
```

Figure 12.22

As shown in Figure 12.22, when there is a speed-up command in the program, the robot will speed up according to the speed-up level.

（7）Use of fish scale welding instructions

J P[0] ‘Normal editing program

ARC_ON（1）

INTERMITTENT_WELD P[1] VEL=8mm/s Time=100ms Interval distance=1mm

INTERMITTENT_WELD P[1] VEL=8mm/s Time=150ms Interval distance=1mm

INTERMITTENT_WELD P[1] VEL=8mm/s Time=80ms Interval distance=1mm

ARC_OFF（1）

J P[4]

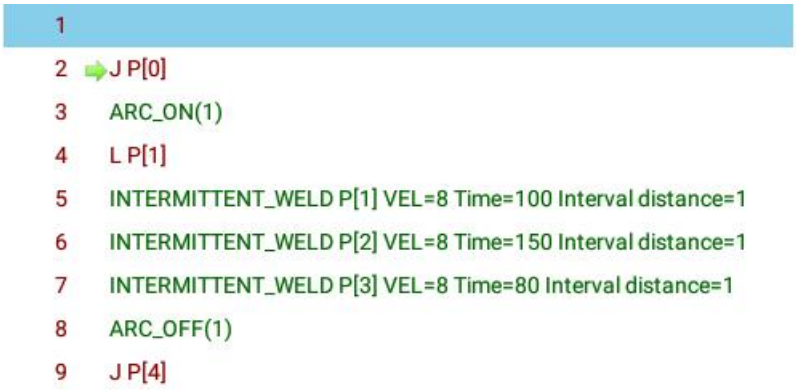


Figure 12.23

As shown in Figure 12.23, when there is fish scale welding instruction in the program, the weld effect is similar to "fish scale".

(8)Use of high precision arc command

J P[0] ‘Transition point

ARC_ON(1) ‘Arc striking command, calling a set of welding channel data

SA P[1] ‘Record high-precision arc point instruction

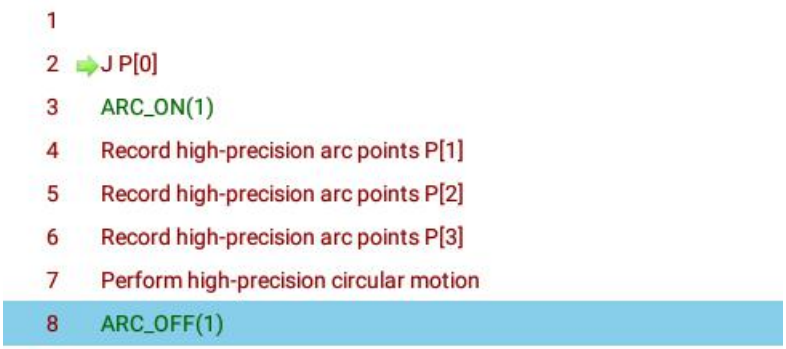
SA P[2] ‘Record high-precision arc point instruction

SA P[3] ‘Record high-precision arc point instruction

MOVE_SA ‘Execute high-precision circular motion command

ORC_OFF（1） ‘Arc stop command

J P[4] ‘Transition point



As shown in Figure 12.24, the use of arc swing welding command

`(9)Application of arc swing welding instruction

J P[0] ‘Transition point

ARC_ON(1) ‘Arc striking command, calling a set of welding channel data

WC P[1] ‘Record the circular arc swing welding spot position command

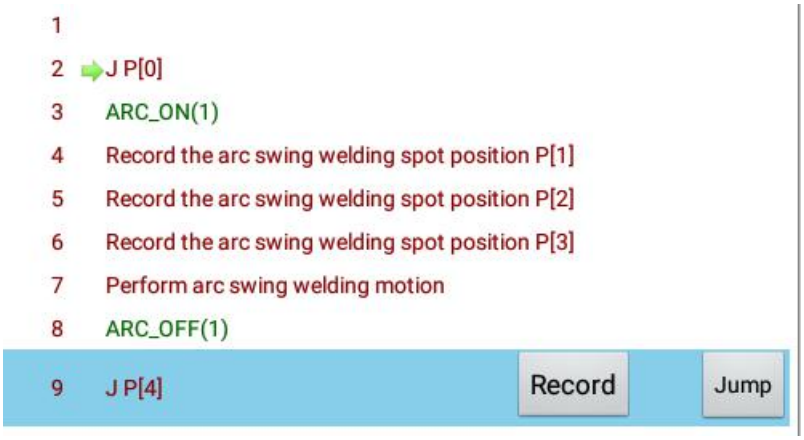
WC P[2] ‘Record the circular arc swing welding spot position command

WC P[3] ‘Record the circular arc swing welding spot position command

MOVE_WC ‘Execute circular arc swing welding motion command

ARC_OFF（1） ‘Arc stop command

J P[4] ‘Transition point



As shown in Figure 12.25, the use of arc swing welding command

(10)Application of arc fish scale welding instruction

J P[0] ‘Transition point

ARC_ON(1) ‘Arc striking command, calling a set of welding channel data

WM P[1] ‘Record the arc fish scale solder joint position command

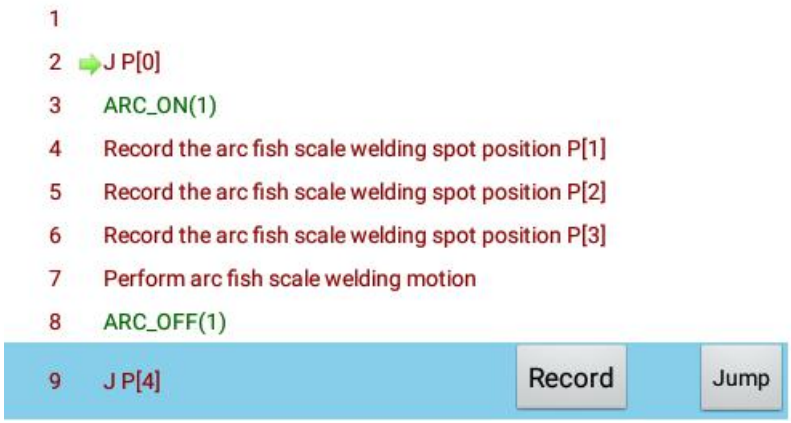
WM P[2] ‘Record the arc fish scale solder joint position command

WM P[3] ‘Record the arc fish scale solder joint position command

MOVE_WM ‘Execute arc fish scale welding motion command

ARC_OFF（1） ‘Arc stop command

J P[4] ‘Transition point



As shown in Figure 12.26, the use of arc fish scale welding instruction

12.1.9 Use of Spare Keys

12.1.9.1 Configure Spare Keys

Configure support keys click Menu-Configure-Configure Teaching Device-Configure Spare Keys, as shown below:

Figure 12.27configure spare keys

Select and enter into the interface shown in Figure 12.28.

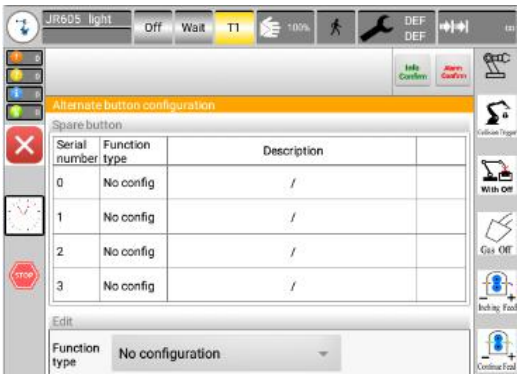


Figure 12.28 select functions for keys

As shown in the figure, there are four spare keys can be configured, Key 0 to Key 3 correspond to the 4 keys (top-down) at the left bottom of teaching device.

12.1.9.2Configuring Procedure of Spare Keys

(1) Click the line to be configured, for example, to configure first key in the teaching device, Line “0” should be selected as shown in Figure 12.29.

Figure 12.29 list of keys

(2)Click “Modify” and the function mode/configuration button below becomes optional, click it and choose “Process Package”, and interface in the Figure 12.30 will display.

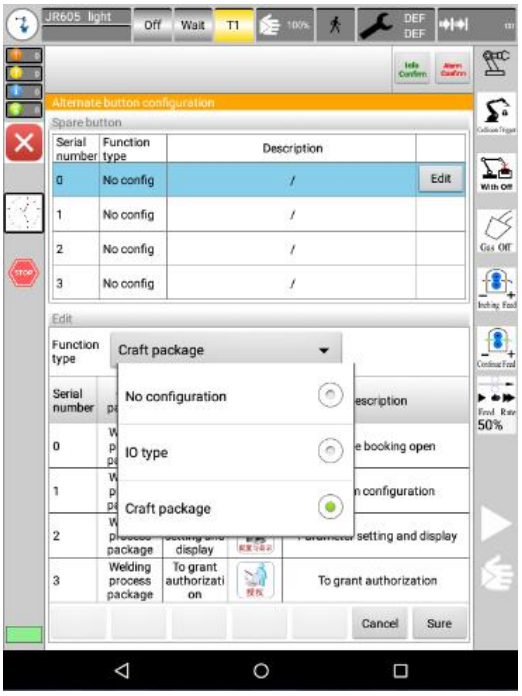


Figure 10.30 function lists

As shown in the figure, select function for spare keys to be configured from contents below.

(3) eSlection the desired function, click “Ok” and a dialog box as shown in Figure12.31will prompt, this spare key is successfully configured.

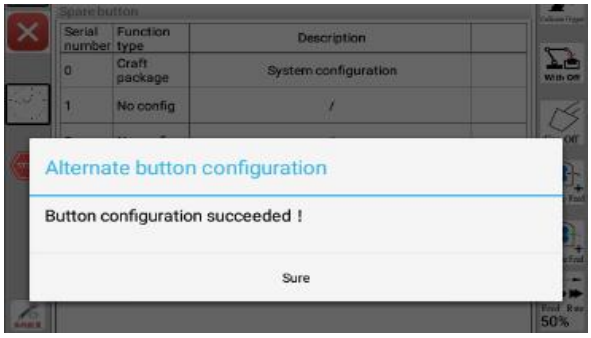


Figure 12.31prompt message of successful configuration

12.1.10 Use of Shortcut Keys

12.1.10.1 Introduction to Shortcut Keys

Figure12.32 shows 4 shortcut keys for programming on the left bar, namely Arc Striking, Arc Stopping, Set Channel and Reset Channel.

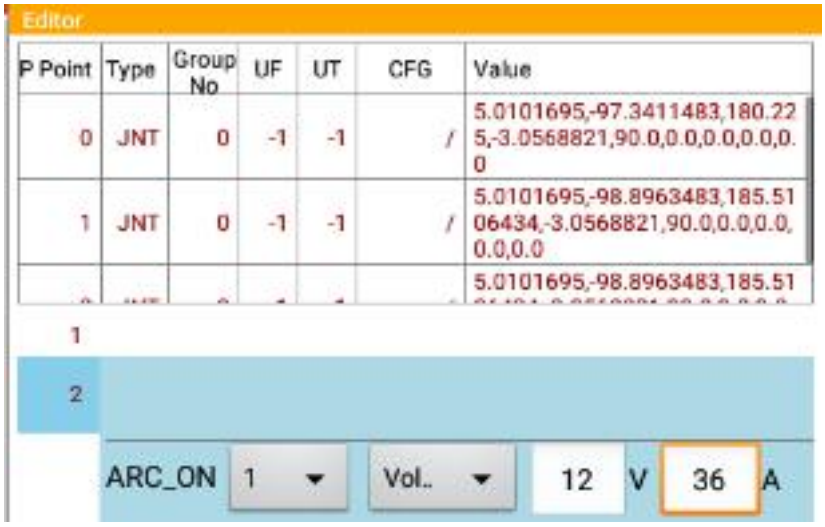


Figure 12.32actual display of instructions

Select a line in the procedure and press a shortcut key, the corresponding instruction will be generated in selected line.

12.1.11 Application of Key Combinations of Welding Functions

12.1.11.1 Introducitons to key combinations

On the upper-right part of the teaching device, lie 12 mobile keys controlling robots. In the welding system, these 12 keys under disenablement condition may be used in combinations. From top to bottom, keys of each line hold seven respective functions naming collision cancellation,

welding switching, gas detection, point-by-point wire feeding, continuous wire feeding, wire feeding magnification and collaboration switching, within which the second line will change their functions to collaboration switching in the manual mode and welding switching in the auto and external modes, with concrete distributions displayed as follows in Figure 12.33:

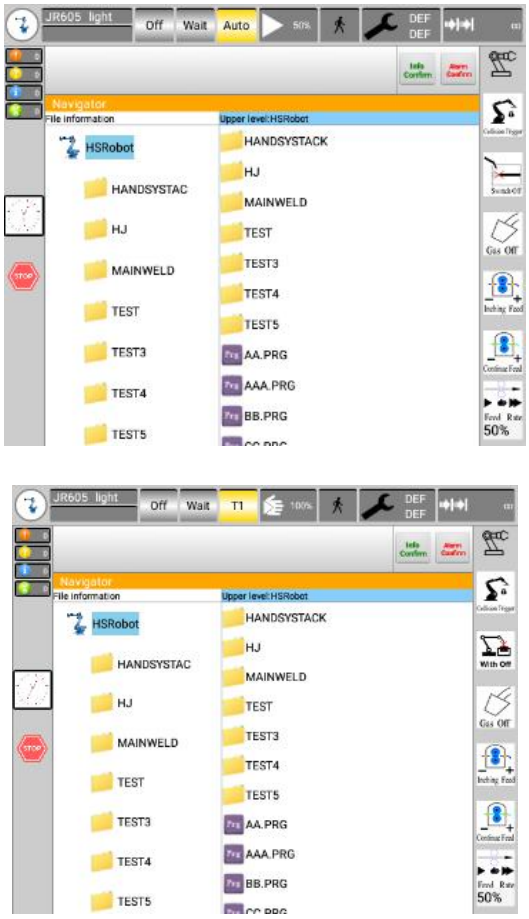


Figure 12.33Key conbinations

12.1.11.2 Introductions to functions

(1)Collision cancellation: When robots running into each other, press “+” as to switch on and remove the collision signal, leaving time of 15 to remove the robots from the crashing point, exceeding which the collision cancellation will be automatically switched off. Therefore, if there is still a robot in need of removing, the function shall be switched on again. Where such operation is completed within the time limit, pressing “-” will switch off the function.

(2)Welding switching: Welding switching serves as the overall switch controlling the welding. It is only displayed in the auto mode while automatically off in the manual mode. If the welding

switching is turned off, the functions with regards to welding will not be functional. The corresponding operation steps are as follows: press “+” or “-” to swich on or off gas detection; “+” or “-“ to open or close gas valve.

(3)Point-by-point wire feeding: A. Press “+” in the actual keyboard to start forward point-by-point wire feeding. Press “-” to start backward poin-by-point wire feeding. B. In the manual T1 and T2 mode, with Enable on, there will show under the axis the buttons allowing feeding by point frame. Click “WireFeed+” to realize forward point-by-point wire feeding and “WireFeed-” to start backward poin-by-point wire feeding (as illustrated in Figure 12.34). Length of the feeded wires will be controlled by the wire feeding magnification.

Figure 12.34 Wire feeding buttons

(4)Continuous wire feeding: Press “+” to realize forward continuous wire feeding, and “+” again to stop. Press “-” to start continuous backward wire feeding and “-” again to stop. Where the forward wire feeding is ongoing, pressing the key to make backward wire feeding will directly reverse its direction, if which is the time to stop wire feeding, pressing “-” again shall stop the process, and vice vesa. The speed of wire feeding can be adjusted through changing the feeding magnification.

(5)Wire feeding magnification: The wire feeding magnification ranges from 10% to 100%. Press “+” to add to 10% and “-” to deduct by 10%, which shall take immediate effect.

(6)Collaboration switching: Press “+” to switch on the function which allows selecting collaborative groups. Press “-” to switch off the collaborative groups and restore to the default status during which the collaborative groups are unchangeable.

12.1.11.3 Single step program key

When it is enabled in the single step mode, the keys in the first row of the axis keys are the function of program single step backward and program single step forward. Press the "-" key to execute one step backward and the "+" key to execute one step forward.

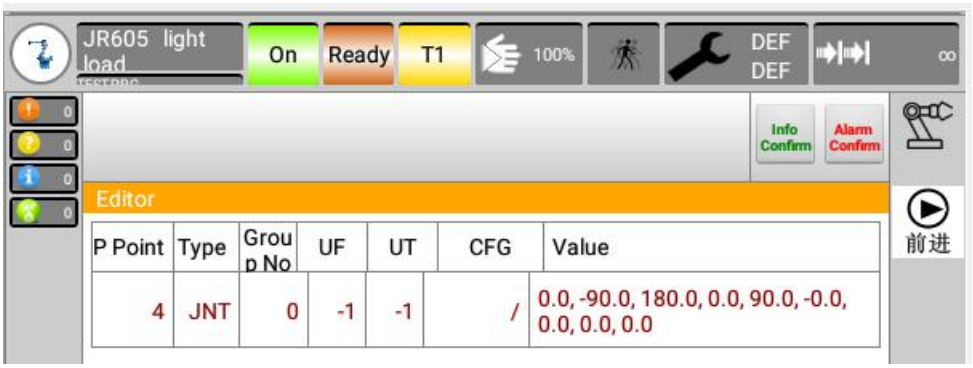


Figure 12.35 key single step operation procedure

12.1.12.1 Description

Remote appointment aims to enable multi-station for a single machine based on the external mode. This function can record the status of production readiness at this station, and directly proceed to the next station after finishing the production at the previous station. So the workers won't need to press the start button for the next station after the production at the previous station is done. This function now supports up to eight appointments.

12.1.12.2 Use Procedure

(1)Configure appointment switch in "Configure Spare Keys", as shown in Figure 12.36.

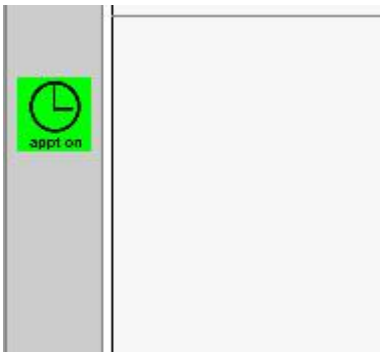


Figure 12.36 appointment switch

(2)Open appointment switch, and switch the current mode into external mode, configure external startup procedure. (See Operation Manual for Huashu III Model Teaching Device for details about configuration of external procedure).

(3)Press “Start” for 2s on the station with workpiece installed to complete the appointment for this station.

()4Press “Appointment” again to cancel all appointments.

12.1.13 Signal Lists

12.1.13.1 Lists of Welding Signals

output：

alarming indicator： Y0.0

arc striking： Y3.0

forward wire feed： Y3.1

backward wire feed： Y3.2

gas detection： Y3.3

collision cancellation： Y3.7

input：

arc striking successful： X3.3

emergency stop feedback： X3.0

12.1.13.2 Lists of External Controlled Signals

工位序号			1	2	3	4	5	6
DIN输入信号（外部控制盒按钮）	按钮名称	信号名称	输入IO(物理)	输入IO(物理)	输入IO(物理)	输入IO(物理)	输入IO(物理)	输入IO(物理)
	启动	iPRG_START--DI100(虚拟IO)	DIN[8]（X1.0）	DIN[12]（X1.4）	DIN[0]（X0.0）	DIN[4]（X0.4）	DIN[16]（X2.0）	DIN[20]（X2.4）
	暂停	iPRG_PAUSE--DI101(虚拟IO)	DIN[9]（X1.1）	DIN[13]（X1.5）	DIN[1]（X0.1）	DIN[5]（X0.5）	DIN[17]（X2.1）	DIN[21]（X2.5）
	停止	iPRG_STOP--DI102(虚拟IO)	DIN[10]（X1.2）	DIN[14]（X1.6）	DIN[2]（X0.2）	DIN[6]（X0.6）	DIN[18]（X2.2）	DIN[22]（X2.6）
	复位	PRG_CLEAR_FAULTS--DI103(虚拟IO	DIN[11]（X1.3）	DIN[15]（X1.7）	DIN[3]（X0.3）	DIN[7]（X0.7）	DIN[19]（X2.3）	DIN[23]（X2.7）
	外部急停	/	与系统急停信号串联					
	启动按钮（指示灯）		DOUT[4]（Y0.4）	DOUT[8]（Y1.0）	DOUT[12]（Y1.4）	DOUT[16]（Y2.0）	DOUT[20]（Y2.4）	DOUT[28]（Y3.4）
	暂停按钮（指示灯）		DOUT[5]（Y0.5）	DOUT[9]（Y1.1）	DOUT[13]（Y1.5）	DOUT[17]（Y2.1）	DOUT[21]（Y2.5）	DOUT[29]（Y3.5）
	停止按钮（指示灯）		DOUT[6]（Y0.6）	DOUT[10]（Y1.2）	DOUT[14]（Y1.6）	DOUT[18]（Y2.2）	DOUT[22]（Y2.6）	DOUT[30]（Y3.6）
	复位按钮（指示灯）		DOUT[7]（Y0.7）	DOUT[11]（Y1.3）	DOUT[15]（Y1.7）	DOUT[19]（Y2.3）	DOUT[23]（Y2.7）	DOUT[3]（Y0.3）

Note: two external control boxes (standard configuration) are configured in the factory. If the

number of button boxes needs to be increased, please refer to the above table for wiring io of button boxes. The system can support button boxes with up to 6 stations!

12.1.14 External operation configuration

explain Configuring the external signal is the process of establishing a mapping relationship between the system signal and the IO input / output index (i.e. binding the function to IO). After establishing the mapping relationship, you can execute the program through the IO signal to obtain the robot status, etc. All system signals must be configured before they can be mapped to the corresponding IO point. In a system without external signal configuration, there is no mapping connection between system signal and IO by default.

	Note: external configuration can only be operated in manual mode T1 / T2 Input configuration: by binding the specified input signal and triggering the input signal, complete the conventional operations of external programs, such as upper enabling, loading, pausing, running programs, clearing alarms, etc. Output configuration: display some states of the robot through the output signal, such as program state, enabling state, current mode, area output, etc

Operation steps

External I/O configuration：

1. Select "configuration → controller configuration → operation configuration" in the main menu to enter the external operation configuration interface.

2. Click "input configuration", select the [flag bit] on the left side of the screen, select the din index number on the right side, click "add" < - "to establish the mapping relationship, and click" remove "-" to cancel the mapping relationship.

3. Click "save" to save the operation.

4. Click "output configuration", which is similar to the above operation. You can set the mapping relationship of output.

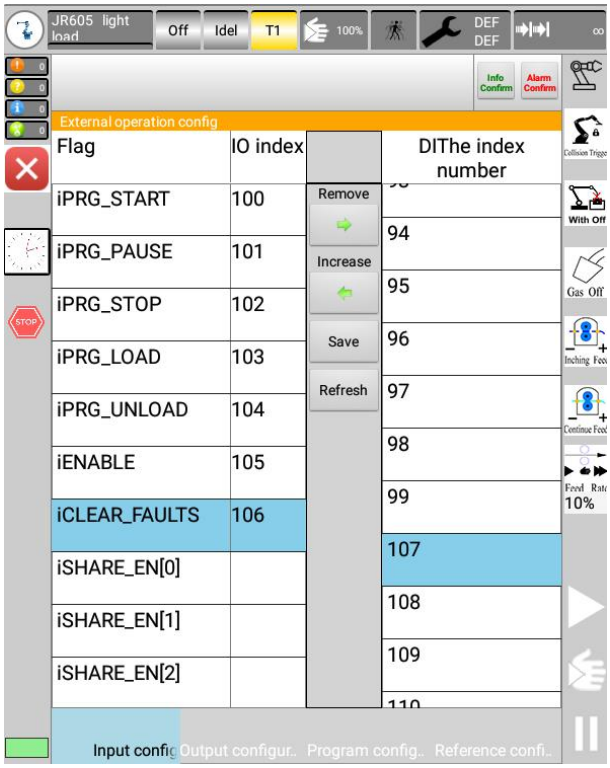
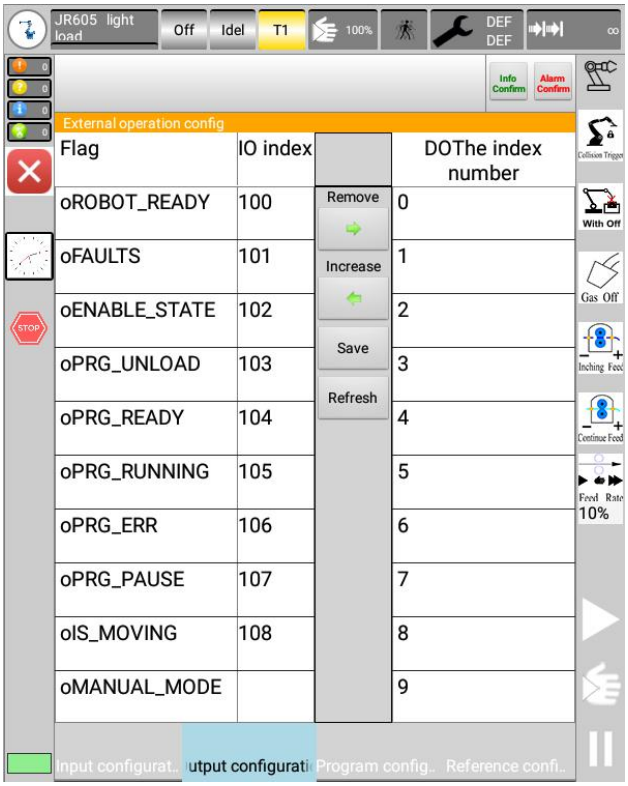


Figure 12.37 input configuration for external operation of welding process



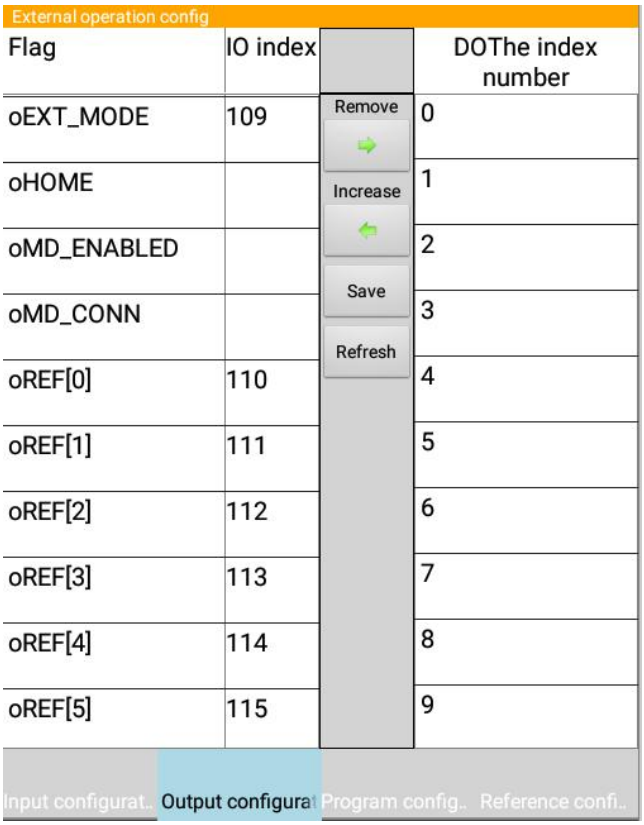


Figure 12-38 output configuration of external operation of welding process

	Note: external configuration can only be operated in manual mode T1 / T2. Note: when the external program is ready, it can be unloaded by unloading signal. When running the program, you need to pause the program first, and then unload the program by stopping the program signal

Welding process input signal table

Signal name	explain	Effective method
iPRG_START	Start program signal. Start the loaded user program run.	Falling edge effect
iPRG_PAUSE	Pause program signal. Pause the user program.	Falling edge effect
iPRG_STOP	Stop program signal. Stop the user program and uninstall the program.	Falling edge effect
iPRG_LOAD	Loader signal. Loads the specified user program.	Rising edge effect
iPRG_UNLOAD	Uninstall program signal. Uninstall ready programs.	Falling edge effect
iENABLE	System enable signal.	Enable the rising edge and set 0 to turn off the enable

iCLEAR_FAULTS	Clear the error signal.	Rising edge effect

Welding process output signal table

Signal name	explain	Effective method
oROBOT_READY	Robot ready signal. When the system initialization is completed and the user program is loaded and enabled, the signal is output.	The signal will not be output during program operation
oDRV_FAULTS	Erroe.	
oENABLE_STATE	Enable state.	
oPRG_UNLOAD	The user program is not loaded.	At the same time, these signals have and only one signal output
oPRG_READY	User program loaded status.	
oPRG_RUNNING	User program loaded status.	
oPRG_ERR	User program alarm status.	
oPRG_PAUSE	User program pause state.	
oLS_MOVING	The robot is in motion.	
oEXT_MODE	The system is in external mode.	
oREF[0]	Reference point1	
oREF[1]	Reference point2	
oREF[2]	Reference point3	
oREF[3]	Reference point4	
oREF[4]	Reference point5	
oREF[5]	Reference point6	
oREF[6]	Reference point7	
oREF[7]	Reference point8	

External running program configuration：

	After the external program is configured, if it is modified or loaded for the first time, it needs to be loaded again in manual or automatic mode, and the program will be distributed and updated to the controller.

1. Click the cursor to select any station number and click the "configuration" button （ There are 10 station numbers in total, and 10 external programs can be configured at the same time)

2. Pop up the program selection interface and click to select the program running

externally.

3. Click "OK" to complete external program configuration.

4.Click "save" on the operation bar to complete the external program configuration.

	After configuring the input, output and program, when switching to the external mode, the main.prg main program will automatically run. When the program does not run, it will be displayed as the program of station 1. After starting the operation, the current running program will be displayed. If the "external operation failed, the robot is not at the reference point, please switch to the manual mode and move the robot to the reference point!" In case of error, configure the reference point in "reference configuration" and move the robot to the reference point. Note: the program file named main.prg cannot be configured when configuring the station program.

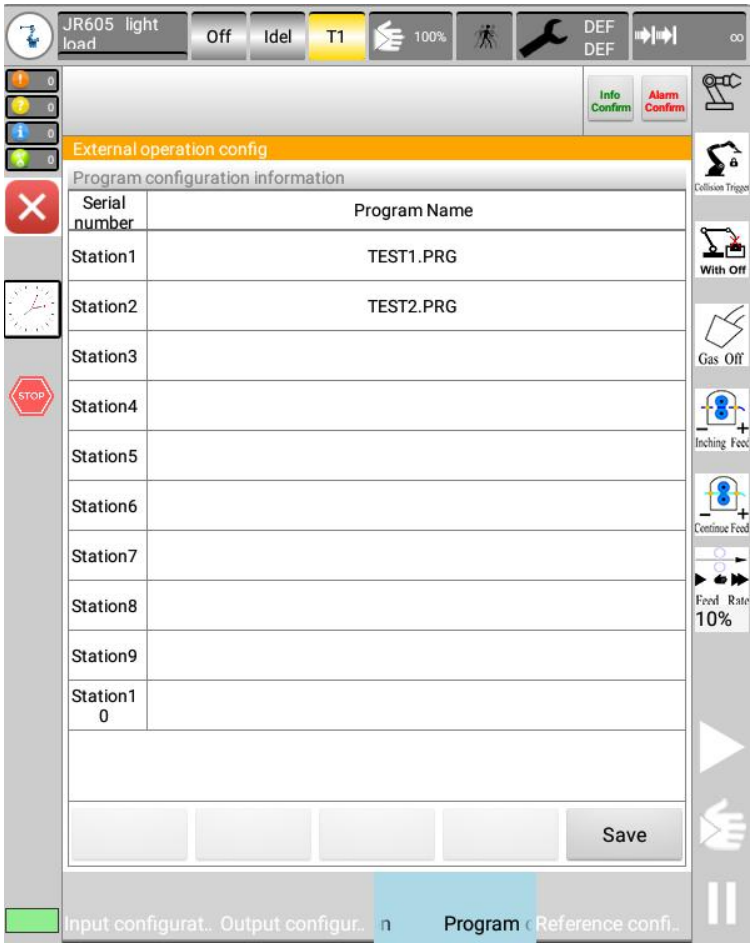


Figure 12-39 external operation - program configuration

Reference configuration:

1. Click "reference configuration" to enter the reference configuration interface.

	Reference configuration function: the specified Jr register can be configured as the reference point. When the actual position of the robot is at the position of the specified Jr register (e.g. Jr [0] = {0, - 90180, 0, 90, 0}), the bound position signal will be output. The precision range can be set. The maximum number of bound Jr registers is 8.

2. Click the "add" button to set the "reference number", "register" index number, and "precision".

3. Click "OK" to complete the setting.

Note: in order to avoid the collision between the welding gun and the workpiece due to the failure of the reference point when starting the robot in the external mode, it is necessary to add a reference point in the reference configuration. If the reference point is not added, when switching to the external mode to run the station program, it will report "external operation failure, the robot is not at the reference point, please switch to the manual mode to move the robot to the reference point!" Error. At this time, switch the mode to the manual mode, add reference points in the operation configuration reference configuration (as shown in figure 12-40), and add the command back to the reference points in the station program. One station can correspond to one reference point, up to 8 reference points.

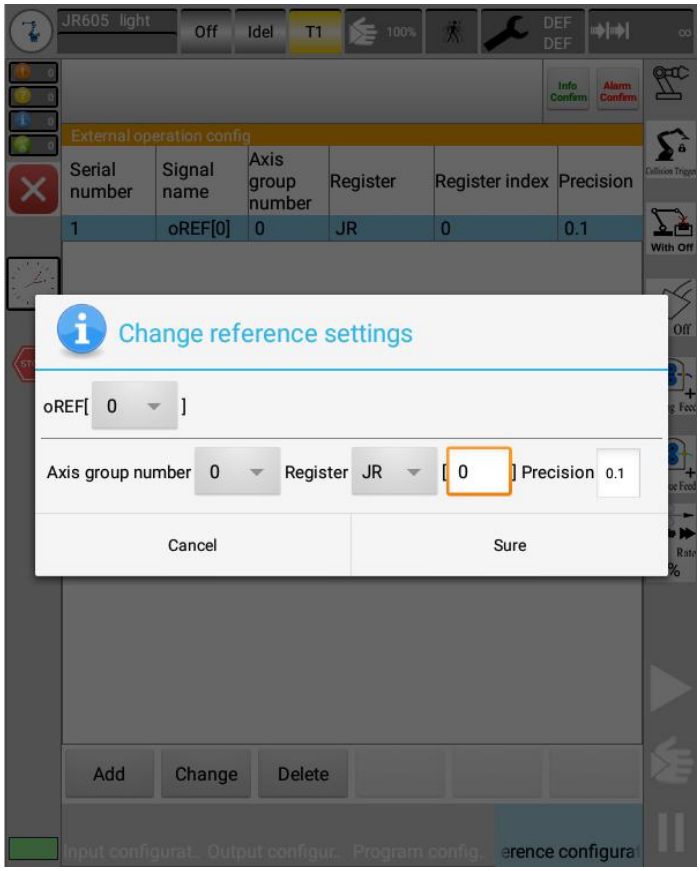


Figure 12-40 external operation reference configuration

12.1.15 One key return to welding pause point function

In order to avoid machine collision caused by startup after suspension during welding, the suspension point detection function is added. After suspension during welding, the program can be run only after returning to the suspension point, otherwise the running program will report an error prompt of "[recoverable] the robot has not returned to the suspension point, please return to the suspension point manually". The quick method to return to the suspension point is as follows:

1、Click the pause icon in the lower right corner of the teaching pendant screen “ ” ,The "return to pause point" button will pop up (as shown in figure 12-41). Keep pressing and holding the "return to pause point" button, the robot will move to the pause point, release and stop the robot, and the running speed can be adjusted by manual magnification

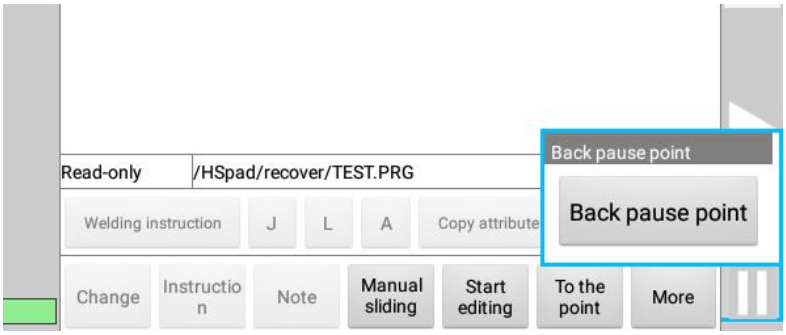


Figure 12-41 return to pause point function

2、The data of pause points during welding is saved in LR [0], click display - variable list - LR in the main menu, select LR [0] (as shown in Figure 12-42), click the "modify" button, click the "straight line to point" button in the pop-up box, the robot will move to the pause point, click the "stop movement" button to stop the robot, and the running speed can be adjusted by manual magnification.

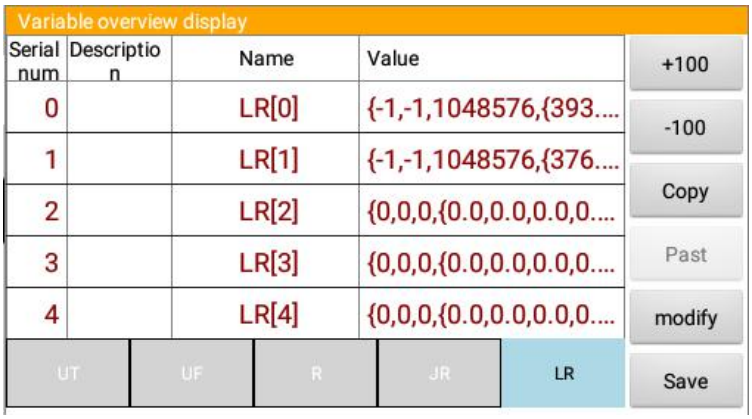


Figure 12-42 pause point LR [0]

12.1.17Asynchronous axis function

12.1.17.1 Non synchronous shaft control mode configuration

In the hspad software menu, select configuration - controller configuration - control mode in shaft group configuration, click the Modify button to select the asynchronous shaft mode, click the Modify button in the number of additional shafts, enter the number of additional shafts (as shown in figure 12-43), and then power off and restart the controller according to the prompt.

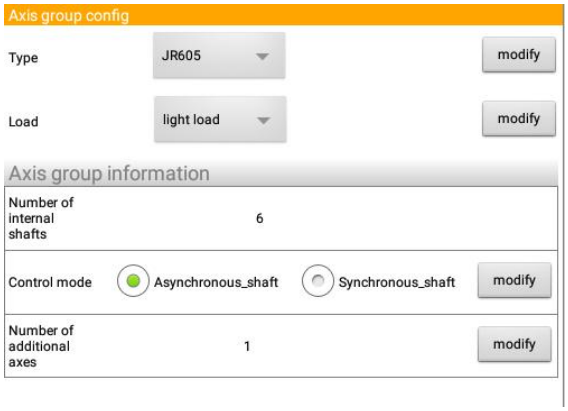


Figure 12-43 configuration of non synchronous shaft control mode

12.1.17.2 parameter configuration of asynchronous shaft

Select configuration - teaching pendant configuration - user group in the hspad software menu, select debug user login in the login interface, log in and enter the welding process package system configuration, click the positioner configuration button to enter the parameter configuration interface, you can configure and increase the reduction ratio, acceleration time, deceleration time, running speed and maximum running speed of the additional shaft, and click Save parameters after input.

12.1.17.3 Asynchronous axis motion

After the parameter configuration is completed, select put into operation - adjustment - Calibration in the hspad software menu, click the additional axis button in the axis calibration interface to enter the additional axis calibration interface, and click Save calibration.

After calibration, click the axis icon on the right side of the teaching pendant, and select the additional axis in the pop-up list box. At this time, the button icon on the right side is the additional axis icon. First turn on an additional axis switch, and then press the corresponding additional axis movement key to move the additional axis, You can select display actual position

in the hspad software menu to see the actual position of the additional axis at this time (as shown in figure 12-45).

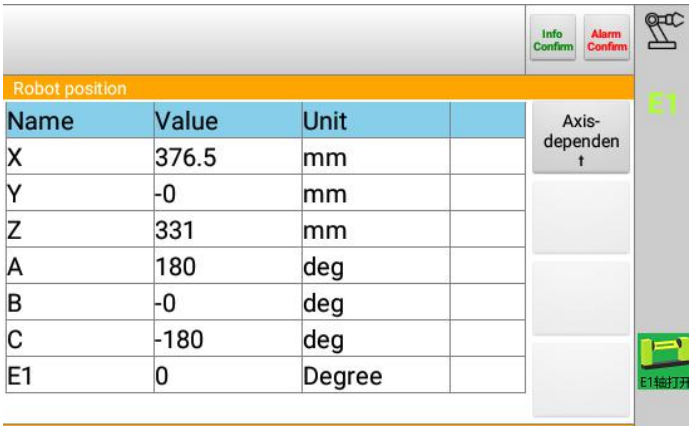


Figure 12-45 non synchronous shaft control movement

12.1.17.4 Asynchronous axis motion command

In the program, the additional axis command is invoked, the current position of the additional shaft is recorded, the additional shaft is moved, a program is opened, and an additional axis motion command can be added by clicking the system instruction movement command additional axis operation instruction. Only when the additional shaft switch is opened, will the position of the additional shaft be recorded, and the additional axis of closing the additional shaft switch will not record the current position.

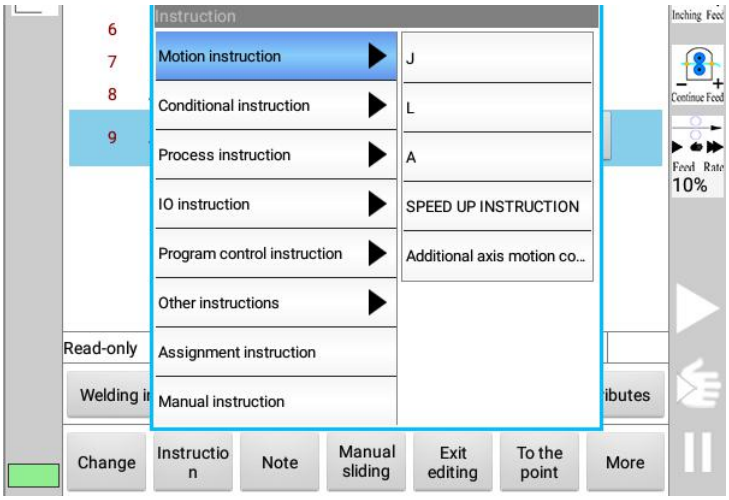


Figure 12-46 additional axis motion command

13 Collaboration Function of Welding System

13.1 Collaboration Group Configuration

From the menu of HSPad software, select Configuration- Controller configuration- Collaboration configuration, the resulting interface of which is as follows in Figure 13-1:

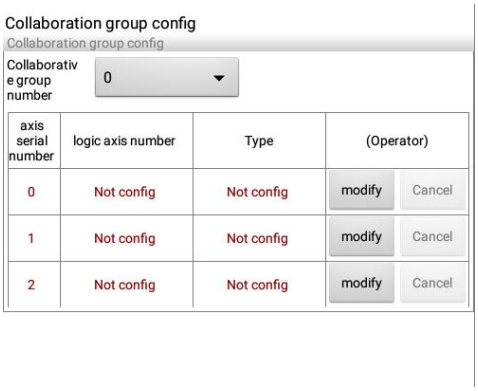


Figure 13-1 Collaboration configuration

From within the figure, collaborative group number, logic axis number and type of axis are seen

Collaborative group number stores the configuration methods of the external axis.

Logic axis number refers to the number of the external axis in the robot axis groups.

Type is to inform of the manner in which the axis is moving, and only rotation is supported by far.

Here, we select number 0 of the collaborative group and click modify in the number 0 line of axis serial as seen in Figure 13-2:

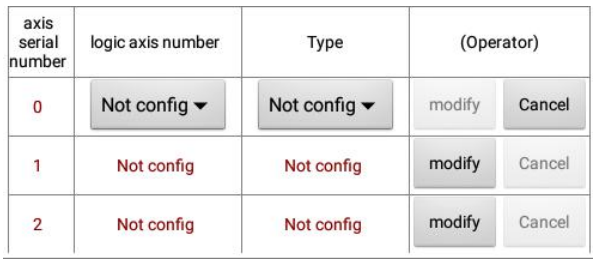


Figure 13-2

Clicking Not config will allow selecting number and type of the axis. We choose number 7 and Axis of rotation as illustrated in Figure 13-3:

axis serial number	logic axis number	Type	(Operator)
0	7	Axis of rotati..	modify Cancel
1	Not config	Not config	modify Cancel
2	Not config	Not config	modify Cancel

Figure 13-3

Setting completed, click Save as to finish the configuration of the first collaborative axis. The configuration steps are the same if it is to set for collaboration of multiple axes.

13.2 Calibration of Collaborative Groups

To access to the collaborative group calibration interface, select Menu→Put into operation→Measure→Collaborative group calibration, the interface of which will be shown as in Figure 13-4:

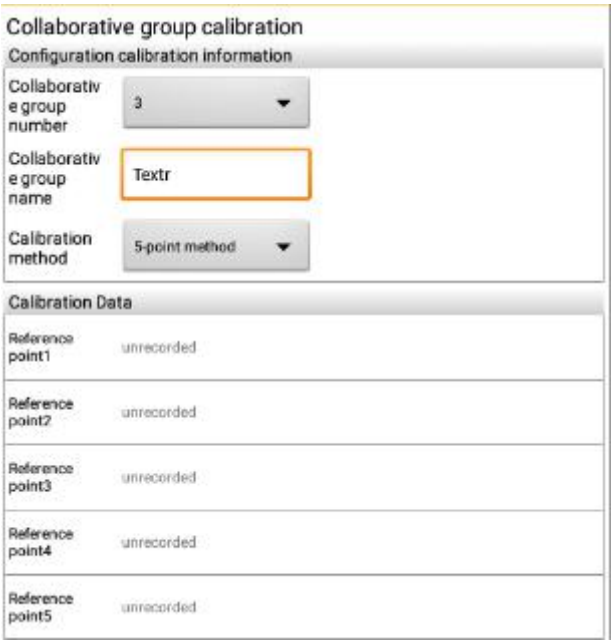


Figure 13-4 Calibration interface

The calibration steps are as follows:

(1)Determine a point (as point P) (as far from the rotary center as possible) on the rotary table of the positioner. Combine the robot controlling point with point P and record it as C1, the first point to be recorded.

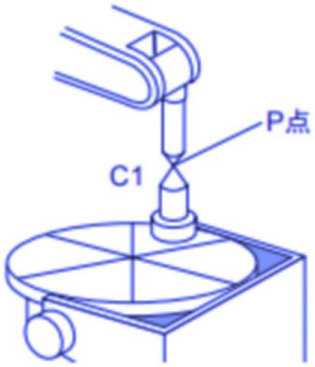


图 13- 5 协同 3 点法标定

Figure 13-5 3-point calibration method of coordinates

(2)Make the positioner rotate for any amount.

Though the rotation amount is not limited, an angle over 30° is preferable.

Both forward and backward directions are acceptable.

Combine the robot controlling point with point P after rotation and record it as C2, the second point to be recorded.

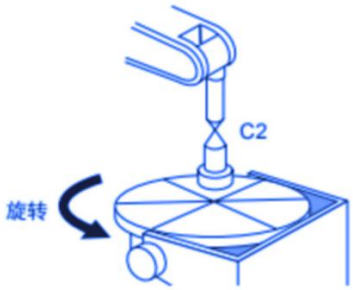


Figure 13-6 3-point calibration method of coordinates

(3)Make the positioner rotate along the direction chose in step 2, and then combine the robot controlling point with Point P which shall be recored as C3.

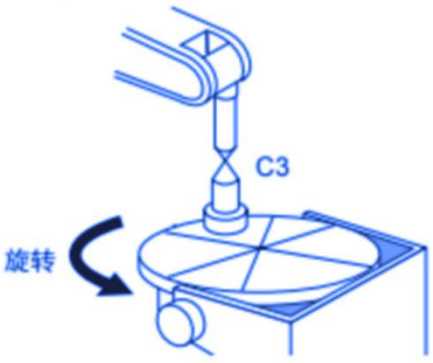


Figure 13-7 3-point calibration method of coordinates

For positioner with two axes, five-point method shall be adopted to calibrate coordinates:

(1)Determine a point (as point P) (as far from the rotary center as possible) on the rotary table

of the positioner.

Position the first axis parallel to the horizontal level, and then combine the robot controlling point with point P which shall be recorded as C1, the first point to be recorded.

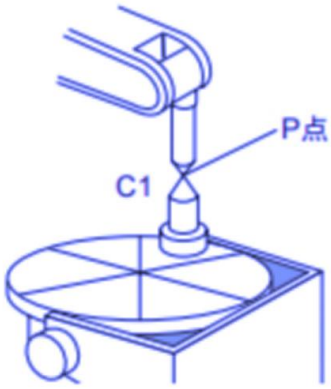


Figure 13-8 5-point calibration method of coordinates

(2)Rotate the first axis by approximately 30°, and combine the robot controlling point with point P which shall be recorded as C2, the second point to be recorded.

Figure 13-9 5-point calibration method of coordinates

(3)Rotate the first axis by about 30°, and combine the robot controlling point with point P afterwards, which shall be recorded as C3, the third point to be recorded.

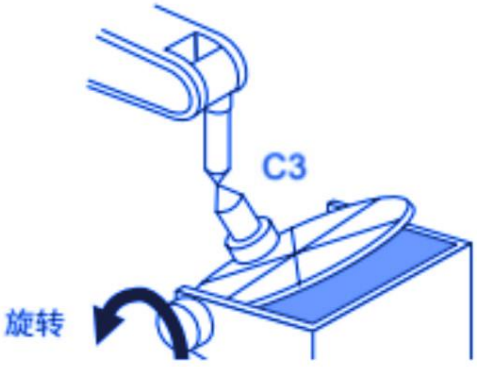


Figure 13-10 5-point calibration method of coordinates

(4)Return to point C1 and rotate the second axis by about 30°. Record the fourth point C4 after combining the robot controlling point with point P.

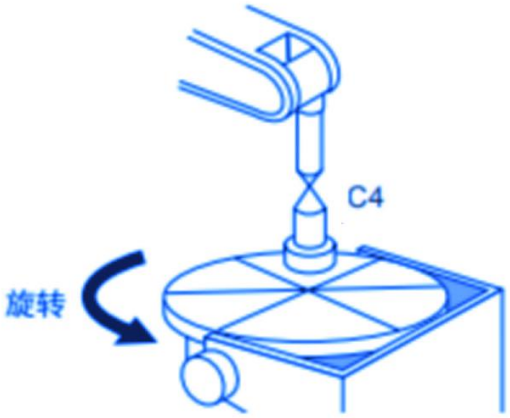


Figure 13-11 5-point calibration method of coordinates

(5)Rotate the second axis by about 30°. Combine the robot controlling point with point P and record the fifth point C5.

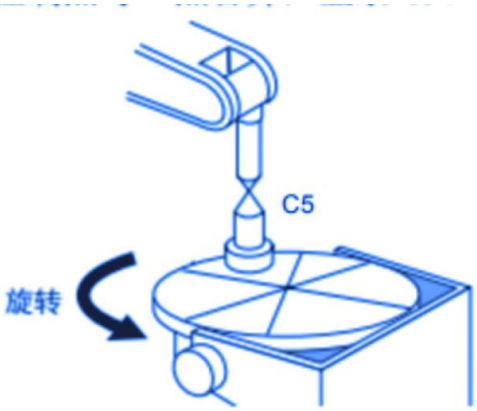


Figure 13-12 5-point calibration method of coordinates

13.3 Collaboration Teaching

Statement Upon collaboration calibration completed, external axis may be switched to. By calling the corresponding collaborative group number, the external axis E1~E2 will be changed into C1~C2 indicating the current collaboration status. At this time, inching the external axis will force the mechanical arms to work in collaboration with the positioner.

Teaching steps:

(1)Open the newly established programme, right side axis icon, and then click “HSRobot” and drag down the list.

(2)Click to choose “External axis”.

(3)Click the toolbar and workpiece in the status column and the collaborative group number after finding Collaborative group selection by dragging down the list Where E1 and E2 are turned to be C1 and C2, click C1 or C2 to make mechanical arms to work in collaboration with the positioner as shown in Figure 13-13.

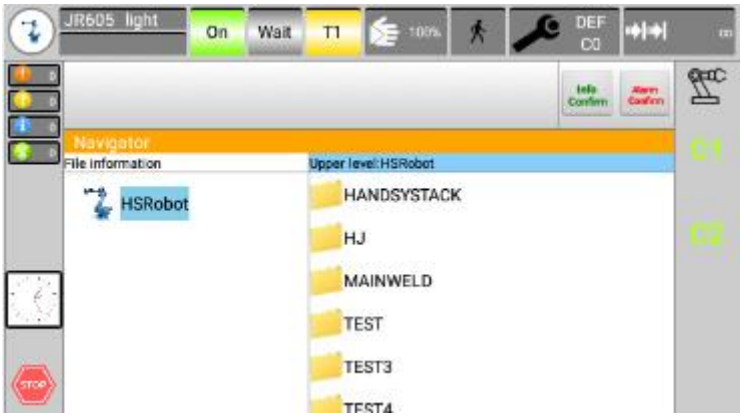


Figure 13-13 Collaborative axis

(4)Press Enable and select the moving angle of C1. Click HSRobot and drag down the option list for switching to the HSRobot.

(5)Move the robot to the due position on the workpiece after rotation and record such point as to finish teaching the first collaborative coordinate. The remaining coordinates may be taught the same way.

Figure 13-14 yields a programming exemplification:

Figure 13-14 Programming exemplification

14 Modbus function

explain Modbus is a common communication protocol between industrial equipment. It is a master-slave agreement. It defines one party as the server and the other as the client to interact and cooperate with each other to realize the information exchange between the two sides.

Modbus configure

As a server, it is necessary to configure the communication protocol, port setting, coil state, input state, holding register and the number of

input registers. After the configuration is completed, turn on the enable switch to save the configuration information. You can observe whether the connection is successful through the connection state.

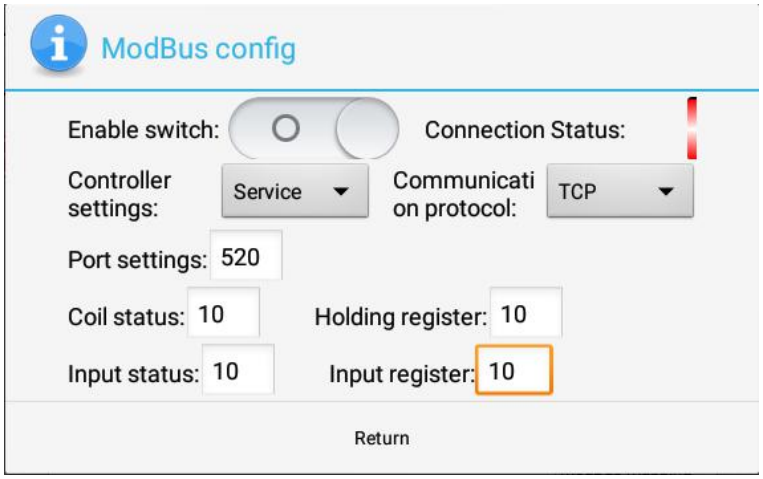


Figure 14-1 MODBUS server configuration interface

As a client, you need to configure the communication protocol, IP settings and port settings (corresponding to the server), coil status, input status, holding registers and the number of input registers. After the configuration is completed, turn on the enable switch to save the configuration information. You can observe whether the connection is successful through the connection status.

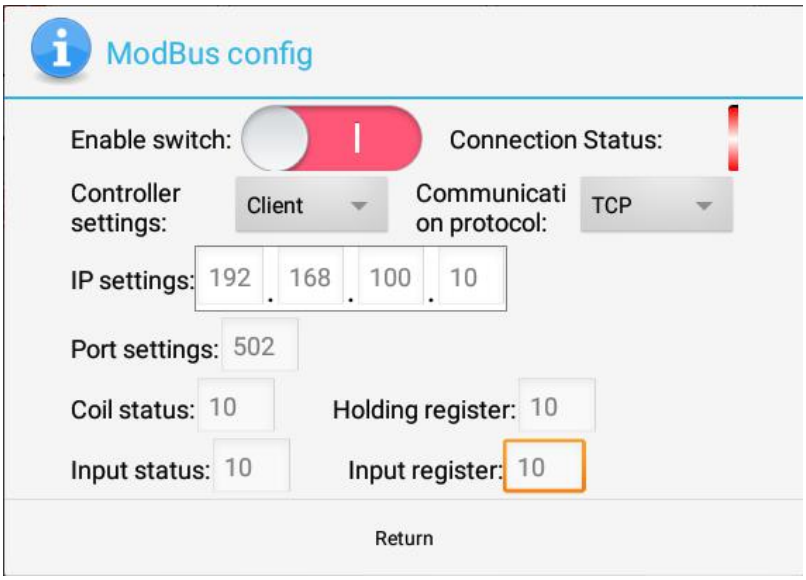


Figure 14-2 MODBUS client configuration interface

Modbus mapping

Modbus mapping can only be set after the Modbus enable state is configured (i.e. MODBUS configuration). The coil status, input status, holding register and the number of input registers are configured in MODBUS configuration, and the mapping is set in MODBUS mapping.

As a server:

Set coil status (coil_ STAT), establish mapping relationship with do [];

Set input status (in)_ STAT) and establish mapping relationship with di [];

Set holding register (hold_ Reg) to establish a mapping relationship with the R register.

Set input register (in)_ Reg) to establish a mapping relationship with the R register.

As a client:

Set coil status (coil_ STAT) and establish mapping relationship with di [];

Set input status (in)_ STAT), establish mapping relationship with do [];

Set holding register (hold_ Reg) to establish a mapping relationship with the R register.

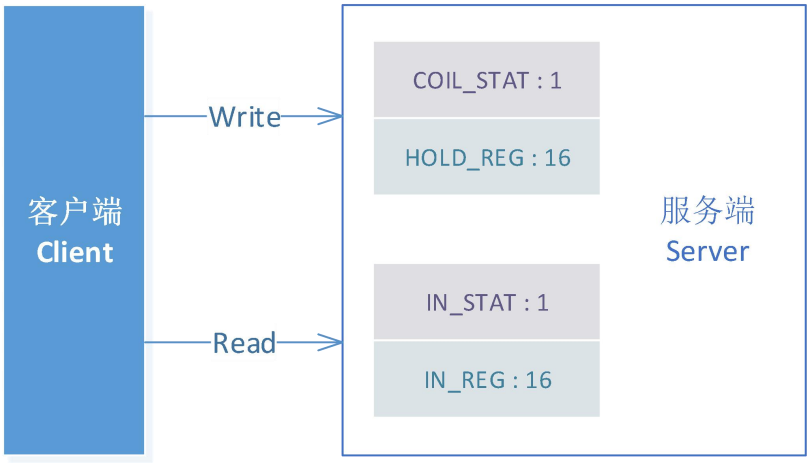
Set input register (in)_ Reg) to establish a mapping relationship with the R register.

	The holding register and the input register cannot establish a mapping relationship to the same r register at the same time.

Modbus display

Modbus mapping can be displayed only after the Modbus enable status (i.e. MODBUS configuration) and mapping relationship are configured. After the connection is successful and the mapping relationship is configured, the data interaction between the server and the client can be viewed through the Modbus display.

- ✧ Coil status register, client only write, server read only
- ✧ Enter the status register. The client is read-only and the server is write only
- ✧ Holding register, the client only writes, and the server is read-only
- ✧ Input register, client read-only, server write only



15 Document function

15.1 File Management Navigator

Explain： Users can manage programs and all system related files in the navigator.

header line

Left area: Displays the selected folder.

Area on the right: Displays files under the selected directory in the directorystructure. The [Open] button opens the corresponding folder

directory structure

Directory overview. Show which directory, click to display the list of directories.

listed files

displays the contents of the directory marked in the directory structur

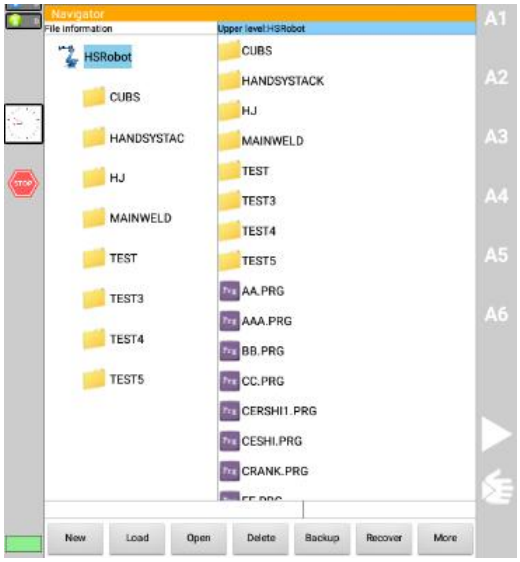


Figure 15-1 Navigator interface

15.2 New File

operating steps

1. select a folder in the directory structure where you want to create a file
2. click New
3. selector or folder
4. give the name of the new file (the name can not contain spaces) and press the confirm button.

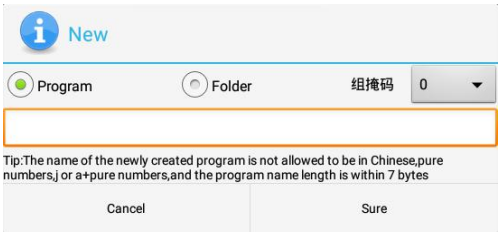


Figure 15-2 New program or folder

15.3 Backup restore settings

Description for backup and restore of navigator interface files

operating steps

1. click "main menu → file → backup restore settings" to open the backup/restore settings dialog box

2. set the path of backup and restore to udisk (U disk) or default path (default path is stored in teach local), the path of backup and restore can be entered manually under super permission.

3. select the file you want to backup in the navigator interface, click on the backup to complete the backup, the backup file is located in the set path

4. in the navigator interface, click on the recovery button, will display the set of restore path under the file, select the that needs to be restored, click on the OK button to complete the file restore. if it is from U disk restore need to insert U disk first.

	The instructor's program files are stored in the SD/HSpad/program/ directory under the [ES file browser] app. After connecting to the U disk, you can also scan to the udisk (disk directory) under the file browser interface.

Figure 15-3 Backup and Restore Settings

15.4 Lock and Unlock Files

operating steps **File lock:**

1.mark the file in the directory structure.

2.select edit → lock and click the lock button in the prompt box.

3.After locking is completed, the selected file icon displays the style of a

Unlock:

1. Select the locked file in the file directory.
2. select edit → lock and click the unlock button in the prompt box.
3. Enter the unlock password and click OK to unlock the currently selected file.unlock initial password "hspad".

Change Unlock Password:

1. select file in main menu → lock password setting.
2. you enter the original password and the new password, click the OK button to save the new password.

	Locking can only operate on files, not on folders. The locked file cannot be renamed, deleted or opened.

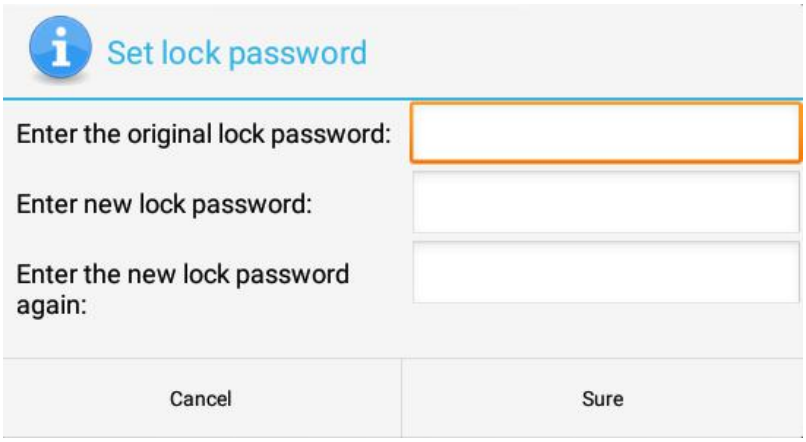


Figure 15-4 Locking Password

15.5 Get register file

Explain that this function is divided into two parts: get register file, send register file (variable list register file), get controller register file through U disk, and send register file to restore register data of controller.

Operation Step Select Menu Bar → File → Get Register File

Click Select Group Number drop-down box option (default 0)

Check the tick box and select the file you want to send or get

Click "Get File "/" Send File" button 。Click OK to confirm the operation

Click the "confirm" button to confirm the operation

	The acquired register file is stored under the U disk / udisk/regfile/ folder. Send register files also need to send text with the U disk / udisk/regfile folder. (Effective after the transmit register file restarts the system)

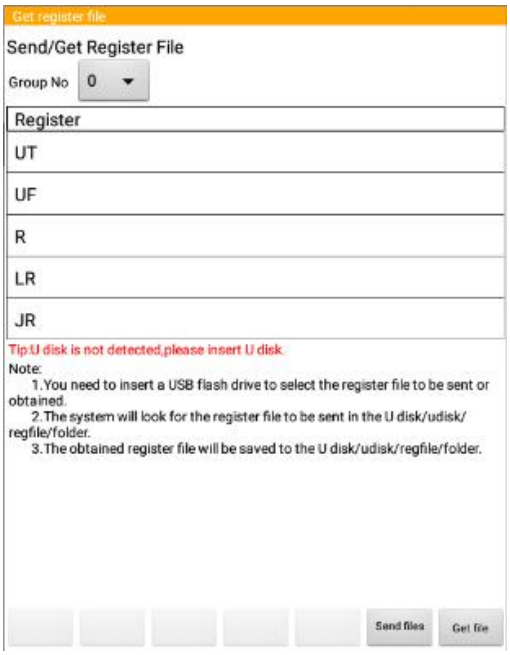


Figure 15-5 Gets the transmit register file

15.6 File/File Delete

operating steps Mark files or folders in the directory structure.

choose edit → delete. (File not locked)

Click the confirmation button in the dialog box and the marked file or folder will be removed.

15.7 Select or open a program

Overview general view a program can be selected or opened. A program editor, not a navigator, will then appear. can switch back and forth between the program display and the navigator.

Distinguish **Program loaded:**

1. statement pointer will be displayed.
2. program can be started.
3. press edit → navigation, after unloading, press the program, enter to the program editor, you can change the program.

Program opened:

1. Program can not start。
2 . The program can be edited.
3.open program applies to people who debug the program for editing.A

file save dialog box pops up when the

4. closes. You can cancel and continue editing, saving, or abandoning saving.

5. the editor, you can load the program only after saving or not saving.

15.8 Loading and Unloading

operating steps

1. Select the program in the navigator and press load.

2. The program is displayed in the editor. The selected program is loaded into the editor. the corresponding open file is always displayed in the editor. while the running cursor is displayed.

3. Unload Program: Select "More → Unload Program" or press the "Unload" button directly. If the program is running, the program must be stopped before canceling the program selection.

15.9 Log file management

explain This function provides log functions such as acquiring controller and instruction operation

operating steps

1. click on the select menu bar-file-log file management enter the log file management interface.

2. tick to get log object tick box.

3. U the disk has been inserted into the instructor and guaranteed to be recognized, click the [Get File] button to pop up the path selection interface.

4. clicking the [ok] button will send the log file under that folder.

Figure 15-6 getting log file

	log can be sent to relevant personnel for problem analysis

16 Display function

16.1 Display digital input/output

	The input REAL can only give the signal through the real external pulse, VIRTUAL can give the pulse signal through the instructor.

operating steps

1. select the digital input/output end → display in the main menu.
2. Click to select a specific input / output, through the interface right button to operate the IO.

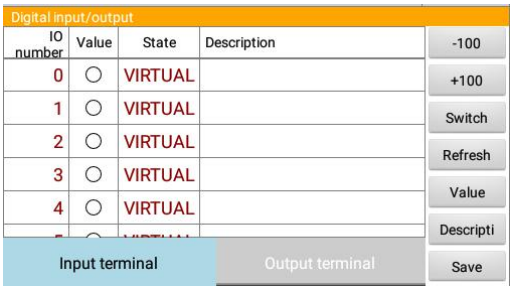


Figure 16-1 Digital input

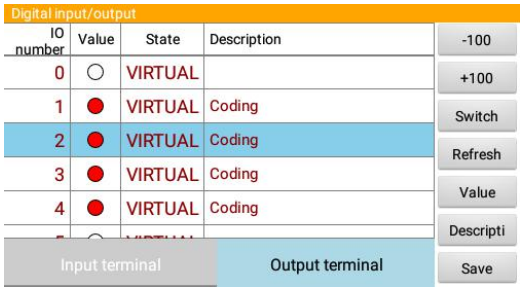


Figure 16-2 Digital output

number	explain
order number	Digital input/output serial number
io No.	Digital input/output IO number
judge	input/output values. marked red if an input or output is TRUE,. The click value switches to TRUE or FALSE..
status	The digital input/output is shown as a real IO or virtual IO, real IO as a REAL, virtual display
explain	Add instructions to this digital input/output.
-100	switch to the previous 100 inputs or outputs in the display.
100	After switching to 100 inputs or outputs in the display。
changing-over	can be switched between virtual and actual input/output.
judge	The selected IO can be set to TRUE or FALSE..
explain	Add explanatory notes to the selected row's digital input/output, click to change after selection.
save	Description IO preservation

16.2 Variables list

operating steps

1. Choose the main menu to display → list of variables. a list of relevant variables will be displayed.

2. clicking on the list of different variables, the related variables are displayed.

3. through the right function button can do page turning, modification, save register function.

4. all changes must be saved by clicking save.

	After setting register, need to click [save] to save, not save power off restart after lost.

explain：

List of variables used for the existence of different types of register data

UT： tool coordinate system variables

UF： base coordinate variables

R ： Value Register

JR： Association Coordinate Register

LR： Cartesian coordinate register

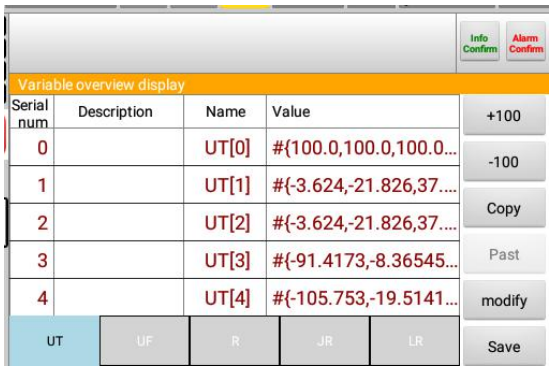


Figure 16-3 Variable List

17 diagnose

17.1 Run log

explain The instructor provides log functionality to view the generated running logs.

operating steps

Operation steps

1. select the diagnostic → run log in the main menu, showing the run log window.

Key Description

number	explain
Log head	Jump to the log header
Log end	Jump to the end of the log
-100	Log over 100.
100	Log down 100.
export	Output log to file currently displayed
renovate	Refresh current log
filter	Sets the log filter display condition

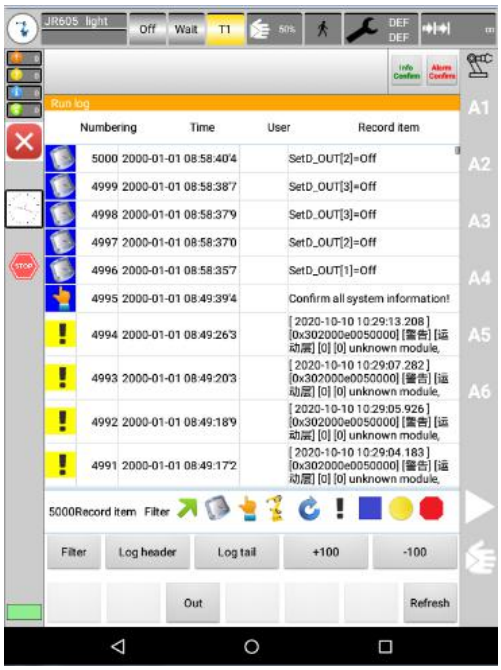


Figure 17-1 Running log

17.1.1 filter

explain filterable filter displays the specified content.

operating steps

1. click the filter button to run the log interface.
2. set the log content to be displayed.
3. click OK, will return to the running log interface, showing the filtered log content.

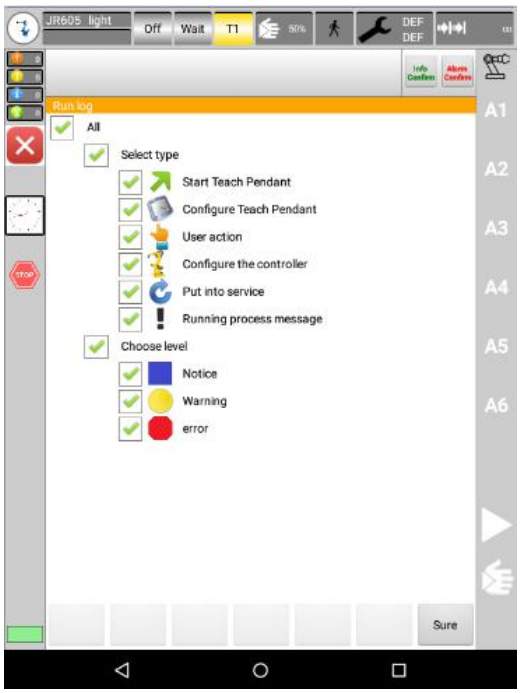


Figure 17-2 Running Logs - Screening

17.1.2 Log configuration

operating steps

1.Click on the main menu to select the diagnostic → running log → configuration, display log configuration interface

2. set log output file etc.

3. click the OK button.

Figure 17-3 Logging Settings

18 Tool/workmarking

18.1 Calibration of base coordinate by three-point method

操作步骤

operating steps

1. select put into operation → measure → user workpiece calibration in menu.
2. select the user artifact number to be calibrated, the user artifact name can be set.
3. click the [start calibration] button.
4. move to the base coordinate origin, click [origin] to get the coordinates to record the origin coordinates.
5. move to a point in the X direction of the calibration base coordinate, click [X direction] to get the coordinate record coordinate.
6. move to a point in the Y direction of the calibration base coordinate, click [Y direction] to get the coordinate record coordinate.
7. click the "Mark" button to determine the program to calculate the calibration coordinate value
8. Click the Save button to calibrate the base coordinates
9. switch to the user coordinate system, select the calibrated workpiece number and go in the XYZ direction, it will move in the calibrated direction.

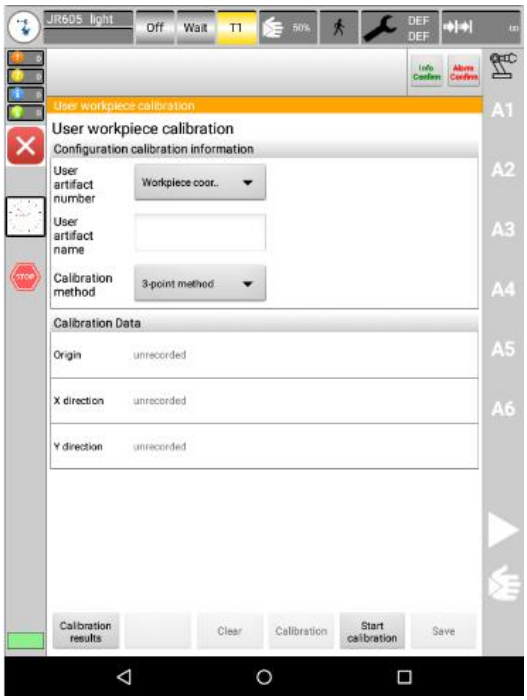
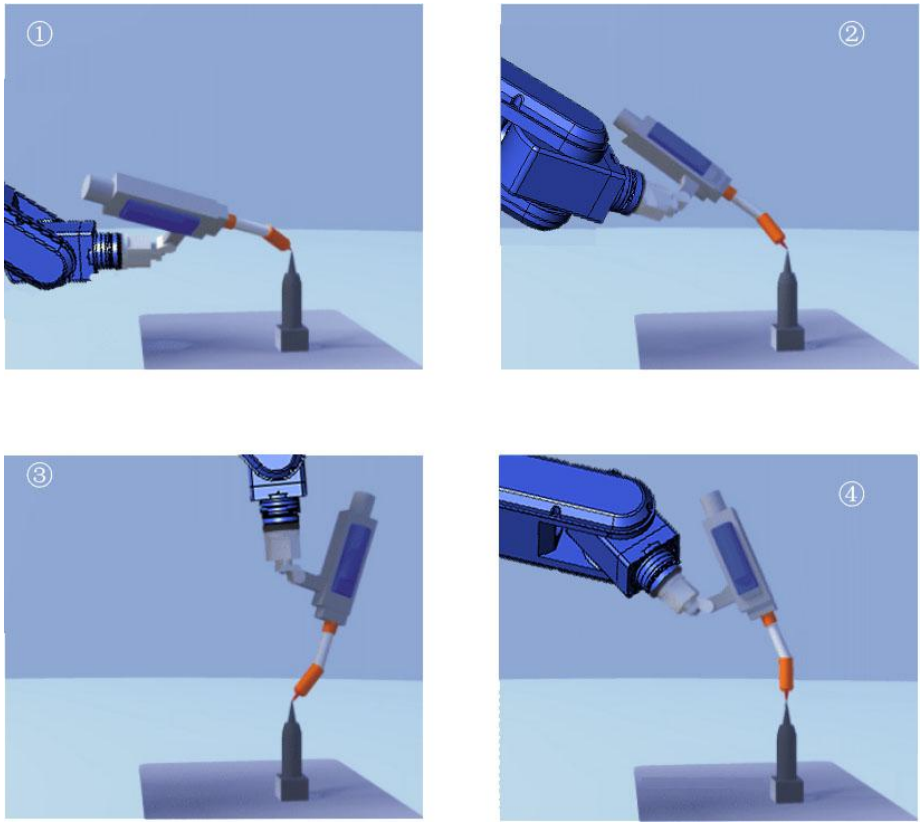


Figure 18-1 Base coordinates

18.2 Calibration of four-point tool calibration

explain moves the TCP of the tool to be measured from 4 different directions to a reference point. reference points can be chosen arbitrarily. A robot control system calculates TCP. from different flange position values The 4 flange positions used to move to the reference point must be dispersed enough distance.



operating steps

1. select the user tool calibration → the running measurement from the menu
2. select the user tool number to be calibrated, the user tool name can be set.
3. click the [start calibration] button.
4. move to the base coordinate origin, click [origin] to get the coordinates to record the origin coordinates.
5. move to a point in the calibrated reference point 1, click [reference point 1], to get the coordinate record coordinates.
6. move to a point in the calibrated reference point 2, click [reference point 2], to get the coordinate record coordinates.
7. move to a point in the calibrated reference point 3, click [reference point 3], to get the coordinate record coordinates.
8. move to a point in the calibrated reference point 4, click [reference point 4], to get the coordinate record coordinates.
9. click the "Mark" button to determine the program to calculate the calibration coordinates
10. Click the Save button to store calibration values for tool coordinates
11. Switch to the tool coordinate system, select the calibrated tool number, and take the ABC direction, then the robot tool will TCP rotate around the workpiece.

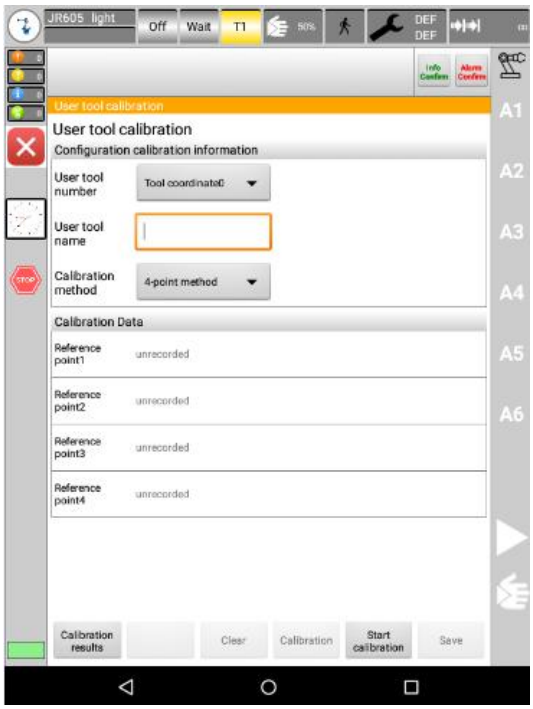


Figure 18-2 Tool coordinate calibration

18.3 Calibration of tool coordinate 6-point method

explain Similar to the 4 point method, the 6 point method can calibrate the attitude of the tool. When recording the point position, the fifth point and the sixth point are used to record the point on the z axis of the tool and the point on the zx plane, respectively.

19 Help

19.1 Information

In the main menu, select Help → Information. In the window that opens, you can view the version information of the current teach pendant and the controller (the controller version information, click the drop-down icon option). Release notes.

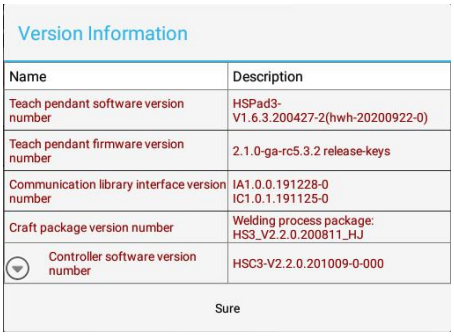


Figure 19-1 Information display window

20 systems

20.1 Language Selection

Description Teach pendant provides selection of alarm language.

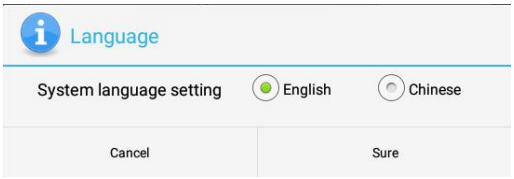


Figure 20-1 Setting the language

Steps

1. Select System → Language Select from the main menu to display the language selection dialog and select the alarm language.

20.2 Heavy Apocalypse

Steps

1. In the main menu, select System → Re-Apocalypse, and select “OK” in the pop-up dialog box to re-apocalypse.

20.3 Cleaning the system

Description This function is used to free up controller storage space and clean up the remaining upgrade package files. The system needs to be cleaned before upgrading the system

Steps

1. Select System → Clean System from the main menu and select “OK” in the pop-up

dialog box to complete the cleaning work.

20.4 Restart the system

Description This function is used to restart the type III controller system and is different from power-off restart (in some scenarios, a power-off restart method is required to restart the system).

Steps

1. Select System → Restart System from the main menu, and select “OK” in the pop-up dialog box to restart the controller Controller

	Some settings need to restart the system before taking effect, such as: load, send register file, etc

20.5 Shutting down the system

Steps

1. Open the menu, click "System → Close System" in turn, and select "OK" in the pop-up dialog box to close the controller system.

20.6 System Upgrade

Description In the teach pendant, an upgrade function is provided for users to upgrade directly on the teach pendant. The extension of the upgrade file is .tar.gz.

Steps

1. Select System → Upgrade System from the main menu to display the upgrade window.
2. Select the upgraded file.
3. Click Send Update Package.
4. Power off and restart the control system

	Before upgrading the system, you need to [Clean up the system] to free up space

Figure 20-2 System upgrade

20.7 Importing and Exporting User PLCs

Description Import / export user PLC function, you can backup the user PLC in the existing controller system through U disk, or import new user PLC to update / restore the system environment.

Export user PLC operation steps

1. Insert U disk, after the U disk is successfully identified

2. Open the menu and click "System → Import / Export User PLC"

3. Click the [Select Directory] button of the export module to determine the export path

4. Click the [Export] button, after prompting that the export is successful, the corresponding file will be found under the selected export path

Figure 20-3 Import and export of user PLC-1

Steps for importing user PLC

1. Insert U disk, after U disk recognition is successful

2. Open the menu and click "System → Import / Export User PLC" in turn

3. Click the [Select File] button of the import module (select the app file) and confirm that you want to import the file

4. Click the [Select File] button of the import module (select the crc file), and confirm the file to be imported.

5. Click the [Import] button, and it prompts "Successfully imported file, please power off and restart the controller!", The user PLC poured into after power off and restart takes effect.

Figure 20-4 Import and export of user PLC-2

	Cannot import and export user PLC when network connection fails

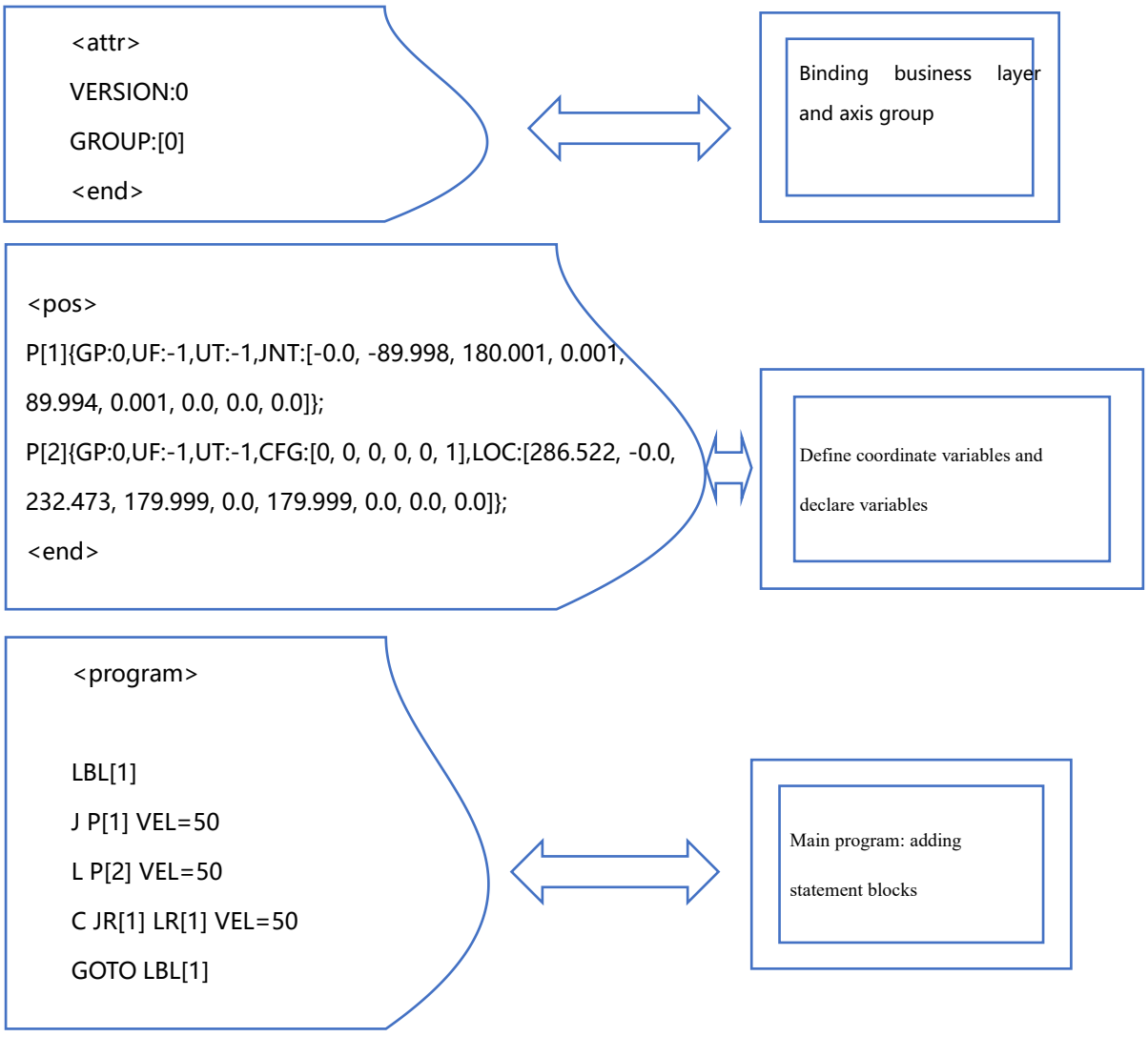
21 Programming Instructions

21.1 File and Program Structure

There are only one type of programs for users of Huashu III control system: PRG files, which support PRG programs to call other PRG programs, that is, the calling party is [main program], and the called party is [subroutine].

21.1.1 Program Structure

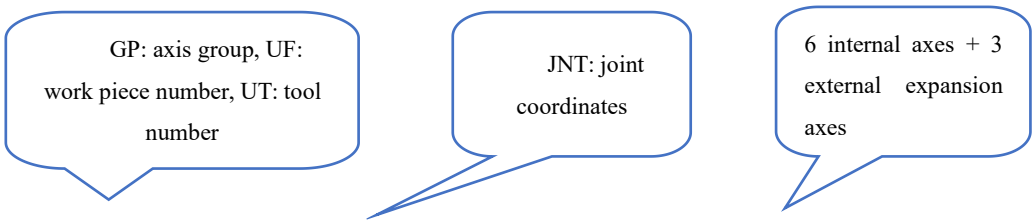
The program is divided into three modules: axis initialization, variable declaration, and main program. The structure is as follows.



The above coordinate variables include point P, a custom coordinate type, and joint-type coordinates JR and Cartesian coordinates LR of the register

21.1.2 Coordinate Type

Define a variable P [1] point, articulated coordinate, meaning as follows:



P[1]{GP:0,UF:-1,UT:-1,JNT:[-0.0, -90.0, 180.0, 0.001, 90.0, 0.0, 0.0, 0.0, 0.0]};

21.1.3 The main program calls other programs

The main program calls other programs with the syntax: CALL "program name", where the program executes here, calls the subprogram, executes the program content of the subprogram, and returns to the main program to continue execution after execution (flow control, see details for details) 2.3 Process Control Instructions). [Teacher interface program is shown below]

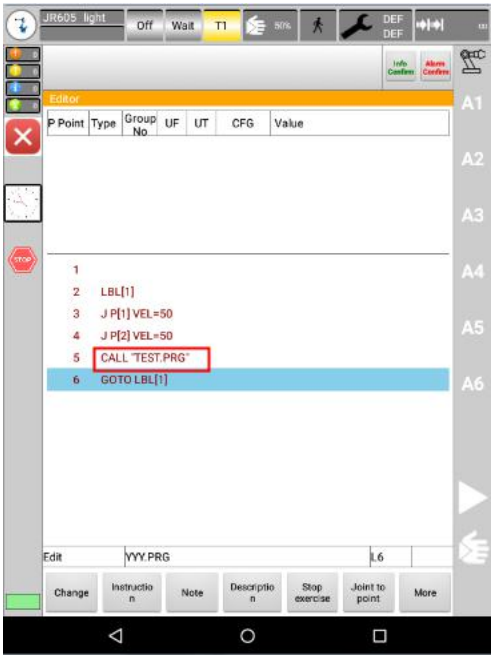


Figure 21-1 program editing interface

21.2 Overview of Programming Instructions

The instruction types and the instructions contained in the types are as follows:

Instruction type	instruction

Motion instruction	J L C
Conditional instruction	IF
Process instruction	CALL GOTO LBL
Loop instruction	WHILE FOR BREAK
IO instruction	DO WAIT WAIT TIME
Timeout instruction	WAIT TIMOUT LBL
PULSE output pulse command	PLUSE TIME
Offset instruction	OFFSET_CONDITION TOOL_OFFSET_CONDITION OFFSET TOOL_OFFSET INC
Get coordinate instruction	JPOS LPOS
Positioning instruction	FINE
Assignment instruction	UFRAME_NUM UTOOL_NUM CNT J_VEL J_ACC J_DEC L_VEL L_ACC L_DEC L_VROT C_VEL C_ACC C_DEC

	C_VROT R JR LR P
Repair instruction	VORD
Manual instruction	Enter instructions manually

21.2.1 Motion instructions

Description Motion instructions include joint motion J and linear motion L, and C commands for drawing arcs.

Motion instruction edit box:

Numbering	Description
1	Select instructions, J, L, C three instructions can be selected. When the C command is selected, two points will pop up in the conversation box for recording the position.
2	The name of the newly recorded point. With the cursor at this point, you can click on the record joint or record Cartesian coordinates.
3	Set running speed
4	For parameter setting, you can add the attribute corresponding to the deletion point in the parameter setting dialog box. After editing the parameter, click OK to correspond the parameter to that point.
5	The new recorded point is assigned a joint coordinate value.
6	Assign this newly recorded point a Cartesian coordinate.
7	Click to open a Modify Coordinates dialog box, and you can manually modify the coordinate values (you need to record the point information first, and the modified coordinates correspond to the coordinate type of the record).
8	The value of the newly added point can be saved by creating a new

	JR register or LR register, and the relevant value can be found in the variable list, which facilitates the use of the point value through the register in the future.

21.2.1.1 J and L instructions

Description The J command uses the current position of a single axis or a group of axes (robot group) as a starting point to move an axis or a group of axes (robot group) to the target point position. There is no trajectory and attitude control during the movement process, that is, joint movement.

Instruction syntax:

```
J [target point] Optional Properties
Ecample:
J P[1] VEL=50 ACC=100 DEC=100
J P[2]
```

Instruction parameters (optional):

The J instruction contains a series of optional motion parameters, such as VEL (speed), CNT (smooth transition), ACC (acceleration ratio), DEC (deceleration ratio), etc. After the property is set, it is only valid for the current movement. After the movement instruction line ends, it returns to the default value. If no parameter is set, the default value of each parameter is used for movement, such as the above-mentioned default parameters used by J P [2]

Instructions:

The L command starts from the current position of the robot, and controls it to perform within a Cartesian space.[Motion], which is often used in situations that require trajectory control. The control object of this instruction can only be [Robot Group].

Instruction syntax:

```
L [target point] Optional Properties
Ecample:
L P[1] VEL=50 ACC=100 DEC=100 VROT=50
L P[2]
```

Instruction parameters (optional):

The L command contains a series of optional motion parameters, such as VEL (speed), CNT (smooth transition), ACC (acceleration ratio), DEC (deceleration ratio), VORT (attitude speed),

and so on. After the property is set, it is only valid for the current movement. After the movement instruction line ends, it returns to the default value. If no parameter is set, the default value of each parameter is used for movement.

Steps

1. Select the previous line of the instruction line to be inserted.
2. Select Command → Motion Command → J or L.
3. Enter the point name.
4. Configure the parameters of the instruction (the default motion parameters if not set).
5. Manually move the robot to the desired attitude or position.
6. Select the point input box, and click "Record joint" or "Record Cartesian" (J command can only select record joint). The coordinates of the record will be displayed at the upper right of the instruction modification box.
7. Click the "OK" button in the operation bar to add the J command / L command to complete.

Program example

```
LBL[1]
J  P[1]  VEL=100  ACC=60  DEC=60
L  P[2]  VEL=800  ACC=100  DEC=100
GOTO LBL[1]
```

21.2.1.2 Arc A instruction

Description Arc A instructs the three points at the current position of the robot to form two arcs with the same radius. The first two points are arcs with one radius and the last two points are arcs with another radius. Point positions can be added and deleted between the two arcs. Different attributes can be set for the motion attributes of the two arcs

Instruction syntax:

C [circle point] [target point] Optional Properties}

Example:

J P[1]

A P[2]

A P[3]

A P[4]

A P[5]

L P[1]

Instruction parameters (optional):

Arc A command contains a series of optional motion parameters - vel (speed), CNT (smooth transition), ACC (acceleration ratio), Dec (deceleration ratio), vort (attitude speed), etc. After the attribute is set, it is only valid for the current motion. After the motion command line ends, it returns to the default value. If no parameters are set, the default values of the parameters are used for the motion.

Steps

1. Calibrate the previous line of the instruction line to be inserted.
2. Select Command → Motion Command → A
3. Click the first position point input box, move the robot to the required attitude point or axis position, click record joints or record Cartesian coordinates, record the first point of the arc is completed.
4. Click the second position input box and manually move the robot to the desired target posture or position. Click record joint or record Cartesian coordinates, record arc target point is completed.
5. Configure the parameters of the instruction
6. Click the OK button in the operation bar to add the C command.

	① You can add and delete points on the arc. ② You can set the middle point of the arc Different motion attributes (speed, acceleration, CNT, tool offset, etc.) are set for and end points. ③ Each arc track has a different radius.

Program example

J P[1]

AP[2]

A P[3]

A P[4]

A P[5]

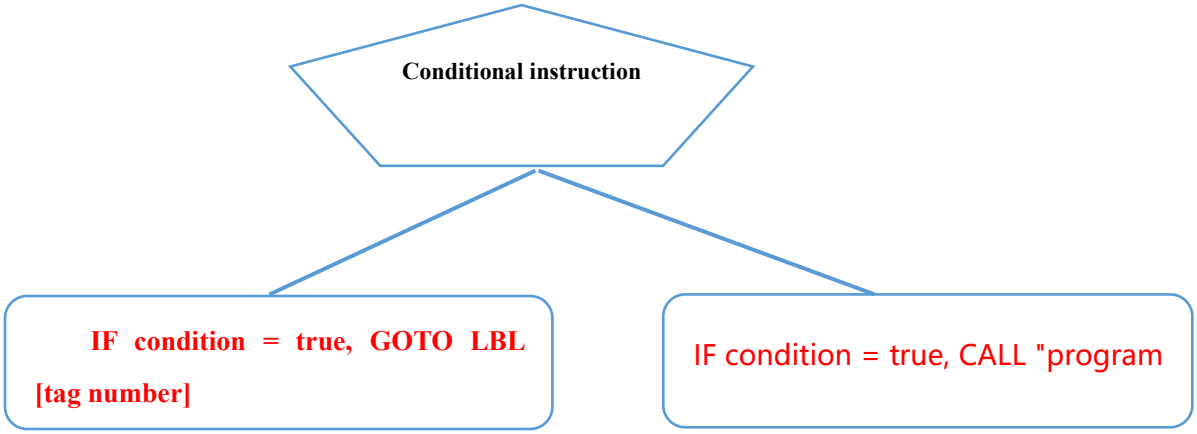
L P[6]

21.2.1.3 Motion parameters

Name	Description
VEL	speed
CNT	smoothing factor
CNT_TYPE	Smoothing type
ACC	Speedup ratio
DEC	Reduction ratio
VROT	Attitude speed
SKIP	Break

21.3 Conditional instructions

Conditional instructions are used for program condition judgment and logic processing. There are the following two types



21.3.1 IF …. ,GOTO LBL[]

Instructions:

IF <condition>, GOTO LBL [1]

Example:

IF DI [1] = ON, GOTO LBL [1] ‘

J P [1] VEL = 50

J P [2] VEL = 50 ‘if the condition is true, jump directly to the label [1]

LBL [1]

DI [1] = OFF

.....

The above indicates that if DI [1] is ON, it will directly jump to LBL [1] and start execution. When the condition is false, it will execute from top to bottom.

The syntax is: if . goto LBL [], when the condition is true, the goto part of the code block is executed; when the condition is not true, the program block starting from if downlink is executed in sequence

Application exampe ①: It is realized by IF GOTO statement. movement to point P1, R [2] = 2, movement to point P2, R [3] = 3, movement to point P3

IF R[1] =1, GOTO LBL[1]

IF R[1] =2, GOTO LBL[2]

IF R[1] =3, GOTO LBL[3]

GOTO LBL[4]

LBL[1]

J P[1]

GOTO LBL[4]

LBL[2]

J P[2]

GOTO LBL[4]

LBL[3]

J P[3]

LBL[4]

Application example ②: It is realized by IF GOTO statement. After 3 times of loop program, exit the loop.

R[1] =0

LBL[1]

IF <condition> , CALL Program name.PRG

Example:

IF DI[1]=ON ,CALL TEST.PRG

J JR[1] VEL=50

DO[1]=OFF

.....

The above indicates that if the di [1] on condition is met, it will be called first TEST.PRG The program content of subroutine, after execution, execute J Jr [1] vel = 50, do [1] = off and the following instructions,

IF R[1]>3 **GOTO LBL[2]**

J P[1]

J P[2]

R[1]=R[1]+1

GOTO LBL[1]

LBL[2]

21.3.2 IF…. , CALL

Instructions:

IF ...., CALL subroutine. When the condition is satisfied, the subroutine is executed. The PRG code content is executed sequentially and then executed downward; when the condition is not satisfied, the content of the program starting from the IF downward is executed and the called subroutine is ignored.

Note: Conditional instructions also support compound conditions AND, OR, and parentheses ()

Description Conditional instructions are used for motion logic control in robot programs. There are two types: IF condition GOTO LBL [], IF condition, CALL "Subroutine"

he syntax is: IF ...., GOTO LBL [], when the condition is satisfied, the GOTO part of the code block is executed; when the condition is not satisfied, the program block starting from the IF downstream is executed sequentially.

IF…., CALL subroutine. When the condition is satisfied, the subroutine is executed after the content of the PRG code and then executed sequentially; when the condition is not satisfied, the content of the program starting from the IF downward is executed and the called subroutine is ignored.

1. Select the previous line to which the IF instruction line needs to be added

2.Select instruction → conditional instruction → IF

3.Click the symbol button above the edit box to add conditions quickly; click the option to add conditions, delete conditions, and modify conditions. When the statement is recorded, the condition list will be connected in order.

Figure 21-2 IF instruction

4. Click the up or down button in the operation bar to move the position of the condition up and down.

5.lick Add Group to bring up the check box. You can select the condition combination to complete the parentheses.

6. Check the condition check boxes for columns 1 to 3, and then click to complete the grouping.

7. As shown in the figure below, select the first row. If you click again to ungroup, you can restore the state shown in the figure above.

Figure 21-3 IF instruction-2

8. Click the OK button in the operation bar to add the IF instruction.

Program example

LBL[1]

IF (R[1]=10 AND R[2]=20 AND R[30]=30) AND DO[31]=ON , GOTO LBL[2]

J P[1] VEL=50

GOTO LBL[3]

LBL[2]

IF R[1]=2,CALL"TEST.PRG"

J P[2] VEL=50

LBL[3]

GOTO LBL[1]

21.4 Process Instructions

21.4.1 CALL instruction

Instructions:

The CALL instruction is used to call a subroutine and execute the program content of the subroutine

CALL program name.PRG

Example: Here are two programs, the main program MAIN.PRG, and the subprogram SON.PRG.

'MAIN.PRG (main program)

J JR [1] VEL = 50

J JR [2] VEL = 50

CALL SON.PRG 'Call subroutine

'SON.PRG (subroutine)

DO [1] = ON

WAIT TIME 500

DO [1] = OFF

The above execution flow moves the joints to JR [1], JR [2] in sequence, executes DO [1] = ON, waits for 500 milliseconds, DO [1] = OFF, turns off the pulse signal, and completes the program execution.

The above indicates that if DI [1] is ON, the program content of the TEST.PRG

Note: The program call supports multiple levels of nesting, and supports 10 levels and above.

Steps

1. Select the previous line of the instruction line to be inserted.
2. Select Instruction → Process Instruction → CALL.
3. Click the Select Subroutine button
4. Select the subroutine and confirm
5. Click the OK button in the operation bar to add the CALL instruction.

Figure 21-3 CALL instruction

21.4.2 GOTO LBL[]

Instructions:

The GOTO instruction is mainly used to jump the program to the designated label position

(LBL). To use the GOTO key word, the LBL label must be defined in the program, and GOTO and LBL must be in the same program block.

```
LBL [label name]
GOTO LBL [tag name]

LBL [1]
J P [1] VEL = 50
J P [2] VEL = 50 ‘Circular motion between two points
GOTO LBEL [1]
```

Note: the program can realize loop movement through goto statement

Explanation The GOTO instruction and LBL instruction are used together to complete the program jump. GOTO will jump to the line specified by LBL.

Steps

1. Select the previous line of the instruction line to be inserted.

2. Select Instruction → Process Instruction → LBL, and enter the label number.

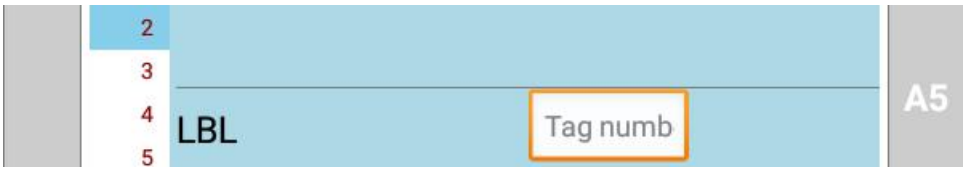


Figure 21-4 Process instruction-1

3. Click the "OK" button in the operation bar, and the LBL instruction is successfully inserted.

4. Select the instruction line to be jumped.

5. Select Instruction → Process Instruction → GOTO, and enter the label number in the input box.

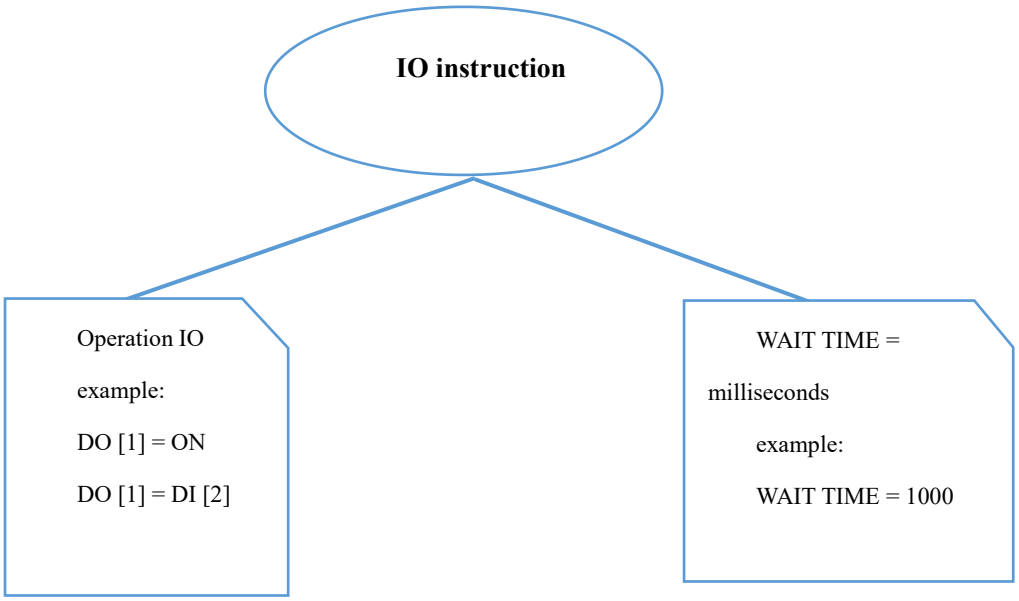
Figure 21-5 Process instruction-2

6.Click the "OK" button in the operation bar, and the GOTO instruction is added successfully.

	Use GOTO LBL [], LBL [] to realize program cycle operation

21.5 IO Instructions

IO instruction is divided into three parts: IO operation, Wait condition wait, WAIT TIME sleep instruction



21.5.1 DO

The DO instruction is used for the operation of output signals and the mapping between IO.

example:

DO [1] = ON ‘Output [1] is set to ON

DO [1] = OFF ‘Output [1] is set to OFF

DO [1] = DO [2] ‘output [2] is assigned to output [1]

DO [1] = DI [2] ‘input [1] is assigned to output [1]

Note: There is no need to add a delay instruction between the movement instruction and the IO [as follows: the IO signal is output only after the movement reaches the P [1] point]

J P[1]

D_OUT[1]=ON

Description IO instructions include DI, DO, and WAIT instructions. The DO instruction can be used to assign the current IO value to ON or OFF, and can also be used to transfer values between DI and DO. The WAIT instruction is used to block waiting for a specified signal. WAIT TIME instruction is used for sleep waiting, the unit is ms.

Steps

DO instruction

1. Select the previous line to which the DO instruction line is to be added.

2. Select instruction → IO instruction → DO

3. Enter the IO number in the first input box

4. Select the corresponding value or IO in the second selection box. If IO is selected, you need to enter the corresponding IO number in the corresponding input box.

5. Click the "OK" button in the operation bar to finish adding the IO instruction.

WAIT instruction

1. Select the previous line where you want to add the WAIT command line.

2. Select any waiting signal in a selection box: DI, DO, R, TIME (in milliseconds), and enter the corresponding values.

3. Click the "OK" button in the action bar to complete the addition of the WAIT instruction.

Program example

WAIT R [1] = 1

J P [1] VEL = 100

DO [1] = ON

DO [2] = OFF

WAIT TIME = 100

J P [2] VEL = 100

21.5.2 WAIT TIME

The purpose of the WAIT TIME instruction is to delay the execution of a program (task) with a minimum delay time of 1 in [ms].

Example:

J P [1]

WAIT TIME 1000 ‘After moving to P1, wait for 1 second after sleep, DI [1] will output the signal number

DI [1] = ON

J P [2]

J P [3]

21.6 Program Control Instructions

Instructions:

This instruction is used for program execution control, including PAUSE suspension, ABORT interrupt, END termination instruction

21.6.1 PAUSE Directive

This instruction is used to suspend program execution.

Steps

1. Select the previous line of the instruction line to be inserted.
2. Select Instruction → Program Control Instruction → PAUSE.
3. Click the OK button in the operation bar, and add the PAUSE instruction.

Figure 21-8 Pause

example:

J P [1]

J P [2]

PAUSE ‘the program is executed to this line, the program status is changed to pause

J P [3]

Remarks: As the above program, the program moves to point P1 and then to point P2. When the program is executed to the PAUSE instruction, the program status changes from running to pause, and the current actual position is still at point P2.

21.6.2 END instruction

This instruction is used to end the program operation.

Steps

1. Select the previous line of the instruction line to be inserted.
2. Select instruction → program control instruction → END.

3. Click the OK button in the action bar and add the END instruction.

Figure 21-9 End instruction

example:

J P [1]

J P [2]

END ‘the program is executed to this line, the program ends, and the program pointer returns to the first line

J P [3]

Remarks: As the above program, the program moves to point P1 and then to point P2. When the program reaches the END instruction, the program status changes from running to ready state, the pointer returns to the first line, the current actual position is at point P2. Press the run button, the program will move to point P1 and then point P2, the program status will change from running to ready, and the pointer will return to the first line.

	Note: When the subroutine is called in the main program and the subroutine contains END, then the subroutine ends and the main program is executed.

Program example

‘Main program MAIN.PRG

J P [1]

CALL LIB.PRG

WAIT TIME = 100

J P [2] VEL = 100

‘Subroutine LIB.PRG

J JR [1]

END

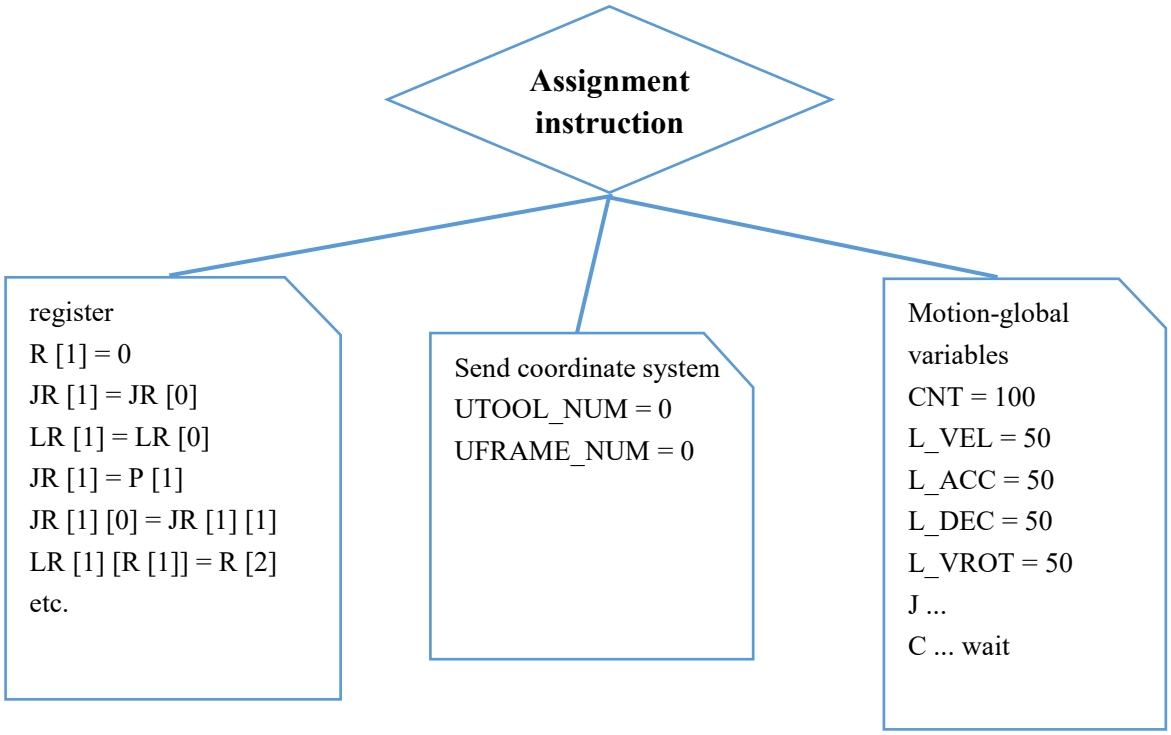
J JR [2]

Remarks: The above program, the main program MAIN.PRG calls the subroutine LIB.PRG. The execution flow is that the program moves to point P1 in turn, then calls the subroutine and

moves to JR [1] point. End the subroutine, return to the main program, and then move to point P2, the program execution is completed.

21.8 Assignmnt Instructions

Description The assignment instruction is divided into three parts: register operation, coordinate system call, and global parameters.



21.8.1 Register Instructions

Instructions:

In China type III system, several sets of different types of registers are predefined for users to use. Contains floating-point R registers, joint coordinate type JR registers, and Cartesian type LR registers, of which there are 300 R registers available for users, and 300 JR and LR registers. In general, the user assigns a preset value to the register corresponding to the index number, such as: R [0] = 1, JR [0] = JR [1], LR [0] = LR [1], and the register can be directly Used in the program.

Register instructions include R [], JR [], LR [], JR [] [], LR [] [], P [], P [] []

Example:

R [1] = 1

R [1] = R [2]

R [1] = R [1] +1

R [1] = DI [1]

R [1] = DO [1]

R [1] = JR [0] [0] + LR [0] [1] * R [2]-(R [3] / 2 + R [4])

JR [1] = JR [2]

JR [1] = JR [2] + JR [3]

JR [1] = (JR [2] * JR [3]) + (JR [4] / JR [5] -JR [6])

JR [R [1]] = P [1]

JR [1] [0] = JR [3] [0]

JR [1] [8] = R [1]

JR [1] [0] = P [1] [0]

JR [1] [1] = JR [1] [R [1]] * 2

JR [1] [1] = JR [1] [1] * R [2]

JR [R [1]] [R [2]] = JR [1] [0] -R [1]

JR [(R [23] + JR [1] [1])-(JR [1] [8] / P [1] [0]) * 2-21] = (JR [1] -JR [2]) + JR [R [1]] * P [R [1]] / (R [1] +1)

As mentioned above, it is used for register compound operation. Same for LR and P

Note: LR [1] = LR [2] + LR [3]. At this time, LR [1] takes the shape bit of LR [2].

Description Register instructions are used for register assignment changes, etc., including floating-point R registers, joint-type JR registers, Cartesian-type LR registers, of which there are 300 R registers available for users and 300 JR and LR registers . In general, the user assigns a preset value to the register corresponding to the index number, such as: R [0] = 1, JR [0] = JR [1], LR [0] = LR [1], and the register can be directly Used in the program.

Register instructions include R [], JR [], LR [], JR [] [], LR [] [], P [], P [] []

Steps

1. Select the previous line where you want to add the registered instruction line.

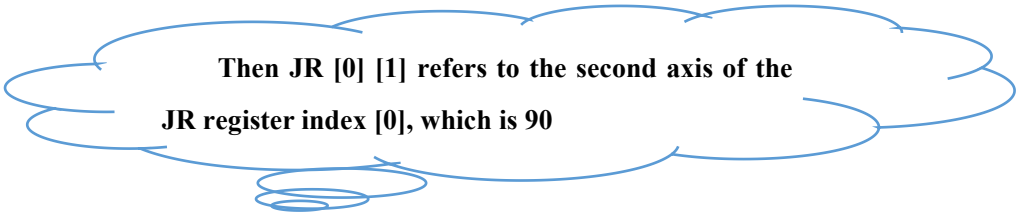
2.Select instruction → assignment instruction

3. In the first input box, select the register type from the Register drop-down box.

4.Enter the register index number in the input box

5. Repeat steps 3 ~ 4 in the second input box.

6. Click the "OK" button in the operation bar to complete the assignment-register instruction addition.



Assume JR [0] = {0, -90, 180, 0, 90, 0}

[Remarks]

The JR \ LR register supports obtaining the current robot position to the position register and modifying the value of the current position register during the program editing process. The specific operation method is as follows (take the motion instruction J JR [0] as an example):

Select the motion instruction J JR [0] and click “Record Joint” to open the JR [0] register editing interface. After modifying the coordinate values, click "OK" to save the currently modified coordinate values to the JR [0] register. It should be noted that when the JR register is used in the motion instruction, only the joint position can be recorded, and when the LR register is used in the motion instruction, only the Cartesian position can be recorded.

21.8.2 Coordinate System Instructions

Instructions:

This instruction is used by the program to call the tool and workpiece number (Note: The point is recorded in the program. If a tool workpiece is used, the tool workpiece coordinate system needs to be added to the program) The coordinate system instruction is divided into the base coordinate system UFRAME and the tool coordinate system. UTOOL, you can select the coordinate system number defined in the program, switch the coordinate system in the program, the tool and workpiece numbers are 0 ~ 15, and the default coordinate system is -1. .

Example:

UFRAME_NUM = 0

UTOOL_NUM = 0

L P [1] VEL = 50

L P [2] VEL = 50

UFRAME_NUM = -1, tool artifacts are not called at subsequent points

UTOOL_NUM = -1

J P [3] VEL = 50

J P [4] VEL = 50

In the above description, P [1] and P [2] call the tool and the work piece number is 0, and P [3] and P [4] points do not call the tool work piece. You need to set the value to -1. Next works.J P [3] VEL = 50

J P [4] VEL = 50

In the above description, P [1] and P [2] call the tool and the work piece number is 0, and P [3] and P [4] points do not call the tool work piece. You need to set the value to -1. Next works.

Remarks:Callable tool work piece number is 0 ~ 15, -1 is the default coordinate system

Note: If the point recorded by the tool or work piece is called, the corresponding coordinate system must be added to the program to instruct the trajectory movement to be correct.

21.8.3 Global Variable Instructions Description

Global variable instructions are used to define program global parameters, which take effect in the entire program, except those with their own parameters.

The range of motion parameters is as follows:

The difference between global parameters and local parameters is as follows:

```
LBL [888]
J   P[1]
J   P[2]  'Is the default motion parameter
J   P[3]
J   P[4]
GOTO LBL[888]
```

```
LBL[888]
CNT =1
J_VEL = 100
J_ACC = 100
J_DEC = 100  'Global motion parameters, function downwards, P [1 ~ 4] use the above motion parameters
J   P[1]
J   P[2]
J   P[3]
J   P[4]
GOTO LBL[888]
```

```
LBL[888]
CNT =1
J_VEL = 100
J_ACC = 100
J_DEC = 100  'Global motion parameters, function downwards, P [1, 3] use the above motion parameters
J P [1]
J P [2] VEL = 50 ACC = 50 DEC = 50 CNT = 0  'P [2] uses its own motion parameters
J P [3] VEL = 50  'P [3] uses its own VEL parameter. Since other parameters are not set, it still uses the global ACC and DEC above.
GOTO LBL [888]
```

Steps

1. Select the previous line where you want to add the registered instruction line.
2. Select instruction → assignment instruction
3. In the first input box, select the type in the "Global Variable" drop-down box
4. Enter a value in the second input box
5. Click the "OK" button in the action bar to finish adding the assignment-global variable instruction.

Program example

LBL[1]

UFRAME_NUM=1

UTOOL_NUM=1

L_VEL = 500

L_ACC = 80

L_DEC = 80

L P [1] ′ Call tool number 1 and work piece number 2 and set global linear motion parameters

L P [2] VEL = 200 ACC = 60 DEC = 60 ′ Use your own linear speed, acceleration ratio, deceleration ratio UFRAME_NUM = -1

UTOOL_NUM = -1

L P [1] ′ Call the default coordinate system tool number -1 and work piece number -1 and set the global linear motion parameters

L P [2] ′ Call the default coordinate system tool number -1 and work piece number -1 and set the global linear motion parameters

The motion parameters are as follows:

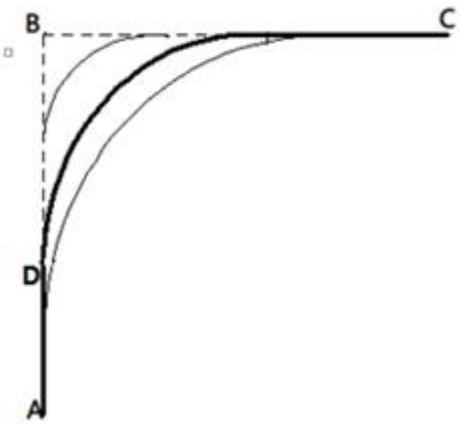
Global parameter instructions are used to define program global parameters, which take effect in the entire program, except those with their own parameters.

Usage reference [Motion parameters] section

CNT = 0 ~ 100 ‘Smooth transition to 0, default is not smooth
CNT_TYPE = 0/1/2/17 ‘Smooth Type
J_VEL = 1 ~ 100 ‘joint speed
J_ACC = 1 ~ 100 ‘joint acceleration ratio
J_DEC = 1 ~ 100 ‘joint reduction ratio
L_VEL = 1 ~ 1000 ‘Linear speed
L_ACC = 1 ~ 100 ‘Linear acceleration ratio
L_DEC = 1 ~ 100 ‘Linear reduction ratio
L_VROT = 1 ~ 100 ‘Linear attitude speed
C_VEL = 1 ~ 1000 ‘arc speed
C_DEC = 1 ~ 100 ‘arc reduction ratio
C_ACC = 1 ~ 100 ‘arc acceleration ratio
C_VROT = 1 ~ 00 ‘arc attitude speed

21.8.4 Arc transition CNT

Description **CNT mode can be used in joint motion and Cartesian interpolation. This parameter defines the starting position of the arc transition, and its value is a percentage.**



The path is A-> B-> C, and the arc transition function is used at point B. The value of the mixing coefficient defines the position of the starting point D of the arc transition: AD = mixing coefficient * AB / 100

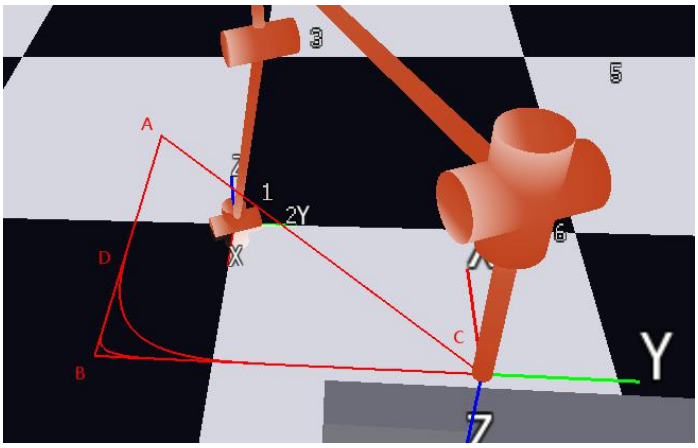
When this parameter is set to 100, it means that the arc transition starts from point A and ends at point C. The whole new path is completely different from the original path. When this parameter is set to 0, it means that the arc transition function is not used.

Example:

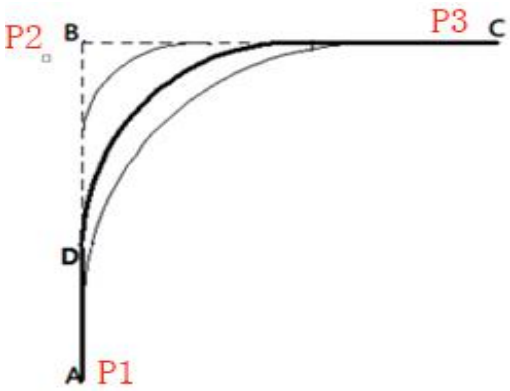
L P[1] A point

L P[2] CNT=40 Point B starts from 40% of line AB and smoothly transits to point C (i.e. point D, BD = 40 / AB)

L P[3] C point



Special instructions: as shown



[Signal output and smooth transition point]

```
L P[1]
L P[2] CNT=50
DO[1] = ON    'At this point, the signal is output at the transition point D
J P[3]
```

[WAIT wait condition and smooth transition]

```
L P[1]
L P[2] CNT=50
WAIT DO[1] = ON    'At this point, the signal is output at the transition point DJ P [3]    'Note: If the WAIT condition is not met, it will stop at The P [2] point wait condition is satisfied, and there is no smooth action at this time.
```

21.9 Manual instruction

Description Used to enter the command line manually.

Figure 21-13 Manual instruction

Steps

1. Select the previous line to insert a manual instruction.
2. Enter the instruction.
3. Click the OK button in the action bar to complete adding the instruction.

Product Warranty Card

Number of Warranty Card:

User Name:

Product Model: Serial Number:

Date of Lodgment: Registration number:

(The above should be filled by user)

Attachment:

Our company's products are guaranteed for one year. During the warranty period, if the product is damaged by improper use of the user, our company will handle it as out-of-warranty period. In Out-of-warranty condition, if the products are sent back to our company for maintenance, only the material fee and maintenance fee will be charged. If there is need for field maintenance by engineers of our company, the material fee, travel fee and maintenance fee of XXX yuan per day will be charged.

Chongqing Huashu Robotics Co., Ltd.

Customer Service Department

Attention:

1.Register with our company before using the product.

2.The product is protected by copyright. The software and hardware technical data of the product shall not be disclosed to third parties without authorization of our company.

3.The software and hardware of this product shall not be disassembled or modified without authorization of our company.

4.Pay for the product on time as required in the contract.

Use this card with invoice.

/ /

This card must be handed over to and kept by the end user, so that end user can enjoy after-sales service provided by our company.

Product Registration Form

Number of Warranty Card:

User Name:

Product Model: Serial Number:

Date of Lodgment: Registration number:

Supplier of the product:

User signature (seal):

/ /

(Please send this copy back to our company for registration as soon as possible, so that you can enjoy after-sales service provided by our company)

This card must be handed over to and registered to our company by the end user, so that our company can provide service to this product.

Maintenance Record

Maintenance Time	Maintenance Content	Maintenance Staff Signature

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