AUCTECH

HRC-I Series Control Cabinet User Manual

V2. 0

Guangzhou Auctech Automation Technology Ltd

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In this manual, we will try to describe the relevant content. Due to space constraints, product development positioning and other reasons, it is not possible to describe in detail all the events that need not be done or cannot be done. Therefore, any event not specifically described in this specification may be considered an "impossible" or "impermissible" event.

We have proofread whether the content of the printed matter is consistent with the hardware and software content described, and inconsistencies cannot be ruled out. We regularly proofread the contents of printed matter and make necessary changes in subsequent editions.

Guangzhou Auctech Automation Technology Ltd.

Catalogue

Content

Introduction

This manual describes the model and installation dimensions of the HRC series control cabinet system, the functions of each interface, the description of shaft drive fault code and handling countermeasures, etc. It is a basic manual for users to learn and use quickly.

This document is intended for installation personnel, maintenance personnel, and maintenance personnel.

1 Safety

1.1 The safety use notice of Robot

Before installation, operation, maintenance and overhaul, please be sure to read this book and other auxiliary documents thoroughly and use this product correctly. Do not use this product until you have fully mastered the equipment knowledge, safety information, and all precautions. The following symbols are used in this specification to indicate the importance of each。

	Danger: indicates a very high risk of death or serious injury to the user if handled incorrectly
	Warning: Indicates a situation that, if handled incorrectly, could result in death or serious injury to the user
	Note: Indicates that when handled incorrectly, it may lead to minor injury or property damage to the user
	Important: Indicates other important circumstances

1.1.1 Safety precautions when operating and debugging robots

1) Operators must wear work clothes, safety hats, safety shoes, etc.

2) When the power is put in, please make sure that there are no operators in the robot's range of motion.

3) The operator can enter the action range of the robot to work after the power supply is cut off.

4) If the overhaul, repair, maintenance and other operations must be carried out in the state of power, at this time, 2 people should be carried out in

1 group. One person is in a position where they can immediately press the emergency stop button, and the other person is within the robot's range of motion, staying alert and working quickly. In addition, the evacuation path should be confirmed before the operation.

5) The load on the wrist and the mechanical arm must be controlled within the allowable weight. Failure to comply with the permitted handling weights can result in abnormal movements or premature damage to mechanical components.

6) Please read carefully the instructions in the "Safety Precautions" section of the Robot Operation Instructions.

7) Do not disassemble or operate parts not covered in the maintenance manual.

The robot is equipped with various self-diagnostic functions and abnormal detection functions, which can safely stop even if an anomaly occurs. Even so, accidents caused by robots still happen.

	Robot disasters are mainly in the following cases: automatic operation is carried out without confirming whether there is a person in the movement range of the robot; Enter the action range of the robot under automatic operation; The robot starts suddenly during operation; Only paying attention to the robot in front of you, not paying attention to other robots.

The above accidents were caused by the same reasons of "neglecting the safe operation steps" and "not thinking that the robot would suddenly move". In other words, the accidents were caused by man-made unsafe behaviors such as "momentary negligence" or "failure to follow the prescribed steps."

The "emergency situation" makes the operator too late to implement the "emergency stop", "escape" and other behaviors to avoid the accident, which is likely to lead to a major accident.

"Emergency situation" generally has the following types:

1) Slow motion suddenly changes to high speed.

2) Other operators performed the operation.

3) Different programs are started due to anomalies and program errors in peripheral devices.

4) Abnormal operation due to noise, fault, defect and other reasons.

5) Misoperation.

6) Originally intended to perform the action at low speed, but performed the high-speed action.

7) The work piece transported by the robot falls and spreads out.

8) The work piece is in the stop state of clamping and interlocking standby, and suddenly loses control.

9) The robot next to or behind performed the action.

These are just a few examples, but there are many forms of "emergencies." In most cases, it is not possible to "stop" or "escape" from a sudden robot movement, so the following best countermeasures should be implemented to avoid such accidents.

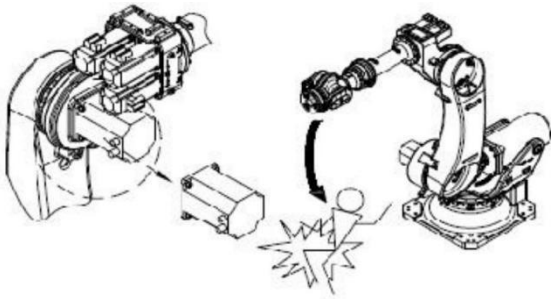
	Be careful. Do not approach the robot.
	When the robot is not in use, measures such as "press the emergency stop button" and "cut off the power supply" should be taken to make the robot unable to move.

	During the robot operation, please configure a monitoring person (a third party) who can press the emergency stop button immediately to monitor the safety status.
	During the operation of the robot, the operation should be carried out in such a way that the emergency stop button can be immediately pressed.

In order to comply with these principles, the following precautions must be fully understood and followed.

1.1.2 Security countermeasures of robot ontology

	The design of the robot should remove unnecessary protrusions or sharp parts, use materials suitable for the working environment, and adopt a fail-safe protection structure that is not prone to damage or accidents during operation. In addition, it should be equipped with a false action detection stop function and an emergency stop function when the robot is in use, as well as an interlock function to prevent the danger of the robot when the peripheral equipment is abnormal, so as to ensure safe operation.
	The main body of the robot is a multi-joint robot arm structure, and the angles of each joint are constantly changing in the movement. When you must approach the robot for teaching and other tasks, please be careful not to be caught by the joint. The action end of each joint is provided with a mechanical stop, which has a high risk of being clamped, especially in need of attention. In addition, if the motor is removed or the brake is removed, the robot arm may fall or move in an uncertain direction due to its own weight. Therefore, it is necessary to implement measures to prevent falling and confirm the safety situation around the operation.

	Remove the motor without a fixed arm. The arm may fall or move back and forth. Please fix the arm first and then remove the motor.  After inserting the zero bolt, use a wooden block or crane to secure the arm to prevent it from falling, and then remove the motor (the zero bolt and stop are used to align the original position, and can not be used to fix the machine.) In addition, do not remove the motor while the arm is supported by a human hand.
	The balance spring device is compressed inside the normal state, and the danger is very high, and disassembly or decomposition is strictly prohibited. (Only models with balancing spring device)
	When installing the attached machine on the terminal actuator and the mechanical arm, the size and number of bolts specified in this book shall be strictly observed, and the torque wrench shall be used to tighten the bolts according to the specified torque. In addition, do not use raw or stained bolts. Tightening outside the regulations and imperfect methods will loosen the bolts, leading to major accidents.
	When designing and making the terminal effecter, it should be controlled within the allowable value of the load of the robot wrist.
	It is strictly forbidden to supply power, compressed air, welding cooling water outside the specifications, which will affect the robot's action performance and cause abnormal action, failure, damage and other dangerous situations.

	Although electromagnetic wave interference is related to its type or intensity, there are no perfect countermeasures with the current technology. In the case of robot operation and power supply, the operation precautions should be observed. The recorded data may be lost due to electromagnetic waves, other noise, and substrate defects. Therefore, back up programs or constants to external storage media such as the compact flash card.
	In large systems, where multiple operators must talk at a distance, intentions should be correctly communicated through the use of gestures and other means. Factors such as noise in the environment can prevent the meaning from being correctly communicated, leading to accidents. Industrial Robot Gestures (For example) 
	Operators in the operation, should also maintain the sense of escape at any time. You must ensure that you can escape immediately in case of emergency.
	Always pay attention to the movements of the robot, and do not work with your back to the robot. Slow response to robot movements can also lead to accidents.

	When an exception is found, press the emergency stop button immediately. This provision must be thoroughly carried out.
	According to the setting place and the operation content, the relevant operation regulations and check list of the robot should be written, such as the starting method, operation method, and solution in case of abnormal occurrence. And work in accordance with the operation regulations. Operating with the memory and knowledge of the operator alone can lead to accidents due to forgetting and errors.
	When the robot does not need to move and operate, please cut off the power supply before performing the job.
	The procedure number or step number should be confirmed before teaching. Editing programs and procedures incorrectly can lead to accidents.
	For finished programs, use the storage protection function to prevent misediting.
	After the teaching operation is finished, clean the operation and make sure whether you forgot to take away the tools. The working area is polluted by oil, forgetting tools and other reasons, which will lead to accidents such as falling. Ensuring safety starts with organizing.

1.1.3 Safety countermeasures for automatic operation

	At the beginning/end of the operation, the cleaning operation should be carried out, and pay attention to sorting and rectification.
	At the beginning of the operation, the prescribed daily maintenance shall be carried out in accordance with the checklist.
	Please hang the "Do not Enter while in operation" sign at the entrance and exit of the fence. In addition, this provision must be implemented.
	At the beginning of automatic operation, it is necessary to confirm whether there is an operator in the protective fence.
	When automatic operation starts, please confirm the program number and step number. Operation mode, starting selection state in the state of automatic operation.
	When automatic operation begins, make sure that the robot is in a position to start automatic operation. In addition, make sure that the program number and step number match the current position of the robot.
	When automatic operation begins, please maintain the position that the emergency stop button can be pressed immediately
	Please master the robot's action path, action status and action sound under normal circumstances, so that you can judge whether there is an abnormal state.

1.2 Safety of test run

During the test run, there may be design errors, teaching errors and working errors in teaching program, fixture, logic controller and other elements. Therefore, safety awareness must be further enhanced during test operation.

Please note the following:

1) First, confirm the action of buttons, switches and signals used to stop the robot, such as emergency stop button and hold/run switch. In the event of a dangerous situation, if the robot cannot be stopped, it will not be able to prevent the accident.

2) When testing the robot, first set the operating speed to low speed (about 5% ~ 10%) and confirm the action. Confirm the action repeatedly for about 2-3 cycles, and if there is a problem, stop the robot immediately and correct it. After that, gradually increase the speed (50% ~ 70% ~ 100%), each with about 2 ~ 3 cycles, repeated confirmation action.

1.3 Safety operation rules

To enter the robot work area, you must press the emergency stop button of the power cabinet or teaching box and hang the work warning sign before entering.

1. It should be done before starting

1) Do not operate the teaching box with gloves;

2) The operator must be familiar with the robot's performance and operation precautions;

3) The robot operator must pass the professional training of robot operation before operation;

4) Before starting, check whether all components (electrical and mechanical) are normal, and confirm that the main cable is correctly connected to the

electrical cabinet.

5) The position and status of all switches, sensors and control signals that cause the robot to move must be known;

6) It is necessary to know the location of the emergency stop button on the robot controller and peripheral control equipment in order to stop the operation of the machine in an emergency.

7) After installing the load, ensure that all the mounting screws are installed in place before starting the robot.

2. Boot should be done

1) Open the main switch of the control cabinet and confirm whether the indicator lights of the electrical cabinet are correct;

2) Before manually operating the robot, it is necessary to confirm whether the position of each axis read by the robot is consistent with the actual position;

3) Manually operate each axis of the robot at a low speed (running at 5% speed), and confirm whether the zero point and soft limit of each axis are normal;

4) When in use, if the action is stopped by half due to power failure, the power switch on the control cabinet should be turned off immediately, and the power can be turned on and used after the power is restored;

5) In use, if the fault must be cut off for troubleshooting, it is strictly prohibited to disassemble and repair by yourself, and timely notify the debugging personnel.

3. Automatic operation should be done

1) Before automatically running the program, it is necessary to confirm that the zero position of the robot and each program point are correct, and manually run at a low speed (at 5% speed) to the end of the program in one step, and then enter the automatic mode after confirming that the operation is correct; After automatic operation at a low speed (at 5% speed), high-speed operation can be entered;

2) It is strictly prohibited to enter the high-speed automatic state directly after starting;

3) Never assume that the robot has not moved because its program has been completed, at this time the robot is most likely waiting for the input signal to keep it moving.

1.4 Robots are not allowed in the following situations

Robots are not suitable for the following situations:

1) Combustion environment.

2) An environment where explosion is possible.

3) Radio interference environment.

4) In water or other liquids.

5) Transporting people or animals.

2 Introduction to products

2.1 Product model definition

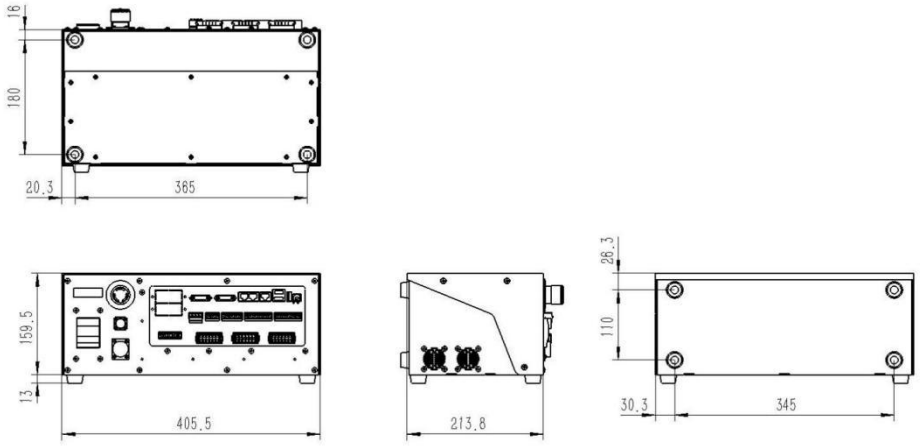
Model definition

Model description	HRC	-	I	4	-	A
Definition number	①	-	②		-	③

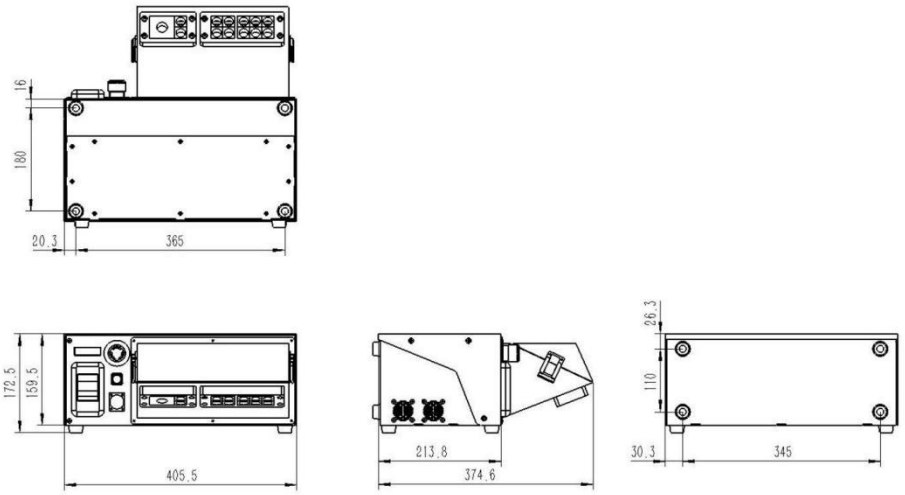
Model definition

Number	Name	Symbol	meaning
①	Enterprise product identification	HRC	AUCTECH robot standard control cabinet
②	Electrical cabinet type	C	Collaborative robot electrical cabinet C1：Power1.5KW C2：Power12.4KW C3：No power supply (external power supply, suitable for composite robots)
		I	Integrated drive control I4: 4 Axis I6：6 Axis
		S	Standard electrical cabinet S1:10 -30Kg S2：Up to 50Kg
		E	Additional axis
③	Version number	A	A-The first version；B-The second version； C-The third version…

2.2 Product dimensions and mounting dimensions



HRC-I□-A



HRC-I□-A shield

HRC-I□-A Specific model parameters

Model	Rated output current Arms						Product size mm			Mounting dimension mm				Weight KG
	1 Axis	2 Axis	3 Axis	4 Axis	5 Axis	6 Axis	Length	Wide	Height	L1	W1	L2	W2	
HRC-I4-A	16	16	10	10	-	-	405.5	213.8	159.5	365	180	345	110	12
HRC-I6-A	16	16	10	10	10	10								

2.3 Specification parameter

specification parameter

category	specification	parameter
structure parameter	size	405.5*213.8*159.5
	weight	12KG
	level of protection	IP20
work environment	storage temperature	-40~60℃
	operating temperature	-20 to 50 ° C: When the temperature is higher than 50 ° C, the derated operation is performed
	humidity	Less than 90%RH, no condensation
	air pressure	80KPa~110KPa
	elevation	Less than 1000 meters, greater than 1000 meters the derated operation is performed
	Other environmental requirements	Indoor use, no direct sunlight, no obvious dust, No corrosive, combustible gas, no oil mist, water vapor environment
External Interface	power interface	Including PE, L, N terminals, support single-phase 220VAC input
	Power line interface	4 axis, including 4 axis power and brake 6 axis, including 6 axis power and brake
	Encoder interface	4-axis, including 4-way encoder 6-axis, including 6-way encoder
	Demonstrator interface	Ethernet included, scram, 24V power connection
	Ethernet interface Extended encoder interface	1-way, MLan, master connector, 1000/100/10Mbps 2-way, Lan1, Lan2, Expansion connector, 100/10Mbps 6-way

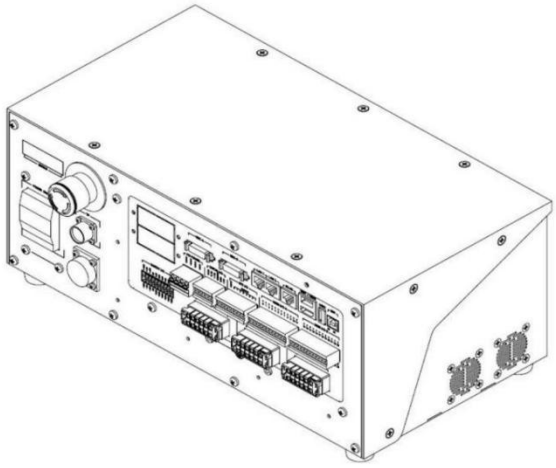
	IO interface	Analog I/O input: 2 Analog I/O output: 2 High Speed IO Input: 2 High speed I/O output: 2 Digital I/O input: 32 Digital I/O output: 32
Switch button	power switch	Circuit 1, circuit breaker, 32A overload current
	Emergency stop button	1 route, placed on the panel 1 way, placed in the panel expansion interface
status display	Nixie tube	Operation and alarm status display
Power input	Input Voltage	Single phase，220VAC±15%，50Hz±20%
	Maximum input current	30Arms
	Built-in fuse rated current	30A
dynamic braking	Over pressure braking threshold	400VDC
	Internal brake resistance	66Ω
Axis Drive	Drive quantity	Reference to type identification
	rated current	Reference to type identification
	Over current	3 times the rated motor current
Axis Brake	output voltage	24VDC±5%
	Maximum output current	1A/Axis
Axis Encoder	Support encoder types	TAMAGAWA，17 bit per cicle，2.5Mbps Panasonic，23 bit per cicle，2.5Mbps
	Voltage	5VDC
	Current	≥200mA/Axis

External Encoder	Support encoder types	TAMAGAWA，17 bit per circle，2.5Mbps Panasonic，23 bit per circle，2.5Mbps AB Phase，incremental encoder
	Power supply output	5VDC±5%，2A
IO auxiliary power output	Power supply output	24VDC，4A
	Overload protection current	4A±5%
I/O power input	Input voltage	24VDC±10%
	Input current	Depending on the load, ≥1A
Common input interface features	Input type	Optocoupler isolated input, DIn input and XCOM common end
	Input voltage	24VDC±10%
	Input current	≥10mA/channel
	time response	≤5KHz
Common output interface features	Output type	N MOSFET open-drain output, common source
	Output voltage	24VDC
	Output current	≤300mA/channel
	time response	≤5KHz
safety function	STO	supply
	SS1	supply

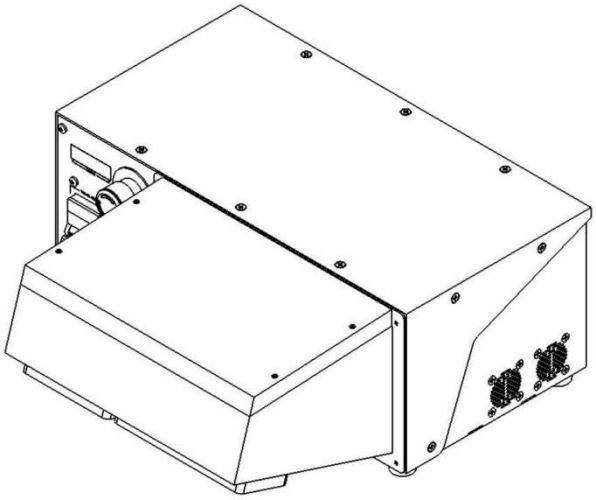
2.4 Production layout overview

HRC series drive and control integrated products, for the positive cube design. The panel integrates weak-current components required for general user operations, engineering installation workstations, and hybrid components required for production lines, including: scram buttons, demonstrator interfaces, nibbles, power interfaces, power switches, power/encoder interfaces, Ethernet, extended encoder interfaces, expansion interfaces, IO interfaces, and cooling exhausts.

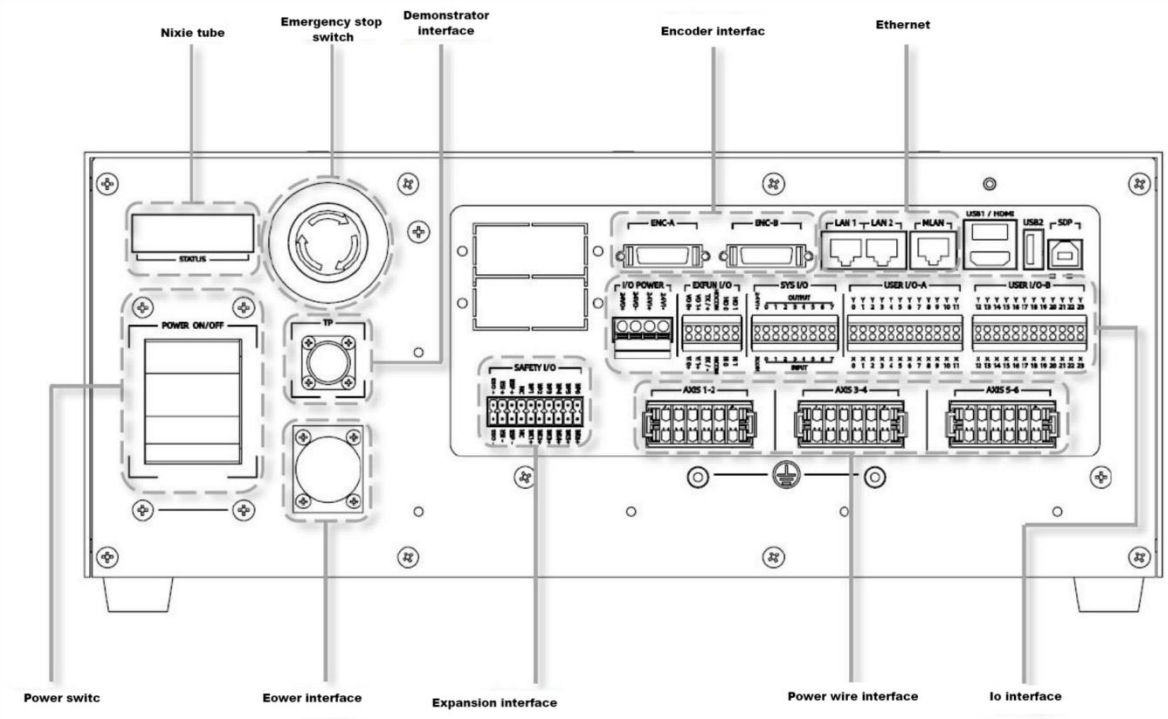
By separating the panel design, avoid the safety hazards of strong and weak current integrated in the same panel, and effectively protect the safety of operators who do not fully have electrical knowledge.



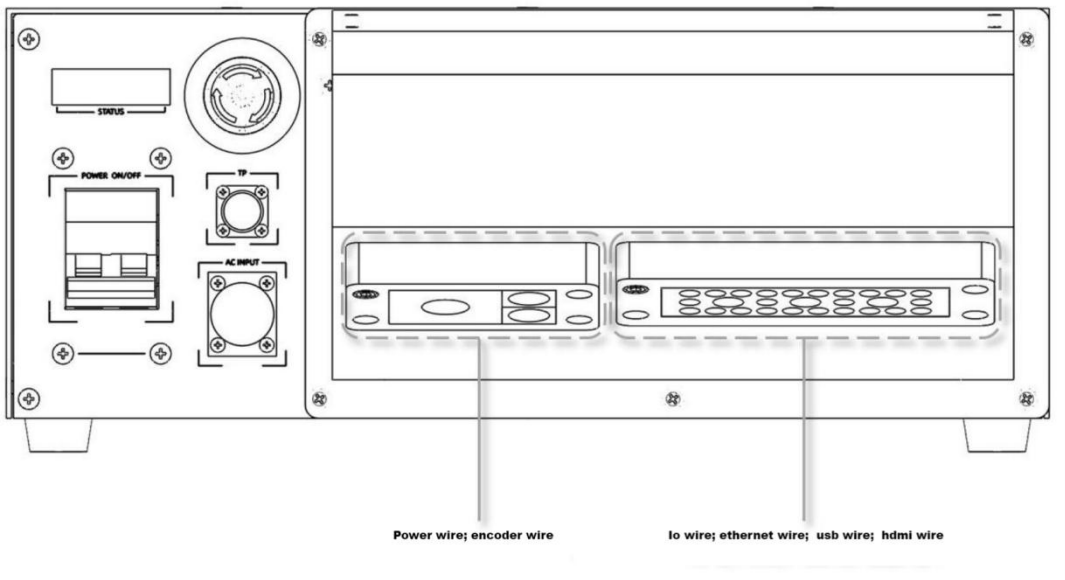
HRC-I□-A appearance



HRC-I□-A appearance with shield



HRC-I□-A



HRC-I□-A with shield

The features description of drive control integration

Features	Features	**Function**
Emergency stop button	Used to manually stop the robot immediately in an emergency.	l SS1 stops and the hardware is powered off. l Spin release, unstop, hardware power.
Demonstrator interface	It is used to connect external independent teaching device to realize robot teaching operation.	Applicable to AUCTECH robot standard teaching device.
Nixie tube	Provides operating and alarm status indication.	SysErr : indicates a system error. SerErr : indicates a server error Idle: idle. Ready : enabled. Run : in motion
Power interface	Connects to the single-phase 220V AC power supply to supply power to the system.	l Input voltage: 220VAC±15%, 50HZ±20%
Power switch	It is used to connect the power supply of the product and has the function of overcurrent protection.	l Rated overcurrent : 32A.
Power/encoder interface	It is used to connect the robot body motor to drive the robot movement.	Including 1~6 axis motor power line, brake line, absolute encoder line.
Ethernet interface	For external Ethernet device link and extension, can be used for EtherCAT device extension.	l 1000M/100M/10M adaptive. l To expand the Ether CAT device, contact our engineers for adaptation.
Extension encoder port	For connecting additional external encoders.	Supports 4 absolute encoders or 2 AB incremental encoders.

Expansion interface	Used with manual lock, external scram, scram output.	l Six DC power output, 24V±5%, ≤6A l 1 I/O power input, range : 24V±10% l 1 emergency stop port.
IO Interface	Used for signal interconnection with external IO systems such as PLCS, sensors, relays, solenoid valves, etc.	l voltage range：24V±10% l The input supports NPN or PNP signals. l Output is drain open output, 300mA/ channel.
Recumbent foot pads	Used as a support for horizontal placement of this product, and has a shock absorption effect.	When installing with screw locking, the internal screws of the foot pad should be removed and locked by fixing plate, foot pad and cabinet body. If it is necessary to remove the foot mat for fixing, ensure that the fixing plate has shock absorption and heat intake flow.

3 Product Installation

3.1 Environment Requirements

HRC drive and control integrated series products are installed with integrated circuits and high-density wiring, and the working voltage is far beyond the safety voltage of the human body, so the following requirements should be complied with when storing, installing and using this product:

- Do not place this product in an environment with corrosive, flammable gases and liquids.
- Do not use this product in an environment where the humidity exceeds 90%RH or where water droplets or condensation exist.
- Do not place this product in an environment that is flammable, explosive, or has metal dust.
- Do not place the product in direct sunlight or near high temperature heat sources.
- Avoid placing this product in an environment with obvious vibration.
- Avoid placing this product in an environment with strong electromagnetic interference or large power grid fluctuations.

If you have other special environmental needs, please contact us.

3.2 Mechanical Installation

HRC drive and control integrated series products, for installation and fixation, shall comply with the following installation requirements:

- This product has a bottom cushioned foot pad and a side cushioned foot pad.
- Horizontal and vertical placement by shock-absorbing foot pads should be placed on a flat surface to ensure smooth placement of the product.
- Horizontal locking or suspension locking is installed through the threaded holes in the underside cushioned foot pad.
- Do not install suspension locks upside down or with side shock-absorbing foot pad screw holes.
- This product does not support compression except for a cushioned foot pad surface. Multiple products are not allowed to be stacked.

- The emergency stop button of the product to avoid obstacles that block or prevent the personnel from performing the emergency stop operation quickly.
- The heat intake and outlet of this product should be avoided to avoid blockage caused by excessive dust in the space.

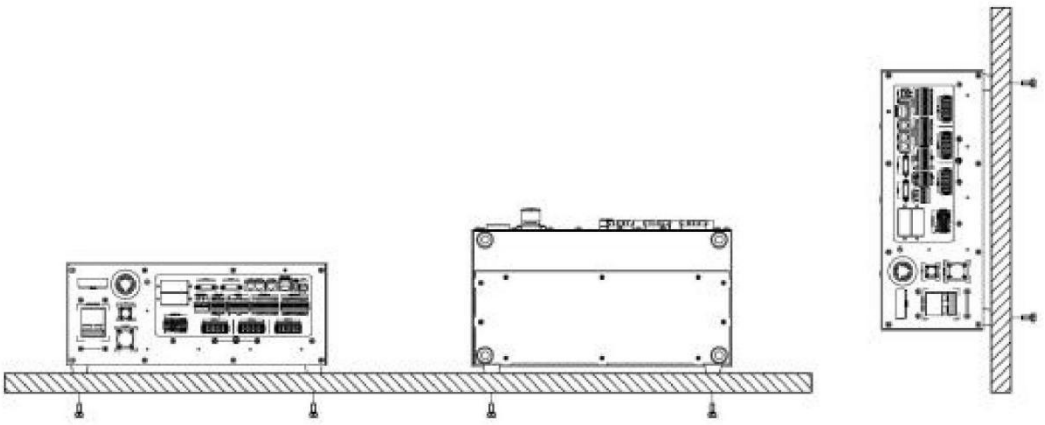
If you have other special environmental needs, please contact us.

3.2.1 Installation way

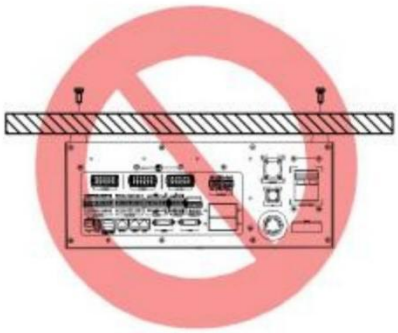
The HRC Drive and Control integrated range is equipped with shock-absorbing foot pads on supported surfaces, including: underside support foot pads, side support foot pads, which support horizontal and vertical placement through the support foot pads.

The threaded holes of the underside support the horizontal lock or suspension lock installation. Do not use the side support foot pad for horizontal suspension lock installation.

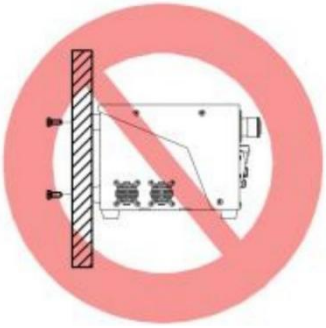
When installing with screw locking, remove the internal screws of the foot pad, place the cabinet on the fixing plate, and lock the cabinet through the fixing plate, foot pad and cabinet with M6 screws. If it is necessary to remove the foot mat for fixing, ensure that the fixing plate has the shock absorption capability and the air circulation of the heat intake port.



Horizontal installation Standing installation Independent suspension installation



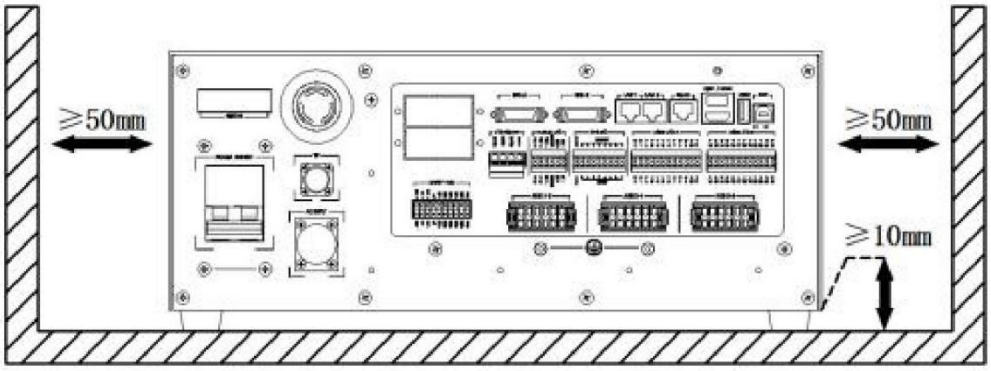
No upside down installation



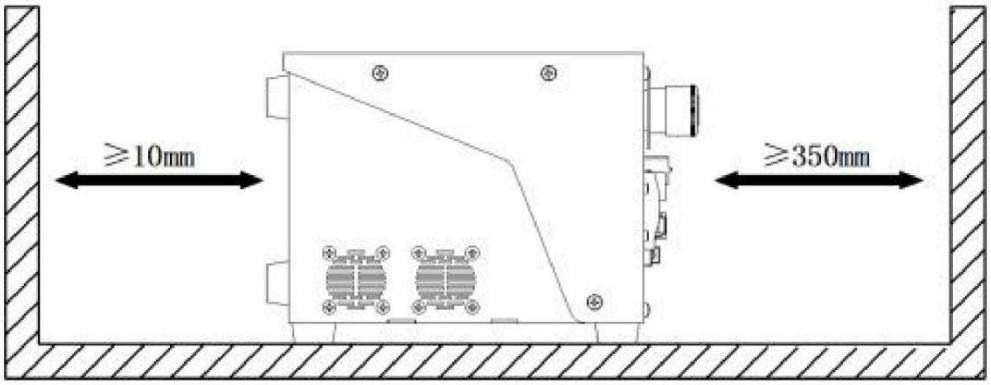
Horizontal suspension is strictly prohibited

3.2.2 Installation Spacing

In order to ensure that devices including heavy-duty connectors, power connectors, and demonstrator connectors have sufficient wiring and wiring space and maximize heat dissipation performance, a certain distance of space clearance is required around the installation of the product. The recommended minimum spacing is shown in the following figure.



Side mounting spacing



Front and rear mounting spacing

3.2.3 Procedure for connecting cables to the protective box

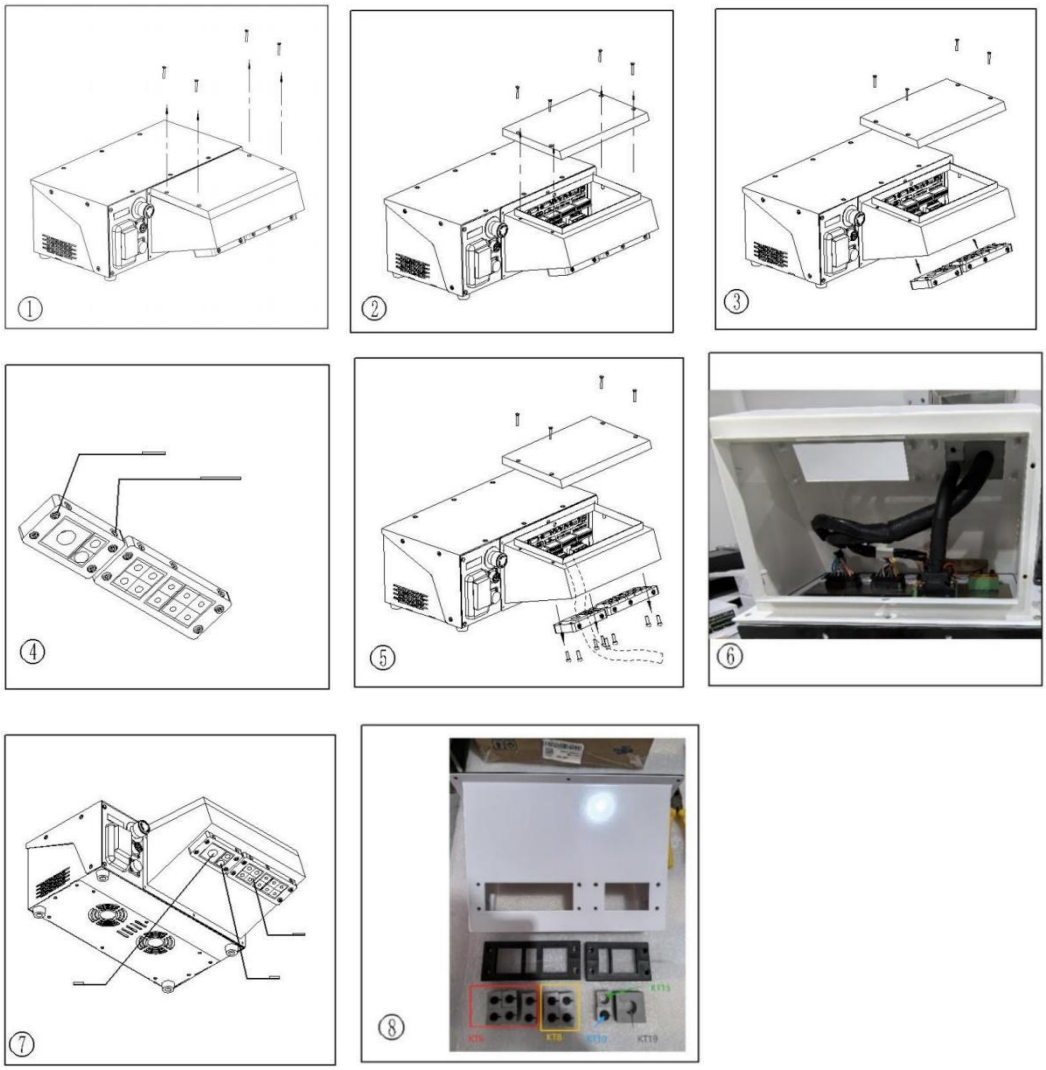
Step 1: Unscrew the top screw with a Phillips screwdriver.

Step 2: Open the top cover;

Step 3: Use the hex screw to unscrew the hex screw through the wall panel; Step 4: Use the hex to unscrew the five M5 screws above the front, and separate the top and bottom of the wall board;

Step 5: As shown in the figure, insert the power line and the code line through the KT19 and KT15 modules to the corresponding positions (FIG. 6, FIG. 7); Step 6: As shown in the figure, install the wall piercing plate back on the protective cover according to the previous disassembly path to complete the installation (Figure 8);

Step 7: The remaining holes are spare holes. Connect cables as required.



3.3 Electrical installation

HRC drive and control integrated series products, electrical installation is mainly concentrated in the connector line connection, the line is used to transmit voltage, current, signal, unreliable line connection will lead to abnormal use or damage to the product, so in the wiring, in accordance with the first chapter of the safety operating guidelines, should also comply with the following requirements:

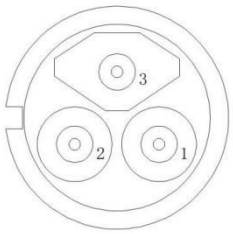
- Ensure that cables work in ambient temperature and humidity. Keep cables away from cold and heat sources, which accelerates cable aging.
- The load current determined by the selected core should be greater than the rated current carried by the core when it is working.
- Ensure that the insulation skin meets the insulation voltage level required for cables. Do not use cables whose insulation skin is broken, punctured, or aged.
- Keep weak current cables, such as communications signals and I/O signals, away from or shield strong current cables, such as motors and AC power supplies, to avoid electromagnetic radiation interference from strong current signals and affect the transmission quality of weak current signals.
- For communication signal cables and differential signal cables, use shielded twisted -pair cables dedicated for communication, and try to control the length within 30 meters.
- For IO signal cables, multiple strands of shielded cables should be used and the length should be controlled within 3 meters as far as possible.
- Do not impose external forces other than the fastening force on the connected cables and connectors, such as lateral pressure and external pulling force. External forces may cause deformation of the cables or connectors, increase the contact resistance of the terminals, or loose the contact resistance, which affects the contact performance.
- For static cable routing, avoid bending a small radius. When bending multi-strand cables, knead them properly at the bending position to release the stress inside the cables and prevent internal short circuit caused by accelerated aging of the insulation skin.

- For dynamic cable routing, use dedicated flexible cables to prevent the cable core and insulation skin from being broken during movement, which may result in disconnection or short circuit.
- Connect the protected ground PE to the local ground reliably and ensure that the resistance at both ends is less than 4 ohms.
- Do not power on the product when the cable connection is not complete, the cable test is not complete, or the cable is suspended.
- Do not operate connectors or cables during the power-on process. Do not remove or insert cables when the power is on.
- It is forbidden to connect capacitive loads on the motor power line, and ensure that the motor housing is reliably connected to the protective earth of the product.

If you have special electrical installation requirements, please contact us.

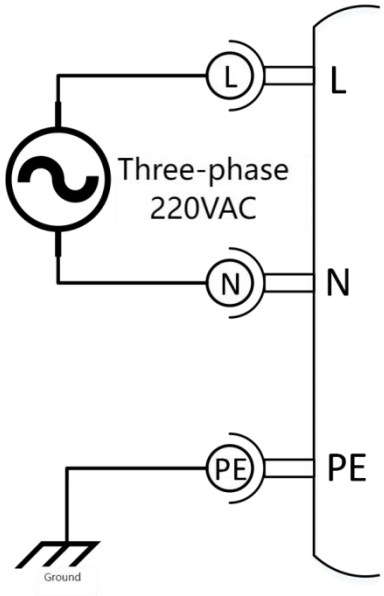
3.3.1 Power Ports

Power interface definition

 Power ports	Port	1	2	3
	Definition	L	N	PE

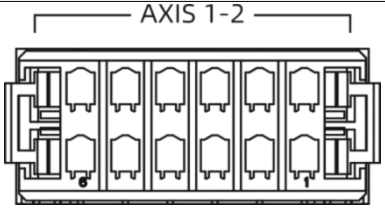
As the power supply interface of this product, it supports single-phase 220VAC power supply access, and the wiring terminals include: neutral line N, live line L, and protected ground PE.

Power interface wiring

symbol	Definition	Graph	Description
L、N	Single-phase 220VAC input		[Interface Description] It is used to connect external single-phase 220VAC as the main power input to supply power to the product. [Recommended wire] Copper core wire, core ≥2.5mm². [Wiring method] L terminal, connected to the external single-phase 220VAC fire wire; N terminal, connected to the external single-phase 220VAC neutral line.
PE	Ground input		[Interface description] It is used to connect the external earth, and the interior is connected with the chassis. [Recommended wire] Copper core wire, core ≥2.5mm². [Connection method] PE terminal, connected to the external earth.

3.3.2 Power line/encoder interface

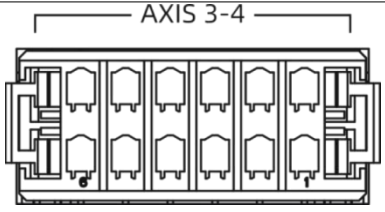
1~2 axis power line definition



AXIS1-2

Ports	B6	B5	B4	B3	B2	B1
Definition	BK+1	BK-1	PE	BK+2	BK-2	PE
Ports	A6	A5	A4	A3	A2	A1
Definition	U1	V1	W1	U2	V2	W2

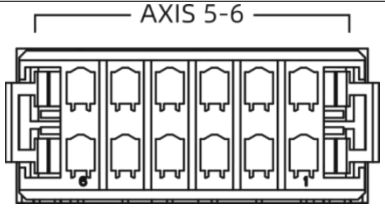
3~4 axis power line definition



AXIS3-4

Ports	B6	B5	B4	B3	B2	B1
Definition	BK+3	BK-3	PE	BK+4	BK-4	PE
Ports	A6	A5	A4	A3	A2	A1
Definition	U3	V3	W3	U4	V4	W4

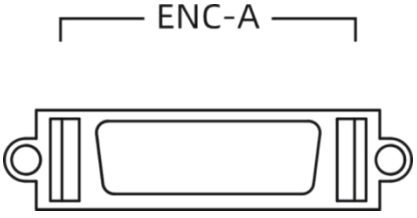
5~6 axis power line definition



AXIS5-6

Ports	B6	B5	B4	B3	B2	B1
Definition	BK+5	BK-5	PE	BK+6	BK-6	PE
Ports	A6	A5	A4	A3	A2	A1
Definition	U5	V5	W5	U6	V6	W6

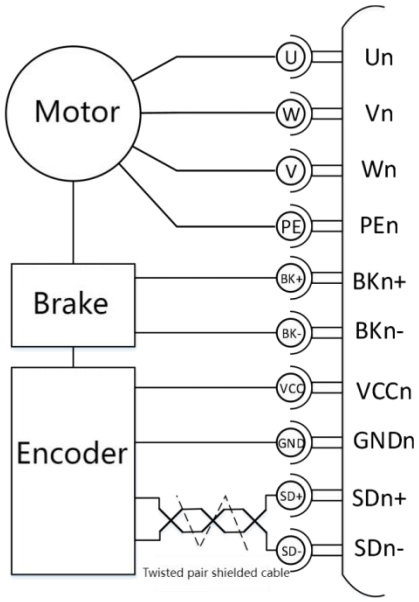
Encoder interface definition

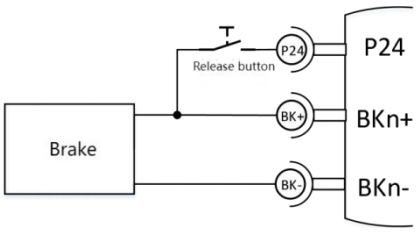


ENC-A

Definition	Pin	Definition	Pin	Definition	Pin
SD1-	11	SD3-	7	SD5-	3
SD1+	12	SD3+	8	SD5+	4
GND1	15	GND3	19	GND5	23
VCC1	14	VCC3	18	VCC5	22
SD2-	9	SD4-	5	SD6-	1
SD2+	10	SD4+	6	SD6+	2
GND2	17	GND4	21	GND6	25
VCC2	16	VCC4	20	VCC6	24

Power/encoder wiring

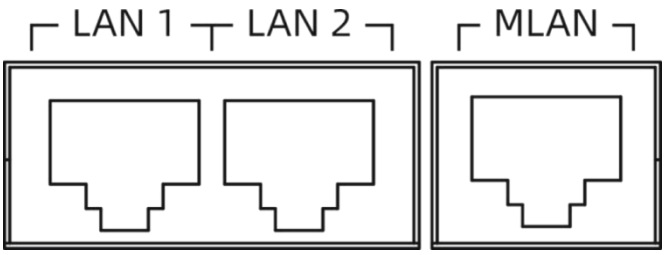
Symbol	Definition	Graph	Description
Un Vn Wn	Three-phase motor drive		[Interface description] It is used to connect the three-phase power line of the robot motor to drive the motor to rotate. [Recommended wire] Copper core wire, core ≥1.5mm². [Connection method] Un terminal, connected to the U phase of the motor; Vn terminal, connected to the motor V phase; Wn terminal, connected to the motor W phase. In particular, the UVW sequence description of different brands of motors will be different.
PEn	Ground		[Interface description] Used to connect the protective ground of the robot motor, the PEn is connected to the PE terminal of the power connector through the housing inside. [Recommended wire] Copper core wire, core ≥1.5mm². [Connection method] PEn terminal is connected to the motor housing wire.
VCCn GNDn	Encoder power supply		[Interface description] Encoder power supply for connecting robot motor. Output capacity: 5VDC, 250mA/ axis. [Recommended wire] Copper core wire, core ≥0.2mm². [Connection method] VCCn terminal, connected to the encoder power input positive terminal; GNDn terminal, connected to the encoder power input negative terminal.

SDn+ SDn-	Encoder signal		[Interface description] Differential communication line for connecting RS485 standard absolute encoder. [Recommended wire] Twisted pair shield, wire core ≥0.2mm². [Connection method] SDn+ terminal, connected to the positive terminal of the encoder differential line; SDn- terminal, connected to the encoder differential line negative terminal. In particular, different brands of absolute encoders will differ in the symbol definition of the difference line.
BKn+ BKn-	Moter Brake		[Interface description] Used to connect the robot motor lock line, control the motor lock close or release. Output capacity: 24VDC, 500mA/ axis. [Recommended wire] Copper core wire, core ≥0.3mm² [Connection method] BKn+ terminal,connected to the positive electrode of the motor lock gate ; BK- terminal, connected to the negative terminal of the motor lock gate. When the BKn+ output, the lock coil gets electricity, the lock release ; When BKn+ has no output, the lock coil loses power and the lock closes.

P24	Positive power of the brake		[InterfaceDescription] It is used to provide additional power supply for the robot body. P24 reference BK-, the output voltage is 24VDC, the maximum current 3A. [Recommended wire] Copper core wire, core ≥0.5mm² [Wiring method] Refer to the diagram. The P24 terminal, via a switch, is connected to the BKn+ of the corresponding shaft. When the switch is off, the lock is controlled by BKn+ power/power loss; When the switch is closed, the lock coil gets electricity and the lock is released.

3.3.3 Ethernet

Ethernet IP Network port address

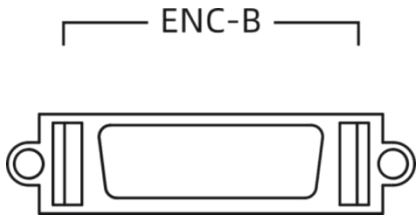
	Object	Default IP address
 Ethernet	Demonstrator connector (Drive and control integrated internal)	10.10.56.214
	MLAN	10.10.57.213
	LAN2	10.10.58.212
	LAN1	10.10.59.211

It has three isolated Ethernet, respectively identified as MLAN for Gigabit Ethernet interface, LAN1, LAN2 network ports for 100 gigabit Ethernet interface, MLAN supports 1000M/100M/10M adaptive; LAN1 and LAN2 only support 100M/10M auto-adaptation. Use a Class 5 network cable that has a good shielding layer and supports 1000 Mbit.

For detailed connection instructions, please contact our engineer.

3.3.4 External encoder interface

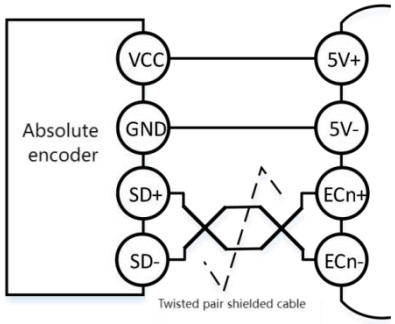
Exteral encoder interface definition

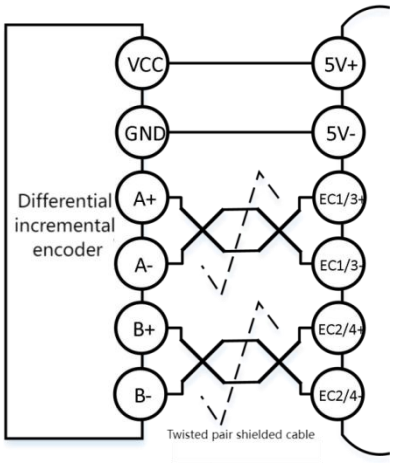
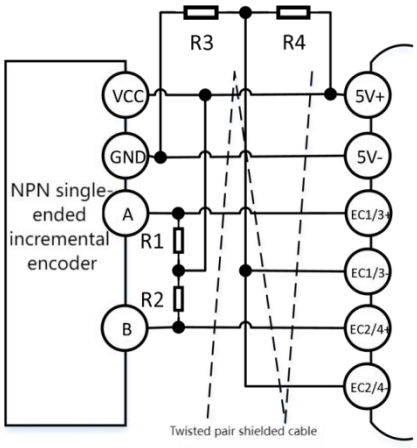
	Definition	pin	Definition	pin	Definition	pin
 ENC-B	SD7-	11	SD9-	7	SD11-	3
	SD7+	12	SD9+	8	SD11+	4
	GND7	15	GND9	19	GND11	23
	VCC7	14	VCC9	18	VCC11	22
	SD8-	9	SD10-	5	SD12-	1
	SD8+	10	SD10+	6	SD12+	2
	GND8	17	GND10	21	GND12	25
	VCC8	16	VCC10	20	VCC12	24

Extended encoder interface for connecting up to 6 absolute encoders or 3 incremental encoders. The connector comprises: 6 pairs of 5V power output and 6 pairs of differential data lines. It should be noted that the extended encoder interface can only be configured as one

encoder type at the same time, and the encoder type can be configured through the servo assistant. Please contact our engineers for specific configuration methods.

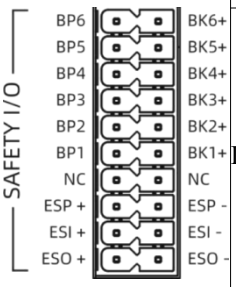
External encoder interface wiring

Symbol	Definition	Graph	Description
5V+ 5V-	5V Power output	 Absolute encoder connection	[Interface Description] Used to provide 5 V DC power for the external encoder. Power supply capacity: 5V± 5%, 250mA/ circuit. [Recommended wire] Copper core wire, core ≥0.2mm². [Connection method] 5V+ terminal, connected to the positive terminal of the power supply of the external encoder; 5V- terminal, connected to the external encoder power supply negative terminal.

ECn+ ECn-	Differential data line	 Differential incremental encoder wiring  NPN single-ended incremental encoder connection	● [Interface Description] Used to connect the differential signal line of the external encoder conforming to the standard level of RS485. ● [Recommended wire] Twisted pair shield, wire core ≥0.2mm². ● [Connection method] For absolute encoders, the ECn+ terminal is connected to the positive end of the differential line of the encoder; ECn-terminal, connected to the negative end of the encoder differential line. ● For differential incremental encoder, EC1+, EC1- terminals, connect encoder A+, A- terminals; EC2+ and EC2- terminals are connected to the encoder B+ and B- terminals. The EC3 and EC4 differential terminal pairs are connected to the A and B differential terminal pairs of the other encoder. ● l For NPN single-ended incremental encoders, connect the EC1+ and EC2+ terminals to the pulled-up 1KR/1W resistors R1 and R2 to the 5V+ terminals, and connect the encoder terminals A and B. Connect 5V+ and 5V- terminals to 510R/1W voltage dividing resistor R3 and R4 to obtain 0.5 times VCC voltage dividing point. Connect the voltage dividing point to EC1- and EC2- terminals as reference voltage. In particular, all resistors should be wired at the end of the extension encoder connector to avoid signal interference.

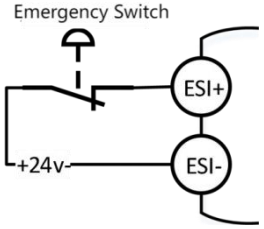
3.3.5 Expanding Interfaces

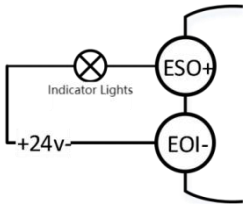
Expanding interfaces definition

 SAFETY I/O	Ports	ESO+	ESI+	ESP+	NC	BP1	BP2	BP3	BP4	BP5	BP6
	Definition	Emergency stop output+	Emergency stop input+	Emergency stop 24V+	/	Brake 24V+	Brake 24V+	Brake 24V+	Brake 24V+	Brake 24V+	Brake 24V+
	Ports	ESO-	ESI-	ESP-	NC	BK1+	BK2+	BK3+	BK4+	BK5+	BK6+
	Definition	Emergency stop output	Emergency stop input	Emergency stop 24V+-	/	1-axis brake	2-axis brake	3-axis brake	4-axis brake	5-axis brake	6-axis brake

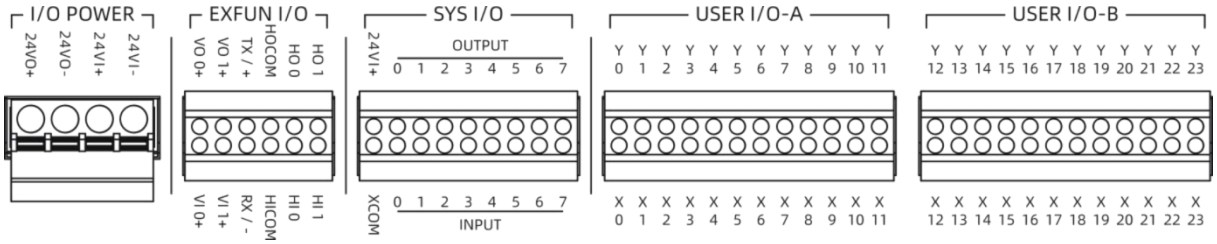
Expansion connector SAFETY I/O to provide remote SCram access and scram output and manual release gate interfaces for external systems.

Expansion port cable reference

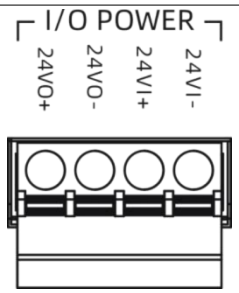
Symbol	Definition	Graph	Description
ESI+ ESI-	Remote emergency stop input		[Interface Description] Expand the emergency stop switch except the emergency stop of the electrical cabinet and the teaching device. When this port is not used, you must short-circuit ESP+ and ESI+, and ESP- and ESI- to avoid false alarms. [Recommended wire] Copper core wire, core ≥0.5mm². [Connection method] ESI+ and ESI-terminals are connected to the external SCRAM switch and 24V positive and negative ends respectively.

ESO+ ESO-	Remote emergency stop output		[Interface Description] When the emergency stop is pressed, ESO- and ESO+ are disconnected. [Recommended wire] Copper core wire, core ≥0.5mm². [Connection method] ESO+ and ESO- terminals are connected to the indicator and 24V positive and negative ends respectively.

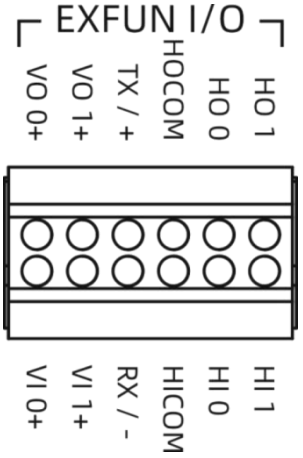
3.3.6 IO Interface



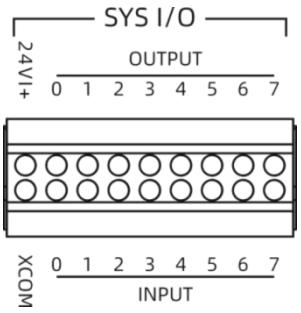
24V Input and output ports definition

 I/O POWER	Ports	24VO+	24VO-	24VI+	24VI-
	Definition	24V+ output	24V- output	24V+ input	24V- input

Analog I/O /232 interface/High-speed I/O port definition

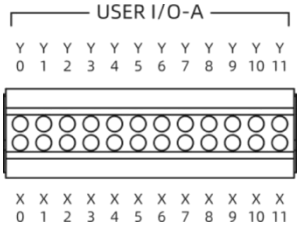
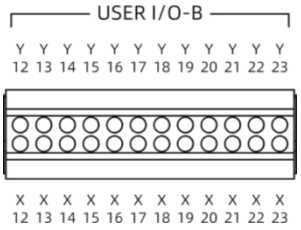
 EXFUN I/O	Ports	VO 0+	VO 1+	TX/ +	HOCOM	HO 0	HO 1
	Definition	Analog output channel 0 0-10V	Analog output channel 1 0-10V	RS232 TX	High speed output IO COM 24V+	High speed output IO 0 (0-24 V)	High speed output IO 1 (0-24 V)
	Port	VO 0-	VO 1-	TX/ -	HICOM	HI 0	HI 1
	Definition	Analog input channel 0 0-10V	Analog input channel 1 0-10V	RS232 RX	High speed input IO COM 24V+	High speed input IO (0-24 V)	High speed input IO 1 (0-24 V)

System I/O port definition

 SYS I/O	Ports	24V I+	OUTPUT 0 、 1.....6 、 7
	Definition	24V+input	System specific digital IO
	Ports	XCOM	INPUT 0 、 1.....6 、 7
	Definition	Input COM	System specific digital IO

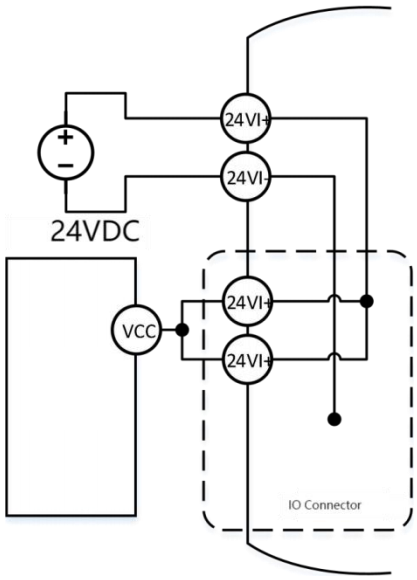
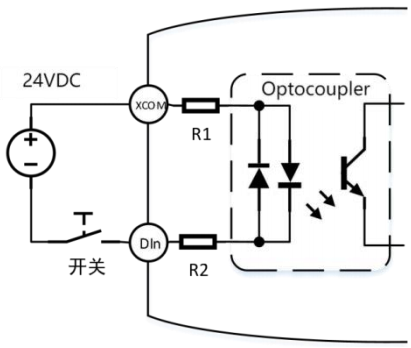
**** Note: When the port is not used by the system, DI0 and DO0 on the system start with port 0. For example, OUTPUT0 is DO0, and Y0 and X0 are DO8 and DI8.***

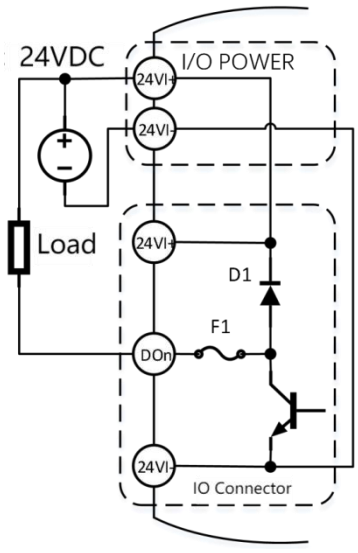
Digital I/O port definition

 USER I/O-A	Ports	OUTPUT Y0 、 Y 1.....Y 10 、 Y 11
	Definition	Digital output IO
	Ports	INPUT X0 、 X 1.....X 10 、 X 11
	Definition	Digital input IO
 USER I/O-B	Ports	OUTPUT Y 12 、 Y 13.....Y22 、 Y23
	Definition	Digital output IO
	Ports	INPUT X 12 、 X 13.....X22 、 X23
	Definition	Digital input IO

**** Note: 0510 terminals are used***

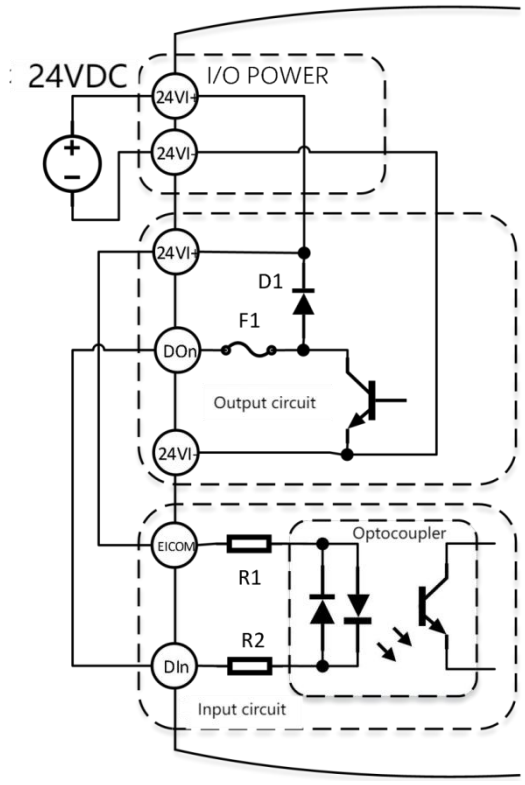
General I/O port cable

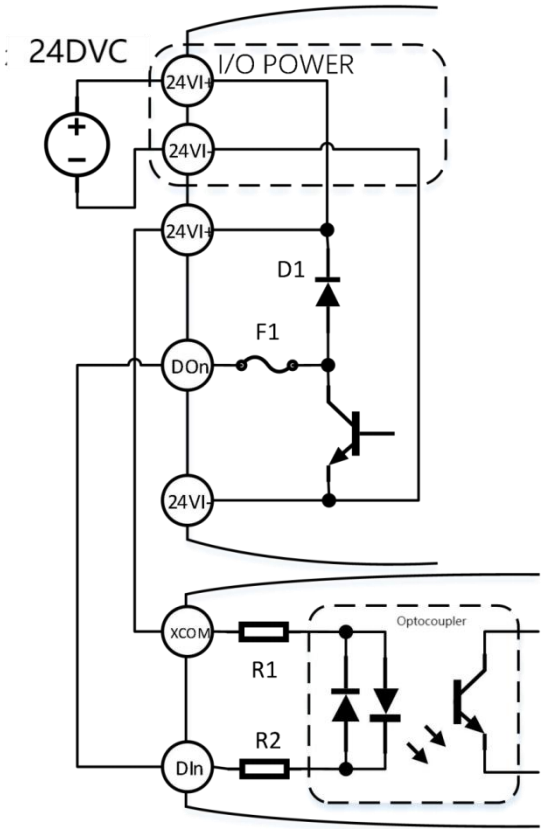
Symbol	Definition	Graph	Description
24VI+ 24VI-	IO Power input		[Interface Description] The terminal is internally connected to the 24V I+ of the SYS I/O terminal. It is used to supply power to external low-power components. The power supply current of each group of terminals is 2A. [Recommended wire] Copper core wire, core ≥0.5mm². [Wiring method] 24V DC POWER supply positive and negative terminals, connect the I/O POWER 24VI+, 24VI- terminals; The 24VI+ terminal of the ISYS I/O connector connects to the positive power input terminal of the external component.
DIn（Y） XCOM	Digital input		[InterfaceDescription]DI1 toDI32 is the optocoupler input end, EICOM1 is the public end of the optocoupler input DI1 to DI8, and EICOM2 is the public end of the optocoupler input DI9 toDI32. WhenDIn or corresponding XCOM is suspended, the input is an invalid signal; When a 24V DC power supply is connected between DIn and XCOM, the input is a valid signal.

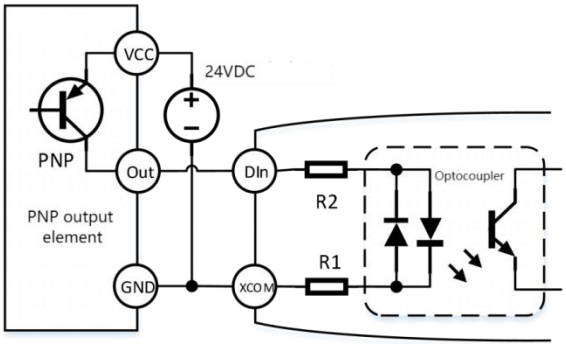
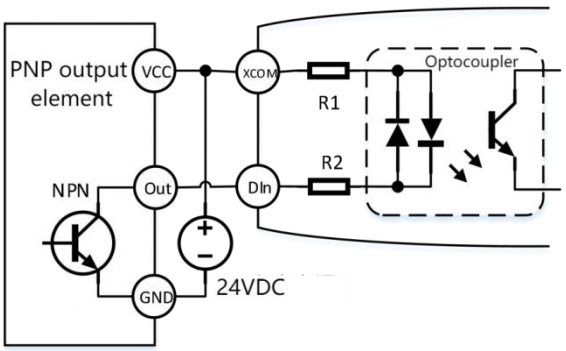
			[Recommended wire] Copper core wire, core ≥0.3mm². [Connection method] 24V DC power supply positive terminal, connect XCOM terminal; 24V DC power supply negative, through a switch, connected to the DIn terminal; When the switch is turned off, DIn is suspended and the input is an invalid signal; When the switch is closed, the DIn connects the negative 24V DC power supply and the input is a valid signal. The types of the switch include: buttons, relay contacts, transistors, etc.
DOn（X）	Digital output		[Interface description] The DOn terminal is connected to the transistor collector through a 300mA recoverable safety F1 inside to achieve an open collector output, and the transistor emitter is connected to VS-. When the output invalid signal, DOn is open state; When a valid signal is output, DOn is connected to 24VI-. [Recommended wire] Copper core wire, core ≥0.5mm². [Wiring method] 24V DC POWER supply positive and negative terminals, connect the I/O POWER 24VI+, 24VI- terminals; The 24VI+ terminal of the ISYS I/O connector connects to the positive power input terminal of the

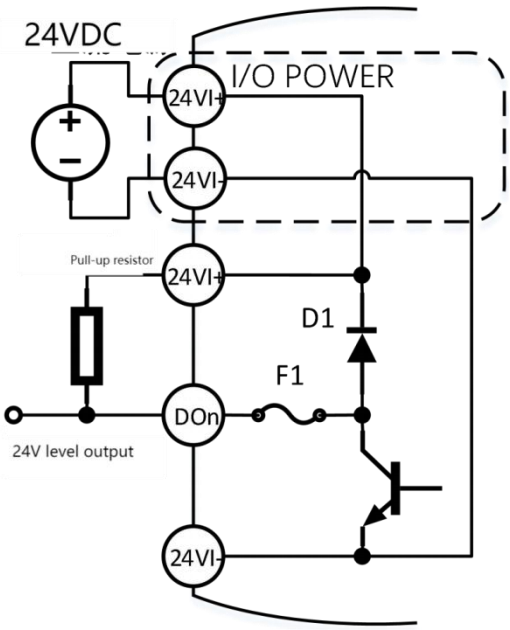
			external component; The DOn terminal is connected to the negative load terminal. When the output invalid signal, DOn open circuit, load power loss; When a valid signal is output, the DOn is connected to 24VI- and the load is powered. The type of load can include: relay coil, solenoid coil, indicator light, buzzer and other required current ≤250mA components.

Other common cable for examples

Examples	Graph	Description
I/O Interconnection of the same system		[Function Description] It is used to cooperate with the PLC program of the system to realize the interconnection and trigger of IO signals. [Recommended wire] Copper core wire, core ≥0.3mm². [Wiring method] 24V DC POWER supply positive and negative terminals, connect the I/O POWER 24VI+, 24VI- terminals; 24VI+ terminals for ISYS I/O connectors; DIn terminal, connected to the corresponding DOn terminal; XCOM terminal, connected to 24VI+ terminal. Support multi-input, multi-output collinear connection.

Independe-nt system I/O interconnec tion		[Function Description] It is used to trigger the IO interconnection of two or more independent systems, supporting the interconnection of this system, PLC and other independent systems. [Recommended wire] Copper core wire, core ≥0.3mm². [Wiring method] 24V DC POWER supply positive and negative terminals, connect the I/O POWER 24VI+, 24VI- terminals; 24VI+ terminals for ISYS I/O connectors; DIn terminal,connected to the corresponding DOnterminal ; XCOM terminal, connected to 24VI+ terminal ; Support multi-input, multi-output collinear connection.

PNP type input for example		[Function Description] It is used to obtain PNP output device signal. Note that the input port sharing EICOM can only be connected by NPN or PNP. [Recommended wire] Copper core wire, core ≥0.5mm². [Connection method] 24V DC power supply positive terminal, connected to the VCC end of PNP device; 24V DC power supply negative terminal, connect XCOM terminal and PNP device GND terminal; DIn terminals connect the signal output of PNP devices.
NPN type input for example		[Function Description] Used to obtain NPN type output device signal, note that the input port of shared XCOM can only use NPN or PNP one mode. [Recommended wire] Copper core wire, core ≥0.3mm². [Connection method] 24V DC power supply positive terminal, connect XCOM terminal and NPN device VCC terminal; 24V DC power supply negative terminal, connected to the GND terminal of NPN device; DIn terminals connect the signal of NPN devices.

Logic level output for example		[Function Description] Use DOn pull-up 4.7KR/1W resistor to achieve logic high level. Note that the VS+ and VS- terminals are separately connected internally, so all IO can only provide the same level as the connected power supply. [Recommended wire] Copper core wire, core ≥0.3mm². [Wiring method] 24V DC POWER supply positive and negative terminals, connect the I/O POWER 24VI+, 24VI- terminals; The DOn terminal is connected to the 24VI+ terminal through a pull-up resistor.

3.4 Checking and Powering on the system

Before powering on the device for the first time after installing and wiring the device, check the reliability and integrity of the installation and wiring to avoid potential hazards such as short circuit, electric leakage, and abnormal functions.

3.4.1 Check Before Power-on

1	The appearance of the product has no obvious deformation, depression, damage
2	The installation position and dimensions meet the requirements of the drawing
3	The installation is stable, and the supporting pads are close to the installation surface without shaking
4	Whether the empty area around the product meets the requirements and whether the cooling air duct is shielded
5	The wiring is stable and reliable, no loose, no exposed copper wire, no unconnected wire
6	The cables are routed smoothly without bending, right angles, tightening or squeezing
7	Avoid heat sources and sharp objects
8	There is no short circuit between power cables. Ground cables should be grounded reliably
9	There is no short circuit between the motor power lines, and it is correctly connected according to the corresponding phase sequence of the motor
10	The shielding layer of communication cables, network cables, IO cables, and encoder cables should be reliably connected to the ground and individually bundled, and should be far away from power lines, power

	lines and other strong current lines
11	The IO power supply should be the only power supply to avoid multiple 24V power supplies at the same time
12	When connected to the demonstrator, ensure that the auxiliary power supply 24V- is disconnected from PE

3.4.2 Power On

After the pre-power-on check is complete, turn on the power switch to power on the device. The power-on process is as follows:

1. Digital tube lights up;

2.Within 60 seconds, if Idle, SvErr, and SysErr are displayed on the nib, the system starts normally. If the digital tube has been showing the circle animation for a long time, the startup is abnormal;

3. The system is running normally.

4. The teaching device shows that the robot has been connected, the prompt message shows that the robot has been successfully set, and there is no alarm information, then the normal power-on and startup process is completed.

The above is the normal power-on state, if there are other states during the power-on process, including the status digital tube is not lit, the teaching device display is not connected, the teaching device display alarm information, etc., may be due to wiring errors, short circuit and other reasons, should record the phenomenon as soon as possible, timely power off, and timely contact our technical personnel.

4 Maintainence

4.1 Electrical Faults and Troubleshooting Methods

The integrated system of drive control, in abnormal circumstances, through its own fault identification system, will take the initiative to identify the fault state, and provide an analytical basis for technical personnel to troubleshoot. The following is the fault information of the drive part, and more system fault information is displayed. Please refer to the instruction for teaching device and contact our technical staff.

Drive failure and troubleshooting

Numbers	Alarm code	Reset method	Alarm message	failure cause	Deal suggestions
1	0x8000F800	Power-off reset	The Communication between the controller and the servo is interrupted	1. Communication 2. between controller and driver times out. 3. The controller process times out.	1. Check codesys engineering logic and program priority setting. 2. Check the program line of the demonstrator with alarm and contact the engineer.
2	0x8000F 100	Power-off reset	220VAC power supply is off	1. The external AC input is disconnected. 2. Switch off the electric cabinet. 3. The fuse in the electric cabinet is blown. 4. Ac input under voltage.	1. whether the external trip or power socket is tight ; 2. re-open the switch, if the trip again, check the electrical cabinet line, body line, IO line is short circuit phenomenon. 3. check the electrical cabinet line, body line, IO line is short circuit phenomenon. Replace the fuse, if blown again, replace the electrical cabinet. 4. Increase the effective external AC input voltage to 220VAC±10%.

3	0x8000F 102	Clear alarm reset	The power supply voltage is too low.	1. The DC bus voltage is lower than the 230VDC threshold. The reasons include: 2. The AC input live line and neutral line are in poor contact, or the AC input power supply is under voltage. 3. the robot overload operation, causing excessive fluctuation of the bus. 4. The cables inside the cabinet are in poor contact, the DC bus detection circuit or the DC bus bleed circuit is faulty.	1. Ensure that the AC input live wire, neutral wire and ground wire are well connected, and increase the effective AC input voltage to 220VAC±10%;reduce the robot running acceleration. 2. Check the signal cables inside the cabinet, or replace the cabinet. 2, the robot overload operation, causing excessive fluctuation of the bus. 3. The cables inside the cabinet are in poor contact, the DC bus detection circuit or the DC bus bleed circuit is faulty.
4	0x8000F 103	Clear alarm reset	The power supply voltage is too high.	1. The DC bus voltage is higher than the 420VDC alarm threshold. The reasons include: 2. Ac input live line and neutral line fall off to PE line. 3. the robot overload operation, causing excessive fluctuation of the bus. 4. The cables inside the cabinet are in poor contact, the DC bus detection circuit or the DC bus bleed circuit is faulty.	1. Ensure that the AC input live wire, neutral wire, and ground wire are well connected. 2. reduce the robot running acceleration. 3. Check the signal cables inside the cabinet, or replace the cabinet.

5	0x8000F200	Clear alarm reset	Emergency stop alarm	1. Electrical cabinet, teaching device and external emergency stop were photographed. 2. The external emergency stop cable of the control panel is not connected or loose. 3. The interface of the demonstrator is not locked. 4. The emergency circuit of the cabinet is faulty.	1. check and loosen the electrical cabinet, teaching device and external emergency stop. 2. Check and lock the wiring of the external emergency stop interface on the control panel. 3. Check and lock the indicator interface. 4. Check whether the emergency circuit inside the electrical cabinet is loose, or replace the electrical cabinet.
6	0x8000F 121	Clear alarm reset	Internal 24V power supply over current	1. Short circuit of the demonstrator interface. 2. Brake short circuit. 3. Internal circuits or components of the cabinet are faulty.	1. Replace the teaching device. 2. check the heavy duty line lock terminal BKn+ and BKn- is short circuit, if the alarm is enabled, use a multi meter ohm file to check the shaft lock resistance, compare the specification is abnormal. 3. Check the internal wiring of the electrical cabinet, or replace the electrical cabinet.
7	0x8000F 131	Clear alarm reset	Auxiliary 24V supply over current	1. auxiliary 24V power short circuit. 2. use the auxiliary 24V power supply of IO short	1. remove the auxiliary power wiring, if the alarm can be cleared, 24V recovery output, check whether there is 24V+ to 24V- short circuit in the

				circuit or PE short circuit. 3. External devices powered by auxiliary 24V power supply exceed the protection limit of 6.5A. 4. the auxiliary 24V power supply and additional 24V power supply at the same time to power a device. 5、The auxiliary power circuit is faulty.	power wiring. 2. remove the external IO wiring, if the alarm can be cleared, 24V recovery output, check whether there is VS+ VS- or VS+ VS PE short circuit in the IO wiring. 3. Calculate whether the rated power of the external device exceeds the power of the auxiliary 24V power supply, if so, use the external 24V power supply. Do not use two power supplies to power different devices of the same system at the same time, which will cause the output error trigger during power-on; 4. switch to only one power supply. 5、Repair or replace electrical cabinets.
8	0x8000F021	Clear alarm reset	The temperature of the electric cabinet is too high	The ambient temperature in the electrical cabinet global.SvTemp exceeds the electrical cabinet alarm temperature threshold IpmTempLimit. The reasons include: 1. The alarm temperature Threshold IpmTempLimit is incorrectly set. 2. he bottom air inlet and the back exhaust are blocked or blocked.	1. 1Use the servo debugging assistant to check whether the ambient temperature of the electrical cabinet is in the range of 0 to 8500, and whether the electrical cabinet temperature alarm threshold IpmTempLimit is correctly set to 8500. 2. 2Open the bottom cover, clean up the debris and dust of the air intake, exhaust outlet, radiator and fan in time, and ensure that the air intake and exhaust outlet

				3. There are high temperature heat sources around the electric cabinet. 4. the cooling fan is not working properly. 5、The cables inside the cabinet are in poor contact or the temperature detection circuit of the cabinet is faulty.	are not blocked. 3. change the electric cabinet installation position, as far away from the heat source as possible. 4. Check the fan and its wiring inside the electric cabinet, or replace the fan. 5、Check the cabling inside the cabinet. Repair or replace the cabinet. The cables inside the cabinet are in poor contact or the temperature detection circuit of the cabinet is faulty.

9	1axis： 0x80001020 2axis： 0x80002020 3axis： 0x80003020 4axis： 0x80004020 5axis： 0x80005020 6axis： 0x80006020	Power-off reset	Encoder initialization failed	1. heavy duty line and electrical cabinet, robot connection poor contact. 2. heavy load line internal break. 3. the model configuration is wrong. 4. Shaft encoder type is not set correctly.	1. heavy duty line and robot, and electrical cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether the terminal has needle withdrawal, bending, loosening phenomenon. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Use the teaching device to check whether the electric cabinet machine type is consistent with the current connected model. For specific operations, please contact our engineer to check.

					4. Use servo acquisition assistant to check shaft encoder type setting, please contact our engineer for specific operation.
10	1axis: 0x80001021 2axis: 0x80002021 3axis: 0x80003021 4axis: 0x80004021 5axis: 0x80005021 6axis: 0x80006021	Power-off reset	Encoder wire break	During power-on initialization, the encoder cannot be detected for a certain period of time. Procedure The reasons include: 1. heavy duty line and electrical cabinet, robot connection poor contact. 2. heavy load line internal break. 3. the robot internal motor encoder connection line loose. 4. The encoder cable inside the cabinet is loose, or the encoder interface is faulty.	1. heavy duty line and robot, and electrical cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether the terminal has needle withdrawal, bending, loosening phenomenon. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Check whether the encoder connector of the axis motor corresponding to the robot is loose and whether the terminal is loose. 4. Check the encoder cable inside the cabinet, or replace the cabinet.
11	1axis: 0x80001022 2axis: 0x80002022 3axis: 0x80003022 4axis: 0x80004022 5axis:	Power-off reset	Encoder battery under voltage	axis encoder detects an alarm when battery voltage is below 3.6V. The reasons include: 1. encoder battery under voltage. 2. The encoder is in poor contact with the battery cable.	1. Check whether the encoder battery connected to axis encoder is lower than 3.6V. If it exists, please contact our engineer for guidance and replacement. 2. Check whether the connection cable between

	0x80005022 6axis: 0x80006022				axis encoder and battery is loose;
12	1axis: 0x80001023 2axis: 0x80002023 3axis: 0x80003023 4axis: 0x80004023 5axis: 0x80005023 6axis: 0x80006023	Power-off reset	Motor multi-turn value exceeds the limit	The multi-turn value returned by the encoder exceeds the upper limit set by the system. The reasons include: 1. The robot has not carried out electrical cabinet adaptation and calibration. 2. The robot is paired with an unmatched cabinet.	1. When the robot is powered off, place the joint to the mechanical zero position, unplug the encoder battery of the alarm axis, reinsert it 2 minutes later, and reset the encoder. Attention! If the robot has been calibrated, removing the battery will cause the robot or equipment motor zero loss! 2. Find the original adapter cabinet of the robot for use, otherwise reset the encoder, re-calibrate and calibrate the zero point.
13	1axis: 0x80001024 2axis: 0x80002024 3axis: 0x80003024 4axis: 0x80004024 5axis: 0x80005024 6axis: 0x80006024	Power-off reset	Location overflow	1. Encoder feedback position, beyond the absolute position of the upper and lower limits. The reasons include: 2. The robot has not carried out electrical cabinet adaptation and calibration. 3. The robot is paired with an unmatched cabinet.	1. When the robot is powered off, place the joint to the mechanical zero position, unplug the encoder battery of the alarm axis, reinsert it 2 minutes later, and reset the encoder. Attention! If the robot has been calibrated, removing the battery will cause the robot or equipment motor zero loss! 2. Find the original adapter cabinet of the robot for use, otherwise reset the encoder, re-calibrate and calibrate the zero point.
14	1axis: 0x80001025	Power-off reset	The encoder CRC check error occurs	Encoder communication CRC check error. The	1. heavy duty line and robot, and electrical

	2axis: 0x80002025 3axis: 0x80003025 4axis: 0x80004025 5axis: 0x80005025 6axis: 0x80006025			reasons include: 1. 1, heavy duty line and electrical cabinet, robot connection poor contact. 2. heavy load line internal break. 3. the robot internal motor encoder connection line loose. 4. The encoder cable inside the cabinet is loose, or the encoder interface is faulty.	cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether the terminal has needle withdrawal, bending, loosening phenomenon. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Check whether the encoder connector of the axis motor corresponding to the robot is loose and whether the terminal is loose. 4. Check the encoder cable inside the cabinet, or replace the cabinet.
15	1axis: 0x80001222 2axis: 0x80002222 3axis: 0x80003222 4axis: 0x80004222 5axis: 0x80005222 6axis: 0x80006222	Clear alarm reset	Sending a over speed alarm	The increment of the motion controller position instruction exceeds the maximum operating speed set by the system. The reasons include: 1. Codesys engineering logic and priority are too high, causing the movement process to time out. 2. Motion instruction causes process timeout.	1. The increment of the motion controller position instruction exceeds the maximum operating speed set by the system. The reasons include: 2. Check Codesys engineering logic and program priority setting. 3. Check the program line of the demonstrator with alarm and contact the engineer.

16	1axis： 0x80001223 2axis： 0x80002223 3axis： 0x80003223 4axis： 0x80004223 5axis： 0x80005223 6axis： 0x80006223	Clear alarm reset	Feedback over speed alarm	axis encoder feedback position increments beyond the maximum operating speed set by the system. The reasons include: 1. heavy duty line and electrical cabinet, robot connection poor contact. 2. heavy load line internal break. 3. the robot internal motor encoder connection line loose. 4. The encoder cable inside the cabinet is loose, or the encoder interface is faulty.	1. heavy duty line and robot, and electrical cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether the terminal has needle withdrawal, bending, loosening phenomenon. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Check whether the encoder connector of the axis motor corresponding to the robot is loose and whether the terminal is loose. 4. Check the encoder cable inside the cabinet, or replace the cabinet.

17	1axis： 0x80001310 2axis： 0x80002310 3axis： 0x80003310 4axis： 0x80004310 5axis： 0x80005310 6axis： 0x80006310	Clear alarm reset	Excessive tracking error	In the upper enabled state, the axis instruction position deviates from the feedback position beyond the allowed threshold range. The reasons include: 1. heavy duty line and electrical cabinet, robot connection poor contact. 2. heavy load line internal break. 3. Robot motor is damaged.	1. 1, heavy duty line and robot, and electrical cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether the terminal has needle withdrawal, bending, loosening phenomenon. 2. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Use a multi meter ohm file

				4．the robot movement is blocked. 5、axis servo parameters are set incorrectly.	4. to check whether the three-phase resistance of the motor is equal; 5. 4, if accompanied by the robot or equipment abnormal sound, please check whether the external mechanism, reducer blocked. 6. If axis servo parameters are set correctly, please contact our engineer. axis servo parameters are set incorrectly.
18	1axis： 0x80001004 2axis： 0x80002004 3axis： 0x80003004 4axis： 0x80004004 5axis： 0x80005004 6axis： 0x80006004	Power-off reset	FO Alarm	1. Rigid contact, collision and impact occur when the robot is running. 2. axis lock fails to release correctly when the robot is running. 3. When the robot is running, the instantaneous 4. acceleration is too large. 5. The internal wiring of the electrical cabinet is in poor contact or the drive axle is faulty.	1. Check whether the axis operation of the robot is abnormal, and whether the zero point is abnormal. After removal, it can be restarted. 2. Check whether the heavy-duty line is firmly connected in the electrical cabinet and the robot, and whether the terminal pins and holes of the heavy-duty line, the electrical cabinet and the internal lock are loose. 3. 3，reduce the point acceleration, or increase the excessive point, to avoid overload operation. 4. Check the signal cables inside the cabinet, or replace the cabinet.
19	1axis： 0x80001010 2axis： 0x80002010 3axis： 0x80003010 4axis： 0x80004010	Clear alarm reset	The U phase AD initialization failed.	1. emergency stop alarm caused. 2. The internal wiring of the electrical cabinet is in poor contact or the drive axle is faulty.	1. Clear the alarm verification after handling such alarms first. 2. Check the signal cables inside the cabinet, or replace the cabinet.

	5axis： 0x80005010 6axis： 0x80006010				
20	1axis： 0x80001011 2axis： 0x80002011 3axis： 0x80003011 4axis： 0x80004011 5axis： 0x80005011 6axis： 0x80006011	Clear alarm reset	U-phase AD detects overcurrent	Axis ADC sampling currents for the U and V phases of the motor exceeded the ADC sampling threshold. The reasons include: 1. encoder CRC check error, over speed, feedback over speed, emergency stop and other alarms caused. 2. when the robot is running, rigid contact, collision and impact occur. 3. axis lock fails to release correctly when the robot is running. 4. When the robot is running, the instantaneous 5. acceleration is too large. 6. if it appears at a specific point, there may be a singularity near the point. 7. The cables inside the cabinet are in poor contact or the AD detection circuit is faulty.	1. Clear the alarm verification after handling such alarms first. 2. Check whether the axis operation of the robot is abnormal, and whether the zero point is abnormal. After removal, it can be restarted. 3. Check whether the heavy-duty line is firmly connected in the electrical cabinet and the robot, and whether the terminal pins and holes of the heavy-duty line, the electrical cabinet and the internal lock are loose. 4. 4，reduce the point acceleration, or increase the excessive point, to avoid overload operation. 5. 5，modify the running point or increase the transition point to avoid the singularity. 6. Check the signal cables inside the cabinet, or replace the cabinet. 5，if it appears at a specific point, there may be a singularity near the point. 7. The cables inside the cabinet are in poor contact or the AD detection circuit is faulty.

21	1axis： 0x80001014 2axis： 0x80002014 3axis： 0x80003014 4axis： 0x80004014 5axis： 0x80005014 6axis： 0x80006014	Clear alarm reset	V phase AD initialization failed.	1. emergency stop alarm caused. 2. The internal wiring of the electrical cabinet is in poor contact or the drive axle is faulty.	1. Clear the alarm verification after handling such alarms first. 2. Check the signal cables inside the cabinet, or replace the cabinet.
22	1axis： 0x80001015 2axis： 0x80002015 3axis： 0x80003015 4axis： 0x80004015 5axis： 0x80005015 6axis： 0x80006015	Clear alarm reset	V phase AD detects overcurrent	Axis ADC sampling currents for the U and V phases of the motor exceeded the ADC sampling threshold. The reasons include: 1. encoder CRC check error, over speed, feedback over speed, emergency stop and other alarms caused. 2. when the robot is running, rigid contact, collision and impact occur. 3. axis lock fails to release correctly when the robot is running. 4. When the robot is running, the instantaneous 5. acceleration is too large. 6. if it appears at a specific point, there may be a singularity near the point. 7. The cables inside the cabinet are in poor contact or the AD detection circuit is faulty.	1. Clear the alarm verification after handling such alarms first. 2. Check whether the axis operation of the robot is abnormal, and whether the zero point is abnormal. After removal, it can be restarted. 3. Check whether the heavy-duty line is firmly connected in the electrical cabinet and the robot, and whether the terminal pins and holes of the heavy-duty line, the electrical cabinet and the internal lock are loose. 4. 4，reduce the point acceleration, or increase the excessive point, to avoid overload operation. 5. 5，modify the running point or increase the transition point to avoid the singularity. 6. Check the signal cables inside the cabinet, or replace the cabinet.

23	1axis： 0x80001121 2axis： 0x80002121 3axis： 0x80003121 4axis： 0x80004121 5axis： 0x80005121 6axis： 0x80006121	Clear alarm reset	axis over the rated current	axis feedback current Iq, beyond the "axis rated current threshold * over rated current percentage", and beyond the "allowed rated current duration threshold" alarm. The reasons include: 1. encoder CRC check error, over speed, feedback over speed alarm caused. 2. when the robot is running, rigid contact, collision and impact occur. 3. axis lock fails to release correctly when the robot is running. 4. When the robot is running, the instantaneous 5. acceleration is too large. 6. if it appears at a specific point, there may be a singularity near the point. 7. The rated current threshold, percentage of overrated current, and over current duration are not set correctly.	1. Clear the alarm verification after handling such alarms first. 2. Check whether the axis operation of the robot is abnormal, and whether the zero point is abnormal. After removal, it can be restarted. 3. Check whether the heavy-duty line is firmly connected in the electrical cabinet and the robot, and whether the terminal pins and holes of the heavy-duty line, the electrical cabinet and the internal lock are loose. reduce the point acceleration, or increase the excessive point, to avoid overload operation. modify the running point or increase the transition point to avoid the singularity.The servo debugging assistant is used to check whether the axis rated current threshold is equal to the maximum allowable current of the axis motor, whether the percentage of axis over-rated current is between 100 and 150, and whether the over current duration is within the range of 500 to 5000. 4. When the robot is running, the instantaneous acceleration is too large. if it appears at a specific point, there may be a singularity near the point. The rated current threshold, percentage of overrated current, and overcurrent duration are not set correctly.

24	1axis： 0x80001123 2axis： 0x80002123 3axis： 0x80003123 4axis： 0x80004123 5axis： 0x80005123 6axis： 0x80006123	Clear alarm reset	axis over the maximum current	axis feedback current Iq, beyond the "axis maximum current threshold * over maximum current percentage", and beyond the "maximum allowable current duration threshold" alarm. The reasons include: 1. encoder CRC check error, over speed, feedback over speed alarm caused. 2. when the robot is running, rigid contact, collision and impact occur. 3. axis lock fails to release correctly when the robot is running. 4. When the robot is running, the instantaneous acceleration is too large. 5. if it appears at a specific point, there may be a singularity near the point. 6. The maximum current threshold, percentage of the maximum over current, and over current duration are not set correctly.	1. Clear the alarm verification after handling such alarms first. 2. Check whether the axis operation of the robot is abnormal, and whether the zero point is abnormal. After removal, it can be restarted. 3. Check whether the heavy-duty line is firmly connected in the electrical cabinet and the robot, and whether the terminal pins and holes of the heavy-duty line, the electrical cabinet and the internal lock are loose. 4. reduce the point acceleration, or increase the excessive point, to avoid overload operation. 5. 5，modify the running point or increase the transition point to avoid the singularity. 6. The servo debugging assistant is used to check whether the maximum current threshold of axis is equal to the maximum allowable current of axis motor, whether the percentage of axis over current is between 7. 100 and 150, and whether the over current duration is within the range of 100 to 1000.

25	1axis： 0x80001009 2axis： 0x80002009 3axis： 0x80003009 4axis： 0x80004009 5axis： 0x80005009 6axis： 0x80006009	Clear alarm reset	The IPM temperature is too high.	The actual drive axle temperature exceeds the alarm temperature threshold. The reasons include: 1. The axis temperature alarm threshold is set incorrectly. 2. axis is in overload state for a long time. 3. The bottom air inlet and the back exhaust are blocked or blocked. 4. There are high temperature heat sources around the electric cabinet. 5. the cooling fan is not working properly. The cables inside the cabinet are in poor contact or the temperature detection circuit of the cabinet is faulty.	1. Use the servo debugging assistant to check whether the axis temperature alarm threshold IpmTempLimit is correctly set to 9500. 2. Use the servo debugging assistant to check whether the actual temperature of axis[x].ipmtemp is less than 9500. If it is higher than 9500, the robot acceleration should be reduced to avoid overload operation. 3. Open the bottom cover, clean up the debris and dust of the air inlet, exhaust outlet, radiator and fan in time, and ensure that the air inlet and exhaust outlet are not blocked. 4. change the electric cabinet installation position, as far away from the heat source as possible. 5. Check the fan and its wiring in the electric cabinet, or replace the fan. 6. Check the cabling inside the cabinet. Repair or replace the cabinet.
26	1axis： 0x80001030 2axis： 0x80002030 3axis： 0x80003030	Clear alarm reset	Axis brake failure	When up-enabled, the lock output did not form a loop. The reasons include: 1. heavy duty line and electrical cabinet,robot connection poor contact.	1. heavy duty line and robot, and electrical cabinet connector has been inserted in place, whether there is foreign matter stuck in, whether

	4axis： 0x80004030 5axis： 0x80005030 6axis： 0x80006030			2. heavy load line internal break. 3. Robot motor lock is damaged. 4. the electrical cabinet internal lock circuit fault.	the terminal has needle withdrawal, bending, loosening phenomenon. 2. Check whether the heavy-duty line is squeezed, or the turning radius is too small, causing the internal copper wire and terminal to fall off and break. In this case, replace the heavy-duty line. 3. Use a multi meter ohm file to check the axis lock resistance and compare whether the specifications are abnormal. 4. Check the internal wiring of the electrical cabinet, or replace the electrical cabinet.

4.2 Regular checking

To ensure that the product is in good working condition, regular maintenance checks should be carried out, including the following inspection measures.

Number	Check content	Solution	Check cycle
1	Whether the cable is old or loose	Replace the connection cable	Every season
2	The dust cover is blocked	Remove the dust cover, clean up the dust, and then reinstall it	Every month
3	Stationary or not	Re-fix the position or the height of the foot pad to ensure smooth fixing	Every season

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