DC00/DC30D/DC15S-J9
Control Cabinet User Manual
(Hardware)

Version: V2.0

Guangzhou Auctech Automation Technology Ltd

Content

1 Safety Specification

1.1 Introduction

This chapter mainly introduces the safety principles and specifications that shall be followed when using control cabinets or robotic systems. Users should carefully read the safety related content of this manual and strictly abide by it. Operators should be fully aware of the complexity and risk of robotic systems, and should pay special attention to the content related to warning signs.

1.2 Description of Safety Warning Signs

The danger level of this manual is illustrated by the following warning labels. Please strictly follow the safety content.

Warning:
This sign indicates a potentially hazardous situation which, if not be avoided, could result in injury or serious damage to equipment.

Warning:
This sign indicates a potentially hazardous electrical situation which, if not be avoided, could result in injury to persons or serious damage to equipment.

Warning:
This sign indicates hot surfaces that may pose a hazard which, if be touched, may result in injury.

1.3 Safety Precautions

This section aims to protect operators and remind them of the precautions to be taken during the first installation. Users need to read the safety warnings in this manual carefully. Many possible risks exist, and the following are described as far as possible including but not limited to these situations.

1. Do not connect security devices to normal I/O ports.
2. Ensure proper installation of the device.
3. Tools and obstacles shall not have sharp corners or points. Make sure all personnel are out of reach of the robot.
4.Linking different mechanical structures can aggravate hazards or create new ones, so a comprehensive risk assessment of the entire system must always be carried out.
5. If the controller uses DC voltage input, use DC power properly. When using battery power, see the risks associated with batteries.
6. For details about the precautions to be taken during the robot use, please see the User Manual of the specific robot model.

1. Professional debugging personnel are required to install and debug the control cabinet and robot in accordance with the specifications.
2. The Settings and changes of robot parameters must be made by authorized personnel, and unauthorized personnel are prevented from changing the parameters.
3. If the operators use their own control cabinet, the risk needs to be borne by

	themselves.
	1. Robots and control cabinets give off heat when they work. Do not touch the marked area of the control cabinet with your hands or any other body parts.

1.4 Special Statement

This manual is only intended as a user guide. The content provided in this manual is for general significance and does not guarantee to cover all usage scenarios of all models. Due to the version upgrade or device model inconsistency, the contents in the manual may be different from the devices used by users. Please refer to the information of the user's device. The differences caused by the preceding cases will not be explained in this manual.

The maximum value provided in this document is the maximum value which the device can reach in specific laboratory scenarios that meet the corresponding standards (for example, constant temperature and humidity without interference environment, typical working conditions). In actual working conditions, the maximum value tested by the equipment may be inconsistent with the data provided in the manual due to changed working environment, specific working conditions, and test methods.

1.5 Responsibilities and Risks

This information does not include how to design, install, and operate a complete robotic system, nor does it include all peripherals that can affect the security of the entire system. In order to protect human safety, the system must be well designed and must be installed in accordance with the safety requirements set out in the standards and regulations of the country/region where the robot is installed.

The robot integrator shall be responsible for ensuring that the robot system complies with the applicable safety laws and regulations of the country or region in which it is located and that the necessary safety equipment to protect the operator of the robot system is properly designed and installed. The details include but are not limited to the following:

- Ensure robot system meets all the basic requirements;
- To complete system perform risk assessment;
- Ensure the whole system accurately designed and installed;
- Set appropriate security settings in the software, and ensure they won't be changed by user;
- Develop detailed operating instructions;
- Issue a declaration of compliance;
- Gather all information into technical documents;
- Label the installed robotic system with the integrator's logo and contact information.

Guangzhou Auctech Automation Technology Ltd is committed to providing reliable safety information and shall not be liable unless it has acted with willful or gross negligence in providing reliable safety information. To be clear, even if everything is done in accordance with safe practices, there is no guarantee that the robot system will not cause personal and property damage to the user.

Guangzhou Auctech Automation Technology Ltd will not be liable for any user loss caused by:

- Force majeure events (e.g., natural disaster, fire, war, etc.);

- Natural damage or the wear of the robot system;
- The site operating environment (such as voltage, temperature, and humidity) or external factors (such as external interference) cannot meet the environmental requirements for normal operation;
- The robot system is not installed correctly (including reinstallation after relocation);
- Improper, negligent or intentional use by the User or a third party (including the user's failure to use in accordance with this User Manual and/or other requirements of Guangzhou Auctech Automation Technology Ltd) or sabotage.

Unless otherwise agreed, Guangzhou Auctech Automation Technology Ltd shall not be liable for indirect, special or incidental losses, including but not limited to loss of revenue, loss of actual or expected earnings, loss of business, loss of opportunity, loss of goodwill, loss of reputation, loss of data, damage or disclosure, etc. arising from the use of the robot system.

2 Technical Parameters of Control Cabinet

Technical parameters of DC15S&30D-J9 Control Cabinet are shown in Table 1:

Table 1 DC15S&30D-J9 Control Cabinet Technical Parameters

Basic Data			
Color		Grey- Pantone 445C	
Size		410x306x292mm（length x Width x Height）	
DC30D Control Cabinet	Power Input	200-240VAC，47-63HZ，10A 100-200VAC，47-63HZ，16A	
	Rated Power Output	48V@1200W	
	Weight	14.8kg	
DC15S Control Cabinet	Power Input	100-240VAC，47-63HZ，10A	
	Rated Power Output	48V@600W	
	Weight	13.6kg	
Environmental conditions			
Working Temperature		-10-50℃	
Storage Temperature		-40-55℃	
Working Humidity		20%-70%RH	
Storage Humidity		10%-95%（without condensation）	
Air Pressure		70-106kPa	
Altitude		0-1000m	
IP Level		IP44	
Noise		≤55db	
Cable Length			
Control Cabinet Power Cable		Standard size 5m	
Robot Connecting Cables		Standard size 5m	
User interface			
Digital Input	User DI	8 channels	
	Function DI	8 channels can be configured	
	Input active level	PNP Type，L:-3V~5V,H：11V-30VDC，2~15mA	
	Switch Time	TON: 50ms TOFF: 50ms	
Digital Output（MAX 0.5A/Channel）	User DO	8 channels	
	Function DO	8 channels can be configured	
	Output Voltage	PNP Type，22~28V,Max:0.5A	
	Output Current	PNP Type：＜2A(When the current exceeds 2A, the user needs to extend the power supply)	
	Switch Time	TON: 50ms TOFF: 50ms	
Analog Inputs & Outputs	Current Analog Signal Input 2 Cchannels (Electrical Isolation)	Signal Current	4-20mA Precision ±1%
		Input Impedance	Input Impedance: 160Ω
	Voltage Analog Signal Output 2 Channels	Signal Voltage	0-10V Precision±1%
		Input Impedance	15kΩ

	(Electrical Isolation)		
Communication Port	CAN	1 channel，Baud Rate is configurable 10k、20k、50k 、100k 、125k、250k、 500k、1000k bps	
	RS485	1 channel，Baud Rate is configurable 4800、 9600、 19200 、38400 、115200 bps	
	LAN	1 channel，supports MODBUS TCP、PROFINET、TCP IP	
	EtherCAT	1 channel，EtherCAT communication	
	INC encoder signal A+，A-;B+,B-;Z+,Z-	Working Voltage: 24VDC	
		Frequency：＜200KHz	
		Input: Square Wave Signal	
Security DI	Emergency-Stop Signal Input	1 channel（Passive signal, dry contact input）	
	Protective-Stop input	1 channel（Passive signal, dry contact input）	
	Configurable Security Input	2 channel（Passive signal, dry contact input）	
Security DO（MAX 0.5A Short-Circuit Protection）	Configurable Security Output	2 channel（PNP Active signal， MAX 0.5A）	
	Emergency-Stop Feedback Output	1 channel（PNP Active signal， MAX 0.5A）	
	Output Voltage	23.52V~25.2VDC	

3 Overview of Control Cabinet

The Control Cabinet contains the communication port and power port of all components in the robot control system. As shown in Figure 1, the control cabinet mainly contains DC00 Controller, Fan, Switching Power Supply, Super Capacitor Module, Brake Resistor, Peripheral Port, etc.

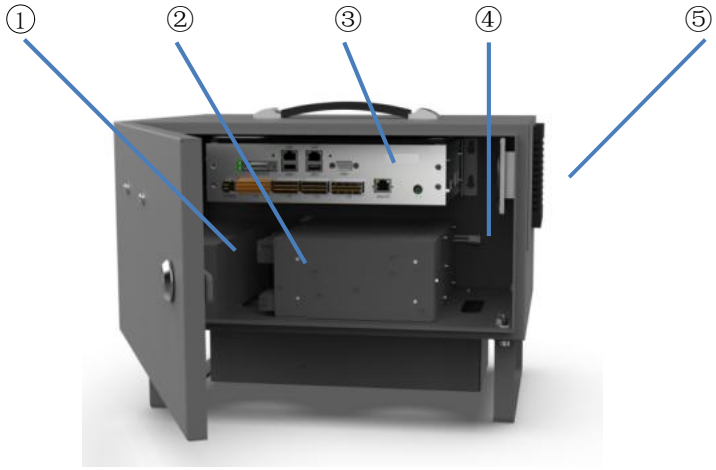


Figure 1 Structure Diagram of Control Cabinet

Instructions：

① ——DC24V Module
② ——Switching Power
③ ——DC00 Controller
④ ——Brake Resistor
⑤ ——Fan

Note: DC24V Module can be configured in two ways: one is the DC48V to DC24V module, and the other is the DC24V module with the super capacitor (this module has the UPS function).

4 External Ports of the Control Cabinet

The external interface diagram and interface description of the control cabinet are shown in Figure 2 and Figure 3:

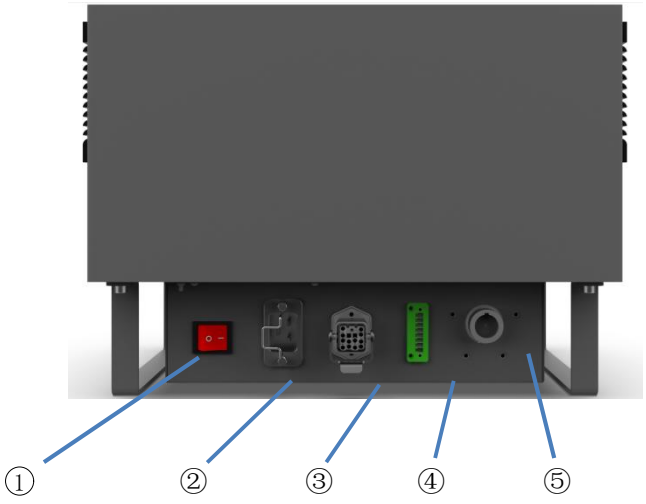


Figure 2 Ports at back of the Control Cabinet

① ——System switch
② ——AC input port
③ ——Robotic arm port
④ ——TP(Teach-pendant) Shielding port
⑤ ——TP(Teach-pendant) port

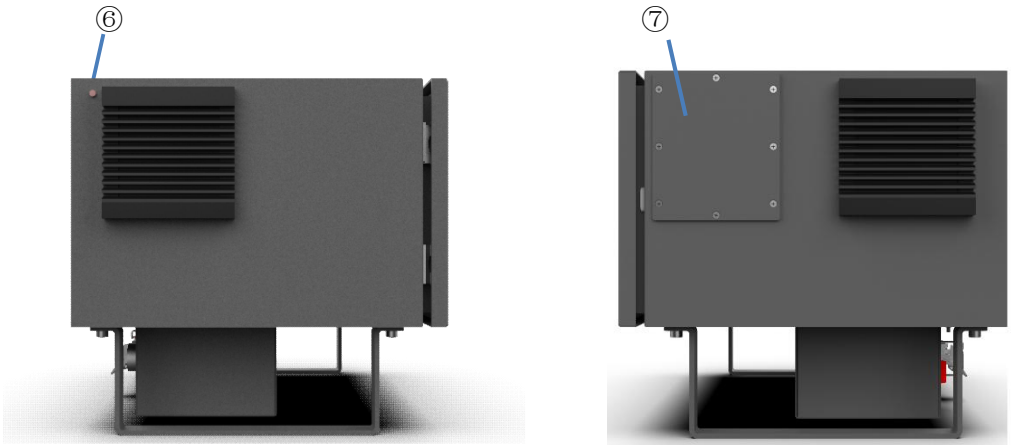


Figure 3　Side Port of Control Cabinet

⑥——ANT (antenna) Port　　⑦——Component Expansion Board

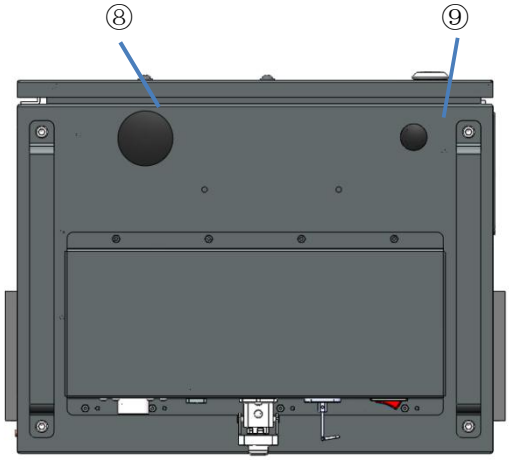


Figure 4　Port at bottom of the Control Cabinet

⑧——Reserved hole 1　　⑨ ——Reserved hole 2

4.1 AC Input

DC15S Control Cabinet Power Supply Input：100-240VAC，47-63HZ，10A；

DC30D Control Cabinet Power Supply Input：200-240VAC，47-63HZ，10A， 100-200VAC，47-63HZ，16A。

4.2 System Switch

The system switch is used to power on and off the control cabinet to realize the power-on function of the whole system. The system is switched on in the " | " state, and the startup operation is carried out by pressing the power on button in this state, and the system is powered on normally. In the state of "◎", the system is disconnected from the power supply, and the system is in the state of power-off and shutdown. There is no power supply input, and the system cannot be started (Note: if the AC input is not disconnected, the incoming end of the wire is in the state of live. Do not touch it).

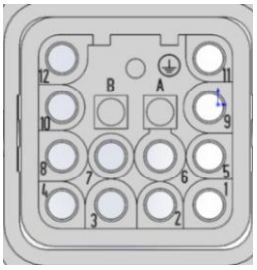
The robot system is powered on in the following order: switch on the AC input in the control cabinet and supply power → press the system switch to " | " state → press the power on button → Power on the system → power on the robot; The system power-off sequence is: power off the UI interface of the Teach-pendant robot (robot power off) → shut down the system of the Teach-pendant Port → press the system switch to the "◎" state → disconnect the AC input

of the control cabinet.

4.3 **Robotic Arm Port**

DC15S＆DC30D Control Cabinet Robotic Port Definition as shown in Table 2：

Table 2　DC15S＆DSC30D Control Cabinet Robot Port Definition



Connector Number	Signal Definition	Remark
9	48V	
10	48V	
11	GND	
12	GND	
PE	PE	
1	EtherCAT Tx+	
2	EtherCAT Tx-	
3	EtherCAT Rx+	
4	EtherCAT Rx-	

4.4 **TP(Teach-pendant) Shielding Port**

The TP shielding port of the control cabinet is used for robot mode switching, emergency stop function or emergency stop short function after TP is unplugged.

Example of application：

a) The application of single TP and multiple control cabinets: After debugging, insert the prefabricated short plug (short stop and mode switching port) into TP shielding port when the robot is running automatically. At this time, pulling out TP will not affect the running state of the robot; When the robot is running automatically and TP needs to be inserted for manual operation, first turn the TP mode selector switch to automatic mode, then insert TP into the TP port of the control cabinet, and then unplug the short connector (already plugged into the shielding port). Then, the robot can be manually operated through TP.

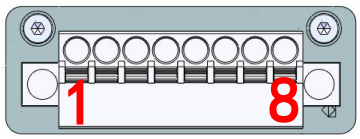
   Note: Except in the process of TP insertion and removal, short plug and TP may be connected to the control cabinet at the same time. Short plug and TP are not allowed to connect to the control cabinet at the same time at any other time.

b) When a PAD is configured with a button box, the TP shielding port can be connected to the button box to provide functional ports for emergency stop and mode switching.

c) The application of single TP and single control cabinet: This port is forbidden.

Table 3 shows the definition of TP shielding port of the control cabinet:

Table 3 TP Shielding Port

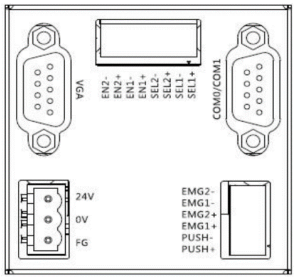


Connector Number	Signal Definition	Remark
1	EMG1+	(TP emergency-stop input 1+)
2	EMG1-	(TP emergency-stop input 1-)
3	EMG2+	(TP emergency-stop input 2+)
4	EMG2-	(TP emergency-stop input 2-)
5	SEL1+	(Mode switching input 1+)
6	SEL1-	(Mode switching input 1-)
7	SEL2+	(Mode switching input 2+)
8	SEL2-	(Mode switching input 2-)

4.5 TP Port

Table 4 shows the TP port of the robot. Please refer to the specifications list for the selection of TP models. The internal wiring harness port is defined as follows:

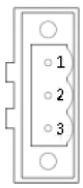
Table 4 Definition of TP Port

DC00 TP port	Corresponding TP junction box port
VGA COM3/COM4	VGA
	COM0/COM1(KEY/TOUCH)
	

4.5.1 TP Junction Box Power Port

Table 5 is the TP junction box power port:

Table 5 TP Junction Box Power Port

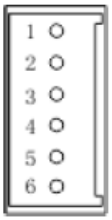


Connector Number	Signal Definition	Remark
1	DC24V	
2	0V	
3	FG	

4.5.2 TP Junction Box IO Port 1

Table 6 is the port of the TP Junction Box IO Port 1：

Table 6 TP Junction Box IO Port 1

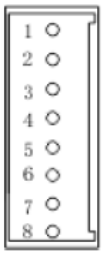


Connector Number	Signal Definition	Remark
1	EMG2-	Emergency-Stop Signal
2	EMG1-	
3	EMG2+	
4	EMG1+	
5	PUSH-	Button signal with light
6	PUSH+	

4.5.3 TP Junction Box IO Port 2

Table 6 is the port of the TP Junction Box IO Port 2:

Table 7 TP Junction Box IO Port 2

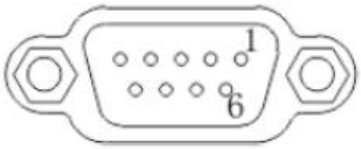


Connector Number	Signal Definition	Remark
1	EN2-	Three-position switch signal （Enable signal）
2	EN2+	
3	EN1-	
4	EN1+	
5	SEL2-	Key switch signal （Mode switching）
6	SEL2+	
7	SEL1-	
8	SEL1+	

4.5.4 TP Junction Box COM0/COM1 Port

This port is a standard 9-pin female D-Sub socket; Table 8 is TP Junction Box COM0/COM1 Port：

Table 8 TP Junction Box COM0/COM1



Connector Number	Signal Definition	COM0[RS-232]	COM1[RS-232]
1	TXD0	RS232 TXD	
2	TXD1		RS232 TXD
3	GND	Ground	
4	RXD0	RS232 RXD	
5	RXD1		RS232 RXD
6	NC	No connection	
7	NC	No connection	
8	NC	No connection	
9	NC	No connection	

4.5.5 TP Junction Box VGA Port

This port is a standard VGA port with a standard 15-pin female D-Sub socket.

4.6 ANT Port

The ANT (WIFI antenna) port is used to install the gain antenna for enhancing the wireless network signal;

The connector is a male inner pin, so the gain antenna of the female inner hole should be used.

4.7 Component Expansion Board

When components such as switching power supply need to be expanded, remove this expansion plate. Then, install the guideway components, and finally install the control cabinet.

4.8 Reserve Hole 1/2

Reserve Hole 1 is a diameter of 18mm round holes

Reserve Hole 2 is a diameter of 40mm round holes

When functions such as digital IO, security IO, and remote switch are required, connect the external wire harness to the control cabinet through the reserved hole:

Removal method of the blank cap: Squeeze the clip of the blank cap towards the center of the circle as shown in the picture, and then push it outward to remove the blank cap.

5 DC00 Controller

The DC00 controller is built into the DC30D/15S to provide the algorithm implementation, motion control, human-computer interaction and other functions of the robot system. The peripheral port provides external communication, IO and other functions. The DC00 controller can be selected independently as a control unit (see next Section for details).

The appearance style of DC00 controller is shown in Figure 5, and the port diagram and description are shown in Figure 6:

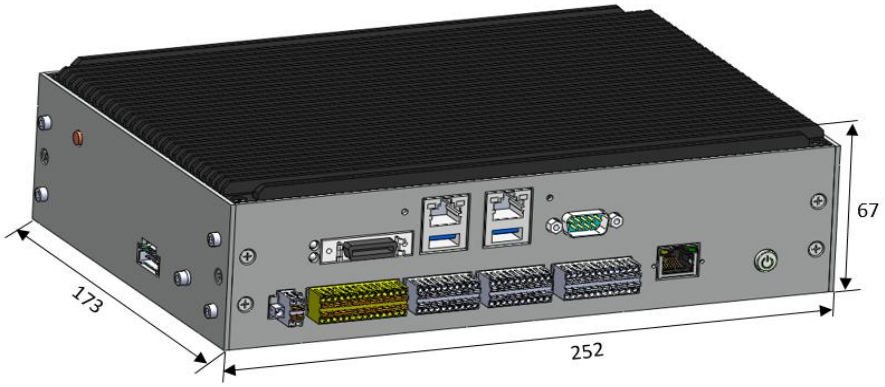
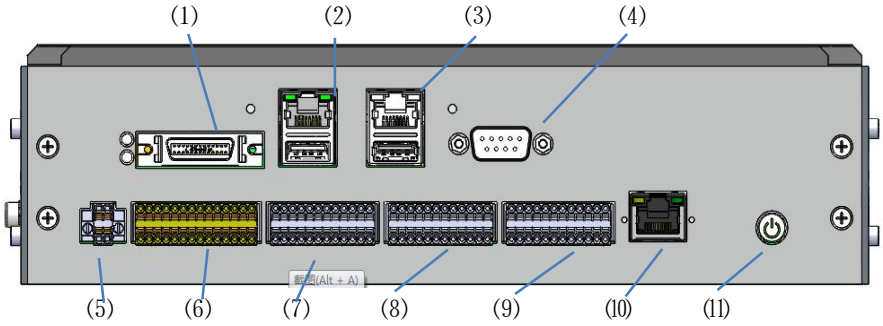
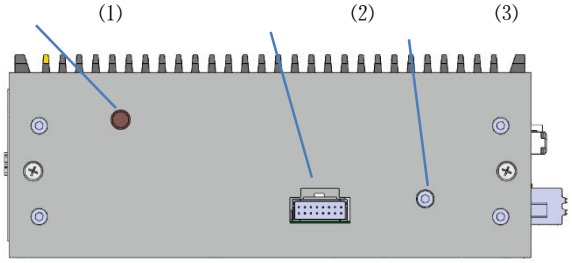


Figure 5 DC00 controller appearance



Ports on the front Panel

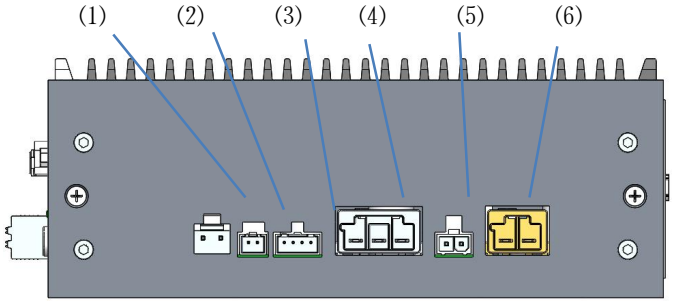
No.	Port	No.	Port
1	VGA&COM3/4	2	LAN1+USB3.0
3	LAN2+USB2.0	4	COM1
5	IO POWER(IO power supply)	6	SIO（Security IO）
7	DIO（Digital IO）	8	CIO（Configurable IO）
9	EIO（Function Expansion IO）	10	EtherCAT2
11	ON/OFF(Power On and off)		



Ports on the left Panel

No.	Port	No.	Port
1	ANT(WIFI Antenna)	2	TP(Teach-pendant IO)

3	Grounding		



Ports on the right Panel

No.	Port	No.	Port
1	24V_INPUT	2	FAN
3	EtherCAT1	4	48V_OUTPUT
5	TR（Resistance to braking）	6	48V_INPUT

Figure 6　DC00 Controller Port Diagram

5.1 ANT Port

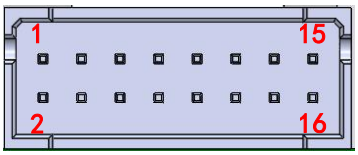
ANT（WIFI antenna）port e is used to install an antenna extension cable;

The connector is a male inner pin, so the antenna extension wire of the female inner hole should be used.

5.2 TP Port

The Teach-pendant IO (TP) port e is used to interact with the TP junction box to display the signals of TP emergency stop, enable, mode selection, and on/off button. The port definition is shown in Table 9:

Table 9　TP port Definition



No.	Signal Definition	No.	Signal Definition
1	EN1+（Three-position enable input 1+）	2	EN1-（Three-position enable input 1-）
3	EN2+（Three-position enable input 2+）	4	EN2-（Three-position enable input 2-）
5	SEL1+(Mode switching input 1+)	6	SEL1-(Mode switching input 1-)
7	SEL2+(Mode switching input 2+)	8	SEL2-(Mode switching input 2-)
9	EMG1+(TP emergency stop input 1+)	10	EMG1-(TP emergency stop input 1-)
11	EMG2+(TP emergency stop input 2+)	12	EMG2-(TP emergency stop input 2-)
13	PUSH+（Button input with light +）	14	PUSH-（Button input with light -）
15	24V	16	0V

Note: This port must be connected when in use; In WIFI mode, the wiring harness of emergency stop button box needs to be connected; In TP mode, TP wiring harness is required. Otherwise it will trigger an emergency stop.

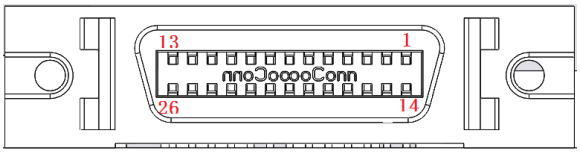
5.3 Grounding Port

This port is connected with PE wire, which is used to eliminate the static electricity of the shell to protect the equipment and personal safety.

5.4 VGA&COM3/4 Port

VGA&COM3/4 port is used to communicate with TP junction box, TP screen display and TP operation signal. The Port definition is shown in Table 10:

Table 10 TP VGA+232 Port definition



No.	Signal Definition	No.	Signal Definition
1	COM3_TX	14	COM4_RX
2	COM4_TX	15	GND_ISO
3	COM3_RX	16	GND_ISO
4	GND_ISO	17	GND
5	GND_ISO	18	GND
6	GND	19	VGA_SCL
7	GND	20	VGA_SDA
8	VGA_HS	21	GND
9	VGA_VS	22	GND
10	GND	23	GND
11	GND	24	VGA_G
12	VGA_B	25	GND
13	5V	26	VGA_R

5.5 LAN1+USB3.0 Port

LAN1 Port, 1000M, support MODBUS TCP/PROFINET/TCP IP communication, used to communicate with other controllers and robots to achieve robot control; Standard network cable port, no longer display port definition;

USB3.0 Port is used to connect the mouse, keyboard and other devices, and facilitate technical personnel to connect the USB disk device for software copy. Standard USB3.0 port, no longer display port definition;

5.6 LAN2+USB2.0 Port

LAN2 Port， 1000M； used to communicate with other controllers and robots to achieve robot control; Standard network cable port, no longer display port definition;

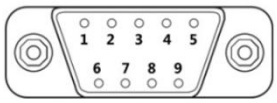
USB2.0 Port is used to connect the mouse, keyboard and other devices, and facilitate technical personnel to connect the USB disk device for software copy. Standard USB2.0 port, no longer display port definition;

5.7 COM1 Port

The COM1 port is an RS232 Port;

This port is the DB9 female header and male pin connector.

Table 11 COM1 Port Definition



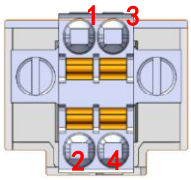
No.	Signal Definition	No.	Signal Definition
1	NC	2	COM1_RX
3	COM1_TX	4	NC
5	GND_ISO	6	NC
7	NC	8	NC
9	NC		

5.8 IO POWER Port

IO POWER port used to power digital I/OS and analog I/OS. The port definition is shown in Table 12:

The harness here is advised to use 8MM length tubular terminals with 22AWG (0.2-0.3²) or less.

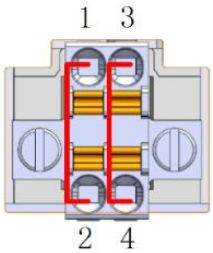
Table 12 IO POWER Port Definition



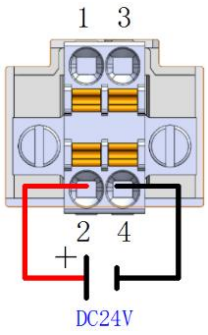
No,	Signal Definition	No.	Signal Definition
1	Power（Controller 24V Output+）	3	GND（Controller 24V Output-）
2	DC24V（IO Power Supply Input+）	4	0V（IO Power Supply Input-）

Note: You can use internal power supply or external power supply based on the I/O load power

- When use the internal power supply, short-circuit the pin 1 and 2 , short-circuit pin 3 and 4 ; At this time, 24V DC of up to 2A will be provided internally (as shown in the picture).



- When use external power supply, remove the short-circuit cable and connect pin 2 to DC24V and pin 4 to DC0V. Now, the maximum bearing capacity is 8A 24V DC (as shown in the figure).

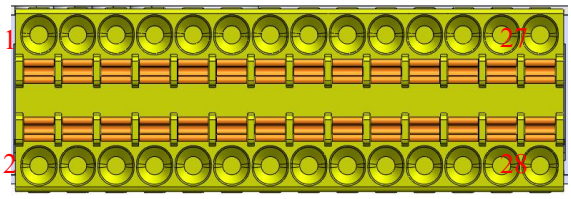


5.9 SIO Port

The Security IO (SIO) port is an external emergency stop and security input/output port provided by the controller, including one emergency stop signal input, one emergency stop feedback output (active signal), one protective stop input, two configurable security input, and two configurable security output (active signal). Among them, the emergency stop signal input, protective stop input and configurable safety input are dry contact signals; In addition, when the configurable safety output and system emergency stop feedback output are used, the relay should be connected for switching. Please refer to the XCore User Manual for instructions on how to set up this port through the software. The port definition is shown in Table 13:

The harness here is advised to use 8MM length tubular terminals with 22AWG (0.2-0.3²) or less.

Table 13 SIO Port Definition



No.	Signal Definition	No.	Signal Definition
1	EI1+ (User emergency stop signal input 1+)	2	EI1- (User emergency stop signal input 1-)
3	EI2+ (User emergency stop signal input 2+)	4	EI2- (User emergency stop signal input 2-)
5	PSI1+ (Protective stop input 1+)	6	PSI1- (Protective stop input 1-)
7	PSI2+ (Protective stop input 2+)	8	PSI2- (Protective stop input 2-)
9	CSI1_1+ [Configurable safety input 1（1+）]	10	CSI1_1- [Configurable safety input 1（1-）]
11	CSI1_2+ [Configurable safety input 1（2+）]	12	CSI1_2- [Configurable safety input 1（2-）]
13	CSI2_1+ [Configurable safety input 2（1+）]	14	CSI2_1- [Configurable safety input 2（1-）]
15	CSI2_2+ [Configurable safety input 2（2+）]	16	CSI2_2- [Configurable safety input 2（2-）]
17	EO1+(System emergency stop feedback output 1+)	18	EO1-(System emergency stop feedback output 1-)
19	EO2+ (System emergency stop feedback output 2+)	20	EO2-(System emergency stop feedback output 2-)
21	CSO1_1+[Configurable safety output 1（1+）]	22	CSO1_1-[Configurable safety output 1（1-）]
23	CSO1_2+[Configurable safety output 1（2+）]	24	CSO1_2-[Configurable safety output 1（2-）]
25	CSO2_1+[Configurable safety output 2（1+）]	26	CSO2_1-[Configurable safety output 2（1-）]
27	CSO2_2+[Configurable safety output 2（2+）]	28	CSO2_2-[Configurable safety output 2（2-）]

Electrical parameters of the security I/O port is shown in Table 14:

Table 14 Security IO Port Parameter Table (PNP type)

Security DI				
Terminal	Parameter			
EIx	Dry contact input			
PSIx	Dry contact input			
CSIx	Dry contact input			
Security DO				
Terminal	Parameter	Minimum	Typical Value	Maximum
EOx/CSOx	Current	0A	—	0.5A
	Voltage	23.52V	24V	25.2V
	Signal type	PNP		

The Security DI sequence diagram is shown in Figure 7:

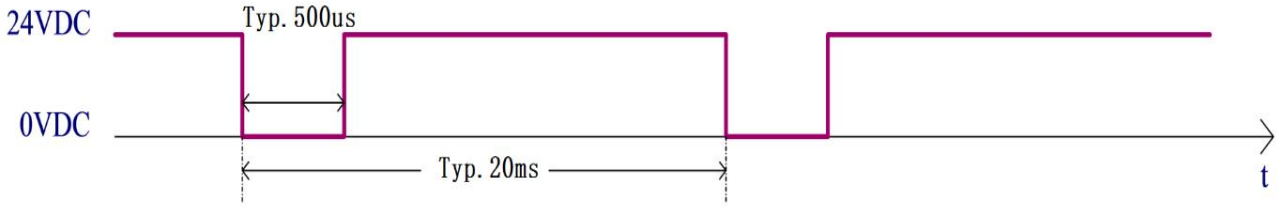


Figure 7 Security Input Sequence Diagram

The diagnostic pulse at the security DI input is shown in Figure 7. The MCU verifies hardware circuit failure by sending a diagnostic pulse which is 20ms diagnostic pulse period and a width of 500 (±100) μs negative pulse.

The security DO sequence diagram is shown in Figure 8:

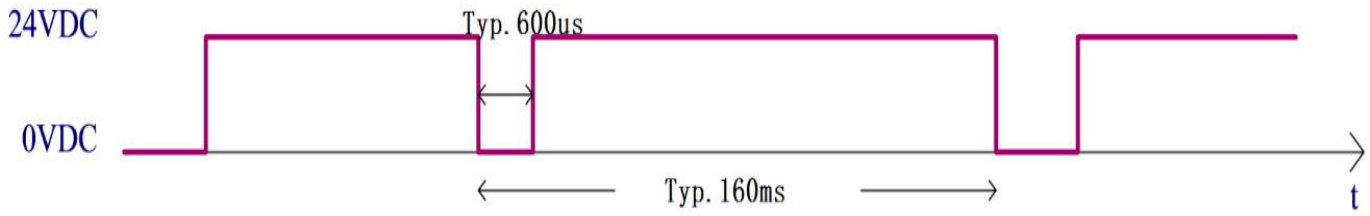


Figure 8 Security Output Sequence Diagram

The output diagnostic pulse for the security DO output is shown in Figure 8. MCU sends output control signal with diagnostic pulse signal, which is 160ms period and is negative pulse that width is 600 (±100) μs.

5.9.1 SIO Port Wiring Diagram

a) Default Security Configuration

Figure 9 shows the wiring diagram of the default configuration of the security port, which allows the robot to operate without any additional security devices.

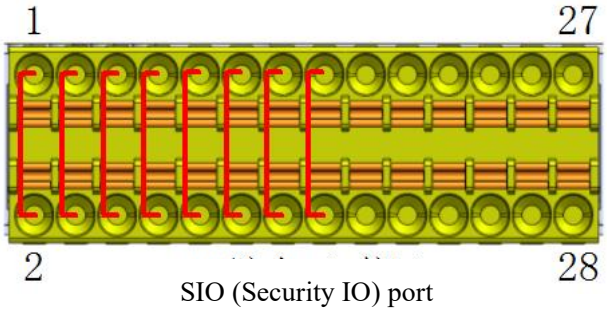


Figure 9 Default Security Configuration Wiring Diagram

b) Connecting external security input signals Figure 10 shows the connection diagram of the security input port connecting external security input signals. The external safety input signal is a dry contact signal. Here the external safety input signal takes the emergency stop button as an example.

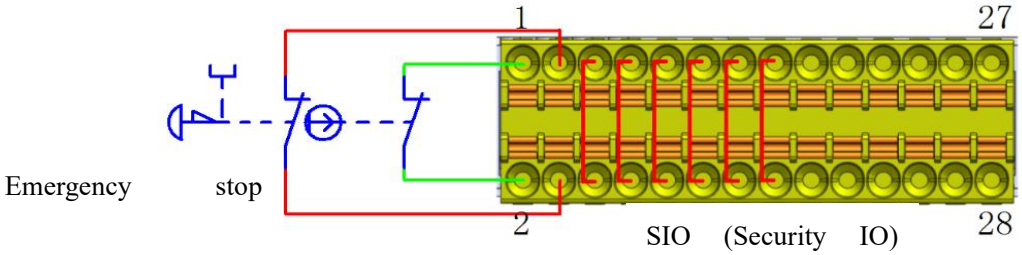


Figure 10 External Safety Signal Input Wiring Diagram

c) Connect the protective stop signal

Figure 11 shows the wiring diagram of the protective stop input signal. Note that the external protective stop input signal is the dry contact signal.

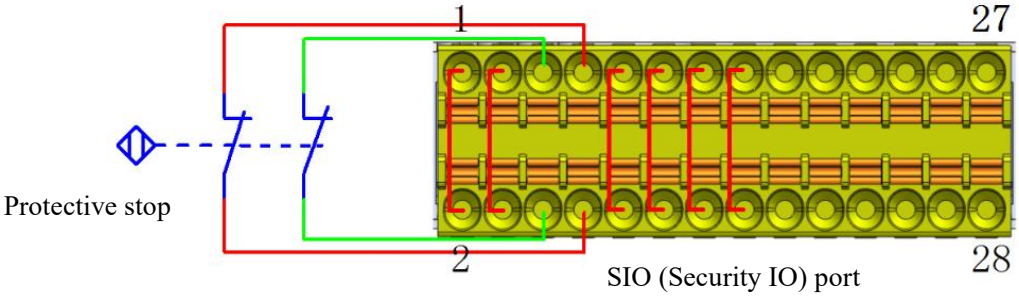


Figure 11 Protective Stop Signal Input Wiring Diagram

d) Connect configurable security input signals

The configurable security input signal wiring diagram is similar to the protective stop input signal wiring.

e) Share emergency stop with other machines

When the robot is used with other machines, it is often necessary to set up a common emergency stop circuit. By setting up a common line, the operator doesn't have to think about which emergency stop button to use.

Since both machines need to wait for each other to jump out of the emergency stop condition, the standard robot emergency stop input cannot be used for sharing. To share the emergency stop function with other machines, it must be configured through the safety input and safety output of the controller safety IO.In addition, the safety output is an active signal, which needs to be connected to the relay before use, as shown in Figure 12:

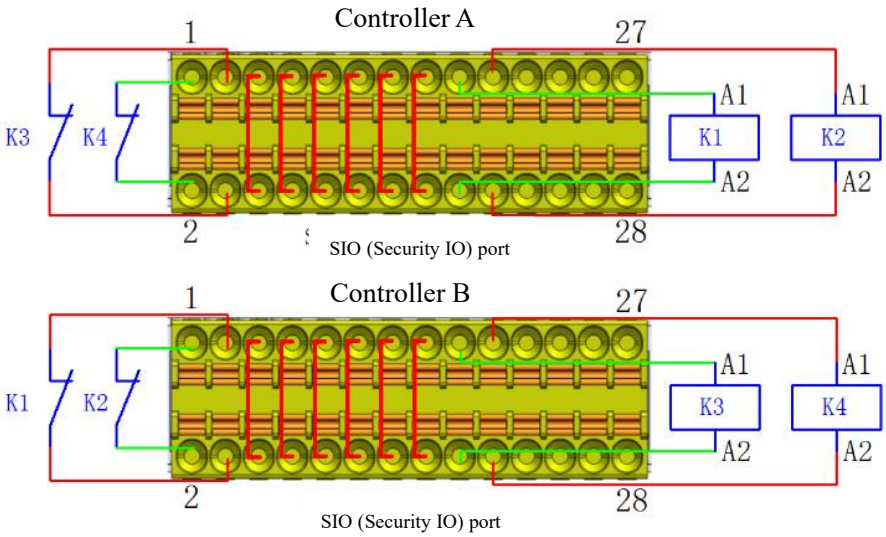


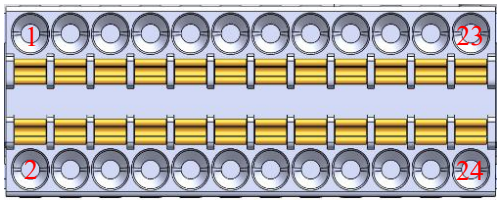
Figure 12 Schematic diagram of the emergency stop of two robot controllers

5.10 DIO Interface

The controller provides DIO (Digital IO) interfaces, including 8-way digital input (DI) interfaces and 8-way digital output (DO) interfaces. The interfaces are defined in Table 15:

The harness here is advised to use 8MM length tubular terminals with 22AWG (0.2-0.3²) or less;

Table 15 DIO Interface Definition



No.	Signal Definition	No.	Signal Definition
1	24V	2	0V
3	24V	4	0V
5	DI1（Normal DI input 1）	6	DO1（Normal DO output 1）
7	DI2（Normal DI input 2）	8	DO2（Normal DO output 2）
9	DI3（Normal DI input 3）	10	DO3（Normal DO output 3）
11	DI4（Normal DI input 4）	12	DO4（Normal DO output 4）
13	DI5（Normal DI input 5）	14	DO5（Normal DO output 5）
15	DI6（Normal DI input 6）	16	DO6（Normal DO output 6）
17	DI7（Normal DI input 7）	18	DO7（Normal DO output 7）
19	DI8（Normal DI input 8）	20	DO8（Normal DO output 8）
21	24V	22	0V
23	24V	24	0V

5.10.1 Digital Input（DI）

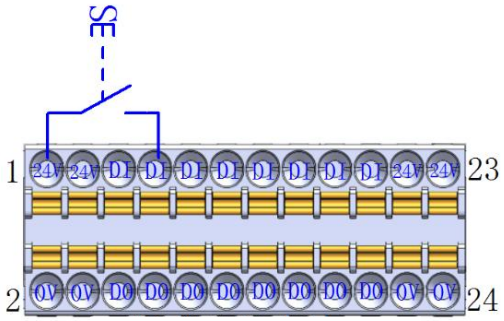
The controller provides a digital input (DI) interface whose input voltage ranges from -3 to 30VDC (0 to 15mA). Table 16 lists the electrical parameters of the interface:

Table 16 DI Interface Parameter Table（PNP type）

Terminal	Parameter	Minimum	Typical Value	Maximum
Digital Input				
DIX-24V	Voltage	-3V	—	30V
DIX-24V	ON area	11V	—	30V
DIX-24V	OFF area	-3V	—	5V
DIX-24V	TON/TOFF delay	TON:50ms TOFF: 50ms		
DIX-24V	Fuction	PNP type		

a) Dry contact signal input

Figure 13 shows the connection between the dry contact signal (button) and the DI interface.

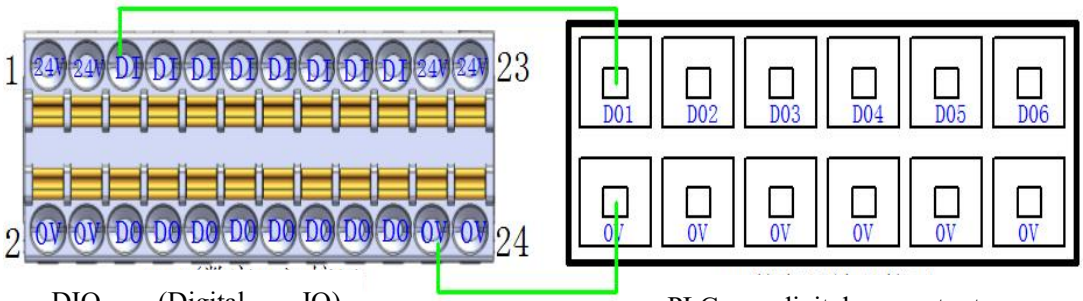


DIO (Digital IO)

Figure 13 Dry Contact Signal Input Wiring Diagram

b) PNP Signal Input

Figure 14 shows the wiring mode of PNP signal (PLC DO interface output, PNP type) input and DI



interface. DIO (Digital IO) PLC digital output

Figure 14 PNP signal input wiring diagram

5.10.2 Digital Output（DO）

The digital output (DO) interface provided by the controller has the output voltage range of 23.52-25.2VDC, the maximum current of 0.5A. Table 17 lists the electrical parameters of the interface:

Table 17 DO Interface Parameter Table（PNP type）

Terminal	Parameter	Minimum	Typical Value	Maximum
Digital Output				
DOX-0V	Current	0A	—	0.5A
DOX-0V	Voltage	23.52V	—	25.2V
DOX-0V	TON/TOFF delay	TON:50ms TOFF：50ms		
DOX-0V	Function	PNP type		

a) DO Output Connection Load

Figure 15 shows the wiring diagram of the DO output directly connected to the load (relay), with the maximum output current of 0.5A.

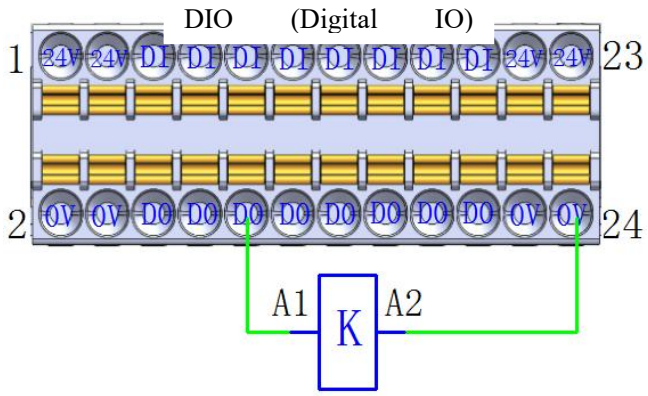


Figure 15 DO Output and Load Reference Wiring Diagram

b) Output and Load Reference Wiring Diagram

Figure 16 shows the wiring diagram between the DO Interface output and other PNP DI input devices (PLC) :

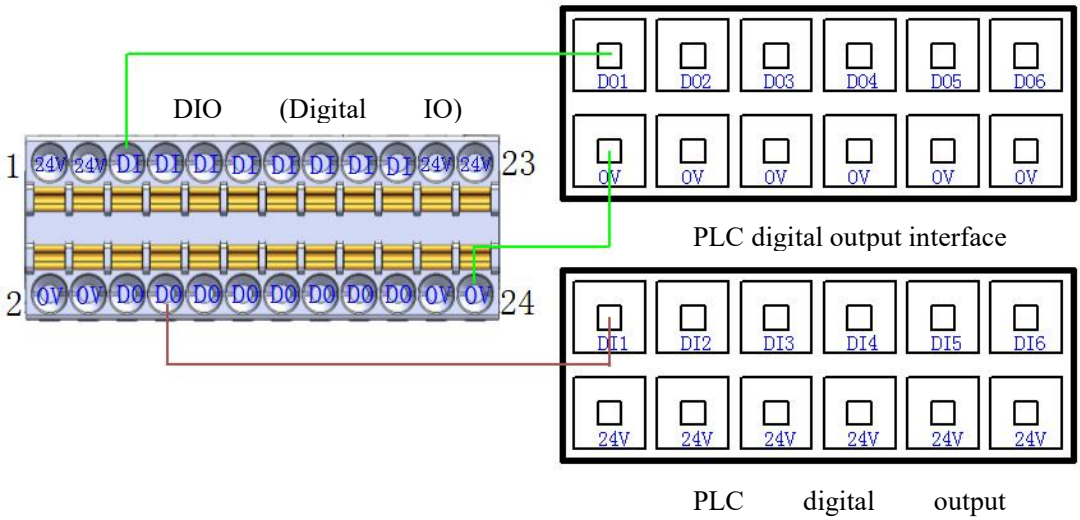


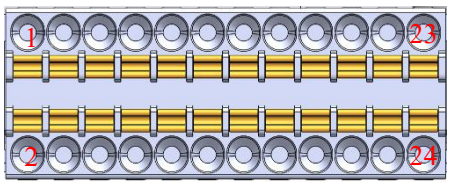
Figure 16 Wiring diagram for other PNP DI input devices

5.11 CIO Interface

The CIO (configurable digital IO) interfaces provided by the controller include eight configurable digital input (DI) interfaces and eight configurable digital output (DO) interfaces. This interface can be configured as user DIO or function DIO by software operation. The default setting is function DIO. The interface definition is shown in Table 18:

The harness here is advised to use 8MM length tubular terminals with 22AWG (0.2-0.3²) or less;

Table 18 Configurable Digital I/O Interface Definitions



No.	Signal Definition	No.	Signal Definition
1	24V	2	0V
3	24V	4	0V
5	CDI1（Configurable DI input 1）	6	CDO1（Configurable DO output 1）
7	CDI2（Configurable DI input 2）	8	CDO2（Configurable DO output 2）
9	CDI3（Configurable DI input 3）	10	CDO3（Configurable DO output 3）
11	CDI4（Configurable DI input 4）	12	CDO4（Configurable DO output 4）
13	CDI5（Configurable DI input 5）	14	CDO5（Configurable DO output 5）
15	CDI6（Configurable DI input 6）	16	CDO6（Configurable DO output 6）
17	CDI7（Configurable DI input 7）	18	CDO7（Configurable DO output 7）
19	CDI8（Configurable DI input 8）	20	CDO8（Configurable DO output 8）
21	24V	22	0V
23	24V	24	0V

Note: Please refer to the XCore User Manual for instructions on how to configure this interface to user DIO or function DIO through software Settings.

5.11.1 Configurable Digital Input（CDI）

The controller provides a configurable digital input (CDI) interface. The input voltage ranges from -3 to 30VDC (0 to 15mA).

For the interface parameter list, sequence diagram, and connection mode, please see section 4.10.1 Digital Input (DI).

5.11.2 Configurable Digital Output（CDO）

The controller provides A configurable digital output (CD0) interface with a voltage range of 23.52-25.2VDC and a maximum current of 0.5A.

For the interface parameter list, sequence diagram, and connection mode, please see section 4.10.2 Digital Output (DO).

5.12 EIO Interface

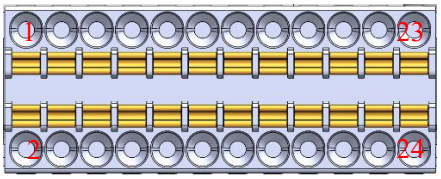
The EIO (function expansion IO) interface of the DC00-J9 controller provides two configurable analog input interfaces, two configurable analog input interfaces, one external CAN communication interface, one external RS485 communication interface, INC encoder differential signal interface, and one remote up and down point interface. The interface definition is shown in Table 19:

The harness here is advised to use 8MM length tubular terminals with 22AWG (0.2-0.3²) or less;

Note: The 24V power supply of the INC encoder may cause damage to the slave interface board in case of short

circuit. Short circuit should be avoided during use.

Table 19 Function Extension 1 Interface Definition



No.	Signal Definition	No.	Signal Definition
1	AI1（Configurable analog input 1）	2	AG（Analog Grounding）
3	AI2（Configurable analog input 2）	4	AG（Analog Grounding）
5	AO1（Configurable analog output 1）	6	AG（Analog Grounding）
7	AO2（Configurable analog output 2）	8	AG（Analog Grounding）
9	24V	10	RC1(Remote Switch ON+)
11	0V	12	PowerON(Remote Switch ON-)
13	A+(INC signal A phase +)	14	RC2(Remote Switch OFF+)
15	A-(INC signal A phase -)	16	Power0FF(Remote Switch OFF-)
17	B+(INC signal B phase +)	18	CAN_L
19	B-(INC signal B phase -)	20	CAN_H
21	Z+(INC signal C phase +)	22	485_B
23	Z-(INC signal B phase -``)	24	485_A

5.12.1 Configurable analog Interfaces

a) Configurable Analog Input（0~10V/4~20mA,±1%）

Configurable analog input interface can be configured by software into voltage analog input or current analog input two different working modes (factory default 0-10V voltage input);

Note: Please refer to the XCore User Manual for instructions on how to configure this interface as a voltage or current analog input by software.

b) Configurable Analog Output（4-20mA/0~10V,±1%）

Configurable analog output interface can be configured by software into voltage analog output or current analog output two different working modes (factory default 0V voltage output);

Note: Please refer to the XCore User Manual for instructions on how to configure this interface as a voltage or current analog output by software.

c) Analog Signal Isolation Specification

Analog signals are electrically isolated from each other. Refer to Table 20 for electrical specifications:

Table 20 Electrical Specification for Analog Quantities

Terminal	Parameter	Minimum	Typical Value	Maximum
Analog input in current mode				
AI_CX-AGND	Current	4mA±1%	—	20mA±1%
	Resistance	—	160Ω	—
	Resolution	—	12 bit	—

Analog input in voltage mode				
AI_VX-AGND	Current	0V±1%	—	10V±1%
	Resistance	—	15KΩ	—
	Resolution	—	12 bit	—

d) Schematic diagram of analog connection

Figure 17 is a schematic diagram of analog interface connection：

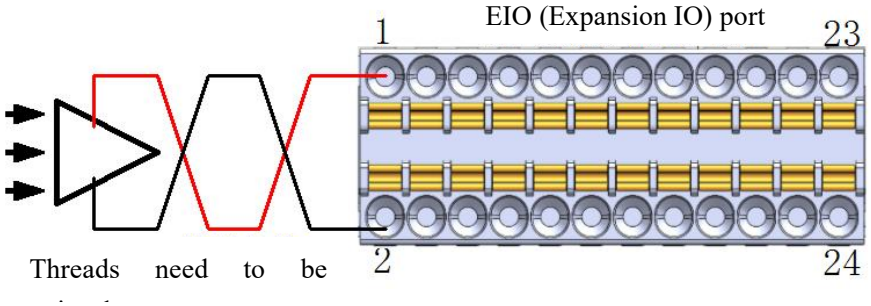


Figure 17 Analog Input Wiring Diagram

5.12.2 Communication Interface（CAN,RS485,INC Signal）

External communication interfaces are isolated from each other. The communication parameters are shown in Table 21:

Table 21 Communication Parameter Specification

Terminal	Parameter	Data
CAN communication	Baud rate	10k、 20k、50k 、100k 、125k、250k、 500k、1000k bps
RS485 communication	Baud rate	4800、 9600、 19200 、38400 、115200 bps
	Line impedance	120Ω
INC encoder communication A+, A-;B+,B-;Z+,Z-	Supply voltage	24VDC
	Allowable frequency	＜200KHz
	Input signal	Square wave signal (compatible with single terminal/differential)

FIG. 18 shows the wiring diagram of INC port differential encoder:

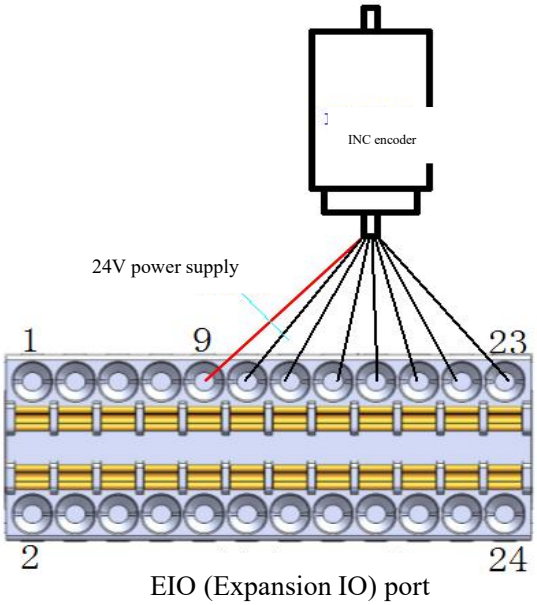


Figure 18　Differential INC Encoder Wiring Diagram

FIG. 19 shows the wiring diagram of INC port single-ended encoder:

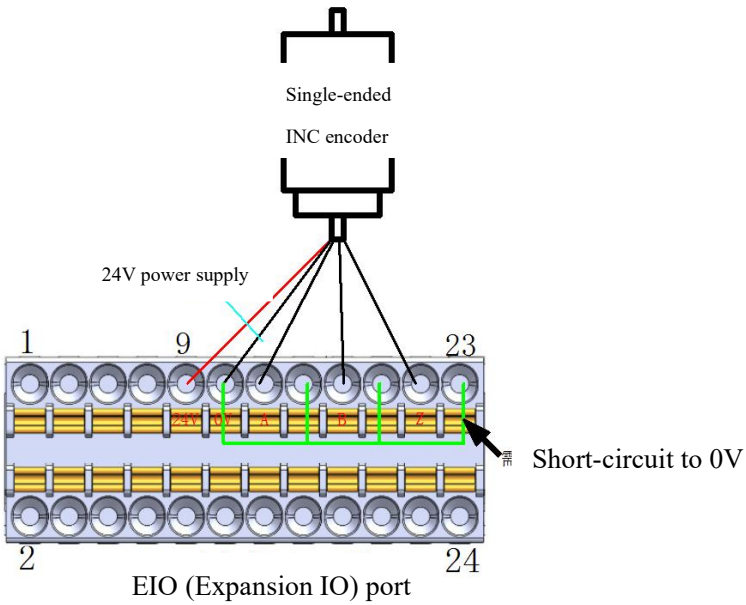


Figure 19　Wiring Diagram of Single-ended INC Encoder

5.12.3 Remote Switching Interface

With the remote switch, the system can be turned on or off without using the TP or the power on button on the controller panel.

The “Power ON” input is the same as the power-on button. You must use “Power OFF” input for remote shutdown. This signal allows the controller to save the open file and shut it down normally (similar to a system software shutdown).

The remote switching interface is defined in Table 22:

Table 22 Remote Switch Interface Definition

Connector Number	Signal Definition	Input Signal Type
10	RC1	Dry contact
12	PowerON	
14	RC2	Dry contact
16	PowerOFF	

Electrical specifications are shown in Table 23 as follows:

Table 23 Electrical Specification for Remote Switching Interfaces

Terminal	Parameter	Minimum	Maximum
PowerON-RC1	Voltage	0VDC	25.2VDC
PowerOFF -RC2	Voltage	0VDC	25.2VDC
PowerON activation time	＞1S		
PowerOFF Turn-off time	＞3S		

Connect the remote switch as follows:

a) Remote PowerON interface (dry contact input)

Figure 20 shows how the remote PowerON button is wired. where the button uses a self-reset button.

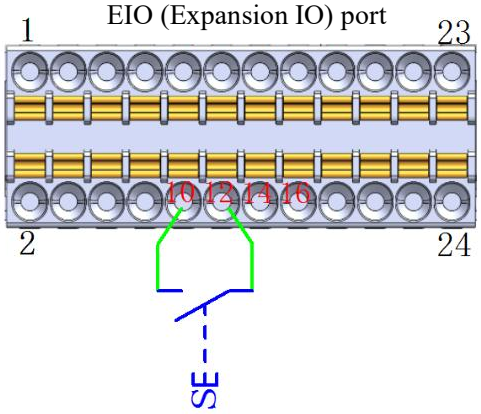


Figure 20 Remote Power-on Cable Diagram

b) Remote PowerOFF interface (dry contact input)

Figure 21 shows how the remote PowerOFF button is wired. where the button uses a self-reset button.

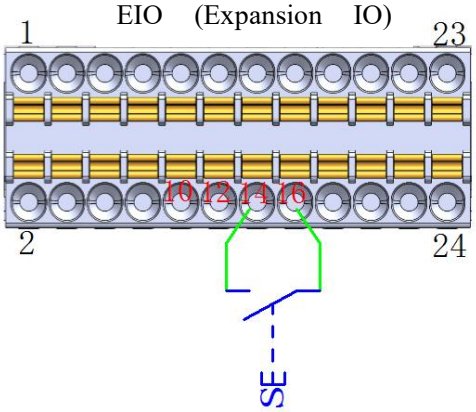


Figure 21 Remote Power-off Cable Diagram

5.13 EtherCAT2 Interface

EtherCAT2 interface, supporting EtherCAT communication; Set aside as a reserve; Standard network cable interface, interface definition is no longer displayed;

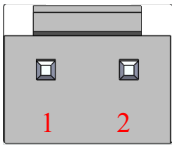
5.14 ON/OFF Button

The power-on button of the DC00-J9 controller is the reset button with green light. When the system switch is ON but the system is not started, press the power button for more than 1 second and release it. When the button is on, the system starts and works normally. When the system needs to be shut down, use the instructor interface for normal power off and shutdown operations. In case of system problems, long press the button for more than 3 seconds to forcibly power off the system (master controller data is normally saved).

5.15 24V_INPUT Port

24V_INPUT port is connected to the external power supply to supply the MCU end of the DC00-J9 controller, the main controller. The port definition is shown in Table 24:

Table 24 24V_INPUT Port Definition

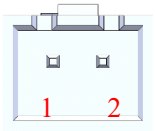


No.	Signal Definition	No.	Signal Definition
1	+	2	-

5.16 FAN Port

The FAN port is used to drive current to the DC FAN (no frequency conversion). The output voltage of this port is DC24V and the maximum output current is 2A. It is recommended to use a DC fan with the power of 5 to 10W. The port definition is shown in Table 25:

Table 25 Fan Port Definition

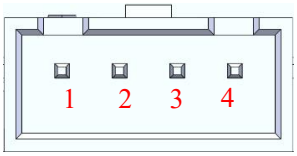


No.	Signal Definition	No.	Signal Definition
1	+	2	-

5.17 **EtherCAT 1 Port**

EtherCAT 1 port is dedicated to communication and interaction with robotic arms; The port definition is shown in Table 26:

Table 26 Ecat OUT1 Port Definition

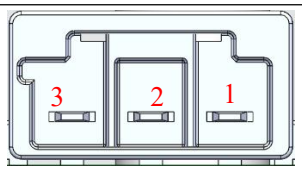


No.	Signal Definition	No.	Signal Definition
1	TX+	2	TX-
3	RX+	4	RX-

5.18 **48V_OUTPUT Port**

48V_OUTPUT port is dedicated to providing DC48V power to the robotic arms. Its port definition is shown in Table 27:

Table 27 DC48V output port definition



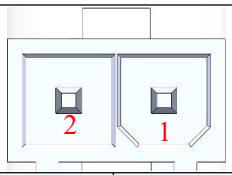
No.	Signal Definition	No.	Signal Definition
1	+	2	-
3	PE		

5.19 **TR Port**

TR port is connected to the brake resistance; When the output torque of the motor and the speed of the opposite direction, it represents the energy from the load to the driver. This energy recharge causes the voltage value to rise. When raised to a certain value, the recharge energy can only be consumed by the brake resistance. The interface definition is shown in Table 28:

The standard brake resistance is 150W, 10Ω.

Table 28 Brake Resistance Interface Definition

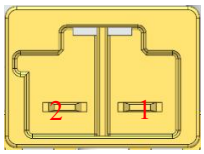


No.	Signal Definition	No.	Signal Definition
1	R+	2	R-

5.20 48V_INPUT Port

48V_INPUT port is dedicated to providing DC48V power to the robotic arms; Its port definition is shown in Table 29:

Table 29 DC48V Input Interface Definition



No.	Signal Definition	No.	Signal Definition
1	+	2	-

5.21 Port Description

The ports on the 24V module are described as follows:

Table 30 24V Module Interface Definition

Terminal code	Terminal function	Pin Definition	Remark
CN1	DC24V Output	1：+；2：-	
CN2	DC48V Input	1：+；2：-	

6 DC00 controller (Independent instructions)

6.1 Basic Parameters

Specification Parameter

Weight	2.5kg
Size	252x173x67mm
Ambient Temperature and Humidity	-10-45℃、20%-70%RH
Protection Class	IP30
Material	Steel and aluminum alloy shell
Input power supply	DC48V(42-59.2V)、 DC24V（22-26V）
Communication port	Supply CAN、RS485、LAN、EtherCAT
Communication mode	TCP/IP、Modbus TCP、Modbus RTU
I/O port	8 channel DI、8 channel DO、8 channel configurable IO、
Function extension IO	2 AI/AO channels, 1 external CAN channel, 1 RC485 channel, incremental encoder port, and 1 remote power-on and power-off port

6.2 Usage Requirements

Users must follow the recommended electrical parameters when using the robot and DC00 control cabinet. When the limit is reached or exceeded, the controller hardware may be damaged.

Parameter	Minimum	Maximum	unit
Working Temperature	-10	45	℃
Storage Temperature	-40	55	℃
Working Humidity	20	70	%RH
Storage Humidity	10%	95%	%RH
Air pressure	70	106	kPa
Altitude	0	1000	M

6.3 Power Supply Requirement

The DC00 control cabinet needs two sets of external power supply, and DC24V provides the power supply of the control circuit. DC48V provides internal IO power supply, as well as robotic arm power supply;

Voltage range	Minimum	Maximum
DC48V	42V	59.2V
DC24V	22V	26V

The recommended control cabinet for X series robot is as follows:

No.	Robotic Arm Specification	Control Cabinet
1	X3、X5、X7、X10	DC15S-J9
2	X12、X16、X10-2000	DC30D-J9
3	X14、X20、X25	

6.4 **Installation Requirements**

The DC00 Controller Sealing Component _ Mounting brackets (4 recommended) can be used as required. Remove the M3 screws from the controller shell as shown in the figure and install the Mounting brackets. Then use M3 screws (provided by the customer) to secure the controller through the reserved holes in the Mounting bracket to the required length. The reference size of the bottom assembly is as follows:

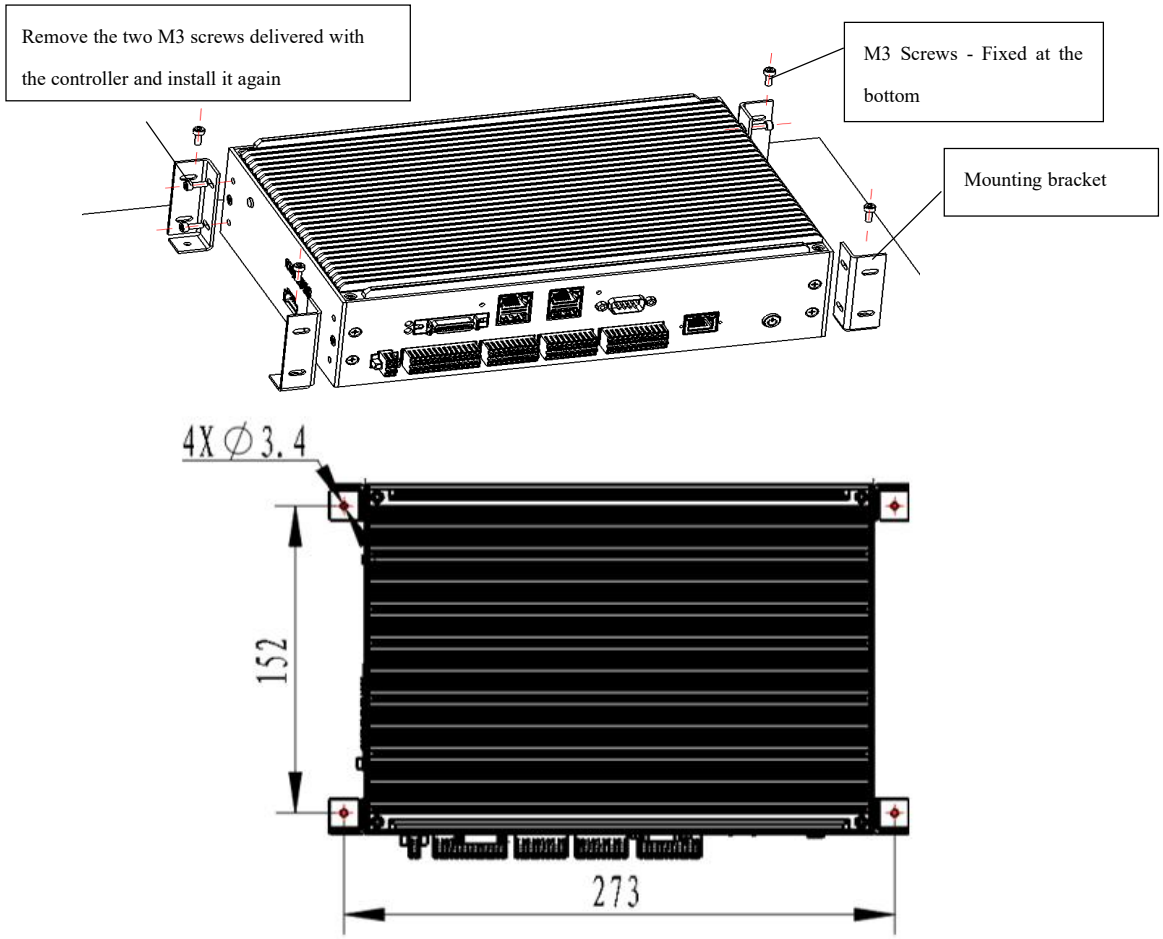


Figure 22 DC00 Controller Mounting Dimensions

DC00 control cabinet shall be installed in a dry place with good ventilation. Natural convection shall be used to cool the DC00 control cabinet. In the case of large heat generation, such as fast running speed, heavy load or frequent braking of the robot body, external fans should be used to cool the DC00 control cabinet. In order to ensure cooling through fans and natural convection, please refer to the following figure for installation. Ensure that the spacing between each DC00 control cabinet is more than 100mm (for heat dissipation), and the spacing between the longitudinal sides is more than 50mm.

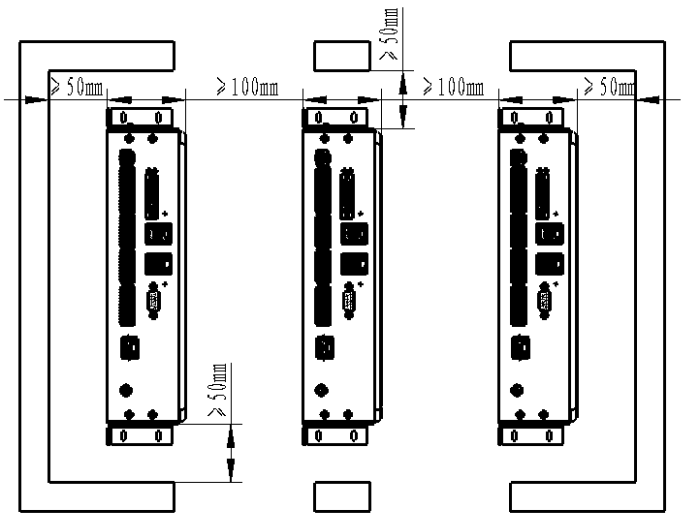


Figure 23 DC00 Control Cabinet Installation Spacing

6.5 On/off the Machine

The DC00 control cabinet supports a variety of on-off modes. The modes are as follows:

6.5.1 On/off button on control cabinet

The on/off button on the DC00 control cabinet is the micro-reset button with green light. When the system switch is ON but the system is not started, press the power button for more than 1 second and release it. When the button is on, the system starts and works normally. When the system needs to be shut down, use the TP interface for normal power off and shutdown operations. In case of system problems, long press the button for more than 3 seconds to forcibly power off the system (data of the main control cabinet is normally saved).

6.5.2 TP on/off button

The on/off button on the TP control cabinet is the self-reset button with micro light (blue). When the system switch is ON but the system is not started, press the power button for more than 1 second and release it. When the button is on, the system starts and works normally. When the system needs to be shut down, use the TP interface for normal power off and shutdown operations. In case of system problems, long press the button for more than 3 seconds to forcibly power off the system (data of the main control cabinet is normally saved).

6.5.3 Remote power on/off button

Using a remote switch, you can turn on or off the system without using the "Power ON" button on the TP panel. (Press the "Power ON" button (hold it for more than 1 second) and release it to power on the system).

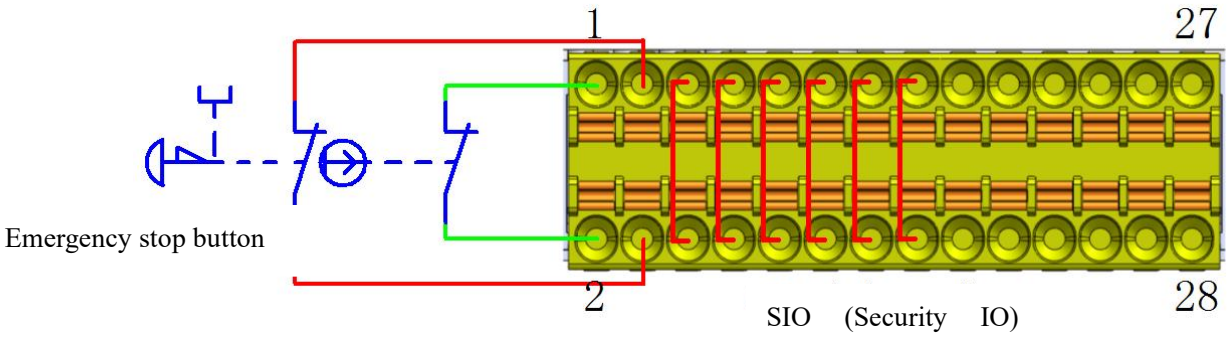
The "Power ON" input principle is the same as the power-on button. You must use "Power OFF" for remote shutdown, When powering off the cabinet, hold down this button for more than 3 seconds to forcibly power off the system.

For details about cable connection requirements, see 5.12.3 Remote Switch Ports.

6.6 Emergency Stop

The emergency stop button is connected to the security IO port. For details, see Section (b) of 5.9.1 SIO Port

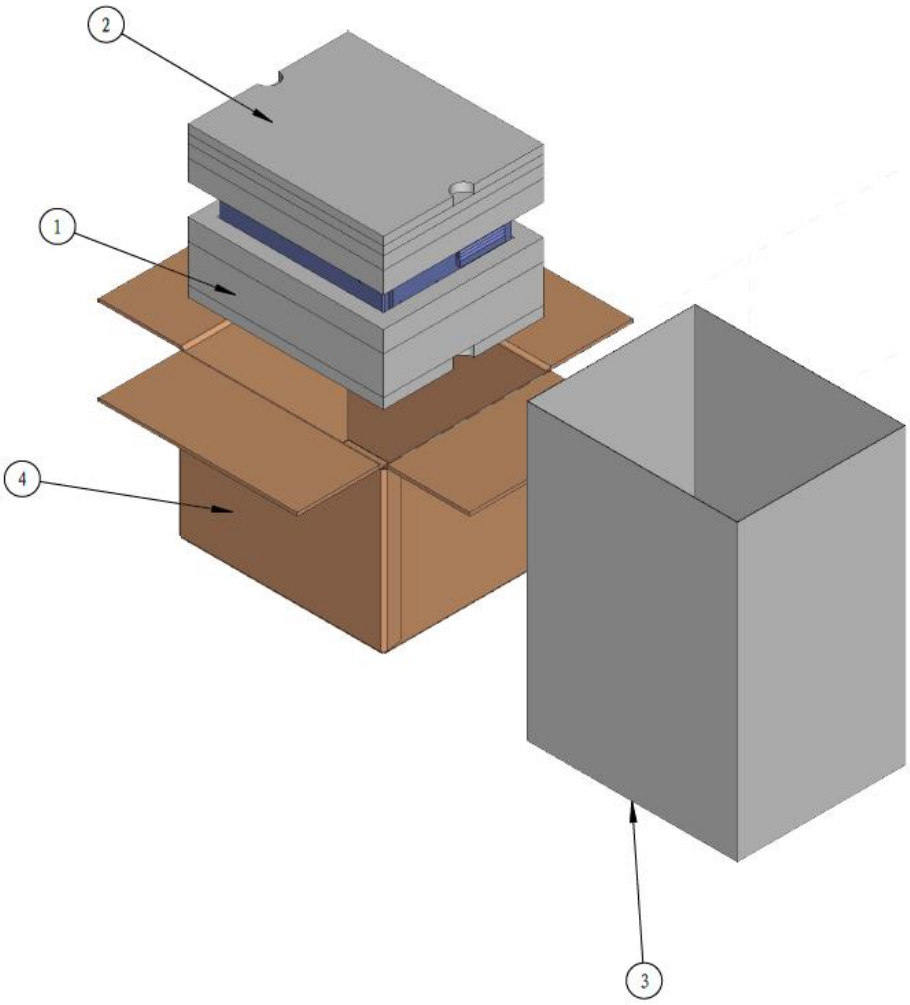
Wiring Diagram.



7 Transportation and Storage

7.1 Packing and Transportation

The control cabinet should be kept upright during transportation and placement, and vibration and collision should be avoided during transportation to prevent damage to the control system.



No.	Name
1	Bottom EPE lining
2	Top EPE lining
3	PE protective film
4	Carton

Reference dimensions of control cabinet packing cases:480×378×395mm

Reference shipping weight:18kg（DC30D）17kg(DC15S)

7.2 **Control System Storage**

Long-term storage must be noted:

- The storage place should be dry and dust-free;
- Avoid temperature fluctuation;
- Avoid condensation;
- Avoid direct sunlight;
- Avoid airflow;
- Select a reasonable storage temperature range;
- Choose a storage location that will not damage the packaging;
- Only store the robot control system in an enclosed space.

8 Maintenance and repair

All safety instructions in this manual must be strictly followed for any maintenance work.

Maintenance must be done by an authorized system integrator or Auctech staff.

When any parts are returned to Auctech, they should be operated according to the service manual.

8.1 Safety Instructions

After maintenance, check to ensure that the safety level required for service is met. Checks must be conducted in compliance with valid national or local safety laws and regulations. At the same time, check whether all safety functions are normal.

The purpose of maintenance is to ensure that the system is functioning properly, or to help restore the system to normal functioning in the event of a failure. Maintenance includes fault diagnosis and actual maintenance.

The following safety procedures and warnings must be followed when operating the control cabinet or robotic arm.

Danger：

1.Do not change any information in the software security configuration. If safety parameters change, the entire robot system should be considered as a new one, which means that all safety review processes, such as risk assessment, must be updated.

2.Replace the faulty part with a new part with the same part number or an equivalent part approved by Auctech.

3.Reactivate all disabled security measures immediately after the job is done.

4.Record all maintenance operations and keep them in technical documents related to the entire robot system.

Danger：

1. Remove the main input cable from the side of the control cabinet to ensure that it completes the power outage. Disconnect other energy sources from the robot or control cabinet. Take necessary precautions to prevent others from re-energizing the system during maintenance.

2. Check the ground connection before restarting the system.

3. Please comply with ESD regulations when disassembling the robot or electrical control cabinet.

4. Prevent water or dust from entering the control cabinet or robot arm.

8.2 Maintenance Items and Cycle

In order to keep the high performance of the robot system for a long time, maintenance inspection must be carried out. The personnel responsible for maintenance shall prepare maintenance plan and carry out maintenance according to the plan. Please refer to the following table for maintenance items. If you have any questions, please contact the service department of the company.

No.	Maintenance Activity	Inspection Mode	Every 1 months	Every 6 months	Every 12 months
1	TP check emergency stop	Functional examination	√		
2	Check the three-position enable switch of the instructor	Functional examination	√		

No.	Maintenance Activity	Inspection Mode	Every 1 months	Every 6 months	Every 12 months
3	Check control cabinet safety input and output	Functional examination	√		
4	Check TP cables and connectors	Visual inspection		√	
5	Check and clean foreign matter outside the control cabinet	Visual and sweeping		√	
6	Check the I/O terminal block of the control cabinet	Functional examination			√
7	Check the power port of the control cabinet	Functional examination			√

8.3 Parts Replacement

When replacing parts of the control cabinet, observe the following precautions to safely operate.

1. Any modification of the company's products is strictly prohibited.。
2. Fires, breakdowns, and errors caused by modifications, which may result in injury or machine damage.
3. Any loss caused by the user's own modification of the Company's products is not within the scope of the company's warranty.

1. To prevent electric shock, disconnect the main power supply before replacing the parts.
2. Switch off the main power supply for at least five minutes before replacing the component.
3. Because of the residual charge in the substrate and electrolytic capacitor, there is a risk of electric shock.
4. Do not work with wet hands.

1. The replacement must be carried out by the specified operator.
2. Being electrocuted or caught by an accidentally acting robot can result in serious injury or death.

1. There are a large number of connecting interfaces between the printed substrate. Exercise caution when replacing the parts to avoid incorrect or missing insertion.
2. Electric shock or fire may result in serious injury or death.

1. Do not damage cables or pull interfaces during replacement.
2. During replacement, do not touch the electronic parts of the printed substrate and the contact parts of the circuit and interface. Hold the edge of the printed substrate.
3. If accidentally touched, it may cause electric shock, which may result in serious injury or death.

1． For maintenance and inspection, the primary power supply must be switched on when the door of the electric control cabinet is open. Do not expose the interior of the electric control cabinet to direct sunlight, searchlight, or other strong light; otherwise, faults or wrong actions may occur.

	1. Release static electricity before operation. 2. Anti-static wrist bands, etc., are very effective. 3.Direct contact with electrical components without taking any preventive measures may cause faults of electrical components.
	1. After the operation is complete, check whether there is a gap or whether the cable is caught, and reinstall the shell. If there is a gap, dirt and dust may enter the electric control cabinet, resulting in faults.

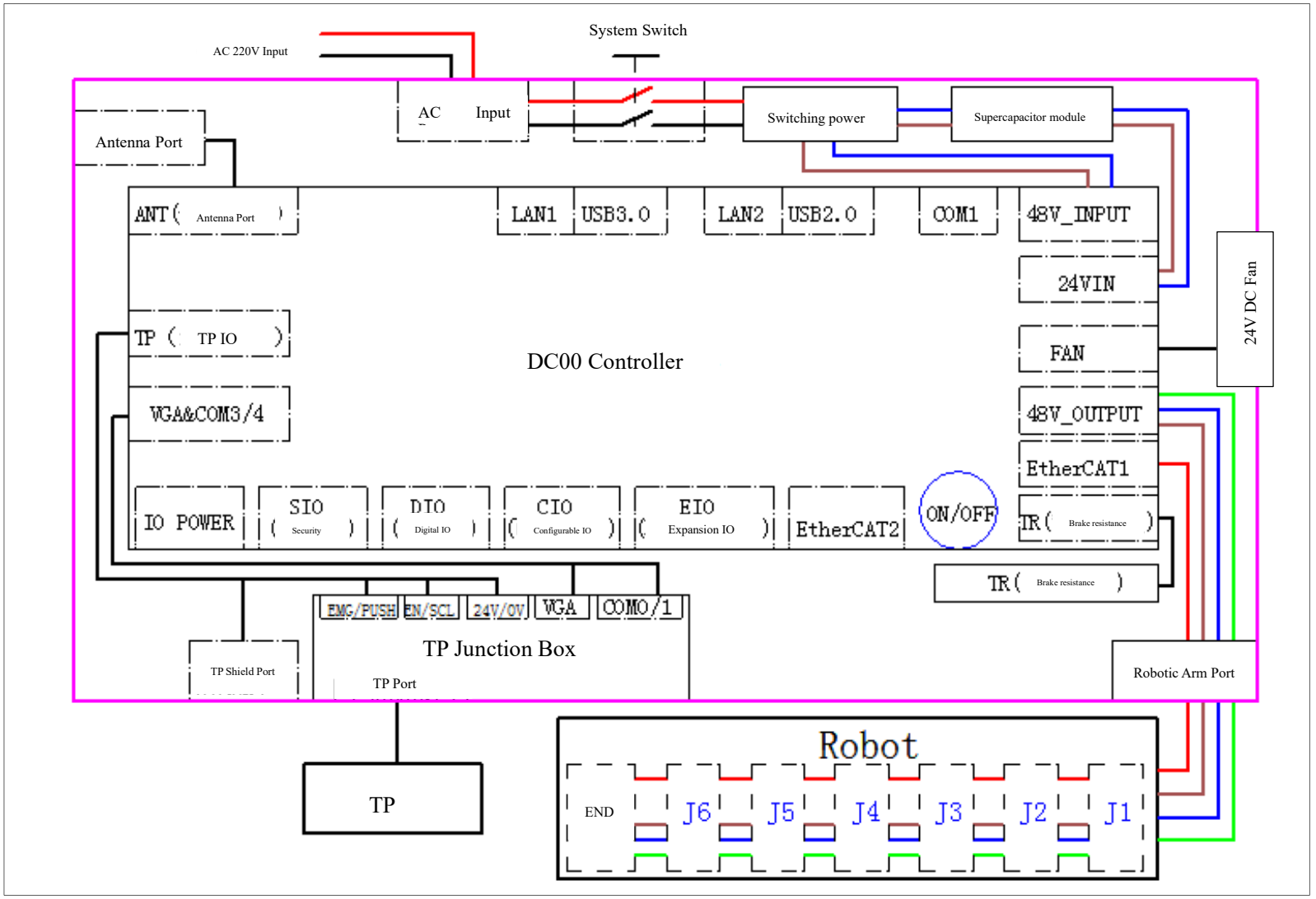
Appendix

Appendix A: Design Standard Reference

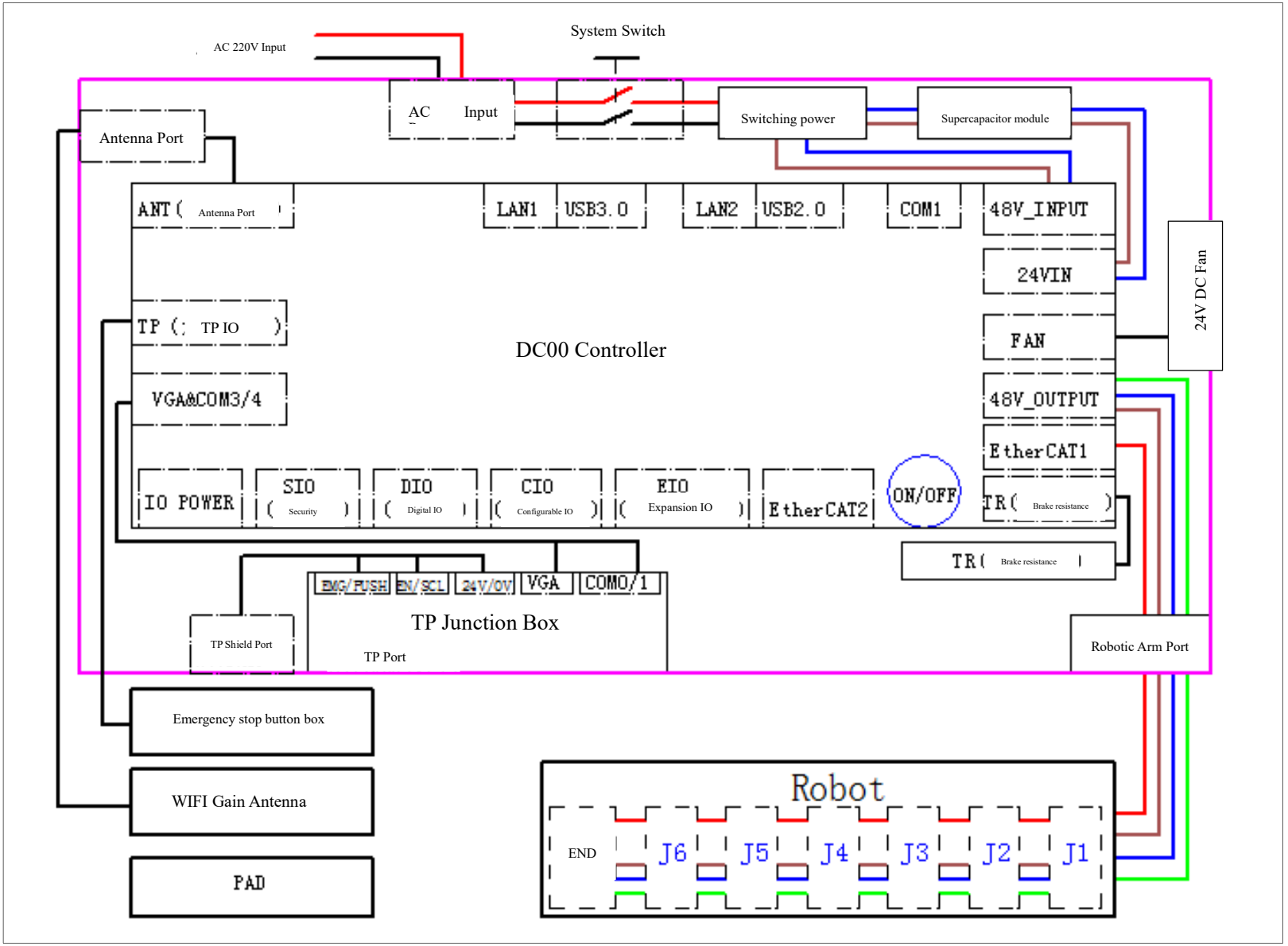
Standard	Definition
ISO 13849-1	Safety of machinery — Safety-related parts of control systems —Part 1:General principles for design
ISO 13849-2	Safety of machinery —Safety-related parts of control systems Part 2: Validation
ISO 13850	Safety of machinery – Emergency stop – Principles for design
ISO 12100	Safety of machinery – General principles for design – Risk assessment and risk reduction
ISO 10218-1	Robots and robotic devices – Safety requirements for industrial robots Part 1: Robots
ANSI/RIA R15.06	Industrial Robots and Robot Systems – Safety Requirements
CAN/CSA Z434-14	Industrial Robots and Robot Systems – General Safety Requirements
IEC 61000-6-2	Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments
IEC 61000-6-4	Electromagnetic compatibility (EMC) Part 6-4: Generic standards - Emission standard for industrial environments
IEC 61326-3-1	Electrical equipment for measurement, control and laboratory use - EMC requirements
IEC 60947-5-5	Low-voltage switchgear and controlgear Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60320-1	Appliance couplers for household and similar general purposes Part 1: General requirements
ISO 9409	Manipulating industrial robots – Mechanical interfaces Part 1: Plates
IEC 61140/A1	Protection against electric shock – Common aspects for installation and equipment
IEC 60068-2-1	Environmental testing Part 2-1: Tests - Test A: Cold
IEC 60068-2-2	Environmental testing Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-27	Environmental testing Part 2-27: Tests - Test Ea and guidance: Shock
IEC 60068-2-64	Environmental testing Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance
IEC 61784-3	Industrial communication networks – Profiles Part 3: Functional safety fieldbuses – General rules and profile definitions

IEC 60204-1/A1	Safety of machinery – Electrical equipment of machines Part 1: General requirements
IEC 60664-1	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests
IEC 60664-5	Insulation coordination for equipment within low-voltage systems Part 5: Comprehensive method for determining clearances and creepage distances equal to or less than 2 mm
ISO 9787	Manipulating industrial robots, coordinate systems, and motion nomenclatures
ISO 9283	Manipulating industrial robots, performance criteria, and related test methods
EN 614-1	Safety of machinery - Ergonomic design principles - Part 1:Terminology and general principles
ANSI/UL 1740	Safety standard for robots and robotic equipment

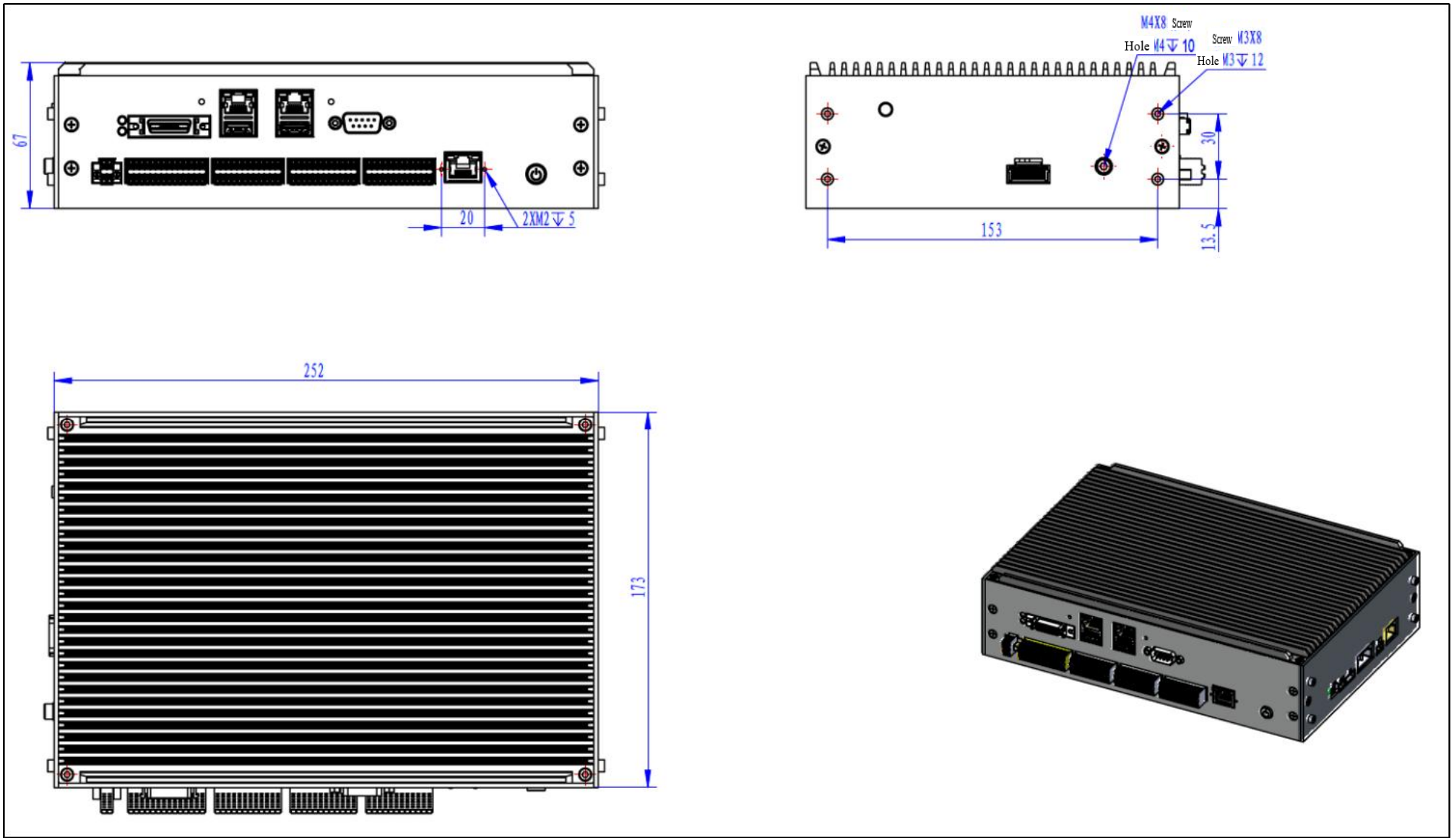
Appendix B：Electrical System Block Diagram（TP connection）



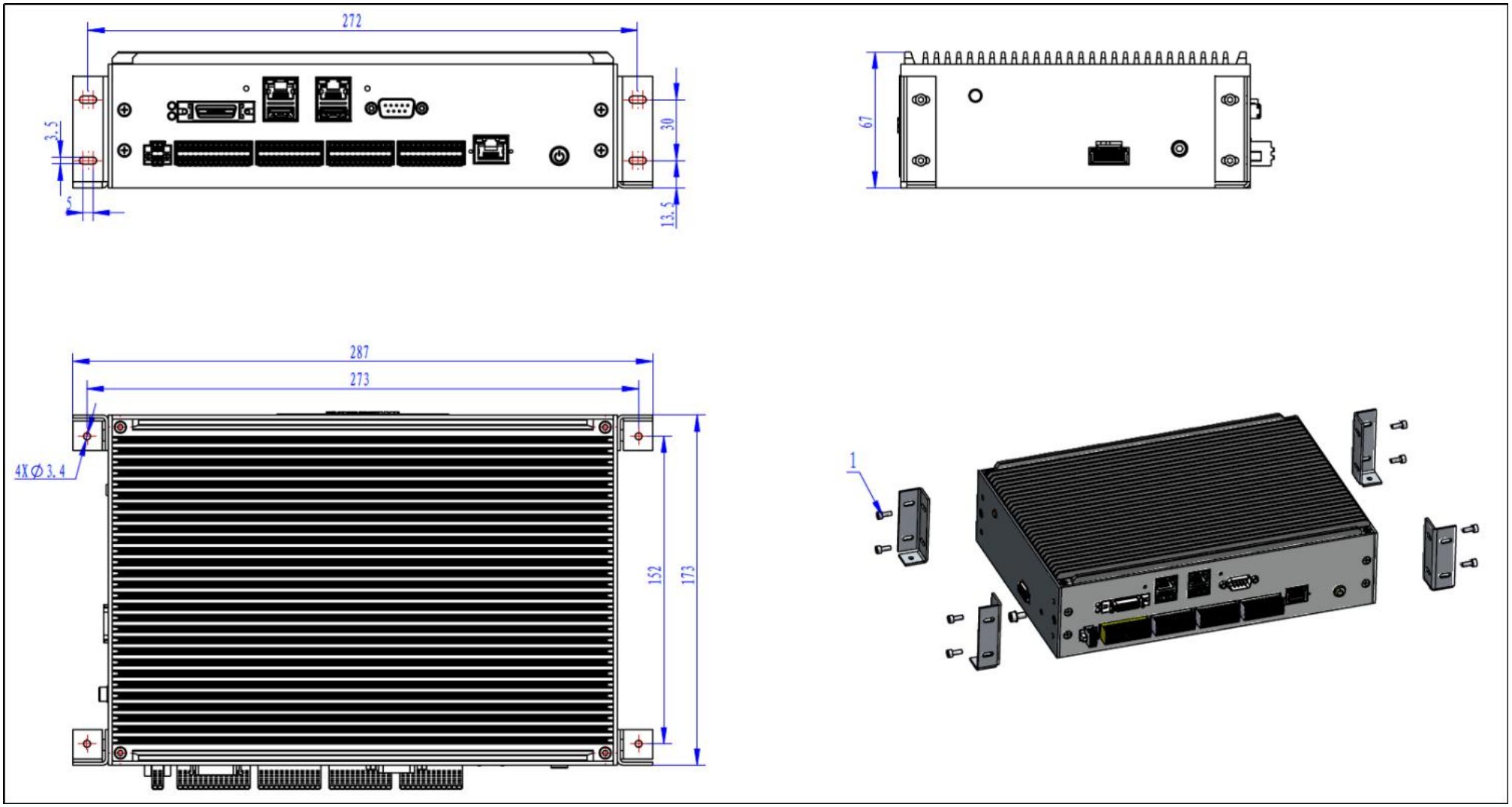
Appendix C：Electrical System Block Diagram (Wireless Pad)



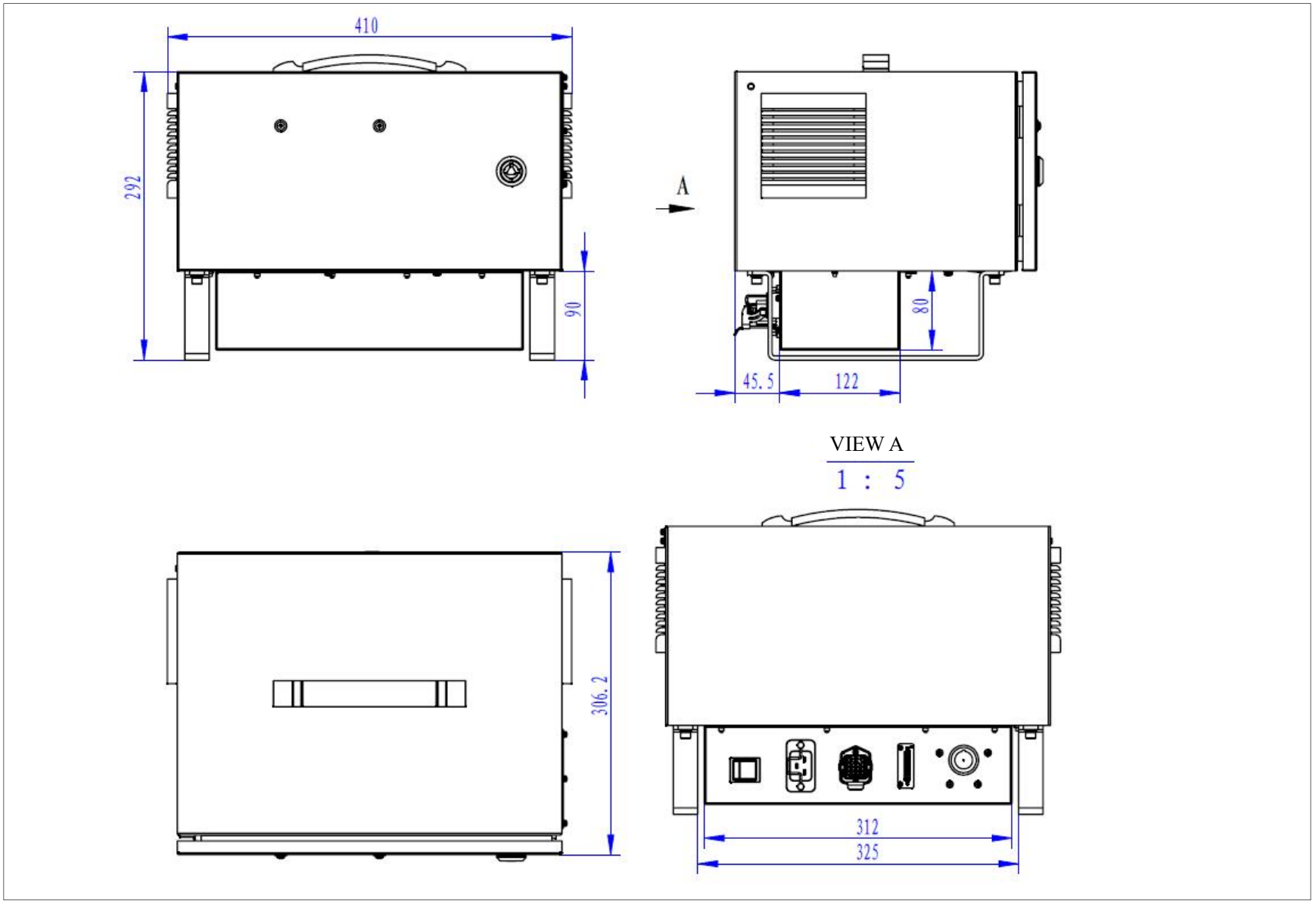
Appendix D：DC00 Controller Contour Size



Appendix E：DC00 Controller Installation Size



Appendix F：DC30D/15S Controller Installation Size



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