QJRH4-1 Industrial robot

Electrical Use and Maintenance Manual

Please make sure that the relevant instruction book reaches the end user of the product.

Preface

	■ Before operating the robot, please read the instruction book carefully and follow all the safety related issues and instructions provided in the text. ■ The installation, operation and maintenance of the robot shall be undertaken by the personnel who have attended the training courses of our company.
	■ Please be sure to deliver the instruction book to the personnel who actually operate the robot.
	■ If there is any ambiguity in the instruction book or if you have any questions about the after-sales service of the robot, please contact the service center directly. See the back cover for the contact way.

Notes

1 The contents described in the instruction book are subject to change without notice.

2 The display of the screen of the suspended teaching operation control key board is just an example. If there is any difference from the actual display, please understand.

3 The contents described in the operating instruction have been given full attention to prevent mistakes, but the company is not responsible for any direct or indirect damages in case of errors.

4 The operating instruction is a part of the robot product. When moving, transferring, or selling the robot, please make sure to attach the operating instruction.

5 All or part of the contents of the operating instruction is prohibited from being reproduced without the consent of our company.

6 About prohibiting modifications

- It is strictly forbidden to make any modifications to our products.
- Fires, faults and malfunctions due to modifications may cause injury and damage to the machine.
- The modifications of the product made by the customer are outside the warranty scope of our company, therefore no responsibility is granted.

Revision history record of instruction book		
Version	Year/Moth	Change contents
V2.0	June, 2018	1. Re-typesetting; 2. Addition of contents; 3. LOGO change

Contents

Chapter I Safety specification

1.1 Safety introduction

Requirements of robots are often different from other those of mechanical equipments, such as its large range of motion, quick operation and fast movement of the arms, all of which will have safety hazard.

Read and understand the instruction and related documents, and follow the various procedures to avoid personal injury or equipment accidents. It is the user's responsibility to ensure that the safe operating environment complies with and observes local and national safety laws, regulations and rules.

MANDATORY!

•The teaching and maintenance of the robot must observe the following regulations:

- Industrial safety and health Laws.
- Mandatory orders on industrial safety and health laws.
- Corresponding regulations on industrial safety and health laws.

•Prepare:

-Safety technical rules

Production safety management is carried out according to specific policies in accordance with relevant laws and regulations.

•Observe:

-Safe operation of industrial robots

The work of teaching and repairing robots is included into the "dangerous operation" of industrial safety and health laws. The operators must attend special training, master the basic knowledge of the robot and understand the welding process.

1.2 Pre-employment training

MANDATORY!

The personnel for teaching and maintaining the robot must be subject to prior training. The repair and maintenance of the robot must be carried out by professionals. The adverse consequences caused by the disassembly of the robot without permission are not the responsibility of our company. The relevant personnel shall not maintain, repair or use the teaching after being affected by drinking, taking drugs and stimulant medications.

1.3 Safety precautions for operators

There is potential danger within the entire maximum range of motion of the robot. All personnel working for the robot (security administrators, installers, operators and service personnel, etc.) must always set up “safety first” thinking to ensure the personal safety of all personnel.

- Make sure to operate outside the range of motion of the robot when there is no need to enter into the working area of the robot.

- Make sure that there is not anything abnormal of the robot or peripheral equipments before teaching.

- The programmer must be careful not to allow others to enter into the working range of the robot. If someone enters by mistake, must stop!

CAUTION!

Any dangerous work is prohibited within the installation area of the robot:

If the robot and its peripheral equipments are touched arbitrarily, there is a danger of injury.

Take strict safety precautions:

- The relative obvious warning signs such as “stop” or “No Entrance” shall be placed in the relevant working area of the robot, and the isolation fences shall be arranged in the placement area of the robot and subsidiary tools to prevent accidental injury during production.

-It is recommended to lay washer switches or photoelectric switches on the floor so that when the operator enters into the range of motion of the machine, an alarm is sounded through buzzer and light to stop the robot to ensure staff safety.

Ignoring these safety details may result in electric shock or personal injury caused by arbitrary touching of the robot and other equipments.

Strictly observe the following provisions:

- Wear work clothes (do not wear loose clothes).
- Do not wear gloves when operating the robot.
- Shirts and ties shall not be exposed from the work clothes.
- The female workers shall wear work caps with hair inside the cap.
-Do not wear big jewelry such as earrings, rings or pendants. Wear appropriate personal protective equipments such as safety helmets, safety shoes (with anti-skidding soles), masks, safety goggles and gloves if necessary.

Unsuitable clothes may cause personal injury, for example, loose clothes hang on the robot or accessory equipments, causing the robot to suddenly stop or start.

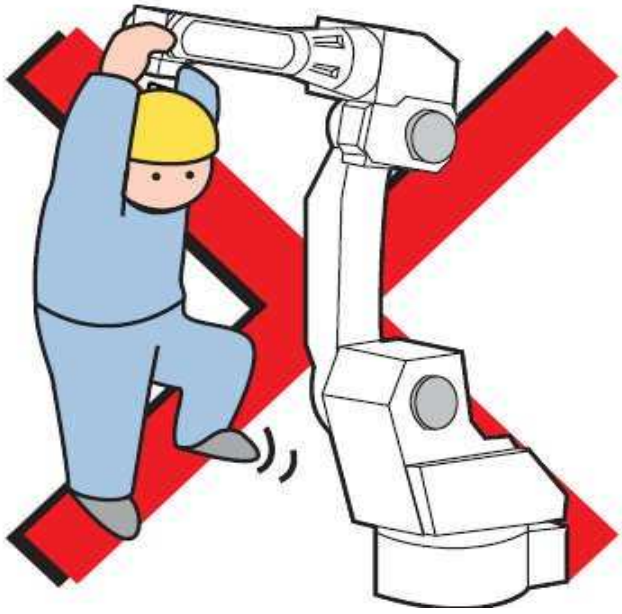
注意

CAUTION!

Unauthorized personnel shall not access the robot and its peripheral auxiliary equipments. Failure to observe the instruction may cause injury due to touching the control cabinet, workpieces and positioning device, etc.

It is strictly forbidden to pull the axes of the robot compulsively. It is not allowed to use tools to hit and impact the robot.

Otherwise, it may cause personal injury and equipment damage, for example, sudden release of the servo motor will cause accidental injury to the worker, and damage to confidential parts such as servo motors and reducers.



Do not lean on the control cabinet or other control cabinets. Do not press the operation keys arbitrarily.

Otherwise, it may cause unexpected movements of the robot, thus resulting in personal injury and equipment damage.

Non-staff are strictly prohibited to touch the control cabinet during operation.

Otherwise, it may cause unexpected movements of the robot, thus resulting in personal injury and equipment damage.

1.4 Safety precautions for robots

1.4.1 Installation and wiring safety

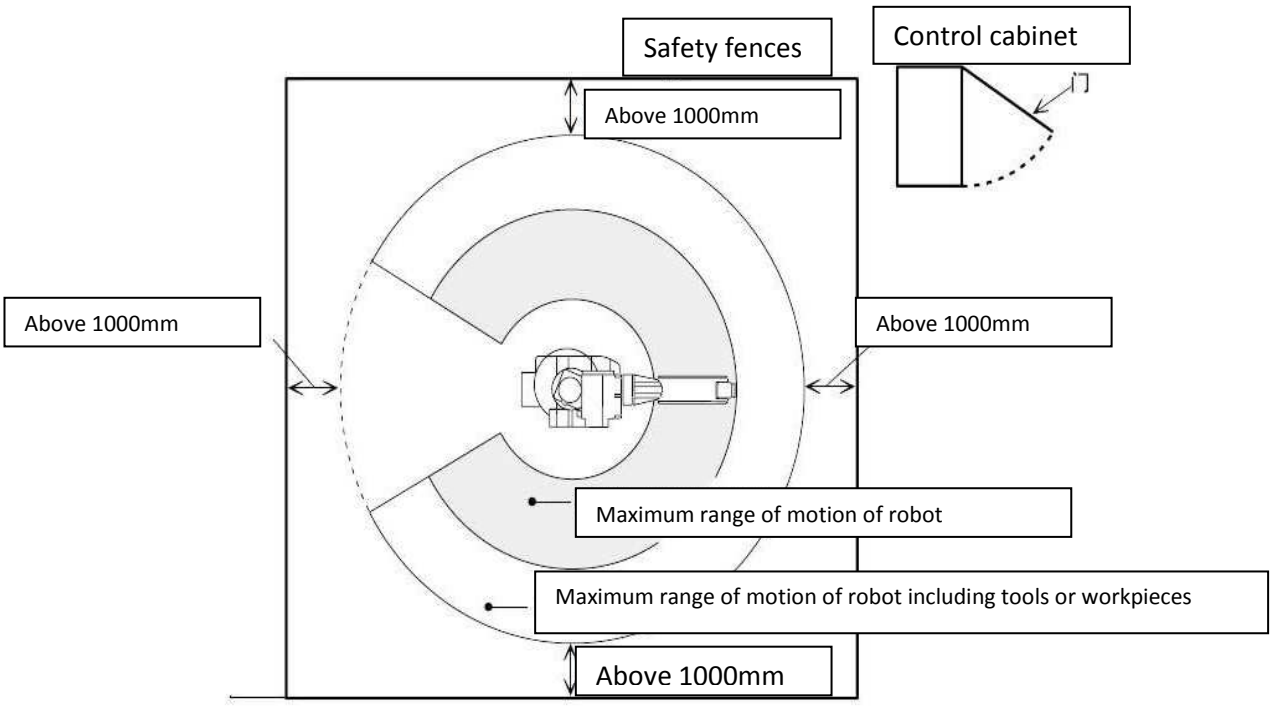
Look up the requirements of robot installation and wiring in the instruction book and the specific installation requirements are described subsequently in the instruction book. In a planned installation, develop simple measures to ensure safety. When planning the installation area, take full account of safety issues.

When installing the robot, observe the following items:

危险

DANGER!

Select an area to install the robot and verify that the area is large enough to ensure that the robot equipped with tools does not touch the wall when rotating, safety fences or control cabinet when it rotates. Otherwise it may cause personal injury or equipment damage due to unintended actions of the robot.



The grounding engineering must comply with electrical equipment standards and interior wiring rules and regulations. Robot wiring must be performed by professional electrical personnel. Wiring without permission is absolutely forbidden.

Otherwise it may result in very serious consequences such as electric shock and fire.

The robot or fixture is controlled by the control cabinet.

In order to ensure safety, it is necessary to operate at a position where the robot can be seen. Operation by unauthorized personnel may cause personal injury or equipment damage.

The control cabinet shall be installed outside the safety fence of the range of motion of the robot.

Otherwise it may cause personal injury and equipment damage due to contact with the robot.

After setting, fix the position of the control cabinet.

Fix the control cabinet to the ground or rack and other objects with screws through the bolt holes on the bottom of the control cabinet.

Otherwise it may cause the control cabinet to shift or dump, thus resulting in personal injury and equipment damage.

Be familiar with the wiring diagram before wiring the control cabinet, and wring must be done according to the wiring diagram.

Incorrect wiring or incorrect displacement of parts can cause equipment damage or personal injury.

CAUTION!

Cranes, spreaders or forklifts shall be operated by authorized personnel.
Otherwise it may cause personal injury and equipment damage.

The robot is kept vertical using the wire rope passing through the lifting ring and the positioning device, and the overhead crane is used to lift and transport according to the requirements specified in the robot instruction book. Otherwise, it may cause the robot to tip over, thus resulting in personal injury or equipment damage.

When lifting the robot and control cabinet, please check the following items.

- Generally, when lifting the control cabinet or robot, it is necessary to use the wire rope to pass through the eyebolt bolt fixed to the robot, lifting with overhead crane. Make sure the wire rope is strong enough to withstand the weight of the robot. The weight of the control cabinet is about 100Kg and the weight of the robot is about 150Kg.

- Check the wire rope before lifting. Do not use damaged, broken or rusted wire ropes.

Select the well-maintained wire ropes for work.
Otherwise it may cause the equipment to suddenly fall off and cause serious damage to persons and equipments.

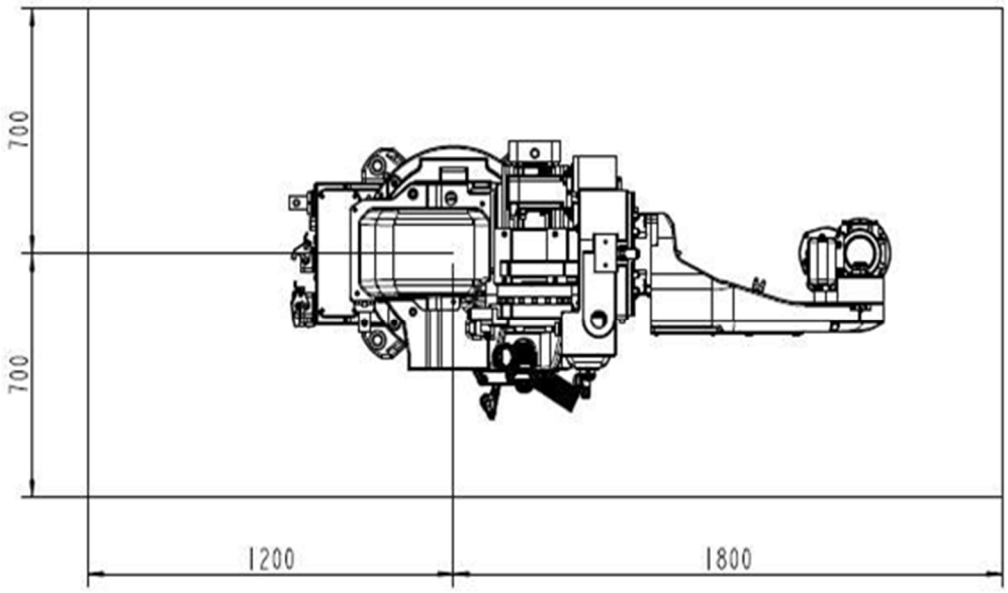
Make sure the eyebolts are fixed firmly. Otherwise it may result in personal injury and equipment damage.

If the robot needs to be temporarily stored before installation, it shall be placed on a stable level and an obvious warning sign shall be set up to prevent non-staff from touching.

Otherwise it may result in personal injury and equipment damage.

CAUTION!

Make sure there is enough space to repair the robot, control cabinet and other peripheral equipments, which shall be performed by professionals. It is strictly forbidden for non-professionals to disassemble the robot system.


700
700
1200
1800

Otherwise it may cause injury accidents during maintenance. The maximum size shown in the figure is the robot maintenance space, to ensure that the staff has enough space to install and maintain the robot and accessory equipments.

- Enter into the maintenance space when the power is off. Lock the circuit breaker, and prevent other people from switching on the power supply.
- The operation personnel shall hang the warning sign "Maintenance work" to remind others not to operate the robot freely.
- When performing pneumatic system separation, make sure that the supply pressure is released.
- Avoid repair tools and equipments from blocking the escape way.
- When the operation personnel start the operation, make sure that there is no one in the maintenance space, and the maintenance tools and equipments are ready. The robot can be operated to move only after ensure that the robot and the peripheral equipments are not abnormal.

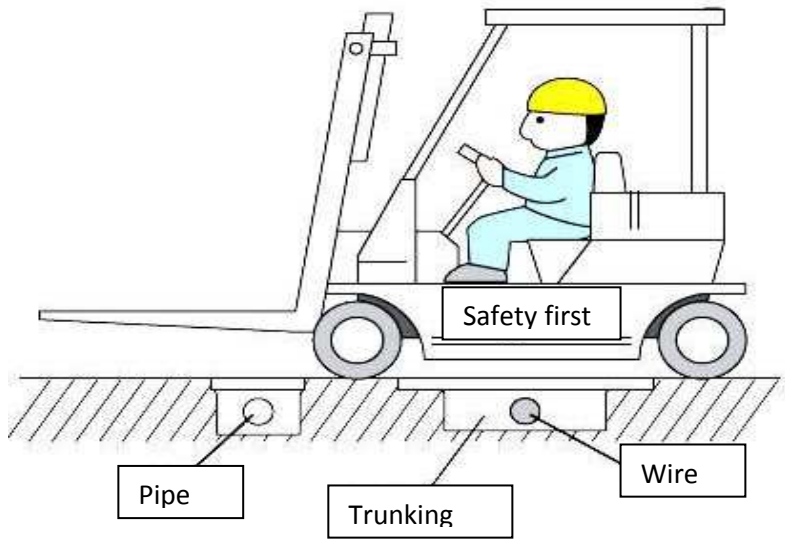
For different positions of the robot, the assembly tasks shall be carried out according to the bolt size and type specified in the instruction book. Otherwise it may cause personal injury and equipment damage.

注意

CAUTION!

Take protective measures when performing the wiring and piping between the control cabinet and the robot and peripheral equipments. For example, run the pipe, wire or cable through pit or covered with a protective cap to prevent from being trampled by individuals or crushed by the forklifts.

The operators and other personnel may be caught by the open wires, cables or pipelines, causing damage, thus causing the abnormal movements of the robot, thus resulting in personal injury or equipment damage.



Note the following items about the cable:

- Do not add cables and hoses other than those recommended by our company to the robot system.

- When installing cables outside the mechanism, avoid blocking the mechanism operation, and the installation of the peripheral equipments shall avoid cable interference.

- For the cables exposed outside the mechanism, do not modify the cable harness freely for convenience (such as adding cover and external cable, etc.).

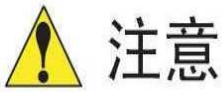
- Always comb the knotted cable to avoid excessive winding, but it must be done in accordance with the relevant safety instructions.

1.4.2 Safety at work area

Careless during work in the work area will cause serious accidents, therefore it is strongly recommended to implement the following precautions:

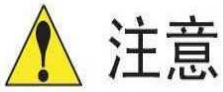
DANGER!

Set the safety fences around the robot to prevent accidental contact with the powered robot. Post the warning sign “Keep away from work area” at the entrance of the safety fence. The door of the safety fence must be installed with a reliable safety interlock devive.
Ignoring the warning will cause serious accidents due to contact with the robot.



CAUTION!

Spare tools and similar equipments shall be placed in the suitable areas outside the safety fences. Tools and scattered equipments shall not be left around the robot, control cabinet or application (such as welding fixtures). Personal injury or equipment accidents can occur if the robot hits the items left in the work area.



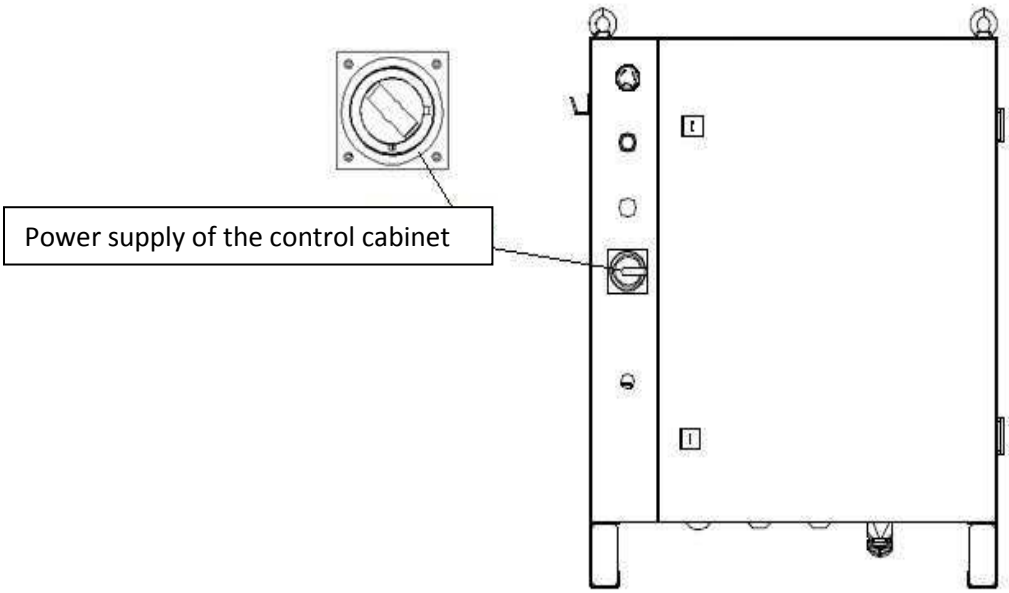
CAUTION!

The fire-fighting equipments must be placed in strict accordance with national standards, regularly inspected and replaced.

1.4.3 Operational Safety

DANGER!

When installing the tools on the robot, cut off (OFF) the power supply of the control cabinet and the installed tools firstly and lock the robot power switch (position of power supply as shown below), and hang the obvious warning sign.


Power supply of the control cabinet

During the installation process (such as swithing on the power supply), it may cause electric shock, or abnormal movement of the robot, thus resulting in damage.

Do not exceed the maximum allowable range of the robot.

Otherwise it may cause personal injury and equipment damage.
The following warnings shall be observed when the teaching must be carried out within the range of motion of the robot:

- Always observe from the front of the robot.
- Always operate in accordance with pre-determined operating procedures.
- Always have an idea of avoiding a robot in case of an unexpected motion.
- Make sure there is a route of retreat in case of emergency.

Otherwise, the robot may be wrong operated, causing injury accidents.

危险

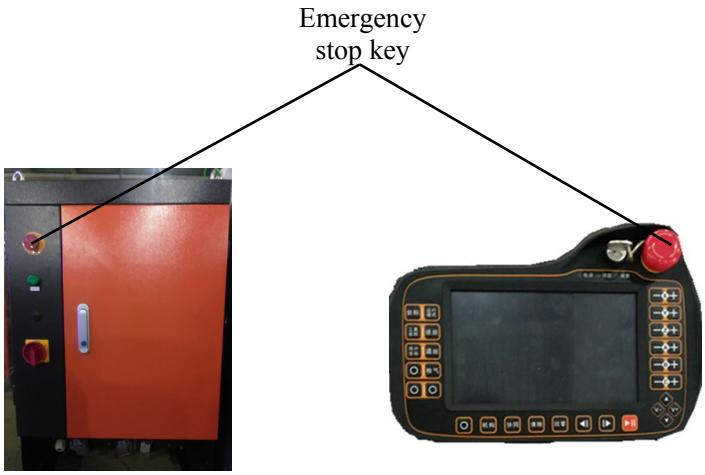
DANGER!

Before operating the robot, press the emergency stop keys on the front door of the control cabinet and on the upper right of the teaching pendant to check whether the indicator of "Servo ready" is off and confirm the power supply is off.

If the robot cannot be stopped in case of emergency, it will cause damage to the mechanical body.

Before performing the following operations, make sure that there is no one in the range of motion of the robot.
- Switch on the power supply of the control cabinet;
- Use the teaching pendant to make the robot move;
- Reproduce to operate the robot;

If an individual accidentally enters into the range of motion of the robot that he/she may be injured due to contact with the robot, press the emergency stop keys immediately. The emergency stop keys are located at the front door of the control cabinet and on the upper right of the teaching pendant (as shown in the figure below)



注意

Perform the following inspection steps before teaching the robot. If problems are found, correct them immediately and confirm that all preparations have been completed.

- Check for problems of robot movement.

- Check the insulation and cover of the external cable for damage.

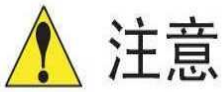
After using the teaching pendant, make sure to put back on the hook of the control cabinet.

If the teaching pendant is left on the robot, on the system fixture or on the ground, the robot or the tool installed on the robot may hit it, causing personal injury or equipment damage.

MANDATORY!

The operators or maintenance personnel for robot must be subject to the training of relevant regulations and company strategies.

1.5 Precautions for moving and transferring robots



CAUTION!

When moving or transferring the robot, the relevant instruction books for the robot shall be attached so that all users have the right to use these necessary instruction books.

If the warning sign on the robot or control cabinet is blurred, please clear the warning sign so that they can be recognized correctly. Please also pay attention to some local regulations, for example, if the safety warning sign is not in the right place, the equipment may be prohibited to use.

When moving or transferring the robot, it is recommended to ask our company to send personnel for inspection.

Incorrect installation and wiring will cause significant personal injury and equipment accidents.

PROHIBITION!

Never make any modification to the robot or control cabinet.

Failure to comply with the warning may result in fire, power fault or operational error. Our company is not responsible for the equipment damage and personal injury caused.

1.6 Precautions for abandoning Robots

CAUTION!

The robots must be abandoned in accordance with the national and local laws and regulations.

Before abandoned, even for temporary storage, the robot shall be fixed firmly to prevent dumping.

Otherwise, personal injury may occur due to the robot dumping.

If disassembly is required when abandoning the robot, please remember the following items before starting disassembly to avoid personal injury.

Make sure to remove all the batteries inside the robot which will explode if heated (such as from a blowtorch).

Make sure to drain the oil in the gearbox which will catch fire if heated (such as from a blowtorch).

When removing the motor from the robot, if the robot is not properly supported before removing the motor, it will suddenly fall down.

Chapter II Description of robot control cabinet

Before you getting familiar with the control cabinet, it is required to know that the setting of control cabinet mode is protected by the safety system. Please confirm the correct level of the operator (refer to the subsequent robot instruction book) to recognize and manage.

2.1 Three-phase power supply

(A) Front

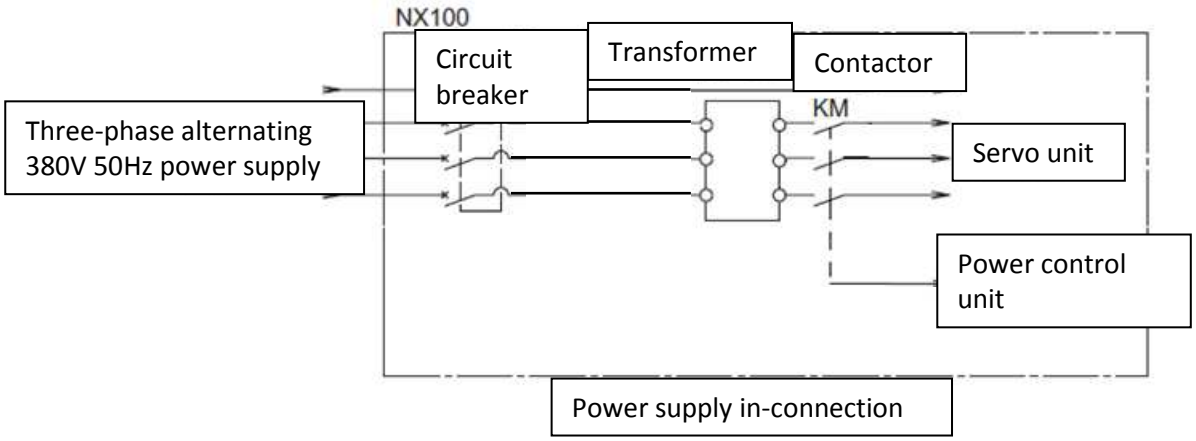
（b）Inside

Schematic diagram of control cabinet

Switching on external three-phase four-wire power supply

The power supply consists of three-phase alternating current 380V and grounding wire.

The function of the circuit breaker is to switch on and switch off 380V power supply. After the network voltage is switched, the transformer converts the power frequency 380V alternating voltage into the voltage required by the servo unit. When the circuit breaker is switched on, the controller unit sends out signals to control the alternating current contactor suction to control the three-phase power on and off.


NX100
Circuit breaker
Transformer
Contactor
KM
Three-phase alternating 380V 50Hz power supply
Servo unit
Power control unit
Power supply in-connection

2.2 Installation of residual-current circuit breaker

DANGER!

If the power supply of the control cabinet is connected to the residual-current circuit breaker, the residual-current circuit breakers that can prevent high frequency shall be used, which can prevent malfunction caused by high frequency leakage current of the rectifier.

2.3 Power on and off

DANGER!

When switching on the main power switch on the control cabinet, make sure that there are no one within the range of motion of the robot.
-Ignoring this reminder may cause personal injury due to accidental contact with the robot.
- In case of any problem, immediately press the emergency stop keys.
- The emergency stop keys are located at the upper left of the front door of the control cabinet and at the upper right corner of the teaching pendant.

2.4 Switching on the main power supply

Turn on the main power switch on the front door of the control cabinet to ON position. At this time, the main power is switched on, but the main power of the drive unit is not switched on. Need to press the “Servo power” key and enable signals are sent out after judged by the control unit, and then the power of the servo unit is fully switched on. At this time, perform the initialization diagnosis and read the current starting position value.

2.4.1 Initialization diagnosis

When the main power is switched on, the controller performs initialization diagnosis and displays the start screen on the screen of the teaching pendant. If the teaching programmer establishes communication with the industrial personal computer successfully, the green light of the teaching programmer will light up, and waiting for a moment, then the initialization diagnosis process is completed.

2.4.2 Successful status after initial diagnosis

After the initialization diagnosis is completed, the main interface of the program edit is popped up, and the current angle, position, and teaching procedure when the program is exited are displayed.

2.5 Switching on the servo power

Before switching on the robot servo power, the operator must be located outside the safety fences (or safety range) to ensure the safety of the staff. Press the "Servo power" key on the control cabinet to switch on the main power of the control cabinet. At this time, the “Servo power

indicator” lights up. After a pause for about 30 seconds, confirm that the servo power of the control cabinet is switched on.

2.6 Teaching/representation/remote mode

2.6.1 Teaching mode

1) Toggle the teaching/representation option switch on the control cabinet so that the indicator arrow of the option switch points to “teaching”.

2) When the operator has to hold the safety switch on the teaching pendant (as shown in figure below), the status bar display on the teaching pendant changes from "Servo off" to "Servo on" and the background color changes from red to green. At this time, the operator can teach movements of the robot.

2.6.2Representation mode

1) Toggle the teaching/representation option switch on the control cabinet so that the indicator arrow of the option switch points to “Representation”.

2) The operator does not need to hold the safety switch on the teaching pendant. Just press the “Run” key on the teaching pendant to make the robot repeat the teaching program under the teaching mode to take action.

2.7 Power off

2.7.1 Cutting off the servo power supply (emergency stop)

When the emergency stop keys are pressed, the servo power is cut off, and the robot

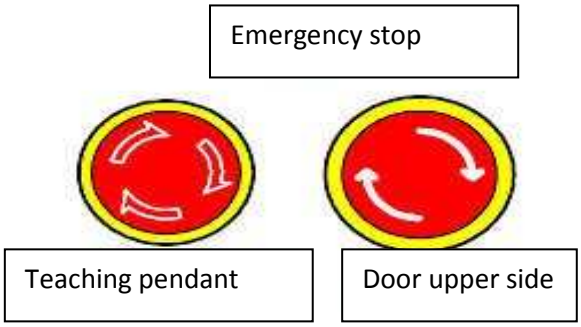
can not be operated. Cut off the servo power supply:

- Toggle the emergency stop key on the front door of the control cabinet or on

the teaching pendant to cut off the servo power supply.

- Once the servo power is cut off, the brake device is activated and the robot is braking that it can not be operated any more.

- The emergency stop state can be reached at any time under any mode (teaching mode, representation mode).



2.8 Action confirm

Before operating the robot, press the emergency stop keys on the right side of the front door of the control cabinet and on the teaching pendant firstly. Confirm that the "Servo power indicator" is off.

If the robot cannot be stopped in case of emergency, it may cause mechanical damage. There are emergency stop keys both on the front door of the control cabinet and on the right side of the teaching pendant.

When teaching within the range of motion of the robot, the following warnings shall be observed:

- Always observe from the front of the robot.
- Always operate in accordance with pre-determined operating procedures.
- Always have an idea of avoiding a robot in case of an unexpected motion.
- Make sure there is a route of retreat in case of emergency.

Improper and careless operation of the robot can cause injury.

Before performing the following operations, make sure that there are one within the range of motion of the robot and ensure that you are within a safe area.

- Switch on the servo power supply of the control cabinet;
- Operate the robot with the teaching pendant;
- Trial run
- Representation mode.

If the robot impacts with any person entering into the range of motion, it will cause personal injury.

CAUTION!

Before teaching the robot, perform the following inspection steps. If problems are found, correct immediately and confirm that all other necessary work has been completed.

- Check the motion of the robot for any abnormal problems.
- Check the insulation and cover of the external cable for damage.

CAUTION!

After the teaching pendant is used, make sure to hang it back to the original position.

If the teaching pendant is left on the robot, on the system fixtures or on the ground, the robot or the tools installed on it will hit it, which may cause personal injury or equipment damage.

Chapter III Description of the internal Hardware inside the control cabinet

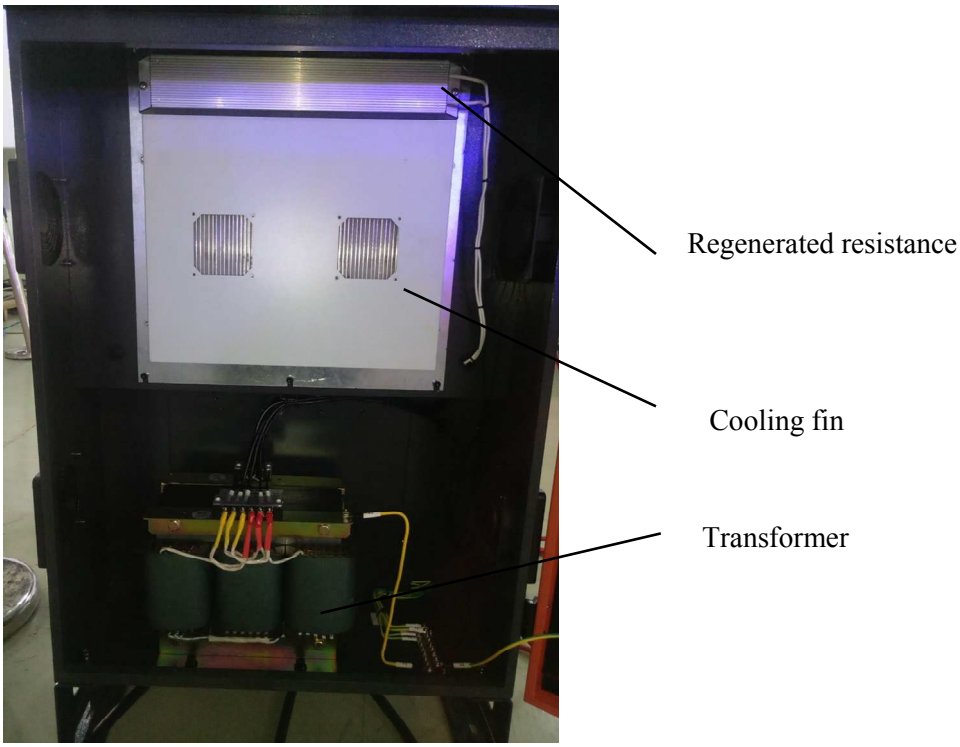
3.1 Schematic diagram of the internal hardware inside the Control Cabinet

Front of interior control cabinet

Left side of interior control cabinet

Right side of interior control cabinet and cabinet door

Control cabinet bottom

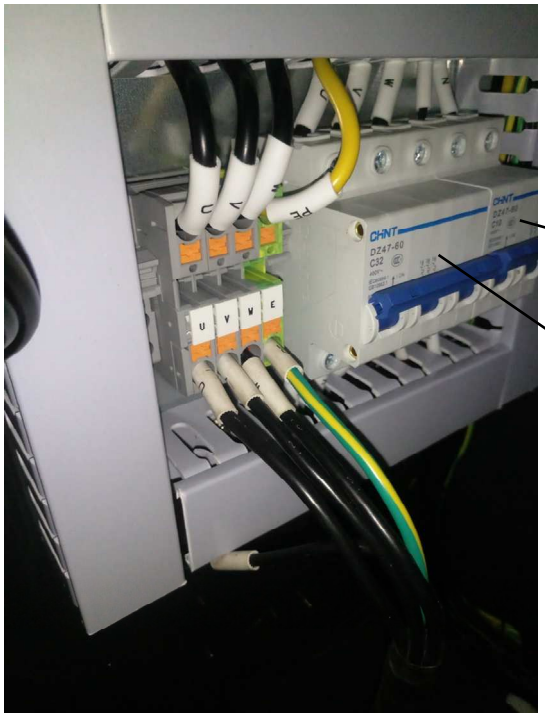


Back of control cabinet

Special instruction: switching power supply, air switch, components for replacing power supply capacity

Control I/O switching power supply

Special brake switching power supply (B24V/BGND special for brake, not allowed to supply power to other devices)



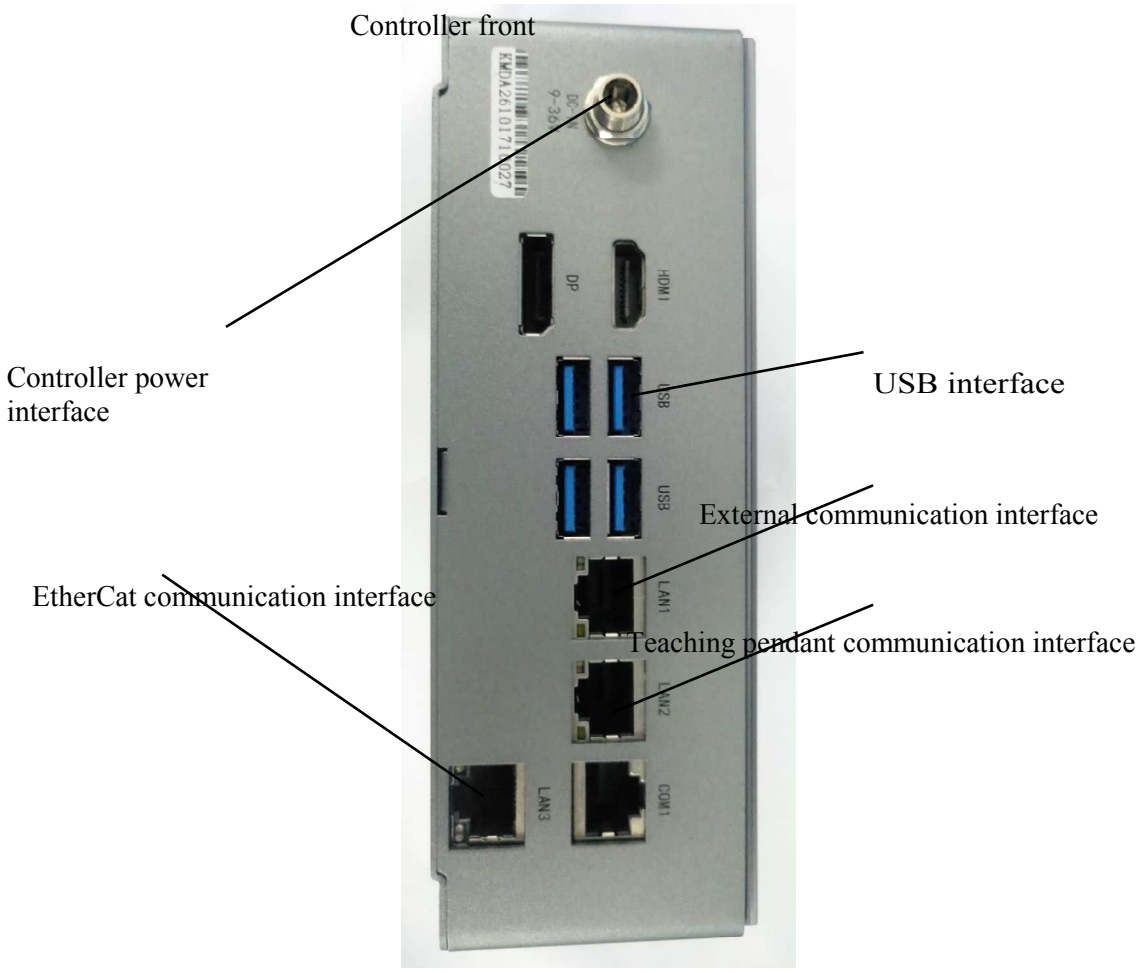
Control cooling fan

Control main power

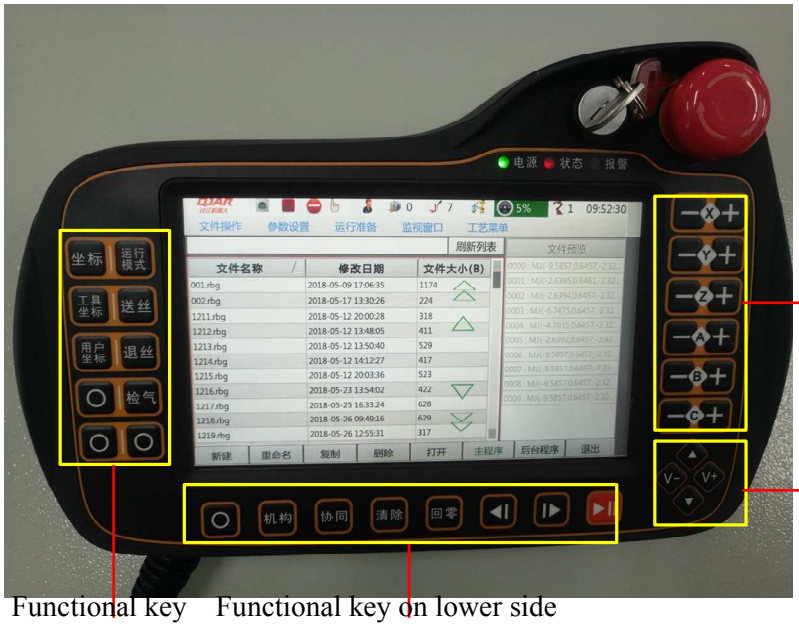
When the 7/8-axis control device other than the standard of the additional electrical cabinet is used, the rated power supply capacity of the original electrical cabinet is insufficient shall be noted. It is required to replace the isolation transformer with a capacity of 6KVA and the switching power supply capacity with 150W.

3.2Controller

Controller front



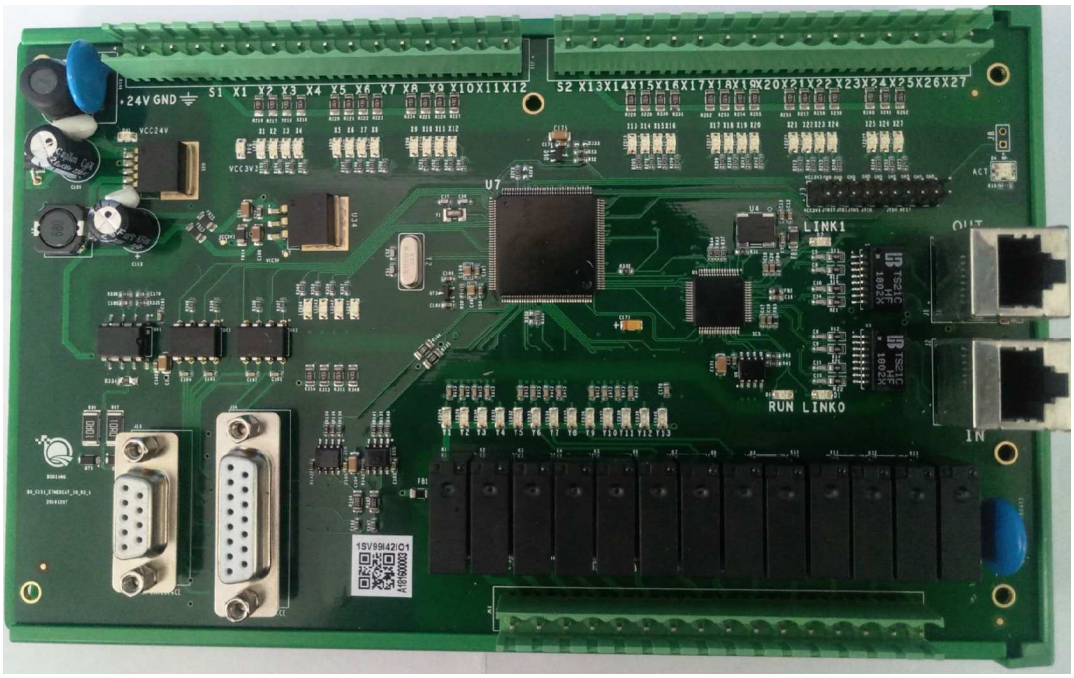
Controller side



Front of teaching box

Back of teaching box

3.4 I/O board



I/O board

3.4.1 Specification of I/O board

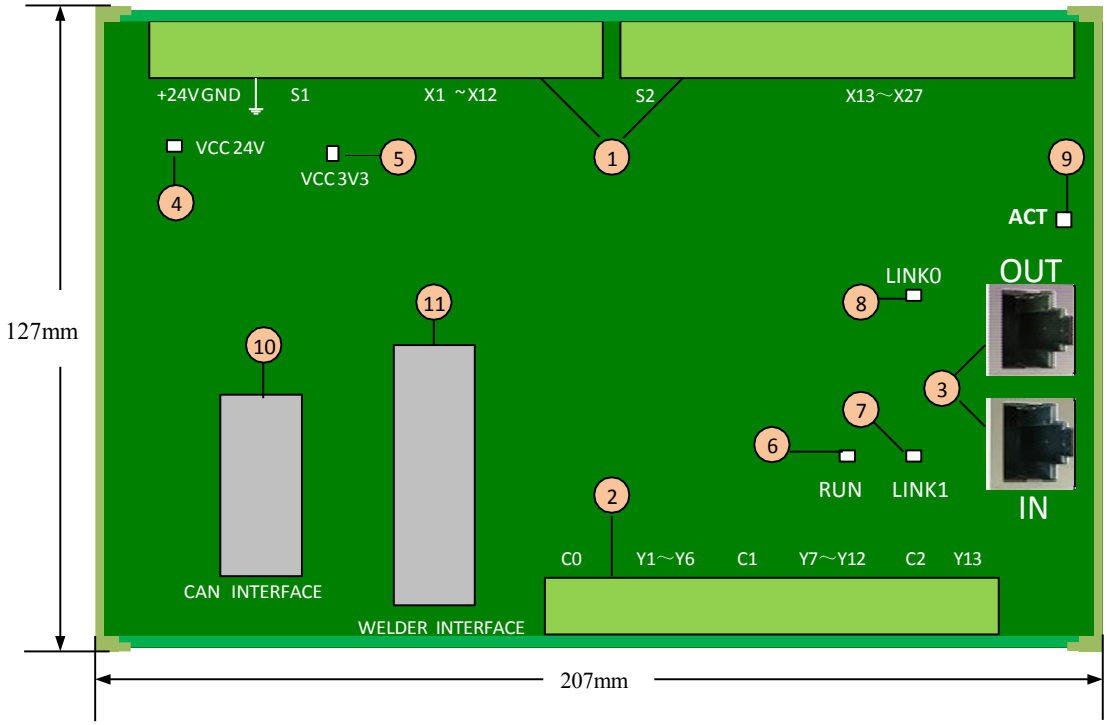
The specifications of ECAT_IO are shown in the table below.

Specification table of ECAT_IO circuit board

Item	Specification
Network topology	ECAT slave station
Power supply	DC24V
General purpose input	27 pieces
General purpose output	13 pieces
Analog quantity welder interface	1 piece
Digital quantity welder interface	1 piece
ECAT internet access	2 pieces

3.4.2 Structure of I/O board

The exterior structure of ECAT_IO and the dimensions after adding the module rack are shown in below figure. The product is mounted on the guide rail of the control box using the module rack.



Exterior structure diagram of ECAT_IO product

① General purpose input

② General purpose output

③ Internet access

④ 24V power indicator light

⑤ 3.3V power indicator light

⑥ Running indicator light

⑦ Internet access IN indicator light

⑧ Internet access OUT indicator light

⑨ ERR indicator light

⑩ Digital quantity welder interface

⑪ Analog quantity welder interface

3.4.3 I/O board system occupation table

EtherCat bus controller system IO occupation table			
Output	IO use	Input	IO use
Y01	Main power for driver	X01	EMG emergency stop input
Y02	Controller warning light	X02	System backup
Y03	Brake power supply	X03	SYKG hand pressure
Y04	Location box 1 indicator light - start	X04	Teaching
Y05	Location box 1 indicator light - stop	X05	Impact input
Y06	Location box 2 indicator light - start	X06	SEL1
Y07	Location box 2 indicator light - stop	X07	SEL2
Y08	Not used	X08	Not used
Y09	Not used	X09	Not used
Y10	Not used	X10	Not used
Y11	Not used	X11	Not used
Y12	Not used	X12	Not used
Y13	Not used	X13	STO1 Location box 1 - stop
		X14	SDA1 Location box 1 - start
		X15	STO1 Location box 2 - stop
		X16	SDA1 Location box 2 - start
		X17	Not used
		X18	Not used
		X19	Not used
		X20	Not used
		X21	Not used
		X22	Not used

		X23	Not used
		X24	Not used
		X25	Not used
		X26	Not used
		X27	Not used

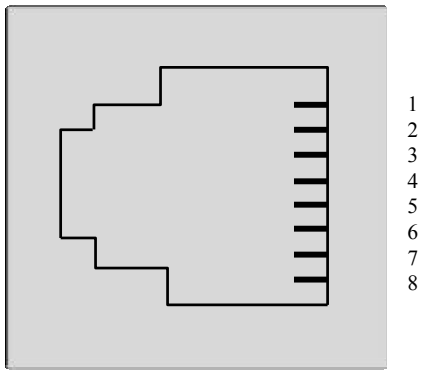
In the table, the input and output remarked as occupied by the system are not allowed to be changed, and please customize those remarked as not used input and output according to your needs.

3.5 ECAT communication interface definition

There are two network accesses IN and OUT. IN connects to the master station or the slave station of the previous level. OUT is used for cascade of the next node.

RJ45 interface pin definition

The network access pin definition is shown in below figure and table.



Internal diagram of the network access Network

access pin definition

Pin	Name	Description
1	TX+	Tranceive Data+(data acceptance positive)
2	TX-	Tranceive Data-(data acceptance negative)
3	RX+	Receive Data+(data acceptance positive)
4	Undefined	Undefined
5	Undefined	Undefined
6	RX-	Receive Data- (data acceptance positive)
7	Undefined	Undefined
8	Undefined	Undefined

3.6 LED indicators

RUN indicator light, LINK indicator light and error indicator light

During communication, the corresponding states of the RUN indicator light, LINK indicator light and error indicator light under different states is shown in the table below.

Status table of indicators under different communication states

Communication state	State of RUN indicator light	State of LINK indicator light	State of error indicator light
Init	Not light	Green flashing	Not light
Pre_OP	Green quick flashing	Green flashing	Not light
Safe_OP	Green slow flashing	Green flashing	Not light
OP	Green light	Green flashing	Not light
Unplug the network cable after communication entering into OP	Green slow flashing	Not light	Red flashing
Remove EEPROM	——	——	Red light

General IO corresponds to LED indicators

Each general purpose input and output has a corresponding LED indicator lights.

Power indicator

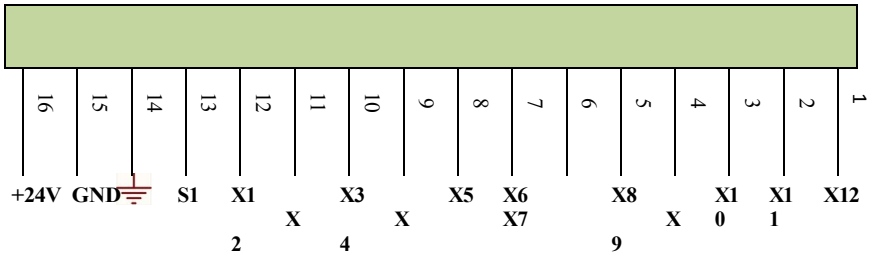
VCC24V indicator andVCC3.3V indicator

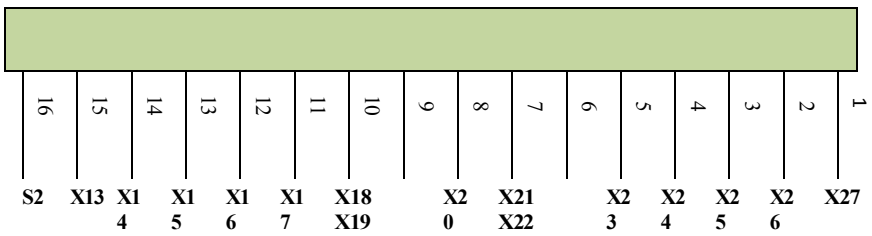
3.7 General purpose input

The product has 27 general purpose inputs available for use.

3.7.1 General purpose input interface definition

As shown in the figure.





General purpose input interface definition

3.7.2 Use of general purpose input

Taking S1 and X1 as examples, the high level effective connection method is shown in Figure 1 as below. The low level effective connection method is shown in Figure 2. Other connection method of the general purpose input is the same.

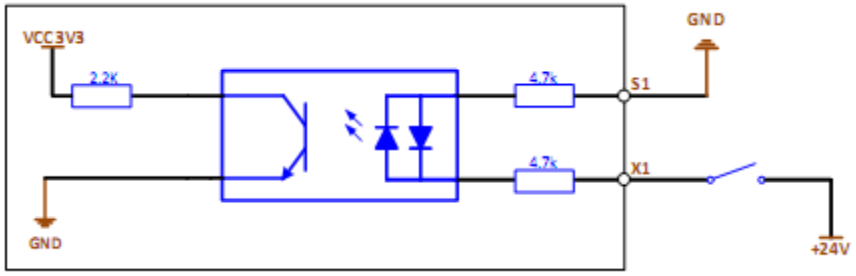


Figure 1 General purpose input active high level connection method

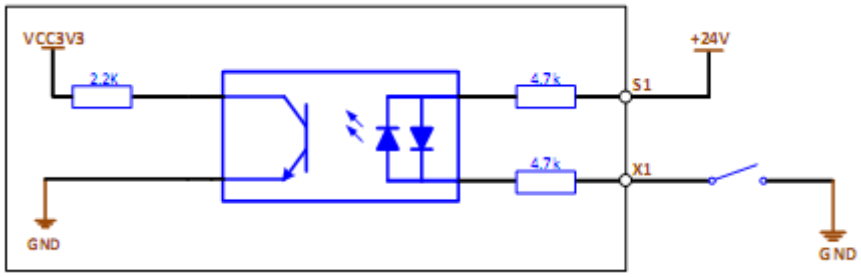


Figure 1 General purpose input active low level connection method

As shown in Figure 3, S1 is the common terminal of X1~X12 and S2 is the common terminal of X13~X27.

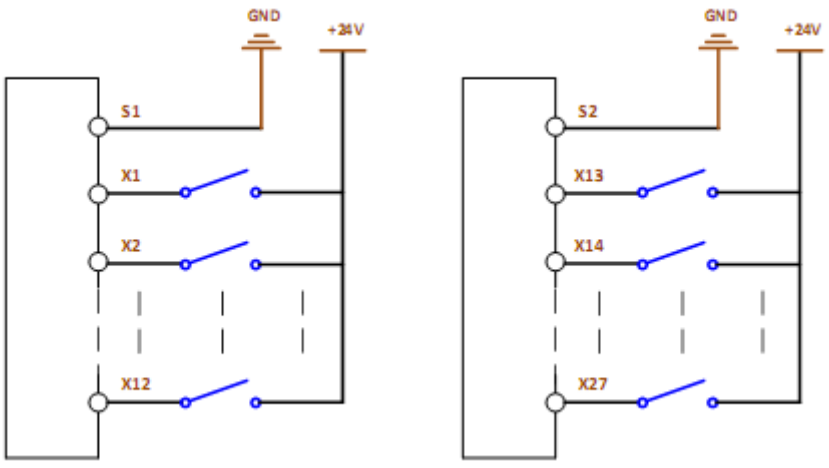


Figure 3 Common terminal connection of active general purpose input high level

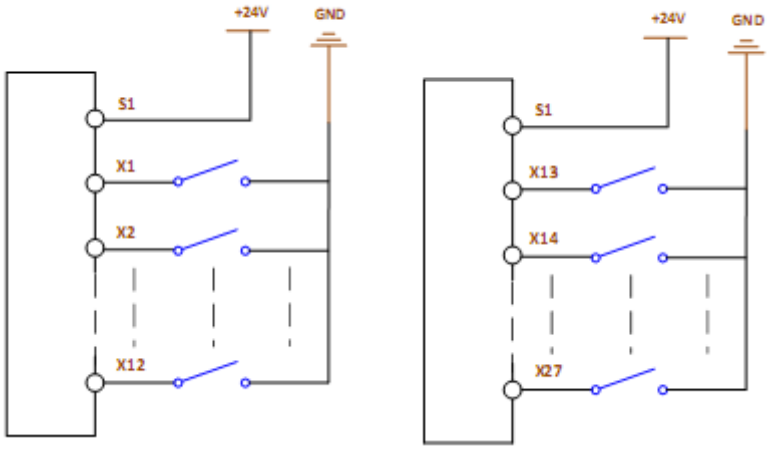


Figure 4 Common terminal connection of active general purpose input low level

In the existing control cabinet, the input common terminal S1 is connected to GND (active high level), X1-X12 is connected to 24V; the common terminal S2 is connected to 24V (active low level), and X13-X27 is connected to GND.

3.8 General purpose output

The product has 13 general purpose outputs available for use.

3.8.1 General purpose output interface definition

As shown in Figure 5 as below.

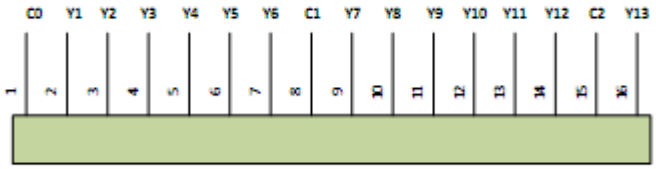


Figure 5 General purpose output interface definition

3.8.2 Use of general purpose output

Taking Y1 and C0 as examples, the functional diagram is shown in Figure 6. Other functions of general-purpose outputs are the same.

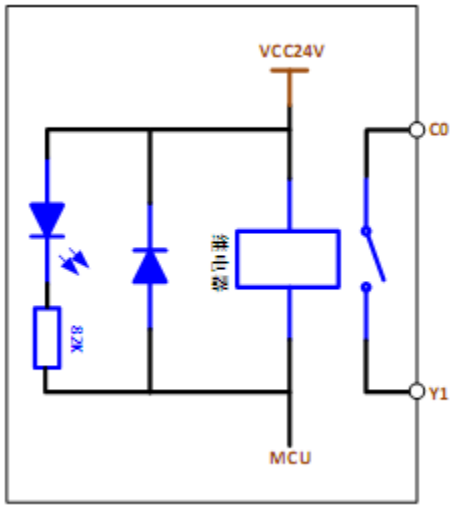


Figure 6 Functional diagram of general purpose output

In the existing control cabinet, the output common terminals C0, C1 and C2 are connected to GND as standard, so the control outputs Y1-Y13 are GND pin output.

As shown in Figure 7, C0 is the common terminal of Y1~Y6. C1 is the common terminal of Y7~Y12. C3 corresponds to Y13.

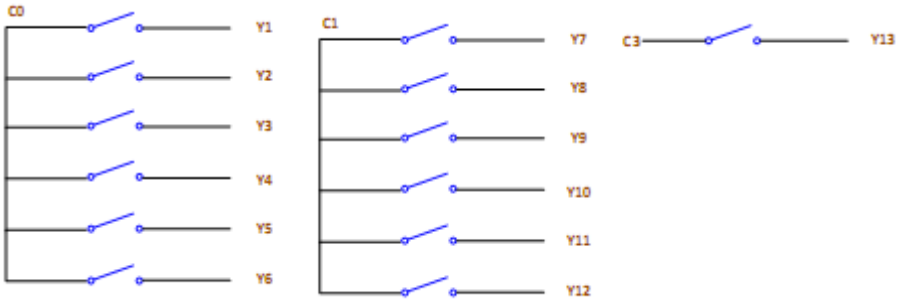


Figure 7 Connection of general purpose output common terminal

3.9 Digital quantity welder interface

3.9.1 Definition of digital quantity welder interface

The definition of digital welder interface is shown in Figure 8 and Table 9.

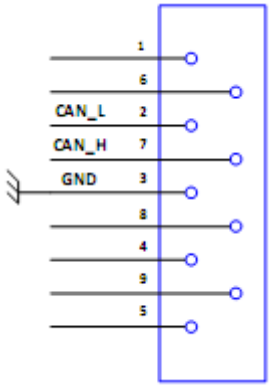


Figure 8 Definition of DB9 digital welder interface

Table 9 Definition table of DB9 digital welder interface

Pin	Name	Description
2	CAN_L	Communication line CAN_L
7	CAN_H	Communication line CAN_H
3	GND	GND

3.9.2 Use of digital quantity welder interface

The functional diagram of CAN_L and CAN_H are shown in Figure 10 as below.

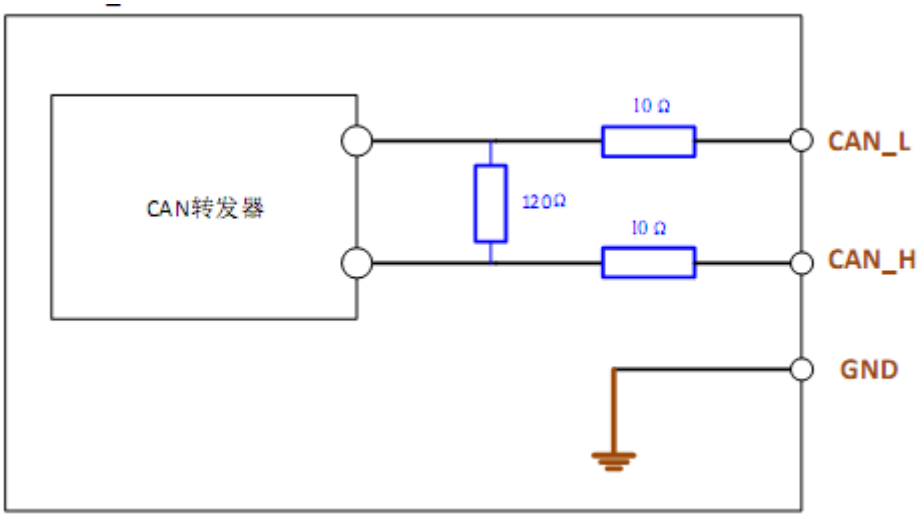


Figure 10 Functional diagram of CAN_L and CAN_H

3.10 Analog quantity welder interface

The definition of DB15 analog welder interface is shown in Figure 11 and Table 12 below, the functional definition of the analog welder interface is shown in Table 13, and DB15 communication terminal definition is shown in Table 14.

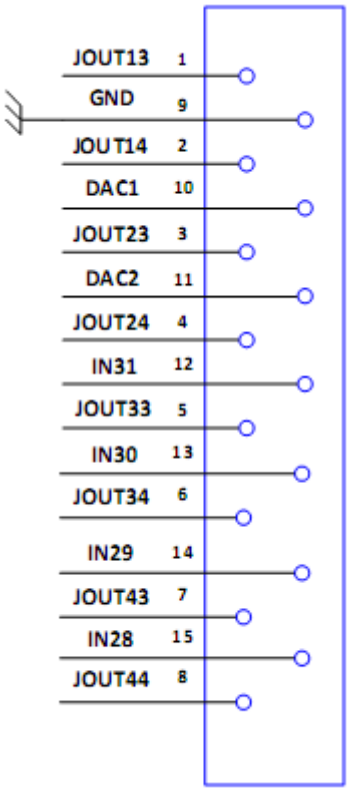


Figure 11 Definition of DB15 analog welder interface

Table 12 Definition table of DB15 analog quantity welder interface

Pin	Name	Description
10	DAC1	Analog quantity output 1
11	DAC2	Analog quantity output 2
15	IN28	General purpose input 1
14	IN29	General purpose input 2
13	IN30	General purpose input 3
12	IN31	General purpose input 4
1	JOUT13	General purpose input channel 1A terminal
2	JOUT14	General purpose input channel 1B terminal
3	JOUT23	General purpose input channel 2A terminal
4	JOUT24	General purpose input channel 2B terminal
5	JOUT33	General purpose input channel 3A terminal
6	JOUT34	General purpose input channel 3B terminal
7	JOUT43	General purpose input channel 4A terminal
8	JOUT44	General purpose input channel 4B terminal
9	GND	GND

Table 13 Function definition of analog quantity welder interface

DB15		MEGMEET welder interface	Panasonic welder interface	Definition of ECAT_IO board	Object dictionary
1	JOUT13	Reverse	Welder	AQW_C1	0x7010.13

2	JOUT14	wire feeding	suspension		
3	JOUT23	Gas detection	Gas detection	AQW_C2	0x7010.14
4	JOUT24				
5	JOUT33	Arc starting signal	Welding gun switch	AQW_C3	0x7010.15
6	JOUT34				
7	JOUT43	Jog wire feeding	Manual wire feeding	AQW_C4	0x7010.1
8	JOUT44				
9	GND	Power ground	Power ground		
10	DA1	Current demand	Current demand	dac_ch0_data	0x7011 Low 12 bit
11	DA2	Voltage reference	Voltage reference	dac_ch1_data	0x7012 Low 12 bit
12	JI4	Empty	Empty	IN31	0x6001.30
13	JI3	Empty	Empty	IN30	0x6001.29
14	JI2	Arc starting successful signal	Current detection	IN29	0x6001.28
15	JI1	Welding gun collision detection	Welding gun collision detection	IN28	0x6001.27

Table 14 DB15 Communication terminal pin definition

Pin Number	Communication cable DB 15 Color	Signal name	Function
1	Black 1	24V power supply	Positive pole of direct current power supply, supplied by the robot to the power supply of the welder.
2	Black 2	Arc starting signal	Output from the robot to the welding power supply, active low level (default).
3	Black 3	Reverse wire feeding signal	Output from the robot to the welding power supply, active low level (default).
4	Brown 1	Arc starting successful signal	Output from the robot to the welding power supply, active low level (default).
5	Brown 2	Prepare signal	Output from the robot to the welding power supply, active low level (default).
6	Brown 3	Analog signal common ground	7, 13, 14 and 15 pin analog signal common ground.

7	Orange 1	Welding current signal	Output from welding power supply to the robot, feedback actual welding current value
8	Orange 2	I/0 signal common land	1, 2, 3, 4, 9, 11 and 15 pin signal common ground.
9	Orange 3	Jog wire feeding signal	Output from the robot to the welding power supply, active low level (default).
10	Purple 1	Robot emergency stop signal	Output from the robot to the welding power supply, active low level (default).
11	Purple 2	Gas detection signal	Analog signal, output from the robot to the welding power supply with a given voltage value.
12	Purple 3	Locating signal	Robot fault emergency stop signal
13	Blue 1	Given voltage signal	Analog signal, output from the robot to the welding power supply with a given voltage value.
14	Blue 2	Given current signal	Analog signal, output from the robot to the welding power supply with a given voltage value.
15	Blue 3	Welding voltage signal	Analog signal, output from welding power supply to the robot, feedback actual welding current value

Functional diagram of analog quantity output

Figure 15 shows the functional diagram of DAC1, and the same function of DAC2. DAC1 and DAC2 are 12 bits.

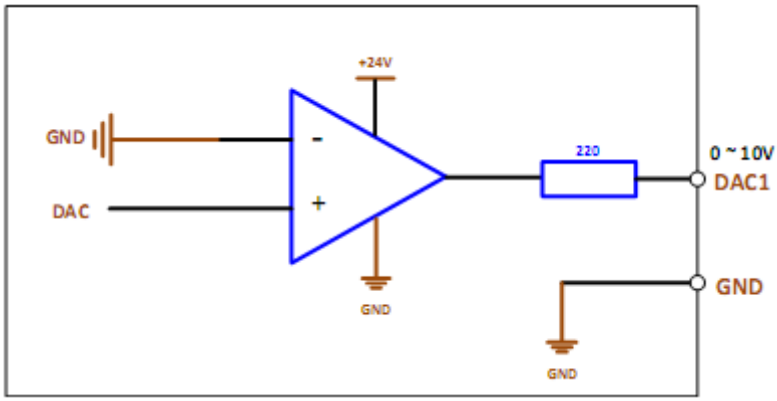


Figure 15 Functional diagram of analog quantity output

Functional diagram of the general purpose output on the analog quantity interface

Figure 16 shows the functional diagram of the general purpose outputs JOUT14 and JOU13. The same function of JOUT23 and JOUT24, JOUT33 and JOUT34, and JOUT43 and JOUT44.

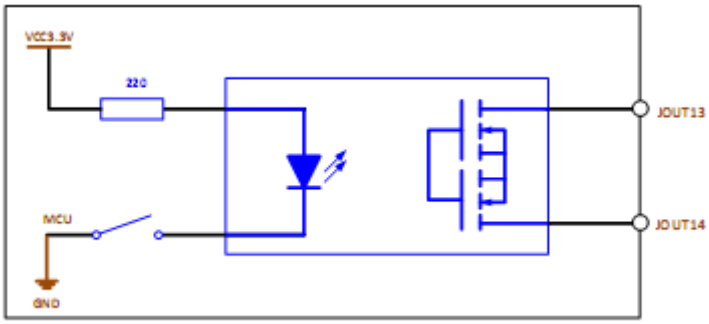


Figure 16 Functional diagram of the general purpose output on the analog quantity interface

Functional diagram of the general purpose input on the analog quantity welder interface

Figure 17 shows the functional diagram of IN28. The same function of IN29, IN30 and IN31.

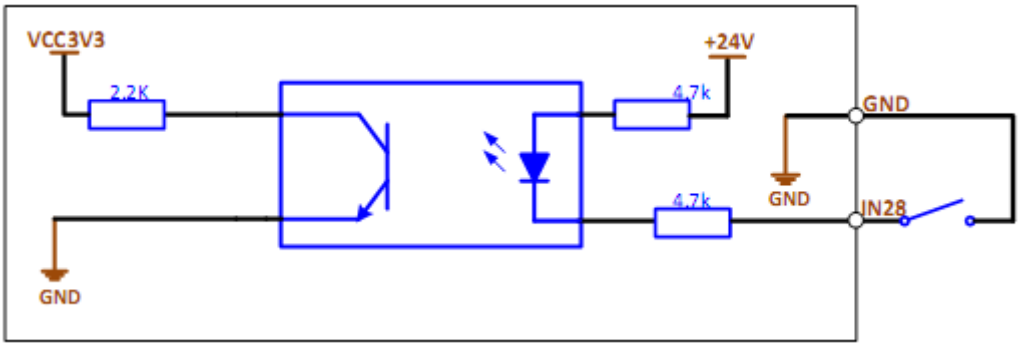
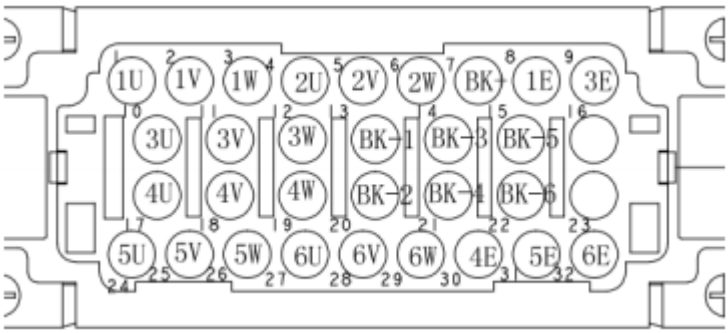
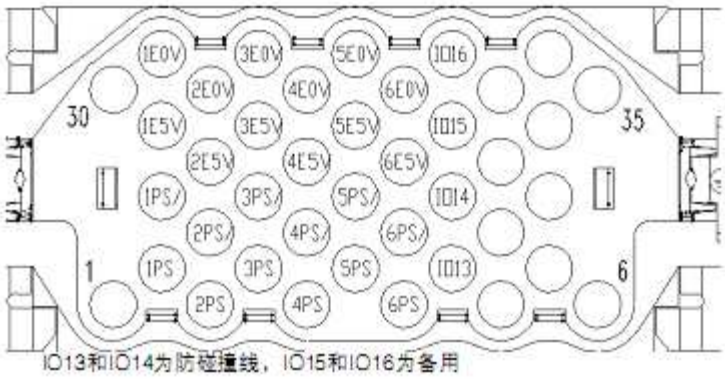


Figure 17 Functional diagram of the general purpose input on the analog quantity welder interface

3.11 Definition of interconnect plug-in

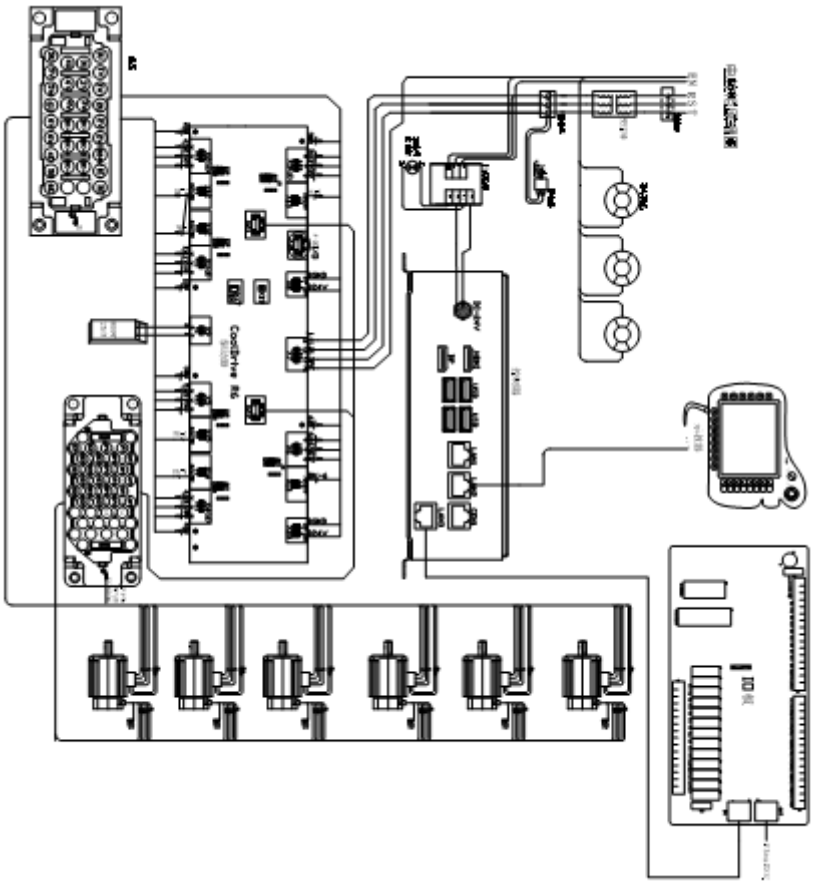


Dynamic plug-in definition



Encoding plug-in definition

3.12 Schematic diagram of electrical control cabinet



1 Safety information

Warning When a fault is detected or the abnormal indicator light occurs, the fail-safe reminders you to stop the equipment, check and troubleshoot the fault to prevent damage to the driver or equipment.

2 Explanation of the faults

When abnormal CoolDrive R series driver occurs, it will be in the form of an alarm or a fault as a warning, and the corresponding protection actions will be performed.

Alarm: The driver detects a lighter degree of abnormality. SYS STA indicator light flashes red and green alternately, and an alarm signal is sent out. The shutdown protection action is not performed.

Fault: The driver detects a sever degree of abnormality. SYS STA indicator light flashes red and a fault signal is send out. The shutdown protection action is performed.

According to the severity of the abnormality of the driver, the faults are divided into the following three types:

Nonrecoverable faults: The driver detects a very severe abnormality. Immediately stop the PWM output and perform shutdown protection action. SYS STA indicator light flashes red quickly. After the fault is eliminated, it can be cleared by restarting the driver (or soft reset through DriveStarter).

Recoverable faults 0: The driver detects a severe abnormality. Immediately stop the PWM output and perform shutdown protection action. SYS STA indicator light flashes red slowly. After the fault is eliminated, it can be cleared by sending a Reset signal.

Recoverable faults 1 and 2: The driver detects a less severe abnormality. Perform shutdown protection action, and the shutdown mode is optional. SYS STA indicator light flashes red slowly. After the fault is eliminated, it can be cleared by sending a Reset signal.

3 Faults and troubleshooting suggestions

3.1 Nonrecoverable faults

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
0	0x2250	Driver short circuit	0	1. driver output wiring short circuit 2.Driver damaged	1. Check the driver output wiring; 2. Repair or replace the driver;
1	0x2330	Electric leakage	0	Drive damaged	Repair or replace the driver;
2	0x2341	Driver UV short circuit	0	Drive damaged	Repair or replace the driver;
3	0x2342	Driver VW short circuit	0	Drive damaged	Repair or replace the driver;
4	0x2343	Driver WU short circuit	0	Drive damaged	Repair or replace the driver;
5	0x5210	Abnormal AD sampling circuit	0	Driver damaged	Repair or replace the driver;；
6	0x5530	Abnormal EEPROM	0	Parameter CRC check error;	Check the driver hardware
7	0xFF28	Stack space overflow	0	Driver firmware running error	Repair or replace the driver;；
8	0x6310	Parameters not initialized	0	Drive damaged	Repair or replace the
9	0xFF04	Abnormal encoder data	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1.Check the encoder wiring 2. Check the encoder cable 3. Replace the encoder 4. Check the encoder parameters
10	0xFF07	Rotor positioning error	0	Drive damaged	Repair or replace the driver;；
11	0xFF82	Driver internal fault	0	1. Abnormal driver hardware 2. Abnormal parameter setting	1. Replace or repair the driver； 2. Check parameter setting
12	0xFF09	Abnormal motor brake output	0	Drive damaged	Repair or replace the driver;
13	0xFF0A	Abnormal charging relay	0	1. Abnormal driver hardware	1. Replace or repair the driver；
14	0x7111	Energy brake wiring error	0	1. Incorrect brake resistor wiring 2. Abnormal driver hardware	1.Check the brake resistor wiring 2. Replace or repair the driver
15	0xFF11	Abnormal AD correction factor	0	1. AD correction factor setting error	1. Reset the AD correction factor
16	0xFF12	Programmable device firmware matching error	0	Drive damaged	Repair or replace the driver
17	0xFF13	Matching error between control board parameters and power board	0	Drive damaged	Repair or replace the driver

18	0xFF1A	Motor wiring phase sequence error	0	Drive damaged	Repair or replace the driver
19	0xFF00	System initialization failure	0	Drive damaged	Repair or replace the driver
20	0xFF2B	Abnormal internal communication of encoder	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1.Check the encoder wiring 2. Check the encoder cable 3. Replace the encoder 4. Check the encoder parameters
21	0xFF05	Encoder internal fault	0	1. Encoder wiring error; 2. Encoder cable damaged;	1.Check the encoder wiring 2. Check the encoder cable

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
				3. Encoder damaged; 4.Encoder parameter setting error	3. Replace the encoder 4. Check the encoder parameters
22	0xFF06	Encoder type change	0	Encoder type changed	Restart the driver or soft reset

3.2 Recoverable faults 0

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
0	0x2310	Driver overcurrent U	0	1. Driver U-phase output short circuit 2. Overload; 3. Cable insulation damaged; 4.Poor motor insulation 5. Driver U-phase overcurrent detection circuit fault	1. Check the U-phase wiring; 2. Reduce load; 3.Check the U-phase, cable, replace if necessary; 4. Measure the insulation of the motor and repair and replace if necessary; 5 Repair or replace the driver;
1	0x2311	Drive overcurrent V	0	1. Driver U-phase output short circuit 2. Overload; 3. Cable insulation damaged; 4.Poor motor insulation 5. Driver U-phase overcurrent detection circuit fault	1. Check the V-phase wiring; 2. Reduce load; 3.Check the V-phase, cable, replace if necessary; 4. Measure the insulation of the motor and repair and replace if necessary; 5 Repair or replace the driver;

索引	故障代码	描述	类型	故障原因	处理建议
2	0x2312	Drive overcurrent W	0	1. Driver U-phase output short circuit 2. Overload; 3. Cable insulation damaged; 4.Poor motor insulation 5. Driver U-phase overcurrent detection circuit fault	1. Check the W-phase wiring; 2. Reduce load; 3.Check the W-phase, cable, replace if necessary; 4. Measure the insulation of the motor and repair and replace if necessary; 5 Repair or replace the driver;
3	0x3210	Direct current bus overvoltage	0	1. Insufficient brake circuit capacity 2. Insufficient braking resistor capacity 3. Basic power module fault	1. Reduce the start-stop frequency; increase the acceleration/deceleration time constant reduce the load inertia; increase the driver and motor capacity 2. Increase the braking resistor power; 3. Repair or replace the basic power module
4	0x5112	24V Control power supply undervoltage	0	24V Control power supply undervoltage	Check control power supply voltage
5	0x6010	Watchdog overflow	0	1. Internal stack overflow;	1. Power on again; 2. Repair or replace the driver;

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
6	0xFF02	Continuous overload of driver	0	1.Mechanical fault; 2.Motor overload; 3.Motor fault; 4.Driver fault	1. Check the mechanical drive part to improve the mechanical drive performance; 2. Check the motor load or increase the capacity of the motor drive module; 3.Check the encoder or encoder cable; 4. Repair or replace the motor; 5. Repair or replace the driver
7	0xFF03	Encoder wiring error	0	1.Encoder wring error; 2.Encoder cable damaged; 3. Encoder damaged;	1. Check the encoder wring; 2. Check the encoder cable; 3. Replace the encoder

8	0xFF29	CPU overload	0	1. Control orders exceeding CPU load capacity 2.Driver damaged	1. Reduce the operating frequency of control orders 2. Replace or repair the driver
9	0xFF15	Motor power line disconnected	0	1. Motor power line disconnected 2.Motor damaged 3. Motor damaged	1.Check the motor wiring; 2. Replace or repair the motor 3. Replace or repair the driver
10	0xFF80	Encoder operation abnormality	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1. Check the motor wiring; 2. Check the encoder cable; 3.Replace the encoder 4.Check the encoder parameters
11	0xFF25	Instantaneous overload of driver	0	1.Output side short circuit 2. Malfunction due to interference; 3. Unreasonable control parameters 4. Driver damaged	1. Check the cable wiring on output side. 2. Reliable grounding of wiring; 3. Readjust the control parameters; 4. Repair or replace the driver
12	0xFF2C	Abnormal encoder external communication sending	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1. Check the motor wiring; 2. Check the encoder cable; 3.Replace the encoder 4.Check the encoder parameters
13	0xFF2F	Abnormal encoder external communication reception	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1. Check the motor wiring; 2. Check the encoder cable; 3.Replace the encoder 4.Check the encoder parameters
14	0x2320	Driver hardware overcurrent	0	1. Encoder wiring error; 2. Encoder cable damaged; 3. Encoder damaged; 4.Encoder parameter setting error	1. Check the motor wiring; 2. Check the encoder cable; 3.Replace the encoder 4.Check the encoder parameters

3.3 Recoverable faults 1

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
0	0x3130	Input phase failure	1	1. Input phase lost 2. Driver input phase failure detection circuit damaged;	1. Check the power circuit, the phase voltage of the main circuit under power on state too high or a single-phase power supply used 2. Repair or replace the
1	0x3220	DC bus undervoltage	1	1. Power supply circuit input voltage too low 2.Poor direct current busbar insulation; 3.Overload 4.Poor insulation of driver cable 5.Driver damaged	1.Check the power circuit; 2. Check direct current bus insulation 3. Reduce load; 4. Check the driver cable; 5. Repair or replace the driver
2	0x4210	Inverter power module overheating	1	1. poor heat dissipation of the driver 2. ambient temperature overheating 3. Inverter overload 4. Poor insulation of driver output cable 5. Driver damaged	1. Check the heat dissipation system of the driver, confirm that the heat emission hole is smooth, and the cooling fan is running normally, or add the external heat dissipation measures; 2. Keep the ambient temperature normal. 3. Replace with inverters of larger capacity 4. Check the output cable, Replace if necessary. 5. Repair or replace the driver
3	0x4220	Inverter power module undercooling	1	Driver damaged	Repair or replace the driver
4	0x7112	Energy consumption brake overload	1	1.Insufficient brake circuit capacity; 2. Driver damaged	1. Reduce the start and stop frequency; increase the increase / deceleration time constant; reduce the load inertia; increase the driver and motor capacity; 2. Repair or replace the driver

5	0x8311	Continuous overload of motor	1	1.Motor mechanically stuck; 2.Too long running time of exceeding the rated torque of the motor 3. Motor unstable and oscillating; 4.Motor input phase failure	1. Check the mechanical drive part to see if there is any locked-rotor; 2. Check load, reduce the accelerated and decelerated speeds, or replace with driver and motor of larger capacity 4. Check the motor power cable and wiring;
6	0xFF19	Energy consumption braking resistor overheating	1	1.Ambient temperature too high; 2. Start and stop frequently	1.Add the external heat dissipation measures 2. Extend the accelerated and decelerated times;

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
				3. Insufficient brake resistor capacity	3. Replace with brake resistors of higher power;
7	0xFF1C	Rectified power module overheating	1	1. Poor heat dissipation of the driver 2. Ambient temperature too high 3. Driver damaged;	1. Check the heat dissipation system of the driver, confirm that the heat emission holes are smooth, and the cooling fan is running normally; 2. Keep the ambient temperature normal; 3. Repair or replace the driver;
8	0xFF20	Motor U phase instantaneous overload	1	1. The rotor compensation angle is set incorrectly 2. The motor accelerated speed is too high; 3 Control parameters not set properly; 4 Motor fault; 5 Driver damaged;	1. The rotor compensation angle is set and retested if necessary.. 2. Appropriately reduce the motor accelerated and decelerated speeds; ; 3. Optimize motor control parameters 4. Repair or replace the motor 5. Repair or replace the driver

9	0xFF21	Motor V phase instantaneous overload	1	1. The rotor compensation angle is set incorrectly 2. The motor accelerated speed is too high; 3 Control parameters not set properly; 4 Motor fault; 5 Driver damaged;	1. The rotor compensation angle is set and retested if necessary.. 2. Appropriately reduce the motor accelerated and decelerated speeds; ; 3. Optimize motor control parameters 4. Repair or replace the motor 5. Repair or replace the driver
10	0xFF22	Motor W phase instantaneous overload	1	1. The rotor compensation angle is set incorrectly 2. The motor accelerated speed is too high; 3 Control parameters not set properly; 4 Motor fault; 5 Driver damaged;	1. The rotor compensation angle is set and retested if necessary.. 2. Appropriately reduce the motor accelerated and decelerated speeds; ; 3. Optimize motor control parameters 4. Repair or replace the motor 5. Repair or replace the driver
11	0xFF1D	Hardware STO1 trigger	1	External emergency stop	Find peripheral faults;
12	0xFF27	Hardware STO2 trigger	1	External emergency stop	Find peripheral faults;
13	0xFF08	Abnormal STO wiring	1	.STO wiring error	Check STO wiring
14	0xFF81	External fault of drive	1	Other axis faults other than the current axis	Check other axes to identify and troubleshoot.

3.4 Recoverable faults 2

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
0	0x6320	Abnormal parameter data	2	1. Parameter range out of limits; 2. Incorrect location unit setting	1. Check whether the parameter setting exceeds the set parameter range; 2. Check the location unit settings;
1	0x8611	Position following error too large	2	1. Incorrect encoder wiring or the poor contact of the connector 2. Unsuitable control parameters 3. External load fluctuations or excessive interference;	1. Check the encoder wiring; 2. Re-adjust the control parameters; 3. Add anti-interference measures;
2	0x8800	Location control overflow	2	feedback position or position order exceeds the 32-bit signed number;	Soft reset or restart the driver after the encoder is reset
3	0xFF18	Speed following error too large	2	1. Incorrect encoder wiring or the poor contact of the connector 2. Unsuitable control parameters 3. External load fluctuations or excessive interference;	1. Check the encoder wiring; 2. Re-adjust the control parameters; 3. Add anti-interference measures;
4	0xFF1B	Control cycle parameter setting error	2	EtherCAT communication cycle is shorter than servo control cycle	Adjust the EtherCAT communication cycle or servo control cycle so that the communication cycle is longer than the servo control cycle
5	0xFF0D	EtherCAT process data error	2	Driver damaged	Repair or replace the driver
6	0xFF1E	Write EEPROM failed	2	Driver damaged	Repair or replace the driver
7	*0xFF0F*	Illegal order of original point searching process	2	Driver damaged	Repair or replace the driver
				1.	1. Main station malfunction, and reset fault

8	0xFF0E	Illegal EtherCAT bus order	2	Under the premise that the servo is enabled and the EtherCAT master obtains control, if the EtherCAT communication state is not in the OP state;	;
9	0xFF10	Abnormal DriveStarter communication	2	1. The serial communication line is interfered;; 2. The serial communication line is not reliably grounded or with poor contact.	1. Check whether R485 cable is connected properly. 2. Check whether RS485 converter is damaged.
10	0xFF0C	Abnormal EtherCAT bus communication	2	1. EtherCAT cable disconnected;; 2. The Ethernet frame loss exceeds the setting value of parameter "EtherCAT communication timeout detection setting"	1. Check the bus wiring; 2. Check whether the cable connector is crimped correctly.

Index	Fault code	Description	Type	Fault cause	Treatment suggestion
11	0x8612	Location hardware over limit	2	1. The external position limit switch of the driver is triggered;	1.Check the location order planning range ;
12	0xFF16	Positive soft limit	2	1. The position feedback value exceeds (positive soft limit value + positioning completion threshold)	If the positive soft limit function is not required, remove the positive soft limit. 2. Check the location order planning range
13	0xFF17	Negative soft limit	2	1. The position feedback value exceeds (positive soft limit value + positioning completion threshold)	1. If the negative soft limit function is not required, remove the negative soft limit. 2. Check the location order planning range
14	0xFF23	Power-on position deviation too large	2	1. When the driver is powered on, it does not match the last power-off save position and exceeds the set threshold.	1. Check whether the mechanical position changes and reset after confirm that there is no abnormality of mechanical zero point.
15	0xFF26	Illegal change of servo parameters	2	1.The servo parameters are modified to exceed the limit value	1. Modify the parameter value within the range that the servo parameters can be modified.
16	0xFF2A	Encoder battery undervoltage fault	2	1. Encoder battery voltage too low.	1. Replace the encoder battery.
17	0xFF0B	Motor overspeed	2	1. The feedback speed exceeds the preset speed and the error exceeds the set threshold. 2. Abnormal encoder	1. Optimize motor parameters and control parameters; 2. Check the encoder settings and encoder wiring

18	0xFF2D	Voltage limit position following error too large	2	1. The motor load changes too fast and the range of variation too large. 2.Driver damaged	1. Reduce the motor load change rate; 2. Repair or replace the driver.
19	0xFF2E	Encoder overspeed fault	2	1. The feedback speed exceeds the maximum allowable speed of the encoder. 2. .The encoder parameters or motor control parameters are not set properly. 3. Abnormal encoder	1. Reduce the running speed of the motor properly. 2. Check the encoder parameters and motor control parameter settings. 3. Check the encoder and encoder wiring.

4 Alarm and treatment suggestions

Index	Alarm code	Description	Alarm cause	Treatment suggestions
0	0xFF30	EEPROM version change	The EEPROM version has been changed.	Restart the driver or soft reset.
1	0xFF31	Motor overload alarm	1. The motor load rate exceeds the set threshold. The default value is 80%. 2. The motor load is too large.	1. Mechanic check for poor lubrication or jamming.
2	0xFF32	Energy consumption brake overload alarm	1. The energy consumption brake resistor power too small.	1. Replace with larger power consumption brake resistor.
3	0xFF33	Undervoltage speed limit alarm	The motor speed is limited due to too low driver input supply voltage.	Check the input supply voltage.
4	0xFF34	Direct bus undervoltage alarm	Direct current bus voltage too low	Check the direct current bus voltage
5	0xFF35	Historical fault record abnormal alarm	1. The history fault record is abnormal. 2. Driver damaged.	1. Restart the driver or soft reset. 2. Repair or replace the driver.
6	0xFF36	Setting control	The driver control mode setting is outside the	Reset parameter

		mode un-supported	**allowable range.**	**0x6060.**
7	**0xFF37**	**Repowered -on valid parameter has been modified**	**Repowered-on valid parameter has been modified**	**Restart the driver or soft reset.**
8	**0xFF38**	**CPU overload alarm**	**Internal fault of the driver**	**Replace or repair the driver.**
9	**0xFF39**	**Encoder battery under voltage alarm**	**The encoder battery voltage is detected to be too low.**	**Replace the encoder battery.**
10	**0xFF3A**	**Internal alarm of the driver**	**The driver has not been factory tested**	**Replace the driver,.**
11	**0xFF3B**	**Mechanical origin is not calibrated.**	**Mechanical origin is not calibrated**	**Recalibrate the mechanical origin**
12	**0xFF3C**	**Driver not ready**	**Internal fault of the driver**	**Replace or repair the driver.**

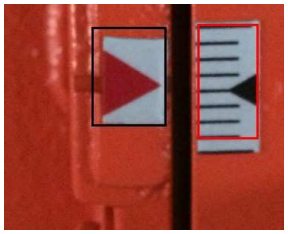
5 Description of precautions of battery replacement process

When ER986 alarm is found on the driver display panel, it indicates that the battery voltage is low. Need to check the battery voltage and replace. When replacing the battery, reset the robot firstly (to prevent zero position lost during the operation process). Please perform the battery replacement operation while keeping the driver control power on. If the battery is replaced when the driver control power is off, Please note that the data stored in the encoder will be lost.

After the zero position of the encoder lost, use the teaching system to move all the joints to recalibrate the zero scale and re-record the system zero position. (Please refer to the relevant instructions and training explanation for technical staff of the system user manual for related system zero record operation and permission usage)

6 System zero record operation setting

1. After reset the encoder or replace the battery, confirm whether the mechanical zero position is at the zero mark position. If it is not aligned, align each axis to the mechanical zero mark position firstly.



2. Click <Parameter Setting> Operation Permission in the system interface parameter setting to select the manufacturer permission and then enter the password 888999.

3. Click <Run Preparation> to select <Robot Zero Setting>. Move the cursor to each axis and click the single-axis calibration button below to record the zero pulse of the encoder or click the zero calibration to one-key record the zero position of all axes.

4. When the motor encoder needs to clear the high circle after losing the battery, press the <Alternate function key> next to the mechanism and then select the axis which needs to clear the encoder high circle by the cursor, then click the <Single-axis Clear multi-circle> button on the screen to clear the high-circle of the encoder.

5. Pay attention to performing the “Zero Calibration” operation after clearing the encoder high circle.

Chapter V Electrical maintenance and service

5.1 Precautions

During maintenance or replacing parts, the following precautions shall be observed for safe operation.

1) When replacing parts, please cut off the power once and then work again after 5 minutes. (Do not open the door of the control unit within 5 minutes after the power is cut off.). Further, do not work with wet hands.

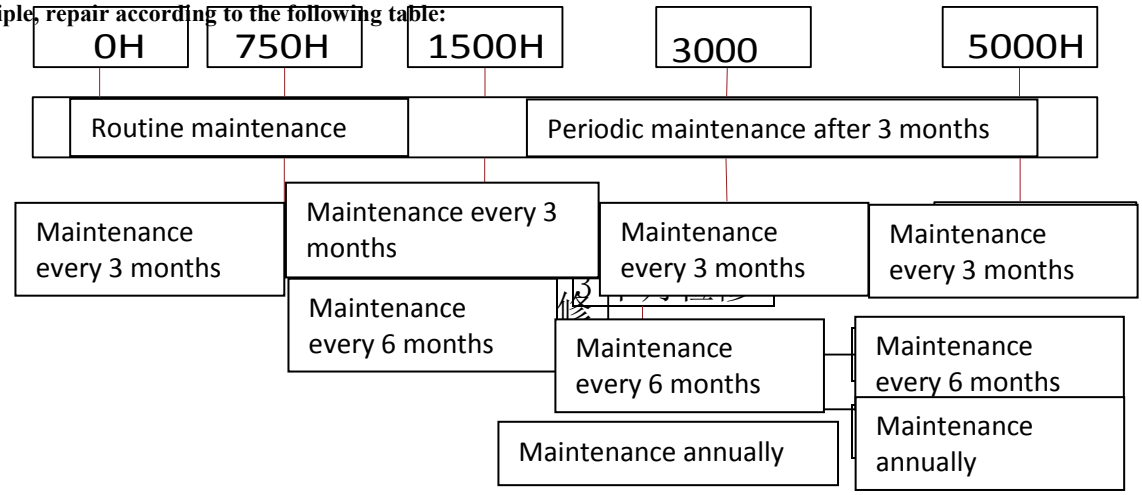
2) The replacement operation must be carried out by personnel who have received the relevant maintenance training from our company.

3) The body (hands) of the operator and the "GND terminal" of the control system must be electrically shorted and shall be operated at the same point location.

4) Do not damage the connection cable during replacement. Further, do not touch the electronic components and wiring of the printing circuit board or the **c**ontact parts of the connectors (should hold the periphery of the printed substrate by hands).

5.2 Maintenance schedule

In principle, repair according to the following table:



5.3 Precautions for periodic maintenance

1）The maintenance must be carried out by personnel who have received the relevant training of maintenance by our company.

2）Before maintenance, please confirm the parts, tools and drawings required for the work.

3）Replace parts with the designated parts by our company.

4）When carrying out the overhaul of the robot, please make sure to cut off the power before operation.

5）When opening the control cabinet door, please make sure to cut off the power supply once, and take care not to let the surrounding dust in.

6）When using hands to touching the parts inside the control cabinet, wipe off the oil before touching, and particularly, when touching parts such as printing substrate boards and connectors, take care to avoid damage to IC parts such as electrostatic discharge.

7) When performing maintenance while operating the robot, it is prohibited to enter into the range of motion.

8) Voltage measurement shall be carried out at the designated parts, and pay full attention to preventing electric shock and wiring short circuit.

9) It is forbidden to carry out maintenance work on the robot and control device at the same time.

10) After maintenance, must confirm the motion of the robot fully before entering into normal operation.

5.4 Periodic maintenance item list

	Period				Test item	Maintenance contents	Method
	Daily	3 months	6 months	1 year			
1	○	●			Fan filter	Whether there is dust	Visual inspection, cleaning, replacement
2	○		●		Cable	Whether the connector is loose, and whether the cable is damaged.	Visual inspection,
3				●	Driver unit	Whether the connection state is good, and whether there is any looseness	Visual inspection, tightening up
4	○			●	Controller	Check the cable connection for looseness	Visual inspection, tightening up
5	○		●		Special interface board	Whether the connection cable loose or working properly	Visual inspection, tightening up, replacement
6	●		●		Transformer	Whether there are abnormal heat, noise, and odor.	Visual inspection, replacement
7	○		●		Grounding wire	Check for slack and defect	Visual inspection, tightening up
8	○		●		Relay	Check for contamination and missing	Visual inspection, replacement
9	○		●		Operation switch	Failure or not?	Visual inspection,
10	○	●			24 switch power supply	Working properly or not?	Visual inspection, replacement
11	○	○	●		Voltage measurement	Voltage confirm of L1/L2/L3	AV200V±15%
12	●			●	Teaching box	Check for damage and operation panel cleaning	Visual inspection, cleaning, replacement

13	○	●			Fan inspection	Whether there are dust accumulation, fan/radiator cleaning and check fan rotation	Visual inspection, cleaning, replacement
14	○	●			Emergency stop switch detection	Check whether the emergency stop button function is normal	Visual inspection, pressing

Note: In the table, ● indicates it must be checked; ○ indicates it is recommended to inspect, but it must be dealt with promptly when the problem is found.

5.5 Maintenance before long vacation

Before preparing for the vacation, please perform the following maintenance before cutting off the power of the robot:

1) Make the robot run to the mechanical zero position for shutdown operation

2) Confirm the voltage of the encoder battery. If the voltage is too low and there is a flickering alarm on the driver, please replace the battery. If it not replaced timely, the motor encoder position data will be lost, and then the encoder reset and position correction work are required. (See the relevant contents of the troubleshooting manual for system zero position recording steps)

5.6 Description of battery replacement step

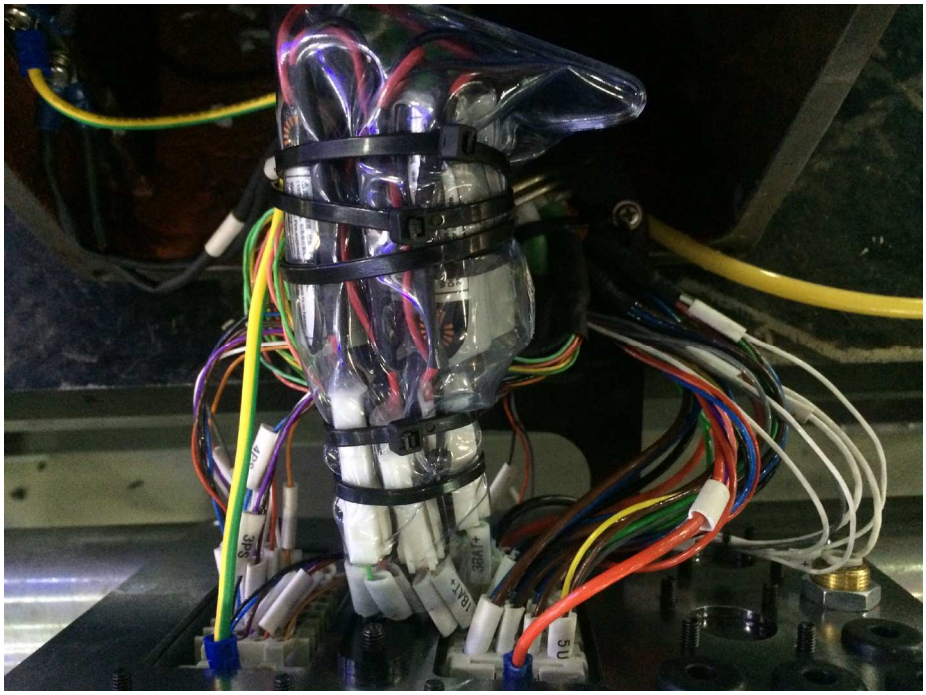
1. Preparing tools and materials: M4—M6 h socket head wrench;

Nylon cable ties and scissors;

Encoder battery with the same connector (3.6V single battery, 3.6V dual battery pack)

2. The storage position of the encoder battery

The encoder battery is stored in the robot base which is used to save the position information of the motor encoder. When the battery is low and the battery needs to be replaced, open the left side cover of the base. The battery installation position is as follows in the figure below:



3. Battery replacement operation

1) In the state of control cabinet on, the axes of the robot can return to the mechanical zero state before moving.

2) Press the emergency stop button

3) Use the socket head wrench to dismantle the plug-in cover of the robot base and pull out the cover to find the axis of the battery undervoltage.

4) Cut off the ties and remove the battery connector to take out the battery that needs to be replaced.

5) Install the new battery into the battery pack and connect to the battery head connector with the same model.

6) Bundle with the nylon cable ties to the original fixing position, plug it back into the plug-in fixing plate and re-tighten the hexagon socket to fix.

7) Shutdown and power on again. Re-check whether the code position is zero position code. If each axis does not return to the mechanical mark zero position firstly before operation, then enter into the system manufacturer permission and zero position operation to record the zero-coded position of each axis.

Thank you very much for selecting our products! Please keep the relevant manual of the system properly for review in case of need! If the equipment needs to be switched, please forward the relevant information to the other party! Buttons, functions, and options not described in the relevant manual of the system are considered to be unavailable. Please do not use!