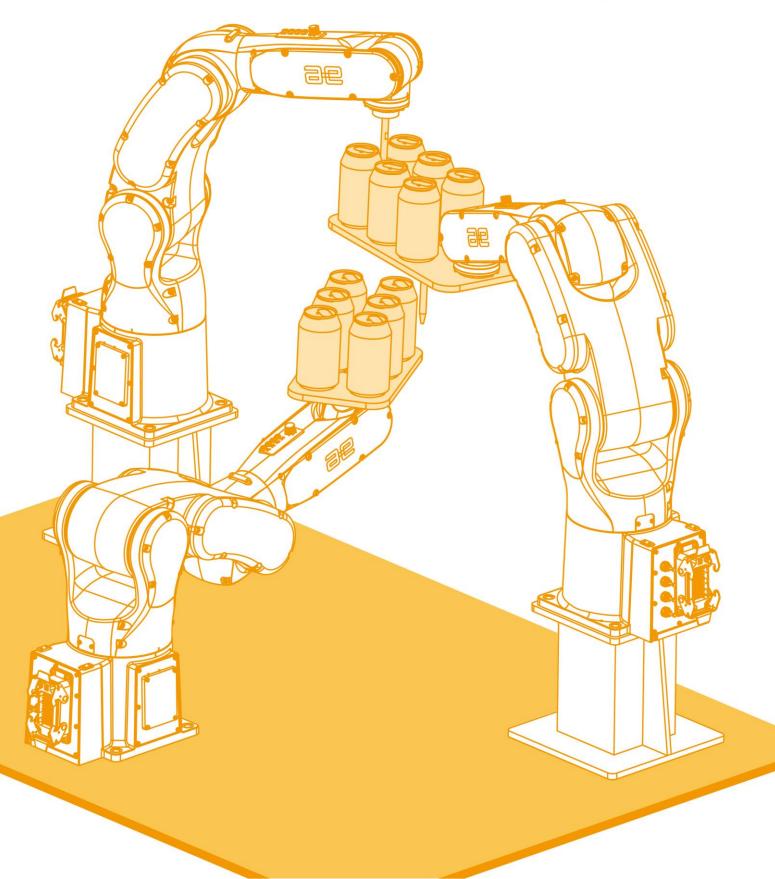


# MultiMove user manual





# Foreword

About This Manual

This manual introduces the application of robot MultiMove, and describes in detail the hardware connection, configuration and verification process of MultiMove. Reading this document will help readers master the working principle and configuration method of MultiMove.

#### Prerequisites

Before operating the robot, be sure to read the relevant safety instructions and operation instructions of the product carefully. Users must understand the safety knowledge and basic operation knowledge before using the robot's MultiMove.

Please read the following documents when necessary:

- "AIR-TP Teach Pendant Operation Manual "
- "ARL Programming Manual"
- "Fault and Troubleshooting Manual of AIR Series Industrial Robot System"

#### **Target Groups**

- Operators
- Product technicians
- Technical service personnel
- Robot teachers

#### Meaning of Common Signs

The signs and their meanings in this manual are detailed in Table 1.

Table 1 Signs used in this manual

Sign	Meaning		
Danger	Failure to follow the instructions may cause accidents, resulting in serious or fatal personal injury.		
Warning	Failure to follow the instructions may cause accidents, resulting in moderate or minor personal injury, and may also cause damage to materials only.		
Notice	You are prompted to keep in mind environmental conditions and important matters, or quick operation methods.		

Sign	Meaning		
(j) Tip	You are prompted to refer to other literature and instructions for additional information or more details about operation instructions.		

#### Manual Description

The contents of this manual are subject to supplementation and modification. Please visit "Download Center" on the website regularly to obtain the latest version of this manual in a timely manner.

Website URL: http://robot.peitian.com/

## **Revision History**

The revision history contains the instructions for each document update. The latest version of the document contains updates to all previous versions of the document.

Version	Publication date	Modification description	
V1.0.0	2020/03/17	1st official publication	
V1.1.0	2020/10/15	2nd official release Upgrade software version to v2.6.3	
V1.2.0	2021/03/20	3rd official release Upgrade software version to v2.6.4 Add "manipulator + external axis" application scenario	
V1.2.1	2023/04/06	4th official release Add "Internal connection method for cabinets"	

Table 2 Signs used in this manual

**Document Number and Version** 

The document-related information is shown in Table 3.

Table 3 Document-related information

Document name	MultiMove user manual	
Document number	UM-S0150000003-008	
Document version	V1.2.1	
Software version	2.6.4	

### Convention of symbols

## See Table 4 for the relevant symbol conventions of the document.

Table 4 convention of symbols

Symbol	Significance		
<>	"< >" indicate the button name, such as "click <yes> button".</yes>		
0	"[]" indicate window name, menu name and data table, such as "pop up [new user] window".		
1	Multi-level menus are separated by "/". For example, the [file / new / folder] multi-level menu indicates the [folder] menu item under the [new] submenu under the [file] menu.		

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# 1 Function introduction

## 1.1 Outline

The purpose of MultiMove is to operate several manipulators through one teach pendant, and coordinate the movement between different manipulators and other mechanical units, while saving the hardware cost. Linkage of up to 6 mechanical units can be realized. The diagram of MultiMove is shown in Figure 1-1.

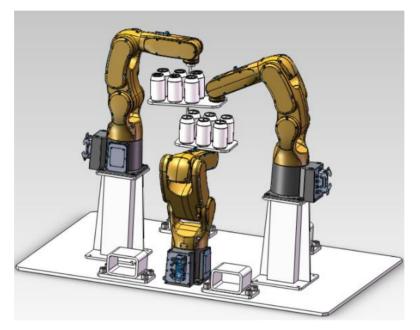


Figure 1-1 Diagram of MultiMove

## 1.2 Application scenario

In some scenarios, relying on the action range of the robot limits the production efficiency and automation. It is necessary to increase auxiliary equipment to cooperate with the robot to achieve the required pose, or two robots need to move together for operation. In the production of industrial robots, the peripheral equipment often equipped are the rotary table for rotating workpieces, the mobile table for moving workpieces, the guide rail of mobile robots, etc. The motion and position control of these peripheral devices need to match with industrial robots and require corresponding accuracy.

The supported application scenarios are as follows:

- Single robot + positioner
- Linkage of multiple robots (multiple robots grasp or operate a workpiece at the same time)
- Two robots + positioner (two robots operate one positioner at the same time)
- One robot + two positioners (one robot operates two positioners, and the positioner can switch position through the external axes)
- Multiple robots + external axis (the robot is not linked with the external axis)

## 1.3 Coordinate system definition

- World coordinate system: a static Cartesian coordinate system defined in the real environment. For MultiMove function, all mechanical units need to use the same world coordinate system. As shown in Figure 1-2.
- Base coordinate system (robot, positioner): fixed on the base of the mechanical unit, it is used to represent the installation position and attitude of the mechanical unit in the world coordinate system. When the robot is

installed on the base axis, the base coordinate system refers to the axis coordinate system at the end of the base axis, as shown in Figure 1-2.

- Axis coordinate system (robot, positioner): a coordinate system fixed on an axis of a mechanical unit and moving with the axis, which is used to describe the installation position and motion state of the axis. Its z axis is along the axis of the rotating axis or the moving direction of the moving axis. Its numbering rule is that the 1 axis is installed on the base coordinate system, the 2 axis is installed on the 1 axis, and so on. The n-axis coordinate system is represented by referring to the N-1 axis coordinate system, and the 1 axis coordinate system is represented by referrence to the base coordinate system. As shown in Figure 1-2.
- Workpiece coordinate system (robot and positioner): the coordinate system describing the position and attitude of the workpiece to be processed, which can be divided into three types: world, robot and positioner The (default) workpiece coordinate system refers to the world coordinate system; the robot type workpiece coordinate system refers to the flange coordinate system of the robot; the positioner type workpiece coordinate system refers to the axis coordinate system of the end axis of the positioner, as shown in Figure 1-2.

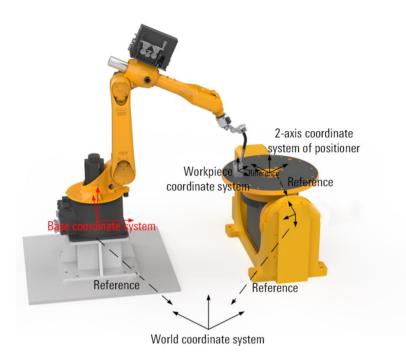


Figure 1-2 Diagram of coordinate system definition

# 2 Hardware connection

## 2.1 "Multi robot linkage + positioner" scenario

## 2.1.1 inCube 10/12

Figure 2-1 shows the connection mode between two inCube10/12 control cabinets and two external motors.

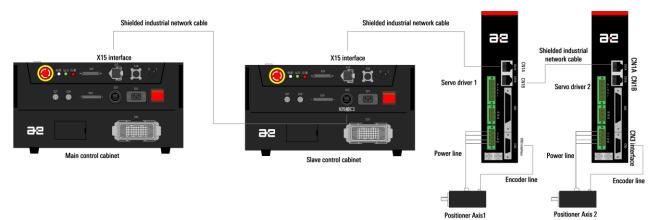
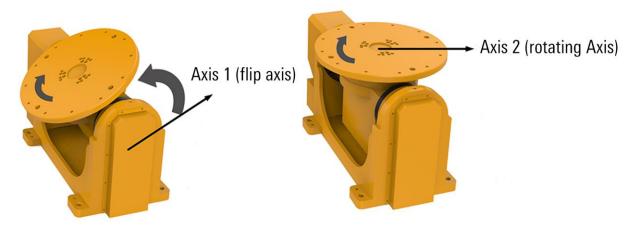
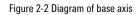


Figure 2-1 Connection diagram between inCube10/12 control cabinet and external motor

The positioner axis 1 refers to the axis closest to the base, the positioner axis 2 refers to the axis placed on the positioner axis 1 (as shown in Figure 2-2), and so on. See "1.3 Coordinate system definition" for the definition of axis coordinate system.





## 2.1.2 inCube 20/21

Figure 2-3 shows the connection mode between an inCube20/21 control cabinet and two external motors.

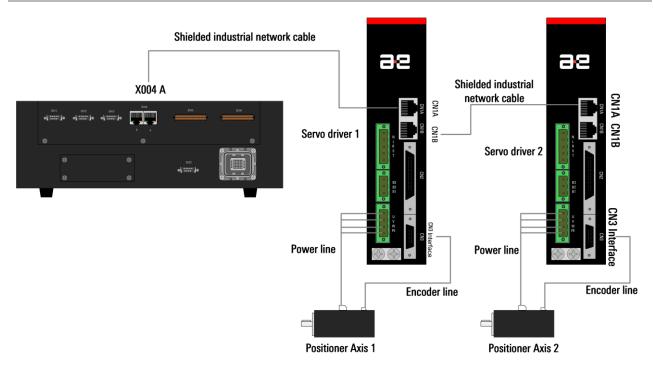


Figure 2-3 Connection diagram between inCube20/21 control cabinet and external motor The diagram of each axis of the positioner is shown in Figure 2-2.

# 2.2 "Multi robot linkage" scenario

## 2.2.1 inCube 10/12

Wiring modification method inside the main control cabinet

Figure 2-4 and Figure 2-5 show the wiring modification method of the main control cabinet:

- Connect the LAN13 port of CCB to MCB EtherCAT
- Connect the LAN12 port of CCB to DCB
- The LAN11 port of CCB is connected to the external axis (X15)

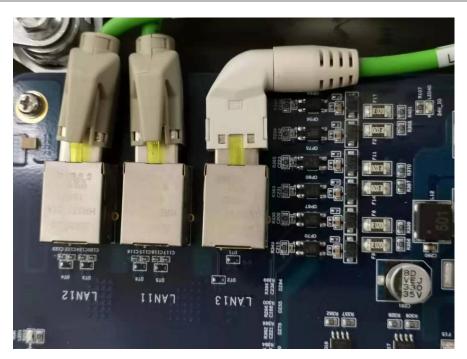


Figure 2-4 LAN12, LAN11, and LAN13 interfaces on CCB

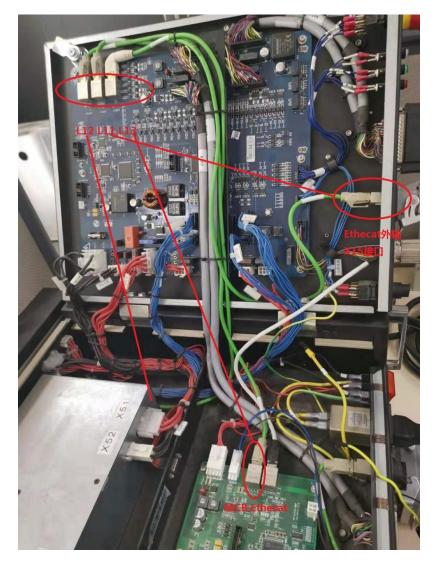


Figure 2-5 Wiring method inside the main control cabinet

Wiring modification method inside the slave control cabinet

Figure 2-6 shows the wiring method from the slave control cabinet:

- Connect the LAN13 port of CCB to the user network port (X25)
- Connect the LAN12 port of CCB to DCB
- The LAN11 port of CCB is connected to the external axis (X15)

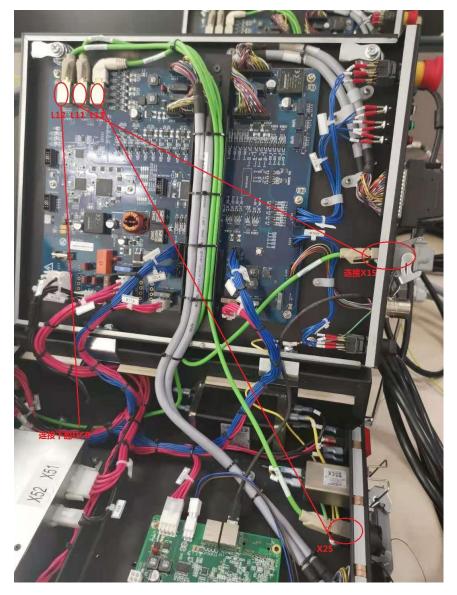


Figure 2-6 Connection method from slave control cabinet

#### Wiring method outside the cabinet

Master slave mode for two control cabinets:

The X15 interface of the main control cabinet is connected to the user network port X25 of the slave control cabinet.

Connection method with external axis:

The X15 interface of the main control cabinet is connected to the Ethercat interface of the external axis;

The Ethercat interface of the external axis is connected to the user network port X25 of the slave control cabinet.

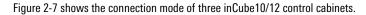




Figure 2-7 Connection diagram of three inCube10/12 control cabinets

## 2.2.2 inCube 20/21/22

inCube 20/21 (P1.0) cabinet wiring modification method

No modifications required for the main control cabinet

The following modifications need to be made to the MCBS board of the control cabinet:

Step1. Short circuit and weld the three corners on the right side of U43 together. As shown in Figure 2-8.

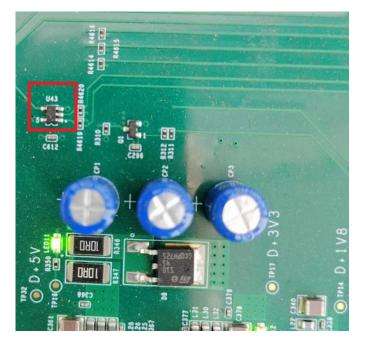


Figure 2-8 Location diagram of U43 on MCBS board

Step2. Short circuit the first two legs of PS105 with a jumper cap. As shown in Figure 2-9.

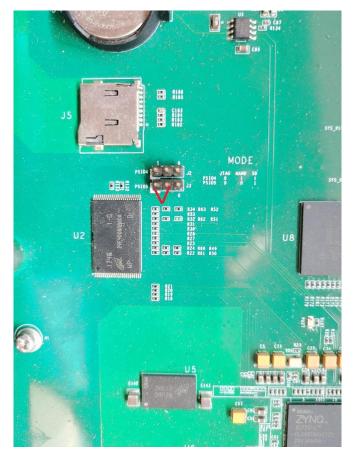


Figure 2-9 Location diagram of PS105 on MCBS board

Step3. Unplug the F2 fuse, as shown in Figure 2-10.

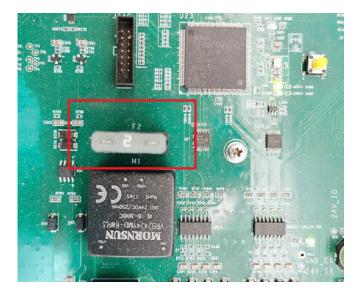


Figure 2-10 F2 Insurance Location Map on MCBS Board

Step4. Unplug one of the two EtherCat network cables that connect (MCBS) to the DCBS board. As shown in Figure 2-11.

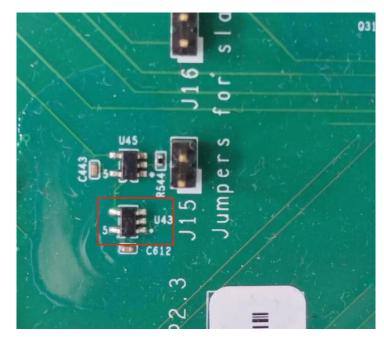


Figure 2-11 EtherCat Network Cable Location Map on DCBS Board

## inCube 20/22 (P2.0) cabinet wiring modification method

No modifications required for the main control cabinet

The following modifications need to be made to the MCBS board of the slave control cabinet:



Step1. Short circuit and weld the three corners on the right side of U43 together. As shown in Figure 2-12.

Figure 2-12 Location diagram of U43 on MCBS board

Step2. Short circuit the 2 pins of PS105 with a jumper cap. As shown in Figure 2-13.

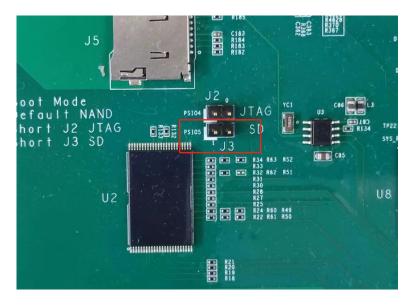


Figure 2-13 Location diagram of PS105 on MCBS board

Step3. Unplug the F6 fuse. As shown in Figure 2-14.



Figure 2-14 Location diagram of F6 fuse on MCBS board

Step4. Unplug one of the two Ethercat network cables that connect (MCBS) to the DCBS board. As shown in Figure 2-15.



Figure 2-15 Ethercat Network Cable Location Map on DCBS Board

## Wiring method outside the cabinet

Master slave mode for two control cabinets:

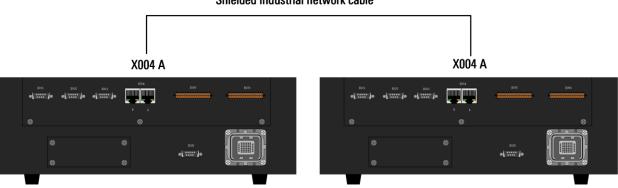
The Ethercat interface of the main control cabinet is connected to the Ethercat interface of the slave control cabinet.

Connection method with external axis:

Connect the Ethercat interface of the main control cabinet to the Ethercat interface of the external axis;

The Ethercat interface of the external axis is connected to the Ethercat interface of the slave control cabinet.

Figure 2-16 shows the connection mode of two inCube20/21 control cabinets.



Shielded industrial network cable

Figure 2-16 Connection diagram of two inCube20/21 control cabinets

# 3 Privilege level

When using the AIR-TP teaching pendant for the first time, the user interface at the first login will be prompted. The user can choose:

Teacher: Authority 4

Under this permission, you can write the robot working program and modify some parameters. The initial login password is: PEACE.

Operator: Authority 5

Under this permission, you can simply view the operation of the robot's position parameters, without program modification and parameter modification permission. The initial login password is: LOVE.



Ordinary users can only log in to the teaching pendant with the authority of teacher and operator.

# 4 Multi-robot linkage + positioner

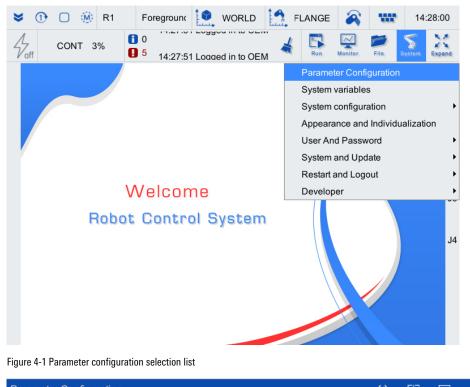
# 4.1 Configure basic parameters

The following describes the configuration steps by taking "two manipulators + positioner" as an example.

## Configure global parameters

Step1. As shown in Figure 4-1, select [System] in the upper right corner of the main interface, and then select

[Parameter Configuration] in the drop-down list to enter various tab selection interfaces shown in Figure 4-2.



Parameter Configu	uration			⇔ LIJ		×
global	channel1	robot	extctrl	iomap	*	>>

Figure 4-2 Parameter configuration tab display area

- Step2. In the [global] interface, click to select the [CHANNEL\_NUM (Foreground Channel Number)] parameter.
- Step3. Click <Edit>, and a dialog box as shown in Figure 4-3 will pop up. Configure the parameter in [Value] as 3, and click <Yes>.

Parameter Edit	X
Variable: Name:	global.CHANNEL_NUM Foreground Channel Number
Value:	3 💌
Unit:	
Type:	uint
Range:	
Effective way:	Hard Reboot
Authority:	Teacher
Description:	Number of foreground channels
	Yes Cancel

Figure 4-3 Foreground channel parameter configuration interface

Table 4-1 Parameter description

Parameter	Description
Value	Number of foreground channels. Each mechanical unit needs to occupy a separate channel. This configuration includes two manipulators and one positioner, so it is configured as 3 here.

- Step4. In the [global] interface, click to select the [SERVO\_NUM (Servo number)] parameter.
- Step5. Click <Edit>, and a dialog box as shown in Figure 4-4 will pop up. Configure the parameters in [Value] and click <Yes>. The parameter description is shown in Table 4-2.

Parameter Edit			×
Variable: Name:	global.SERVO_N Servo Number	NUM	1
Value:	14		
Unit:			
Туре:	uint		
Range:	[0,64]		
Effective way:	Hard Reboot		
Authority:	Teacher		
Description:	Number of servo slave stations connected to the bus: the inconsistency between the configured value of this parameter and the number of actually		
	Yes		Cancel

Figure 4-4 Configuration interface of servo slave stations

Parameter	Description		
Value	The number of servo slave stations connected on the bus, including the servo slave station of the manipulator and the external servo slave station. The configuration case includes 12 (2 manipulators) servo slaves and 2 (1 positioner) external axis servo slaves.		
	The configuration of this parameter is inconsistent with the act slave stations, which may cause bus connection failure when s system.		

Step6. After the configuration is completed, click <Save>, and it will take effect after restarting the control cabinet.

#### Configure channel 1 parameters (R1)

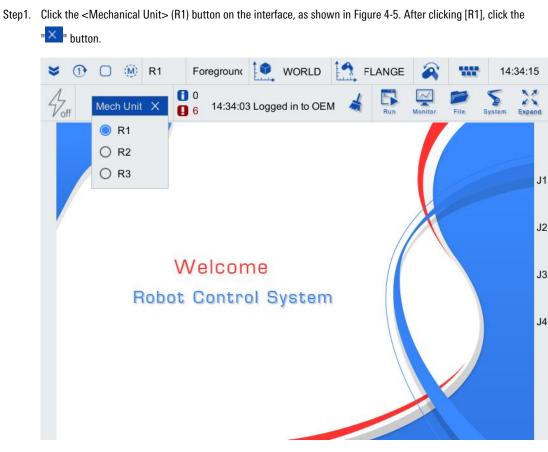


Figure 4-5 Interface for mechanical unit switching

- Step2. In the [channel 1] interface, click to select the [EX\_JOINT\_NUM (External Axes Num)] parameter;
- Step3. Click <Edit>, and a dialog box as shown in Figure 4-6 will pop up. Configure the parameter in [value] as 0, and click <Yes>. The parameter description is shown in Table 4-3.

Parameter Edit		Х
Variable: Name: Value: Unit: Type:	channel1.EX_JOINT_NUM External Axes Num 0 •	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Number of external axes controlled by this channel	
	Yes Cance	1

Figure 4-6 External axis quantity configuration interface

Table 4-3 Parameter description

Parameter	Description
Value	This channel controls the number of external axes. In integer form, the value range is 1-6.

- Step4. In the [Channel 1] interface, click to select the [MECH\_UNIT\_NUM (Number of mechanical units)] parameter.
- Step5. Click <Edit>, and a dialog box as shown in Figure 4-7 will pop up. Configure the parameter in [Value] as 1, and click <Yes>. The parameter description is shown in Table 4-4.

Parameter Edit	×
Variable: Name: Value:	channel1.MECH_UNIT_NUM Mechanical Unit Num
Unit: Type: Range:	uint
Effective way:	Hard Reboot
Authority:	Teacher
Description:	Number of mechanical units in the channel
	Yes Cancel

Figure 4-7 Interface of mechanical unit quantity configuration

Table 4-4 Parameter description

Parameter	Description
Value	Number of mechanical units in this channel.

- Step6. In the [Channel 1] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and click to select "[0]" ([0] is the robot body) in the expanded sub-items item.
- Step7. Click <Edit>, and the dialog box shown in Figure 4-8 will pop up. The parameter in the configuration [Value] is the actual robot model, click <Yes>. The parameter description is shown in Table 4-5.

Parameter Edit		Х
Variable:	channel1.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	AIR6L_V2 🔻	
Unit:		
Туре:	string	
Range:		
Effective way	: Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	əl

Figure 4-8 Mechanical unit model configuration interface

Table 4-5 Parameter description

Parameter	Description
Value	The model of the mechanical unit controlled by this channel.

- Step8. In the [Channel 1] interface, click [+] to the left of the [MECH\_UNIT\_NAME (Mechanical unit name)] parameter, and click to select the sub-item "[0]" ([0] is the robot body) among the expanded sub-items.
- Step9. Click <Edit>, and the dialog box shown in Figure 4-9 will pop up. Configure the parameters in [Value] (for example: R1), and click <Yes>.

Parameter Edit		X
Variable:	channel1.MECH_UNIT_ NAME.[0]	
Name:		
Value:	R1	
Unit:		
Type:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Name of mechanical unit controlled by this channe the user can set this parameter to distinguish mechanical units of	
	Yes Ca	ncel

Figure 4-9 Configuration interface of mechanical unit name

Step10. After the parameter configuration is complete, click <Save>, and the dialog box shown in Figure 4-10 will pop

up. Select "Save all" in [Please select the save type], and click <Yes>.

		×
Please se	lect the sa	ve type:
Save all		•
	Yes	Cancel

Figure 4-10 Dialog to select save type

Step11. Click <Yes> in the prompt dialog box that pops up. As shown in Figure 4-11.

Prompt		X
?	Confirm to save all modified parameters?	
	Yes Cancel	

Figure 4-11 Confirm to save the modification prompt box

Step12. Click <Yes> in the pop-up dialog box of successful parameter saving. As shown in Figure 4-12.

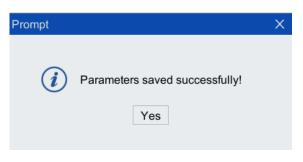


Figure 4-12 Save successful prompt box

#### Configure channel 2 parameters (R2)

Step1. Click the <Mechanical unit switch> button on the interface, as shown in Figure 4-13, click [R2], and then click the "

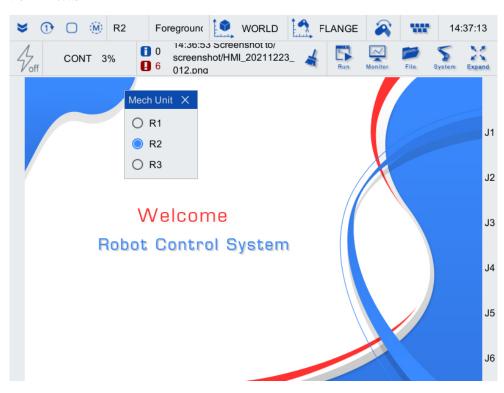


Figure 4-13 Mechanical unit switching interface

- Step2. In the [Channel 2] interface, click to select the [EX\_JOINT\_NUM (External Axis number)] parameter.
- Step3. Click <Edit>, and the dialog box shown in Figure 4-14 will pop up. Configure the parameter in [Value] to 0, click <Yes>. The parameter description is shown in Table 4-6.

Parameter Edit		×
Variable: Name: Value: Unit: Type: Range:	channel2.EX_JOINT_NUM External Axes Num 0 -	
Effective way: Authority: Description:	Hard Reboot Teacher Number of external axes controlled by this channel	
	Yes Cance	Ι

Figure 4-14 Configuration interface for the number of external axes

Table 4-6 Parameter description

Parameter	Description
Value	The number of external axes controlled by this channel. The value is an integer, ranging from 1 to 6.

- Step4. In the [Channel 2] interface, click to select the [MECH\_UNIT\_NUM (Number of mechanical units)] parameter.
- Step5. Click <Edit>, and the dialog box shown in Figure 4-15 will pop up. Configure the parameter in [Value] to 1, and click <Yes>. The parameter description is shown in Table 4-7.

Parameter Edit	X
Variable: Name: Value:	channel2.MECH_UNIT_NUM Mechanical Unit Num
Unit: Type: Range:	uint
Effective way:	Hard Reboot
Authority:	Teacher
Description:	Number of mechanical units in the channel
	New Owned
	Yes Cancel

Figure 4-15 Configuration interface for the number of mechanical units

Table 4-7 Parameter description

Parameter	Description
Value	The number of mechanical units in this channel.

- Step6. The number of mechanical units in this channel.
- Step7. Click <Edit>, and the dialog box shown in Figure 4-16 will pop up. The parameter in the configuration [value] is the actual robot model, click <Yes>. The parameter description is shown in Table 4-8.

Parameter Edit		Х
Variable:	channel2.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	AIR6L_V2 💌	
Unit:		
Туре:	string	
Range:		
Effective way	: Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	el

Figure 4-16 Configuration interface of mechanical unit model

Table 4-8 Parameter description

Paramete	Description	
Value	The model of the mechanical unit controlled by this channel.	

- Step8. In the [Channel 2] interface, click [+] to the left of the [MECH\_UNIT\_NAME (mechanical unit name)] parameter, and click to select the sub-item "[0]" ([0] is the robot body) among the expanded sub-items.
- Step9. Click <Edit>, and the dialog box shown in Figure 4-17 will pop up. Configure the parameters in [Value] (for example: R2), and click <Yes>.

Parameter Edit		×
Variable:	channel2.MECH_UN NAME.[0]	VIT_
Name:		
Value:	R2	
Unit:		
Type:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Name of mechanica controlled by this ch the user can set this parameter to disting mechanical units of	annel:
	Yes	Cancel

Figure 4-17 Configuration interface of mechanical unit name

Step10. After the parameter configuration is complete, click <Save>, and the dialog box shown in Figure 4-18 will pop

up. Select "Save all" in [Please select the save type], and click <Yes>.

	×
Please select the save type	e:
Save all	•
Yes Car	ncel

Figure 4-18 Dialog to select save type

Step11. Click <Yes> in the prompt dialog box that pops up. As shown in Figure 4-19.

Prompt				Х
?	Confirm to sa parameters?		ified	
	Yes	Cancel		

Figure 4-19 Prompt box to confirm the saved modification

Step12. Click <Yes> in the pop-up dialog box of successful parameter saving. As shown in Figure 4-20.



Figure 4-20 Prompt box of successful save

#### Configure channel 3 parameters (P1)

Before using the positioner, please complete the relevant parameter configuration of the system.

Step1. Click the <Mechanical unit switching> button on the interface, as shown in Figure 4-21. After clicking [R3], click the "

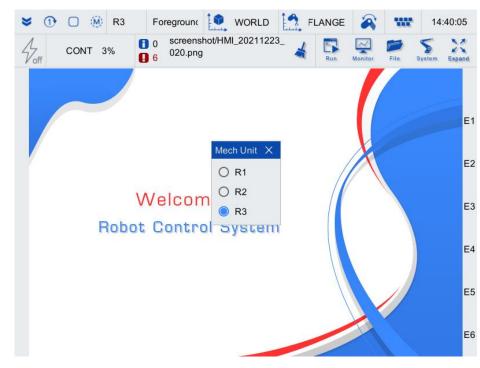


Figure 4-21 Switch channel interface

- Step2. In the [Channel 3] interface, click to select the [EX\_JOINT\_NUM (External axis number)] parameter.
- Step3. Click <Edit>, and a dialog box as shown in Figure 4-22 will pop up. Configure the parameters in [Value], and click <Yes>. Parameter description is shown in Table 4-9.

Parameter Edit		Х
Variable: Name: Value: Unit: Type:	channel3.EX_JOINT_NUM External Axes Num 2	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Number of external axes controlled by this channel	
	Yes Cance	I

Figure 4-22 Configuration interface of external axis quantity

Table 4-9 Parameter description

Parameter	Description	
Value	This channel controls the number of external axes. In integer form, the value range is 1-6. When the external axis is a positioner, the value range is 1-3.	

- Step4. In the [Channel 3] interface, click to select the [MECH\_UNIT\_NUM (Number of mechanical units)] parameter.
- Step5. Click <Edit>, and a dialog box as shown in Figure 4-23 will pop up. Configure the parameter in [Value] as 2, and click <Yes>. Parameter description is shown in Table 4-10.

Parameter Edit	×
Variable: Name: Value:	channel3.MECH_UNIT_NUM Mechanical Unit Num 2 •
Unit: Type: Range:	uint
Effective way:	Hard Reboot
Authority:	Teacher
Description:	Number of mechanical units in the channel
	Yes Cancel

Figure 4-23 Configuration interface of mechanical unit quantity

Table 4-10 Parameter description

Parameter	Description
Value	Number of mechanical units in this channel. When configuring the positioner function, the mechanical unit includes the manipulator and the positioner, so the value is configured as 2.

- Step6. In the [Channel 3] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and select the sub item "[0]" ([0] is the manipulator and [1] is the positioner) among the expanded sub items.
- Step7. Click <Edit>, and a dialog box as shown in Figure 4-24 will pop up. Configure the parameter in [Value] as virtualrobot, and click <Yes>.

Parameter Edit		Х
Variable:	channel3.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	VirtualRobot 🔹	
Unit:		
Туре:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	I

Figure 4-24 Configuration interface of mechanical unit model

- Step8. In the [Channel 3] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model) ] parameter, and click to select the sub item "[1]" ([0] is the manipulator and [1] is the positioner) among the expanded sub items.
- Step9. Click <Edit>, and a dialog box as shown in Figure 4-25 will pop up. Configure the parameter in [Value] as positioner, and click <Yes>.

Parameter Edit		Х
Variable: Name:	channel3.MECH_UNIT_ MODEL.[1]	
Value:	Positioner •	
Unit: Type: Range:	string	
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	I

Figure 4-25 Configuration interface of mechanical unit model

- Step10. In the [Channel 3] interface, click [+] on the left side of the [MECH\_UNIT\_NAME (Mechanical unit name)] parameter, and select "[1]" in the expanded sub items ([0] is the manipulator and [1] is the positioner.).
- Step11. Click <Edit>, and a dialog box as shown in Figure 4-26 will pop up. Configure the parameters in [Value] (e.g. P1)

Parameter Edit		X
Variable:	channel3.MECH_UNIT_ NAME.[1]	
Name:		
Value:	P1	
Unit:		
Туре:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Name of mechanical unit controlled by this channel: the user can set this parameter to distinguish mechanical units of	
	Yes Cancel	

and click <Yes>.

- Figure 4-26 Configuration interface of mechanical unit name
- Step12. In the [channel 3] interface, click [+] on the left side of the [EXJOIN\_TYPE (external axis)] parameter, and click to select "[0] and [1]" (when the number of external axes is 2) among the expanded sub items.



When configuring, you need to select several sub items for several external axes according to the actual situation. For example, if there are two external axes, select [0] and [1] for configuration; When there are three external axes, select [0], [1] and [2] for configuration.

Step13. Click <Edit>, and a dialog box as shown in Figure 4-27 will pop up. The parameters in the configuration [value]

are all 0 (rotation axis), and click <Yes>.

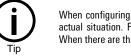
Parameter Edit	×
Variable: Name:	channel3.EXJOINT_TYPE.[0]
Value:	1 -
Unit:	
Type:	int
Range:	
Effective way:	Hard Reboot
Authority:	Teacher
Description:	Type of external axis; 0: rotational axis, 1: linear axis
	Yes Cancel

Figure 4-27 Configuration interface of external shaft type

Step14. If the external shaft is connected with a reducer, in the [channel 3] interface, click [+] on the left side of the

[EXJOINT\_REDUCER\_RATIO (Reduction ratio of external shaft reducer)] parameter, and click to select the [1]

(when the number of external shafts is 1) sub item among the expanded sub items.



When configuring, you need to select several sub items for several external axes according to the actual situation. For example, if there are two external axes, select [0] and [1] for configuration; When there are three external axes, select [0], [1] and [2] for configuration.

Step15. The dialog box as shown in Figure 4-28 pops up. Configure the parameters in [value] (the value shall be

determined according to the parameters of the actual connected positioner), and click <Yes>.

Parameter Edit	2	×
Variable:	channel3.EXJOINT_ REDUCER_RATIO.[1]	
Name:		
Value:	100	
Unit:		
Туре:	double	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Reduction ratio of reducer on external axis: this value represents the ball screw ratio for linear axis, unit: mm/r	
	Yes Cancel	

Figure 4-28 Configuration interface of reduction ratio of external shaft reducer



After the parameter configuration is completed, "zero calibration" and "positive/negative limit configuration" need to be done for the positioner. Please refer to the operation manual of positioner for detailed configuration steps.

Step16. After the parameter configuration is completed, click <Save>, and a dialog box as shown in Figure 4-29 will

pop up. Select "Save all" in [Please select the save type], and click <Yes>.

	×							
Please select the save type:								
Save all	•							
Yes	Cancel							
Figure 4-29 Save type dialog box								

Step17. Click <Yes> in the pop-up prompt dialog box. As shown in Figure 4-30.



Figure 4-30 Prompt box to confirm saving changes

Step18. Click <Yes> in the pop-up dialog box of successful parameter saving. As shown in Figure 4-31. The parameters

take effect after power failure and restart the control cabinet.

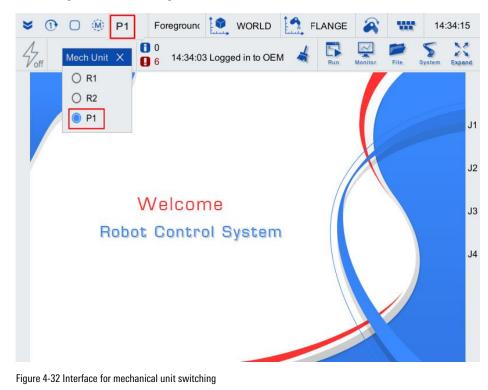
Prompt		×
i	Parameters saved successfully!	
	Yes	

Figure 4-31 Prompt box for successful saving

## 4.2 Check configuration

The inspection steps are as follows:

Step1. After power failure and restart, click the <Mechanical unit switching> (e.g. <P1>) button on the interface, as shown in Figure 4-32. After clicking [P1], click the "



Step2. Click [System/Parameter Configuration] in the main interface of teaching pendant, and the newly created [Positioner P1] tab is added in the [Parameter Configuration] interface. Click this tab to enter the interface

shown in Figure 4-33 for parameter viewing and modification. The parameter configuration of positioner is the

same as that in [Channel 1]. Parameter description is shown in Table 4-4.

Parameter Configu	ration					⇔	בום		X
robot	ex	tctrl iomap		safetyio		PositionerP		«	>>
Variable		Name		Value	Unit	Туре	Validit	y	Ran
MECH_UNIT_M	ODE	Mech Uni	t Model Flag	Positioner		string	Hard F	Reboot	
MECH_UNIT_T	ΥPE	Mechanic	al Unit Type	positioner		string	Hard F	Reboot	{robc
POSITIONER_A	XIS	Axis Num	1	2		uint	Hard F	Reboot	{1,2,:
+ POSITIONER_U	SER	User Defi	ned Flange CS		mm,°	frame	Hard F	Reboot	
- POSITIONER_E	XAXI	Mapping	With External Axis			uint[3]	Immed	liately	
[0]				1		uint	Immed	liately	
[1]				2		uint	Immed	liately	
[2]				3		uint	Immed	liately	
+ POSITIONER_G	EOM	Geometry	,		mm,°	frame[3]	Immed	liately	
Defreeh				Caus			Deeet		,
Refresh			Edit	Save			Reset		

Figure 4-33 Configuration interface of positioner T1 parameters

Table 4-11 Parameter description

Parameter	Description							
POSITIONER_AXIS_NUM (Number of axes)	Number of axes of the positioner.							
POSITIONER_EXAXIS_MAP (Mapping of axes to external axes)	The mapping relationship between each axis of the positioner and the external axis. The default configuration is that the positioner 1 axis corresponds to the external axis 1, the positioner 2 axis corresponds to the external axis 2, and the positioner 3 axis corresponds to the external axis 3. The user does not need to modify the configuration. When installing the positioner, it needs to be installed according to this mapping order.							
	Tip If the wiring is carried out according to Section 2.1, this item does not need to be configured.							

# 4.3 Coordinate system calibration

Calibration tool coordinate system

Before calibrating the tool coordinate system, you need to install a tool with a tip on R1 and R2 and use the tip as TCP.

The calibration steps of coordinate system are as follows:

Step1. Select [Run/Calibrate/Coordinate Calibration] on the main interface of the teaching pendant, as shown in Figure 4-34.

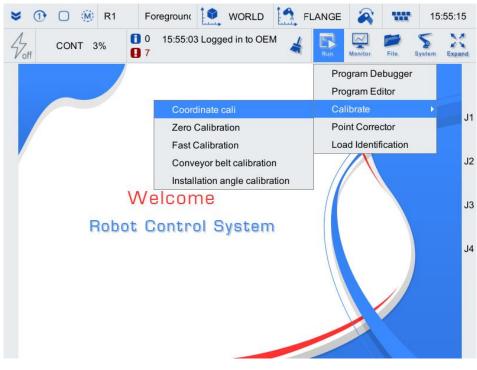


Figure 4-34 Main interface diagram

Step2. In the pop-up [Coordinate system measurement] interface, select [Coordinate system Type] as "Tool", as shown in Figure 4-35.

1	0 🛞	R1	Foregrou	nc 🚺	WORLD	F	LANGE	2	w	15:5	5:44
N Voff	CONT 39		4	Run	Monitor	File Sy	stem	Expand			
Coord	Coordinate system measurement $\Leftrightarrow$ ED $\square$ X										
Coo	Coordinate system Type Tool 💌									J1	
I	D Name	x	Y	Z	А	В	С	Fix	Mech	U 🔺	
(	0 tool0	-0.011	-0.011	-0.018	0.000	0.000	0.000		WOR	L	-
	1 tool1	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L 📃	J2
:	2 tool2	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L —	
:	3 tool3	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L	J3
4	4 tool4	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L	
	5 tool5	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L	
(	6 tool6	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L	J4
	7 tool7	0.000	0.000	0.000	0.000	0.000	0.000		WOR		
		Attitu	de calibrat	te mu	ıti-point	Refres	h Sa	ave			
Coordi	inate system i	measurem	ent								

Figure 4-35 Zero calibration interface

- Step3. Click to select the line of the tool used by R1 (e.g. tool0), and click <multi-point>.
- Step4. In the pop-up interface as shown in Figure 4-36, select the value of [Calibration point number]. The multi-point method supports 4-9 calibration points. The more points, the higher the calibration accuracy.

Step5. Calibrate each point according to the operation steps prompted in the [muti-point] interface, when "  $\times$  " change

all to " $\sqrt{}$ ", and click <Calculate>.

muti-point		Х
Calibration	point number 4 💌	
state	Operation method	Move point
*	Move it from the 1 direction to the reference point and click on the record	Record Move
*	Move it from the 2 direction to the reference point and click on the record	Record Move
*	Move it from the 3 direction to the reference point and click on the record	Record Move
*	Move it from the 4 direction to the reference point and click on the record	Record Move
	Remeasure	Calculate

Figure 4-36 Multi-point calibration interface

- Step6. Click <Yes> in the pop-up prompt dialog box to complete the calibration.
- Step7. After the tool calibration of R1 is completed, calibrate the tool of R2 in the same way.
- Step8. After R2 calibration, click <Save> to save the calibration results.

### Calibration base coordinate system

After the tool coordinate system calibration of R1 and R2 is completed, it is necessary to calibrate the base coordinate system of R2 and positioner (P1). The calibration steps of coordinate system are as follows:

Step1. Select [Run/Calibrate/Coordinate calibration] on the main interface of the teaching pendant, as shown in Figure 4-37.



- Figure 4-37 Main interface diagram
- Step2. In the pop-up [Coordinate system measurement] interface, select [Coordinate system Type] as "Base", as shown in Figure 4-38.

dinat	$\Leftrightarrow$	בום								
Coordinate system Type Base T										
ID	Name	х	Y	z	Α	В	С	Refe	rence	
0	R1	0.000	0.000	0.000	0.000	0.000	0.000	WO	RLD	
1	R2	0.000	0.000	0.000	0.000	0.000	0.000	WO	RLD	
2	P1	0.000	0.000	0.000	0.000	0.000	0.000	wo	RLD	

Figure 4-38 Zero calibration interface

Step3. Click to select the row of R2 and click <Calibrate>. The interface shown in Figure 4-39 will pop up.

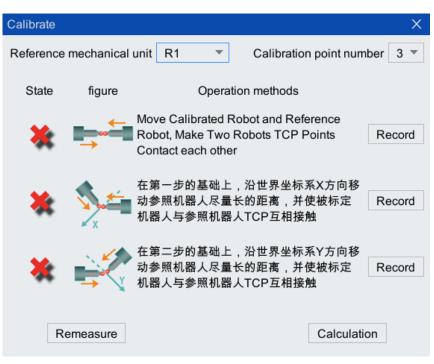


Figure 4-39 R2 base coordinate system calibration interface

- Step4. In the pop-up [Calibrate] interface (as shown in Figure 4-39), select [Reference mechanical unit] as "R1" and [Calibration point number] as "3" (the more points, the higher the calibration accuracy. Here, take the 3-point method as an example).
- Step5. Calibrate each point according to the operation steps prompted in the [calibrate] interface, when "  $\times$  " change all to " $\sqrt{}$ ", and click <Calculation> to complete the calibration.
- Step6. Click to select the row in P1 and click <Calibrate>. The interface as shown in Figure 4-40 will pop up.

Positione	er Calibrat	$\Leftrightarrow$	כום		Х						
ра	rameters										
Name	х	Y	Z	А	В	С	Axis type	Exte	ernal ax	is mapp	oin
Axis1	0.000	0.000	0.000	0.000	0.000	0.000	TransAxis	1			
Axis2	0.000	0.000	0.000	0.000	0.000	0.000	TransAxis	2			
	Re	efresh		Calibra	ate		Save				

Figure 4-40 Positioner calibration interface

Step7. In the pop-up [Calibrate] interface (as shown in Figure 4-41), select [Reference mechanical unit] as "R1", [base] as "Positioner", and [Calibration point number] as "3" (the more points, the higher the calibration accuracy. Here, take the 3-point method as an example).



Figure 4-41 Calibration interface

Step8. Calibrate each point according to the operation steps prompted in the [Calibrate] interface, when "  $\times$  " change all to " $\sqrt{}$ ", and click <Calibrate>. As shown in Figure 4-42.

Calibrate			Х
Reference	mechanical unit R1 🔻	base Position	ner 🔻
Axis numbe	er: 1	Calibration point	t number 3 🔻
-	将变位机1轴移动到位置 位机上一固定点	疍1,使TCP驶向变	Record
-	将变位机1轴移动到位置 位机上一固定点	置2,使TCP驶向变	Record
-	将变位机1轴移动到位置 位机上一固定点	置3,使TCP驶向变	Record
	•	Calibrate	Romosouro
		Calibrate	Remeasure
		Up	Down

Figure 4-42 Calibration success interface

Step9. Click the <Calibrate> button at the bottom of the interface. After successful calibration, click <Down> to calibrate the next external axis in the same way.

Step10. After all external axes are calibrated, click <Calculate>, and the calibration success interface will pop up, Click <Yes> to save the calibrated data.

Step11. Click <Yes> in the pop-up prompt dialog box.

#### Calibrate workpiece coordinate system

When R1 and P1 are linked, the workpiece coordinate system of R1 needs to be fixed on the positioner. The setting and calibration steps are as follows:

Step1. Select [Run/Calibrate/Coordinate calibration] on the main interface of the teaching pendant, as shown in Figure 4-43.

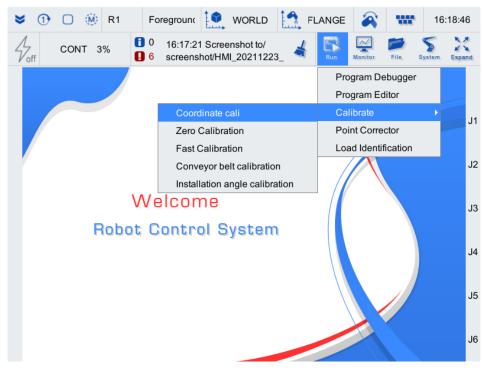


Figure 4-43 Main interface diagram

Step2. In the pop-up [Coordinate system measurement] interface, select [Coordinate system Type] as "Wobj", as shown in Figure 4-44.

Coordina	te system	measurer	nent					⇔		×
Coordin	ate syster	m Type	Wobj 🔻							
ID	Name	х	Y	Z	А	В	С	Move	Mech U 🔺	
0	wobj0	0.000	0.000	0.000	0.000	0.000	0.000		P1	
1	wobj1	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
2	wobj2	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
3	wobj3	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
4	wobj4	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
5	wobj5	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
6	wobj6	0.000	0.000	0.000	0.000	0.000	0.000		WORL	1
7	wobi7	0.000	0.000	0.000	0.000	0.000	0.000		WORL	
	3-point Refresh Save									

Figure 4-44 Zero calibration interface

Step3. Select the line of any workpiece coordinate system and select [Mech unit] as "P1", which means that the workpiece coordinate system is fixed on the positioner and moves with the positioner.



If there are no special requirements for the pose of the workpiece coordinate system, the default value of all zeros can be used without step 4-step 8.

Step4. (Optional) Click to select the line in P1 and click <3-point>. The interface shown in Figure 4-45 will pop up.

3-point			×
Tool too	0 -		
State	figure	Operation Method	Move Point
*	X	Move TCP to the origin of coordinate system of <sup>Y</sup> workpiece to be measured and click on the record	Record Move
*	Z X	Move TCP to the positive point at X axis of coordinate y system of the workpiece to be measured and click on the record	Record Move
*	X o	Move TCP to the point where the Y component is positive in the XY plane of coordinate y system of workpiece to be measured and click on the record	Record Move
	Reme	calcul	ate

Figure 4-45 3-point calibration interface

- Step5. (Optional) In the pop-up [3-point] interface, select [Tool] as the calibrated tool (e.g. "tool0").
- Step6. (Optional) Use R1 (when "tool0" is selected) to calibrate each point according to the operation steps prompted on the interface, when "  $\times$  " change all to " $\sqrt{}$ ", and click <Calculate>. As shown in Figure 4-46.

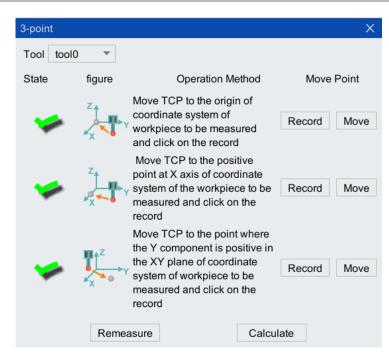


Figure 4-46 Calibration success interface

Step7. (Optional) After all external axes are calibrated, click <Calculate>, and the calibration success interface will pop up. Click <Yes> to save the calibrated data.

Step8. (Optional) Click <Yes> in the pop-up prompt dialog box.

## 4.4 JOG configuration

The workpiece coordinate system of the robot is the coordinate system associated with the positioner, and the robot is linked with the workpiece, that is, the position and posture of the robot's TCP remain relatively static relative to the workpiece coordinate system, as shown in Figure 4-47.



Figure 4-47 Diagram of robot linkage operation

The setting steps of this method are as follows:

Step1. Click the <Mechanical unit switch> (R1) button on the interface, as shown in Figure 4-48, click [R1], and then click the " button.

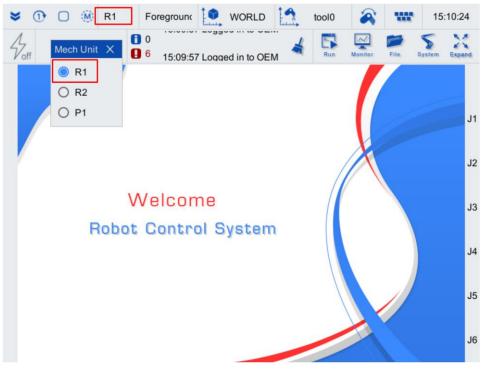


Figure 4-48 Mechanical unit switching interface

Step2. Click the *CONT 3%* icon in the upper left corner of the main interface, and the [JOG] operation parameter configuration interface will pop up. As shown in Figure 4-49.

JOG		Х				
Single-axis C	) Cartesian model 🔘	Tool mode				
O Main-axis Mod	le O Extern-axis	s mode				
Speed override	-	+ 3%				
Tool	tool0	•				
Coordinate system	WORLD	•				
O Linkage						

Figure 4-49 Running parameter configuration interface

Step3. Move the TCP point to a fixed sharp point, and configure the parameters of the [JOG] interface. The configuration method is shown in Table 4-12.

Table 4-12 Configuration steps and instructions

Steps	Parameter	Configuration instructions
1	Single-axis Cartesian model Tool mode	Click to select [Cartesian model]. In this mode, the TCP point of the manipulator can be controlled to move along the positive or negative directions of the X, Y or Z axes, and the TCP of the manipulator

Steps	Parameter	Configuration instructions
		can also be controlled to rotate around the Z, Y or X axes.
2	O Extern-axis Mode	Click to select [Main-axis Mode].
3	Speed override - + 3%	In JOG mode, this item means that the speed magnification of the lower "JOG" can be adjusted through "Image" and "Image" in the function keys of the teach pendant.
4	Tool	Select tool "tool0" for R1.
5	Coordinate System	Select the calibrated workpiece coordinate system "wobj0".
6	Linkage	Click to select the [Linkage] check box.

In the case of multiple robots, after checking [Linkage] on the [JOG] interface, each robot is in a linked state. At this time, the linkage can be controlled by selecting [Coordinate System] in the [JOG] interface of a robot.



- If "wobj (workpiece coordinate system)" is selected for [Coordinate System], and the mechanical unit of the workpiece coordinate system belongs to other robots, when other robots jog, the robot will follow the linkage;
- If the [Coordinate System] of the robot selects "WORLD", or selects "wobj (workpiece coordinate system)" and the mechanical unit of the workpiece coordinate system belongs to WORLD, it will not be linked.
- Step4. Rotate the axis 1 or axis 2 of the positioner, the robot TCP moves with the positioner, and keeps the relative position unchanged with the cusp on the positioner, and there is no obvious error. If the error visible to the naked eye is too large, recalibration is required.
- Step5. Click the <Mechanical Unit Switch> button on the interface, as shown in Figure 4-50, click [R2], and then click the ">" button.

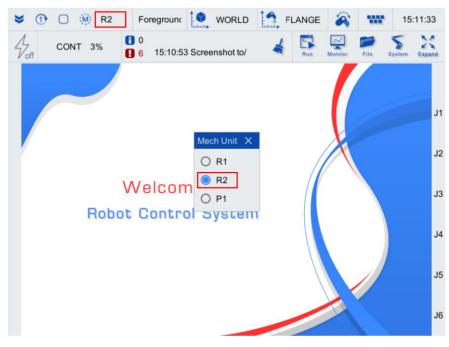


Figure 4-50 Mechanical unit switching interface

Step6. Click the " CONT 3% " icon in the upper left corner of the main interface, and the [JOG] operation parameter configuration interface will pop up. As shown in Figure 4-51.

JOG		Х					
🔿 Single-axis 🤇	○ Single-axis						
O Main-axis Mod	le 🔘 Extern-	axis mode					
Speed override	-	+ 3%					
Tool	FLANGE	▼					
Coordinate system	WORLD	•					
Linkage							

Figure 4-51 Configuration interface of running parameters

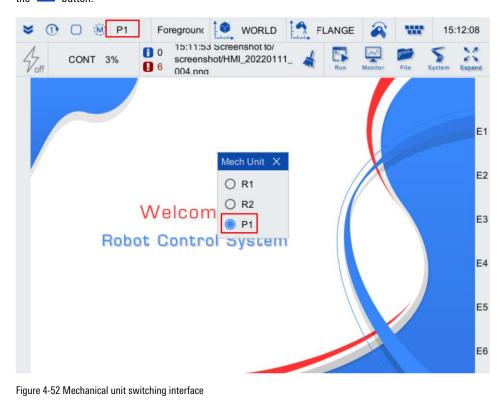
Step7. Move the TCP point to a fixed sharp point, and configure the parameters of the [JOG] interface. The configuration steps and descriptions are shown in Table 4-13.

Table 4-13 Configuration steps and instructions

Steps	Parameter	Configuration instructions
1	○ Single-axis    Cartesian model    Tool mode	Click to select [Cartesian model]. In this mode, the TCP point of the manipulator can be controlled to move in the positive or negative direction of the X-axis, Y-axis or Z-axis, or the TCP of the manipulator can be controlled to rotate around the Z-axis, Y-axis or X-axis.

Steps	Parameter	Configuration instructions
2	O Main-axis Mode O Extern-axis mode	Click to select [External-axis mode].
3	Speed override - + 3%	In JOG mode, this item means that the speed magnification of the lower "JOG" can be adjusted through " and " " in the function keys of the teach pendant.
4	Tool	Select the tool "tool1" for R2.
5	Coordinate system	Select the calibrated workpiece coordinate system "wobj0".
6	Linkage	Click to select the [Linkage] check box.

Step8. Click the <Mechanical unit switch> button on the interface, as shown in Figure 4-52, click [P1], and then click the "



Step9. Click the " CONT 3% " icon in the upper left corner of the main interface, and the [JOG] operation parameter configuration interface will pop up. The parameter configuration is shown in Figure 4-53.

JOG		×
🔿 Single-axis 🤇	Cartesian model 🔘 Tool moo	de
O Main-axis Mod	de 💿 Extern-axis mode	
Speed override	- + 39	6
Tool	FLANGE	▼
Coordinate system	WORLD	•
🔵 Linkage		

Figure 4-53 Running parameter configuration interface

## 4.5 Teaching practice

### Enable button description

The enable buttons can be installed on the left and right sides of the rear housing of the teach pendant. The default is to install on the right side when leaving the factory, as shown in Figure 4-54.

The enable button provides 3 key positions. The specific operation methods are as follows:

- When the enable key is completely released, the natural state is the first key position, the robot is not enabled and cannot be operated.
- Gently hold the enable key (located on the right side of the teach pendant) in Figure 4-54, this is the second key position, enable it on the robot (you hear a "click" sound), and at the same time, enable the status bar (See Figure

4-55), the lightning bolt icon is displayed as " \* " (highlighted), and the "run" indicator of the control cabinet will be on, and then manual operation can be performed (keep the enable key pressed).

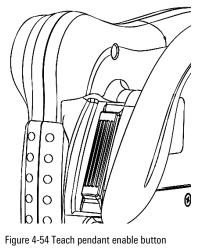




Figure 4-55 Enable status bar

Continue to press hard, this time is the 3rd key position, the robot is disabled (you hear a "lick" sound), and the lightning icon in the enable status bar (see Figure 4-55) is displayed as " // (gray), the "Operation" indicator of the control cabinet goes out.

#### **Teaching practice**

The teaching steps are as follows:

Step1. Set the "Single-axis" operation. Click the "CONT 3%" key in Figure 4-55, and the [JOG] dialog box will pop up, as shown in Figure 4-56, select [Single-axis], [JOG] represents the speed in manual mode, here it is recommended to set 5%.

JOG		×
Single-axis ⊂	)Cartesian model(	) Tool mode
Main-axis Mod	le 🔿 Extern-a	axis mode
Speed override	-	+ 3%
Tool	tool0	•
Coordinate system	WORLD	•
C Linkage		

Figure 4-56 JOG run settings dialog box

Step2. Single axis operation. Press and hold the enable button with the left hand and do not release it, then click the control buttons shown in Figure 4-57 with the right hand in turn ("De"" and "De"" can control the forward and reverse directions of each axis movement) to confirm that all six axes can operate normally. Release the enable key or continue to push it in, the robot stops moving and disconnects the enable (a "click" sound is heard). At the same time, the lightning icon in the enable status bar (see Figure 4-55) displays as "  $\checkmark$  " (Grey).

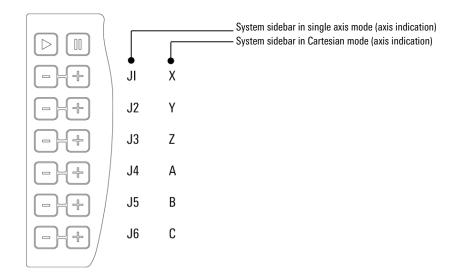


Figure 4-57 Control keys on the right side of the teach pendant



If the enable is disabled during the robot movement, an alarm will be generated. After the alarm is cleared, the robot needs to be enabled again to continue running the robot.

- Step3. Click [Run/Program Editor] on the main interface of the teach pendant.
- Step4. In the pop-up [Program Editor] interface, click [More Editors/Open] to open the created arl program file.
- Step5. Click [Insert Cmd/Motion Control/Group Move/use], as shown in Figure 4-58.

Program Editor				⇔	כום		×
Load Save Cut Copy Pa	Ste Comment Comment Delete	Mo edit	Fore Insert Function Cmd	e Set pose	lin	) movej	<i>S</i> gmove
new_file1.arl $\times$	movej		motion control	Þ			
1 func void main() 2 init()	ptp		logical control	+			
3 startcasfloat rf:"WORLI	lin		process control	+			
4 5	cir		interrupt trigger	+			
6	ccir		auxiliary comman	id 🕨			
7 endfunc	spl		user subprog				
8	startweave		function pack	•			
	endweave						
	Group Move	•	use				
	conveyor belt	►	gmove				
	soft float	•					
	tool compensation	•					
Program Editor File Man	agement						

Figure 4-58 Insert use

Step6. The configuration interface shown in Figure 4-59 will pop up. Click to select the mechanical unit to be linked, and click <Insert>.

*	1	Ο	(M)	P1	F	oregr	ounc		WO	RLD	1	tool	0	8	100	15	5:15:10
4	, off	use						7 Scre hot/HM		ot to/ 22011	1_ 🚽	Ru		Aonitor	File,	System	Expand
F	Progra	Sele	ct me	chanio	cal un	it								⇔	בום		×
	<b>T</b>	✓	R1			/	Remo			More	C	F	Revise	2	•	>	S
	Load	~	R2			nme	ntComm	ove Dele	ete	editors	Cmd	Function		Get pose	lin	movej g	Imove J1
	new_f	~	P1														
	1 <mark>fun</mark> 2 init		Ir	nsert													J2
	3 sta 4		ouri			ora:cf	11										
	5																J3
	6 7 <mark>en</mark> o	lfunc															00
	8																
																	J4
																	J5
	Progra	m Edi	tor	File M	lanad	omon											J6
							•										
Figur	e 4-59 l	nsert o	comm	and int	erface	)											

Step7. Instructions inserted in [Program Editor] are shown in Figure 4-60.

💙 🛈 🗌 🖗 P1	Foreground WORLD tool0 🐼 🐨 15:15:48
CONT 3%	screenshot/HMI_20220111_
Program Editor	
Load Save Cut Copy	Paste Comment Comment Delete Paste Comment Comment Delete
new_file1.arl* $\times$	L
1 func void main() 2 init()	J:
3 use R1,R2,P1 4 5 6 7 endfunc	
5	J
8	J.
	J
	J
Program Editor File N	lanagement
inura 4.60 Program aditar inte	,

Figure 4-60 Program editor interface

Step8. Click [Insert Cmd/Motion Control/Group Move/gmove] to pop up the configuration interface as shown in Figure 4-61. The parameter description is shown in Table 4-14.

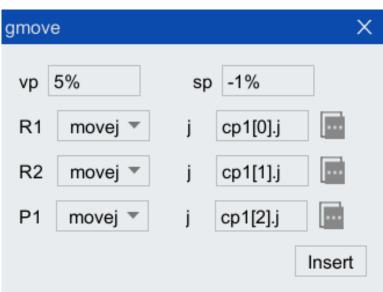


Figure 4-61 Insert command interface

Table 4-14 Parameter Description
----------------------------------

Parameter	Description
vp	TCP speed. This parameter specifies the movement speed percentage. It can be used as an alternative to the speed parameter v, which is used for occasions where it is not necessary to specify the speed value precisely. Format vp: 10%, indicating that the current line speed is 10% of the maximum speed of the robot
sp	Smoothness of TCP. This parameter specifies the smoothing percentage. An alternative to the smoothing parameter s, which is used when it is not necessary to precisely specify the smoothing value. The format is sp:10%, indicating that the smoothing distance of the current line target point is

Paramet	er	Description		
		10% of the maximum smoothing distance		
R1/R2	to a specified axis position. All axes reach the target pose p; // Cartesian target axis position at the same time.	The comppos structure is as follows: pose p; // Cartesian target point joint j; // Axis target point		
	ptp	The ptp command is used to quickly move the robot from one point to another without requiring the shape of the trajectory taken by the TCP point. All axes reach the target point at the same time.	unsigned int w // Tool coordinate system serial number; unsigned int t; // Workpiece coordinate system serial number	
lin	The lin command is used to move the robot TCP point to the target point pose along a linear path; the position movement and the attitude rotation are synchronized.	For parameter explanation, see "ARL Programming User Manual".		
	ccir	The ccir command is used to move the robot TCP point to the target point along an arc path; the translational motion and the rotational motion are synchronized.		

Step9. When the motion command of R1 is not selected as "movej", click the drop-down triangle to select other

motion commands. And click " behind the point data, the configuration interface as shown in Figure 4-62 will pop up.

cp1[0].	р				Х	
tool	tool0 -		wobj	wobj0	~	
·	Wobj Coordir	ate -				
х	522.876	mm	А	180.000	deg	
Y	-0.011	mm	в	68.614	deg	
Z	705.623	mm	С	180.000	deg	
	External Axis					
EJ1	9.000e+09	mm	EJ4	9.000e+0	)9 mm	
EJ2	9.000e+09	deg	EJ5	9.000e+0	)9 mm	
EJ3	9.000e+09	mm	EJ6	9.000e+0	)9 mm	
J6 J5 J4 J3 J2 J1						
🔽 t	urn 0 0	0 0	0	0 b	Ok	

Figure 4-62 Interface for configuring point data

Step10. Select [Tool] as "tool0". If you need to make linear or circular motion relative to the workpiece fixed on the positioner, the [Workpiece] coordinate system needs to select the workpiece coordinate system "wobj0" of P1 set in Section 4.3, and in other cases, the workpiece coordinate system can be selected "WORLD".

Step11. When the motion command of R2 is not selected as "movej", click the drop-down triangle to select other

motion commands. And click " 📠 " after the point data, the configuration interface as shown in Figure 4-63 will pop up.

	×
tool tool1 = wobj wobj0 =	
Wobj Coordinate	
X -82.000 mm A 90.000	deg
Y 378.000 mm B 2.592	deg
Z 35.000 mm C -90.000	deg
External Axis	
EJ1 9.000e+09 mm EJ4 9.000e+09	mm
EJ2 9.000e+09 mm EJ5 9.000e+09	mm
EJ3 9.000e+09 mm EJ6 9.000e+09	mm
J6 J5 J4 J3 J2 J1	
✓ turn 0 0 0 0 0 0 b Ok	¢

Figure 4-63 Interface for configuring point data

Step12. Select [Tool] as "tool1". If you need to make linear or circular motion relative to the workpiece fixed on the positioner, the [Wobj] coordinate system needs to select the workpiece coordinate system "wobj0" of P1 set in Section 4.3, and in other cases, the workpiece coordinate system can be selected "WORLD".



When the workpiece coordinate system refers to the positioner, it is in the linked state, and the "&" symbol will appear before the inserted command; in other cases, it is in the non-linked state, and the "@" symbol will appear before the inserted command.

Step13. After the configuration is complete, click <Insert>, and insert the motion instruction in the [Program Editor] as shown in Figure 4-64.

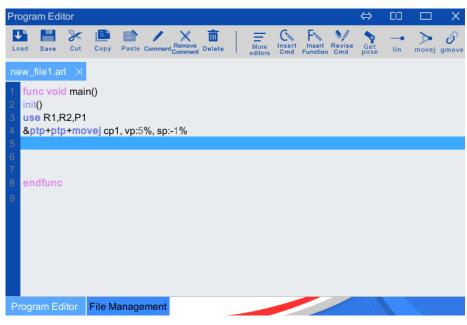


Figure 4-64 Program editor interface

#### Program execution

The program execution steps are as follows:

- Step1. After the code is generated, click <Load> to load the code into the program debugger.
- Step2. Turn the mode switch key on the upper left of the robot teach pendant to the [Manual Low Speed] mode. As shown in Figure 4-65.

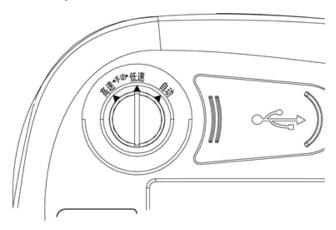


Figure 4-65 Teach pendant mode switch key

Step3. Press the enable button of the rear casing of the teach pendant to the **II** (middle) key position and not release it (as shown in Figure 4-66), the upper left corner of the teach pendant interface " \* " lights up (as shown in Figure 4-67), indicating that the motor is powered on.

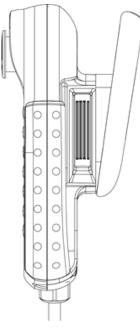


Figure 4-66 Teach Pendant Enable Switch



Figure 4-67 The motor is powered up

- Step4. Select the debug mode in the debugger (for details, please refer to "Section 5.1 Program Debugger" in the "AIR-TP Teaching Pendant Operation Manual"), and simultaneously press the "D" button on the front panel of the teaching pendant to start the executing code. Run the program in low-speed mode to check whether the program is running correctly, and whether the robot interferes with the surrounding environment, causing safety hazards and other problems.
- Step5. After confirming that the program is correct and there are no other faults, directly release the enable button, and turn the mode switch key on the upper left of the front of the robot teach pendant to the [Auto] mode. Press the <Enable> button to power on the motor, and click the "D" button to make the robot run automatically.

# 5 Multi-robot linkage

## 5.1 Configure basic parameters

The following uses "two robot manipulators" as an example to describe the configuration steps.

### Configure global parameters

Step1. As shown in Figure 5-1, select [System] in the upper right corner of the main interface, and then select the [Parameter Configuration] option in the drop-down list, and then enter the various tab selection interface shown in Figure 5-2.

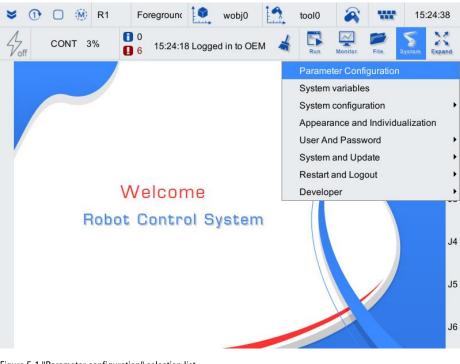


Figure 5-1 "Parameter configuration" selection list

Parameter Configuration $\Leftrightarrow$ []						>	ĸ	
global	channel1	robot	extctrl	iomap			« »	>
Variable	Name			Value	•	Un	it	

Figure 5-2"Parameter configuration" tab display area

- Step2. In the [Global] interface, click to select the [CHANNEL\_NUM (Foreground Channel Number)] parameter.
- Step3. Click <Edit>, the dialog box shown in Figure 5-3 will pop up. Set the parameter in [Value] to 2, and click <Yes>.

Parameter Edit	X
Variable: Name: Value:	global.CHANNEL_NUM Foreground Channel Number
Unit: Type: Range:	uint
Authority:	: Hard Reboot Teacher
Description:	Number of foreground channels
	Yes Cancel

Figure 5-3 Interface of the number of foreground channels

- Step4. In the [Global] interface, click to select the [SERVO\_NUM (Servo Number)] parameter.
- Step5. Click <Edit>, the dialog box shown in Figure 5-4 will pop up. Configure the parameters in [Value] and click <Yes>. The parameter description is shown in Table 5-1.

Parameter Edit		X
Variable: Name: Value:	global.SERVO_NUM Servo Number 12	
Unit: Type: Range: Effective way:	uint [0,64] Hard Reboot	
Authority:	Teacher	
Description:	Number of servo slave stations connected to the bus: the inconsistency between the configured value of this parameter and the number of actually	
	Yes Cance	əl

Figure 5-4 The configuration interface of the number of servo slaves

Table 5-1 Parameter Description

Parameter	Description				
Value	The number of servo slaves connected to the bus, including the servo slaves of the robot manipulator and the external servo slaves.				
	Tip The parameter configuration does not match the actual number of slave stations, which may cause the bus connection failure when starting the system.				

Step6. It will take effect after restarting the control cabinet.

#### Configure channel 1 Parameters (R1)

Step1. Click the <Mechanical unit switch> button on the interface, as shown in Figure 5-5, click [R1], and then click the "

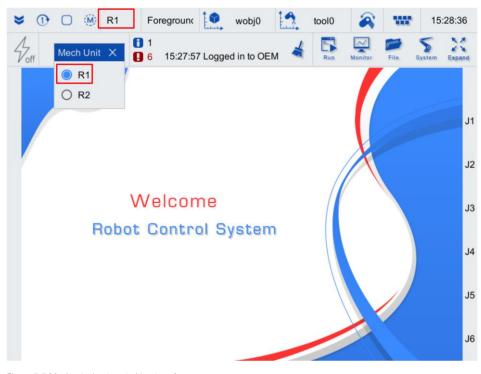


Figure 5-5 Mechanical unit switching interface

- Step2. On the [Channel 1] interface, click to select the [EX\_JOINT\_NUM (External Axis Num] parameter.
- Step3. Click <Edit>, the dialog box shown in Figure 5-6 will pop up. Set the parameter in [Value] to 0, click <Yes>. The parameter description is shown in Table 5-2.

Parameter Edit		Х
Variable:	channel1.EX_JOINT_NUM	
Name:	External Axes Num	
Value:	0 -	
Unit:		
Type:	uint	
Range:		
Effective way	: Hard Reboot	
Authority:	Teacher	
Description:	Number of external axes controlled by this channel	
	Yes Cance	el

Figure 5-6 Configuration interface for the number of external axes

Table 5-2 Parameter Description

Parameter	Description
Value	The number of external axes controlled by this channel. Integer form, the value range is 1 to 6.

Step4. On the [Channel 1] interface, click to select the [MECH\_UNIT\_NUM (Mechanical unit num)] parameter.

Step5. Click <Edit>, the dialog box shown in Figure 5-7 will pop up. Set the parameter in [Value] to 1, and click <Yes>. The parameter description is shown in Table 5-3.

Parameter Edit	2	×
Variable: Name: Value:	channel1.MECH_UNIT_NUM Mechanical Unit Num	
Unit: Type: Range:	uint	
Effective way: Authority:	Teacher	
Description:	Number of mechanical units in the channel	
	Yes Cancel	

Figure 5-7 Configuration interface for the number of mechanical units

Table 5-3 Parameter Description

Parameter	Description
Value	The number of mechanical units in this channel.

- Step6. In the [Channel 1] interface, click the [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and click to select "[0]" in the expanded sub-items ([0] is the robot manipulator).
- Step7. Click <Edit>, the dialog box shown in Figure 5-8 will pop up. Configure the parameters in [Value] as the actual robot manipulator model, and click <Yes>. The parameter description is shown in Table 5-4.

Parameter Edit		Х
Variable:	channel1.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	AIR7L_B_V1 🔹	
Unit:		
Type:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	Ι

Figure 5-8 Configuration interface for mechanical unit models

Table 5-4 Parameter Description

Parameter	Description
Value	The model of the mechanical unit controlled by this channel.

- Step8. In the [Channel 1] interface, click the [+] on the left side of the [MECH\_UNIT\_NAME (Mechanical unit name)] parameter, and click to select "[0]" in the expanded sub-items ([0] is the robot manipulator).
- Step9. Click <Edit>, the dialog box shown in Figure 5-9 will pop up. Configure the parameters in [Value] (for example: R1), and click <Yes>.

Parameter Edit	×		
Variable:	channel1.MECH_UNIT_ NAME.[0]		
Name:			
Value:	R1		
Unit:			
Type:	string		
Range:			
Effective way:	Hard Reboot		
Authority:	Teacher		
Description:	Name of mechanical unit controlled by this channel: the user can set this parameter to distinguish mechanical units of		
	Yes Cancel		

Figure 5-9 Configuration interface for mechanical unit names

Configure channel 2 Parameters (R2)

Step1. Click the <Mechanical Unit Switch> button on the interface, as shown in Figure 5-10, click [R2], and then click the " button.

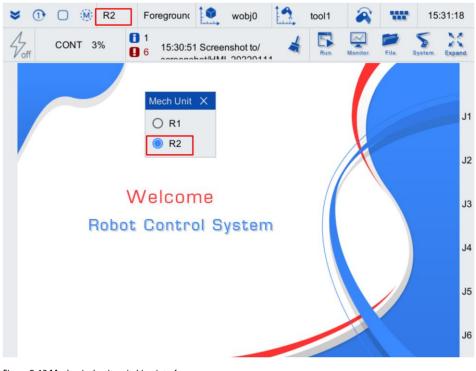


Figure 5-10 Mechanical unit switching interface

- Step2. On the [Channel 2] interface, click to select the [EX\_JOINT\_NUM (external axis number)] parameter.
- Step3. Click <Edit>, the dialog box shown in Figure 5-11 will pop up. Set the parameter in [Value] to 0, click <Yes>. The parameter description is shown in Table 5-5.

Parameter Edit		$\times$
Variable: Name: Value: Unit:	channel2.EX_JOINT_NUM External Axes Num	
Type: Range:	uint	
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Number of external axes controlled by this channel	
	Yes Cance	I

Figure 5-11 Configuration interface for the number of external axes

Table 5-5 Parameter Description

Parameter	Description
Value	The number of external axes controlled by this channel. Integer form, the value range is 1-6.

Step4. On the [Channel 2] interface, click to select the [MECH\_UNIT\_NUM (Mechanical unit num)] parameter.

Step5. Click <Edit>, the dialog box shown in Figure 5-12 will pop up. Set the parameter in [Value] to 1, and click <Yes>. The parameter description is shown in Table 5-6.

Parameter Edit	Х	
Variable: Name: Value:	channel2.MECH_UNIT_NUM Mechanical Unit Num	
Unit: Type: Range:	uint	
Effective way: Authority:	Hard Reboot Teacher	
Description:	Number of mechanical units in the channel	
	Yes Cancel	

Figure 5-12 Configuration interface for the number of mechanical units

Table 5-6 Parameter Description

Parameter	Description
Value	The number of mechanical units in this channel.

- Step6. In the [Channel 2] interface, click the [+] on the left side of the [MECH\_UNIT\_MODEL (mechanical unit model)] parameter, and click to select "[0]" in the expanded sub-items ([0] is the robot manipulator).
- Step7. Click <Edit>, the dialog box shown in Figure 5-13 will pop up. Configure the parameters in [Value] as the actual robot manipulator model, and click <Yes>. The parameter description is shown in Table 5-7.

Parameter Edit		$\times$
Variable:	channel2.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	AIR6L_V2 T	
Unit:		
Type:	string	
Range:		
Effective way	: Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	əl

Figure 5-13 Configuration interface for mechanical unit models

Table 5-7 Parameter Description

Parameter	Description
Value	The model of the mechanical unit controlled by this channel.

- Step8. In the [Channel 2] interface, click the [+] on the left side of the [MECH\_UNIT\_NAME (mechanical unit name)] parameter, and click to select "[0]" in the expanded sub-items ([0] is the robot manipulator).
- Step9. Click <Edit>, the dialog box shown in Figure 5-14 will pop up. Configure the parameters in [Value] (for example: R2), and click <Yes>.

Parameter Edit	X	
Variable:	channel2.MECH_UNIT_ NAME.[0]	
Name:		
Value:	R2	
Unit:		
Туре:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Name of mechanical unit controlled by this channel: the user can set this parameter to distinguish mechanical units of	
	Yes Cancel	

Figure 5-14 Configuration interface for mechanical unit names

Step10. Click <Save> after parameter configuration is complete, and the dialog box shown in Figure 5-15 will pop up. Select "Save All" in [Please select the save type], and click <Yes>.

		×	
Please select the save type:			
Save all		•	
	Yes	Cancel	

Figure 5-15 Save type dialog

Step11. Click <Yes> in the pop-up prompt dialog box. As shown in Figure 5-16.



Figure 5-16 Confirm save changes prompt box

Step12. Click <Yes> in the pop-up parameter save successfully dialog box. As shown in Figure 5-17.

Prompt		X
(i)	Parameters saved successfully!	
$\odot$		
	Yes	

Figure 5-17 Save successful prompt box

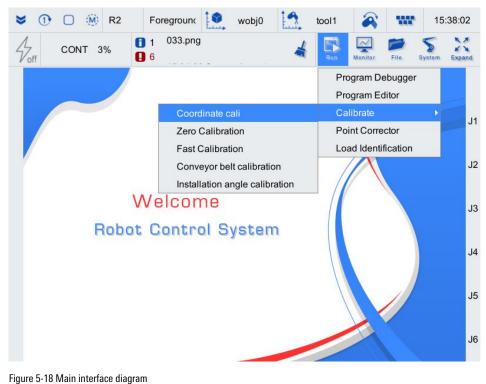
## 5.2 Coordinate system calibration

Calibration tool coordinate system

Before calibrating the tool coordinate system, it is necessary to install a tool with a tip on R1 and R2, and use the tip as a TCP.

The coordinate system calibration steps are as follows:

Step1. Select [Run/Calibrate/Coordinate Calibration] on the main interface of the teach pendant, as shown in Figure 5-18.



- Figure 5-16 Main interface ulayram
- Step2. In the pop-up [Coordinate System measurement] interface, select [Coordinate System Type] as "Tool", as shown in Figure 5-19.

*	1		R2	Foregrour	n <b>(19</b>	wobj0		tool1	2	w	15:3	8:31	
<i>V</i> of	ff	CONT 3%	% <b>1</b>		:02 Scree	nshot to/	4	Run	Monitor	File Sy	stem	Expand	
С	Coordinate system measurement ↔ E□ □ X												
Coordinate system Type Tool 🔻													
	ID	Name	Х	Y	Z	A	В	С	Fix	Mech	U 🔺	]   .	
	0	tool0	-0.011	-0.011	-0.018	0.000	0.000	0.000		WOR		-	
	1	tool1	0.000	0.000	0.000	0.000	0.000	0.000		WORL		J2	
	2	tool2	0.000	0.000	0.000	0.000	0.000	0.000		WOR			
	3	tool3	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L	J3	
	4	tool4	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L		
	5	tool5	0.000	0.000	0.000	0.000	0.000	0.000		WOR	L		
	6	tool6	0.000	0.000	0.000	0.000	0.000	0.000		WOR		J4	
	7	tool7	0.000	0.000	0.000	0.000	0.000	0.000		WOR			
												J5	
	Attitude calibrate muti-point Refresh Save												
Сс	Coordinate system measurement												

Figure 5-19 Zero calibration interface diagram

- Step3. Click to select the row of the tool used in R1 (for example: tool0), and click < Multi-Point>.
- Step4. In the pop-up interface as shown in Figure 5-20, select the value of [Calibration Point number]. The number of calibration points supported by multi-point method calibration is 4 to 9. The more the number of points, the higher the calibration accuracy.

Step5. Follow the operation steps indicated on the [Position Calibration] interface to calibrate each point. When all the

```
" \times " become "\sqrt{}", click <Calculate>.
```

muti-point		X
Calibration	point number 4 💌	
state	Operation method	Move point
*	Move it from the 1 direction to the reference point and click on the record	Record Move
*	Move it from the 2 direction to the reference point and click on the record	Record Move
*	Move it from the 3 direction to the reference point and click on the record	Record Move
*	Move it from the 4 direction to the reference point and click on the record	Record Move
	Remeasure	Calculate

Figure 5-20 Multipoint calibration interface

- Step6. Click <Yes> in the pop-up prompt dialog box to complete the calibration.
- Step7. After the tool calibration of R1 is completed, calibrate the tool of R2 in the same way.
- Step8. After R2 calibration, click <Save> to save the calibration results.

#### Calibration of base coordinate system

After the calibration of the tool coordinate system of R1 and R2 is completed, it is necessary to calibrate the base coordinate system of R2 based on R1. The calibration steps of coordinate system are as follows:



If three robots are linked, R3 also needs to be calibrated based on R1, and the calibration steps are the same as R2.

Step1. Select [Run/Calibrate/Coordinate calibration] on the main interface of the teaching pendant, as shown in Figure 5-21.

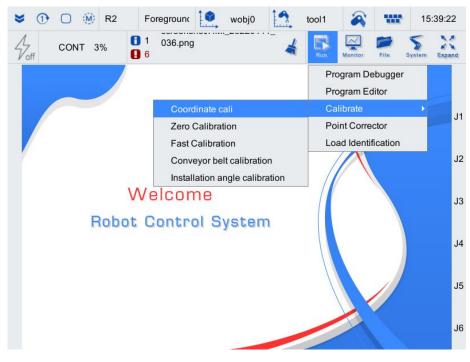


Figure 5-21 Main interface diagram

Step2. In the pop-up [Coordinate system measurement] interface, select [Coordinate system Type] as "Base", as shown in Figure 5-22.

ordir	nate syster	n Type	Base *						
ID	Name	х	Y	Z	A	В	С	Reference	
0	R1	0.000	0.000	0.000	0.000	0.000	0.000	WORLD	
1	R2	0.000	0.000	0.000	0.000	0.000	0.000	WORLD	

Figure 5-22 Zero calibration interface



If there are no special requirements for the pose of the base coordinate system, the default value of all zeros can be used without step 3 to step 6.

- Step3. (Optional) Click to select the row of R1 and click <Calibrate>. The interface shown in Figure 5-23 will pop up.
- Step4. (Optional) In the pop-up [Calibrate] interface, select [Reference mechanical unit] as "WORLD", and [Calibration point number] is "3" by default.

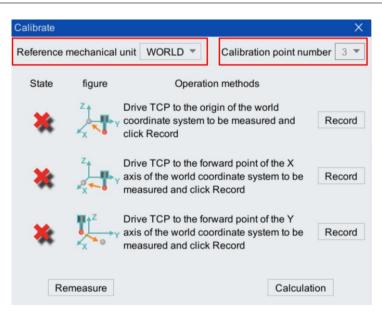


Figure 5-23 Three point calibration interface

- Step5. (Optional) Calibrate each point according to the operation steps prompted in the [Calibrate] interface. When "
  - × "When all become " $\sqrt{}$ ", click <Calculate >. As shown in Figure 5-24.

Calibrate		X
Reference	mechanical	unit WORLD  Calibration point number 3
State	figure	Operation methods
1	X	Drive TCP to the origin of the world coordinate system to be measured and click Record
-		Drive TCP to the forward point of the X axis of the world coordinate system to be measured and click Record
-		Drive TCP to the forward point of the Y axis of the world coordinate system to be measured and click Record
Re	emeasure	Calculation

Figure 5-24 Interface for successful calibration

- Step6. (Optional) Click the <Calculation> button at the bottom of the interface to complete the calibration.
- Step7. Click to select the row of R2 and click <Calibration>. The interface shown in Figure 5-25 will pop up.
- Step8. In the pop-up [Calibrate] interface, select [Reference mechanical unit] as "R1" and [Calibration point number] as "3" (the more points, the higher the calibration accuracy. Here, take the 3-point method as an example).

Calibrate				Х
Reference	mechanical	unit R1 🔻	Calibration point numb	oer 3 🔻
State	figure	Operatio	on methods	
*	<b>-</b>	Move Calibrated Ro Robot, Make Two R Contact each other	obot and Reference Robots TCP Points	Record
*			,沿世界坐标系X方向移 长的距离,并使被标定 TCP互相接触	Record
*	÷?		,沿世界坐标系Y方向移 €的距离,并使被标定 ❑TCP互相接触	Record
R	emeasure		Calculatio	n

Figure 5-25 Three point calibration interface

Step9. Calibrate each point according to the operation steps prompted in the [Calibrate] interface. When "  $\times$  " Change all to " $\sqrt{}$ ", and click <Calculation>. As shown in Figure 5-26.

Calibrate			×
Reference	mechanical	unit R1  Calibration point num	ber 3 💌
State	figure	Operation methods	
-		Move Calibrated Robot and Reference Robot, Make Two Robots TCP Points Contact each other	Record
\$		在第一步的基础上,沿世界坐标系X方向移 动参照机器人尽量长的距离,并使被标定 机器人与参照机器人TCP互相接触	Record
1		在第二步的基础上,沿世界坐标系Y方向移 动参照机器人尽量长的距离,并使被标定 机器人与参照机器人TCP互相接触	Record
R	emeasure	Calculatio	on

Figure 5-26 Interface for successful calibration

Step10. Click the <Calculation> button at the bottom of the interface to complete the calibration.

Step11. Click <Save> to save the calibrated data.

Calibration of workpiece coordinate system

If the workpiece is placed on R1, the workpiece coordinate system needs to be calibrated with reference to R1. The calibration steps of coordinate system are as follows:

Step1. Select [Run/Calibrate/Coordinate calibration] on the main interface of the teaching pendant, as shown in Figure 5-27.

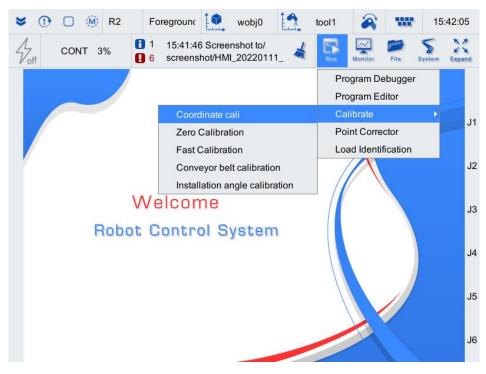


Figure 5-27 Main interface diagram

Step2. In the pop-up [Coordinate system measurement] interface, select [Coordinate system type] as "Wobj", as shown in Figure 5-28.

ID	Name	ĸ	Y	Z	Α	В	С	Move	Mech Unit
0	wobj0	00	0.000	0.000	0.000	0.000	0.000		R1 🔻 .
1	wobj1	000	0.000	0.000	0.000	0.000	0.000		WORLD
2	wobj2	000	0.000	0.000	0.000	0.000	0.000		WORLD
3	wobj3	000	0.000	0.000	0.000	0.000	0.000		WORLD
4	wobj4	000	0.000	0.000	0.000	0.000	0.000		WORLD
5	wobj5	000	0.000	0.000	0.000	0.000	0.000		WORLD
6	wobj6	000	0.000	0.000	0.000	0.000	0.000		WORLD
7	wobi7	000	0.000	0.000	0.000	0.000	0.000		WORLD

Figure 5-28 Zero calibration interface

- Step3. Select the row of any workpiece coordinate system and select [Mech Unit] as "R1".
- Step4. Click to select the row of R1 and click <3-point>. The interface shown in Figure 5-29 will pop up.

3-point			Х
Tool tool1	•		
State	figure	Operation Method	Move Point
×		Move TCP to the origin of coordinate system of workpiece to be measured and click on the record	Record Move
*	Z X	Move TCP to the positive point at X axis of coordinate system of the workpiece to be measured and click on the record	Record Move
*		Move TCP to the point where the Y component is positive in the XY plane of coordinate system of workpiece to be measured and click on the record	Record Move
	Reme	asure	ate
Figure 5-29 Calibrat	tion interface		

Figure 5-29 Calibration interface

Step5. In the pop-up [3-point] interface, select [tool] as the calibrated tool (e.g. "tool1").



When the workpiece is placed on the manipulator R1, it needs to be calibrated with the tool1 of the manipulator R2.

Step6. Calibrate each point according to the operation steps prompted on the interface. When "  $\times$  " Change all to " $\sqrt{}$ ",

and click <Calculate>. As shown in Figure 5-30.

3-point				X
Tool tool1	▼			
State	figure	Operation Me	ethod	Move Point
-	X	Move TCP to the origin coordinate system of workpiece to be mease and click on the record	ured	Record Move
-	Z M X X	Move TCP to the posi point at X axis of coord system of the workpied measured and click on record	linate ce to be	Record Move
-	X o Y	Move TCP to the point the Y component is po the XY plane of coordi system of workpiece to measured and click on record	sitive in nate be	Record Move
	Remea	asure	Calcula	te

Figure 5-30 Interface for successful calibration

Step7. After all external axes are calibrated, click <Calculate>, and the calibration success interface will pop up. Click <Yes> to save the calibrated data.

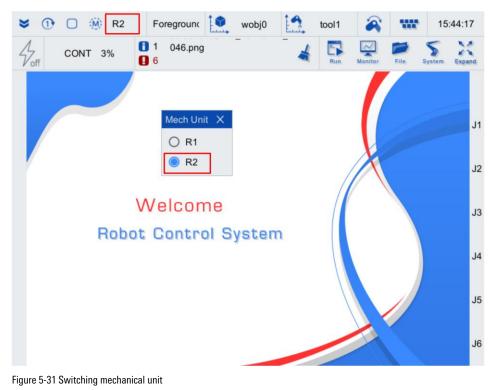
Step8. Click <Yes> in the pop-up prompt dialog box.

# 5.3 Jog configuration

The following configuration takes "workpiece on robot R1" as an example. The workpiece coordinate system of robot R2 is the coordinate system associated with robot R1. Robot R2 is linked with robot R1, that is, the position and attitude of robot R2 remain relatively stationary relative to the workpiece coordinate system.

The setting steps of this mode are as follows:

Step1. Click the <Mechanical unit switching> button on the interface, as shown in Figure 5-31. Click and select [R2] and click the ">" button.



Step2. Click the " CONT 3% " icon in the upper left corner of the main interface to pop up the [JOG] operation parameter configuration interface. As shown in Figure 5-32.

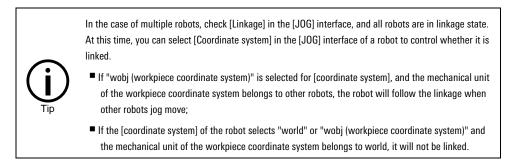
JOG		Х				
🔿 Single-axis 🤇	Cartesian model 🔘	Tool mode				
O Extern-axis mode						
Speed override - + 3%						
Tool	tool0	▼				
Coordinate system	WORLD	-				
🔘 Linkage						

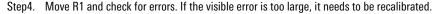
Figure 5-32 Interface of operation parameter configuration

Step3. Move the TCP of R2 to a sharp point on the coordinate system of R1 workpiece, and configure the [JOG] interface parameters of R2. The configuration method is shown in Table 5-8.

Table 5-8 Configuration steps and instructions

Step	Parameter	Configuration description
1	○ Single-axis    Cartesian model    Tool mode	Click to select [Cartesian mode]. In this mode, the TCP point of the manipulator can be controlled to move along the positive or negative direction of X axis, Y axis or Z axis, and the TCP of the manipulator can also be controlled to rotate around Z axis, Y axis or X axis.
2	Main-axis Mode     C Extern-axis mode	Click to select [Extern-axis Mode].
3	Speed override + 3%	In jog mode, this item indicates that the speed magnification of the lower "jog" can be adjusted through "Image" and "Image" in the function keys of the teaching pendant.
4	Tool	Select "tool1" of manipulator R2.
5	Coordinate system	Select the calibrated workpiece coordinate system "wobj0".
6	Linkage	Click to select the [Linkage] check box.





# 5.4 Teaching practice

Enable key description

Enable buttons can be installed on the left and right sides of the rear shell of the teaching pendant. By default, they are installed on the right side when leaving the factory, as shown in Figure 5-33.

The enable key provides three key positions. The specific operation methods are as follows:

- When the enable key is fully released, the natural state is the first key position, and the robot is not enabled and cannot be operated.
- Gently fasten the enable key (located on the right side of the teaching pendant) in Figure 5-33. This is the second key position. It is enabled on the robot (hear the "click" sound). At the same time, the lightning icon in the enable status bar (see Figure 5-34) is displayed as " / " (highlighted), the "run" indicator light of the control cabinet turns on, and then manual operation can be carried out (keep pressing and holding the enable key).

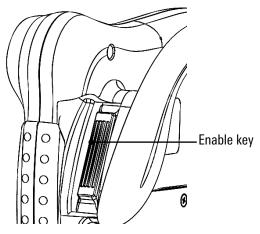


Figure 5-33 Teaching pendant enable button



Figure 5-34 Enable status bar

Continue to press hard. This is the third key position. The robot is enabled (hear the "click" sound). At the same time, the lightning icon in the enabling status bar (see Figure 5-34) is displayed as " '' (gray), and the "operation" indicator of the control cabinet is off.

## **Teaching practice**

The teaching operation steps are as follows:

Step1. Set "single axis mode" operation. Click the "CONT 3%" key in Figure 5-33 to pop up the [JOG] dialog box, as shown in Figure 5-35. Select [Single-axis], [jog] represents the speed in manual mode, which is recommended to be set to 5%.

JOG		X
Single-axis C	) Cartesian model ()	Tool mode
Main-axis Mod	le O Extern-axi	s mode
Speed override	-	+ 3%
Tool	tool0	•
Coordinate system	WORLD	•
O Linkage		

Figure 5-35 Jog run settings dialog box

Step2. Single axis operation. Press the enable key with the left hand for a long time without releasing it, and jog the control keys shown in Figure 5-36 with the right hand in turn ("D" and "D" can control the positive and negative directions of the movement of each axis) to confirm that all six axes can operate normally. Release the enable key or continue to buckle in, the robot stops moving and the enable is broken (hear the "click" sound). At the same time, the lightning icon in the enable status bar (see Figure 5-34) is displayed as " \* " (gray).

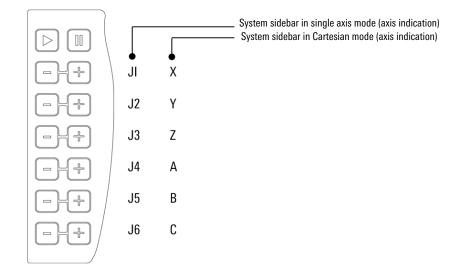


Figure 5-36 Right control key of teaching pendant



If the enable is disconnected during the movement of the robot, an alarm will be given. After the alarm is cleared, the robot needs to be enabled again to continue to run.

- Step3. Click [Run/Program Editor] on the main interface of teaching pendant.
- Step4. In the pop-up [Program Editor] interface, click [More editors/Open] to open the created ARL program file.
- Step5. Click [Insert Cmd/motion control/Group Move/use], as shown in Figure 5-37.

Program Editor				$\Leftrightarrow$	CID		×
Load Save Cut Copy Pa	Ste Comment Comment	More	C F N Insert Insert Rev Cmd Function Cm	ise Get d pose	• lin	movej	<i>S</i> gmove
new_file2.arl* × 1 func void main() 2 init() 3 4 5 6 7 endfunc 8	movej ptp lin cir ccir spl startweave		motion control logical control process control interrupt[trigger auxiliary comma user subprog function pack	and		_	
	endweave Group Move conveyor belt soft float tool compensation	• • •	use gmove				

Figure 5-37 Insert instruction

Step6. The configuration interface as shown in Figure 5-38 pops up. Click to select the mechanical unit to be linked, and click <Insert>.

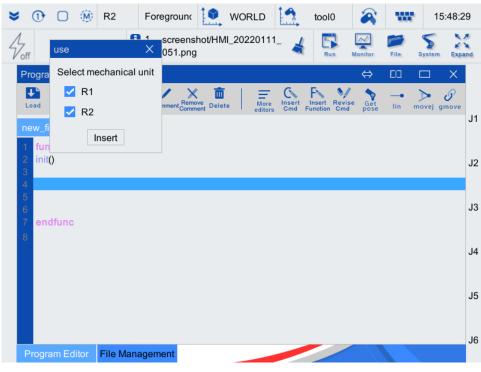


Figure 5-38 Insert use

Step7. The instructions inserted in [Program Editor] are shown in Figure 5-39.

Program Editor			⇔		X
Load Save Cut Copy	Paste Comment Comment Delete	More Insert Cond Function	Revise Get	in movej	<i>S</i> gmove
new_file2.arl* $\times$					
<ol> <li>func void main()</li> <li>init()</li> <li>3</li> </ol>					
4 use R1,R2					
5					
7					
8 endfunc 9					

Figure 5-39 Program editor

Step8. Click [Insert Cmd/motion control/Group Move/gmove] to pop up the configuration interface as shown in Figure 5-40. The parameter description is shown in Table 5-9.

gmove		X
vp 5%	sp -1%	
R1 movej 🔻	j cp1[0].j	
R2 movej 🔻	j cp1[1].j	
		Insert

Figure 5-40 Insert gmove

Table 5-9 Parameter description

Paramet	er	Description				
vр	TCP speed. This parameter specifies the percentage of motion speed. It can replace the speed parameter V, which is used when it is not necessary to specify the speed accurately. Format VP: 10 <sup>4</sup> indicating that the current line speed is 10% of the maximum speed of the robot					
sp	sp Smoothness of TCP. This parameter specifies the smoothing percentage. It can replace the smoot parameter s, which is used when it is not necessary to specify the smoothing value accurately. Th format is SP: 10%, indicating that the smoothing distance of the target point in the current line is of the maximum smoothing distance					
R1/R2	movej	The movej instruction is used to move the robot axis to a specified axis position. All axes reach the target axis position at the same time.	The comppos structure is as follows: pose p; // Cartesian target point joint j; // Axis target point			
	ptp	PTP instruction is used to quickly move the robot from one point to another without requiring the trajectory shape of TCP point. All axes reach the	unsigned int w // Tool coordinate system serial number; unsigned int t; // Workpiece coordinate system serial number			

Parame	eter	Description			
	target point at the same time.		See "ARL programming manual" for parameter		
	lin	The Lin instruction is used to move the TCP point of the robot to the pose of the target point along the linear path; Position movement and attitude rotation are synchronized.	explanation.		
	ccir	The ccir instruction is used to move the robot TCP point to the target point along the arc path; Translational motion and rotational motion are synchronized.			

Step9. When the motion command of R1 is not "movej", click the drop-down triangle to select other motion

commands. Click " 💼 " after the point data to pop up the configuration interface as shown in Figure 5-41.

cp1[0].	р				×
tool	tool0 💌		wobj	wobj0 🔻	
\	Wobj Coordina	ate –			
Х	-0.011	mm	А	0.000	deg
Y	-0.011	mm	В	0.000	deg
Z	-0.018	mm	С	0.000	deg
	External Axis				
EJ1	9.000e+09	mm	EJ4	9.000e+09	mm
EJ2	9.000e+09	deg	EJ5	9.000e+09	mm
EJ3	9.000e+09	mm	EJ6	9.000e+09	mm
	J6 J5 J4	1 J3	J2 J	J1	
🗸 ti	urn 0 0 0	0	0	0 b (	Ok

Figure 5-41 Configure point data interface

- Step10. Select [tool] as "tool0". If it is necessary to move in a straight line or circular arc relative to the workpiece fixed on the positioner, select the workpiece coordinate system "wobj0" of P1 set in Section 5.2 for the [wobj] coordinate system. In other cases, select "WORLD" for the workpiece coordinate system.
- Step11. When the motion command of R2 is not "movej", click the drop-down triangle to select other motion commands. Click " after the point data to pop up the configuration interface as shown in Figure 5-42.

cp1[1].	р									Х
tool	to	ol1	,	•		wob	j w	obj0	-	]
, ·	Woł	oj Co	oord	ina	te –					
х	84	5.00	5		mm	А	87	.586		deg
Y	37	8.00	0		mm	в	-0.	.945		deg
Z	-31	18.70	01		mm	С	15	8.634	,	deg
	Exte	erna	Axi	s						
EJ1	9.0	)00e	+09		mm	EJ4	9.0	000e+	09	mm
EJ2	9.0	)00e	+09		mm	EJ5	9.0	000e+	09	mm
EJ3	9.0	)00e	+09		mm	EJ6	9.0	000e+	09	mm
		J6	J5	J4	J3	J2	J1			
🗹 ti	urn	0	0	0	0	0	0	b	C	)k

Figure 5-42 Configure point data

Step12. Select [tool] as "tool1". If you need to move in a straight line or circular arc relative to the workpiece fixed on the positioner, select the workpiece coordinate system "wobj0" of P1 set in Section 5.2 for the [wobj] coordinate system. In other cases, select "world" for the workpiece coordinate system.



When the workpiece coordinate system refers to the positioner, it is in linkage state, and the "8" symbol will appear before the inserted instruction; In other cases, it is not linked, and the "@" symbol will appear in front of the inserted instruction.

Step13. After the configuration is completed, click < Insert>, and insert the motion instruction in the [Program Editor],

as shown in Figure 5-43.

Program Editor	⇔	בום		X
Load Save Cut Copy Paste Comment Comment Delete	Get	• lin	) movej g	<i>S</i> move
new_file2.arl ×				
1 func void main() 2 init() 3				
<ul> <li>use R1,R2</li> <li>&amp;ptp+lin cp1, vp:5%, sp:-1%</li> </ul>				
6 7				
8 9 endfunc 10				

Figure 5-43 Program editor

Step14. After the program is inserted, execute the program.

## Program execution

The procedure is as follows:

- Step1. After the code is generated, click <Load>, and load the code into the program debugger.
- Step2. The mode switching key at the top left of the front of the robot teaching pendant rotates to the [Manual low speed] mode. As shown in Figure 5-44.

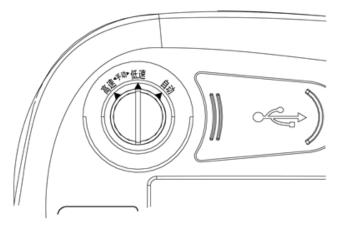


Figure 5-44 Teaching pendant mode switching key

Step3. Press the enable button of the rear shell of the teaching pendant to the II (middle) key position without loosening (as shown in Figure 5-45), and the " ' in the upper left corner of the teaching pendant interface lights up (as shown in Figure 5-46), indicating that the motor has been powered on.

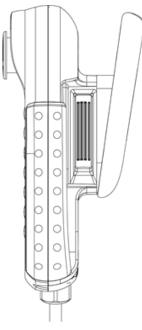


Figure 5-45 Teaching pendant enable switch



Figure 5-46 The motor is powered on

- Step4. Select the debugging mode in the debugger (refer to "section 5.1 program debugger" in the operation manual of "AIR-TP teaching pendant" for the specific use method), and press the "D" key on the front panel of the teaching pendant to start executing the program. Run the program in the low-speed mode to detect whether the program runs correctly and whether the robot interferes with the surrounding environment, causing potential safety hazards and other problems.
- Step5. After confirming that the program is correct and there are no other faults, directly release the enable button and rotate the mode switching key at the top left of the front of the robot teaching pendant to the [automatic] mode. Press the <Enable> button to power on the motor, and click the "D" button to make the robot run automatically.

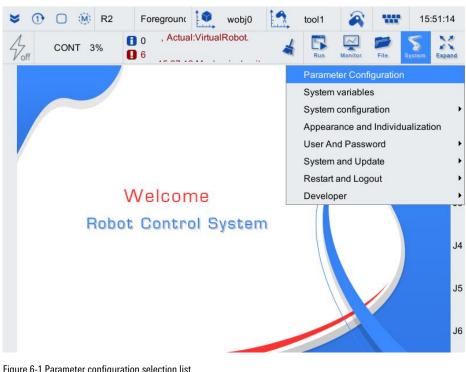
# 6 Robot + external axis

# 6.1 Configure basic parameters

The following takes "one robot + one external axis" as an example to illustrate the configuration steps.

#### Configure global parameters

Step1. As shown in Figure 6-1, select [System] in the upper right corner of the main interface, and then select the [Parameter Configuration] option in the drop-down list to enter the various tab selection interfaces shown in Figure 6-2.



|--|

Parameter Configu	$\Leftrightarrow$ []		$\times$			
global	channel2	robot	extctrl	iomap	«	»
Variable	Name			Value	Unit	

Figure 6-2 Parameter configuration tab display area

- Step2. In the [global] interface, click to select the [CHANNEL\_NUM (Number of foreground channels)] parameter.
- Step3. Click <Edit>, and a dialog box as shown in Figure 6-3 will pop up. Configure the parameter in [value] as 2, and click <Yes>.

Parameter Edit	×
Variable: Name: Value: Unit: Type:	global.CHANNEL_NUM Foreground Channel Number 2
Range: Effective way: Authority: Description:	Hard Reboot Teacher Number of foreground channels
	Yes Cancel

Figure 6-3 Foreground channel parameter configuration

Table 6-1 Parameter description

Parameter	Description
Value	Number of foreground channels. Each mechanical unit needs to occupy a separate channel. This configuration includes two robots and an external axis, so it is configured as 2 here.

Step4. In the [global] interface, click to select the [SERVO\_NUM (Servo slave)] parameter.

Step5. Click <Edit>, and a dialog box as shown in Figure 6-4 pops up. Configure the parameters in [value], and click <Yes>. The parameter description is shown in Table 6-2.

Parameter Edit			×
Variable: Name: Value: Unit: Type:	global.SE Servo Nu 7 uint	RVO_NUI mber	M
Range:	[0,64]		
Effective way:	Hard Reb	oot	
Authority:	Teacher		
Description:	stations of bus: the i between value of t	of servo sla connected nconsister the configu this parame	to the ncy ured eter
		Yes	Cancel

Figure 6-4 Servo slave station number configuration

Table 6-2 Parameter description

Parameter	Description	
Value	The number of servo slave stations connected on the bus, including the servo slave station of the and the servo slave station of the external axis. The configuration case includes 6 (1 Robot) main servo slave stations and 1 external axis servo slave station.	
	(j) Tip	The configuration of this parameter is inconsistent with the actual number of slave stations, which may cause bus connection failure when starting the system.

Step6. After the configuration is completed, click <Save>, and it will take effect after restarting the control cabinet.

Configure channel 1 parameters (R1)

Step1. Click the <Mechanical unit switching> button on the interface, as shown in Figure 6-5. After clicking [R1], click the "

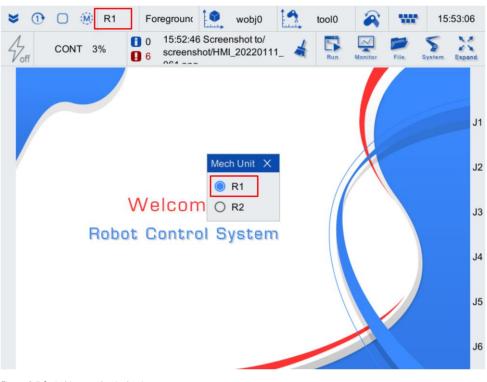


Figure 6-5 Switching mechanical unit

- Step2. In the [System/Parameter Configuration/Channel 1] interface, click and select the [EX\_JOINT\_NUM (number of external axes)] parameter;
- Step3. Click <Edit>, and a dialog box as shown in Figure 6-6 will pop up. Set the parameter in [value] to 0, and click <Yes>. The parameter description is shown in Table 6-3.

Parameter Edit		Х
Variable: Name: Value: Unit: Type:	channel1.EX_JOINT_NUM External Axes Num 0	
Range: Effective way: Authority:	Hard Reboot Teacher	
Description:	Number of external axes controlled by this channel	
	Yes Cance	I

Figure 6-6 Number configuration of external axes

Table 6-3 Parameter description

Parameter	Description
Value	This channel controls the number of external axes. In integer form, the value range is 0 - 6.

- Step4. In the [Channel 1] interface, click to select the [MECH\_UNIT\_NUM (Number of mechanical units)] parameter.
- Step5. Click <Edit>, and a dialog box as shown in Figure 6-7 pops up. Configure the parameter in [value] as 1, and click <Yes>. The parameter description is shown in Table 6-4.

Parameter Edit	×	C
Variable: Name: Value: Unit: Type: Range:	channel1.MECH_UNIT_NUM Mechanical Unit Num 1	
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Number of mechanical units in the channel	
	Yes Cancel	

Figure 6-7 Mechanical unit quantity configuration

Table 6-4 Parameter description

Parameter	Description
Value	The number of mechanical channels in the unit.

- Step6. In the [Channel 1] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and click to select the sub item "[0]" ([0] is the robot manipulator) among the expanded sub items.
- Step7. Click <Edit>, and a dialog box as shown in Figure 6-8 will pop up. The parameter in the configuration [Value] is the actual robot model, and click <Yes>. The parameter description is shown in Table 6-5.

Parameter Edit		Х
Variable:	channel1.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	AIR7L_B_V1	
Unit:		
Туре:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	əl

Figure 6-8 Mechanical unit model configuration

Table 6-5 Parameter description

Parameter	Description
Value	Model of mechanical unit controlled by this channel.

- Step8. In the [Channel 1] interface, click [+] on the left side of the [MECH\_UNIT\_NAME (Mechanical unit name)] parameter, and click to select the sub item "[0]" ([0] is the robot manipulator) among the expanded sub items.
- Step9. Click <Edit>, and a dialog box as shown in Figure 6-9 pops up. Configure the parameters in [value] (for example: R1), and click <Yes>.

Parameter Edit		×
Variable:	channel1.MECH_UN NAME.[0]	IIT_
Name:		
Value:	R1	
Unit:		
Туре:	string	
Range:		
Effective way	: Hard Reboot	
Authority:	Teacher	
Description:	Name of mechanica controlled by this cha the user can set this parameter to disting mechanical units of	annel:
	Yes	Cancel

Figure 6-9 Mechanical unit name configuration

#### Configure channel 2 parameters (E1)

Before using the positioner, please complete the relevant parameter configuration of the system.

Step1. Click the <Mechanical unit switching> button on the interface, as shown in Figure 6-10. After clicking [R2], click the "

Mech Unit	X
() R1	
🔵 R2	

Figure 6-10 Switch channel interface

- Step2. In the [System/Parameter configuration/Channel 2] interface, click and select the [EX\_JOINT\_NUM (Number of external axes)] parameter.
- Step3. Click <Edit>, and a dialog box as shown in Figure 6-11 will pop up. Configure the parameters in [Value], and click <Yes>. The parameter description is shown in Table 6-6.

Parameter Edit		Х
Variable: Name: Value: Unit: Type: Range:	channel2.EX_JOINT_NUM External Axes Num 1	
Effective way	Hard Reboot	
Authority: Description:	Teacher Number of external axes controlled by this channel	
	Yes Cance	I

Figure 6-11 Number configuration of external axes

Table 6-6 Parameter description

Parameter	Description
Value	This channel controls the number of external axes. In integer form, the value range is 0-6.

Step4. In the [Channel 2] interface, click to select the [MECH\_UNIT\_NUM (Number of mechanical units)] parameter.

Step5. Click <Edit>, and a dialog box as shown in Figure 6-12 will pop up. Configure the parameter in [Value] as 2, and click <Yes>. The parameter description is shown in Table 6-7.

Parameter Edit		X
Variable: Name: Value: Unit: Type: Range:	channel2.MECH_UNIT_NUM Mechanical Unit Num 2	
-	Hard Reboot	
Authority:	Teacher	
Description:	Number of mechanical units in the channel	
	Yes Cancel	

Figure 6-12 Mechanical unit quantity configuration

Table 6-7 Parameter description

Parameter	Description
Value	The number of mechanical channels in the unit. When configuring the positioner function, the mechanical unit includes the robot manipulator and external axis, so the value is configured as 2.

- Step6. In the [Channel 2] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and click to select the sub item "[0]" ([0] is the robot manipulator and [1] is the external axis) among the expanded sub items.
- Step7. Click <Edit>, and a dialog box as shown in Figure 6-13 will pop up. Configure the parameter in [Value] as virtualrobot, and click <Yes>.

Parameter Edit		Х
Variable:	channel2.MECH_UNIT_ MODEL.[0]	
Name:		
Value:	VirtualRobot 🔹	
Unit:		
Type:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical unit controlled by this channel	
	Yes Cance	I

Figure 6-13 Mechanical unit model configuration

- Step8. In the [Channel 2] interface, click [+] on the left side of the [MECH\_UNIT\_MODEL (Mechanical unit model)] parameter, and click to select the sub item "[1]" ([0] is the robot manipulator and [1] is the external axis) among the expanded sub items.
- Step9. Click <Edit>, and a dialog box as shown in Figure 6-14 will pop up. Configure the parameter in [Value] as ExtJoint, and click <Yes>.

Parameter Edit		×
Variable:	channel2.MECH_UNI MODEL.[1]	T_
Name:		
Value:	ExtJoint	•
Unit:		
Туре:	string	
Range:		
Effective way:	Hard Reboot	
Authority:	Teacher	
Description:	Model of mechanical controlled by this cha	
	Yes	Cancel

Figure 6-14 Mechanical unit model configuration

- Step10. In the [Channel 2] interface, click [+] on the left side of the [MECH\_UNIT\_NAME (Mechanical unit name)] parameter, and click to select the sub item "[1]" ([0] is the robot manipulator and [1] is the external axis) among the expanded sub items.
- Step11. Click <Edit>, and a dialog box as shown in Figure 6-15 will pop up. Configure the parameters in [value] (e.g.

E1), and click <Yes>.

Parameter Edit	×	C			
Variable:	channel2.MECH_UNIT_ NAME.[1]				
Name:					
Value:	E1				
Unit:					
Type:	string				
Range:					
Effective way:	Hard Reboot				
Authority:	Teacher				
Description:	Name of mechanical unit controlled by this channel: the user can set this parameter to distinguish mechanical units of				
	Yes Cancel				

Figure 6-15 Mechanical unit name configuration

Step12. After the parameter configuration is completed, click <Save>, and a dialog box as shown in Figure 6-16 will

pop up. Select "Save all" in [Please select the save type], and click <Yes>.

	×
lect the sa	ve type:
	•
Yes	Cancel

Figure 6-16 Save type dialog box

Step13. Click <Yes> in the pop-up prompt dialog box. As shown in Figure 6-17.

Prompt		×
?	Confirm to save all modified parameters? Yes Cancel	

Figure 6-17 Confirm to save the changes

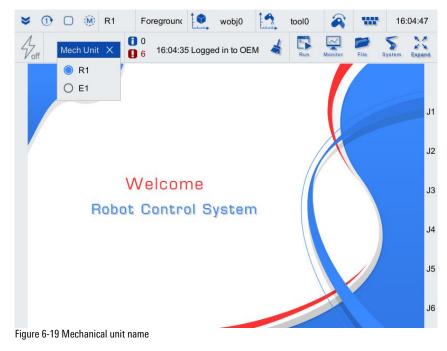
Step14. Click <Yes> in the pop-up dialog box of successful parameter saving. As shown in Figure 6-18. The parameters

take effect after power failure and restart the control cabinet.

Prompt		×
i	Parameters saved successfully! Yes	

Figure 6-18 Prompt box for successful saving

Step 15. After restart, click R1, and the names of the configured robot R1 and external axis E1 can be viewed on the



pop-up [Mech Unit] interface. As shown in Figure 6-19.

# 6.2 Teaching practice

**Teaching practice** 

The teaching operation steps are as follows:

Step1. Click [Foreground task] on the main interface, select [[1] Foreground Task 1] in the pop-up channel task management interface, and close the page. As shown in Figure 6-20.

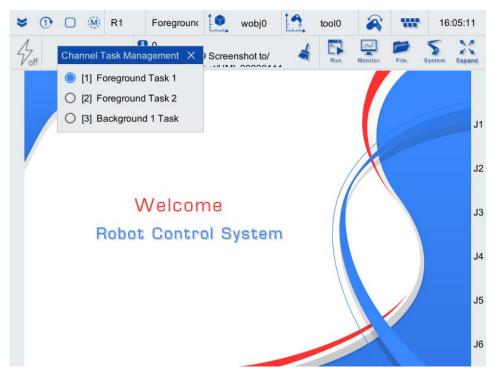
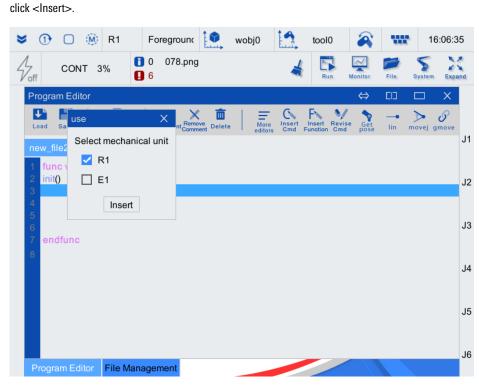


Figure 6-20 Channel task management interface

- Step2. Click [Run/Program Editor] on the main interface of teaching pendant.
- Step3. In the pop-up [Program Editor] interface, click [More Editors/Open] to open the created ARL program file.
- Step4. Click [Insert Cmd/motion control/Group Move/use], as shown in Figure 6-21.

ݢ 🕦 🗆 🛞 R1	Foreground wobj	tool0 🜊	16:06:18
	0 6 16:05:13 Screenshot to	/	File System Expand
Program Editor		⇔	
Load Save Cut Copy Pa		More ditors Cmd Finett Revise Cmd Function Cmd Cmd	> S lin movej gmove
new_file2.arl* $\times$	movej	motion control	J1
1 func void main() 2 init()	ptp	logical control	10
3	lin	process control	J2
4	cir	interrupt trigger	
5	ccir	auxiliary command	J3
7 endfunc	spl	user subprog	
8	startweave	function pack	
	endweave		J4
	Group Move	use	
	conveyor belt	gmove	J5
	soft float		
	tool compensation		J6
Program Editor File Man	agement		50

Figure 6-21 Insert instruction



Step5. The configuration interface as shown in Figure 6-22 pops up. Click to select the mechanical unit R1 to run and

Figure 6-22 Insert use

Step6. The instructions inserted in [Program Editor] are shown in Figure 6-23.

nev	w_file24.arl* ×	51
2 3	func void main() init() use R1	J2
4 5 6 7	endfunc	J3
8		14

Figure 6-23 Program editor interface

- Step7. Insert other motion instructions in [Program Editor] and click <load>.
- Step8. Click [Foreground task] on the main interface, select [ [2] foreground task 2] in the pop-up channel task management interface, and close the page. As shown in Figure 6-24.

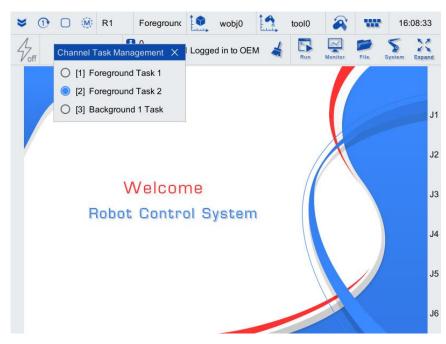


Figure 6-24 Channel task management interface

Step9. Click [Run/Program Editor] on the main interface of teaching pendant.

Step10. In the pop-up [Program Editor] interface, click [More Editors/Open] to open the created ARL program file.

Step11. Click [Insert Cmd/motion control/Group Move/use], as shown in Figure 6-25.

ݢ 🕕 🗆 🛞 R1	Foreground 💓 wobj	0 🔝 tool0 🏹	16:09:12
ZZ CONT 3%	0 16:08:35 Screenshot		File System Expand
Program Editor		⇔	CD 🗆 🗙
Load Save Cut Copy P	aste Comment Comment Delete	More editors Cmd FN Newise Cmd Function Cmd Set	> S lin movej gmove
new_file3.arl $ imes$	movej	motion control	J1
1 func void main() 2 init()	ptp	logical control	J2
3	lin	process control	
4	cir	interrupt trigger	
6 endfunc	ccir	auxiliary command	J3
7	spl	user subprog	
	startweave	function pack	J4
	endweave		54
	Group Move	use	
	conveyor belt	gmove	J5
	soft float		
	tool compensation	•	J6
Program Editor File Man	agement		

Figure 6-25 Insert use

Step12. The configuration interface as shown in Figure 6-26 pops up. Click to select the mechanical unit E1 to be run, and click <Insert Cmd> the instruction inserted in the [Program Editor].

🐱 🕦 🗆 🛞 R1	Foreground	wobj0	tool0	16:09:44
Goff CONT 3%	1016:09:13 Screens106screenshot/HMI_		Run Monitor	File System Expand
Program Editor			⇔	CD 🗆 🗙
Load Save Cut Copy	USE X Delate	More Insert editors Cmd F	Finsert Revise Get pose	→ iin movej gmove J1
new_file3.arl ×	Select mechanical unit			
1 func void main() 2 init()	🗌 R1			J2
3 4	🛃 E1			
2 init() 3 4 5 6 endfunc 7	Insert			J3
				J4
				J5
Program Editor File M	lanagement			J6
	anagomone			

Figure 6-26 Insert mechanical unit

- Step13. Insert "movej" motion instruction in [program editor] and click <load>.
- Step14. Click [Foreground task] again, and you can see the name of the loaded program file in the pop-up [Channel Task Management] interface, as shown in Figure 6-27.

🐸 🕦 🗆 🛞 R1	Backgroun	wobj0	1	tool0	8	w	16:	10:08
CONT 3%		Screenshot to/	4	Run	Monitor	File File	System	Expand
File Management					⇔	בום		×
New New Open Load ret		ut Copy Paste	Delete Rena					
Current Path /script								J1
Name $ abla$	Size Chanr	nel Task Manager	ment X	Descript	ion			
EM1-R6	0 [1	] Foreground Ta	sk 1					J2
package	0 [2	2] Foreground Ta	sk 2					
new_folder1	🥥 [3	3] Background 1	Task					J3
new_file3.arl	34 bytes	2022-01-11 16:0	8:58					
new_file2_data.arl	1 KB	2022-01-11 15:5	50:09					J4
new_file2.arl	42 bytes	2022-01-11 16:0	07:00					
new_file1_data.arl	814 bytes	2022-01-11 15:1	8:25					J5
new_file1.arl	81 bytes	2022-01-11 15:1	8:25					
								J6
File Management								

Figure 6-27 Channel task management file

## **Program Execution**

R1 and E1 are not linked, so it is necessary to run the procedures of R1 and E1 respectively according to the following steps. The procedure is as follows:

Step1. After the code is generated, click <Load>, and load the code into the program debugger.

Step2. The mode switching key at the top left of the front of the robot teaching pendant rotates to the [manual low

speed] mode. As shown in Figure 6-28.

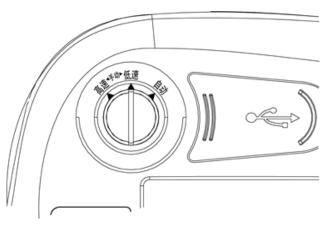


Figure 6-28 Teaching pendant mode switching key

Step3. Press the enable key of the rear shell of the teaching pendant to the II (middle) key position without loosening (as shown in Figure 6-29), and the " \* " in the upper left corner of the teaching pendant interface lights up (as shown in Figure 6-30), indicating that the motor has been powered on.

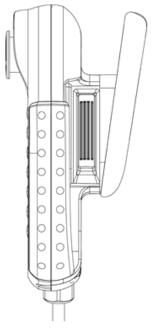


Figure 6-29 Teaching pendant enable switch



Figure 6-30 The motor is powered on

Step4. Select the debugging mode in the debugger (refer to "section 5.1 program debugger" in the *AIR-TP teaching pendant user manual* for the specific use method), and press the "<sup>1</sup><sup>2</sup>" key on the front panel of the teaching pendant to start executing the program. Run the program in the low-speed mode to detect whether the program runs correctly and whether the robot interferes with the surrounding environment, causing potential safety hazards and other problems.

Step5. After confirming that the program is correct and there are no other faults, directly release the enable button and rotate the mode switching key at the top left of the front of the robot teaching pendant to the [Automatic] mode. Press the <Enable> button to power on the motor, and click the "D" button to make the robot run automatically.







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