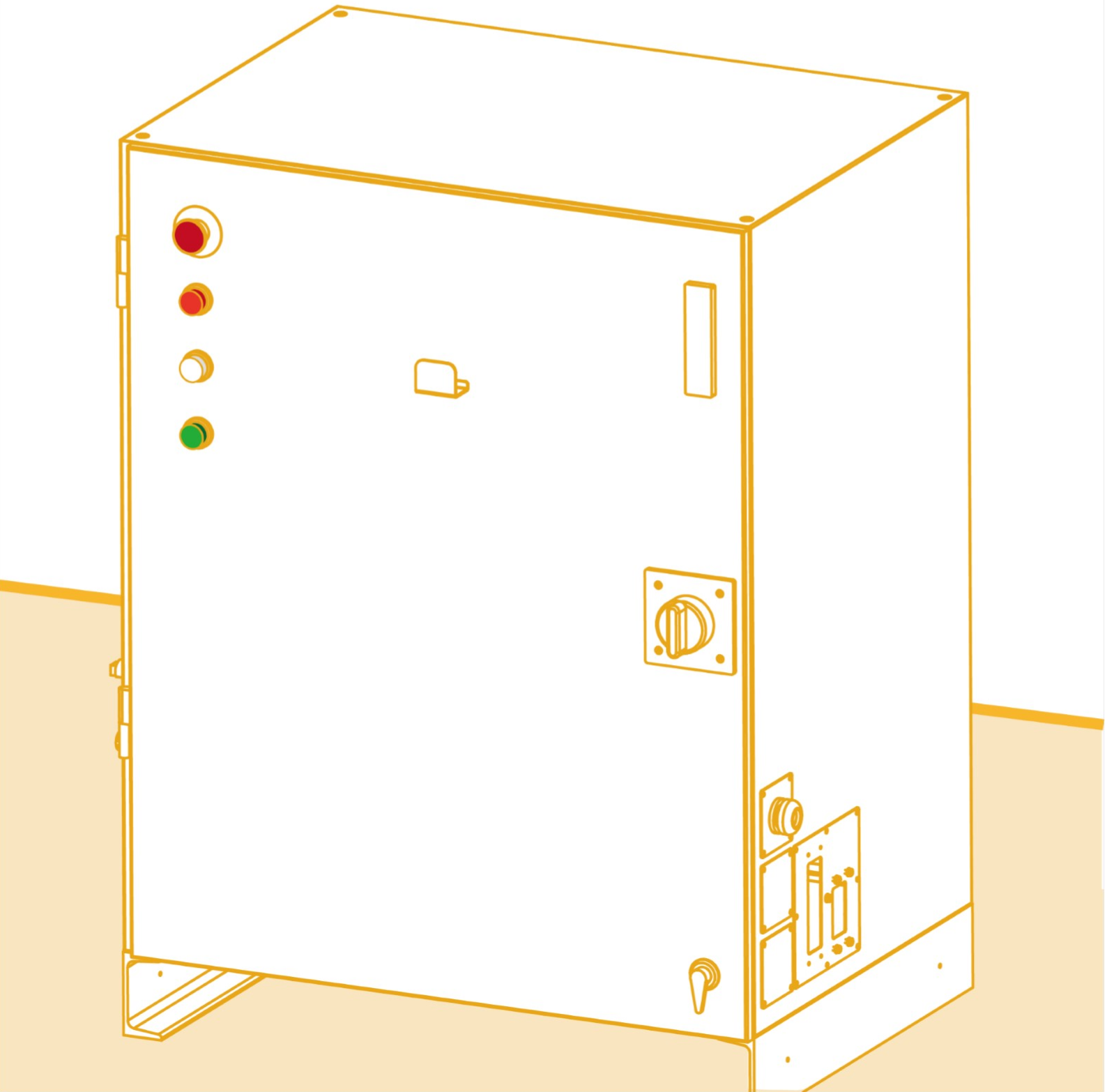
PEITIAN ROBOTICS

ARC4-165 Control Cabinet Manual

V1.2.1



Introduction

About this manual

This manual is for technicians to quickly, correctly and safely install and use the ARC4-165 control cabinet, familiarize themselves with relevant precautions and do regular routine maintenance of the control cabinet.

Operating prerequisites

Before operating the robot, please read the general safety instructions and safety precautions of the product carefully. The user must understand the safety knowledge and basic operating knowledge before operating the robot.

Please refer to:

- "AIR165-2750A Industrial Robot Manipulator Manual"
- "AIR-TP Teach Pendant Operation Manual"
- "ARL Programming Manual"
- "AIR165-2750A Industrial Robot Quick Operation Manual"

Target groups

- Operator
- Product technicians
- Technical service personnel
- Teachers

Common identification meanings

The signs and their meanings in the manual are shown in Table 1 below.

Table 1 Identifiers used in this article

Sign	Meaning
 Danger	If you do not follow the instructions, accidents may occur, resulting in serious or fatal personal injury
 Warning	If you do not follow the instructions, accidents may occur, resulting in moderate injuries or minor injuries, or only material damage may occur
 Notice	Prompt you to pay attention to environmental conditions and important matters, or quick operation methods

Sign	Meaning
 Tip	You are prompted to refer to other documents and instructions for additional information or more detailed operating instructions

Manual description

The content of this manual will be supplemented and modified. Please pay attention to the "Download" of our company website regularly to obtain the latest version of the manual in time.

My company website URL:http://robot.peitian.com/

Revision record

The revision record accumulates the description of each document update. The latest version of the document contains the updated content of all previous versions of the document.

Table 2 Document revision history

Version	Release time	Modify the description
V1.1.0	2021.01.05	1. Optimize the layout of the manual 2. Specification and connector size description of encoder cable and power cable
V1.2.0	2021.04.25	Update section 6.1 PLC_MF with illustrations, modify PIN numbers for DI and DO connectors
V1.2.1	2023.07.17	Fix known bugs

Document number and version

See Table 3 for document number and version information.

Table 3 Document number and version information

Name	ARC4-165 Control Cabinet Manual
Document number	UM-P05110000027-001
Document version	V1.2.1

Declaration of applicable safety standards

The requirements that the industrial robot system design meets are shown in Table 4.

Table 4 Declaration of applicable safety standards

Standard	Description	Version
2006/42/EC	**Machinery directive:** Machinery Directive 2006/42/EC (new edition) released by the European Parliament and Council on May 17, 2006, including changes to 95/16/EC	2006
2014/30/EU	**EMC directive:** Directive 2014/30/EU released by the European Parliament and Council on February 26, 2014 to balance EMC regulations among member states	2014
2014/68/EU	**Pressure equipment directive:** Directive 2014/68/EU released by the European Parliament and Council on May 15, 2014 to balance the pressure equipment regulations among member states (Only applicable for robots with hydro-pneumatic balance weights.)	2014
ISO 13850	**Safety of machinery:** Emergency stop function - Principles for design	2015
ISO 13849-1	**Safety of machinery:** Safety-related parts of control systems; Part 1: General principles for design	2015
ISO 12100	**Safety of machinery:** General principles for design - Risk assessment and risk reduction	2010
ISO 10218-1	**Safety requirements for industrial robots:** Part 1: Robots (tip: The content complies with ANSI/RIAR.15.06-2012, Part 1)	2011
61000-6-2	**Electromagnetic compatibility (EMC):** Part 6-2: Professional basic standards; Immunity for industrial environments	2005
61000-6-4 + A1	**Electromagnetic compatibility (EMC):** Part 6-4: Generic standards; Radiated interference for industrial environments	2011
60204-1 + A1	**Safety of machinery:** Electrical equipment of machines; Part 1: General requirements	2009
IEC 60529	**Degrees of protection provided by enclosures (IP code):** This standard applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage above 72.5kv.	2001

General safety instructions

Thanks very much for your purchase of the manipulator made by the company. The information described is necessary for safely using the manipulator. Please read associated manual carefully before using the manipulator, and properly use it under the premise of understanding its contents.

Please adequately understand the manipulator specifications through available instructions for detailed function.

Safety precautions

In general, the manipulator cannot be operated singly, but it is efficient when fitting with end effector, and constructed with peripheral equipment and system.

In consideration of security, the manipulator cannot put into separate consideration, while it shall be placed in the system environment.

Please take corresponding measures for safety barriers during the manipulator operation.

Warning, caution and notices

This manual contains various attentions including operating personnel safety and preventing manipulator damage. The significance of safety is described in form of "Warning" and "Caution", and other supplementary instructions are stated in form of "Notices".

Please thoroughly read these matters described in "Warning", "Caution" and "Notices".

 Warning	Faulty operation may lead to death or serious injury of operator or other operating personnel.
 Tip	Faulty operation may lead to minor injury of operator or other operating personnel or equipment damage.

General cautions

 Warning	■ When connecting or disconnecting related peripheral devices (such as safety fences, etc.) and various signals of the manipulator, be sure to confirm that the manipulator is in a stopped state to avoid incorrect connections. ■ Do not use the manipulator in the following situations. Otherwise, it will not only cause adverse effects on the manipulator and peripheral equipment, but also may cause injury or death to operators: ● Use in flammable environment

- Use in explosive environment
- Use in environments with a lot of radiation
- Use in water or high humidity environment
- Use for the purpose of transporting people or animals.
- Use as a tripod (such as climbing on top of the manipulator, or hanging below)

■ Operators who use the manipulator should wear the following safety equipment before performing work:

- Work clothes suitable for the content of the job
- Safety shoes
- Safety helmet


Tip

Personnel performing programming and maintenance operations must receive appropriate training through relevant training provided by the company.

Installation attentions


Warning

■ Please follow the methods shown in the manual for proper operation during carrying and installing the manipulator. Any operation in wrong methods may lead turnover of the manipulator and then result in injury and death of operating personnel.

■ Please operate the manipulator in low speed, and then increase the speed gradually to ensure whether it is abnormal when the manipulator is used for the first time upon installation.

Attentions during the operation


Warning

■ During the manipulator operation, please ensure there is no one in the safety barriers for subsequent operation. Accordingly, check whether there are potential risks; when the potential risks are verified, operate it after eliminating the risks.

■ During the demonstrator operation, wearing gloves may cause errors in operation, thus, taking the gloves off is necessary for subsequent operation.


Tip

Program, system variables and other information can be saved in the storage card and other storage medium. To prevent data loss from unexpected accidents, the users are recommended to backup data regularly.

Attentions during the programming


Warning

■ Operate outside safety barrier as far as possible during the programming. If it is required to operate in the safety barrier for unavoidable conditions, following precautions shall be noticed:

- Carefully view the conditions in the safety barrier, and then enter the barrier after ensuring there is no danger;
- Make sure the emergency stop button can be pressed at any time;
- Operate the manipulator in low speed;
- Operate it after ensuring the whole system state to prevent the operating personnel from caught in danger due to the remote-control command or motion for peripheral equipment.

■ Operators who use the manipulator should wear the following safety equipment before performing work:

- Work clothes suitable for the content of the job
- Safety shoes
- Safety helmet

■ When programming, it should be carried out outside the safety fence as much as possible. When it is necessary to carry out inside the safety fence due to unavoidable circumstances, the following matters should be paid attention to:

- Check the situation inside the safety fence carefully and confirm that there is no danger before entering the inside of the fence.
- You can press the emergency stop button at any time.
- The manipulator should be operated at a low speed.
- The operation should be performed after confirming the status of the entire system to prevent operators from falling into dangerous situations due to remote control commands or actions for peripheral equipment.


Notice

After programming, be sure to perform the test operation in accordance with the prescribed steps. At this time, the operator must operate outside the safety fence.


Tip

Those who perform programming and maintenance operations must pass the relevant training of our company.

Attentions during the maintenance


Warning

■ Some maintenances have electric shock hazard when powered on, thus it shall be carried out under the disconnection of the manipulator and system power supply. Professional maintenance personnel shall be designated to take maintenance as required; other personnel shall be avoided to switch on power in the maintenance, if it is required, the personnel shall press the emergency stop button for subsequent operation.

■ Please consult the company if it is necessary to replace the parts.

- If customers replace the parts by themselves, unexpected accidents may occur, and then it will cause damage and injury to the manipulator and operating personnel respectively.
- When entering into the safety barrier, the whole system shall be checked to ensure there is no danger. If there is dangerous situation and there is no choice but to enter the barrier, the system state shall be grasped, and extremely careful.
- If it is necessary to replace any part, please use the one specified by the company. But beyond this, it may cause damage to the manipulator.
- When dismounting motor or brake, it shall be dismantled after crane lifting and other measures are taken to prevent manipulator arm, etc. from falling.
- If the manipulator is moved for unavoidable reasons during the maintenance, the following matters shall be noticed:
  - Make sure the escape routes are unobstructed, and operate it after grasping the whole system operation conditions to avoid manipulator and peripheral equipment blocking the route of retreat.
  - Constantly notice whether there is danger around, and make preparations for pressing emergency stop button at any time when needed.
- When mobile motor, reducer, etc. equipped with parts unit with a certain weight, crane and other auxiliary equipment shall be used to prevent overlarge operation burden for operating personnel. Meanwhile, any mistake shall be avoided; otherwise, it will cause injury and death of operating personnel.
- Don't tumble due to the lubricating oil scattered on the floor, and wipe it off for ruling out the possibility of danger.
- During the operation, any part of the body cannot be put on the manipulator, and climb on the top of the manipulator to avoid unnecessary damage or adverse effects on the manipulator.
- Note that the following section will become hot. Well prepare heat-resistant gloves and other protective tools when the equipment is required to touch under heating circumstance for unavoidable reasons.
  - Servo motor;
  - Reducer;
  - Components near motor / reducer;
  - Interior control cabinet.
- The parts dismantled from components (such as bolts, etc.) shall be installed in the original position. If the parts are not sufficient or surplus, ensure it again and install it normally.
- When maintaining pneumatic system and hydraulic system, internal pressure shall be released to 0 at first for subsequent operation.

- Testing and operation shall be carried out in accordance with prescribed methods after components replacement. At this moment, the operating personnel shall operate outside the safety barrier.
- After maintenance ends, lubricating oil, debris, water, etc. scattered on the floor around the manipulator and in the safe barriers shall be swept thoroughly.
- Dust and other foreign matters are not allowed in the manipulator during the process of components replacement.
- Operating personnel who are in charge of maintenance and repair shall accept the company's training and pass the examination.
- During the maintenance, appropriate luminaire shall be equipped, but note that this cannot be the sources to cause new danger.
- Take periodic maintenance with reference to this instruction; if not, it will cause the service life of the manipulator and may result in accidents.

Safety precautions

Before operating the manipulator, peripheral equipment and its manipulator system, sufficiently study the safety precaution for operating personnel and system. Figure 1 is a diagram of the safe work of industrial robots.

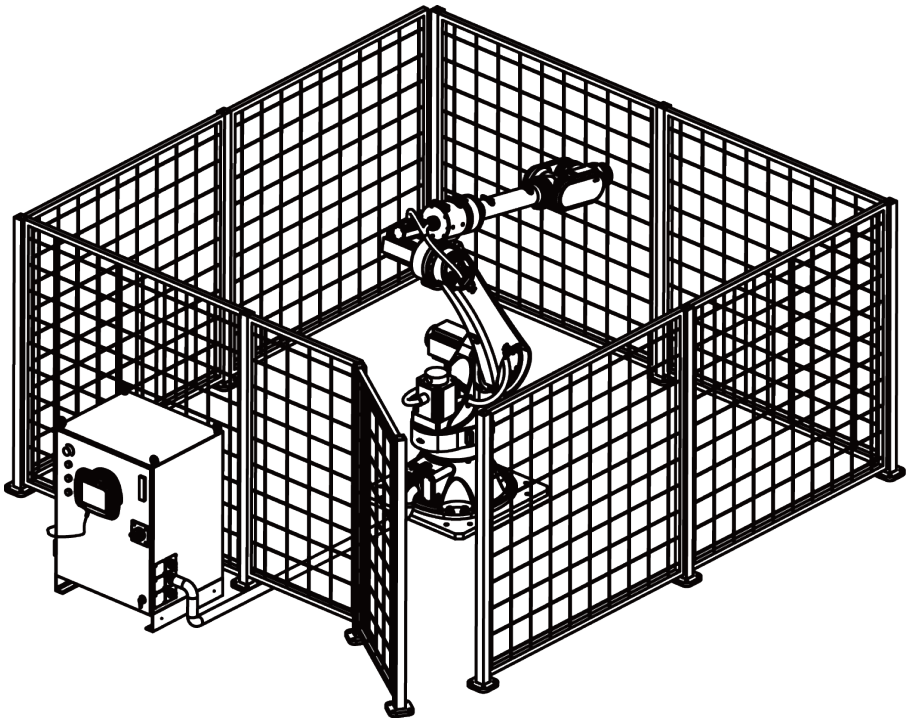


Figure 1 Diagram of the safe work of industrial robots

Definition of operating personnel

Operators of the manipulator are mainly divided into three types: operators, teachers, and maintenance engineers. The conditions that these three types of operators need to meet are described as follows:

Operator

- Carry out the operation of manipulator power ON/OFF;
- Start the manipulator program through the operation panel;
- No right to work in the safety fence.

Teacher

- Have the functions of an operator;
- The operation machine can be taught in the safety fence.

Maintenance engineer

- Have the function of a demonstrator;

- The manipulator can be maintained (repair, adjustment, replacement, etc.) operations.

Safety of operating personnel

When operating, programming, and maintaining the manipulator, operators, instructors, and maintenance engineers must pay attention to safety and at least wear the following items for work:

- Appropriate working clothes;
- Safety shoes;
- Safety helmet.

When applying the automatic system, the safety of operating personnel shall be guaranteed. Since the motion range is very dangerous, measures for preventing the operating personnel from entering into the manipulator motion range shall be applied.

General cautions are shown as below. Proper available measures shall be applied to ensure the safety of operating personnel:

- Operating personnel who are in charge of operating the manipulator system shall accept the company's training and pass the examination.
- During the equipment operation, even the manipulator seems to be shut down, it may be because the manipulator may be in motion state waiting for start signal. This state shall be treated as operation state. To ensure the safety of operating personnel, warning lamps and other equipment display or sound shall be applied to ensure the manipulator is in the operation state;
- Safety barriers and safety door around the system shall be set, so as to make operating personnel cannot enter into the safety barriers if the safety door is not opened. Interlock switch, safety latch, etc. shall be set on the safety door, so as to stop the manipulator when operating personnel open the safety door;
- Electrical grounding shall be applied for peripheral equipment;
- Peripheral equipment shall be set outside the manipulator motion range as far as possible;
- The motion range of the manipulator shall be marked with a line on the ground or in other ways, the operator knows clearly about the motion range, including mechanical arm and other tools fitted on the manipulator;
- The ground shall be set with cushion switch or fitted with photoelectric switch, etc. so as to sound alarm through buzzer or to glows, etc. when operating personnel enter into the motion range of the manipulator;
- One lock shall be set as required; no one can connect the manipulator power except the operating personnel;

- When taking single commissioning of peripheral equipment, the manipulator power shall be disconnected.

The safety of operator

Operator is not entitled to operate in the safety barriers:

- If the manipulator motion is not required, its control cabinet power shall be disconnected or the emergency stop button shall be pressed;
- Manipulator system shall be operated outside the safety barrier;
- To prevent irrelevant personnel from spraying into manipulator motion range or to prevent operator from entering into hazardous area, protective fence and safety door shall be set;
- Emergency stop button shall be set in arm's reach for operator.


Tip

Manipulator control device can connect external emergency stop button. Thus, once the emergency stop button is pressed, the manipulator will be shut down through this connection.

Safety of teachers

When taking manipulator demonstration operation, if entering into manipulator motion range is required in some cases, please pay particular attention to safety:

- Please operate outside the manipulator motion range in case that there is no need to operate in its range;
- Please ensure the manipulator or peripheral equipment is in safety state before demonstration operation;
- Please confirm location, state, etc. of safety device (such as emergency stop button, emergency stop the switch of demonstrator, etc.) in advance if the demonstration is operated in the manipulator range for unavoidable reasons;
- Programmer shall pay special attention to keep other personnel from entering into manipulator motion range;
- Please fully confirm that there is no one in the manipulator range and no abnormal sign before starting;
- Please follow the following procedures to carry out testing and operation after demonstration ends:

  Step1. Execute for at least one cycle with single cycle at low speed to ensure there is no abnormal sign;

  Step2. Continuously operate for at least one cycle at low speed to ensure there is no abnormal sign;

Step3. Continuously operate for at least one cycle at intermediate speed to ensure there is no abnormal sign;

Step4. Continuously operate for at least one cycle at intermediate speed to ensure there is no abnormal sign;

Step5. Execute programming under automatic operation mode;

- Programmer shall evacuate to the outer place of the safety barrier during automatic operation of the manipulator.

The safety of maintenance engineer

To ensure the safety of maintenance engineer, the following items shall be fully noticed:

- During the manipulator operation, don't enter into its motion range;
- Take maintenance when the power supply of control device is disconnected. Apply lock, etc. to lock on main circuit breaker to prevent other personnel from connecting the power;
- Press control cabinet or demonstrator emergency stop button if entering into the manipulator motion range is required for unavoidable reasons in an energized state. In addition, operating personnel shall put up the sign of "under maintenance", and remind the other personnel of not operating the manipulator arbitrarily;
- Please ensure the manipulator or peripheral equipment is in safety state before maintenance;
- Don't execute automatic operation when there is someone in the manipulator motion range;
- Don't block the escape routes of the operating personnel when operating near wall, tool, etc. or the distance between personnel is close;
- When the manipulator is equipped with the tool and there are movable appliances such as band carrier, etc. except manipulator, attentions shall be fully paid for these devices;
- One person who is familiar with manipulator system and can easily observes dangers shall be assigned around the manipulator during the operation to ensure that the emergency button can be pressed at any time;
- When replacing the parts or reassembling, attentions shall be paid in case of foreign material adhesion or foreign material invasion;
- When maintaining internal control device, in case of contacting unit, printed circuit board, etc., to prevent electric shock, power supply of main circuit breaker of control device shall be disconnected firstly before the operation;
- Use parts specified by the company when replacing the parts;

- Fully ensure that there is no one within operation scope of the manipulator and the manipulator and peripheral equipment are in good conditions when restarting the manipulator system after the maintenance.

Safety of peripheral equipment

Attentions on relevant program

- Checkout equipment such as limit switch, etc. shall be used in order that dangerous condition is detected, and the manipulator shall be shut down as appropriate according to the signal of checkout equipment;
- Applicable measures such as stopping the manipulator, etc. shall be taken against abnormality in other manipulators or peripheral equipment even if there are no problems in this manipulator;
- Mutual interference shall be avoided on system in which the manipulator and peripheral equipment operate synchronously;
- In order to control status of all equipment from manipulator, the manipulator and peripheral equipment can be mutually locked and the operation of manipulator can be stopped according to the needs.

Attentions on machinery

- Keep the system of the manipulator clear and use it under environment without influence from grease, water, dust, etc.;
- Cutting fluid and cleaning agent are not allowed to use;
- Control the operation of the manipulator with limit switch and mechanical brake in case of mutual collision between manipulator and peripheral equipment;
- Subscriber cable, hose, etc. are not allowed to be put inside the manipulator;
- Mechanical movement shall be avoided when installing the cable outside the manipulator;
- As for the model of exposed cables in the manipulator, operation for exposed cable shall not be modified;
- Interference in other parts of the manipulator shall be fully avoided when installing peripheral equipment on the manipulator;
- Any frequent outage and shutdown through emergency stop button, etc. on operating manipulator can lead to manipulator fault.

Machinery safety of the manipulator

Attentions during the operation

Operators shall be on high alert and quickly respond to occurrence of all problems when operating the manipulator through slow feeding mode under any condition.

Attentions on relevant program

Mutual interference between manipulators shall be fully avoided during operational scope from multiple manipulators.

Set a specified work origin for manipulator program and create a program starting from work origin and ending at this one to see clearly whether operation of the manipulator is finished or not from the outer edge.

Attentions on mechanism

Keep operating environment of the manipulator clear and use it under environment without influence from grease, water and dust, etc.

Safety for end effector

Time difference before the command reaches the actual operation shall be fully considered and exercise the control with some extension and contraction after sending control command out when controlling all actuators (pneumatic, hydraulic and electric).

Set the detection unit on end effector to monitor status of end effector and control operation of the manipulator.

Contents

1 Overview of ARC4-165 control cabinet

1.1 Overview of industrial robot

The industrial robot is composed of the following components:

- Manipulator
- Control cabinet
- Teach pendant
- Connection (power supply) cables, etc.

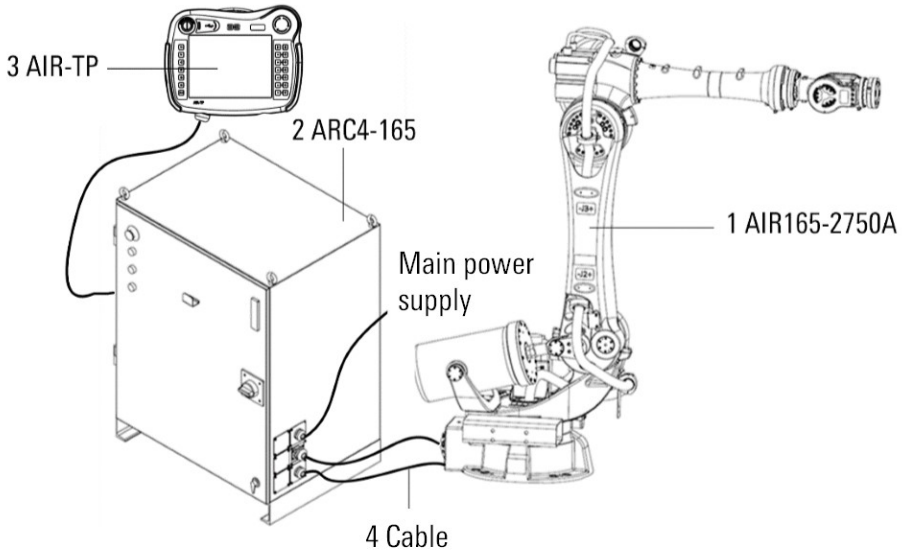


Figure 1-1 Composition of robot system

Figure 1-1 shows an example for industrial robot system, where:

1. Manipulator 2. Control cabinet

3. Teach pendant 4. Connection (power supply) cable

Robot body

The robot body refers to the mechanism that is used to grab or move an object (tool or workpiece) in the robot system, and also is known as the manipulator.

Control cabinet

The control cabinet is equipped with the electrical equipment that is required to control the robot, including the motor drive, PLC, safety module, power module, movement control module and other components, and provides the connection interfaces with the robot body and other external equipment. The appearance of the control cabinet is as shown in Figure 1-2.

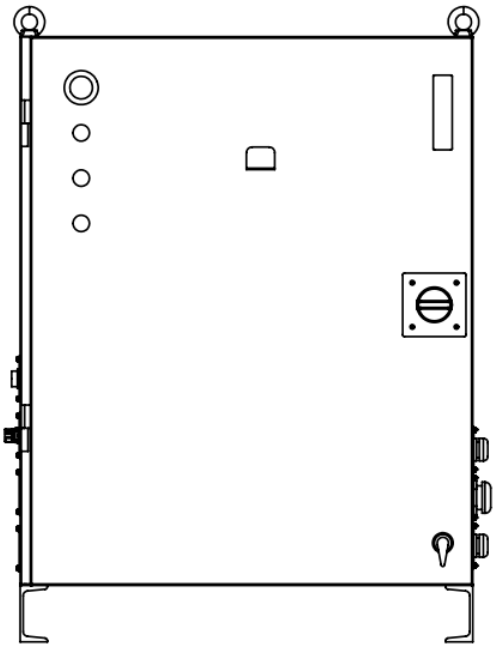


Figure 1-2 Control cabinet appearance

Teach pendant

The teach pendant is connected to the master control system of the robot's control cabinet. It is used to remotely control the robot to run manually and automatically, record the running trajectory, display playback or record teach points and program according to the teach points.

1.2 Basic composition of control cabinet

The position of internal devices in the control cabinet is shown in Figure 1-3.

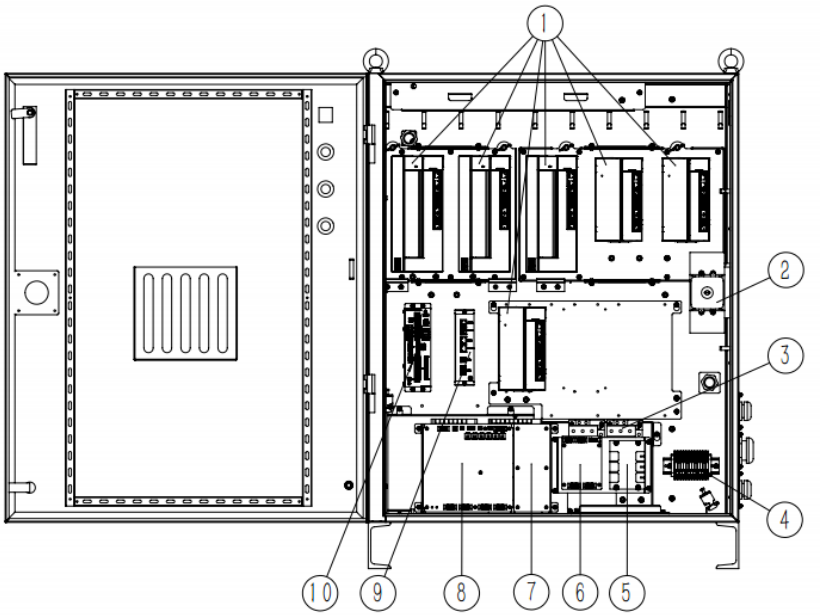


Figure 1-3 Diagram of internal components of control cabinet

See Table 1-1 for the serial number and name of each device.

Table 1-1 Serial number and name of components inside the control cabinet

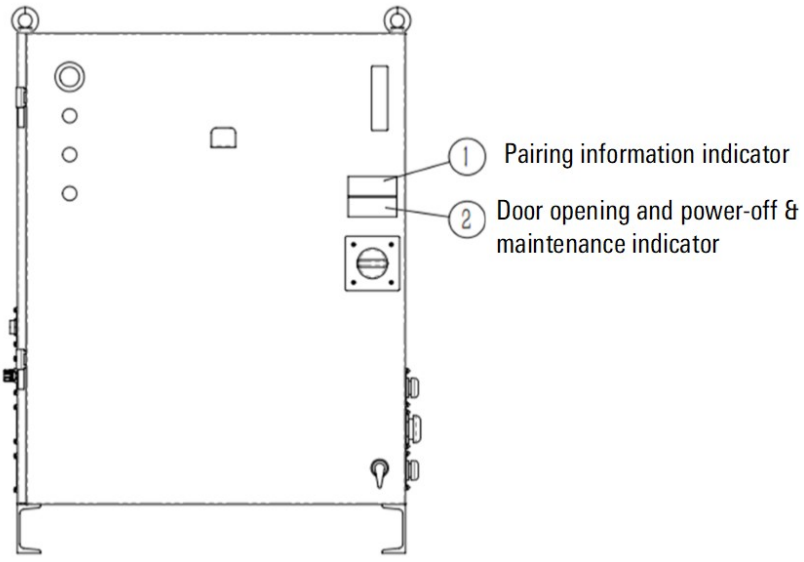
Serial number	Name
1	Driver
2	Disconnector
3	Contactor group
4	Terminals
5	Three-phase arc extinguisher
6	SAF-CNT
7	CON_INT
8	PLC_INT
9	MCB components
10	MF- components

1.3 Control cabinet characteristics

- The total weight of ARC4-165 control cabinet is 240kg.
- The control cabinet size is 800 (width) × 592.5 (thickness) × 1070 (height) mm.
- The top of the control cabinet can withstand an average load of 1000N.

1.4 Control cabinet labels and their meanings

ARC4-165 type control cabinet contains five kinds of labels. Refer to Figure 1-4 for the specific location of each label.



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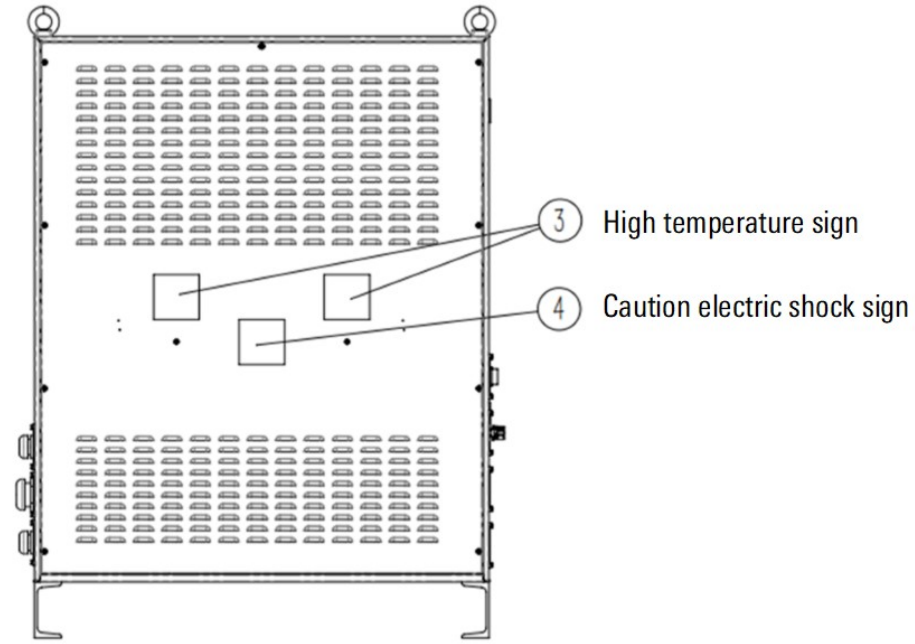
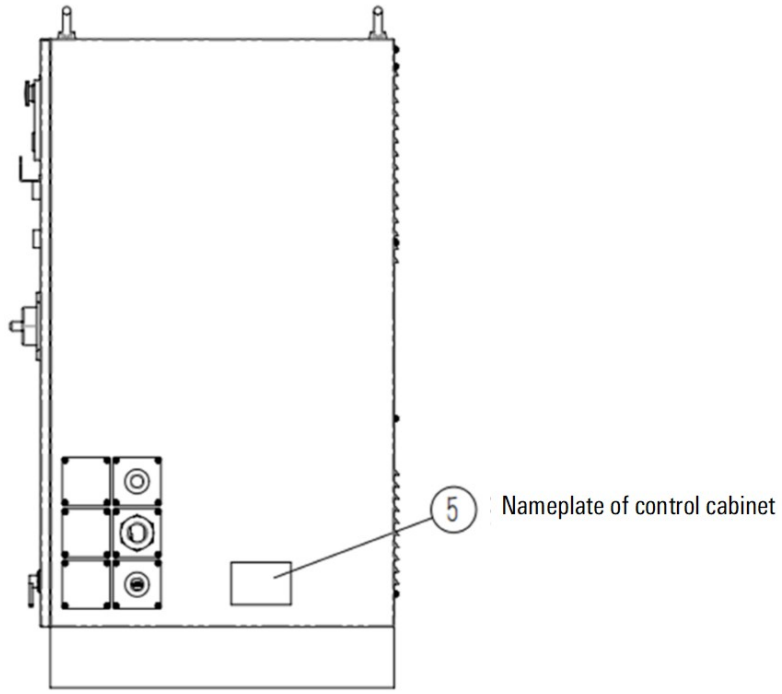


(b)



(c)

Figure 1-4 Location diagram of labels contained in control cabinet

Pairing information indicator

The pairing information indicator is shown in Figure 1-5.

Figure 1-5 Pairing information indicator

Door opening and power-off & maintenance indicator

The door opening and power-off & maintenance indicator is shown in Figure 1-6.

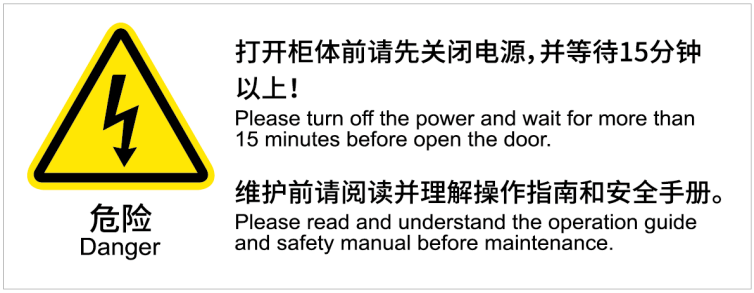


Figure 1-6 Door opening and power-off & maintenance indicator

High temperature sign

The place with high temperature sign (Figure 1-7) may get hot again. When you see this sign, you should pay attention to it to avoid scalding. If you have to touch the equipment under the condition of heat, please use protective equipment such as inner heat gloves before touching.

Figure 1-7 Identification of high temperature

Caution electric shock sign

Watch out for electric shock sign as shown in Figure 1-8.

Figure 1-8 Electric shock sign

Nameplate of control cabinet

The nameplate of the control cabinet is shown in Figure 1-9. The nameplate indicates the model, serial number, weight, production date and other relevant information of the control cabinet (the parameters are subject to the actual object).

配天机器人技术有限公司
Peitian Robotics Technology Co., Ltd.

型号	Type	ARC4-165
产品号	Product No.	
序列号	Serial No.	
生产日期	Date	
重量	Weight	240kg
电源电压	Supply Voltage	380V/3AC
电源频率	Frequency	49~61Hz
满载电流	Full-load Current	25A

Figure 1-9 Nameplate of control cabinet

1.5 Installation environment of control cabinet

- The ambient temperature should be 0°C -40°C.
- The relative humidity should be 20%-80% RH.
- The dust, oil mist and water vapor in the installation environment must be minimized.
- The environment must be free of flammable and corrosive liquids or gases.
- The equipment should be installed away from the impact and vibration sources.
- The control cabinet should have a heat dissipation distance of at least 20cm from the surrounding installation environment.

1.6 Working environment of control cabinet

- The control cabinet can operate normally within the range of 0℃~40℃, and can be stored and transported for a long time within the range of -25℃~40℃. And can withstand short-term transportation and storage (with backup batteries) at a temperature of 70℃ for no more than 24 hours.
- The control cabinet can work normally under the relative humidity of 20%~80% RH.

- The control cabinet can work normally when the altitude is ≤ 1000m. Please consult our company when using at an altitude higher than 1000 meters.
- The control cabinet can work normally under the atmospheric pressure of 86kPa ~106kPa.

2 ARC4-165 control cabinet transportation and handling

Four M12 lifting screws are provided above the control cabinet, as shown in Figure 2-1. Four lifting rings can be used for lifting and handling.

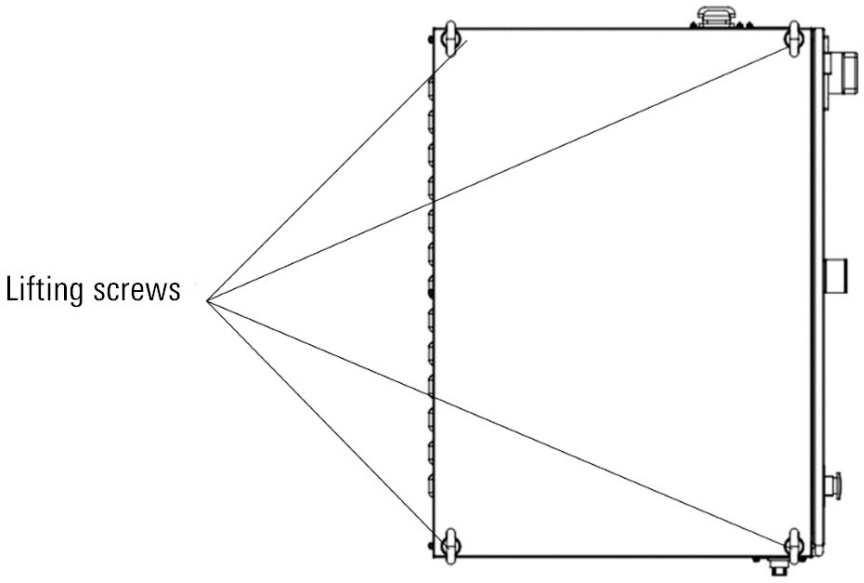


Figure 2-1 Control cabinet lifting ring handling

Caution	When the control cabinet is transported by lifting ring, please place the lifting point on the central axis of the top surface of the control cabinet, otherwise it is easy to tilt and cause other accidents such as collision of the control cabinet.

The cabinet body of the control cabinet is designed with a forklift handling bracket, which can be handled by the forklift in the following ways (see Figure 2-2).

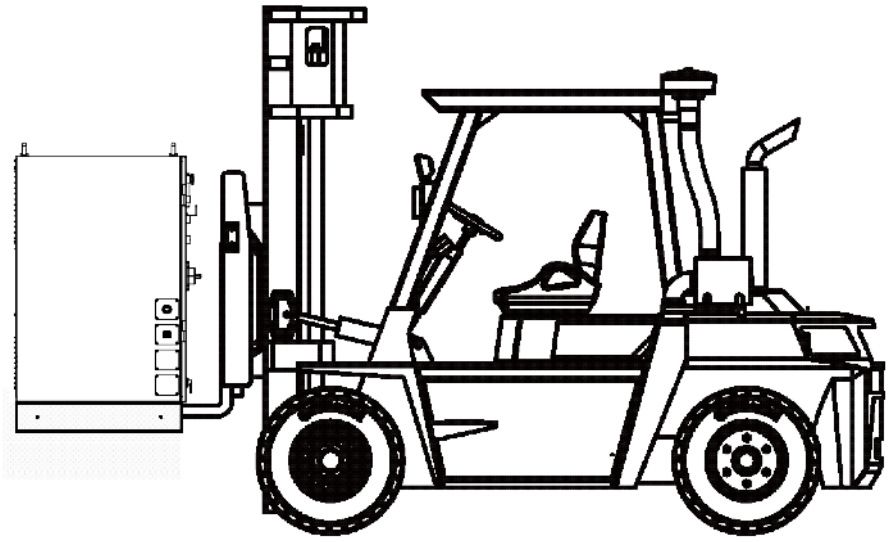


Figure 2-2 Control cabinet forklift handling

3 Installation and connection of ARC4-165 control cabinet

3.1 Check item

Before installing the control cabinet, the following items must be strictly observed:

- Make sure that the installation personnel must pass the relevant training of the company and perform the installation work in compliance with international and local laws and regulations.
- Make sure that the control cabinet is free from bump or damage after unpacking.
- Make sure that the control cabinet installation environment meets the requirements in Section 1.5 of this manual.

3.2 Definition of control cabinet electrical connection

Definition of power line interface for heavy-duty plugs in control cabinets

The definition of the power line interface for the heavy-duty plug of the ARC4-165 control cabinet is shown in Figure 3-1.

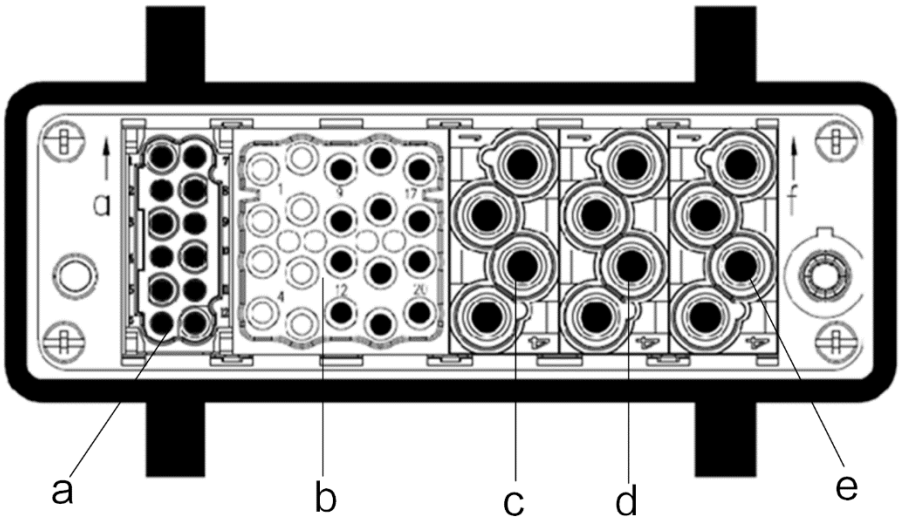


Figure 3-1 ARC4-165 control cabinet heavy-duty control cabinet power line interface

The definition of the power line interface for the heavy-duty plug of ARC4-165 control cabinet is detailed in Table 3-1.

Table 3-1 Definition of heavy-duty plug power line interface

Plug pin number	Core wire number	Indicator tube	Plug pin number	Core wire number	Indicator tube
f-1	1,2,3	1axis-U1	b-15	63,64,65	5 axis -W5
f-2	4,5,6	1 axis -V1	b-16	66,67,68	5 axis -PE5
f-3	7,8,9	1 axis -W1	b-9	69	6 axis -U6
f-4	10,11,12	1 axis -PE1	b-10	70	6 axis -V6

Plug pin number	Core wire number	Indicator tube	Plug pin number	Core wire number	Indicator tube
e-1	13,14,15,16	2 axis -U2	b-11	71	6 axis -W6
e-2	17,18,19,20	2 axis -V2	b-12	72	6 axis -PE6
e-3	21,22,23,24	2 axis -W2	a-7	73	Brake line -1 axis YB1+
e-4	25,26,27,28	2 axis -PE2	a-1	74	Brake line -1 axis YB1-
d-1	29,30,31,32	3 axis -U3	a-8	75	Brake line -2 axis YB2+
d-2	33,34,35,36	3 axis -V3	a-2	76	Brake line -2 axis YB2-
d-3	37,38,39,40	3 axis -W3	a-9	77	Brake line -3 axis YB3+
d-4	41,42,43,44	3 axis -PE3	a-3	78	Brake line -3 axis YB3-
b-17	45,46,47	4 axis -U4	a-10	79	Brake line -4 axis YB4+
b-18	48,49,50	4 axis -V4	a-4	80	Brake line -4 axis YB4-
b-19	51,52,53	4 axis -W4	a-11	81	Brake line -5 axis YB5+
b-20	54,55,56	4 axis -PE4	a-5	82	Brake line -5 axis YB5-
b-13	57,58,59	5 axis -U5	a-12	83	Brake line -6 axis YB6+
b-14	60,61,62	5 axis -V5	a-6	84	Brake line -6 axis YB6-

Control cabinet heavy-duty (Encoder) interface definition

The interface definition of ARC4-165 control cabinet heavy-duty (encoder) is shown in Figure 3-2.

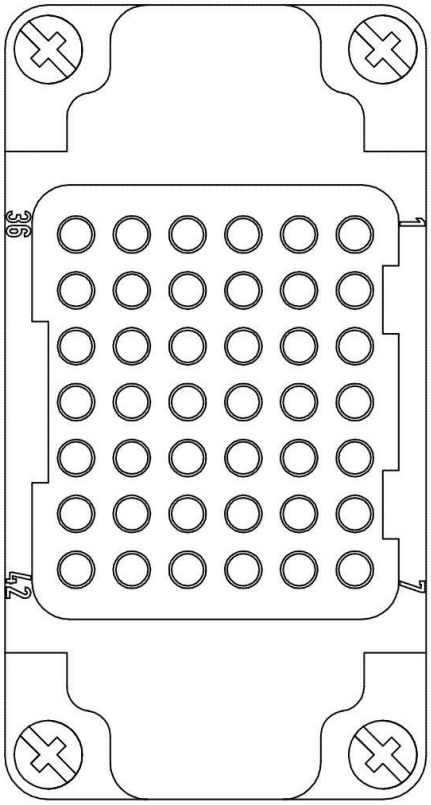


Figure 3-2 ARC4-165 control cabinet heavy-duty (encoder) interface definition

The definition of the encoder line interface for ARC4-165 control cabinet is detailed in Table 3-2.

Table 3-2 Encoder line interface definition

Signal name	**Axis number**	**Pin number**	**Signal name**	**Axis number**	**Pin number**
$\overline{\text{PS}}$	1 axis	1	$\overline{\text{PS}}$	5 axis	29
PS	1 axis	2	PS	5 axis	30
E0V	1 axis	3	E0V	5 axis	31
E5V	1 axis	4	E5V	5 axis	32
$\overline{\text{PS}}$	2 axis	8	$\overline{\text{PS}}$	6 axis	36
PS	2 axis	9	PS	6 axis	37
E0V	2 axis	10	E0V	6 axis	38
E5V	2 axis	11	E5V	6 axis	39
$\overline{\text{PS}}$	3 axis	15	$\overline{\text{PS}}$	DI1	5
PS	3 axis	16	PS	DI2	12
E0V	3 axis	17	E0V	DI3	19
E5V	3 axis	18	E5V	DI4	26
$\overline{\text{PS}}$	4 axis	22		DO2	34
PS	4 axis	23		GND	35

Signal name	Axis number	Pin number	Signal name	Axis number	Pin number
E0V	4 axis	24		DO1	40
E5V	4 axis	25		24V	41
				DI5	33

Encoder wire specifications and joint size instructions

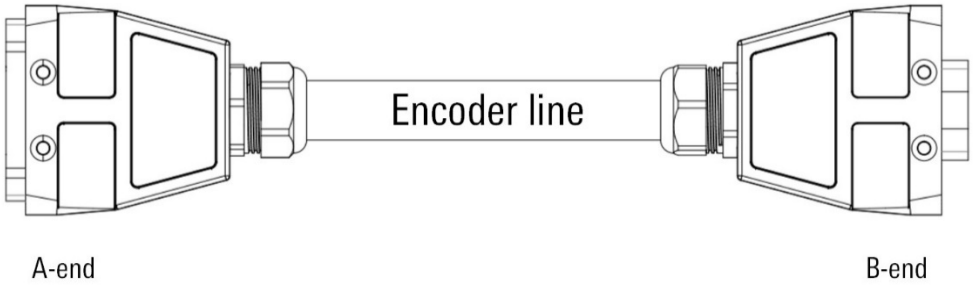


Figure 3-3 Diagram of ARC4-165 encoder line

Table 3-3 ARC4-165 encoder cable specification table

Name	A-end connection form	B-end connection form	Wire diameter/mm	Minimum bending radius
ARC4-165 encoder cable	Snap connection	Snap connection	19	8D

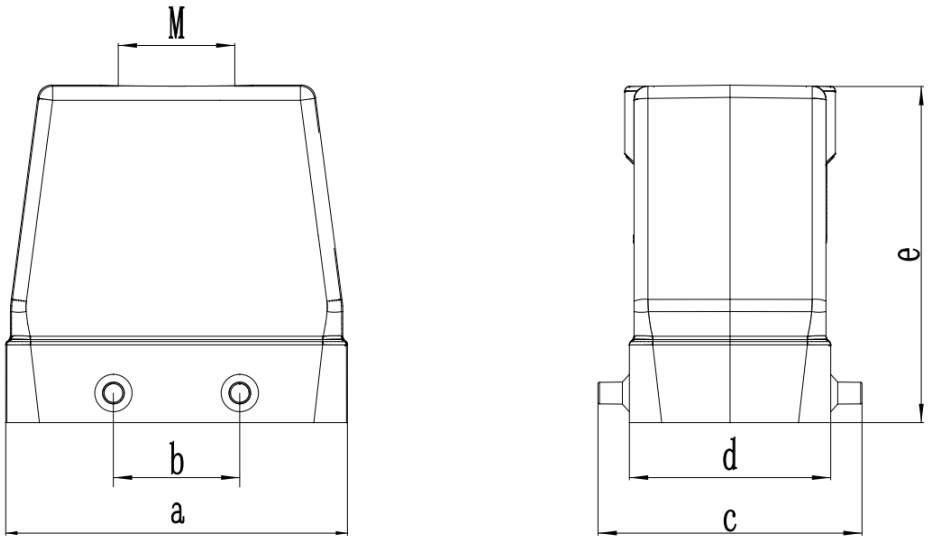


Figure 3-4 Encoder line heavy-duty connector size

Table 3-4 Encoder line heavy-duty connector size table

Control cabinet	a	b	c	d	e	M
ARC4-165	73	27	56.4	43	72	M32

Power line specifications and joint size instructions

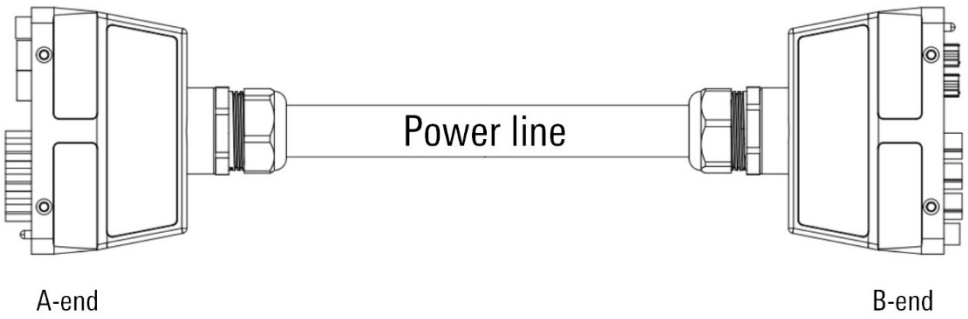


Figure 3-5 ARC4-165 power line diagram

Table 3-5 ARC4-165 power line specification table

Name	A-end connection form	B-end connection form	Wire diameter 1/mm	Wire diameter 2/mm	Minimum bending radius
ARC4-165 Power line	Snap connection	Snap connection	22.5	22.5	6D

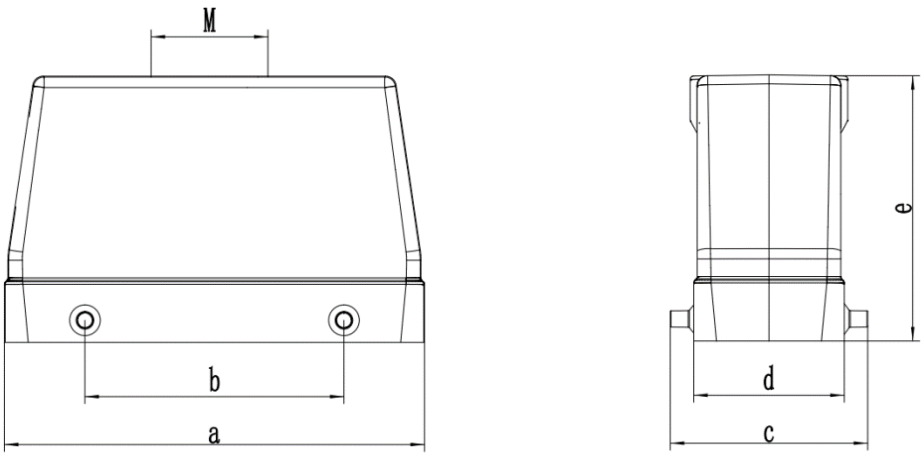


Figure 3-6 Dimensions of heavy-duty connectors for power lines

Table 3-6 Power line heavy-duty joint size table

Control cabinet	a	b	c	d	e	M
ARC4-165	120	74	56.4	43	76	2× M32

Control cabinet input power supply definition

- Nominal voltage: three-phase 380V.
- Nominal frequency: 50Hz.
- Full load power: 14kW.
- Full load current: 25A.

Control cabinet input power requirements

- Voltage: The steady-state voltage value is 0.9~1.1 times the nominal voltage.
- Frequency: 0.99~1.01 times nominal frequency (continuous); 0.98~1.02 times nominal frequency (short-time operation).

3.3 Connection method between control cabinet and manipulator

The ARC4-165 control cabinet has 3 external cables, 2 of which are connected to the manipulator, and 1 of which is a 4-core main power cable connected to the power supply. The power cord specifications are shown in Table 3-7.

Table 3-7 Power line specifications

Name	Material Number	Specifications	Length	Cable connector specifications
ARC4-165 power line	P04081000024	4x6mm², With yellow and green two-color PE wire, outer diameter 13.4mm	6m	M25B

When connecting a heavy-duty connector, insert the male plug of the heavy-duty connector into the female plug body. There is a plug to prevent mis-insertion, and just tighten the lock. The encoder cable in the cabinet needs to be shielded. Peel off the outer cover of the encoder cable to expose the shielding layer and clamp it on the shielding clip (see Figure 3-7).

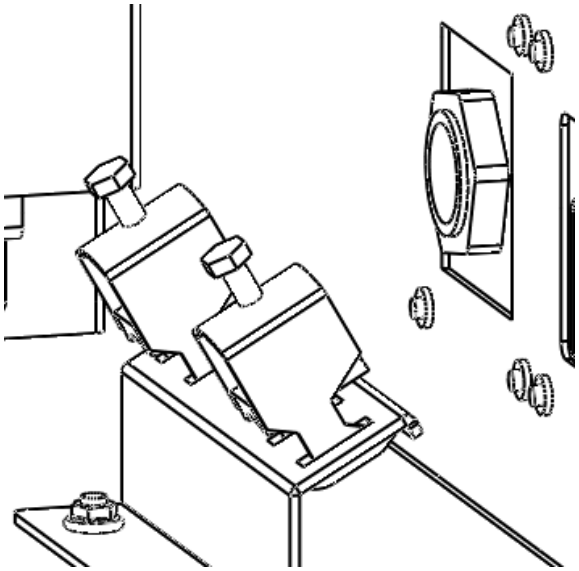


Figure 3-7 Encoder wire shielding

4 Safe use of ARC4-165 control cabinet

4.1 Grounding of control cabinet

ARC4-165 control cabinet shall be reliably grounded for the following main purposes:

- Grounding makes all unit circuits in ARC4-165 control cabinet have a common reference zero potential, so that there is no potential difference between the ground of each circuit, and ensures the stable operation of the system.
- The reliable ground connection of ARC4-165 control cabinet can prevent the interference of external electromagnetic field. The casing grounding provides a discharge channel for transient interference, which can discharge a large amount of electricity accumulated on the casing due to electrostatic induction through the ground.
- Can ensure safe work. When the electromagnetic induction of direct lightning occurs, the damage of electronic equipment can be avoided; When the input voltage of the power frequency AC power supply is directly connected to the casing due to poor insulation or other reasons, the operator can avoid electric shock.

The ARC4-165 control cabinet is grounded through the PE pin in the power cord entrance. It must be ensured that the cable input end connected to the control cabinet has a reliable ground connection. Under normal circumstances, the resistance between the cable input end PE and the earth is required to be no greater than 100Ω .

4.2 Robot stop mode

According to 9.2.2 "Definition of stop function" of GB5226.1-2008 "Electrical safety of machinery-Part 1: General Conditions", in combination with the specific design of the robot, the three stop methods are defined below. The corresponding description is given in Table 4-1:

Table 4-1 Stop method and corresponding description

Type	**Description**	
STOP0	*Case1*	PLC_INT alarm *stop0 indicate*, the drive execution stops immediately without maintaining the trajectory, and then the PLC_INT delay control cuts off the power supply through the contactor, which is an uncontrollable stop.
	Case2	An uncontrollable fault occurs in the driver and triggers a free stop or brake stop, which is an uncontrollable stop.
	Case3	If the external power is suddenly cut off, the driver cannot stop immediately and triggers the brake to stop, which is an uncontrollable stop.
STOP1	Robot stops quickly and keeps the current planned path. After the robot stops, the control drive *serve_off*, and cuts off the power supply via the thyristor, which is a controllable stop.	
STOP2	Robot stops quickly and keeps the current planned path. After the robot stops, it does not *serve_off* and does not cut off the power supply, which is a controllable stop.	

5 ARC4-165 control cabinet interface and indicator light instructions

5.1 Control cabinet indicator light description

ARC4-165 control cabinet provides three indicator lights, as shown in Figure 5-1, among which:

- The white power indicator light of the control cabinet lights up when the control cabinet is started.
- The green indicator light of the driver power supply lights up when the driver power supply is connected.
- System abnormality red indicator light lights up when the control system is abnormal.

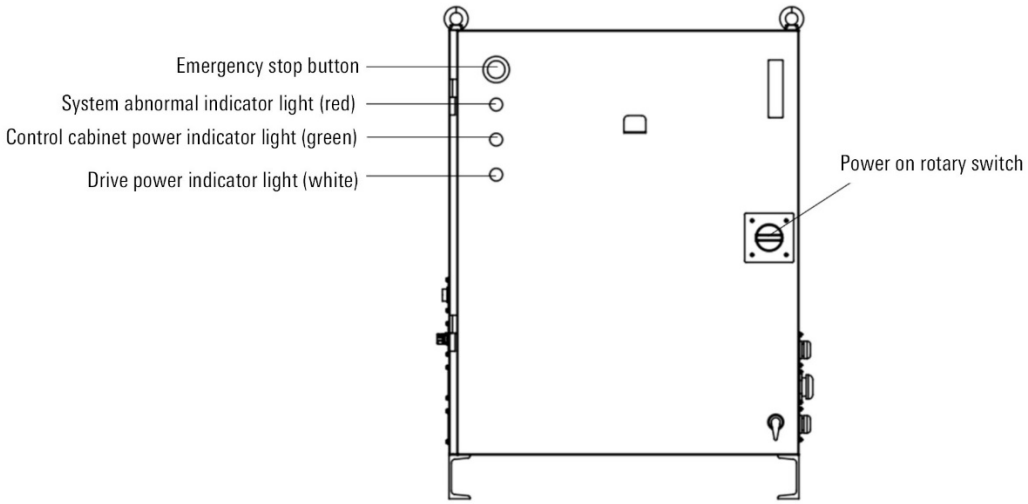


Figure 5-1 Control cabinet indicator light

5.2 Functions of switches outside the control cabinet

Power-on rotary switch

The power-on rotary switch of the control cabinet (see Figure 5-1 for the specific position) is used to turn on and off the power supply of the control cabinet. The text on the rotary switch (see Figure 5-2) is described as follows:

- ON - Power on.
- OFF - Power off.
- OPENRESET - Open the door.

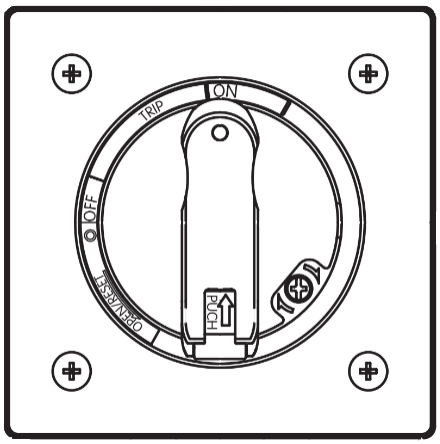


Figure 5-2 Power-on rotary switch

> Caution
>
> Turn the switch to the "OPENRESET" position before opening the control cabinet door, otherwise the knob switch and circuit breaker will be damaged!

Emergency stop button

Press the emergency stop button and the robot will stop immediately (see Figure 5-1). When it is necessary to release the safety status, the emergency stop button shall be turned in the direction indicated on the button.

> Caution
>
> Do not use the emergency stop button as a pause function, otherwise the manipulator may be damaged.

5.3 Functions of switches inside the control cabinet

Manual release brake button

The PLC_INT module at the bottom of the front of the robot control cabinet provides 1~6 axis motor brake release buttons (refer to Figure 5-3).

Steps:

Step1. Unplug the PLC_INT power terminal.

Step2. Insert the manual brake release interface.

Step3. Press the brake release button, and the corresponding motor brake will be released.

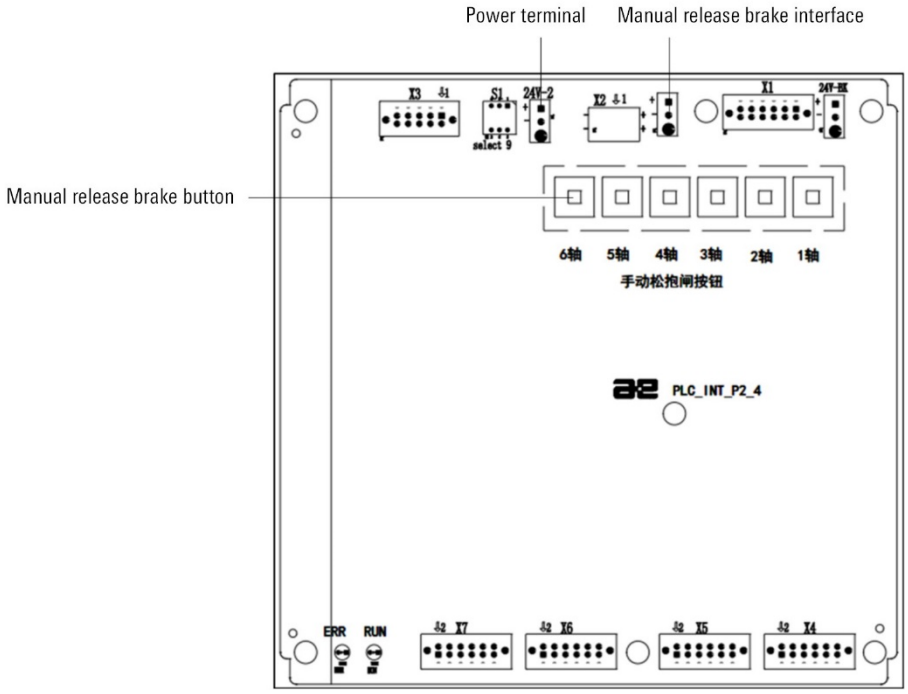


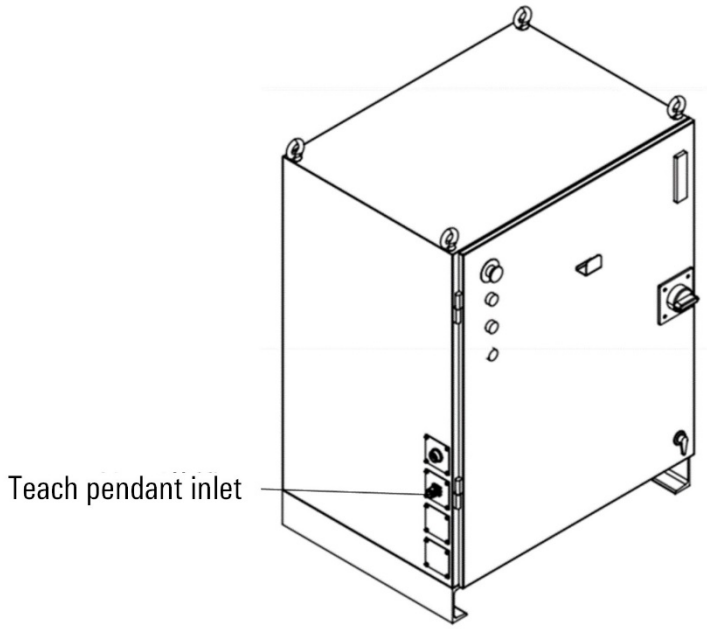
Figure 5-3 Manual brake release interface description

Warning

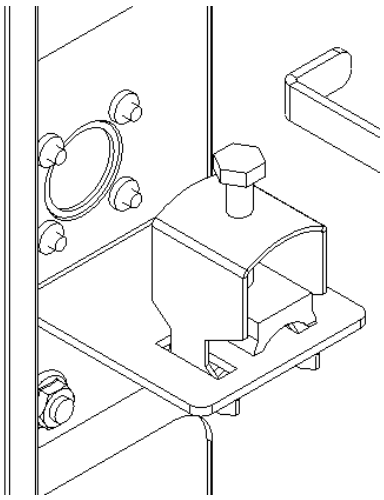
When using the manual brake release function, please be aware that the corresponding axis may suddenly fall under the action of gravity, and auxiliary support and personnel safety issues must be considered in advance.

5.4 External interface of control cabinet

The control cabinet provides a teach pendant installation interface, which is located under the left side of the control cabinet (see Figure 5-4 (a)). The cable is connected to the control cabinet from the position shown in the figure and is divided into two routes, one of which is connected to the network port of the MCB; the other is connected to the lead-out connector of the security module. The shielding layer of the teach pendant cable is pressed onto the bracket with a cable clamp (see Figure 5-4 (b)).



(a)



(b)

Figure 5-4 Teach pendant connector

In addition to the teach pendant interface, the control cabinet also provides 2 heavy-duty connector interfaces, namely the motor power and brake cable interface and the encoder interface, as well as 1 external power input interface, which is led out from the lower right side of the control cabinet. As shown in Figure 5-5.

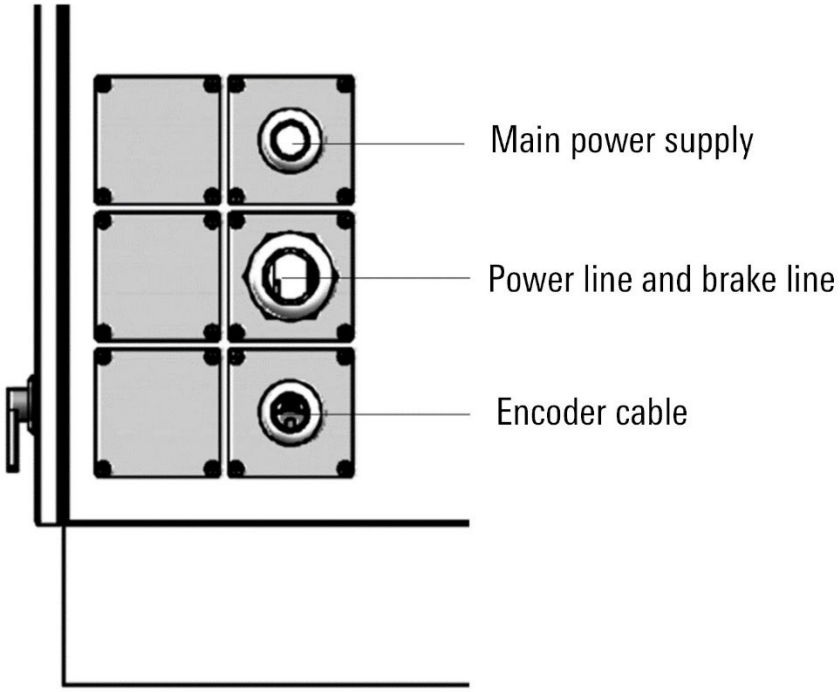


Figure 5-5 ARC4-165 control cabinet external cable

The power and brake heavy-duty wires and the encoder heavy-duty cables are divided into cabinet wire harnesses and cabinet external cable harnesses. The material numbers and specifications of each cable harness are shown in Table 5-1.

The control cabinet supports optional external expansion axis interfaces, which can connect up to 6 external axes.

Table 5-1 Heavy duty cable specifications

Cable harness	**Material number**	**Connector type**
Power and brake cables	P04082000343-P1.1	One end Weien H24B-TEN-4B-M40 heavy duty connector One end loose thread
Encoder cable outside the cabinet	P04082000341-P1.1	One end Weien H10B-TEN-4B-M25 heavy duty connector One end loose thread

6 Introduction to ARC4-165 control cabinet hardware modules

6.1 PLC_MF

Definition of each port

PLC_MF is used for communication with external devices. As shown in Figure 6-1.

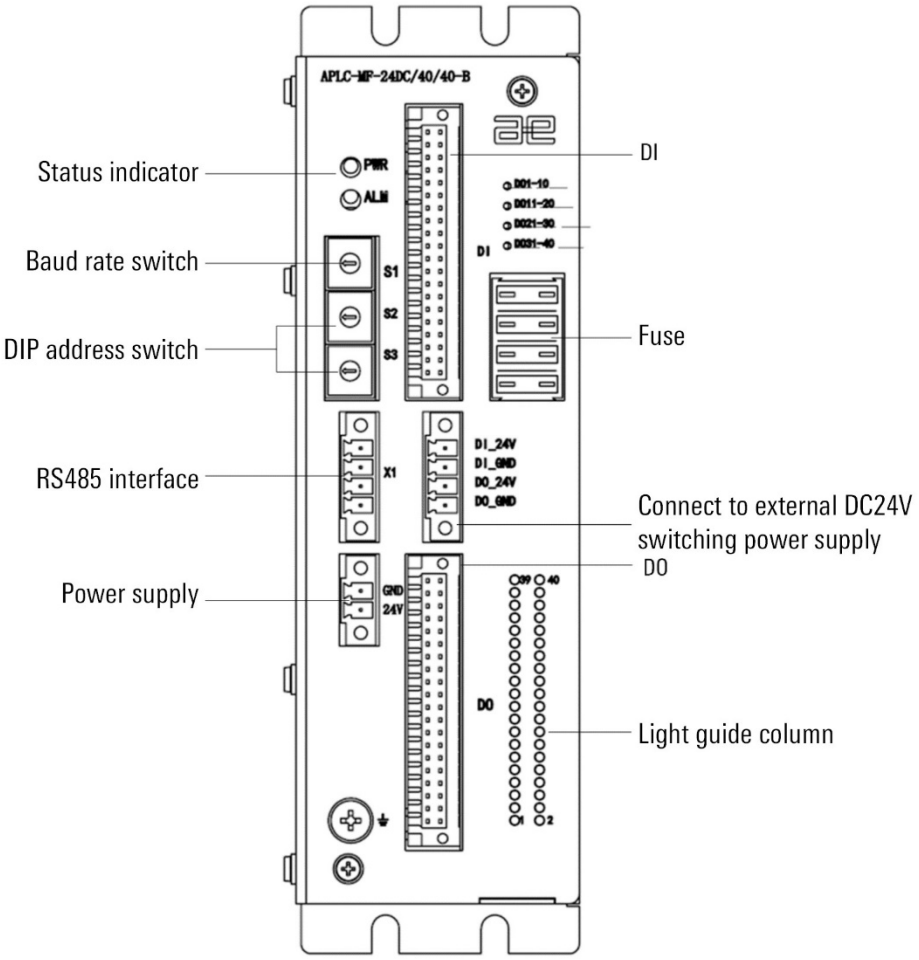


Figure 6-1 PLC_MF

Station address dial switch

- S2 high position.
- S3 low position.

Power port connector

- Above 0V.
- Under 24V.

DI port connector

The DI port connector numbers are shown in Figure 6-2.

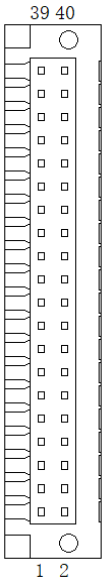


Figure 6-2 DI port number

DO port connector

The DO port connector number is shown in Figure 6-3.

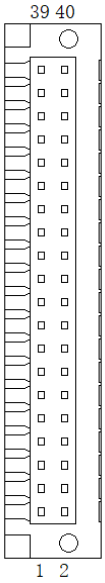


Figure 6-3 DO port number

If you need to control the body IO through PLC_MF, you can connect the unconnected IO cables in the encoder harness inside the cabinet according to the label content of the cable identification tube to the corresponding pins on the DI and DO interfaces of PLC_MF. Connect the lead-out cables of the external device at the 3-axis electrical interface connector of AIR165, and refer to the definition of the connector interface in the "AIR165-2750A Industrial Robot Operation Manual".

Baud rate setting

Refer to Table 6-1 for detailed instructions on setting the PLC_MF baud rate.

Table 6-1 PLC_MF baud rate setting

DIP switch points	Baud rate	DIP switch points	Baud rate
0	1200	7	56000
1	2400	8	57600
2	4800	9	115200
3	9600	A	230400
4	14400	B	460800
5	19200	C	921600
6	38400	Other	1200

6.2 PLC_INT

PLC_INT is used for internal control of the control cabinet, as shown in Figure 6-4.

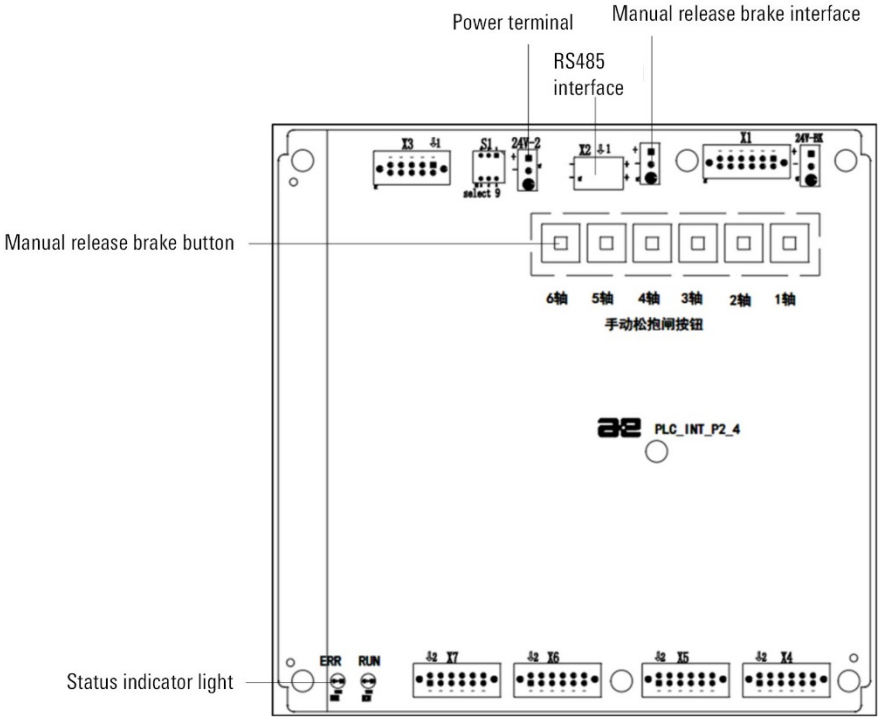


Figure 6-4 PLC_INT

PLC_INT brake holding input connector (X1) definition

The port number with the "PBT" mark on the terminal plug is 1, and the opposite side is 2, and so on.

The definition of the PLC_INT brake input connector (X1) is detailed in Table 6-2.

Table 6-2 Definition of PLC_INT brake holding input connector (X1)

Pin number	Signal name	Pin number	Signal name
1	COMMON_MOTOR/GND (Common terminal for brake signal of	2	DI_MOTOR1

Pin number	Signal name	Pin number	Signal name
	drive 1)		(Drive 1 Brake Signal/Input)
3	COMMON_MOTOR/GND (Common terminal for brake signal of drive 2)	4	DI_MOTOR2 (Drive 2 Brake Signal/Input)
5	COMMON_MOTOR/GND (Common terminal for brake signal of drive 3)	6	DI_MOTOR3 (Drive 3 Brake Signal/Input)
7	COMMON_MOTOR/GND (Common terminal for brake signal of drive 4)	8	DI_MOTOR4 (Drive 4 Brake Signal/Input)
9	COMMON_MOTOR/GND (Common terminal for brake signal of drive 5)	10	DI_MOTOR5 (Drive 5 Brake Signal/Input)
11	COMMON_MOTOR/GND (Common terminal for brake signal of drive 6)	12	DI_MOTOR6 (Drive 6 Brake Signal/Input)

PLC INT RS485 connector (X2) definition

PLC INT RS485 connector (X2) definition refers to Table 6-3.

Table 6-3 PLC INT RS485 connector (X2) definition

Pin number	Signal name
1	RS485+ (485 bus positive)
2	RS485- (485 bus negative)
3	RS485+ (485 bus positive)
4	RS485- (485 bus negative)

PLC_INT safety module connector (X3) definition

The definition of PLC_INT safety module connector (X3) is detailed in Table 6-4.

Table 6-4 PLC_INT safety module connector (X3) definition

Pin number	Signal name	Pin number	Signal name
1	COMMON_SAFE (SAF module status common terminal)	2	DI_SAFE_STATE (SAF module status/input)

Pin number	Signal name	Pin number	Signal name
3	DGND_IO (Signal ground)	4	DO_SAFE_RESET_N (SAF module reset signal negative/output)
5	DO_SAFE_RESET_P (SAF module reset signal positive/output)	6	DO_CTR_STATE_N (SAF module control signal negative/output)
7	DO_CTR_STATE_P (SAF module control signal positive/output)	8	DO_CONTACTOR2 (Contactor control signal 2/output)
9	DO_CONTACTOR1 (Contact control signal 1/output)	10	DO_MODE_SW (Circuit breaker control mode/output)

PLC_INT brake output connector (X4) definition

PLC_INT brake output connector (X4) definition refers to Table 6-5 for details.

Table 6-5 PLC_INT brake output connector (X4) definition

Pin number	Signal name	Pin number	Signal name
1	A6_BRAKE (6th motor brake power/output)	2	A6_BRAKE_COM/GND (6th motor brake power ground)
3	A5_BRAKE (5th motor brake power/output)	4	A5_BRAKE_COM/GND (5th motor brake power ground)
5	A4_BRAKE (4th motor brake power/output)	6	A4_BRAKE_COM/GND (4th motor brake power ground)
7	A3_BRAKE (3rd motor brake power/output)	8	A3_BRAKE_COM/GND (3rd motor brake power ground)
9	A2_BRAKE (2nd motor brake power/output)	10	A2_BRAKE_COM/GND (2nd motor brake power ground)
11	A1_BRAKE (1st motor brake power/output)	12	A1_BRAKE_COM/GND (1st motor brake power ground)

PLC_INT output reserved connector (X5) definition

The definition of the PLC_INT output reserved connector (X5) is detailed in Table 6-6.

Table 6-6 Definition of PLC_INT output reserved connector (X5)

Pin number	Signal name	Pin number	Signal name
1	DO_PANEL2/GND (Panel signal 2 corresponds to ground)	2	DO_PANEL2 (Panel signal 2/output)
3	DO_PANEL1/GND	4	DO_PANEL1

Pin number	Signal name	Pin number	Signal name
	(Panel signal 1 corresponds to ground)		(Panel signal 1/output)
5	DO_RESERVE4/GND (Digital signal 4 corresponds to ground)	6	DO_RESERVE4 (Digital signal 4/output)
7	DO_RESERVE3/GND (Digital signal 3 corresponds to ground)	8	DO_RESERVE3 (Digital signal 3/output)
9	DO_RESERVE2/GND (Digital signal 2 corresponds to ground)	10	DO_RESERVE2 (Digital signal 2/output)
11	DO_RESERVE1GND (Digital signal 1 corresponds to ground)	12	DO_RESERVE1 (Digital signal 1/output)

PLC_INT input reserved connector (X6) definition

The definition of PLC_INT input reserved connector (X6) is detailed in Table 6-7.

Table 6-7 PLC_INT input reserved connector (X6) definition

Pin number	Signal name	Pin number	Signal name
1	COMMON_RESERVE6/+24V (Number signal 6 public end)	2	DI_RESERVE6 (Digital signal 6/input)
3	COMMON_RESERVE5/+24V (Number signal 5 public end)	4	DI_RESERVE5 (Digital signal 5/input)
5	COMMON_RESERVE4/+24V (Number signal 4 public end)	6	DI_RESERVE4 (Digital signal 4/input)
7	COMMON_RESERVE3/+24V (Number signal 3 public end)	8	DI_RESERVE3 (Digital signal 3/input)
9	COMMON_RESERVE2/+24V (Number signal 2 public end)	10	DI_RESERVE2 (Digital signal 2/input)
11	COMMON_RESERVE1/+24V (Number signal 1 public end)	12	DI_RESERVE1 (Digital signal 1/input)

PLC_INT internal input connector (X7) definition

The definition of PLC_INT internal input connector (X7) is detailed in Table 6-8.

Table 6-8 PLC_INT internal input connector (X7) definition

Pin number	Signal name	Pin number	Signal name
1	DI_STOP1 (Cabinet door emergency stop signal/input)	2	DI_PANEL1 (Panel Signal 1/Input)

Pin number	Signal name	Pin number	Signal name
3	COMMON_PANEL/+24V (Signal common ground)	4	DI_PANEL2 (Panel Signal 2/Input)
5	COMMON_DOOR/+24V (Common terminal for cabinet door switch status signal)	6	DI_DOOR (Cabinet door switch status signal/input)
7	COMMON_PWR_STATE/+24V (Power status signal common terminal)	8	DI_PWR_STATE (Power status signal/input)
9	COMMON_STOP2/+24V (Common terminal for emergency stop signal of the teach pendant)	10	DI_STOP2 (Teach pendant emergency stop signal/input)
11	COMMON_KEY_EN/+24V (Teach pendent enable signal common terminal)	12	DI_KEY_EN (Teach pendent enable signal/input)

Baud rate setting

Refer to Table 6-9 for detailed instructions on setting the PLC_INT baud rate.

Table 6-9 PLC_INT baud rate setting

DIP switch points	Baud rate	DIP switch points	Baud rate
0	1200	7	56000
1	2400	8	57600
2	4800	9	115200
3	9600	A	230400
4	14400	B	460800
5	19200	C	921600
6	38400	Other	1200

6.3 Security module

The safety module is used for security function backup, as shown in Figure 6-5.

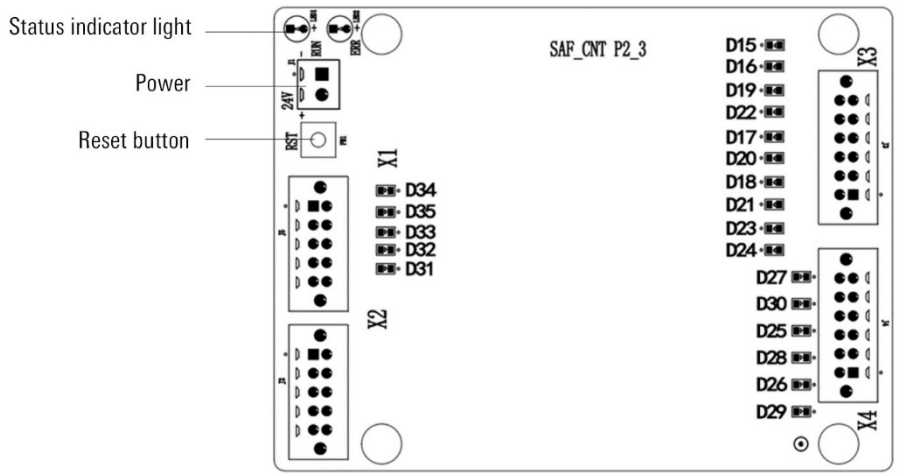


Figure 6-5 Security module

Safety module internal PLC Connector (X1) definition

The definition of the internal PLC connector (X1) in the safety module is detailed in Table 6-10.

Table 6-10 Definition of safety module internal PLC connector (X1)

Pin number	Signal name	Pin number	Signal name
1	DGND_IO (Public ground)	2	DO_SAFE_STATE (Security module status)
3	DGND_IO (Public ground)	4	DI_RSTN (Safety module reset signal N)
5	DI_RSTP (Safety module reset signal P)	6	DI_CTRLN (Safety module enable signal N)
7	DI_CTRLP (Safety module enable signal P)	8	DI_KM2_CON (Contactor 2 control input)
9	DI_KM1_CON (Contactor 1 control input)	10	DI_MODE_SW (Brake control mode signal)

Safety module output connector (X2) definition

Table 6-11 defines the output connector (X2) of the security module.

Table 6-11 Safety module output connector (X2) definition

Pin number	Signal name	Pin number	Signal name
1	CONTACT1- (Contactor 1 control output-)	2	CONTACT1+ (Contactor 1 control output+)
3	CONTACT2- (Contactor 2 control output)	4	CONTACT2+ (Contactor 2 control output+)
5	EXT_SAFE2-	6	EXT_SAFE2+

Pin number	Signal name	Pin number	Signal name
	(External safety signal 2-)		(External safety signal 2+)
7	EXT_SAFE1- (External Safety Signal 1-)	8	EXT_SAFE1+ (External safety signal 1+)
9	AC220_L (220V positive)	10	AC220_N (220V ground)

Safety module input signal connector 1 (X3) definition

For the definition of safety module input signal connector 1 (X3), see Table 6-12.

Table 6-12 Safety module input signal connector 1 (X3) definition

Pin number	Signal name	Pin number	Signal name
1	DI_EXT_SAFE1 (External safety input signal 1)	2	DI_EXT_SAFE2 (External safety input signal 2)
3	DI_DOOR (Control cabinet door travel switch)	4	DI_PWR_STATE (Main circuit abnormal signal input)
5	DI_RESERVE1 (Reserve safe input 1)	6	DI_RESERVE2 (Reserve safe input 2)
7	COMMON_OTHER (Control cabinet travel switch ground)	8	D+24V_IO (24VDC)
9	DI_PANEL_SAFE (Panel safety input)	10	COMMON_PANEL_SAFE (Panel safety input ground)
11	DI_STOP1 (Cabinet door emergency stop input)	12	COMMON_STOP1 (Cabinet door emergency stop input ground)

Security module input signal connector 2 (X4) definition

For the definition of safety module input signal connector 2 (X4), see Table 6-13.

Table 6-13 Security module input signal connector 2 (X4) definition

Pin number	Signal name	Pin number	Signal name
1	DI_ALARM (Driver 1 alarm input)	2	DI_ALARM (Driver 2 alarm input)
3	DI_ALARM (Driver 3 alarm input)	4	DI_ALARM (Driver 4 alarm input)
5	DI_ALARM (Driver 5 alarm input)	6	DI_ALARM (Driver 6 alarm input)

Pin number	Signal name	Pin number	Signal name
7	COMMON_ALARM (Driver alarm input ground)	8	COMMON_ALARM (Driver alarm input ground)
9	DI_KEY_EN (Teach pendant key signal input)	10	COMMON_KEY_EN (Teach pendant key signal input ground)
11	DI_STOP2 (Teach pendant emergency stop input)	12	COMMON_STOP2 (Teach pendant emergency stop input place)

6.4 MCB module

The MCB module is shown in Figure 6-6.

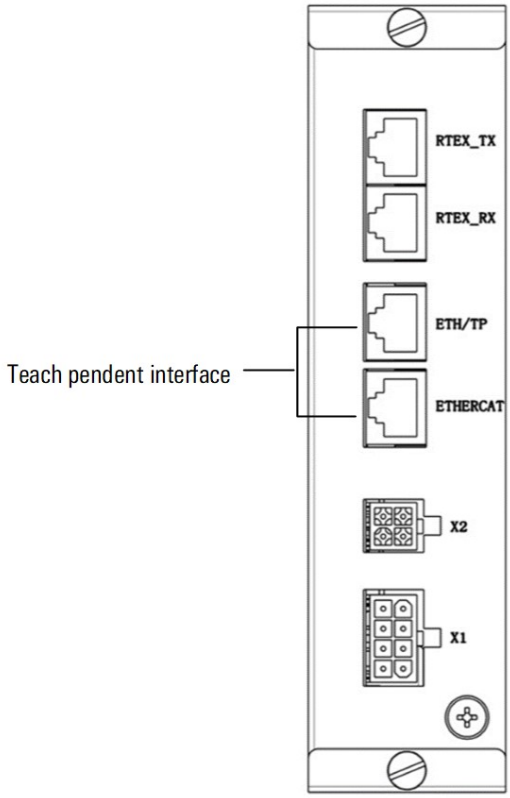


Figure 6-6 MCB module

MCB module connector (X1) definition

The definition of MCB module connector (X1) is detailed in Table 6-14.

Table 6-14 MCB module connector (X1) definition

Pin number	Signal name	Pin number	Signal name
1	NC	2	NC
3	GND	4	D+24
5	NC	6	NC

7	24V	8	MANUAL_ PowerDown

MCB module connector (X2) definition

The definition of MCB module connector (X2) is detailed in Table 6-15.

Table 6-15 MCB module connector (X2) definition

Pin number	**Signal name**
1	485+
2	NC
3	485-
4	GND

7 ARC4-165 control cabinet maintenance and fault handling

7.1 Routine maintenance items and cycles

The routine maintenance items and cycles of the ARC4-165 control cabinet are detailed in Table 7-1.

Table 7-1 Routine maintenance items and cycles

Maintenance project	**Maintenance cycle**
Emergency stop switch	6 months
Circuit breaker	6 months
Driver	6 months
Contactor	6 months
Arc extinguisher	6 months
Indicator light	6 months
Heavy-duty connectors	6 months
Fan and air duct	6 months

Maintenance process

Check whether the circuit breaker operation reset mechanism can be flexibly connected and disconnected, whether the appearance is clean, without damage or carbonization phenomenon, whether indicator lights and other indicating devices can send signals normally, and whether the connection at the heavy-duty connector is loose.

7.2 Possible trouble shooting steps

Circuit breaker and contactor

When the reset mechanism of the circuit breaker and other operations cannot be flexibly switched on and off, or there are damages and carbonization on the appearance, they should be replaced immediately. If the contactor is damaged or the armature movement is not flexible, or there is a blocking phenomenon, it should be replaced immediately (all the above operations should be carried out by personnel with professional qualifications).

Encoder battery

When replacing the encoder battery, connect the drive with a USB cable and use Servodebugger to clear the encoder multi-turn value.

Indicator light

When the indicator light or other indicating device fails to emit signals normally, first check if the connecting circuit is faulty; if the circuit is fine, then replace the indicating device and observe if it can emit signals normally.

Heavy duty connector

When the heavy-duty connector or other connecting devices become loose, the heavy-duty connector plug should be separated from the socket part, reconnected, and tightened to ensure a reliable connection.

Fuse

When the power indicator of the control cabinet is on but some electrical components cannot be powered on, please check if the corresponding fuse on the adapter board (refer to Figure 7-1) is burnt out. If there is a burnt fuse, please replace it according to Table 7-2.

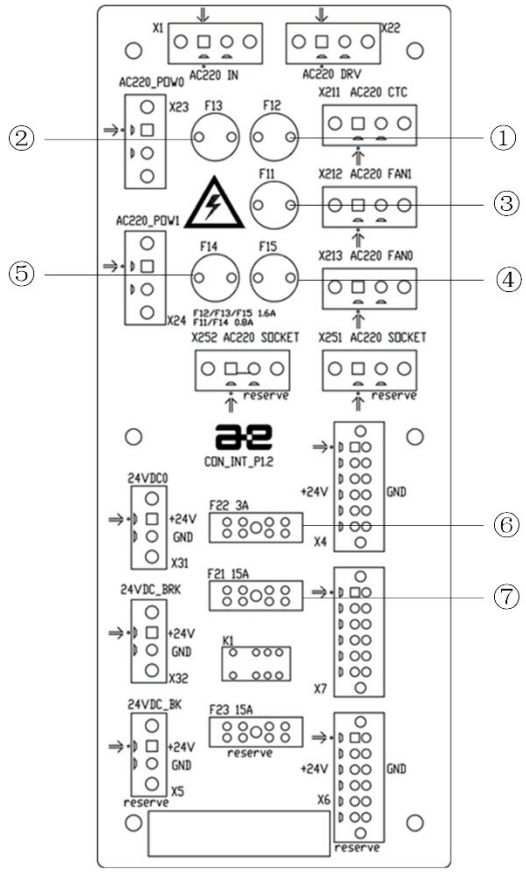


Figure 7-1 Diagram of power adapter and fuse

Table 7-2 Functions and replacement instructions of various fuses

No.	Fuse	Corresponding terminal	Function	Specifications
1	F12	X22	Protect the drive control power	2.5A
2	F13	X23	Protect 220V to 24V power module 1	1.6A
3	F11	X211,X212,X213	Protect the power supply of the fan and contactor coils	0.8A

No.	Fuse	Corresponding terminal	Function	Specifications
4	F15	X251,X252	Protect 220V backup power supply	1.6A
5	F14	X24	Protect 220V to 24V power module 2	0.8A
6	F22	X4	Protect other 24VDC power supplies	3A
7	F21	X32	Protect the output power of the holding brake	15A

Common alarms and corresponding solutions for drivers

For common alarms and their handling, please refer to Table 7-3 in the manual.

Table 7-3 Common alarms and solutions for drivers

Alarm code	Alarm name	Solution
Er100	Authorization expired	Request for long-term authorization code
Er101	EEPROM parameter abnormal	Confirm the correctness of the configuration file and try to rewrite the configuration file
Er102	Programmable logic configuration fault	Restart
Er103	FPGA initialization error	Restart
Er104	Incorrect firmware type	Check the control panel model or modify the firmware type configuration
Er105	Calculation engine timed out	Restart
Er106	FPGA loading error	Restart
Er107	Encoder power-on initialization timeout	Restart
Er110	Overcurrent detection fault	Check whether the gain settings, path planning, and interpolation timeout are reasonable.
Er112	Fan stopped malfunction	Check if the fan is running properly
Er113	Control power outage	Check if the LN interface voltage is too low
Er400	Bus initialization error	Check if the bus type and the control board match
Er401	Bus verification error	Check if a shielded ethernet cable is being used
Er402	Bus ID error	Check if Pn008 is configured correctly
Er403	Bus instruction error	Confirm whether the system sends instructions to drive the driver.
Er404	Bus communication timeout	Check if the communication using shielded ethernet cable is disconnected

Alarm code	Alarm name	Solution
Er405	Bus UpdateCnt error	Check if shielded ethernet cable is used, and if the communication is disconnected
Er410	Bus signal synchronization error	Restart
Er504	Speeding fault	Check the reasons for speeding
Er512	Motor overload	Check the reasons for the overload
Er515	Regeneration abnormality	Check the reasons for abnormal regeneration
Er516	Regeneration overload	Check the reasons for regeneration overload
Er530	Over temperature	Check the heat dissipation, which is usually detected at the same time as overcurrent.
Er550	RST three-phase input phase loss	Check the cause of phase loss
Er551	DC bus overvoltage	Check the cause of overvoltage
Er552	DC bus undervoltage	Check the cause of undervoltage
Er560	Encoder frequency division pulse output is too fast	Check the reason
Er650	Position deviation is too large	Check the master station input instructions
Er660	Abnormal pulse frequency	Check pulse frequency input
Er900	Current sampling failure	Restart the drive
Er901	Drive motor type does not match	Replace the drive or motor
Er997	Serial port failure	Check if the serial cable is shielded and the connection is intact
Er995	Virtual 64-bit encoder multi-turn overflow fault	Through Fn010 to clear multi-turn value
Er999	Power supply failure	Check if RST voltage is too low or zero

For common alarms and handling of motor encoders, please refer to Table 7-4.

Table 7-4 Common alarms and solutions for motor encoders

Alarm code	Alarm name	Solution
Er800	Encoder input power supply short circuit fault	Check the encoder wiring
Er830	Encoder offline fault	Check the encoder wiring
Er831	Encoder overspeed	Check the encoder wiring or replace the encoder

Alarm code	Alarm name	Solution
Er832	Encoder overheating	Check the encoder heat dissipation environment
Er833	Encoder battery voltage alarm	Check encoder battery voltage
Er834	Encoder battery voltage fault	Check encoder battery voltage
Er835	Encoder multi-turn error	Replace the encoder
Er836	Encoder multi-turn overflow	Clear multi-turn value through Fn010
Er837	Encoder transmission verification (PE) fault	Check the encoder wiring
Er838	Encoder count abnormal (CE)	Replace the encoder
Er839	Encoder frame boundary level error (DE)	Replace the encoder
Er840	Encoder CRC check failure	Check the encoder wiring
Er841	Encoder synchronization failure	Check the encoder wiring
Er842	Encoder frame check error	Check the encoder wiring
Er843	Encoder multi-turn fault	Replace the encoder
Er844	Encoder storage fault (MEMERR)	Replace the encoder
Er845	The battery voltage was insufficient when the power was turned off last time.	Check encoder battery voltage
Er846	Encoder internal matching exception 1 (STERR)	Replace the encoder
Er847	Encoder internal matching exception 2 (PSERR)	Replace the encoder
Er849	Encoder internal matching exception 3 (ES0)	Replace the encoder

For common warnings and handling details, please refer to Table 7-5.

Table 7-5 List of warning codes

Alarm code	Alarm name	Solution
Ca999	Main power off warning	Check if the RST three-phase voltage is too low or zero
Ca552	Under-voltage warning	Check if the RST three-phase voltage is too low
Ca550	Phase Loss Warning	Check if there is a phase loss in the RST three-phase power supply

Ca516	Regeneration overload warning	Check for regeneration overload

8 ARC4-165 control cabinet storage conditions

During long-term storage, the control cabinet shall be placed in a cool and waterproof place away from direct sunlight. The specific environmental requirements are shown in Table 8-1:

Table 8-1 Storage conditions

Parameter	**Value**
Minimum ambient temperature	-25° C
Maximum ambient temperature	+40° C
Maximum ambient temperature for 24 hours storage	+70° C
Maximum humidity	95% non-condensing under constant temperature conditions

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