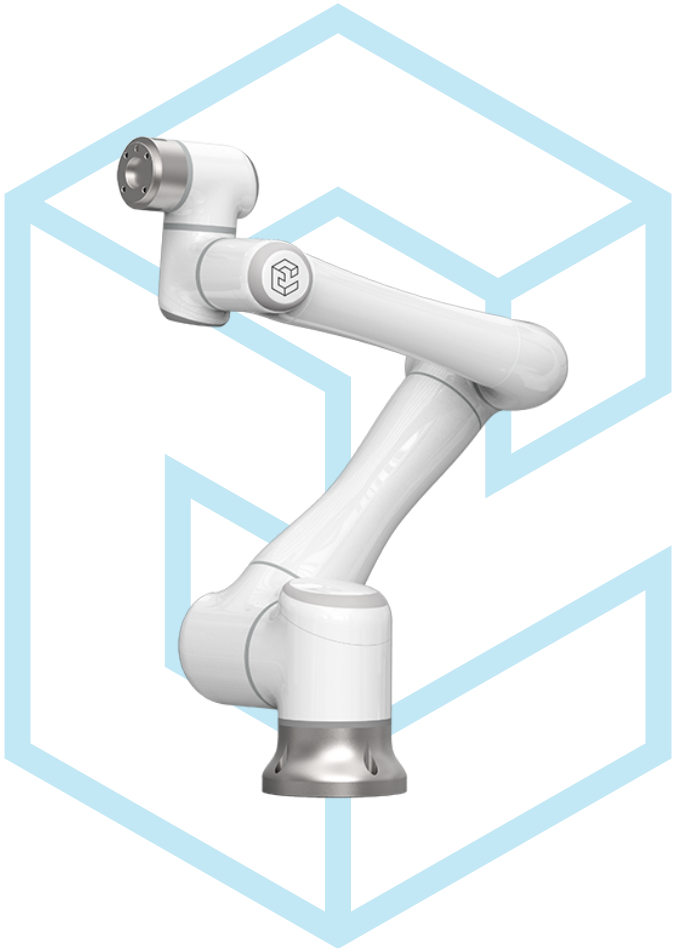
ELITE ROBOT EC Series
User Guide



EC66 User Manual

2022-04-29

Version: Ver3.2.2

www.Troysupply.com

Please read this manual carefully before use

Please carefully check the version informations in this manual matches the corresponding software version of the system, to ensure consistency.

This user manual shall be periodically checked and revised, and the renewed contents will appear in the new version. The contents or information herein is subject to change without prior notice.

ELITE ROBOT Co.,Ltd. shall assume no liability for any errors which will occur in the manual probably.

ELITE ROBOT Co.,Ltd. shall assume no liability for the accident or indirect injury as a result of using this manual and the product mentioned herein.

Please read this manual before installing and using the product.

Please keep this manual so that you can read and use it for reference at any time.

The pictures in the specification shall be used for reference only. The goods received shall prevail.

Table 1 . Version Information

Name	Version
Software version	v3.2.2
Servo version	11.38
Mechanical version	V4.B2.1
Hardware version	2.0
Web teach pendant version	1.2.1-38-g2e8569e
Manual version	Ver3.2.2

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Preface

Thank you for purchasing and using the lightweight 6-degree-of-freedom (DOF) collaborative robot EC66 developed by ELITE Robot Co., Ltd.



Figure 1 : EC66

The EC66 is one of the ELITE 6-DOF modular collaborative robot series with a payload of 6kg.

The ELITE collaborative robot series adopts a joint modular design and the uses a developer-oriented robot system. Users can develop a customize control system in accordance with an application program interface provided by a ELITE collaborative robot platform. In addition, the ELITE collaborative robot is equipped with a dedicated programmable interface, which allows the users to program, adjust multiple control settings, implement offline simulations, and observe the running state of the robot in real-time. Accordingly, the work efficiency of the practical application may be improved greatly.

Product Composition

The detailed outbound list of one set of complete EC66 robot is shown in the **Table** 2 .

Table 2 . outbound

Name	Quantity
Robot body	1
Controller including teach pendant	1
Power cord	1
Base (Optional)	1

More Information

For more Information please visit our website:www.troysupply.com

Chapter 1 Safety

1.1 Introduction

This chapter introduces the safety principles and specifications that should be followed when operating the robot. The integrator and the user must read this manual carefully and comply with all safety guidelines and warning labels. Users must fully understand the inherent risks of operating the robot arm, and strictly comply with the requirements listed in this manual. The user and the integrator must comply with ISO 10218 Industrial Robots - Safety Specification.

1.2 Liability

ELITE ROBOT Co.,Ltd. should provide the necessary spare parts to replace or repair relevant parts if the new equipment and its components are trapped in defects resulting from manufacturing and/or poor materials.

ELITE ROBOT Co.,Ltd. shall possess the ownership of the equipment or components replaced or returned to ELITE ROBOT Co.,Ltd.

If the product is no longer under warranty, ELITE ROBOT Co.,Ltd. shall reserve the right of charging the customer for replacement or repair. In case of defects of the equipment which is out of warranty, ELITE ROBOT Co.,Ltd. shall not be responsible for any damage or loss caused therefrom, such as loss of production or damage due to other production equipment.

If the equipment defect is caused by improper disposal or falling to comply with the relevant information stated in the user manual, the “Product Quality Assurance” will be invalid.

Failure caused by the following circumstances will not be covered by the warranty:

1. Installation, wiring and connection to other control equipment are not in line with the industrial standards or not implemented in accordance with the requirements of the user manual.
2. Outside the specification or standards shown in the user manual during use.
3. This product is applied to the non-designated purposes.
4. The storage mode and operating environment are beyond the specified scope (such as pollution, salt damage and dewing) of the user manual.
5. The product is damaged as a result of improper transportation.
6. Damage due to the accident or impact.
7. The non-original parts and accessories are installed.
8. Damage as a result of modification, debugging or repair of the original parts by the third party beyond ELITE ROBOT Co.,Ltd. or other integrators designated by ELITE ROBOT Co.,Ltd.

9. Natural disasters, such as fire, earthquake, tsunamis, lightning stroke, gale and flood.
10. Failure outside the abovementioned circumstances and not caused by ELITE ROBOT Co.,Ltd.

The following circumstances should not be covered by warranty:

1. The date of production or the start date of the warranty cannot be identified.
2. Alteration of the software or internal data.
3. The failure cannot be reproduced, or ELITE ROBOT Co.,Ltd. cannot identify the failure.
4. This product is used on the radioactive equipment, the biological test equipment or in the dangerous use judged by ELITE ROBOT Co.,Ltd.

In accordance with the product quality assurance agreement, ELITE ROBOT Co.,Ltd. shall be responsible for making the commitment of quality guarantee for the defects or deficiencies occurring in the products and the parts sold to the dealers.

As for any other explicit or implied warranties or liabilities including, but not limited to, any implied warranty for marketability or specific use, ELITE ROBOT Co.,Ltd. shall not bear the related liability to guarantee. In addition, ELITE ROBOT Co.,Ltd. shall not be responsible for the related liabilities in allusion to any form of indirect damage or consequence generated by the related product.

1.3 Warning Symbols

The safety-related contents of this manual are illustrated with the following warning symbols. The descriptions related to the warning symbols in this manual represent the important contents, please comply with these symbols.

DANGER



This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING



This indicates a hazardous situation which, if not avoided, may result in death or serious injury.

CAUTION



This indicates a hazardous situation, which, if not avoided, may result in minor or moderate injury.

WARNING



This indicates a potentially hazardous electrical situation which, if not avoided, could result in injury or major damage to the equipment.

WARNING



This indicates a potentially hazardous hot surface which, if not avoided, may result in burns.

1.4 Safety Precautions

When running the robot system, safety of the operating personnel must be ensured first. The general cautions are listed below. Please properly take corresponding measures of ensuring safety of the operating personnel.

CAUTION



1. Preliminary tests and inspections must be performed before using the robot for the first time or putting it into production.
2. All personnel operating the robot system should receive training from ELITE ROBOT Co.,Ltd. Users should fully understand the operational process and be qualified to operate the robot. For detailed training, please contact with the company by E-mail: tech@elibot.cn.
3. While operating the robot system loose clothing or jewellery should not be worn. Long hair must also be tied back for safety.
4. When the equipment is powered on, even if the robot is not moving, maintain caution as the robot may be waiting for a signal to continue motion.
5. Markings, guardrails, ropes, signage, or protective screens should be placed around the robot to clearly show the workspace of the robot.
6. Maintenance workers or operators should ensure that the robot is not plugged in or powered on while performing electrical maintenance.
7. Gloves should not be worn while operating the robot.
8. Electrical equipment must be installed in accordance with specifications in the manual.
9. Make sure that the robot arm and tools are properly and securely installed.
10. Make sure that the robot arm has ample space to operate freely.
11. Never use the robot if it is damaged.
12. Do not connect any safety equipment to normal I/O's. Use safety-related I/O's only.
13. Stand clear of the robot while using the teach pendant.
14. Never modify the robot. If the robot is changed or altered in any way, ELITE ROBOT Co.,Ltd. will not take any responsibility.
15. Before transporting the robot, the user needs to ensure that the robot is safely and properly packaged.
16. Comply with the transportation requirements when transporting the robot.
17. When the robot is combined, or works with the machines capable of damaging the robot, it is highly recommended to test all functions and the robot program separately.
18. Do not expose the robot to permanent magnetic fields for long periods of time. Strong magnetic fields may damage the robot.

WARNING



1. The robot and the controller may generate heat during running. When the robot is working or just stops working, please do not operate or touch the robot.
2. Provide ample time for the robot to cool down after pausing operations.
3. Do not place hands near or around the heating part of the controller.

1.5 Risk Assessment

A risk assessment is the most important task an integrator or operator must complete. The information in this manual does not cover how to design, install, or operate an integrated system, nor does it cover proper safety and handling of peripheral devices. The safety of the complete system depends on how the robot tooling and devices are installed and used. Integrators should comply with all laws, regulations, safety specifications, and standards of the country where the integrator is working while installing the robot system.

WARNING



A risk assessment must be performed before setting up and operating the EC66

The integrator may perform the risk assessment by using the following standards for reference:

- ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction
- ISO 10218-2:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 2: Industrial robot system and integration
- RIA TR R15.306-2014 Technical report of industrial robots and robot systems - Safety requirements and task-based risk assessment method
- ANSI B11.0-2010 Safety of machinery – General requirements and risk assessment

The ELITE robot integrator should perform, but not limited to, the following responsibilities:

- Make a comprehensive risk assessment for the complete robot system
- Confirm that the whole system is designed and installed accurately
- Provide users and staff with proper safety training
- Create the operation specification of the complete system and clarify the instructions for using the robot
- Establish appropriate safety measures
- Remove potential hazards or minimize all hazards to acceptable levels with appropriate safety measures

- Pass the remaining risks to the end-user
- Mark the logo and contact information of the integrator on the robot
- Store this manual and other related technical documents where they can be easily accessed for reference

Dangerous interactions between operating personnel and the robot during operation should be considered during the risk assessment. Situations where the robot or tooling could come into contact with the neck, face, or head must be avoided. Risk assessments must be performed before using the robot to avoid injury or death. Potential risks to safety may include, but are not limited to:

- Potential injury resulting from using a sharp or pointed end effector tool
- Handling of toxic or other harmful substances
- Fingers or limbs getting pinned between the robot and a workpiece
- Potential collisions with personnel or equipment
- Tools or equipment coming loose during operation
- Damage to the robot caused by hard impacts

Integrators must determine the level of risks through the risk assessment then implement safety measures to reduce the risk to acceptable levels.

For reference to applicable standards and legal guide, please visit the website: www.troysupply.com. Allsafety-related information contained in this manual shall not be regarded as the warranty of ELITEROBOT Co.,Ltd. Even though all safety instructions are followed, the personnel injury or equipmentdamage caused by the operating personnel may occur.

ELITE ROBOT Co.,Ltd. is committed to continuously improving reliability and performance of the products, and accordingly reserves the right to upgrade the products without prior notice. ELITE ROBOT Co.,Ltd. strives to ensure accuracy and reliability of the contents in this manual, but takes no responsibility for any errors or missing information herein.

For more information refer to Chapter 14

1.6 Intended Use

The EC66 is intended for use in lightweight manufacturing. Not all environments are suitable for operation of the EC66. The EC66 must not be used in the following scenarios:

- Flammable, explosive, or other hazerdous environments
- Carrying or moving humans or animals
- Used as a medical device of any type
- High traffic areas without appropriate safety barriers
- Environments subject to excessive vibration
- Installed on a vehicle or ship.
- As a climbing tool.

1.7 Emergency Situations

In the event of an emergency, the user may press the emergency stop button to cut power to the robot arm immediately.



Figure 1-1 : Emergency stop button

CAUTION

When the emergency stop button is pressed, the robot arm may fall a small distance while the system brakes engage.

when the emergency stop button is pressed, it will be in the lock state. To unlock, twist the button in the clockwise direction and pull up. This will disengage the emergency stop button.

In emergency situations where a user is pinned between the robot and a workpiece and the robot needs to be moved to release the trapped user. Do not power on the robot!

WARNING

If a user is pinned down by the robot, do not power on the robot

To free a user who is pinned by the robot, immediately cut power by pressing the emergency stop button. The EC66 can implement the function of forcing joint movement in the opposite direction in an emergency, pushing or pulling the robot arm forcefully to force the joint to move. In this case, the

joints of the robot may be damaged, but the safety and health of all personnel is more important. If needed, seek medical attention. If the robot cannot be backdriven for whatever reason, the appropriate joint cover can be removed and the brake retaining solenoid pin can be released to allow the joint to spin freely. For more information on how to remove the joint covers and where to find the brake solenoid refer to the maintenance manual.

Although the EC66 does have a collision detection function, it is not a guarantee of safety. If the robot is moving fast and collides with an object or individual, the robot will stop, but injury can still occur. Caution should still be exercised when operating the robot with the collision detection activated.

Chapter 2 Transporting

Each robot comes with a default packing program. By running this program, the robot will move to the original packaging position. The robot can then be placed in its original packaging in the proper configuration. If the original packaging is no longer available, users must ensure that all components of the robot are well supported and protected to avoid damage to the arm or controller while in transit.

Please ensure that the mounting surface is prepared before unpacking the robot. Placing the robot on the floor or work surface is not recommended. Install the robot in the desired mounting position immediately after removing it from its original packaging to avoid any damage.

An original package should be kept upon completion of the installation. The packaging material should stay dry, in case of repackaging the robot in the future.

CAUTION



1. Please make sure that your back or shoulder not overloaded when lifting the robot.
2. All regional and national guidelines should be followed. Elite Robotics Co., Ltd. is not responsible for the damage caused during the transportation of the equipment.
3. Make sure that the robot is installed in accordance with the installation instructions.
4. The storage temperature for the robot system typically ranges from -25~50 Celsius.
5. The robot equipment sent oversea may not be able to deliver battery products due to the restrictions of air transportation. So that the 3V button battery on the main board in the controller box may not be able to delivered together with the Controller. If the battery is missing, it will cause start up failure. Please insert 3V battery before power on.

Chapter 3 Hardware Composition

The EC66 robotic system is composed of three main parts:

1. Controller
2. Robot Arm
3. Teach Pendant

The system also includes three cables:

1. Main Power Cable
2. Robot Cable
3. Teach Pendant Cable

Setup and assembly of the system is discussed in Chapter 5. This chapter will briefly describe each of the system components.

3.1 Robot Arm

3.1.1 Components



Figure 3-1 : EC66 robot system

The robot arm is shown in **Figure** 3-1 . The robot has six degrees of freedom, or in other words, the robot has six joints that rotate independently. **Figure** 3-2 shows the robot joints including a base (joint

1), a shoulder (joint 2), an elbow (joint 3), and three wrist joints.

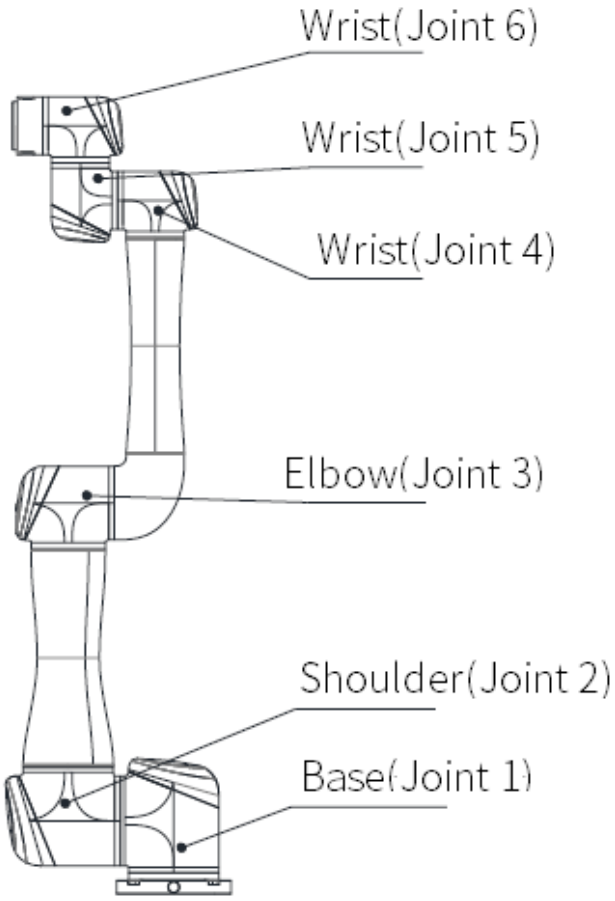


Figure 3-2 : EC66 Robot joints

3.1.2 Dimensions

The physical dimensions of the EC66 robot are shown in **Figure** 3-3 .

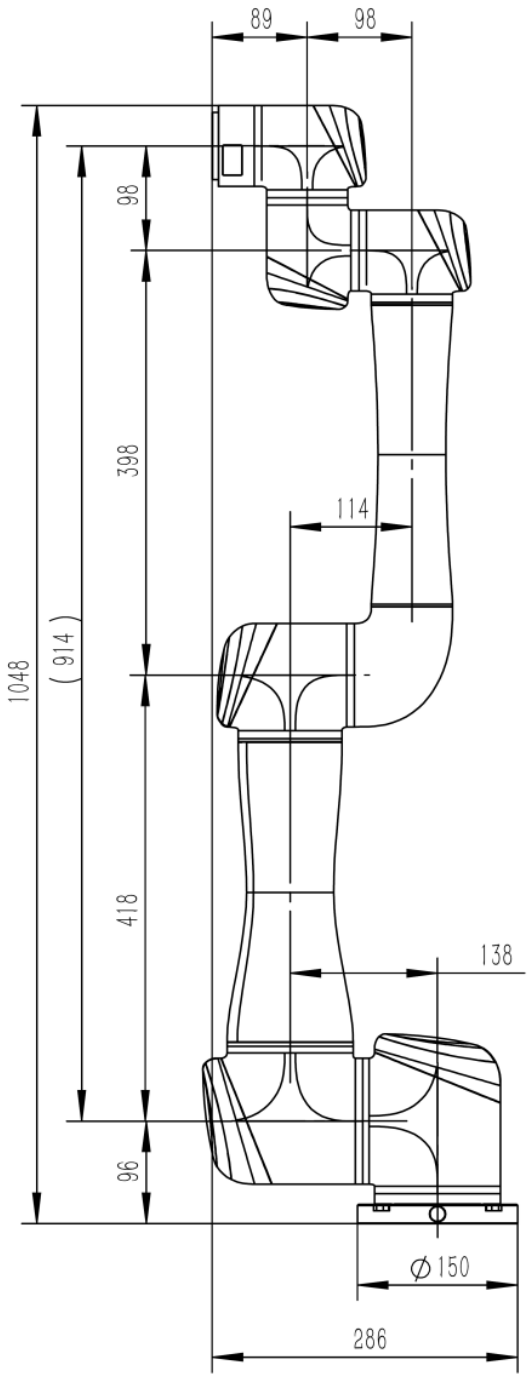


Figure 3-3 : Mechanical dimensions of the EC66robot, with unit of mm

The dimensions of the base and the mounting bolt pattern are shown in **Figure** 3-4

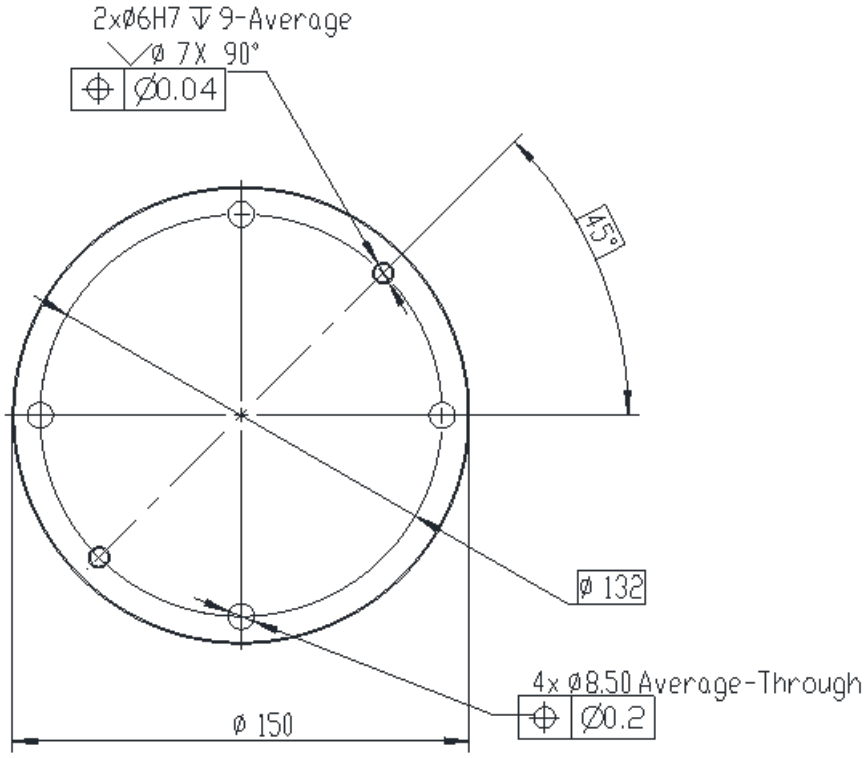


Figure 3-4 : Dimensions of installation holes on the base in millimeters

The tool flange is where tools can be mounted to the robot's end effector. The dimensions of the tool flange are shown in **Figure** 3-5 .

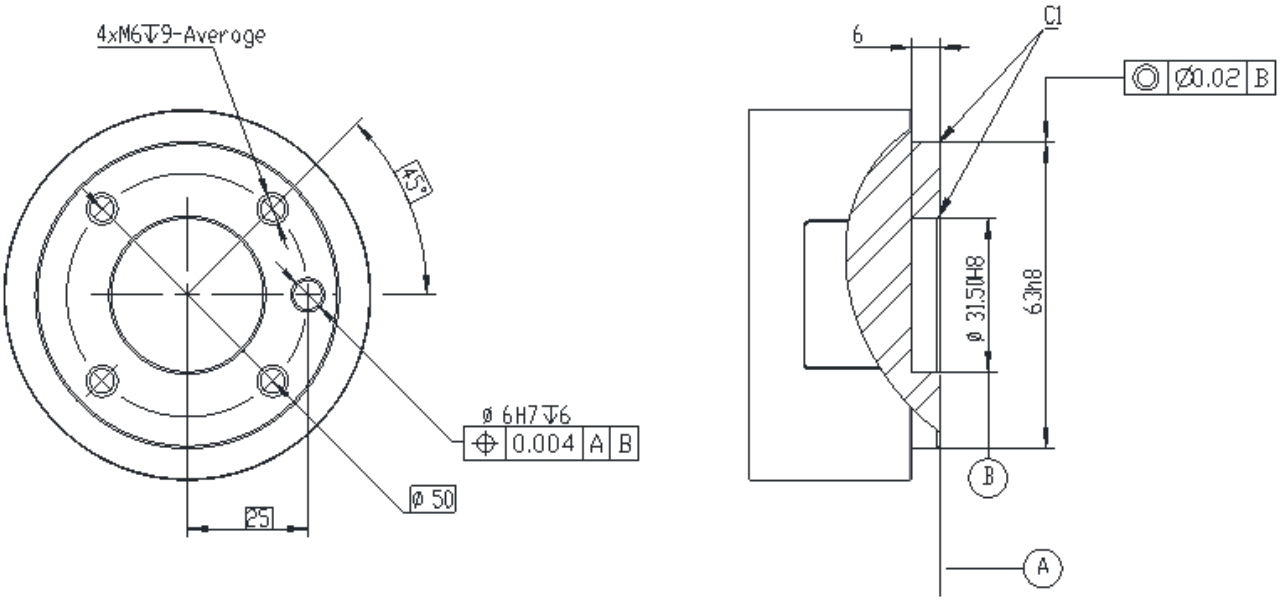


Figure 3-5 : Mechanical dimensions of the tool flange of the robot in millimeters

The tool I/O port is located on the side of the robot end effector as shown in **Figure** 7-16 . To access the tool I/O port, remove the gray cover.



Figure 3-6 : Location of the Tool I/O plug

3.1.2.1 Workspace

Figure 3-7 shows the shape of the EC66's workspace, comprised of a sphere with a radius of 914mm. The cylindrical space directly above and below the base is a singularity zone. Singularities are positions where the robot loses a degree of freedom due to its configuration, or where the commanded velocity of the trajectory causes the joint speeds to exceed safe limits. Singularities should be avoided when programming the robot, as they can cause sudden or rapid movements or disrupt program execution.

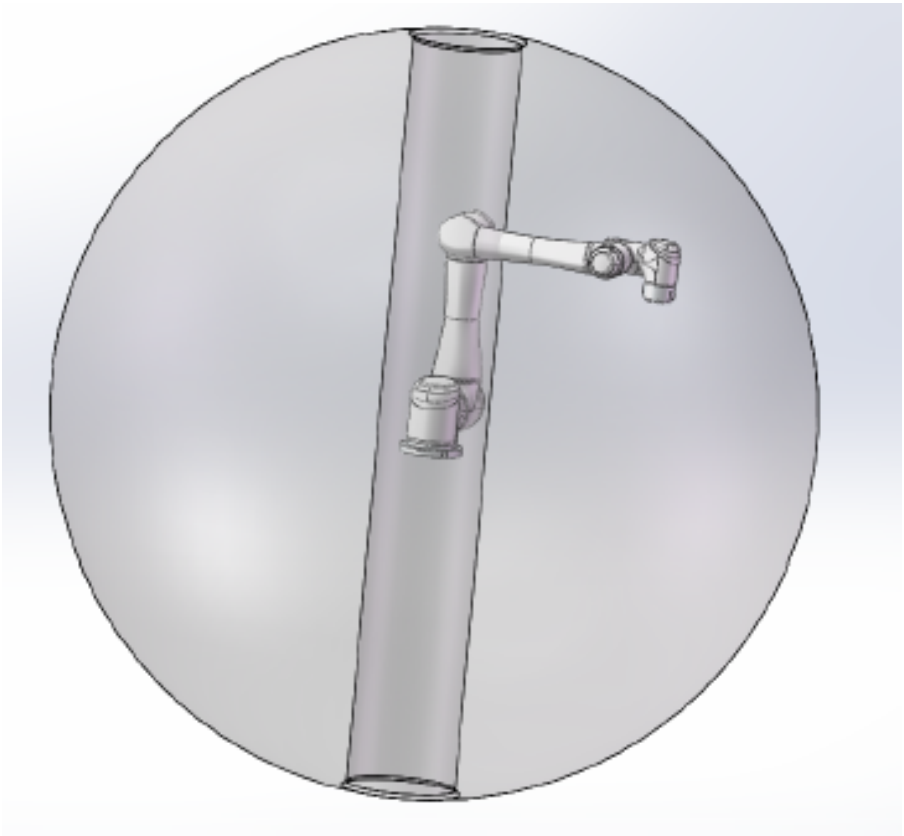


Figure 3-7 : workspace of the manipulator

The robots joints cannot rotate continuously and are limited to specified ranges. The rotational joint limits are listed in table **Table** 3-1 . It is important to note that these ranges may be adjusted if desired. Modifying the joint ranges is discussed in Subsection 12.3.3.

Table 3-1 . The EC66's joint limits

Joint	Min Angle	Max Angle
Joint 1	-360°	360°
Joint 2	-360°	360°
Joint 3	-165°	165°
Joint 4	-360°	360°
Joint 5	-360°	360°
Joint 6	-360°	360°

3.1.2.2 DH Parameters

Denavit-Hartenberg parameters, or DH parameters, are the tradition way of representing the forward kinematics of robotic arms. They are used to express the position of the tool center point, or TCP, in the base coordinate system given the joint angles of the robot arm, as shown in **Figure** 3-8 .

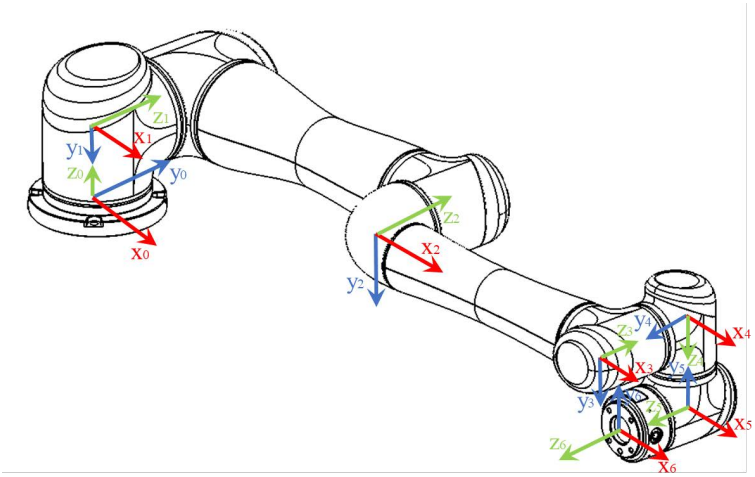


Figure 3-8 : Robot DH diagram

The DH parameters of the EC66 are given in table **Table** 3-2 .

Table 3-2 . EC66 DH Parameters

Kinematics	θ	a	d	α
Joint 1	0.0	0.0	0.096	-π/2
Joint 2	0.0	0.418	0.0	0.0
Joint 3	0.0	0.398	0.0	0.0
Joint 4	0.0	0.0	0.122	-π/2
Joint 5	0.0	0.0	0.098	-π/2
Joint 6	0.0	0.0	0.089	0.0

3.2 Controller

The controller contains the control board, power supplies, and general I/O ports including safety, digital and analog I/O's.

3.2.1 Components

The controller is identified in **Figure** 3-9 .

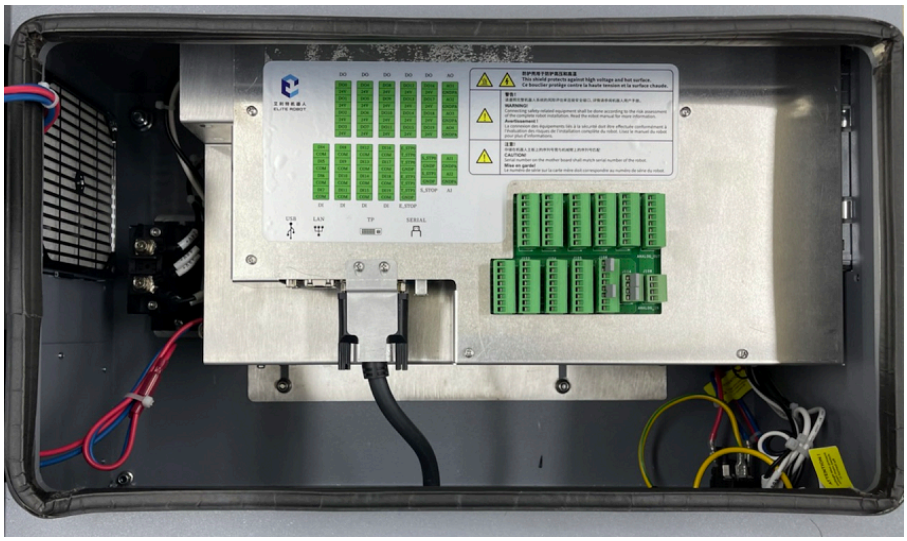


Figure 3-9 : ERB2E series controller

3.3 Teach Pendant

The EC-serie's teach pendant is a handheld multifunctional device that has a touch screen and physical buttons. Users can perform many functions, i.e., setting, monitoring the acquired data, and program-

ming the robot. The physical buttons around the touch screen can activate other options or functions.

3.3.1 Pendant Layout

The front view of the teach pendant is shown in **Figure** 3-10 .

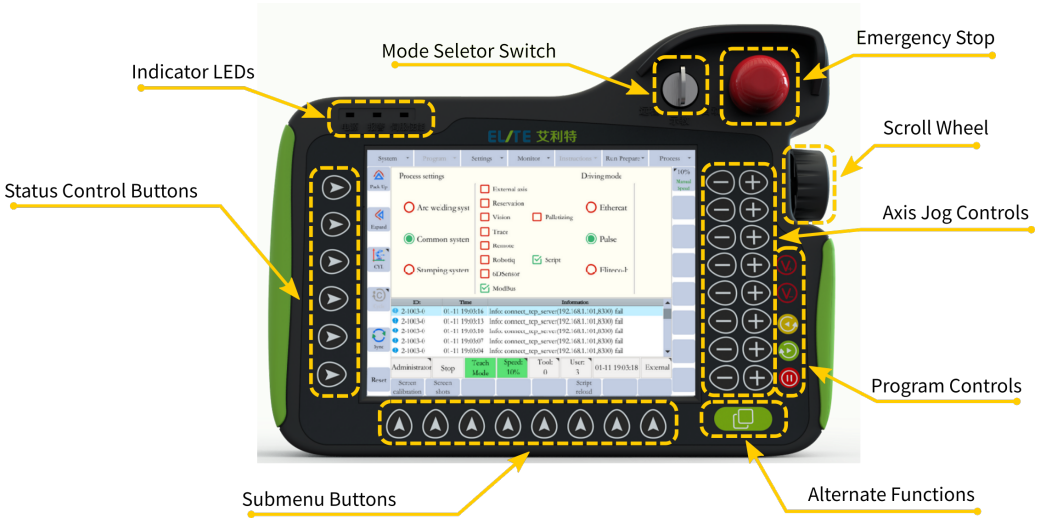


Figure 3-10 : Layout of teach pendant (front)

The following is a description of each feature running counter clockwise from the emergency stop button:

1. Emergency stop button - used whenever an emergency occurs. The user can press it to cut power to the robot arm.
2. Mode selector - used to set the mode to PLAY, TEACH, or REMOTE. If this switch is moved from PLAY to TEACH, the current running program will end immediately.
3. Indicator LED - notify the user if the power is on, if there is an active alarm, or if the robot servos can be actuated.
4. Status control buttons - used to select items from the status control menu without using the touch screen.
5. Submenu buttons - select menu items from the submenu without using the touch screen.
6. Alternate functions button - the user must press and hold it to see the available alternative functions on the current screen and select a suitable function from the submenu.
7. Program controls - allow users to control the robot program. These buttons can be used only when the mode selector switch is at PLAY mode.
   (a). The orange buttons, V+ and V-, are used to increase and decrease the running speed of the robot.
   (b). The yellow servo button is used to activate the servos before running a program. The robot cannot run programs unless this button is pressed and the yellow servo indicator LED is lit.

(c). The green play button is used to run a program or step through a program (see Section 6.8). It is also used to move to a recorded waypoint to check its position.

(d). The red pause button will pause a program that is currently running.

8. Axis jog buttons - used to move the robot arm relative to the current coordinate system.
9. Scroll wheel - used to scroll through the lines of a robot program. It is disabled by default. To enable scrolling simply press the scroll wheel in toward the teach pendant. To disable the scroll feature press the scroll wheel again.

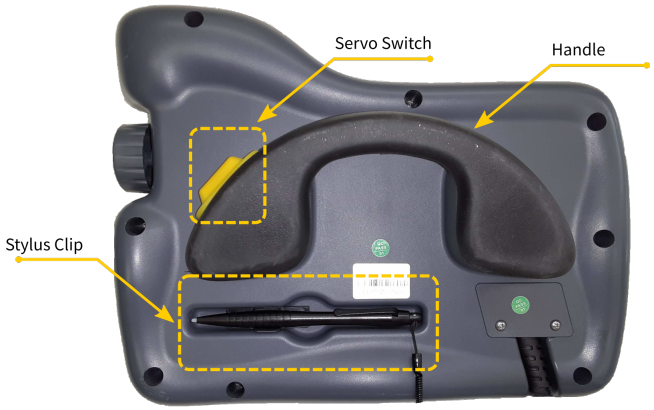


Figure 3-11 : Layout of teach pendant (back)

The servo switch (**Figure** 3-11) on the back of the teach pendant is used to activate the servo motors. It must be pressed and held to enable the servo indicator LED and move the robot. In addition, the mode must be set to TEACH. There is also a stylus clip for convenience on the back of the teach pendant. The stylus can be stored while not in use.

Chapter 4 Quick Start

This chapter focuses on getting started quickly. It is not a comprehensive startup guide. Please refer to the appropriate sections for more information on setup and programming.

4.1 Setup

The following steps are the order that should be taken when setting up the robot:

1. Mount the robot arm to a stable platform or surface with 4 X M8 bolts
2. Connect the robot cable to the controller
3. Connect the main power cable to the controller
4. Mount any tools necessary to the tool flange and connect the appropriate I/O's of the tool
5. Plug main power cable into an appropriate outlet
6. Make sure that the workspace of the robot is clear of personnel and safety hazards before operating
7. Perform a risk assessment

4.2 Power On

To power on the robot, ensure that all cables are connected correctly and the controller is plugged into a suitable power source. Locate the power switch on the controller. Insert the provided key into the power switch and turn it to the on position.

4.3 Initialization

Once the teach pendant is powered on, the alarm LED indicator will be on. Locate the alarm/reset button at the bottom left of the teach pendant screen and press it to clear the alarm. Once the alarm is clear, set up the mount config of the robot (see Subsection 12.2.2). In the main menu at the top of the screen, navigate to **Preparation -> Mount config**. The screen in **Figure** 4-1 should be seen on the teach pendant. Enter the correct mounting angles in euler angle notation (Roll, Pitch, Yaw - RPY) and the appropriate mounting method or installation mode.

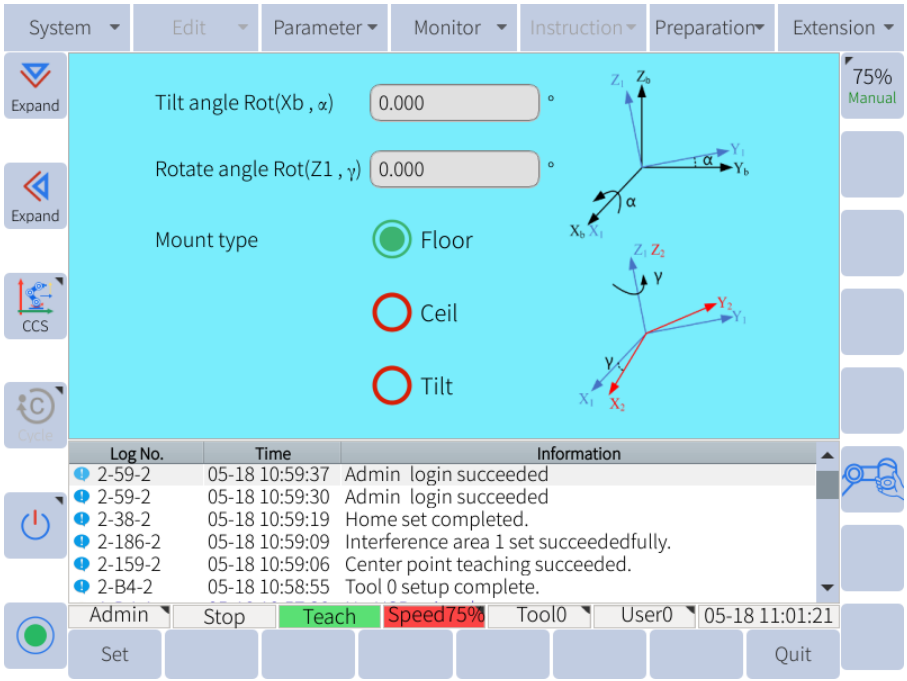


Figure 4-1 : Mount config page for initial setup

Once the correct information has been entered, press the save button at the bottom of the screen in the submenu.

NOTICE

Mount config are not saved unless the ”save” button is pressed after entering information

WARNING

If the correct mounting position is not used, the hand guiding function will not work properly and the robot will drift in an unexpected manner

4.4 Tool Setup

If a tool is installed on the end effector of the robot, it must be set up in the software. In the main menu navigate to **Preparation -> Tool Config** (see **Figure** 4-2). There are a total of 8 tools that can be stored in the software’s memory. They are kept track of by number.

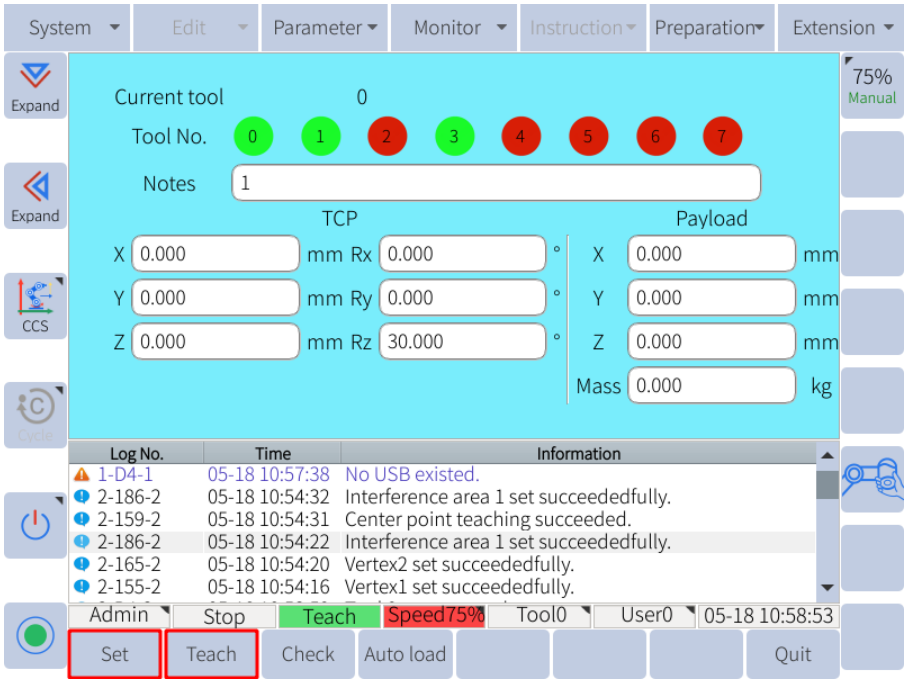


Figure 4-2 : Tool coordinates setting

Select the tool number you wish to configure and enter the offsets of the tool center point (TCP) from the tool flange origin. Enter the center of gravity of the tool and the payload of the tool. Remember to click ”save” in the submenu. See Subsection 6.11.3 for more information on setting up a tool.

CAUTION



If the tool information is not saved or the incorrect tool is selected, the robot gravity compensation will not work correctly

4.5 Jog Axes

Once the system is turned on, the robot can be moved in various ways. To jog the robot using the teach pendant:

1. Click the initialization button on the bottom left of the teach pendant screen
2. Press and hold the servo safety switch on the back of the teach pendant and click the imprecise button to calibrate the encoder.
3. Ensure that the button is set to reset
4. Stand clear of the robot
5. Press and hold the servo switch on the back of the teachpendant - the servo indicator LED will light up
6. Press the +/- button of the desired axis jog button (see **Figure** 3-10)

Users can also move the robot by hand. To activate the hand guiding feature of the robot, locate the hand guide enable button located on the side of the tool flange. The button is lit by a blue LED ring (see **Figure** 4-3).



Figure 4-3 : Hand guide enable button

The user must press and hold the hand guiding button while they guide the robot to the desired location. To stop hand guiding, simply release the hand guide enable button. Do not press the servo switch while hand guiding.

4.6 Program

4.6.1 Create Program

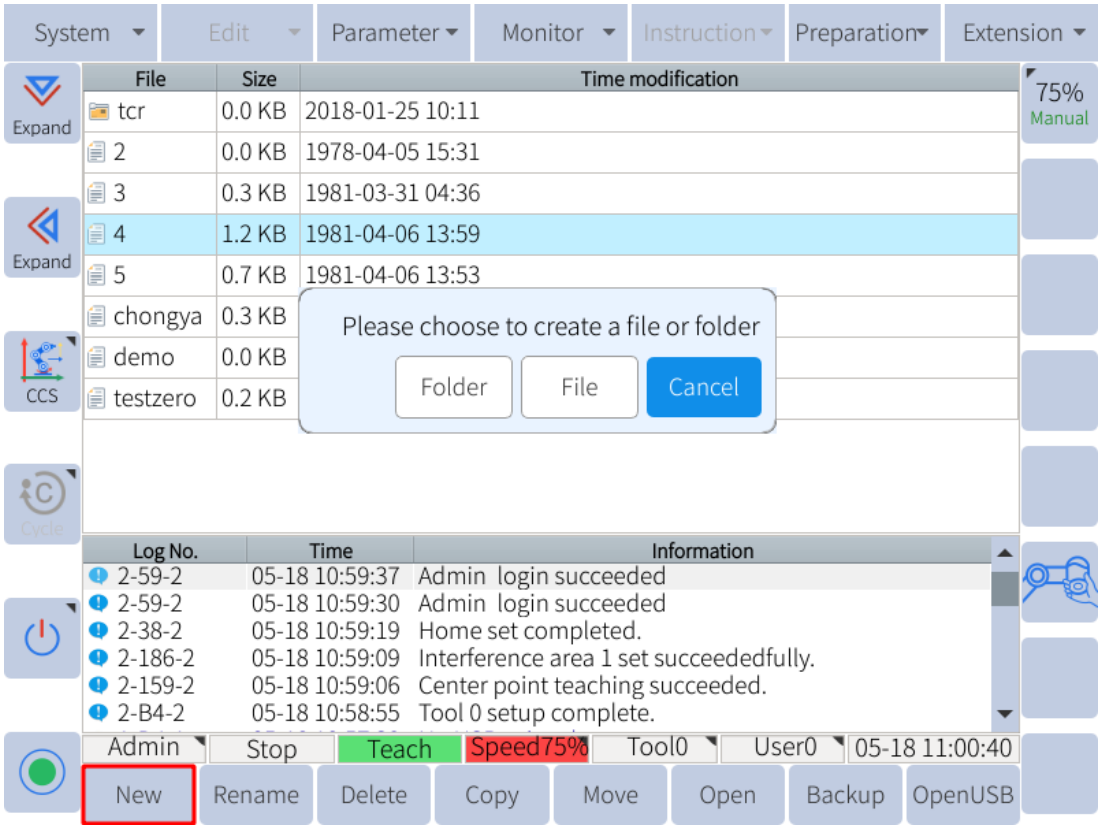


Figure 4-4 : New Program File

To create a program, click “New” and an interface will pop up as shown in **Figure** 4-5 .

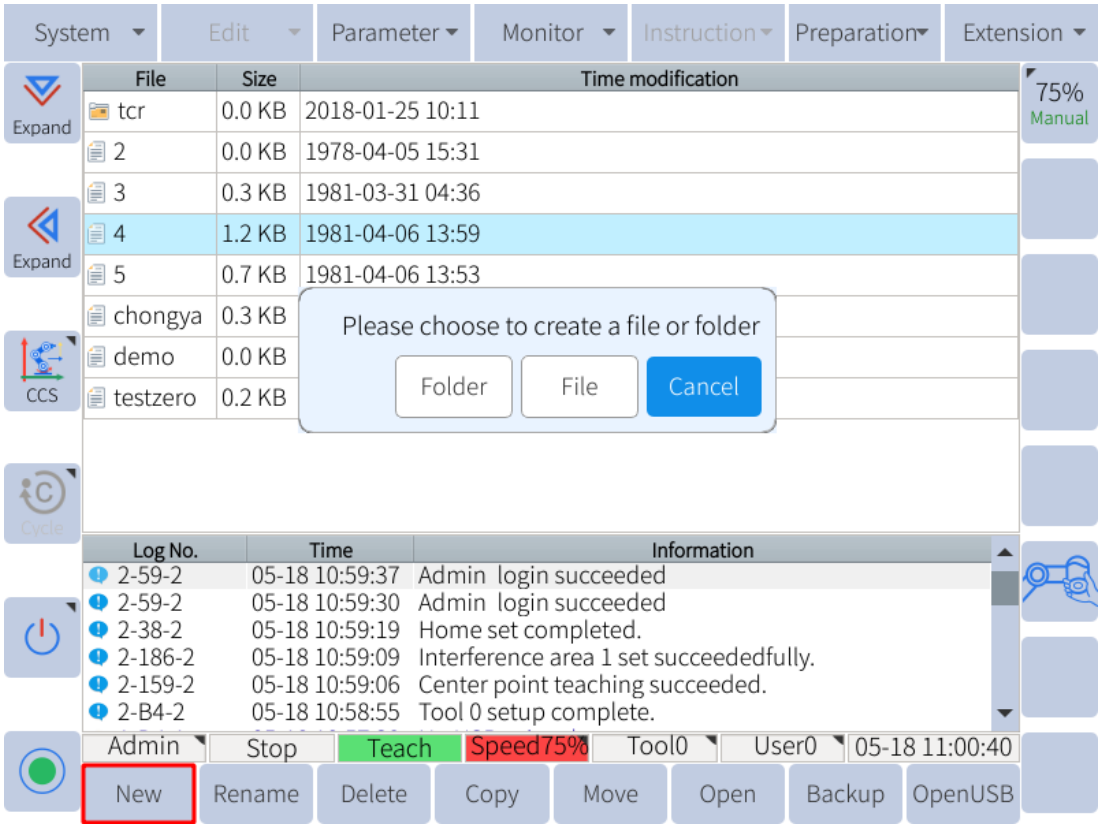


Figure 4-5 : New Program File

After clicking “File”, enter the desired file name in the input field and click “OK”.

To open an existing file, select the program and click “Open” to open the program to the editing interface (**Figure** 4-6).

NOTICE

Programs are saved automatically while a program is being edited

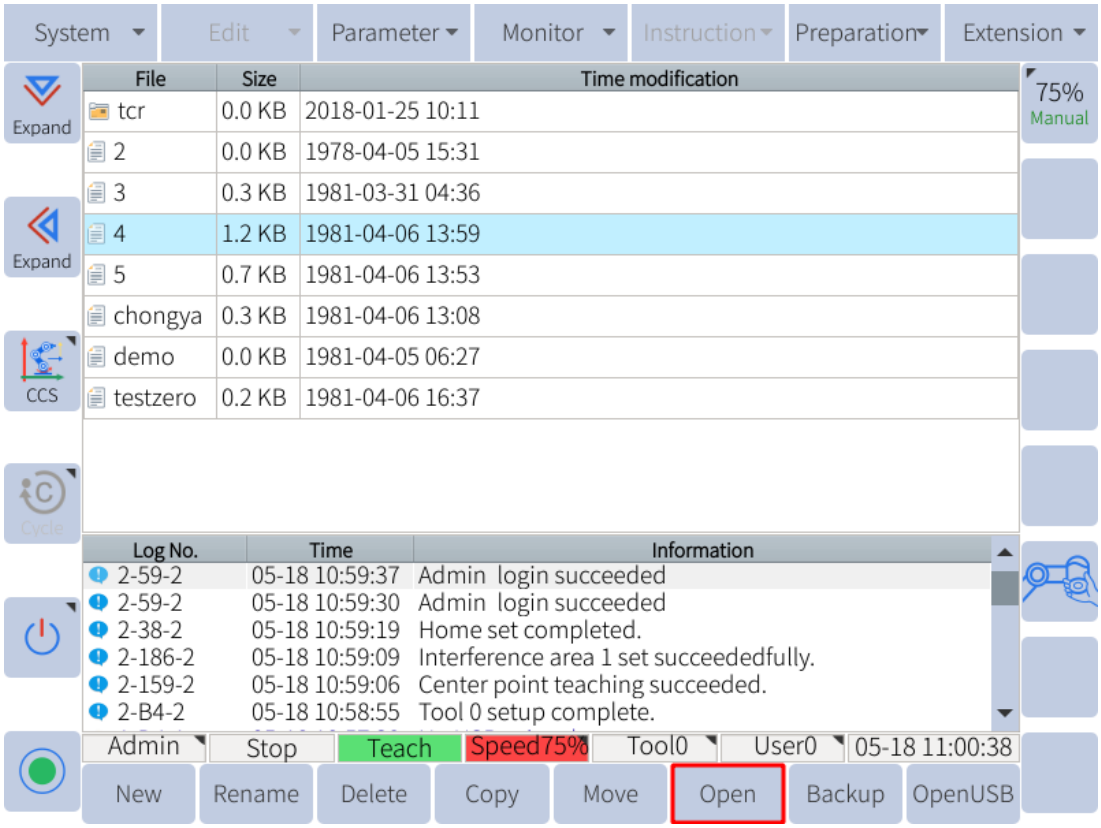


Figure 4-6 : Open program file

4.6.2 Inserting Commands

To insert a command, locate and click the “Instructions” tab in the main menu bar. The following command categories are available:

1. Input and putput
2. Logic control
3. Mathmatic
4. Set and get
5. Lua control
6. Others
7. Motion

The methods of inserting all instructions are identical except the move instruction.

1. In the program editing page, move the cursor to the line immediately before the line where the instruction needs to be inserted.
2. Then press “Instruction” under the main menu or “Custom” in the submenu area to select the instruction to be inserted, as shown in **Figure** 4-7

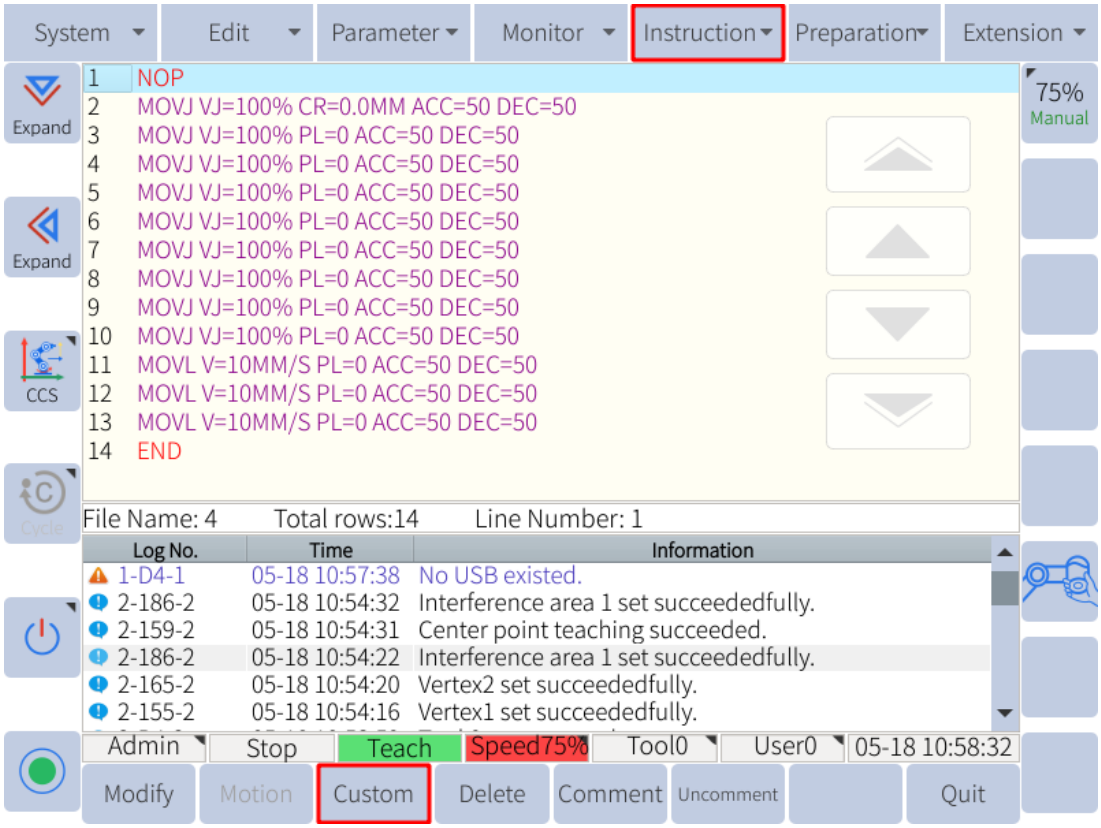


Figure 4-7 : Inserting other instructions

3. After editing the additional items, press “OK” to insert the instruction.

The “Custom” tab in the submenu area contains only some of the instructions, but all instructions can be found by pressing “Instructions” in the main menu bar.

4.6.3 Inserting Move Commands

When inserting a move instruction without using P variables, the current position of the manipulator is recorded into the move instruction. Be sure to press the servo safety switch to successfully insert the movement command.

The procedure for inserting a move command is as follows:

1. Move the manipulator to the desired position using hand guiding or the jog axis buttons
2. Move the program cursor to the line immediately before the position where a move instruction is to be inserted
3. Press and hold the servo switch - the ”SERVO” indicator light will turn on
4. Click “Run” in the submenu bar or select **Instruction -> Move Instruction**, and select the desired move method on the drop down menu, as shown in **Figure** 6-29 .

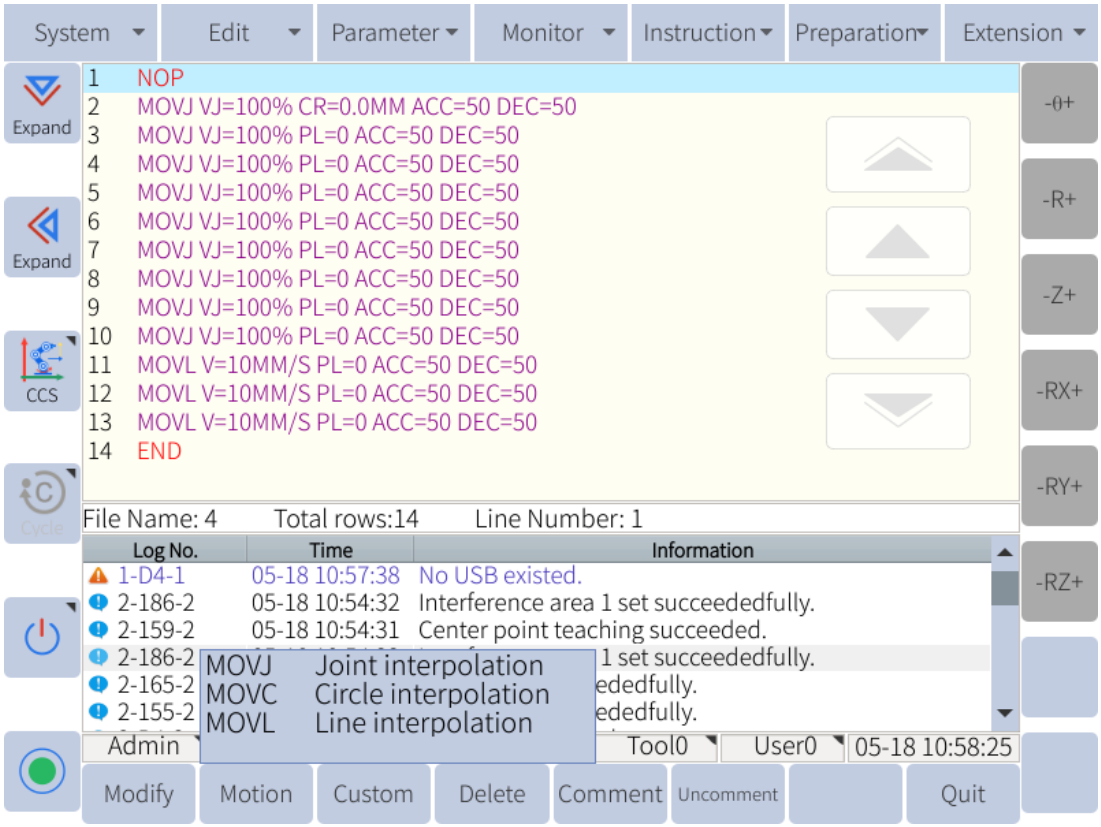


Figure 4-8 : Selecting the move instruction

5. After selecting the move instruction, edit the parameters and press “Confirm” to insert it

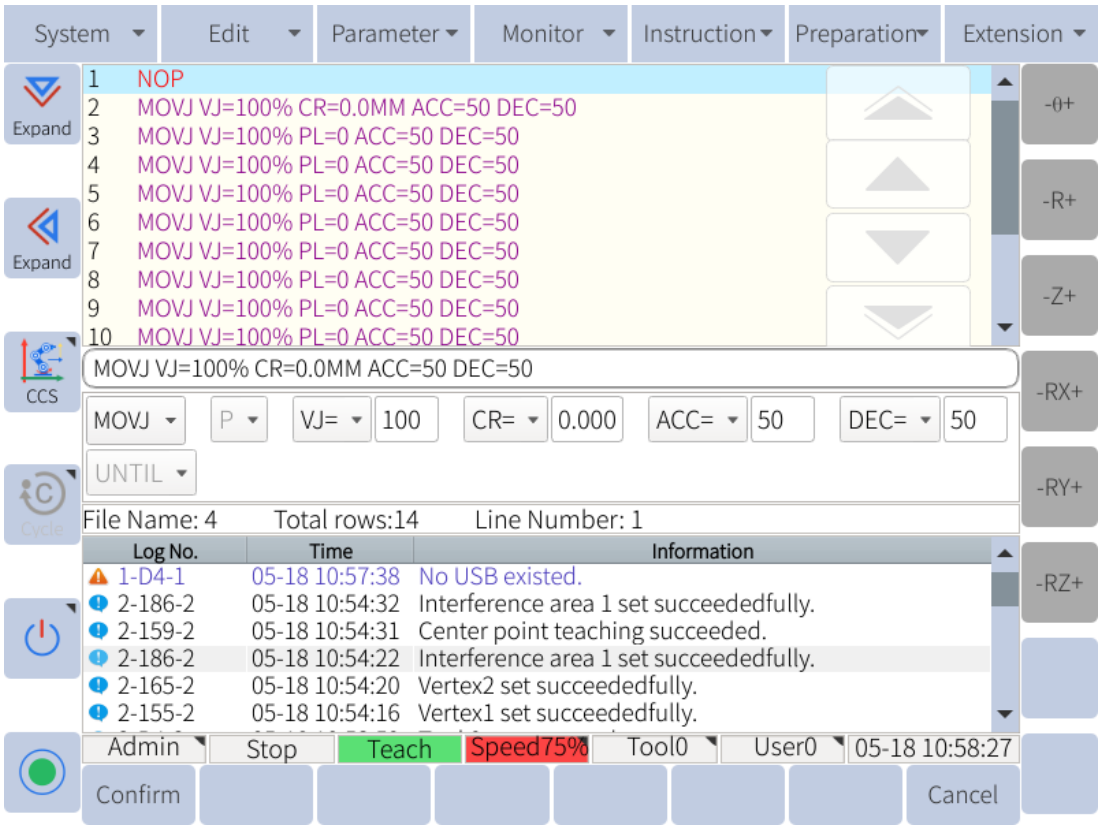


Figure 4-9 : Inserting the move instructions

NOTICE

The servo switch must be held when inserting the move instructions. Otherwise, the move instruction **will not** be inserted.

4.6.4 Run Program

Switch to PLAY mode using the mode selector at the top of the teachpendant. Press the icon 

in the status control area to select one of three types of manipulator operation cycles:

1. SINGLE STEP: Executes one step (instruction) at a time.
2. SINGLE CYCLE: Executes a program once.
3. CONTINUOUS CYCLE: Repeat to execute the program continuously.

After completing all above preparations, first press “SERVO ENABLE” button 

on the bottom right corner of the teachpendant. The SERVO ON lamp lights up when the servo is enabled. Then, press “PROGRAM START” button  , and the program will start running automatically.

4.7 Power Off

When the user is ready to power off the system, first turn the teach pendant mode (**Figure** 3-10) switch from PLAY or REMOTE to TEACH to stop the current program.

The user can select  , and then click ”OK” to power off the robot.

When the robot has come to a complete stop, turn the power switch on the controller to the off position, as shown in **Figure** 4-10 .



Figure 4-10 : Switching power supply of the controller

Chapter 5 Setup and Assembly

5.1 Important Safety Instructions

DANGER



Before installation, please ensure the serial number of the robot matches with the controller. Since the arm parameters need to correspond to the controller parameters, if there is mismatch it may cause uncontrolled arm motion.

Environmental conditions for installation:

- No corrosive gas or liquid
- No dust or metal powder
- No radioactive material
- No oil mist
- No mechanical shock and vibration
- Low humidity
- Less than 1200m above sea level
- Avoid long periods of direct sunshine (prevent the robot from being used outdoors)
- No salt mist
- No electromagnetic noise
- No flammable materials

Ambient temperature: 0°C ~ 50°C

Operating humidity: 5%~95% (without dewing)

5.1.1 Bearing Surface

The robot should be installed on a hard surface. The bearing surface must be able to bear at least ten times the resulting torque of the base joints and at least five times the weight of the robot arm. In addition, the surface should be free of vibrations. Please refer to Chapter 14 for the specific bearing capacity. The safety assessment must be implemented upon completion of each installation of the robot, and the instructions in Chapter 1 should be strictly followed.

WARNING



The risk assement must be performed after setting up the robot and before operation

5.2 Materials Needed

The following is a list of materials needed for installation:

- 4 X M8 bolts (base). See **Figure** 3-4
- 4 X M6 bolts (tool). See **Figure** 3-5
- Torque wrench

5.3 Electrical Specifications

5.3.1 Controller

The power supply in the controller should be equipped with the following:

- Ground connection
- Mains fuse
- Residual current device

It is recommended to install a mains switch to the power supply of all equipment in the robot application, in order to facilitate lockout and tagout during repair.

The electrical requirements of the external power supply are shown in **Table** 5-1 .

Table 5-1 . Electrical specifications of the mains connection

Parameter	Min	Typ	Max	Units
Input voltage (Normal version)	90	-	264	VAC
External mains fuse (when the voltage is 90-130V)	8	-	16	A
External mains fuse (when the voltage is 200-240V)	8	-	16	A
Input frequency	47	-	63	Hz
Input voltage (M version)	19	-	72	VDC
External mains fuse (when the voltage is 24V)	64	-	100	A
External mains fuse (when the voltage is 48V)	32	-	64	A
Rated operating power	100	250	1600	W

DANGER



1. Please make sure that the robot is grounded correctly (electrical connection to ground). The grounding conductor should have at least the rated current of the max system current.
2. Make sure that the input current of the controller is protected with the residual current device (RCD) and the appropriate fuse.
3. The lockout and tagout should be implemented for all power supplies when robot maintenance is required. The robot I/O should not be powered by other equipment when the system is being repaired.
4. Please make sure that all cables are connected correctly before the controller is powered on. Always use the original power cord.

5.3.2 Tool

For more information regarding tool I/O's refer to Section 7.7.

5.4 Assembly

5.4.1 Mounting the Robot Arm

The robot can be installed in the various positions as shown in **Figure** 5-1 . Ensure that the robot position is set up according to the installation instructions. (see Subsection 12.2.2)

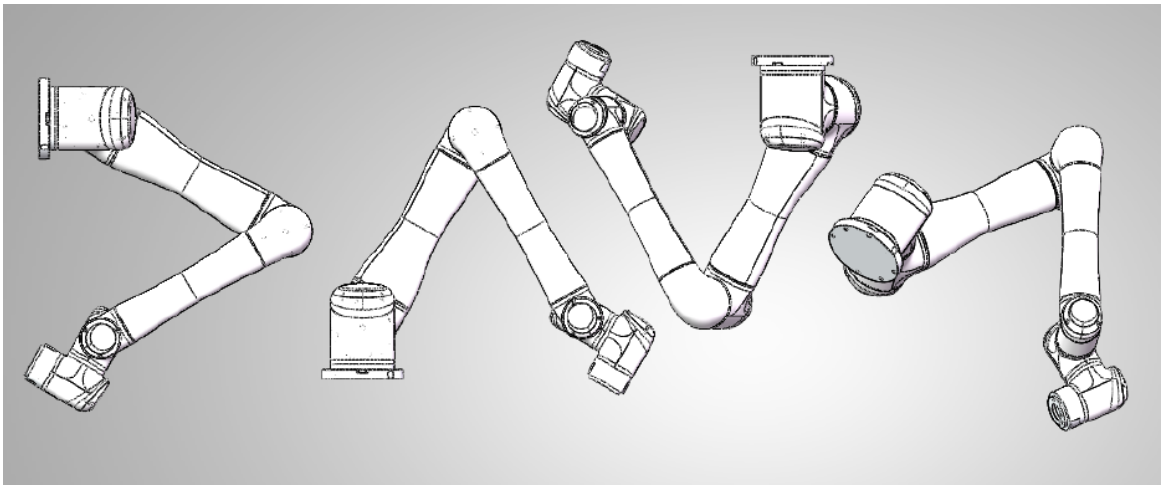


Figure 5-1 : Schematic diagram of different installation poses

When installing the robot arm, the robot body is fixed to the mounting surface with four M8 bolts. The bolts must be tightened with 20 Nm of torque. It is recommended that integrators install the dowel pins in the two locating holes to improve the installation accuracy. The dimensions of the mounting hole pattern are shown in **Figure** 3-4 .

The bearing surface should be strong enough to bear at least 3500Nm torsional force and a weight of at least 100kg. The surface should be free of vibrations.

CAUTION



Make sure the robot arm is correctly and securely installed before operation

CAUTION



If the robot is installed on a moving platform, acceleration should be low to avoid triggering the collision function of the robot

WARNING



It is recommended to use a bearing surface material with strong heat dissipation performance, such as aluminum. This is especially important when operating temperatures are greater than 35°C

5.4.2 Connecting the controller

The main power cable of the controller need to insert into the controller power port and plug the other end into an appropriately grounded and protected socket. Please refer to **Figure** 5-2 .



Figure 5-2 : Main power plug

CAUTION

The longest customizable cable distance between the robot and the controller is 6 meters.

The robot cable also has a heavy-load rectangular plug at the end shown in **Figure** 5-3 . Insert the heavy-load rectangular plug into the controller robot cable port and lock the connector into place.

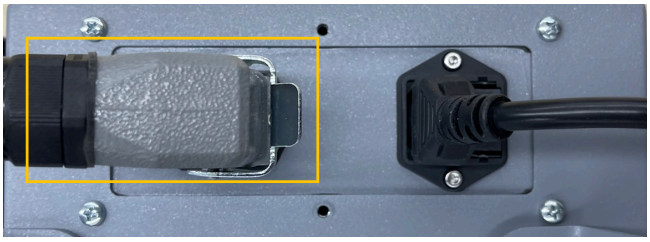


Figure 5-3 : Connection of the robot cable to the controller

The front of the controller is a switching power supply, as shown in **Figure** 5-12 , turn it clockwise 90 degrees to turn on the power.

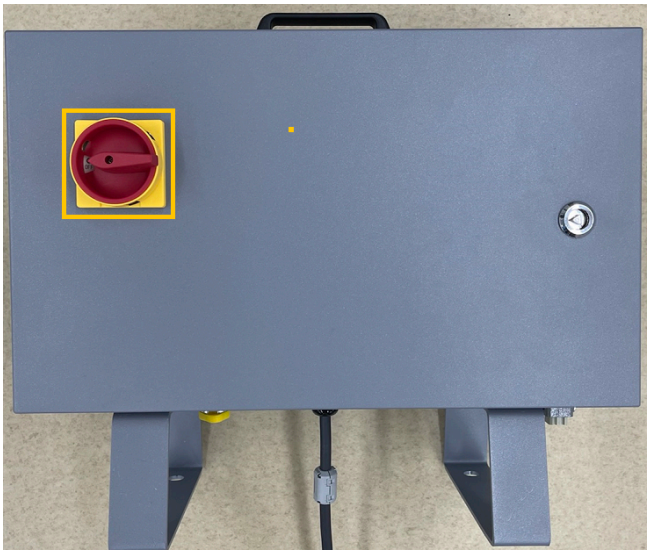


Figure 5-4 : Power on and off at the bottom of the controller

CAUTION

It is recommended that the height of the controller is: the switch of the controller should be 0.6-1.5m away from the ground, and the power port should be 0.2m above the ground.

5.4.3 Install 3V button battery (optional)

Robot equipment sent outside may be restricted by air transportation and cannot ship battery products. Users need to install and configure it by themselves.

The specific operation steps are as follows:

1. Make sure the controller is powered off.
2. Open the cover of the controller, unplug all the terminals on the IO board, use a screwdriver to remove the fixing sheet metal of the teach pendant plug, lightly twist the fixing screws at both ends of the teach pendant plug, and pull out the teach pendant plug, as shown in **Figure** 5-5 .

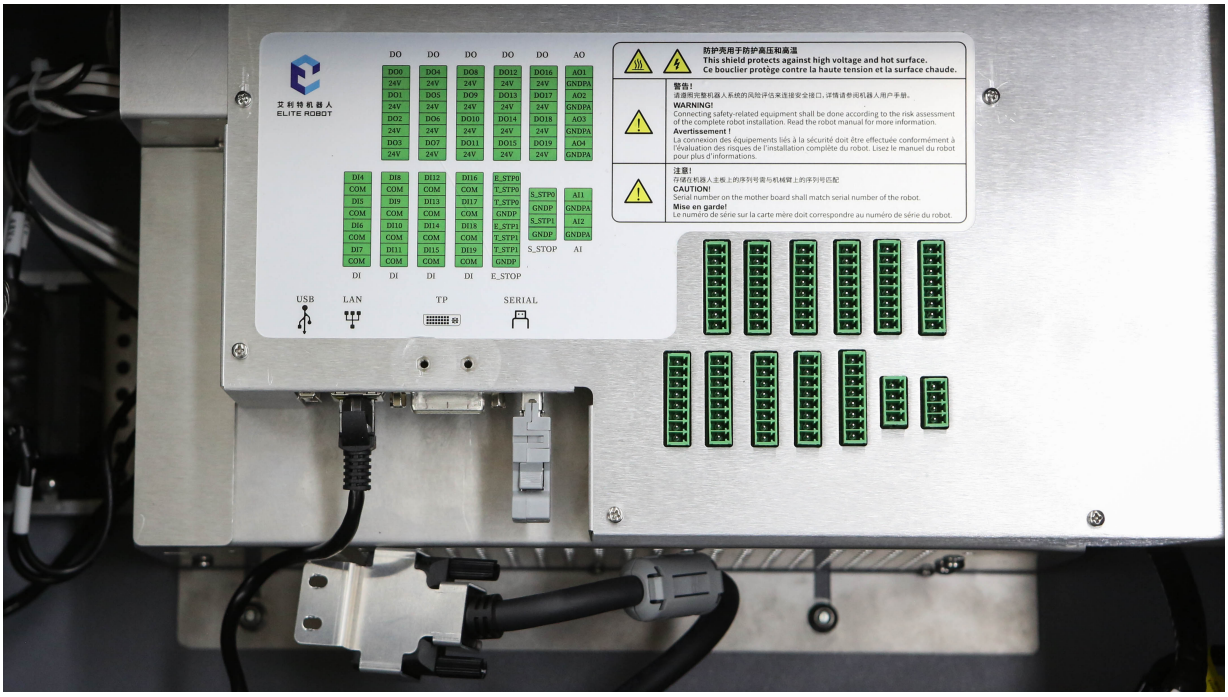


Figure 5-5 : Dismantling the controller

3. Use a Phillips screwdriver to remove the 5 fixing screws protecting the sheet metal on the core board, remove the sheet metal, and find the installation position of the 3V button battery on the core board, as shown in **Figure** 5-6 .

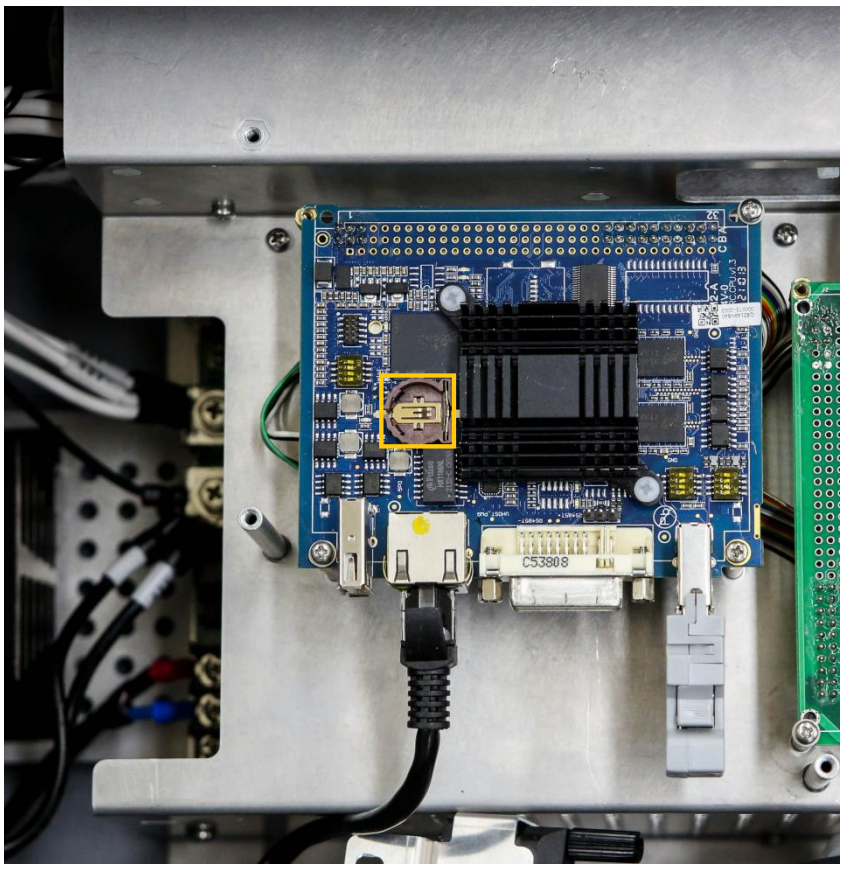


Figure 5-6 : Battery installation position

4. Put the electromagnetic positive pole of the 3V button upward, insert one end into the position where the battery slot has a buckle, and press down gently until the battery slot card can catch the battery, as shown in **Figure** 5-7 .

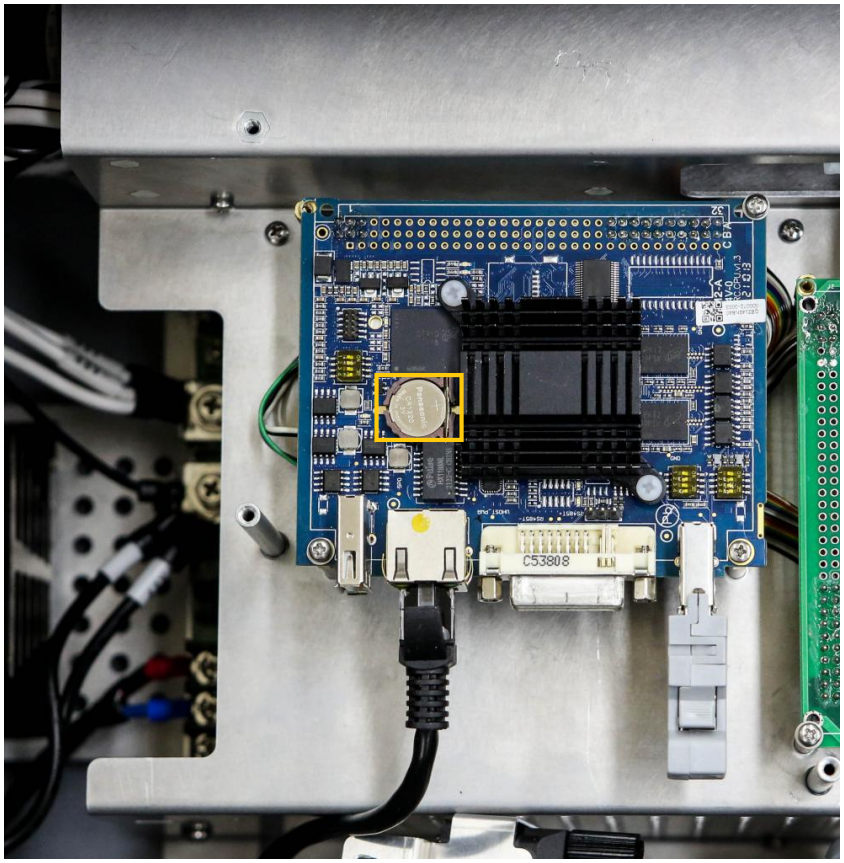


Figure 5-7 : Battery installation completed

5. Put the protective sheet metal in the original position, and fasten 5 screws, align the plug of the teach pendant and insert the screws on both sides and fasten the fixed sheet metal screws.
6. Insert the terminals on the IO board as they are, as shown in **Figure** 5-8 .

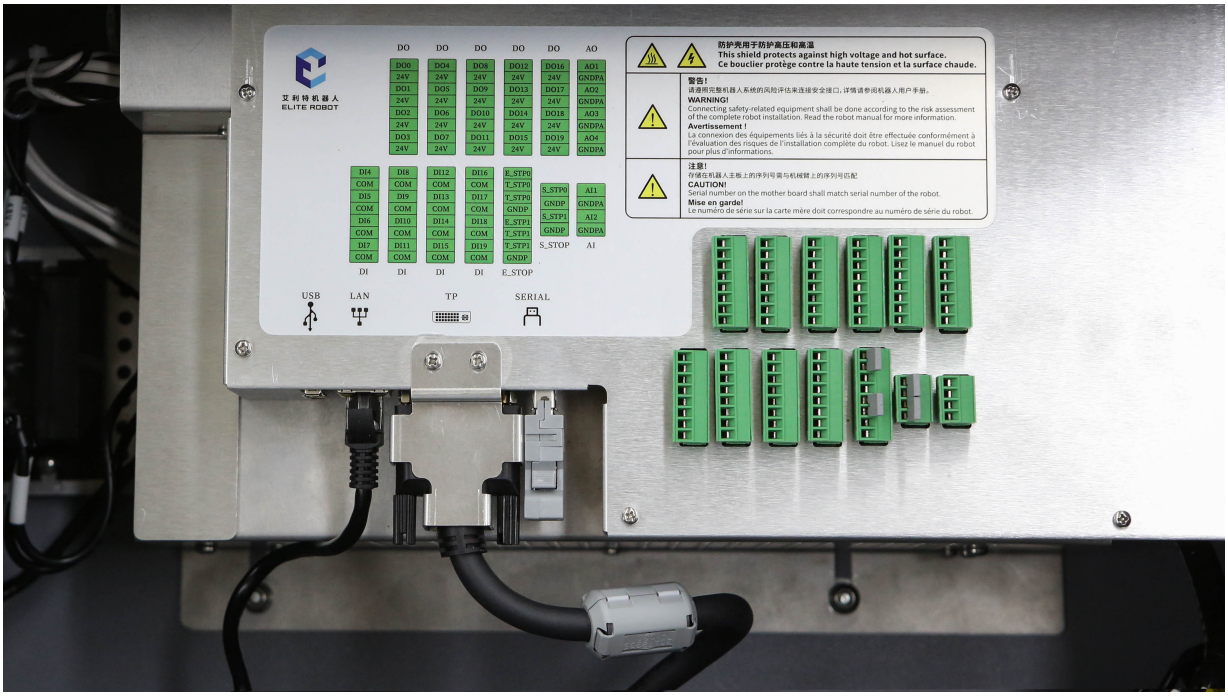


Figure 5-8 : Restore controller

CAUTION

Please wear an electrostatic wristband for battery installation.

5.4.4 Mounting the Tool

The EC66 has a max payload rating of 6kg during normal operation. The center of gravity of the payload must be located less than 260mm from the central axis of the tool flange.

The tool flange has four M6 threaded holes and one ϕ6 locating hole for increased installation accuracy. The M6 bolts must be tightened with 8 Nm torque. The mechanical dimensions of the tool flange are shown in **Figure** 3-5 .

CAUTION

Make sure the tool is correctly and securely installed

The max payload diagram is shown in **Figure** 5-9 . This diagram is to show how large a payload the robot can handle based on how far the center of gravity of the tool is from the center of the tool flange.

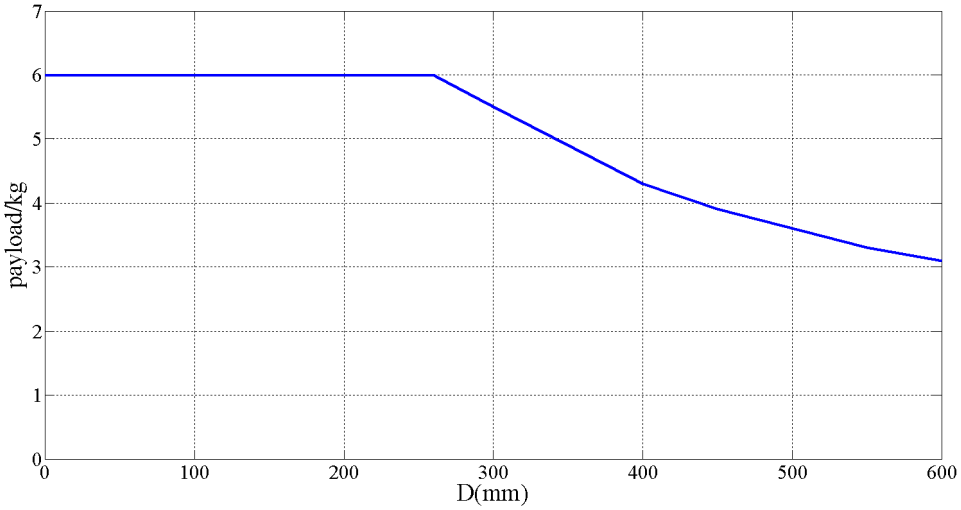


Figure 5-9 : payload diagram

The horizontal axis represents how far the center of gravity of the tool is from the center of the tool flange. The vertical axis represents the max allowed payload. The farther the center of gravity of the payload is from the center of the tool flange, the smaller the allowed payload becomes.

CAUTION

1. The payload shown in the diagram indicates a maximum payload. It must not be exceeded under any circumstance
2. The robot may be damaged if the payload exceeds the allowable value

5.5 Initialization

Once the robot is setup and all cables are properly installed, the robot can be powered on.

CAUTION

Always stand clear of the robot while it is booting up

To power on the robot, ensure that all cables are connected correctly and that the controller is plugged into a suitable power source. Locate the power switch on the controller. Insert the key provided into the power switch and turn the switch to the on position. If the controller is powered the cooling fans will turn on and the teachpendant power LED indicator will light up. The teachpendant screen will also turn on.

Once the teach pendant is powered on, the alarm LED indicator will be on. Locate the alarm/reset

button at the bottom left of the teach pendant screen and press it to clear the alarm.

In the main menu at the top of the screen, navigate to **System -> System Configuration -> Installation Settings** and set up the mounting pose (see Subsection 12.2.2).

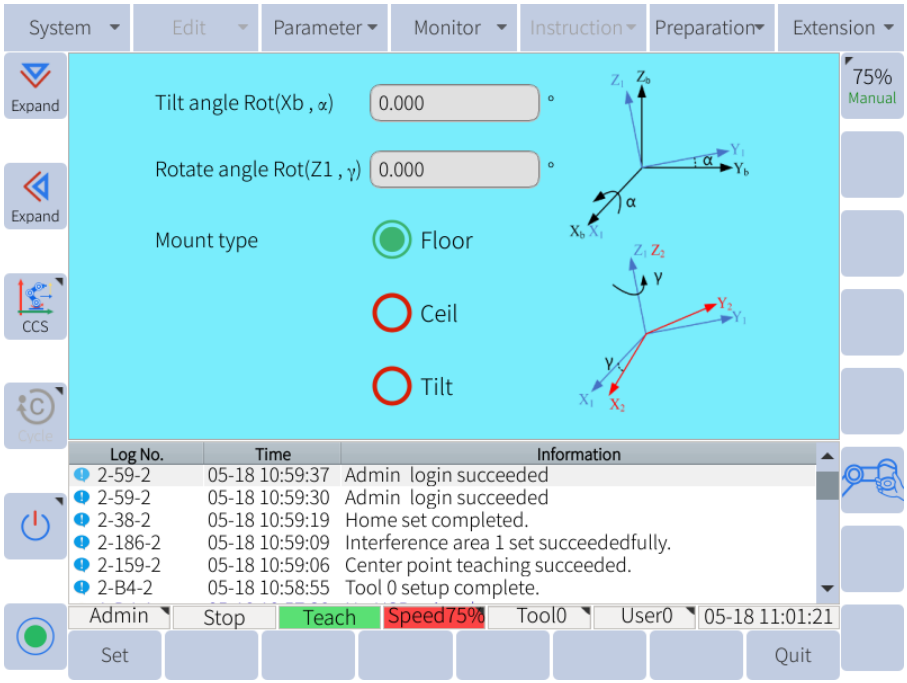


Figure 5-10 : Installation settings page for initial setup

In the main menu at the top of the screen, navigate to **Preparation -> Mount config** and set up the mounting pose (see Subsection 12.2.2).

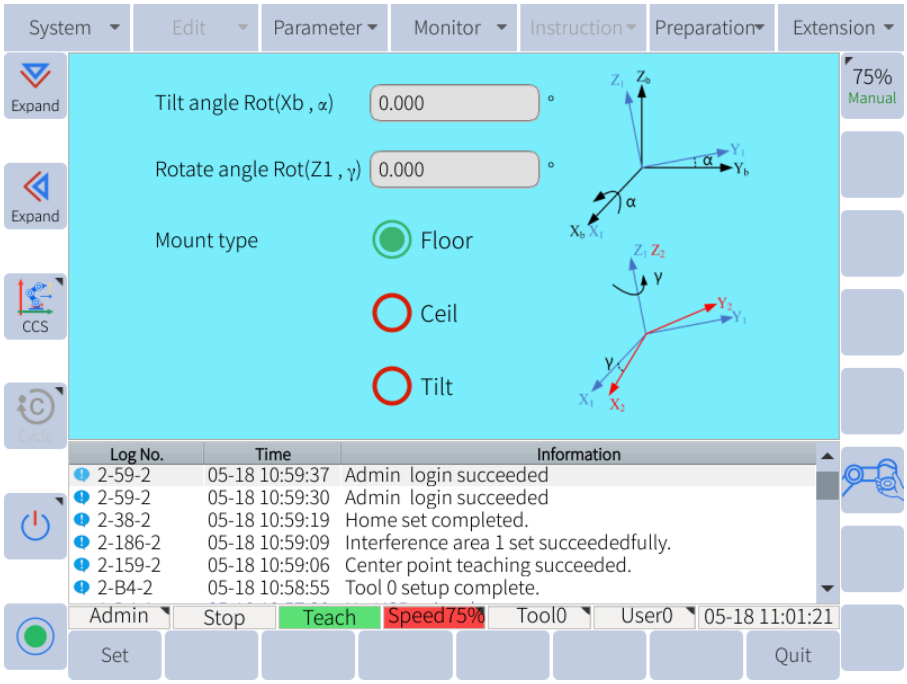


Figure 5-11 : Mount config page for initial setup

Once the correct information has been entered, press the save button at the bottom of the screen in the submenu.

NOTICE

Mount config are not saved unless the ”save” button is pressed after entering information

WARNING

If the correct mounting position is not used, the hand guiding function will not work properly and the robot will drift in unexpected directions

5.6 Tool Setup

If a tool is installed on the end effector of the robot, it must be set up in the software. In the main menu navigate to **Preparation -> Tool Coordinate** and set up the tool (see Subsection 6.11.3 for more information).

CAUTION

If the tool information is not set up or the incorrect tool is selected, the robot gravity compensation will not work correctly

5.7 Power Off

When the user is ready to power off the system, first turn the teachpendant mode (**Figure** 3-10) switch from PLAY or REMOTE to TEACH to end the current program.

The user can select **System -> Poweroff**, and then click ”OK” to power off the robot.

When the robot has come to a complete stop turn the power switch on the control box to the off position, as shown in **Figure** 5-12 .

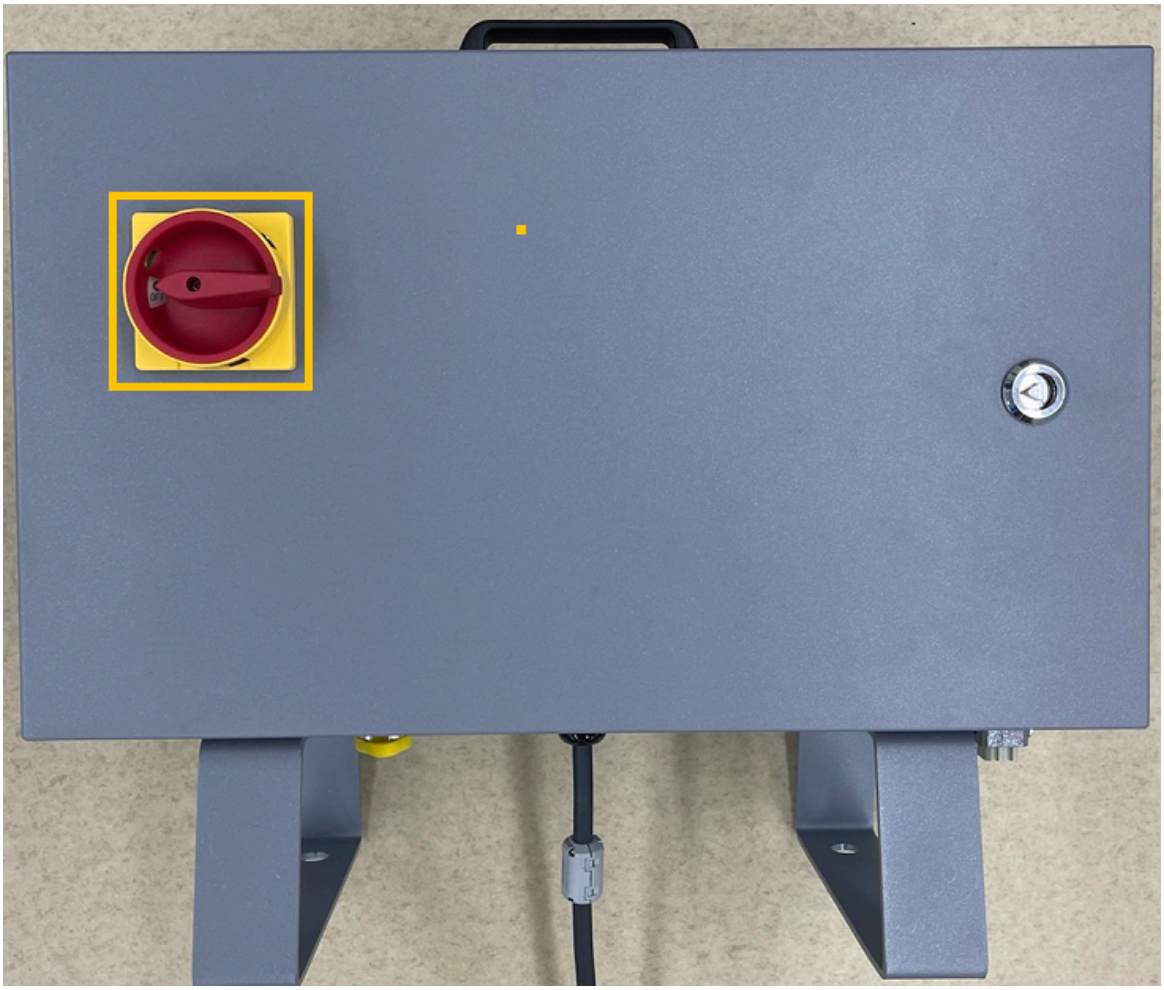


Figure 5-12 : switching power supply of the control box

Chapter 6 Programming the Robot

This chapter will describe the process a user will take to program the EC66. Each element of the layout will be described in detail. How to create a program and run a program will also be discussed.

6.1 System Startup

To power on the robot, ensure that all cables are connected correctly and that the controller is plugged into a suitable power source. Press the power switch on the controller.

Once the teach pendant is powered on, the alarm LED indicator will be on. Locate the alarm/reset button at the bottom left of the teach pendant screen and press it to clear the alarm.

Once the alarm is clear set up the mount config of the robot. In the main menu at the top of the screen, navigate to **Preparation -> Mount config** and set up the mounting pose (see Subsection 12.2.2).

WARNING



If the correct mounting position is not used, the hand guiding funciton will not work properly and the robot will drift in unexpected directions

If a tool is installed on the end effector of the robot, it must be set up in the software. In the main menu navigate to **Preparation -> Tool config** and set up the tool (see Subsection 6.11.3 for more information)

CAUTION



If the tool information is not set up or the incorrect tool is selected, the robot gravity compensation will not work correctly

6.2 Robot Modes

There are three modes that the robot can operate in:

- REMOTE
- TEACH
- PLAY

Modes can be selected by turning the mode selection switch (**Figure** 6-1) to any of these three modes.

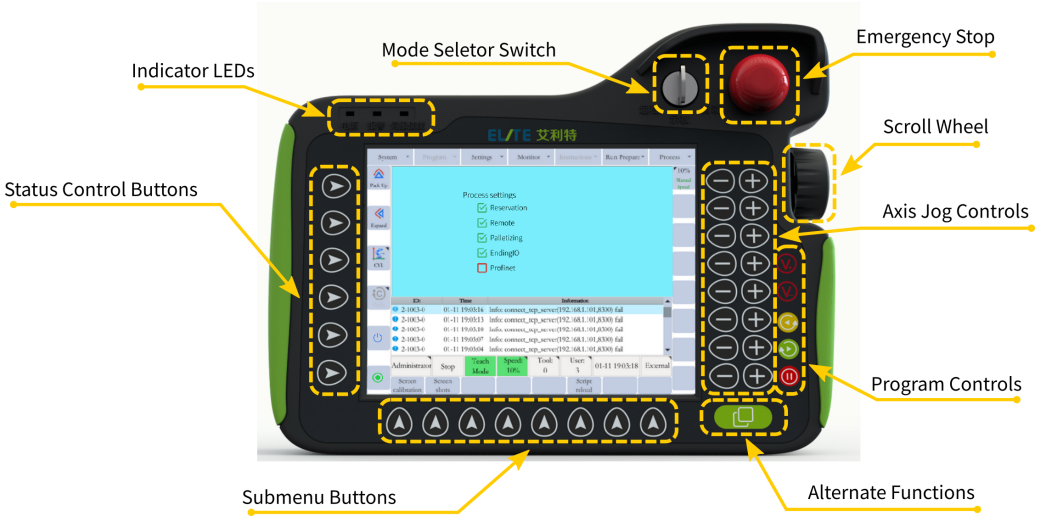


Figure 6-1 : Layout of teach pendant (front)

REMOTE mode is used when the robot is being controlled through an external method that does not use the teach pendant. This can be direct control through the EC66 software development kit (SDK). In this situation commands would be sent from a computer through the ethernet port on the controller.

TEACH mode is the mode that the robot must be in when creating a program or modifying variables or I/O's. If the robot is not in TEACH mode, changes cannot be made to programs or settings. To make changes move the mode selection switch to TEACH.

PLAY mode is used when a program has been created and the user is ready to execute the program.

CAUTION

Use caution when approaching the robot in REMOTE or PLAY mode. If the robot is stationary ensure that a program is not running or that the robot is not being controlled remotely before entering the robot's workspace.

6.3 UI Layout

The general user interface layout is shown in **Figure** 6-2 . There are also subwindows for various functions such as monitoring variables and I/O's and system settings that can be displayed.

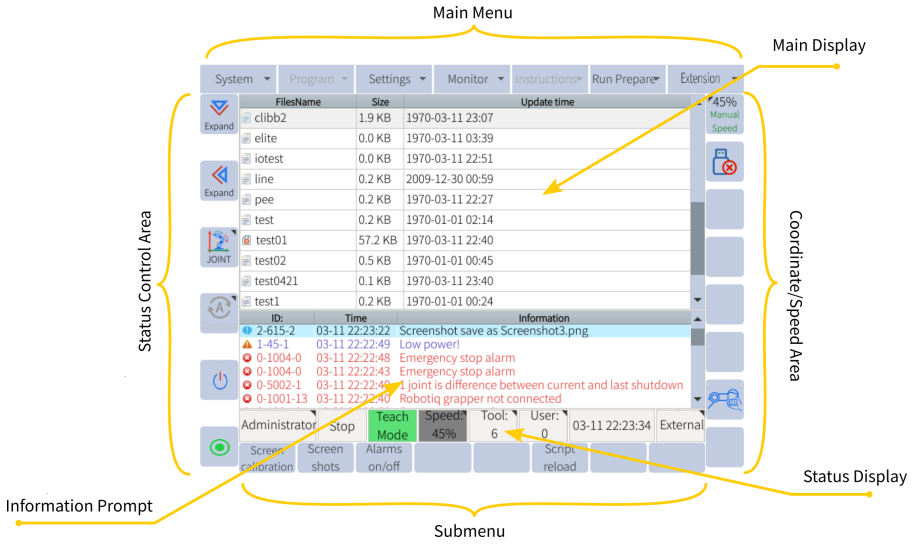


Figure 6-2 : Layout of user interface

6.4 User Levels

Certain functions and settings can only be accessed by users with the proper user level. There are four user levels:

1. Operator
2. Expert User
3. Super User
4. Administrator

All levels require a password to activate except for the Operator level.

Different users have different operation access. The default passwords for higher-level users are shown in **Table** 6-1 .

Table 6-1 . Default password

User Type	Default Password
Expert user	111111
Super user	222222
Administrator	333333

6.5 User Interface

6.5.1 Main Menu

The Main Menu is the toolbar at the top of the user interface, where a user can configure the settings, insert commands, or access variables and I/O's. Not all settings are available to normal operators. Some settings can only be accessed through the administrator level.

The main operations of ordinary users are: log backup, and the program cannot be modified. The main operations of expert users are: run and modify programs, backup data and modify variables. The main operations of the super user are: security configuration and so on. The administrator level has the highest authority.

The following table summarize the main menu setting and the required user level to view and/or modify it:

System		
Main Menu	**Submenu**	**Operation Authority**
Save to USB	Migration	Administrator
	Log backup	Ordinary user
	Varible Parameter IO notes PLC User data Script backup/delete Filedbus configuration Language Variable notes Identification file backup/delete	Expert user
Load from USB	Migration recovery	Administrator
	Parameter PLC User data	Super user
	IO notes Script update Varible Identification file Language import Variable notes Program	Expert user
System update		Super user

System		
Main Menu	**Submenu**	**Operation Authority**
System setting	Remote password	Administrator
	VNC setting	Super user
	Network setting	Expert user
	Language setting	Ordinary user
Mechanism info		Ordinary user
System info		Ordinary user

Edit		
Main Menu	**Submenu**	**Operation Authority**
Copy	Line copy Piece copy	Expert user
Cut	Line cut Piece cut	
Paste		
Delete	Line delete Piece delete	
Replace		
Custom collection		
Find		Ordinary user

Parameter		
Main Menu	**Submenu**	**Operation Authority**
Kinematics Controller		Expert User
Soft limit		Super User
DH parameter JOG parameter Joint servo		Administrator
Permission	User switch	Ordinary user
	Password	Super user

Monitor		
Main Menu	**Submenu**	**Operation Authority**
Position	Joint User Base	Ordinary user
Global variable	Var_B Var_I Var_D Var_P Var_V	Ordinary users can read only, expert users can modify
Input and output	Digital input Digital output Virtual input Virtual output Analog input Analog output	
Motor data	Raw pulse Motor speed Runtime pulse Motor torque	Expert user
Cycle statistics		Ordinary user
Runtime position		

Instructions		
Main Menu	**Submenu**	**Operation Authority**
IO Control Calculatie Assignment Move instruction Others		Expert user

Preparation		
Main Menu	**Submenu**	**Operation Authority**
Tool config User config Interference zone Process config		Expert user
Main program		Ordinary user read only Expert user can modify
Home position	Mechanical home	Super user read only Administrator can modify
	Program home	Ordinary user read only Expert user can modify
Mount config Hand drag	Zero calibration	Administrator
Safety config	Safety limit Collision detection	Super user

Extension		
Main Menu	**Submenu**	**Operation Authority**
flange IO	Drag setting Button setting	Expert User
Palletizing	Parameter config Program config	
Lua script Modbus slave		
User PLC		Administrator

6.5.2 General Purpose Display Area

The general-purpose display area is mainly used to display the program list, program editing interface, and various system setting interfaces. Most of the operations and settings of the system are displayed and configured in this general-purpose display area. The following figures shows examples of interfaces that appear in the general-purpose area.

File	Size	Time modification
tcr	0.0 KB	2018-01-25 10:11
2	0.0 KB	1978-04-05 15:31
3	0.3 KB	1981-03-31 04:36
4	1.2 KB	1981-04-06 13:59
5	0.7 KB	1981-04-06 13:53
chongya	0.3 KB	1981-04-06 13:08
demo	0.0 KB	1981-04-05 06:27
testzero	0.2 KB	1981-04-06 16:37

Figure 6-3 : Program list interface

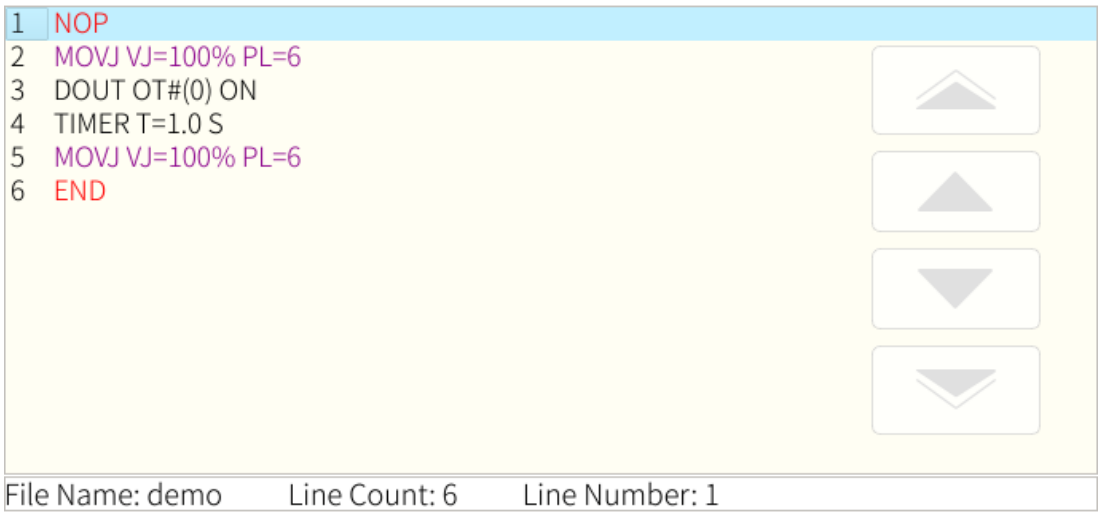


Figure 6-4 : Program editing interface

	Value	Notes
1	Elite	Servo type of axis 1
2	Elite	Servo type of axis 2
3	Elite	Servo type of axis 3
4	Elite	Servo type of axis 4
5	Elite	Servo type of axis 5
6	Elite	Servo type of axis 6
7	3133	Maximum speed of 1-axis motor
8	3133	Maximum speed of 2-axis motor

Figure 6-5 : Parameter setting interface

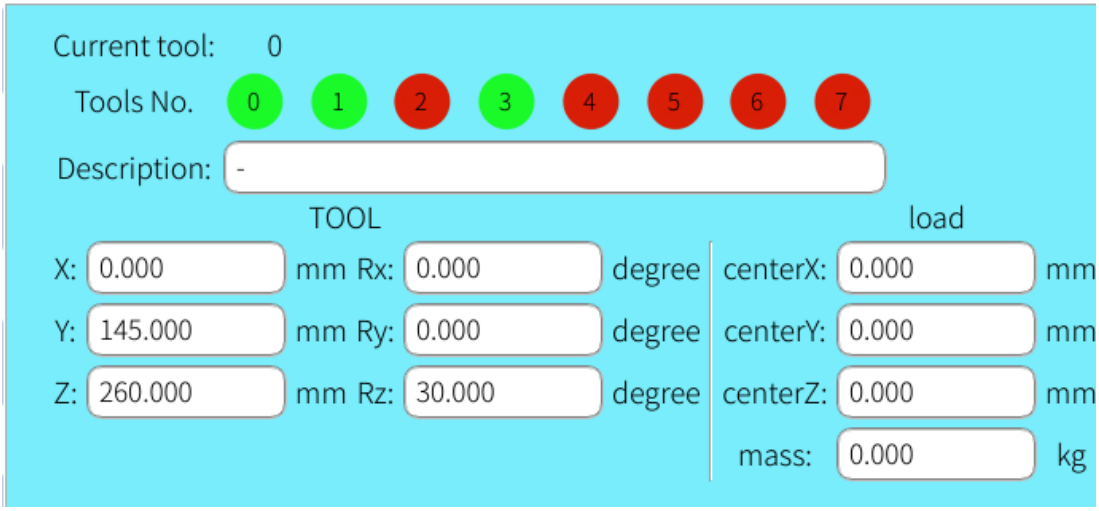


Figure 6-6 : Tool coordinate setting interface

6.5.3 Monitoring Area

The monitoring area is mainly used to display the robot coordinates, variable values, IO port status, motor running status, etc. All the options under the “Monitor” menu are displayed in the monitoring area, as shown in the following figure (the half-width display and full-frame display of the monitoring area).

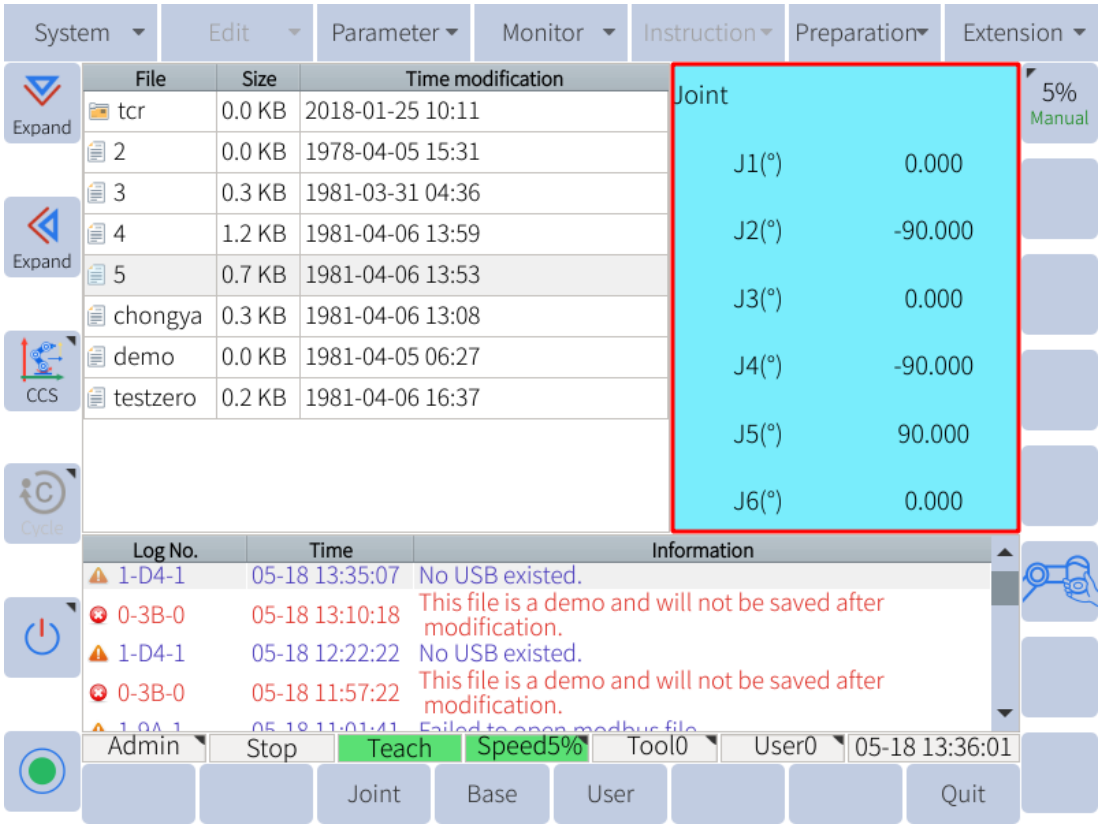


Figure 6-7 : Half display of the monitoring area

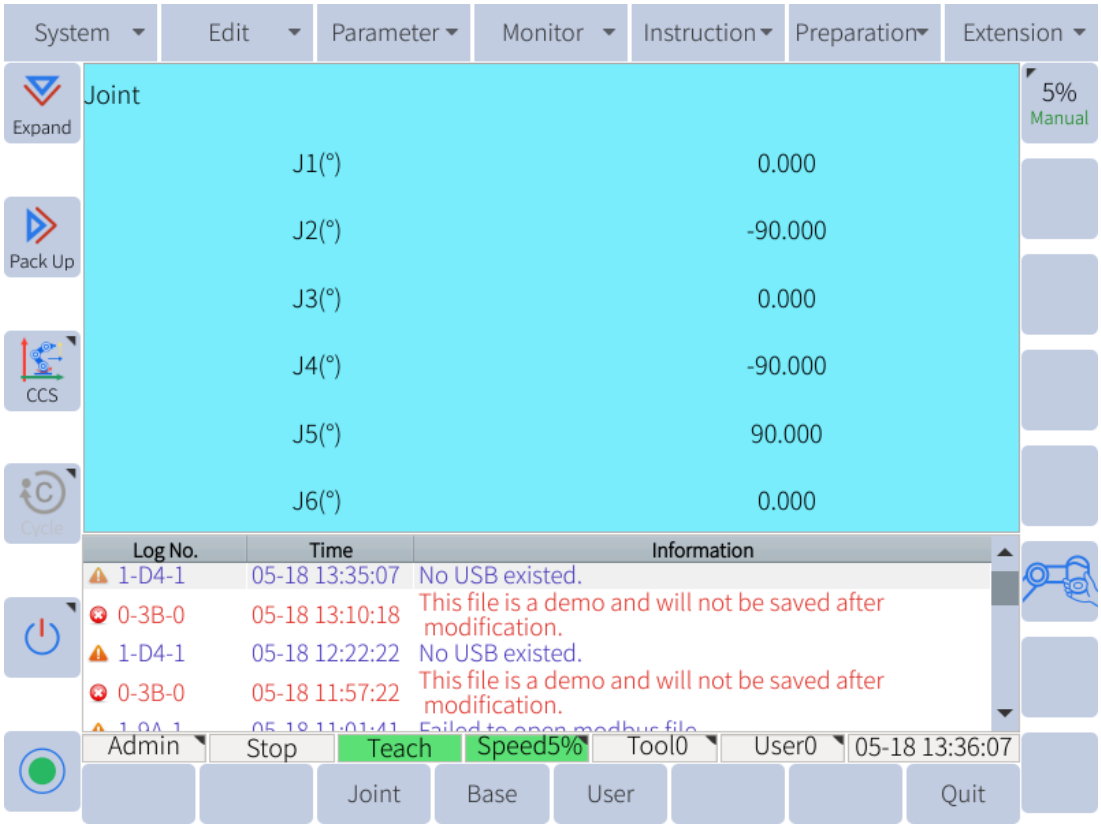


Figure 6-8 : Full display of the monitoring area

6.5.4 Information Log

The information prompt area is mainly used to display work information, alarms, prompts, and robot logs, as shown in **Figure** 6-9 .

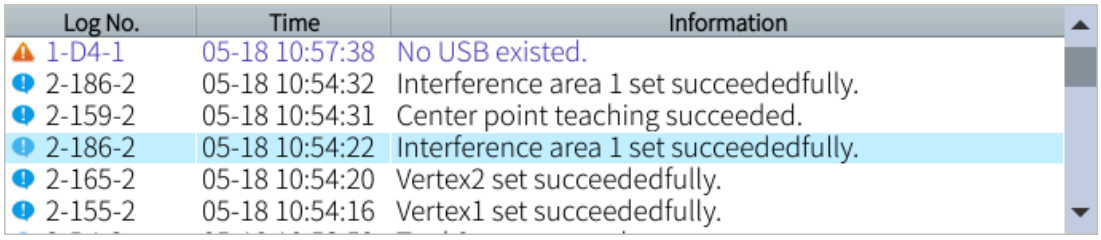


Figure 6-9 : Information prompt area

6.5.5 Status Control

The status control area mainly contains state control related to the robot, such as area expand/minimize subwindow, coordinate system selection (joint, base, tool, user, cylinder), operation cycle selection (single step, single cycle, continuous cycle), initial, reset, etc.

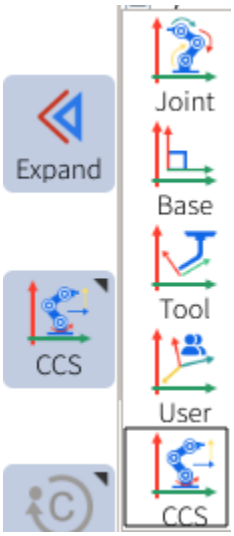
The area can be operated by directly clicking the icon or clicking the corresponding physical button. The coordinate and operation cycle need to be selected when a small pop-up window is displayed and can only be selected by pressing on the icon.



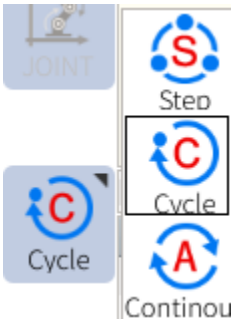
Collapse or expand the information prompt area.



Collapse or expand the imonitoring area



Coordinate system selection, can only be operated in TEACH mode



Operation cycle selection, can only be selected in PLAY mode



Initial button, only appears when booting



Reset/Alarm button



Imprecise



Shutdown button, back drive mode, initial button

Some windows in the system can be displayed in both full size mode and half-size mode. The selected window can be expanded by pressing the “Expand” button. This allows multiple windows to be displayed during program execution

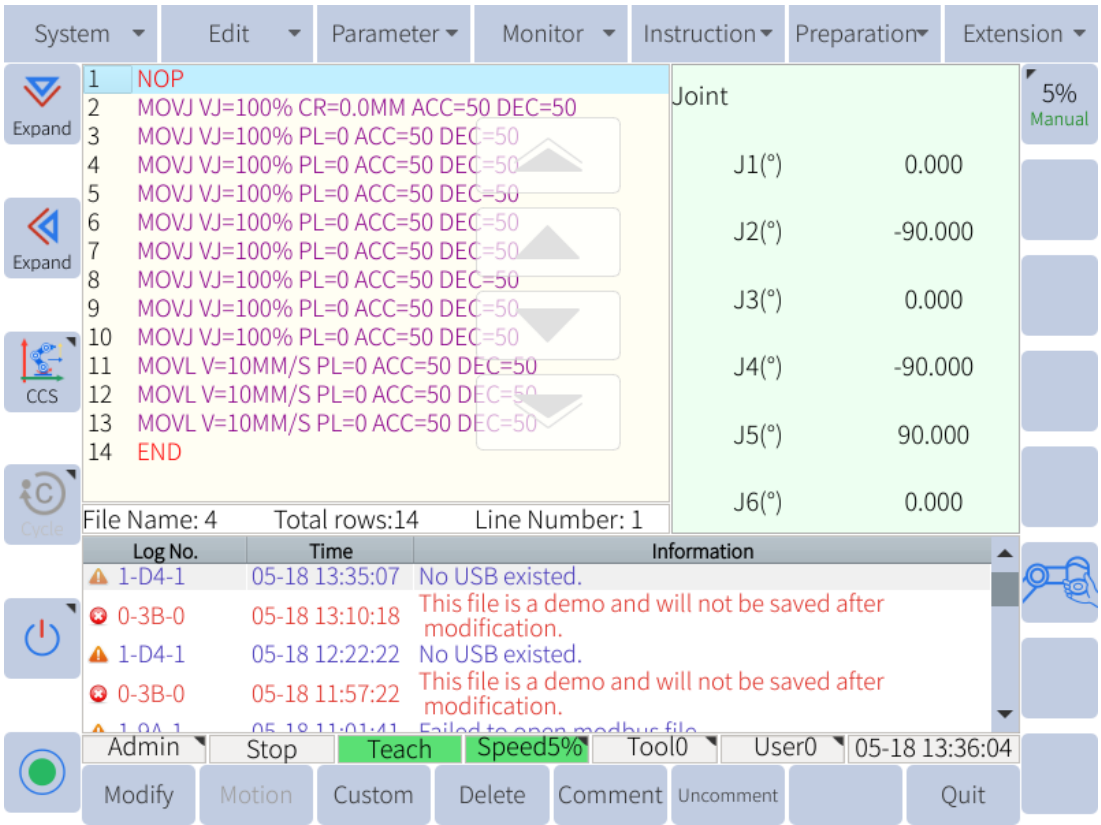


Figure 6-10 : Multi-window display

6.5.6 Coordinate Control Area

To set the desired coordinate system, the user may select the coordinate system from the status control menu. The coordinate area will display the corresponding icon according to the selected coordinate system. The user can only jog the robot when the robot is in TEACH mode. The following sections are descriptions of the various types of coordinate systems available to the user.

6.5.6.1 Joint Coordinates

Joint coordinates allow the user to move each joint individually. For “joint coordinates” the controls from top to bottom are -J1+, -J2+, -J3+, -J4+, -J5+, -J6+, as shown in **Figure** 6-11 . When the move

type is set to MOVEJ, the robot will move each joint to the commanded joint position. There are no singularities when moving in the joint space of the robot.

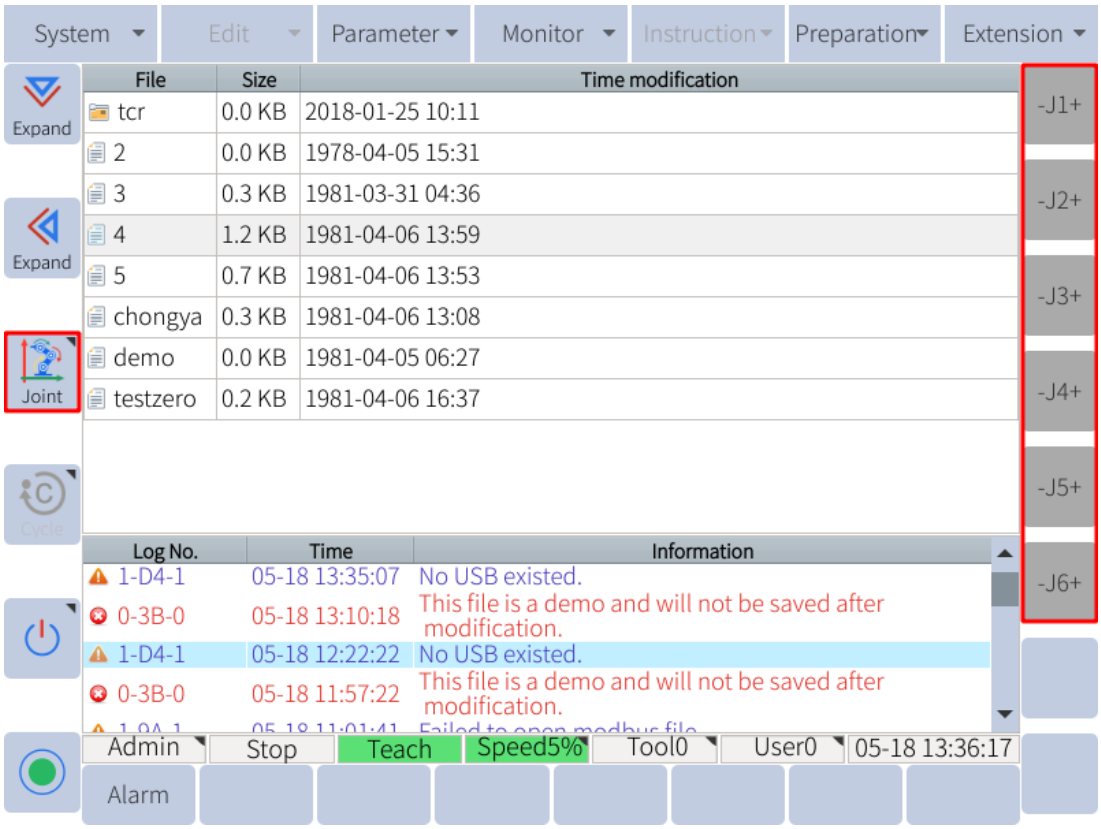


Figure 6-11 : Joint coordinates

6.5.6.2 Base Coordinates

Base coordinates are positions and directions in the robots XYZ or world frame. For “Base/Tools/User Coordinates” the controls from top to bottom are -X+, -Y+, -Z+, -RX+, -RY+, -RZ+, as shown in **Figure** 6-12 .

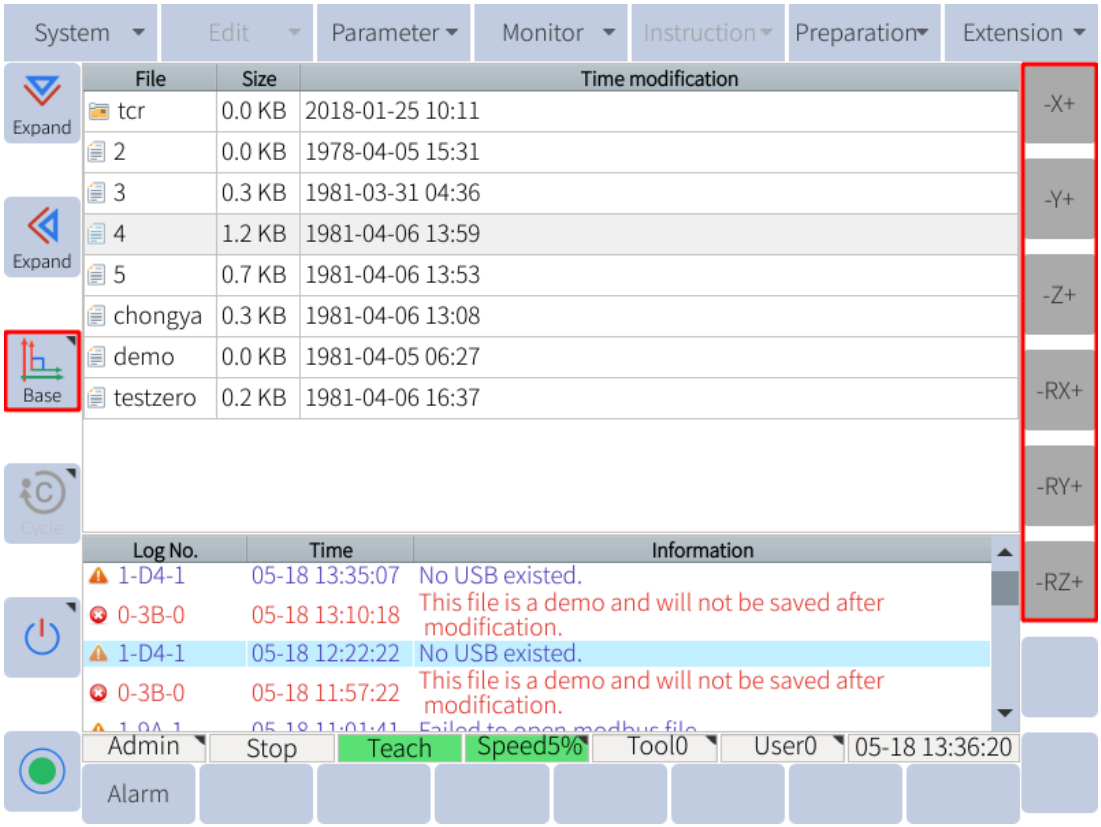


Figure 6-12 : Base/Tools/User coordinates

Moving in a base frame allows the robot to move in a linear fashion along specified coordinate axes. For example, if the robot is commanded to move along the positive X axis, it will move in a linear motion along the robot's X axis. There are singularities in the base space. Occasionally the robot may loose manipulability depending on the robot's orientation and commanded direction.

Taking a manipulator of 6 axes as an example, the directions of motion are as shown in **Figure** 6-13 .

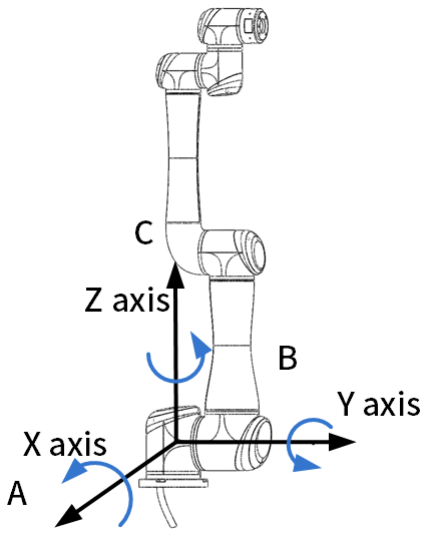


Figure 6-13 : Movement direction of the 6-axis robot(outlet: the negative direction of the X axis)

6.5.6.3 Cylindrical Coordinates

Cylindrical coordinates are related to base coordinates, but the robot can only move along the surface of a theoretical cylinder. For cylindrical coordinates the coordinate options are -θ+, -R+, -Z+, -RX+, -RY+, -RZ+, as shown in **Figure** 6-14 .

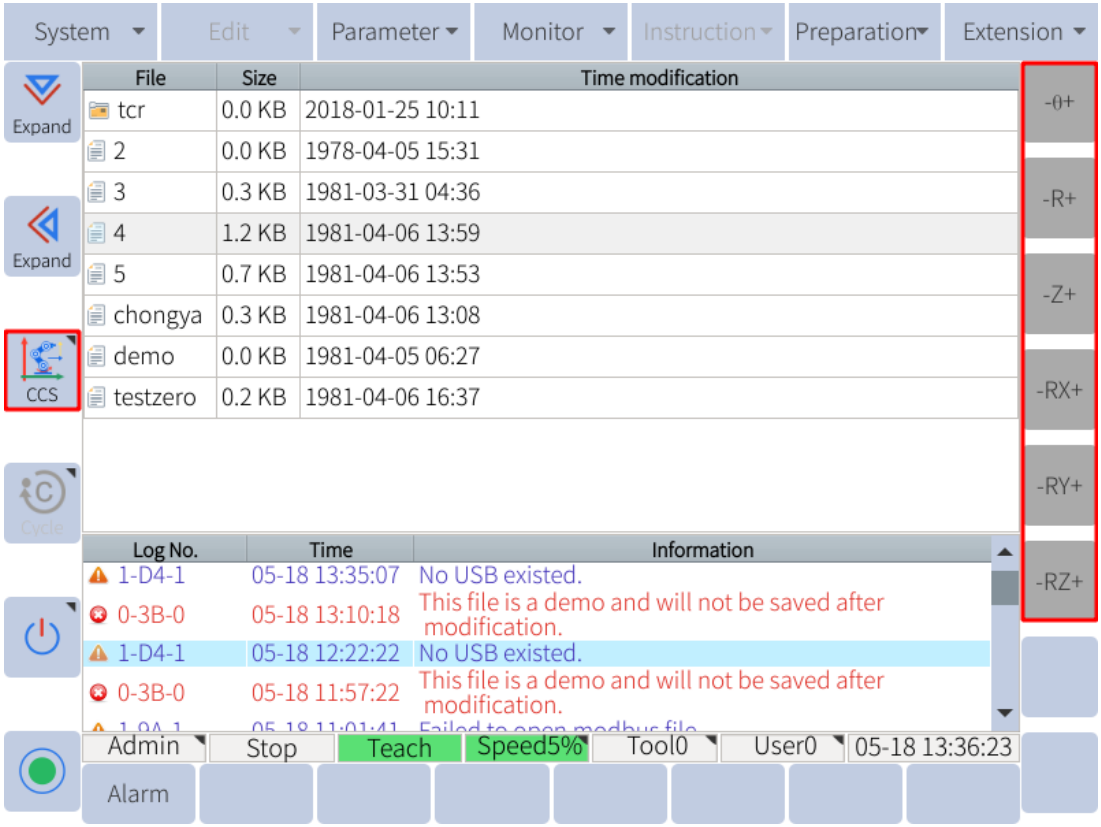


Figure 6-14 : Cylinder coordinates

θ represents the angle from 0 and controls the rotation of the robot about the Z axis of the world frame. R represents the radius of the cylinder and will move the TCP towards the Z axis or away from the Z axis. The Z parameter controls the up and down movement of the TCP parallel to the world's Z axis. RX, RY, and RZ will change the orientation relative to the World frame in the same manner RX, RY, and RZ are used in base coordinates. See **Figure** 6-15 for an example of cylindrical coordinates.

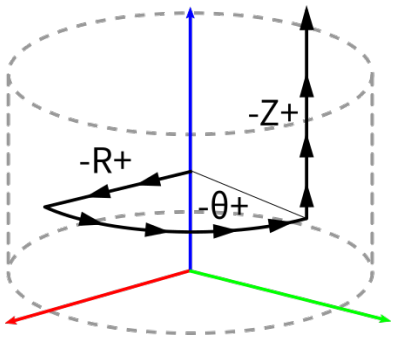


Figure 6-15 : An example of cylindrical coordinates

6.5.6.4 User Coordinates

User coordinate systems are the same as base or world coordinate systems. They have XYZ axes, but are oriented differenly than the world frame as in **Figure** 6-16 .

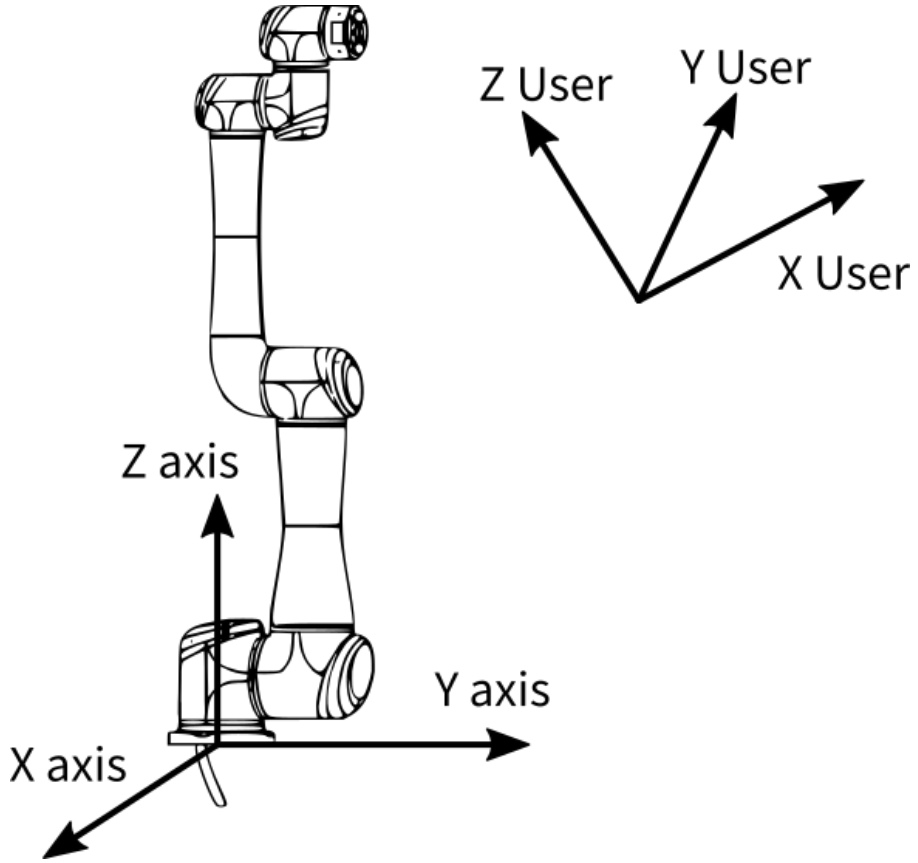


Figure 6-16 : example of a user frame(outlet: the negative direction of the X axis)

If a user selects a user coordinate frame, and jogs the robot along the X axis, the robot will move in a linear fashion along the X axis of the selected user frame instead of the X axis of the world frame.

6.5.6.5 Tool Coordinates

The tool coordinates are defined at the tip of the tool, assuming that the effective direction of the tool mounted on the manipulator wrist flange is the Z-axis. Therefore, the tool coordinates axis direction moves with the wrist.

In tool coordinates motion, the manipulator can be moved using the effective tool direction as a reference regardless of the manipulator position or orientation. These motions are best suited when the manipulator is required to move parallel while maintaining the tool orientation with the workpieces.

User can set the tool coordinates number 0~7 according to the actual tool conditions, as shown in **Figure** 6-17 .

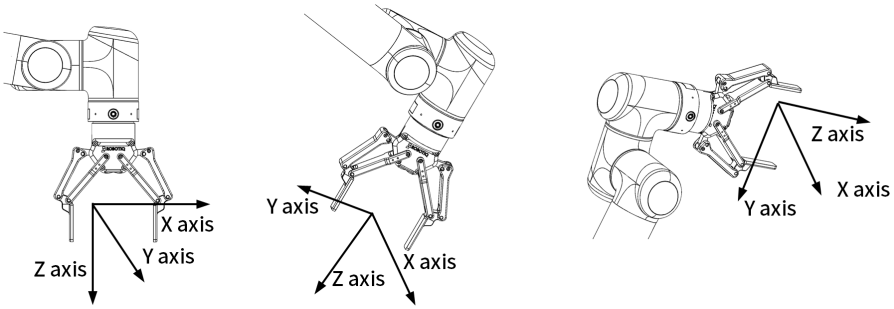


Figure 6-17 : Tool coordinates eaxmples

6.5.7 Backdrive mode

The reverse drive mode is mainly used to manually move the manipulator to a safe position after power-on. For example, the power-on exceeds the soft limit, the brake cannot be released by itself for encoder calibration, or some joints cannot be moved.

Here's how to enter backdrive mode:

Users can click  , then click  , and click "OK" on the pop-up page to enter the reverse drive mode, as shown in **Figure** 6-18 .

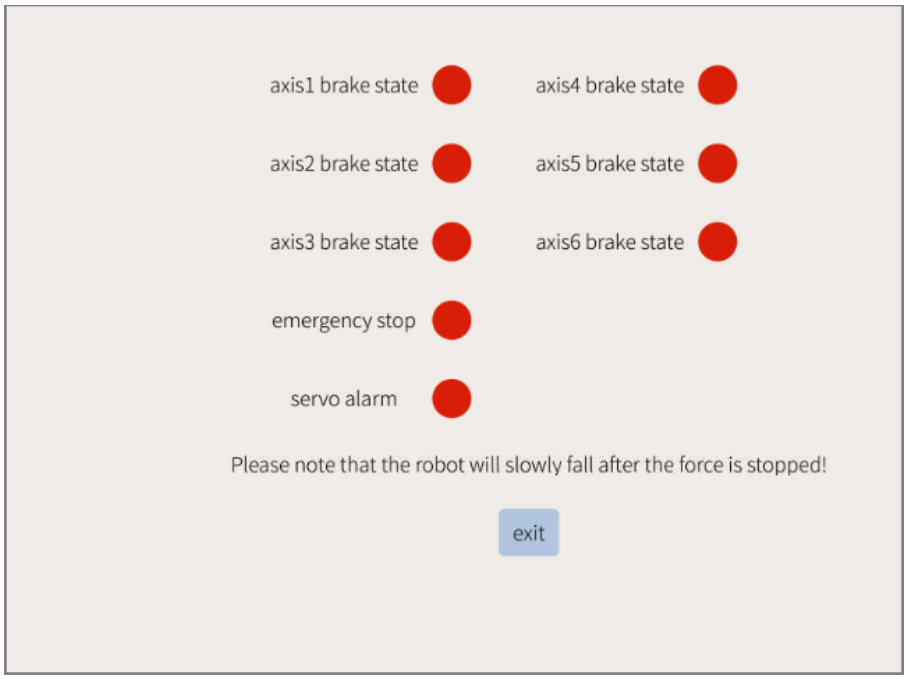


Figure 6-18 : back drive mode interface

Note: Backdrive mode can only be entered when the robot is initialized.

After entering the reverse drive mode, the user can drag the robot directly.

6.5.8 Status Display

6.5.9 Status Display Area

The status display area is mainly used to display the current status of the robot, including permissions, running status/mode/speed, current tool coordinate number, current user coordinate number, system time, external axis, etc., as shown in **Figure** 6-19 .



Figure 6-19 : Status display area

- **Permissions:** Display the current permissions, can open the permission settings window by touching screen
- **Running status:** Display the current running status of the robot, including stop, pause, run, alarm, stop(Imprecise), etc.
- **Running mode:** Display the current running mode of the robot, including TEACH, PLAY, REMOTE mode
- **Speed:** Display the current speed. The same speed in PLAY and REMOTE mode while a separate speed in TEACH mode, you can click to pop up the speed control window
- **Current tool coordinate:** Display the current tool coordinate number, which can be opened by clicking the tool coordinate setting page
- **Current user coordinate:** Display the current user coordinate number, which can be opened by clicking the user coordinate setting page
- **System time:** Display the current time of the system, click to pop up the modify system time page

6.5.10 Submenu

The submenu area is mainly used as an auxiliary button for the focus area, which changes depending on the focus area. The submenu area can be operated by clicking the icon or by the corresponding key. The submenu area shows as **Figure** 6-20 when program list is focused.



Figure 6-20 : Submenu area

6.5.10.1 Additional Options

There are several functions that are not seen when the robot is first started up. To view these additional options in the submenu area press and hold the Additional Options button (see **Figure** 6-21).

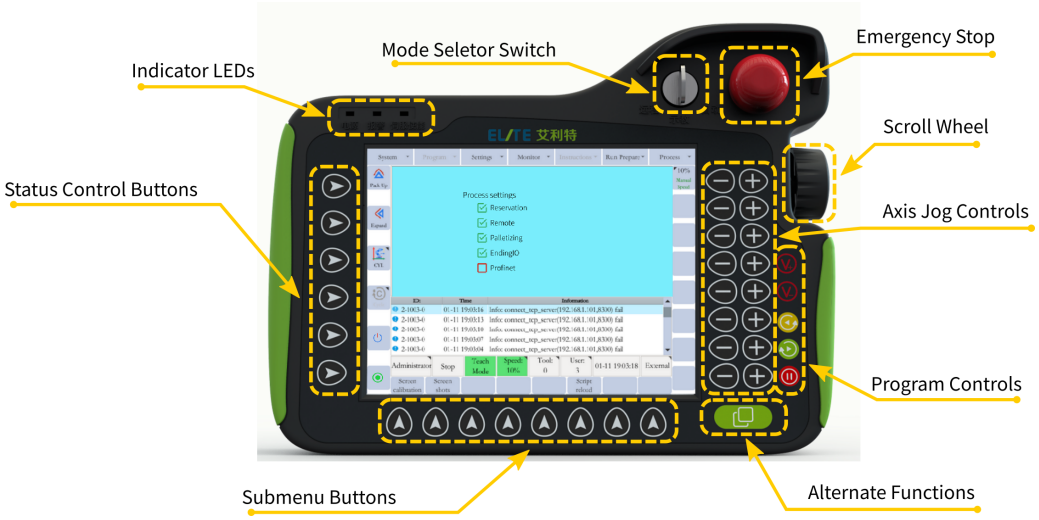


Figure 6-21 : Layout of teach pendant (front)

Several additional options will appear in the submenu area corresponding to different convenience functions. The conventional key combination functions include screen validation, screenshot, normal mode,advanced mode, etc. There are different options available for different user processes depending on what is being shown in the general purpose display area or subwindow.

6.5.11 Speed Selection

There are three different types of speed parameters that can be modified: manual (teach) speed, play speed and remote speed. The play speed and remote speed are the same. There are three ways to adjust the speed:

1. Press the icon [20% manual] in the coordinate area 

and select the speed or drag the slider to adjust speed directly in the pop-up dialog box.

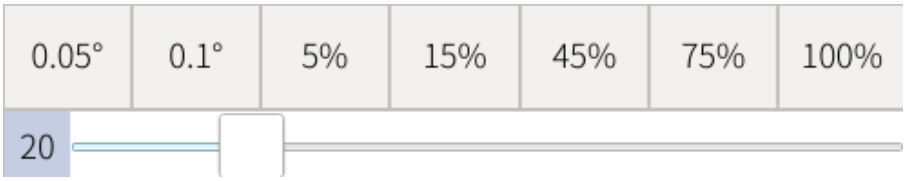


Figure 6-22 : manual speed

2. Press the icon 

in the status display area and select or drag the slider to adjust the speed in the pop-up dialog box. When the speed of the area is within 0.05~30%, the icon is displayed in green (safe speed) 

. When the speed is within 31%~70%, the icon is gray (normal speed) 

. when the speed is within 71%~100%, the icon is displayed in Red (alert speed) 

.

3. Press the speed adjustment button   on the right side of the pendant to adjust the running speed.

6.6 Moving the Robot Arm

There are various ways to move the robot; using the teachpendant or moving the robot by hand. These methods will be discussed in the following sections.

6.6.1 Servo Switch

If a user wishes to jog the robot, the servo switch must be engaged. The servo switch is a three state button for safety purposes. If the user presses down on the servo switch it will click once. This means that the servo switch is in the correct position to enable servo motion. If the switch is pressed down harder, it will click a second time. This disables the servos. The switch must be held in the middle position to enable to servos.

6.6.2 Jog Position

The following steps describe how to jog the robot axes:

1. Set the robot mode to TEACH
2. Make sure the reset button is green.
3. Select the desired coordinate system
4. Hold the servo switch on the back of the teach pendant
5. Press and hold the desired jog axis button next to the coordinate display area
6. Release the button when the desired position is reached.

CAUTION



Ensure the robot workspace is clear before jogging the robot

6.6.3 Hand Guide

To more easily position the robot in a desired configuration, users can also move the robot by hand. To activate the hand guiding feature of the robot, locate the hand guide enable button located on the

side of the tool flange. The button is lit by a blue LED ring (see **Figure** 6-23).



Figure 6-23 : Hand guide enable button

The user must press and hold the hand guiding button while they guide the robot to the desired location. To stop hand guiding, simply release the hand guide enable button.

NOTICE

The user **does not** need to hold the servo switch on the back of the teachpendant while hand guiding

6.7 Creating a Program

6.7.1 JBI

JBI is the programming language used to control the robot. JBI (short for Job Instruction) files for Elite collaborative robots can be created via the teach pendant or created and edited on a PC. JBI is a text based command language that can be directly translated into robot motion and events through the ELITE Robot software. Elite robot controllers use a Linux-based operating system and comes with an sFTP server. You can access the files with the .jbi extension by logging into /rbctrl folder with FTP software (e.g. FileZilla, with username: root, password:elite2014, port:22.) Some free text editors, such as notepad++, come with an sFTP plug-in for remote online editing.

The following list shows the available JBI instructions. For more detailed information on the following instructions please visit Elite Robot's website for the JBI user manual.

Instruction Group	Instruction	Description
Input and output	DOUT	Digital output
	MOUT	Virtual digital output
	DIN	Digital input
	MIN	Virtual digital input
	PULSE	Pulse output
	AOUT	Analog output
	AIN	Analog input
Logic control	JUMP	Jump to the specified label
	CALL	Call a subprogram
	IF	If statement
	ELSEIF	else if statement
	ELSE	Else statement
	ENDIF	End if statement
	WHILE	While loop statement
	BREAK	Jump out of loop statement
	CONTINUE	Skip this loop statement
	ENDWHILE	End while statement
	LABEL	Instruction tag
	TIMER	A timer
	RET	Subprogram return
	PAUSE	Program pause
	WAIT	Wait
	MCWAIT	Temporarily cancel collision

Instruction Group	Instruction	Description
Mathmatic	CCOOD	Specify the coordinate
	INC	Variable plus one
	DEC	Variable minus one
	ADD	Add operation
	SUB	Subtraction operation
	MUL	Multiplication operation
	DIV	Division operation
	MOD	Mod operation
	AND	Logic AND operation
	OR	Logic OR operation
	NOT	Logic NOT operation
	XOR	Logic XOR operation
	DIST	Calculate the distance between the two points

Instruction Group	Instruction	Description
	SETPOSE	Pose assignment
	SET	Variable assignment
	SETJOINT	Position assignment
	GETPOS	Get the current position
	GETTOOLFRAME	Get tool coordinates
	SETTOOLFRAME	Set tool coordinates
	GETUSERFRAME	Get user coordinates
	SETUSERFRAME	Set user coordinates
	GETTOOLNUMBER	Get tool number
Set and get	MFRAME	Establish a coordinate
	POSETOJOINT	Inverse kinematics
	JOINTTOPOSE	Forward kinematic
	POSEMUL	Position multiply
	POSEINV	Pose inversion
	SETPAYLOAD	Set payload
	SETTOOLNUMBER	set tool number
Palletizing	PALLET	Pallet process

Instruction Group	Instruction	Description
Motion	MOVDRAG	Free drive repeat
	MOVJ	Joint interpolation
	MOVC	Circular interpolation
	MOVL	Linear interpolation
	TTINIT	Transparent transmission initiate
	TTSTARTJOINT	Transparent transmission start
	TTTARGETJOINT	Transparent transmission add target
	TTSTOP	Transparent transmission end
	LOADML	Load script file
	UNLOADML	Unload script file
	MOVML	Micro-interpolation
Lua control	STARTLUA	Run script
	STOPLUA	stop script
	RESTARTLUA	script reload
	GETLUASTATE	Get script status
Others	CLEAR	Clear the variable
	//	A comment
	SAVEVARP	Save P variable
	TPWRITE	Print

6.7.2 Initial Setup

When the program list is showing in the general purpose display, the options for program file operation appear in the submenu area, as shown in **Figure** 6-24 . If the general purpose display is showing a page other than the program list, the user can press the quit button at the bottom of the teach pendant screen until the program list is displayed.



Figure 6-24 : Options for program file operation

All waypoints and robot instructions are stored in the program file, so you should first familiarize with the various operations of the program file before teaching. To create a program, click ”New” and an interface will pop up as shown in **Figure** 6-25 .

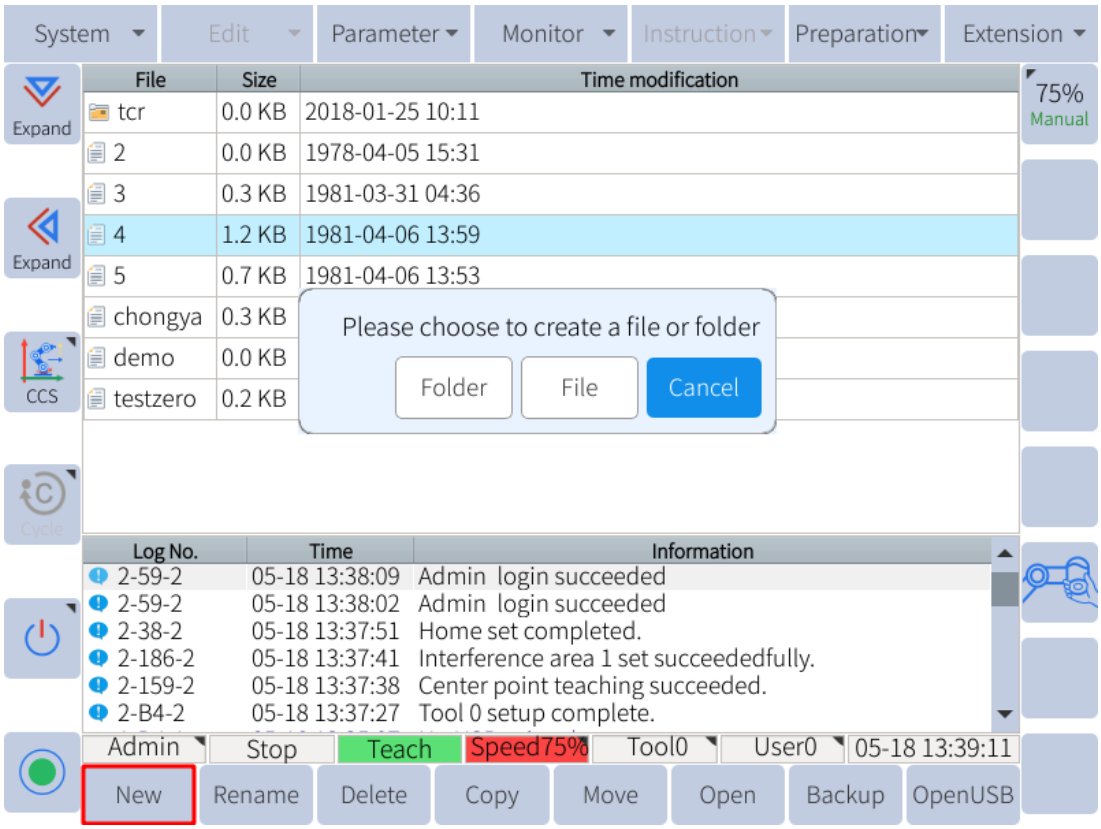


Figure 6-25 : New Program File

After clicking “File”, in the file name input interface, enter the desired file name and click “OK”.

To open an existing file, select the program and click “Open” to open the program to the program editing interface (**Figure** 6-32).

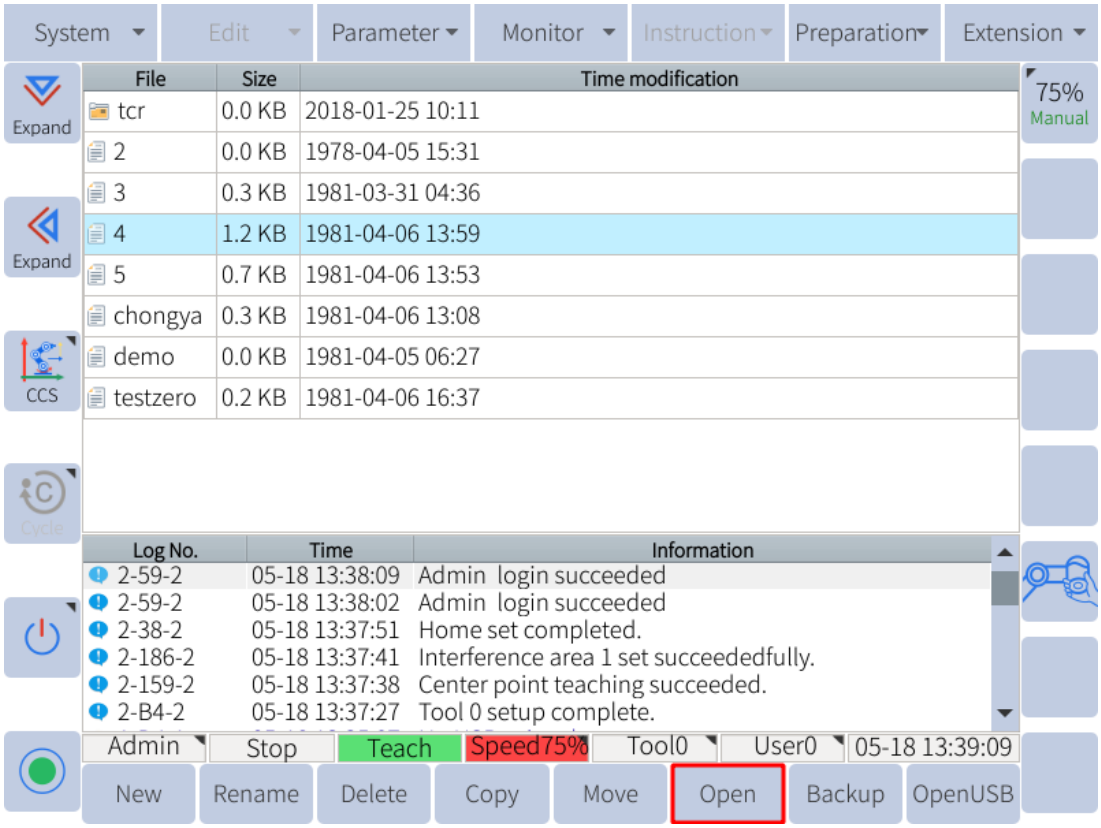


Figure 6-26 : Open program file

6.7.2.1 Navigating through the Program

There are two ways to navigate through the program lines. The first way is using the navigation arrows to the right of the program text shown in **Figure** 6-27 . The outer arrows jump to the top or the bottom of the program and the inner arrows move up or down a single line.

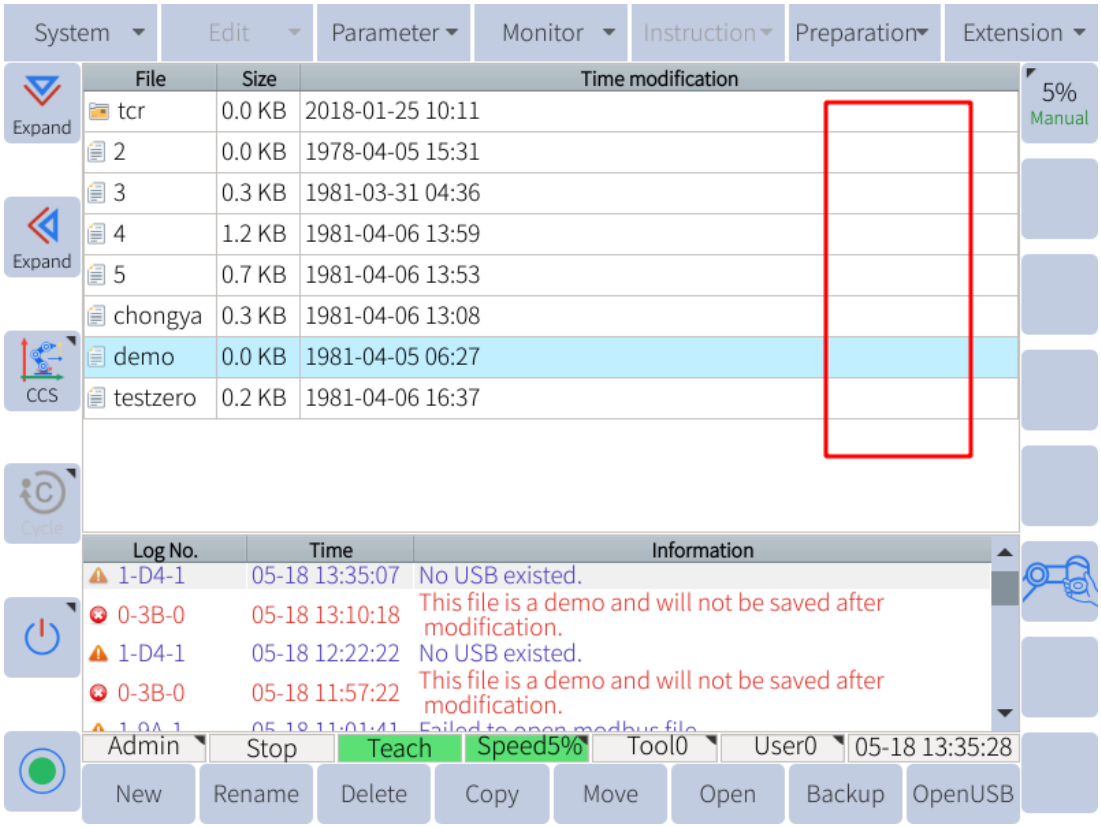


Figure 6-27 : Program navigation arrows

The second way to navigate through the program is to use the scroll wheel located on the right side of the each pendant. The scroll wheel is disabled by default after booting. Push the scroll wheel inward to enable the scrolling feature. To disable press inward a second time.

6.7.3 Inserting Commands

To insert a command, locate the main menu bar at the top of the screen and click on the “Instructions” tab. The following command categories are available:

1. Input and putput
2. Logic control
3. Mathmatic
4. Set and get
5. Lua control
6. Others
7. Motion

The methods of inserting all instructions except for the move instruction are identical. The steps for inserting commands are as follows:

1. In the program editing page, move the cursor to the line immediately before the position where the instruction is to be inserted.

2. Press “Instruction” under the main menu (or “Custom” in the submenu area) to select the instruction to be inserted (see **Figure** 6-28)

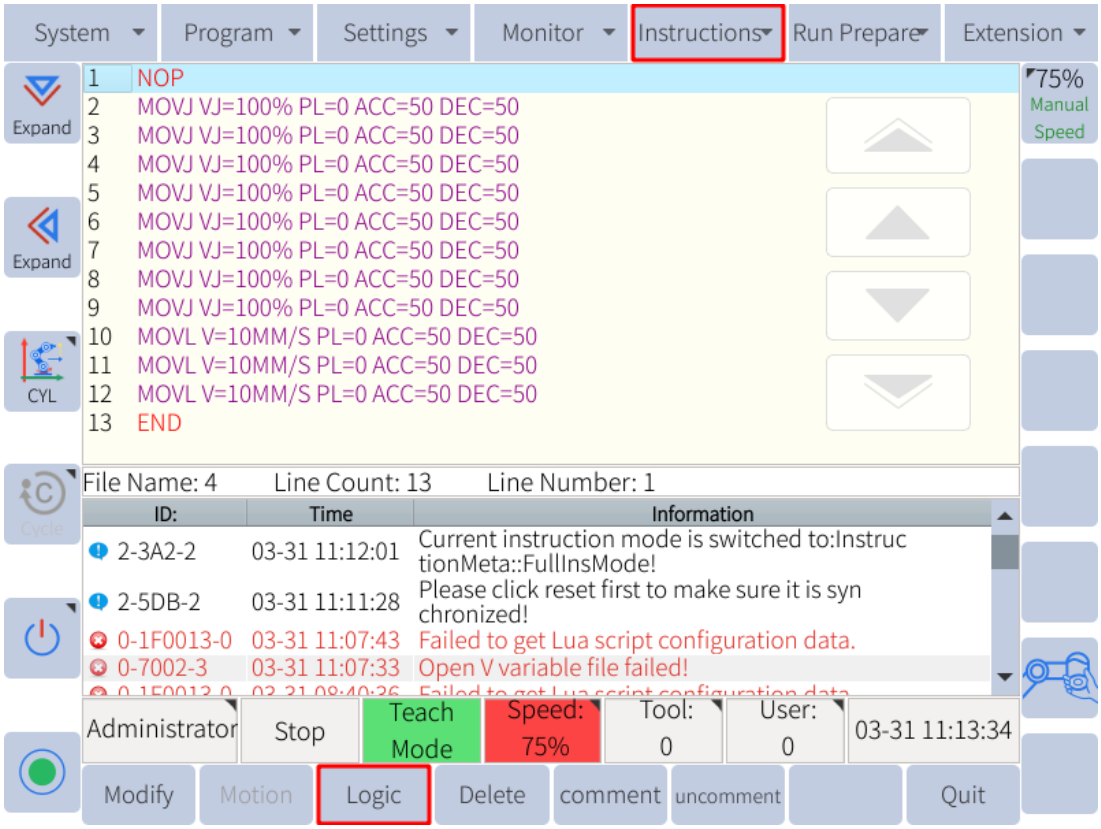


Figure 6-28 : Inserting other instructions

3. After editing the additional parameters, press “OK” to insert the instruction.

The “Logic” tab in the submenu area contains only some of the instructions, but all instructions can be found by pressing “Instructions” in the main menu bar.

NOTICE

Programs are saved automatically while a program is being created

6.7.4 Inserting Move Commands

When inserting a move instructions without using P variables, the current position of the manipulator is recorded into the move instruction. Be sure to press the servo safety switch to successfully insert the movement command.

The detailed procedure for inserting a move command is as follows:

1. Move the manipulator to the desired position using hand guiding or the jog axis buttons

2. Move the program cursor to the line immediately before the position where a move instruction is to be inserted.
3. Press and hold the servo switch - the ”SERVO” indicator light will turn on.
4. Click ”Motion” in the submenu bar, as shown in **Figure** 6-29 , or select **Instruction -> Move-Instruction**, and select the desire move method on the drop down menu.

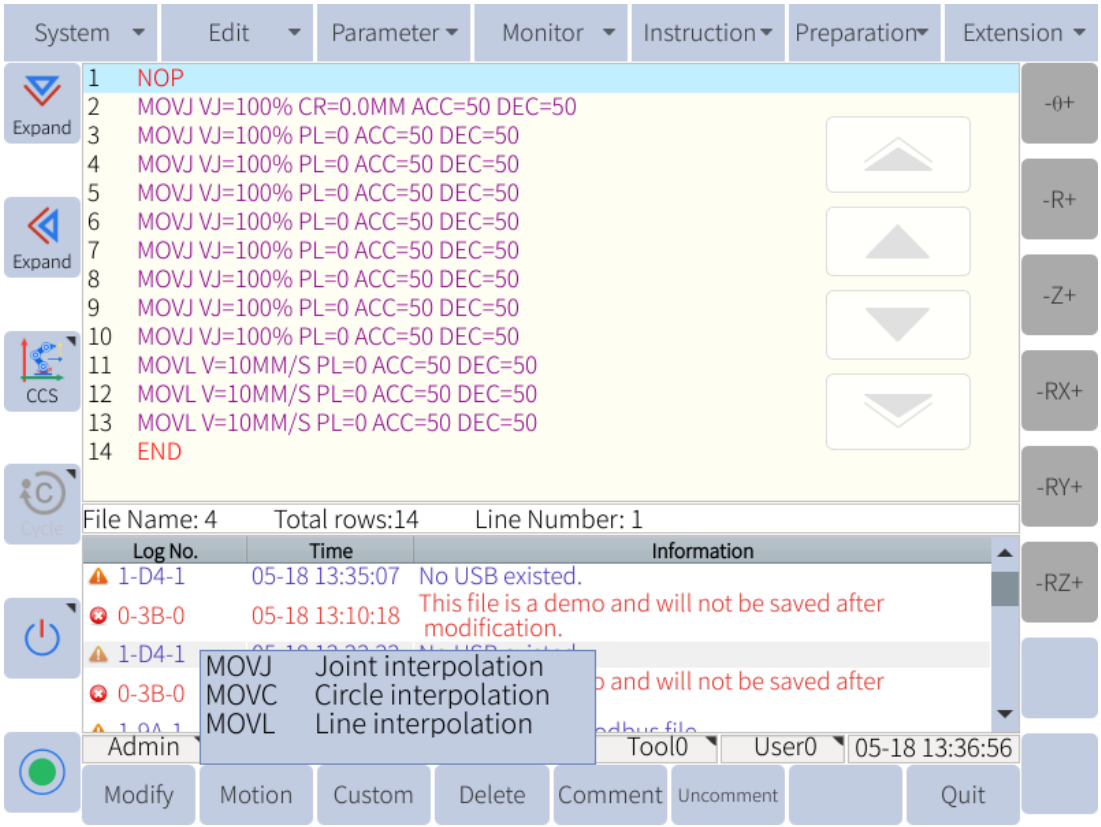


Figure 6-29 : Selecting the move instruction

5. After selecting the move instruction, edit the parameters and press “Confirm” to insert it.

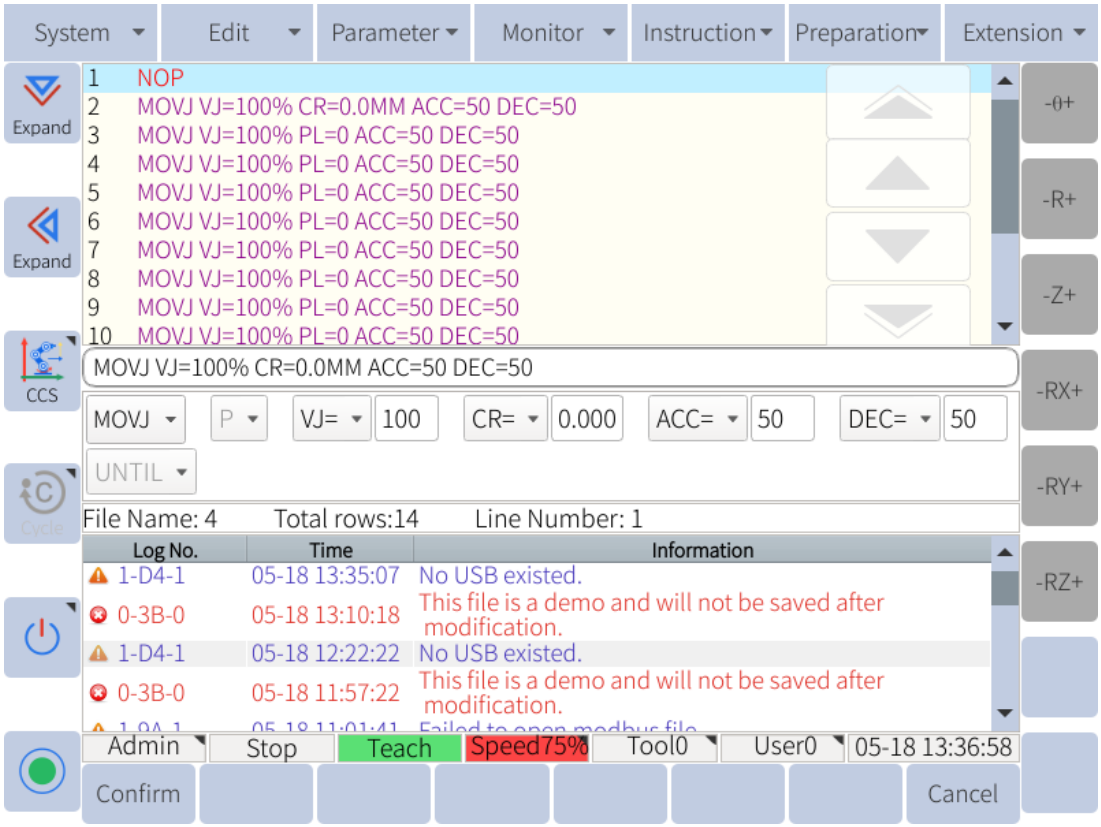


Figure 6-30 : Inserting the move instructions

NOTICE

The servo enable switch must be held when inserting the move instructions. Otherwise, the move instruction **will not** be inserted.

6.7.4.1 Checking Steps

After completing the program editing, the manipulator can be moved to the recorded waypoint in order to check whether the recorded waypoint is correct. The following steps describe how to move the manipulator to a previously recorded waypoint:

1. Switch to TEACH mode using the mode selector switch
2. Set manual speed at an appropriate level for safety
3. Select the move instruction the user wishes to verify
4. Press and hold the servo enable Switch
5. Press and hold the "PROGRAM START" button  on the bottom right corner of the teach pendant
6. When the manipulator reaches the target step point, the information prompt area will display the

following message: “The manipulator reaches the target point”

NOTICE

The manipulator will stop moving when it has reached the selected waypoint or if the user releases the ”Program Start” button

6.7.5 Advanced Functions

There are two types of program instruction mode in this system: normal mode and advanced mode. The normal mode is used by default after booting.

In the normal mode, only the basic items for each instruction are available for editing. After enabling the advanced mode, all commands will be available while inserting program instructions.

Advanced mode can be enabled as follows: Press and hold the Additional Options button  . The submenu area will change to show the additional options available. The “Advanced Mode” button will appear.



Figure 6-31 : Mode conversion interface

While holding the additional options button, click on “Advanced Mode” to allow access to the advanced robot instructions.

6.7.6 Editing a Program or Command

6.7.6.1 Manage Programs

The user can create files or folders to better organize their programs. To create a folder, select “New” in the submenu area, click on “folder” in the pop-up window, and enter a name for the newly created file. Programs can also be managed in the following ways:

- **Rename**
  Select the program that needs to be renamed, click “Rename”, enter the new file name in the pop-up interface, and click “OK”.
- **Delete**
  Select the program to be deleted, click “Delete”. A confirmation prompt box will pop up. Click “OK”.

CAUTION

The program opened last time is active and cannot be deleted. You need to open a different programs before deleting.

- **Copy**
  Select the program to be copied, click “Copy”, enter the new file name in the pop-up window, and click “OK”.
- **Move**
  The move operation is used for moving the program file into and out of the folder. Select the program file that needs to be moved, click “Move”, select the desired folder, and click “OK”.
- **Open**
  Select the program and click “Open” to open the program to the program editing interface, as shown in **Figure** 6-32 .

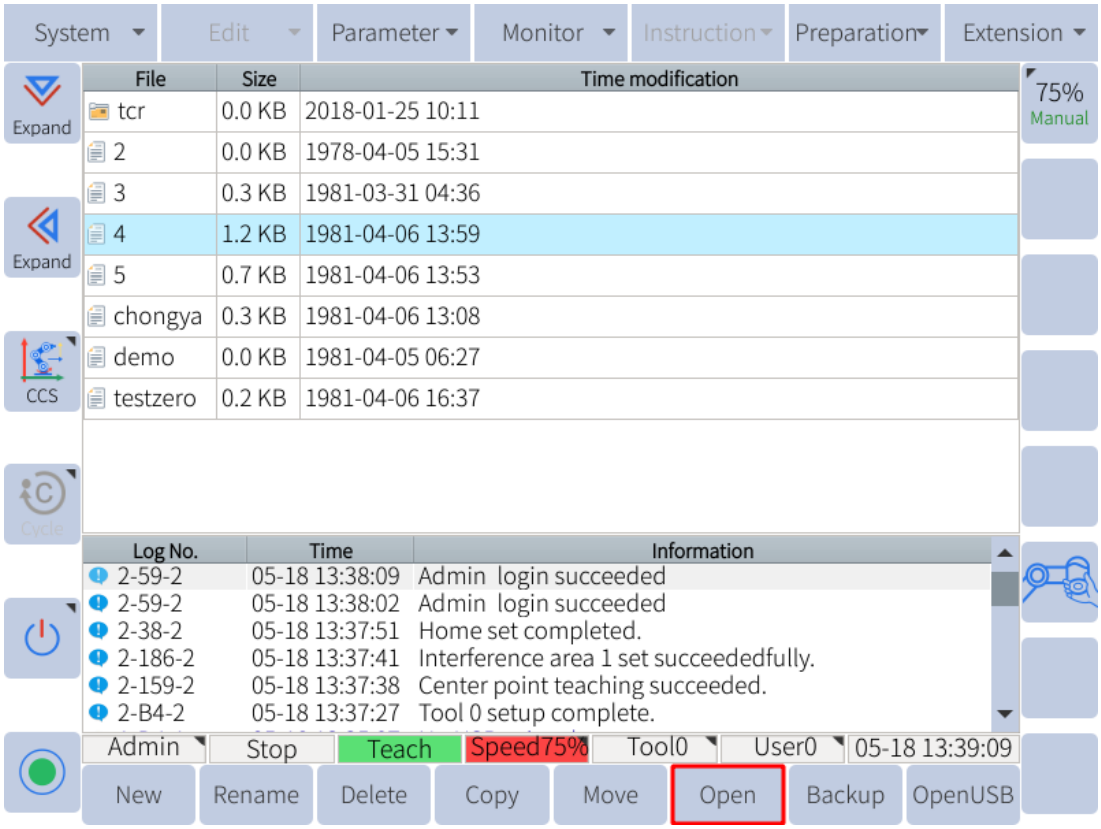


Figure 6-32 : Open program file

NOTICE

After opening the program file, “Program” and “Instructions” will become available in the main menu area.

- **Backup**

When a USB device is connected with the controller, select the program that needs to be backed up, and click “Backup” to store the program in the USB.

- **Open USB Device**
  Connect a USB device with the controller and click “OpenUSB” to display the existing programs in the USB. Select the desired program and click “Usb 2 local” at the bottom left of the interface to import the program file.

6.7.6.2 Updating Instruction Parameters

Instruction parameters can be updated by selecting the instruction with the program cursor and clicking on “modify” in the submenu. The user can then make the desired changes. To save the changes, click on “update parameters” at the bottom of the screen. The changes will then be saved in the program. If the user decides if the user decides not to save the changes, press “quit” in the submenu.

6.7.6.3 Modifying Programs

Once a program has been opened, then, a user can take the following actions to reorganize or modify the lines of the program:

- **Copy**
  There are two types of copy operations: “Line copy” and “Piece copy”.
  Line copy: Only copy the instruction line selected by the cursor (Note that the NOP and END lines cannot be copied).
  Piece copy: Press “Piece copy”, and the dialog box will pop up for specifying the range of the instruction lines to be copied. Press “OK” to complete the copy operation.
- **Cut**
  There are two types of cut operations: “Line cut” and “Piece cut”.
  Line cut: Only cut the instruction line selected by the cursor (Note that the NOP and END lines cannot be cut).
  Piece cut: Press “Piece cut”, and the dialog box will pop up for specifying the range of the instruction lines to be cut. Press “OK” to complete the cut operation.
- **Paste**
  After performing a copy operation or a cut operation, move the cursor to the line immediately before the desired position in the program editing page. Press “Paste” to complete the paste operation.

NOTICE



The instruction lines are inserted in the next line of the cursor line.

- **Delete**

  There are two types of delete operations: “Line delete” and “Piece delete”.

  Line delete: Only deletes the instruction line selected by the cursor (Note that the NOP and END lines cannot be deleted).

  Piece delete: Press “Piece delete”, and the dialog box will pop up for specifying the range of the instruction lines to be deleted. Press “OK” to complete the delete operation.

- **Find**

  Press “Find” and the search window will pop up. The items can be searched are the additional items of each instruction. Note that the items displayed for each instruction in the normal instruction mode and advanced instruction mode are different. Select the item to search, and input the corresponding value. Then press “Find” in the submenu area to find the instruction line that meets the requirements in the current program. The cursor will move to the line automatically,as shown in **Figure ??**.

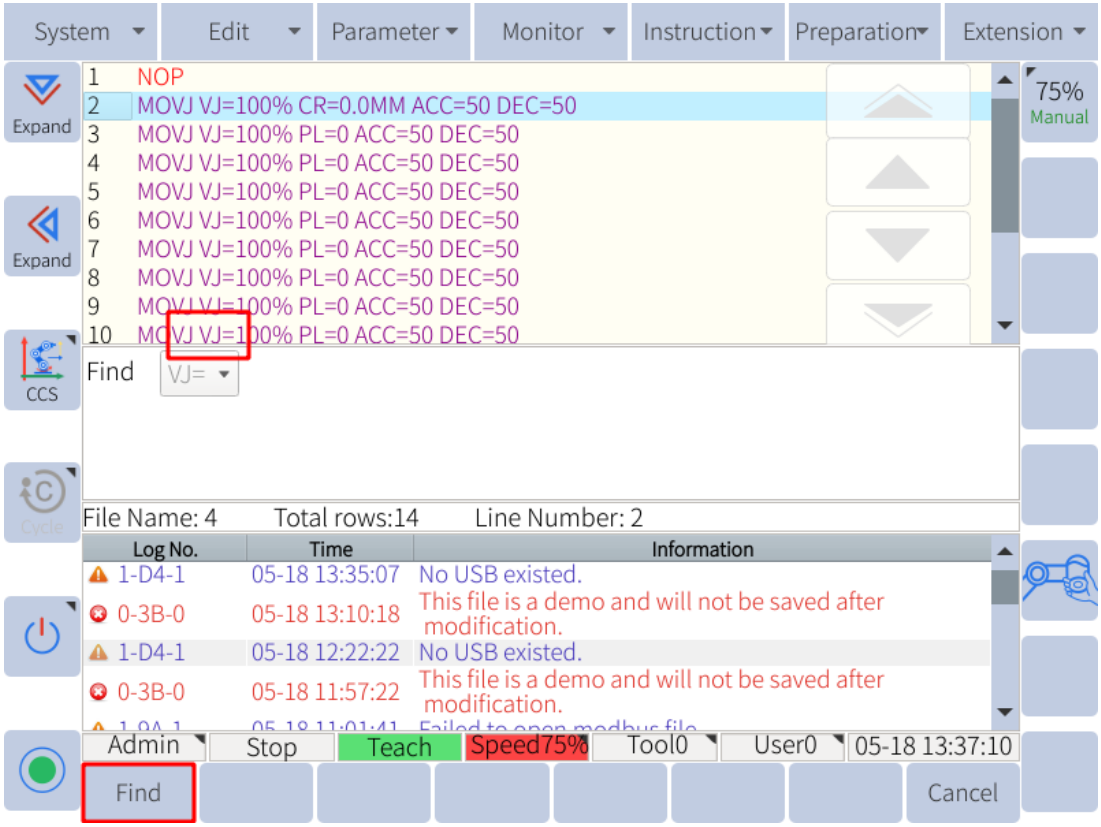


Figure 6-33 : Searching

- **Replace**

  The replace operation is used to replace the additional item value that meets the search requirements with the given value. Press “Replace”, then the submenu area displays three new options: “Replace”, “Skip” and “Replace all”.

  “Replace” can be used to sequentially replace the value of the matching item with the specified value one by one.

  “Skip” can be used to skip the current matching item.

"Replace all" can be used to replace the values of all matching items in the program with the specified value at once.

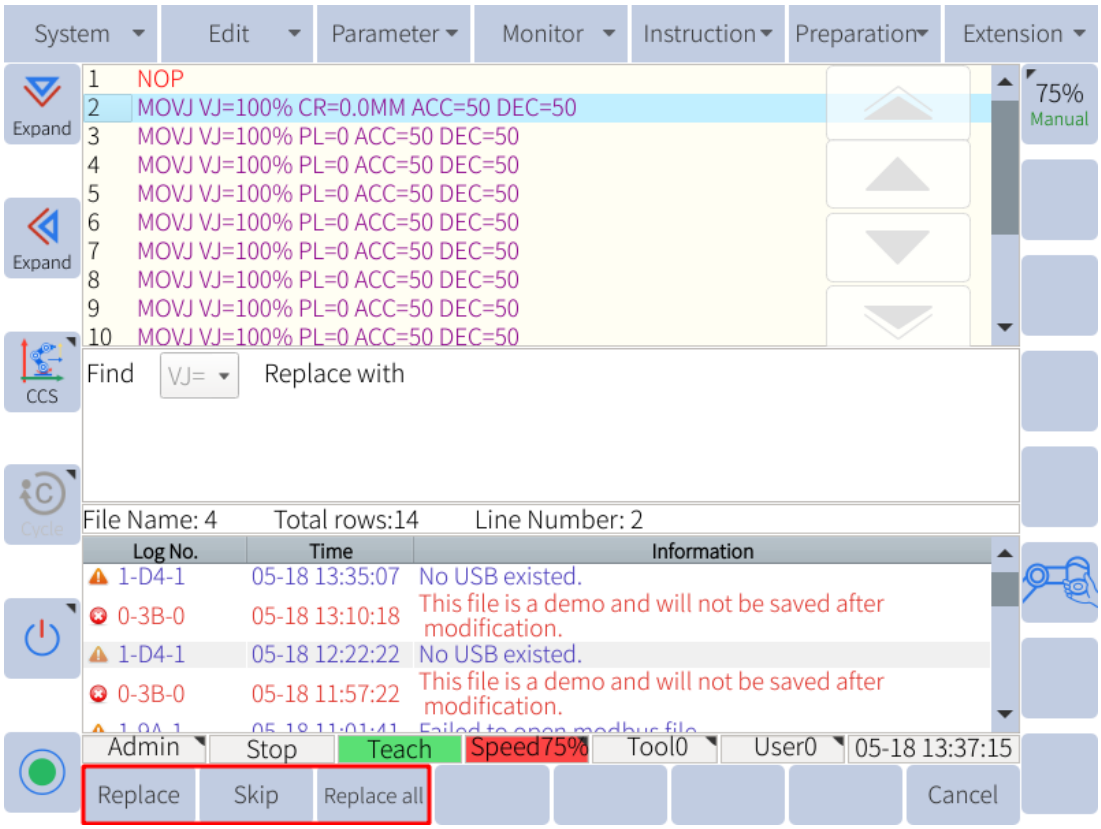


Figure 6-34 : Replacing

- **Custom collection**
  To customize the Quick Instructions see Subsection 6.7.7

6.7.7 Customizing Quick Access Commands

The custom tab in the submenu bar can be customized to contain the users most frequently used robot instructions. The frequently used instructions can be added to the quick instructions for easy use. To customize the "Logic" menu, navigate to **Edit -> Custom collection** to enter the customizing page. Select the desired instruction in the left instruction selecting window, and press the right arrow to add the selected instruction to the quick instructions list.

Select the desired instruction in the right quick instruction window, and press left arrow to remove the selected instruction from the list, as shown in **Figure** 6-35 .

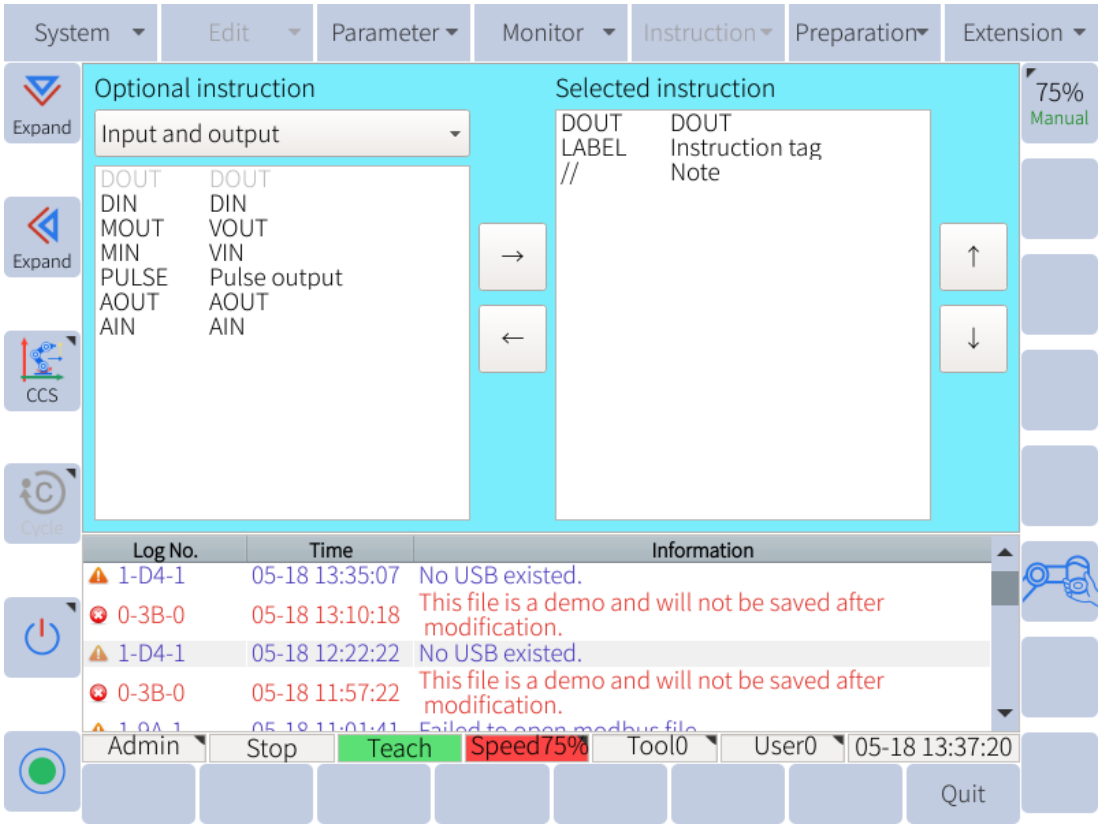


Figure 6-35 : Customizing quick instructions

6.8 Running a Program

6.8.1 Program Execution

6.8.1.1 Selecting Programs

Before playback operation, select the desired program file in the list and press “OPEN” in the submenu area to open the programming interface. Move the cursor to the starting line of the program. Generally, the program is executed from the NOP line.

CAUTION

The program starts from the position highlighted by the cursor. If the program was stopped in the middle of the program and is restarted, the program will continue from where the cursor is.

6.8.1.2 Selecting Operation Cycle

Switch to PLAY mode, press the icon in the status control area to select one of three types of manipulator operation cycles:

SINGLE STEP: Executes one step (instruction) at a time.

SINGLE CYCLE: Executes a program once. The program will be executed again if "PROGRAM START" button is pressed.

CONTINUOUS CYCLE: Repeats a program continuously.

6.8.1.3 Startup

After completing all above preparations, first press "SERVO ENABLE" button 

on the bottom right corner of the teachpendant. The SERVO ON lamp lights up when the servo is enabled. Then, press "PROGRAM START" button  , and the program will start running automatically.

6.8.1.4 Modifying Play Speed

The TEACH mode and PLAY mode use different speed values. After switching to PLAY mode, the speed can be modified to an appropriate level by following the instructions shown in Subsection 6.5.11.

6.8.2 Pause, Resume, and Stop

- Program Pause Operation
  In PLAY mode, if the program pause operation is executed, the program will pause at the current line, and the manipulator will slow down and stop.
- Emergency Stop Operation
  If the emergency stop operation is executed, the servo power will be turned OFF and the manipulator will stop immediately.
  There are two methods for executing emergency stop operation:
  1. Press "EMERGENCY STOP" button on the programming pendant.
  2. Use external emergency stop.

  After an emergency stop, first correct the cause of the alarm and then reset "EMERGENCY STOP" button. The alarm can then be reset by pressing the alarm reset button at the bottom left of the teach pendant screen. To restart the program press the green program start button.

NOTICE

After the emergency stop, the program call relations between the main program and the subprogram will be cleared.

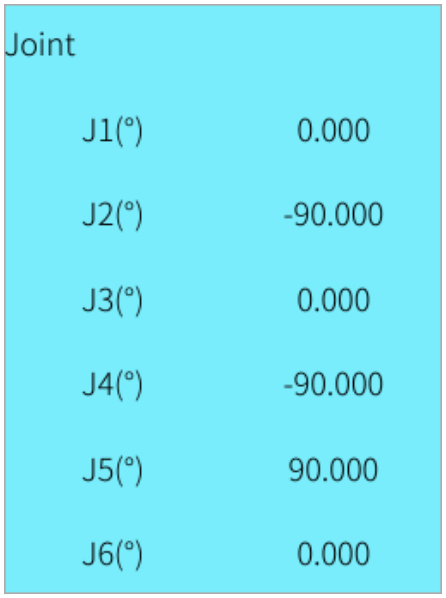
- Stop Caused by Alarm
  Except for program pause and emergency stop, when other system alarms occur during program runtime, the program execution will end, and the manipulator will stop immediately. The information log will display an alarm message and the alarm LED indicator will light up. For a description of error codes see Section 13.6
- Other Stops
  In addition to the above stop methods, there are two ways to stop the program:
  1. The mode switch is switched from PLAY mode to TEACH mode.
  2. The PAUSE instruction is executed in the program.

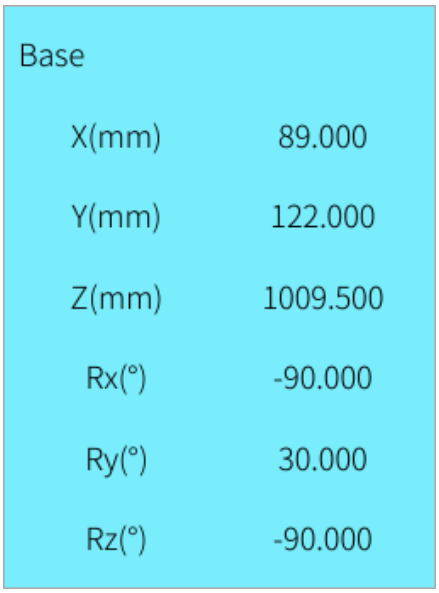
6.8.3 Monitoring

The monitoring options in the main menu area are mainly used to view the current working status of the manipulator and the variables of various data types. The system can monitor the following contents: coordinates, variables, IO (input and output), motor, reservation, operational monitoring, etc.

6.8.3.1 Position

The coordinate monitors are used to monitor coordinate data, including joint coordinates and base coordinates.





6.8.3.2 Input and output

The input and output monitor page includes: digital input, digital output, analog input, analog output, virtual input, and virtual output. Select the desired option to open the corresponding monitor page, as

shown in **Figure** 6-36 .

In the “TEACH” mode, select the output signal and click “Modify” at the bottom left to force the “0” of the output signal to be changed to “1”.

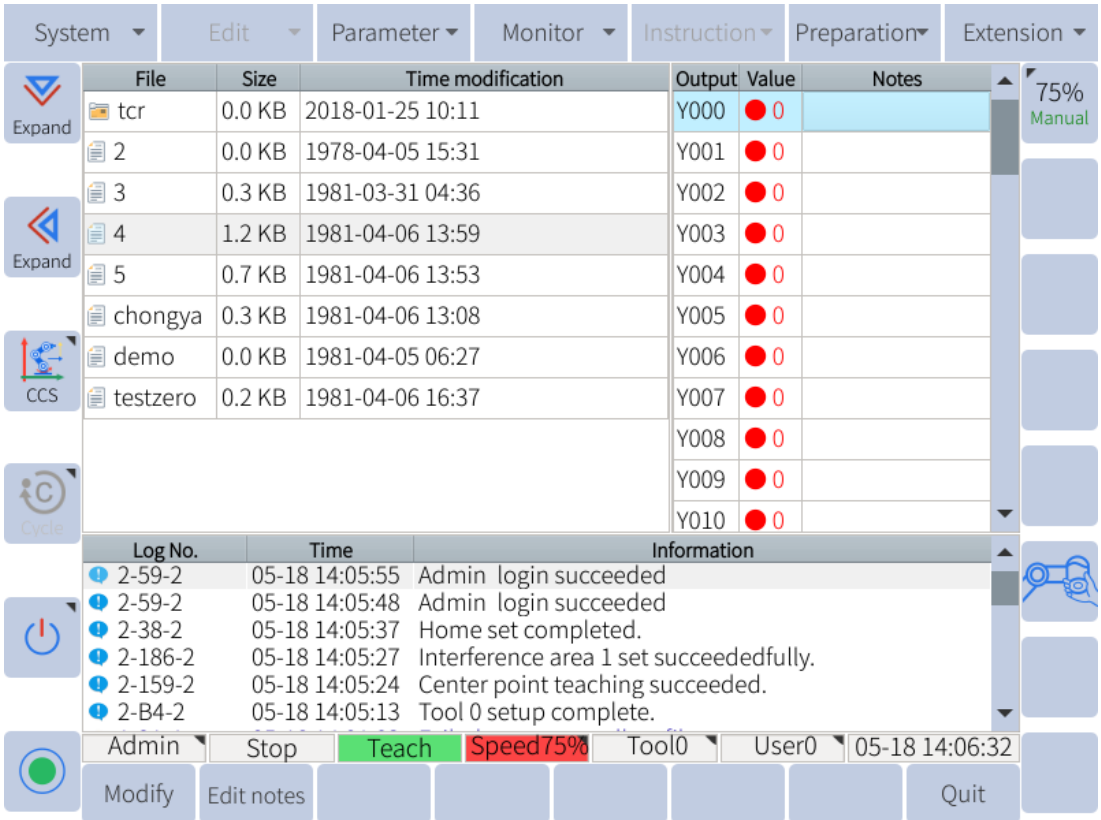


Figure 6-36 : I/O monitor pag

Each option parameter is shown in **Table** 6-3 :

Table 6-3 . Option parameter

Position	Type	Hardware Interface	Variable Address Range
Control cabinet	Digital input	X4~X19 has	X0~X63
	Digital output	Y0~Y19 has	Y0~Y63
	Virtual input	No	M0~M399
	Virtual output	No	M400~M799
	Analog input	Yes	AI001~AI002
	Analog output	Yes	AO001~AO004
Terminal	Digital input	Yes	X48~X51
	Digital output	Yes	Y48~Y51
	Virtual input	No	No
	Virtual output	No	No
	Analog input	Yes	AI003
	Analog output	Yes	AO005

The digital inputs and virtual inputs are read only.

Note that the digital outputs and the virtual outputs with red labels are used by the system, and their states cannot be modified.

6.8.3.3 Global variables

The content displayed in the global variable interface includes variable data of B, I, D, P and V. The variable parameters are shown in **Table** 6-4 :

Table 6-4 . Variable parameter

Variable	Types	Total Number	Power Retention	Visible	Value Input Range
B	int	0~255	Maintained	visible	[0,2147483647]
I	int	0~255	Maintained	visible	[-32767,32767]
D	double	0~255	Maintained	visible	[-1e+09,1e+09]
P	double array	0~255	Maintained	visible	each axis is [-360,360]
V	double array	0~255	Maintained	visible	xyz unlimited, rx,ry,rz are [-180,180]

To modify a variable navigate to **Monitor -> Global variable** and select the type of variable the user wishes to modify. Press “Modify” button in the submenu area assign a value to the variable using the pop-up box. Note that the values in the variable monitor page can only be modified in TEACH mode.

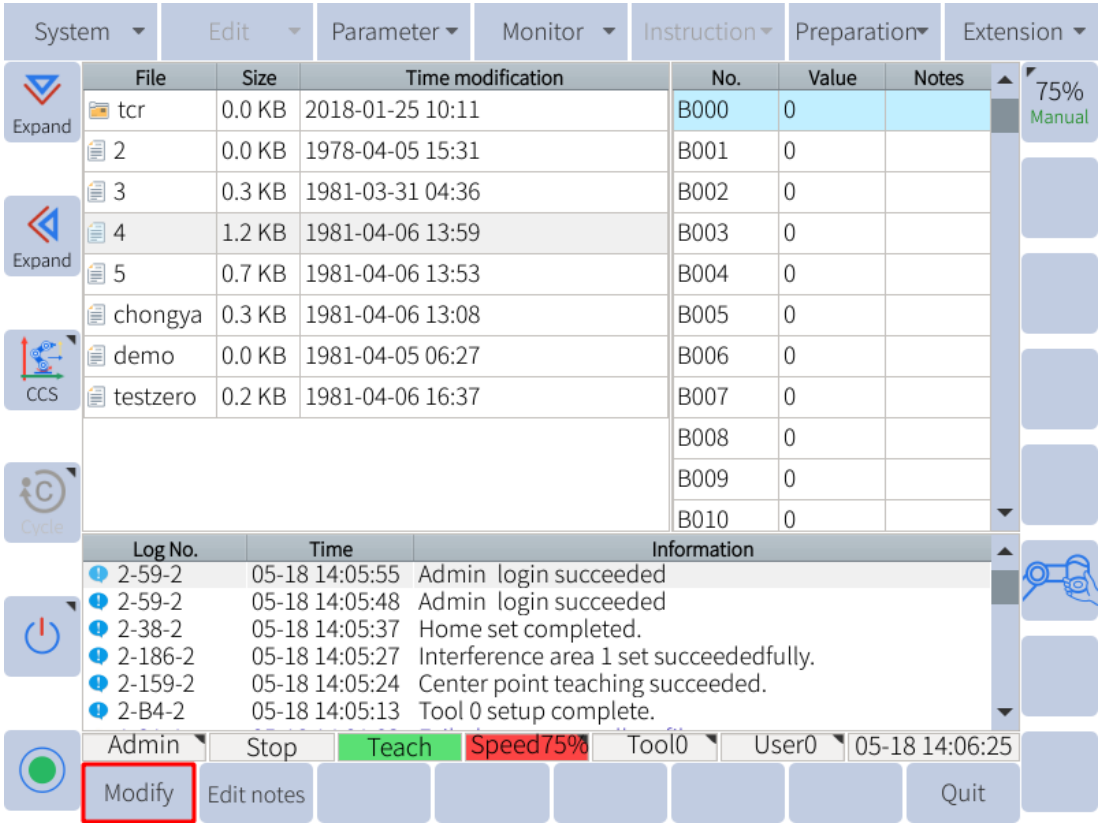


Figure 6-37 : Variable monitor page

The P variable is the position type variable. Select the desired P variable using the cursor in the variable monitor page. Press “Check” to view its value in the information prompt area.

Press “Modify” to record the current joint coordinates into the selected P variable.

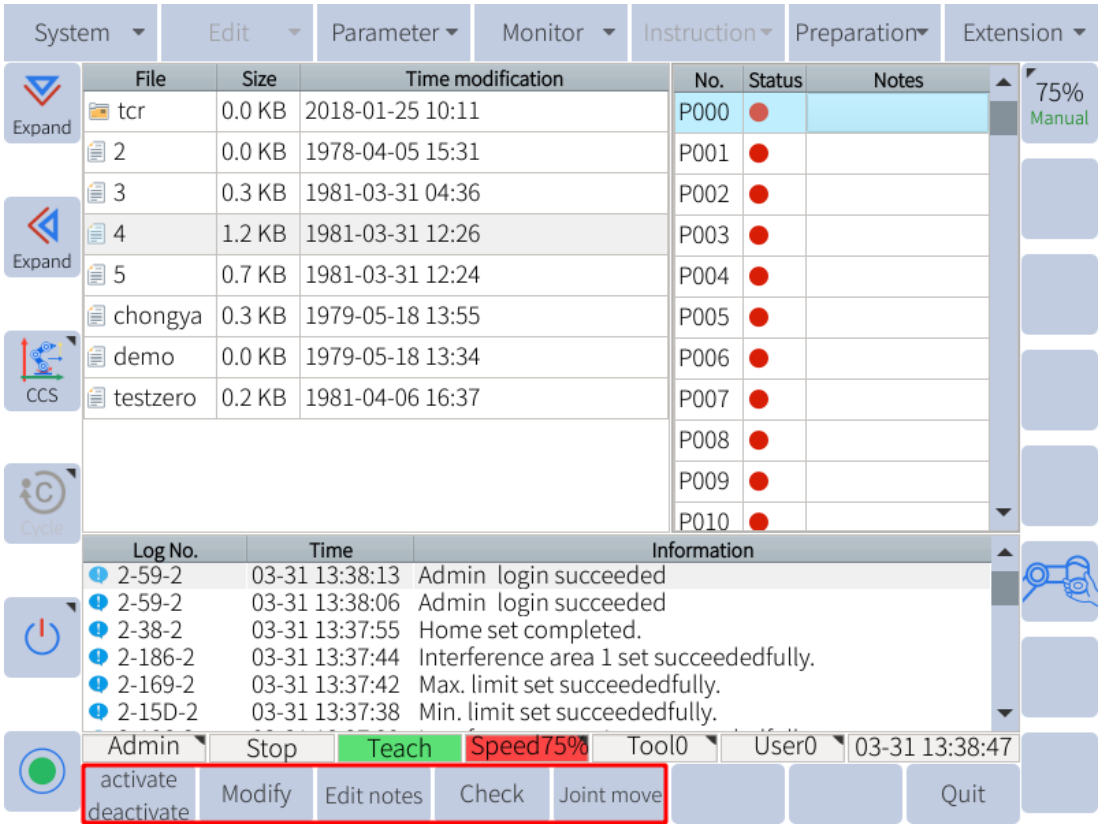


Figure 6-38 : P variable

6.8.3.4 Motor data

The motor options include four options: raw pulse, motor speed, runtime pulse and motor torque. The raw pulse monitor page displays three items: the sending pulse counting, the feedback pulse counting and the difference.

For pulse motors, if there is a movement position deviation, you can monitor the changes of various values on this interface to find out the cause. This monitor option is hardly used by the general users.

Joint	Tx	Rx	Diff.
J1	0	0	0
J2	0	0	0
J3	0	0	0
J4	0	0	0
J5	0	0	0
J6	0	0	0

Figure 6-39 : Raw pulse monitor page

In the motor speed monitor page, the real-time rotational speed of each axis can be viewed according to the actual requirements.

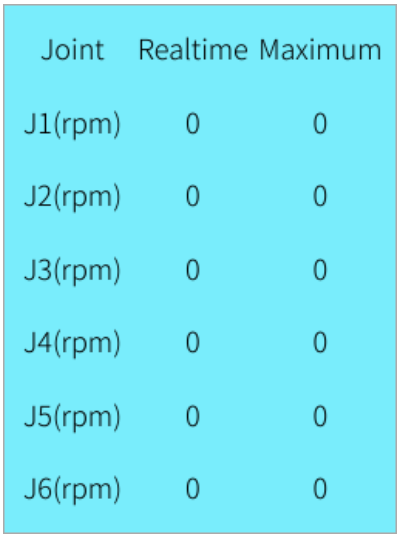


Figure 6-40 : Speed monitor page

In the runtime pulse monitor page, the pulse counting at the current position for the motor of each axis can be viewed according to the requirements.

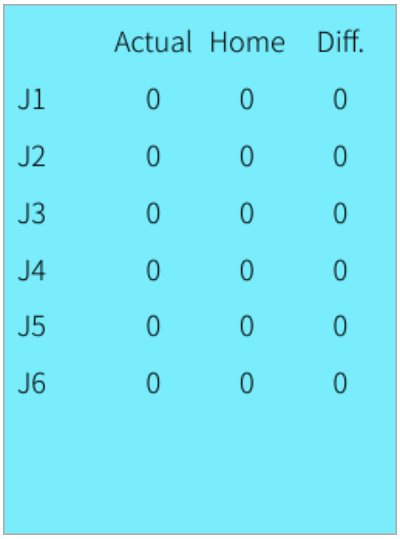


Figure 6-41 : Runtime pulse monitor page

The motor torque monitoring interface reflects the ratio per thousand of the rated torque, the unit is ‰.

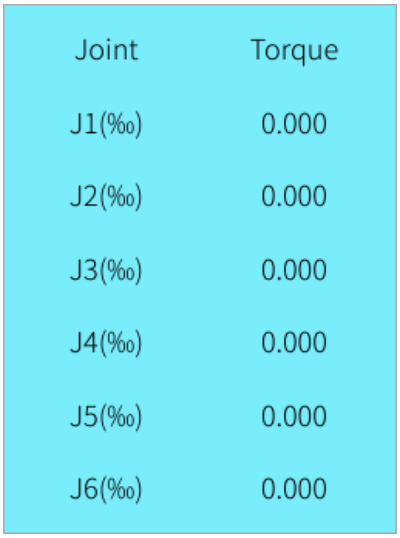


Figure 6-42 : Motor torque monitoring monitoring interface

6.8.3.5 Runtime position

In the runtime position page, the coordinate values of the current position and the coordinate values of the target positin can be viewed. The joint coordinates are displayed by default, which can be switched to the Base coordinates by pressing “Joint/Base” button in the submenu area. In the program editing window, use the cursor to select the desired move instruction, and the coordinate values of the target point corresponding to the instruction will be displayed in the operational monitor page.

6.9 Saving to USB

Insert a USB device in the USB port of the controller

The **System -> Save to USB** option includes:

- **Parameter**
  Backup all parameter settings, including speed parameters, system parameters, limit parameters, servo parameters, mechanism parameters, and other parameters.
- **IO notes**
  Backup comment files for input, output, virtual input and virtual output.
- **PLC**
  Backup system PLC program files.
- **User data**
  Include parameter backup, IO annotation backup, and PLC backup. In addition, backup all program files, user coordinates files, tool coordinates files, user processes files and screenshots, etc.
- **Script backup / delete**
  Backup lua scripts

- **Filedbus configuration**
  Backup Modbus function configuration file.
- **Log backup**
  Backup system information Log
- **Identification file backup/delete**
  backup or delete dynamics identification file.
- **Migration**
  backup user data, zero data and lap information, variable data, etc.

When performing “Save to USB” operation, if there is no folder called ”rbctrl” in the root directory of the USB flash disk, the system will automatically generate the folder and save the backup file in it. If the folder exists in the root directory, the backup file will be saved in it directly.

6.10 Load from USB

The **System > Load from USB** option includes parameter upgrade, IO annotation upgrade, PLC upgrade, user data recovery, script upgrade, and identification file import, migration recovery.

When performing “Load from USB” operation, a folder named “rbctrl” must exist in the root directory of the USB drive. Select **System > Load from USB** and click on the type of data the user wants to import. Selecting ”User data update” will import the following:

1. Parameter
2. IO notes
3. PLC
4. Program
5. User coordinates files
6. Tool coordinates files
7. User processes files
8. Screenshots
9. Migration

CAUTION



Encryption operations can be performed when importing .jbi and .lua files, but the operation is irreversible.

DANGER

Do not move the robot during the ”migration backup” and ”migration recovery” process.

6.11 Advanced Setup

6.11.1 End Effector Button Configuration

There are blue and green LED buttons on either side of the end effector, or the user has an external button, and every button has three functional states: Drag, Record, and Disable. The user can click **Extension -> Flange IO -> Button setting** to set the function.

The function status of every button can be set independently without affecting each other. For example: All buttons can be defined as “drag”, as shown in **Figure** 6-43 .

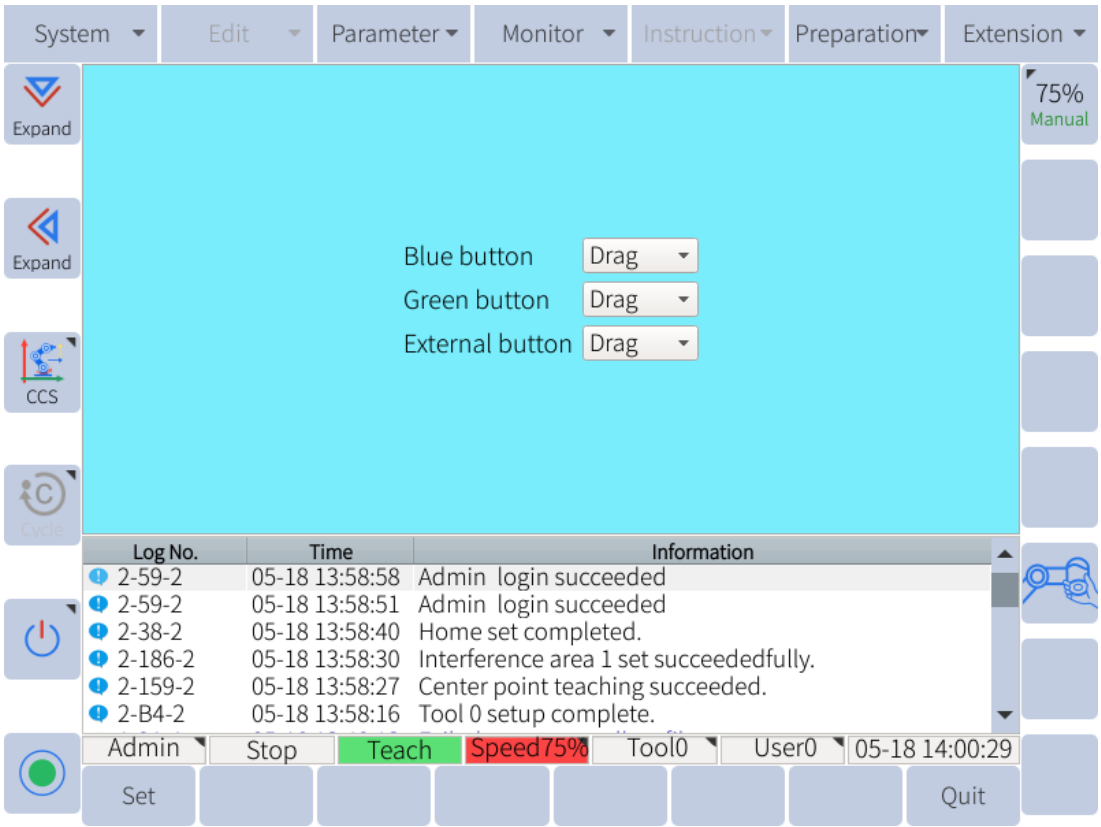


Figure 6-43 : Button Configuration

6.11.2 Recording

6.11.2.1 Record Track

Users may prefer to hand guide the robot along a complicated trajectory for a continuous path. Users may record a path for playback in their program.

The operation steps are as follows:

1. Click **Preparation -> Hand drag** to enter the drag teaching interface, as shown in **Figure** 6-44 .

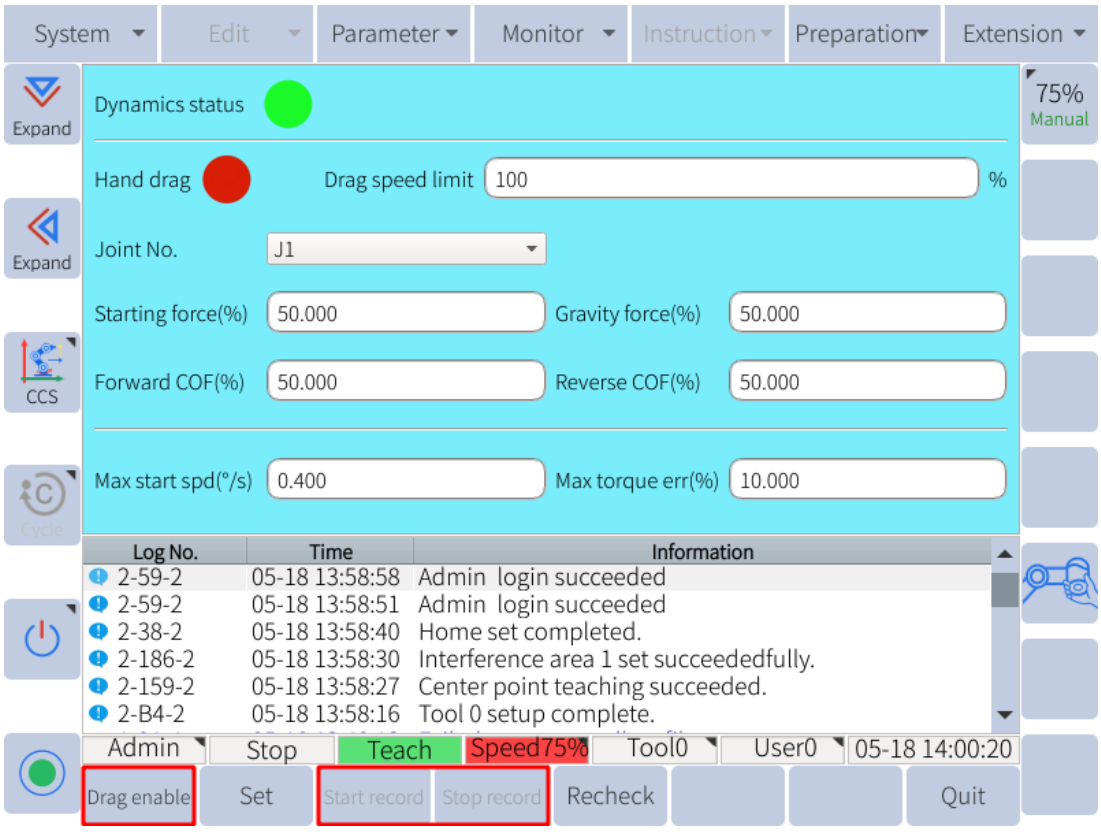


Figure 6-44 : Drag and teach

2. Enable Dragging:
   (a). Click “Enable drag” at the bottom left (the drag enable status light will turn green)
   (b). Press and hold the button configured as ”drag” to enable the drag mode.
3. Click “Start recording” to start drag recording, which can record up to 20 minutes.
4. After dragging is finished, click “Stop recording” or release the drag enable button.
5. Enter a file name and click “OK”.
   Note: This file cannot be opened. You can use the “MOVDRAG” JBI command into a program to reproduce the drag track.

When the force control status is green, the user can perform normal dragging, collision detection and use the safety restriction function. When the force control status is red, the above functions are not

available.

NOTICE

1. After normal automatic identification, the power control status is green.
2. After the installation method is changed, the force control status will turn red and need to click “Reclick” to be re-identified.
3. When the robot body changes, the user needs to change the force control status to red.

6.11.2.2 Record Waypoints

Users can quickly switch to force control mode and record points through the buttons located on the end effector. The file created using this method can be called from another program using the CALL instruction, or it can be run as a stand alone program.

The specific steps for recording a set of waypoints are as follows:

1. Select **Extension -> Flange IO -> Drag setting**, as shown in **Figure** 6-45

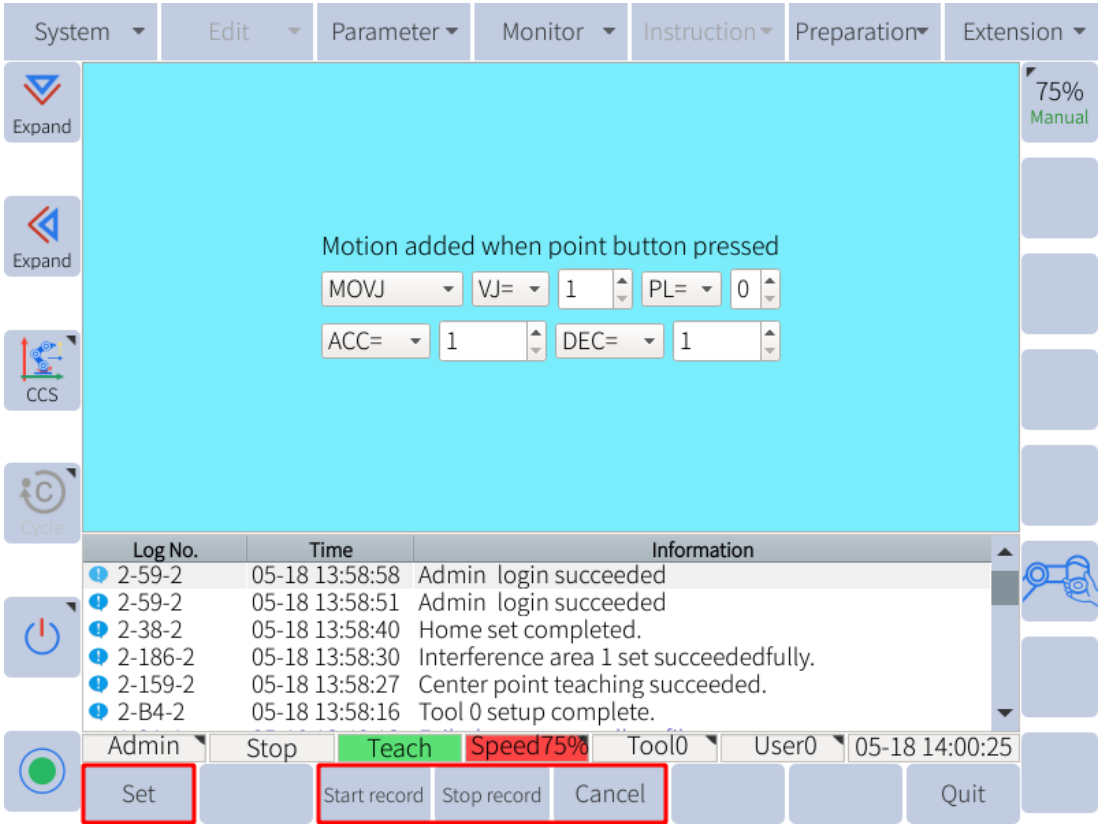


Figure 6-45 : Drag to mark

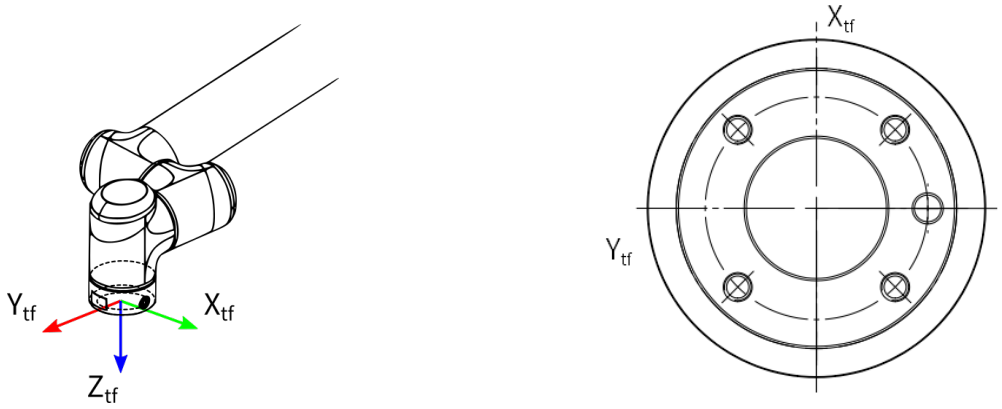
2. Set the parameters on the screen to the desired settings for all recorded moves
3. Click “Record start”, press and hold the “Drag” button of the end IO, and drag the robot to the desired position

4. Click the “Record” button of the end IO, the system will prompt “Current record points”
5. Repeat steps 2 and 3 to record other points
6. After finishing the point recording, click “Record stop”
7. Enter the file name and click “OK”

6.11.3 Tool Setup

To ensure that the manipulator can perform motion type operations such as linear and circular motion type correctly, accurate dimensional information on tools must be registered and the position of the Tool Center Point (TCP) must be defined. The tool coordinates are measured from the origin of the tool flange to the location of the TCP. They are recorded with respect to the tool flange coordinate frame.

The tool flange frame and its orientation relative to the tool flange is show in below(the positioning pin hole is in the negative direction of the Y axis).



6.11.3.1 Manual Setup

There are 8 tool coordinates numbered from 0 to 7 that can be set in the system. Go to the page of **Preparation -> Tool config**, and select the tool coordinate number. The TCP can be calculated by inputting the tool coordinate values (the position of TCP and the tool frame orientation) in the flange coordinates. Click “Save” in the submenu bar, and the message prompt bar will prompt “The tool coordinate is successfully set!”, as shown in **Figure** 6-46

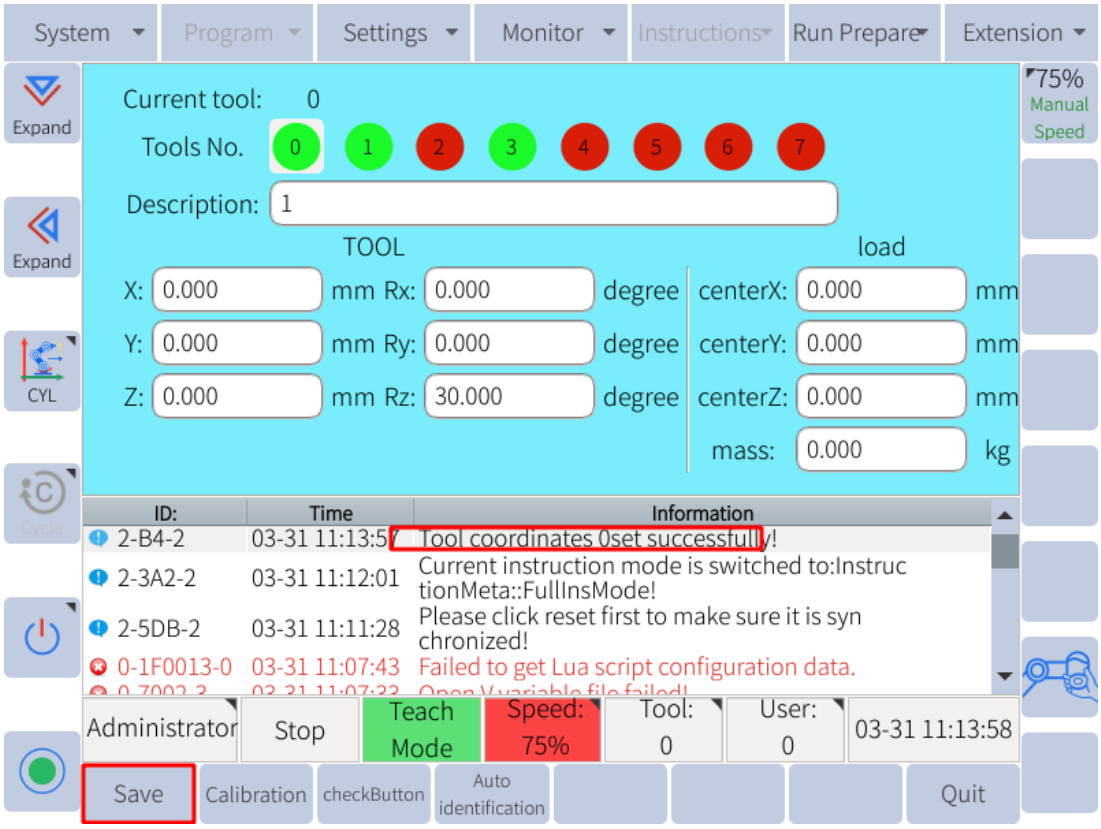


Figure 6-46 : Setting coordinate successfully

Three cases are given as examples for registering the coordinate data:

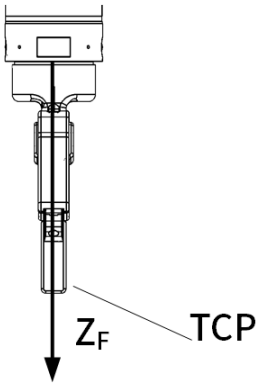


Figure 6-47 : Tool A

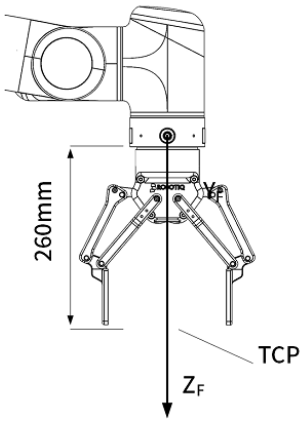


Figure 6-48 : Tool B

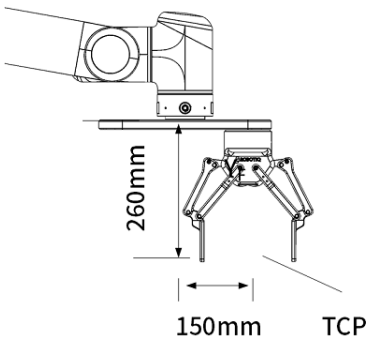


Figure 6-49 : Tool C

- Cases of Tool A, B:
  X, Y, Rx, Ry, Rz are 0, and Z is 260.
- Cases of Tool C:
  X, Rx, Ry, Rz are 0, Y is 150, and Z is 260.

6.11.3.2 TCP Estimation - 7 Point Calibration

If the user does not know the exact offsets of the TCP, they can perform a TCP estimation procedure using seven distinct points. In order to perform the seven-point tool calibration, seven points with different postures must be taught with the TCP as the reference point. The tool dimensions are automatically calculated using these seven points.

1. In the page of tool coordinates, press “Calibration” in the submenu area to open the seven-point tool calibration window.
2. Record seven points numbered from P1 to P7 according to the schematic diagram. The postures of the four points P1-P4 are as different as possible; when teaching P5, the desired z axis of the tool must be kept in a straight line with the calibration device; The vector between P5 and P6 is used to determine the direction of tool X coordinate, and vector between P5 and P7 is used to determine the direction of tool coordinate Z. When teaching, P7 can move a certain distance in the direction of tool coordinate Z based on P6.
3. First select the target point in the window, then press “Save” to record the current position of the manipulator. After that, the color corresponding to the point will change from red to green.
4. Record the seven points respectively. After selecting the taught point, “Running point” button can be pressed to move the manipulator to the point, and “Clear point” button can be used to clear the point data.
5. After teaching all points, press “Calculation” to generate the desired tool coordinate.

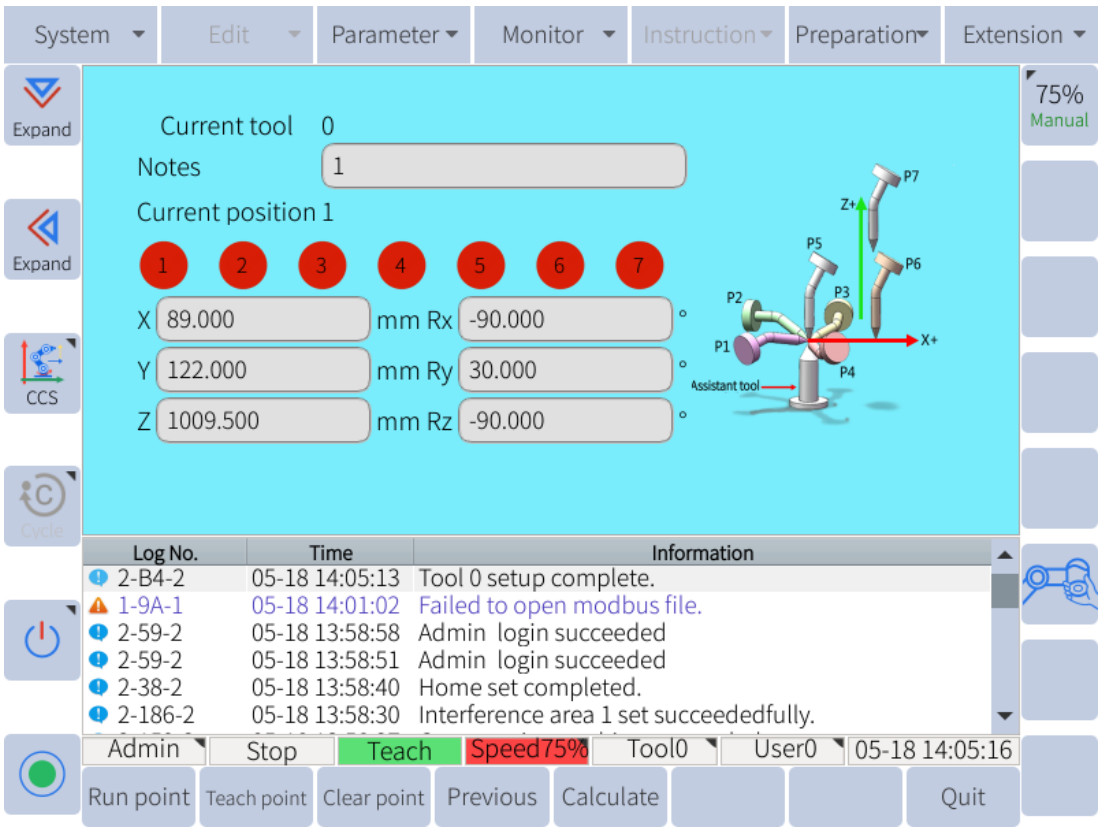


Figure 6-50 : Seven-point tool calibration

6.11.4 Set load parameters

When the robot end is equipped with a load, and the drag operation is required, the load parameters need to be set first.

If the mass of the center of mass of the load is known, the user can click “Preparation -> Tool coordinate”, directly input the center of mass and mass on the tool interface, and click “Save” to complete the setting of the load parameters.

If the mass of the mass center of the load is unknown, the load identification needs to be carried out. The specific steps are as follows:

1. Confirm that the robot is not equipped with a load, and click “Preparation -> Tool config” to ensure that the load parameter is 0.
2. Set the loop mode to “single loop”.
3. Turns the key to PLAY mode and turns the servo on.
4. Long press the window switch key  , click “Script reload”, and wait for three minutes.
5. Assemble the load, repeat the previous step again.
6. Turn the key to teach mode, click ”Preparation > Tool config” to enter the tool setting interface.
7. Click ”Auto identification”, click “OK” on the pop-up page, wait patiently for 2 minutes, and the system will calculate the center of mass and mass corresponding to the load and display it.
8. Click “Save” to drag the robot.
   Note: There will be a certain error between the calculated value and the actual value, please pay attention to safety when dragging the robot.

6.11.5 User Coordinate System

The user coordinate settings allow easy teaching and programming in various situations, as shown in **Figure** 6-51 . When multiple positioners are used, manual operation can be simplified by setting the user coordinates for each fixture.

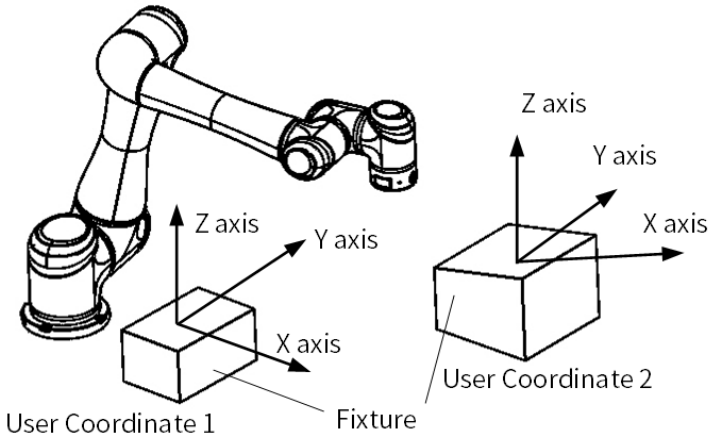


Figure 6-51 : Setting user coordinates for fixture

As shown in **Figure** 6-52 , User coordinates are defined by three points that have been taught to the manipulator through axis operations. These three defining points are RORG, RXX, and RXY. These three points of positional data are registered in a user coordinate file.

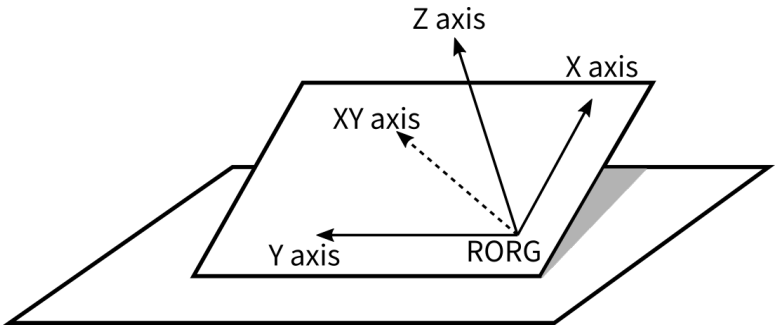


Figure 6-52 : Three defining points

A user coordinate is defined as follows: RORG is the origin of the coordinate system, and RXX is a point on the X-axis. RXY is a point on the XY plane of the user coordinate. The directions of Y and Z axes are determined by point RXY. Note that it is important that the two points RORG and RXX be taught accurately.

The setting steps are:

1. Choose **Preparation -> User config** to open the user coordinate setting page.
2. First select the user coordinate number to be set.
3. Select the point “RORG” on the interface with the cursor, and teach the required point.
4. Click “Record” in the submenu bar to complete the recording of the point (the point where the recorded position will change from red to green).
5. Complete the recording of RXX and RXY points in sequence.
6. Click “Calculation” to generate the corresponding user coordinates.

When holding the Enable switch, “RUN RORG”, “RUN RXX” and “RUN RXY” in the submenu area can be used to move the manipulator to the each point used to create a new frame for verification.

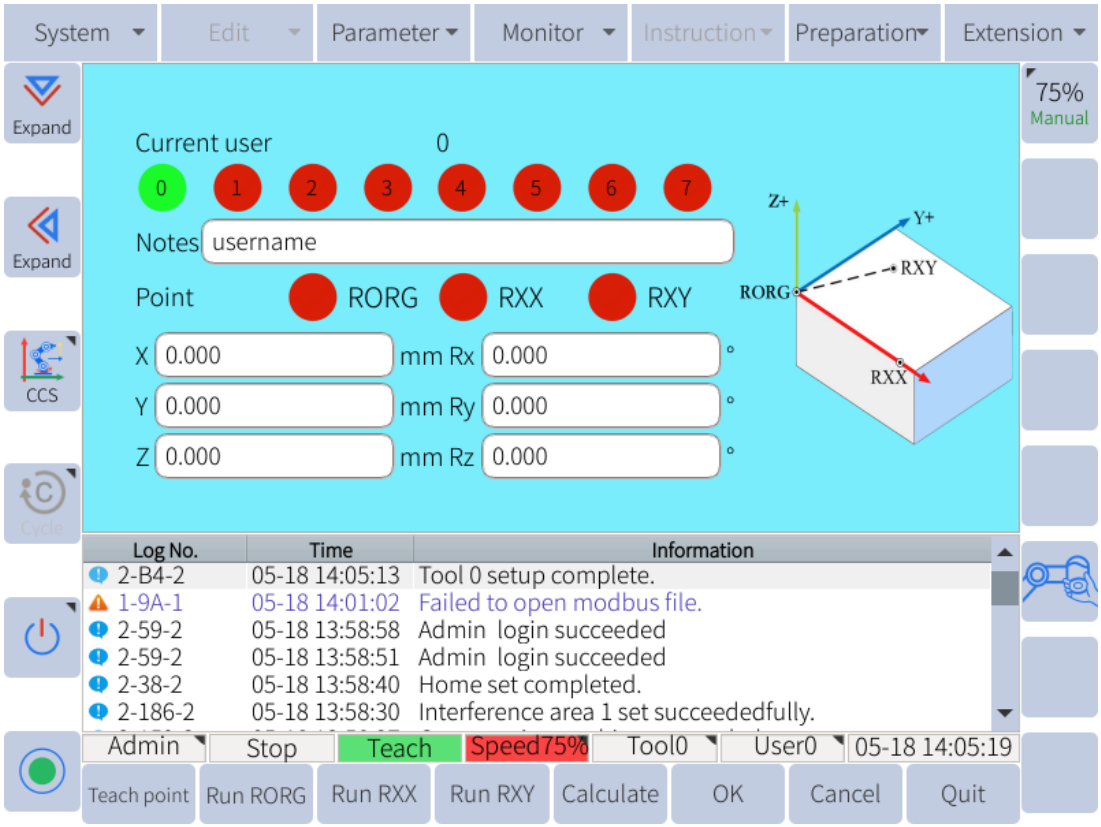


Figure 6-53 : User coordinate setting interface

6.11.6 Interference Zones

The interference area is a function that prevents interference between multiple manipulators or the manipulator and a peripheral device. There are 16 total interference zones that can be configured. There are two types of interference areas:

- cubic interference area
- joint interference area

The output signals of the interference area 1 to 16 are corresponding to the virtual outputs M440 to M455 respectively. If the TCP moves into a designated area, or a joint enters a certain range, the signal will go HIGH. Once it leaves the interfence zone the signal will return to LOW. If the signal needs to be output to the external device, the corresponding virtual output should be mapped to the actual output Y by modifying the PLC program (see Chapter 10).

6.11.6.1 Cubic Interference Zones

This area is a rectangular prism relative to the base coordinate (Base coordinate) system. The software determines whether the TCP of the manipulator is inside or outside this area, and outputs this status as a signal. (ON: inside, OFF: outside)

There are two ways to set cubic interference areas:

- Cube - Corner to corner
  1. Select **Preparation -> User config**
  2. Set “Type” to “Cube” and “Mode” to “Vertex”
  3. Choose “Vertex1”, move the robot to the position of vertex 1 of the cube and click “Position 1” in the submenu
  4. Choose “Vertex2”, move the robot to the position of vertex 2 of the cube and click “Position 2” in the submenu
  5. Click ”Save” in the submenu bar, and the target cubic interference area will be set

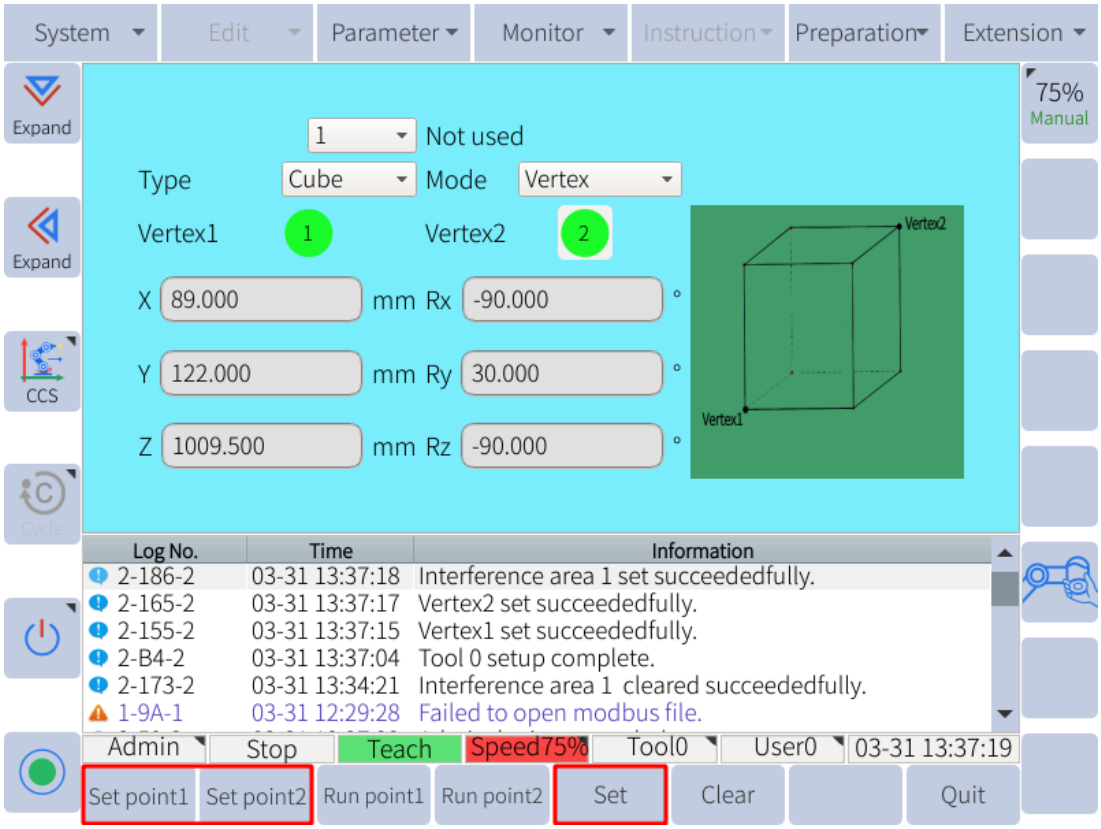


Figure 6-54 : Teaching corner

- Cube - Center with Dimensions (length, width, height)
  1. Select **Preparation -> User config**
  2. Set “Type” to “Cube” and “Mode” to “Center”.
  3. Choose “Center point”, Move the manipulator to the center point of the cube and click “Position 1” in the submenu
  4. Enter the length, width, and height of the cube
  5. Click ”Save” in the submenu bar, and the target cubic interference area will be set

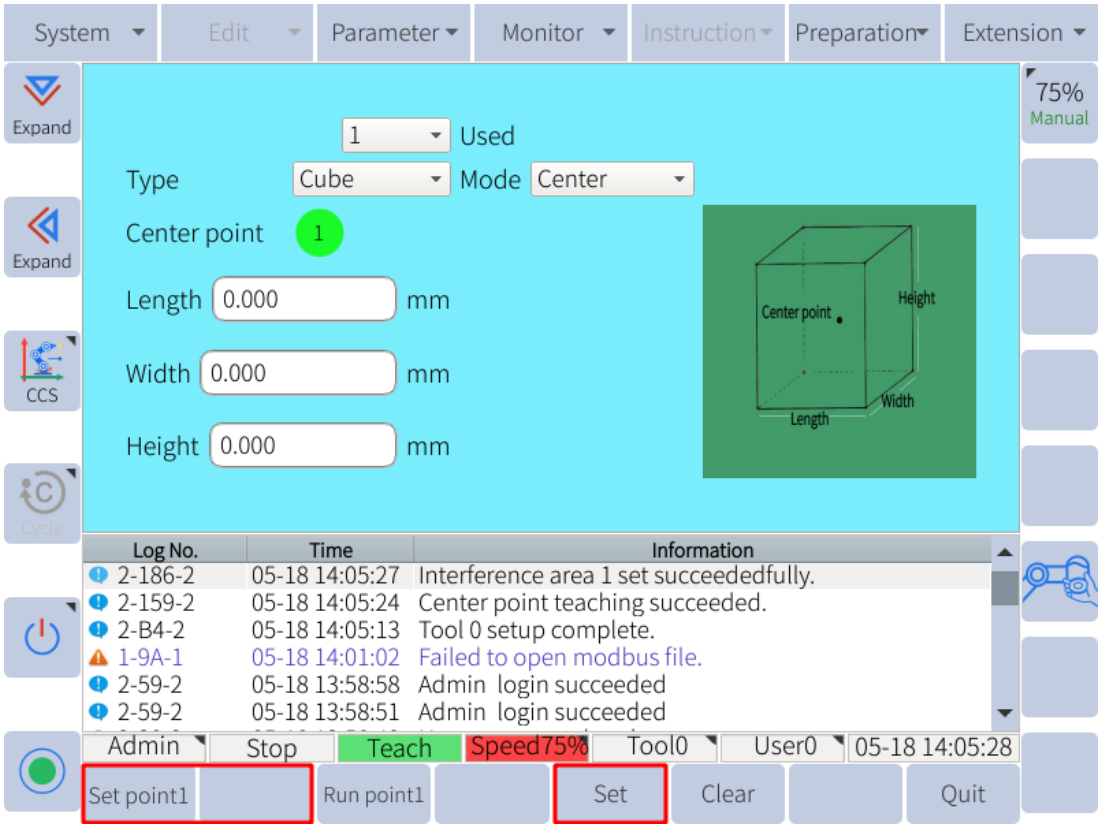


Figure 6-55 : Number Input of the Side of Cube and Teaching Center

6.11.6.2 Joint Interference Zones

The axis interference area is a function that determines whether the current position of each axis lies within a specified range. Once the maximum and minimum joint angles have been set for a specific joint (axis), a signal indicating whether the current position of the joint is inside or outside this range is output. (ON: inside, OFF: outside)

1. Select **Preparation -> User coordinate**
2. Set “Type” to “Joint”.
3. Select the desired axis number.
4. Select ”Min”, move the joint to the minimum joint angle and click ”Set point 1”.
5. Select ”Max”, move the joint to the maximum joint angle and click ”Set point 2”.
6. Record the points be pressing “Set” in the submenu area, as shown in **Figure** 6-56 .

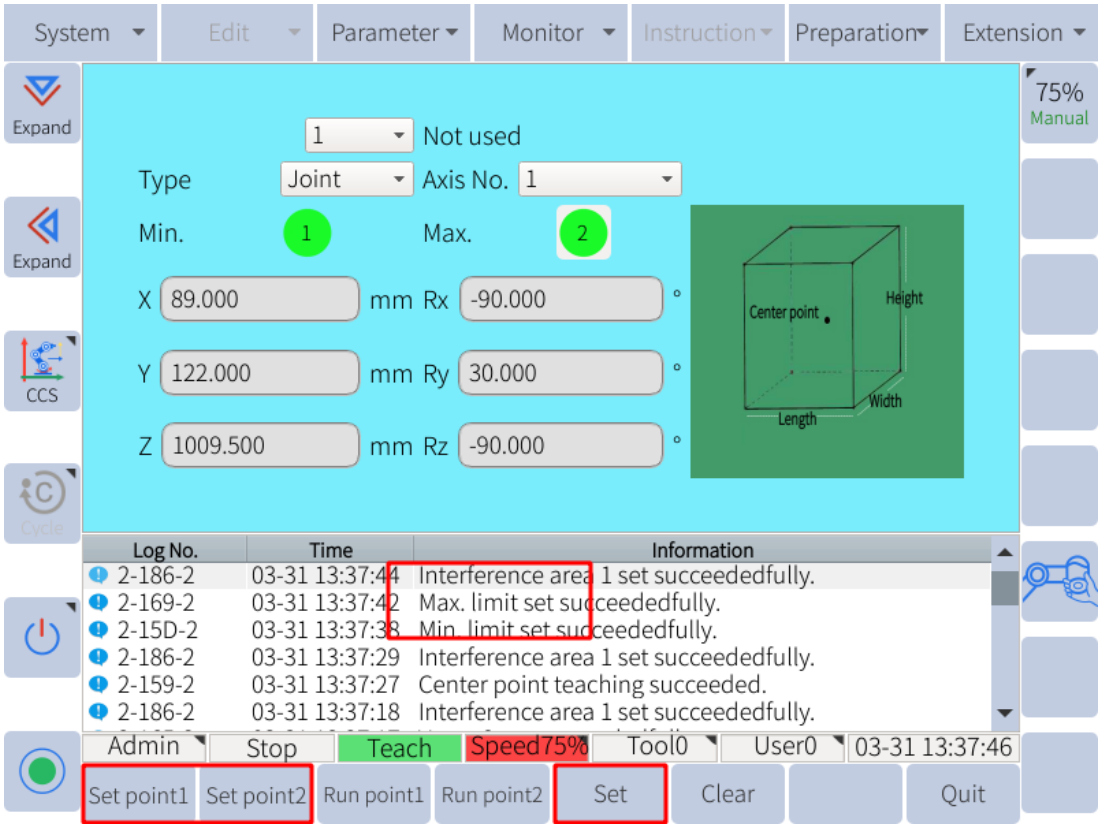


Figure 6-56 : Axis interference area

6.12 Mechanical Home

The Mechanical Home position represents the zero positions of each of the manipulator's joints. To manually change the zero position of the joints navigate to **Preparation -> Home position -> Mechanical home**. Although the mechanical home position is calibrated prior to shipment from the factory, the following cases may require the calibration to be performed again.

- Change in the combination of the manipulator and cabinet.
- Replacement of the motor or absolute encoder.
- Mechanical home position deviation caused by collision.

NOTICE

Changing the mechanical home position will change the zero positions of the joints. Do not attempt unless the process and purpose of changing the mechanical home position is fully understood.

After each axis is adjusted to the zero position manually, the manipulator record its posture for the home position by pressing the "Record" button for each axis in the mechanical home position page. The zero position can also be directly modified by changing the pulse counts of the mechanical home position, as shown in **Figure** 6-57 .

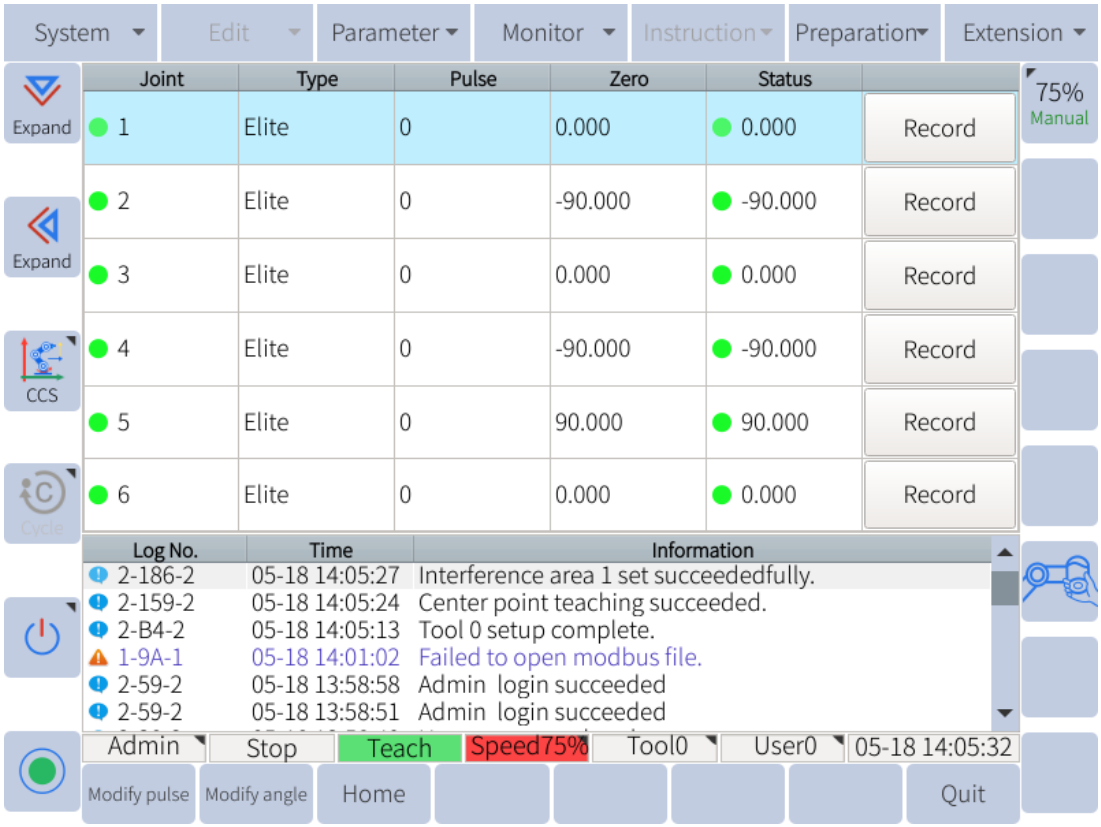


Figure 6-57 : Mechanical home position page

To modify the pulse count, click on the axis the user wishes to change and click ”modify” in the submenu. Enter the desired pulse count ($2.583\ \mathrm{deg}/10000$ counts) and click return. A popup will ask the user to confirm the change.

To move the robot arm to the current mechanical home position, press and hold the servo switch on the back of the teachpendant and click on ”Home”.

6.12.1 Zero Calibration

The zero calibration of the manipulator body and the accuracy of TCP can be calibrated by using the home position calibration function.

CAUTION



Do not re-calibrate the robot unless the calibration process is well understood and the user has consulted with ELITE Robot technical support engineers

While performing this calibration, use a sturdy mounting surface with little to no deflection, and attach a long pointed tool to the end effector. The operation procedures are described as follows:

1. Create a program with 20 positions. These positions must all be distinct from one another. This

is done by placing the tip of the TCP on a fixed point and recording the position of the TCP. Lift the TCP move the robot to a different pose and place the TCP back on the exact same point and record the position of the TCP again. Repeat this process until the program has 20 distinct poses where to TCP of each pose is located at the exact same position for each pose. For a simplified means of recording multiple waypoints into a single progam refer to Subsection 6.11.2.2.

2. Go to **Preparation -> Home Position -> Zero Calibration**, as shown in **Figure** 6-58 .

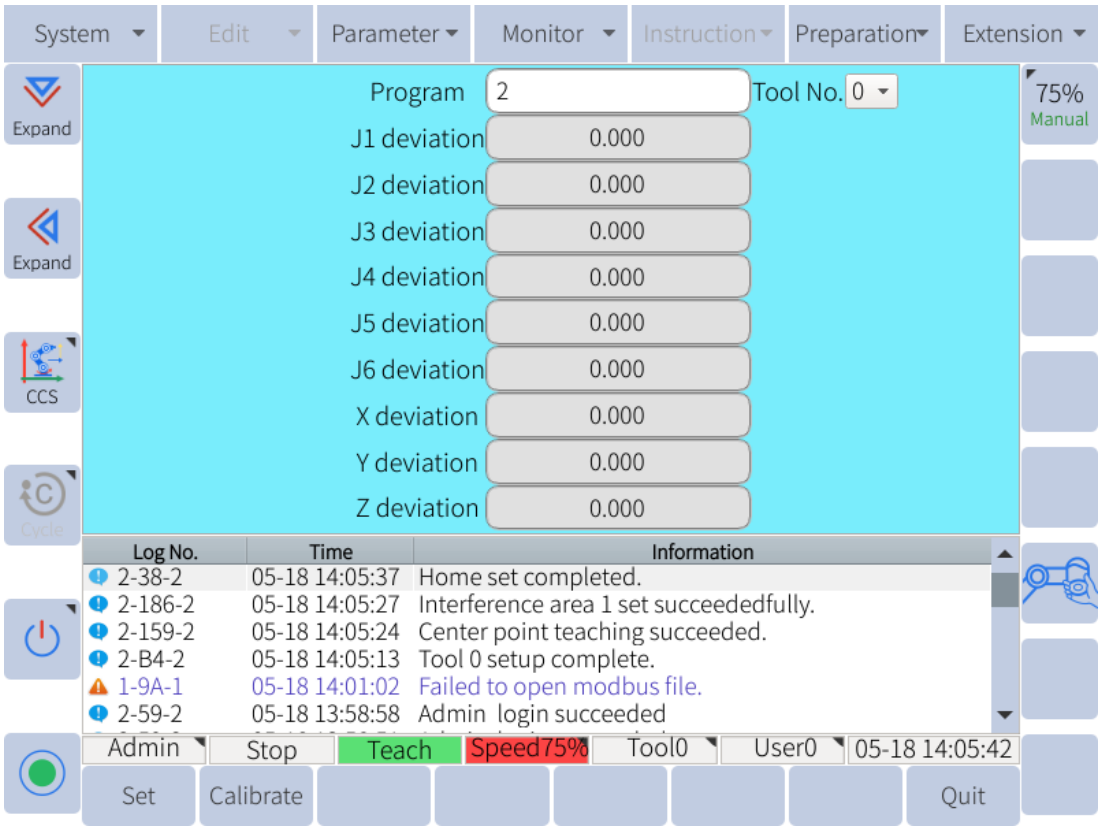


Figure 6-58 : Home position calibration

3. Select the program that was just created
4. Set the tool number to the TCP that was used for recording the 20 waypoints
5. Press “Save” button, and if the calibration data is valid, the information prompt area will display the following message:”The mechanical home position is calibrated successfully!”
6. Press “Calibrate” button
7. Go back to **Preparation -> Home Position -> Mechanical Home**
8. Hold the servo enable switch, and press “Home” to move the manipulator back to the mechanical home position
9. Then press “Record” to record the home position for each axis respectively

NOTICE

If the TCP is not set correctly or the incorrect calibration file was used when the user clicks ”calibrate”, the same calibration file cannot be used again. A new calibration file must be created, becase the old calibration file was made relative to the old mechanical home position.

6.13 Program Home

The program home position is the starting position for programs. It can prevent interference with peripheral devices by ensuring that the manipulator starts from a known position.

Move the robot to the desired program home position. Navigate to **Preparation -> Home position -> Program home**, press the “Save” button to set the current position of the manipulator as the program home position.

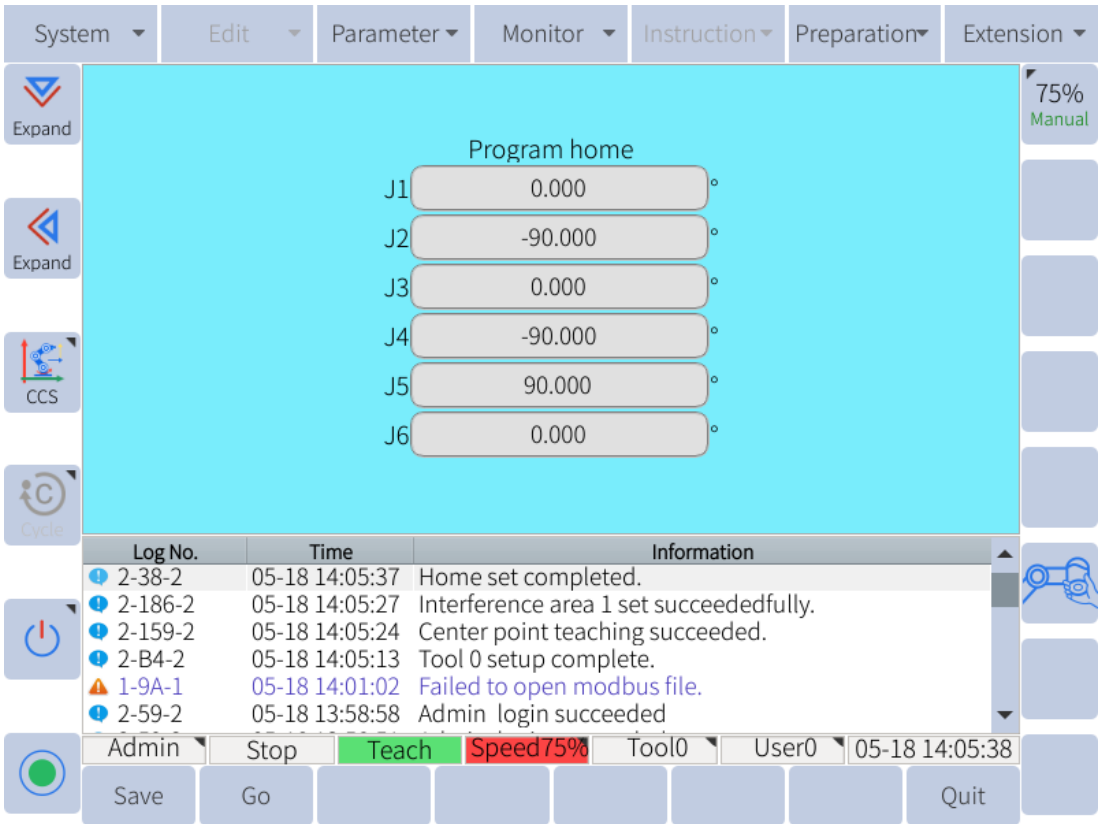


Figure 6-59 : Program home position page

When the manipulator is located at the program home position, the value of the virtual output M401 is 1, and the special output signal “Home” is valid. The program home position can be set and used according to the requirements of the production line.

6.14 Reservation start

Reservation start refers to the function of starting the program on each tool in the order of reservation through the start button on each tool.

For example, in the case where three toolings handle different workpieces, the user should do the following preparations in advance:

On Tooling 1, edit Program 1 of Tooling 1.

On Tooling 2, edit Program 2 of Tooling 2.

On Tooling 3, edit Program 3 of Tooling 3.

When running, switch to ”remote” mode, after preparing workpiece 1, press the start button on tooling 1, and the robot executes program 1. When executing program 1, prepare workpiece 2 and workpiece 3, and then press the start buttons on tooling 2 and tooling 3 in turn. At this time, even if the program 1 is still running, because the start button is pressed, the program 2 and the program 3 are also scheduled for work in order, and the programs will be executed sequentially in the reserved order.

CAUTION



1. There cannot be a ”RET” command at the end of each reservation program, otherwise the next reservation program cannot be performed.
2. Before the reservation function can be used, it must be ensured that each program can function properly. The
3. system can make reservations for up to 8 toolings.

6.14.1 Set reservation start valid

1. Click “Extension > Reservation” to enter the reservation start interface.
2. Select the reservation file to be set, and then click the “Select/Cancel” button in the lower right corner to set the reservation file.
   At this time, the circle in front of the corresponding reservation file turns green, indicating that the reservation has been opened.
3. Connect corresponding input and output signals to each tool. Each tooling usually has a “start” button, a “run” indicator, and a “pause” button.
   - “Start” button: one for each tool. The corresponding auxiliary relays are M8-M15 (corresponding to 8 stations), the factory default PLC program, X1 has been set to correspond to scheduled start 1, and X2 to correspond to scheduled start 2.
   - “Run” indicator: one for each tool. The corresponding auxiliary relays are M408-M415 (corresponding to 8 stations), the factory default PLC program, Y1 corresponds to the reservation 1 running command light, and Y2 corresponds to the reservation 2 running indicator. When the corresponding tooling is successfully reserved, the running indicator

will flash; when the tooling program is being executed, the running indicator will remain valid.

- "Pause" button: one for each tool, and finally each tool is used in parallel. The corresponding auxiliary relay is M4, and the factory default PLC program has corresponded to EXT-HD and X5.

4. switches to "remote" mode and the servo is automatically turned on.
5. Long press (not less than 2 seconds) the start button of the installed workpiece tooling, and the robot will run the program corresponding to the tooling.

CAUTION



1. After setting the reservation function to be valid, the reservation function can only be executed in the "remote" mode.
2. When the program is running, the start button indicator light of the tooling is on. The necessary preparation of the workpiece on the tooling should be done before pressing the start button.
3. During the program running of a certain tooling, press the start button of other tooling programs (hold for 2 seconds), the corresponding program is reserved and enter the startup waiting state, at this time the tooling running indicator is flashing. The programs are reserved in the chronological order of the tooling button presses, and then executed in the reserved order.
4. For the tool that is running the program, the job reservation cannot be made even if the start button is pressed.

6.14.2 Clear Appointment Status

CAUTION



A running program cannot clear its reservation status.

If you want to cancel the reservation of a certain tooling, you need to press and hold the start button on the tooling again for more than 2 seconds, the reservation status will be canceled, and the corresponding running indicator will turn off.

Chapter 7 System I/O

7.1 Overview

This chapter describes all electrical interfaces of the collaborative robot. Examples are given for most types of I/O. The term “I/O” refers to both digital and analog control signals.

- Controller I/O
- Tool I/O
- Serial Communication
- Ethernet

The digital I/O’s, analog I/O’s, and all safety I/O’s of the controller are shown in **Figure** 7-1

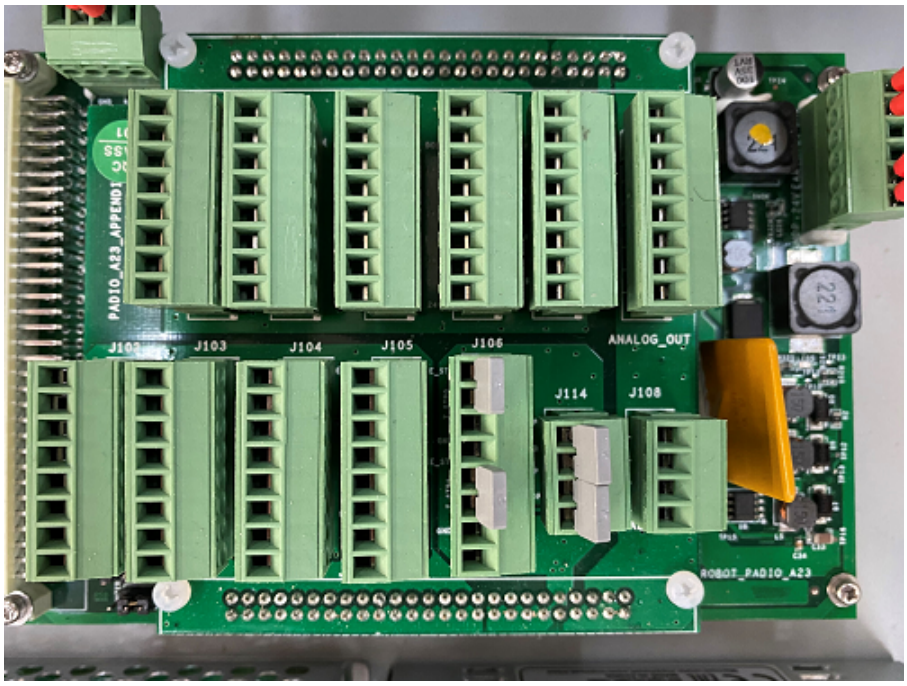


Figure 7-1 : The controller I/O interface

A schematic of the controller I/O interface is shown in **Figure** 7-2 .

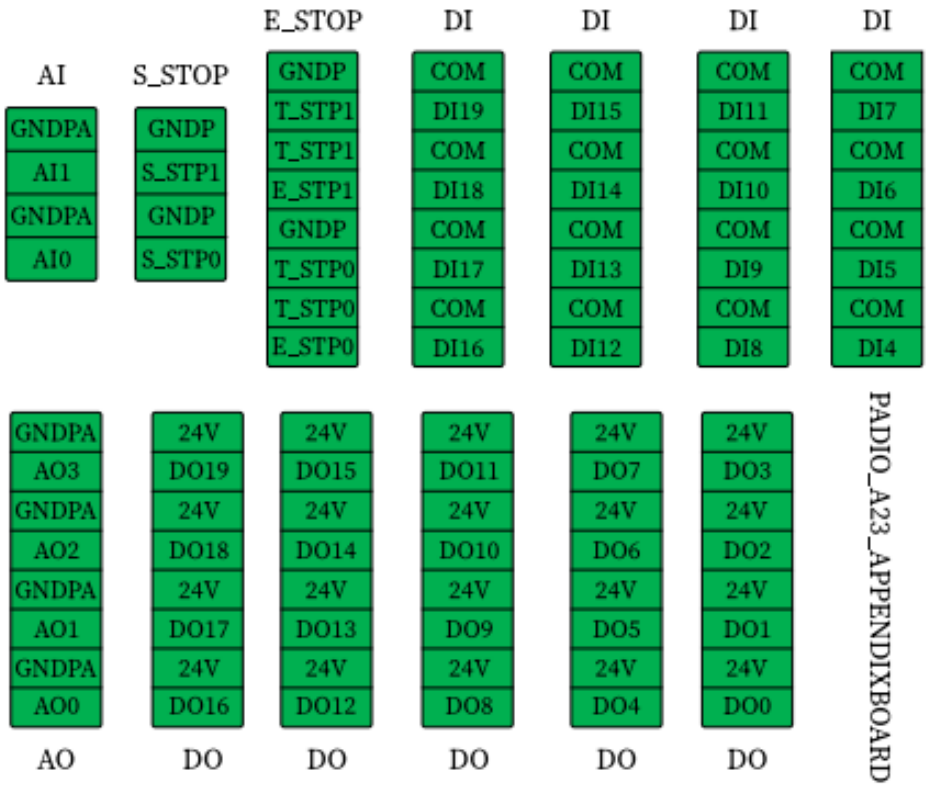


Figure 7-2 : The layout of the electrical interfaces inside the controller

NOTICE

It is recommended that the IO wiring length does not exceed 3m.

7.2 Safety

Observe the following warnings and cautions when working with the EC66's electrical systems, and when performing maintenance.

DANGER



1. Never connect the safety signals to a PLC that is not a safety-related PLC with the proper safety level. Failure to follow the warning may result in serious injury or even death as certain safety stop function may fail.
2. Do not use general I/O signals as safety I/O signals.
3. All safety related signals are dual channel (two independent channels). Keep the two channels independent so that a single failure would not lead to a loss of the safety function.
4. Some I/O inside the controller may be configured as normal I/O or safety-related I/O.
5. Any input device used to start automatic operation must be installed outside the safety area.

WARNING



1. Make sure that all equipment is kept dry. If water enters into the product, please turn off the power supply and contact your provider for assistance.
2. Only use the original cables supplied with the robot. Do not use the robot in applications where the cables are subjected to flexing. Contact the service provider if a longer cable or a flexible cable is needed.
3. Please be careful when installing the interface cable to the robot I/O.
4. Please remove the metal cable management plate before drilling holes.

CAUTION



1. The robot has been tested in accordance with international IEC standards for electromagnetic compatibility (EMC). EMC signals with levels higher than those defined in the IEC standards may cause unexpected behaviours of the robot. Very high signal level or excessive exposure may damage the robot permanently. The EMC problems can occur during activities such as welding. EMC error messages will appear in the error messages in the log. ELITE shall not be held responsible for any damages caused by EMC problem.
2. The cable for connecting the controller I/O to other machinery and factory equipment may not be longer than 30m, unless extensive tests are performed.

NOTICE



All voltages and currents are direct current (DC), unless otherwise specified. Use of the digital I/O should comply with IEC 61131-2-2007.

7.3 Internal Power Supply

The internal 24V power supply provides power to the digital I/O. The J14 Terminal is where the internal power supply connects to the I/O board inside the controller (**Figure** 7-3).

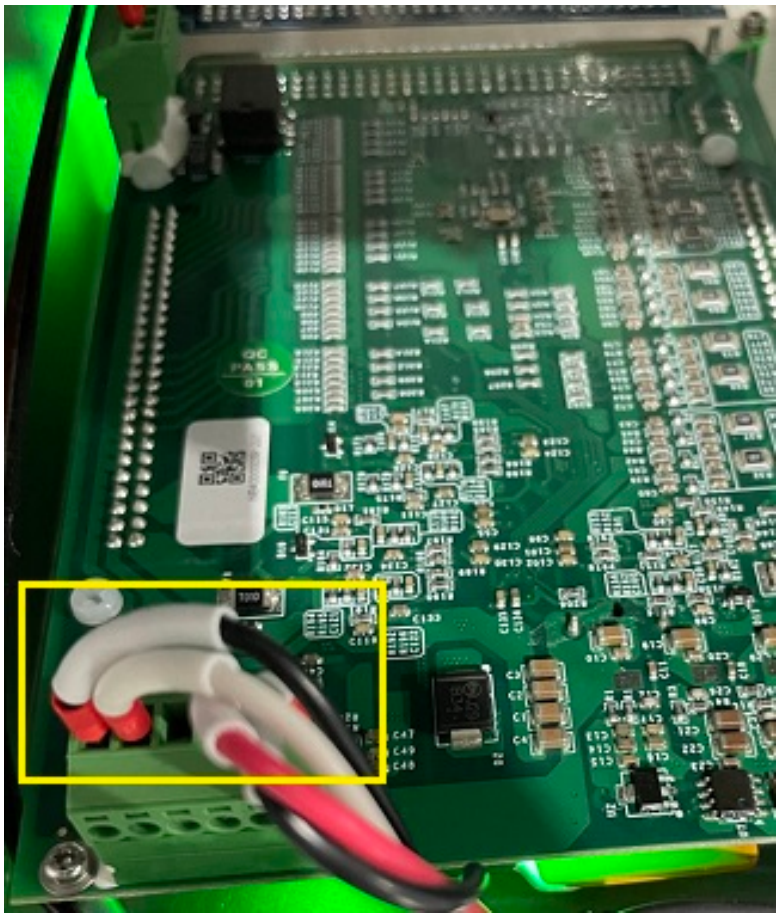


Figure 7-3 : J14 power supply terminal

The electrical specifications of the internal power supply is as shown in **Table** 7-1 .

Table 7-1 . Electrical specifications of the internal power supply

Terminal	Parameter	Min	Typ	Max	Unit
Internal 24V power supply					
24V - GNDP	Voltage	22.8	24	26.4	V
	Current	0	-	4	A

When the internal 24V power supply is insufficient, an external 24V supply can be used, as shown in **Figure** 7-4 . Disconnect the internal 24V power supply wires from the J14 terminal and cap the wires. Then connect the external power supply to J14.

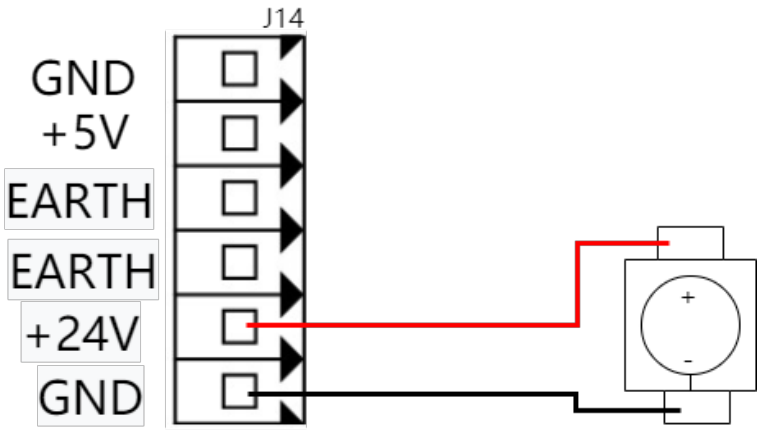


Figure 7-4 : external 24V power supply

CAUTION

The external 24V power supply current must not exceed 5A

CAUTION

Ensure that internal power supply wires are capped if an external power supply is used

7.4 Safety I/O

This section introduces the dedicated safety inputs. Please observe the specifications in Subsection 7.4.1. The safety device and equipment must be installed in accordance with the safety instructions and the risk assessment in Chapter 1. All safety I/O are dual-channel (redundant) and two separate wires must be used. A single failure should not cause loss of the safety function. There are two permanent inputs: emergency stop and safeguard stop.

The emergency stop input should only be used with safety rated emergency stop equipment. The safeguard stop input should also be used with safety-related protective equipment. The functional differences between the emergency stop and the safeguard stop are listed in **Table** 7-2 .

Table 7-2 . Difference between emergency stop and safeguard stop

	Emergency stop	Safeguard stop
Motion stop of the robot	Yes	Yes
Program execution	Stop	Pause
Power supply of motors	Off	On
Reset	Manual	Automatic or manual
Frequency of use	Infrequent	Once within each cycle
Stop category (IEC 60204)	1	2
Performance level (ISO 13849-1)	PLd	PLd

The emergency stop input and other safety I/O functions may be set with the digital inputs in conjunction with the internal PLC. Some examples about how to use the safety I/O are given in sections Subsection 7.4.2 and Subsection 7.4.3.

DANGER



Safety functions must be verified before putting the robot into operation. Safety functions must be tested regularly.

7.4.1 Safety Electrical Specifications

The electrical specifications of the safety inputs are as shown in **Table** 7-3 .

Table 7-3 . Safety input electrical specifications

Terminals	Parameter	Min	Typ	Max	Unit
Safety inputs					
	Voltage	-3	-	30	V
	OFF region	-2	-	2	V
	ON region	8	-	30	V
	Current (8-30V)	2	-	8.5	mA
	Function	-	NPN	-	Type
	IEC 61131-2	-	3	-	Type

7.4.2 Emergency Stop

Most applications require one or more additional emergency stop buttons. **Figure** 7-5 shows the connection method of using only an external emergency stop.

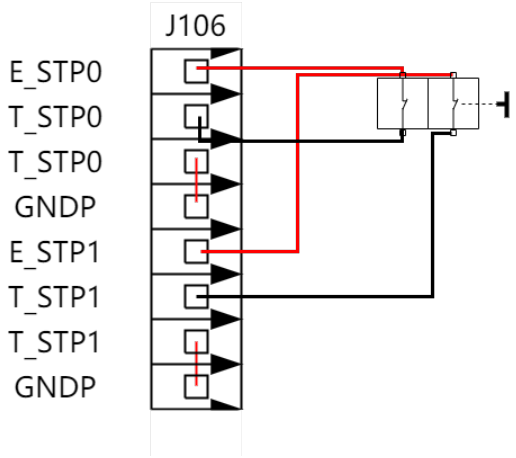


Figure 7-5 : External emergency stop

Figure 7-6 shows the connection method if the operator wants to use the teach pendant emergency stop and an external emergency stop at the same time.

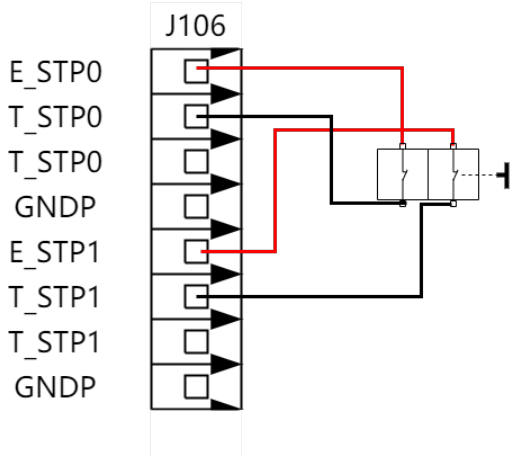


Figure 7-6 : Teach pendant emergency stop and external emergency stop

Stopping distance and stopping time of emergency stop

The table below shows the stopping distance and the stopping time measured when the emergency stop is triggered. These measuring results correspond to the following configurations of the robot:

- Extension: 100% (the robot arm is completely extended horizontally)
- Speed: 10%, 50%, 100%
- a maximum payload (6kg) that can be handled by the robot connected to TCP.

The Joint 0 test was carried out by performing a horizontal movement, where the rotational axis was perpendicular to the ground. During the Joint 1 and Joint 2 tests, the robot followed a vertical trajectory,

where the rotational axes were parallel to the ground, and the stop was performed while the robot was moving downward.

Table 7-4 . EC66 Emergency stop stop speed

Emergency stop angle (rad)	10% speed	50% speed	100% speed
Joint 1	0.00212649	0.0507745	0.181914199
Joint 2	0.00206342	0.0472514	0.186870007
Joint 3	0.00256917	0.0565973	0.221164466

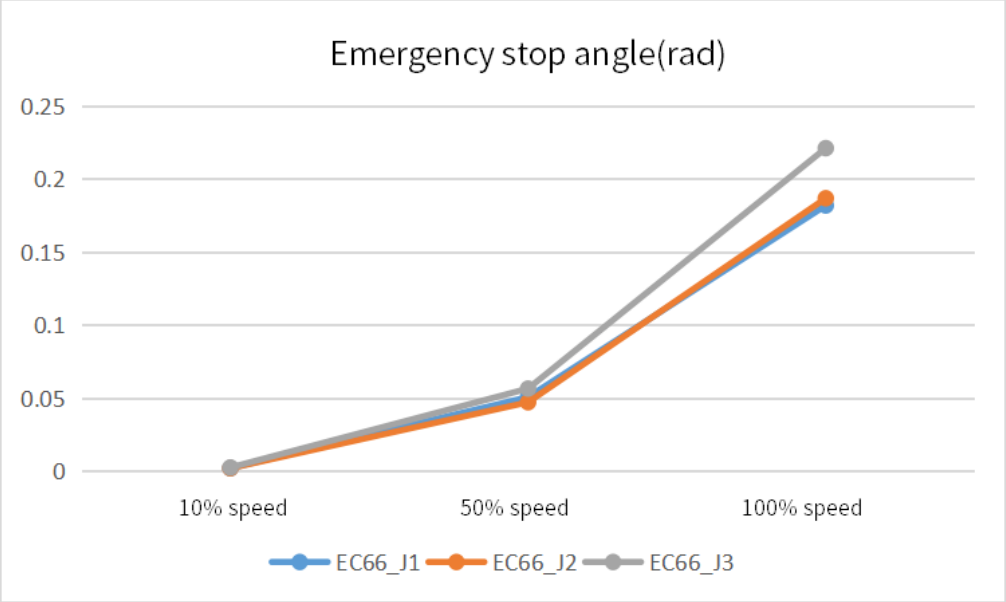


Figure 7-7 : EC66Emergency stop angle

Table 7-5 . EC66 Emergency stop stop time

Emergency stop time (s)	10% speed	50% speed	100% speed
Joint 1	0.018	0.076	0.144
Joint 2	0.017	0.074	0.145
Joint 3	0.018	0.074	0.145

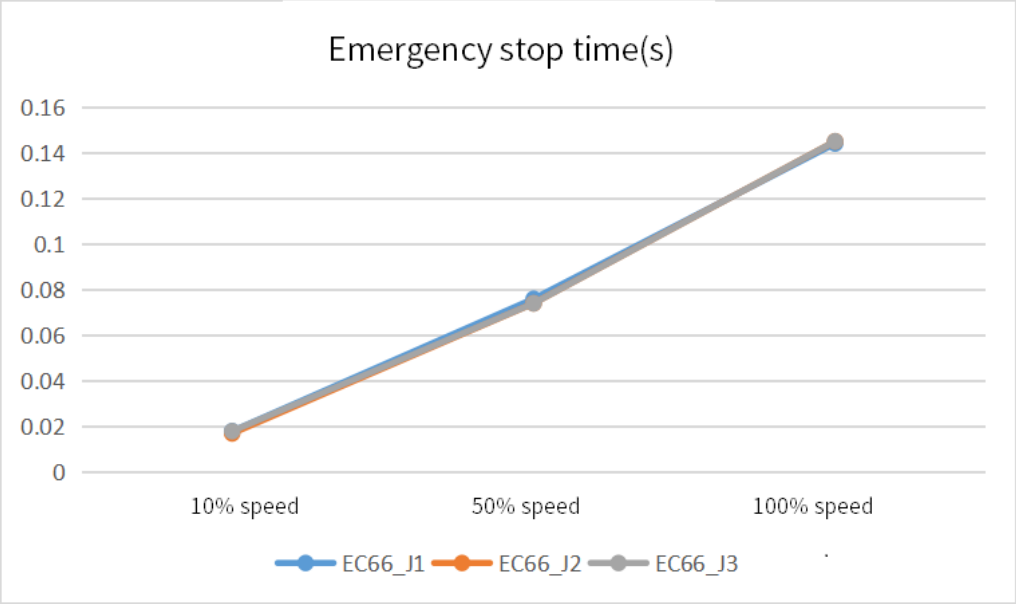


Figure 7-8 : EC66 emergency stop time

7.4.3 Safeguard Stop

The safeguard stop will pause a program temporarily. By default, the user must press the green play button on the teachpendant to resume the program execution. The safeguard stop can be configured to automatically resume when the signal is LOW. This is done by using the internal PLC discussed in Chapter 10 User PLC.

Figure 7-9 shows an example of how basic safeguard stop equipment is set up.

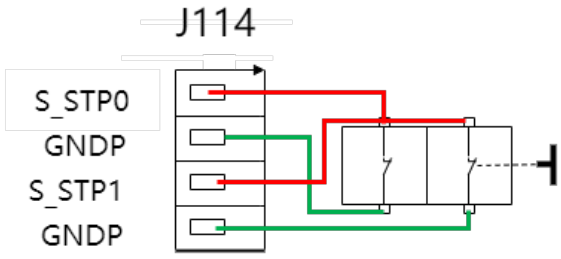


Figure 7-9 : Setup of dual-channel safeguard stop

DANGER

The robot may (if configured) resume motion automatically when the safeguard signal is re-established. Do not use this configuration if the signal can be re-established from inside the safety perimeter.

7.5 Digital I/O

7.5.1 Digital Electrical Specifications

The electrical specifications of the digital I/O are shown in **Table** 7-6

Table 7-6 . Digital input electrical specifications

Terminals	Parameter	Min	Typ	Max	Unit
Digital outputs					
	Current	0	-	0.7	A
	Voltage drop	0	-	1	V
	Leakage current	0	0	0.1	mA
	Function	-	NPN	-	Type
	IEC 61131-2	-	1	-	Type
Digital inputs					
	Voltage	-3	-	30	V
	OFF region	-2	-	2	V
	ON region	8	-	30	V
	Current (8-30V)	2	-	8.5	mA
	Function	-	NPN/PNP	-	Type
	IEC 61131-2	-	3	-	Type

7.5.2 Digital Input

This example shown in **Figure** 7-10 demonstrates how to connect a simple button to a digital input.

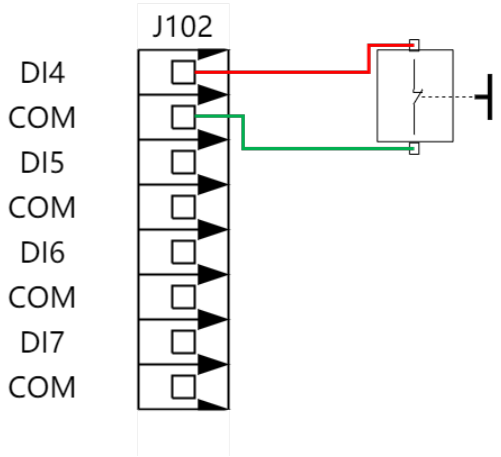


Figure 7-10 : Two-wire sensor

Similarly, the connection method of a three-wire sensor is shown in **Figure** 7-11 .

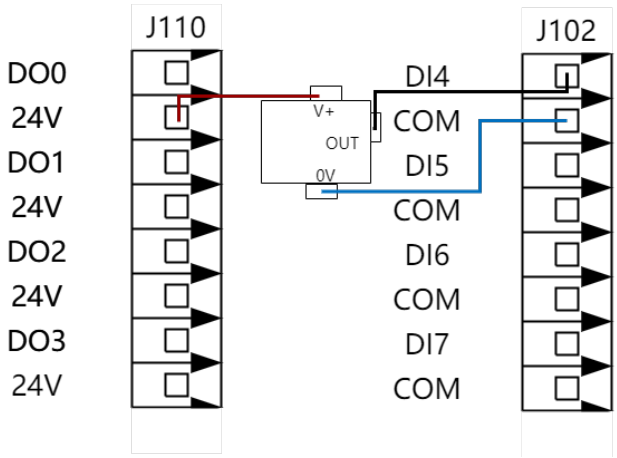


Figure 7-11 : Three-wire sensor

The digital inputs may be configured to two input modes including NPN and PNP. The digital inputs can be configured to NPN or PNP by changing the jumper on terminal J22 (**Figure** 7-12) or J25.

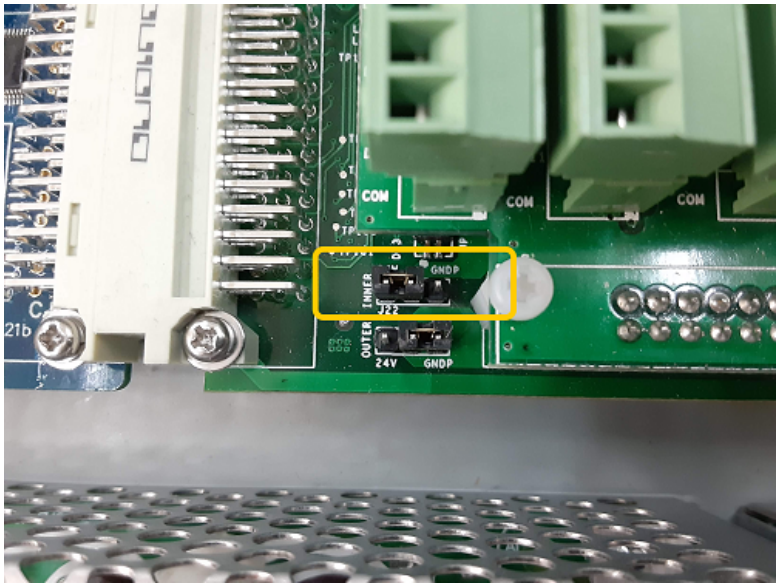


Figure 7-12 : Jumper j22 for configuring digital input

Table 7-7 describes where to place the jumpers for NPN or PNP type inputs.

Table 7-7 . Jumper connection in different modes

Input type	J22 connection method	J25 connection method	Remarks
high level effective	GNDP	24V	2/3 wire sensor
		GNDP	only connect to three-wire sensor
low level effective	24V	24V	2/3 wire sensor
		GNDP	only connect to three-wire sensor

At the same time, the user can change the high and low levels of the com port through J25. J25 is connected to GND by default, and the output of the com port is 0V. If J25 is connected to 24V, the com port output is 24V at this time.

7.5.3 Digital Output

All digital outputs are NPN and are not configurable. When a digital output is HIGH it is connected to ground. When the digital output is LOW it is open circuit.

This example shows how to connect a load controlled by the digital output (**Figure** 7-13).

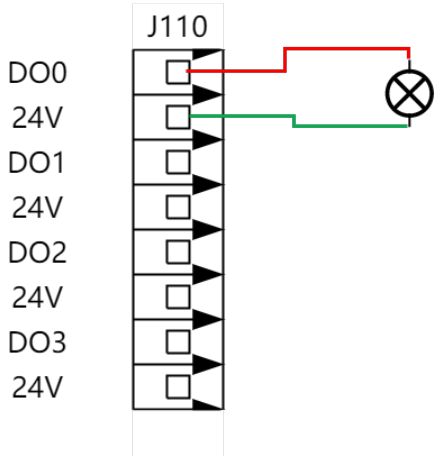


Figure 7-13 : Drive solenoid wiring case (increase the power of the solenoid valve)

7.6 Analog I/O

The analog I/O interface can be used to set or measure the voltage (-10V~10V) in and out of other equipment.

In order to acquire a high accuracy for analog readings, it is recommended to comply with the following instructions:

- Use the GNDPA terminal closest to the I/O. The I/O pair shares a common mode filter.
- Use the same GND (0V) for the equipment and the controller. The analog I/O is not galvanically isolated from the controller.
- Use a shielded cable or twisted pair. Connect the shielded cable to the “GNDP” terminal on the “Power” terminal.

7.6.1 Analog Electrical Specifications

The electrical specifications are shown in **Table** 7-8 .

Table 7-8 . Electrical Specifications of Analog I/O

Terminal	Parameter	Min	Typ	Max	Unit
analog input					
	Voltage	-10	-	10	V
	Resistance	-	100	-	K ohm
	Resolution	-	12	-	bit
analog output					
	Voltage	-10	-	10	V
	Resistance	-	10	-	ohm
	Resolution	-	12	-	bit

7.6.2 Analog Input

The example in **Figure** 7-14 illustrates how to connect an analog sensor to the analog input.

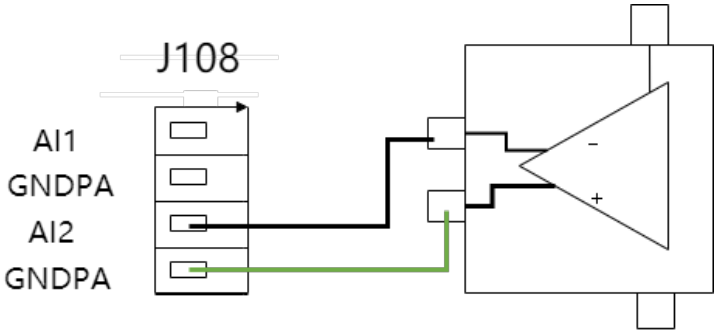


Figure 7-14 : Connecting with an analog sensor

7.6.3 Analog Output

The example in **Figure** 7-15 illustrates how to control the welding current of a welder with an analog input.

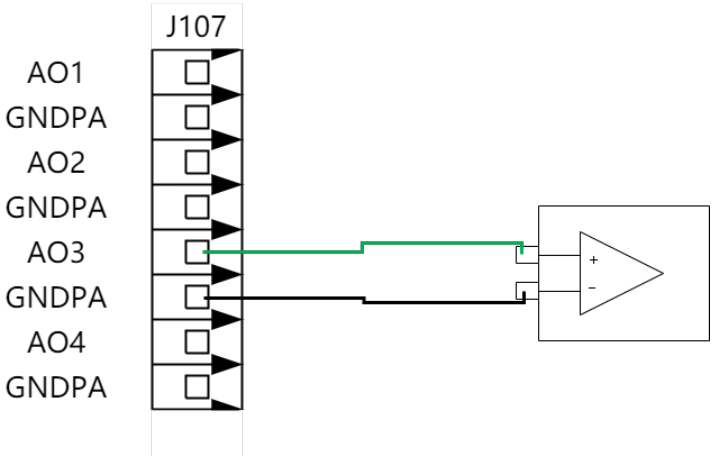


Figure 7-15 : General purpose analog output

7.7 Tool I/O

The tool flange of the manipulator has a 12 pin connector, which can be used to control various grippers and sensors, as shown in **Figure** 7-16 .



Figure 7-16 : Tool I/O connector

NOTICE

The tool connector must be manually tightened to a force of no more than 0.4Nm.

Use **Table** 7-9 for a pinout of 12 connecting pins of an aviation plug:

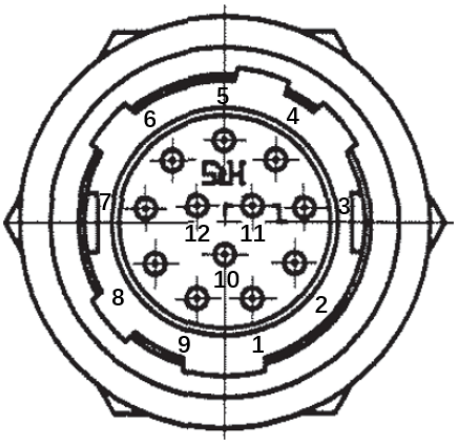


Figure 7-17 : 12-pinned connector

Note: the model of the aviation plug is HR10A-10R-12P of HRS company

Table 7-9 . Function list of connector

Pin No.	Function description
1	Digital ground (GND)
2	Terminal digital output 1 (Y048)
3	Terminal digital output 2 (Y049)
4	Terminal digital input 1 (X048)
5	Terminal digital input 2 (X049)
6	Analog input interface (AI003)
7	Analog output interface (AO005)
8	RS485+
9	RS485-
10	+24V power output
11	+24V power output
12	Digital ground (GND)

The tool's digital outputs 1 and 2 are controlled using Y048 and Y049 in the teachpendant. Digital inputs 1 and 2 are read using X048 and X049 in the teachpendant interface.

7.7.1 Tool Electrical Specification

The electrical specifications of the digital input ports are shown in **Table** 7-10 :

Table 7-10 . Electrical specifications of digital input interface

Parameter	Min	Typ	Max	Unit
Input voltage	-0.5	-	26	V
Logical low voltage	-	-	10	V
Logical high voltage	22	-	-	V

The electrical specifications of the digital output ports are shown in **Table** 7-11 :

Table 7-11 . Electrical specifications of tool digital output interface

Parameter	Min	Typ	Max	Unit
Voltage when open	-0.5	-	26	V
Voltage when sinking 1A at 25 °C	-	0.19	0.24	V
Sinking current	0	600	1000	mA

The tool analog input is a non-differential input, with voltage (0-10V). The electrical specifications are shown in **Table** 7-12 .

Table 7-12 . Electrical specifications of tool analog input

Parameter	Min	Typ	Max	Unit
Input voltage	-0.5	-	24	V
Input resistance	-	-	>100	M ohm
Resolution	-	10	-	Bit

The tool analog output is a non-differential output, with voltage (0-10V). The electrical specifications are shown in **Table** 7-13 .

Table 7-13 . Tool analog output

Parameter	Min	Typ	Max	Unit
Output current	-	17	-	mA
Output short circuit current	-	60	-	mA
Resolution	-	10	-	Bit

7.7.2 Power

The tool I/O of the Elite collaborative robot can provide the external tool with a 24V power, as shown in **Figure** 7-18 .

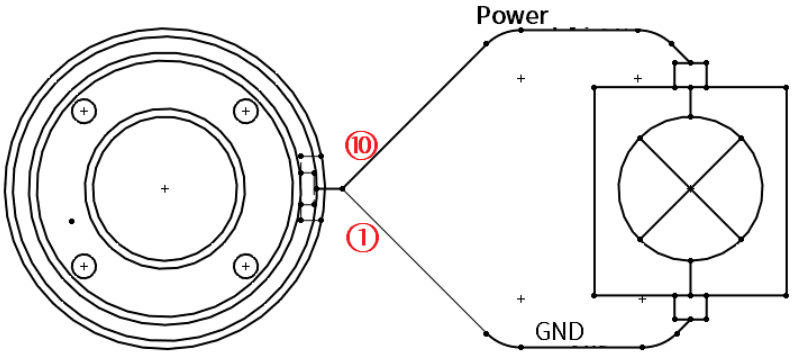


Figure 7-18 : Tool power supply

7.7.3 Digital I/O

The implementation mode of the digital input interface is shown in the **Figure** 7-19 .

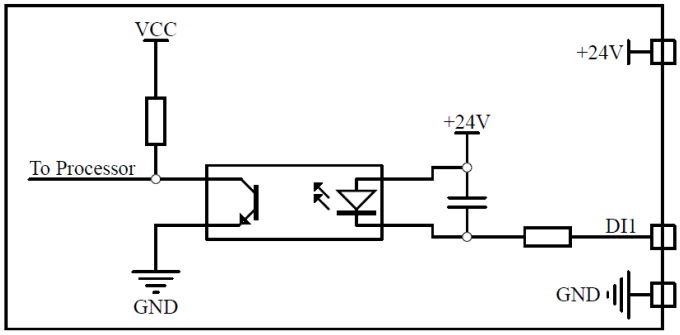


Figure 7-19 : Digital input interface

This example illustrates how to connect with a simple button, as shown in **Figure** 7-20 .

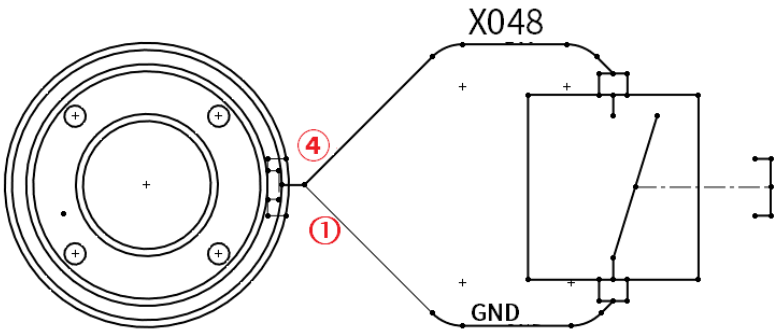


Figure 7-20 : Connection with a simple button

Figure 7-21 shows how to turn on the load using 24V internal power supply.

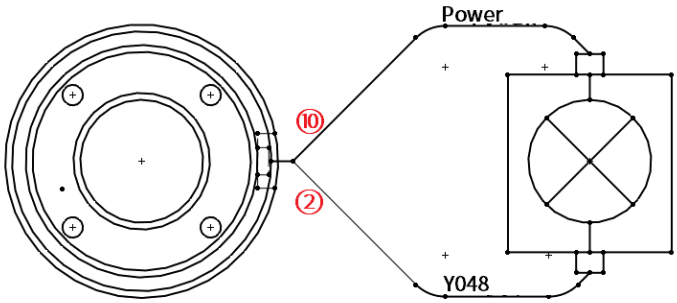


Figure 7-21 : Openning a load of the internal power supply

It is recommended to use a protective diode for the inductive load, as shown in the **Figure** 7-22 .

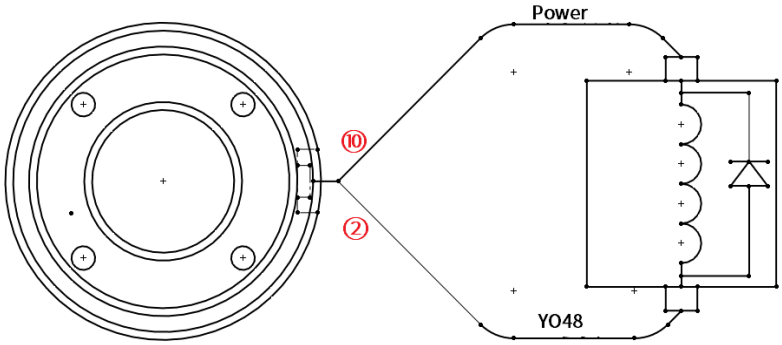


Figure 7-22 : Protective diode

CAUTION



Even when a tool is not mounted on the robot, 24V is still supplied to the tool connector.

7.7.4 Analog I/O

Two examples of how to use the analog input are illustrated in the following section.

Using the tool analog input - non-differential

This example illustrates an analog sensor connection with a non-differential output, as shown in **Figure** 7-23 .

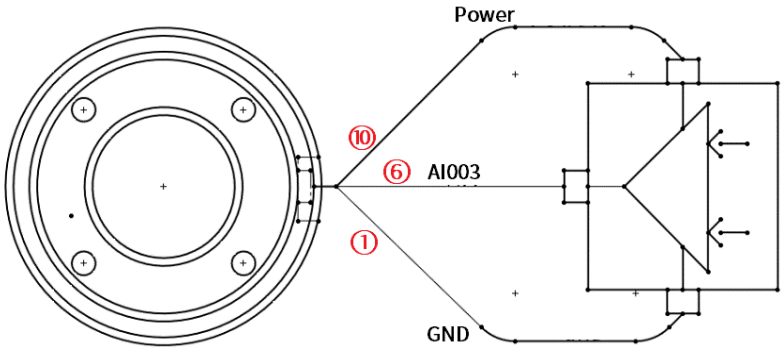


Figure 7-23 : Analog sensor connection with a non-differential output

Using the tool analog input - differential

This example illustrates an analog sensor connection with a differential output. This works in the same way as the non-differential sensor after connecting the negative output end to the GND (0V).

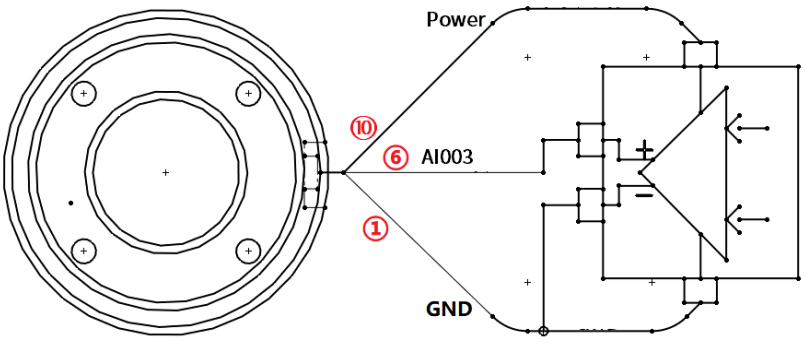


Figure 7-24 : analog sensor connection with a non-differential output

The examples of how to use the analog output are illustrated in the following section.

Using the tool analog output

This example illustrates a method of connecting to an analog signal with a non-differential output, as shown in **Figure** 7-25 .

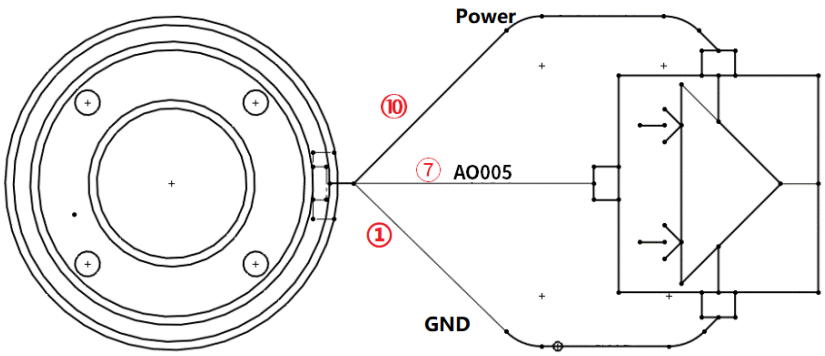


Figure 7-25 : Analog signal with a non-differential output

7.7.5 Communication I/O

The tool connector also provides a serial interface for communicating to a tool using the RS485 protocol. While using the communication I/O keep in mind the following:

- Signal requests: RS485 signals use internal fail-safe biasing. If the connected device is not compatible with this fail-safe, the signal biasing must either be done in the connected tool, or added externally by adding a pull-up resistor to RS485A and a pull-down resistor to RS485B.
- The latency is 2ms to 4ms from writing in data to be sent on a robot controller to the start of sending the data on the RS485. The latency is 2ms to 4ms from the start of receiving the data on the RS485 to receiving of the data by the robot controller and the start of handling.

Table 7-14 shows the available settings of the RS485 interface.

Table 7-14 . Tool communication I/O

Setting	Options
Baud rate	2.4k,4.8k,9.6k,115.2k
Stop bit	1, 2
Parity bit	Null, Odd, Even

7.8 Serial Communication Port

Users can perform serial communication from the controller by connecting an RS485 device to the black connector shown in **Figure** 7-26 .

In order to set up the RS485 connector in the controller, the serial port connector must be disassembled and RS485 wires should be soldered to the metal contacts on the back of the black connector (**Figure** 7-27). The front and back sides of the black plastic device are marked with PIN “1 3 5” and “2 4 6”

respectively. PIN3 should be soldered to RS485B and PIN4 should be soldered to RS485A. The maximum supported baud rate of this interface is 2 Mbits/sec.

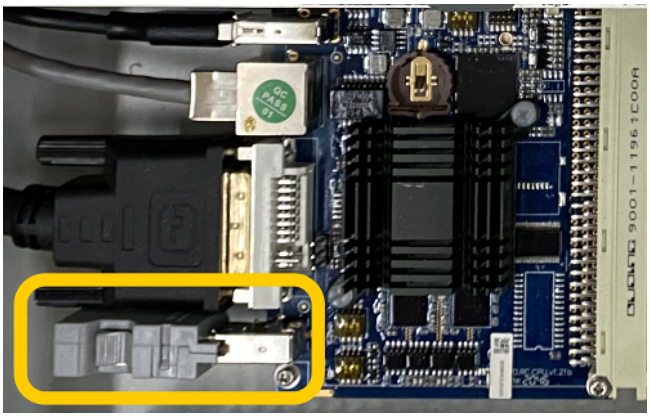


Figure 7-26 : Controller RS485 connector

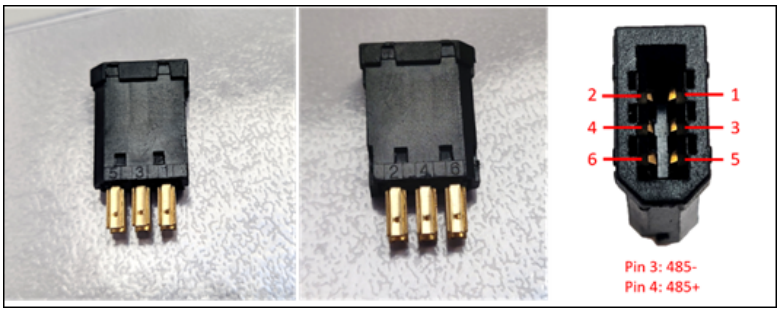


Figure 7-27 : Black device

7.9 Ethernet Port

The Ethernet port can be found on the top of the controller. Please refer to **Figure ??**. The Ethernet port is used to send and receive information or commands using the SDK or through Lua scripts (see Chapter 9). When the ethernet port is used to control the manipulator externally using the SDK, the robot mode switch at the top of the teach pendant must be set to REMOTE. The ethernet port can also be used for Modbus TCP which is discussed in Chapter 8

NOTICE

It is recommended that the length of the network cable does not exceed 3m.

Chapter 8 Modbus

Modbus is an industrial protocol used for serial communication between master and slave devices. A modbus master will send messages to slaves using specific addresses encoded in the messages and the slaves will respond with the requested information.

Table 8-1 shows the object types provided by a Modbus slave device that can be accessed by a Modbus master device.

Table 8-1 . Description of Modbus object types

Object type	Access	Size	Address Space
Coil	Read-write	1 bit	00001 - 09999
Discrete input	Read-only	1 bit	10001 - 19999
Input register	Read-only	16 bits	30001 - 39999
Holding register	Read-write	16 bits	40001 - 49999

Click **Extension -> Modbus slave**, the user can choose to use Modbus RTU or Modbus TCP.

Modbus RTU uses the RS485 interface discussed in Section 7.8. This interface requires the user to configure the slave ID, baud rate, number of bits, parity, and stop bits (see **Figure** 8-1).

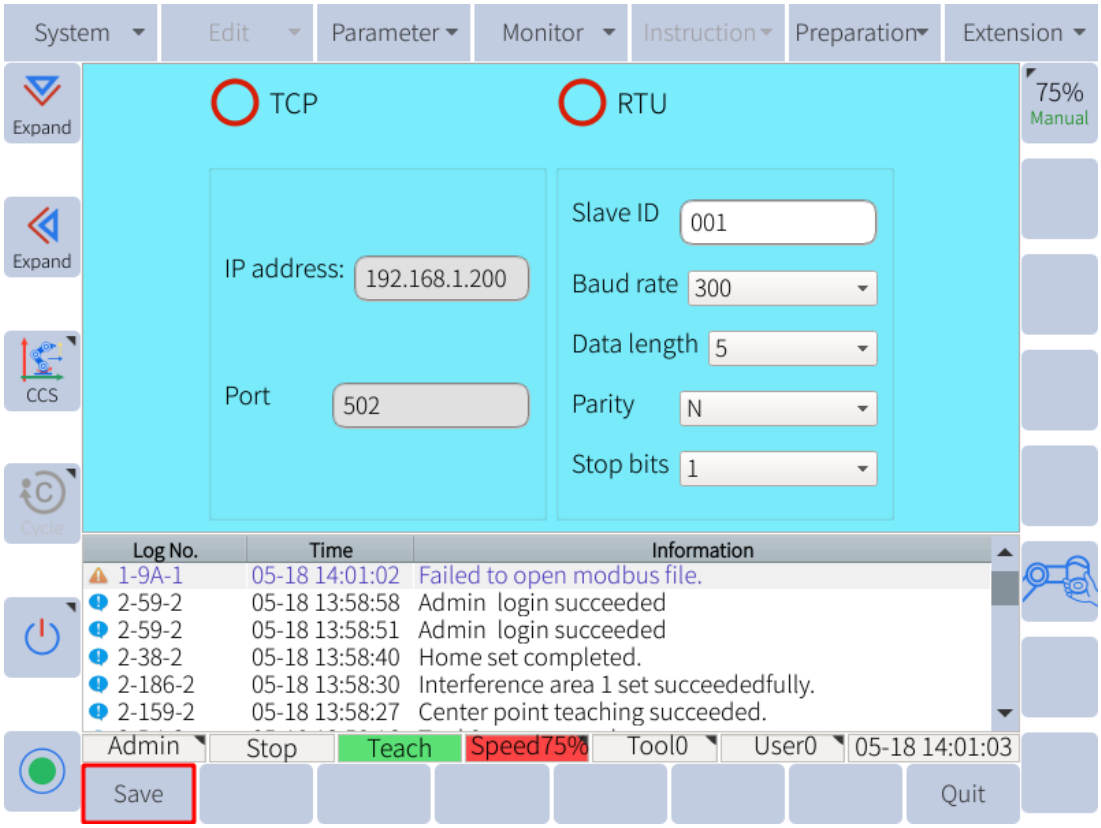


Figure 8-1 : Modbus configuration page

Modbus TCP uses the ethernet port at the top of the controller. Only the IP address of the modbus TCP settings can be modified. The default port for modbus TCP is 502. The IP address can only be modified from the network configuration page. To modify the IP address navigate to **System -> System setting -> Network Configuration** and set the IP address, netmask, and gateway.

The modbus coils and registers of the system are listed in **Table** 8-2

Table 8-2 . Function code

Variables	Coil Address	Register Address	Supported Function Code	Read and Write Authority
M0-M527	0x0000-0x020F	0x0000-0x0041	0x01,0x03,0x04	read only
M528-M1535	0x0210-0x05BF	0x0042-0x00B7	0x01,0x03,0x05, 0x06,0x0F,0x10	read/write

NOTICE

1. M0-M527 is used by the system and can only read the status. The range of M variables that can be modified through the teach pendant is M528-M799.
2. The coil address of the M variable is the serial number address of the variable. The register address of the
3. M variable starts from M0, and every 8 consecutive M variables form a register address, such as MO-M7, the register address is 0x0000; M8-M15, the register address is 0x0001, and so on.
4. In the Modbus protocol, a register is a 16-bit variable, so when operating on a register address of the M variable, the actual operation is a continuous 16 M variables.

For more information on using the modbus interface please refer to the Modbus Script Manual on the ELITE Robot website or forum.

Chapter 9 Lua Scripting

Lua is a scripting language that can be embedded in an application. Lua is used to extend the programming functionality of a program such that a user can use simple commands to perform complicated tasks. Lua is lightweight and fast.

For EC66 system, more advanced users may find Lua helpful in creating more complex tasks that cannot be easily achieved using the JBI robot instructions. These Lua scripts can be started, restarted, or stopped directly from a JBI program, or they can be started immediately when the system boots. These scripts run in the background parallel to a JBI program.

Scripts must be loaded into the /rbctrl/luadir folder from a USB device or through an FTP server. To load from a USB device, create the Lua script and place it in the /rbctrl/luadir folder on the USB drive.

If the /rbctrl/luadir folder does not exist, create one and place the Lua script inside. Insert the USB drive into the controller and navigate to **System -> Load from USB -> Script Update** and click "OK". Next navigate to **Process -> Script** (see **Figure** 9-1).

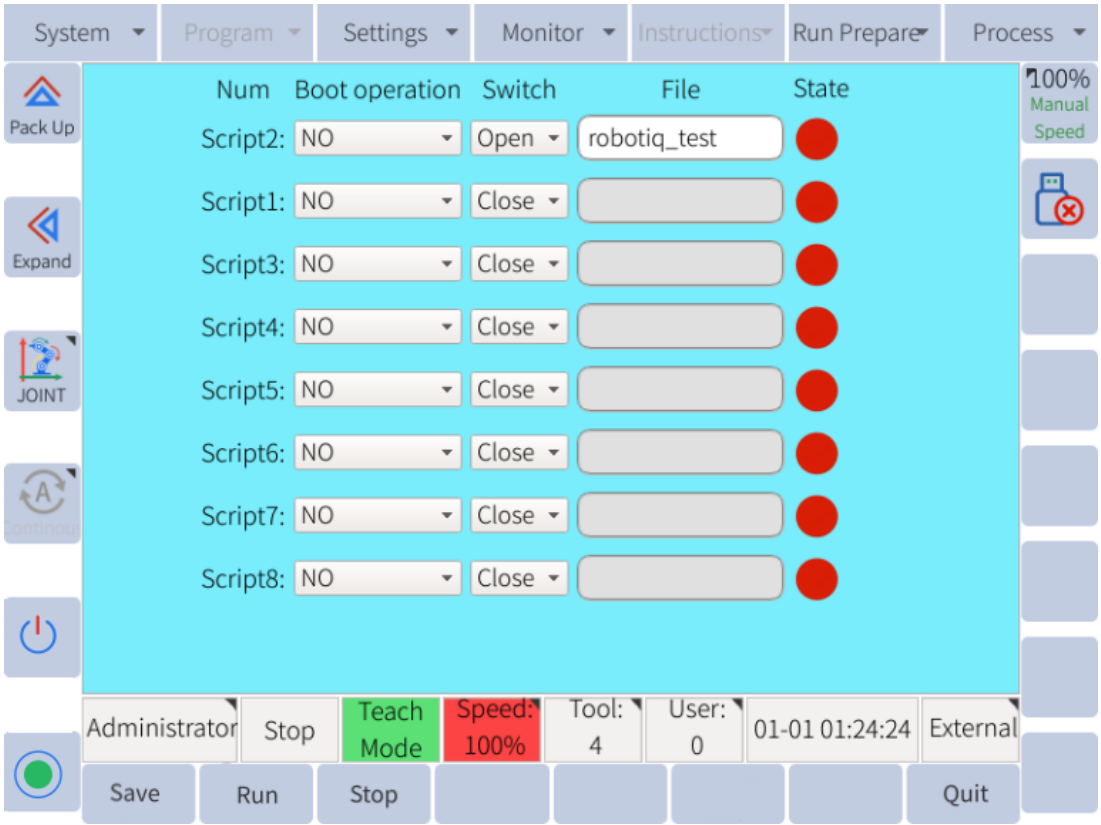


Figure 9-1 : Lua script setup page

Scripts are identified by indices. There are 8 total indices that can be assigned a Lua script. Once the Lua scripts are uploaded from a USB device, click on the box under the File column, and select the desired script from the list that appears.

To run the desired Lua scripts, click on the dropdown menu in the Switch column and select “Open”. Once the user has selected “Open” for all the scripts they want to run, click “Save” in the submenu, then click “Run”. All scripts with the dropdown showing “Open” will run. Cick “Stop” in the submenu to stop the running scripts.

The “Boot Operation” column is used to control which scripts will be started automatically when the system boots up. This allows users to not have to remember to start up a lua script if the program is being executed without an operator’s supervision.

To start Lua scripts from the JBI program, the user needs to enable the JBI advanced functions (see Subsection 6.7.5). In the main menu bar navigate to **Instructions -> Script** and select STARTLUA, STOPLUA, RESETLUA, or GETLUASTATE.

For more information on Lua scripting, please refer to the Lua scripting manual found on the ELITE Robot website or forum.

Chapter 10 User PLC

The User PLC is a PLC program that always runs in the background. The PLC uses ladder logic, which is a graphical programming language. Each line is called a rung, and the PLC executes one rung at a time, starting from the top to the bottom rung. Once all the ladder's rungs have been executed, the PLC program returns to the top rung and again executes the program line by line. The PLC supports up to 200 lines or rungs.

To access the user PLC navigate to **Extension -> User PLC**. You will see the screen shown in **Figure** 10-1 .

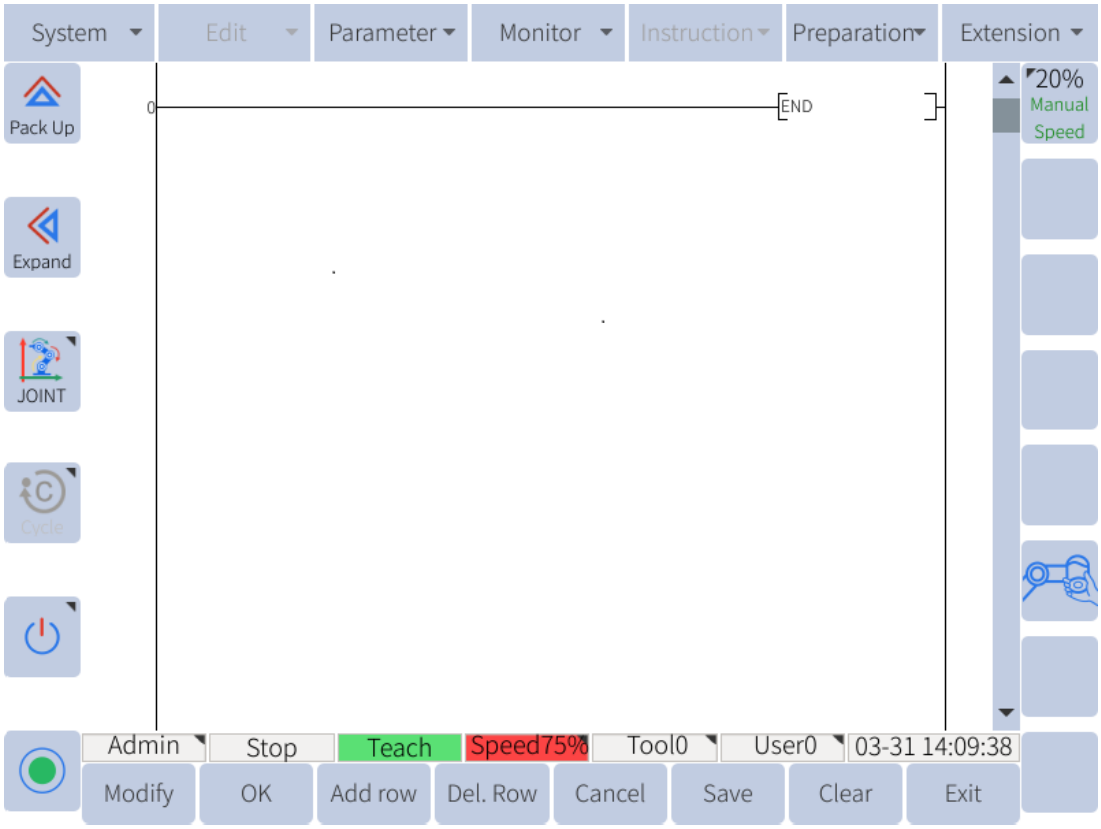


Figure 10-1 : User PLC

To add a rung to the ladder select a row and click "insert row". A new row will be inserted above the selected row. Once the rung has been inserted, select the row and click "Modify" (see **Figure** 10-2).

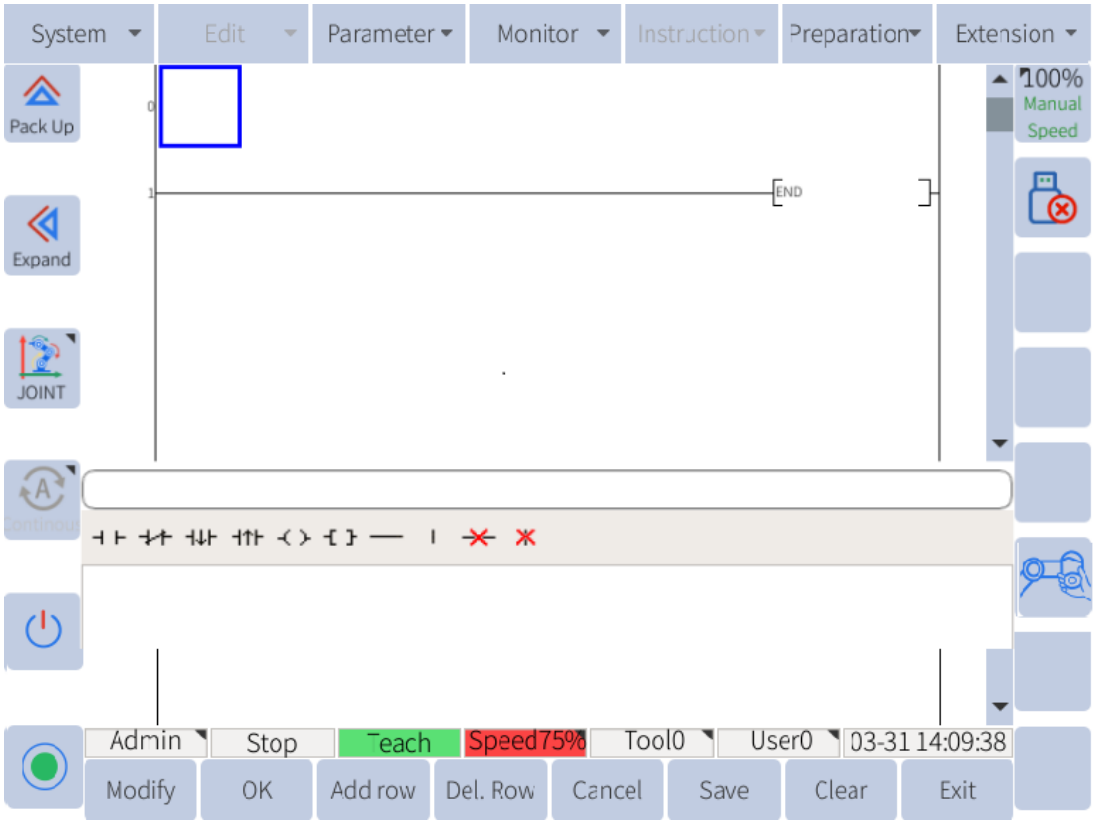


Figure 10-2 : Programming elements of the PLC program

By clicking the “modify” button, the user can see various logic symbols used to create ladder programming. (**Figure** 10-2). The various symbols are described as follows:

- ⊣⊢ - Normally open contact. When the I/O or variable associated with the symbol is LOW, the signal will not pass through. If the I/O or variable is HIGH, the signal will pass through.
- ⊣/⊢ - Normally close contact. When the I/O or variable associated with the symbol is HIGH, the signal will not pass through. If the I/O or variable is LOW, the signal will pass through.
- ( ) - Set the associated I/O or variable to HIGH.
- [ ] - If configured to “Reset”, set the associated I/O or variable LOW. If configured to “Set”, set the associated I/O or variable HIGH
- ⊣↑⊢ - Allows signal to pass through if the associated I/O or variable is toggle from LOW to HIGH.
- ⊣↓⊢ - Allows signal to pass through if the associated I/O or variable is toggle from HIGH to LOW.
- —— - Insert a horizontal line.
- | - Insert a vertical line. Useful for creating “OR” logic.
- ⊣ ⊢ - Delete an existing horizontal line.
- ✳ - Delete an existing vertical line.

Example: if a user wants to connect virtual input M485 to digital output Y004 so that Y004 outputs HIGH when M485 is HIGH, they can do the following:

1. Insert new row by clicking on the “end” row and pressing “insert row” in the submenu.
2. click on the left side of the newly created row and click “Modify” in the submenu.
3. select the normally open contact icon.
4. From the drop down box select the I/O type to be M for virtual input.
5. Enter ’485’for M485 in the text box next to the dropdown menu.
6. Click “OK” in the submenu and the new normally open contact will be inserted.
7. Click on the row again next to the newly inserted contact and click “Modify”
8. Select the Set ⊣( )⊢ contact.
9. In the dropdown menu select “Y” for digital output and in the text box enter “004” for Y004.
10. Click “OK” in the submenu.
11. Click save to save the new PLC setup. The system will restart automatically.

Safety related relays of the User PLC can be controlled or reset using the ⊣( )⊢ symbol. The safety relays control safety related functions such as external emergency stop, external start, external suspension, servo ON, clear alarm, reduced speed, automatic recovery, etc. The User PLC signal mapping for the safety relays and generic I/O’s is shown in **Table** 10-1 .

Table 10-1 . PLC Signal Mapping

PLC Signal	Function	Trigger Mode	Remarks
S0	external emergency stop	low level effective	
S1	external start (program)	active on rising edge	hold time at least 300ms
S2	external pause button(active during operation)	high level effective	
S3	external servo power up	active on rising edge	hold time at least 200ms
S4	external clear alarm	active on rising edge	hold time at least 400ms
S5	external stop (program)	high level effective	
S6	return to the first line of the main program	active on rising edge	hold time at least 400ms
S7	servo off	high level effective	
S9-S16	appointment procedure	high level effective	
S17/S18	reduced mode enabled	low level effective	any signal triggers
S19	guard stop program auto re-set settings	high level effective	
S20	external button function trigger	high level effective	
S21	clear collision warning	active on rising edge	hold time at least 200ms
S22	encoder calibration	active on rising edge	hold time at least 200ms
S23	reset system	active on rising edge	hold time at least 200ms
S24	enter reverse drive	high level effective	low exit
S25	collision detection en-able/disable	high level effective	hold time at least 100ms
T100-T149	100ms timer		
C100-C149	16-bit storable counter		
X0-X19	digital input (decimal)		corresponding to DIN4-DIN19, X0-X3 have been occupied by safety IO
Y0-Y19	digital output (decimal)		corresponding to DO0-DO19
M0-M1535	virtual signal register		for details, please refer to Section 14.1

DN:EC

10.1 PLC example(S0-S4/S6)

Figure 10-3 shows an example of a PLC program, the user can create this program to run the main program.

The operation steps are as follows:

1. Wire the three switches to input 4-input 9, namely DI4-DI9. (This is only a sample, it can be connected to other input points according to actual needs.)
2. Select "**Preparation -> Main program**" and select 3.jbi.
3. Click "Setting", and when a prompt box pops up, click "OK" to set 3.jbi as the main program.
4. Select "**Extension -> User PLC**", edit the following PLC sample program, as shown in **Figure** 10-3 :

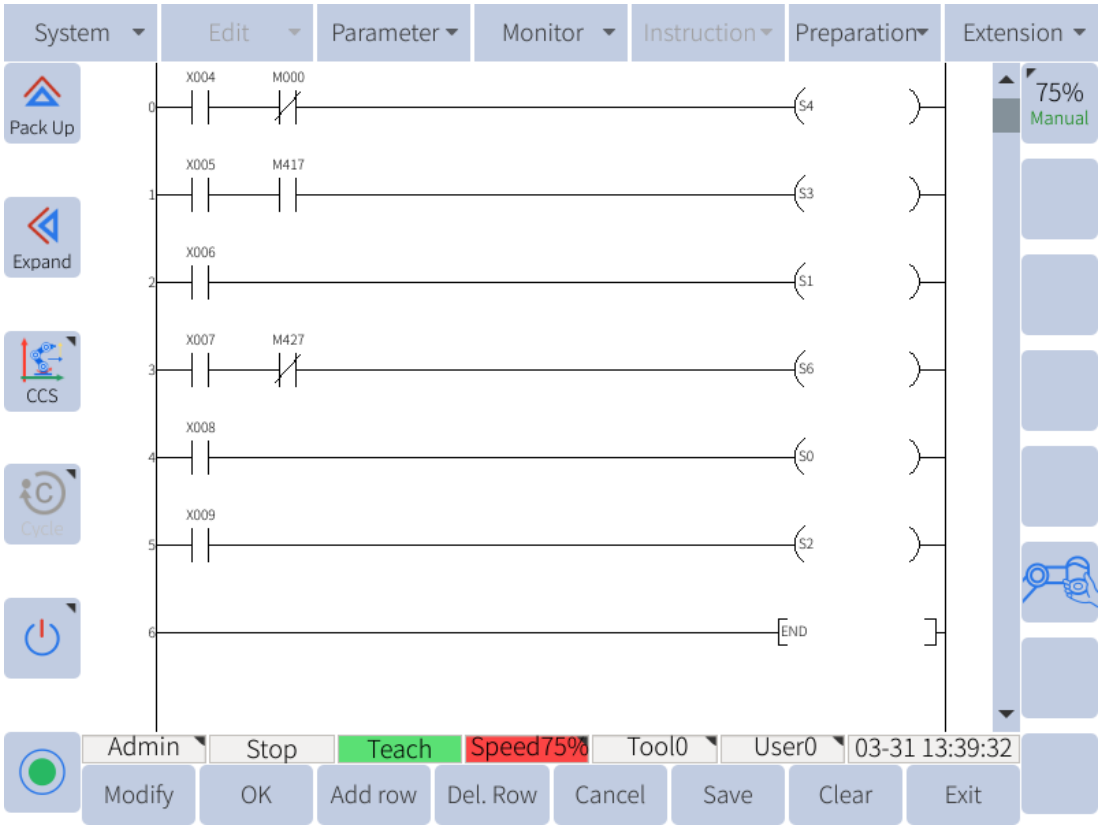


Figure 10-3 : Example of how to set the PLC to make the robot jump to the main program

The PLC program is explained as follows:

- Line 0: Press the switch of input 4 (X004), if there is no internal emergency stop (M0), the alarm will be cleared and synchronized.
- Line 1: Press the switch of input 5 (X005), and the robot is in PLAY mode (M417), then the upper servo is enabled.
- Line 2: Press the switch of input 6 (X006) to start the robot.
- Line 3: Press the switch of input 7 (X007), the robot is not running (M427), jump to the first line of the main program.

- Line 4: Press the switch of input 8 (X008), external emergency stop.
- Line 5: Press the switch for input 9 (X009), and the program pauses.

5. After finishing editing, click “Save” at the bottom right, as shown in **Figure** 10-4 :

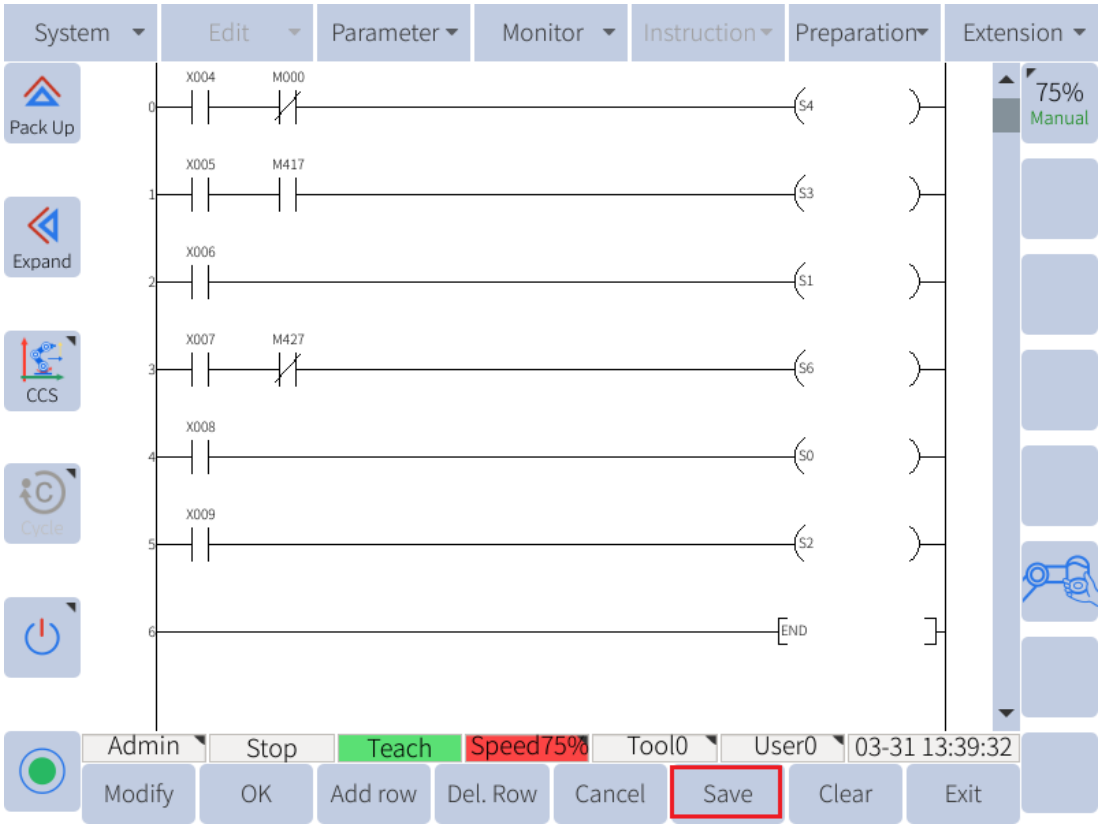


Figure 10-4 : save the program

6. After the prompt box pops up, click “OK” to restart the robot.
7. During or after the restart, you can turn the mode switch (key switch) to PLAY mode.
8. At this time, the teach pendant interface will automatically jump to the main program interface.

The results are verified as follows:

1. Press the button of input 4 to clear the alarm information and synchronize,
2. Press the button of input 5, the SERVO status light in the upper left corner of the teach pendant lights up.
3. Press the button for input 6, and the robot starts.
4. Press the button for entering 7 to jump to the first line of the main program.
5. Press the button of input 8, and the robot stops in an emergency.
6. Press the button to enter 9 to pause the main program. If you need to continue running, you can press the button to enter 9 again.

CAUTION

The PLC program is only a sample, and the corresponding user PLC program needs to be written according to the actual situation when using it.

10.2 PLC example (S7)

As shown in **Figure** 10-5 is an example of a PLC program where the user can close the servo.

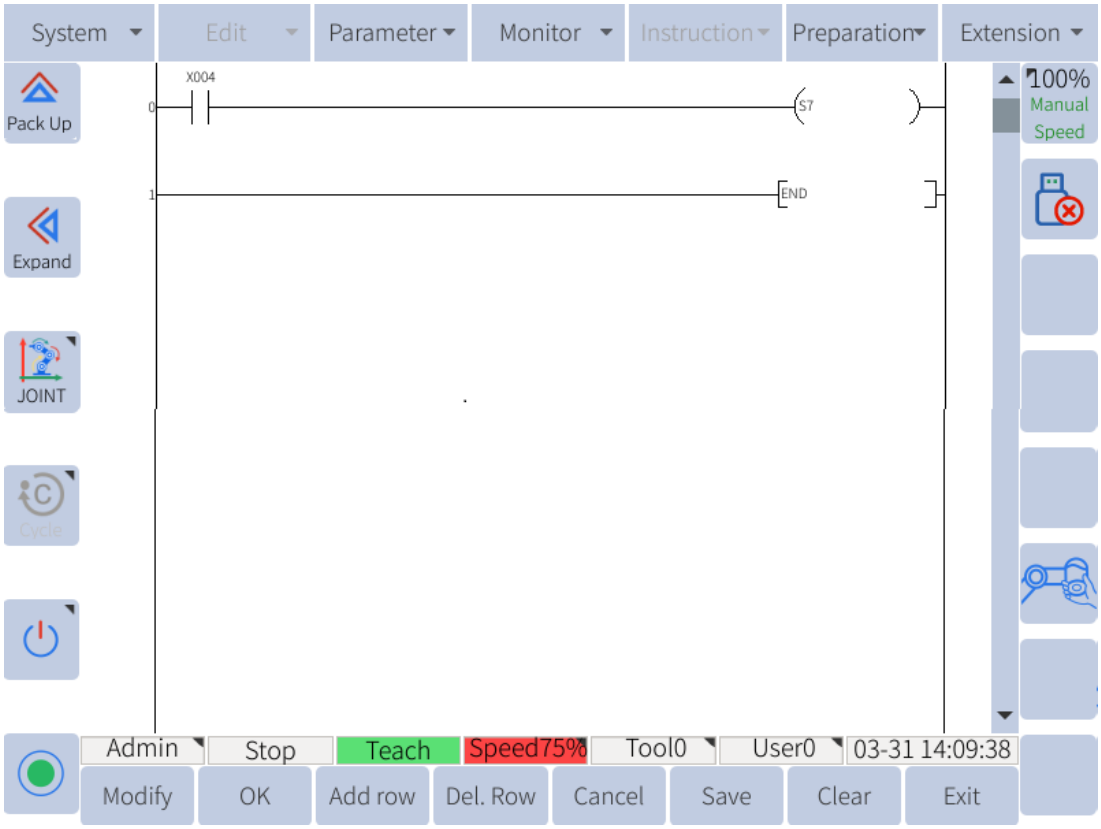


Figure 10-5 : Closeservo PLC example

In this example, X004 is a digital input connected to an external button, The user presses a button to turn off the servo.

10.3 PLC example (S17/S18)

Figure 10-6 is an example of a PLC program the user can create to trigger reduced speed mode.

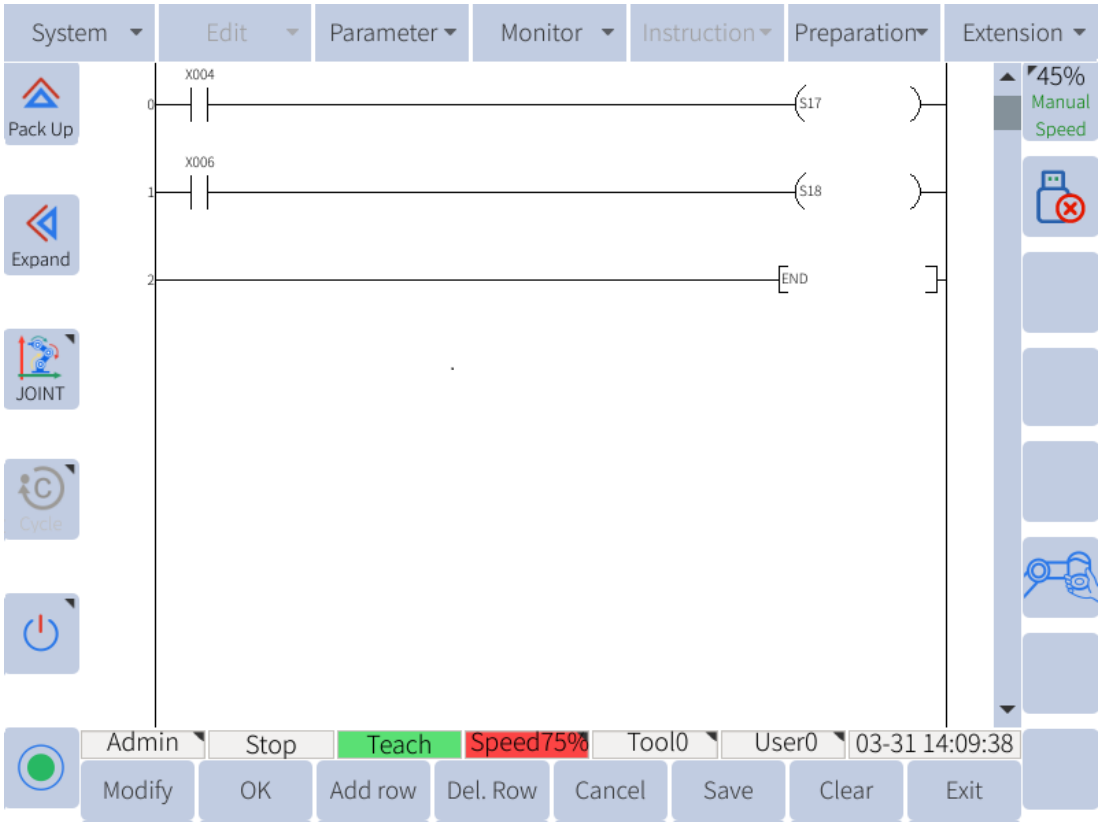


Figure 10-6 : An example of how to set up the PLC so the robot will enter reduced speed mode

In this example, X004 and X006 are digital inputs connected to two external buttons. When the two buttons are pressed, S17 and S18 are set. If the robot is running a program, when the buttons are pressed S17 and S18 are triggered and the robot speed is reduced. Make sure that the collaborative function of the robot is enabled and the reduced speed is set lower than the normal speed (see Subsection 12.2.3).

10.4 PLC example (S19)

Figure 10-7 shows an example of a PLC program that the user can create to protect the automatic recovery after stopping.

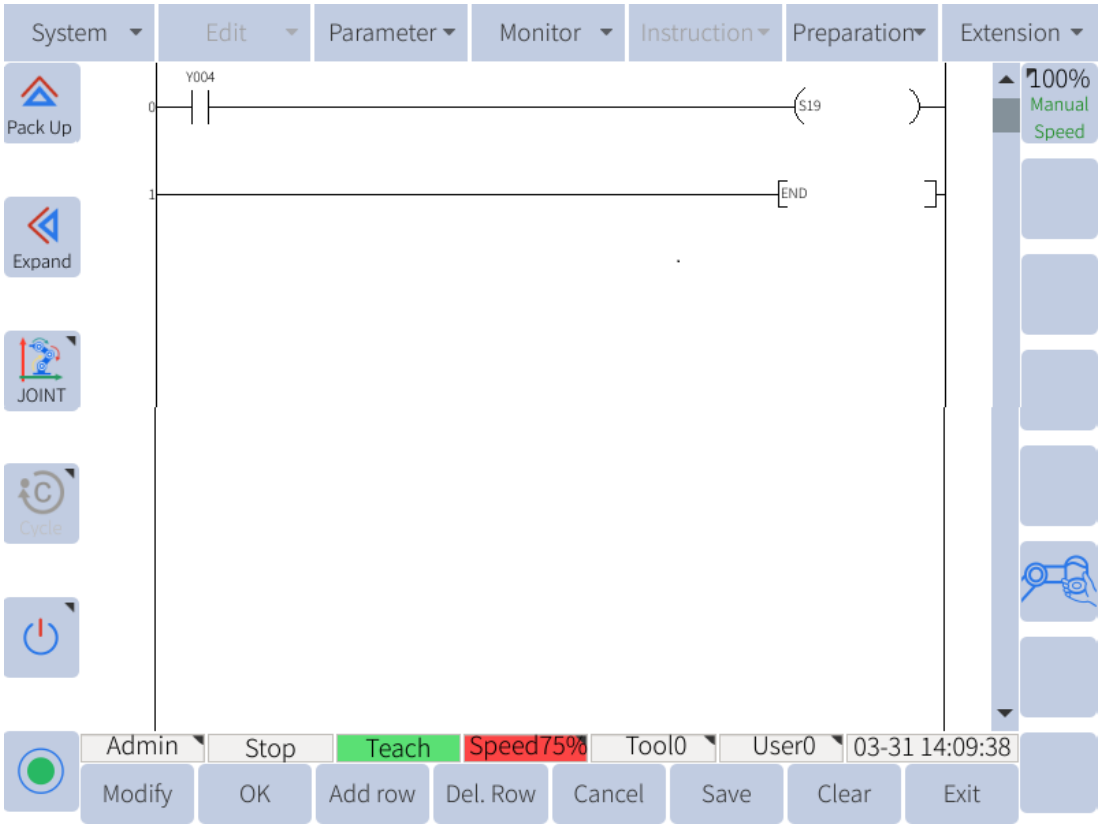


Figure 10-7 : Example of a PLC that automatically recovers after the protection stops

In this example, when Y004 is set to 1, after the protection is stopped and suspended, the task can automatically resume running.

CAUTION

A pause caused by a non-protective stop has no such effect. Such as: pause button on the teach pendant, external pause, program pause, etc.

10.5 PLC example (S20)

Figure 10-8 shows an example of a PLC program where the user can connect an external button to mark, drag or record the robot.

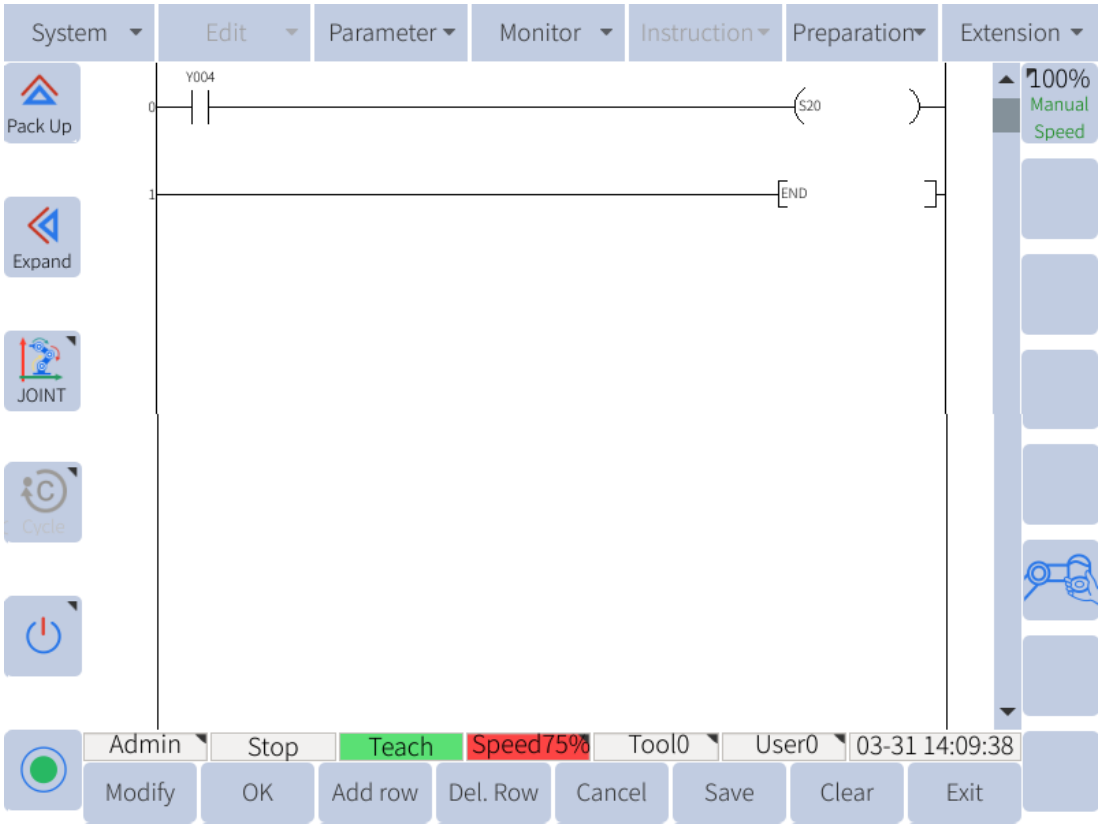


Figure 10-8 : PLC example of external button

In this example, Y004 is a digital output connected to an external button, The user can configure the functions of the external buttons in the "**Extension -> EndingIO-> Button Configuration**" interface. After configuration, just press the button.

CAUTION

If the user uses the teach pendant to turn off the drag function in the middle, the external button will be invalid. You need to click "Preparation > Drag Move settings" to re-enable the drag function. The external buttons only work after turning it back on.

10.6 PLC example (S21)

As shown in **Figure** 10-9 , it is an example of a PLC program that the user can clear the collision alarm.

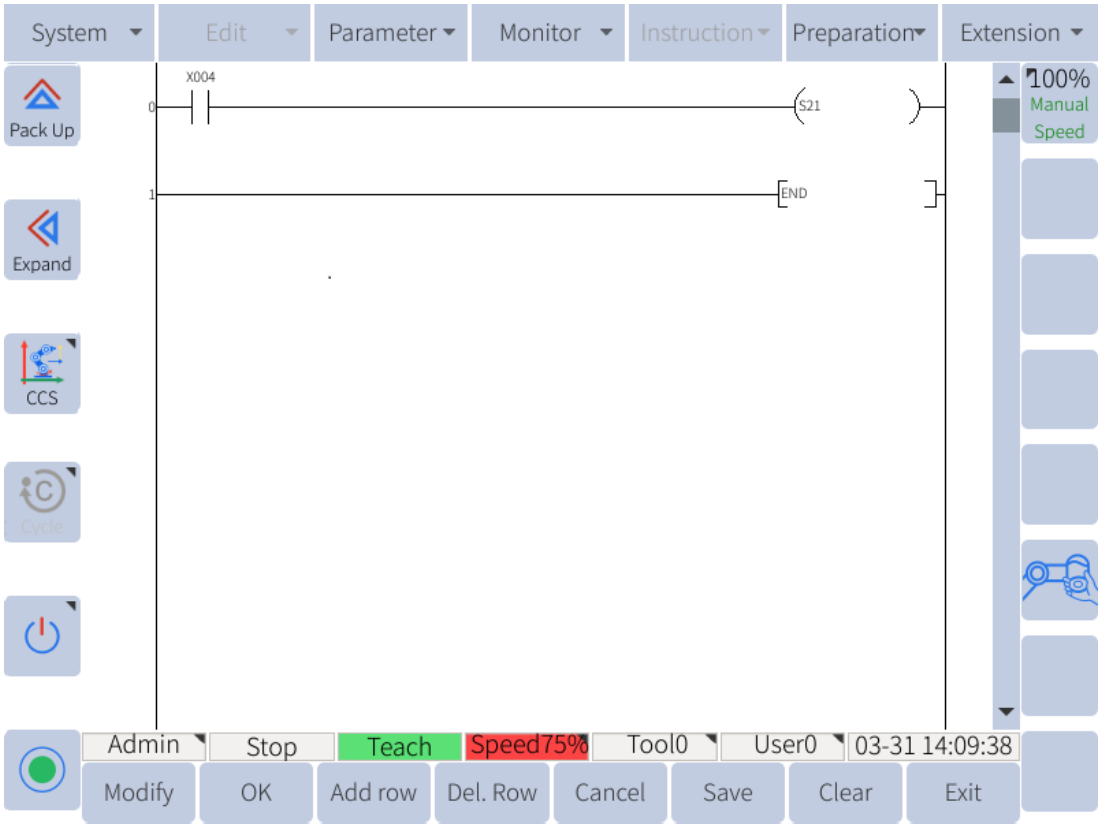


Figure 10-9 : PLC example for clearing collision alarm

In this example, X004 is a digital input connected to an external button, The user presses the button to clear the collision warning.

10.7 PLC example (S22)

Shown in **Figure** 10-10 is an example of PLC program where users can calibrate the encoder.

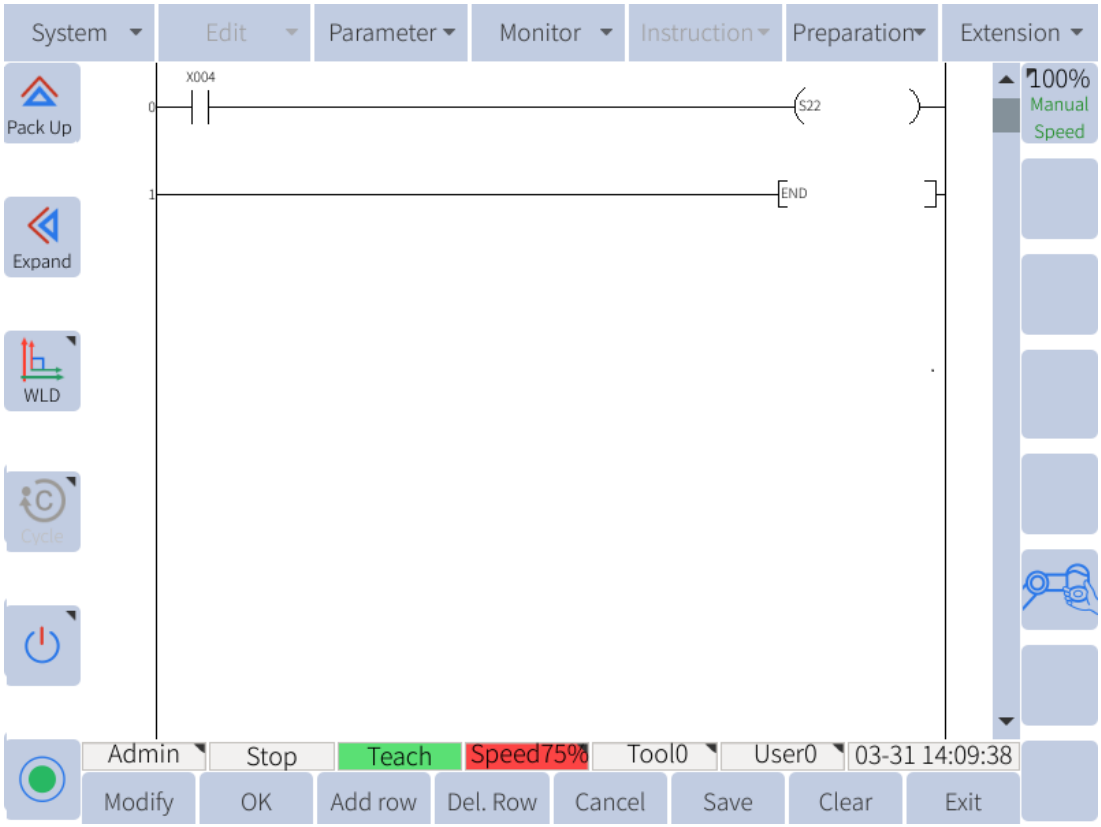


Figure 10-10 : PLC example of encoder calibration

In this example, X004 is a digital input connected to an external button, The user can perform encoder calibration at the push of a button.

10.8 PLC example (S23-S24)

The user can enter the reverse drive mode through the two PLC registers S23 and S24. First, the S23 register is initialized, and then the S24 register is used to enter the backdrive mode.

As shown in **Figure** 10-11 is an example of a PLC program where the user can enter backdrive mode.

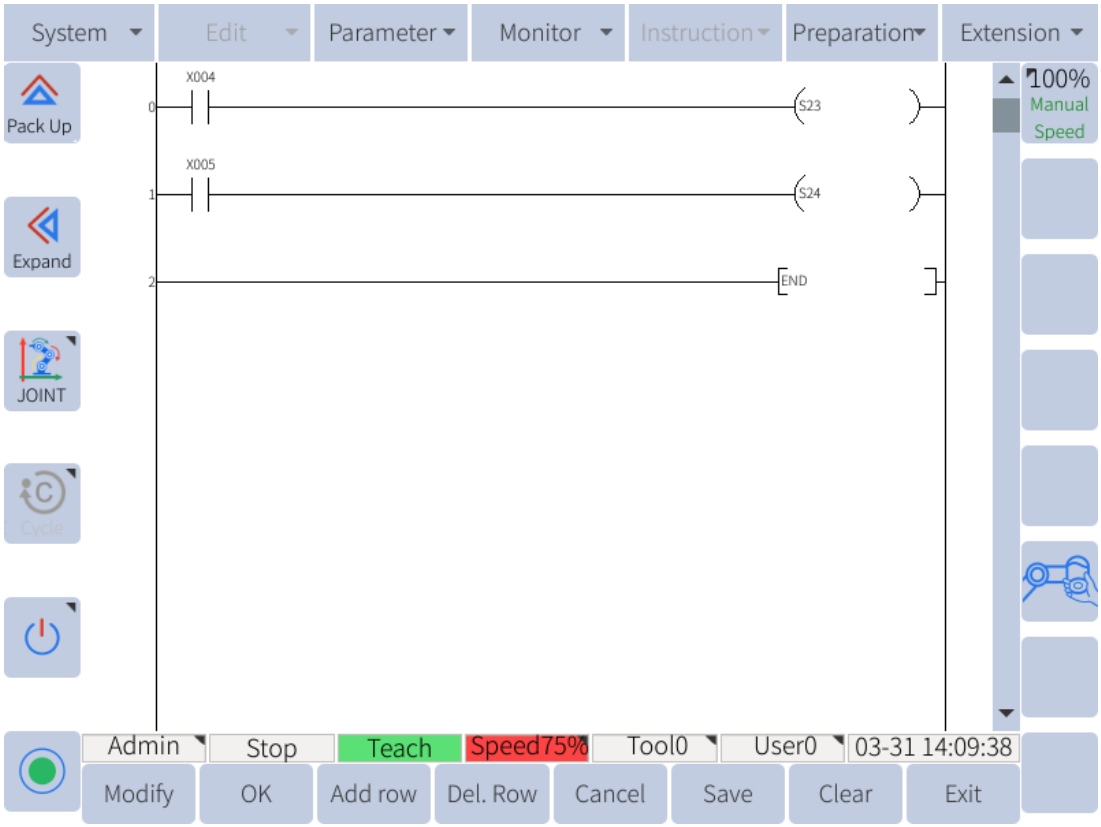


Figure 10-11 : PLC example in backdrive mode

In this example, X004 is a digital input connected to an external button, the user presses the button and the robot becomes initialized. X006 is a digital input connected to an external button, the user presses the button and the robot goes into backdrive mode.

CAUTION

When entering backdrive mode, the robot must be in an initialized state.

Chapter 11 Webpage remote control robot

Elite Robot supports users to log in to the website and perform remote control of the robot, such as VNC display, file management, etc.

The specific flowchart is shown in **Figure** 11-1 :

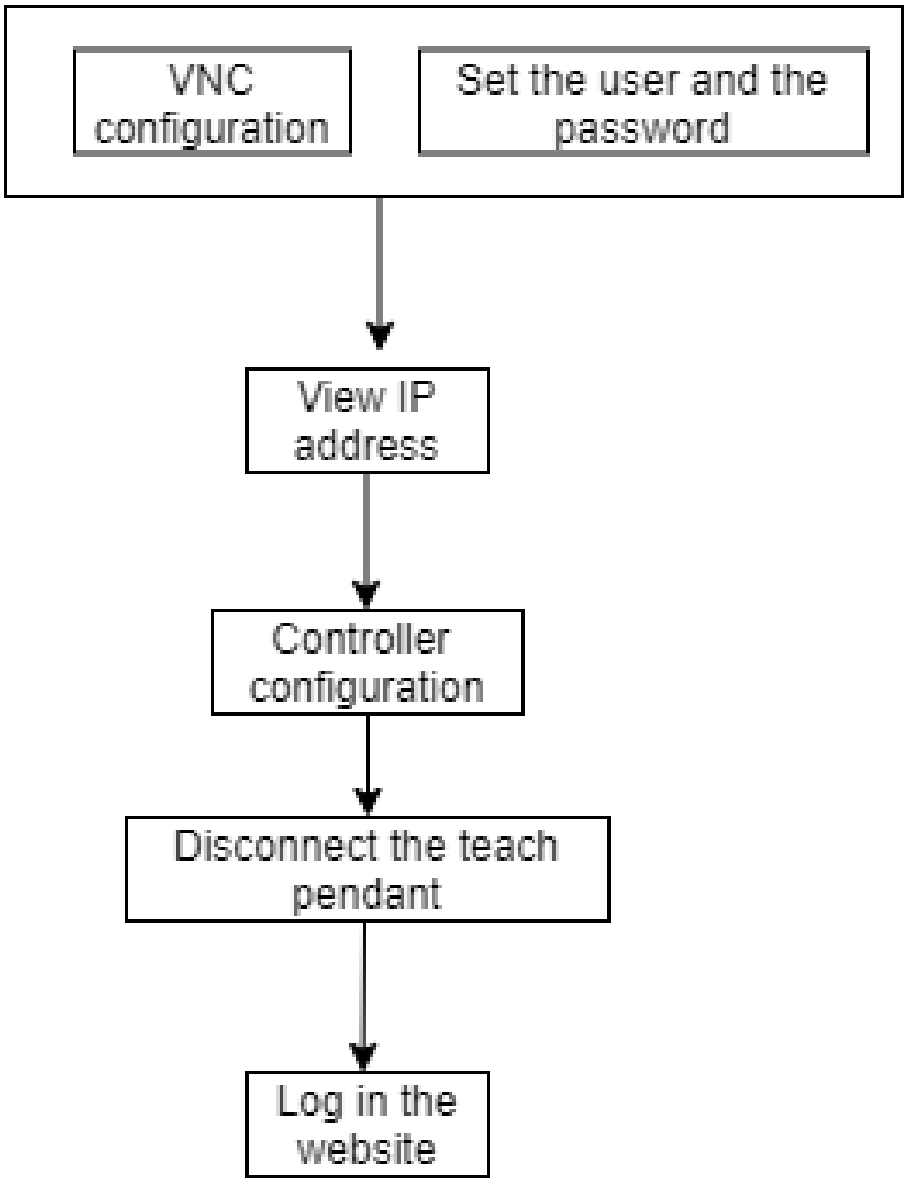


Figure 11-1 : flowchart

11.1 Configure VNC

After the user configures the VNC, the robot can be remotely controlled on the website. The specific steps are as follows:

1. Choose System > System setting > VNC setting.
2. Set “Auto start” to “Yes”, click “Set”.
3. Click “Restart” to start VNC, as shown in **Figure** 11-2 .

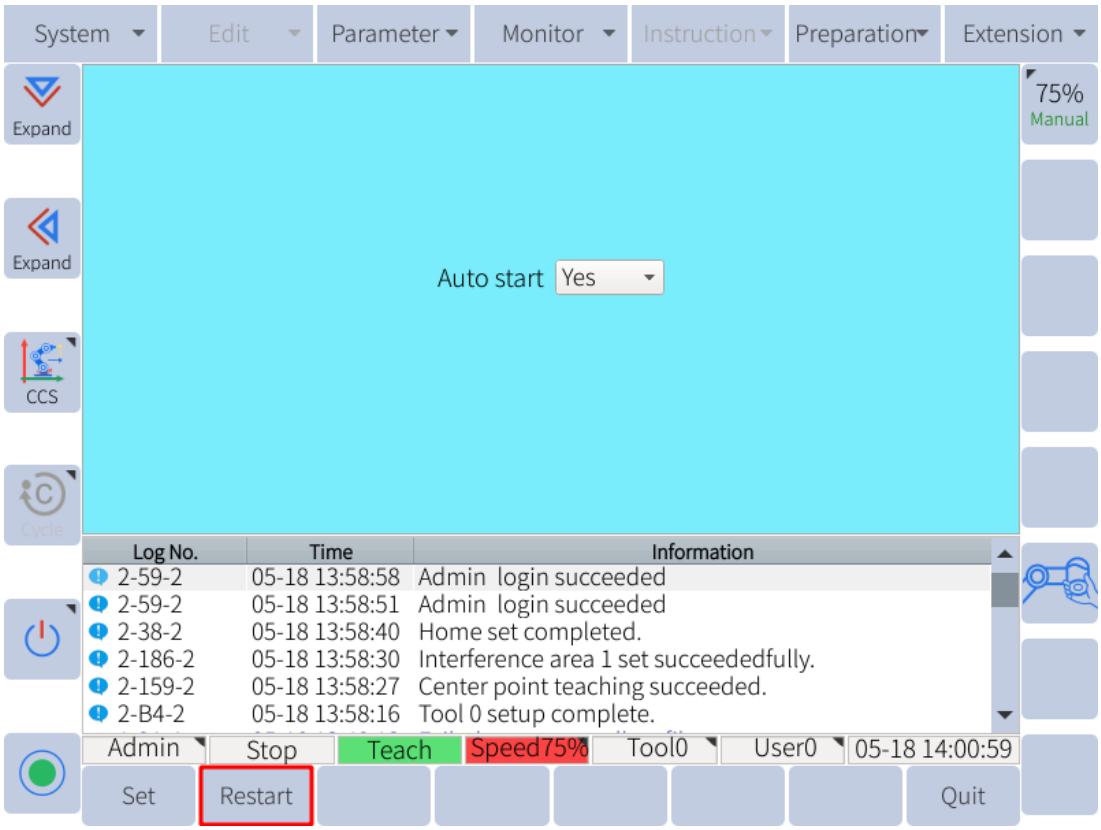


Figure 11-2 : VNC setting page

11.2 Set username and password

1. Choose System > System setting > Remote password.
2. Set the type of the password as “RTP”.
3. Enter the username and password, which is used to log in the website, as shown in **Figure** 11-3 .

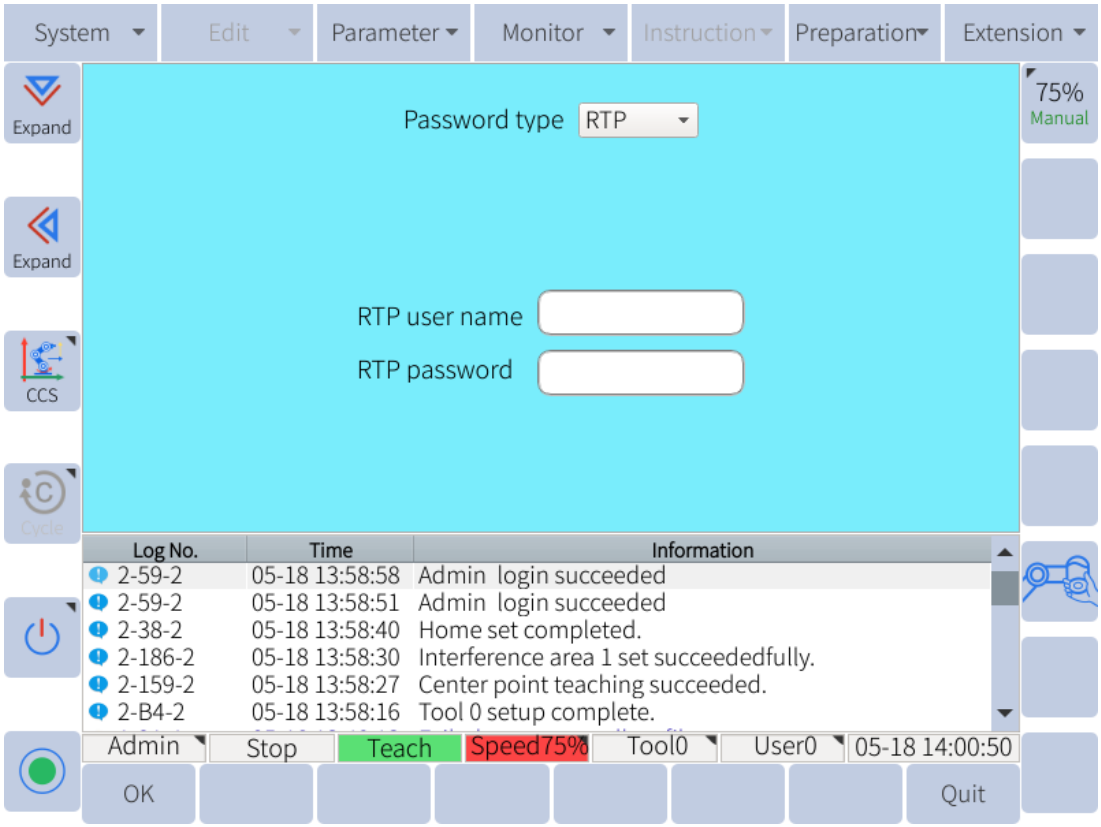


Figure 11-3 : set username and password

11.3 View IP address

Choose System > System setting > Network Configuration to check the IP address of the device, as shown in **Figure** 11-4 .

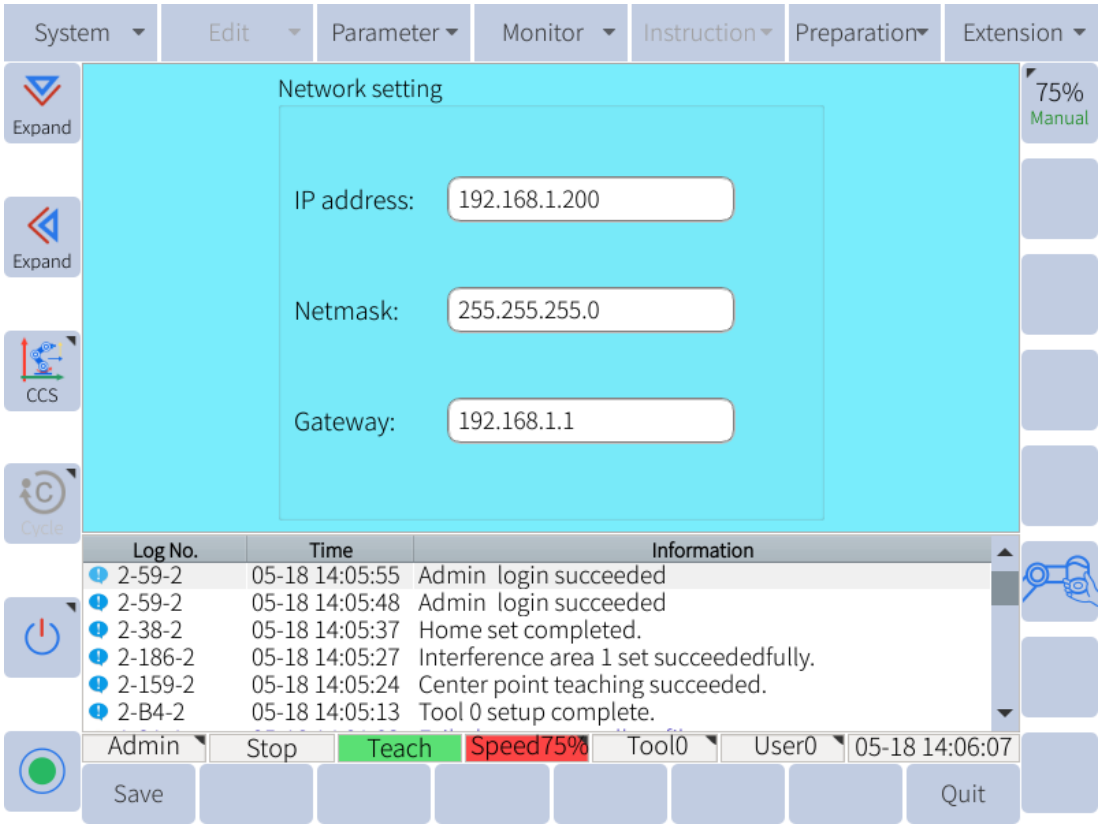


Figure 11-4 : Network Configuration Page

11.4 Setup Controller

1. Select “Parameter > Controller”.
2. Move down to the “Teach Pendant Connection State” row and click “Modify”.
3. Set “Teach Pendant Connection State” to “Disconnect”, disconnect the Teach Pendant connection status.

11.5 Remove the teach pendant

First press the switch button to disconnect the robot power supply, and then disconnect the teach pendant from the robot body.

After removing the teach pendant, press the switch button again to restart the robot, and then the robot can be controlled remotely through the web page.

11.6 Remote control robot

11.6.1 Operation prerequisites

1. Install windows system
2. Install Google Chrome, recommended version 97 or above
3. Install graphics driver
4. It is not recommended to use the translation plugin that comes with the browser

Users can log in to the website through a browser and control the robot remotely. It is recommended to use Google Chrome or Firefox.

1. Open the browser, enter the URL: http://current device IP address:6680/, and press Enter.
2. Enter the user name and password, click “Login” to enter the webpage.

11.6.2 Select view mode

On the menu bar at the top left of the website, users can click “Console view” and select the appropriate view mode from “Default view”, “Teach pendant view”, “Manipulator view”, as shown in **Figure** 11-5 .



Figure 11-5 : view mode

- Teach Pendant View: Only the teach pendant interface is displayed, and the user can monitor the teach pendant and simulate clicking on the teach pendant screen.
- Robot arm view: Only the interface of the robot arm is displayed, and the user can simulate the rotation or translation of the robot to observe the state and movement trajectory of the robot.
- Default view: both the teach pendant view and the arm view.

11.6.2.1 Teach pendant view

The user can perform the following operations in the teach pendant view:

- Simulate the actual teach pendant, simulate the actual teach pendant screen through the virtual screen, and operate the robot.
- simulates the actual teach pendant, and the status of the robot can be observed through the virtual LED.
- simulates the actual teach pendant, which can be set to PLAY, REMOTE.TEACH mode through the virtual key bit.
- simulates the actual teach pendant, which can be simulated as clicking the button of the real teach pendant through the virtual button.
- In teach mode, the servo can be enabled or disabled by pressing the CTRL key on the keyboard or by clicking the “CTRL (servo)” virtual button.

11.6.2.2 Robot view

The user can perform the following operations in the robotic arm view:

- The virtual scene can observe the real-time state of the physical robot arm and observe and clear the movement trajectory of the robot.
- Drag the virtual robot arm with the left mouse button to simulate a rotating physical robot and observe it from different angles.
- Drag the virtual arm with the right mouse button to simulate a translational physical robot.

11.6.3 File management

Users can click “File Management” in the upper menu bar to enter the “File Management” interface.

CAUTION



The file management function is only supported in teach mode.

In the interface, the following operations can be implemented:

1. Click the upper right button menu to create a new folder, upload a file, and create a new file, as shown in **Figure** 11-6 .
   Note: The format of the uploaded file can only be .jbi and .lua.

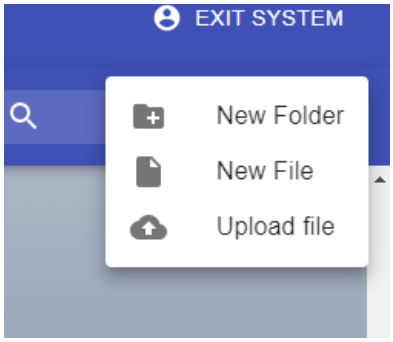


Figure 11-6 : button related operations

2. After selecting a folder, right-click the mouse to open, move, rename, and delete the folder, as shown in **Figure** 11-7 .

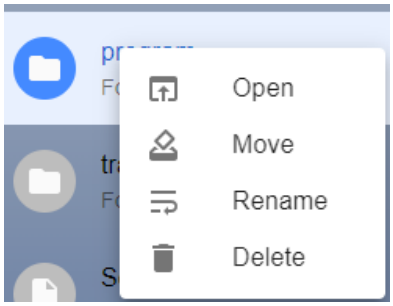


Figure 11-7 : operations on folders

3. After selecting the file, right-click the mouse to download, edit, copy, move, rename, delete the file, as shown in **Figure** 11-8 .

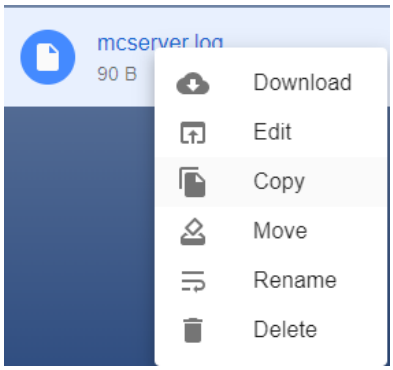


Figure 11-8 : operation on file

4. Double-click the files with the suffixes .jbi and .lua to edit the files online.



Figure 11-9 : online edit page

11.6.4 System upgrade

Users can upgrade the system through the web teach pendant. The specific operation steps are as follows:

1. Confirms that the teach pendant is in “Teach” mode.
2. Click “System > Flash Upgrade”.
3. Click “Upload File”.
4. Click “Select File” and select the software upgrade package “firmware.bin”, as shown in **Figure** 11-10 .



Figure 11-10 : Select file

5. Click “Upload”, upload the file, and wait patiently for the system to upgrade.

11.6.5 Exit system

Users can click the “Exit System” menu on the upper menu bar to exit the web system. After logging out of the web system, if you want to continue using it, you need to enter your username and password to log in again.

Chapter 12 System Settings

12.1 System Settings

12.1.1 Network Configuration

To set up the network for the EC66 navigate to **System -> System setting -> Network Configuration**. **Figure** 12-1 shows the network configuration page. Enter the IP address, netmask, and gateway addresses. Make sure to click "Save" in the submenu to apply any changes. The system does not need to be restarted for changes to take affect.

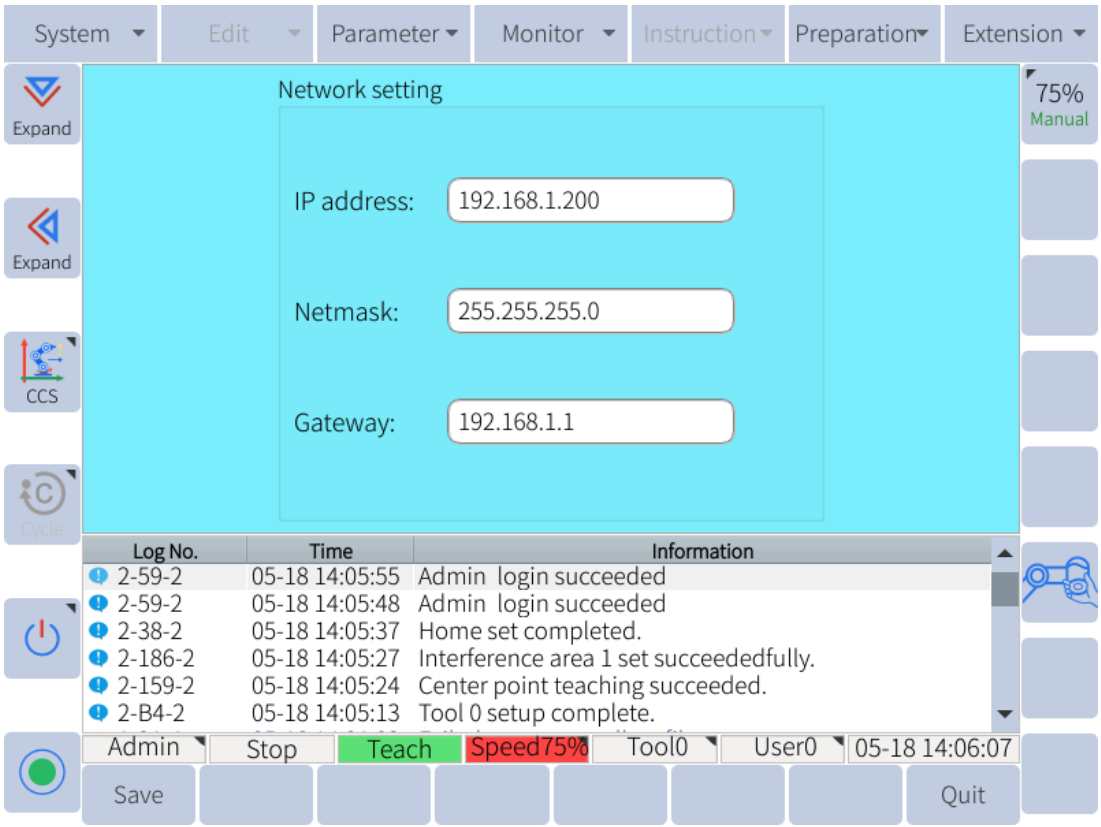


Figure 12-1 : The network configuration page

12.1.2 Language Configuration

To select the desired language navigate to **System -> System setting -> Language setting**. **Figure** 12-2 shows the language configuration window. Select the appropriate language and click "OK".

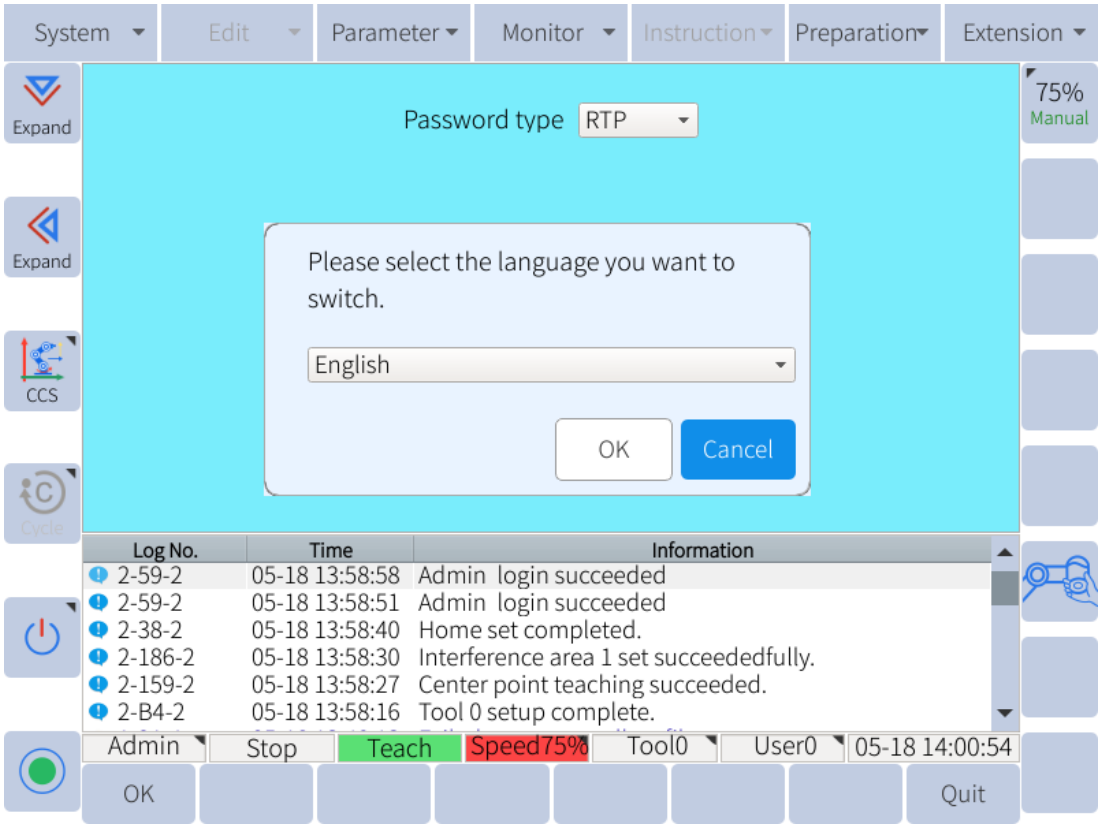


Figure 12-2 : The language configuration page

NOTICE

This version supports users to import French, Italian, Spanish, German, and Thai languages. Import the translated form, and then switch the language.

12.1.3 VNC setting

In order to use the VNC server for viewing the GUI from a laptop or desktop computer, navigate to **System -> System setting -> VNC setting**. The user will see the window shown in **Figure** 12-3 .

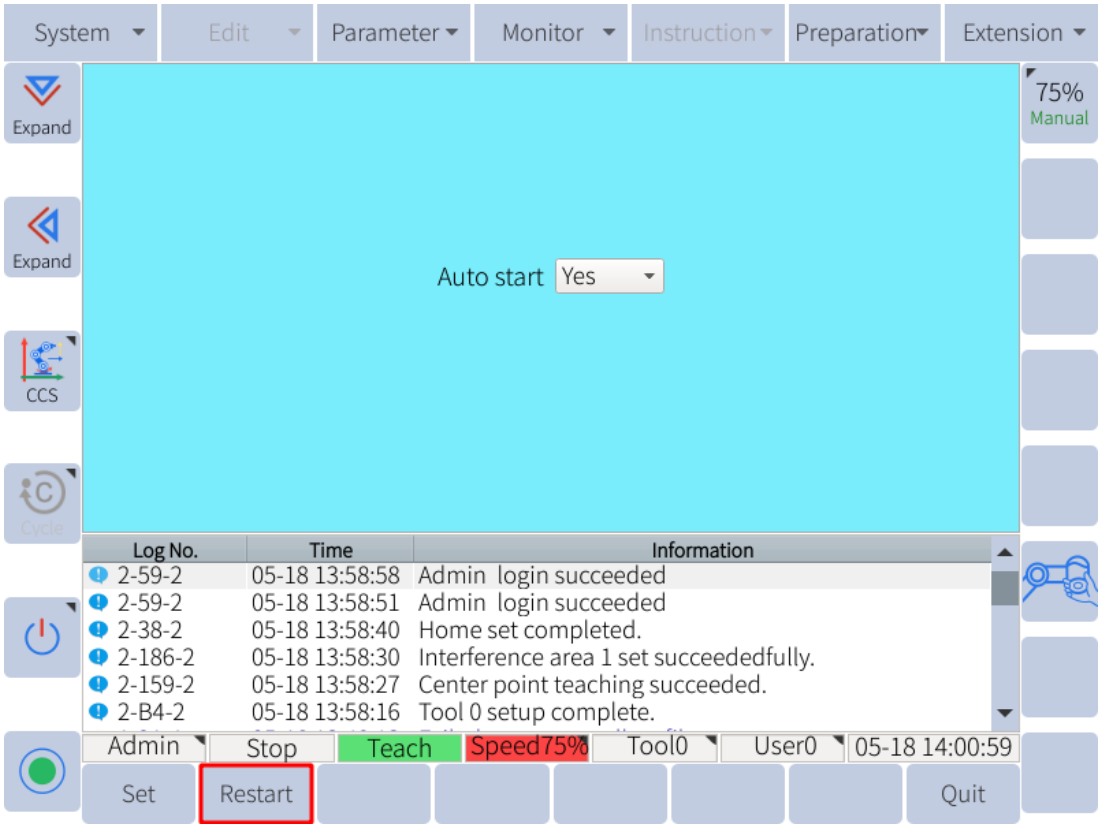


Figure 12-3 : The VNC setting page

To turn on the VNC viewer click on the “Restart” button. This will turn on the VNC server until the robot system is restarted. If the user wishes to start the VNC server automatically on system startup, they can click on the drop down menu and select YES for Autostart.

To access the VNC server and view the GUI on an external screen, the user must install a VNC viewer on their PC. Enter the IP address of the robot system in the VNC client. The user will be prompted for a password. The default VNC viewer password is 333333.

12.1.4 Password Configuration

For password configuration, please navigate to **System -> System setting -> Remote password**. The user will see the window shown in **Figure** 12-4 .

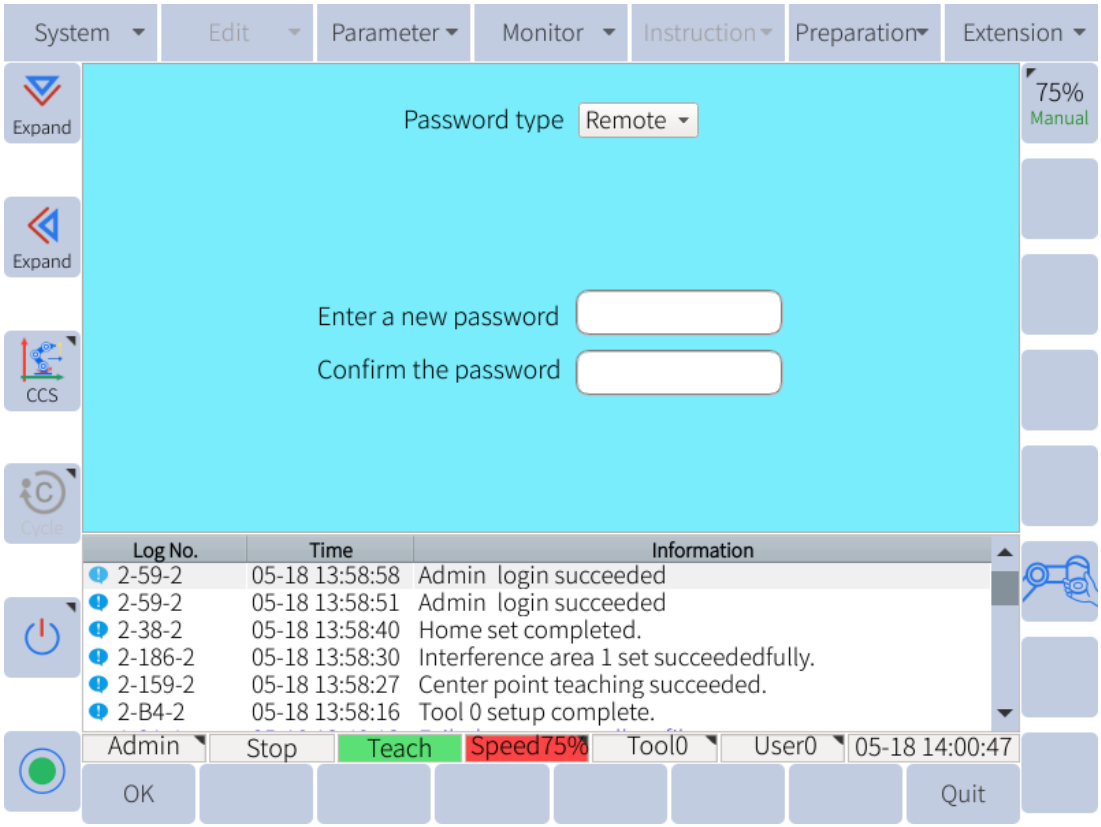


Figure 12-4 : Password configuration

The user can set a password in the remote mode, and the security parameters can be set only after obtaining the password in the remote mode. If not set, the default is ”123456”.

The user can also set the RTP username and RTP password to log in to the Web page.

12.2 Preparation

12.2.1 Robot Configuration

To set up which peripherals an operator wishes to use with the robot, navigate to **Preparation -> Process config**. **Figure** 12-5 shows the available peripherals and settings.

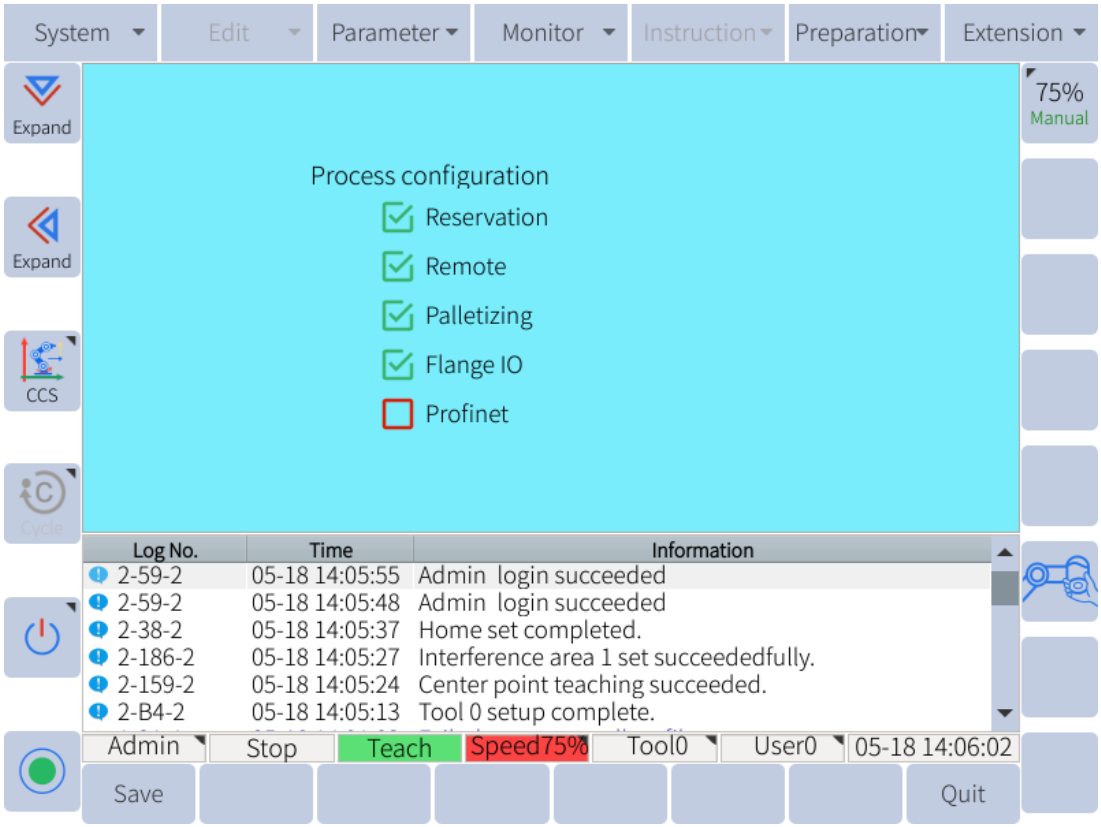


Figure 12-5 : The robot configuration page

To select or unselect a setting, click on the check box next to the setting the user wishes to configure. When finished, click “Save” in the submenu. In the popup box click “OK” to accept the action. The system will restart. If the user configured any settings, their functions will be available when the system restarts.

12.2.2 Mount config

The mount config page is used to identify the mounting pose of the robot. This information is important because it helps the robot determine the gravitational forces on the robot arm.

CAUTION



It is very important that this information is entered correctly. Gravity compensation for handguiding and other algorithms use this information. Failure to set the mount config appropriately can result in unpredictable robot motion.

Figure 12-6 shows the settings that need to be entered for the mounting pose of the robot. The mounting pose must be entered correctly. The deflection and rotation angles are the euler representation of the robot’s orientation relative to a world frame. The order of rotation for euler angles is rotation about the Z axis followed by a rotation about the Y axis, and finally a rotation about the X axis, or ZYX euler rotation.

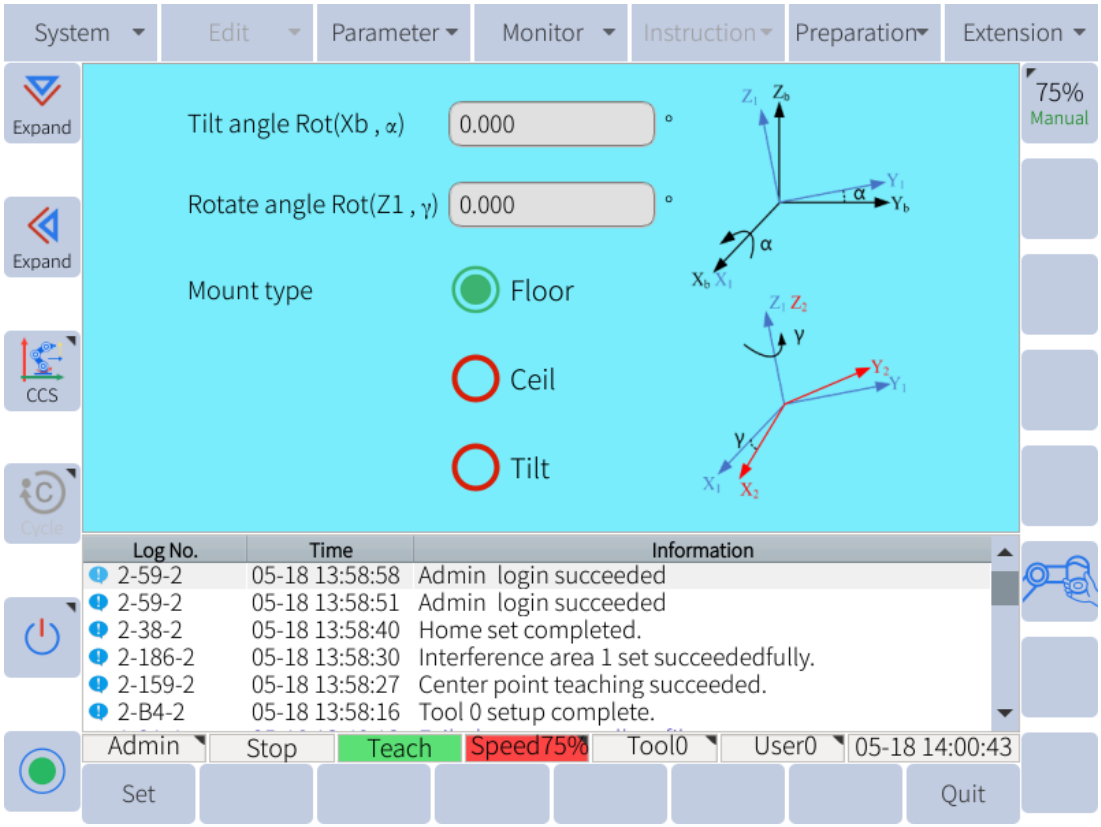


Figure 12-6 : The installation configuration page

Suppose the intersection of the mounting surface and the horizontal plane is X1, and the X axis of the robot coincides with X1, and the Z axis is the opposite direction of gravity; Rotate the X-axis first (the rule of the right hand, the thumb is the X-axis direction, and the rotation along the four-finger direction is positive, otherwise it is negative), Make the XY axis plane of the robot base mark parallel to the mounting surface, The angle of rotation is the deflection angle Rot (Xb, α); Then rotate the latest Z axis of the robot (the rule of the right hand, the thumb is the Z axis direction, and the rotation along the four fingers direction is negative, The opposite is positive), so that the X axis of the robot base matches the installation position, The angle of rotation is the rotation angle Rot(Z1,γ).

12.2.3 Safety Limit

Certain collaborative functions of the robot can be limited for safety reasons. To configure these settings navigate to **Preparation -> Safety Config -> Safety Limit**. **Figure** 12-7 shows which of these features can be set.

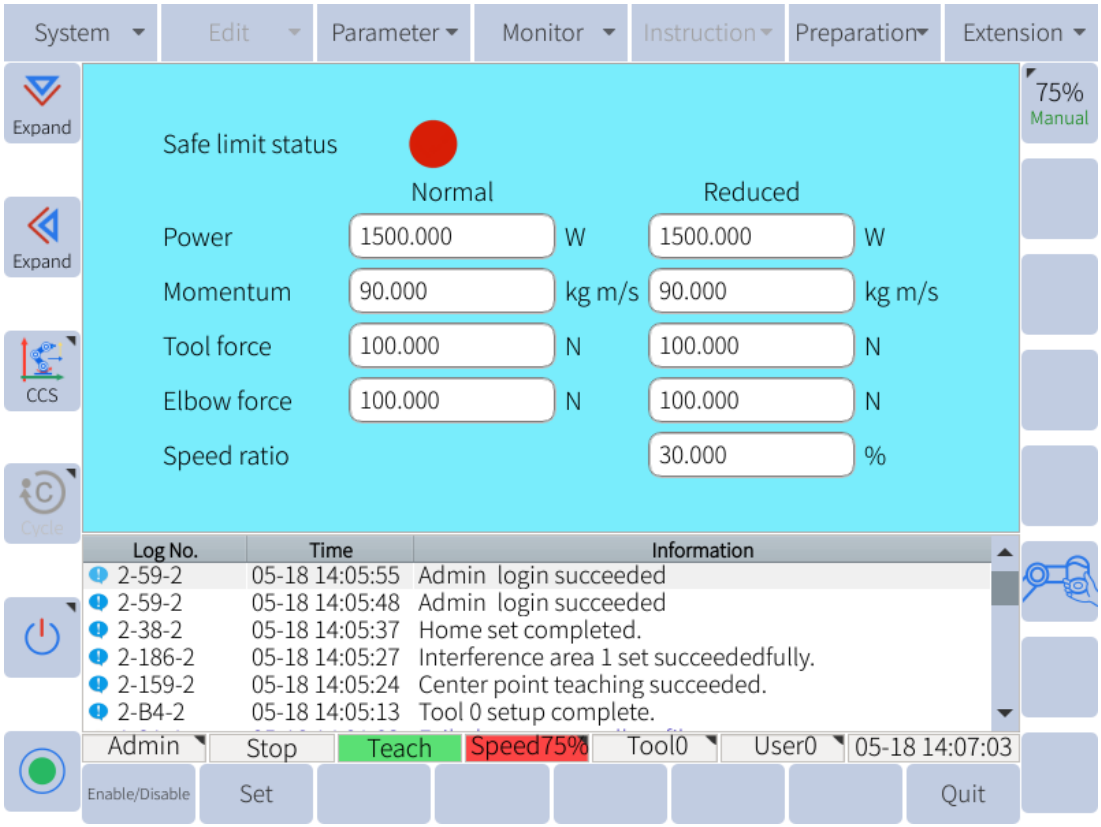


Figure 12-7 : Safet limit configuration page

The user can define normal mode and reduced mode.

After entering the reduced mode through the virtual M526 (S17) and M527 (S18), the robot runs according to the parameters of the reduced mode.

Note: Users can check whether M526 and M527 are in reduced mode on the ”Monitor > Input and output > Virtual Output” interface.

The interface parameters are explained as follows:

- power: limit the power of the robot to the environment
  Note: This restriction treats the payload as part of the robot and not the environment.
- momentum: limit the momentum of the robot in the process of movement
- tool force: limit the maximum force exerted by the robot tool in a clamping situation.
- elbow force: limit the maximum force exerted by the robot’s elbow on the environment.
- speed ratio: limit the speed in automatic mode.

To enable these collaborative functions and safety limits click on “Enable/Disable” in the submenu area. Once the limits have been set, click on “Set” to save the new safety limits.

12.2.4 Collision Configuration

The collision detection function of the robot can be enabled or disabled. To configure the collision detection navigate to **Preparation -> Safety config -> Collision Detection**, as shown in **Figure** 12-8 .

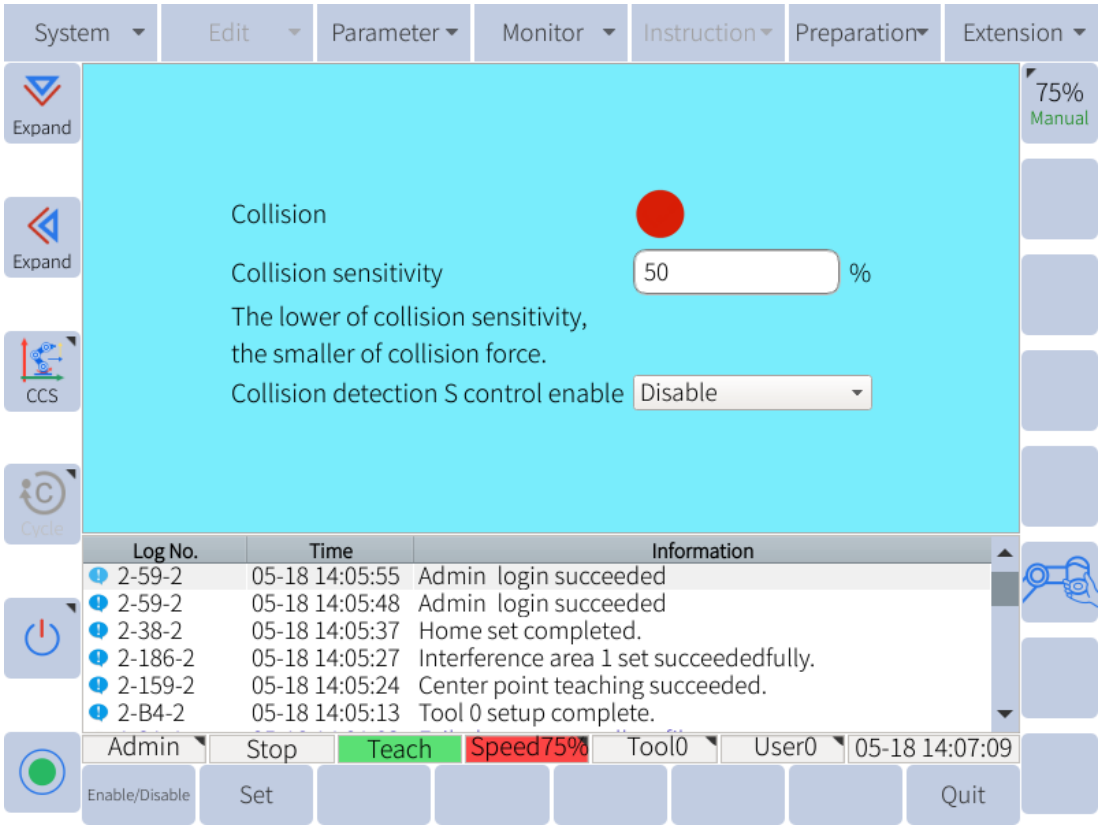


Figure 12-8 : Collision configuration page

To enable collision detection, click on “Enable/Disable” in the submenu. To set the sensitivity of the collision detection enter the sensitivity level from 0% to 100%. Click “Set” to save the new collision detection settings.

12.3 General Settings

Access to these settings are user level dependent. All settings are available to administrator level users. **Table** 12-1 shows which settings are available to each user level.

Table 12-1 . Settings accessability by user level

User Level	Parameter
Ordinary User	1. Kinematic 2. Authority (a). User switch
Expert User	1. Kinematic 2. Controller 3. Authority (a). User switch
Super User	1. Kinematic 2. Controller 3. Soft limit 4. Authority (a). User switch (b). Password
Administrator	1. Kinematic 2. Controller 3. Soft limit 4. Joint servo 5. DH parameter 6. JOG parameter 7. Authority (a). User switch (b). Password

12.3.1 Kinematic

If users need to modify the kinematics parameters of the robot, they can go to **Parameter -> Kinematics**. The kinematics setting page is shown as **Figure** 12-9 .

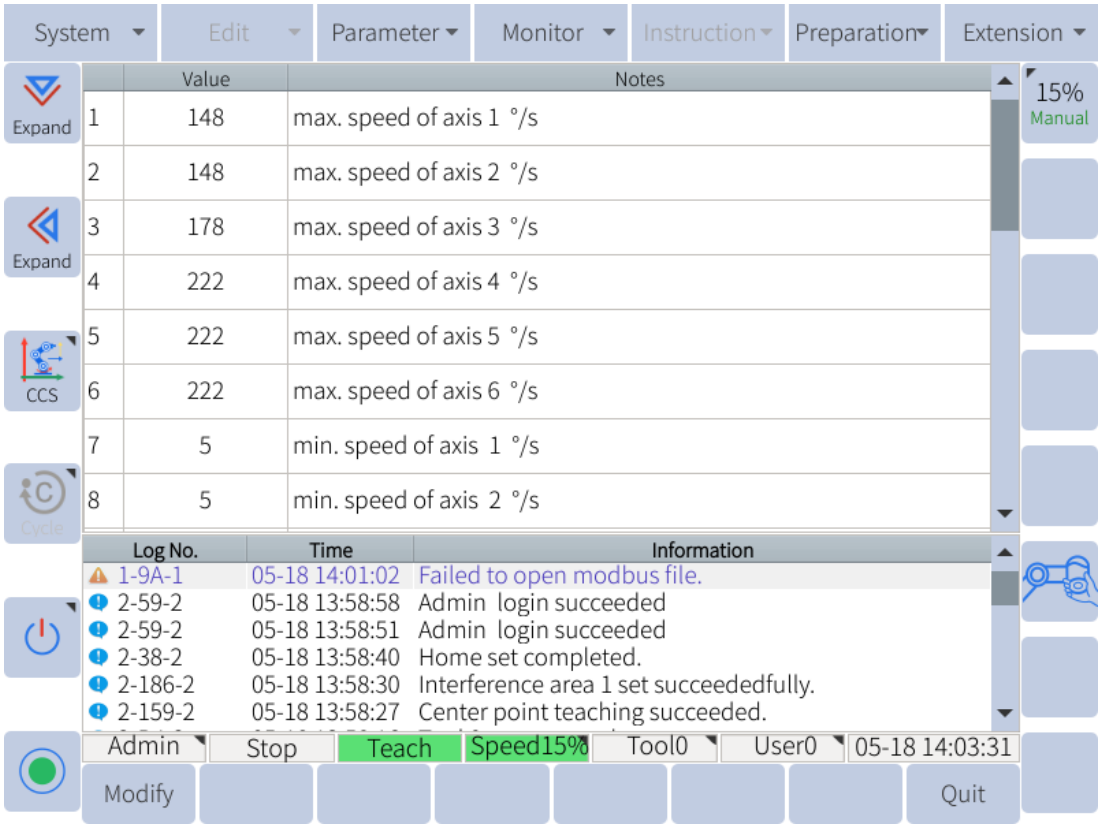


Figure 12-9 : Kinematics Setting Page

The following list shows what settings can be modified along with a description of what each setting does:

- Max speed of Axis # (deg/s) - This controls the maximum rotation rate of each joint in degrees per second
- Min speed of Axis # (deg/s) - This controls the minimum rotation rate of each joint in degrees per second
- Max line speed (mm/s) - This controls how fast the robot TCP will move in a linear motion in millimeters per second
- Min line speed (mm/s) - This controls how slowly the robot TCP will move in a linear motion in millimeters per second
- Max Pose rotation angular velocity (deg/s) - this controls how fast the robot TCP will rotate about a fixed point in degrees per second
- Min Pose rotation angular velocity (deg/s) - this controls how slowly the robot TCP will rotate about a fixed point in degrees per second

CAUTION

These settings should not be modified. If any of these settings need to be modified please consult with ELITE ROBOT Co.,Ltd. support engineers

12.3.2 Controller settings

The system parameters are used to modify some of the teach pendant settings. To modify the system parameters navigate to **Parameter -> Controller**. **Figure** 12-10 shows the available system settings that can be modified.

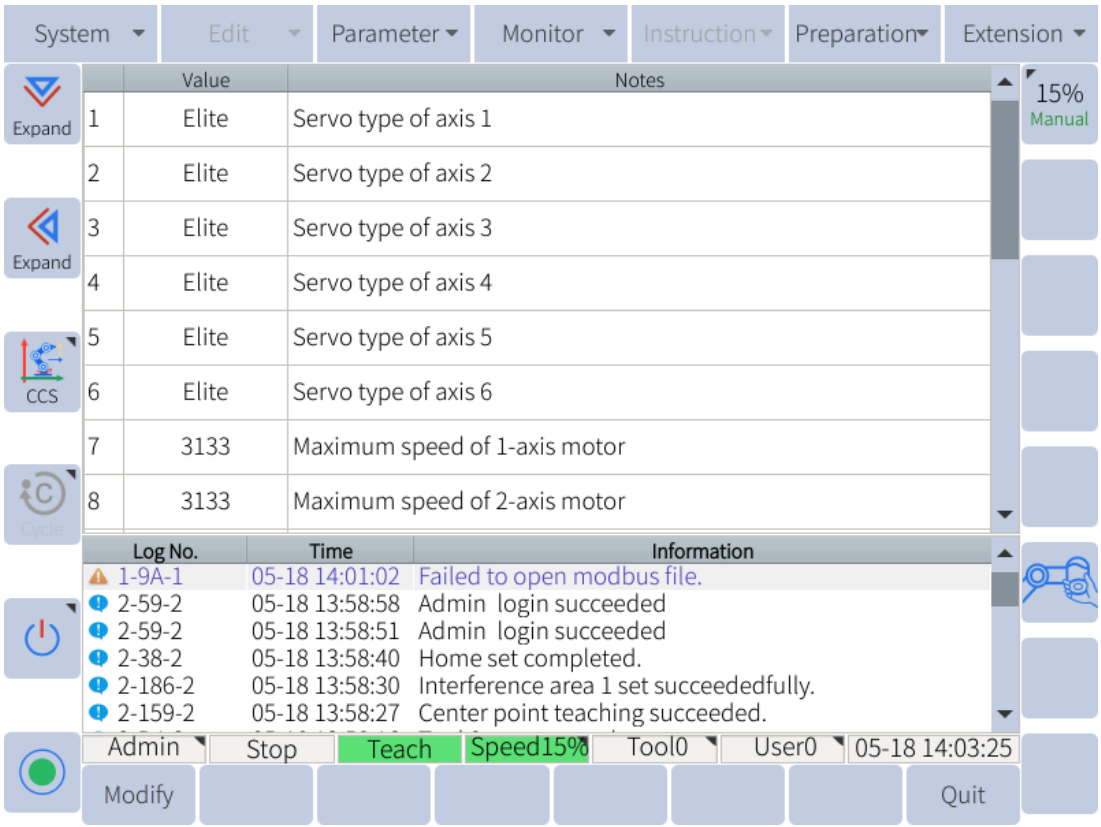


Figure 12-10 : Controller settings page

The following list contains the settings and their description:

- Servo type: If you need to modify, please contact ELITE ROBOT Co.,Ltd. support engineers
- Maximum motor speed: the maximum speed of the motor in the joint
- Backlight brightness in normal mode- How bright the teachpendant screen is when in use (0%-100%).
- Backlight brightness in power saving mode - How bright the teachpendant screen is when not in use for a specified amount of time (0%-100%).
- Time to enter power saving mode- How long in seconds the teachpendant will wait before going to half brightness.
- Backlight off Time - How lond in seconds the teachpendant will wait until the teachpendant becomes locked and the lock screen is displayed.
- Teach pendant connection state - This controls whether the teach pendant display is used or not. If set to “disconnect” the GUI can be accessed through a VNC viewer.
- Emergency stop deceleration stop time - How long the system takes to respond to an emergency stop (range from 1 to 200 ms)

12.3.3 Soft limit settings

Limits may be placed on how far each joint of the manipulator can rotate. To set these limits navigate to **Parameter -> Soft limit** (**Figure** 12-11). The maximum joint limit is +360 degrees and the minimum joint limit is -360 degrees.

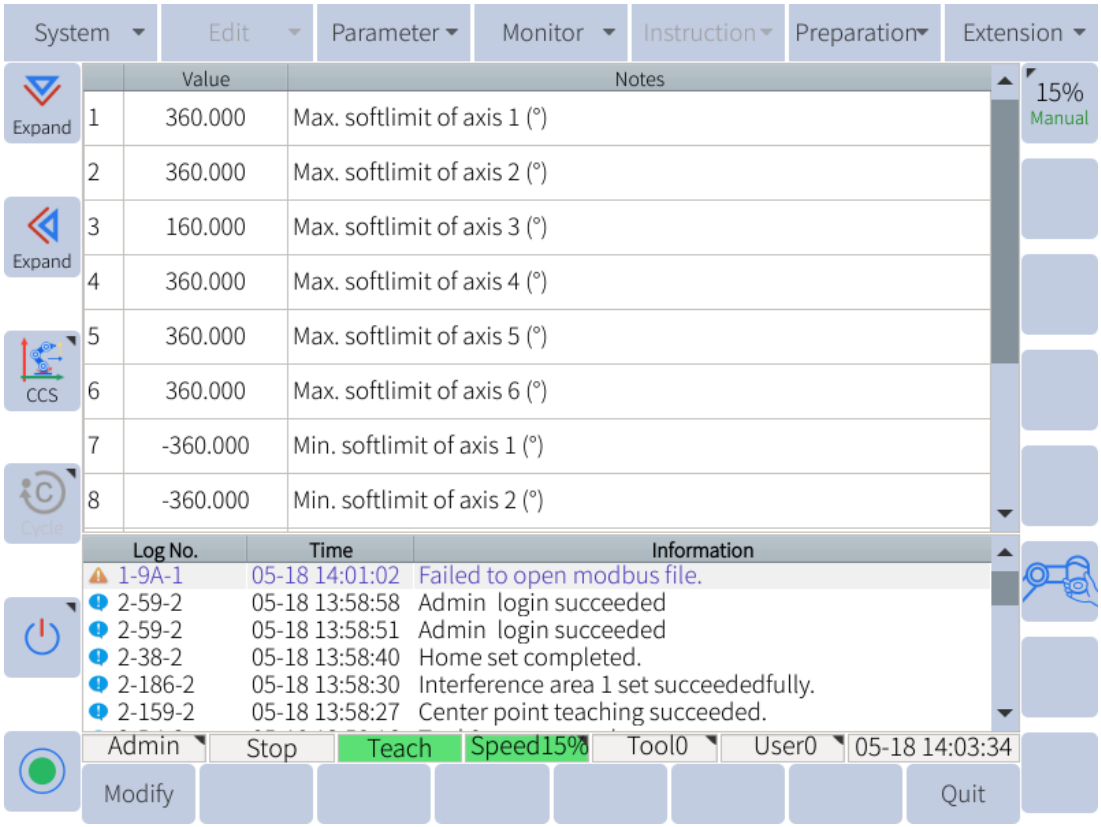


Figure 12-11 : Soft limit parameters page

12.3.4 DH Parameters

The DH parameter settings page allows the user to set the type of robot that is connected to the controller. This does not need to be modified by the user. The system comes setup so that the robt and controller are paired correctly. There is also a window showing the DH parameters of the robot. Numbers are not given. To determine the correct dimension of each DH parameter refer to Subsection 3.1.2.

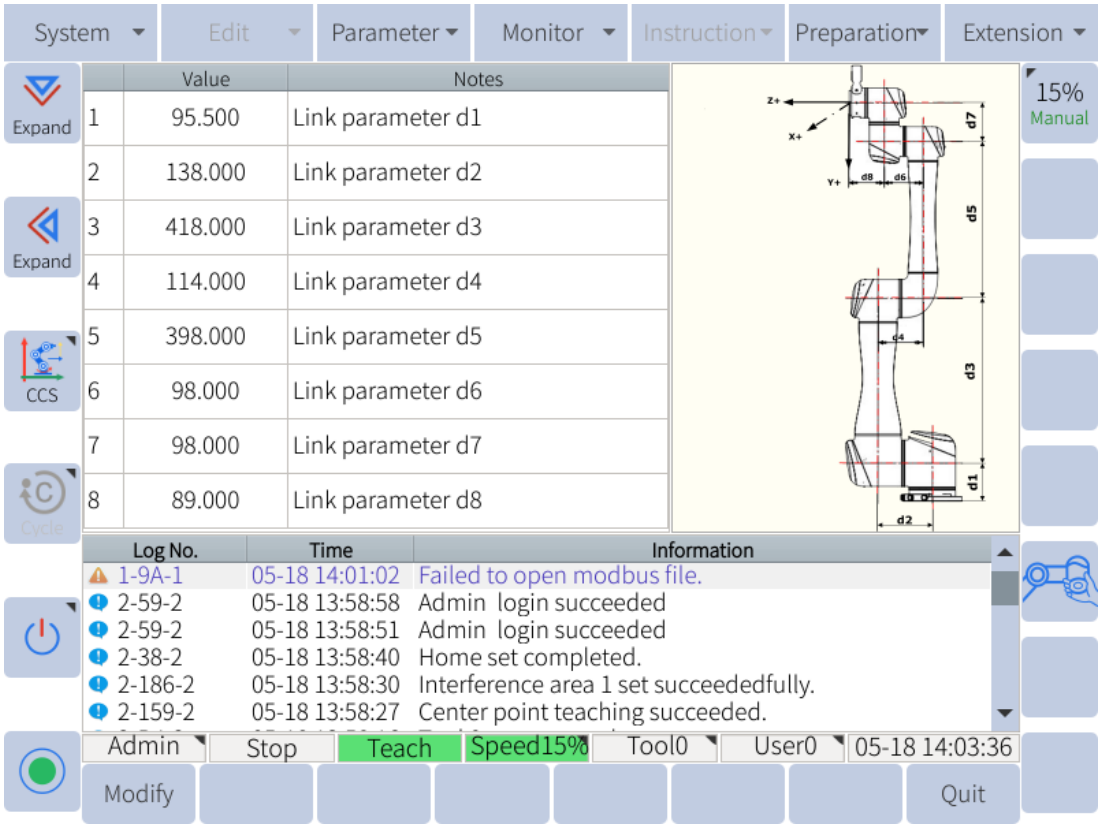


Figure 12-12 : DH parameter settings page

12.3.5 JOG Parameters

JOG parameters includes JOG parameters of the manipulator. These settings are not open for users to modify. For questions about these settings, or if the user needs to modify these settings, please consult with ELITE Robot technical support.

12.3.6 Joint servo

Servo joint are used to modify the behavior of the motor control inside the joints of the manipulator. These settings are not open for users to modify. For questions about these settings, or if the user needs to modify some settings, please consult with ELITE Robot technical support.

12.3.7 Authority

The Authority settings deal with user levels and user accessability. With these settings, users can switch to a different user level or modify user level passwords.

12.3.7.1 User switch

Figure 12-13 shows the authority settings page. Here users can select the desired user level. The user levels and what settings are available to them are discussed in Subsection 6.5.1.

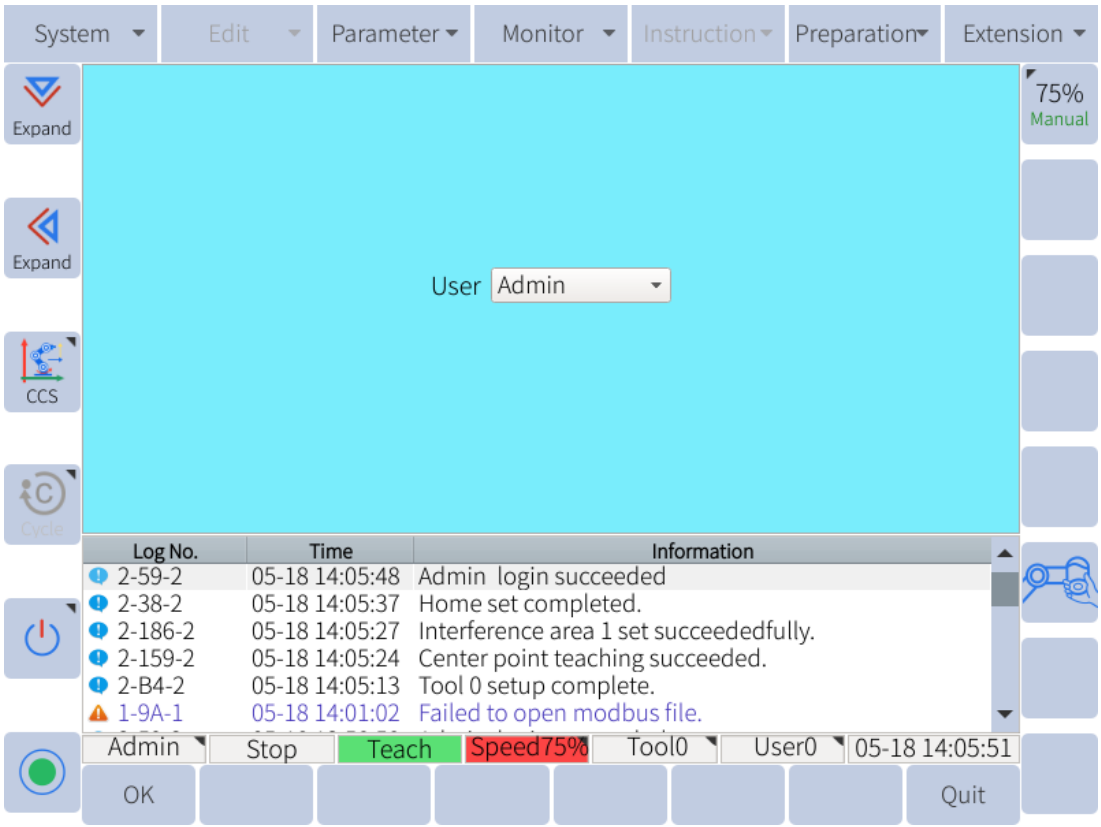


Figure 12-13 : Authority page for switching user levels

To modify the user level navigate to **Parameter -> Authority -> User switch**. Click on the drop down menu and select the desired user level. Click “OK” in the submenu to accept the change.

12.3.7.2 Modify Passwords

Figure 12-14 shows the page for modifying the administrator password. If the user wishes to modify the administrator password, they must have the administrator user level active. To modify the super user password they must have the super user level active, and so on.

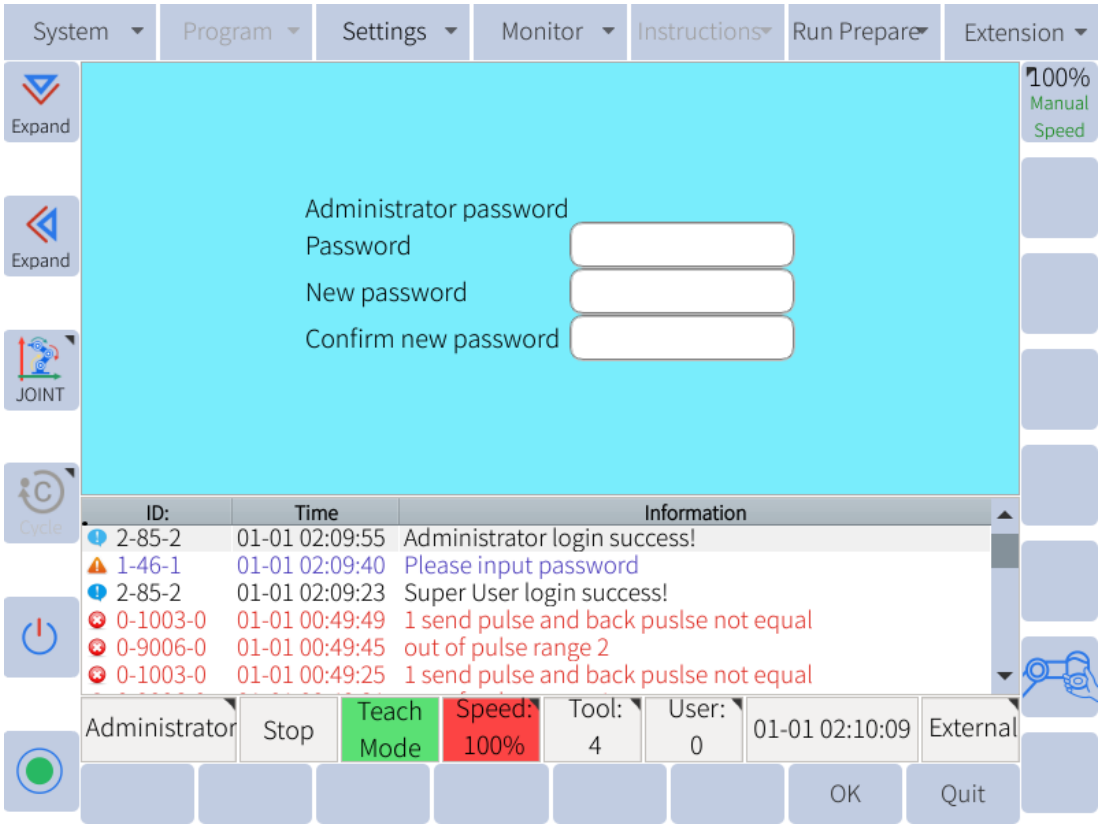


Figure 12-14 : Password page

To modify the password of the currently selected user level, navigate to **Parameter -> Authority -> Password**. Enter the current password. Enter the new password and confirm the new password. Click "OK" in the submenu to save the changes.

CAUTION

Make sure to save the new passwords in a secure location. If the user forgets the password they will not be able to log into that user level.

Chapter 13 Updates, Maintenance, Repair, and Disposal

13.1 Quality Assurance

ELITE ROBOT Co.,Ltd. should provide the necessary spare parts to replace or repair relevant parts if the new equipment and its components are defective resulting from manufacturing and/or poor materials.

ELITE ROBOT Co.,Ltd. shall possess the ownership of the equipment or components replaced or returned to ELITE ROBOT Co.,Ltd.

If the product is no longer under warranty, ELITE ROBOT Co.,Ltd. shall reserve the right of charging the customer for replacement or repair.

In case of defects of equipment that is out of warranty, ELITE ROBOT Co.,Ltd. shall not be responsible for any damage or loss caused therefrom, such as loss of production or damage due to other production equipment.

13.2 Disclaimer

If the equipment defect is caused by improper disposal or falling to comply with the relevant information stated in the user manual, the “Product Quality Assurance” will be invalid.

The warranty shall not cover the failure caused by the following circumstances:

1. Installation, wiring and connection to other control equipment are not in line with the industrial standards or not implemented in accordance with the requirements of the user manual.
2. When the EC66 is used outside the specification or standards shown in this user manual.
3. This product is applied to the non-designated purposes.
4. The storage mode and operating environment are outside the specified scope (such as pollution, salt damage and dewing) of the user manual.
5. The product is damaged as a result of improper transportation.
6. Damage due to accident or impact.
7. When non-original parts and accessories are installed.
8. Damage as a result of modification, debugging or repair of the original parts by the third party outside ELITE ROBOT Co.,Ltd. or other integrators specified by ELITE ROBOT Co.,Ltd.
9. Natural disasters, such as fire, earthquake, tsunamis, lightning strikes, wind and flood.
10. Failure outside the above mentioned circumstances and not caused by ELITE ROBOT Co.,Ltd.

The following circumstances will not be covered by warranty:

1. The date of production or the start date of the warranty cannot be identified.
2. Alteration of the software or internal data.
3. The failure cannot be reproduced, or ELITE ROBOT Co.,Ltd. cannot identify the failure.
4. This product is used near or around radioactive equipment, biological test equipment, or in environments deemed hazardous by ELITE ROBOT Co.,Ltd.

In accordance with the product quality assurance agreement, ELITE ROBOT Co.,Ltd. shall be responsible for making the commitment of quality guarantee for the defects or deficiencies occurring in the products and parts sold to the dealers.

As for any other explicit or implied warranties or liabilities including, but not limited to, any implied warranty for marketability or specific use, ELITE ROBOT Co.,Ltd. shall not bear the related liability to guarantee.

In addition, ELITE ROBOT Co.,Ltd. shall not be responsible for the related liabilities in allusion to any form of indirect damage or consequence generated by the related product.

13.3 System Update

13.3.1 Image update

The user can update the computer image and the specific operations are as follows:

1. Prepare a USB flash drive and copy the image to the root directory of the USB flash drive
2. Insert the USB drive into the USB port of the control cabinet
3. Select **System -> Local from USB -> imageupdate**.
4. In the pop-up dialog box, select the desired image file and click “OK”. The system will restart automatically

NOTICE

The reimaging process may take a while. Do not power off the robot until the process is complete.

13.3.2 Software Update

System upgrade can be performed when the software needs to be updated or system failures occur. The existing user data should be backed up before the system upgrade. Note that the mechanical home position is not included for user data backup. Thus, take a photo or screenshot of the mechanical home

position page before the system upgrade.

The detailed upgrade procedure is as follows:

1. Prepare a USB flash disk and copy the system upgrade file “firmware.bin” to its root directory.
2. Insert the USB flash disk into the USB port of the controller or the collaborative robot cabinet.
3. Go to **System -> Save to USB -> User Data Backup** to back up the user data.
4. Go to **System -> System Upgrade** then press “OK” button and wait several minutes. The system will check the firmware and be upgraded automatically. It will restart the system after successful upgrade, as shown in **Figure** 13-1 .

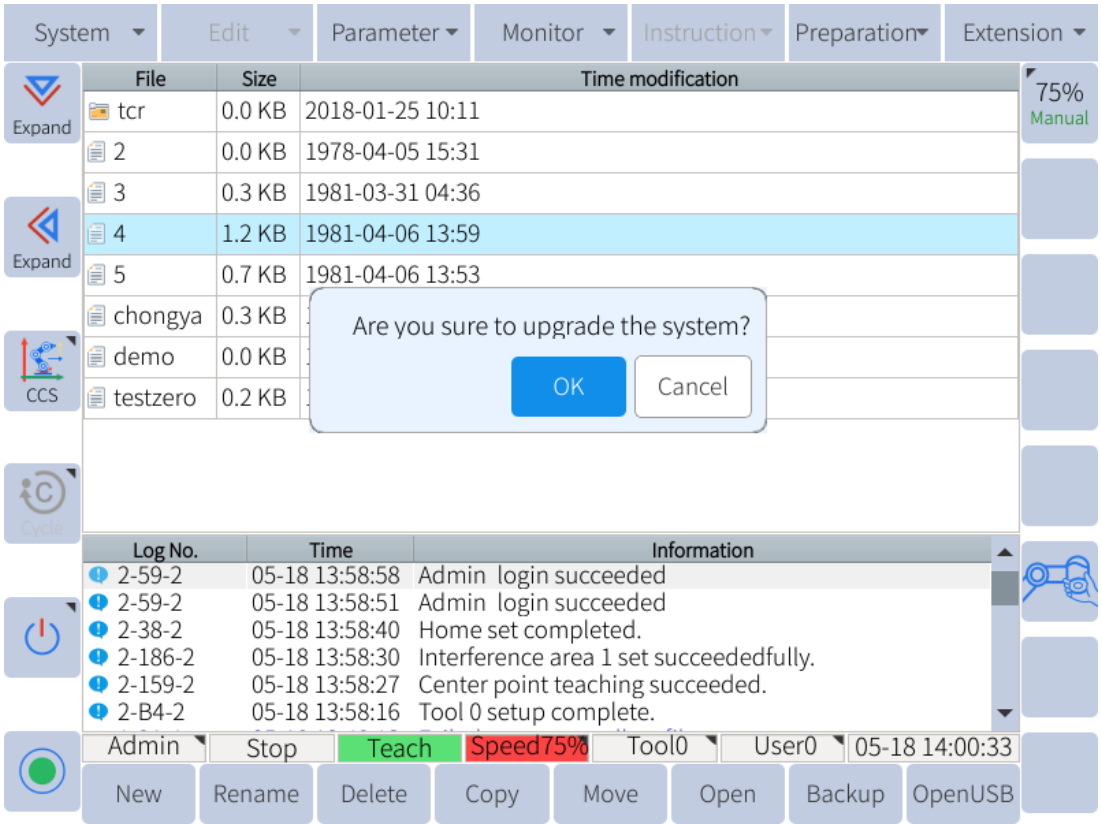


Figure 13-1 : System Upgrade

DANGER

After the software is upgraded and restarted, please reconfirm whether the zero position of the robot is normal.

13.3.3 Firmware Update

The firmware upgrade is peculiar to the collaborative robot and the detailed upgrade procedures are as follows:

1. In the root directory of the USB flash disk, create a new folder named “rbctrl” and copy the firmware upgrade file into it.
2. Insert the USB flash disk into the USB port of the collaborative robot cabinet, and a USB device icon will be displayed in the coordinate area of the programming pendant screen.
3. Go to “System > System Upgrade”, and a dialog box with the message “Confirm System Upgrade” will pop up.
4. After pressing “OK” button, the system will give the message “Please select the content that needs to be upgraded”. Then select “Upgrade Firmware”, as shown in **Figure** 13-2 .

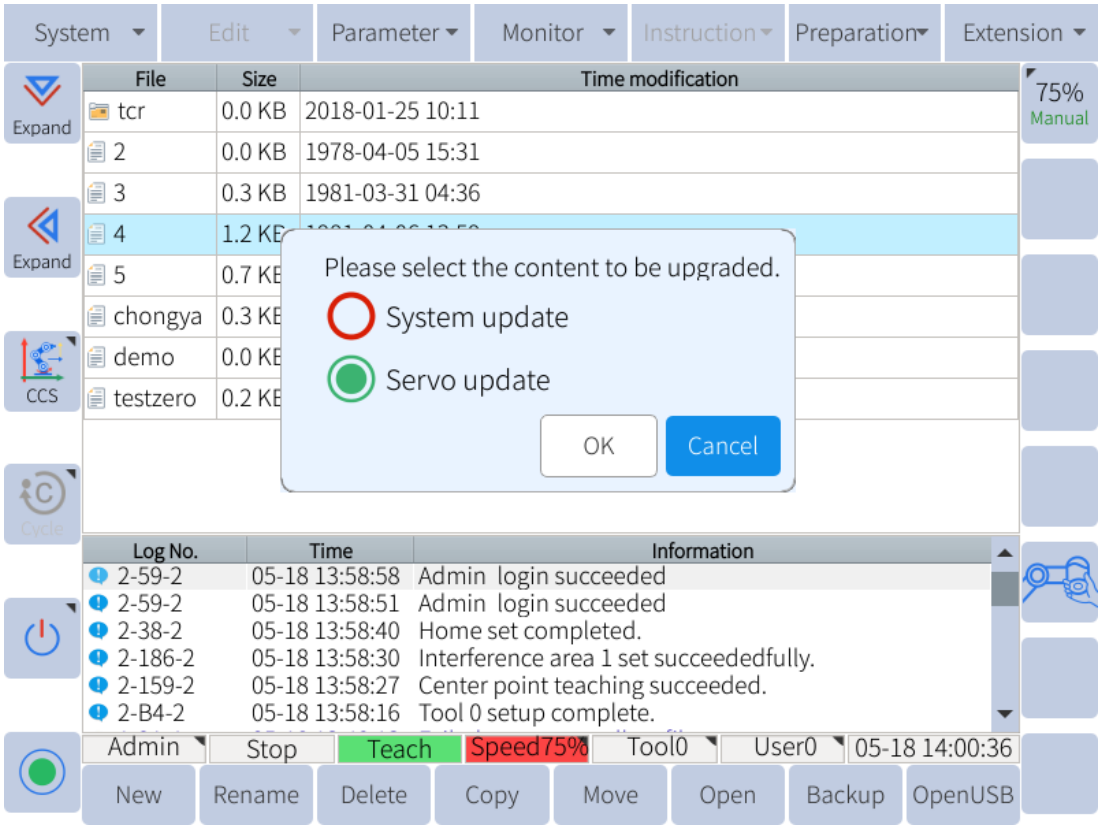


Figure 13-2 : Selecting the content that needs to be upgraded

5. Choose “Single joint upgrade” or “Whole upgrade”.
   Single joint upgrade:
   For the robot EC66, select:
   - Axis 1, Axis 2: ”j25_xxxxxxxx.bin” file.
   - Axis 3: ”j20_xxxxxxxx.bin” file.
   - Axis 4, Axis 5 and Axis 6: ”j14_xxxxxxxx.bin” file.

   Press “Setting” button every time the upgrade file is selected for an axis until the upgrade for all axes are finished.
   Whole upgrade:
   After selecting the file with the suffix .esu, click “Settings” and wait for the upgrade to complete.
6. Power off and restart after completing the upgrade.

13.3.4 PLC Update

After the system software is updated, the system PLC is also automatically upgraded, but only supports the A23 board.

For the A22 board, before the software upgrade, you need to navigate to **System -> Save to USB -> PLC** for backup. After the upgrade is completed, navigate to **System -> Load from USB -> PLC Update** to import PLC.

To update the PLC version, acquire the plc.dat file from the ELITE Robot website or forum. Navigate to **System -> Load from USB -> PLC**.

Select “System PLC” from the list and click on “OK”.

CAUTION



The PLC upgrade must be performed after the software upgrade.

13.4 Maintenance

The maintenance and repair work must be implemented in strictly accordance with all safety instructions in this manual.

The maintenance, calibration and repair work must be operated in accordance with the latest service manual which can be found at: www.elibot.cn.

After changing the control system, the robot joints or the tool, the robot and the tool zero should be re-calibrated on the spot, and the calibration operation and the result judgment method are introduced in the specification of check for zero. In addition, the parameter settings should be checked. If the parameters are backed up, the backup parameters may be imported; if the parameters are not backed up, the parameters should be set again. If the robot joints or the tool needs to be replaced, the dynamics of the robot needs to be reentry.

Maintenance must be performed by an authorized system integrator, distributor, or ELITE ROBOT Co.,Ltd. When the parts are returned to ELITE ROBOT Co.,Ltd., disassembly and packaging should be performed in accordance with the instructions listed in the service manual.

The safety level stipulated by the maintenance and repair work must be ensured, the effective national or regional working safety rules must be followed, and all safety functions run normally must be tested.

In order to avoid damage to the robot arm or controller the following safety procedure and cautions must be followed:

Safety procedure:

1. Remove the main power cable from the back of the controller to ensure that the robot is completely powered off. Take necessary precautions to prevent other persons from re-energizing the system during the repair period. When it is powered off, double check the system to ensure that it has been completely powered down.
2. Please check the earth connection before re-starting the system.
3. Please comply with the electrostatic discharge (ESD) regulations when disassembling the robot arm or the controller.
4. Avoid disassembling the power supply system of the controller. The high voltage can be remained inside the power supply system for several hours when the controller is switched off.
5. Prevent water or dust from entering into the robot arm or the controller.

Cautions:

1. Replace faulty parts with the identical part number or the corresponding parts approved by ELITE ROBOT Co.,Ltd.
2. Reactivate all safety measures immediately upon completion of the work.
3. Record all maintenance operations in written form and save these records in the relevant technical documents for the whole robot system.
4. The controller cannot be repaired by end-users. If maintenance or repair services are needed, please contact your distributor or ELITE ROBOT Co.,Ltd.

13.5 Disposal

The EC66 robot must be disposed of in accordance with the local and national laws, regulations, and national standards.

13.6 Error Codes

13.6.1 Program alarm

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2000-nline	Unsupported IO type %s	When calling input and output instructions, the assignment status is incorrect or the status parameter is missing	
0-2000-nline	Wrong type	Parameter type in JBI instruction does not match	
0-2000-nline	TIMER instruction decoding error	TIMER T= No seconds are entered or the instruction format is wrong	
0-2000-nline	PULSE instruction decoding error	PULSE IF followed by no condition or input error	Check JBI Parameters
0-2000-nline	AOUT instruction decoding error	No input AO#, serial number, analog	
0-2000-nline	AOUT decoding error parameter %s	AOUT AO# No serial number, analog or input error (including AO#)	
0-2000-nline	AIN decoding error	no AI#, serial number, analog input after AIN	
0-2000-nline	AIN decoding error parameter variable %s	AOUT AI# No serial number, analog input or input error	

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2000-nline	The JOB parameter file %s in the command MOVEFILE does not exist, or error exsist!	Call parameter file does not exist, or there is an error, or the file name contains illegal characters	Check whether the JBI file exists or is wrong, or modify it file name
0-2000-nline	%s DRAGV parameter is incorrect!	Out of acceptable range or data format is incorrect	Check JBI Parameters
0-2000-nline	%s VJ parameter is incorrect!	VJ parameter format or type error	
0-2000-nline	MOVML analyze JOB	JBI file called by micro-segment interpolation error	Check the called JBI file or re-import the file
0-2000-nline	MOVML analyze VJ=	When editing VJ= There is an error in the following format	
0-2000-nline	TIMER instruction decoding error	TIMER T= no milliseconds or input error	
0-2000-nline	CLEAR instruction decoding error	No variable character or input error after CLEAR	
0-2000-nline	CLEAR length parameter must be a constant or ALL!	When clearing a variable, no serial number or serial number is not entered	Check JBI Parameters
0-2000-nline	CLEAR instruction parameter type is incorrect!	CLEAR after the clear variable character type is wrong	
0-2000-nline	Coordinate system parameter error!	CCOOD did not add coordinate command or added command error	
0-2000-nline	Unsupported parameters type	Syntax error in JBI file	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2000-nline	Unknown coordinate system error	CCOOD did not add coordinate command or added command error	
0-2000-nline	DIN/MIN instruction decoding error	No relevant characters added after DIN/MIN or incorrect characters added or there are spaces in the file name	
0-2000-nline	MFRAME parameter is incorrect!	MFRAME format error or incorrect parameter, unable to complete calculation	
0-2000-nline	PL error in MOV instruction decoding	PL format error or unedited smoothing level or out of range	
0-2000-nline	ACC error in MOV instruction parameters	Acceleration adjustment ACC format error or acceleration adjustment ratio exceeds the range	Check JBI Parameters
0-2000-nline	DEC error in MOV instruction parameters	Deceleration adjustment DEC format error or deceleration adjustment ratio exceeds the range	
0-2000-nline	UNTIL error in MOV instruction decoding	When editing movement instruction meets the conditions and terminates, there is an error in setting UNTIL format or the letter is illegal	
0-2000-nline	Parmameter VJ is incorrect in MOV instruction	When editing the movement instruction to specify the moving speed, there is an error in setting the VJ format	

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2000-nline	Parmameter AV is incorrect in MOV instruction	When editing the movement command to specify the linear absolute movement speed, there is an error in setting the AV format	
0-2000-nline	Parmameter V is incorrect in MOV instruction	When editing the movement instruction to specify the linear movement speed, there is an error in setting the V format	
0-2000-nline	Parmameter AVR is incorrect in MOV instruction	When editing the movement command to set the linear absolute rotation angular velocity, there is an error in the AVR format	
0-2000-nline	Parmameter VR is incorrect in MOV instruction	When editing the movement instruction to set the linear rotation angular velocity, there is an error in the VR format	Check JBI parameters
0-2000-nline	Parmameter DIST is incorrect in MOVCA instruction	When editing movement command is triggered at the same time within the specified time, there is an error in setting the TIMER format	
0-2000-nline	Parmameter R is incorrect in MOVCA instruction	When editing the complete circle motion instruction rule, there is an error in the complete circle radius R format	
0-2000-nline	Parmameter DIR is incorrect in MOVCA instruction	When editing the full circle movement, there is an error in the DIR format setting the circle movement direction	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2000-nline	%s decoding error	Syntax error in JBI file	Check JBI parameters
0-2000-nline	Parmameter TF is incorrect in TOOL instruction	When editing tool command, the tool number used is out of range	check whether the tool number is within the range
0-2000-nline	1st parameter is incorrect in DIST instruction	When editing the distance seeking command, the data can only be stored in D variable	Check JBI Parameters
0-2000-nline	2nd parameter is incorrect in DIST instruction	When editing the distance command, position 1 can only use the P variable	
0-2000-nline	3rd parameter is incorrect in DIST instruction	When editing the distance command, position 2 can only use P variable	
0-2000-nline	Incorrect DOUT/MOUT instruction parameters	When editing, no relevant characters or incorrect characters are added after DOUT/MOUT	
0-2001-nline	%s Serial number should be in the range of [0-9]	The input interval value is out of range	According to the prompt of the input box, enter the allowed value
0-2001-nline	%s is ON or OFF	Digital or switch is expressed in the way of 0/1	Currently only ON/OFF exists, please edit
0-2002-nline	IO decoding error!	Syntax error in input and output instructions	Check JBI Parameters

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2002-nline	PULSE %s instruction decoding error	No condition or input error after PULSE IF	Check JBI Parameters
0-2002-nline	AOUT %s instruction decoding error	No input AO#, serial number, analog quantity after AOUT	
0-2002-nline	Unknown %s format, the correct format is %s	Unrecognized command format	check whether the label called by JUMP and CALL exists
0-2002-nline	TIMER [%s] instruction decoding error	TIMER T= There is no second input or illegal input error	Check JBI parameters
0-2002-nline	%s [%s] instruction decoding error	The number of instruction parameters does not match	Check whether there are extra parameters in the instruction
0-2002-nline	NOP [%s] instruction decoding error	There is more than one NOP instruction in the file	Check whether there are multiple NOP in the program
0-2002-nline	CLEAR [%s] instruction decoding error	No variable character is input after CLEAR or input is illegal	
0-2002-nline	%s instruction decoding	When editing related commands on the computer, use illegal variables	Check JBI Parameters
0-2002-nline	data1 [%s] decoding error		
0-2002-nline	data2 [%s] decoding error	When editing related commands, use illegal variables	
0-2002-nline	Coordinate system parameter error!	CCOOD command writing error or format error	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2002-nline	TIMER instruction must set the T parameter	TIMER T= no seconds are input or input illegal error	
0-2002-nline	MFRAME parameter %s is incorrect!	MFRAME command input parameter is wrong or invalid	
0-2002-nline	DIN/MIN instruction parameter [%s] is incorrect!	When editing, no relevant characters were added after DIN/MIN or incorrect characters were added	
0-2002-nline	ELSEIF instruction decoding error!	ELSEIF command did not find the corresponding ENDIF command	
0-2002-nline	ELSE instruction decoding error!	ELSE command did not find the corresponding IF or ELSEIF command	Check JBI Parameters
0-2002-nline	ENDIF instruction decoding error!	ENDIF command did not find IF or ELSEIF command	
0-2002-nline	ENDWHILE instruction decoding error!<	ENDWHILE command did not find the corresponding WHILE	
0-2002-nline	CONTINUE instruction decoding error!	When the program jumps out of this loop, CONTINUE needs to be added between the loop body command and the loop command	
0-2002-nline	BREAK instruction decoding error!	When the program jumps out of this loop, BREAK needs to be added between the loop body command and the loop command	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2002-nline	PL level can only be an integer from 0 to 7	PL parameter setting in motion instruction is incorrect	
0-2002-nline	Unknown [%s] parameter error in MOV instruction	MOV instruction writing error or format error or input invalid parameters	Check JBI Parameters
0-2002-nline	Unknown parameters in TOOL instruction	Wrong tool number or tool data does not exist	
0-2002-nline	DOUT/MOUT %s decoding error	No relevant characters are added after OUT/MOUT or wrong characters are added	Please check whether the command format is correct, and refer to the JBI programming manual for correction.
0-2003-nline	Unknown condition %s	There are extra invalid parameters in the program	
0-2003-nline	Repeat condition, forget | or &	Forget to edit when repeat condition is used | or &	Check JBI Parameters
0-2004-nline	%s is empty label	When editing the label on the computer, do not input any string	
0-2004-nline	Empty LABEL		
0-2005-nline	%s label memory out of bounds	Insufficient space available for system allocation	Delete unused JBI files
0-2006-nline	Execution file %s memory overflow		
0-2006-nline	No Label %s@%s found!	The label to be jumped is not found in the program	Check JBI parameters.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-2007-nline	LABEL must start with *	JBI file label does not start with *	Please check whether the command format is correct, and refer to the JBI programming manual for correction.
0-2008-nline	The %s Label has been defined in the %s line of the %s file.	The same label is repeated in the same direction in the same JBI file	Please check whether the command format is correct, and refer to the JBI programming manual for correction.
0-6000-0	Matrix inversion failed 0	DH parameter or tool setting is unreasonable or the 20-point calibration data is too large	Reset the DH parameter or tool, or perform the 20-point calibration
0-6000-20	The robotic arm is in a singular zone or unreachable zone	The robot arm is in the singular area or the motion instruction exceeds the limit position	Please re-plan the trajectory or target position
0-6004-0	Error with speed calculation result of 0	The computer-edited JBI program command is wrong	Please check whether the command format is correct, and refer to the JBI programming manual for correction.
0-6005-0	Calibration requires 20 waypoints, %s have been taught.	Calibration information is incomplete, less than 20 points, unable to calibrate correctly	Complete the calibration points, or restart Carry out calibration
2-6006-2	The calibration joint number %s is beyond!	Calibration point serial number error	The teach pendant will not appear

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
2-6006-4	Please teach the point %s first !	Calibration data does not exist or is incomplete is an attempt to calibrate calculation	Please teach the calibration point according to the prompt
0-6006-8	Please make sure the values of axis %s are not the same !	Calibration point is repeated or too close to	Re-teach the repeated calibration point to ensure inconsistency
0-6006-9	Please make sure the values of axis %s are the same !	Calibration point posture does not meet the requirements	Re-teach the calibration points that do not meet the requirements
0-5000-0	During the zero calibration of 20 points,calculation error, the point is unreasonable	The calibration data is incorrect or unreasonable, unable to complete the calculation	Recollect the calibration data
0-5001-0	During the zero calibration of 20 points, waypoints coincidence error, point %s and point %s coincide	Reuse the calibration point data	Delete the repeated point data
2-5002-0	error > 5	The calculation result prompts	TCP deviation is too large
2-5002-0	error = %s mm	Prompt of calculation result	Calculate compensation result

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-5002-1	joint is difference between current and last shutdown	The normal power-on reminder. Due to the slight posture change of the robotic arm during the power outage, it was not caught.	Under normal circumstances, it is sufficient to synchronize the encoder. If it continues to appear and cannot be eliminated, please contact the official after-sales department.
2-1000-4	Failed to open Modbus library!	Fail to load modbus function when communicating with external devices	System version does not match or does not support, please contact the official after-sales department
0-1000-5	can't open invdyn lib %s	Kinetic parameter file is wrong or missing	Software version does not match or does not support, please contact the official after-sales department
0-1001-0	Failed to open %s	Cannot open the specified program	The program does not support access or the file has an error
2-10010-0	The current parameter format is different from the last shutdown. Use the backup parameter.	Logarithms do not match after system upgrade	Re-import parameters
2-10010-1	No parameter file, import default parameters.y	Logarithm does not match after the system upgrade.	Re-import the parameters

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1002-0	Current robot type does not support this function!	The robot type is not set correctly	Set the correct robot type parameters (“System setting-Robot Configuration” interface)
0-1002-1	The type of robot does not match the number of axes and can only run in joint coordinates.	Robot type or servo parameter setting is incorrect	Check whether the robot type parameter or servo parameter is set correctly
0-1003-0	Please turn off the servo enablement before switching the servo control mode.	When the servo is activated and powered on, some functions are not allowed to be used	Turn off the servo enable and then turn on the corresponding function
2-1003-0	%s axis target position does not match the feedback position	Servo parameter setting is wrong or motor pulse signal is lost	Please contact the official after-sales department
2-1003-0	Lua script load completed!	Prompt	
2-1003-0	Lua script error: %s: %s	There is an error in the script file, which cannot be correctly loaded and run	Please check the content or format of the script file, you can refer to the Lua script manual for modification.
2-1003-0	Lua script format error: %s		Please check the content or format of the script file, You can refer to the Lua script manual for modification.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
2-1003-0	Lua script parameter range: 0~%s	The called script serial number is incorrect	Please enter the correct script serial number, currently only supports 1-8
2-1003-0	Lua script parameters do not match	There is an error in the script file, which cannot be loaded and run correctly.	Please check the content or format of the script file, refer to the Lua script manual for modification.
2-1003-0	elite scripts print: %s		
0-1003-0	Axis %s starts to update the firmware!	Prompt	
0-1003-0	Axis %s update firmware completed!		
2-1003-0	No Lua script file is loaded	Press the “Run” button in the script interface, but there is no script that has been loaded or opened for running at this time	Please load or open the script first, and press the ”Set” button to confirm
2-1003-0	Lua script file %s does not exist	Attempt to load or run a script file that does not exist	Please check whether the script exists or the file name is correct

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1004-0	emergency stop		Emergency stop button on the teach pendant is pressed Reverse rotation of the emergency stop button to release the alarm state
0-1005-0	External emergency stop alarm	IO board-J106 interface connected to the safety signal is triggered	Check the signal source, the signal will be automatically restored after the external device state is restored.
0-1005-1	External emergency stop alarm	Safety signal connected to IO board-J107 interface is triggered	
0-1006-0	%s axis alarm	Axis alarm	Please check the servo alarm document
0-1006-0	%s Stack communication alarm	Controller and servo communication disconnected	Please contact the official after-sales department
0-1006-0	The %s axis servo is in bootloader state	Servo joint upgrade or connection fails	Upgrade again or contact the official after-sales department
0-1008-0	fold inverse error	Inverse solution error	Check whether the inverse solution parameter is correct; Check whether the reference point position is reasonable
0-1008-1	%s axis soft limit alarm		

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1008-4	%s axis exceeds the lower limit of soft limit	Soft limit limit alarm	Manually move the robot back to the reachable range in TEACH mode
0-1008-5	%s Axis exceeds the upper limit of soft limit		
0-1008-9	P%s position exceeds the soft limit.		
0-1009-0	The parameters of receiving and sending pulses after one revolution of %s-axis motor are not set	The servo parameters or cooperation parameters are set incorrectly or the data is lost	Please contact the official after-sales department
0-100A-3	Parameter setting failed, parameter range %s-%s	Parameter setting out of limit	According to the prompt of the input box range, enter the allowed value
0-100A-0	Axis %s division ratio is wrong, please reset it.	Servo parameter setting error or data loss	please contact the official after-sales department
0-100B-0	System shared memory application failed!	After the upgrade, the parameters are inconsistent after power-off	The system will use the default backup file, which will not affect normal use
0-100B-1	System shared memory application failed!		
0-100C-3	Failed to load NVRAM backup data	Do not turn on the force control function, check whether the zero position is correct	If the zero position is abnormal, please contact your local dealer immediately
0-100C-4	Backup of NVRAM data failed		
0-100C-5	Failed to backup nvram data		

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-100C-0	Robot configuration information is invalid, use the default value!	Do not turn on the force control function, check whether the zero position is correct	If the zero position is abnormal, please contact your local dealer immediately
0-100C-2	To reset the robot configuration information, please restart the system!	Prompt	Restart the system to make the parameters take effect
0-100D-0	Current robot type does not support this function!	The robot type setting is wrong	Check the ”Process configuration” item in ”Robot Configuration” and the “Robot Type” item in “Parameter Setting”
0-100F-0	%s axis reading encoder data error	Encoder reading error	Please contact the official after-sales department
2-C000-1	get ip error	The network setting of this machine is wrong, or the communication fails due to hardware reasons	Please check the network setting and restart the robot. If the alarm continues to appear, please contact the official after-sales department
0-C002-0	send data faile	The network is disconnected unexpectedly	Please check the network cable connection and restart the robot.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-3001-nline	The address of variable in the CLEAR instruction parameter is incorrect	CLEAR instruction format is wrong or parameter is incorrect	
0-3001-nline	P variable index out of bounds	P variable serial number exceeds 255	
0-3001-0	P%s data format error!	P variable lacks values or too many elements (P variable is composed of 8 floating-point numbers)	Check JBI Parameters
0-3001-1	P variable index out of bounds!	P variable serial number exceeds 255	
0-3002-3	Point singularity	The calculation result is incorrect or no solution	Check whether the data is correct, and make sure that the calculated reference point is not near the singular point
0-3002-nline	P variable is not opened.	the P variable used in the program is not enabled or activated	Enter “Monitor > Var > Var P”, select the P variable you want to use, and click ”open/close” in the submenu bar to enable variable.
0-3002-nline	Planning of a full circle failed, please move to the first full circle command	MOVCA instruction is not used as required for 3 consecutively, and trajectory planning cannot be carried out	Please check the instruction format is correct, and refer to JBI The programming manual was revised.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-3002-nline	Failed to obtain data	Invalid setting variable value when executing JBI instruction	Modify the var assignment instruction and restart the robot to become effective.
0-3002-nline	Failed to set data	Invalid setting variable value when executing JBI instruction	Modify the var assignment instruction and restart the robot to become effective.
0-3002-0	The delay value of the TIMER instruction cannot be less than 0 seconds.	TIMER instruction delay value cannot be less than 0!	Check JBI parameters.
0-3002-0	CALL instruction is nested more than 10 layers and cannot be executed.	CALL subroutine is deleted	Check whether the called subroutine exists or the file name is reasonable
0-3002-nline	Unable to run the MOVC instruction, please check the teaching waypoint!	MOVC instruction 3 points data can not form an arc trajectory	Please teach three points again to ensure that the points are correct
0-3002-0	The point positions of MOVC parameters coincide and cannot be run.	In the MOVC instruction, the data of 3 points are overlapped, and the arc trajectory cannot be traveled.	Please teach the points again to ensure that the three consecutive points of arc interpolation cannot overlap.
0-3003-0	The call of CALL cannot be found in the RET instruction	Run the subroutine with RET instruction alone	Check whether the currently running program has RET instruction

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-3004-0	Location data is illegal	P variable data is wrong	Check whether P variable is turned on and assigned correctly
0-3005-0	volid pos 2axis !=0	There are singular points in the motion path	Re-plan the robot movement posture and path
0-3006-nline	Two waypoints coincide.	Position data in MOVC, MFRAME or DIST instructions are duplicated, the instruction cannot be executed correctly	Check whether the P variable position data is correct
0-3006-nline	Three waypoints coincide.	Position data in MOVC, MFRAME or DIST instructions are repeated, and the instruction cannot be executed correctly	Check whether the P variable position data is correct
0-3006-nline	V variable is not opened	3 overlapping points cannot follow arc	Re-teach the points, the three consecutive points cannot be overlapped in circular interpolation
0-3006-nline	Points %s and %s coincide, can not go arc	Points %s and %s coincide, can not go arc	
0-3007-nline	There is only two MOVC instructions.	3 MOVC instructions are not used continuously as required, and trajectory planning cannot be carried out.	Please check whether the instruction format is correct and refer to the JBI programming manual for correction.
0-3009-nline	Please teach three points in a row.	Don’t teach the full circle command MOVCA three points continuously	Please set the continuous full circle command three points correctly

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Alarm Number	Description	Possible Reasons	Suggested Treatment
0-3009-nline	Please set the radius, distance and direction parameters of the first full circle command	The radius, distance and direction parameters of the first line of MOVCA complete circle command are not set	Please set the radius, distance and direction of the first line of the entire circle correctly Distance and direction parameters
0-3009-nline	There are less than three road points in MOVC!	MOVCA instruction does not use 3 consecutively as required, so trajectory planning cannot be performed	Please check whether the instruction format is correct, and refer to the JBI programming manual for correction.
0-3009-1	Check data error	Point repeat	Please teach the point again
0-300A-1	Check data error	Abnormal memory data	Restart. If it continues to be unable to repair, please contact the official after-sales department.
2-2-2	please teach 4 point	Lack of point data	Please teach 4 points as required
1-7-0	can’t open file %s	JBI file error or illegal file name	Check JBI file or file name
0-7000-0	Loading file :%s repeatedly.	The script file has been loaded or opened	Check the file name
0-7001-0	CALL has too many subroutine calls %s	CALL subroutine calling too many layers	CALL instructions can be nested up to 10 layers

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-7002-1	Failed to open JOB file %s	JOB file type is wrong or cannot be opened	Check JOB file type or file name
2-7002-2	Device file %s is occupied.	Controller serial port is already occupied	Check the serial port connected device and serial port setting parameters to avoid conflicts
0-7002-0	Open file failed %s %s %s	The file called by the command is deleted or damaged	Restore or create a deleted file with the same name
0-7002-1	MOVML file open faile %s	The file called by MOVML was deleted or damaged	Restore or create a deleted file with the same name
0-7002-0	Failed to open the file %s	JBI file name is wrong or the format does not support access (the dragged file cannot be opened through the teach pendant)	Correct the name or content of the JBI file and upload it to the controller again.
0-7002-2	%s var init failer	Variable file is damaged or missing, it is normal that this alarm appears when the system is turned on for the first time after the system is upgraded	This alarm does not affect normal use, it will be automatically produced when the variable is enabled. If it continues to appear, please contact the official after-sales department.

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Alarm Number	Description	Possible Reasons	Suggested Treatment
0-7002-3	Incorrectly calculating node vector	Variable file is damaged or missing, it is normal that this alarm appears when the system is turned on for the first time after the system is upgraded	This alarm does not affect normal use, it will be automatically produced when the variable is enabled. If it continues to appear, please contact the official after-sales department.
0-7002-2	Failed to save P variable!	File system memory is full or damaged	Clean the file and release part of the storage.
0-7002-1	Fail to open the JOB file.	JBI file name error or format does not support access (drag and drop files cannot be opened through the teach pendant)	Correct the JBI file name or content, and upload it to the controller again.
2-7002-5	The main program has not been set!	Main program not set	Please set main program
2-7002-4	Clear main program settings		
2-7002-4	Set the main program as: %s	Prompt	
2-7002-4	%s file is not a JBI program and cannot be set as the main program	The format of the main program set is wrong	Check the name or content of the main program file.
2-7002-2	P variable setting failed, %s axis exceeded the soft limit	trying to send joint data exceeding the limit range to P variable	check whether the assigned value meets the requirements, you can go to the ”limit parameter” in the ”parameter setting” Get the reference range.

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Alarm Number	Description	Possible Reasons	Suggested Treatment
0-7003-0	Too many MOV instructions (number:%s),insufficient memory!	MOV instruction in a single JBI file exceeds 10240 lines	Optimize motion program
0-7004-0	Incorrect file format, NOP should be on the first line, END on the last line.	File format error, NOP should be on the first line of the program END on the last line	NOP should be on the first line of the program END on the last line
0-7004-0	WHILE or IF instruction is used incorrectly	JBI logic instruction format error	Please check whether the instruction format is correct, and refer to the JBI programming manual for correction.
0-7005-0	Incorrect file format,2 or more NOP exsist	File format error, there are two or more NOPs	delete redundant NOP lines
0-7006-0	Incorrect file format,2 or more END exsist		Delete extra END lines
2-A000-0	Exit reservation mode!	Prompt	
2-A001-0	The robot is in an external pause state.	Robot’s system PLC version is incorrect or robot is in external pause state	Select the correct robot PLC file or the externally connected pause button has been activated, which serves as a reminder
0-F000-0	Set dynamics.xml data error and use backup data	Dynamics data error	Try to identify

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-F000-0	Failed to open the file.	Import the dynamic identification file is incorrect	Re-import the dynamic identification file
2-F000-1	dynamics identify succeed	Prompt	
2-F000-1	Incorrectly setting the robot installation method.	The installation method of the robot does not match the method set in the system	Enter the “Preparation > Security Configuration” interface to modify
0-F000-0	Unknown robot dynamics type!	Robot type setting error	Enter ”Parameter Settings> Collaboration Parameters” interface to modify
0-F000-0	open dynamics file failed	The dynamic identification file is incorrect or does not exist	Re-import the dynamic identification file (you can contact the official after-sales department to obtain)
0-F000-0	The system parameters required for dynamic identification are empty!	The dynamic identification file is incorrect or damaged	
0-F000-0	The dynamics function cannot be used due to the failure of dynamics initialization!	Dynamic identification is unsuccessful	Perform dynamic identification again
0-F000-0	get dynamis.xml data error and Use backup data	Dynamic data file is damaged or missing	It does not affect the use, the system will use the backup file. If the effect of the force control function is not satisfactory, it is recommended to perform dynamic identification again.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
2-F000-1	The robot is in collision alarm state.	Robot force has reached the collision sensitivity	Reduce the force, or increase the collision sensitivity
0-F000-0	payload payload identify failed	Automatic payload identification failed	Re-execute the load identification operation
2-F000-1	dynamics identify start	Dynamic identification start	Prompt
0-F000-0	dynamics identify failed	When dynamics identification, the robot was operated and interfered	Dynamic identification was performed again. Do not operate the robot or cut off the power supply during the recognition process.
0-F000-1	The angular interval between adjacent calibration points of the external axis should not be less than %s degrees.	Collision check function is turned on	Prompt
2-F000-1	Load identification completed.	End of automatic load identification	Prompt
0-F000-0	Trajectory record failed!	The drag recording process was interrupted unexpectedly	Re-record the track
2-F000-0	Drag enable is not turned on!	Force control function is not turned on	Enter the drag mode through the flange button or the ”Extension > Force Control Function> Drag and Teach” interface

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-F000-1	identify status error,please payload identify again!	Change the installation method or replace the joint module in the arm, at this time the force control function is disabled	Restart dynamic identification
0-F000-1	Load identification failed!	Responsible for the identification process was interrupted unexpectedly	Restart the load identification operation
2-F000-1	payload payload identify begins	Load identification start	Prompt
2-F000-1	payload payload identify succeed	Load identification succeeded	
2-F000-1	The track has been recorded for %s minutes, and up to %s minutes can be recorded.	The recorded time is %s minutes, the remaining recording time is %s minutes	Prompt
2-F000-1	The track record exceeds the maximum time, the exceeding track will no longer be recorded!	The track drag has exceeded the maximum recording time, the exceeding track will no longer be recorded	The track drag time is controlled within 20 minutes
0-F000-0	No identification file or identification file error!	No recognition file or recognition file error	Reimport identification file
0-F000-1	No identification file or identification file error!		
0-2002-nline	Parmameter [%s] has grammatical error in DIST instruction	The input DIST command parameter is wrong	Check JBI parameters
0-1F001-0	Error getting data for tool %s		

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Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1F001-1	incorrectly setting tool data.	Tool data error	Under the ”Tools” interface modify data
2-1F001-0	Failed to obtain kinetic parameters!	Kinetic parameter error	Modify kinetic parameter
0-1F001-1	Failed to save kinetic parameters!	Kinetic parameter error	Modify kinetic parameter
0-1F0010-0	Failed to create user coordinate system!	User coordinate creation error, lack of teaching points or incorrect point data	Check each teaching point and recreate user coordinates
0-1F0013-0	Failed to get Lua script configuration data.	Script configuration file is wrong or missing	Confirm script configuration settings
0-1F0013-0	Failed to get reservation configuration.	Reservation file is damaged or missing	Check whether the reservation file is correct and available, reset the reservation file
0-1F0014-0	Failed to set Lua script configuration document.	Script configuration file error or missing	Confirm script configuration settings
0-1F0014-1	Failed to set Lua script configuration.	Script configuration file error or missing	Confirm script configuration settings
0-1F0014-1	The reservation programm is set incorrectly!	No reservation file setting	Reservation file setting
0-1F0014-0	Failed to set reservation configuration.	The current software version does not support reservation function	Use the correct software version, or contact the official after-sales department for more information.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1F0015-0	Divide by zero error in DIV instruction	0 cannot be used as a divisor	Check JBI parameters.
0-1F0015-1	Divide by zero error in MOD instruction	0 cannot be used as a divisor	Check JBI parameters.
0-1F0016-0	Three waypoints coincide!	Tool coordinate number is set incorrectly or out of range	Correct tool coordinate number, range 0~7
0-1F002-0	Incorrect tool settings	Tool setting error	Modify data under ”Tools” interface
0-1F002-2	Calculation tool failed %s	Tool verification is incorrect, there is data missing or reused when using the seven-point method for verification	Re-calibrate tool coordinates
0-1F002-0	save inverse dynamic param error	The system cannot save kinetic parameters. It may be that the data is incorrect or the file is being accessed	Please restart the machine and try again. If it continues to appear, please contact the official after-sales department.
0-1F003-0	Incorrect PL in MOVJ	In the motion instruction, the PL parameter format is wrong or the smoothing level is not edited or exceeds the range	Check JBI parameters
0-1F003-7	Memory request failed!	MOVML instruction cannot allocate enough memory	Please clean up unnecessary files, free some memory and restart the robot before trying again.

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
2-1F004-0	The robot has reached the target point.	Prompt	
2-1F005-0	Error in obtaining interference area data.	Interference area is not set	Go to the “Operation Preparation > Interference Zone” interface to reset the interference zone
0-1F006-0	Failed to save interference zone.	The interference area is set incorrectly, which may be caused by unreasonable teaching points or input data.	
0-1F007-0	Failed to set interference zone.		
0-1F008-0	Incorrect user coordinate system index	The user coordinate number is not set correctly or out of range 7	set user number 0-7 correctly
0-1F008-0	Invalid user coordinate system	The user coordinate number is not set correctly or out of range 7	set user number 0-7 correctly
0-1F009-0	Tool number %s is not set, please set first!	The called tool coordinate system is not set	Check the called tool coordinate serial number, or set the corresponding tool coordinate system
0-1F00A-0	User coordinate system %s is not set! %s	The called user coordinate system is not set	Check the called user coordinate serial number, or set the corresponding user coordinate system

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Alarm Number	Description	Possible Reasons	Suggested Treatment
0-1F00B-0	%s axis has not been set	%s axis is not selected correctly or disabled	Go to the ”parameter setting > servo parameters” interface to enable the axis and check the parameters
0-1F00E-0	Failed to obtain user coordinate system data!		
0-1F00F-0	Failed to save user coordinate system data!	User coordinate system file is missing or damaged, may appear after the system upgrades and downgrades	re-create the user frame system, or import the userframe.xml file of the backup
0-1F00F-1	Failed to set user coordinate data!		
0-200000-3	File %s already exists	Duplicate new file name	Change file name
0-200000-3	Failed to create file %s	palletizing file creation failed	check palletizing parameter settings are correct
2-200000-6	File %s is successfully created.	palletizing file created successfully	prompt
0-200000-4	can’t open %s		
0-200001-1	The palletizing process number is entered incorrectly.		
0-200001-2	The palletizing process number is entered incorrectly.		
0-200001-1	The user coordinate number is entered incorrectly!		

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-200001-1	The layout number is entered incorrectly!		
0-200001-1	The layer number is entered incorrectly!	Internal error in palletizing process package	Depending on the situation, set the parameters correctly
0-200001-1	The layer layout mode is entered incorrectly!		
0-200001-1	The layer height mode is entered incorrectly!		
0-200001-1	Palletizing parameter input error.		
0-200001-1	The layout mode is entered incorrectly!		
0-200001-1	The palletizing point number is entered incorrectly!		
0-200001-1	The preparation point number is entered incorrectly.		
0-200001-1	Leaving point number is entered incorrectly!		
0-200001-1	layer layout input errorThe palletizing process number is entered incorrectly!		

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Alarm Number	Description	Possible Reasons	Suggested Treatment
2-200001-1	Note the entered layout value and set the maximum layout to %s !		
0-200001-1	The layer height is entered incorrectly.	Internal error in palletizing process package	Depending on the situation, set the parameters correctly
0-200001-1	Transition point height exceeds limit!		
0-200001-1	Layout %s has been used.		
0-200001-1	The layout type is entered incorrectly!		
0-200001-1	The number of pallets is entered incorrectly!		
0-200001-1	The parameter input of the palletizing point is incorrect!		
0-200001-1	The leave point parameter is entered incorrectly!		
0-200001-1	The parameter of the preparation point is entered incorrectly!		
0-200001-1	The palletizing point parameter is invalid, please set the parameter first!		

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-200001-1	Wrong number of columns. The column value should be greater than 1.	Internal error in palletizing process package	Depending on the situation, set the parameters correctly
0-200001-1	Wrong number of rows. The row value should be greater than 1.		
0-200001-1	The number of rows, columns or pallets is entered incorrectly		
0-200001-2	Failed to check the validity of palletizing process parameters!		
0-200001-2	Palletizing process parameters are invalid!		
0-200001-2	The current pallet number exceeds the limit!		
0-200001-1	Process %s layout %s layout mode error!		
0-200001-1	Process %s layout %s Status are invalid!		
0-200001-1	Process %s reference point does not exist!		
0-200001-1	Process %s transition point does not exist!		

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-200002-2	Palletizing command is not enabled	Internal error in palletizing process package	Depending on the situation, set the parameters correctly
0-200002-5	Palletizing command is not enabled		
0-200002-2	PALLET instruction decoding error.		
0-200002-2	Palletizing instruction parameter [%s] is incorrect!		
0-200002-5	Incorrect palletizing parameters		
0-B001-0	Singular points : Shoulder Singularity!	The collaborative robot is in the shoulder singularity	Manually operate the robot to leave the shoulder singularity position, and re-plan the program trajectory to avoid entering the singularity area again
0-B001-0	Singular points : Elbow Singularity! singular	The collaborative robot is at the elbow singularity	Manually operate the robot to leave the elbow singularity position, and re-plan the program trajectory to avoid entering the singularity area again

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-B001-0	Singularity.	Robot at singular point position (different types of robots have different singular point positions)	Manually operate the robot to leave the singular point position, and re-plan the program trajectory to avoid entering the singular area again
0-9001-2	The servo is not enabled. Please turn on the servo first.	In automatic mode, if there is no servo enabled, press the start button directly	Please confirm that the servo is normally enabled before performing the motion operation
2-9002-0	The robot is not in PLAY mode.	The robot is in teaching mode or remote mode	Set the robot to automatic mode
0-9002-1	The robot is not in TEACH mode.	The robot is in automatic mode or remote mode	Set the robot to the teaching mode
0-9004-0	PL illegal	Error in PL format or unedited smoothing level or out of range	Check JBI parameters
0-9005-0	The robot is in suspended state	Robot external pause signal is always valid	Reset robot external pause signal
0-9006-0	%s axis motor overspeed	The robot is at a singular point or the robot's trajectory or speed design is unreasonable	Manually operate the robot to leave the singular zone or modify the taught robot speed or re-plan the trajectory

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Treatment
0-9006-0	Joint %s overspeed!	The robot is at a singular point or the robot's trajectory or speed design is unreasonable	Manually operate the robot to leave the singular zone or modify the taught robot speed or re-plan the trajectory
2-9007-0	The reserved program %s has not been set	No corresponding reservation file is set	Under the reservation process, set the corresponding reservation file to be valid
2-9008-1	The reservation function is not enabled, please enable it first!	If the appointment function is not enabled, this alarm will be triggered when a machine with a lower system version enters the Remote mode	If you want to use the appointment function, please set it in the robot configuration Check and set the appointment function, and it will take effect after the system restarts

13.6.2 Servo drive alarm

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
		The load and acceleration parameters are incorrectly set	Check whether the load and acceleration parameters are set correctly
10	Joint hardware overcurrent	The load is too large and exceeds the load characteristic curve	Check whether the load is too large and exceeds the load characteristic curve of the user manual
		Mechanical stuck phenomenon caused by impact, joint brake not opened, etc.	Clear the alarm, power off and restart, check whether each joint can operate normally
		Joint driver hardware damage	If the alarm continues to appear, please contact the official after-sales department
20	The joint current zero offset is abnormal	The zero drift detected by the joint driver is too large	Clear the alarm, power off and restart, check whether the alarm appears again, if it persists and cannot be eliminated, please contact the official after-sales department
21	Joint software overcurrent	The load and acceleration parameters are incorrectly set	Check whether the load and acceleration parameters are set correctly
		The load is too large, exceeding the load characteristic curve	Check whether the load is too large and exceeds the user manual load characteristic curve

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
21	Joint software overcurrent	Mechanical stuck phenomenon caused by impact, joint brake not opened, etc.	Clear the alarm, power off and restart, check whether each joint can operate normally
		Joint driver hardware damage	If this alarm continues to appear, please contact the official after-sales department
22	Overcurrent during joint startup	Servo brake is not opened	Clear the alarm, restart after power off, use the reverse drive function, push the robot to a lower gravity position to open the brake, and then use the normal brake opening function; If this alarm phenomenon persists, please contact the official after-sales department
23	The deviation between the actual position of the joint and the target position is too large	The load and acceleration parameters are incorrectly set	Check whether the load and acceleration parameters are set correctly
		The load is too large and exceeds the load characteristic curve	Check whether the load is too large and exceeds the load characteristic curve of the user manual
		The mechanical jam phenomenon caused by the impact, the joint brake is not opened, etc.	Clear the alarm, break Power cycle, check each joint for normal operation

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
23	The deviation between the actual position of the joint and the target position is too large	The hardware of the joint driver is damaged	If this alarm phenomenon persists, please contact the official after-sales department
30	The deviation between the actual position of the joint and the target position is too large	The load and acceleration parameters are incorrectly set	Check whether the load and acceleration parameters are set correctly
		The load is too large and exceeds the load characteristic curve	Check whether the load is too large and exceeds the load characteristic curve of the user manual
		Mechanical stuck phenomenon caused by impact, joint brake not opened, etc.	Clear the alarm, power off and restart, check whether each joint can operate normally
		The hardware of the joint driver is damaged	If this alarm phenomenon persists, please contact the official after-sales department
31	The deviation between the actual position and the target position when the joint is started is too large	The servo brake is not opened	Clear the alarm, power off and restart, use the reverse drive function, push the robot to a lower gravity position to open the brake, and then use the normal Open the brake function; if the alarm phenomenon persists, please contact the official after-sales department

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
40	Joint emergency stop status	The emergency stop button of the teach pendant is photographed	Check whether the emergency stop button of the teach pendant is photographed. If the emergency stop button is photographed, turn the emergency stop button to perform reset and synchronization operations.
40	Joint emergency stop status	External interference causes emergency stop false alarm (the burned FPGA version is wrong)	If the alarm cannot be eliminated continuously, please contact the official after-sales department.
50	Communication is abnormal, bus verification failed	Communication verification failed	Clear the alarm, power off and restart, check whether the alarm appears again, if it persists and cannot be eliminated, please contact the official after-sales department; or check whether it is in a strong electromagnetic environment.
51	Communication is abnormal, the bus is not synchronized	The communication is synchronizing or the synchronization fails	Click the 'reset' button to clear the alarm; or the alarm persists and cannot be eliminated, please contact the official after-sales department

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
52	Communication is abnormal, data from master station is not received	Frame from master station is not received	Usually occurs after the controller and servo software are upgraded, the alarm will be eliminated after power off and restart, if it cannot be eliminated, please contact the official after-sales department.
54	Communication is abnormal, the communication frame is incomplete	The master frame is received, not executed	Usually occurs after the controller and servo software are upgraded, the alarm will be eliminated after power off and restart, if it cannot be eliminated, please contact the official after-sales department
60	The joint encoder data is abnormal	The joint encoder cable is connected incorrectly, the cable is loose, and the cable is disturbed, which causes the joint encoder value to be incorrect or the joint encoder related hardware is interfered, resulting in incorrect joint encoder value	Clear the alarm, power off and restart, check whether the alarm appears again, If it persists and cannot be eliminated, please contact the official after-sales department
61	The data difference between the joint and the motor encoder is too large	The joint encoder cable is connected incorrectly, the cable is loose, and the cable is interfered, causing the joint encoder value to be incorrect or the joint encoder related hardware is interfered, resulting in an incorrect joint encoder value correct	

DN:EC

Alarm Num-ber	Description	Possible Reasons	Suggested Solution
62	The joint and motor encoders are not calibrated, the joint encoder data is abnormal	The encoder is not calibrated	
63	The fluctuation of joint and motor encoder difference is to too large	The joint encoder is damaged or the contact is poor	1.Clear the alarm, power off and restart, check whether the alarm appears again. If it persists and cannot be eliminated, please contact the official after-sales department;
70	Motor encoder calibration, no index signal detected	Motor encoder not calibrated or calibration failed	
71	Motor encoder index signal not detected	Motor encoder pulse may be contaminated	
72	Motor encoder data is abnormal, phase check failed	Motor encoder pulse may be polluted	
73	The motor encoder data is abnormal, the data fluctuation between phases is too large	The motor encoder pulse may be polluted	Clear the alarm, power off and restart, check whether the alarm appears again, If it persists and cannot be eliminated, please contact the official after-sales department
74	The joint and motor encoder are not calibrated, the motor encoder data is abnormal	The motor encoder is not calibrated or the calibration fails	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
75	The electrical angle deviation is too large, the check of the motor encoder data and the calibration data fails	The motor encoder pulse may be polluted	
76	The electrical angle deviation is too large, the check of the motor encoder data and the hall data fails	The motor encoder pulse may be polluted	
78	The electrical angle is abnormal, the encoder data is out of range	The motor encoder pulse may be polluted	Clear the alarm, power off and restart, check whether the alarm appears again, If it persists and cannot be eliminated, please contact the official after-sales department
79	The electrical angle is abnormal, the encoder data is out of range	The motor encoder pulse may be polluted	
80	Hall sensor abnormal	Hall sensor wiring error, looseness, cable damage, etc. cause inaccurate return value of hall sensor or related hardware damage of hall sensor, resulting in inaccurate return value of hall sensor	
81	Hall sensor accuracy is poor	Hall sensor is not calibrated or calibrated abnormally	

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
90	The brake is abnormal, the motor fails to rotate forward	The brake is abnormal	
91	The brake is abnormal, the motor fails to rotate forward and reverse	Abnormal when opening the brake	Clear the alarm, power off and restart, check whether the alarm appears again, If it persists and cannot be eliminated, please contact the official after-sales department
92	Brake abnormality, motor reversal failure	Abnormality when opening the brake	
94	The brake is abnormal, the distance of the brake is too large	The sliding distance is too large after closing the brake	
100	Joint overload	The load and acceleration parameters are incorrectly set	Check whether the load and acceleration parameters are set correctly
		The load is too large and exceeds the load characteristic curve	Check whether the load is too large and exceeds the load characteristic curve of the user manual
		Mechanical stuck phenomenon due to impact, joint brake not opened, etc.	Clear the alarm, power off and restart, check whether each joint is functioning properly
		Joint driver hardware damage	If this alarm phenomenon persists, please contact the official after-sales department

DN:EC

Alarm Number	Description	Possible Reasons	Suggested Solution
110	Joint overspeed	The use speed exceeds the maximum allowable value	Set the controller speed parameters correctly, and try again after power off and restart.
120	Overvoltage of the joint bus	The brake plate of the control box may be abnormal	Clear the alarm, power off and restart, check whether the alarm appears again, if it persists and cannot be eliminated, please contact the official after-sales department
121	The joint busbar is under voltage	The power of the control box is not enough due to hardware damage	Clear the alarm, power off and restart, check whether the alarm appears again, if it persists and cannot be eliminated, please contact the official after-sales department
130	Joint overheating	The load used is too large, exceeding the load characteristic curve	Check the size of the end load, and configure the load correctly according to the model
		The working environment temperature used is too high	Check the working environment temperature and use the robot according to the requirements specified in the user manual; Questions, please contact the official after-sales department
201	The joint is not ready	The drive has not been initialized	Usually appears after the power is turned on, which is a normal alarm content; or click the ’reset’ button to clear the alarm.

DN:EC

Chapter 14 Appendix

14.1 A IO Instructions for Use

The typical IO usage instructions are shown in the following table:

IO name	Function	Valid status	Remarks
X0	Emergency stop	low level effective	Any one of X0/X1 is valid to trigger
X1	Emergency stop	low level effective	
X2	Protection stop	low level effective	Any one of X2/X3 is valid to trigger
X3	Protection stop	low level effective	
X4	Digital input 0		
X5	Digital input 1		
X6	Digital input 2		
X7	Digital input 3		
X8	Digital input 4		
X9	Digital input 5		
X10	Digital input 6		
X11	Digital input 7		
X12	Digital input 8		
X13	Digital input 9		
X14	Digital input 10		
X15	Digital input 11		
X16	Digital input 12		
X17	Digital input 13		
X18	Digital input 14		
X19	Digital input 15		
X50	End drag/mark/disable (blue)	high level effective	Pressed back to 1

IO name	Function	Valid status	Remarks
X51	End drag/mark/disable (green)	high level effective	Pressed back to 1
Y0	Digital output 0		
Y1	Digital output 1		
Y2	Digital output 2		
Y3	Digital output 3		
Y4	Digital output 4		
Y5	Digital output 5		
Y6	Digital output 6		
Y7	Digital output 7		
Y8	Digital output 8		
Y9	Digital output 9		
Y10	Digital output 10		
Y11	Digital output 11		
Y12	Digital output 12		
Y13	Digital output 13		
Y14	Digital output 14		
Y15	Digital output 15		
Y50	Blue Button		The light is always on (the end IO is checked)
Y51	Green button		
M36	External Sync	high level effective	hold time at least 20ms
M38	Servo enable status bit	high level effective	Servo enable is 1, not enabled is 0
M44	collision detection enable/disable	high level effective	1 is to open collision detection, 0 is to close collision detection
M48	Automatic start after guard stop	high level effective	The robot resumes motion after the object leaves due to guard stop and not by other means (such as through the teach pendant)

IO name	Function	Valid status	Remarks
M49	Protection stop status bit	high level effective	Enter the protection stop status is 1, it will be set to 0 after the program is resumed
M50	External Pause Status Bit	high level effective	Set to 1 when Pause is triggered externally
M51	Teach pendant pause status bit	high level effective	Set to 1 when the pause is triggered by the teach pendant, the hold time is at least 20ms
M400	Servo enabled status	high level effective	Servo enabled is 1, not enabled is 0
M401	Reaching the program far point status bit	high level effective	Set to 1 when the robot is at the program origin, and 0 when it is not at the program origin
M406	Reservation function enable	high level effective	Set to 1 when the reservation function is checked, 0 when it is not checked
M408	Scheduled program 1 running status bit	high level effective	
M409	Scheduled Program 2 Running Status Bit	high level effective	
M410	Scheduled Program 3 Running Status Bit	high level effective	
M411	Scheduled Program 4 Running Status Bit	high level effective	
M412	Scheduled Program 5 Running Status Bit	high level effective	
M413	Scheduled Program 6 Running Status Bit	high level effective	
M414	Scheduled Program 7 Running Status Bit	high level effective	
M415	Scheduled Program 8 Running Status Bit	high level effective	
M416	Teach Mode Status Bit	high level effective	Set to 1 when the robot is in Teach Mode

IO name	Function	Valid status	Remarks
M417	Auto Mode Status Bit	high level effective	Set to 1 when the robot is in Auto Mode
M418	Remote Mode Status Bit	high level effective	Set to 1 when the robot is in Remote Mode
M419	Status bit of the teach pendant start button	high level effective	After pressing the start button at the lower right corner of the teach pendant, set it to 1
M420	Pause button status bit of the teach pendant	high level effective	After pressing the pause button in the lower right corner of the teach pendant, set it to 1
M421	Teach pendant servo button status bit	high level effective	After pressing the servo button in the lower right corner of the teach pendant, set it to 1
M422	The status bit of the teach pendant clear alarm button	high level effective	After pressing the clear alarm button in the lower left corner of the teach pendant, it is set to 1
M423	General Purpose M Register		
M424	Robot stop status bit	high level effective	detection hold time is at least 20ms
M425	Robot Pause Status Bit	high level effective	Detection hold time is at least 20ms
M426	General Purpose M Register		
M427	Robot running status bit	high level effective	detection hold time is at least 20ms
M428	Alarm Status Bit	high level effective	Detect Hold Time at least 20ms
M440	Interference Area Signal 1 Status Bit	high level effective	
M441	Interference Area Signal 2 Status Bit	high level effective	
M442	Interference Area Signal 3 Status Bit	high level effective	
M443	Interference Area Signal 4 Status Bit	high level effective	

IO name	Function	Valid status	Remarks
M444	Interference Area Signal 5 Status Bit	high level effective	
M445	Interference Area Signal 6 Status Bits	high level effective	
M446	Interference Area Signal 7 Status Bit	high level effective	
M447	Interference Area Signal 8 Status Bits	high level effective	
M448	Interference Area Signal 9 Status Bit	high level effective	
M449	Interference Area Signal 10 Status Bit	high level effective	
M450	Interference Area Signal 11 Status Bit	high level effective	
M451	Interference Area Signal 12 Status Bit	high level effective	
M452	Interference Area Signal 13 Status Bit	high level effective	
M453	Interference Area Signal 14 Status Bit	high level effective	
M454	Interference Area Signal 15 Status Bit	high level effective	
M455	Interference Area Signal 16 Status Bits	high level effective	
M464	Cursor status bit of the first line of the main program	high level effective	The cursor is set to 1 when the cursor is in the first line of the main program, and set to 0 after leaving the first line of the main program, and the detection hold time is at least 20ms
M465	Sync status bit	high level effective	detection time needs to be more than 20ms
M468	Program single-step execution status bit	high level effective	set to 1 when single-step, the detection time needs to be more than 20ms

IO name	Function	Valid status	Remarks
M469	Program single cycle status bit	high level effective	Set to 1 during single cycle, the detection time needs to be more than 20ms
M470	Program continuous loop status bit	high level effective	Set to 1 when continuous loop, the detection time needs to be more than 20ms
M471	General Purpose M Register		
M472	Precise Mode Status Bit	high level effective	0: Inaccurate; 1: Accurate; detection hold time is at least 20ms
M473	Initialization mode status bit	high level effective	0: non-initialization; 1: initialization; detection hold time is at least 20ms
M474	Reverse drive mode status bit	high level effective	set to 1 when entering reverse drive mode, detection hold time is at least 20ms
M475	get collision detection switch status	high level effective	1 is on, 0 is off

14.2 B Glossaries

Stop Category 0: The robot motion is stopped immediately when the power supply of the robot is turned off. It is an uncontrolled stop, where the robot may deviate from the programmed path as each joint may brake as fast as possible. This protective stop may be used when a safety-related limit is exceeded, or when a fault occurs in the safety-related assessment part of the control system. For more information, please refer to EN ISO 13850:2015 or EN IEC 60204-1:2018.

Stop Category 1: The robot motion is stopped with power available for the robot to achieve the stop, and the power supply is turned off when the stop is achieved. It is a controlled stop, where the robot will comply with the programmed path. The power is turned off after one second or once the robot stands still. For more information, please refer to EN ISO 13850:2015 or EN IEC 60204-1:2018.

Stop Category 2: It is defined as a controlled stop with power available to the robot. The robot stops all motions within one second. Through the operation of the safety-related assessment control system, the robot may stay at the stop position. For more information, please refer to EN IEC 60204-1:2018.

Diagnostic coverage (DC): It is used to measure effectiveness of the diagnosis which is implemented to achieve the assessed performance level. For more information, please refer to EN ISO 13849-1:2015.

Integrator: The integrator is an organization designing the final installation of the robot. The integrator is responsible for implementing the final risk assessment, and must make sure that the final installation complies with local laws and regulations.

Mean time to dangerous failure (MTTFd): The MTTFd is defined as a value acquired by calculation and detection which are implemented to achieve the assessed performance level. For more information, please refer to EN ISO 13849-1:2015.

Risk assessment: The risk assessment is the whole process of identifying all risks and reducing these risks to an appropriate level. The risk assessment should be recorded and archived. please refer to ISO 12100 for details.

Performance level (PL): The PL is a discrete level which is used to specify the ability of each safety-related part in the control system to implement the safety function under foreseeable conditions. PLd is a second highest reliability classification, meaning that the safety function is extremely reliable. For more information, please refer to EN ISO 13849-1:2015.

14.3 C Certification and Detection

Through verification and evaluation of the quality management system and the sample type test of the enterprise by the third party certification organization, the productEC66 of the company is confirmed to be in line with the specific requirements and have the ability of producing the qualified products continuously and steadily, with the written confirmation. The description is as follows:

The EC66 has passed detection and certification of multiple well-known international third party organizations, and has acquired the EU CE certification and Korean KC certification. The product safety has achieved the international leading level.

The EC66 has passed the robot performance test of National Robot Testing and Assessment Center (Headquarters) of China; and the performance indexes have exceeded most of the domestic brands and achieved the standard of the traditional industrial robot, and have been gradually narrowing a gap with the top international brands.

The EC66 robot has passed the EU CE certification, and the product is in line with all relevant requirements of the EU CE directive:

Low-voltage Directive (LVD) 2006/95/EC

Machinery Directive (MD) 2006/42/EC

Electro Magnetic Compatibility Directive (EMC) 2004/108/EC

EN ISO 10218:2011

EN ISO 12100:2012

EN 60204-1: 2006+A1: 2009

The EC66 robot has been certified and tested by the official authority of Korea, has passed Korean KC certification, and is in line with all relevant requirements of the certification standards of Korea.

The EC66 robot has been certified and tested by National Robot Testing and Assessment Center (Headquarters) of China, has passed the CR certification and is in line with all relevant requirements of the CR certification standards regarding the collaborative robot. The test standards are as follows:

GB 5226.1-2008 GB 11291.1-2011

GB/T 15706-2012

GB/T 17799.2-2003 GB 17799.4-2012

The EC66 robot is subjected to the robot performance test implemented by National Robot Testing and Assessment Center (Headquarters) of China, and the test basis and standards are as follows:

GB/T 12642-2013 Industrial robots – Performance criteria and related test methods.

14.4 D Stopping Time and Stopping Distance

Stopping distance and stopping time of stop category 0

The table below shows the stopping distance and the stopping time measured when the stop category 0 is triggered. These measuring results correspond to the following configurations of the robot:

- Extension: 100% (the robot arm is completely extended horizontally)
- Speed: 100% (the general speed of the robot is set as 100%, and the robot moves at a joint speed of 180°/s)
- a maximum payload (6kg) that can be handled by the robot connected to TCP.

The Joint 0 test was carried out by performing a horizontal movement, where the rotational axis was perpendicular to the ground. During the Joint 1 and Joint 2 tests, the robot followed a vertical trajectory, where the rotational axes were parallel to the ground, and the stop was performed while the robot was moving downward.

Table 14-2 . Stopping distance and stopping time

	Stopping distance (rad)	Stopping time (ms)
Joint 0 (base)	0.224	174
Joint 1 (shoulder)	0.462	426
Joint 2 (elbow)	0.314	217

14.5 E Spare Parts List

For the spare parts list, please refer to: T202001007-Parts list of collaborative robots.

14.6 F Reference Standards

The robot is designed by using the following standards for reference, as shown in **Table** 14-3 .

Table 14-3 . Reference standards

Standard	Definition
2006/42/EC:2006	Machinery Directive: Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)
2004/108/EC:2004	EMC Directive: Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
EN ISO 13850:2015	Safety of machinery: Emergency stop - Principles for design
EN ISO 13849-1:2015	Safety of machinery: Safety-related parts of control systems - Part 1: General principles of design
EN ISO 13849-2:2012	Safety of machinery: Safety-related parts of control systems - Part 2: Validation
EN ISO 12100:2012	Safety of machinery: General principles of design, risk assessment and risk reduction
EN ISO 10218:2011	Industrial robots: Safety Note: Content equivalent to ANSI/RIA R.15.06-2012, Part 1
ISO/TS 15066:2016	Safety requirements for collaborative industrial robot Robots and robotic devices —Collaborative robots

14.7 G Technical Specifications

Robot type	EC66
Weight	17.5kg
Maximum payload	6kg
Reach	914mm
Joint range	+/-360°
Joint speed	J1-J2:144°/s J3:180°/s J4-J6:224°/s
TCP speed	2.8m/s
Repeated positioning accuracy	+/-0.03mm
Controller IO	16 x DI, 16 x DO, 2 x AI, 4 x AO
Tool IO	2 x DI, 2 x DO, 1 x 24V 1 x AI, 1 x AO, 1 x RS485
IO power supply	The controller is 24V 2A, and the tool end is 24V 2A
Communication with controller	Ethernet TCP/IP, UDP, ModbusTCP. RS485/RS232, Modbus-RTU. Profinet, EthernetIP, CCLink.
Tool Communication	RS485
Protection class	IP54
Typical power consumption	250W/1600W
Temperature	0-50°C
Power supply	90-264VAC 50-60Hz 19-72VDC
controller weight	15kg
Anticipated service life	35000 hours