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Expert

A background image of a large industrial robot arm in a factory setting, rendered in a monochromatic orange-red color. The robot arm is positioned in the center-right, with its joints and cables visible. The background shows a complex industrial environment with various structures and equipment.

Industrial Robot Quick Operation
Manual for ER130-4-2800

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Statement

Thank you for purchasing EFT robot products. In order to ensure that the products have been set correctly, please read this operation manual carefully before using this product. The contents mentioned in this statement and the manual are related to your personal and property safety. If you do not follow the instructions and warnings in the manual or operate without authorization, it may cause personal injury to you and the people around you or property damage to the robot or other objects around you. This statement and manual are the latest version of this batch of products before leaving the factory. Please visit www.efort.com.cn Official website for updated information.

This manual is only used as a guide for the normal operation of the product. During the use of the product, EFT will not be liable for personal injury and property loss caused by other reasons except product defects. EFORT company solemnly suggests that: personnel participating in robot operation, teaching, maintenance, repair, spot inspection and other related activities should not be given permission to operate the robot before completing the training courses prepared by EFORT company.

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Contents

Chapter One Safety.....	1
1.1 Safety instructions	1
1.2 Safety guidelines.....	1
1.3 Safety precautions in the process of work	3
1.3.1 Safety of robot installation and connection.....	3
1.3.2 Safety before robot starting	4
1.3.3 Safety of robot starting	5
1.3.4 Test run safety	6
1.3.5 Safety in teaching process	6
1.3.6 Security in autorun	8
1.3.7 Safety during maintenance	9
1.3.8 Safety during spot check and maintenance	10
Chapter Two Handling and installation.....	13
2.1 Overview.....	13
2.2 Basic Description.....	13
2.2.1 unpacking list	13
2.2.2 Preparation work before installation	14
2.2.3 Robot storage environment	14
2.2.4 Robot operation environment.....	14
2.2.5 Start robot in cold environment.....	15
2.2.6 Table of robot performance parameters.....	15
2.2.7 Robot workplace	17
2.2.8 Working space of control cabinet	17
2.3 Handling	18
2.3.1 Precautions for robot handling	18
2.3.2 Robot body handling	19

2.3.3 Robot control cabinet handling	21
2.4 Installation	22
2.4.1 Setting of safety bar	22
2.4.2 Robot installation method	23
2.4.3 Ground installation	23
2.4.4 Bracket installation	25
2.4.5 Installation site and environment	25
Chapter Three Electrical connection	29
3.1 Robot power supply	29
3.2 Connection between robot control cabinet and robot body	31
3.3 Controller local IO definition	34
3.4 IO module expansion	35
3.4.1 Controller local IO extension	35
3.4.2 Controller remote IO extension	36
Table 3-8 connection mode of remote IO module	37
3.4.3 Motion control card	37
3.5 IO settings	39
3.5.1 Update IO module	39
3.5.2 Remote IO configuration	40
3.5.4 Analog IO configuration	43
3.5.5 Group IO configuration	45
3.6 Introduction of external emergency stop	47
Figure 3-8 position indication of external emergency stop and wiring diagram	48
Figure 3-10 schematic diagram of safety door and grating wiring terminal block ...	49
Chapter Four Quick operation	50
4.1 Teach pendant	50
4.1.1 About teach pendant	50
4.1.2 Function area and interface	51

4.1.3 How to hold the teach pendant	53
4.2 Power on and start	54
4.3 Jog operation.....	54
4.3.1 What is Jog operation	54
4.3.2 Points for attention on jogging operation	54
4.3.3 Start jogging operation	55
4.3.4 Joint coordinate system - jogging operation	56
4.4 Program operation	56
4.4.1 What is program operation	56
4.4.2 Points for attention on program operation.....	56
4.4.3 Start program operation.....	57
4.5 Shut down and power off.....	59
Chapter Five Common faults and investigation methods during installation.....	60

Chapter One Safety

1.1 Safety instructions

According to the relevant laws, regulations and regulations of the state and the local government, safety prevention is the most basic concern when using industrial systems including industrial robots.

In the event of personal injury and property loss caused by the use of robots, the factory using robots is responsible. Therefore, in addition to understanding this manual and relevant information, all laws and standards concerning health and safety must be understood and must be observed.

For safety, it is only the minimum requirement to comply with the provisions of this manual and other EFFORT company manuals. As a general rule, the safety related information recorded in this manual does not fully cover all aspects of robot application system. Therefore, when using robots, necessary safety measures should be taken and strictly observed according to the actual situation of the system and its application environment.

Operators must carefully read the following information, especially the safety measures listed in this chapter.

Users of the EFFORT industrial robots shall be responsible for ensuring compliance with applicable safety laws and regulations in the country/district and that the necessary safety equipment used to protect the operator of the robot system is designed reasonably and installed correctly. Robot operators must be familiar with the operation and handling of industrial robots as described in the following applicable documents:

ER Series Robot Operation Manual

Electrical Use and Maintenance Manual for ER 130-4-2800 Industrial Robot

Mechanical Use and Maintenance Manual for ER 130-4-2800 Industrial Robot

This manual contains all the safety instructions contained in the product manual for robots and controllers. The robot system shall be designed and manufactured very well in order to safely enter all areas necessary for intervention during operation, adjustment and maintenance. For the situation that it is necessary to work in the safe protection space, it is necessary to ensure safe and sufficient access to the working position.

1.2 Safety guidelines



Prohibited acts

1. Do not change or remove the protective device and safety device of industrial robot at will.
2. In case of waterlogging, do not touch the robot. First cut off all power and drain the site.
3. The operation of industrial robots can only be carried out by professionals who have received sufficient training and guidance (including those who have read this manual).
4. Make sure that the area around the emergency stop equipment is unblocked. Do not pile up sundries before the emergency stop equipment, which will hinder the use of the equipment in emergency.
5. It is not allowed to use unsuitable materials, adjust and modify the robot improperly.

	6. Unauthorized personnel or personnel who have not received training in the use of the robot and are aware of the existing risks shall not operate the robot. 7. Do not use the robot when: • Exposure of robot components • The safety device is disabled • When all or part of the fuse and / or mechanical equipment is disabled • The processed materials do not meet the requirements • No more than one person is allowed to use the machine at the same time 8. It is strictly forbidden to use the robot in violation of the above requirements, especially the use of nonoriginal accessories. 9. Do not move the safety protection device. It is the user's responsibility to ensure that the safety protection device is fixed and operated orderly. 10. The safety device can only be moved during maintenance, but the operation procedures of the maintenance personnel must be followed, and the operation must be carried out under the condition of ensuring the safety of the robot.
	Coercive measures 1. Make sure that no one is in the danger area before starting the machine. 2. All operators must receive special training on the use and maintenance of industrial machines. 3. The foreman shall continuously monitor to ensure the normal operation of all procedures and ensure the correct application of safety protection procedures. 4. Carry out maintenance according to the maintenance requirements in this manual to keep the industrial robot clean and tidy. 5. Appropriate tool kits should be prepared to store cleaning tools and maintenance tools; personnel must wear the personal protective equipment. 6. In addition to these instructions, the trial users must comply with current health and safety regulations. 7. When the robot fails, or is suspected to be damaged, and the machine does not work or makes abnormal noise, the machine should be stopped. 8. Once you find a fire in the machine (regardless of the size of the fire), you should immediately call the police and find a professional team to put out the fire. 9. When the machine is running, the control cabinet door must be closed all the time and cannot be opened. The key of control cabinet must be kept by electrician. 10. When operating with the mode of power-on, personnel are not allowed to enter the safety protection area. 11. Before the automatic mode is turned on, all the temporarily disabled safety functions must be restored to the normal working state.
	warning 1. The release of gravity and brakes may cause a fall hazard. 2. When the safety protection device is inspected, it may cause danger to the maintenance personnel because the safety protection device cannot work. Therefore, the maintenance

	personnel must be very careful and take all kinds of protective measures.
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1.3 Safety precautions in the process of work

1.3.1 Safety of robot installation and connection



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For all operations of installation and connection, please strictly observe the following items and refer to the following national / international standards. The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006).

1. Before operation, please read and understand all manuals, specifications and other relevant documents provided by Efort. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective.
2. When transporting robots, avoid exceeding the specified height:
 - Only people with forklift and crane operation qualification are allowed to move / transport robot body, control cabinet, etc
 - During transportation, never approach or walk under the lifted robot body or control cabinet.
 - Do not stay on the robot body and control cabinet during transportation, and do not touch or support them manually.
3. Hook the wire rope to the lifting ring as described in the robot lifting diagram, and make sure that the lifting ring is not loose before operation.
4. When using sling to transfer control cabinet, please remove the teach pendant and its support to avoid the cable from hooking other equipment.
5. Before moving the robot, remove all unwanted objects and clean up the access to the installation location.
6. If it is handled by forklift, please fix the control cabinet to prevent the control cabinet from dumping.
7. Since the robot is composed of precise components, please protect the robot from collision and impact.
8. When the main power supply of the installation ground is on, the power cable of the control cabinet shall not be connected. Otherwise, it will be extremely dangerous and can cause electric shock. When connecting the input power cable, make sure that the main power supply is off. Meanwhile, to prevent the input power supply or circuit breaker from being misclosed, please place clear off- mark on all power supply units and circuit breakers to indicate that the inspection / maintenance and maintenance are in progress, and lock or clamp the main power switch.

	9. When the wiring is finished, always shut the cover plate of the input power connection end. Otherwise, it will be extremely dangerous. If the terminal is touched by mistake, electric shock may be caused. 10. Place the motor / signal cables connecting the robot into the cable tray to prevent damage. Also take measures to avoid pressure on them. Do not connect the power supply until all the connection between the control cabinet and the robot body is completed. Otherwise, it will be very dangerous, which can lead to electric shock and other accidents.
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1.3.2 Safety before robot starting

	DANGER The operation of the robot before starting must strictly comply with the following matters, and refer to the relevant national / international safety standards. The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006). 1. Before operation, please read and understand all manuals, specifications and other relevant documents provided by EFT. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective. 2. Make sure that the robot's control cabinet, operation panel and all other control devices are installed outside the safety protection device (fence). Only in this way can the whole movement range of the robot be monitored. 3. Confirm that there are no personnel, packaging materials, fixtures or other obstacles within the range of motion of the robot arm. 4. Eliminate any area between the fixed device and the mobile device that may trap people. 5. Before connecting the power cable, please confirm whether the voltage, frequency and cable specification of the power supply meet the requirements. 6. Ensure that the control cabinet and surrounding equipment are properly grounded. The ground wire of robot control cabinet and the ground wire of peripheral equipment should be grounded separately, not connected together. At the same time, if the external equipment is equipped with electromagnetic switch, contactor and other devices, please install power filter or equivalent device on the power-incoming line adjacent to the robot control cabinet. 7. Before turning on the "power" of the robot, please confirm that the installation of the robot meets the requirements of robot installation. 8. When the operator operates the robot, he must be equipped with an observer for monitoring, and the observer must also complete the corresponding training provided by Efort company. 9. For application projects (water, compressed air, protective gas, etc.), the system must be equipped with monitoring instruments, so as to automatically detect the abnormal situation of water supply and gas supply in time.
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| | 10. If the robot will produce the largest amount of waste, metal dust particles, fine particles, etc. in the process of working, please cover the robot body, robot control cabinet, and peripheral devices with a suitable cover. |
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1.3.3 Safety of robot starting



DANGER

To start the robot, first connect the power line, and then turn the power switch from OFF to On. For these operations, please strictly abide by the following items and refer to relevant domestic / international standards.

The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006).

Before starting the robot, please make sure that the emergency stop switch works normally.

1. Before operation, please read and understand all manuals, specifications and other relevant documents provided by Efort. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective.
2. Check the name and function of all switches, displays and signals necessary for robot operation.
3. Do not enter the security fence unless the robot is powered off. At the same time, before starting the robot, make sure that all safety protection devices function normally.
4. If there are several operators working together in the robot application system, all operators and related personnel must know that the robot has been activated before starting the robot.
5. Before turning ON the motor power and starting teaching or automatic operation, please confirm again that there are no workers or left obstacles in and around the robot safety fence.
6. When starting the robot and recovering from the fault state, put your hand on the emergency stop switch after turning on the power supply of the control cabinet, so as to cut off the power supply of the motor immediately in case of any abnormal situation.
7. Before activating the robot, please confirm again that the following conditions have been met.
 - Confirm that the installation status of the robot is correct and stable.
 - Make sure that all kinds of connections of robot control cabinet are correct, and the power specifications (power supply voltage, frequency, etc.) meet the requirements.
 - Make sure that all kinds of application connections (water, compressed air, protective gas, etc.) are correct and consistent with the specifications and models.
 - Make sure the connection with peripheral devices is correct.

	• Please make sure that in addition to using the software motion limit, the mechanical limit block / or limit switch has been installed to limit the motion range of the robot. • When the robot is stopped by the mechanical limit block, please confirm that the relevant parts have been inspected or the failed mechanical limit block has been replaced (if necessary). • Confirm that safety measures have been taken: some installation protective devices have been installed such as safety fences or alarm devices. • Please confirm that the function of safety protection device and interlock is normal. • Confirm that the environmental conditions (temperature, humidity, light, noise, dust, etc.) meet the requirements, or do not exceed the specifications of the system and robot.
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1.3.4 Test run safety

	DANGER During test run, there may be design error, teaching error and work error in many elements such as teaching program, fixture, logic controller. Therefore, the safety awareness must be further improved during the test run. The following points should be noted during the test run: 1. First, confirm whether the emergency stop button, hold / run switch and other buttons, switches and signals used to stop the robot are normal. Once a dangerous situation occurs, if the robot can not be stopped, it will not be able to prevent the accident. 2. During the test run of the robot, the operation speed of the robot is set to low speed (about 5% - 10%) to confirm the teaching action. Confirm the action repeatedly with about 2-3 cycles. If any problem is found, stop the robot immediately and correct it. After ensuring that there is no problem, gradually increase the speed (50% → 70% → 100%), and repeat the confirmation action again with about 2-3 cycles.
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1.3.5 Safety in teaching process

	DANGER Efort recommends that teaching should be completed outside the safety fence. However, if it is necessary to enter the safety fence, please strictly observe the following items, and refer to the following domestic / international safety standards. The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006). Please confirm that the emergency stop switch is functioning normally before teaching. 1. Please read and understand all manuals, specifications and other relevant documents provided by Efort before operation. In addition, the operation, teaching, maintenance and other processes are fully understood. At the same time, confirm that all safety measures are
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	in place and effective. 2. Before starting the robot, please confirm that all safety guards (safety fences) are working properly. 3. Teaching should be done by two people, one instructor and one observer. The observer also bears the responsibility of safety supervision, and confirms the signal conditions such as "work start" before teaching. 4. Before entering the safety fence, the instructor must set the teaching switch on the teach pendant to the manual position to prevent the switch on control cabinet turning to the automatic mode and cause accidents. Once the robot makes any abnormal movement, press the emergency stop switch immediately and exit the robot working area from the preset retreat path immediately. 5. Please install an emergency stop switch for the observer outside the safety fence and where the whole robot can be monitored. Once the robot is moving improperly, the observer must be able to press the switch very easily to stop the robot immediately. In addition, if you need to restart the robot after an emergency stop, reset and restart manual operation outside the safety fence. The instructor and observer must be qualified personnel who have been specially trained. 6. Please clearly mark that teaching is in progress to avoid any robot system device being misoperated by anyone through control cabinet, operation panel, teach pendant, etc. 7. After completing the teaching work, before confirming the movement track and teaching data of teaching, please clear all personnel and obstacles left in the safety fence and around the robot. After confirming that there are no personnel and obstacles left in the safety fence, please perform the confirmation work outside the safety fence. At this time, the speed of the robot shall be less than or equal to the safe speed (250mm/s), that is, until the movement is confirmed to be normal. 8. If you need to restart the robot after an emergency stop, reset and restart manually outside the safety fence. Meanwhile, confirm all safety conditions and confirm that there are no personnel and obstacles left around the robot and in the safety fence. 9. During the teaching process, please confirm the range of motion of the robot and prohibit the approach to the lower part of the robot arm. Avoid the danger caused by accidental operation. Pay special attention to the danger caused by accidental falling of the workpiece when the robot claw holds the workpiece. 10. For safety, in teaching or inspection mode, the maximum speed of the robot is limited to 250mm / S (safe operation speed). However, when the operator verifies the teaching data after the teaching or error recovery is completed, please set the speed of inspection operation as low as possible. 11. During the teaching process, whether the instruction operator or supervisor, the robot must be monitored for abnormal movement, possible collision and extrusion points around the robot. Also, please confirm the safety access for the instruction operator to retreat in
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	case of emergency. 12. After movement teaching of the robot is completed, please set the software limit of the robot a little beyond the teaching range of the robot. For how to set the software limit, refer to the operation manual of Efort industrial robot.
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1.3.6 Security in autorun

	DANGER As the teaching program will run at high speed, please strictly abide by the following items and refer to the relevant international and domestic safety standards. The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006). Before automatic operation, please make sure that all switches function normally. 1. Before operation, please read and understand all manuals and other relevant documents provided by Efort. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective. 2. Never enter or partially enter the safety fence during automatic operation. At the same time, please make sure there are no people or obstacles left in the safety fence before starting the robot. 3. In automatic operation, the robot looks like it has stopped when waiting for timer delay or external signal input. But at this time do not get close to the robot, because when the timer reaches the time or external signal receives the input, the robot will immediately resume operation. 4. In the automatic operation, this situation will be extremely dangerous: if the grip of the workpiece is not enough, the workpiece may be thrown off in the movement of the robot. Please make sure that the workpiece is firmly grasped. When the workpiece is grasped by pneumatic gripper, electromagnetic mechanism method, etc., please use the failure-prevention safety system to ensure that once the driving force of the mechanism is suddenly disconnected, the workpiece will not be ejected. Even in the case of error, the possibility of the workpiece out is the smallest, please also install protective fence, such as mesh cover, etc. 5. Display the sign of "automatic operation" on the safety fence and do not enter the work area. At the same time, please confirm the safe passage for the operator to withdraw in case of emergency. 6. If the robot stops in automatic operation due to fault, please check the fault information displayed, and recover and restart the robot according to the correct fault recovery sequence. 7. Before restarting the robot, please confirm that the safe working conditions are met after the fault recovery sequence and that there are no personnel, fixtures, peripheral devices or
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	obstacles left in the safety protection device or around the robot.
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1.3.7 Safety during maintenance



DANGER

To carry out maintenance, please strictly abide by the following terms, and refer to the relevant international and domestic safety standards.

The safety function of the robot is designed according to the safety requirements of industrial robots (GB11291.1-2011/ISO10281- 1:2006).

Please make sure that all switches are working properly before maintenance.

1. Before operation, please read and understand all manuals and other relevant documents provided by Efort. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective.
2. Before entering the security fence, please make sure that all necessary security measures are ready and functioning well.
3. Before entering the security fence, please cut off the control power until the main power supply. Clear signal display should be placed to show that the power is off and maintenance is in progress, and the main power switch should be locked or clamped to prevent someone from turning on the power by mistake.
4. The maintenance work is limited to the personnel who have completed the special training of the corresponding type of robot.
5. Before maintenance, make sure there is enough space around the robot to avoid interference with peripheral equipment. At the same time, the peripheral devices are fixed to prevent any sudden action.
6. Be sure to turn off the automatic operation function before entering the safety fence. If the robot has any abnormal movement, it should immediately press the emergency stop switch and withdraw from the specified evacuation route.
7. In addition to the emergency stop switch of the teach pendant in the hands of the operator, please install another emergency stop switch for the inspector outside the safety bar, where it is convenient to observe the movement range of all robots. In case of abnormal action of the robot during maintenance, the switch must be easily pressed by the inspector. After the emergency stop, please reset and restart the robot from outside the fence. In addition, both operators and inspectors must be personnel who have completed special training courses.
8. During the operation, both the operator and the inspector must pay attention to the abnormal movement, the possible collision point and the surrounding of the robot.
9. When replacing, please use only the parts provided by Efort company.
10. Support the robot arm with a suitable lifting device before removing the servo motor of

	any joint axis. If the motor is removed, the brake mechanism of the axis will fail. If there is no reliable support, the arm will fall. Please note that if you press any axle brake release switch on the control cabinet, the same danger will appear. 11. When the driver module and power module need to be replaced, please turn off the control power and wait for at least 7 minutes. Then, please confirm that the output voltage of the power supply is 0V before starting to replace the work, remove the connector, etc. Please also note that do not touch any parts to prevent electric shock or scald. 12. If compressed air or water is supplied, please cut off the supply source and remove any residual pressure in the pipeline before maintenance. 13. When the robot expands the additional axis, make sure that the emergency stop signal of the additional axis is connected in series to the emergency stop circuit of the control cabinet. 14. When changing the robot parts, it is necessary to confirm the matching degree of the changing parts and the original parts, and carefully check the schematic diagram, so as to prevent the wrong wiring from causing damage to the robot control cabinet components or external components.
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1.3.8 Safety during spot check and maintenance

	DANGER In order to prevent system failure, please clean, inspect, maintain or replace the parts of the robot in strict accordance with the following terms. At the same time, refer to the relevant international and domestic safety standards. Before inspection and maintenance, please make sure that all emergency stop switches function normally. 1. Before operation, please read and understand all manuals and other relevant documents provided by EFT. In addition, a complete understanding of the operation, teaching, maintenance and other processes. At the same time, confirm that all safety measures are in place and effective. 2. Before inspection and maintenance, remove unwanted objects and clear the passage to the installation position. 3. The spot inspection and maintenance work is limited to the personnel who have completed the special training of the robot or the same type of robot. 4. Before spot check and maintenance, please make sure there is enough space around the robot to avoid interference with peripheral equipment. At the same time, set the peripheral equipment to a fixed state to ensure that they will not suddenly move. 5. Before entering the safety fence, please cut off the power supply of the whole line or robot according to the work needs, and cut off the power supply until the total power supply. Clear signal shall be placed to show that the power is off, inspection / maintenance is in
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	progress, and the main power switch shall be locked or clamped by lock, so as to avoid someone turning on the power by mistake. If the whole line cannot stop, install a temporary safety fence between the target robot and any adjacent robots. 6. When carrying out spot inspection and maintenance of interlocking signal line, please turn off the power supply of all signal associated equipment to ensure safety. Do not enter the safety fence during this work. After the completion of spot inspection and maintenance, please confirm that the safety protection devices (safety fence, safety bolt, emergency stop switch, etc.), peripheral equipment, interlocking lines and other safety devices work normally. 7. In addition to the emergency stop switch held by the operator, please install another emergency stop switch for the supervisor outside the safety fence. The installation position should be selected where all the robot motion ranges can be monitored. If the robot moves abnormally during maintenance / spot inspection, the supervisor must easily press the switch. After the emergency stop, the recovery and restart of the robot must be carried out outside the safety fence. In addition, operators and supervisors must be personnel who have completed special training courses. 8. Before entering the safety fence, the instructor must turn the teaching mode switch on the teach pendant to the manual mode, so as to prevent accidents caused by turning the cabinet mode switch to the automatic mode. Once the robot makes any abnormal movement, immediately press the emergency stop switch and exit the robot working area from the preset retreat path. 9. In the process of spot inspection / maintenance, both operators and supervisors must always monitor whether the robot has abnormal movement, possible collision, extrusion, etc. At the same time, please confirm the operator's safe passage for emergency evacuation. 10. If it is inevitable to remove the safety fence in the process of spot inspection / maintenance, please provide sufficient safety measures: • Park the robot and peripherals in the right place. • Lock / calibrate the power supply and switch. It must be avoided that anyone turns on the power supply by mistake or sets the switch to automatic mode by mistake. • After the completion of spot inspection / maintenance, the safety fence shall be installed again, and all safety measures and safety functions shall be confirmed to be the same as the original. 11. Please use only the parts approved by Efort company for replacement. In addition, in the spot inspection / maintenance, please use the teaching mode and move the robot as low as possible. 12. When the driver module and power module need to be replaced, please turn off the control power and wait for at least 7 minutes. Then, please confirm that the output voltage of the power supply is 0V. After confirming that the output power of DC power supply is changing to 0V, replace or pull out the connector. In addition, if the robot has just stopped running, the heat sink or regenerative absorption resistance may still be hot. Therefore, be careful not to touch any hot parts.
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	13. Before removing the servo motor from the shaft, firmly support the robot arm with a suitable lifting device. Removing the motor outside the shaft will disable the brake system of the shaft, and the arm will fall. In addition, pressing any brake release button on the control panel will cause the same danger. 14. If the robot must maintain the same pose and attitude before and after maintenance, please record the pose and attitude data of the robot before replacing parts. 15. At the beginning of the replacement process, when the printed circuit board or cable is removed, check and record their position, connector number, installation method, setting data, etc., so that they can be restored as they are. After the connector is inserted, its locking mechanism must be locked firmly. Also, never touch the connector pin. 16. When the application devices (water, compressed air, protective gas, etc.) are used, please shut down their supply sources and remove the residual pressure in the pipeline before spot inspection / maintenance. 17. After repair / maintenance, please make sure that all safety protection devices are working properly 18. Do not change or modify the robot without permission of the company. In case of unauthorized modification, Efort will not be responsible. 19. In the robot arm and control cabinet, a variety of data backup batteries are built in. If the wrong battery is used, it will cause combustion, overheating, explosion, corrosion, leakage and so on. Therefore, the following requirements must be strictly observed. • Only use batteries specified by EFT; • The battery can not be recharged, disassembled, changed and heated; • Do not discard the battery in water or fire; • The battery with damaged surface may have been short circuited inside and must not be used again; • Do not use metal, such as wires, to short circuit the positive and negative poles of the battery. The waste batteries should not be discarded in the garbage of incineration, landfill and dumping to the ground. When discarding batteries, wrap them in bags to prevent them from contacting other metals, and handle them correctly according to local regulations. 20. When the robot expands the additional axis, make sure that the emergency stop signal of the additional axis is connected in series to the emergency stop link of the control cabinet. After connecting to the extension axis, it is necessary to test the safety function of the emergency stop link to ensure that it conforms to the safety control logic. After changing the safety related components, it is necessary to test the safety function of the emergency stop link to ensure that it meets the safety control logic. 21. When changing the robot parts, the matching degree between the changing parts and the original parts must be confirmed, and the schematic diagram must be checked carefully to prevent the wrong wiring from causing damage to the robot control cabinet components or external components.
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Chapter Two Handling and installation

2.1 Overview

This chapter contains assembly instructions and information about installing the ER130-4-2800 industrial robot on the job site.

Before starting any installation work, it is very important to check all safety information first! Be sure to read the safety manual of EFORT robot carefully, as well as the first chapter of this manual. There are several general safety aspects that must be read in full, as well as more specific safety information about the dangers and safety risks encountered in performing the operation procedures.

2.2 Basic Description

2.2.1 unpacking list

1. Before unpacking, please confirm whether the outer package of the product is in good condition.
2. After unpacking, please confirm whether the robot accessories are complete and whether the model is consistent with the order. In case of missing or wrong parts, please contact the supplier in time.

Table 2-1 robot packing list

Unpacking list				
Name	Type	Quantity	Unit	Remark
Robot body	ER130-4-2800	1	PC	
Control cabinet	EC-L4	1	PC	
Teach pendant + teach pendant line	11500010563	1	PC	
control cabinet –robot body power line	10900016326	1	SET	Standard length 8m, Support regular customization 12m、16、20m
control cabinet –robot body brake line	10900016327	1	SET	Standard length 8m, Support regular customization 12m、16、20m
control cabinet - robot body encoder line	10900016328	1	SET	Standard length 8m, Support regular customization 12m、16、20m
power aerial plug for control cabinet	10900001237	1	PC	has been installed on the control cabinet
	10900001229	1	PC	
	10900001236	1	PC	
dust cover of power aerial plug	10900002138	2	PC	has been installed on the control cabinet and the body
	10900001113	2	PC	
	10900001122	3	PC	

accessories (bracket, pin)	\	1	SET	has been installed on the robot body
-------------------------------	---	---	-----	---

Note: the above is the standard configuration list, excluding customized models.

2.2.2 Preparation work before installation

This section is intended for the first time to open the box and install the robot. It also contains useful information needed in the process of reinstalling the robot later.

Before the robot installation, the following inspection items shall be carried out:

Table 2-2 Precautions before installation

1	Visually check the robot to ensure it is not damaged.
2	Ensure that the lifting device used is suitable for handling the specified robot weight.
3	If the robot is not directly installed, it must be stored according to the requirements of the robot storage environment.
4	Ensure that the expected operating environment of the robot meets the requirements of the robot operating environment.
5	Before transporting the robot to its installation site, please ensure that the site meets the ground installation requirements.
6	Before moving a robot, please check the stability of the robot.
7	After these prerequisites are met, the robot can be transported to its installation site as described in the following sections.

2.2.3 Robot storage environment

The following table shows the allowed robot storage conditions:

Table 2-3 Robot storage environment

Parameter	Value
Minimum ambient temperature	-40℃
Maximum ambient temperature	+55℃
Maximum ambient humidity	93% RH, no condensation (40℃)

2.2.4 Robot operation environment

The following table shows the allowed robot operation conditions:

Table 2-4 Robot operation environment

Parameter	Value
-----------	-------

Minimum ambient temperature	0℃
Maximum ambient temperature	+45℃
Maximum ambient humidity	80% RH, no condensation (40℃)

2.2.5 Start robot in cold environment

This procedure describes how to start a robot in a cold environment. The temperature rise rate must be adjusted according to the ambient temperature and the operating procedure used. The following table shows an example of speed adjustment methods:

Table 2-6 Working cycle of starting the robot in cold

cycle	speed percentage
3 working cycles	20%
5 working cycles	50%
5 working cycles	80%
5 working cycles	100%

2.2.6 Table of robot performance parameters

The following table shows the performance parameters of the robot

Table 2-6 parameters of robot packing list

Robot Modal		ER130-4-2800
Type of Movement		Joint
Control axis		4 axis
Maximum operating speed	J1 axi	110 %sec
	J2 axi	110 %sec
	J3 axi	105 %sec
	J4 axi	330 %s
Maximum range of motion	J1 axi	±178 °
	J2 axi	+42 °-85 °
	J3 axi	+85 °-55 °
	J4 axi	±360 °
	-115° <2axi+ 3axi<+20°	
The maximum active radius(mm)		2800
The maximum load of wrist(kg)		130

Installation conditions	ground installation, bracket installation
Degree of protection	Body IP40(IP43 Electric cabinet)
The repeat positioning accuracy	$\pm 0.03\text{mm}$
The body weight	970kg

The following table shows the performance parameters of the control cabinet

Table 2-7 control cabinet parameters

Control cabinet model	EC-L4
IP class	IP43
Digital quantity IO	24 digital inputs / 24 digital outputs (support expansion)
Power supply	$3 \times 380\text{V} \pm 10\%$, 50/60Hz
Dimension	W900mm×D490mm×H1213mm

2.2.7 Robot workplace

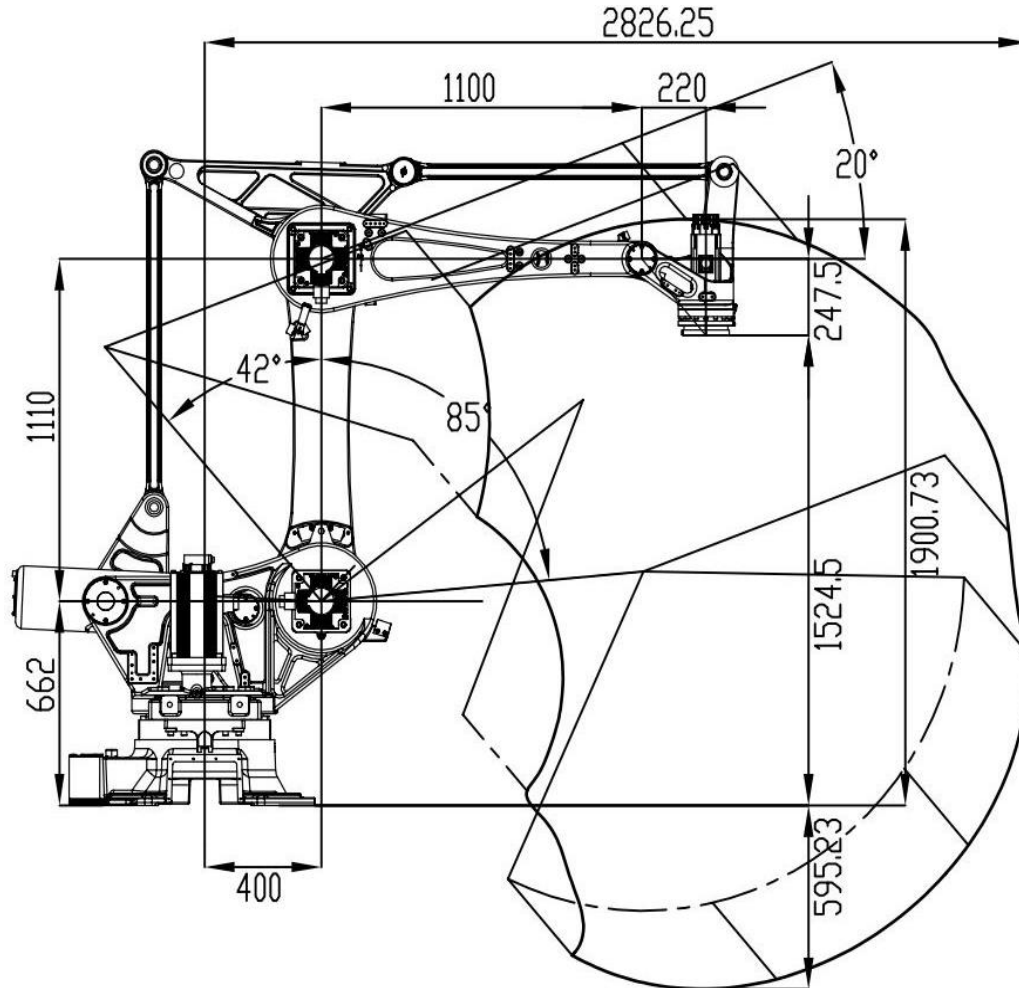


Figure 2-1 Robot motion range diagram

Note: the workspace shown in this figure is the maximum that can be reached in theory, and the actual operation will be affected by the installation mode. In the actual use, please consider the impact of the installation mode on the workspace.

2.2.8 Working space of control cabinet

Outline dimension of control cabinet for ER130-4-2800 (unit: mm)

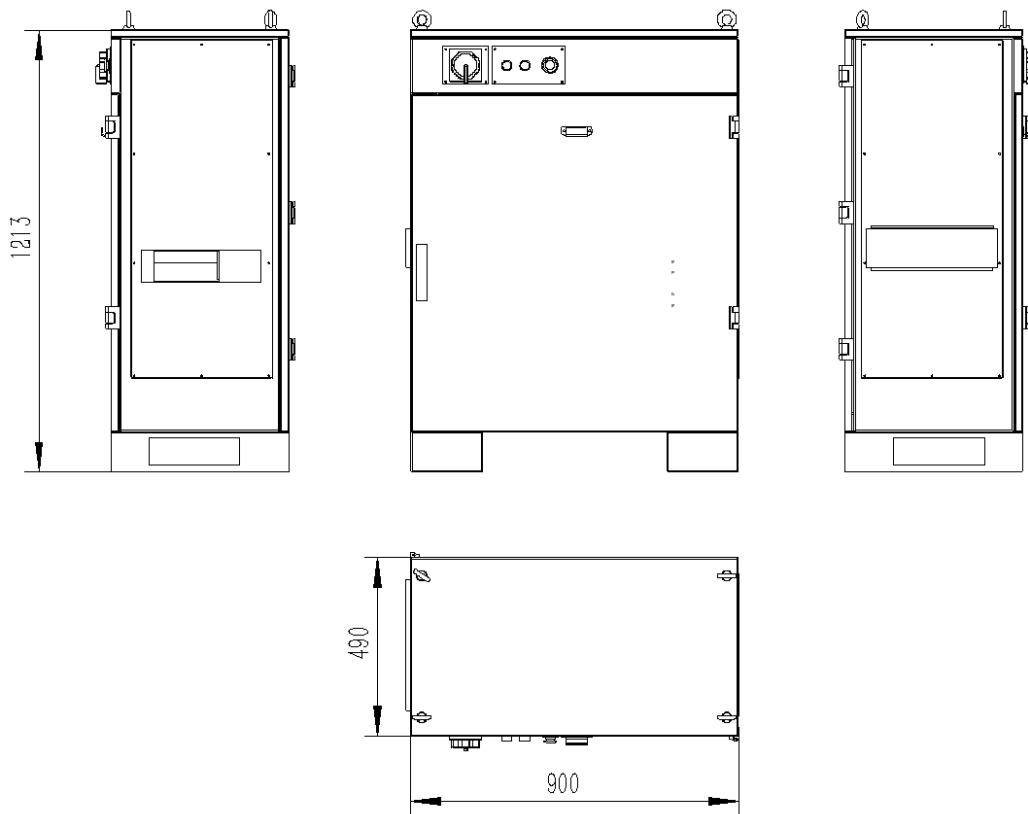


Figure 2-2 dimensions of robot control cabinet

When placing the control cabinet, please do not block the air vent of the electric cabinet, which will affect the heat dissipation of the electric cabinet. Please reserve more than 150 mm space around the electric cabinet.

When installing the robot, make sure it can move freely in the whole workspace. If there is a risk of collision with other objects, the working space can be limited by the adjustable limit block of hardware and the safe working space of software.

Mechanical operation and maintenance manual for Er130-4-2800 industrial robots

System operation manual of Efort industrial robot

2.3 Handling

2.3.1 Precautions for robot handling

The following contents are the precautions in robot handling operation. Please fully understand the following contents before safe operation:

 Attention	The handling of robots and control devices must be carried out by qualified personnel for hook, lifting operation, forklift, etc. If the operators do not master the correct skills to carry out the operation, it may lead to overturning, falling and other accidents.
 Attention	When handling the robot and control device, please confirm the weight and steps according to the method recorded in the manual. If the operation cannot be carried out according to the specified method, the robot and control device may overturn or fall during the handling process, resulting in accidents.
 Attention	When handling and installing, pay attention to avoid damaging the wiring. In addition, after the assembly of the device, protective measures such as covering with protective cover should be taken to avoid damage to wiring by operators and forklifts.

2.3.2 Robot body handling

1) Handling method 1

When handling the robot, first set the robot according to the posture shown in Fig. 2-3, then install 4 M10 lifting ring screws on the main frame and lift it with four steel cables. It is suggested that the length of the steel cable should not be less than 3m, and rubber hose should be put on the contact part between the steel cable and the main body of the robot for protection.

Note: in Fig. 2-3, there are no other devices installed on the end effector and manipulator, so please pay more attention once other devices are installed.

2) Handling method 2

Set the robot to the posture shown in Fig. 2-4 below and use the forklift to carry.

The angle of each axis of the handling attitude and posture is set as follows:

Table 2-8 angle setting values of each axis of handling attitude

Position	1 axis	2 axis	3 axis	4 axis
Joint angle/°	0	42	-55	0

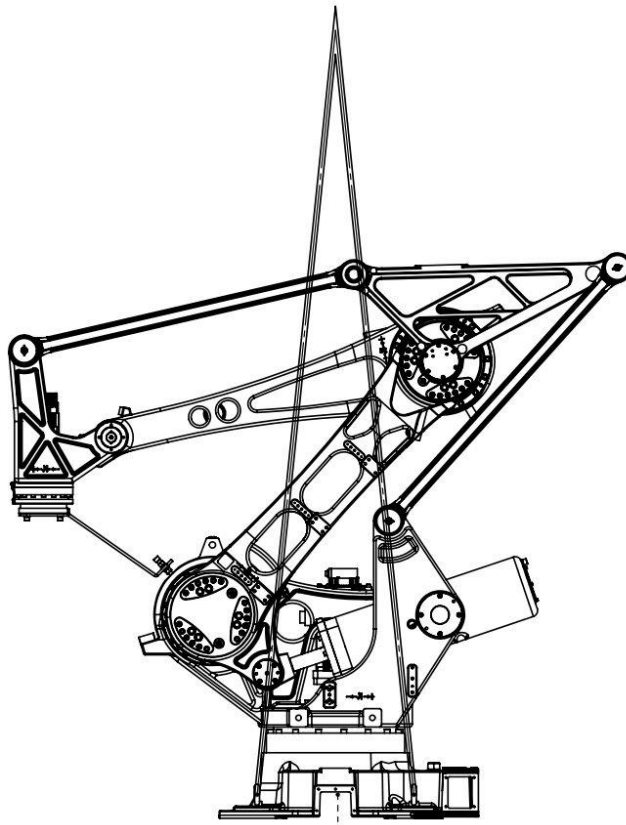


Figure 2-3 schematic diagram of lifting handling

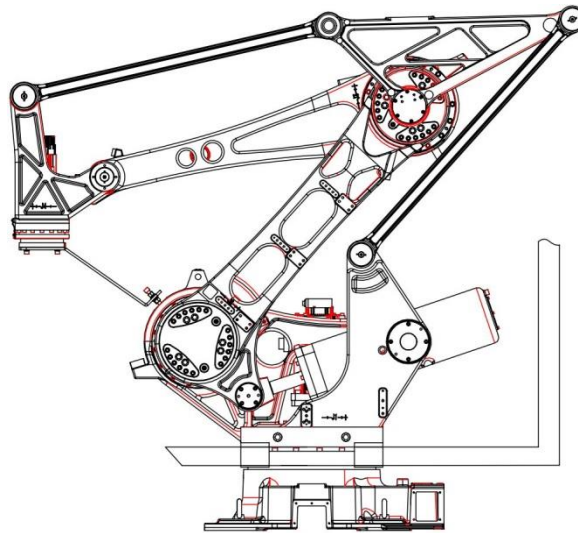


Figure 2-4 schematic diagram of forklift handling

 Attention	When handling, please be sure to install and use the fixed fixture! When using other handling methods instead of crane and forklift, please note that the arm and motor of the robot cannot be affected by external force! After unpacking, be sure to remove the handling fixture and rubber pad! Due to the need of robot handling in the future, please keep the fixture properly!
---	---

2.3.3 Robot control cabinet handling

1、Hoisting method:

When handling the robot control cabinet, first fix the control cabinet as shown in Fig. 2-5. The top of the control cabinet is equipped with two M10 lifting ring screws, which are lifted by two soft lifting belts.. It is suggested that the length of the soft sling should not be less than 2m, and the rubber hose should be put on the contact part between the soft sling and the control cabinet for protection. In the case that the lifting cannot be carried without lifting equipment, the forklift should be used for handling.

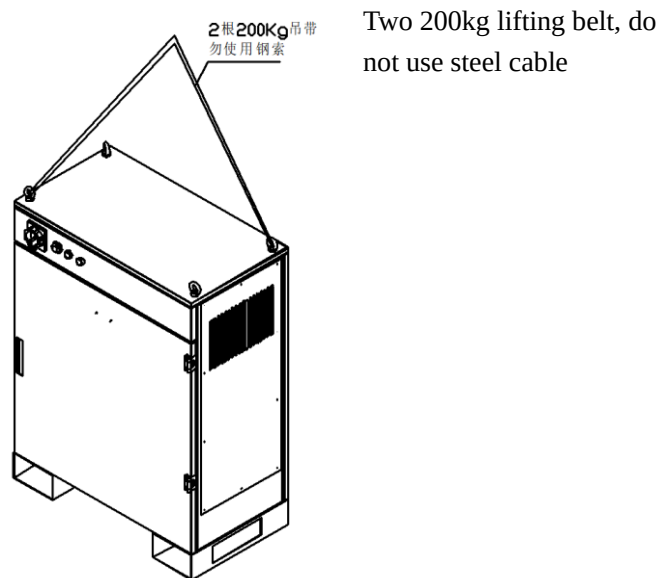


Figure 2-5 lifting diagram of robot control cabinet

2. Forklift handling method:

When there is no lifting equipment and it cannot be lifted, the forklift is used for handling. Refer to figure 2-6 for handling diagram. There are two forklift handling positions at the bottom of the control cabinet.

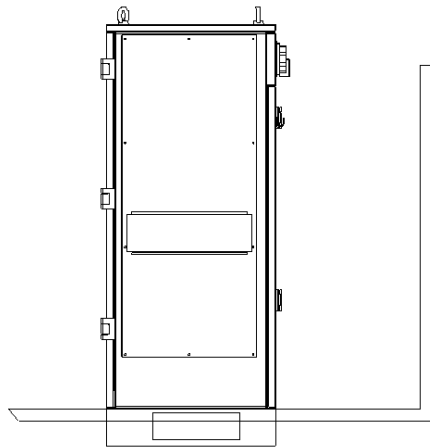


Figure 2-6 forklift handling diagram of control cabinet

2.4 Installation

 Danger	1. Set security bar Otherwise, personal injury, equipment damage and other accidents may occur. The robot should be placed in a position where the tool and workpiece tip of the robot arm will not touch the safety bar even if the robot arm reaches the longest. Otherwise, personal injury and equipment damage may occur. 2. The robot cannot be electrified and operated if it is not fixed. Otherwise, accidents such as dumping, personal injury and equipment damage may occur. 3. When choosing the installation method of upside down and wall hanging, it should be fixed on the ceiling and wall with sufficient strength, and the treatment scheme of preventing falling should also be considered. Otherwise, personal injury, equipment damage and other accidents may occur.
--	--

2.4.1 Setting of safety bar

The national standard of the People's Republic of China (GB11291.2-2013): *Robot and Robot Equipment and Safety Requirements for Industrial Robots Part 2: Robot system and Integration* should be observed. Section 5.10 *Provisions of Safety Protection Device* stipulates that: "when industrial robots are running automatically, safety measures such as protection against operators' proximity must be provided because the operator is in danger of contacting the robot".

In order to avoid equipment damage and personal injury to the operator and surrounding personnel during the operation of the robot, please set up the safety bar (with interlocking door and other safety settings)!

Note: GB11291.2-2013 is equivalent to ISO 10218-2:2011

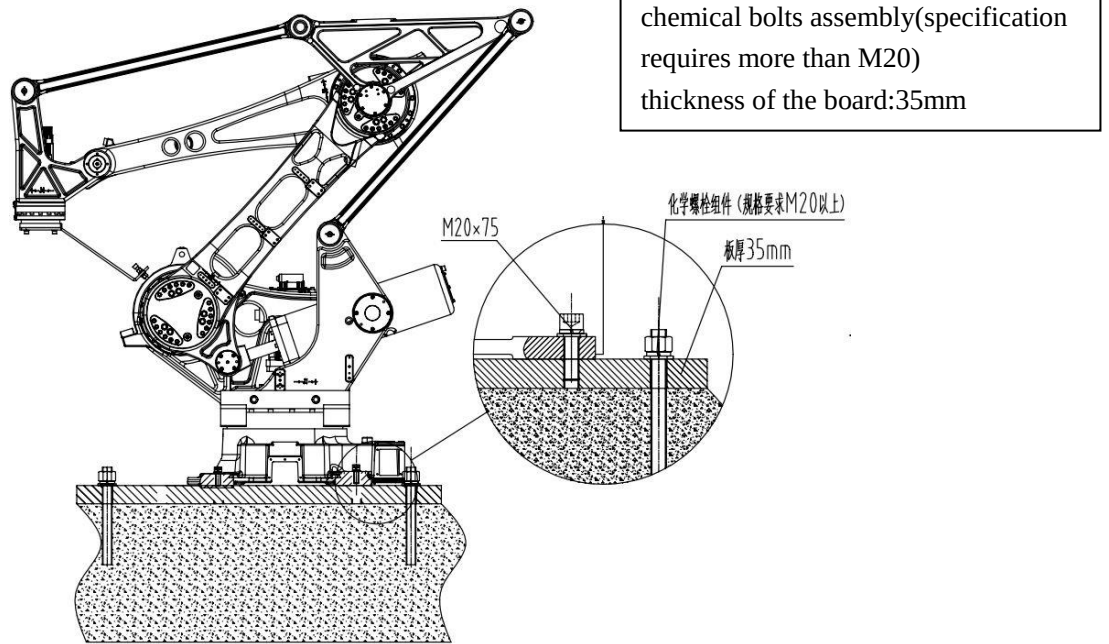


Figure 2-8 "example of robot installation"

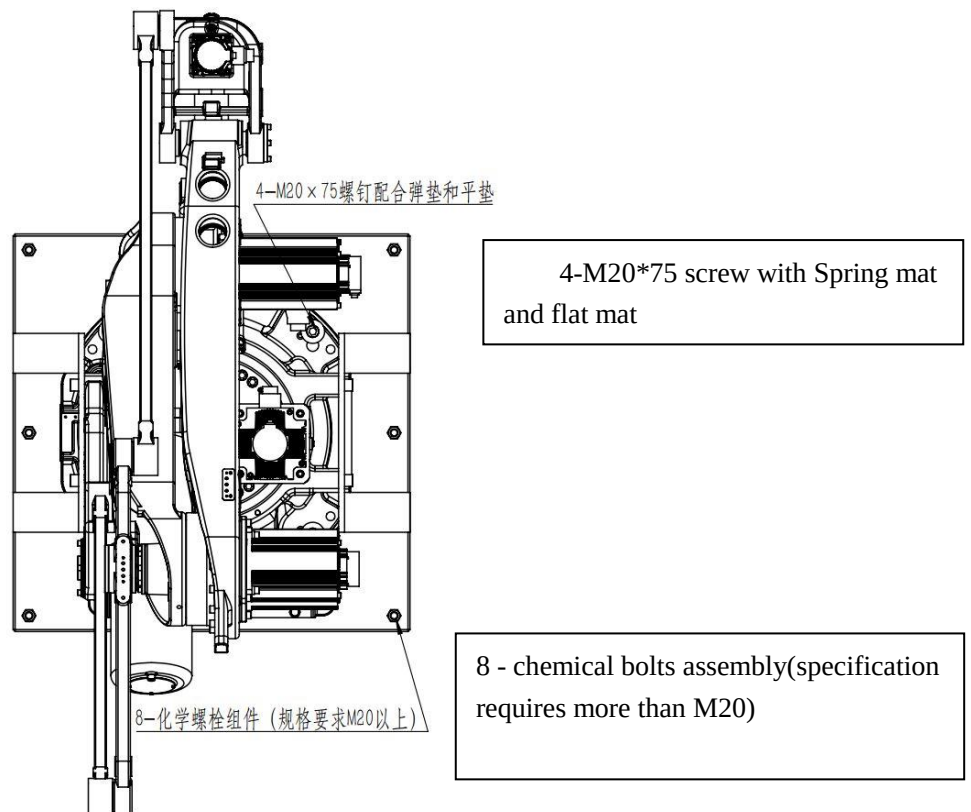


Figure 2-9 "example of robot installation"

2.4.4 Bracket installation

When the height of the bracket is less than 600mm, its fixing mode is similar to the ground installation mode, which is divided into two parts: robot base installation, bracket and ground installation.

When the height of the bracket is more than 600mm, the connection strength between the bracket and the ground should be strictly checked to ensure that the connection between the bracket and the ground is safe and reliable.

	The specification, quantity and embedded depth of chemical bolt group can be increased appropriately; Improve the strength of concrete foundation. The strength of concrete foundation is higher than that of corresponding chemical bolt components;
---	---

2.4.5 Installation site and environment

The robot shall be able to keep normal when used, transported and stored under specified environmental conditions, and its performance shall meet the requirements.

Note: For robots to be used, if there is strong vibration in the use environment, there is a lot of dust, cutting oil splashing, or other objects, please contact the after-sales service department of the company to protect the robot parts by using robot sleeve or other means.

 Warning	Too long or too short screw for fixing robot base will cause bad fixing accident! The connection strength of chemical bolts depends on the strength of concrete. When the strength of concrete is insufficient, it can be strengthened by the following methods: 1. Increase the number of chemical bolt group; 2. Increase the embedded depth of chemical bolts;
--	--

Table 2-8 table of robot environment parameters

Robot environmental conditions	
environmental conditions	working conditions
Ambient temperature:	0-45℃
Relative humidity	80%RH, No condensation (40℃)
Atmospheric pressure	86-106 KPa
Vibration	less than 0.5G, 4.9m/s ²
Other	non corrosive gas (note)

2.4.6 Integrated application installation interface

The following table shows the robot body external interface size

Robot external interface size	shown in the figure	remark
Dimension of end load mounting flange	Figure 2-10	dimension of end load mounting
Dimension drawing of external part installed on big arm	Figure 2-11	installation dimension of external parts
Dimension drawing of external parts installed on swivel seat	Figure 2-12	installation dimension of external parts
Dimension drawing of external components installed on small arm	Figure 2-13	installation dimension of external parts
Dimension drawing of external components installed on wrist body	Figure 2-14	installation dimension of external parts

1. End flange mounting interface, figure 2-10

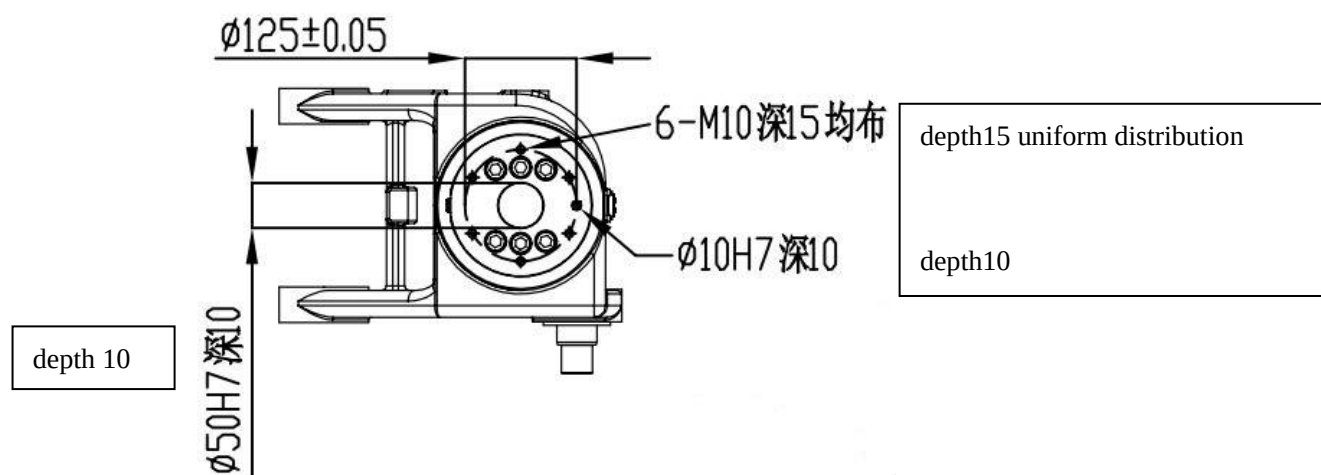


Figure 2-10 dimensions of end load mounting flange

2. Other auxiliary interfaces



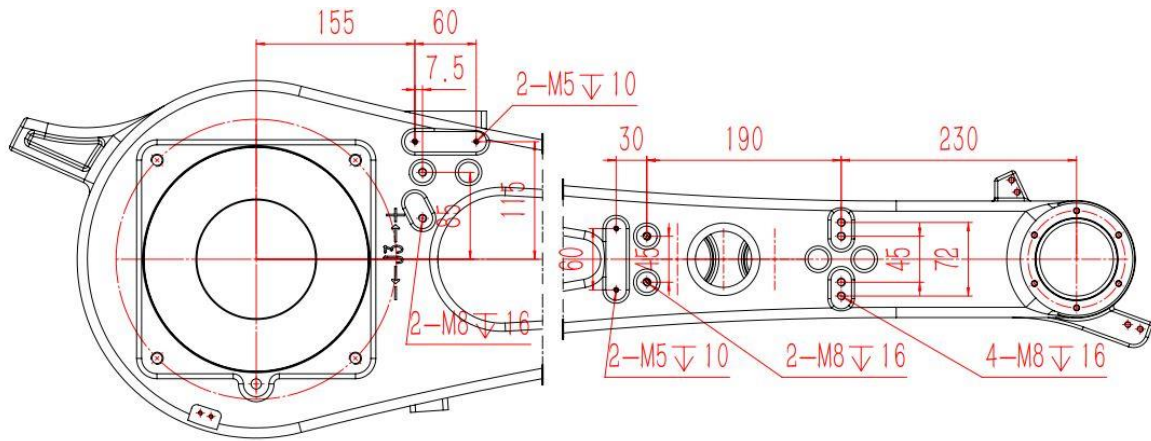


Figure 2-13 Dimension drawing of external part installed on small arm

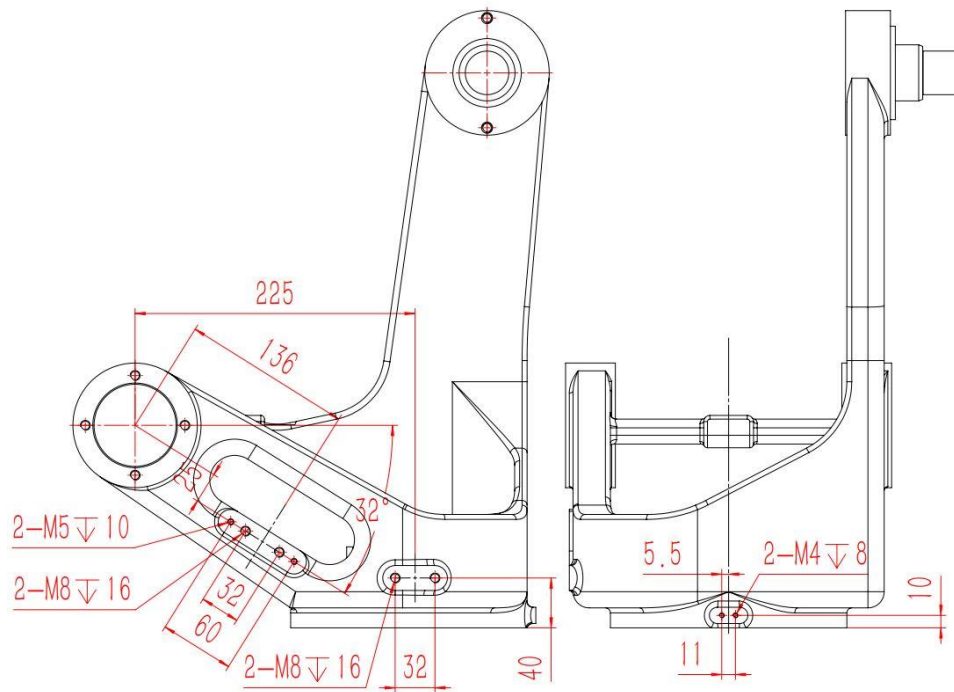


Figure 2-14 Dimension drawing of external part installed on wrist body

Chapter Three Electrical connection

The connecting cables between the robot control cabinet and the robot body include power cable, signal cable and grounding wire. Before connecting, the robot control cabinet and the robot body must be fixed, and then the cables are connected to the left side of the control cabinet and the connector part on the back of the base of the robot body. The power cable and signal cable have the design of preventing wrong insertion, and pay attention to the direction when connecting.

 Warning	warning 1. The cable connection operation must be carried out after the power supply is cut off. 2. Do not wind the redundant part of the robot connecting cable (more than 10m) into a coil. When used in such a state, the temperature of the cable may rise greatly when some robot actions are executed, which will have an adverse effect on the coating of the cable. 3. Before connecting the power supply of the control device, please connect the mechanism part and the control part through the ground wire. If the ground wire is not connected, there is a risk of electric shock.
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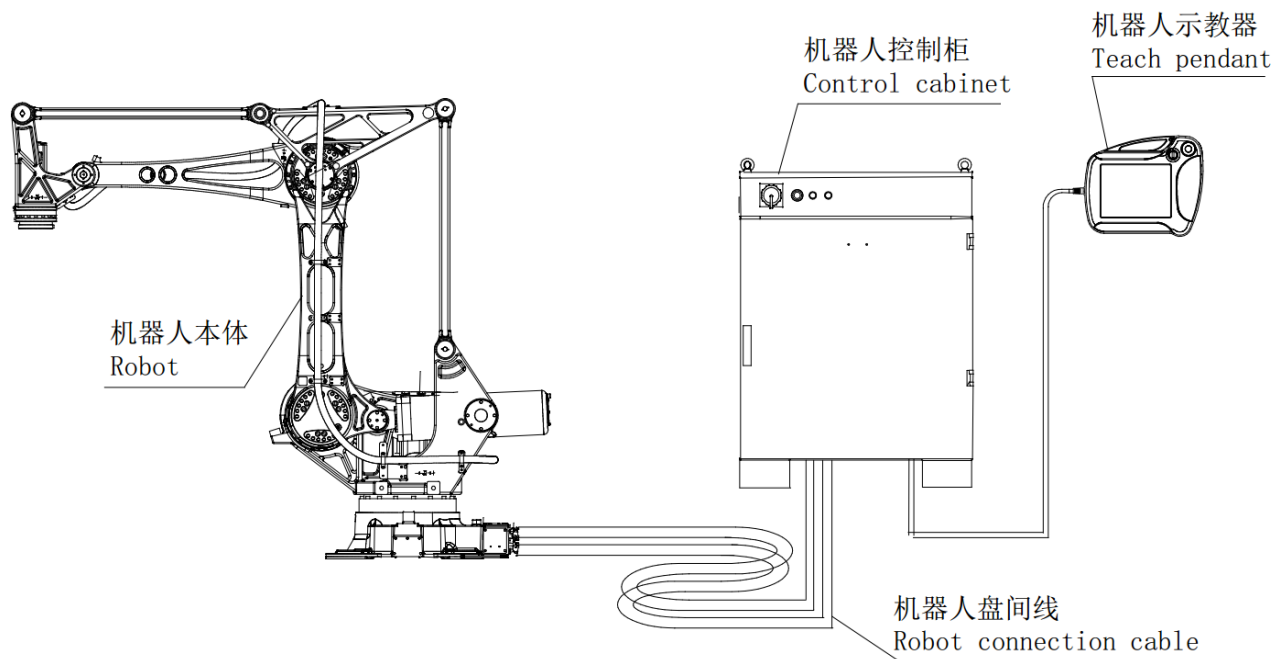


Figure 3-1 schematic diagram of robot cable connection

3.1 Robot power supply

Requirements for input power and cable of control cabinet:

1. The main power supply is three-phase four wire system (3 * AC380V + PE), and the voltage fluctuation range is $\pm 10\%$

- 2 Please use $3C \times 4mm^2 + PE$ or above cable for power line;
3. Between the power grid and control cabinet, the obvious breaking devices such as isolation switch must be installed to ensure the personal safety during equipment maintenance.

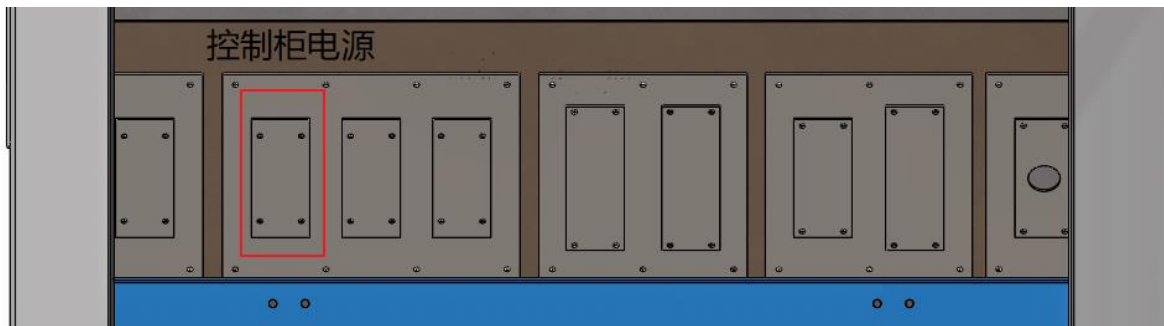


Figure 3-2 interface of input power supply X10

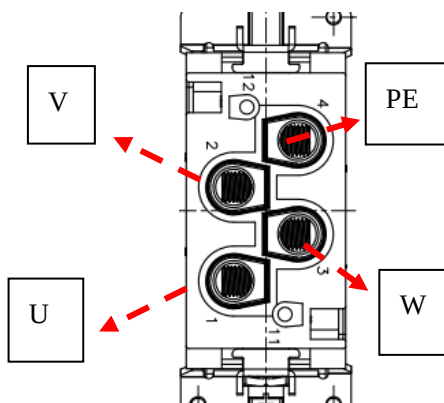


Figure 3-3 definition of aerial plug pin for 380V power grid incoming line

Table 3-1 definition of input power X10 interface

Terminal PIN bit	Function description
1	L1
2	L2
3	L3
4	PE(ground contact)

The use of control cabinet input power leakage protector:

Wiring diagram of leakage protector

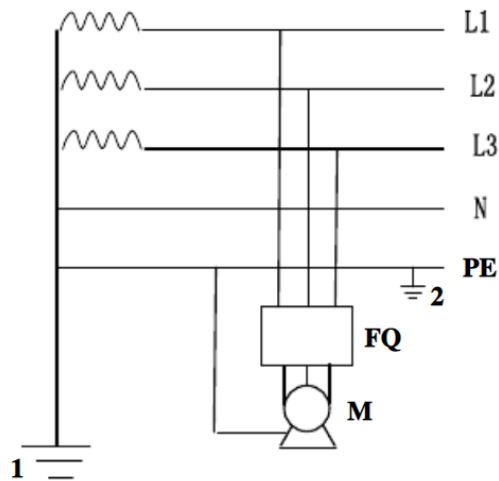


Figure 3-4 wiring diagram of leakage protector

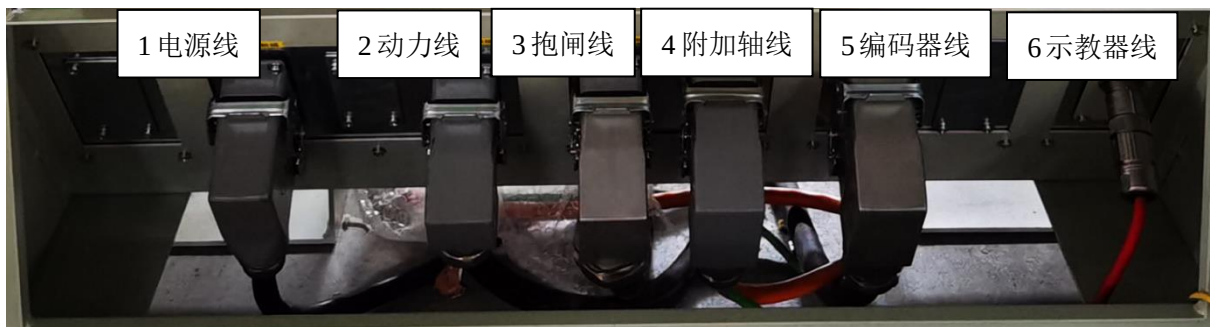
L1, L2, L3 - phase line; N – working “zero” line - protection zero line; 1 - working grounding; 2 - repeated grounding; M - electric motor; FQ - leakage protector.

Note: if the leakage protector with zero line is used, do not connect the ground wire of the control cabinet to the zero line.

3.2 Connection between robot control cabinet and robot body

The standard robot includes power cable, brake cable, encoder cable, and can be connected with the control cabinet at any time.

1 power supply cable 2 power cable 3 brake cable 4.adtional axis cable 5 encoder cable 6teach pendant line



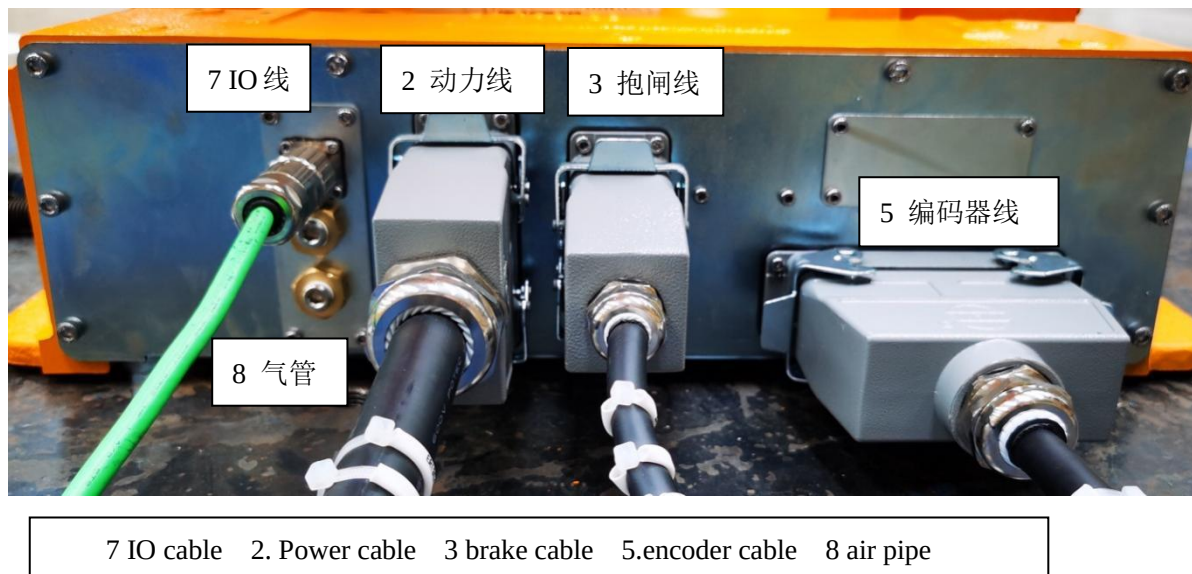


Figure 3-5 schematic diagram of connection between control cabinet and body

Table 3-2 cable category description

Sequence	cable category	description
1	Power supply cable	Supply AC 380V for control cabinet
2	Robot power cable	The power is transmitted from the driving device in the control cabinet to the robot motor
3	Robot brake cable	Connect the body motor brake and provide power for motor brake
4	Robot additional axis cable	Connect signal interaction between additional axis and control cabinet
5	Robot encoder cable	The encoder data is transmitted to the driver serial measurement circuit board
6	Teach pendant cable	Connect signal interaction between teach pendants
7	IO cable	Connect the signal interaction between the control cabinet and the body
8	Φ10 air pipe	Two Φ 10 air pipes to supply airs for the user's fixture

The robot body has built-in IO harness with 16 cores. The figure below shows the definition of IO harness pins

Length of wire printing left end right end
direction of printing
positive

WIRE RUN LIST							
AWG	COLOR	线长	印字	左端		右端	
				印字方向	CONN13	印字方向	CONN14
23AWG*16C	WHITE	6700	I1	正	1	正	1
	YELLOW		I2	正	2	正	2
	GREEN		I3	正	3	正	3
	ORANGE		I4	正	4	正	4
	BLUE		I5	正	5	正	5
	RED		I6	正	6	正	6
	GRAY		01	正	7	正	7
	BLACK		02	正	8	正	8
	VIOLET		03	正	9	正	9
	PEACH		04	正	10	正	10
	SKY BLUE		05	正	11	正	11
	BROWN		06	正	12	正	12
	BLACK		07	正	13	正	13
	VIOLET		08	正	14	正	14
	PEACH		24V	正	15	正	15
	SKY BLUE		0V	正	16	正	16

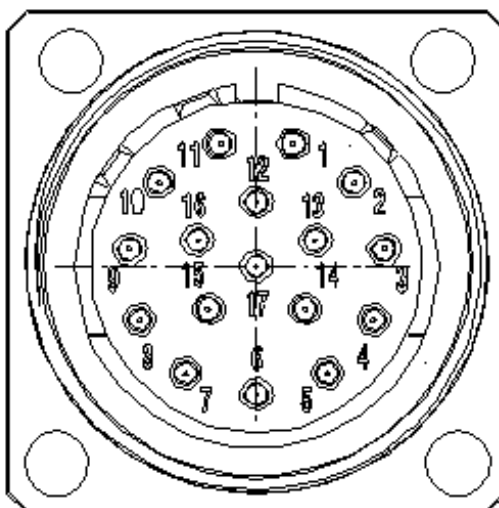


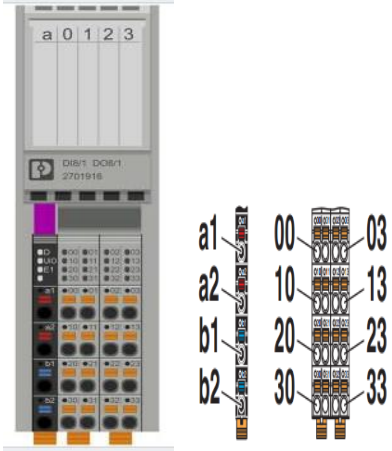
Figure 3-6 position indication of external emergency stop and wiring diagram

3.3 Controller local IO definition

The robot uses an 8-in-8-out IO module and a 16 in-16-out IO module. The input and output voltage is 24 VDC, 500 mA, and the high level is effective. The IO module supports expansion.

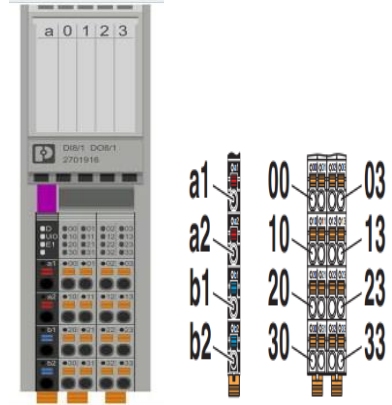
1. IO port of motion controller system

Table 3-3 definition of OUTPUT port

	IO address	PIN bit	Description
	DO0	02	System occupancy
	DO1	03	System occupancy
	DO2	12	Servo confirmation status
	DO3	13	System occupancy
	DO4	22	System occupancy
	DO5	23	User defined
	DO6	32	User defined
	DO7	33	User defined
		a1、a2	24VDC
		b1、b2	GND

The IO output signal has "user-defined" port, and other ports are fixed functions used by the system, which cannot be changed. Users can expand local IO or remote IO module according to their needs. Please consult Efort for details. Among them, a1, a2, b1 and b2 are the power supply interfaces of IO module.

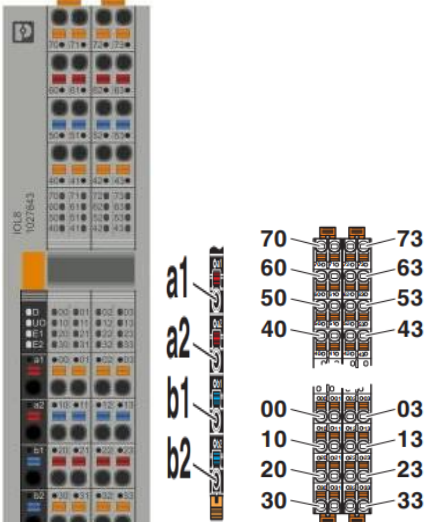
Table 3-4 input definition table

	IO address	PIN bit	Description
	DI0	00	Emergency stop alarm 1
	DI1	01	Servo enable
	DI2	10	Servo confirmation
	DI3	11	Hot swap of teach pendant
	DI4	20	High temperature alarm
	DI5	21	Emergency stop alarm 2
	DI6	30	Safety door 1
	DI7	31	Safety door 2

In addition to the "user-defined" port, other ports are fixed functions used by the system and cannot be changed. Users can expand the body IO or remote IO module according to their needs. Please consult Efort for details.

2、Motion controller extension IO port

Table 3-5 definition of extended IO module

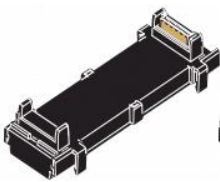
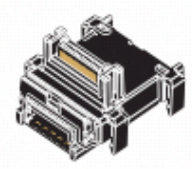
	IO address	PIN bit	Description
	DI20 DI21 DI22 DI23	70 71 72 73	Input IO module User defined
	DI16 DI17 DI18 DI19	60 61 62 63	
	DI12 DI13 DI14 DI15	50 51 52 53	
	DI8 DI9 DI10 DI11	40 41 42 43	
	DO20 DO21 DO22 DO23	00 01 02 03	Input IO module User defined
	DO16 DO17 DO18 DO19	10 11 12 13	
	DO12 DO13 DO14 DO15	20 21 22 23	
	DO8 DO9 DO10 DO11	30 31 32 33	
		a1、a2	24VDC
		b1、b2	GND

3.4 IO module expansion

3.4.1 Controller local IO extension

This section mainly introduces the expansion of the local IO module of the controller in the control cabinet. Due to the limited space, the local IO can expand up to four 16dDI/ 16DO modules with 24 VDC input and 24 VDC 500mA output.

Table 3-6 local IO module extension list

Category	Diagram	Quantity	Remark
Bus coupler		1	
Bus Base module		n	Prepare for expansion requirements, $n \leq 4$.

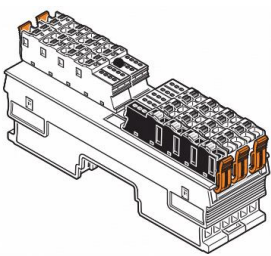
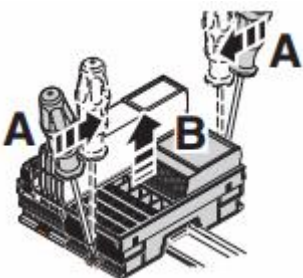
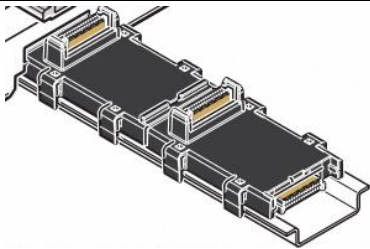
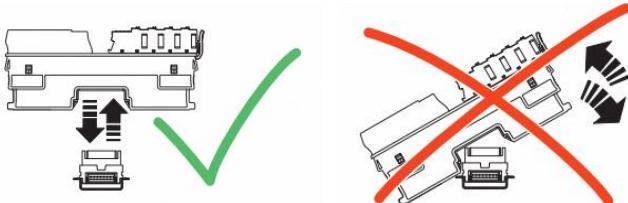
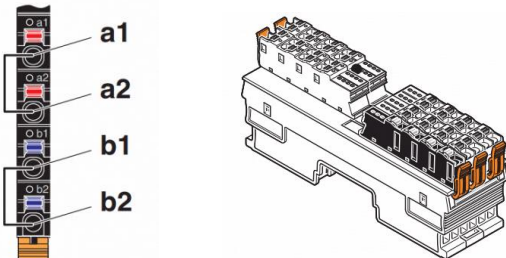
IO module		n	Prepare for expansion requirements, $n \leq 4$.
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Table 3-7 Installation steps of local IO module expansion

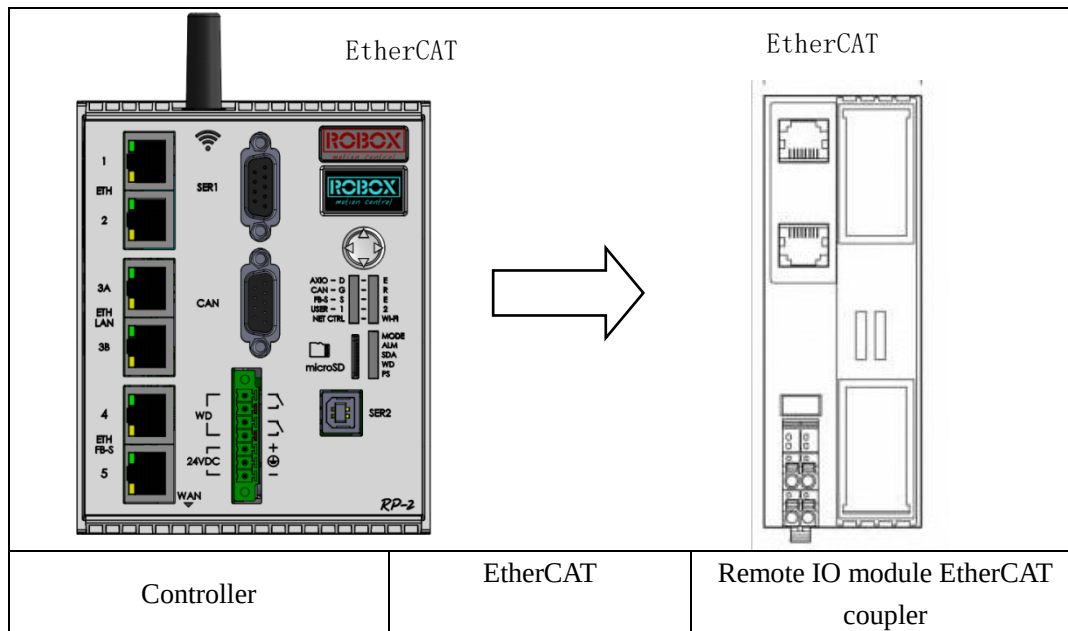
Step	Diagram
1、Remove the controller from the guide rail;	
2、Connect the bus coupler to the bus base module and install it on DIN rail.	
3、The controller and IO module are installed on the bus coupler and bus base module respectively.	
4、Connecting power supply: A1 / A2 on Io module is connected to the positive pole of 24 V; B1 / B2 is connected to the negative pole of 24 v.	

3.4.2 Controller remote IO extension

2、Controller remote IO extension

The remote IO extension of controller adopts standard EtherCAT bus communication protocol. RJ45 interface can be connected directly with network cable (selected as required), and is not limited by the internal space of control cabinet.

Table 3-8 connection mode of remote IO module



3.4.3 Motion control card

1. Precautions for using motion control card:

(1) The motion control card is used to store program data and firmware of related applications. The controller must insert the corresponding motion control card to run the corresponding application program. In some applications, motion control card can also be used to store machine data.

(2) Be sure to use the motion control card recommended by Efort. Other motion control cards not recommended by Efort cannot guarantee the normal operation of the controller.

(3) Please don't use brute force when inserting the card. The memory card slot has error proofing design, so the card can only be inserted into the slot from one direction. Normal card should only need a small force to insert, improper insertion may damage the pin of the motion control card slot.

(4) The motion control card should be moisture-proof, heat insulation, avoid direct sunlight, anti-static, not falling or bending.

(5) When the controller writes to the memory card, it cannot power off or pull out the card.

(6) It is forbidden to format the motion control card.

2. Steps of inserting motion control card

Please insert the motion control card as follows:

(1) Power off the controller.

(2) Insert the motion control card into the slot and pay attention to the direction, as shown in the figure below.

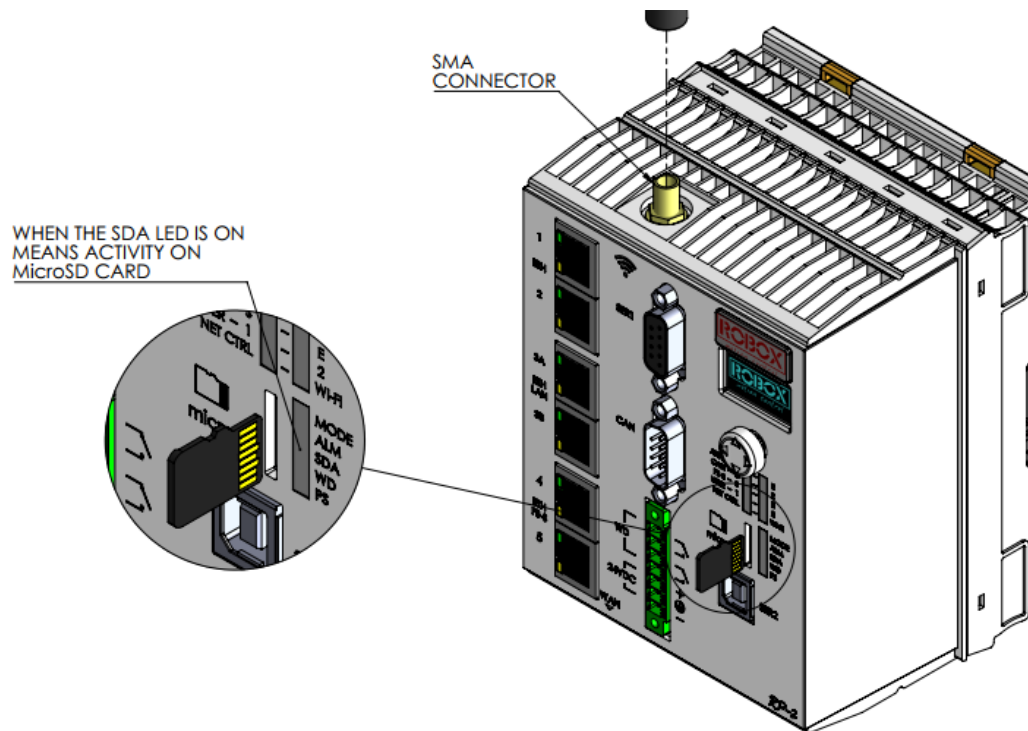


Figure 3-7 inserting motion control card

3. Steps to pull out the motion control card

Please insert the motion control card as follows:

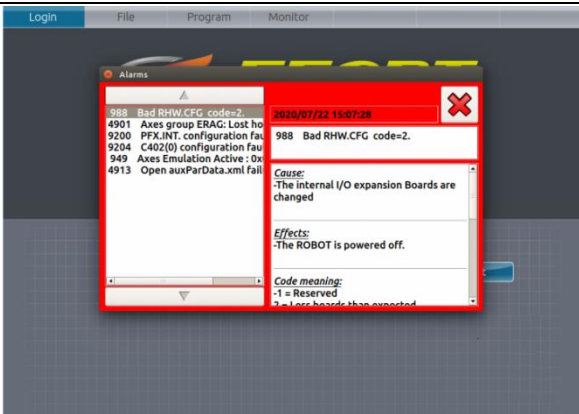
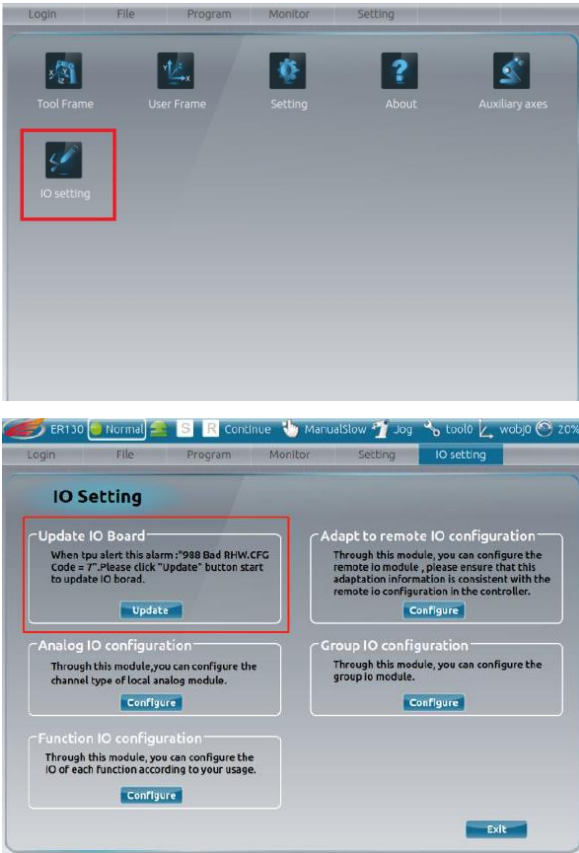
- (1) Turn off the power supply of the control cabinet.
- (2) Press the motion control card (with the help of small tools, plastic parts).
- (3) After the motion control card pops up, pull out the motion control card.

3.5 IO settings

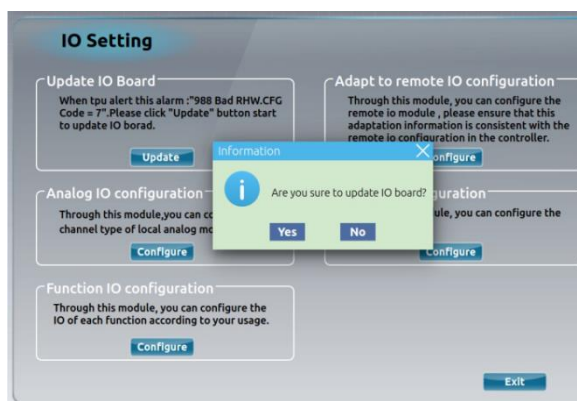
This section mainly introduces the operation steps of updating IO module, remote IO configuration adaptation, analog IO configuration, group IO configuration and function IO configuration. The monitoring of related IO needs to be viewed in the section monitoring- IO.

3.5.1 Update IO module

Table 3-9 operation steps of updating IO module

Steps	Diagram	Description
1. If the actual IO quantity of the hardware does not match the preset IO quantity, the teach pendant will pop up an alarm.		“Hardware configuration error such as 988 RHW.CFG IO module” If this alarm appears, hide the alarm box, and then clear the alarm by updating the IO module.
2. Enter the IO and set APP. Select the function of updating IO module, and click the "update" button.		

3. After the IO module is updated, click the "YES" button to restart the robot.



During the restart of robot, the interface of the teaching pendant is not operable. After the controller is fully started, the teaching pendant can operate normally.

3.5.2 Remote IO configuration

Table 3-9 remote IO configuration operation steps

Step	Diagram	Description
1. Open the remote IO configuration interface.		Open the teaching pendant desktop and click the "IO settings" icon. Select "remote IO configuration adaptation" and click "configuration" to enter the configuration interface.
2. Remote IO module configuration		First click the password input box, enter "1975", and then click the "enter" button. Set the number of configuration modules, and each set module needs to be configured. Select the module type,



including input and output of digital and analog signals.

Set the **address of each module**, pay attention to the length of address occupied by different modules, and the occupied address cannot be set.

When the selection module is AM600-4AD or AM600-4DA module, the **type** of four **channels** needs to be selected.

Click the "save" button to save the remote IO configuration information.

Remote IO Configuration Description:

Module quantity: the corresponding contents of each module need to be set, otherwise it cannot be saved.

Type: there are six types, the input and output of digital signal, including 16 bits and 32-bit respectively. Input and output of analog signal.

Address: address range is 300-500; different modules occupy different address length, and cannot be configured occupied address.

Am600-0016XXX (16DO) : 16 bit digital signal output, occupying 1 address

Am600-0032XXX(32DO) : 32-bit digital signal output, occupying 2-bit address

Am600-0016END(16DI) : 16 bit digital signal input, occupying 1 address

Am600-0032END(32DI): 32-bit digital signal input, occupying 2-bit address

Am600-4AD(4AI): analog signal input, occupying 4-digit address

Am600-4DA(4AO): analog signal output, occupying 4-bit address

Channel: when the selection module is AD or DA, the channel value type needs to be

selected. There are 7 channel types of AD module and 6 channel types of DA module.

Enable: Switch for remote IO configuration information to take effect. Tick the "enable" switch to make the configuration information effective..

Output interface:

1. Description - output:

General functions

Serial number	Description	Illustration	Signal detection	Operation mode
1	Servo status	Servo status of current robot	high / low level	automatic/ manual effective
2	running status	Status for whether the current program is running	high / low level	automatic/ manual effective
4	Alarm status	Is there an alarm at present?	high / low level	automatic/ manual effective
5	Emergency stop status	Robot emergency stop switch status	high / low level	automatic/ manual effective
6	Program loading completed status	When the program is loaded, the signal is sent out; the program starts to run, the signal is reset.	high / low level	automatic/ manual effective

Safety monitoring

Serial number	Description	Illustration	Signal detection	Operation mode
1	A1 occupied output A2 occupied output A3 occupied output A4 occupied output Safe	Occupancy output signal of areas 1 to 4. When the robot enters the shared area, it sends the occupancy output signal, and when it exits the shared area, it cancels sending the signal.	high / low level	automatic/
2	location 1 / 2 / 3 / 4	Four position status signals defined in safety monitoring function. When the robot reaches the	high / low level	manual effective

		position, it outputs the corresponding signal.		
--	--	--	--	--

Advanced palletizing

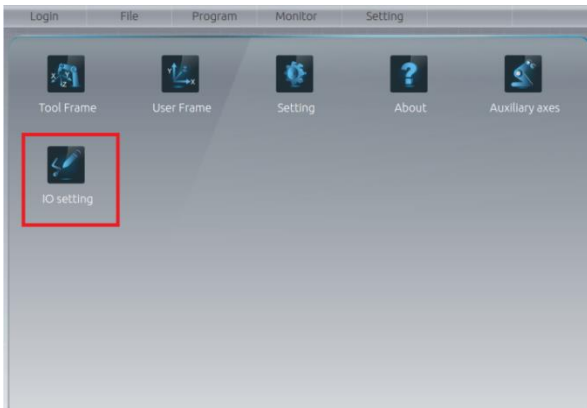
Serial number	Description	Illustration	Output Signal	Operation mode
1	Full stack signal of No.1 / 2 stacking position	Output signal after palletizing full stack	high / low level	automatic mode effective
2	clamping area no.1/2/3/4 open	The output is used to control each clamping area to release the product	high / low level	automatic mode effective
3	clamping area no.1/2/3/4 close	The output is used to control each clamping area to grasp the product	high / low level	automatic mode effective

2. Address: valid address range of local IO module: 1-168, in which 1-3 is occupied by the system and cannot be configured; valid address range of remote IO module: 0-63; if there is no IO module option in the configuration interface, the access remote module address value follows the local actual maximum address value. For example, if there are 16 local output ports, the address of the first port of the remote module is 17.

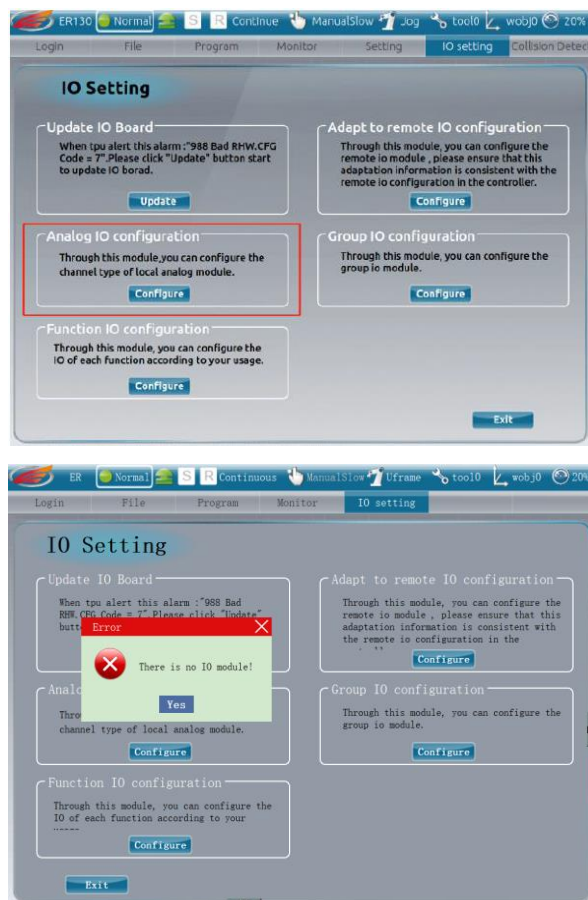
3. Valid value: 0 or 1, valid value of 1 means that when the state value is true, high level is output, and there is a signal; when the state value is false, low level is output; valid value of 0 means that when the state value is true, low level is output, and when the state value is false, high level is output, and there is a signal.

3.5 .4 Analog IO configuration

Table 3-12 operation steps of analog IO configuration

step	diagram	Description
1. Enter the IO setting interface.		Open the teaching pendant desktop and click the "IO settings" icon.

2. Enter the analog IO configuration interface.



Select the “**analog IO configuration**” function.

Click the “**configuration**” button to enter the configuration interface.

If the analog IO hardware module is not configured, there will be a pop-up prompt and the analog quantity configuration function cannot be entered.

When there is analog IO hardware module, you can enter the analog IO interface to display the IO module type and the channel type configured last time.

3. Enter the analog IO configuration interface to configure channel parameters.



The previously configured IO information of analog quantity can be viewed here.

Click the “**Edit**” button to enable the editing function.

After editing, click “**Save**” to save the information of analog channel set, and click the “**give up**” button to not save.

Click the “**exit**” button to return to the configuration homepage.



3.5.5 Group IO configuration

Table 3-13 operation steps of group IO configuration

Step	Diagram	Description
1. Enter the IO setting interface.		Open the teach pendant desktop and click "IO settings".
2. Enter the group IO configuration interface of continuous address.		Select the group IO configuration function. Click the "group IO" button to enter the configuration interface.

3. Enter the group IO configuration interface to determine the continuous address of each group of IO.



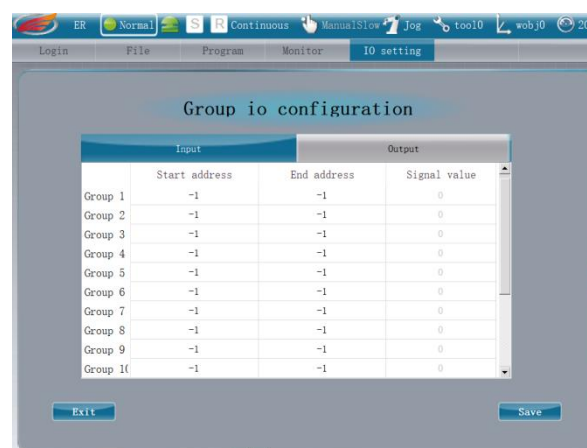
The red box 1 shows that the current table is an input or output table. You can click the left to right arrow to complete the switch.

The red box 2 shows the group number and supports up to 16 groups.

The red box 3 determines the starting address of the successive address.

The red box 4 determines the planting address of the successive address.

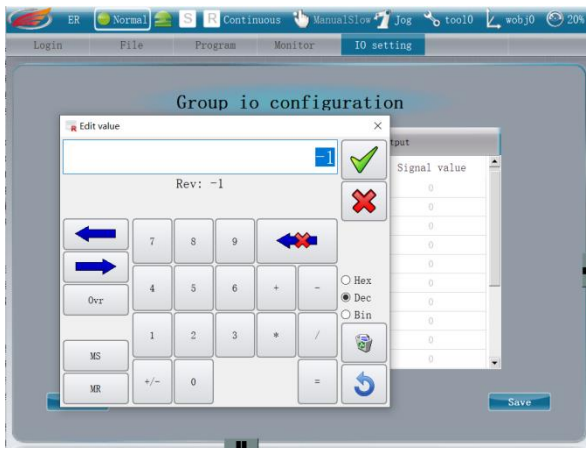
Red box 5 shows the decimal value to which the status of a group of IO signals is converted.



After clicking the "Edit" button, the button will change to save, and the table will change to editable status. Users can edit the start and end addresses of each group.

After editing, click the "save" button to make the form in a non-editable state, and send the generated configuration file to the controller for saving.

The signal value column of the input interface displays decimal number, corresponding to the continuous address IO signal state, which constitutes the decimal

	value converted from binary value. The signal value column of the output interface can be set with output value, and a decimal value can be set on the pop-up keyboard to convert to a binary value to control the corresponding group IO output.
--	---

3.6 Introduction of external emergency stop

The emergency stop button includes the emergency stop button of the teaching pendant, the emergency stop button of the control cabinet and the external emergency stop button. The function of the emergency stop button is to quickly cut off the output of the driver and make the robot stop immediately. Turn the emergency stop button clockwise to release it.

An emergency stop is a state that takes precedence over all other robot controlled operations and will cause all controlled hazards to stop, eliminate the motor power supply from the robot starter, remain valid until reset, and can only be reset by manual operation. It means that all the power supply of the robot is cut off from the emergency state except the circuit released by manual brake. You must perform the restore steps, that is, reset the emergency stop button and clear the alarm to resume normal operation. The robot system can be configured to stop the strike to produce any of the following effects:

- Class 0 stop Stop the robot operation immediately by stopping the motor power supply
- Class 1 stop Stop the robot operation while maintaining the motor power to maintain the robot path. After completion, the motor power supply stops.

The default setting is 0 class stop. However, it is recommended to choose type 1 stop because it can avoid unnecessary wear and tear of the robot and the additional operations needed to restore the system to production.

	The emergency stop function can only be used for its specific purpose and defined conditions.
	The emergency stop function is used to stop the equipment immediately in case of emergency.
	Emergency stop should not be used for normal program stop as this may cause additional unnecessary wear to the robot.

1、External emergency stop X6

When is needed, pull out the "short-circuit strip" at X6 terminal block in the emergency stop circuit, and connect the external emergency stop button in series into the circuit. The user can connect the wire according to the need (the recommended wire diameter is more than 0.5mm), as shown in the figure below.

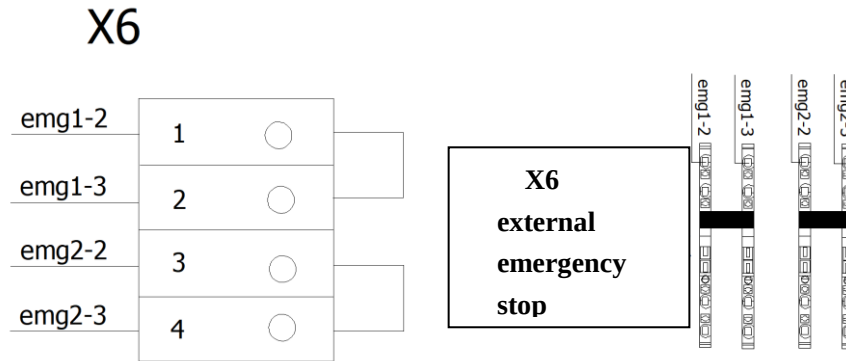


Figure 3-8 position indication of external emergency stop and wiring diagram

2、Emergency stop output dry contact X5

When the robot's emergency stop is triggered, the external equipment needs to know whether the robot's emergency stop is triggered. In EC-L4 control cabinet, K3 and K4 are emergency stop output relays, and the normally open contacts of K3 and K4 are connected to terminal 3 / 4 / 5 / 6 of X11 terminal block (K3-5 / K3-9 is a pair of normally open contacts, K4-5 / K4-9 is a pair of normally open contacts). Users can wire according to their needs (the recommended wire diameter is more than 0.5mm), as shown in the figure below

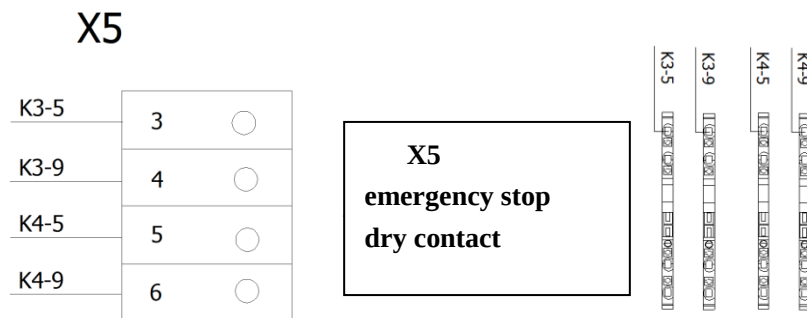


Figure 3-9 emergency stop dry contact terminal

3、Safety door and grating X4

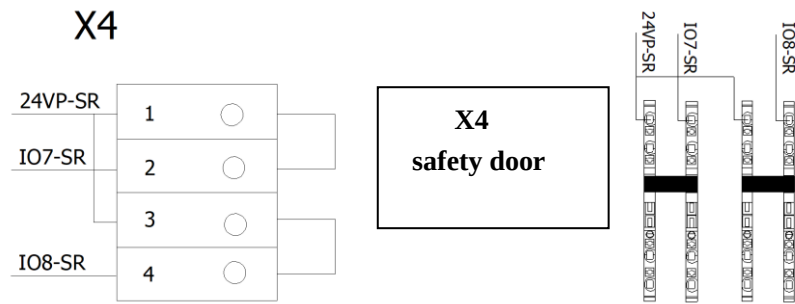


Figure 3-10 schematic diagram of safety door and grating wiring terminal block

When the robot leaves the factory, the safety door is disconnected by default, and the robot can be inched under the manual low speed mode. If the manual high speed mode and automatic mode are used, the customer needs to handle the safety door by himself and connect it to the safety door on the customer's site; if the customer does not want to use it, the safety door bridge connector needs to be used to short circuit 1 / 2, 3 / 4.

Chapter Four Quick operation

4.1 Teach pendant

4.1.1 About teach pendant

The teaching pendant (as shown in Figure 4-1) is an interactive device between the operator and the robot. With the teaching pendant, the operator can control all the functions of the robot. For example, manual control of robot motion, programming control of robot motion, setting IO interactive signal and so on.



Figure 4-1 EFORT teaching pendant

Table 4-1 basic parameters of teaching pendant

Sequence number	Item	Basic parameter
1	Display size	TFT 8-inch LCD
2	Display resolution	1024*768
3	Touch or not	Yes
4	Function keys	Emergency stop button, mode selection key switch, respectively: automatic (Auto), manual slow (T1), manual full speed (T2), 28 membrane buttons

5	mode knob	Three section mode knob
6	External USB	A USB 2.0 interface
7	Power Supply	DV24V
8	Dustproof and waterproof grade	IP65
9	Work environment	Ambient temperature - 20 °C ~ 70 °C

4.1.2 Function area and interface

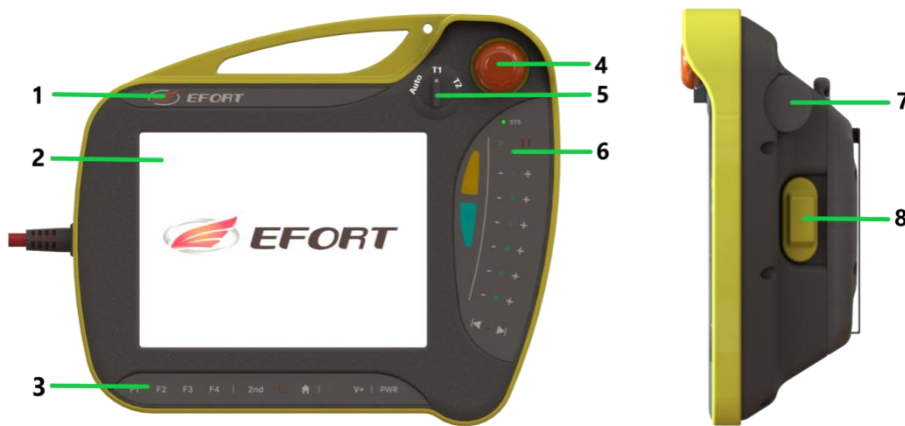


Figure 4-2 teach pendant

Table 4-2 functions of each part of the teach pendant

Serial number	Name	Description
1	Membrane panel 3	Company logo painting
2	Liquid crystal display	For human-computer interaction, operating robot
3	Membrane panel 2	Contains 10 buttons
4	Emergency stop switch	Double circuit emergency stop switch
5	Mode knob	Three section mode knob
6	Membrane panel 1	contains 18 buttons and 1 red, yellow and green LED
7	USB	USB2.0, used to import and export files and update the teaching pendant
8	Three section manual pressure switch	In the manual mode, press the manual switch to servo

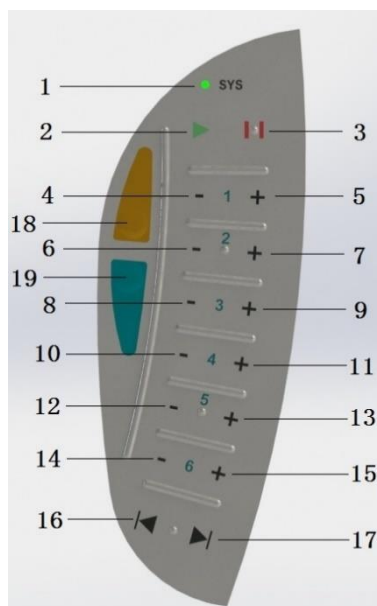


Figure 4-3 right side button

Table 4-3 right side buttons

Serial number	Name	Serial number	Name
1	Tricolor lamp	11	Axis 4 motion+
2	start	12	Axis 5 motion-
3	pause	13	Axis 5 motion+
4	Axis 1 motion-	14	Axis 6 motion-
5	Axis 1 motion+	15	Axis 6 motion+
6	Axis 2 motion-	16	step backward
7	Axis 2 motion+	17	Step forward
8	Axis 3 motion-	18	Hotkey 1: slow-speed switch
9	Axis 3 motion+	19	Hotkey 2: step length switch
10	Axis 4 motion-		

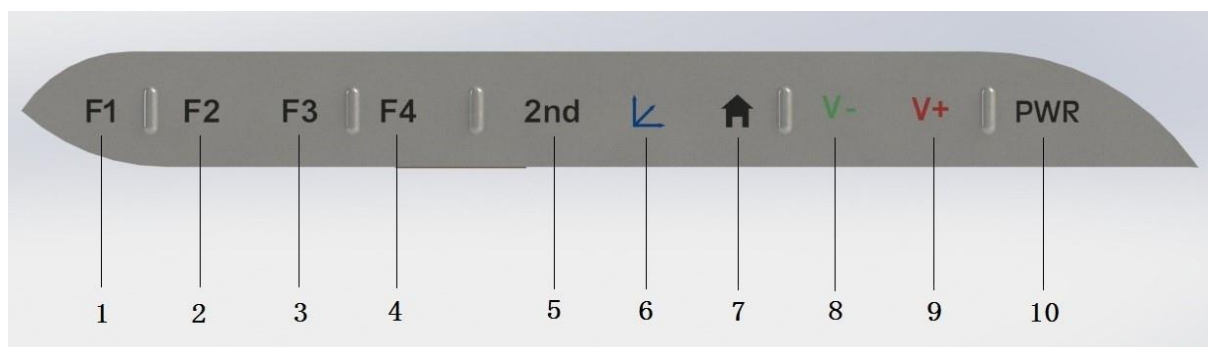


Figure 4-4 bottom button

Table 4-4 bottom keys

Serial number	Name	Serial number	Name
1	Multifunction key F1, Call out / hide current alarm content	6	Coordinate system switching
2	Multifunction key F2, Double click on the screenshot	7	Back to home
3	Multi function key F3, Program operation mode (continuous, single step in, single step skip, etc.)	8	Speed-
4	Multifunction key F4,	9	Speed+
5	Multifunction key F2,	10	Servo power on

4.1.3 How to hold the teach pendant

When the left hand holds the teach pendant and jogs the robot, the left finger needs to press the hand pressure switch to make the robot in the servo on state. The specific method is shown in the figure below.

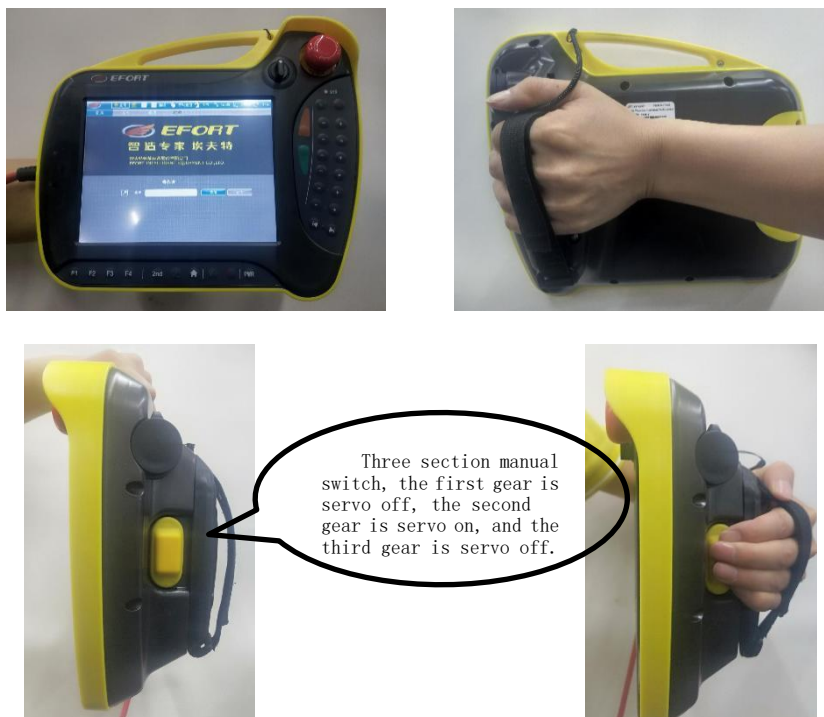


Figure 4-5 holding method of teach pendant

4.2 Power on and start

After mastering the key function of 4.1 teaching pendant, press the power switch in the lower left corner of the control cabinet (OFF → ON), Start the system (as shown in the figure below). If everything is normal, you can see that the system automatically enters the login interface from the teaching pendant, and the user can operate the robot according to different permissions. If there is an error prompt, please handle it according to the fault information prompt or view the fault handling manual according to the fault code.

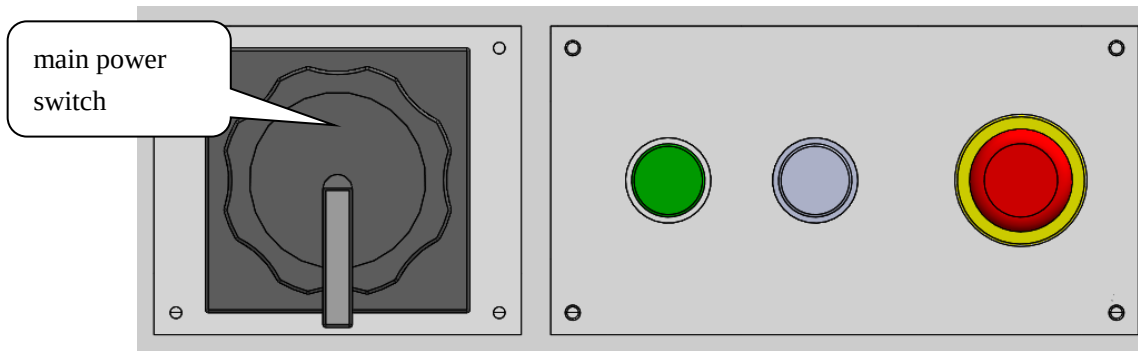


Figure 4-6 position of main power switch

4.3 Jog operation

4.3.1 What is Jog operation

In manual mode. After servo enable, the coordinate system type and motion rate of robot should be set, and then the jogging operation should be carried out.

The point operation can be divided into two ways: continuous jogging and incremental jogging. Jogging operation is divided into continuous Jogging and incremental jogging.

- 1) Continuous jogging is to press and hold the "+" and "+" buttons to make the robot move;
- 2) Incremental jogging needs to set the step length, and then press the "+" and "+" buttons to make the robot move incrementally.

4.3.2 Points for attention on jogging operation

Please read the safety manual of EFT robot before inching operation

1. The operator must stand outside the working space of the robot;
2. The operator keeps observing the robot from the front to ensure a safe exit in case of emergency;
3. Ensure that there are no people in the radiation range of the robot;
4. Check whether the robot has an alarm. If there is an alarm, please clear it first and then run it;
5. Check whether the mechanical zero position of the robot is consistent with the position of each axis of the teaching pendant;
6. Confirm the global speed of jogging and confirm the currently selected coordinate system before servo up.

4.3.3 Start jogging operation

After logging in as an administrator, click "**monitor**" in the menu bar, and then click "**position**". The following jogging operation can be performed in the interface that jumps out, as shown in Figure 4-7.



Figure 4-7 axis position display interface

Click the coordinate system switch button on the teach pendant panel to switch the coordinate system type, as shown in the figure below. The order of switching is joint coordinate system, →robot coordinate system, →tool coordinate system and →user coordinate system. The switching result is displayed in the status bar of the teach pendant.



Figure 4-8 switching of coordinate system

4.3.4 Joint coordinate system - jogging operation

Set the coordinate system type to joint coordinate system, and click the coordinate system button at the bottom of the teach pendant panel until the status “Joint” is displayed in the status bar of the teach pendant.

Press and hold the hand pressing switch and click the corresponding "-" and "+" buttons on the right side of the teach pendant panel as shown in figure below to adjust the motion angle of the corresponding joint axis of the industrial robot.



Figure 4-9 hand pressing and function key of teaching pendant at right side

For detailed steps of jogging operation of ER130-4-2800 , please read *ER series robot operation manual*.

4.4 Program operation

4.4.1 What is program operation

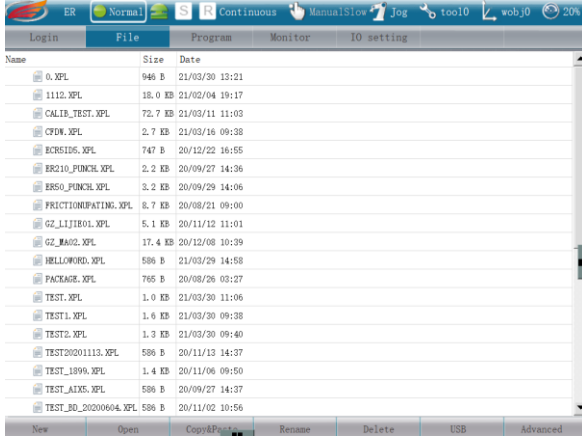
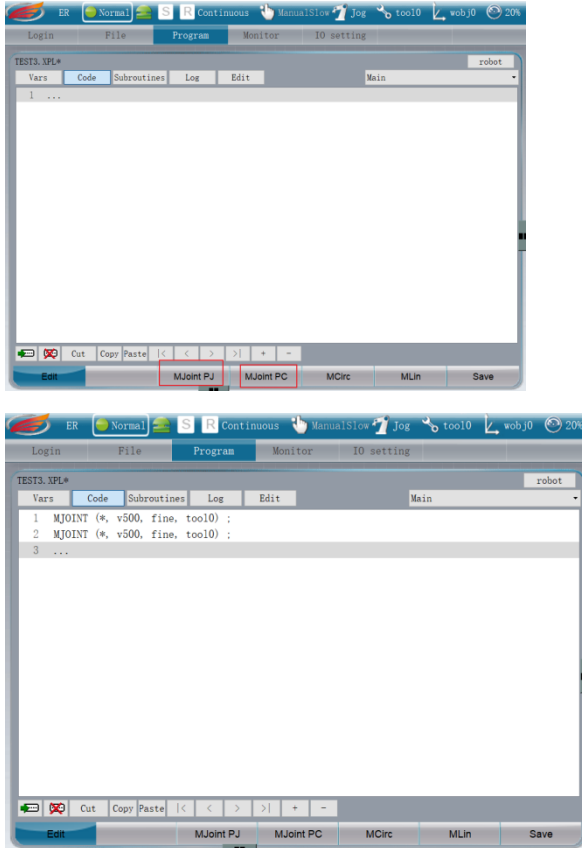
In automatic mode. Open the program file stored in the controller or create a new blank program file to edit, save, debug and run the program file, so that the robot can move by itself according to the program instructions.

4.4.2 Points for attention on program operation

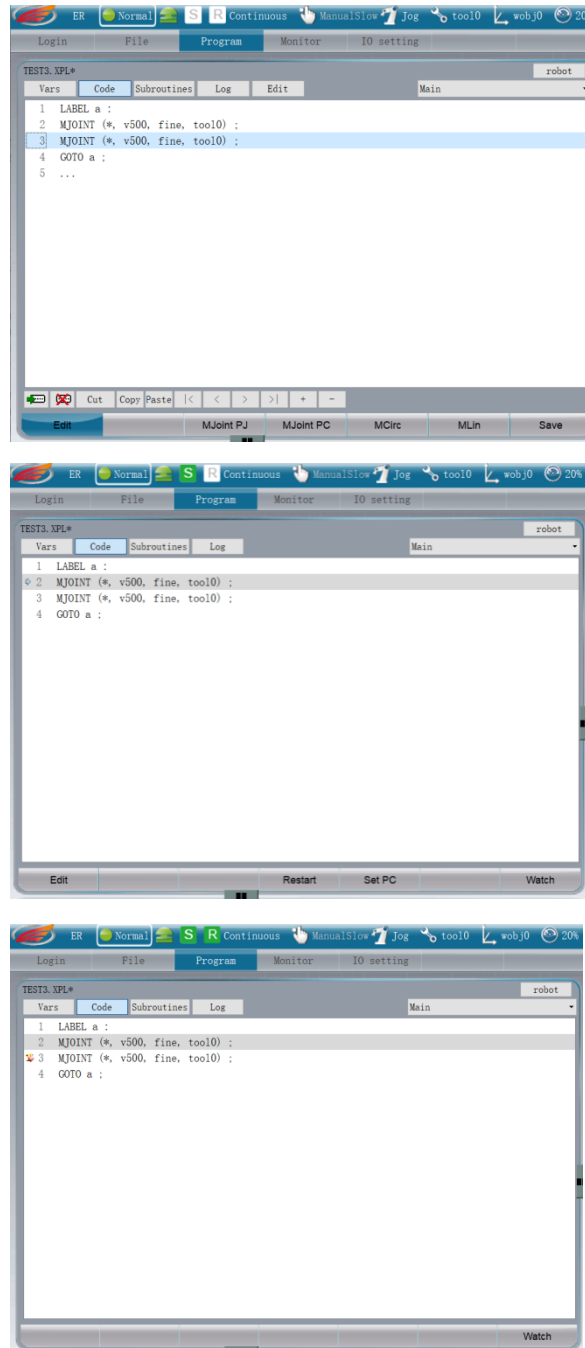
1. The operator must stand outside the working space of the robot;
2. The operator keeps observing the robot from the front to ensure a safe exit in case of emergency;
3. Ensure that there are no people in the radiation range of the robot;
4. Check whether the robot has an alarm. If there is an alarm, please clear it first and then run it;
5. Check whether the mechanical zero position of the robot is consistent with the position of each axis of the teaching pendant;
6. Confirm the global speed of jogging and confirm the currently selected coordinate system before servo up.

4.4.3 Start program operation

Figure4-5 steps of program operation

step	diagram	description
1. Enter the file management interface.		Open the file management interface, click the "open" button at the bottom to open an existing program file, or click the "new" button at the bottom to complete the creation of a blank program file. The teach pendant interface will automatically jump to the program editor interface.
2. Complete the editing of program files.		If you need to modify and edit the program, switch the motion mode knob to "T1" or "T2", and then click the "Edit" button in the lower left corner to edit. If you need to jog-teaching, you need to move the robot to the corresponding point and click the point-teaching button at the bottom of the teach pendant to insert the point-teaching instruction automatically. After editing, click the "save" button to save. For detailed operation of program editing, please refer to <i>Er robot operation manual</i>

3.Run the program.



Before running the program, you need to enable the robot servo. The specific operation is as follows:

Switch the motion mode knob switch to the automatic mode, press the "automatic operation confirmation" button on the mechanical electric cabinet, and press the "**PWR**" function key on the teach pendant.

Select a line and click it, then click the "**Set Pc**" button to set the program to run from this line. Or directly click the "**restart**" button, the program will be set to run from the first line.

Click the "**start**" button, the program starts to run until the end of the program.

In the process of running, click the "**pause**" button to pause the program; then press the "**start**" button to continue the program.

When there are problems in the edited program files, statements, and motion errors, an alarm will be generated. By clicking the "**log**" button to view the operation log, you can obtain specific alarm information.

4.5 Shut down and power off

If it is necessary to shut down the robot on holidays or rest days, the operation steps are as follows:

- 1、 After the robot runs the current program, press the "pause" button to stop the robot, or directly pause the robot;
- 2、 Turn the mode switch to "T1" manual low speed mode;
- 3、 .Press the "hand pressure switch";
- 4、 In the manual low-speed mode, the robot moves to the mechanical zero point or working zero point by jogging or single step motion;
- 5、 Release the "hand pressure switch";
- 6、 Press the power switch in the upper left corner of the control cabinet (OFF → ON) to turn off the power, as shown in the figure below. Please wait for more than 5S when restarting again.

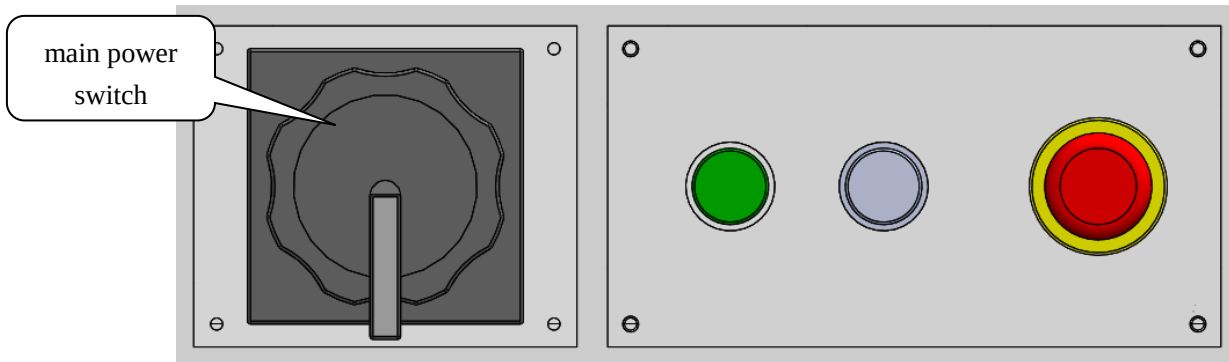


Figure 4-10 position of main power switch

Chapter Five Common faults and investigation methods during installation

Fault description	Investigation methods	Remark
The control cabinet cannot be started	Check 1: whether the input power supply is normal; Check 2: whether the sequence of control cabinet power aerial plug-in wiring is correct; Check 3: whether the disconnecter is closed; Check 4: whether the fuse core of fuse "FU1" is damaged. If it is damaged, please replace it; Check 5: whether the fuse core of fuse "FU2" is damaged. If it is damaged, please replace it; Check 6: whether the fuse core of fuse "FU3" is damaged. If it is damaged, please replace it; Check 7: after the above operation, the problem still cannot be solved. Please contact our after-sales personnel.	If the fuse core or fuse is damaged, please replace it with the same specification
After the control cabinet is started, the emergency stop alarm is displayed	Check 1: whether the emergency stop button on the control cabinet panel is reset; Check 2: whether the teaching pendant is connected normally and whether the emergency stop button of the teaching pendant is reset; Check 3: whether the emergency stop button of the control cabinet is connected and reset normally. Check 4: after the above operation, the problem still cannot be solved. Please contact our after-sales personnel.	The emergency stop button is triggered by default, please reset when using.
The teach pendant cannot be started	Check 1: whether the harness connector of the teaching pendant is installed in place and rotate the latch; Check 2: whether the fuse core of fuse "fu4" is damaged. If it is damaged, please replace it; Check 3: the motion control card file is damaged, contact our after-sales personnel. Check 4: after the above operation, it still cannot be solved, please contact our after-sales personnel.	If the fuse core or fuse is damaged, please replace it with the same specification.
The teach pendant cannot be servo enabled	Check 1: whether there are other faults not reset, if so, please reset; Check 2: in the manual low speed mode (T1), whether the manual pressure switch of the teaching pendant operates correctly, and whether the controller normally receives the	When entering manual high-speed (T2) and automatic mode (Auto), it is necessary to press

	"Enable" signal; Check 3: whether the servo confirmation button (servo) of control cabinet works normally in manual high speed (T2) and automatic mode (Auto). Check 4: after the above operation, the problem still cannot be solved. Please contact our after-sales personnel.	servo confirmation button of control cabinet first.
The robot can't move	Check 1: whether there is an alarm in the teaching device interface, if so, please operate according to the alarm; Check 2: after the above operation, it still cannot be solved, please contact our after-sales personnel.	
Hot plug function of teaching pendant cannot be used	Check 1: whether hot swap button works normally; Check 2: whether relay K1 operates normally; Check 3: whether the short connector of the teaching pendant is installed normally and locked; Inspection 4: after the above operation, if it still cannot be solved, please contact our after-sales personnel.	When using hot plug function, please strictly follow the description of electrical maintenance manual.
The brake release unit cannot be used	Check 1: check whether the input power "24VP-BR / 24VG-BR" is normal; Check 2: whether "QF2" is closed or not; Check 3: after the above operation, if the problem still cannot be solved, please contact our after-sales personnel.	
24V power supply in control cabinet is not started	Check 1: check whether fuse fu2 fuse core is damaged, and replace if damaged; Check 2: check fuse fu4 fuse core for damage, if there is damage please replace;; Check 3: check whether the power supply of switch power supply is normal; Check 4: check whether the switch power supply is damaged; Inspection 5: after the above operation, if the problem still cannot be solved, please contact our after-sales personnel.	If the fusible core and switching power supply are damaged, please replace them with the same specifications.
Cooling unit fan not activated	Check 1: the robot has just started, the ambient temperature is low, and the fan has not started, which is a normal phenomenon; Check 2: check whether the fan power supply wiring is good; Check 3: check whether the temperature control switch is damaged; Check 4: after the above operation, if the problem still cannot be solved, please contact our after-sales personnel.	

Service hotline: 400-0528877

The rated power, specifications and external dimensions of this product are subject to change without prior notice. The technical data and illustrations are for reference only, and we reserve the right to change them.



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