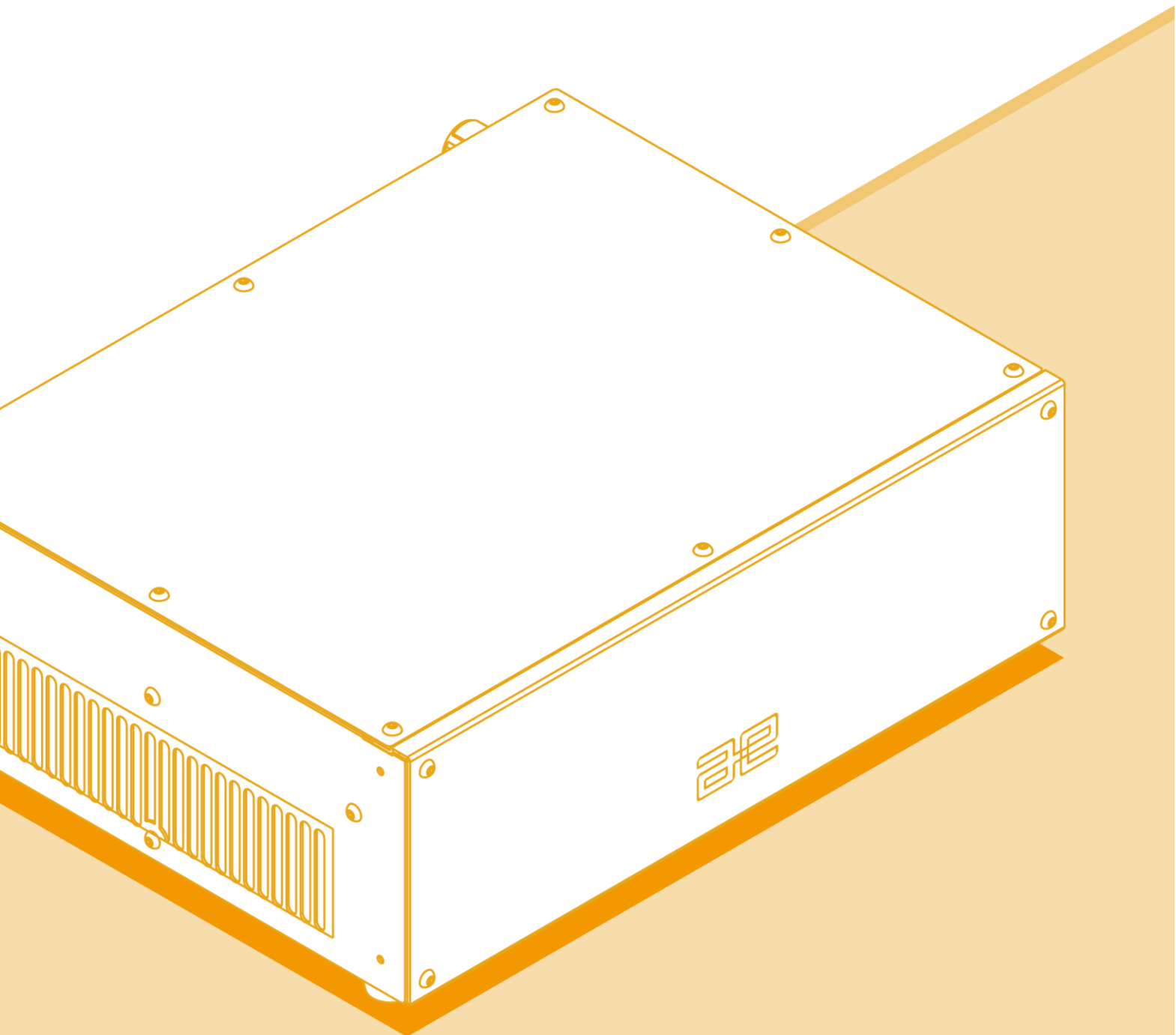# inCube2S-6
Control Cabinet Manual

V1.0.2

Foreword

About this manual

This manual is for technicians to install, use, and use the inCube2S-6 control cabinet quickly, correctly, and safely, to be familiar with the relevant precautions, and to perform regular routine maintenance work on the control cabinet.

Prerequisites

Before operating the robot, be sure to read the relevant safety instructions and operation instructions of the product carefully. Users must understand the safety knowledge and basic operation knowledge before using the robot.

Please read the following documents when necessary:

- "AIR3SC-400A Horizontal Multi-joint Industrial Robot Manual"

- "AIR6SC-600A Horizontal Multi-joint Industrial Robot Manual"

- "SCARA type teach pendant operation manual"

- "ARL Programming Manual"

Target groups

- Operators

- Product technicians

- Technical service personnel

- Robot teachers

Meaning of common signs

The signs and their meanings in this manual are detailed in Table 1.

Table 1 Signs used in this manual

Sign	Meaning
⚠ Danger	Failure to follow the instructions may result in an accident causing the severe or fatal injury or the great losses of property.
⚠ Warning	Failure to follow the instructions may resulting in moderate injuries or minor injuries, or only material damage may occur.

Sign	Meaning
⚠ **Caution**	Prompt for the environmental conditions and important things or shortcuts you shall pay attention to
ⓘ **Prompt**	Prompt for additional literature and instructions for additional information or more detailed operating instructions

Manual description

The contents of this manual are subject to supplementation and modification. Please visit "Download Center" on the website regularly to obtain the latest version of this manual in a timely manner.

Website URL: http://robot.peitian.com/

Revision history

The revision history contains the instructions for each document update. The latest version of the document contains updates to all previous versions of the document.

Table 2 Signs used in this manual

Version	Publication date	Modification description
V1.0.0	2020.06.30	1st official publication
V1.0.1	2021.08.10	2nd official release Fix known bug
V1.0.2	2022.07.21	3rd official release Fix known bug

Manual Number and Version

The manual-related information is shown in Table 3.

Table 3 Document-related information

Document name	" inCube2S-6 control cabinet manual "
Document number	UM-P05310000029-001

Document name	" inCube2S-6 control cabinet manual "
Document version	V1.0.2

Declaration of applicable with product standards

The requirements for industrial robot system design are detailed in Table 4.

Table 4 Declaration of applicable safety standards

Standard	Description	Version
2006/42/EC	Machinery directive : Machinery directive 2006/42/EC (new version) issued by European Parliament and Council on May 17, 2006 to modify 95/16/EC	2006
2014/30/EU	Electromagnetic compatibility directive: 2014/30/EU directive issued by European Parliament and Council on February 26, 2014 to balance the electromagnetic compatibility regulations of member states	2014
2014/68/EU	Pressure facility directive: Electromagnetic compatibility directive: 2014/68/EU directive issued by European Parliament and Council on May 15, 2014 to balance the pressure facility regulations of member states (It is only suitable for the robot with hydraulic balance weight)	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	Robots and robotic devices - Safety requirements for industrial robots : Part 1: Robots (Prompt: Information is consistent with ANSI/RIAR.15.06-2012, Part 1)	2011
61000-6-2	Electromagnetic compatibility (EMC): Part 6-2: Generic standards - Immunity for industrial environments	2005
61000-6-4 + A1	Electromagnetic compatibility (EMC): Part 6-4: Generic standards - Emission standard for industrial environments	2011
60204-1 + A1	Safety of machinery: Electrical equipment of machines - Part 1: General requirements	2009
IEC 60529	IP rating provided by enclosures (IP Code): This standard applies to the IP rating for the electrical equipment with enclosures and the rated voltage exceeding 72.5kv.	2001

Contents

1.   Product specification

1.1.   General functions and intended applications

Industrial robot systems are used to move tools and devices, or process and transport workpieces or products. It is allowed to be used only in accordance with the specified climatic and environmental conditions. For specific storage conditions and working environment requirements, please refer to *Chapter 1.2.*

All non-compliant use is illegal and prohibited. These non-compliant uses include:

■ Use in environments where there is a danger of explosion.

■ Use outside the allowed motion range.

■ Transporting people or animals.

■ Used as a climbing aid.

⚠ Caution	Changing the structure of the robot, such as drilling holes, can cause component damage. This is regarded as improper use and will result in loss of warranty and claim eligibility.

1.2.   Environmental conditions and working and storage limitations

1.2.1.   Installation environment requirements

■ The ambient temperature is required to be 0℃-45℃.

■ The relative humidity requirement is 20%-80%RH.

■ Keep dust, oil mist and water vapor in the installation environment to a minimum.

■ The environment must be free of flammable and corrosive liquids or gases.

■ The equipment installation must be far away from the impact and seismic source.

■ Keep a heat dissipation distance of at least 20cm between the control cabinet and the surrounding installation environment.

1.2.2.   Storage environmental conditions

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

Table 1-1 Long-term storage environmental conditions of the control cabinet

Parameter	Value
Minimum ambient temperature	-25° C
Maximum ambient temperature	+60° C
Maximum humidity	90% non-condensing under constant temperature conditions

1.3.   Basic specifications

The basic specifications of inCube2S-6 control cabinet are shown in Table 1-2:

Table 1-2 Basic specifications of inCube2S-6 control cabinet

Name	Characteristic	
Type of cabinet	19 inch cabinet	
Dimensions (width × height × depth)	364 × 135 × 283（mm）	
Colour	Silver	
Weight	11kg	
Protection level	IP20	
Number of axes	4 axes, 2 axes can be expanded	
Noise	50dB（A）	
Rated power supply voltage	AC220V ± 10%	
Power frequency	49Hz~61Hz	
Full load power	2.2KVA	
Fusing current	10A	
Vibration conditions	At work	In transit
Vibration acceleration	0.5g	6g
Vibration frequency	4Hz~120Hz	5Hz~500Hz
Shock acceleration	2.5g	300g
Impact waveform/period	Half sine /11ms	Sawtooth /9ms
Operating temperature	0℃~45℃	
Temperature change rate	<1.1K/min	
Storage temperature	-25℃~60℃	
Working humidity	80%RH	
Storage humidity	90%RH	
Altitude	Normal operation below 1000m altitude	
	Use at an altitude of 1000m-4000m, derating by 5%/1000m	

2.   Robot system introduction

2.1.   Introduction to industrial robots

The industrial robot system is mainly composed of three basic parts: industrial robot manipulator, control cabinet and teach pendant:

■   Manipulator refers to the mechanism used to grab or move objects (tools or workpieces) in the robot system, also known as the robot body. This manipulator is a horizontal multi-joint industrial robot, including a linear axis and three rotary axes.

■   Control cabinet is installed with the electrical equipment needed to control the robot, and provides a connection interface with the robot manipulator and other external equipment.

■   Teach pendant is connected to the main control system of the control cabinet, and is used to control the manual/automatic operation of the robot, record the running track, display playback or record the teaching point and program according to the teaching point.

The structure of AIR3SC-400A horizontal multi-joint industrial robot system is shown in Figure 2-1.
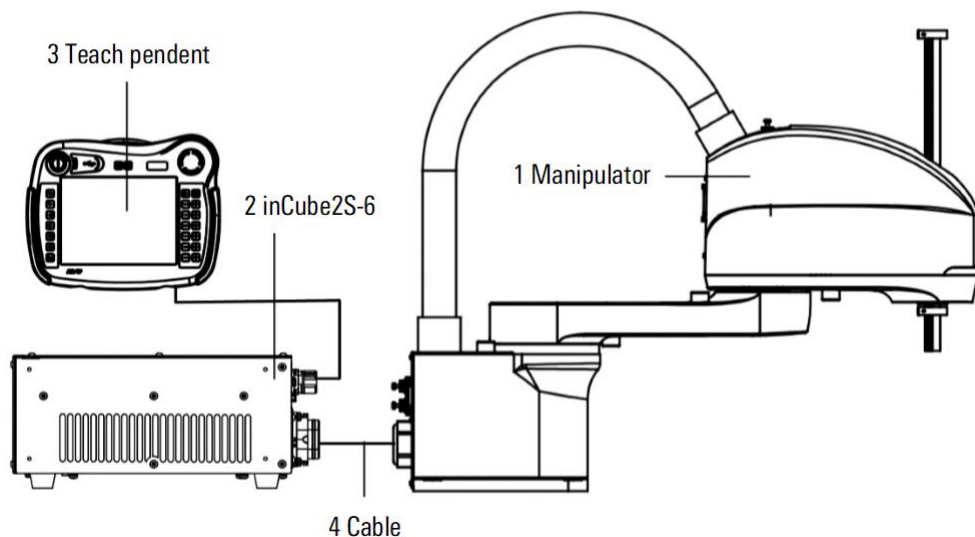
Figure 2-1 Composition of industrial robot system

2.2.   Basic composition of control cabinet

The electrical equipment required to control the robot is installed in the control cabinet, including motor drives, safety modules, motion control modules and other components, and provides connection interfaces with the robot body and other external equipment.

The appearance of the control cabinet and the names of its parts are shown in Figure 2-2, and related descriptions are shown in Table 2-1.

(a)

(b)
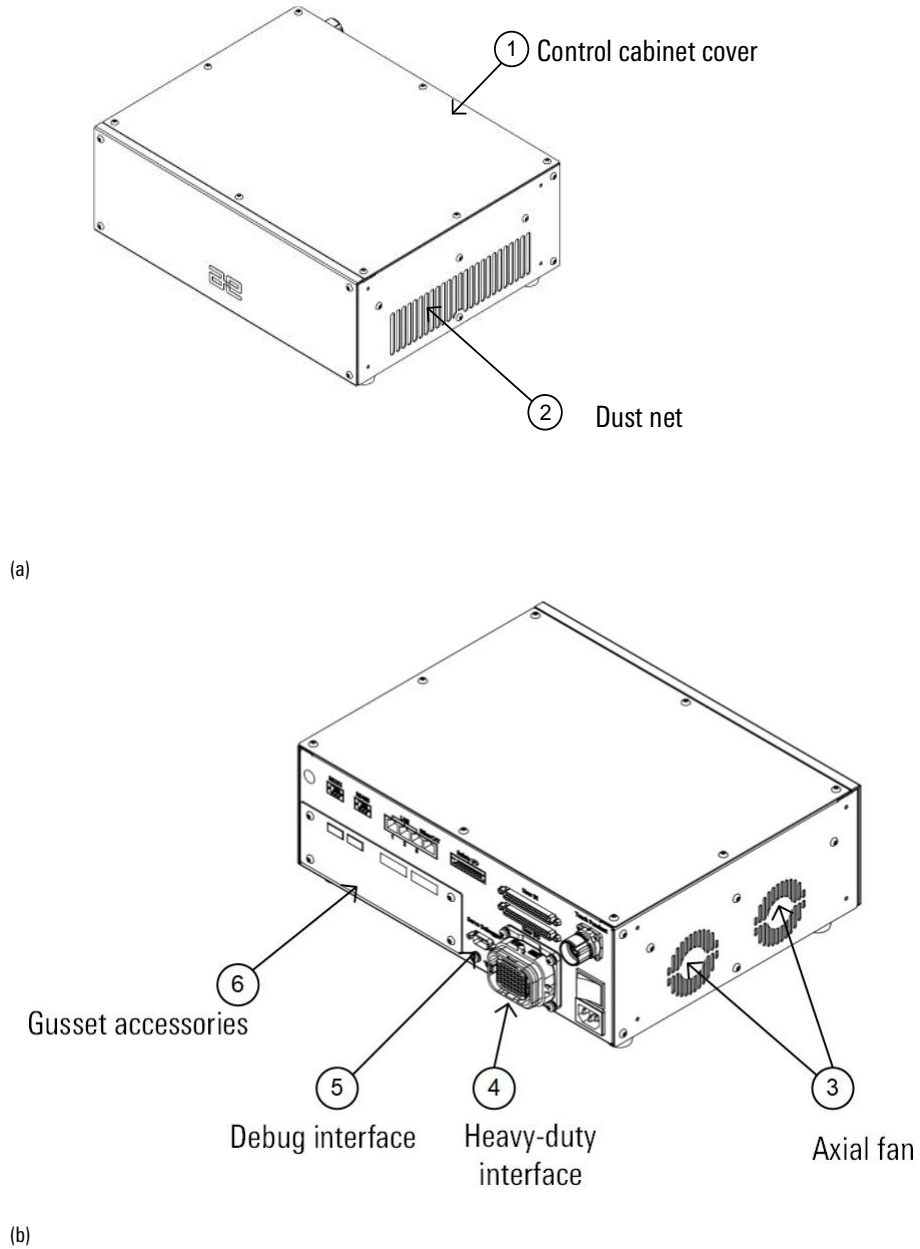
Figure 2-2 The appearance of the control cabinet

Table 2-1 The appearance of the inCube2S-6 control cabinet and the name and description of each part of the control cabinet

No.	Name	Description
1	Control cabinet cover	The upper cover of the control cabinet
2	Dust net	Prevent dust from entering the control cabinet
3	Axial fan	Used for heat dissipation and ventilation of control cabinet
4	Overload interface	Connect the heavy-duty cable of the manipulator to provide power and encoder signal
5	Debug interface	Driver parameter debugging interface
6	Gusset accessories	Use when choosing an assembly

The names of the internal components of the upper cavity of the control box are shown in Figure 2-3, and the related descriptions are shown in Table 2-2.
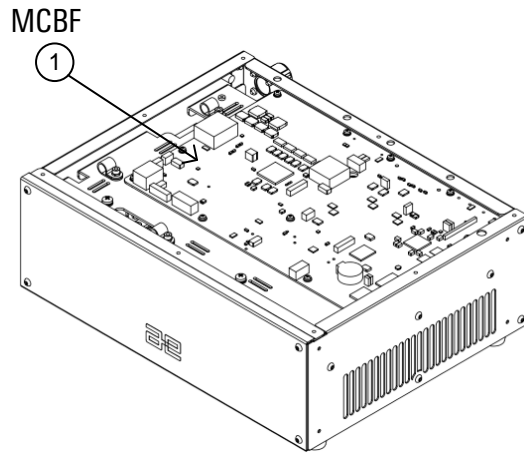
MCBF

Figure 2-3 Schematic diagram of the components in the upper cavity of the control box

Table 2-2 The name and description of each part of the components in the upper cavity of the control box

No.	Name	Description
1	MCBF	Main control circuit

The names of the internal components of the drive box are shown in Figure 2-4 and the related descriptions are shown in Table 2-3.

Switched power supply

DCBF
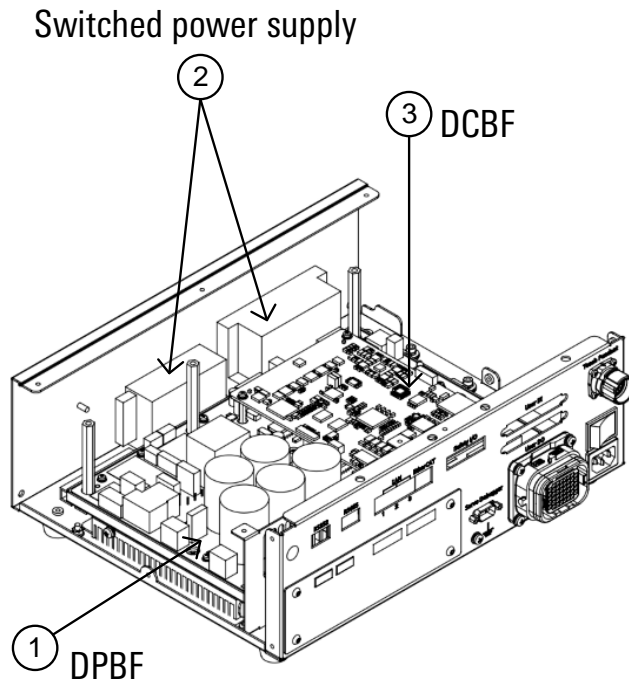
DPBF

Figure 2-4 Schematic diagram of the components in the drive box

Table 2-3 The name and description of each part of the components in the drive box

No.	Name	Description
1	DPBF	4-axis drive module
2	Switching power supply	Provide power supply for brake and control circuit
3	DCBF	Drive control circuit

2.3.   Product label and meaning

The inCube2S-6 control cabinet contains 4 kinds of labels. Please refer to Figure 2-5 for the specific location of each label. See Table 2-4 for specific instructions.
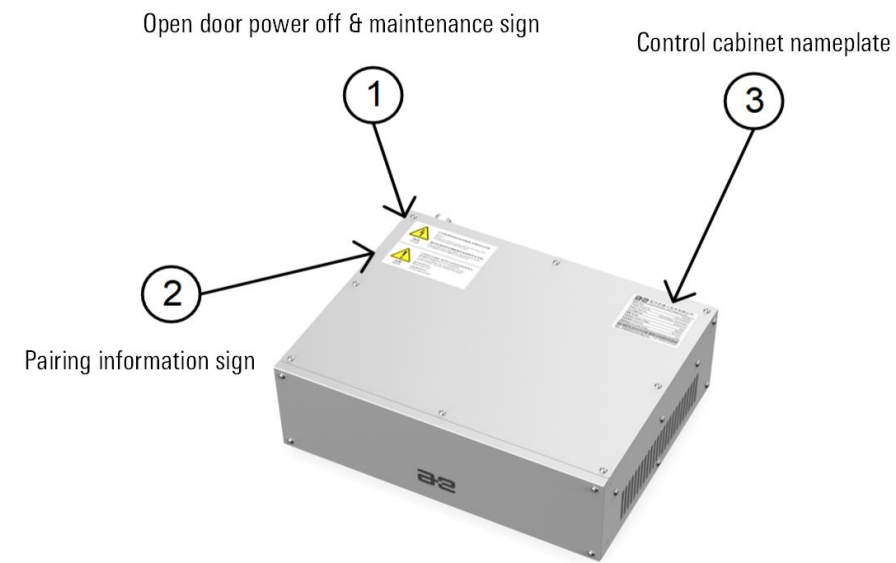
(a)
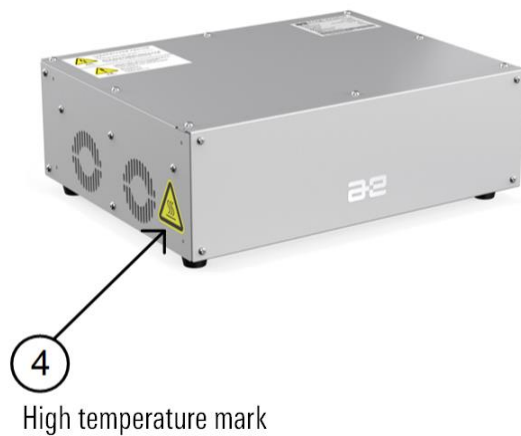
(b)

Figure 2-5 Schematic diagram of the location of the label in the control cabinet

Table 2-4 inCube2S-6 control cabinet label description

No.	Name	Description
1	Open door power off & maintenance sign	The open the door and power off & maintenance signs are shown in Figure 2-6. When opening the cabinet, please make sure to turn off the power and wait for more than 15 minutes.
2	Pairing information sign	The pairing information indicator is shown in Figure 2-7. When opening the box, please check whether the serial number on the indicator is consistent with the serial number on the nameplate of the supporting manipulator. If not, please contact our company's after-sales service personnel.
3	Nameplate of the control cabinet	The nameplate of the control cabinet is shown in Figure 2-8 The model, serial number, weight, and production date of the control cabinet are marked on the nameplate.
4	High temperature mark	There may be heat in the place where the high temperature mark (see Figure 2-9) is attached. When you see this mark, you should pay attention to avoid being burned. If you have to touch the device when it is hot, please use heat-resistant gloves and other protective equipment before touching it

Figure 2-6 Open door power off & maintenance sign

Figure 2-7 Pairing information sign

Figure 2-8 Nameplate of the control cabinet
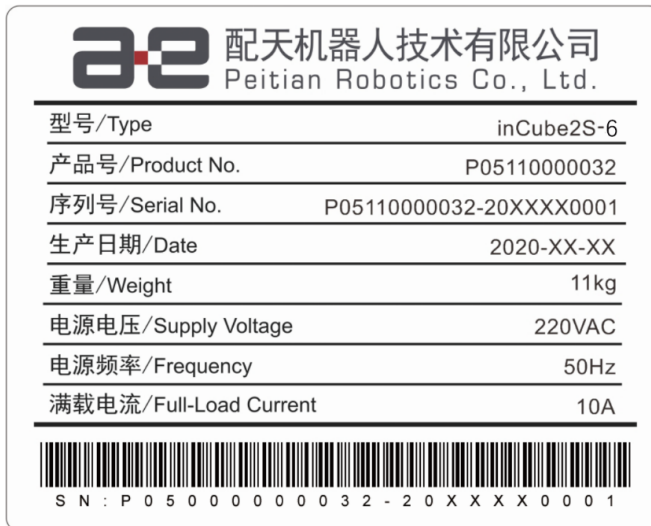

Figure 2-9 High temperature mark

型号/Type

产品号/Product No.

3.   Preparation before use

3.1.   Safety precautions before use

Before operating the manipulator, peripheral equipment and manipulator system, the safety precautions of the operator and the system must be fully studied.

Operator definition

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

Operators

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

Teachers

- Possess the function of operator;
- The operation machine can be taught in the safety fence.

Maintenance engineers

- Possess the function of teacher;
- Can carry out maintenance (repair, adjustment, replacement, etc.) operation of the manipulator.

Operator safety

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

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

When using an automatic system, you must try to ensure the safety of the operators. It is very dangerous to enter the operating range of the manipulator. Measures should be taken to prevent the operators from entering the operating range of the manipulator.

The general precautions are listed below, please take appropriate measures to ensure the safety of the operators:

- The operation personnel running the manipulator system shall receive the training from the company and pass the relevant assessment.
- While the equipment is running, even if the manipulator seems to have stopped, the manipulator is possibly waiting for the start signal and is about to act. The manipulator shall be regarded as operating at this state. To ensure the safety of operation personnel, it is necessary to confirm that the manipulator is in the operating state via the audible and visual alarms such as the warning lamp
- Be sure to set the safety barrier and safety door around the system so that the operation personnel cannot enter the safety barrier without opening the safety door. The interlock switch, safety pin, etc. shall be set on the safety door so that when the operator opens the safety door, the manipulator will stop.
- Peripheral equipment shall be electrically grounded.
- The peripheral equipment shall be set outside the range of manipulator if possible.

■ The range of manipulator shall be clearly marked with the lines on the floor to make the operator understand the range of manipulator including the mechanical arm and other tools.

■ A proximity switch or photoelectric switch shall be installed on the floor so that when the operation personnel are about to enter the range of manipulator, the audible and visual alarms such as the buzzer are issued to stop the manipulator, thereby ensuring the safety of operation personnel.

■ A lock shall be set if it is possible to make sure that the manipulator power cannot be turned on except by the operation personnel responsible for the operation.

■ Always disconnect the manipulator power when performing the individual commissioning of peripheral equipment.

Safety of Operators

The operator is not authorized to perform operations within the safety fence:

■ When you do not need to operate the manipulator, disconnect the power supply of the manipulator control cabinet or press the emergency stop button.

■ The manipulator system should be operated outside the safety fence.

■ In order to prevent irrelevant personnel from entering the working range of the manipulator by mistake, or to prevent the operator from entering dangerous places, protective fences and safety gates should be installed.

■ The emergency stop button should be set within the reach of the operators.

(i) Prompt	Manipulator controller is designed to be connected to an external emergency stop button. With this connection, the manipulator will stop when the external emergency stop button is pressed.

Safety of Teachers

In the teaching operation of the manipulator, in some cases, it is necessary to enter the working range of the manipulator, in this case, special attention should be paid to safety:

■ If you do not need to enter the manipulator range, be sure to operate outside the manipulator range.

■ Before proceeding with the teaching, verify that the manipulator or peripheral equipment is in a safe state.

■ If it is inevitable to enter the range of manipulator to conduct the teaching, first confirm the positions and states of safety devices (such as the emergency stop button, emergency automatic stop switch of teach pendant, etc.).

■ Teachers shall pay special attention to make other people away from the range of manipulator.

■ Before starting the manipulator, first confirm that there is no people and no abnormality in the range of manipulator.

■ After the teaching is over, be sure to perform the test run following the steps below:

Step1.   At low speed, execute at least one cycle intermittently to confirm no abnormality.

Step2.   At low speed, execute at least one cycle continuously to confirm no abnormality

Step3.   At intermediate speed, execute at least one cycle continuously to confirm no abnormality

Step4.   At operating speed, execute at least one cycle continuously to confirm no abnormality

Step5.   Execute the program in automatic operation mode.

■ The instructor must evacuate to the safety fence when the manipulator is running automatically.

3.2.   Product unpacking

3.2.1.   Unpacking method

For the unpacking method of inCube2S-6 control cabinet and ARCSP-AIR_TP teach pendant, please refer to our company's "XX Horizontal Multi-joint Industrial Robot Manipulator Manual".

3.2.2. Repacking to prevent transportation damage

For the repackaging of inCube2S-6 control cabinet and ARCSP-AIR_TP teach pendant, please refer to our company's "XX Horizontal Articulated Industrial Robot Manipulator Manual".

3.2.3. Safe disposal of packaging materials

After unpacking, all parts and components of the packing box must be properly stored. When storing, pay attention to:

- The storage place must be dry and clean.
- The temperature of the storage location should be stable.
- The selected storage location must ensure that the materials of each component of the packing box are not damaged.
- The packing box must be kept indoors.

3.2.4. Disposal of waste materials

Industrial robot system waste disposal must be carried out in accordance with the laws, regulations and standards of various countries.

3.3. Preparation before installation

Before installing the manipulator, the items listed below must be strictly observed:

- Ensure that the installation staff must pass the relevant training of the company, and can only carry out installation work in compliance with international and local laws and regulations.
- After unpacking, make sure that the manipulator is not bumped and damaged.
- Ensure that the installation environment of the manipulator meets the requirements of *Chapter 1.2.1* of this manual.

3.4. Installation and assembly

3.4.1. Installation dimensions

The inCube2S-6 control cabinet is a 3U height control cabinet, which can be placed on a 19-inch cabinet tray. The specific dimensions are shown in Figure 3-1.
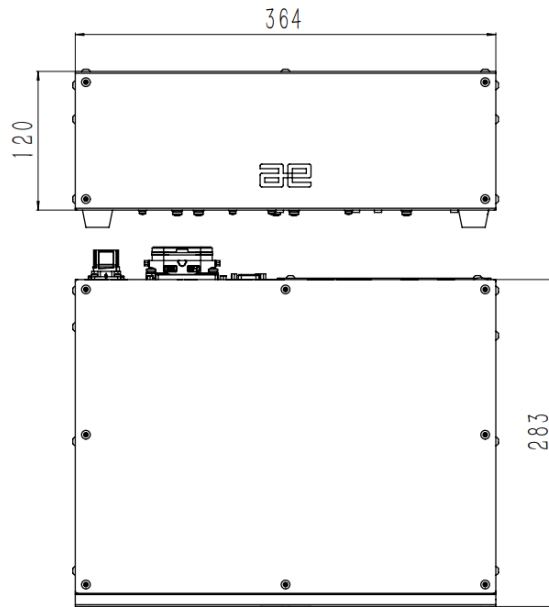
Figure 3-1 Dimensions of the cabinet

3.4.2.   Installation method

Direct installation

The inCube2S-6 control cabinet can be directly placed on a platform that meets the installation environment. The platform is not allowed to be a moving platform. The contact points between the platform and the four foot pads of the control cabinet are on the same plane.

Installation requirements:

- When placed normally, the platform and the four feet pads are in contact. The placement surface of the control cabinet is allowed to have a certain angle of inclination, but the inclination angle is not more than 30°.
- A certain weight of load is allowed to be placed on the upper surface of the control cabinet, but the load weight is not more than 40kg, and the load contact area is not less than 80% of the upper surface of the cabinet.

Stacking of cabinets

The inCube2S-6 control cabinet supports the stacking of up to three cabinets. For the occasions where multiple control cabinets are used and the space occupied by the control cabinet is relatively high, the cabinets can be stacked in the manner shown in Figure 3-2. For information about the materials used for stacking, see *Appendix A of this manual inCube2S-6 accessories list.*
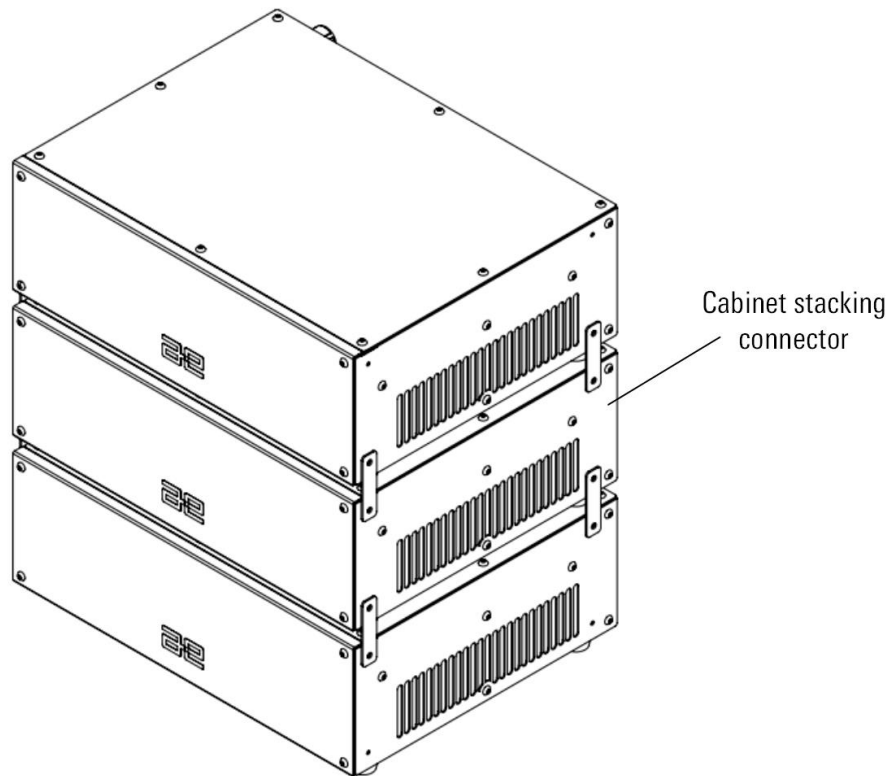
Figure 3-2 Stacking of cabinets

3.4.3.   Connection of control cabinet

Connect the teach pendant

The upper right corner of the front panel of the inCube2S-6 control cabinet is the teach pendant connection interface, which is connected by a quick-plug connector (see Figure 3-3).
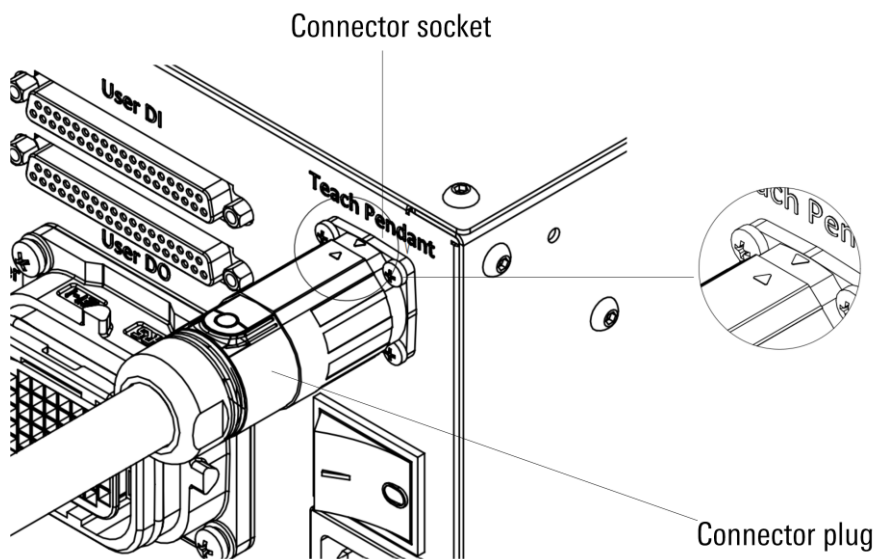
Figure 3-3 Teach pendant connection interface

Connection method:

Align the triangle symbol of the connector plug ① with the triangle symbol of the connector socket ② (as shown in the partial enlarged view of Figure 3-3), push in the connector plug ①, and rotate it 45° clockwise to make it align with the connector socket ② tight.

Connect the manipulator

The lower right corner of the rear panel of the inCube2S-6 control cabinet is the power encoder connection interface of the manipulator, which uses a heavy-duty connector. The two ends of the heavy-duty line are respectively used to connect the manipulator and the control cabinet.

Step1. Connect the manipulator. Confirm that the heavy-duty line and the manipulator are well fixed (see Figure 3-4).
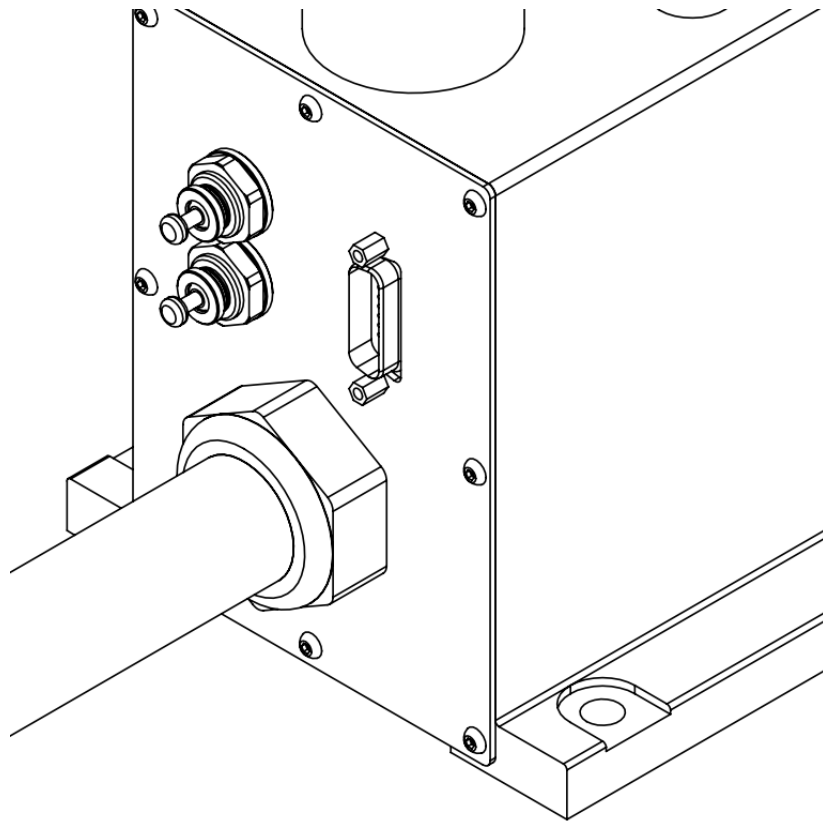
Figure 3-4 The connection interface of the heavy duty cable of the manipulator

Step2. Connect the control cabinet. Insert one end of the heavy-duty cable plug into the heavy-duty cable connection interface of the control cabinet (see Figure 3-5), and fasten the lock.
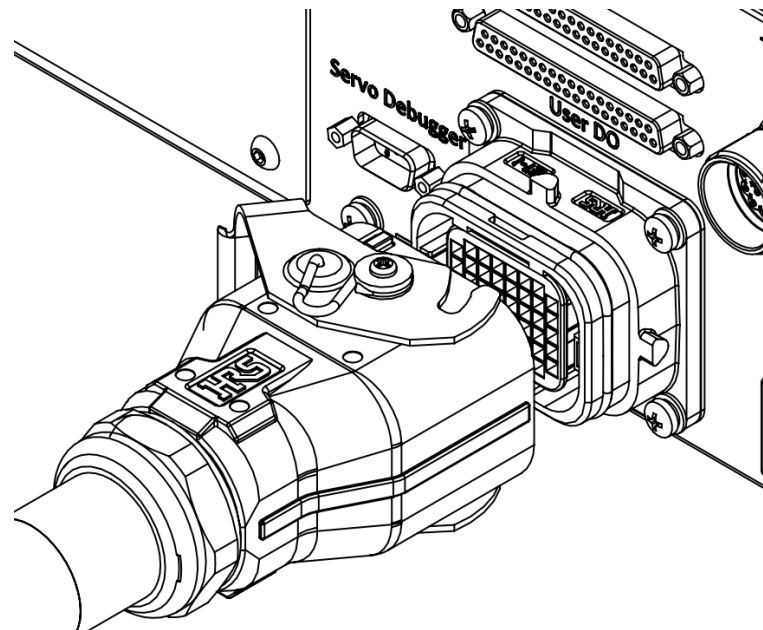
Figure 3-5 Control cabinet heavy-duty connector interface

> **(i) Prompt**　For the connection method of other types of manipulators, please refer to our company's "XX Horizontal Multi-joint Industrial Robot Manipulator Manual".

The length of the power encoder cable of AIR3SC-400A/AIR6SC-600A is 3m. The dimensions of the heavy-duty plug on the cabinet side are shown in Figure 3-6 below.
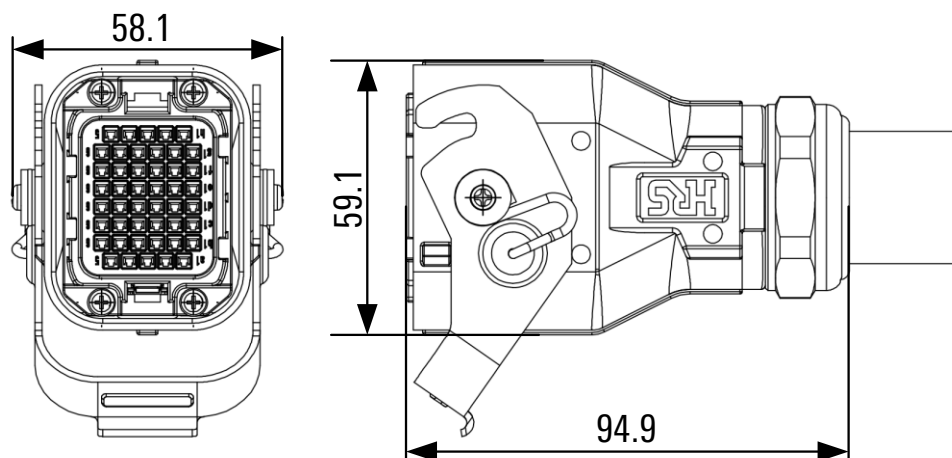
Figure 3-6 The size of the heavy-duty plug on the side of the cabinet

Connect the power supply

The two ends of the power cable are used to connect the control cabinet and the power supply.

Connection steps:

Step1.　Connect the control cabinet. Insert the fret-shaped plug of the power cable into the power cable connection interface of the control cabinet (see Figure 3-7).
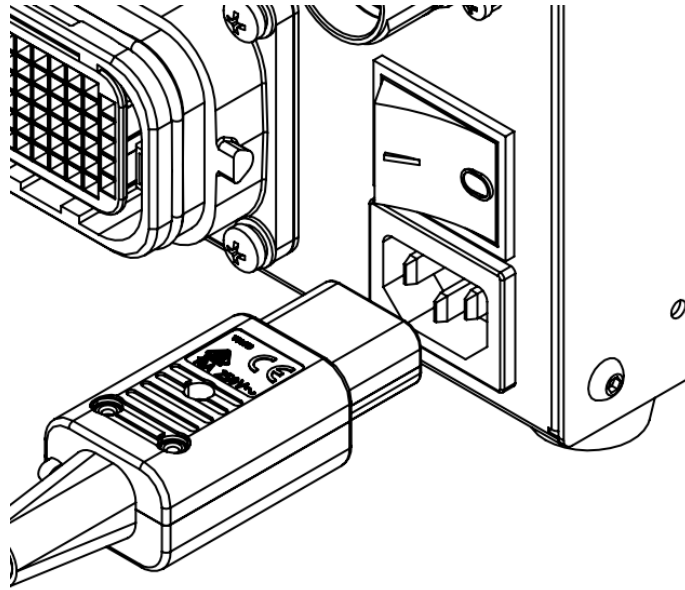
Figure 3-7 Power cable connection interface

Step2.   Connect the power supply. Insert the three-head plug of the power cable into the power socket.

Step3.   Confirm that the on-site power supply voltage and current meet the needs of the control cabinet (provide 220VAC voltage and meet at least 10A peak current load).

Step4.   Confirm that the safety short-circuit module of the control cabinet is connected normally (Safety I/O in Figure 3-8 is in a normal connection state).
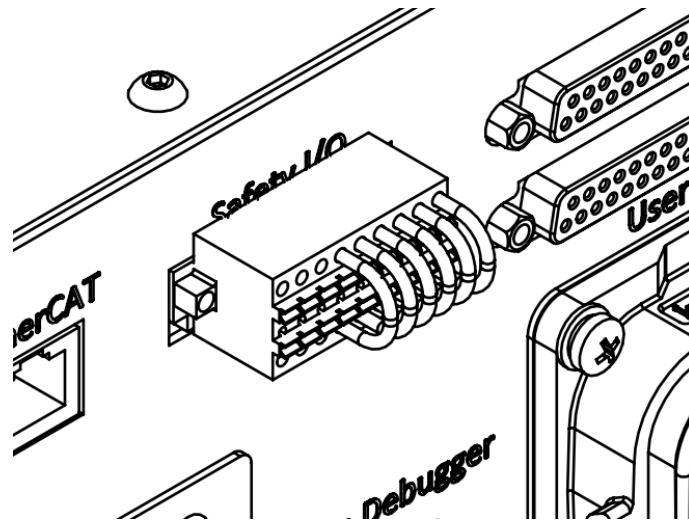
Figure 3-8 Safety short circuit module

Step5.   After powering on, switch the rocker switch from "O" to "I" (refer to Figure 3-9), start the control cabinet, at the same time the switch's own light is on, and the teach pendant starts.
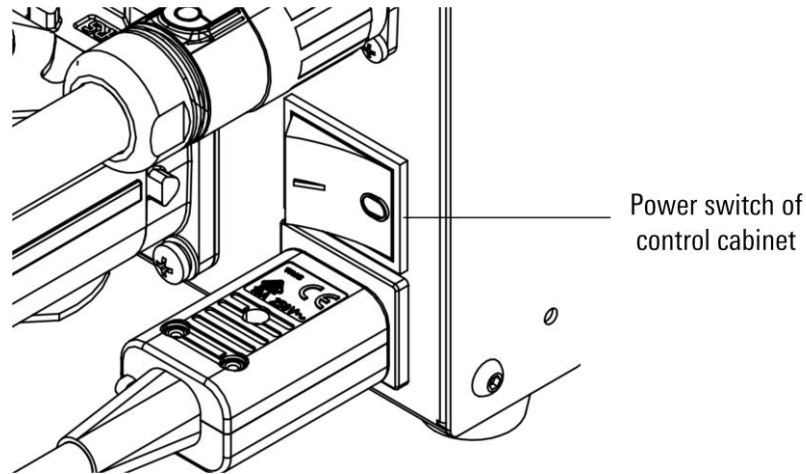
Figure 3-9 Power switch of control cabinet

Step6.   Before powering off, please confirm that the program has stopped running. After the motor is powered off, turn
off the switch on the control cabinet. It is forbidden to unplug the power cord directly.

Connect other interfaces

"Other interfaces" are mainly the interfaces reserved for users by the inCube2S-6 control cabinet.

For the user interface with threaded locking mechanism, the thread must be tightened when connecting, for example:

- RS232—user serial port RS232;
- RS485—PLC-MF master station interface RS485;
- Safety IO—Safety IO interface;
- User DI—User DI interface;
- User DO—User DO interface;

When the user interface without locking mechanism is connected, such as the LAN 1/2/3 user EtherCAT interface, the
EtherCAT interface of the EtherCAT extension external axis, the plug must be fully inserted into the plug when
connecting; for example, the power cable connector, when connecting, Insert the product-shaped power plug fully into
the socket.

(i) Prompt	For the connection cable information of the above interfaces, refer to *Appendix A of this manual inCube2S-6 accessory list*.

3.4.4.   Definition of control cabinet electrical connection

Definition of heavy-duty interface

The definition of the heavy-duty interface of the inCube2S-6 control cabinet is shown in Figure 3-10. The definition and
description of the heavy-duty interface are shown in Table 3-1 and Table 3-2.
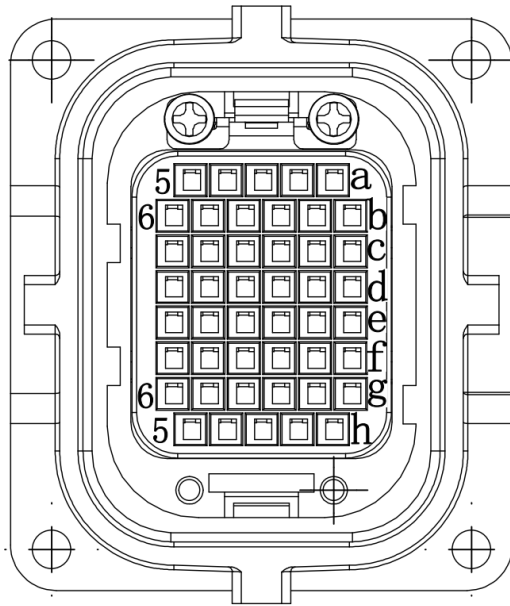
Figure 3-10 Interface of power cable encoder

Table 3-1 Definition of heavy-duty interface

Pin number	a	b	c	d	e	f	G	h
1	J1_PS+	J1_PS-	J1_0V	J1_5V	PE	U1	V1	W1
2	J3_PS+	J3_PS-	J3_0V	J3_5V		U3	V3	W3
3	J2_PS+	J2_PS-	J2_0V	J2_5V	PE	U2	V2	W2
4	J4_PS+	J4_PS-	J4_0V	J4_5V	-	U4	V4	W4
5	-	LED_B#	LED_R#	-	-	GND	GND_24VBR	-
6	-	LED_24V	LEC_G#	-	-	BR_MANUAL	24V_BR_OUT	-

Table 3-2 Explanation of the definition of heavy-duty interface

Pin number	a	b	c	d	e	f	G	h
1	One-axis encoder RS485 signal positive	One-axis encoder RS485 signal negative	One-axis encoder 5V power reference ground	One-axis encoder 5V power supply	Chassis land	One-axis power electric U phase	One-axis power electric V phase	One-axis power electric W phase
2	Three-axis encoder RS485 signal positive	Three-axis encoder RS485 signal negative	Three-axis encoder 5V power reference ground	Three-axis encoder 5V power supply		Three-axis power electric U phase	Three-axis power electric V phase	Three-axis power electric W phase
3	Two-axis encoder RS485 signal positive	Two-axis encoder RS485 signal negative	Two-axis encoder 5V power reference ground	Two-axis encoder 5V power supply	Chassis land	Two-axis power electric U phase	Two-axis power electric V phase	Two-axis power electric W phase
4	Four-axis	Four-axis encoder	Four-axis	Four-axis		Four-axis	Four-axis power	Four-axis

Pin number	a	b	c	d	e	f	G	h
	encoder RS485 signal positive	RS485 signal negative	encoder 5V power reference ground	encoder 5V power supply		power electric U phase	electric V phase	power electric W phase
5	-	Light with signal blue	Light with signal red	-	-	Manually release the brake signal reference ground	Brake output reference ground	-
6	-	Lamp with 24V power supply	Light with signal green	-	-	Manual brake release signal	Brake 24V output	-

Definition of teach pendant interface

The teach pendant interface of the inCube2S-6 control cabinet is shown in Figure 3-11, and the pin number definition of the connector interface is shown in Table 3-3.
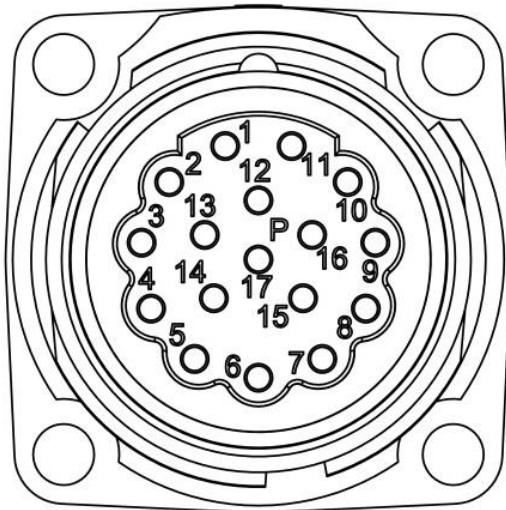
Figure 3-11 Interface of teach pendant

Table 3-3 Definition of the pin number of the connector interface of the teach pendant

Pin number	Signal name	Signal meaning	Cable color
1	D+24V	24V power supply for teach pendant	White
2	ESTOP_TP_INT	Emergency stop button 1 of the teach pendant	Brown
3	D+24V	24V power supply for teach pendant	Green
4	ESTOP_TP_SAF	Emergency stop button 2 of the teach pendant	Yellow
5	D+24V	24V power supply for teach pendant	Gray
6	ENABLE_1_TP_INT	Enable button 1 of teach pendant	Orange
7	D+24V	24V power supply for teach pendant	Blue
8	ENABLE_1_LOCK_STATE1_TP_SAF	Enable button 2 of teach pendant/Key status of teach pendant 1	Red

Pin number	Signal name	Signal meaning	Cable color
9	D+24V	24V power supply for teach pendant	Black
10	GND	Power supply of teach pendant/Signal reference ground	Purple
12	ZYNQ_ETNET2_PHY_TX+	The teach pendant Ethernet sends positive	White/Orange
13	ZYNQ_ETNET2_PHY_TX-	Teach pendant Ethernet sends negative	Orange
14	ZYNQ_ETNET2_PHY_RX+	Teach pendant Ethernet receiving positive	White/Green
15	ZYNQ_ETNET2_PHY_RX-	Teach pendant Ethernet receiving negative	Green
17	Shield ground	Teach pendant cable shield ground	Compilation network

Prompt

Refer to *Chapter 4.2* of this manual for other interface connector definition information.

4.   Product safe use

4.1.   Control cabinet interface
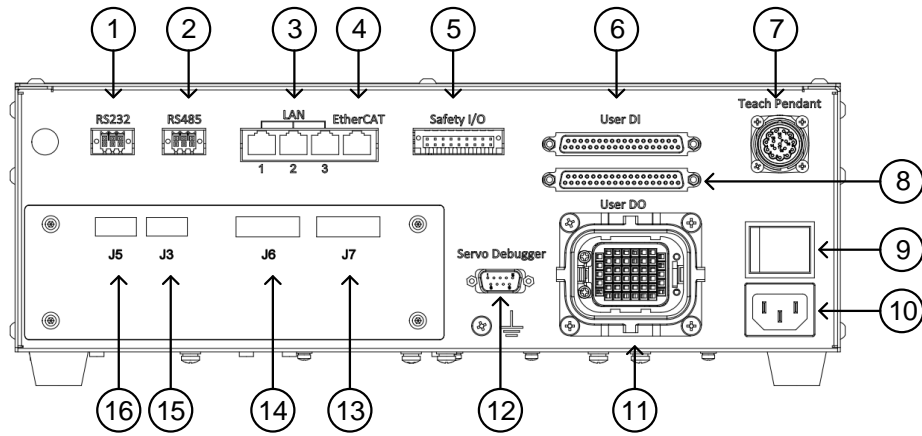
Figure 4-1 Schematic diagram of the location of each interface of inCube2S-6

All operation buttons, instructions and connection interfaces of the inCube2S-6 control cabinet are designed on the front panel, as shown in Figure 4-1. The name and function of each interface are shown in Table 4-1.

Table 4-1 Schematic description of each interface of inCube2S-6

No.	Interface marking	Interface name	Description
1	RS232	User serial port RS232	Connect any device that supports RS232 serial port protocol
2	RS485	PLC-MF master station interface RS485	Connect to peitian's PLC-MF module to expand user DI/DO
3	LAN 1/2/3	User Ethernet interface	Connect any device that supports Ethernet TCP/IP protocol
4	EtherCAT	Expand the EtherCAT interface of the external axis	Connect any device that supports the EtherCAT bus protocol
5	Safety I/O	Safety I/O interface	Realize safety functions such as safety fence, emergency stop output, and emergency stop input
6	User DI	User DI interface	Connect any device that supports DI function.
7	Teach Pendant	Interface of teach pendant	Connection port of teach pendant
8	User DO	User DO interface	Connect any device that supports DO function
9	-	Power switch	Main power switch of control cabinet
10	-	Entrance outlet	220V mains interface

No.	Interface marking	Interface name	Description
11	-	Heavy-duty outlet	The interface of the control cabinet to the manipulator
12	Servo Debugger	Driver debugging interface	Connect to Peitian's servo debugging software "ServoDebugger"
13	J7（Optional）	Encoder connector	Connect incremental encoder or absolute encoder
14	J6（Optional）	Magnetic grating ruler and CAN interface	Connect incremental magnetic grating ruler or CANopen welding machine
15	J3（Optional）	Connectors for voltage input and current input	Connect any device that supports AO function, -10V-+10V or 0 mA-20mA
16	J5（Optional）	Connector for PWM and analog output	Connect to any device that supports 0V-24V PWM signal input, or connect to any device that supports AI function, including -10V-+10V voltage input or 0mA-20mA current input

Refer to *Chapter 4.2* of the manual for instructions on the use of the above interfaces.

Prompt

4.2.   Instructions for use of control cabinet interface

4.2.1.   Description of control cabinet indicator

Control cabinet power switch
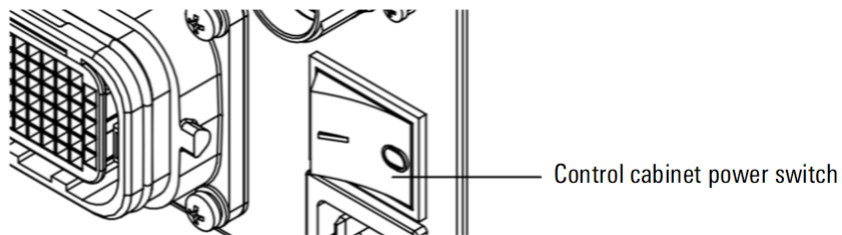
Figure 4-2 Power switch

The inCube2S-6 control cabinet provides 1 indicator light, which is the indicator light of the power switch (refer to Figure 4-2 for the position). The indicator light is on after the switch is powered on.

4.2.2.   Description of control cabinet operation buttons

Power switch

The power switch of the inCube2S-6 control cabinet is a lighted switch (refer to Figure 4-2), and the word O/I is printed on the switch. The normal usage is as follows:

■   When the switch is in the I position, it means that the control cabinet is on, and the indicator light inside the switch is on.

■   When the switch is in O position, it means that the control cabinet is in the closed state, and the indicator light inside the switch is off.

Prompt

Refer to *Chapter 4.6* of this manual for the normal startup process of the control cabinet.

Caution

When the cabinet is not in use, the switch must be set to O position.

4.2.3.   Instructions for the external interface of the control cabinet

Safety IO interface

The wiring diagram of the Safety IO interface of the inCube2S-6 control cabinet is shown in Figure 4-3.

The definition of each signal of the Safety IO interface is fixed. Refer to Table 4-2. Users cannot configure it. See Figure 4-4 for the pin numbers of the Safety IO interface.

The Safety IO interface provides the output signal of the emergency stop output. For the signal usage, please refer to the pin number 15-18 in Figure 4-5. Safety IO provides input signals for external emergency stop input, safety fence input, external safety input, and external alarm input. For signal usage, refer to pin numbers 1-14 in Figure 4-5.
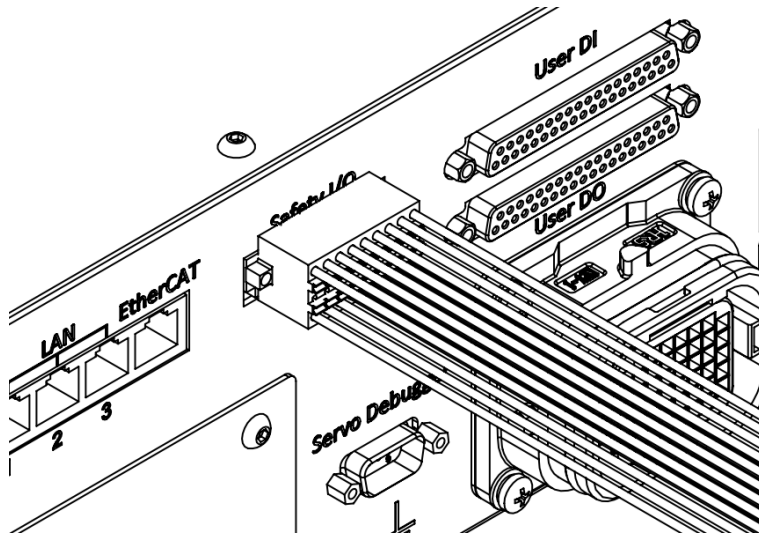
Figure 4-3 Schematic diagram of Safety I/O interface wiring
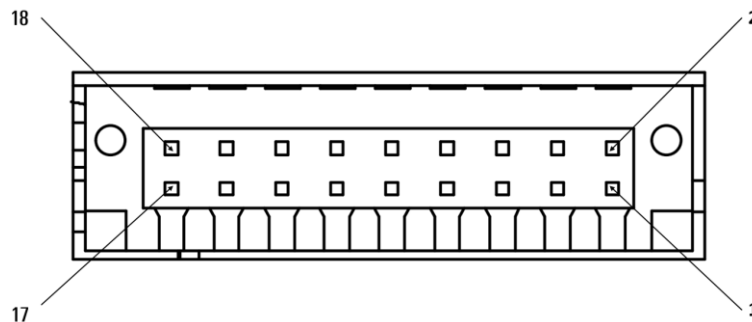
Figure 4-4 Diagram of Safety I/O interface pin numbers

Table 4-2 List of Safety IO interface definitions

Pin number	Signal name	Signal meaning	In/Out
1	D+24V_EX	24V power supply	Power
2	EX_ESTOP_DI_SAF	External emergency stop input	In
3	D+24V_EX	24V power supply	Power
4	EX_ESTOP_DI_INT	External emergency stop input	In
5	D+24V_EX	24V power supply	Power
6	BARRIER_DI_SAF	Security fence input	In
7	D+24V_EX	24V power supply	Power
8	BARRIER_DI_INT	Security fence input	In
9	D+24V_EX	24V power supply	Power
10	EX_SAFE_DI_SAF	External safety input	In
11	D+24V_EX	24V power supply	Power
12	EX_SAFE_DI_INT	External safety input	In
13	GND_EX	Signal ground	GND
14	EX_ALARM_DI	External alarm input Note: Peitian's dedicated alarm input pin for	In
15	ESTOP_OUT_1+	Emergency stop output contact 1 positive	Out
16	ESTOP_OUT_1-	Emergency stop output contact 1 negative	Out
17	ESTOP_OUT_2+	Emergency stop output contact 2 positive	Out
18	ESTOP_OUT_2-	Emergency stop output contact 2 negative	Out

(i) Prompt	■ The signals corresponding to the 6 pins of 2/4/6/8/10/12, if the external safety device is not connected, need to be short-circuited with the signal of the corresponding level, otherwise the control cabinet will continue to alarm and fail to operate. ■ Short-circuit mode: short-circuit pins 2 and 1, short-circuit pins 4 and 3, short-circuit pins 6 and 5, short-circuit pins 8 and 7, and short-circuit pins 10 and 9, short-circuit pins 12 and 11.
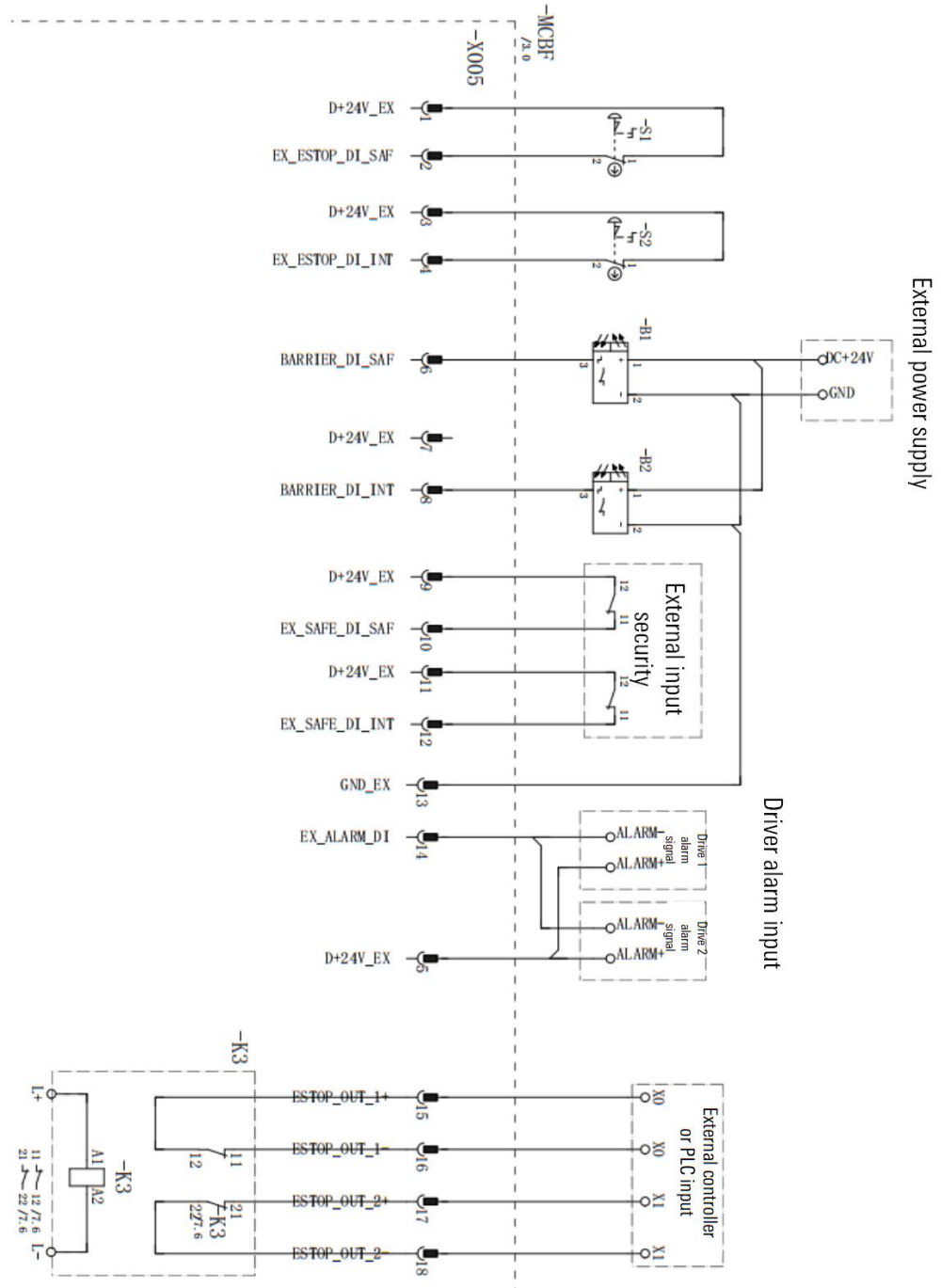
Figure 4-5 Schematic diagram of Safety IO output signal

User DI (user DI) interface

The inCube2S-6 control cabinet provides users with 26 DIs, 6 input common ports and 2 power ports. The D+24V_EX and GND_EX of this power port can only be used for the test of DI itself and cannot be used for power output higher than 0.5W. Otherwise, it will cause abnormality or failure of IO function.

When using DI interface, external power supply must be used.

> **(i) Prompt**
>
> The User DI and User DO of the SCARA control cabinet use the same connector, and there is a possibility of incorrect insertion. When User DO is connected to an inductive load, an external 24V power supply needs to be connected. At this time, if User DI and User DO are inserted incorrectly, the circuit of the control cabinet will be damaged. Please make sure that the

connector is connected to the correct socket when using User DI and User DO.

The wiring diagram of the User DI interface is shown in Figure 4-6. The pin numbers of the User DI interface are shown in Figure 4-7. The definition of the User DI interface is shown in Table 4-3. The interface usage information is shown in Figure 4-8.
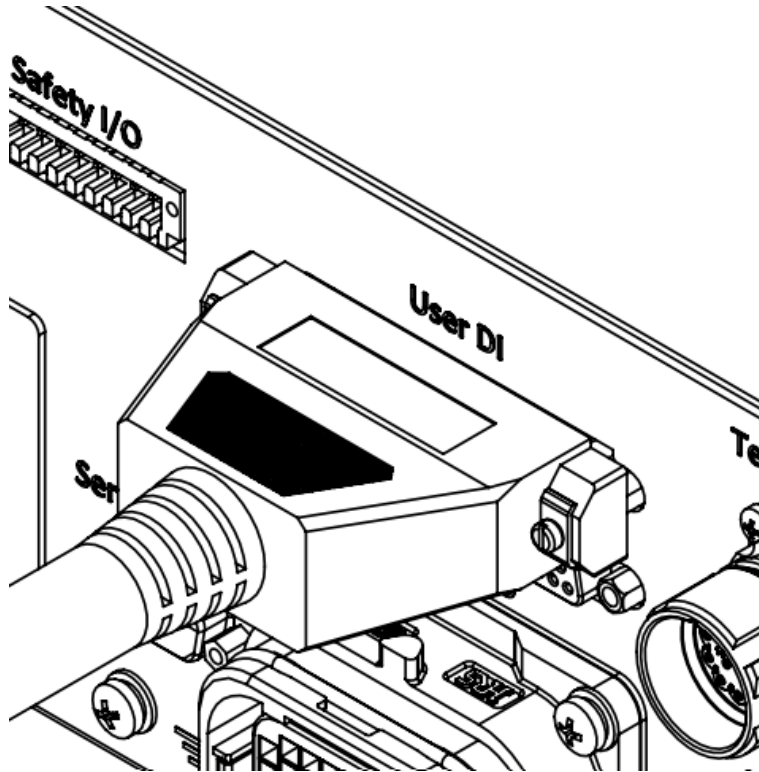
Figure 4-6 Schematic diagram of User DI interface wiring
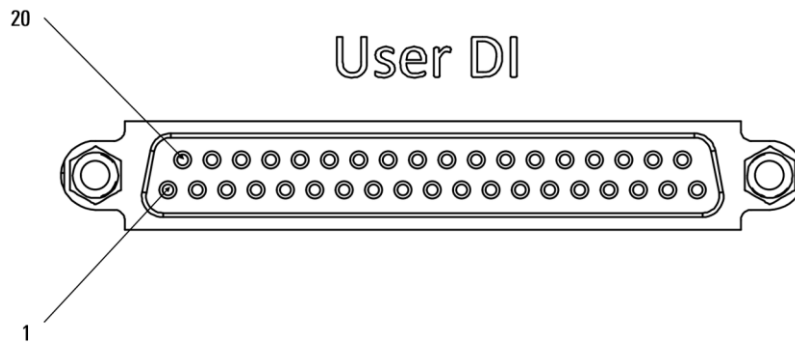
Figure 4-7 Labeling diagram of User DI interface pins

Table 4-3 List of User DI interface definitions

Pin number	Signal name	Signal meaning	In/Out
A1	OPERATED_DI1	Configurable digital input	In
A2	OPERATED_DI2	Configurable digital input	In
A3	OPERATED_DI3	Configurable digital input	In
A4	OPERATED_DI4	Configurable digital input	In
A5	OPERATED_DI5	Configurable digital input	In
A6	OPERATED_DI6	Configurable digital input	In

Pin number	Signal name	Signal meaning	In/Out
A7	OPERATED_DI7	Configurable digital input	In
A8	OPERATED_DI8	Configurable digital input	In
A9	OPERATED_DI9	Configurable digital input	In
A10	OPERATED_DI10	Configurable digital input	In
A11	OPERATED_DI11	Configurable digital input	In
A12	OPERATED_DI12	Configurable digital input	In
A13	OPERATED_DI13	Configurable digital input	In
A14	OPERATED_DI14	Configurable digital input	In
A15	OPERATED_DI15	Configurable digital input	In
A16	OPERATED_DI16	Configurable digital input	In
A17	OPERATED_DI17	Configurable digital input	In
A18	OPERATED_DI18	Configurable digital input	In
A19	OPERATED_DI19	Configurable digital input	In
A20	OPERATED_DI20	Configurable digital input	In
A21	OPERATED_DI21	Configurable digital input	In
A22	OPERATED_DI22	Configurable digital input	In
A23	OPERATED_DI23	Configurable digital input	In
A24	OPERATED_DI24	Configurable digital input	In
A25	OPERATED_DI25	Configurable digital input	In
A26	OPERATED_DI26	Configurable digital input	In
A27	Not Connected	No connection	
A28	DI_COM_2	DI14-26 input common	
A29	DI_COM_2	DI14-26 input common	
A30	DI_COM_2	DI14-26 input common	
A31	DI_COM_1	DI1-13 input common	
A32	DI_COM_1	DI1-13 input common	
A33	DI_COM_1	DI1-13 input common	
A34	GND_EX	Signal ground	GND
A35	GND_EX	Signal ground	GND
A36	D+24V_EX	24V power supply	Power
A37	D+24V_EX	24V power supply	Power

PNP or NPN type sensor signal, switch signal, relay contact signal can be used as the input of user DI.inCube2S-6. The control cabinet supports PNP and NPN sensor inputs. When using NPN sensors, the common terminal corresponding to the DI needs to be positively connected to the external 24V power supply. When using the PNP sensor, the public corresponding to the DI needs to be positively connected. The terminal is connected with the external power ground. The control cabinet provides two sets of configurable common terminals. Among them, COM1 corresponds to DI1-13, and COM2 corresponds to DI14-26.
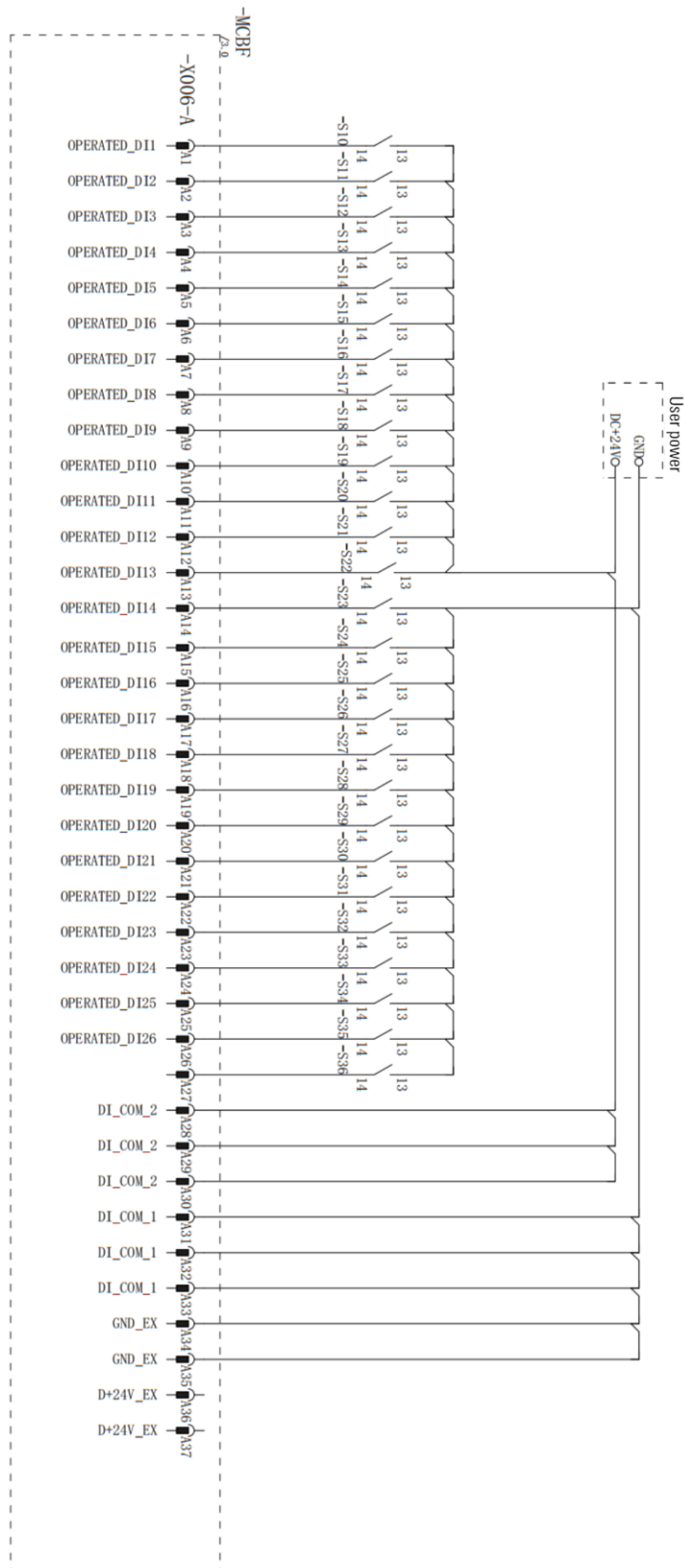
Figure 4-8 User DI interface instructions

User DO interface

The inCube2S-6 control cabinet provides users with 26 channels of DO and 4 channels of freewheeling power interfaces. The wiring diagram of the User DO interface is shown in Figure 4-9. The pin numbers of the User DO interface are shown in Figure 4-10. The definition of the User DO interface is shown in Table 4-4.

The inCube2S-6 control cabinet provides users with 26 DO interfaces, the DO polarity is NPN, and the maximum single input current of all DOs is 160mA. The sum of the maximum input current of each group of DO1-8, DO9-16 and DO17-24 is 1A. When the DO is connected to an inductive load, in order to avoid damage to the interface when it is turned off, it is necessary to connect "D+24V_FWD" to an external power supply. Refer to Figure 4-11 for interface usage information.

If you need to connect PNP polarity sensors and switches, you need to use the corresponding polarity switching equipment.

(i) Prompt	The User DI and User DO of the SCARA control cabinet use the same connector, and there is a possibility of incorrect insertion. When User DO is connected to an inductive load, an external 24V power supply needs to be connected. At this time, if User DI and User DO are inserted incorrectly, the circuit of the control cabinet will be damaged. Please make sure that the connector is connected to the correct socket when using User DI and User DO.
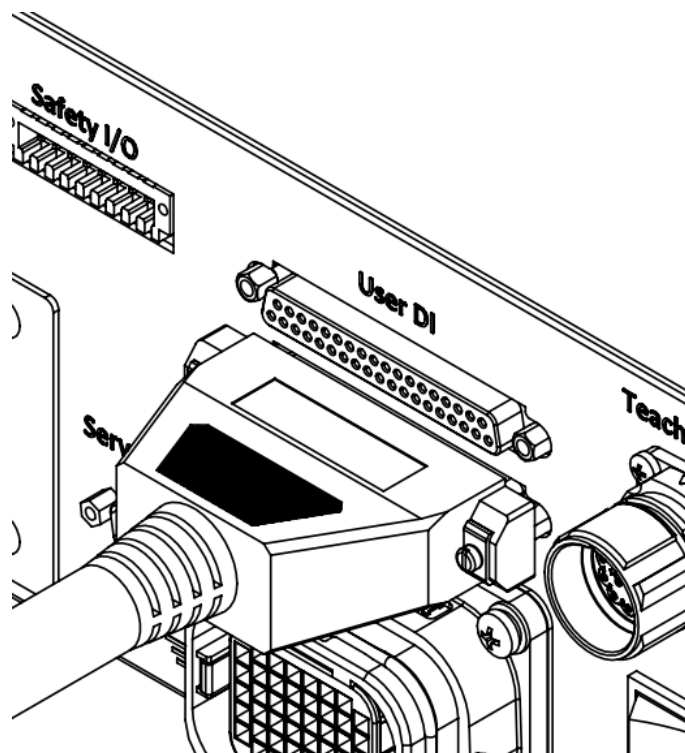
Figure 4-9 Schematic diagram of User DO interface wiring
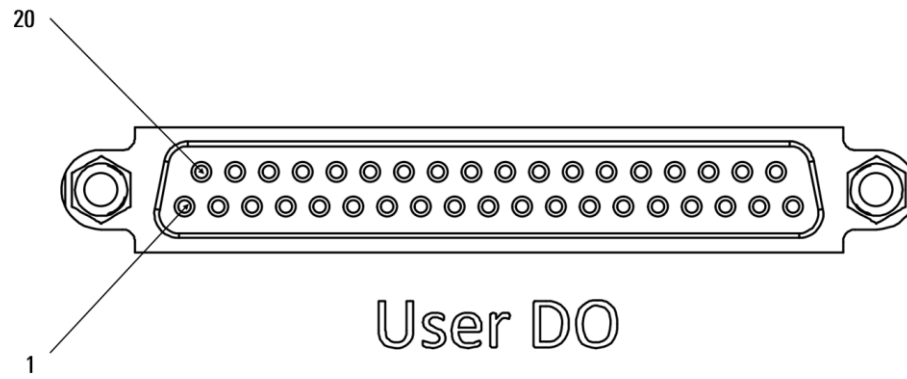
Figure 4-10 Pin labeling diagram of User DO interface

Table 4-4 List of User DO interface definitions

Pin number	Signal name	Signal meaning	In/Out
B1	OPERATED_DO1	Configurable digital output	Out
B2	OPERATED_DO2	Configurable digital output	Out
B3	OPERATED_DO3	Configurable digital output	Out
B4	OPERATED_DO4	Configurable digital output	Out
B5	OPERATED_DO5	Configurable digital output	Out
B6	OPERATED_DO6	Configurable digital output	Out
B7	OPERATED_DO7	Configurable digital output	Out
B8	OPERATED_DO8	Configurable digital output	Out
B9	OPERATED_DO9	Configurable digital output	Out
B10	OPERATED_DO10	Configurable digital output	Out
B11	OPERATED_DO11	Configurable digital output	Out
B12	OPERATED_DO12	Configurable digital output	Out
B13	OPERATED_DO13	Configurable digital output	Out
B14	OPERATED_DO14	Configurable digital output	Out
B15	OPERATED_DO15	Configurable digital output	Out
B16	OPERATED_DO16	Configurable digital output	Out
B17	OPERATED_DO17	Configurable digital output	Out
B18	OPERATED_DO18	Configurable digital output	Out
B19	OPERATED_DO19	Configurable digital output	Out
B20	OPERATED_DO20	Configurable digital output	Out
B21	OPERATED_DO21	Configurable digital output	Out
B22	OPERATED_DO22	Configurable digital output	Out
B23	OPERATED_DO23	Configurable digital output	Out
B24	OPERATED_DO24	Configurable digital output	Out
B25	OPERATED_DO25	Configurable digital output	Out
B26	OPERATED_DO26	Configurable digital output	Out
B27	Not Connected	No connection	
B28	GND_EX	Ground	GND
B29	GND_EX	Ground	GND

Pin number	Signal name	Signal meaning	In/Out
B30	GND_EX	Ground	GND
B31	GND_EX	Ground	GND
B32	GND_EX	Ground	GND
B33	GND_EX	Ground	GND
B34	D+24V_FWD	Power interface for freewheeling	Power
B35	D+24V_FWD	Power interface for freewheeling	Power
B36	D+24V_FWD	Power interface for freewheeling	Power
B37	D+24V_FWD	Power interface for freewheeling	Power
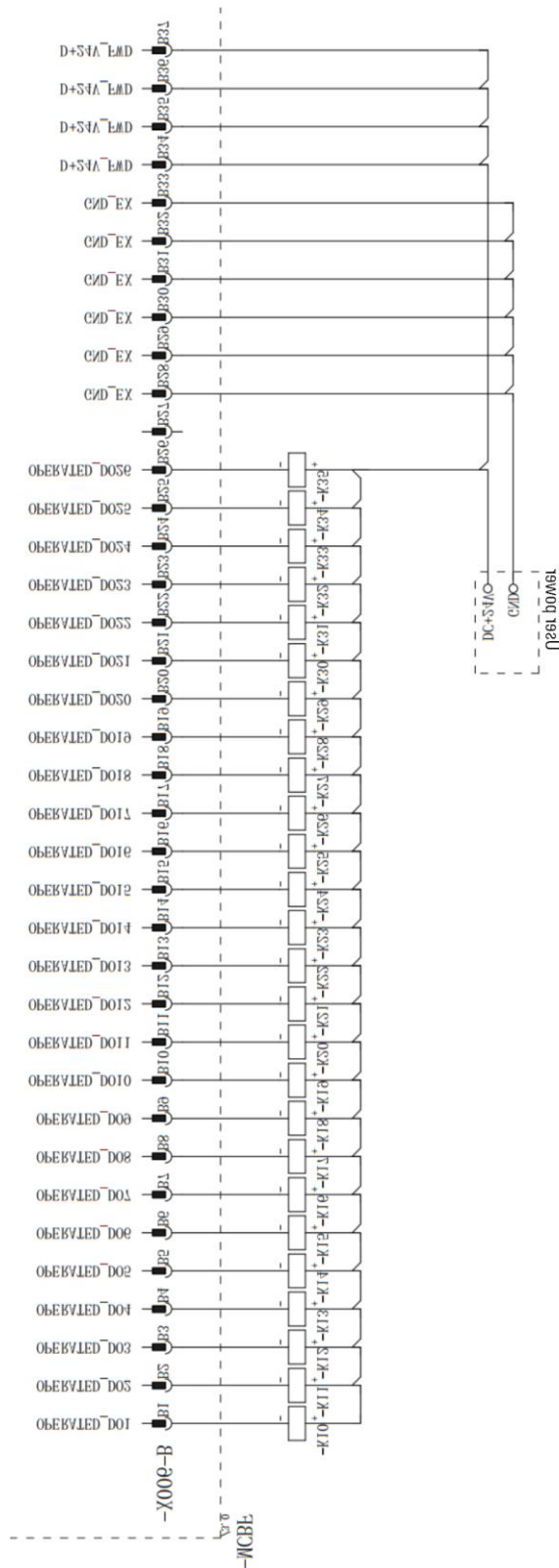
Figure 4-11 User IO-DO interface instructions

RS232 interface

The RS232 interface of the inCube2S-6 control cabinet is the RS232 communication interface provided for users. The RS232 interface is a plug-in terminal connector. The RS232 interface wiring diagram is shown in Figure 4-12.

When using this interface, you can wire it according to the RS232 pin label (see Figure 4-13) and the RS232 interface definition (see Table 4-5). You can also select the cable paired with the RS232 interface according to *Appendix A inCube2S-6 accessories list*.
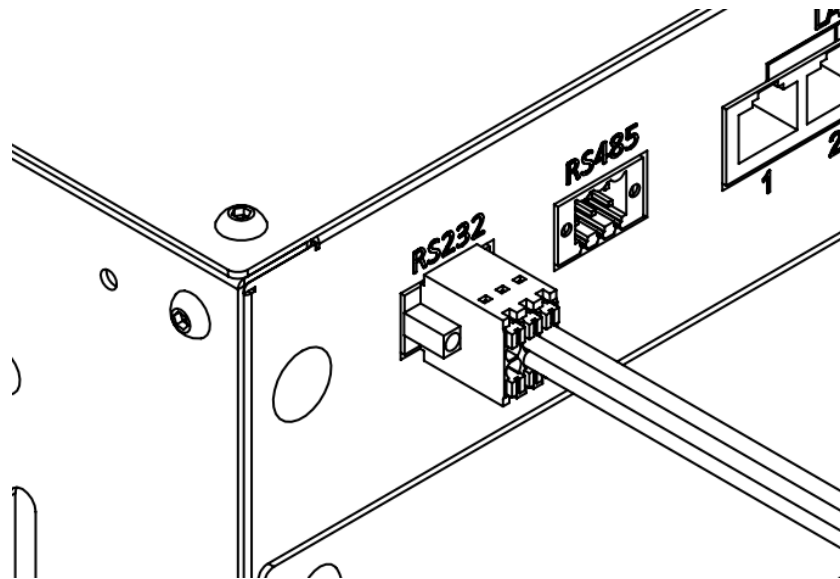
Figure 4-12 Schematic diagram of RS232 interface wiring
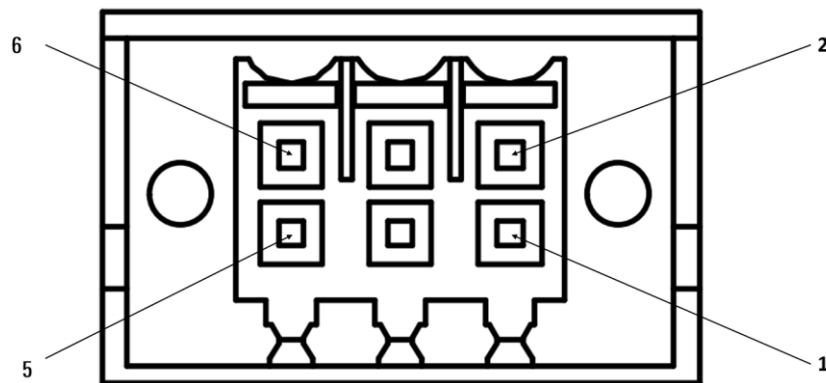
Figure 4-13 Diagram of RS232 pin label

Table 4-5 Table of RS232 interface definition

Interface	Pin	Definition	Description
RS232	1	PC_UART0_RXD	RS232 receiving
	2	PC_UART0_TXD	RS232 transmission
	3	GND_ISO_RS232	RS232 signal ground
	4	CHGND_1	Shell ground
	5	-	-
	6	-	-

RS485 interface

The RS485 interface of inCube2S-6 control cabinet is Peitian's internal bus AE_modbus master interface. When the IO quantity of the control cabinet is insufficient, the PLC-MF module can be connected through this interface to realize the expansion of the IO quantity.

The RS485 interface is a pluggable terminal connector. The wiring diagram is shown in Figure 4-14. When this interface is used, you can define it according to the RS485 pin number (see Figure 4-15) and the RS485 interface (see Table 4-6), you can also select the cable paired with the RS485 interface according to the appendix A inCube2S-6 accessories list.
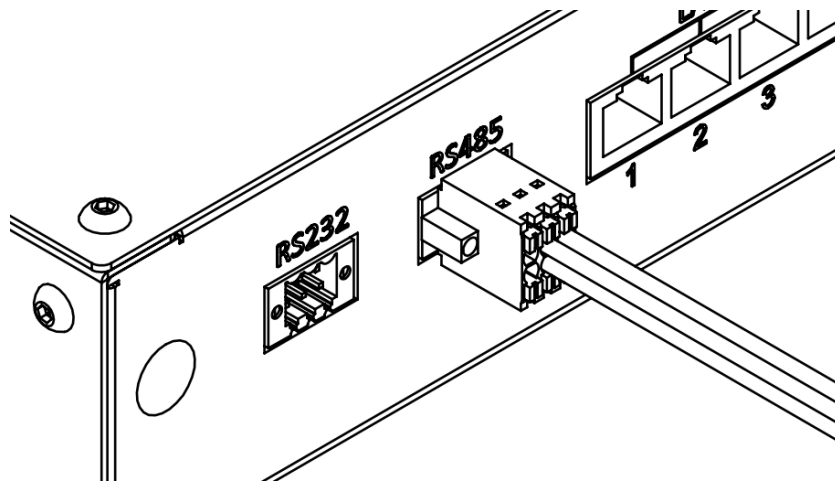
Figure 4-14 Schematic diagram of RS485 wiring
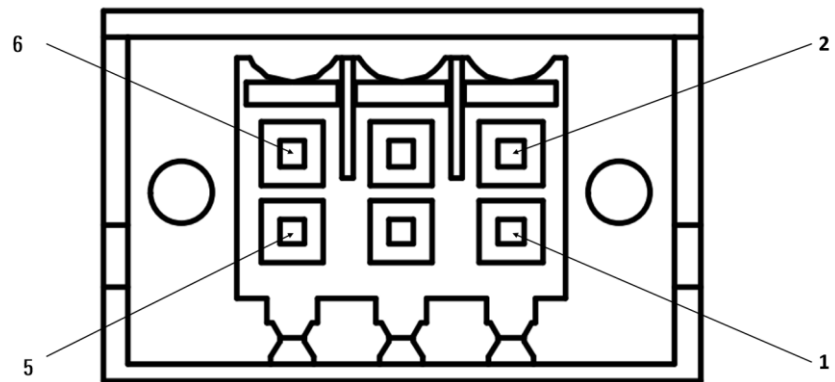
Figure 4-15 Schematic diagram of RS485 pin label

Table 4-6 List of RS485 interface definitions

Interface	Pin	Definition	Description
RS485 interface	1	RS485 bus positive	RS485 receiving
	2	RS485 bus negative	RS485 sending
	3	GND_ISO_MF	RS485 ground
	4	CHGND_1	Shell ground
	5	-	-
	6	-	-

LAN 1/2/3 network interface

The inCube2S-6 control cabinet provides users with 3 Ethernet interfaces, which are used to connect industrial Ethernet and sensors that communicate with Ethernet. The wiring diagram of the LAN 1/2/3 network interface is shown in Figure 4-16.
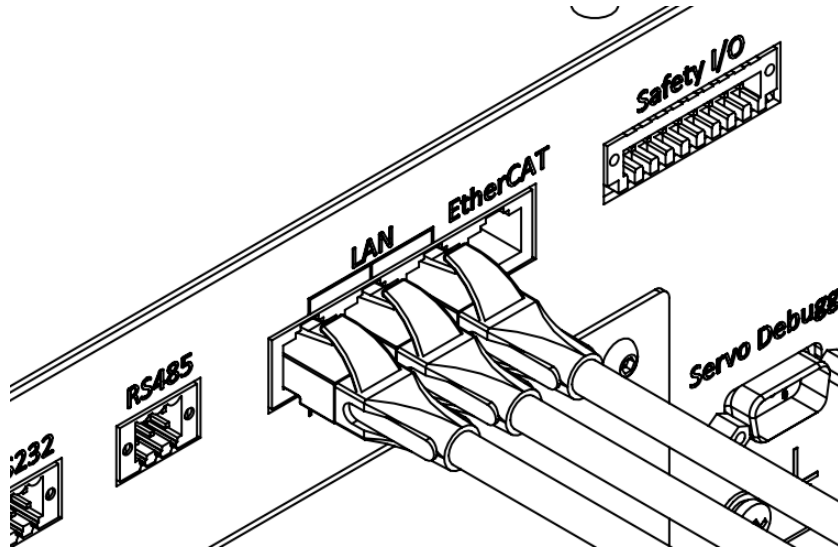
Figure 4-16 Wiring diagram of LAN1/2/3 network interface

EtherCAT network interface

The inCube2S-6 control cabinet reserves an EtherCAT interface as an extended external axis interface and an EtherCAT protocol conversion interface. The wiring diagram of the EtherCAT network interface is shown in Figure 4-17. Maximum support for expansion of 6 external axes.
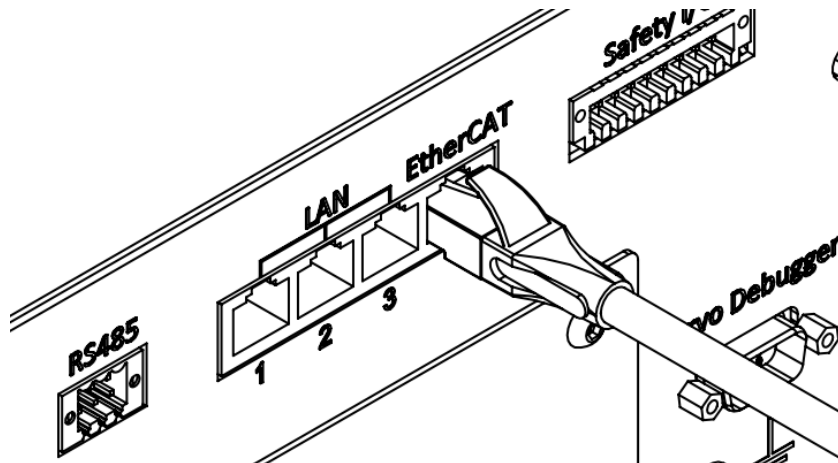
Figure 4-17 Schematic diagram of EtherCAT network interface wiring

The external axis expansion method is: the external axis drive is installed externally. The compact cabinet does not provide power supply for the external axis motor and external axis drive, and does not provide power supply for the external axis brake. The external axis and the compact cabinet communicate through the EtherCAT bus, and the external axis drive alarm is from the safe IO interface is connected to the compact cabinet.

> (i) **Prompt**
>
> When connecting the EtherCAT communication interface of the external expansion shaft of the inCube2S-6 control cabinet, you can use the connectors shown in the *appendix A inCube2S-6 accessories list* for installation and connection.

4.3. Control cabinet grounding

The inCube2S-6 control cabinet must have a reliable ground connection. The main purposes of the ground connection are:

- Grounding makes all unit circuits in the inCube2S-6 control cabinet have a common reference zero potential, so that there is no potential difference between the grounds of each circuit, and the stable operation of the system is ensured.

- The reliable ground connection of inCube2S-6 control cabinet can prevent the interference of external electromagnetic field. The chassis grounding provides a discharge channel for transient interference, allowing a large amount of charges accumulated on the chassis due to electrostatic induction to discharge through the ground.

- Able to ensure safe work. When electromagnetic induction of direct lightning occurs, damage to electronic equipment can be avoided; when the input voltage of the power frequency AC power supply is directly connected to the case due to poor insulation or other reasons, it can prevent the operator from getting an electric shock.

The inCube2S-6 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 ground is not greater than $100\,\Omega$. In addition, the control cabinet body provides a grounding point. If necessary, connect the ground wire to the grounding point shown in the Figure 4-18.

Control cabinet grounding point

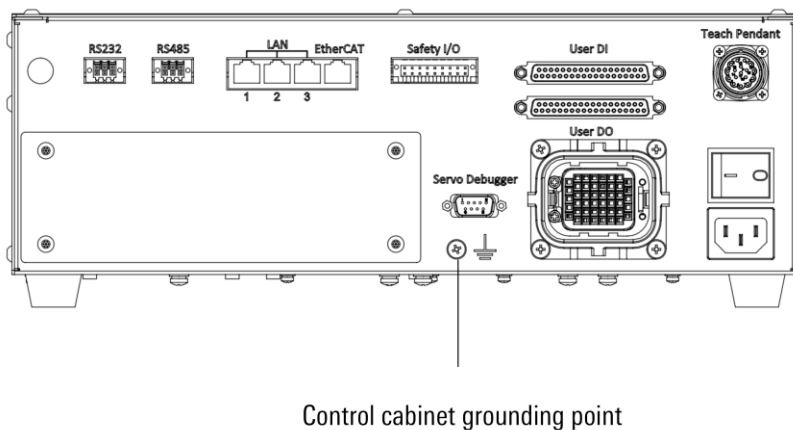Figure 4-18 Schematic diagram of inCube2S-6 control cabinet ground cable access point

4.4. Robot stop mode

According to the definition of stop function in 9.2.2 of GB5226.1-2008 "Mechanical and Electrical Safety-Part 1: General Technical Conditions", combined with the specific design of the robot, three stop modes are defined and corresponding descriptions are shown in Table 4-7:

Table 4-7 Stop method and corresponding instructions

Type	Description	
STOP0	Case1	MCBF alarm stop0 indicate, DCBF execution stops immediately, and does not keep track, after which MCBF delay control cuts off the power supply through the main circuit relay control signal, which is an uncontrollable stop.
	Case2	DCBF has an uncontrollable fault, triggering a free stop or brake stop, which is an uncontrollable stop.
	Case3	Sudden external power failure, DCBF cannot perform immediate stop, trigger brake to stop, it is an uncontrollable stop.
STOP1	Make the robot stop quickly and maintain the current planned path. When the robot stops, control the driver servo_off and cut off the power supply through the main circuit relay, which is a controllable stop.	
STOP2	Make the robot stop quickly and need to maintain the current planned path. When the robot stops, do not servo_off or cut off the power supply, which is a controllable stop	

4.5.   Robot system safety

The robot system (manipulator, control cabinet, teach pendant and all the software and hardware included) referred to in this manual can only operate normally when the peripheral equipment and system are constructed. These peripheral equipment and systems must include safety fences, external emergency stop devices, and external safety input devices necessary for the safe use of the robot.

The signal definitions of the above safety devices are fixed in the inCube2S-6 control cabinet Safty IO interface. Only when the safety signal of the SAFETY IO has a reasonable level, the control cabinet can be used normally, otherwise the control cabinet alarms. Refer to Figure 4-5 for the connection of the safety signal of the Safety IO interface. The names and meanings of the pin numbers in the figure are shown in Table 4-2.

The safety input signals include safety fence signals, external emergency stop signals and external safety signals, see Table 4-8 for details.

Table 4-8 Description of safe input signals

Signal name	Description
Safety fence signal	Safety light curtain signal equipped for safety fence Support PNP type sensor, must be equipped with external DC24V power supply
External emergency stop input signal	Emergency stop signal for external systems that complete tasks in collaboration with robots When the emergency stop button of the external system is photographed, the external emergency stop signal of the control cabinet is valid, and the robot stops according to STOP0 The external emergency stop output signal needs to have two channels, one of which is used as a safety link backup, and the external emergency stop input signal is valid at high level
External safety input signal	It is mainly the safety (fault) signal of the external system that completes the work with the robot. The control cabinet will judge whether the robot needs to be stopped according to the state of the external system. External safety input signal is active high

4.6.   Control cabinet startup

In order to ensure that the inCube2S-6 control cabinet can be started and used normally, the startup operation must be carried out in strict accordance with the following steps:

Step1.   Visually inspect the appearance of the control cabinet to check whether the cabinet body is bumped or deformed.

Step2.   Confirm that there is no condensation and water droplets in the control cabinet. Make sure that there are no water droplets in the cabinet before starting up.

Step3.   Install the control cabinet, refer to *Chapter 3.4.3* of this manual.

Step4.   Connect the teach pendant, refer to *Chapter 3.4.3* of this manual.

Step5.   Connect the power encoder cable, refer to *Chapter 3.4.3* of this manual.

Step6.   Connect the power supply, refer to *Chapter 3.4.3* of this manual.

Step7.   Connect the safety input of Safety IO, refer to *Chapter 4.5* of this manual.

Step8.   Turn on the switch of the control cabinet, refer to *Chapter 4.2.2* of this manual.

5.   Transportation and handling

5.1.   Handling posture

■   Make sure that all connectors on the control cabinet panel are unplugged.

■   Ensure that the control cabinet is transported in a horizontal position.

5.2.   Forklift handling

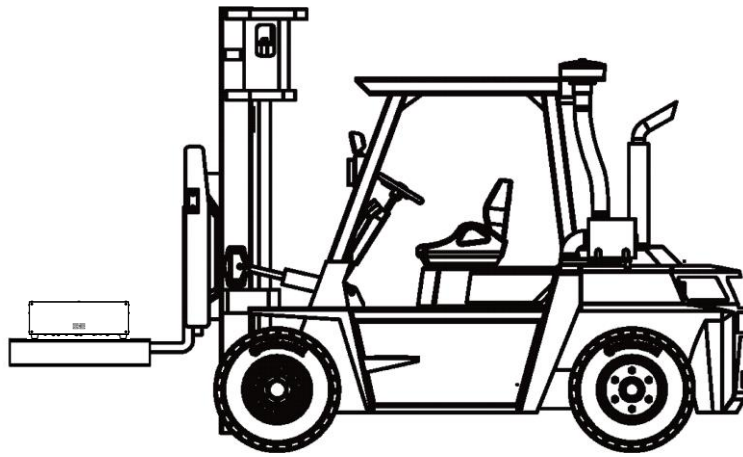Place a handling tray under the control cabinet when handling, refer to Figure 5-1.

Figure 5-1 Schematic diagram of forklift handling in control cabinet

6.   Preventive maintenance

6.1.   Safety protection measures

Precautions during maintenance

<table>
<tr>
<td rowspan="2">⚠
Warning</td>
<td>

■ When the power is turned on, there is a danger of electric shock in part of the maintenance operations. The maintenance operations should be performed with the manipulator and system power off as much as possible; professional maintenance personnel should be designated as needed to perform maintenance operations; other personnel should be avoided during maintenance operations Turn on the power; even in the case where the power must be turned on before the work can be performed, press the emergency stop button before proceeding.

■ When you need to replace parts, please consult our company.

■ The customer's independent replacement of parts may cause unexpected accidents, damage the manipulator, and cause injury to the operators.

■ If you need to replace parts, be sure to use the parts designated by our company. If parts other than the specified parts are used, it may cause damage to the manipulator.

■ When disassembling the motor and brake, take measures such as lifting by a crane before dismantling, so as to prevent the manipulator arm from falling

■ During maintenance operations, when the manipulator needs to be moved due to unavoidable circumstances, the following items should be noted:

   ● Make sure that the escape route is unblocked, and you should perform operations after you have grasped the operation of the entire system to avoid blocking the exit route by the manipulator and peripheral equipment

   ● Always pay attention to whether there are dangers around and be prepared so that you can press the emergency stop button at any time when needed

■ When moving parts with a certain weight such as motors and reducers, auxiliary equipment such as cranes should be used to avoid excessive work burdens on operators. At the same time, it is necessary to avoid wrong operation, otherwise it may cause injury or death of the operator.

■ Be careful not to fall down because of the lubricating oil spilled on the ground. Wipe off the lubricating oil on the ground as soon as possible to eliminate possible dangers.

■ During the operation, do not put any part of the body on any part of the manipulator, and it is forbidden to climb on the manipulator to avoid unnecessary personal injury or adverse effects on the manipulator.

■ The following parts will generate heat, so be careful. When it is necessary to touch the device under heat, you should prepare protective equipment such as heat-resistant gloves:

   ● Servo motor

   ● Reducer

   ● Components adjacent to the motor/reducer

   ● Inside the control cabinet

■ The parts (such as screws, etc.) that are removed when replacing parts should be correctly installed back to their original positions. If parts are found to be insufficient or there are remaining parts, they should be reconfirmed and installed correctly.

■ When repairing the pneumatic system and hydraulic system, be sure to release the internal pressure to 0 before proceeding.

■ When replacing parts, avoid dust and other foreign objects from entering the inside of the manipulator.

■ Operators who perform maintenance and repair operations must be trained by our company and

</td>
</tr>
</table>

> pass relevant assessments.
>
> ■ Appropriate lighting equipment should be equipped for maintenance work, but care should be taken not to make the lighting equipment the source of new hazards.
>
> ■ Please refer to this manual for regular maintenance. Failure to perform regular maintenance will affect the service life of the manipulator and may result in accidents.

Safety of maintenance engineers

In order to ensure the safety of maintenance engineers, the following items should be fully paid attention to:

■ During the operation of the manipulator, do not enter the operating range of the manipulator.

■ Carry out maintenance work with the power supply of the control device disconnected as much as possible. The main circuit breaker should be locked with a lock, etc. as needed to prevent other people from turning on the power.

■ When it is necessary to enter the working range of the manipulator during power-on, you should press the emergency stop button of the control cabinet or the teach pendant before entering. In addition, the operator should put up a "maintenance operation" sign to remind other personnel not to operate the manipulator at will.

■ Before performing maintenance work, confirm that the manipulator or peripheral equipment is in a safe state.

■ Do not perform automatic operation when there are people in the operating range of the manipulator.

■ When working near walls, appliances, etc., or when several operators are close, be careful not to block the escape passages of other operators.

■ When there are knives on the manipulator, and when there are moving devices such as conveyor belts in addition to the manipulator, pay full attention to the actions of these devices.

■ A person who is familiar with the manipulator system and can detect the danger should be arranged beside the operation panel and operation box during operation, so that they can press the emergency stop button at any time.

■ When replacing parts or reassembling, pay attention to avoid foreign matter adhesion or mixing.

■ When inspecting and repairing the inside of the control device, if you want to touch the unit, printed circuit board, etc., in order to prevent electric shock, be sure to disconnect the power supply of the main circuit breaker of the control device before proceeding.

■ The replacement parts must use the parts designated by our company.

■ When restarting the manipulator system after the maintenance work is completed, fully confirm in advance that no one is within the operating range of the manipulator, and that the manipulator and peripheral equipment are in normal state.

6.2.   Routine maintenance items and cycles

The Servo Debugger interface of the inCube2S-6 control cabinet is a multi-axis drive debugging interface, located on the rear panel of the control cabinet. Refer to Figure 6-1 below. When debugging the multi-axis drive parameters, you need to use an RS422 to USB cable to connect to the interface shown in Figure ①.
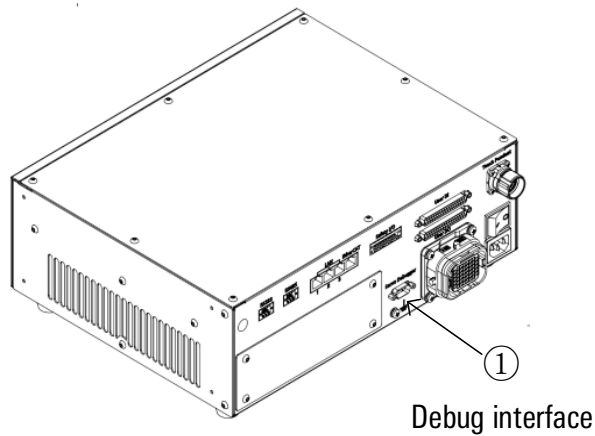
Debug interface

Figure 6-1 Interface of control cabinet Servo Debugger

The routine maintenance items and cycle of inCube2S-6 control cabinet are shown in Table 6-1.

Table 6-1 Routine maintenance items and cycles

Maintenance project	Maintenance cycle
Emergency stop switch	6 months
Power switch	6 months
Indicator light	6 months
Heavy-duty connector	6 months
Fan and air duct	6 months
Connector	6 months

6.3.   Maintenance process

■ Check whether the wiring in the cabinet is firm and whether the connector is loose;

■ Whether the power switch, emergency stop button can be pressed or photographed normally, and whether the shielding knob can be turned;

■ Whether indicator lights and other indicating devices can send out signals normally;

■ Whether the connection of the heavy-duty connector is loose;

■ Whether the fan rotates normally;

■ Whether there is much dust accumulated in the cabinet.

6.4.   Replace the dust filter

InCube2S-6 is equipped with a dust-proof net at the entrance of the air duct of the control cabinet. Refer to Figure 6-2. Under normal use, the dust-proof net of the control cabinet should be cleaned every 3 months and replaced every other year; when the environment is bad, you should shorten the replacement and cleaning cycle.
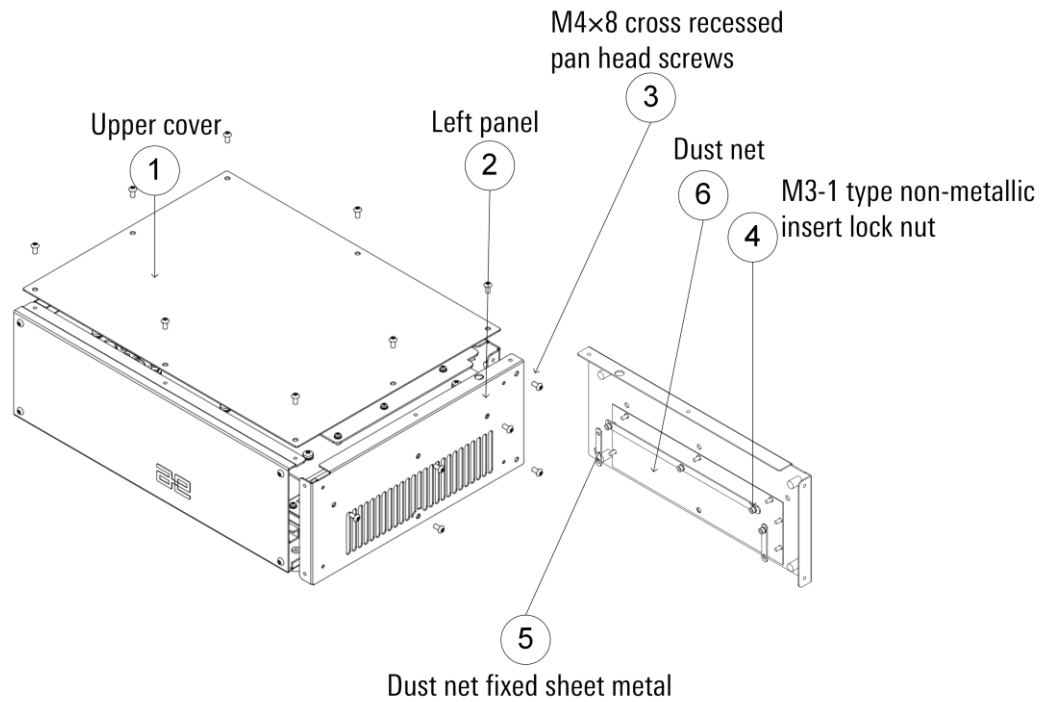
Figure 6-2 Replacement or cleaning of dust screen

Steps to remove the dust screen:

Step1.   Use a screwdriver to remove the M4 × 8 cross recessed pan head screws ③ of the upper cover and take off the upper cover ①.

Step2.   Use a screwdriver to remove the M4 × 8 cross recessed pan head screw ③.

Step3.   Remove the sheet metal on the left side ②.

Step4.   Remove the 6 M3 type 1 non-metallic insert lock nuts ④ on the inner side of the left side sheet metal ② using a hex wrench, and remove the dust screen to fix the sheet metal ⑤.

Step5.   Remove the dust screen ⑥ for cleaning or replacement.

Installation steps of the dust filter:

Step1.   -Stick the cleaned or new dust-proof net ⑥ to the left side sheet metal ② through its own double-sided adhesive.

Step2.   Use 6 M3 type 1 non-metallic insert lock nuts ④ to fix the dust screen fixing sheet ⑤ on the left side sheet metal ②.

Step3.   Install the left side sheet metal ② on the left side of the control cabinet, and use M4 × 8 cross recessed pan head screws ③ to fix it on the control cabinet.

Step4.   Fix the upper cover ① with M4 × 8 cross recessed pan head screws ③.

7.   Fault finding, diagnosis and repair

7.1.   Indicator light

The inCube2S-6 control cabinet has a power switch with indicator lights. If the power indicator fails to send out signals normally, first determine whether the connection line is faulty; if there is no fault in the line, replace the power switch with indicator lights to observe whether the signal can be sent normally.

7.2.   Heavy-duty connector

When the heavy-duty connector and other connecting devices become loose, the heavy-duty connector plug and socket should be separated, re-inserted and tightened to ensure reliable connection.

7.3.   Fan

When the fan does not rotate normally, first determine whether the connecting harness is faulty; if there is no fault in the wiring, replace the fan and observe whether it rotates normally.

7.4.   Fuse

When the power indicator of the control cabinet is on, but the control cabinet cannot be powered on, please check whether the corresponding fuse on the adapter board is burned out. If it is burned out, please replace the fuse according to Table 7-1.

Table 7-1 The function of each fuse and replacement instructions

DPBF				
No.	Label	Model	Parameter	**Meaning**
1	F1	215010	10A/250VAC	Main circuit fuse
MCBF				
No.	Label	Model	Parameter	**Meaning**
1	F1	0454002.	2A/125VAC	Logic power supply 24V input fuse
2	F2	0454001.	1A/125VAC	Safety IO/Body lamp with 24V output fuse
3	F4	0454001.	1A/125VAC	Teach pendant 24V output fuse
4	F5	0454001.	1A/125VAC	Fan 24V output fuse

Appendix A   List of inCube2S-6 accessories
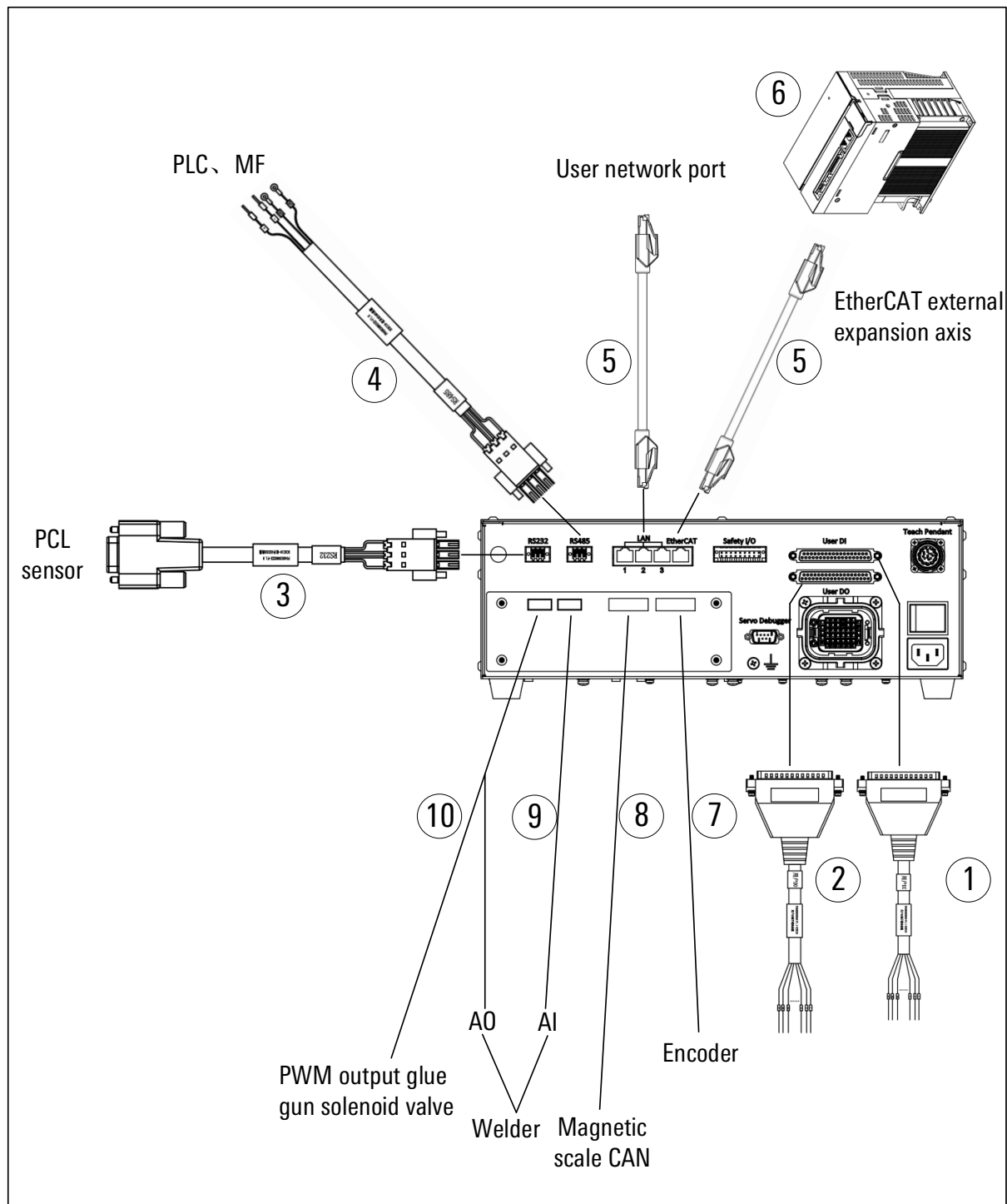
Appendix Table 1 List of inCube2S-6 control cabinet installation accessories

Accessory name	Part number	Quantity	Accessory attributes
inCube2S-6-cabinet stacking connector	P01035000694	8	Optional
inCube2S-6-Teach Pendant Bracket	P01035000263	1	Optional

Appendix Table 2 List of inCube2S-6 control cabinet cable accessories

Accessory name	Part number	Corresponding interface	Accessory attributes
SCARA-3Kg&6Kg heavy-duty wiring harness	P04082000803	Heavy-duty interface	Standard configuration (length 2.5 meters)
Power cable	P04082000869	-	Standard configuration (length 3 meters)
inCube2S-6-RS232 wiring harness outside the cabinet	P04082000843	RS232	Optional (length 3 meters)
inCube2S-6-outside the cabinet RS485 wiring harness	P04082000844	RS485	Optional (length 5 meters)
inCube2S-6-Extended MF cable	P04082000539	MF-RS485	Optional (length 5 meters)
Industrial network cable	P04082000279	LAN 1/2/3	Optional (length 3 meters)
inCube2S-6-Ethernet wiring harness	P04082000279	EtherCAT	Optional
inCube2S-6-User DI terminal module cable	P04082000849	User DI	Optional (length 5 meters)
inCube2S-6-User DO terminal module cable	P04082000849	User DO	Optional (length 5 meters)
APLC-MF-24DC-40-40-B	P05050000001	MF-RS485	Optional
USB to RS422 / RS485 cable	P04082000251	Servo Debugger	Optional
inCube2S-6-Install the gusset sheet metal	P01035000693	\	Optional (Need to be selected at the same time)
MCBF-IEB gusset	P05245000108	\	
inCube2S-6-MCBF and gusset connection line	P04082000595	\	
PWM and analog output_voltage and current input cable	P04082000594	J3\J5	Optional (length 5 meters)
Magnetic scale and CAN_ encoder share wiring harness	P04082000596	J6\J7	Optional (length 5 meters)

Appendix B   Description of inCube2S-6 accessories

Appendix diagram 1 Diagram of inCube2S-6 control cabinet accessories

External wiring of heavy-duty interface

The basic specifications and installation methods of the external wiring of the heavy-duty interface are shown in Appendix Table 3.

Appendix Table 3 Basic specifications and installation methods of external wiring for heavy-duty interface

No.	-	Name	SCARA-3Kg&6Kg heavy-duty wiring harness	Device code	P04082000803
A connector	Heavy-duty, metal upper shell, female terminal, metal shell, sticker protective cover				
B connector	Cable connector, plastic connector				
Cable	Custom cables:8 × 18AWG+6 × 20AWG+9 × 22AWG+（9 × 2 × 24AWG）		Cable length	2.5 meters (standard configuration)	

	■	SCARA-3Kg&6Kg heavy-duty wiring harness is integrated with the main body, and the heavy-duty wiring harness interface corresponds to the wiring sequence of the control cabinet side interface.
Prompt	■	Refer to *Chapter 3.4.4* for the definition of heavy-duty interface.

External wiring of power interface

The basic specifications and installation methods of inCube2S-6-power wire harness are shown in Appendix Table 4.

Appendix Table 4 Basic specifications and installation methods of inCube2S-6-power wire harness

No.	-	Name	inCube2S-6-power cable	Device code	P04082000869
A connector	Power connector plug				
B connector	Three-pin plug				
Cable	3 core，1.5mm^2		Cable length	3 meters	

User DI interface external wiring

The basic specifications and installation methods of inCube2S-6-user DI terminal module cable are shown in Appendix Table 5.

Appendix Table 5 Basic specifications and installation methods of inCube2S-6-user DI terminal module cable

No.	1	Name	inCube2S-6-User DI terminal module cable	Device code	P04082000849
A connector	D_SUB, DB37 male header, plug, plastic shell				
B connector	European style cold pressed terminal				
Cable	36 core 0.3mm²		Cable length	5 meters	

	■	The wire sequence of the connectors at both ends of the inCube2S-6-user DI terminal module cable corresponds to the number tube label.
	■	The serial number of the inCube2S-6 user DI terminal module has a one-to-one correspondence with the control cabinet and User DI interface number.
Prompt	■	If you choose your own wire harness, it is recommended to choose the wire diameter AWG22-AWG24.

User DO interface external wiring

The basic specifications and installation methods of the inCube2S-6-user DO terminal module cable are shown in Appendix Table 6.

Appendix Table 6 Basic specifications and installation methods of inCube2S-6 user DO terminal module cable

No.	2	Name	inCube2S-6-User DO terminal module cable	Device code	P04082000846
A connector	D_SUB, DB37 male header, plug, plastic shell				
B connector	European style cold pressed terminal				
Cable	36 cores 0.3mm²		Cable length	5 meters	

■ The wire sequence of the connectors at both ends of the inCube2S-6-user DO terminal module cable corresponds to the number tube label.

■ The serial number of the inCube2S-6 user DO terminal module has a one-to-one correspondence with the control cabinet and User DI interface numbers.

■ If you choose your own wire harness, it is recommended to choose the wire diameter AWG22-AWG24.

Prompt

RS232 interface external wiring

The basic specifications and installation methods of inCube2S-6-outside the cabinet RS232 cable are shown in Appendix Table 7.

Appendix Table 7 he basic specifications and installation methods of inCube2S-6-RS232 cable outside the cabinet

No.	3	Name	inCube2S-6-RS232 cable outside the cabinet	Device code	P04082000843
A connector	Weidmüller, B2CF 3.50/06/180F SN BK BX quick plug terminal type connector				
B connector	D_SUB, DB9 male header, plug, plastic enclosure				
Cable	3×0.25mm² shielded wire		Cable length	3 meters	

Quick-plug terminal connector-DB9 connector line sequence is, 1-2, 2-3, 3-5, 4-shield.

Prompt

RS485 interface external wiring

The basic specifications of inCube2S-6-outside cabinet cable RS485 are shown in Appendix Table 8.

Appendix Table 8 The basic specifications of inCube2S-6-outside the cabinet cable RS485

No.	4	Name	inCube2S-6- external cable RS485	Device code	P04082000844

A connector	Weidmüller, B2CF 3.50/06/180F SN BK BX quick plug terminal type connector		
B connector	Cold pressed terminal		
Cable	2×2×0.25mm² twisted pair shielded wire	Cable length	5 meters

EtherNet interface external wiring

The basic specifications of the industrial network cable are shown in Appendix Table 9.

Appendix Table 9 The basic specifications of inCube2S-6-industrial network cable

No.	5	Name	Industrial network cable		Device code	P04082000279
Brand				Hellolink		
Cable		4 cores AWG26		Cable length	5 meters	

EtherCAT interface external cable

The basic specifications of the drive are shown in Appendix Table 9.

Servo Debugger external wiring

The basic specifications of the USB to RS422/RS485 cable are shown in Appendix Table 10.

Appendix Table 10 Basic specifications of USB to RS422/RS485 cable

No.	-	Name	USB to RS422/RS485 cable		Device code	P04082000251
A connector	DB9		Brand/Model		Z-TEK	
B connector	USB		Brand/Model		Z-TEK	
Cable	5 cores		Cable length		1.8 meters	

Accessories related to gusset

The basic specifications and installation methods of inCube2S-6-installation of the sheet metal of the gusset are shown in Appendix Table 11-Appendix Table 12.

Appendix Table 11 inCube2S-6- basic specifications and installation methods for installing sheet metal

No.	\	Name	inCube2S-6-Install the gusset sheet metal	Device code	P01035000693
Length	185mm		Width	\	
Height	60mm		Board thickness	1.2mm	
Installation	\		Mounting screws	4 hexagon socket flat head screws M4X8	
Use	Used to fix MCBF-IEB gusset in the inCube2S-6 control cabinet				

Appendix Table 12 Basic specifications of MCBF-IEB gusset

No.	\	Name	MCBF-IEB gusset	Device code	P05245000108

Description	Gusset

Prompt   The DF50S point numbers at both ends correspond one to one.

J3\J5 interface external wiring

For the basic specifications of PWM and analog output_voltage and current input cables, see Appendix Table 13.

Appendix Table 13 The basic specifications of PWM and analog output_voltage and current input cables

No.	7	Name	PWM and analog output_voltage and current input cables	Device code	P04082000594
A connector	Hirose, DF51-10DS-2C				
B connector	European terminal C0.5-8				
Cable	10C × 0.2mm²		Cable length		5 meters

J6\J7 interface external wiring

The basic specifications of the wire harness shared by the magnetic scale and CAN_ encoder are shown in Appendix Table 14.

Appendix Table 14 The basic specifications of the wire harness shared by the magnetic scale and CAN_ encoder

No.	8	Name	Common wire harness for magnetic scale and CAN_ encoder	Device code	P04082000596
A connector	Jingyuanrong SCSI 14P M				
B connector	European terminal C0.5-8				
Cable	Jingyuanrong 10.0 Twelve cores (6 pairs) shielded braided black wire, φ 10		Cable length		5 meters

inCube2S-6-cabinet stacking connector

The basic specifications and installation methods of inCube2S-6-cabinet stacking connectors are shown in Appendix Table 15.

Appendix Table 15 Basic specifications and installation methods of inCube2S-6-cabinet stacking connectors

No.	-	Name	inCube2S-6-cabinet stacking connector	Device code	P01035000694
Length	88mm		Width		15mm

Height	-	Board thickness	1.5mm
Installation method	Refer to *Chapter 3.4.2*	Mounting screws	2 cross recessed pan head combination screws M4X10
Use	For cabinet stacking		

inCube2S-6-Teach Pendant Bracket

For the basic specifications and installation methods of the inCube2S-6-teach pendant bracket, see Appendix Table 16.

Appendix Table 16   The basic specifications and installation method of inCube2S-6-teach pendant bracket

No.	-	Name	inCube2S-6-Teach Pendant Bracket	Device code	P01035000263
Length	232mm		Width	221mm	
Height	87mm		Board thickness	1.5mm	
Installation method	Refer to *Chapter 3.4.2*		Mounting screws	3 cross recessed pan head combination screws M5X10	
Use	Install the teach pendant				

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