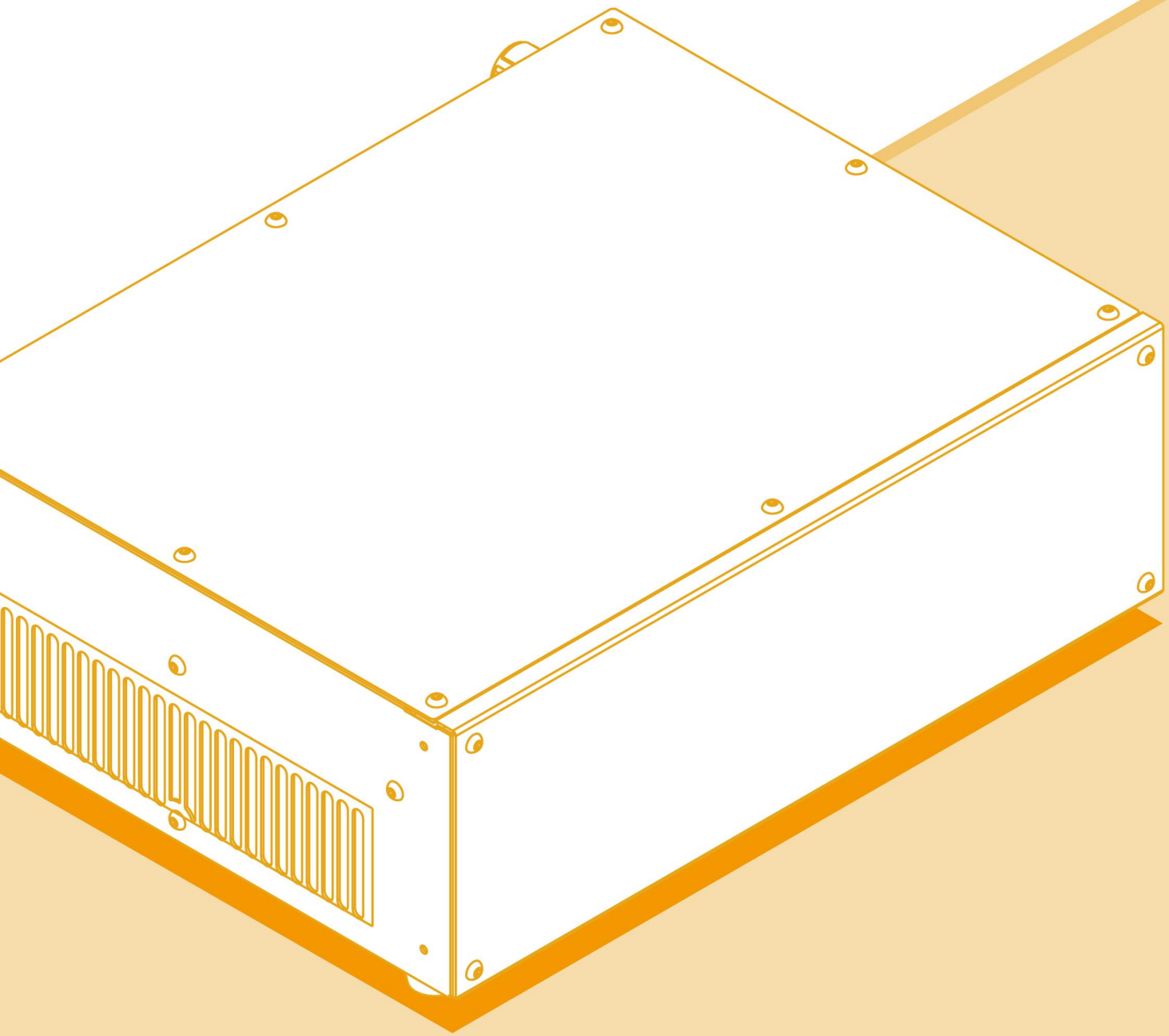
inCube20
Control Cabinet Manual

V1.5.0



Foreword

About this manual

This manual is for technicians to install, use, and use the inCube20 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:

- "SR6-A industrial robot manipulator manual"
- "SR6L-A industrial robot manipulator manual"
- "SR10-A industrial robot manipulator manual"
- "SR-TP 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://ligentrobot.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
V1.4.3	2020.03.19	1st official publication
V1.5.0	2020.07.07	2nd official publication Fix known bugs.

Manual Number and Version

The manual-related information is shown in Table 3.

Table 3 Document-related information

Document name	" inCube20 control cabinet manual "
Document number	UM-P05110000030-001
Document version	V1.5.0

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

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 the 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

- 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.


Warning

- 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 safety barriers shall be swept thoroughly.
- Dust and other foreign matters are not allowed in the manipulator during the components replacement.
- Operating personnel who are in charge of maintenance and repSR shall accept the company's training and pass the examination.
- During the maintenance, appropriate luminSRe 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 schematic diagram of the safe work of industrial robots.

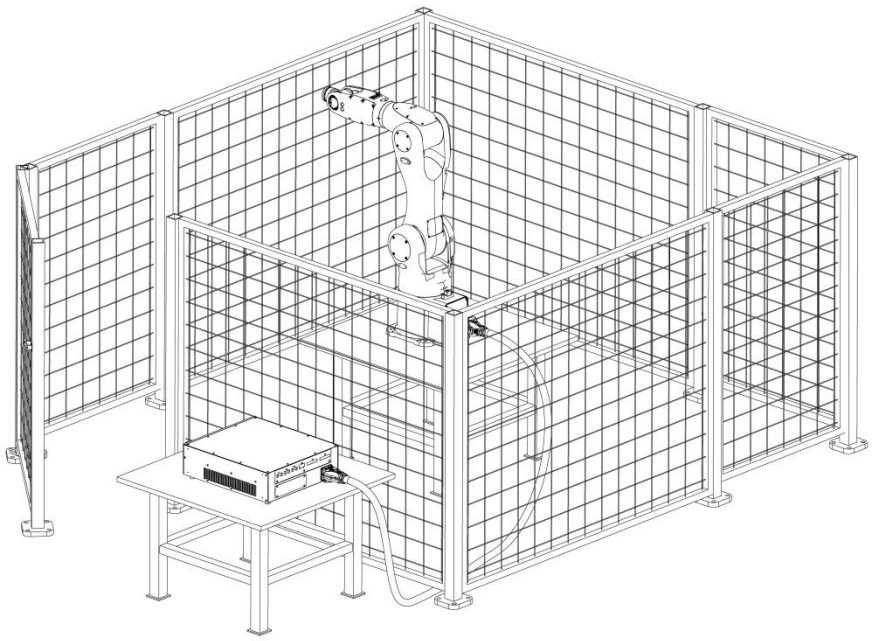


Figure 1 Schematic diagram of the safe work of industrial robots

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 operation machine can be maintained (repSR, 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 and other ways, thus, 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 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 inCube20 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.

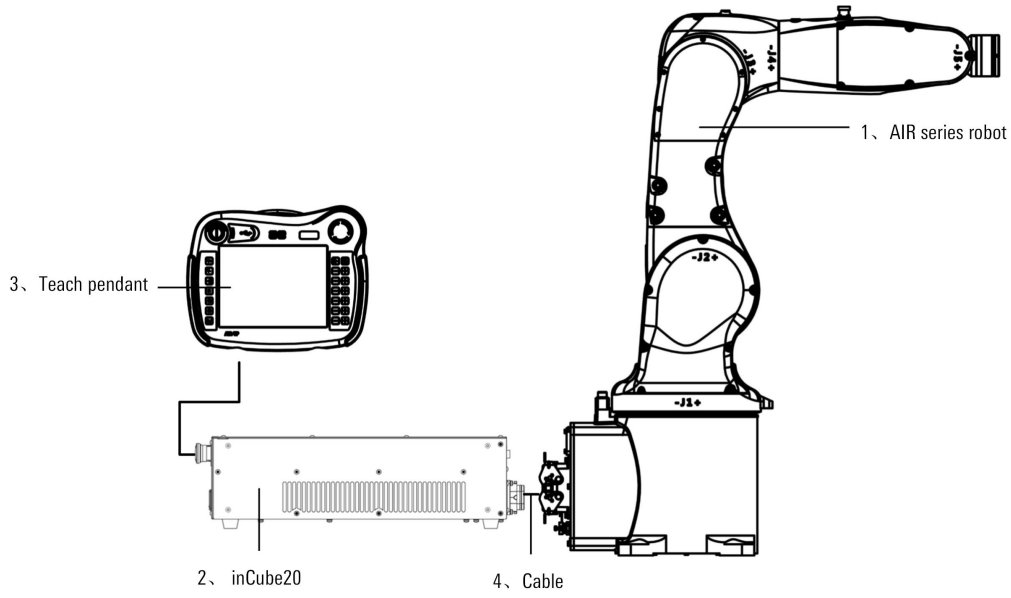


Figure 1-1 Composition of robot system

Manipulator

The manipulator 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, safety module, power module, movement control module and other components, and provides the connection interfaces with the robot body and other external equipment.

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 control cabinet is equipped with the electrical equipment that is required to control the robot, including the motor drive, safety 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 and the names of its various parts are shown in Figure 1-2~Figure 1-4.

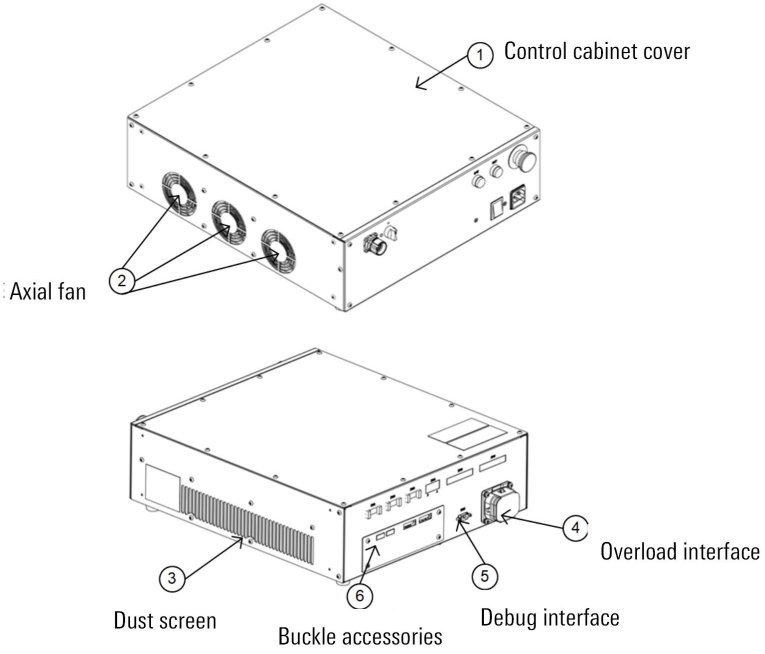


Figure 1-2 Appearance of control cabinet

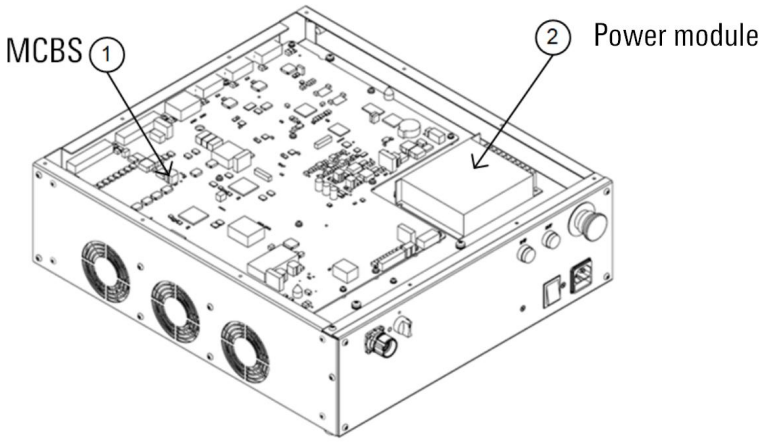


Figure 1-3 Schematic diagram of internal components of upper cavity of control box

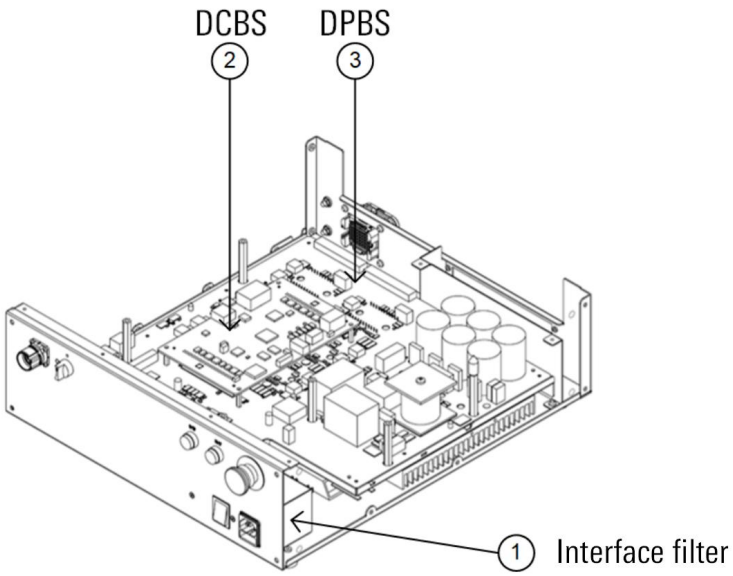


Figure 1-4 Schematic diagram of internal components of drive box

1.3 Basic specifications of control cabinet

The basic specifications of inCube20 control cabinet are shown in Table 1-1:

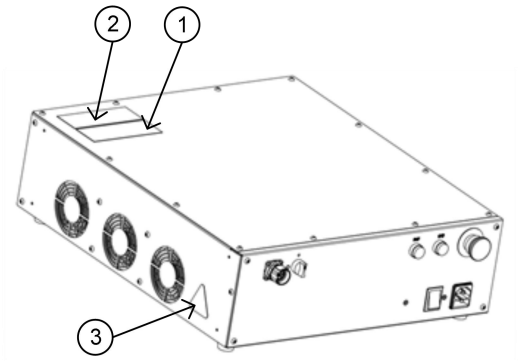
Table 1-1 Basic specifications of inCube20 control cabinet

Name	**Characteristic**	
Cabinet body type	19″ cabinet	
Color	Black	
Weight	20kg	
Protection class	IP20	
Number of axes	6-axis, 2 axes can be expanded	
Noise	50dB(A)	
Rated supply voltage	AC220V±10%	
Power frequency	49~61Hz	
Full load power	2.2KVA	
Fusing current	16A	
Vibration condition	Operation	Transportation
Vibration acceleration	0.5g	6g
Vibration frequency	4~120Hz	5~500Hz
Impact acceleration Instantaneous	2.5g	300g
Impact waveform/period	Half sine/11ms	Sawtooth wave/9ms

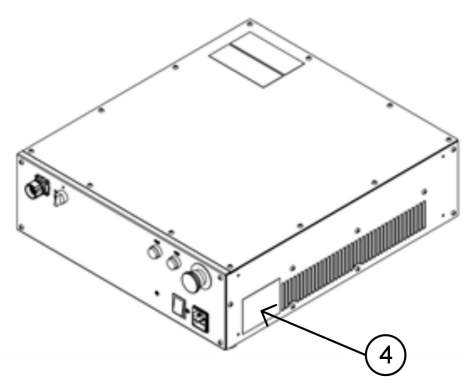
Name	Characteristic
Operating temperature	0~45 ℃
Temperature change rate	<1.1K/min
Storage temperature	-25~60℃
Operating humidity	80% RH
Storage humidity	90%RH
Altitude	Normal operation at the altitude of below 1000m
	Derated by 5%/1000m at the altitude of 1000-4000m

1.4 Control cabinet label and meaning

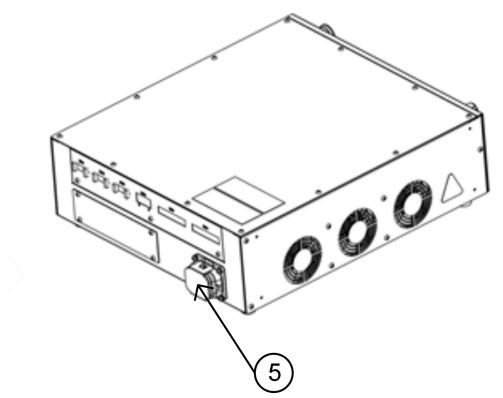
The inCube20 control cabinet contains 5 types of labels. The specific positions of the labels are shown in Figure 1-5.



(a)



(b)



(c)

Figure 1-5 Schematic diagram of positions of labels contained in the control cabinet

The meanings of labels are as follows:

①PSRing information signboard

The pSRing information signboard is shown in Figure 1-6.

Figure 1-6 PSRing information signboard

② Door-opening power-off & maintenance signboard

The door-opening power-off & maintenance signboard is shown in Figure 1-7.

Figure 1-7 Door-opening power-off & maintenance signboard

③High temperature sign

There may be heat in places where high temperature signs are provided (see Figure 1-8). When you see the sign, you should be careful not to be burned. If you have to touch the equipment under heat, be sure to wear protective equipment such as heat-resistant gloves before touching it.

Figure 1-8 High temperature sign on control cabinet

④Control cabinet nameplate

The control cabinet nameplate is shown in Figure 1-9. The nameplate indicates the model, serial number, weight, manufacture date and other related information of the control cabinet.

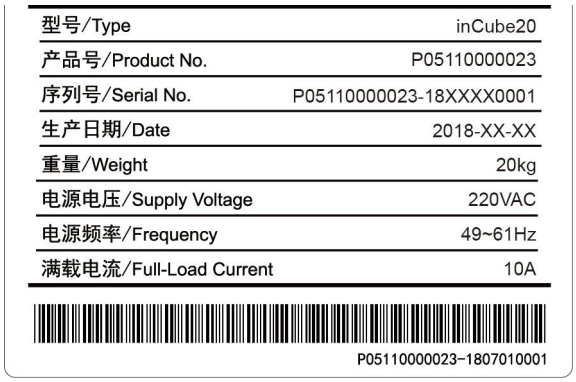


Figure 1-9 Control cabinet nameplate

⑤Overload protection label

The overload protection label on the control cabinet is shown in Figure 1-10. The protection label reminds you to remove the protective film before using the overload.

Figure 1-10 Overload protection label

1.5 Installation environment of control cabinet

- The ambient temperature should be 0-45°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.

2 Transportation of inCube20 Control Cabinet

Transportation posture

- Make sure that all connectors on the control panel are unplugged.
- Make sure that the control cabinet is transported in a horizontal posture.

Transportation by forklift

- A transportation tray should be provided under the control cabinet during transportation, as shown in Figure 2-1.

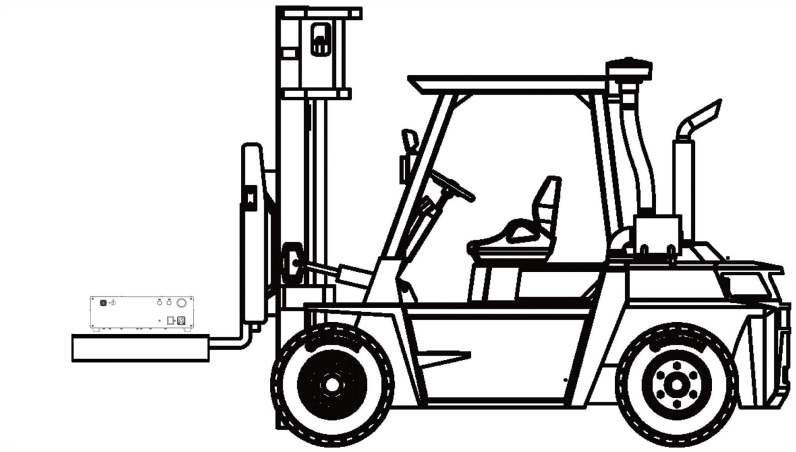


Figure 2-1 Schematic diagram of control cabinet transportation by forklift

3 Unpacking of inCube20 Control Cabinet

3.1 Unpacking method and sequence

The schematic diagram of unpacking box of unCube20 control cabinet and ARCSP-SR_TP teach pendent is shown in Figure 3-1. The names of parts are shown in Table 3-1.

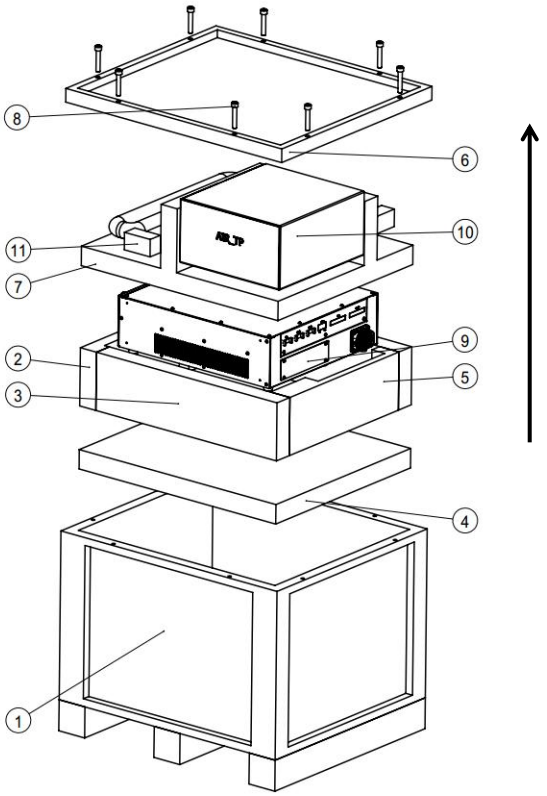


Figure 3-1 Schematic diagram of unpacking box of control cabinet and teach pendent

The unpacking method of inCube20 control cabinet and ARCSP-SR_TP teach pendent is as follows:

Step1. Remove the hexagon socket head cap screws M10×55 (8) from the wooden box cover (8) with a 16MM Allen wrench, and open the wooden box cover (6).

Step2. Remove ARCSP-SR_TP teach pendant-package (10) and cable (11) and put them aside for installation.

Step3. Remove the EPE-cabinet-cover (7).

Step4. Remove inCube20 control cabinet (9) and set it aside for installation.

Step5. After removing inCube20 control cabinet and ARCSP-SR_TP teach pendant, it is necessary to properly store each part of the packing box for subsequent packaging during transportation.

Table 3-1 Names of parts of packing box of control cabinet and teach pendant

No.	Name
1	Box
2	EPE-Cabinet-1
3	EPE-Cabinet-2
4	EPE-cabinet-bottom
5	EPE-Cabinet-3
6	Wooden box cover
7	EPE-cabinet-cover
8	Hexagon socket head cap screw M10 × 55
9	inCube20 control cabinet
10	ARCSP-SR_TP teach pendant-packaging
11	Cable

3.2 Repacking to prevent damage due to transportation

The schematic diagram of repacking box of inCube20 control cabinet and ARCSP-SR_TP teach pendant is shown in Figure 3-2. The names of parts are shown in Table 4-1.

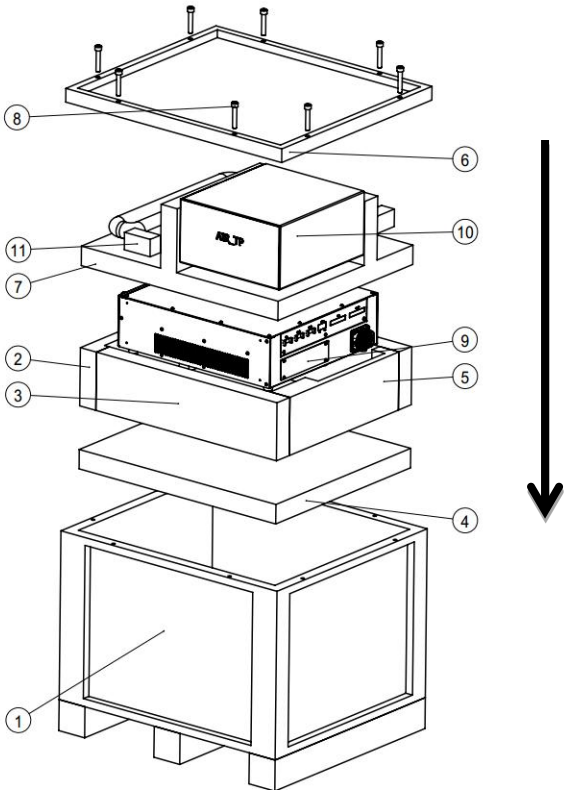


Figure 3-2 Schematic diagram of repacking box of control box and teach pendant

In order to prevent damage due to transportation, the original packing box should be used for repacking. The repacking process is as follows:

Step1. Place the EPE-cabinet-bottom (4) on the bottom of the box (1).

Step2. Place the EPE-cabinet-1 (2) and the two EPE-cabinet-2 (3) according to the positions on the EPE-cabinet-bottom (4) next to the side wall of the box, as shown in the exploded view.

Step3. Place the inCube20 control cabinet (9) between the EPE-Cabinet-1 (2) and the two EPE-Cabinet-2 (3).

Step4. Place the EPE-Cabinet-3 (5) in the gap on the side of the handle of the inCube20 control cabinet (9).

Step5. Place the EPE-cabinet-cover (7) above the inCube20 control cabinet (9).

Step6. Place the ARCSP-SR_TP teach pendant-package (10) and cable (11) in the position shown in the exploded view of the EPE-cabinet-cover (7).

Step7. Use a 16MM Allen wrench to tighten the wooden box cover (6) onto the box (1) with the hexagon socket head cap screws M10×55 (8) to complete the repacking work.

3.3 Safe disposal of packaging materials

After unpacking, all parts of the packing box should be properly stored, during which attention should be paid to the followings:

- The storage area should be dry and clean.
- The temperature in the storage area should be stable.
- The storage area must be selected to ensure that the materials of component of the packing box will not be damaged.
- The packing box should be stored indoors.

4 Installation and Connection of inCube20 Control Cabinet

4.1 Check items

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.

4.2 Installation dimensions

The inCube20 control cabinet is a control cabinet of 3U height that supports installation in a 19″ cabinet. The specific dimensions are shown in Figure 4-1.

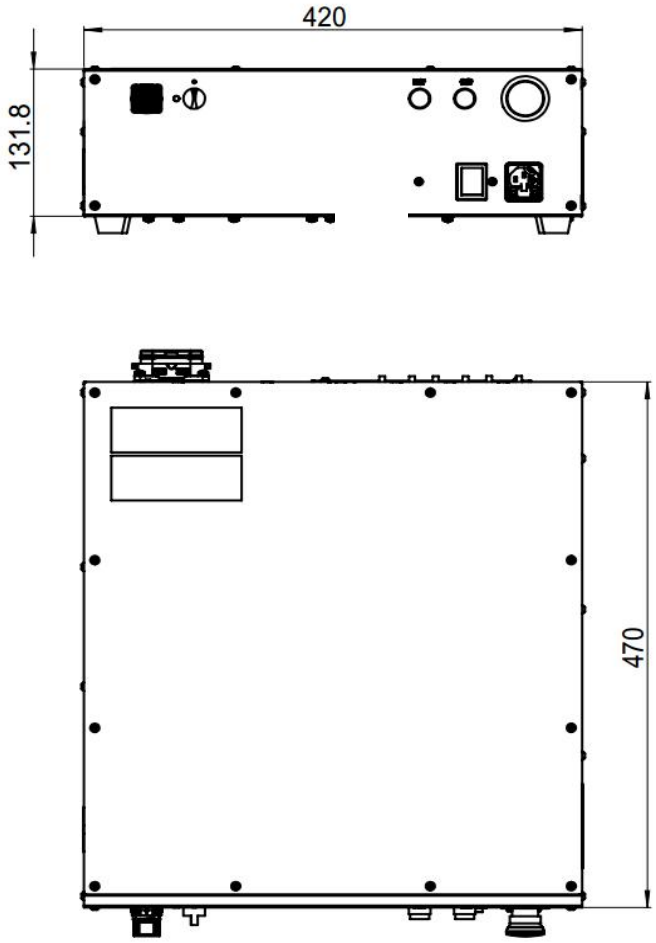


Figure 4-1 Outline dimensions of cabinet

4.3 Installation method

Direct installation

The inCube20 control cabinet can be placed directly on a platform that meets the installation environment, which may not be a movement platform. The contact points between the platform and the four foot pads of the control cabinet must be on the same plane.

Requirements:

- The platform will come into contact with the four foot pads during normal placement. The surface on which the control cabinet is placed can have a certain angle of inclination, which, however, may not be greater than 30°.
- A certain weight load can be placed on the top surface of the control cabinet, but the load weight may not be greater than 40kg, and the load contact area may not be less than 80% of the top surface of the cabinet.

Installation of 19″ cabinet

The inCube20 can be installed in a 19″ cabinet, should be greater than 600mm in the direction of the depth of the cabinet, and should be reserved with vents on the left and right sides. The control cabinet can be installed with the accessories shown in Figure 4-2. For details about the accessories that may be required for installation of the control cabinet, please refer to Appendix A ″List of Accessories″ in this manual.

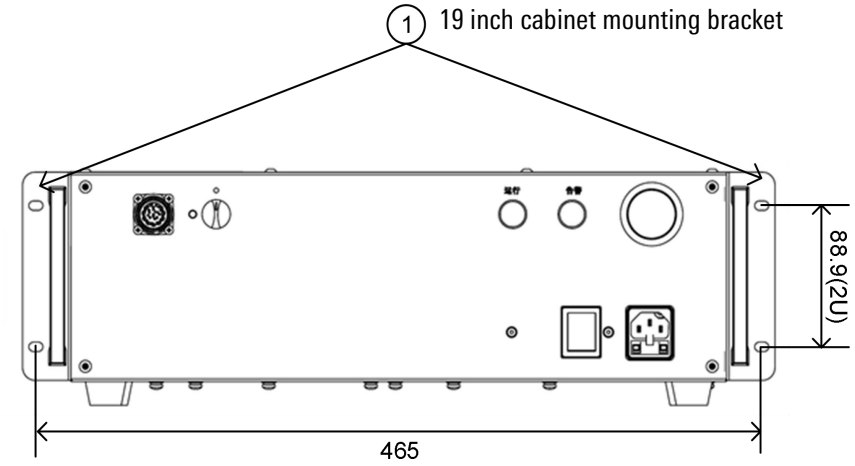


Figure 4-2 Installation diagram of 19″ cabinet

When the control cabinet is installed in a 19″ cabinet, high-strength screws (such as hexagon socket head screw, grade 12.9, M5X12) should be used, and a 19″ cabinet tray should be installed at the bottom of the control cabinet.

Stacking of control cabinet

The inCube20 control cabinet supports a maximum of three stacking cabinets. If multiple control cabinets are used and high requirements are posed on the footprint of the control cabinet, the cabinets can be stacked in the manner shown in Figure 4-3. For details about the materials used for stacking, please refer to Appendix A ″List of Accessories″ in this manual.

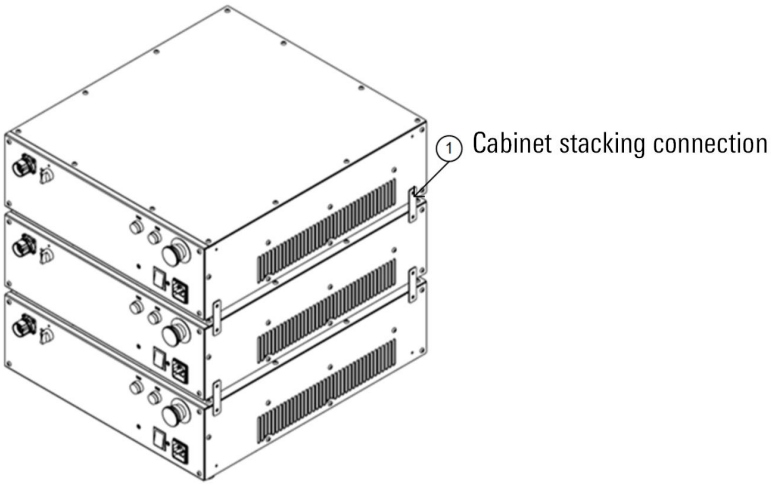
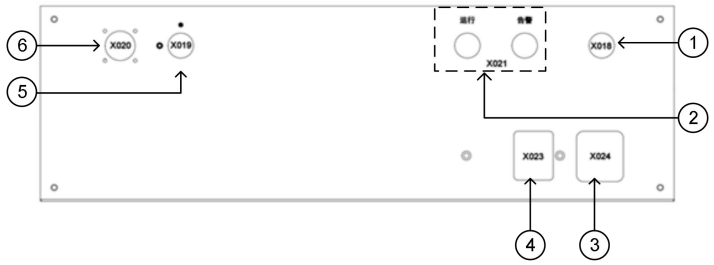
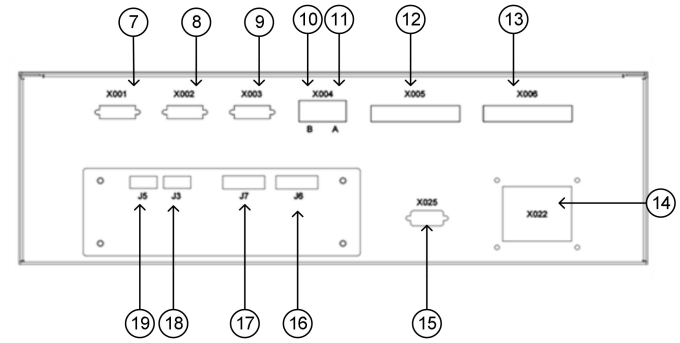


Figure 4-3 Cabinet stacking

4.4 Control cabinet interface



(a)



(b)

Figure 4-4 Position of interface of inCube20 control cabinet

All operation buttons, indicators and connection interfaces of the inCube20 control cabinet are designed on the front panel, as shown in Figure 4-4. The names and functions of interface are shown in Table 5-1.

Table 4-1 Description of interface of inCube20 control cabinet

No.	Interface identification	Interface name
1	X018	Emergency stop button
2	X021	Indicator group
3	X024	Power cord inlet
4	X023	Power switch
5	X019	Teach pendant knob
6	X020	Teach pendant interface
7	X001	User serial port RS232
8	X002	Modbus slave interface RS485
9	X003	PLC-MF master station interface RS485
10	X004-B	User EtherNET network port
11	X004-A	Expanded external axis EtherCAT network port
12	X005	Safety IO interface
13	X006	User IO interface
14	X022	Overload interface
15	X025	Debug interface

No.	Interface identification	Interface name
16	J6	Magnetic scale and CAN interface
17	J7	Encoder connector
18	J3	Voltage/current input connectors
19	J5	MCBS and MCBS-IEB connectors

Tip

For description of the above interface, please refer to Section 5.4 ″Description of control cabinet interface″.

4.5 Connection of control cabinet

Connection of teach pendant

The upper left corner of front panel of inCube20 control cabinet is the teach pendant connection interface, which is connected by a quick-plug connector:

- When connecting, align the plane of #1 plug with that of #2 socket, as shown in Figure 4-5. At this time, align the triangle alignment symbols on the plug and the socket, and then push the connector inside. Turn the plug clockwise 45 degrees to lock the plug onto the socket.
- When removing, turn the plug 45 degrees counterclockwise to align the plane of #1 plug with that of #2 socket, and then pull out the plug.

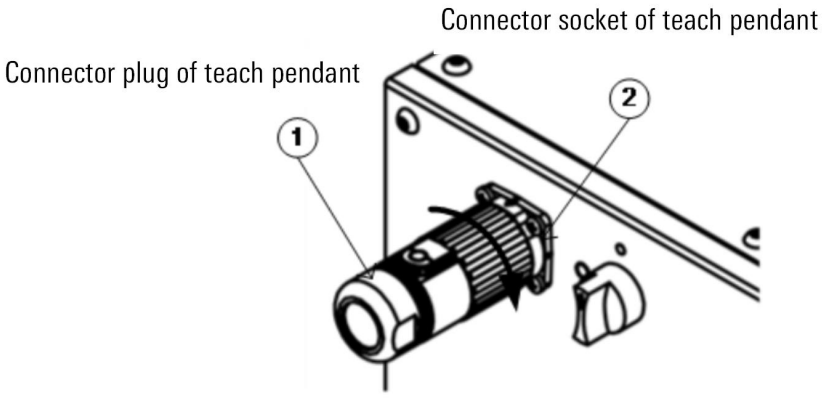


Figure 4-5 Connection of teach pendant

Manipulator power encoder connection

The lower right corner of the rear panel of the inCube20 control cabinet is the power encoder connection interface of the manipulator. It uses a heavy-duty connector. The heavy-duty connector has the function of clamping and error prevention. When connecting, insert the male plug of the heavy-duty connector into the female Insert the body and fasten the lock.

The size of the heavy-duty plug is shown in Figure 4-6, the heavy-duty wire diameter is 20.2±0.6mm, and the minimum bending radius is 6D (six times the cable diameter).

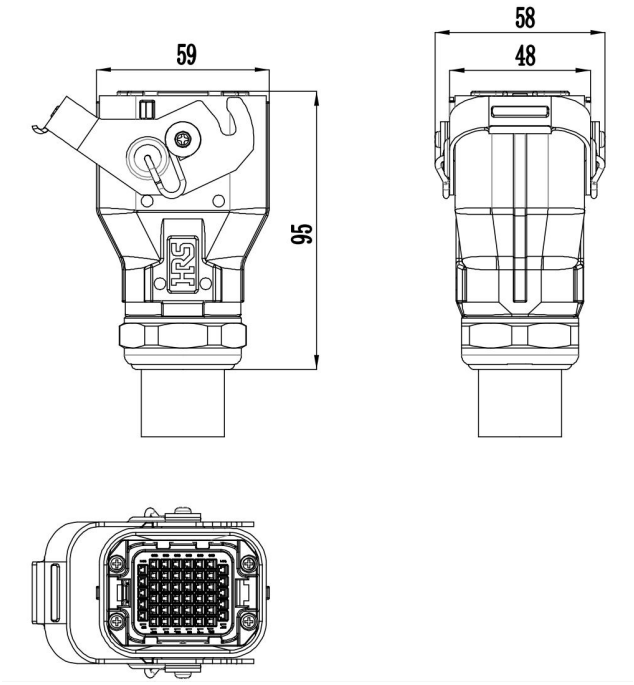


Figure 4-6 Heavy-duty plug size chart

Connection of other interfaces

"Other interfaces" are the interfaces that are reserved on inCube20 control cabinet for users:

- When connecting the user interface with a thread locking mechanism, such as X001 user serial port RS232, X002 Modbus slave interface RS485, X003 PLC-MF master interface RS485, X005 Safety IO interface, X006 User IO interface, the thread must be tightened.
- When connecting the user interface without a locking mechanism, such as X004-A expanded external axis EtherCAT network port, X004-B user EtherNET network port, the crystal head must be fully inserted into the plug; for the power cable connection interface, the triangle power plug must be fully inserted into the socket.

Tip

For details about connection cables with the above interfaces, please refer to Appendix A ″List of Accessories″.

4.6 Definition of control cabinet electrical connection

Definition of teach pendant interface X020

The teach pendant interface X020 of inCube20 control cabinet is shown in Figure 4-7. The pin number of the connector interface is defined in Table 4-2.

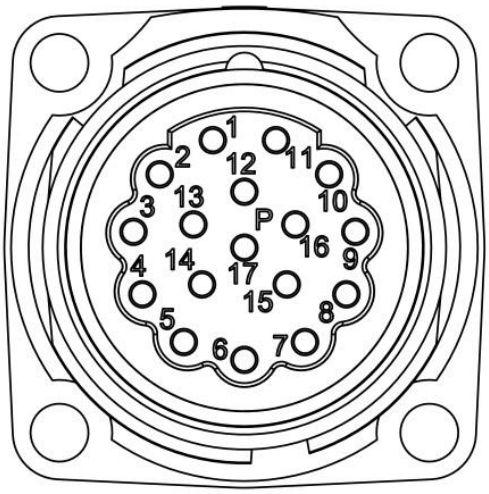


Figure 4-7 Teach pendant interface X020

Table 4-2 Definition of pin number of teach pendant connector interface X020

Pin No.	Signal name	Wire color	Pin No.	Signal name	Wire color
1	ESTOP_INT+	White	9	+24VD	Black
2	ESTOP_INT-	Brown	10	+24VD_RTN	Purple
3	ESTOP_SAF+	Green	12	TX+	White/orange
4	ESTOP_SAF-	Yellow	13	TX-	Orange
5	ENA_INT+	Gray	14	RX+	Whit/green
6	ENA_INT-	Orange	15	RX-	Green
7	ENA_SAF+	Blue	17	Shielding layer	Shell
8	ENA_SAF_	Red			

Definition of overload interface X022

The definition of overload interface X022 of ARCC10 control cabinet is shown in Figure 4-8. The definition of overload interface X022 of the of inCube20 control cabinet is shown in Table 4-3.

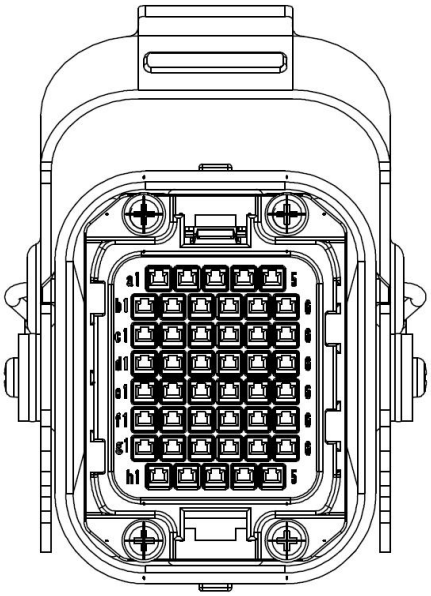


Figure 4-8 Definition of overload interface X022 of ARCC10 control cabinet

Table 4-3 Definition of overload interface X022 of inCube20 control cabinet

Pin No.	a	b	c	d	e	f	G	h
1	J1_PS+	J1_PS-	Encoder 0V	PE	GND_24VBR	U1	V1	W1
2	J2_PS+	J2_PS-	Encoder 24V	-	24V_BR+2_0	U2	V2	W2
3	J3_PS+	J3_PS-	E_NAME_BOARD_RS485_B	-	24V_BR+	U3	V3	W3
4	J4_PS+	J4_PS-	E_NAME_BOARD_RS485_A	PE	-	U4	V4	W4
5	J5_PS+	J5_PS-	DC_24V_ISO_RDC	-	U6	U5	V6	W5
6	-	J6_PS+	J6_PS-	GND_ISO_RDC	-	V6	W6	-

Tip

For definition of other interface connectors, please refer to ***Section 5***.

5 inCube20 control cabinet interface instructions

5.1 Control cabinet indicator light description

The inCube20 control cabinet provides 2 indicator lights, of which:

- The green indicator is a running indicator, which is on when the program is running.
- The red indicator is an alarm indicator, which lights up when the control system is abnormal.

5.2 Description of control cabinet operation buttons

Switch

The power switch of the inCube20 control cabinet is a rocker switch with light, and the word O/I is printed on the switch. Under normal use:

- 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 set to O position, it means that the control cabinet is closed, and the indicator light inside the switch is off.


Tip

Refer to ***Chapter 8*** for the normal startup process of the control cabinet.


Notice

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

Emergency button

The emergency stop button of the inCube20 control cabinet is a mushroom emergency stop button. When the emergency stop button is pressed, the robot stops immediately (STOP1). When you need to release the safe state, you should turn up the emergency stop button in the direction indicated on the button first.


Notice

Do not use the emergency stop button as a pause function, otherwise it may cause damage to the manipulator.

Teach Pendant Plug Knob

inCube20 control cabinet teach pendant plug-in knob, the knob has two positions 0/1:

- When the knob is set to gear 1, it means that the teach pendant must be connected for normal use, otherwise the control cabinet will give an alarm.
- When the knob is set to gear 0, it means that the teach pendant can be removed, and the robot system can still continue to run at this time.

When the teach pendant is connected to the normal operation, if you want to unplug the teach pendant, you must first set the knob to 0, and then unplug the teach pendant; if you want to connect the teach pendant again, you need to plug in the teach pendant and wait for the display. The start of the teach pendant is completed, and the interface of the teach pendant shows that the network connection is normal, and then set the knob from 0 to 1. If you operate the knob without waiting for the start of the teach pendant to complete, it may cause the robot to stop.


Notice

For the system that still needs to run after unplugging the teach pendant, make sure that the control cabinet is connected to an external control device before unplugging it.

5.3 Instructions for the external interface of the control cabinet

X005 Safety IO interface

The X005 interface of the inCube20 control cabinet is a Safety IO interface. The interface signals include external emergency stop input, safety fence status, external safety, external alarm input, LED light tower, buzzer, emergency stop output and other signals.

The definition of each signal of the Safety IO interface is fixed and cannot be configured by users. Refer to Table 5-1 for the definition of X005 Safety IO interface.

Table 5-1 X005 Safety IO interface definition list

Pin No.	Signal name	Signal meaning	In/Out
1	D+24V_EX	Isolated 24V power supply	Power
2	GND_EX	In isolation	Power
3	RUNLED_TOWER_CCB+	Lighthouse operating light contact is positive	Out
4	RUNLED_TOWER_CCB-	Lighthouse operating light contact negative	Out
5	POWERLED_TOWER_CCB+	Lighthouse power light contact positive	Out
6	POWERLED_TOWER_CCB-	Lighthouse power light contact negative	Out
7	ERRORLED_TOWER_CCB+	Lighthouse warning light contact is positive	Out
8	ERRORLED_TOWER_CCB-	Lighthouse warning light contact negative	Out
9	BUZZER_TOWER_CCB+	External buzzer contact positive	Out
10	BUZZER_TOWER_CCB-	External buzzer contact negative	Out
11	D+24V_EX	Isolated 24V power supply	Power
12	GND_EX	In isolation	Power
13	ESTOP_CCB_OUT2-1	Emergency stop external output contact	Out
14	ESTOP_CCB_OUT2-2	Emergency stop external output contact	Out
15	ESTOP_CCB_OUT1-1	Emergency stop external output contact	Out
16	ESTOP_CCB_OUT1-2	Emergency stop external output contact	Out
17	D+24V_EX	Isolated 24V power supply	Power
18	GND_EX	In isolation	Power
19	EX_ESTOP_SAF	External emergency stop input	In
20	EX_ESTOP_INT	External emergency stop input	In

Pin No.	Signal name	Signal meaning	In/Out
21	D+24V_EX	Isolated 24V power supply	Power
22	GND_EX	In isolation	Power
23	EX_ALARM2_DI	External alarm input 2	In
24	EX_ALARM1_DI	External alarm input 1	In
25	D+24V_EX	Isolated 24V power supply	Power
26	GND_EX	In isolation	Power
27	BARRIER_CCB	External safety fence input	In
28	EX_SAFE_SAF	External safety confirmation input	In
29	D+24V_EX	Isolated 24V power supply	Power
30	GND_EX	In isolation	Power
31	EX_SAFE_INT	External safety confirmation input	In
32	GND_EX	In isolation	Power
33	RESERVE_4	Reserve a safety signal	Out
35	RESERVE_3	Reserve a safety signal	Out
37	D+24V_EX	Isolated 24V power supply	Power
39	D+24V_EX	Isolated 24V power supply	Power
40	GND_EX	In isolation	Power

The X005 Safety IO interface provides output signals such as LED light tower, buzzer, emergency stop output, and provides emergency stop input, safety fence status, external safety, and external alarm input. Refer to Figure 5-1 for signal usage.

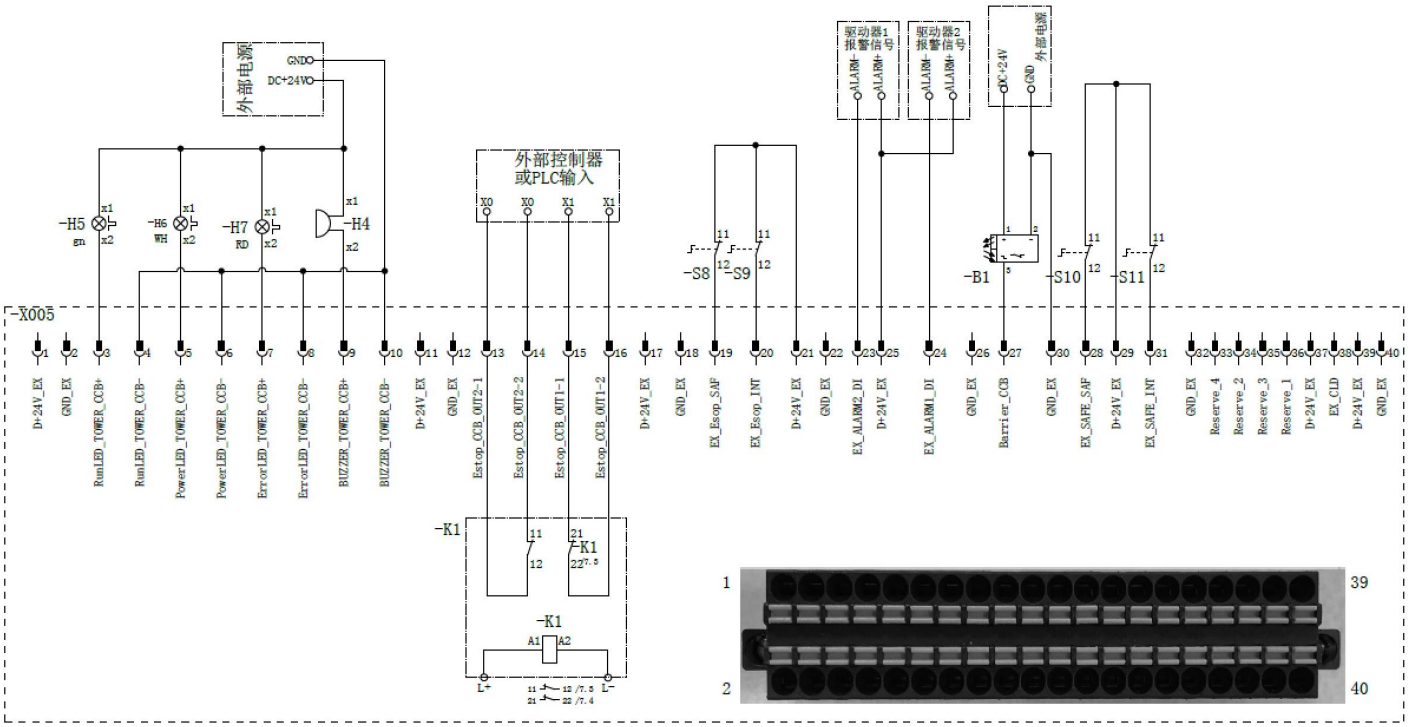


Figure 5-1 X005 Safety IO output signal

X006 User IO interface

The inCube20 control cabinet provides users with 16 DI and 16 DO interfaces. When using DI and DO interfaces, an external power supply must be used. Refer to Figure 5-2 for DI interface usage information.

PNP sensor signal, switch signal, relay contact signal can be used as the input of user DI. The inCube20 control cabinet supports PNP type sensor input. When NPN type sensor is used, a relay is required for conversion.

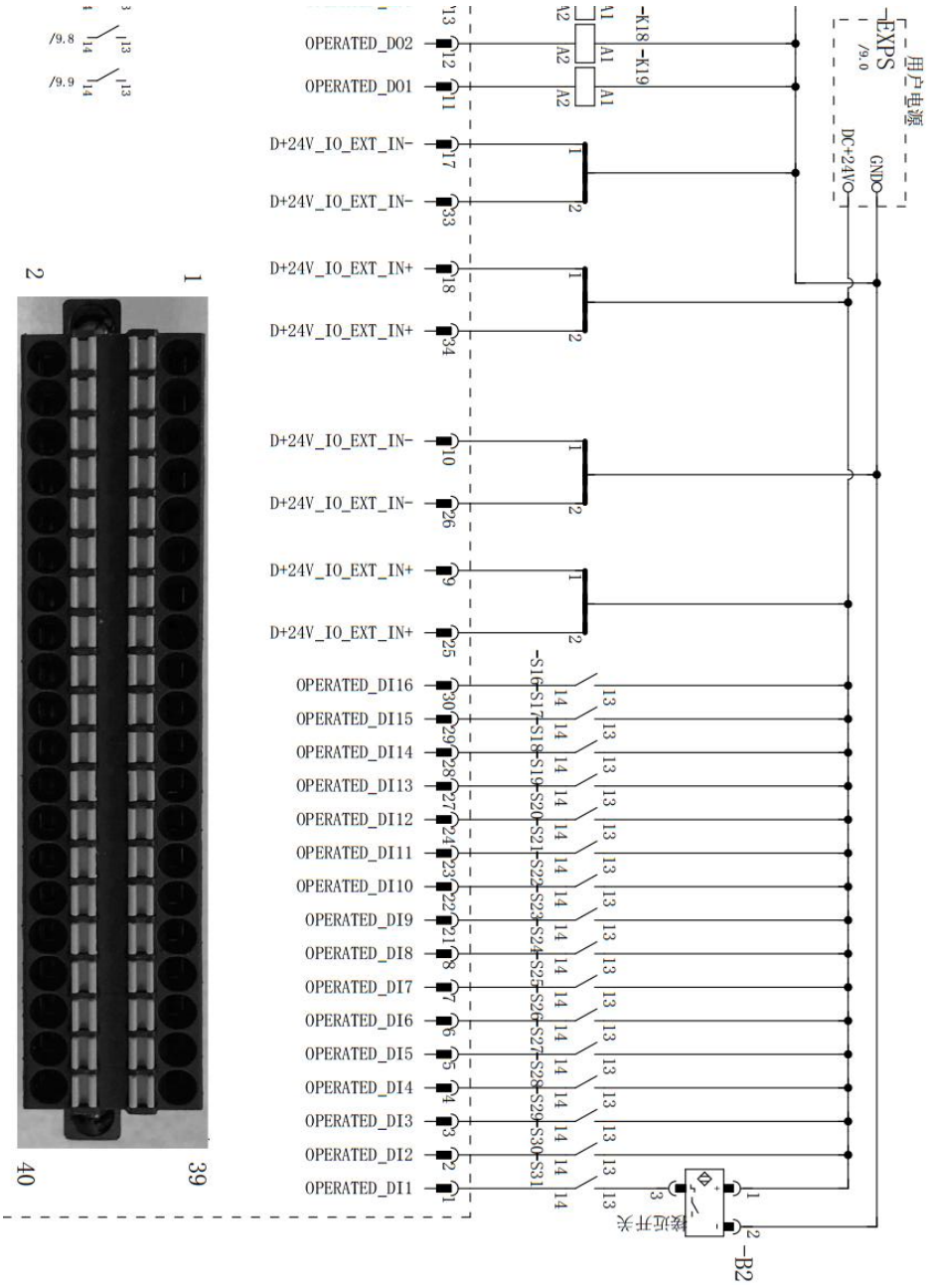


Figure 5-2 X006-DI interface instructions

The inCube20 control cabinet provides users with 16 DO interfaces. The maximum allowable output current of DO10, DO12, DO14, and DO16 is 500mA, and the maximum allowable output current of the remaining DO is 160mA. When the user DO interface is used, an external power supply must be used. Refer to Figure 5-3 for interface usage information.

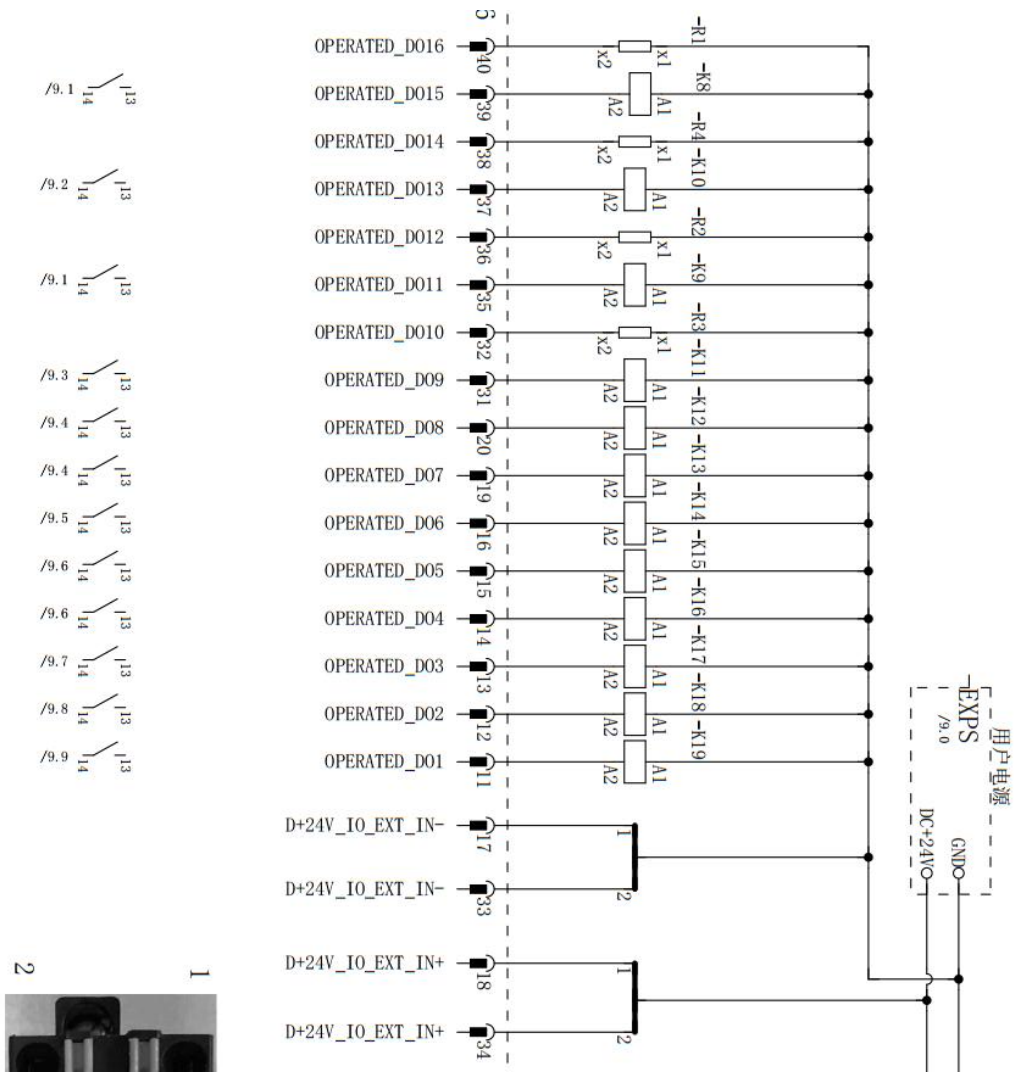


Figure 5-3 X006-DO interface instructions

X001 user RS232 interface

The X001 interface of the inCube20 control cabinet is an RS232 communication interface provided for users. The X001 interface is a standard DB9F connector. When this interface is used, you can select the cable that matches X001 according to the "Appendix A" accessory list, and the cable color It is black, brown, and blue. Refer to Table 5-2 for cable definition.

Table 5-2 X001 interface definition

Interface	Pin	Cable color	Cable definition	Description
X001	2	Black	RXD	Control cabinet sending
	3	Brown	TXD	Control cabinet receiving
	5	Blue	GND	In isolation

X002 Modbus slave interface

The X002 of the inCube20 control cabinet is a PLC interface (Modbus slave), and the physical layer is RS485. This interface is used for communication between the control cabinet and the PLC. Refer to Table 5-3 for cable definition.

Table 5-3 X002 interface definition

Interface	Pin	Cable color	Definition	Description
X002	3	/	RS485_2_O_+	RS485+
	4	/	RS485_2_O_+_R	RS485+ reserved for switching terminal resistance
	5	/	GND_ISO_RDC	GND
	7	/	RS485_2_O_-_R	RS485-reserved, used to switch the terminal resistance
	8	/	RS485_2_O_-	RS485-

X003 external expansion MF interface

The X003 interface of the inCube20 control cabinet is an externally expanded MF interface. When the number of IOs used exceeds the 16 DI and 16 DO reserved by the system, the inCube20 control cabinet provides an MF module with extended IO. The MF module has 40 DI and 40 DO signals, and communicates with the control cabinet through the Modbus protocol.

The X003 interface is a standard DB9F connector. When using this interface, you can select the cable pSRed with X003 according to the "Appendix A" accessory list. The cable has three colors of black, brown, and blue. The cable definition refers to the Table 5-4.

Table 5-4 X26 interface definition

Interface	Pin	Cable color	Definition	Description
X003	3	Black	RS485+	RS485 bus positive
	8	Brown	RS485-	RS485 bus negative
	5	-	GND	In isolation

X004-B user Ethernet port

The inCube20 control cabinet provides users with an Ethernet interface, which is used to connect industrial Ethernet and sensors that communicate with Ethernet.

X004-A extended external axis EtherCAT network port

The inCube20 control cabinet reserves an EtherCAT interface as an extended external axis interface and an EtherCAT protocol conversion port. Supports maximum expansion of 6 external axes.

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 alarms are passed safely. The IO interface is connected to the compact cabinet.

When connecting the EtherCAT communication port of the expansion shaft outside the inCube20 control cabinet, you can use the connectors shown in the accessories list in "Appendix A" for installation and connection.

6 Safe Use of inCube20 Control Cabinet

6.1 Grounding of control cabinet

The inCube20 control cabinet must have reliable ground connection. The main purpose of the ground connection is as follows:

- The grounding makes all unit circuits in inCube20 control cabinet have a common reference zero potential, so that there is no potential difference between the grounds of various circuits, which ensures the stable operation of the system.
- The reliable ground connection of inCube20 control cabinet can prevent the jamming from any external electromagnetic field. The case grounding provides a relief channel for transient jamming, which allows a large amount of charge accumulated on the case due to electrostatic induction to be discharged through the ground.
- It can guarantee safe operation. When the electromagnetic induction of direct lightning occurs, it can avoid any damage to electronic equipment; 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 protect the operator from electric shock.

The inCube20 control cabinet is grounded through the PE pin in the power cord inlet. It must be ensured that the cable input terminal connected to the control cabinet has a reliable ground connection. Under normal circumstances, the resistance between the cable input terminal PE and the ground should be no more than 100 Ω. In addition, the control cabinet is provided with a grounding point. If necessary, the grounding wire can be connected to the grounding point shown below.

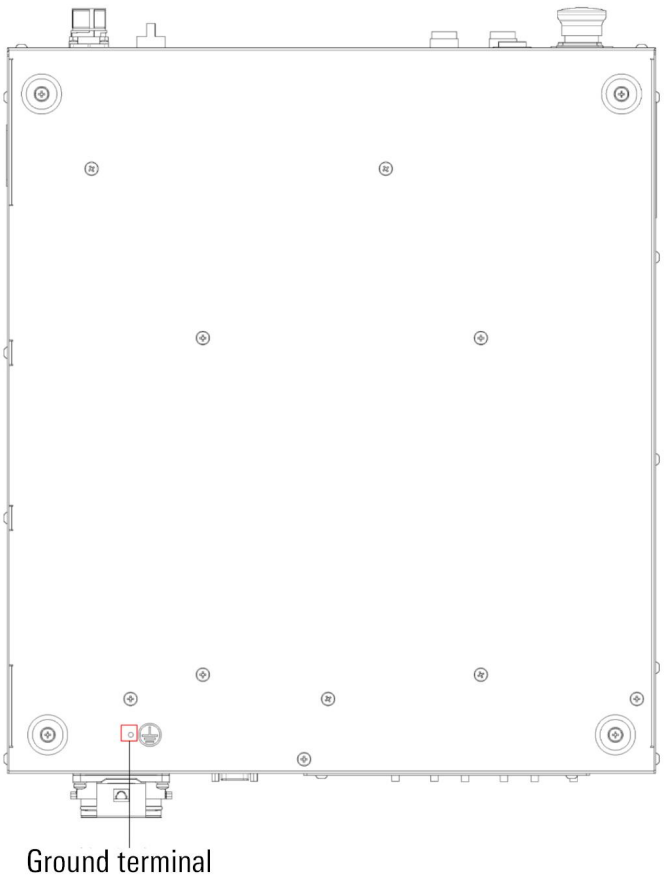


Figure 6-1 Schematic diagram of grounding wire connection point of ARCC20 control cabinet

6.2 Safety of robot system

The robot system herein (including the manipulator, control cabinet, teach pendant and all software and hardware) can work normally only when the peripheral equipment and system are constructed. The peripheral equipment and system must contain the safety barrier, external emergency stop equipment and external safety input equipment necessary for the safe operation of the robot.

The signal definitions of the above safety devices are fixed in the inCube20 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 6-1 for the connection of the safety signal of the Safety IO interface, and refer to Table 5-1 for the names and meanings of the pin numbers in the figure.

The safety input signals include safety fence signals, external emergency stop signals and external safety signals. See Table 6-1 for details.

Table 6-1 Safety input signal description

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

6.3 Robot stop method

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 6-2:

Table 6-2 Stop method and corresponding description

Type	Description	
STOP0	Case1	When MCBS warns stop0 indicate, DCBS will stop execution immediately and will not maintain the trajectory. Then MCBS delay control will enable the power to be cut off via the thyristor, which is an uncontrollable stop.
	Case2	When an uncontrollable fault occurs in DCBS, the free stop or the brake stop will be triggered, which is an uncontrollable stop.
	Case3	When there is a sudden external power failure and DCBS fails to execute an immediate stop, the brake stop will be triggered, which is an

Type	Description	
		uncontrollable stop.
STOP1	It will stop the robot quickly and maintain the current planned path. When the robot stops, it will control the drive to servo_off and cut off the power supply via the thyristor, which is a controllable stop.	
STOP2	It will stop the robot quickly and maintain the current planned path. When the robot stops, it will not control the drive to servo_off and cut off the power supply, which is a controllable stop.	

7 inCube20 control cabinet start

In order to ensure the normal startup and use of the inCube20 control cabinet, 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 is knocked 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 4.3" Control Cabinet Installation.

Step4. Connect the power encoder cable, refer to "Chapter 4.5" Power Encoder Connection.

Step5. Connect the teach pendant, refer to "Chapter 4.5" Connect the teach pendant.

Step6. Make sure that the teach pendant plug-in knob is in the I position, refer to "Chapter 5.2" X13 teach pendant plug-in knob.

Step7. Connect the power cord of the control cabinet, refer to "Chapter 4.5" for other interface connections.

Step8. Connect the safety input of X005, refer to "Chapter 6.2" Robot System Safety.

Step9. Turn on the switch of the control cabinet, refer to "Chapter 5.2" for the power switch of the control cabinet.

Step10. Configure the external IO interface, refer to the control cabinet operation manual.

8 Routine Maintenance Items and Cycles

The multi-axis drive debugging interface X025of the inCube20 control cabinet is located on the rear panel of the control cabinet, as shown in Figure 8-1 . When adjusting multi-axis drive parameters, you must connect RS422 to the interface ① via USB cable.

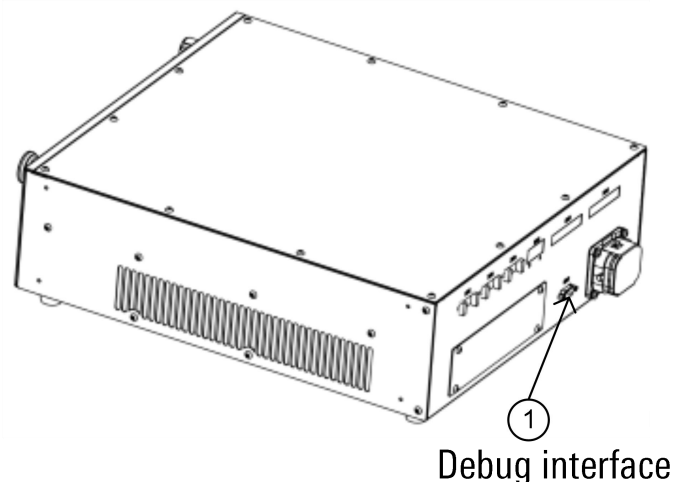


Figure 8-1 X025 multi-axis drive debugging interface of control cabinet

Some versions of inCube20 control cabinet must be maintained through opening the door. The control cabinet door can be opened as follows:

Step1. Remove the M4 hexagon socket flat head screws that secure the top cover with a 2.5mm hexagon wrench.

Step2. Remove the top cover, as shown in Figure 8-2.

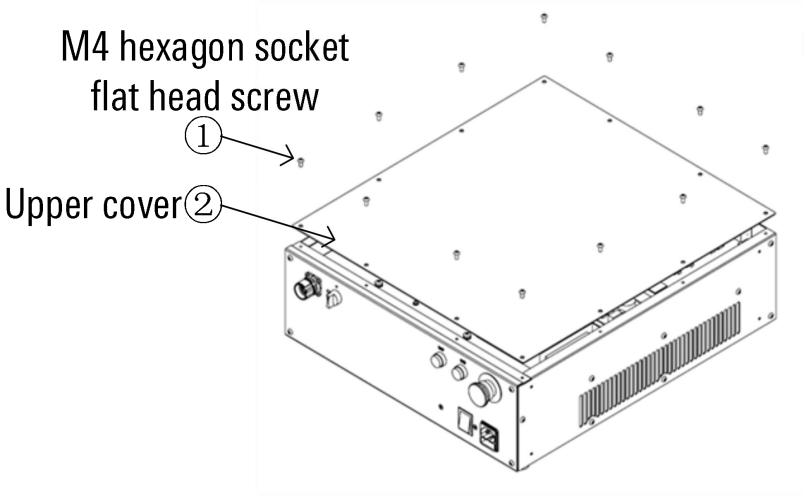


Figure 8-2 Opening method of top cover of control cabinet

The multi-axis drive debugging interface X025 of the inCube20 control cabinet is located on the sheet metal in the middle partition of the control cabinet, as shown in Figure 8-3. When adjusting the multi-axis drive parameters, you must connect RS422 to the interface ① via USB cable. For details about debugging, please refer to "Operation Manual of Robot Body".

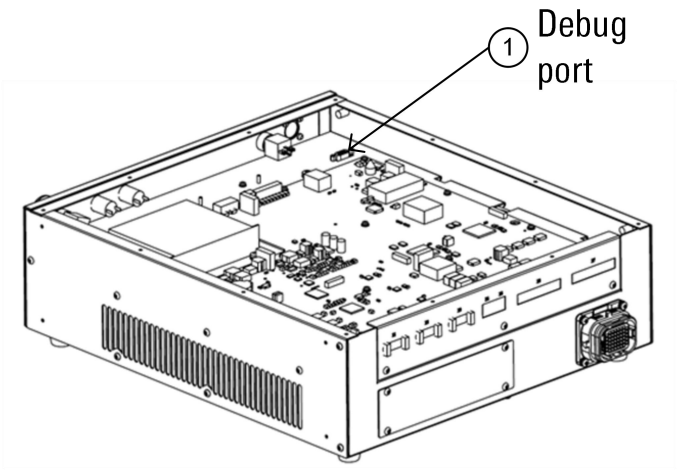


Figure 8-3 Schematic diagram of position of debugging port

For routine maintenance items and cycles of inCube20 control cabinet, please refer to Table 8-1.

Table 8-1 Routine maintenance items and cycles

Maintenance item	Maintenance cycle
Emergency stop switch	6 months
Power switch	6 months
Indicator light	6 months
Overload connector	6 months
Fan and duct	6 months
Connector	6 months

Maintenance steps

Check whether the wires inside the cabinet are secure, whether the connector is loose, whether the power switch and emergency stop button can be pressed normally, whether the knob can be rotated, whether the indicator light and other indicating devices can send signals normally, whether the overload connector is loose, whether the fan rotates normally, and whether there is dust accumulated in the cabinet.

Replacement of dust screen

The inCube20 control cabinet is installed with a dust screen at the inlet of the SR duct, as shown in Figure 8-4. Under normal circumstances, the dust screen of the control cabinet should be cleaned every 3 months and replaced every year. In harsh environmental conditions, the replacement and cleaning cycle should be shortened.

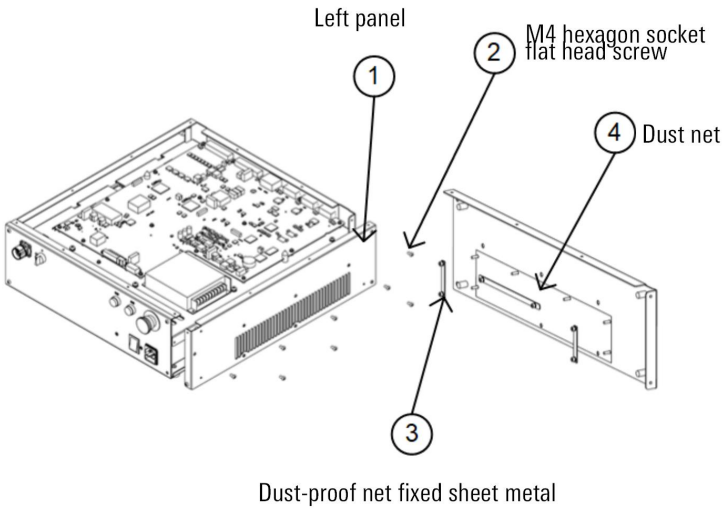


Figure 8-4 Replacement or cleaning of dust screen

9 Common Faults and Troubleshooting

Indicator light

When the indicating device such as indicator light fails to send signals normally, check whether there is a fault in the connection wire; and if not, replace the indicating device and observe whether the signal can be sent normally.

Overload connector

When the connection device such as the overload connector is loose, separate the overload connector plug from the socket and re-plug it and tighten it to ensure a reliable connection.

Fan

When the fan fails to rotate normally, check whether the connection wiring harness is faulty; and if not, replace the fan and observe whether it rotates normally.

Fuse

When the control cabinet power indicator is on while some electrical components fail to be powered on, please check whether the corresponding fuse on the adapter board is burnt out; and if yes, replace the fuse according to Table 9-1.

Table 9-1 Role and replacement of fuse

MCBS				
No.	**Grade**	**Model**	**Parameter**	**Role**
1	F1	287002	2A/32VDC	MCBS board, 24VDC power supply
2	F2	287001	1A/32VDC	Safety IO, 24VDC isolated power supply
3	F3	287001	1A/32VDC	Body, 24VDCisolated power supply
4	F119	287001	1A/32VDC	Teach pendent, 24VDC power supply
DPBS				
No.	**Grade**	**Model**	**Parameter**	**Role**
1	F1	215010	10A/250VAC	DPBS board, 220VAC power supply
Filter				
No.	**Grade**	**Model**	**Parameter**	**Role**
1	F1	215010	10A/250VAC	Filter, 220VAC power supply

10 Storage Conditions

The control cabinet should be placed in a waterproof, cool place protected from sunlight during long-time storage. The specific environmental requirements are shown in Table 10-1:

Table 10-1 Environmental conditions for long-time storage of control cabinet

Parameter	Value
Min ambient temperature	-25°C
Max ambient temperature	+60°C
Humidity	90% non-condensing at constant temperature

Appendix A List of inCube20 Accessories

Schedule 1 List of installation accessories of inCube20 control cabinet

Accessory name	Accessory number	Qty.	Accessory property
Mounting rack of inCube20-19" cabinet	P01035000520	2	Optional
inCube20-cabinet stacking connector	P01035000521	8	Optional
inCube20-teach pendent bracket	P01035000263	1	Optional

Schedule 2 List of cable accessories of inCube20 control cabinet

Accessory name	Accessory number	Corresponding interface	Accessory property
inCube20-cabinet external overload wire harness	P04082000567	X022	Standard (length 5 m)
inCube20-teach pendent wire harness	P04082000250	X020	Standard (length 5 m)
inCube20-power cord	P04082000483	X024	Standard (length 3 m)
inCube20-user RS232 cable	P04082000542	X001	Optional (length 3 m)
inCube20-expanded Modbus cable.	P04082000540	X002	Optional (length 5m)
inCube20-expanded MF cable	P04082000539	X003	Optional (length 5m)
ndustrial network cable inCube20-Ethernet wire harness	P04082000279 P04082000279	X004-A X004-B	Optional (length 5m) Optional
nCube20-IO terminal module cable	P04082000541	X005 X006	Optional (length 5m)
IO terminal module	P05050000010	X003\X005\X006	Optional
APLC-MF-24DC-40-40-B	P05050000001	X003	Optional
RS422/RS485 cable via USB	P04082000251	X025	Optional
inCube20-mounting buckle sheet metal	P01035000547	\	Optional (optional at the same time)
MCBS-IEB buckle	P05245000108	\	
Connection wire between inCube20-MCBS and buckle	P04082000595	\	
Cable between PWM and analog output_voltage/current input	P04082000594	J3\J5	Optional (length 5m)

Accessory name	Accessory number	Corresponding interface	Accessory property
Wire harness shared between magnetic scale and CAN_encoder	P04082000596	J6\J7	Optional (length 5m)

Appendix B Description of inCube20 Accessories

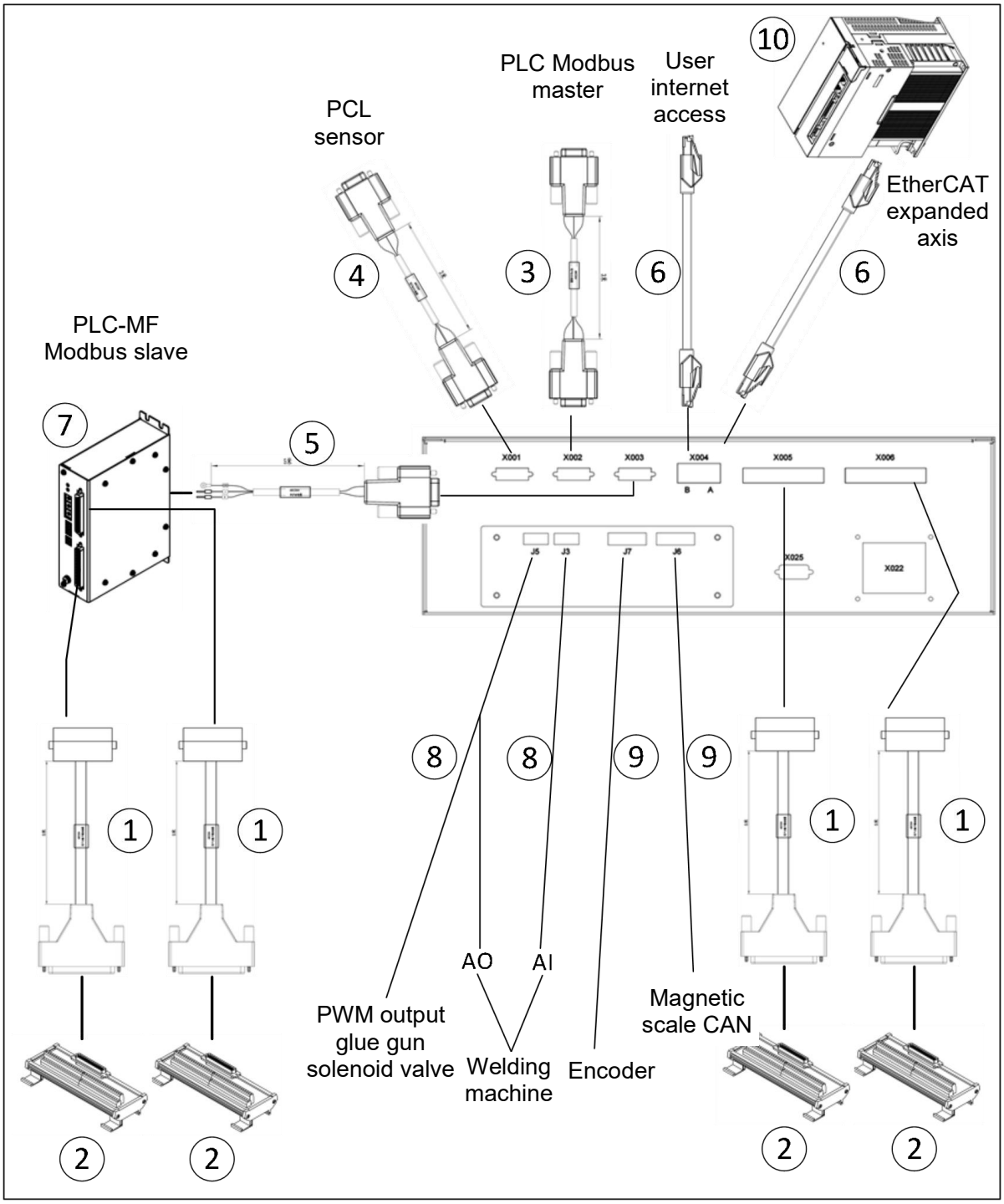


Figure 1 Accessories of inCube20 control cabinet

Overload interface external wire

For the basic specification and installation method of the external wire of the overload interface, please refer to Schedule 1.

Schedule 1 Basic specification and installation method of external wire of overload interface

S/N		Name	inCube20-cabinet external	Component	P04082000567

S/N		Name	inCube20-cabinet external	Component	P04082000567
A-terminal		Overload, metal upper case, female terminal, metal case, sticker protective cover			
B-terminal		Overload, metal upper case, female terminal, metal case, sticker protective cover			
Cable		Custom cable: 8×18AWG+6×20AWG+9×22AWG+ (9×2×24AWG)		Cable length	5m (standard)

Tip

- The overload wire harness interfaces on the side of the inCube20-cabinet correspond to those on the body side.
- For definition of overloaded interface, please refer to Section 5.6.

External wire of teach pendant interface

For basic specification and installation method of inCube20-teach pendent wire harness, please refer to Schedule 2.

Schedule 2 Basic specification and installation method of wire harness of inCube20-teach pendent

S/N		Name	inCube20-teach pendent wire harness	Component	P04082000250
A-terminal		M23 female			
B-terminal		Teach Pendant			
Cable		14 cores totally, 4 of which are CAT5 network cables, and the remaining 10 cores are connected directly		Cable length	5m

Tip

For definition of teach pendant interface, please refer to Section 5.6.

External wire of power interface

For basic specification and installation method of inCube20-power wire harness, please refer to Schedule 3.

Schedule 3 Basic specification and installation method of inCube20-power wire harness

S/N		Name	inCube20-power wire harness	Component	P04082000483
A-terminal connector		Power connector plug			
B-terminal connector		3 cores plug			
Cable		3 cores, 1.5mm2		Cable length	3m

External wire of interfaces X005, X006

For the basic specification and installation method of the inCube20-IO terminal module cable, see Appendix 4.

Schedule 4 Basic specification and installation method of inCube20-IO terminal module cable

S/N	1	Name	inCube20-IO terminal module cable	Component	P04082000541
A-terminal connector	D_SUB, DB50 male, plug, plastic shell				
B-terminal connector	Terminal plug, 40 pins				
Cable	40 cores 23AWG		Cable length	5m	

Tip

- The inCube20-IO terminal module cables correspond to each other at both ends.
- The inCube20-IO terminal module cable serial number corresponds to the X005 and X006 interface number of the control cabinet.
- If you select the wire harness by yourself, it is recommended to select the cable with a diameter of AWG22-AWG24.

For basic specification and installation method of IO terminal module, please refer to Schedule 5.

Schedule 5 Basic specification and installation method of IO terminal module

S/N	2	Name	IO terminal module	Component	P05050000010
Input terminal	D_SUB, DB50 female, PCB board connector				
Output terminal	Terminal lock screw terminal, two layers, 50 pins totally				
Instructions for use	When 0.3~0.5mm2 cable is used, crimp it with European terminal C0.5-8 and tighten it into the output terminal				

X001 interface external wiring

For basic specification and installation method of external wire of inCube20- X001 interface, please refer to Schedule 6.

Schedule 6 Basic specification and installation method of external wire of inCube20- X001 interface

S/N	4	Name	inCube20-user RS232 cable	Component	P04082000542
A-terminal connector	D_SUB, DB9 male, plug, plastic shell				
B-terminal connector	D_SUB, DB9 male, plug, plastic shell				
Cable	9 cores direct connection		Cable length	3m	

External wire of interface X002

For basic specifications of inCube20-expanded Modbus cable, please refer to Schedule 7.

Schedule 7 Basic specifications of inCube20-expanded Modbus cable

S/N	3	Name	inCube20-expanded Modbus cable	Component code	P04082000540
A-terminal connector	D_SUB, DB9 male, plug, plastic shell				
B-terminal connector	D_SUB, DB9 male, plug, plastic shell 8P)				
Cable	2×3 cores, 0.25mm^2		Cable length	5m	

Tip

DB9 numbers 2, 3, 5, 7 & 8 at both ends correspond to each other

X003 interface external wiring

For the basic specifications of related accessories of external wire of inCube20- interface X003, please refer to Schedule 8~9.

Schedule 8 Basic Specifications of inCube20-expanded MF Cable

S/N	5	Name	inCube20-expanded MF cable	Component code	P04082000539
A-terminal connector	D_SUB, DB9 male, plug, plastic shell				
B-terminal connector	Two C0.25-8 cold-pressed terminals, one OT1.25-5 cold-pressed terminal				
Cable	3 cores 0.25mm^2		Cable length	5m	

Schedule 9 Basic specifications of APLC-MF-24DC-40-40-B

S/N	7	Name	APLC-MF-24DC-40-40-B	Component code	P05050000001
Description	The number of user IOs can be expanded to 40 DIs and 40 DOs (two can be cascaded, with a maximum of 80 DIs and 80 DOs)				

Tip

It is recommended to use PLC-MF and supporting cables for expanded IO number.

External wire of interface X004-B

For the basic specifications of the industrial network cable, please refer to Schedule 10.

Schedule 10 Basic specifications of inCube20-industrial network cable

S/N	6	Nam	Industrial network cable	Component	P04082000279
Brand			Hellolink		
Cable	4 cores AWG26		Cable length	5m	

External wire of interface X004-A

For the basic specifications of the drive, please refer to Schedule 11.

Schedule 11 Basic specifications of drive

S/N	10	Name	Drive	Component code	
Description	AE5115EtherCAT bus drive				

External wire of debugging interface

For the basic specifications of RS422/RS485 cable via USB, please refer to Schedule 12.

Schedule 12 Basic specifications of RS422/RS485 cable via USB

S/N		Name	RS422/RS485 cable via USB	Component code	P04082000251
A-terminal	DB9		Brand/model	Z-TEK	
B-terminal	USB		Brand/model	Z-TEK	
Cable	5 cores		Cable length	1.8m	

Related optional accessories of buckle

For the basic specification and installation method of inCube20-buckle sheet metal, please refer to Schedule 13~14.

Schedule 13 Basic specification and installation method of inCube20-mounting sheet metal

S/N	\	Name	inCube20-mounting buckle sheet metal	Component code	P01035000547
Length	185mm		Width	\	
Height	60mm		Thickness	1.2mm	
Installation method	\		Mounting screw	4 hexagon socket flat head screws, M4X8	
Purpose	It is used to fix the buckle MCBS-IEB in the inCube20 control cabinet				

Schedule 14 Basic specifications of buckle MCBS-IEB

S/N	\	Name	MCBS-IEB buckle	Component code	P05245000108
Description	Buckle				

Tip

The DF50S numbers at both ends correspond to each other.

External wire of interface J3\J5

For the basic specifications of the PWM and analog output _ voltage/current input cables, please refer to Schedule 15.

Schedule 15 Basic specifications of PWM and analog output_voltage/current input cable

S/N	**8**	**Name**	**Cable between PWM and analog output_voltage/current input**	**Component code**	**P04082000594**
A-terminal connector	Hirose, DF51-10DS-2C				
B-terminal connector	European terminal C0.5-8				
Cable	10C×0.2mm²		Cable	10C×0.2mm²	

External wire of interface J6\J7

For the basic specifications of the wire harness shared between the magnetic scale and CAN_encoder, please refer to Schedule 16.

Schedule 16 Basic specifications of wire harnesses shared between magnetic scale and CAN_encoder

S/N	**9**	**Name**	**Wire harness shared between magnetic scale and CAN_encoder**	**Component code**	**P04082000596**
A-terminal connector	JYR SCSI 14P M				
B-terminal connector	European terminal C0.5-8				
Cable	JYR 10.0 12 cores (6 pSRs) shielding braided black wire, φ10		Cable	JYR 10.0 12 cores (6 pSRs) shielding braided black wire, φ10	

Mounting rack of inCube20-19″ cabinet

For the basic specification and installation method of inCube20-19″ cabinet mounting rack, please refer to Schedule 17.

Schedule 17 Basic specification and installation method of inCube20-19″ cabinet mounting rack

S/N		**Name**	**Mounting rack of inCube20-19" cabinet**	**Component code**	**P01035000520**
Length		31.5mm	Width	31mm	
Height		131.1mm	Thickness	1.5mm	
Installation method		Please refer to ***Section 4.3.***	Mounting screw	4 hexagon socket countersunk head screws, M5X8	

S/N		Name	Mounting rack of inCube20-19" cabinet	Component code	P01035000520
Purpose	It is used for installation in the 19" cabinet. During installation, the left and right sides of the cabinet are fixed to the 19" cabinet through the handles, and a pallet should be placed at the bottom of the cabinet to bear the weight.				

inCube20-cabinet stacking connector

For the basic specification and installation method of inCube20-cabient stacking connector, please refer to Schedule 18.

Schedule 18 -Basic specification and installation method of inCube20-cabinet stacking connector

S/N		Name	inCube20-cabinet stacking connector	Component code	P01035000521
Length	88mm	Width	15mm		
Height	-	Thickness	1.5mm		
Installation method	Please refer to ***Section 4.3***	Mounting screw	2 cross recessed pan head combination screws, M4X10		
Purpose	It used for cabinet stacking				

inCube20-teach pendent bracket

For the basic specification and installation method of inCube20-teach pendant bracket, please refer to Schedule 19.

Schedule 19 Basic specification and installation method of inCube20-teach pendant bracket

S/N		Name	inCube20-teach pendent bracket	Component code	P01035000263
Length	232mm	Width	221mm		
Height	87mm	Thickness	1.5mm		
Installation method	Please refer to ***Section 4.3.***	Mounting screw	3 cross recessed pan head combination screws, M5X10		
Purpose	Installation of teach pendant				

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