SUSTAINABLE DEVELOPMENT GROUP

SHARE WELL

User Manual

Controller Hardware section

SUZHOU SHARE WELL AUTOMATION TECHNOLOGY CO.,LTD

Preface

Document Overview

Dear User:

Thank you for choosing our PowerNex robot. We are honored to provide you with this high-performance and highly reliable product. To ensure that you can make the most of the PowerNex robot's various features, we have specially prepared this user manual, hoping to offer you useful references and assistance. This manual outlines the necessary information for the proper use of the robotic system.

To improve the reliability, design, and functionality of our products, the information in this manual is subject to change without prior notice, and does not constitute a commitment by the manufacturer. The manufacturer shall not be liable for any direct, indirect, special, incidental, or consequential damages arising from the use of the product or documentation (even if advised of the possibility of such damages).

Our products undergo rigorous testing and inspection to ensure that the robotic system's performance meets our company's standards. However, using this product outside the environments described in this manual may affect its fundamental performance.

The controller is an integrated drive and control unit designed for use with SCARA robots, characterized by its lightweight structure, rich functionality, easy installation, and convenient expansion. The MRC-100 controller is compatible with various SCARA robot models, including the desktop-mounted P series with load capacities of 3Kg, 6Kg, 10Kg, 20Kg, and 40Kg; the suspended E series with load capacities of 4Kg and 10Kg; the 360° desktop-mounted R series with a load capacity of 6Kg; and the wall-mounted W series with a load capacity of 6Kg. The MRC-200 controller is used with SCARA robot models with load capacities of 60Kg and 100Kg. These controllers are widely applied in industries such as mobile phones, plastics, automotive, electronics, and pharmaceuticals.

This manual provides product information, installation and environment details, wiring, safety, and other content related to the MRC-100 and MRC-200.

Safety Precautions [Please Adhere Strictly]

Danger
● Do not use the robot in areas with water, in environments containing corrosive or flammable gases, or near combustible materials. ● Do not use the robot in areas with water, in environments containing corrosive or flammable gases, or near combustible materials. ● Do not use the robot in areas with water, in environments containing corrosive or flammable gases, or near combustible materials. ● Do not use the robot in areas with water, in environments containing corrosive or flammable gases, or near combustible materials. ● Follow the operational steps and requirements outlined in the respective manuals. ● Do not enter the robot's motion range. ● Consider contingency plans for sudden movements of the robot in your direction. ● Ensure designated safe zones are established as a precaution. ● Accidental entry into the robot's motion range or collision with the robot may result in personal injury. Additionally, in case of abnormal operation, immediately press the emergency stop button.
Attention
● Before conducting robot teaching operations, check the following items and ensure any abnormalities are addressed promptly. ● Verify that all connections are secure. ● Check for any abnormal movements of the robot (such as shaking). ● Inspect external wiring coverings and packaging for any damage. ● Do not frequently switch the power on and off for the controller. ● Always return the teach pendant to its designated location after use. ● If the teach pendant is accidentally left on the robot, tool, or on the ground, it may collide with the robot or tool during operation, potentially causing personal injury or equipment damage.

- Do not modify, disassemble, or repair the equipment without authorization.

Catalogue

1. Product Information

1.1 Product Model

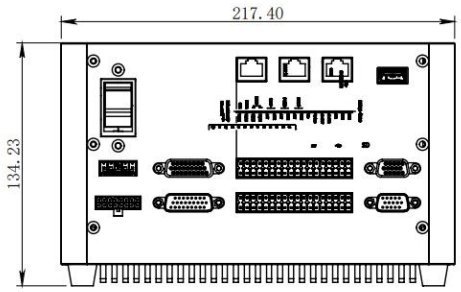
-- MRC-100 Suitable for P3 - P40 Series

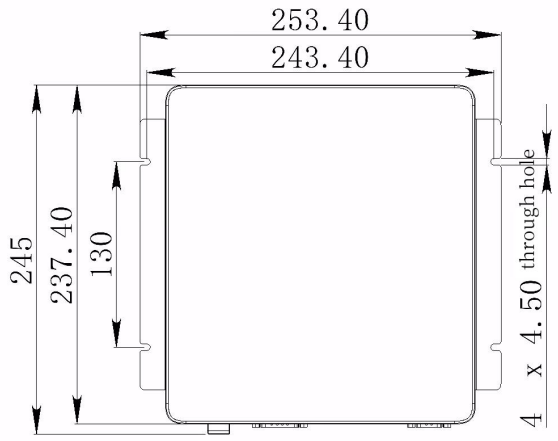
-- MRC-200 Suitable for P60 - P100 Series

-- MRC-600 Suitable for S Series

1.2 Dimensions Specifications

1.2.1 MRC-100

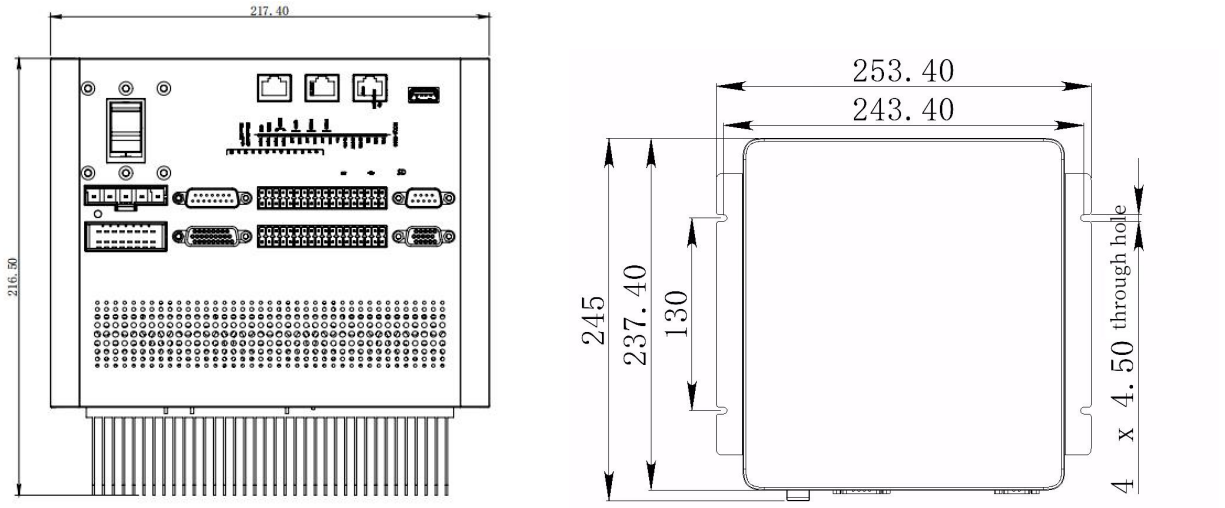




Device Dimensions: Length: 217.40 mm, Width: 237.40 mm, Height: 134.23 mm

(Suitable for P3 - P40 Series)

1.2.2 MRC-200

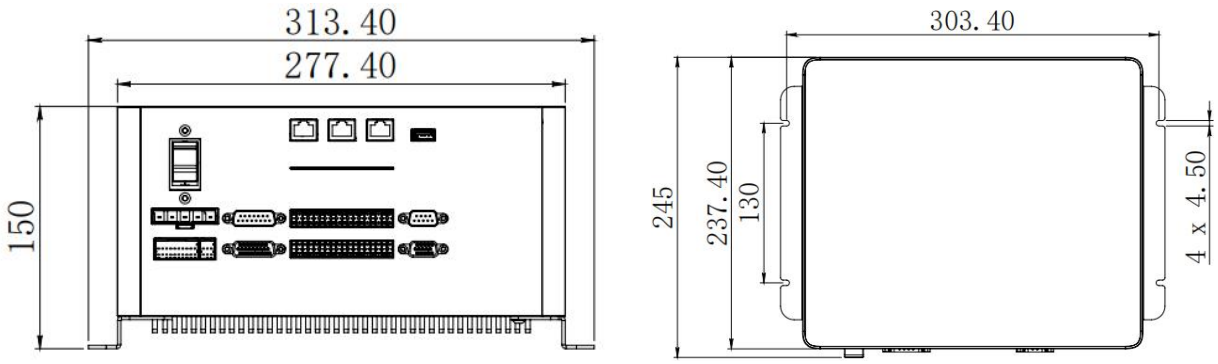


Device Dimensions: Length: 217.40 mm, Width: 237.40 mm, Height: 216.50 mm

(Suitable for P60 - P100 Series)

[Unit: mm]

1.2.3 MRC-600



Device Dimensions: Length: 277.40 mm, Width: 237.40 mm, Height: 150 mm

(Suitable for S Series)

[Unit: mm]

1.3 Component Overview

1.3.1 MRC-100 Component Overview

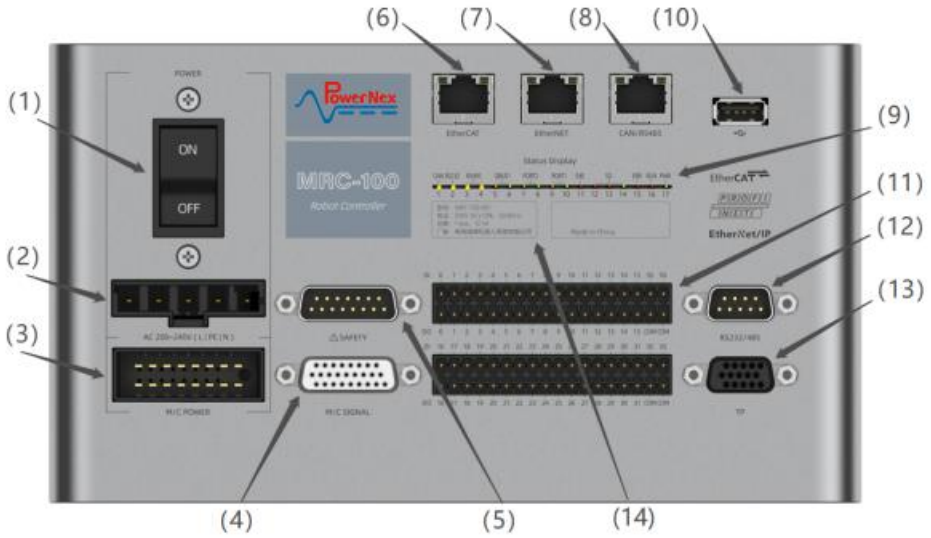


Figure 1-1 Component Information

No.	Name	Function Description
(1)	POWER Switch	Controller power switch
(2)	AC Power Interface	For inputting AC220V power to the controller
(3)	M/C POWER (Power Line Interface)	For connecting the robot's power line
(4)	M/C SIGNAL (Encoder Line Interface)	For connecting the robot's encoder line
(5)	SAFETY Port	For connecting emergency stop, safety guard door, and other safety-related input signals
(6)	EtherCAT Interface	Fieldbus communication interface
(7)	EtherNET Interface	Network port for PC-based debugging software
(8)	CAN/RS485 Interface	For CAN/RS485 communication with external devices
(9)	Indicator Light	Displays the connection status of the controller
(10)	USB Interface	USB 2.0 interface
(11)	I/O Interface	For connecting 16-bit standard input ID and 16-bit

		standard output DO
(12)	RS232/485	For RS232/485 communication with external devices
(13)	TP Port	Dedicated interface for the teach pendant
(14)	Product Information	Records product model, serial number, and other information

1.3.2 MRC-200 Component Overview

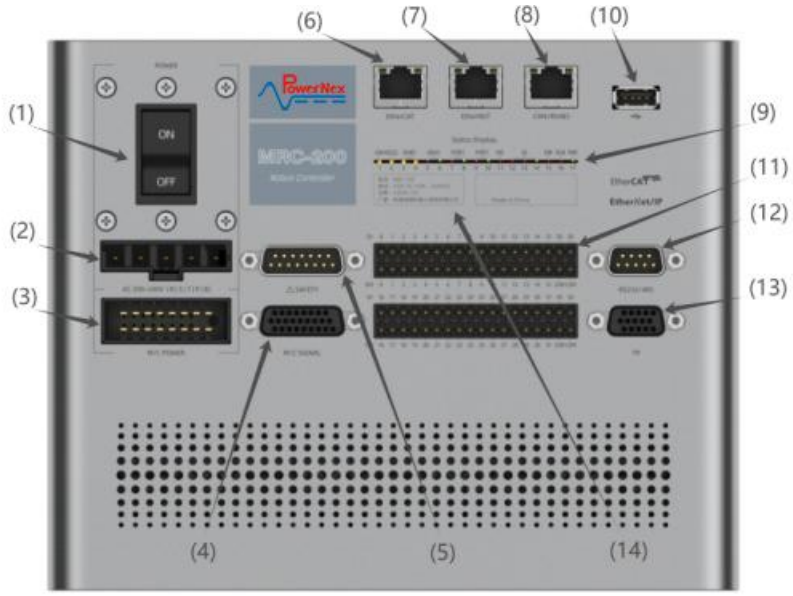


Figure 1-2 Component information

No.	Name	Function Description
(1)	POWER Switch	Controller power switch
(2)	AC Power Interface	For inputting AC220V power to the controller o r AC380V power
(3)	M/C POWER (Power Line Interface)	For connecting the robot's power line
(4)	M/C SIGNAL (Encoder Line Interface)	For connecting the robot's encoder line
(5)	SAFETY Port	For connecting emergency stop, safety guard door, and other safety-related input signals
(6)	EtherCAT Interface	Fieldbus communication interface
(7)	EtherNET Interface	Network port for PC-based debugging software
(8)	CAN/RS485 Interface	For CAN/RS485 communication with external devices
(9)	Indicator Light	Displays the connection status of the controller
(10)	USB Interface	USB 2.0 interface
(11)	I/O Interface	For connecting 16-bit standard input ID and 16-bit

		standard output DO
(12)	RS232/485	For RS232/485 communication with external devices
(13)	TP Port	Dedicated interface for the teach pendant
(14)	Product Information	Records product model, serial number, and other information

1.3.3 Component Overview

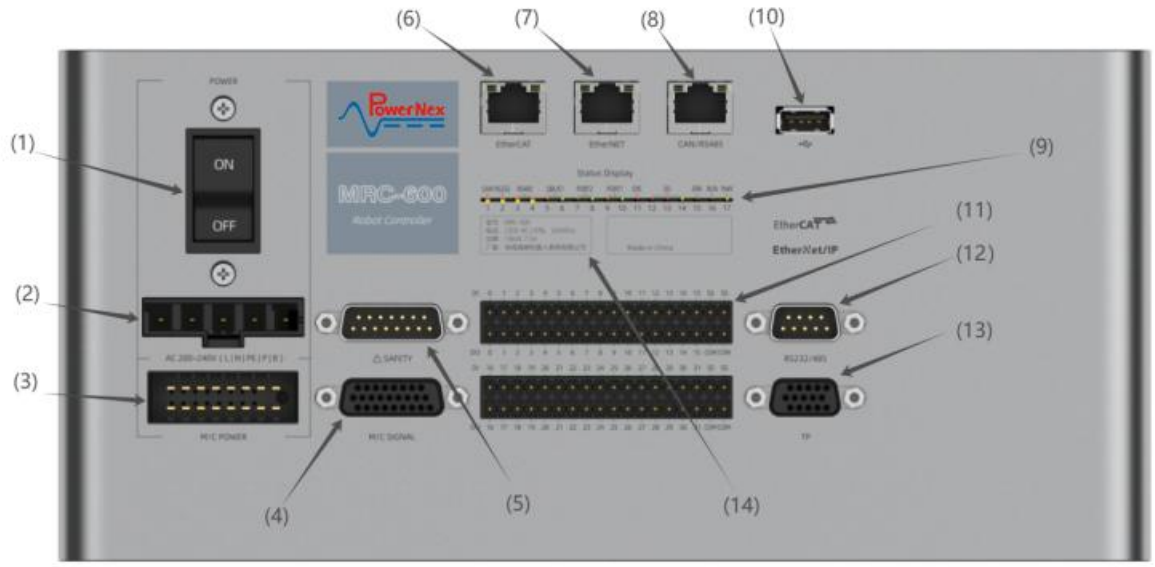


Figure 1-2 Component information

No.	Name	Function Description
(1)	POWER Switch	Controller power switch
(2)	AC Power Interface	For inputting AC220V power to the controller
(3)	M/C POWER (Power Line Interface)	For connecting the robot's power line
(4)	M/C SIGNAL (Encoder Line Interface)	For connecting the robot's encoder line
(5)	SAFETY Port	For connecting emergency stop, safety guard door, and other safety-related input signals
(6)	EtherCAT Interface	Fieldbus communication interface
(7)	EtherNET Interface	Network port for PC-based debugging software

(8)	CAN/RS485 Interface	For CAN/RS485 communication with external devices
(9)	Indicator Light	Displays the connection status of the controller
(10)	USB Interface	USB 2.0 interface
(11)	I/O Interface	For connecting 16-bit standard input ID and 16-bit standard output DO
(12)	RS232/485	For RS232/485 communication with external devices
(13)	TP Port	Dedicated interface for the teach pendant
(14)	Product Information	Records product model, serial number, and other information

1.4 Technical Specifications

1.4.1 MRC-100 Technical Specifications

Item	Specification
Model	MRC-100
Maximum Control Axes	4 Axes
Supported Robot Models	P3-401S、P6-502S、P6-602S、P6-702S P10-602S、P10-702S、P10-802S P20-804S、P20-904S、P20-1004S P40-804S、P40-904S、P40-1004S
Motion Modes	PTP (Point-To-Point) Mode Line (Continuous Path) Mode
IO	Input: 16 (Standard), Output: 16 (Standard)
Interface configuration	EtherCAT(network port))*1 、 EtherNet(network port))*1 CAN/RS485(network port))*1 、 USB2.0*1 RS232/485(serial port)*1 、 safety door interface*1
Communication Protocol (Standard)	EtherNet/IP(Slave) 、EtherCAT(Master) ModBus - TCP/RTU(Master/Slave) TCP/IP 、 Mitsubishi PLC-MC Protocol (Slave)
Communication Protocol (Extended)	PROFINET(Master Station) - Additional gateway module required

Rated capacity	Maximum input power 4kW The actual rated capacity depends on the type, motion and load of the robotic arm. P3 : 0.8 Kw E4 : 1.1 Kw P6/R6 : 1.2 Kw P10 : 2.4 Kw P20/P40/E10 : 2.65 Kw
Input Voltage	220V AC±10%
Frequency	50Hz
Noise	50dB
Operating Environment Temperature	5~45℃
Controller Net Weight	6KG

1.4.2 MRC-200 Technical Specifications

Item	Specification
Model	MRC-200
Maximum Control Axes	4 Axes
Supported Robot Models	P60-1004S、P60-1204S P100-1204S
Motion Modes	PTP (Point-To-Point) Mode Line (Continuous Path) Mode
IO	Input: 16 (Standard), Output: 16 (Standard)
Interface configuration	EtherCAT(network port))*1 、 EtherNet(network port))*1 CAN/RS485(network port))*1 、 USB2.0*1 RS232/485(serial port)*1 、 safety door interface*1
Communication Protocol (Standard)	EtherNet/IP(Slave) 、EtherCAT(Master) ModBus - TCP/RTU(Master/Slave) TCP/IP 、 Mitsubishi PLC-MC Protocol (Slave)
Communication Protocol (Extended)	PROFINET(Master Station) - Additional gateway module required

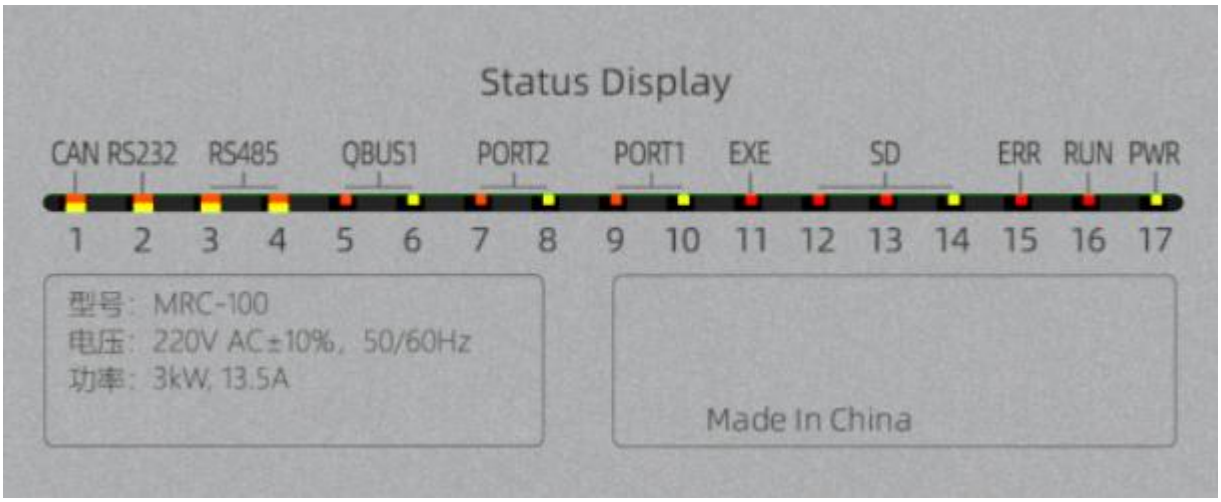
Rated capacity	Maximum input power7.5 Kw The actual rated capacity depends on the type, motion and load of the robotic arm. P60/P100 ：4.6 Kw
Input Voltage	220V AC±10% / 380V AC±5%
Frequency	50Hz
Noise	50dB
Operating Environment Temperature	5~45℃
Controller Net Weight	9KG

1.4.3 MRC-600 Technical Specifications

Item	Specification
Model	MRC-600
Maximum Control Axes	6 Axes
Supported Robot Models	S4-540A、S5-910A、S6-720A、S25-1600 S7-700、S7-900
Motion Modes	PTP (Point-To-Point) Mode Line (Continuous Path) Mode
IO	Input: 16 (Standard), Output: 16 (Standard)
Interface configuration	EtherCAT(network port))*1 、 EtherNet(network port))*1 CAN/RS485(network port))*1 、 USB2.0*1 RS232/485(serial port)*1 、 safety door interface*1
Communication Protocol (Standard)	EtherNet/IP(Slave) 、EtherCAT(Master) ModBus - TCP/RTU(Master/Slave) TCP/IP 、 Mitsubishi PLC-MC Protocol (Slave)
Communication Protocol (Extended)	PROFINET(Master Station) - Additional gateway module required
Rated capacity	Maximum input power7.5 Kw The actual rated capacity depends on the type, motion and

	load of the robotic arm. S4 ： 1.6 Kw S5/S6 ： 1.9 Kw
Input Voltage	220V AC±10%
Frequency	50Hz
Noise	50dB
Operating Environment Temperature	5~45℃
Controller Net Weight	7KG

1.5 Indicator Panel Overview



No.	Indicator	Function	Description
1	CAN Indicator	CAN Communication Status	Green: Link established; Red: Data transmission in progress
2	RS232 Indicator	RS232 Communication Status	Green: Link established; Red: Data transmission in progress
3	RS485-1 Indicator (Display)	Internal RS485 Communication	Green: Link established; Red: Data transmission in progress

4	RS485-2 Indicator	External RS485 Communication	Green: Link established; Red: Data transmission in progress
5	QBUS1 Indicator (Data)	Fieldbus Data Transmission Status	Red blinking: Data transmission active
6	QBUS1 Indicator (Link)	Fieldbus Connection Status	Green steady: Physical layer connected
7	Port-2 Indicator (ECAT Data)	EtherCAT Data Transmission	Red blinking: Process data exchange ongoing
8	Port-2 Indicator (ECAT Comm)	EtherCAT Communication Status	Green steady: EtherCAT network synchronized
9	Port-1 Indicator (ETH Data)	Ethernet Data Transmission	Red blinking: TCP/IP packet transfer active
10	Port-1 Indicator (ETH Link)	Ethernet Link Status	Green steady: PHY layer connection established
11	EXE Indicator	Internal Reservation	Reserved for system internal use
12	SD Indicator 1		
13	SD Indicator 2		
14	SD Indicator 3		
15	ERR Indicator	System Error Status	Red blinking: Fault condition detected
16	RUN Indicator	System Operational Status	Red blinking: System in ready state
17	PWR Indicator	System power-on indicator	Steady green: The system is powered on

2. Installation and Environment

2.1. Installation environment requirements

This product must be placed in its packaging before installation. If it is not used for the time being, in order to comply with the company's warranty range and future maintenance, it is necessary to pay attention to the following matters when storing:

* Storage temperature range: -20° to +65°

* Robot operating temperature range: 0° to 40°.

* Controller operating temperature range: 0° to 55°, if the ambient temperature exceeds 45° please maintain good ventilation.

It is recommended to keep the temperature below 45° for a long period of time.

* Relative humidity range: 0% to 90% dew free.

* No high heat device, no water droplets, no steam, no dust, no corrosion, no flammable items, no liquid, no metal particles, no electromagnetic interference signals.

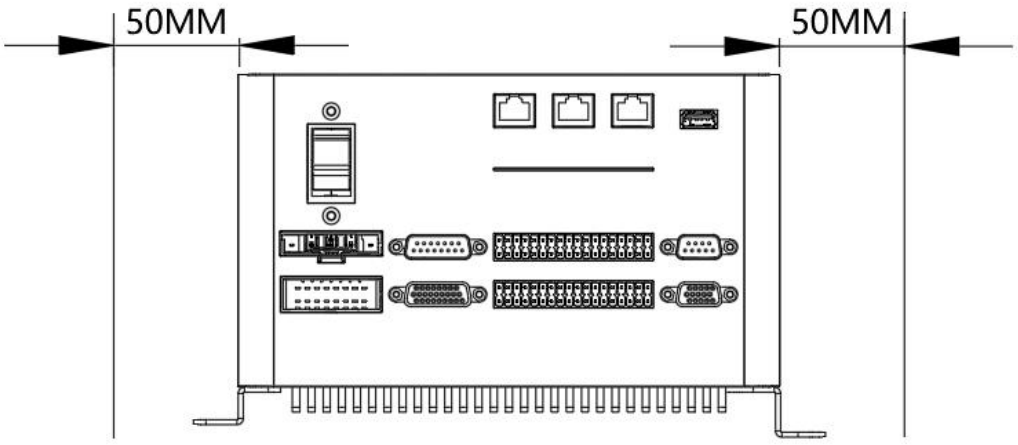
2.2. Installation parameter

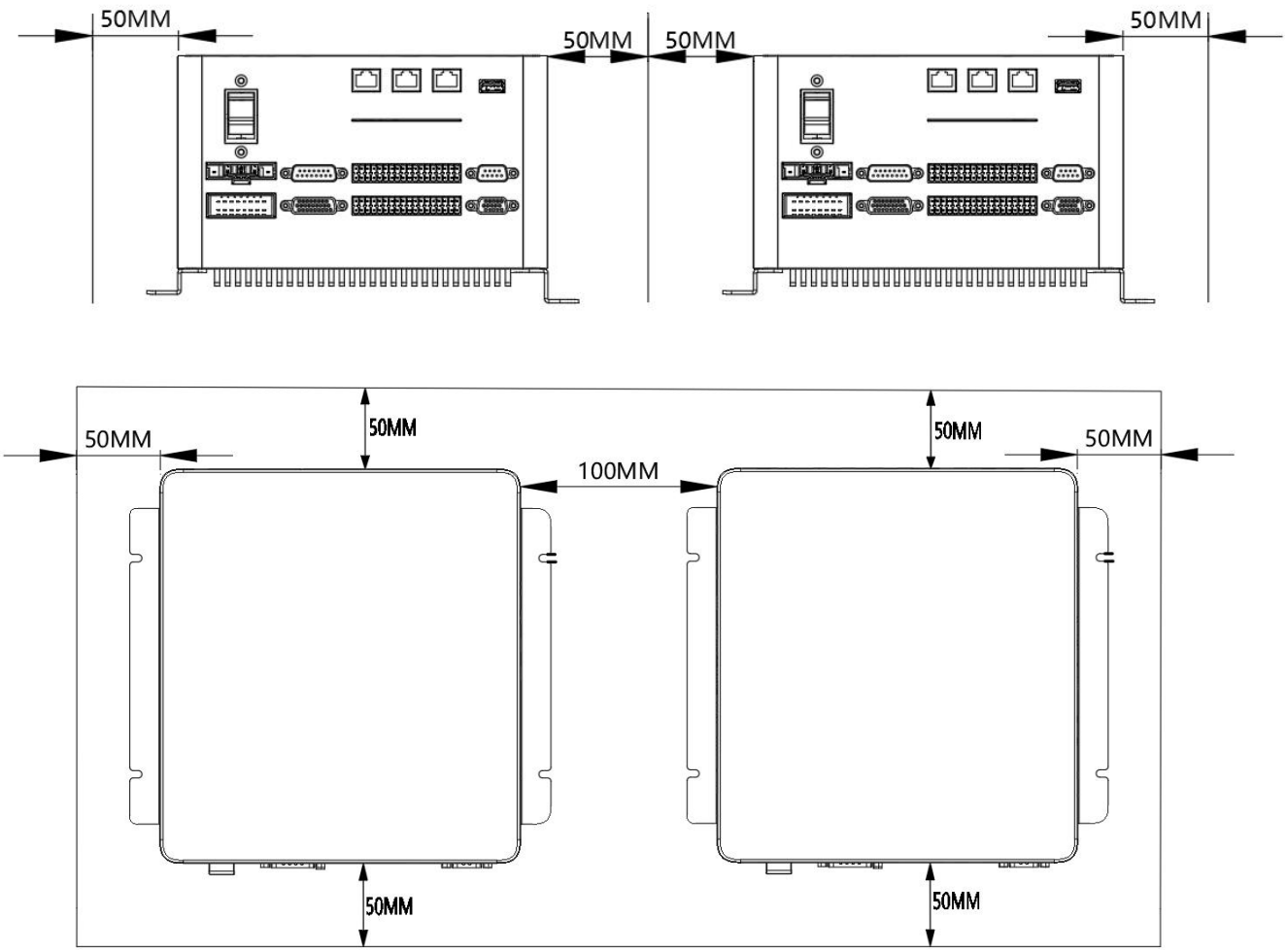
The installation direction must be as shown in the following figure:

In order for the cooling cycle to be effective, the adjacent items and baffles above and below the controller must be retained when installing it

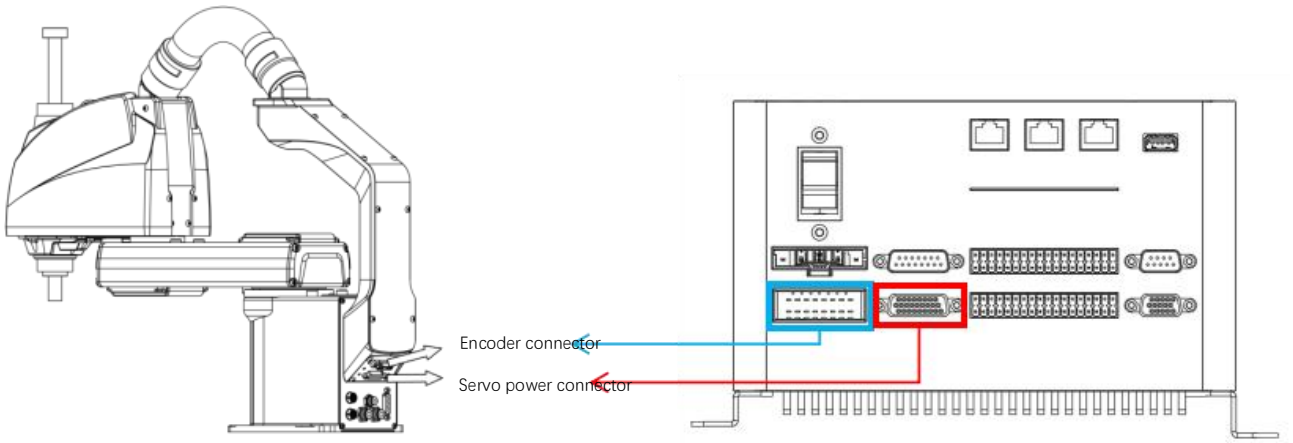
Plenty of space.

During installation, the suction and exhaust holes of the controller cannot be sealed, nor can they be placed upside down.





2.3. The controller is connected to the robot



2.4. Matters needing attention

When appropriate environmental conditions cannot be met, take protective measures appropriate to the current environment, such as masking the controller with a enclosure with a cooling system.

Avoid direct sunlight on the controller in the installation environment.

Avoid dust, dust, soot, salt, iron filings, corrosive liquids, and corrosive gases in the air.

In the installation environment, do not install the device in the area of external vibration or impact.

In the installation environment, do not install the device in an area containing electrical interference sources such as relays and contactors.

In the installation environment, avoid installation in an environment that is prone to strong magnetic production and strong electric field.

In order to maintain the function of the robot system and ensure safe use, set up the controller in a location that meets the following conditions.

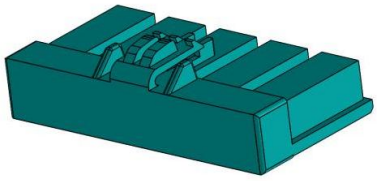
The controller is not clean grade specification. When located in a clean room, take relevant measures to adapt to the clean room environment, such as using a box with an exhaust structure or cooling structure to cover the controller.

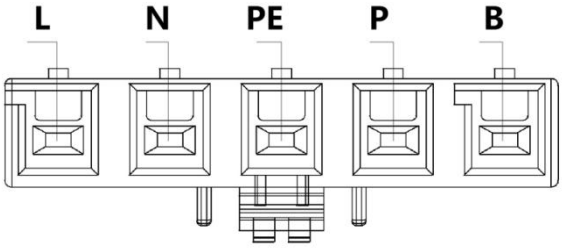
Locate the controller near the socket and in a place where it is easy to unload the plug.

3.wiring

3.1 AC Power Interface

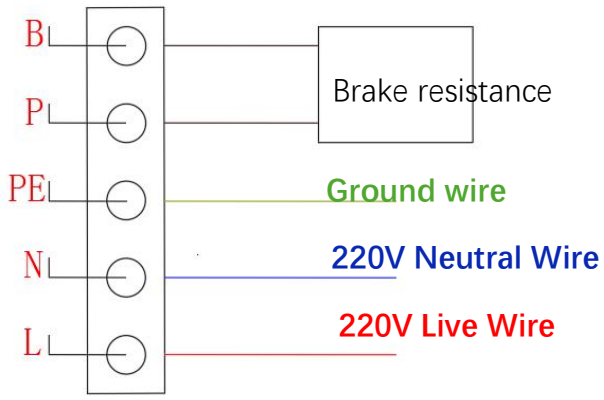
3.1.1 AC220V interface Definition





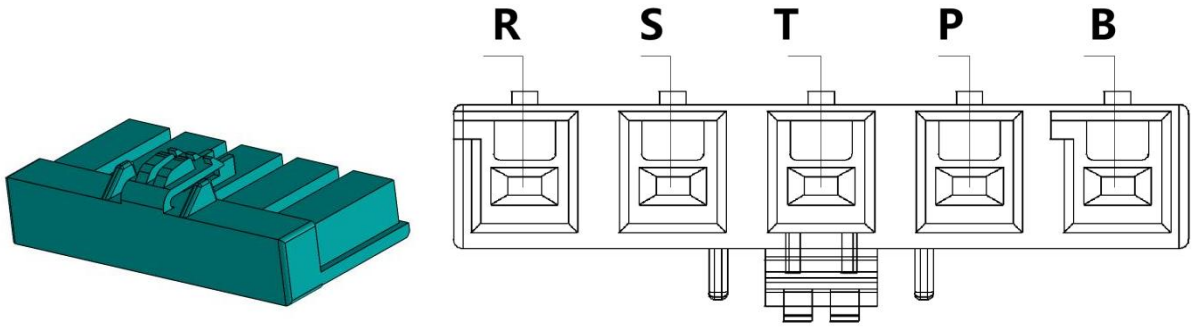
Pin Number	Definition	Description	Remarks
1	L	Single-phase AC Live Wire	
2	N	Single-phase AC Neutral Wire	
3	PE	Ground Wire	
4	P	Brake Resistor	
5	B	Brake Resistor	

3.1.2 MRC - 100 / MRC - 600 Wiring diagram



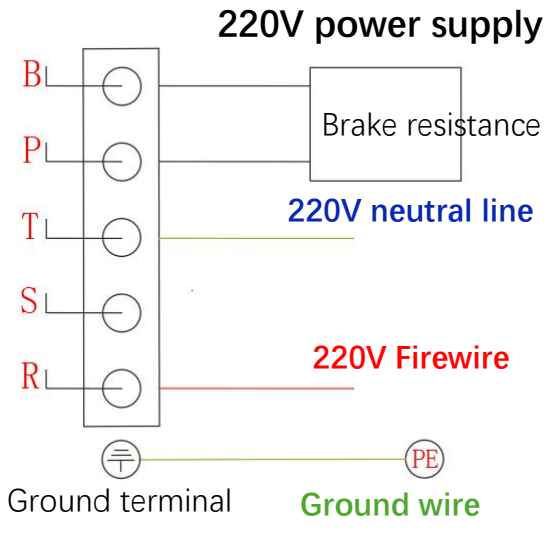
wiring

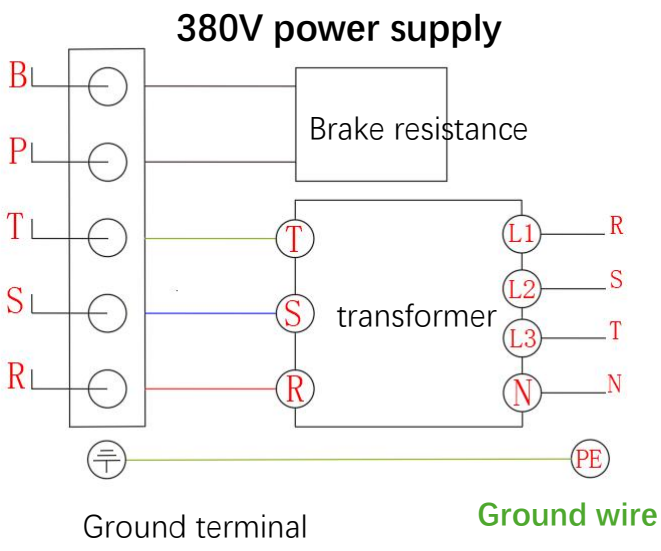
3.1.3 AC380V Interface definition



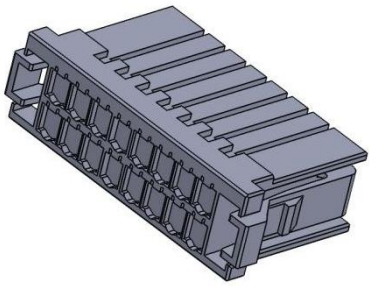
Pin Number	Definition	Description	Remarks
1	R	220V: single-phase AC live line 380: three-phase AC R-phase (L1) live wire	
2	S	220V: empty 380: three-phase AC S-phase (L2) live wire	
3	T	220V: single-phase AC neutral line 380: three-phase AC T-phase (L3) fireline	
4	P	Brake resistance	
5	B	Brake resistance	

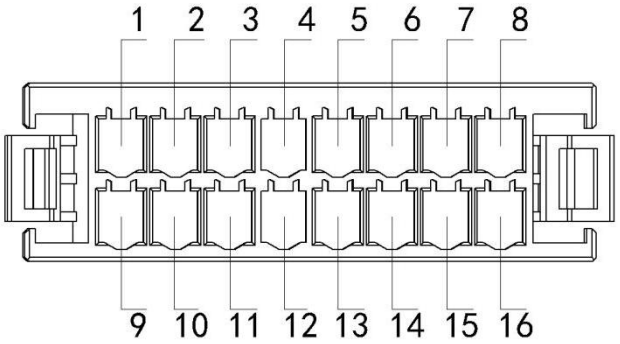
3.1.4 MRC - 200 Wiring diagram





3.2 M/C POWER Power line interface

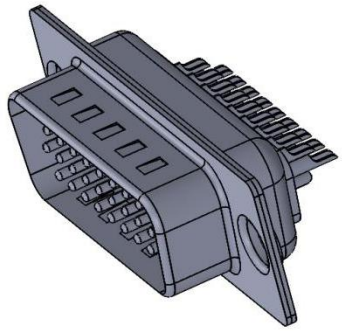


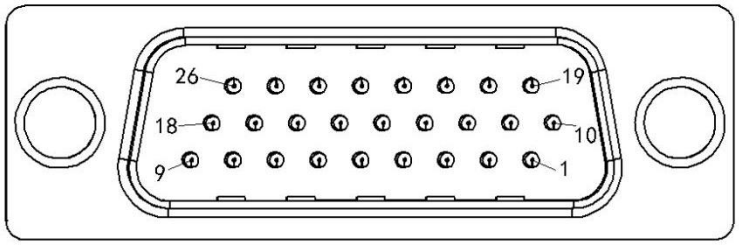


3.2.1 Power line interface

Pin Number	Definition	Remarks	Pin Number	Definition	Remarks
1	U1	Motor U Phase Output for Axis 1	9	W3	Motor W Phase Output for Axis 3
2	V1	Motor V Phase Output for Axis 1	10	U4	Motor U Phase Output for Axis 4
3	W1	Motor W Phase Output for Axis 1	11	V4	Motor V Phase Output for Axis 4
4	U2	Motor U Phase Output for Axis 2	12	W4	Motor W Phase Output for Axis 4
5	V2	Motor V Phase Output for Axis 2	13	DC24V	Internal Output Power DC 24V
6	W2	Motor W Phase Output for Axis 2	14	Brake	Body Brake Control for Axes 3/4
7	U3	Motor U Phase Output for Axis 3	15	DC0V	Internal Output Power DC 0V
8	V3	Motor V Phase Output for Axis 3	16	PE	Ground Wire

3.3 M/C SIGNAL Encoder Wire Interface





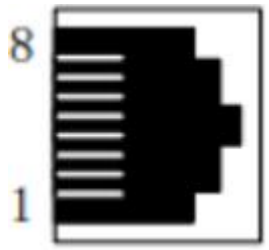
3.3.1 Encoder Wire Interface

Pin Number	Definition	Remarks	Pin Number	Definition	Remarks
1	1T+	Differential Positive for Encoder Axis 1	14	4T-	Differential Negative for Encoder Axis 4
2	1T-	Differential Negative for Encoder Axis 1	15	4VCC	Power Positive
3	1VCC	Power Positive	16	4GND	Ground Wire
4	1GND	Ground Wire	17	/	/
5	2T+	Differential Positive for Encoder Axis 2	18	/	/
6	2T-	Differential Negative for Encoder Axis 2	19	/	/
7	2VCC	Power Positive	20	/	/
8	2GND	Ground Wire	21	/	/
9	3T+	Differential Positive for Encoder Axis 3	22	/	/
10	3T-	Differential Negative for Encoder Axis 3	23	SDI2	Origin Sensor for Axis 4
11	3VCC	Power Positive	24	1RS485+	Controller RS-485

					Positive
12	3GND	Ground Wire	25	1RS485-	Controller RS-485 Negative
13	4T+	Differential Positive for Encoder Axis 4	26	PE	Controller RS-485 Ground Wire

3.4 Communication Port Description

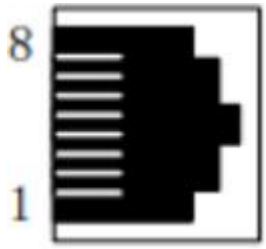
3.4.1 EtherCAT Interface Description



Serial Number	Definition	Remarks
1	DP_PHY0_TX+	Transmit Data +
2	DP_PHY0_TX-	Transmit Data -
3	DP_PHY0_RX+	Receive Data +
4	/	
5	/	
6	DP_PHY0_RX-	Receive Data -
7	/	/
8	/	/

wiring

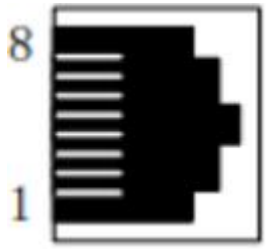
3.4.2 EtherNET Interface description



RJ45 100Mbps Ethernet port, used for connecting to PC debugging software (default IP is 192.168.1.220)

Pin Number	Definition	Remarks
1	Transceive Data +	Transmit Data +
2	Transceive Data -	Transmit Data -
3	Receive Data +	Receive Data +
4	/	
5	/	
6	Receive Data -	Receive Data -
7	/	
8	/	

3.4.3 CAN/RS485 Interface Description



Pin Number	Definition	Remarks
1	CAN-H	High Level CAN Bus
2	CAN-L	Low Level CAN Bus
3	GND	Common Ground for RS485 Master and CAN
4	485-A	RS485 Master A
5	485-B	RS485 Master B
6	/	
7	/	/
8	/	/

3.5 Connecting Input DI

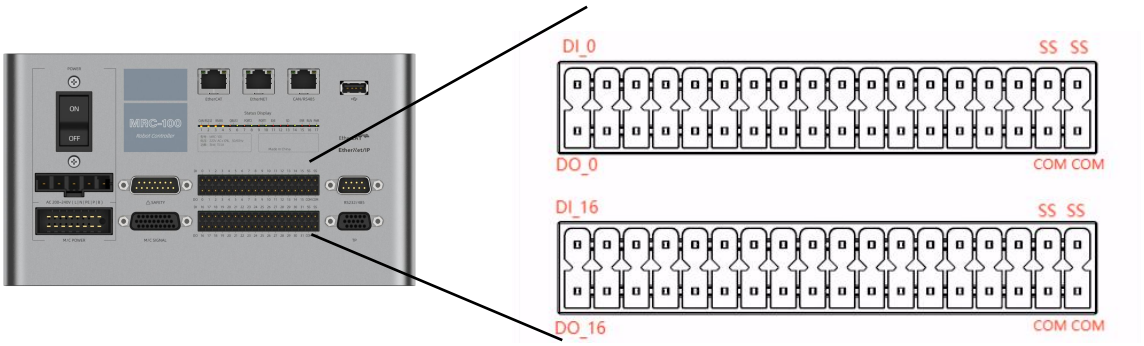
3.5.1 Input DI Port Specifications

Item	Specification
Number of Input Channels	32
Input Type	Compatible with NPN and PNP (Standard NPN)
Wiring Method	Crimp-type terminal, 2-wire, common ground
Common Method	One common terminal for every 16 points
Input Voltage Range	DC 24V (+10% to -10%)
Input Signal Current	7mA/DC 24V
Input Resistance	4.86kΩ

wiring

Input ON Sensitivity Current	Above 5.35mA
Input OFF Sensitivity Current	Above 2.1mA
Input Voltage Threshold	VIH_Min: 15V
VIL_Max: 5V	
Input Response Frequency	5kHz
Input Response Time	Below 0.1ms
External Input Power Range	DC 5V to 30V
Maximum Load Current	0.25A per point, 2A for 8 points
Voltage Drop when ON	Below 1V
Leakage Current when OFF	0.1mA/DC 24V
Pulse Waveform	Pulse Width: Above 100us Rise/Fall Time: Below 50us
Isolation Voltage Level	1.5kVrms
Factory Configuration	16 Input Channels

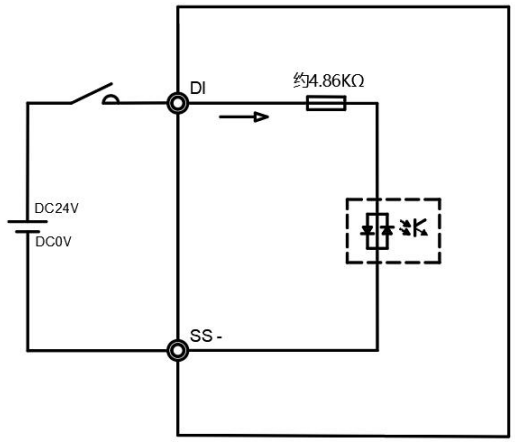
3.5.2 Input DI Interface Definition



PIN	I/O Number	Name	PIN	I/O Number	Name
1	DI_0	Standard Input 0	37	DI_16	Standard Input 16
2	DI_1	Standard Input 1	38	DI_17	Standard Input 17
3	DI_2	Standard Input 2	39	DI_18	Standard Input 18
4	DI_3	Standard Input 3	40	DI_19	Standard Input 19
5	DI_4	Standard Input 4	41	DI_20	Standard Input 20
6	DI_5	Standard Input 5	42	DI_21	Standard Input 21

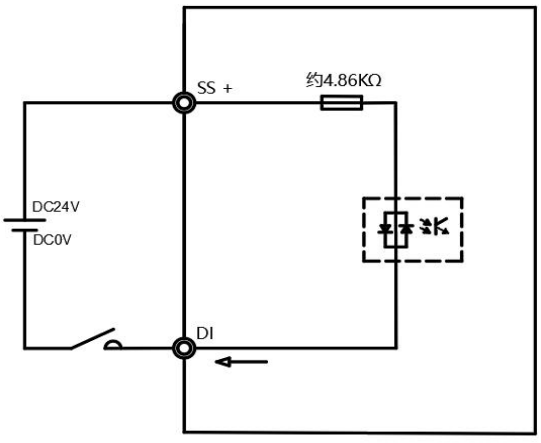
7	DI_6	Standard Input 6	43	DI_22	Standard Input 22
8	DI_7	Standard Input 7	44	DI_23	Standard Input 23
9	DI_8	Standard Input 8	45	DI_24	Standard Input 24
10	DI_9	Standard Input 9	46	DI_25	Standard Input 25
11	DI_10	Standard Input 10	47	DI_26	Standard Input 26
12	DI_11	Standard Input 11	48	DI_27	Standard Input 27
13	DI_12	Standard Input 12	49	DI_28	Standard Input 28
14	DI_13	Standard Input 13	50	DI_29	Standard Input 29
15	DI_14	Standard Input 14	51	DI_30	Standard Input 30
16	DI_15	Standard Input 15	52	DI_31	Standard Input 31
17	SS	Common Terminal for DI_0~DI_15	53	SS	Common Terminal for DI_16~DI_31
18	SS	Common Terminal for DI_0~DI_15	54	SS	Common Terminal for DI_16~DI_31
Note: The factory configuration is for 16 inputs. The 32 input configuration is optional.					

3.5.3 Connection Method



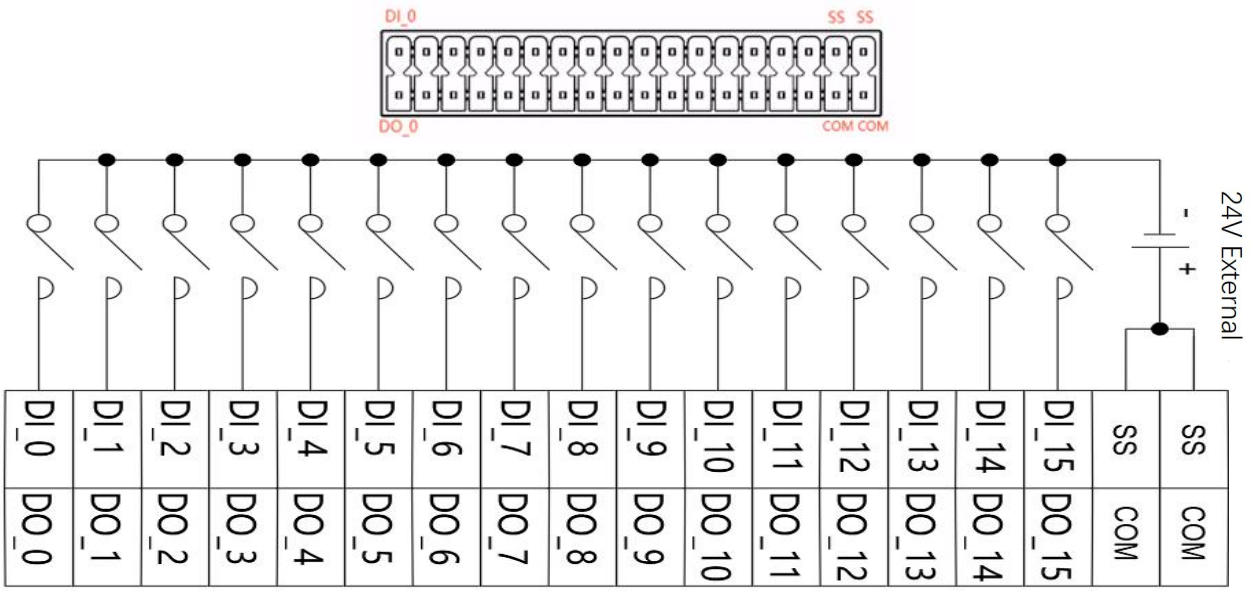
PNP

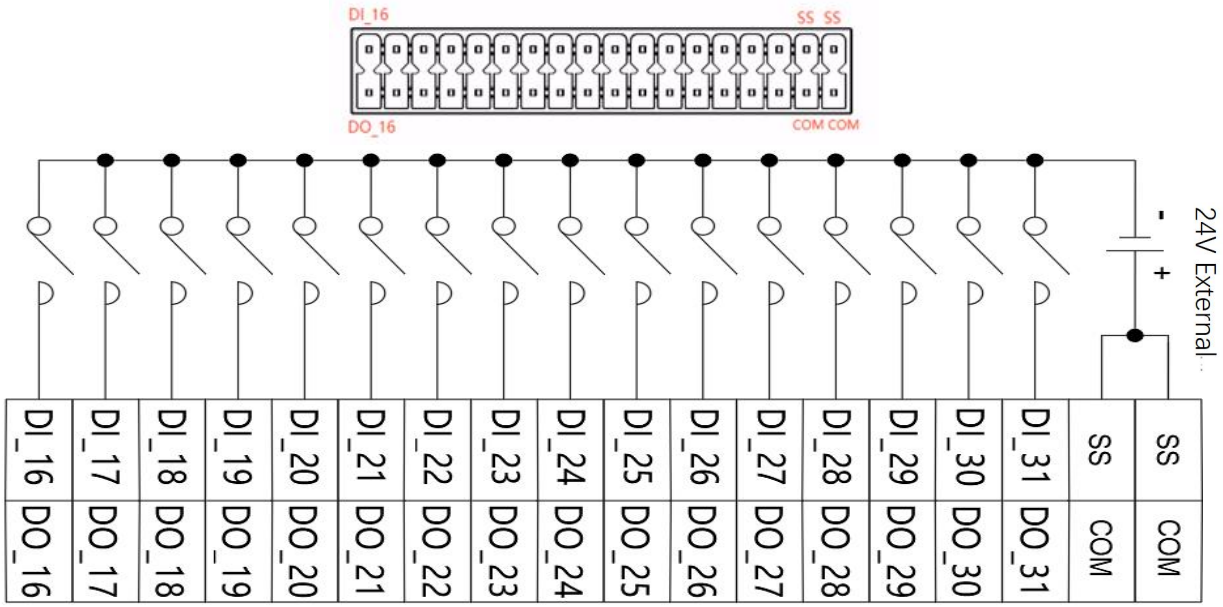
Common Cathode (SOURCE Mode)



NPN

Common Anode (SINK Mode)





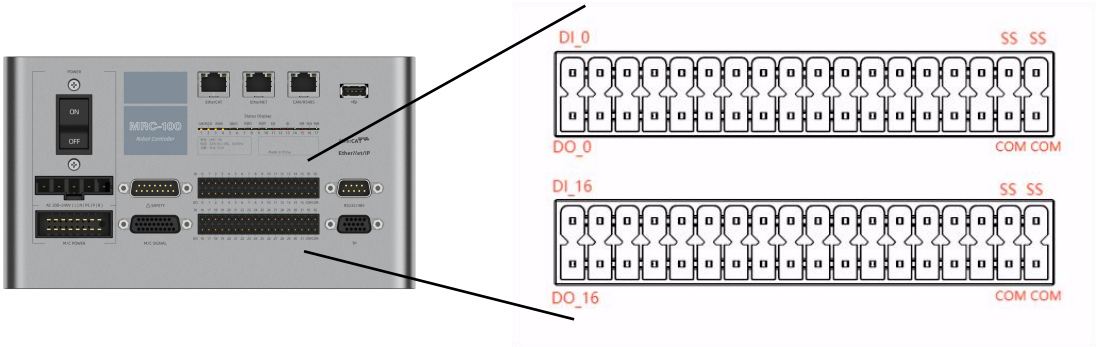
3.6 Connecting Output DO

3.6.1 Output DO Port Specifications

Item	Specification
Number of Output Channels	32
Output Type	NPN
Wiring Method	Crimp-type terminal, 2-wire, common ground
Common Method	One common terminal for every 16 points
Input Voltage Range	DC 24V (+10% to -10%)
Input Signal Current	7mA/DC 24V
Input Resistance	4.86kΩ
Input ON Sensitivity Current	Above 5.35mA
Input OFF Sensitivity Current	Above 2.1mA
Input Voltage Threshold	VIH_Min：15V VIL_Max：5V
Output Response Frequency	5kHz
Output Response Time	Below 0.1ms
External Power Range	DC 5V to 30V
Maximum Load Current	0.25A per point, 2A for 8 points
Voltage Drop when ON	Below 1V
Leakage Current when OFF	0.1mA/DC 24V
Pulse Waveform	Pulse Width: Above 100us Rise/Fall Time: Below 50us
Isolation Voltage Level	1.5kVrms
Factory Configuration	16 Output Channels

wiring

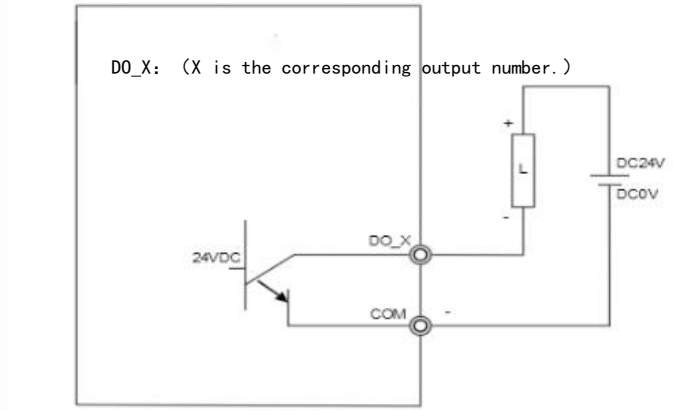
3.6.2 Output DO Port Definition

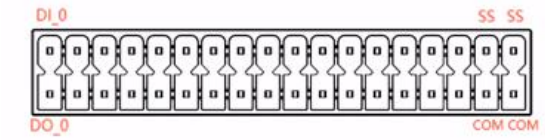


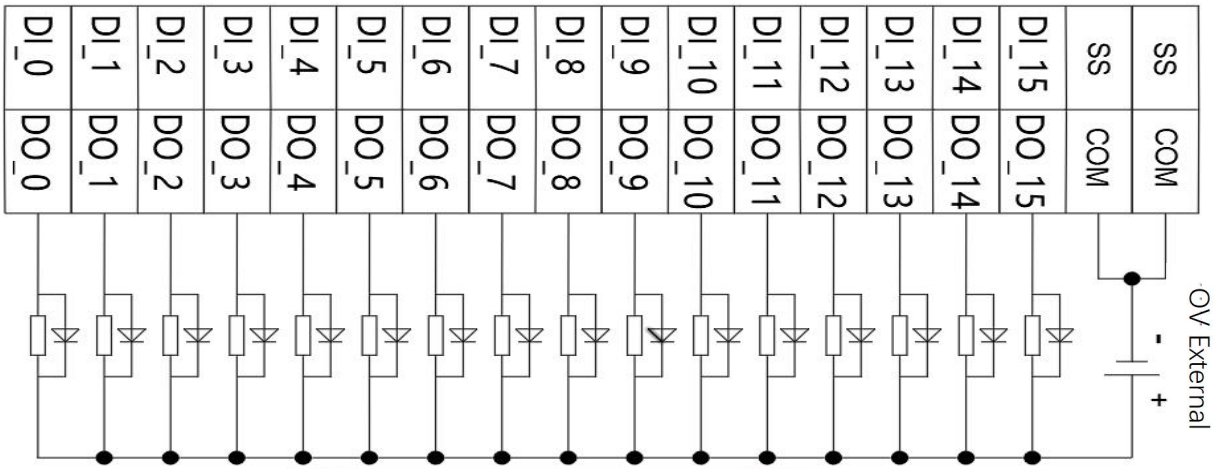
PIN	I/O Number	Name	PIN	I/O Number	Name
19	DO_0	Standard Output 0	55	DO_16	Standard Output 16
20	DO_1	Standard Output 1	56	DO_17	Standard Output 17
21	DO_2	Standard Output 2	57	DO_18	Standard Output 18
22	DO_3	Standard Output 3	58	DO_19	Standard Output 19
23	DO_4	Standard Output 4	59	DO_20	Standard Output 20
24	DO_5	Standard Output 5	60	DO_21	Standard Output 21
25	DO_6	Standard Output 6	61	DO_22	Standard Output 22
26	DO_7	Standard Output 7	62	DO_23	Standard Output 23
27	DO_8	Standard Output 8	63	DO_24	Standard Output 24
28	DO_9	Standard Output 9	64	DO_25	Standard Output 25
29	DO_10	Standard Output 10	65	DO_26	Standard Output 26
30	DO_11	Standard Output 11	66	DO_27	Standard Output 27
31	DO_12	Standard Output 12	67	DO_28	Standard Output 28
32	DO_13	Standard Output 13	68	DO_29	Standard Output 29
33	DO_14	Standard Output 14	69	DO_30	Standard Output 30
34	DO_15	Standard Output 15	70	DO_31	Standard Output 31
35	COM	Common Terminal for DO_0~DO_15	71	COM	Common Terminal for DO_16~DO_31
36	COM	Common Terminal for DO_0~DO_15	72	COM	Common Terminal for DO_16~DO_31

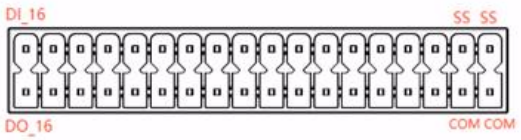
Note: The factory configuration is for 16 outputs. The 32 output configuration is optional.

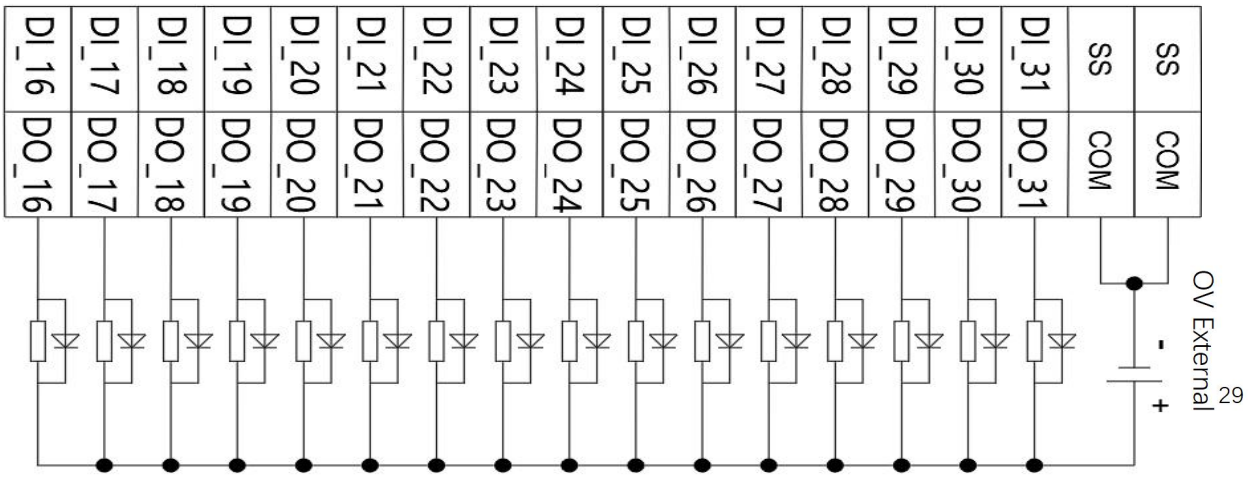
3.6.3 Connection Method



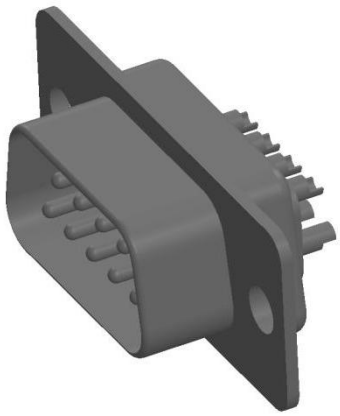


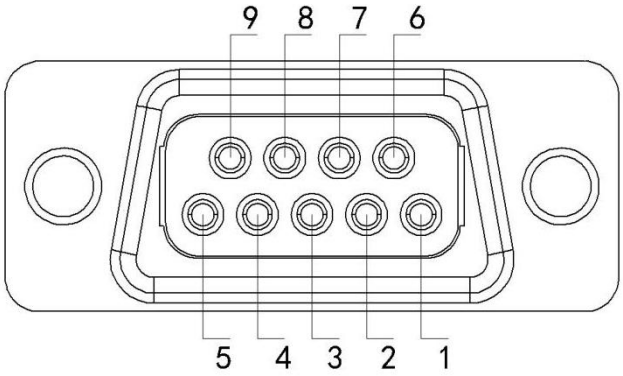






3.7 RS232/485





3.7.1 RS232/485 Interface Definition

Pin Number	Definition	Remarks
1	2RS485+	Driver (internal) RS-485 positive terminal
2	2RS485-	Driver (internal) RS-485 negative terminal
3	GND (internal)	Driver (internal) RS-485 shield ground
4	3RS485+	Controller network port shared RS-485+
5	3RS485-	Controller network port shared RS-485-
6	RS232+	Controller RS-232+
7	RS232-	Controller RS-232-
8	GND (common)	Shield ground
9	/	

3.8 Connecting the Teach Pendant

3.8.1 Teach Pendant Interface Definition

No.	Definition	Remarks	No.	Definition	Remarks
1	TX+	Teach pendant to controller communication wire	9	/	
2	TX-		10	/	
3	RX+		11	/	
4	RX-		12	/	
5	DC24V	Positive terminal of 24V power	13	/	
6	SDI0	Teach pendant emergency stop	14	/	
7	SDI0-1		15	DC0V	Negative terminal of 0V power
8	SDI1	Teach pendant manual/automatic input	/	/	

4.Safety function

4.1 overview

Safety functions are defined in IEC61508-1:

· safety-related systems comprising one or more electrical/electronic/programmable electronic devices;

·covers possible hazards arising from the failure of safety functions performed by E/E/PE safety-related systems;

·mainly for E/E/PE safety-related systems whose failure has an impact on human and/or environmental safety;

·considers E/E/PE safety-related systems, other technical safety-related systems and external risk reduction facilities so that safety specifications for E/E/PE safety-related systems can be determined in a systematic and risk-based manner.

In order to protect the operator from the dangerous action of the moving parts of the machine, reduce the risk when using the machine, and improve its safety, the robot controller has built-in safety features.

The functional safety of the robot is prevented by safe torque shutdown (STO), which prevents accidental starting and uncontrolled stopping.

This section describes the features and uses of the STO function of the robot controller.

4.2 STO Function Definition

The STO function is defined as an uncontrolled stop in the standard EN/IEC 61800-5-2 and corresponds to the stop category 0 of IEC 60204-1.

The EN/IEC 61800-5-2 standard defines the functions required for the safety of speed-regulated electric drive systems. According to this standard, when the STO function is enabled, electric motors that may cause movement will not be applied. The STO function can be used in situations where a power outage is required to prevent accidental start-up.

4.3 Security function risk assessment

When using the STO security feature, be sure to conduct a risk assessment of the device to confirm that the device meets the security level specified in the standard.

Even when STO functionality is used, the following dangers may still exist:

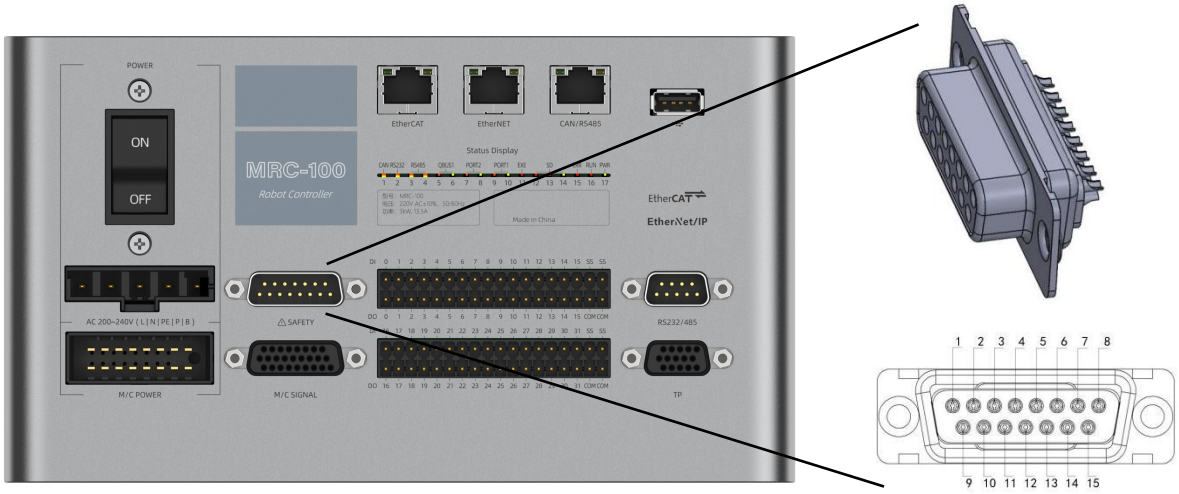
・If the power component of the servo controller fails and causes a short circuit between the servo motors, the servo motors can operate and continue to be excited within a maximum electrical Angle of 180 degrees. Be sure to use this action without causing danger.

・When mechanical installation and replacement of the controller, please be sure to perform a confirmation test for this function. If a connection error occurs, the normal use of this function may be affected, resulting in danger.

・The input power to the controller is not cut off when this function is performed. When maintaining and inspecting the controller, please work after the power is off.

4.4 STO pin distribution

Declare the approximate location and pin distribution of the STO interface in the robot controller.

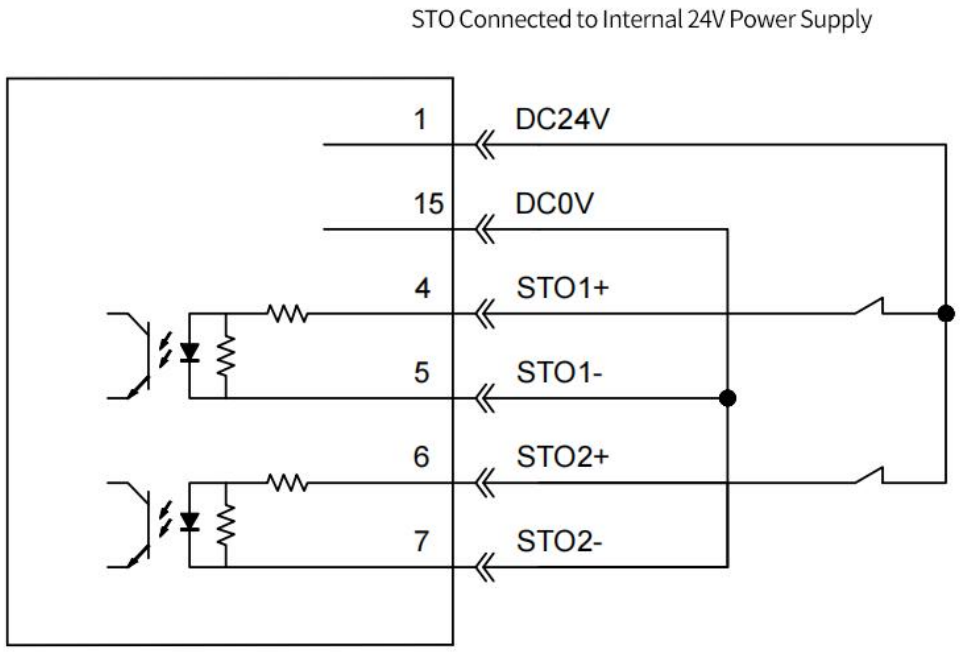


Pin Number	Definition	Remarks
1	DC24V	24V power supply positive terminal provided inside the controller
2	SDIO-1	Indicator scram access point
3	DC0V	
4	STO1+	Internal STO port 1 of the controller

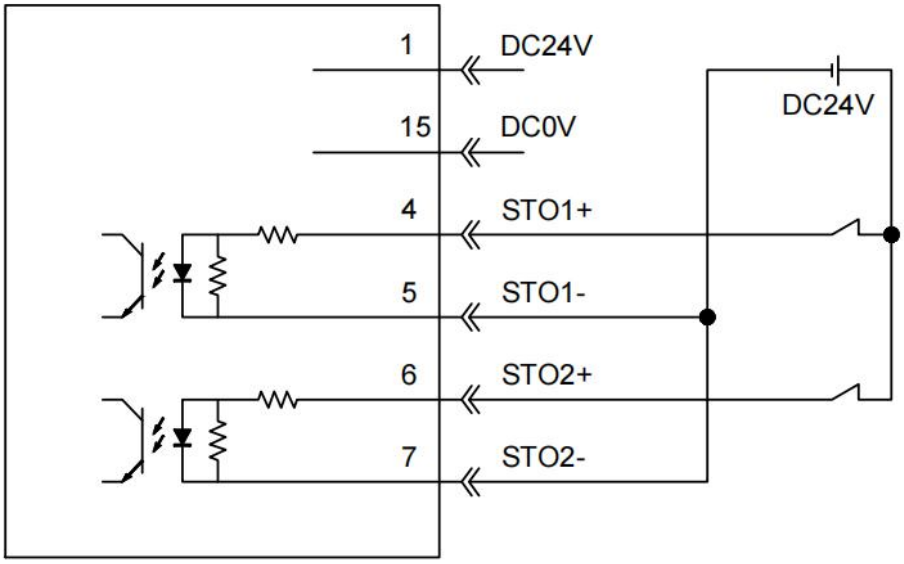
5	STO1-	
6	STO2+	Internal STO port 2 of the controller
7	STO2-	
8	SDO0	System alarm status output (low)
9	SDO1	Program running status output (low)
10	/	/
11	/	/
12	/	/
13	/	/
14	/	/
15	DC0V	24V power supply negative terminal provided inside the controller
By default, STO1/2 has been short-circuited to the internal power supply		

4.5 STO function implementation and wiring

The safe torque off (STO) function of the robot controller is to forcibly turn off the drive signal of the power device inside the servo driver from the safety input signal through the hardware circuit, thus turning off the output torque of the motor.



STO Connected to External 24V Power Supply



4.6 STO action timing

STO action sequence diagram during normal operation of robot controller: