Product Manual

Instructions for IRC-I8A-S Controller

Product Manual

Instructions for IRC-I8A-S Controller

V1.2

Copyright, 2022 Agilebot Robotics Co., Ltd. All rights reserved!

The information in this Manual must not be considered as a commitment of Agilebot and may be changed without prior notice. Agilebot assumes no responsibility for errors (if any) in this Manual.

Except as expressly specified in this Manual, nothing in this Manual shall be construed as any warranty or guarantee made by Agilebot for personal loss, property damage or specific applicability.

Agilebot assumes no responsibility for any accidents or indirect injuries caused by the use of this Manual or the product described therein.

This Manual and any parts thereof must not be reproduced or duplicated without written permission from Agilebot.

Additional copies of this Manual may be obtained from Agilebot.

The original language of this Publication is Chinese.

International standard units are adopted in all publications. GB means Chinese national standard.

© Copyright, 2022 Agilebot Robotics Co., Ltd. All rights reserved!

Agilebot Robotics Co., Ltd.

Shanghai, China

Revised

Ver.	Date	Status
V1.2	Nov 30, 2023	Delete
V1.3	Aug 21, 2023	Release

Table of Contents

Safety instructions **7**

I. Maintenance **13**

1 Summary **13**

2 Structure **14**

2.1 Appearance of controller 14

2.2 Functions of component units 17

2.3 Maintenance and repair 19

3 Resolution of common faults **20**

3.1 Don’t power on 20

3.2 When the teach pendant cannot be powered on (the LED of the teach pendant does not light up) 20

3.3 Alarm screen 21

3.4 Stop signal 23

3.5 Zero calibration 24

3.6 Resolution of common faults based on alarm codes 27

4 Replacement of units **34**

4.1 Steps before replacement 35

4.2 Replacement of safety board 36

4.3 Replacement of I/O board 36

4.4 Replacement of filter board 37

4.5 Replacement of Circuit Breaker 37

4.6 Replacement of power input port 38

4.7 Replacement of core board 38

4.8 Replacement of Controller Main Board 39

4.9 Replacement of drive board 39

4.10 Replacement of Power Soft Start Circuit Board 40

4.11 Replacement of AC-DC Power Supply 40

4.12 Replacement of fan unit 41

II. Connection **43**

1 Summary **43**

1.1 System configuration 43
1.2 External ports 44
2 Connection with devices 46
2.1 Connecting cables of the robot 46
2.2 Cables of teach pendant 46
2.3 Preparation of input power cable 47
2.4 Grounding and shielding connection 48
2.5 Elimination of interference 49
2.6 About leakage Circuit Breaker 50
2.7 About On/Off time of Circuit Breaker 50
2.8 Connection of external emergency stop signals 50
3 Peripheral devices 51
3.1 Ports of peripheral devices 51
3.2 Ports and connection of peripheral devices 57
3.3 Connection between safety board and peripheral devices 61
3.4 Connection between arm I/O port and peripheral devices 62
3.5 Connection of communication device (Ethernet port) 63
4 Handling and mounting 64
4.1 Handling method 64
4.2 Mounting method 65
4.3 Mounting conditions 66
4.4 Adjustment and confirmation items during mounting 67
Appendice 68
A. List of Specifications 68
B. Meaning of control system I/O signals of peripheral devices 70

Safety instructions

It is necessary to read and understand the contents described in this chapter before using robots.

In this Manual, the robot system refers to an integrated system integrating the industrial robot and its controller, teach pendant, cables, software and other accessories. So, it is required to fully consider the safety precautions of the user and the system.

Nobody is allowed to modify the industrial robot without authorization from Agilebot Robotics Co., Ltd. Agilebot Robotics Co., Ltd. shall assume no responsibility for any damage to the industrial robot or its components due to the use of any other components (software, tools, etc.) not provided by Agilebot.

Agilebot Robotics Co., Ltd. assumes no responsibility for any consequences caused by misuse of the industrial robot. The misuse includes:

- Use the robot beyond the specified parameter range
- Use it as a carrier for humans or animals
- Use it as a climbing tool
- Use it in explosive environments
- Use it without safety protection

Besides safety precautions in this chapter, this Manual contains other safety instructions, which must be followed as well.

Definition of user

The operators are defined as follows:

- Operator

  Perform power-on/off operation on the robot.

  Start the robot program from the panel board.

- Robot Engineer

  Operate the robot.

  Perform teaching and programming debugging of the robot within the safety fence.

- Maintenance Engineer

  Operate the robot.

  Perform teaching of the robot within the safety fence.

  Carry out maintenance (repair, adjustment, replacement) operations on the robot.

The “Operator” is not allowed to enter the safety fence.

The "Robot Engineer" and "Maintenance Engineer" can carry out operations within the safety fence.

The operations within the safety fence include handling, setting, teaching, adjustment, maintenance, etc.

To carry out the operations within the safety fence, it is necessary to receive professional training on the robot.

When operating, programming and maintaining the robot, the operator, programmer and maintenance engineer must give a safety warning and wear at least the following protective articles.

- Work clothes suitable for operations
- Safety shoes
- Safety helmets

Definition of safety records

This Manual includes safety warnings to ensure personal safety of the users and avoid any damage to the machine tool and describes them with "Danger" and "Warning" in the main text based on their importance in safety.

In addition, relevant supplementary explanations are described as "Caution".

Before use, the user must thoroughly read the precautions described in "Danger", "Warning" and "Caution".

Identification	Definition
Danger	It indicates dangerous situations possibly resulting in serious injury or death to the user during incorrect operation.
Warning	It indicates dangerous situations possibly resulting in mild or moderate personal injury or property damage during incorrect operation.
Caution	It provides supplementary explanations outside the scope of danger or warning.

Please read this Manual carefully and keep it secure for easy reference at any time.

Warnings and precautions related to operation of the controller

Warning

Warnings and precautions related to operation of the controller

1. IRC-I8A-S is a closed structure. During design, it is required to prevent dust, oil mist and other conductive foreign objects around the controller from entering its interior. Regardless of whether the controller is running or not, its airtightness may be lost if it is not locked properly, leading to a malfunction and even possible electric shock, leakage or fire due to insulation degradation.

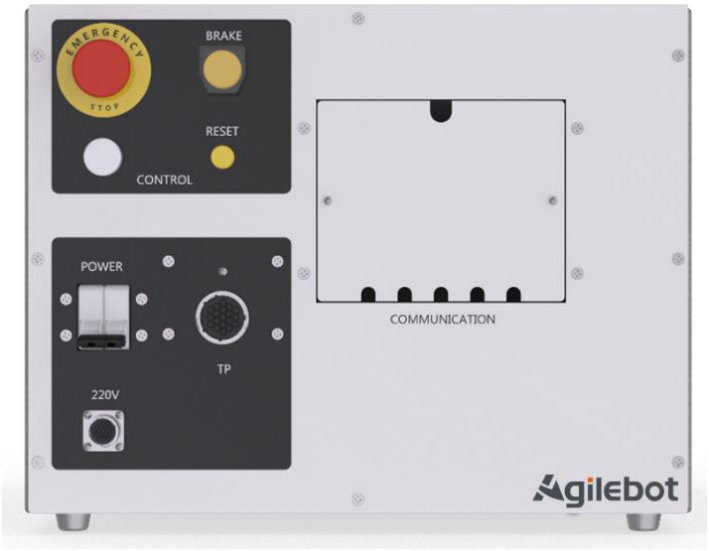
2. Except for maintenance engineers, nobody is allowed to open the door of the controller. So, please lock it properly.

3. To prevent electric shock, do not power on the controller while the door is open.

4. Lock the Circuit Breaker to prevent power-on if the controller is connected to the power source.

5. Provide more than one E-stop button within reach of the operator according to the system configuration.

Make sure to connect the ground wire when the controller is connected to the power source.



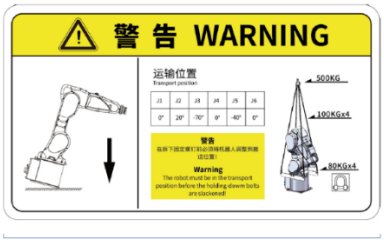
Safety warning label

Both the robot and the controller bear several safety and information labels, which contain important information related to the product. This information is very useful for all persons operating the robot system, e.g. during mounting, maintenance or operation.

The safety labels are only graphical and applicable to all languages.

Caution
It is required to observe the safety and health signs on the product label. In addition, it is also necessary to comply with the supplementary safety information provided by the system builder or integrator.

Sign	Description
	An electric shock may occur if the internally energized parts of the controller are touched when powered on.
	Operation against the instructions may result in an accident of injury and/or product damage. This is a warning message applicable to certain functional requirements.
	Grounding sign of controller
	Electric shock

Sign	Description
	Keep your hand away from moving parts, otherwise your hand or fingers may get stuck between the axis and the cover. The robots equipped with telescopic covers do not pose the risk of pinching hands or fingers. Therefore, they do not have this label.
	Never enter the work area while the robot is moving. Otherwise, the robot may collide with the operator. This is very dangerous and may cause serious safety issues.
	Beware of burns due to high temperature.
	Handling and hoisting
	Beware of collision in the work area.

I. Maintenance

1 Summary

This Instructions is applicable to the IRC-I8A-S controller.

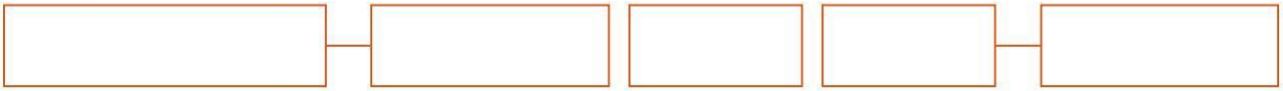
It describes the maintenance and connection of IRC-I8A-S for the robot.

Maintenance: Resolution of common faults, unit setting, adjustment and replacement methods

Connection: Methods for connecting IRC-I8A-S and the robot mechanism and peripheral devices and mounting the controller.

> ⚠ Warning
>
> Provide more than one (inclusive) E-stop button within reach of the operator according to the system configuration. Please disconnect the power supply of the controller or press the E-stop button when entering the range of motion of the robot.

Naming rules for robot controller



Category	
IRC	Industrial robot controller

Technical characteristics	
I	Integrated
D	Drive-distributed

Number of axles	
4	4 axes
6	6 axes
8	8 axes

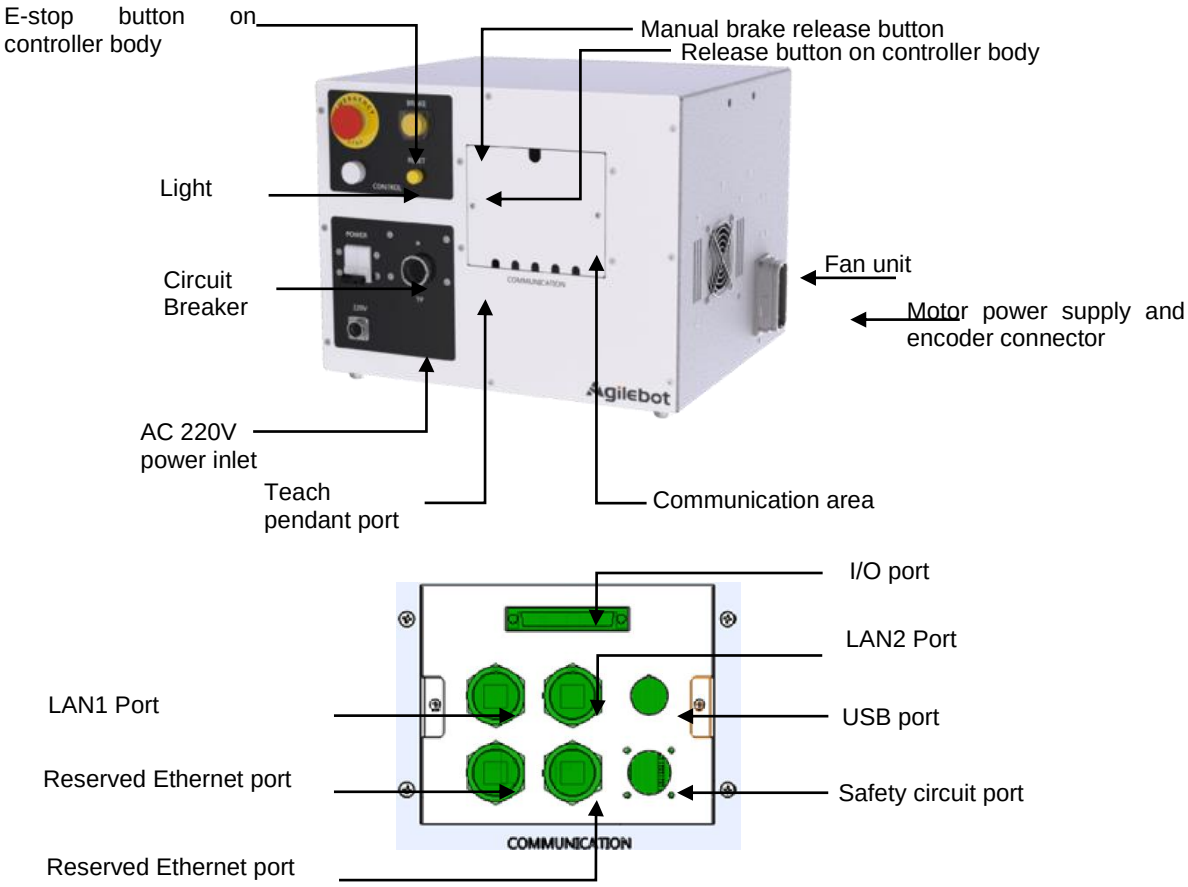
Version	
A	Generation I
B	Generation II

Type	
Blank	Standard
S	Small
C	Compact

2 Structure

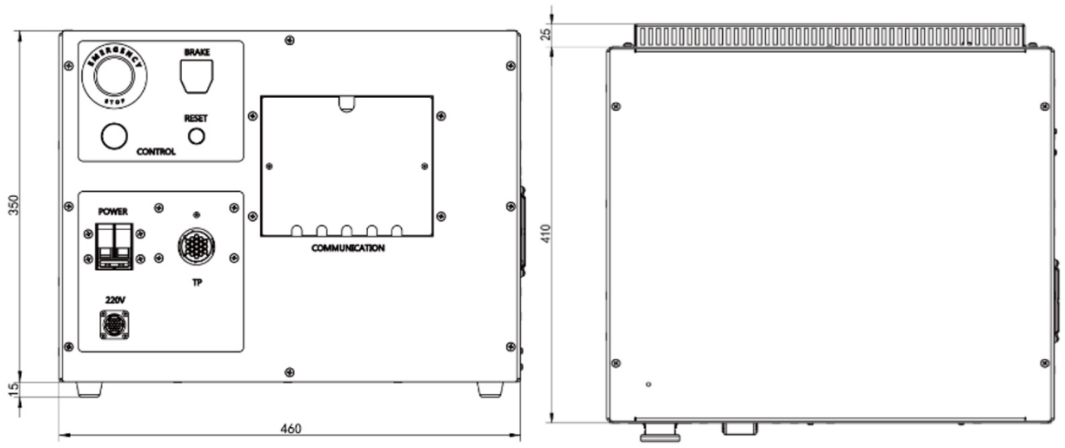
2.1 Appearance of controller

The appearance and components of the controller may vary slightly according to the robot, various option configurations and application programs.



(Communication area)

Fig. 2.1 Appearance of IRC-14A-C Controller



Front view

Top view

Fig. 2.2 Dimensions of Controller

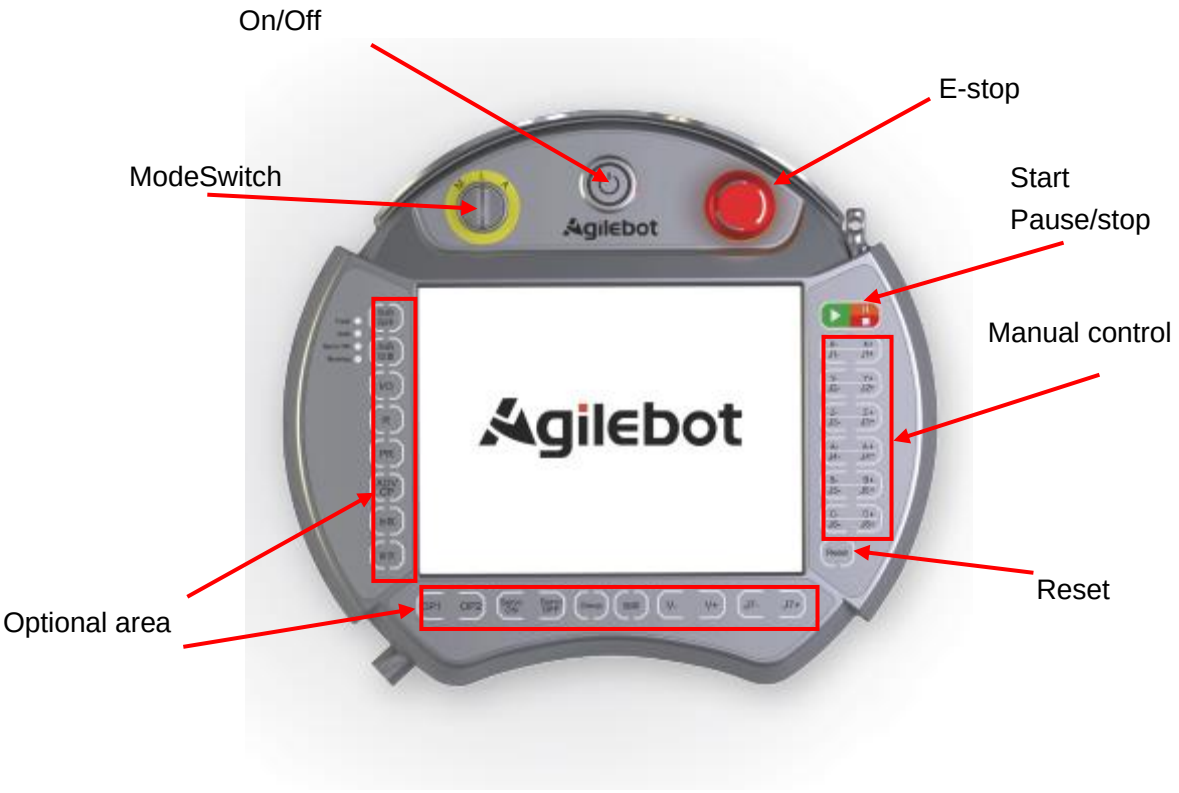


Fig. 2.3 Front View of Teach Pendant

Three-Postion Enabling Switches

Fig. 2.4 Rear View of Teach Pendant

⚠ Caution

When the USB port on the controller is used to back up related data of the robot, it is recommended to use a storage device in the FAT32 format of the USB2.0 protocol and with a capacity between 8G-32GB, such as USB flash drive, mobile hard drive, etc.

The recommended USB drive brands and models are shown in the table below:

Brand	Model	Capacity
Kingston	DTXM	32G
SanDisk	CZ73	32G

The USB memory has security features and the product requiring password authentication when accessing to the drive cannot be used.

2.2 Functions of component units

The following figure illustrates the internal structure and main component functions of the IRC-I8A-S controller.

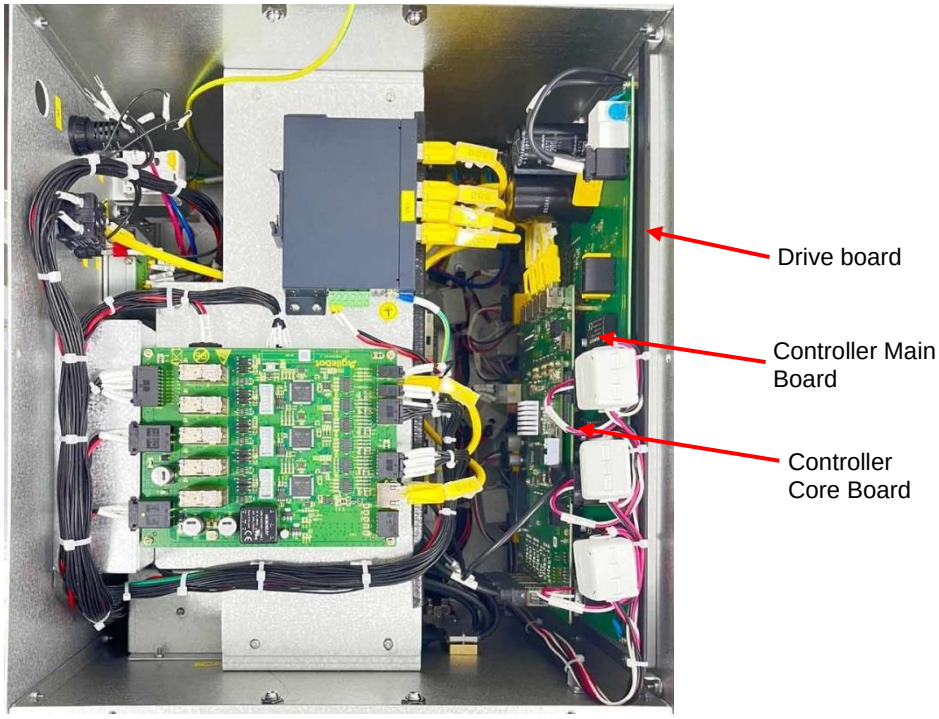


Fig. 2.5 Interior of Controller

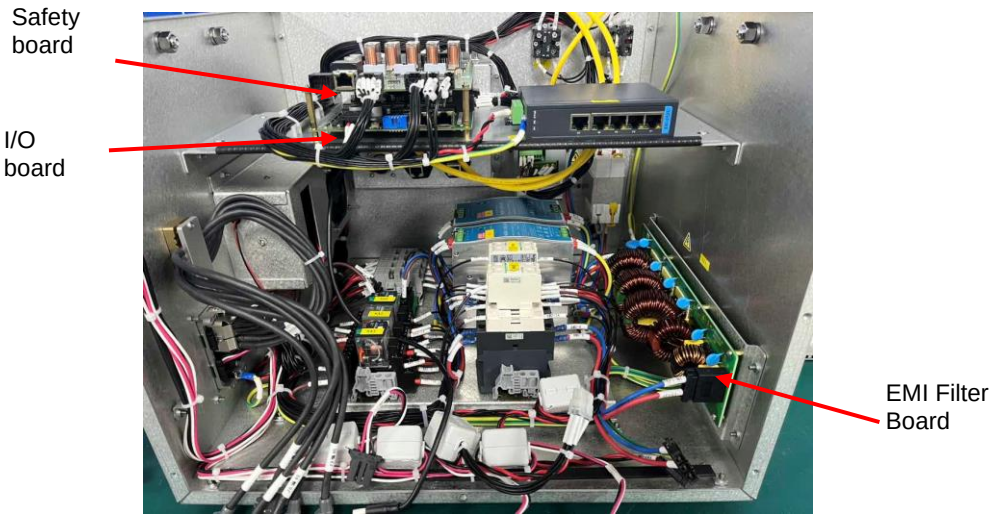


Fig. 2.6 Interior of Controller

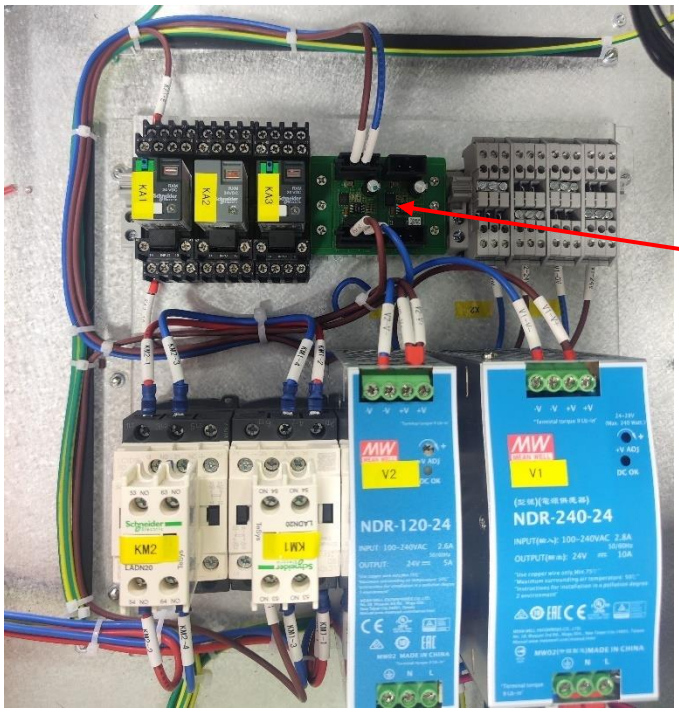


Fig. 2.7 Interior of Controller

Controller Core Board: The core circuit of main control mainly realizes servo control and motion control of the robot controller.

Controller Main Board: Peripheral circuits of main control, including the circuits for encoder port, IO port, Ethernet port, USB port, RS485, RS232 and other ports; it is integrated with safety board functions and can achieve board expansion of 2 slots.

EMI Filter Board: It achieves EMI noise suppression, reduces the conducted radiation of the noise generated by the robot on the power grid and suppresses external conducted interference to the robot.

Drive board: The motor drives the power circuit to input a weak current control signal and outputs the driving current required for motor rotation.

I/O board: An electrical signal management board used by the robot to communicate with peripheral devices, e.g. end-effector and external devices. The I/O board in standard configuration can provide 6 RI ports, 6 RO ports, 25 DI ports and 25 DO ports.

Safety board: The safety logic management component of the robot control system, which centrally controls safety functions and operation logics of the entire system, ensuring the safety and reliability of the whole control system.

2.3 Maintenance and repair

It is possible to maintain the performance of the robot in a long-term stable state through daily maintenance, regular maintenance and regular repair.

- **Daily maintenance**

  During daily operation of the system, clean and repair all parts, check for cracks or damage on each part and conduct maintenance for the following items at any time.

  Before running:

  Confirm if the teach pendant cable is excessively twisted. Please confirm if the controller and peripheral devices are abnormal.

  After running:

  Return the robot to the appropriate position and cut off the power supply to the controller after running. Confirm whether there are cracks or damages while cleaning and maintaining various parts. Clean excessive dust (if any) attached to the vent of the controller.

- **1-month maintenance**

  1) Confirm if the fan rotates normally. Clean excessive dust and other impurities (if any) adhering to the fan.

  2) Confirm that an alarm is detected after the emergency stop is input, or stop and reset the controller to confirm normal startup in order to confirm normal operation of safety functions.

  3) Check for any abnormal stains outside the controller. If any, please identify the cause and take necessary measures to clean them. Check whether the cable port is connected securely and reliably.

- **Maintenance tools**

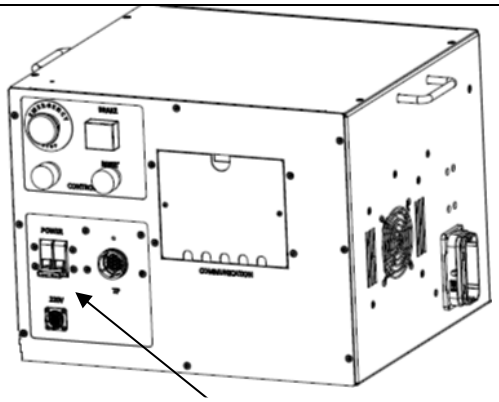
  It is recommended to prepare the following measuring instruments as maintenance tools: AC/DC voltmeter (sometimes, a digital voltmeter is required)

  1) Measuring instrument: AC/DC voltmeter (sometimes, a digital multimeter is required)

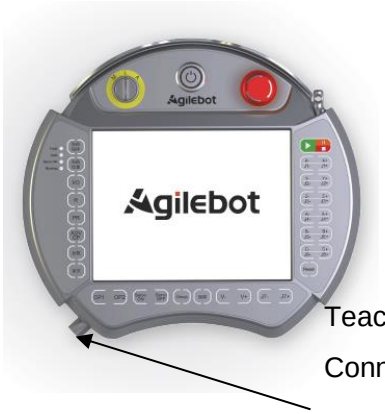
  2) Tools: Phillips screwdriver, slotted screwdriver, socket screwdriver, wire pliers, scissors and tweezers.

3 Resolution of common faults

3.1 Don’t power on

Inspection and treatment	Diagram
Inspection 1: Confirm that the Circuit Breaker has been switched on. Treatment 1: Switch on the Circuit Breaker when it is not connected. Treatment 2: Check if the Circuit Breaker is in a trip state.	 Circuit Breaker

3.2 When the teach pendant cannot be powered on (the LED of the teach pendant does not light up)

Inspection and treatment	Diagram
Inspection 1: Confirm if the Teach Pendant connection cable is damaged. Inspection 2: Confirm if the pin of the Teach Pendant Connector is damaged. Treatment 1: Check if the cable is damaged and replace it if damaged. Treatment 2: Check if the pin is damaged and replace it if damaged.	 Teach Pendant Connector

3.3 Alarm screen

Check if the robot currently has alarms and view the alarm history by the following operations.

1. In the main screen of the teach pendant, click on the tab in the red box below in Fig. 3.1 for the Active Alarm to pop up as shown in Fig. 3.2.

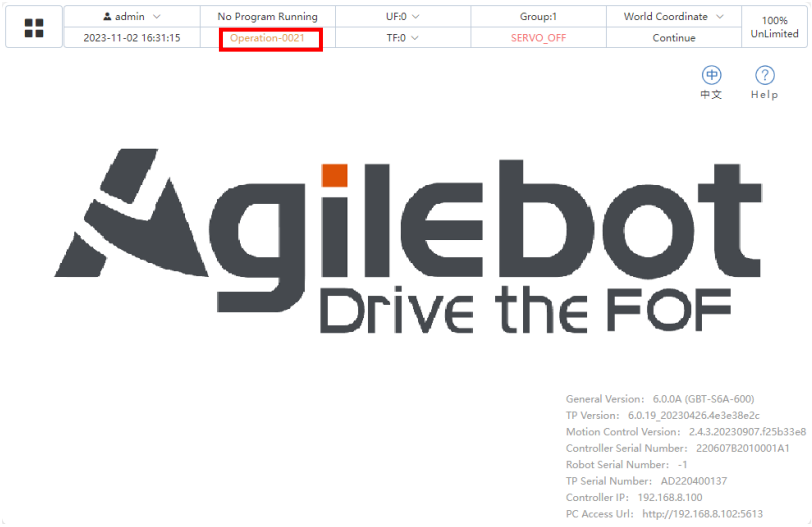


Fig. 3.1 Main Screen of Teach Pendant

2. Click on the History Event to view the Active Alarm log and the alarm history, as shown in Fig. 3.3.

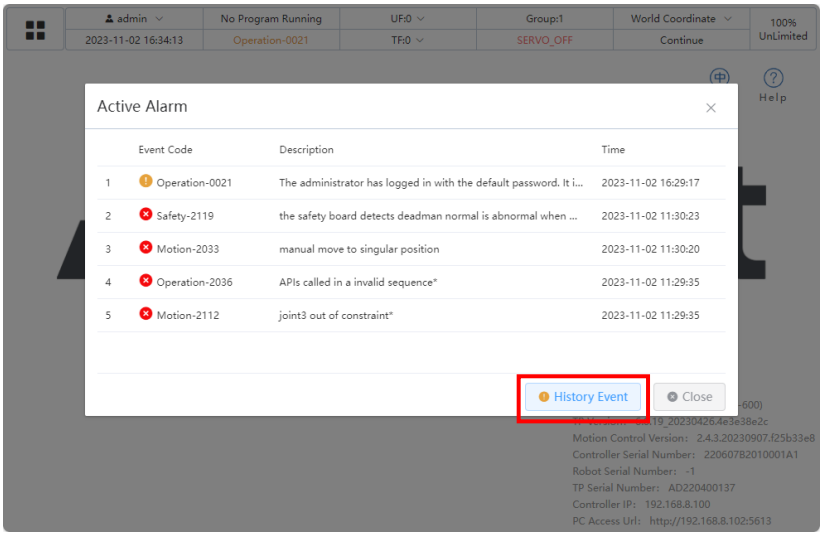


Fig. 3.2 Active Alarm Popup

3. After clicking on the History Event, Event Codes and Descriptions of all levels will pop out. Click on the red box in Fig. 3.3 to filter the event levels.

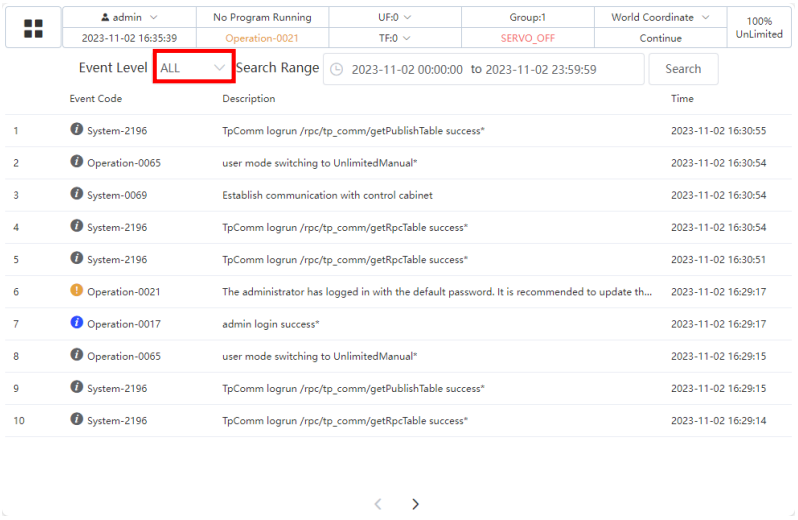


Fig. 3.3 History Event Screen

4. After filtering the event levels, you can see corresponding event descriptions as shown in Fig. 3.4.

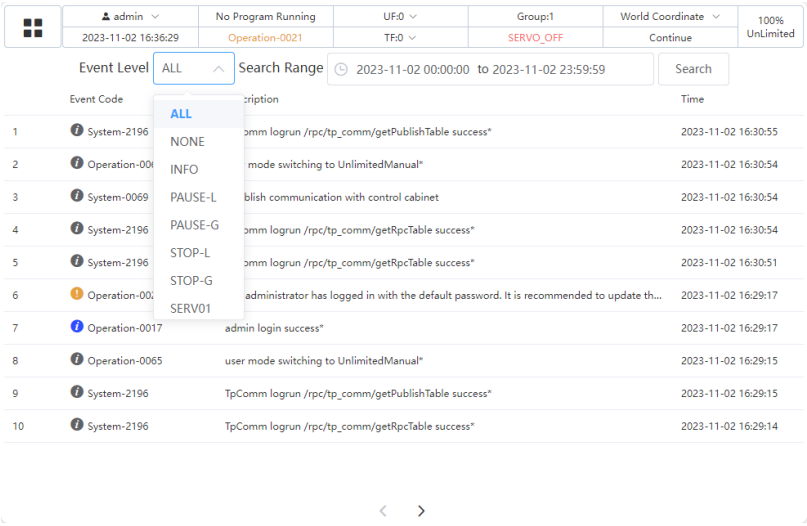


Fig. 3.4 Selection of Event Levels

3.4 Stop signal

The following table describes stop signals of the controller. The controller can stop the motion of the robot through external buttons and the means in the following table.

Stop signal	Description
External E-stop button	It indicates the status of the external emergency stop signal and is pressed to stop running.
Limit switch	The device stops running when it is enabled.
Safety door	It indicates the status of the safety door. The device stops running when the safety door is opened.
Safety switch (enable device)	It indicates whether the safety switch on the teach pendant is held in the appropriate position. When the teach pendant is valid, releasing or holding the safety switch may trigger an alarm and disconnect the power supply of the servo device.
Emergency stop of teach pendant	It indicates the status of the E-stop button on the teach pendant and TRUE is displayed when it is pressed.

3.5 Zero calibration

Zero calibration is required in the following two cases.

Case 1: A zero-calibration loss alarm or zero-calibration abnormality alarm occurs.

Case 2: The motor is replaced, the battery discharged or the encoder cable disconnected.

In Case 1, only a simple zero calibration is required. In Case 2, please contact us for technical services.

Simple zero-calibration steps are listed in the following:

1. Click on the login window of the TP screen, and the screen shown in Fig. 3.5 will pop up. Click on “Name” and select "admin", enter the password "123", and then click "Confirm" to log in.

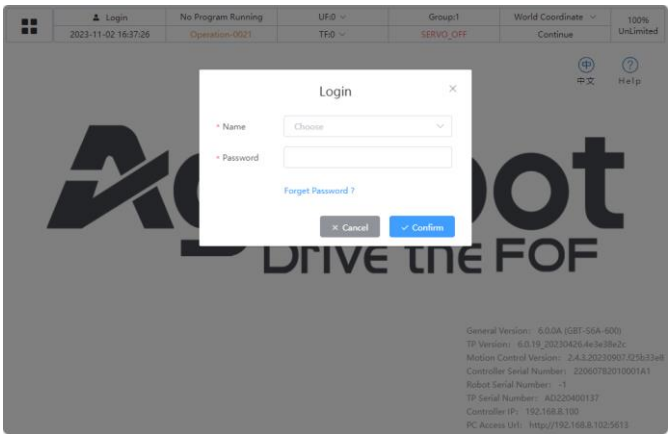


Fig. 3.5 Login Popup

2. Click on the menu icon at the upper left corner of the TP screen.

Fig. 3.6 Menu Button at Upper Left Corner

3. Click on the “System” option.

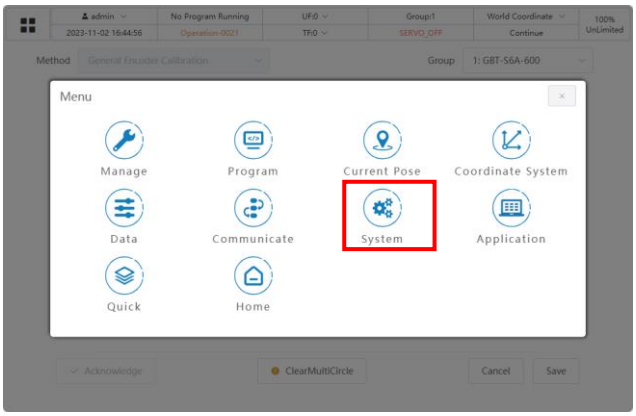


Fig. 3.7 Click on “System” in the Menu

4. Click on the “Basic Setting” option.

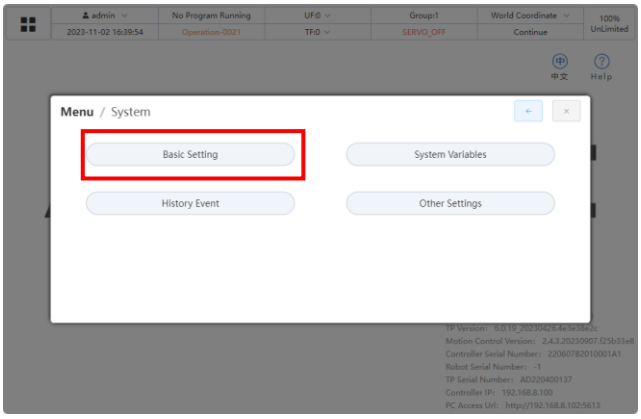


Fig. 3.8 Click on “Basic Setting” in System

5. Click on the “Encoder Calibration” option.

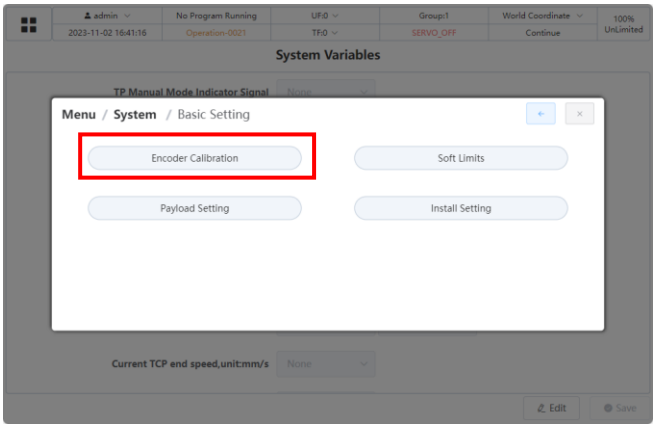


Fig. 3.9 Click on “Encoder Calibration” in Basic Setting

6. If the Status is “uncalibrated” on the calibration screen, it means that the zero-calibration information of the axis is lost and should be calibrated.

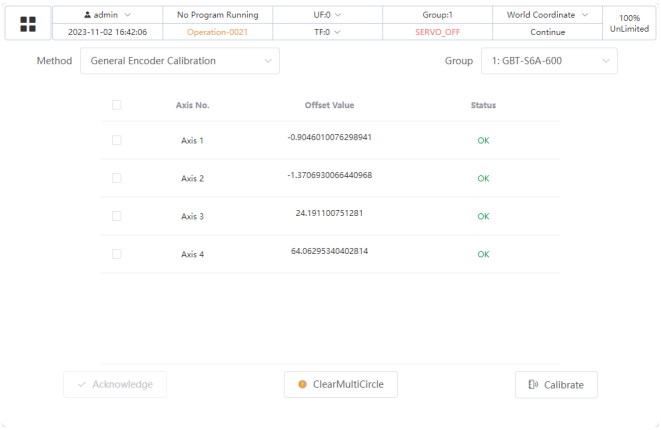


Fig. 3.10 Zero-calibration Status Screen

7. Select between “General Encoder Calibration” and “Direct Input Encoder Calibration”.

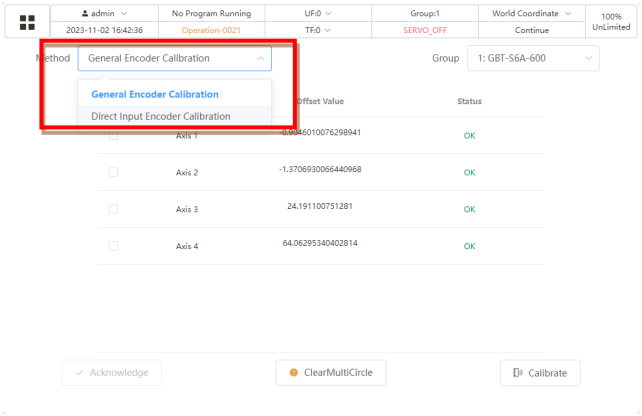


Fig. 3.11 Selecting Calibration Methods

8. Select the axis to be calibrated on the left and click “Calibrate” to perform the calibration.

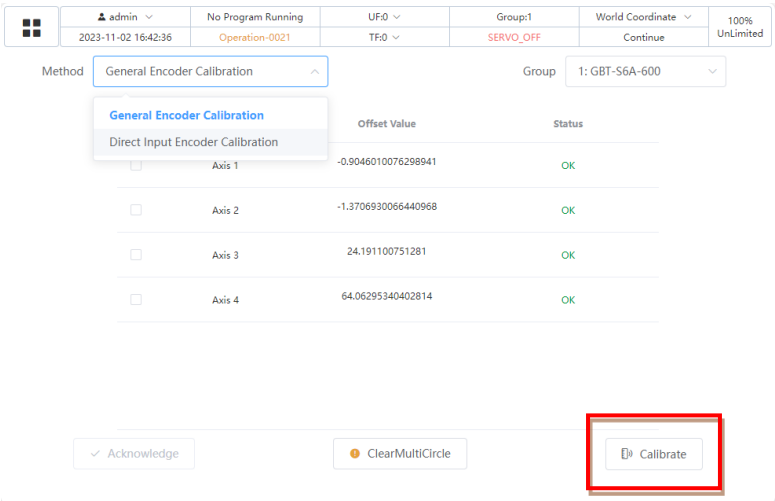


Fig. 3.12 Click “Calibrate” for Calibration

9. A prompt message indicating “Calibration success” will appear on the upper right corner after successful calibration. Click "Save" to complete the calibration.

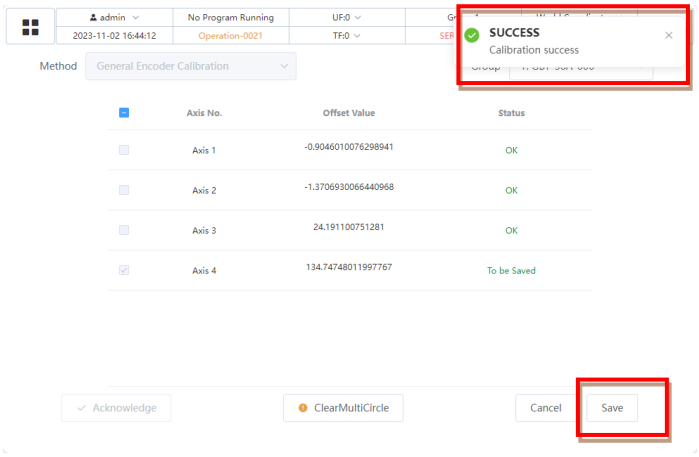
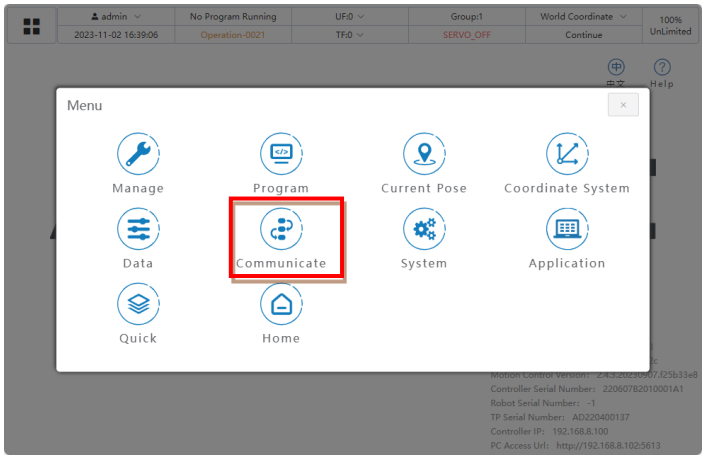
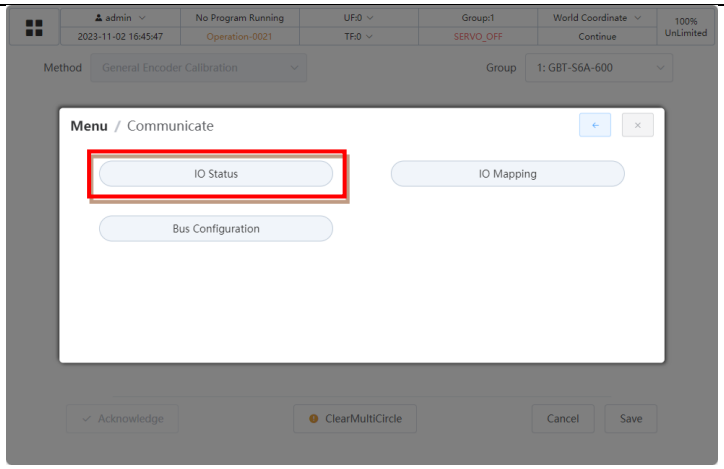


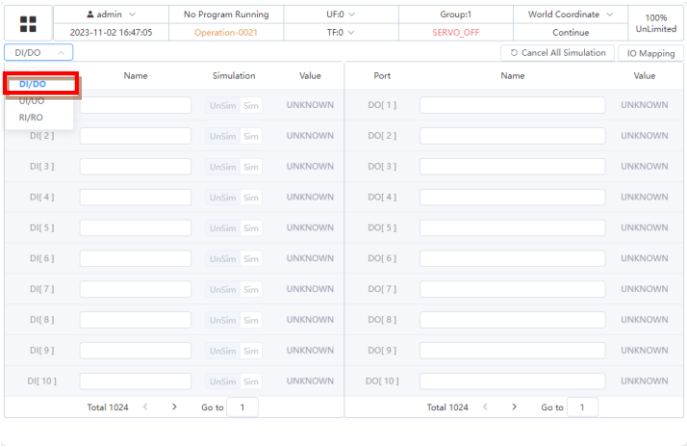
Fig. 3.13 Click “Save” to complete the Calibration

3.6 Resolution of common faults based on alarm codes

Motion-A32097 - UI servo enable is off*
Phenomenon: UI servo enable is off Result: Stop Cause: triggered by UI signal Countermeasure: Keep the UI signal at a high level. Otherwise, the low level may trigger a Class 0 stop. (1) To view the UI signal, click on the menu at the upper left corner of the TP screen, as shown below, and then click “Communicate”.      (2) On the “Communicate” screen as shown below, click “IO status” to view the IO signal.



(3) On the “IO status” screen as shown below, click on the button circled in red to view different types of signals.



(4) UI1, UI2 and UI5 should be normally closed signals as shown below.

Safety-2115 - The safety board dual channel data are not the same.*

Phenomenon: The safety board dual channel data are not the same. Result: ESTOP status Cause: error in hardware signal Countermeasure: Check if the safety circuit on the safety board is normal.

Safety-2116 - The safety board detects external stop signal.*
Phenomenon: The safety board detects external stop signal. Result: ESTOP status Cause: status of hardware signal Countermeasure: Check external ESTOP signal.

Safety-2117 - The safety board detects safety door stop signal.*
Phenomenon: The safety board detects safety door stop signal. Result: ESTOP status Cause: status of hardware signal Countermeasure: Check safety door signal.

Safety-2118 - The safety board detects limited stop signal.*
Phenomenon: The safety board detects limited stop signal. Result: ESTOP status Cause: status of hardware signal Countermeasure: Check the limit signal.

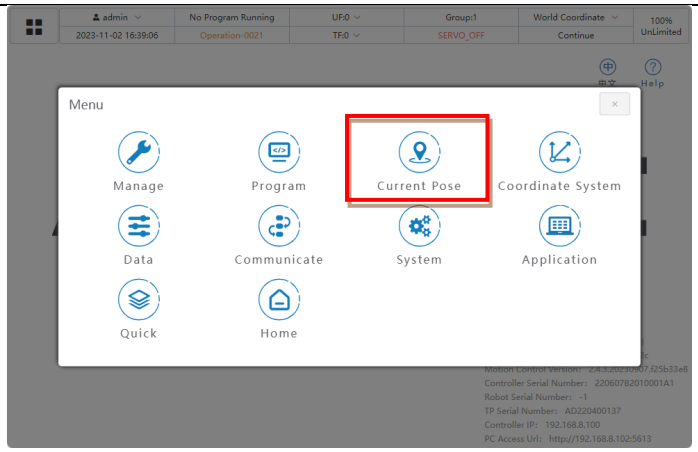
Safety-2119 - The safety board detects Deadman Normal is abnormal when in manual mode.*
Phenomenon: The safety board detects that Deadman Normal is releases in manual mode. Result: ESTOP status

Cause: status of hardware signal Countermeasure: Check if the Deadman button is pressed in the manual mode.

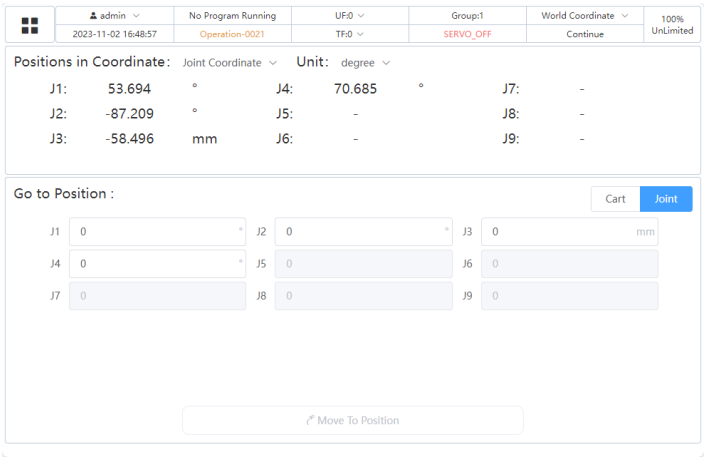
Safety-2122 - The safety board detects TP-ESTOP signal.*
Phenomenon: The safety board detects TP-ESTOP signal. Result: ESTOP status Cause: status of hardware signal Countermeasure: Check the TP-ESTOP button.

System-2193 - Controller detects the safety board is not ready when reset operation*
Phenomenon: The robot cannot be powered on after RESET is pressed. Result: The operation fails. Cause: The safety board signal is not ready. Countermeasure: Check the alarm codes reported simultaneously and the safety board signal

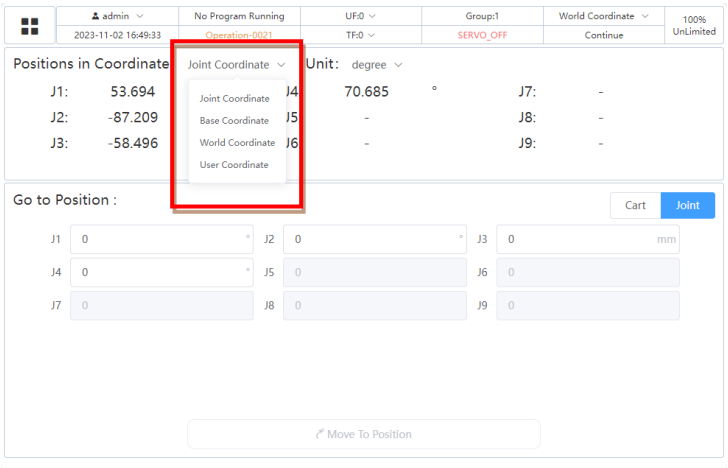
Motion-2110-Motion-2115 - Joint out of constraint* (Axis 1 - Axis 6)
Phenomenon: Joint out of constraint Result: The program cannot run continuously. It is paused and should be reset. Cause: Input joint value exceeds the constraint. Countermeasure: Move the robot to within the soft limit position. Perform the following operations when it exceeds the soft limit. 1) View current position message and soft limit position message of each axis. 2) Implement zero calibration due to the soft limit caused by the loss of zero calibration. The operation steps are as follows for Case 1: 1. Click the menu button and then click “Current Pose”.



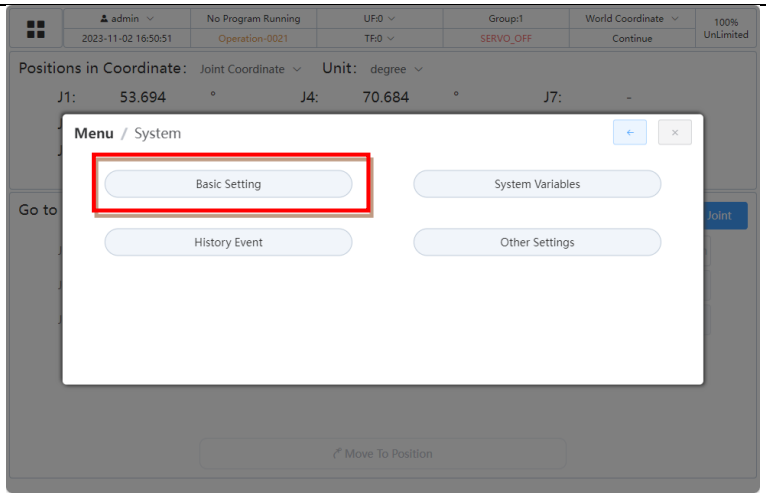
2. After clicking “Current Pose”, you can view the position information of each axis as shown below.



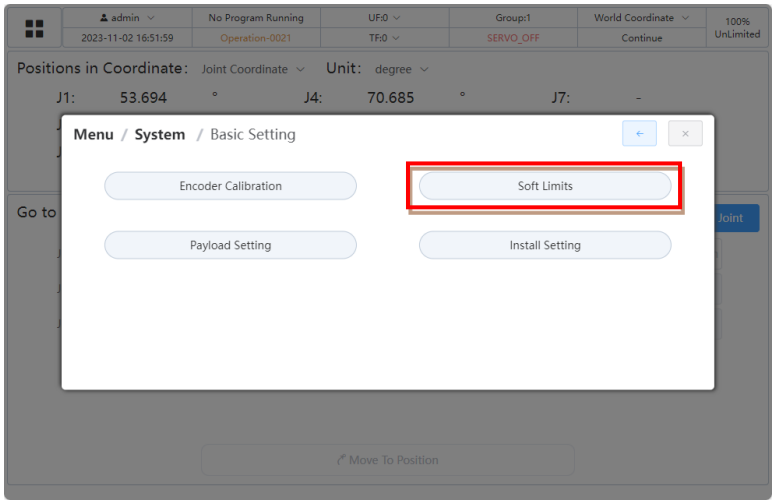
3. Switch relative coordinate systems to view the position information of each axis under different coordinate systems, as shown below.



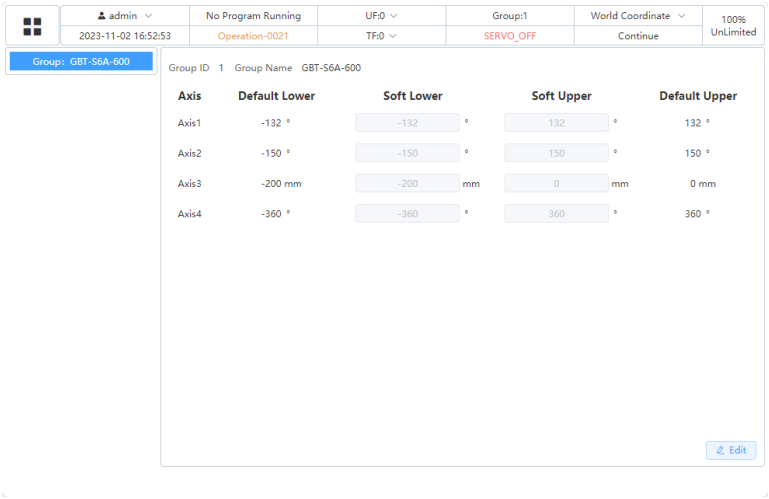
4. Click “System” as shown below, then click “Basic Setting” to show the “Soft Limits” button.



5. Click “Soft Limits” to view the soft limit positions of each axis.



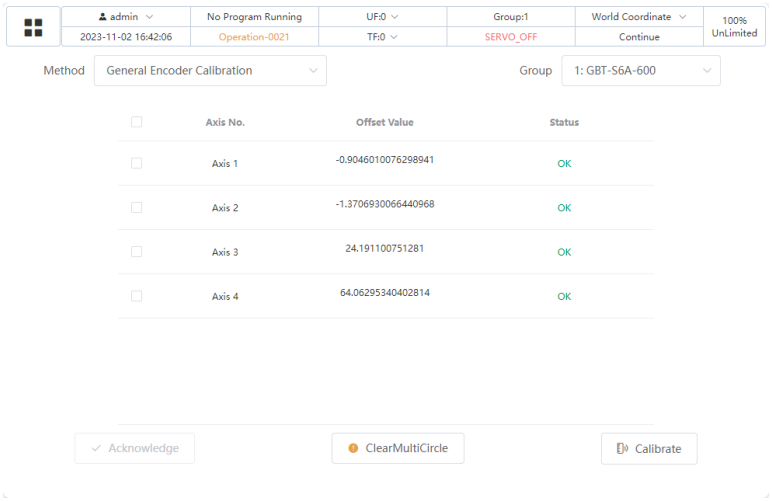
6. The Soft Lower and Soft Upper of each axis are shown as below.



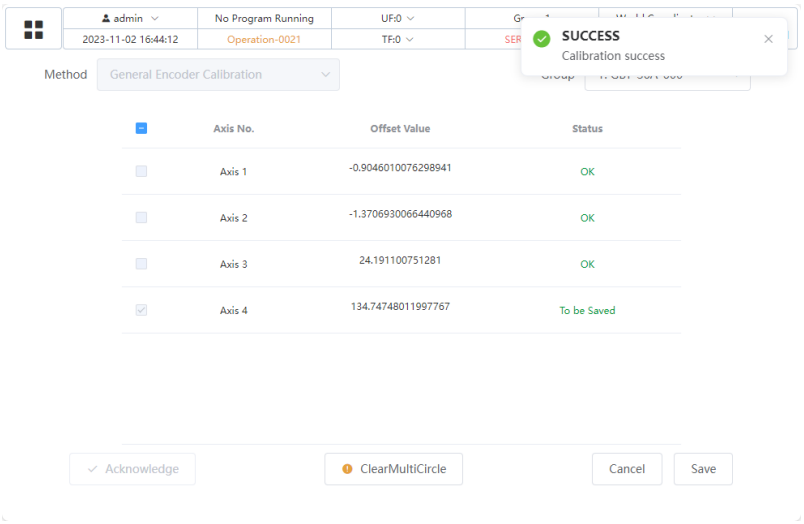
Operation steps for Case 2 are as follows:

1. The soft limit error may also be caused in case of loss of zero calibration. Click Basic Setting - Encoder Calibration to open the calibration screen. If the Status is “uncalibrated”, it should be calibrated

again.



2. A prompt message indicating “Calibration success” will appear on the upper right corner after successful calibration. Click "Save" to complete the calibration.



4 Replacement of units

This chapter describes the methods for replacing each unit in the controller.

Warning

When units or printed circuit boards are replaced through maintenance and repair, turn off the Circuit Breaker and remove the power cord. Do not touch internal units or printed circuit boards in 1 min after the Circuit Breaker is turned off. It is only allowed in the safe state that surrounding machines or other devices are not moving.

Warning

When replacing parts, make sure to read the Maintenance Manual in advance and proceed with the operation after fully understanding the operating steps. Operations in wrong steps may lead to unexpected accidents, resulting in damage to the robot or injury to the operator.

Caution

Please note that the parts inside the controller may be hot. Heat-resistant gloves and other protective devices should be available when it is necessary to touch the equipment in a hot state.

Caution

1) When removing the printed circuit board, make sure to avoid touching the semiconductor parts on the circuit or other parts with hands. It is required to confirm that the settings for the printed circuit board to be replaced have been correctly made.

2) After replacement, correctly adjust the printed circuit board to be adjusted.

3) The replacement of the rear panel, power unit or main board (including base board and module) may sometimes result in the loss of robot parameters, teaching data, etc. Therefore, it is necessary to back up the data in the memory card in advance.

4) Re-mount the cables removed during replacement. If unable to figure out the joints, make appropriate records before removing the cables.

4.1 Steps before replacement

Disconnect the power supply of the controller.

(1) Switch off the Circuit Breaker.

(2) Remove the power cable.

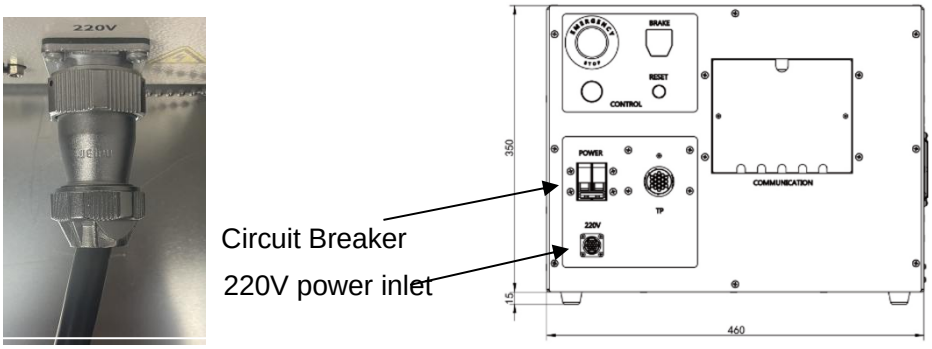


Fig. 4.1 Power Inlet

Remove the top cover of the controller.

(1) Unscrew the screws on the top cover.

(2) Lift the cover upwards slowly.

Remove the back cover of the controller.

(1) Unscrew the screws on the back cover.

(2) Remove the back cover.

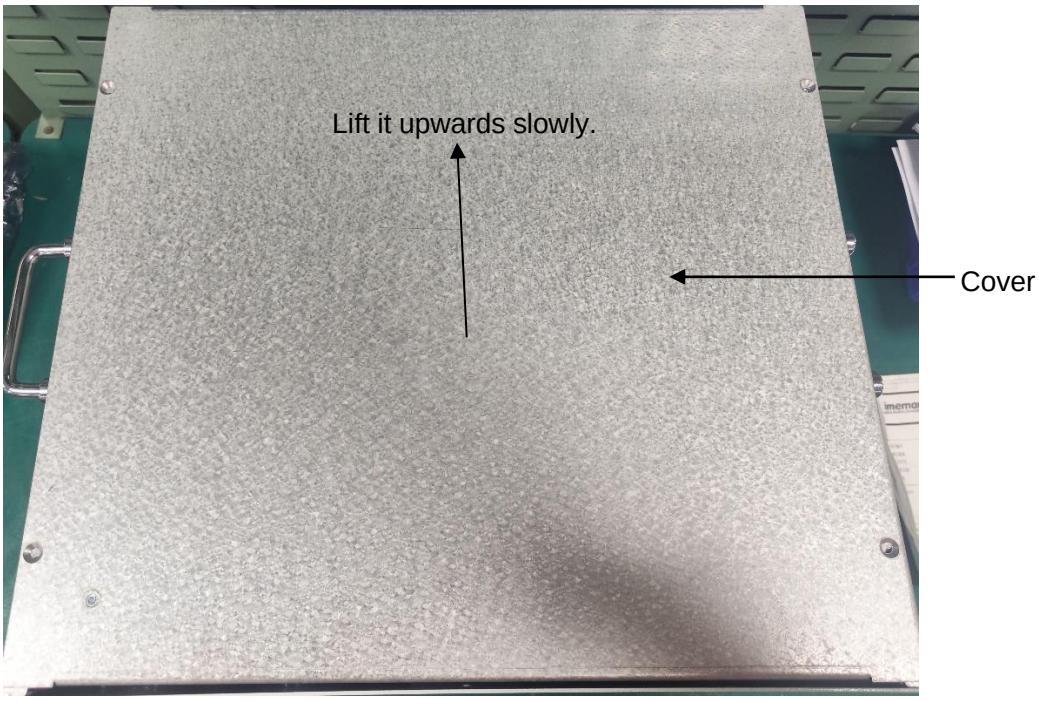


Fig. 4.2 Top Cover

Fig. 4.3 Back Cover

4.2 Replacement of safety board

(1) Remove cables on safety board.

(2) Dismantle M3 nuts to replace the safety board.

(3) Mount the safety board according to the reverse steps of removal.

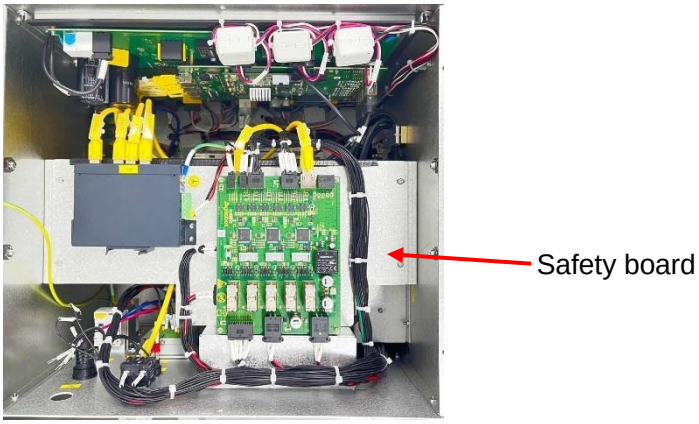


Fig. 4.4 Safety Board

4.3 Replacement of I/O board

(1) Dismantle the safety board firstly before removing the I/O board. Please refer to Section 4.2 for details.

(2) Dismantle the fixing copper studs on the I/O boards to remove it.

(3) Mount the I/O board according to the reverse steps of removal.

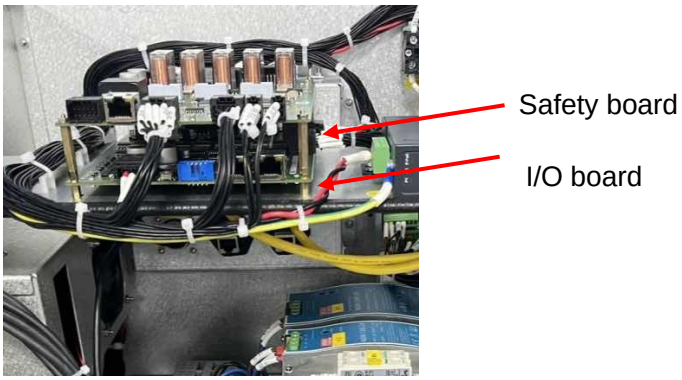


Fig. 4.5 I/O Board

4.4 Replacement of EMI filter board

(1) Unscrew the fixing screws on the EMI filter board.

(2) Remove cables on the EMI filter board.

(3) Mount the EMI filter board according to the reverse steps of removal.

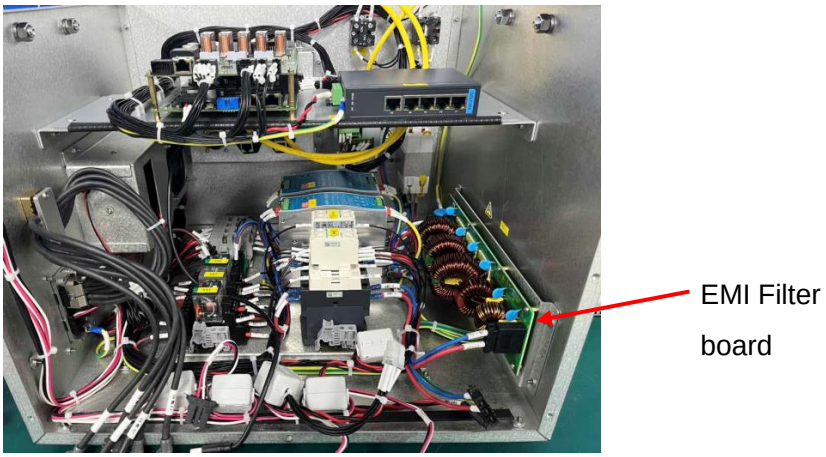


Fig. 4.6 EMI Filter Board

4.5 Replacement of Circuit Breaker

(1) Unscrew the fixing screws on the Circuit Breaker.

(2) Remove cables on the Circuit Breaker.

(3) Mount the Circuit Breaker according to the reverse steps of removal.

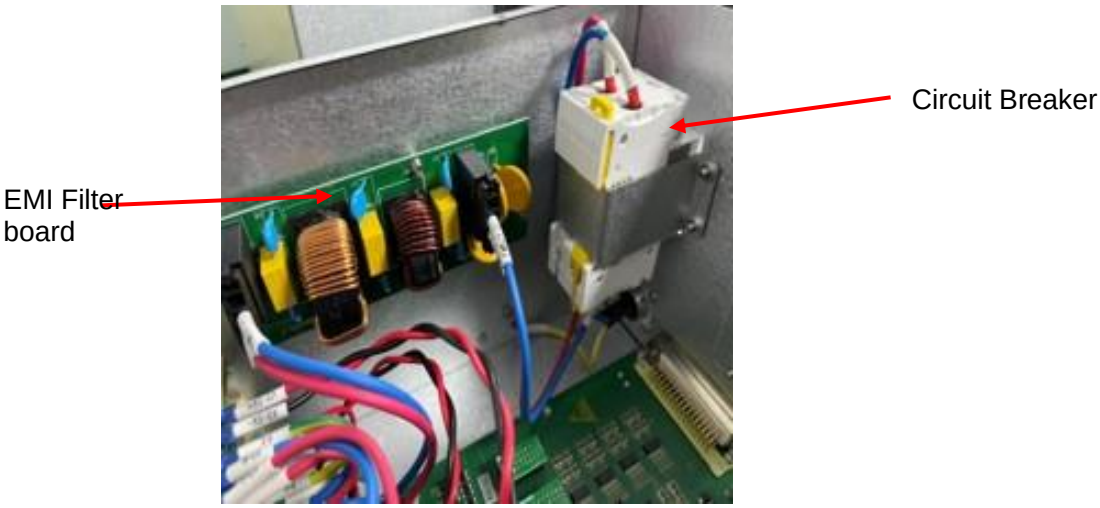


Fig. 4.7 Circuit Breaker

4.6 Replacement of power inlet

(1) Unscrew the screws on the power inlet.

(2) Mount the power inlet according to the reverse steps of removal.

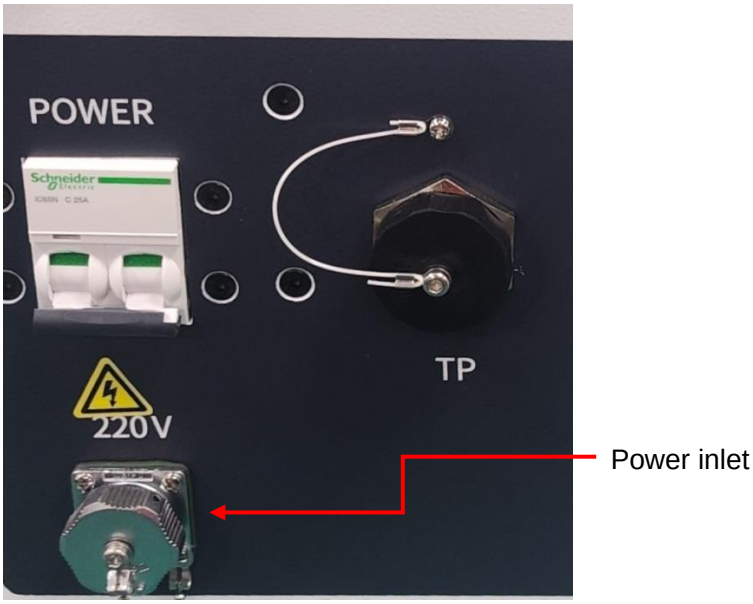


Fig. 4.8 Power Inlet

4.7 Replacement of controller core board

(1) Unscrew the fixing screws M3 on the controller core board.

(2) Pull upwards to remove the controller core board (note the falling of the same height studs below the controller core board).

(3) Mount the controller core board according to the reverse steps of removal.

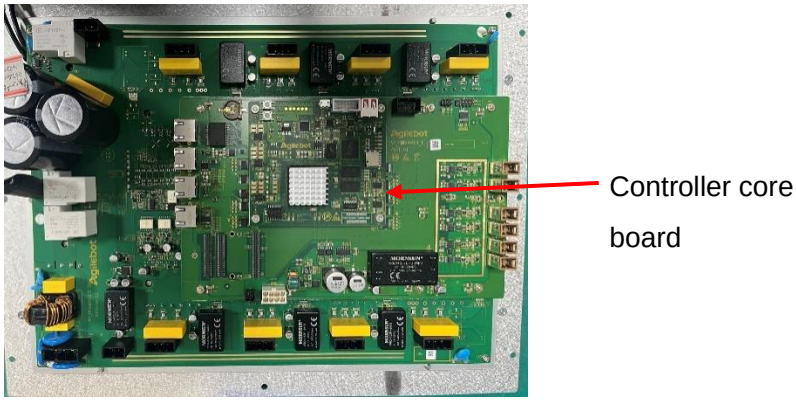


Fig. 4.9 Controller Core Board

4.8 Replacement of Controller Main Board

(1) Dismantle the controller core board firstly before replacing the Controller Main Board. Please refer to Section 4.7 for details.

(2) Remove cables on Controller Main Board.

(3) Unscrew the fixing screws M3 of the Controller Main Board to remove the Controller Main Board.

(4) Mount the Controller Main Board according to the reverse steps of removal.

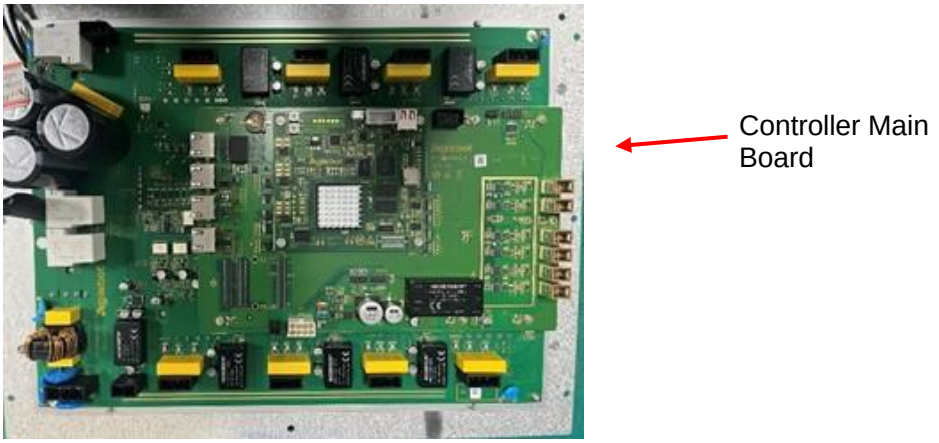


Fig. 4.10 Controller Main Board

4.9 Replacement of drive board

(1) Dismantle the main control board firstly before replacing the drive board. Please refer to Section 4.8 for details.

(2) Remove cables on the drive board.

(3) Unscrew the fixing screws M3 on the drive board.

(4) Mount the drive board according to the reverse steps of removal.

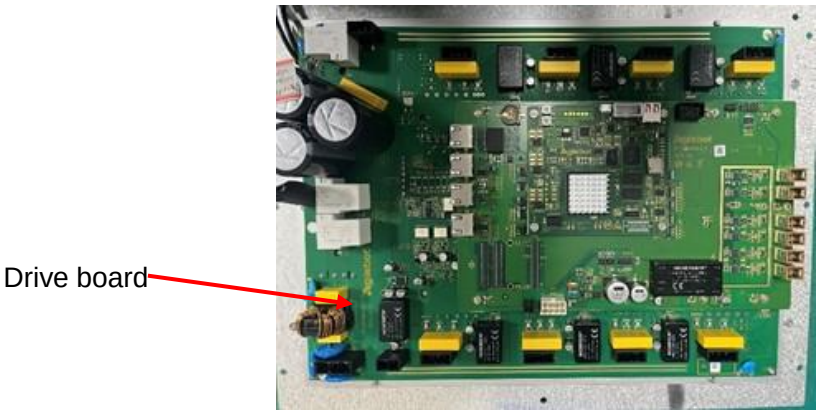


Fig. 4.11 Drive Board

4.10 Replacement of Power Soft Start Circuit Board

(1) Remove cables on the Power Soft Start Circuit Board.

(2) Unscrew the fixing screws M3 to remove the Power Soft Start Circuit Board.

(3) Mount the Power Soft Start Circuit Board according to the reverse steps of removal.

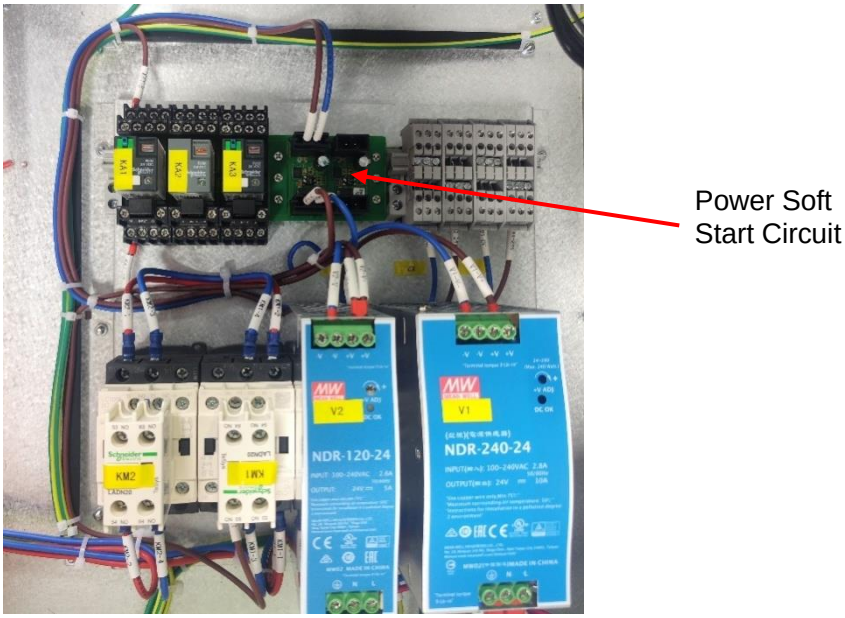


Fig. 4.12 Power Soft Start Circuit Board

4.11 Replacement of AC-DC Power Supply

(1) Remove the cable at the bottom right of the EMI filter board.

(2) Remove cables of the AC-DC Power Supply.

(3) Pull out the fixing clip and then remove the AC-DC Power Supply.

(4) Mount the AC-DC Power Supply according to the reverse steps of removal.

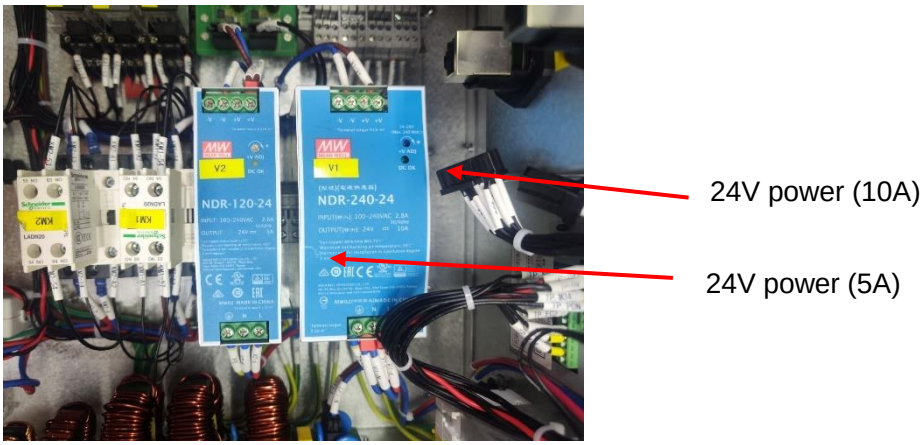


Fig. 4.13 AC-DC Power Supply

4.12 Replacement of fan unit

(1) Remove cables of the fan unit.

(2) Unscrew the fixing screws M3 to remove the fan unit.

(3) Dismantle the outer fan filter screen of the controller to remove the outer fan (Fig. 4.15).

(4) Unscrew the fixing screws M3 around the fan unit to remove the radiator.

(5) Unscrew the fixing screws on the inner fan to remove the inner fan (Fig. 4.16).

(6) Mount the fan unit according to the reverse steps of removal. Take care not to entangle the cables in the fan.

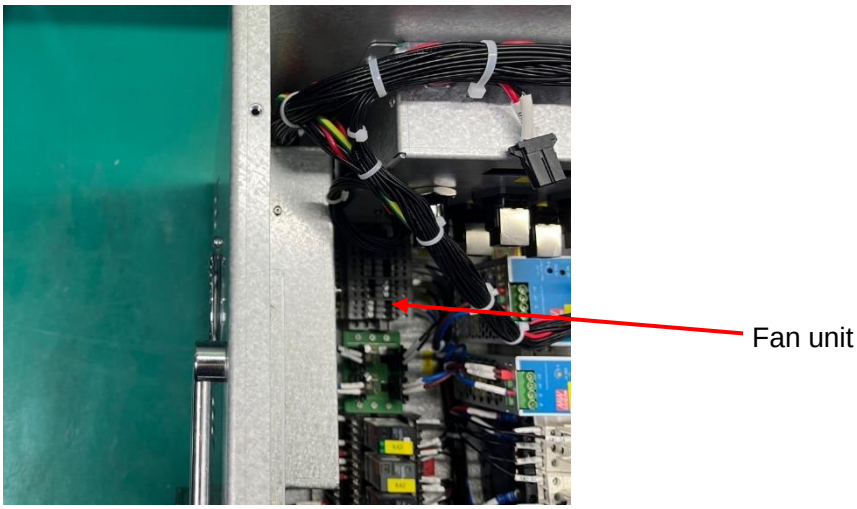


Fig. 4.14 Fan Unit 1

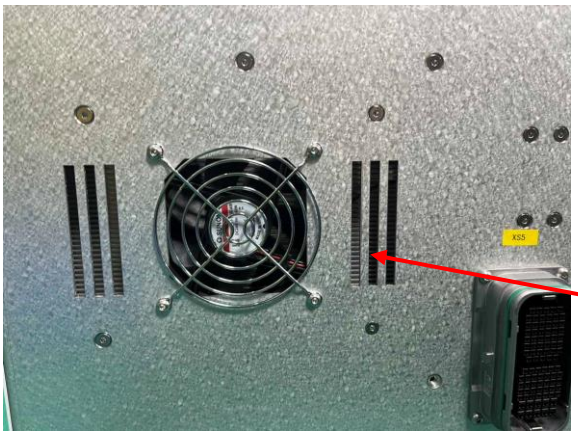


Fig. 4.15 Fan Unit 2

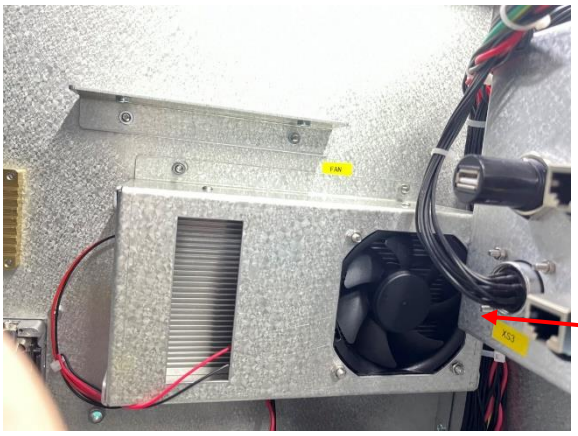


Fig. 4.16 Fan Unit 3

II. Connection

1 Summary

1.1 System configuration

Fig. 1.1 illustrates relevant ports configured on the IRC-I8A-S controller.

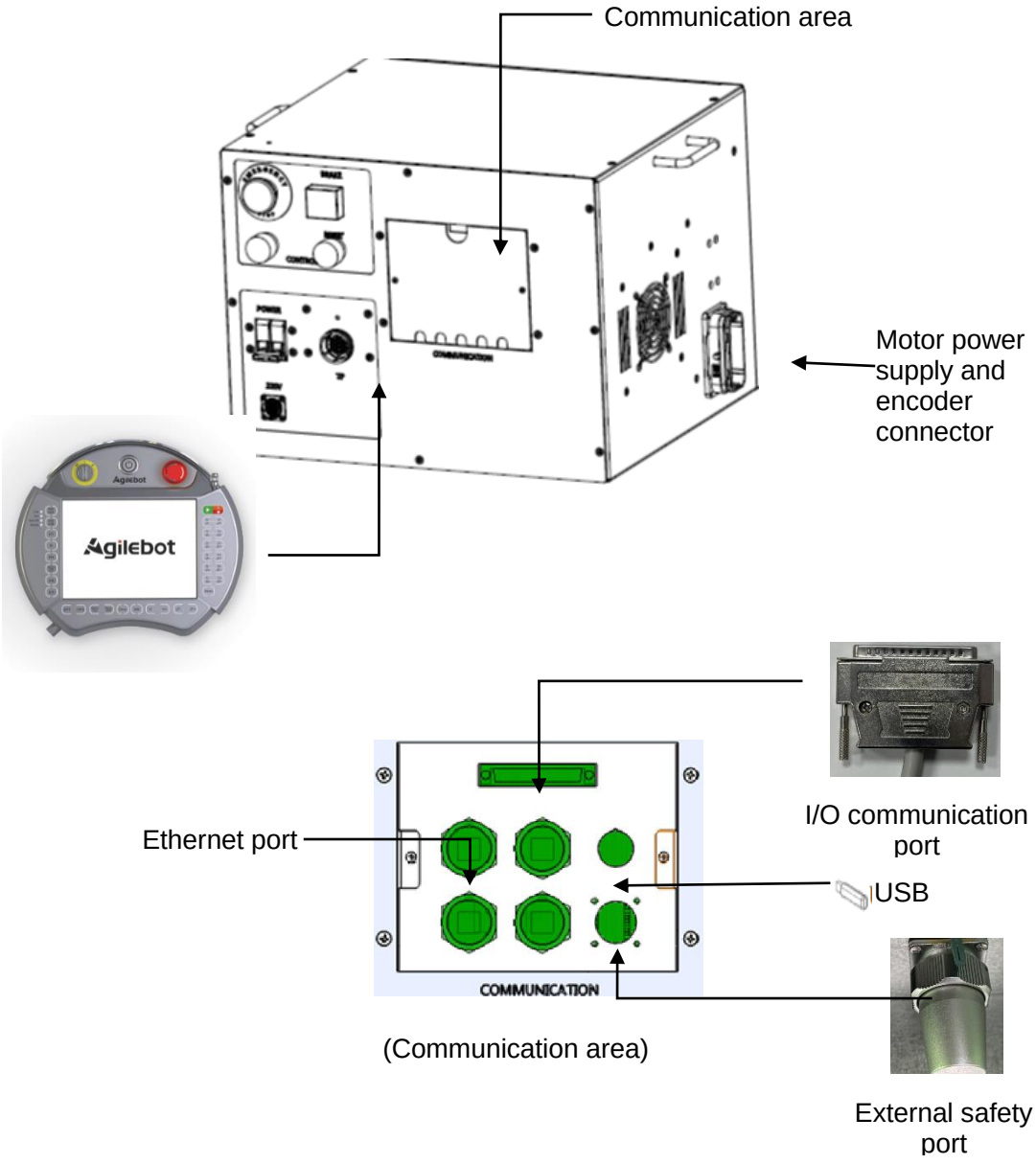


Fig. 1.1 Illustration of Controller Ports

1.2 External ports

The following diagram describes the connection ports on the front panel of the IRC-I8A-S controller.

> Caution
>
> Before connecting the connector to the controller, make sure to check for dirt or damage. Please clean the components or replace damaged ones.

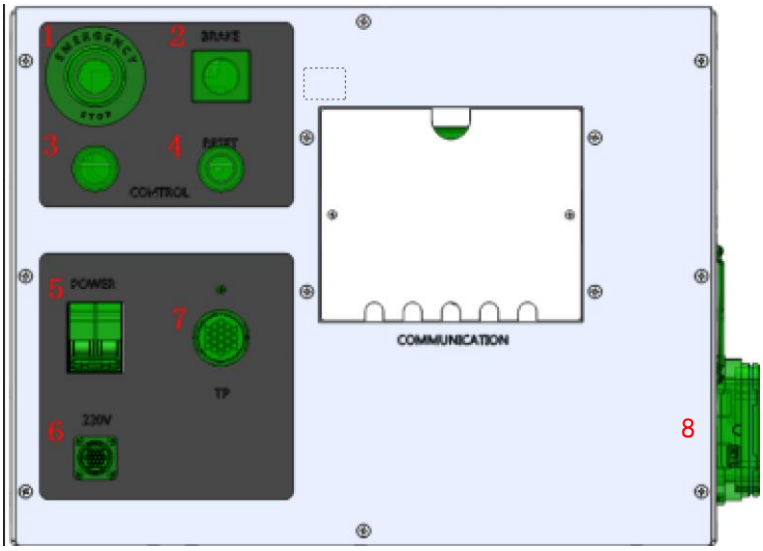


Fig. 1.2 Front View of Controller

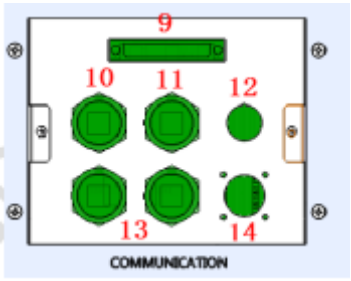


Fig. 1.3 Communication Connector Unit

S/N	Part name	Function
1	E-stop	Emergency stop function for controlling the on-off of the robot's safety circuit
2	Manual brake release button	A yellow button with a protective shell, used to control the release/application of the motor brake on each axis of the robot. Note: 1. The button function is valid as long as the light (Device 3) is on; 2. The brakes at six axes are released/applied simultaneously. Therefore, be careful when using this button!
3	light	This is a dual-color light: Red: The light is in red if the Circuit Breaker (Device 5) of the controller is switched on, indicating that the controller is live; Green: It is in green after successful

S/N	Part name	Function
		communication between the control system and TP.
4	Release button on controller body	Orange indicates the function of reset. Note: The function of this button is completely consistent with the reset button of TP!
5	Control system switch	Start/stop the control system.
6	AC220V power inlet	220V AC power inlet
7	TP port	For connecting the teach pendant
8	Motor power supply and encoder connector	RCC POWER, power output RCC SIGNAL, encoder output port
9	I/O port	25 DI, 25 DO ports
10	LAN1	LAN1, an Ethernet port of the controller, used for debugging
11	LAN2	LAN2, an Ethernet port of the controller, used for debugging
12	USB port	For USB backup
13	Two reserved Ethernet ports	2 reserved; this Ethernet port is not connected
14	External safety port	External safety signal adapter for safety signal control

Warning

The IO port on the robot controller and the external safety (emergency stop circuit) ports do not support hot swapping. Otherwise, it may cause damage to the fuse inside the robot controller!

2 Connection with devices

2.1 Connecting cables of the robot

The connecting cables between the robot and the controller include power cables and signal cables.

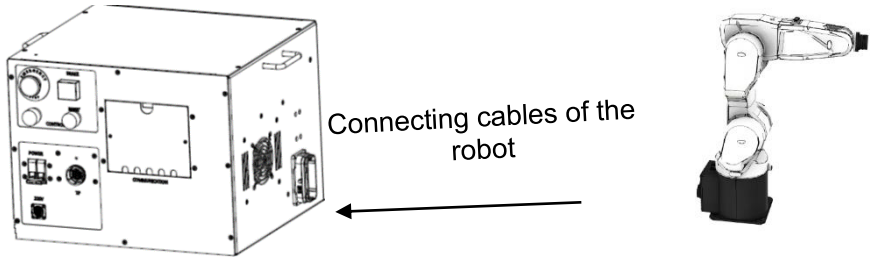


Fig. 2.1 Connection between Robot and Controller

> ⚠ Caution
>
> Ground the controller before startup. Otherwise, the risk of electric shock exists.

2.2 Cables of teach pendant

The teach pendant connector on the IRC-I8A-S controller is located at the front of the controller. Before connecting the connector to the controller, make sure to check for dirt or damage. Please clean the components or replace damaged ones.

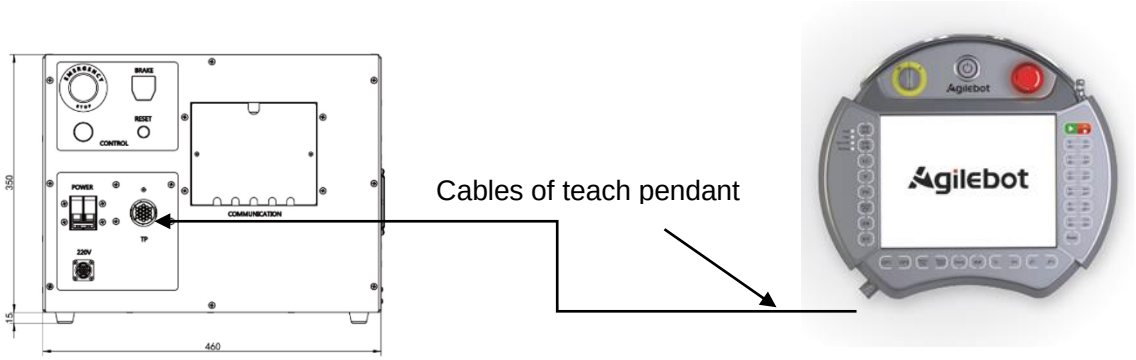


Fig. 2.2 Connection between Controller and Teach Pendant

Method for connecting the teach pendant:

S/N	Operation	Precautions
1	Find the teach pendant socket connector on the controller or operation panel.	The controller must be in an Off state.
2	Align it to the fool-proofing port and tighten it.	Align the fool-proofing port when inserting.

2.3 Preparation of power cable

Connect the power cable on IRC-I8A-S, or use accessories provided by us, or the user should prepare them independently. Prepare the power cable according to the following requirements. Connect the power side according to the customer's device.

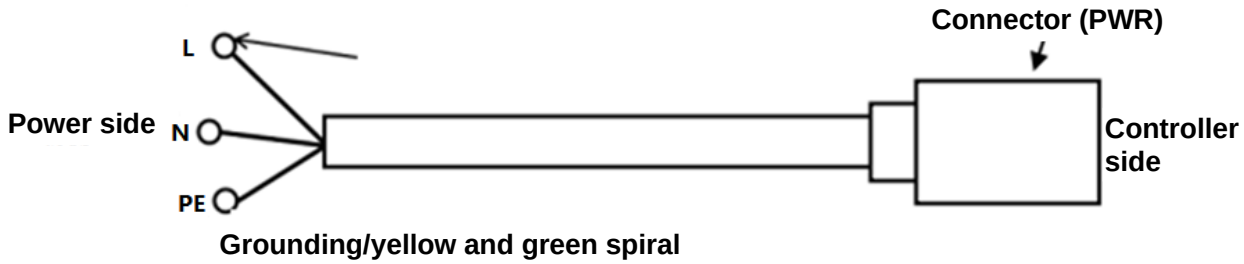


Fig. 2.3 Connection of Power Cable

The specifications of power cables are shown in the table below:

Cable number	Name	Specification	Standard	Length	Outside diameter	Minimum bend radius
RVVP,3*2.5mm^2, red/blue/yellow green	Cables outside single-phase power cabinet	4010300001	JB8734.5-2016	5m	10.5mm	63mm

Caution

It is required to observe any local standards and regulations regarding insulation and cross-sectional area.

2.4 Grounding and shielding connection

The following figure shows two examples of grounding and shielding methods.

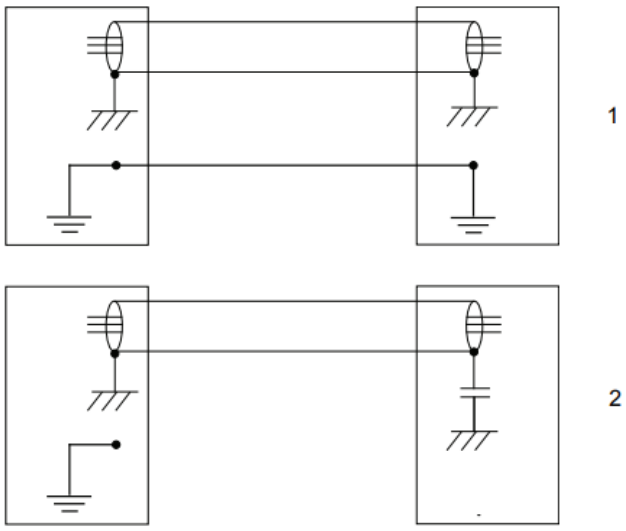


Fig. 2.4 Grounding Connection

Example 1: If all components are well grounded, the best shielding effect can be achieved by grounding all shielding layers at both ends of all components.

Example 2: If the cable ends are not well grounded, a noise suppression capacitor can be used. The shielding of two cables must be connected as shown in the figure, but not to the base of the device.

2.5 Elimination of interference

For internal relay coils and other components possibly causing interference inside the controller, their interference is eliminated through offset. External relay coils and other components must be c lighted in the same manner. The following figure shows the specific method. Please note that the closing time of the DC relay may increase after offset, especially if a diode is connected through a coil. The varistor can achieve a shorter closing time. Mutual offset of coils can extend the lifespan of the controller switch.

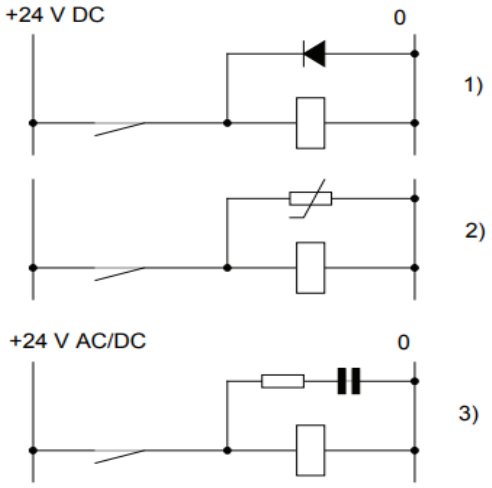


Fig. 2.5 Elimination of Interference

1. As for the specifications of the diode, the same current as the relay coil and the voltage equivalent to twice power supply should be used.

2. As for the specifications of the varistor, the same energy as the relay coil and the voltage equivalent to twice power supply should be used.

3. When AC voltage is adopted, a maximum voltage of >500 V and a nominal voltage of 125 V should be used for the component. The resistance should be 100 Ω and the capacitance should be 1W 0.1-1 μ F (usually 0.47 μ F).

2.6 About power protection device

The robot generates high-frequency leakage current during operation, which sometimes causes the leakage circuit breaker or leakage protector of the controller's power supply to trip. Therefore, such false tripping is to be avoided when selecting leakage circuit breaker or leakage protector.

During mounting and operation of the robots, it is required to install an independent power protection device for each robot. A circuit breaker with leakage protection is a common choice for such protection. Specification & parameters of circuit breakers: 2P; over 25A; type C trip curve. Specification & parameters of leakage protectors: leakage current limit of 30mA.

2.7 About On/Off time of Circuit Breaker

The controller may not start when the Circuit Breaker repeatedly turns on or off the power supply in a short period of time.

Turn on the power of the controller in more than 10s after it is disconnected.

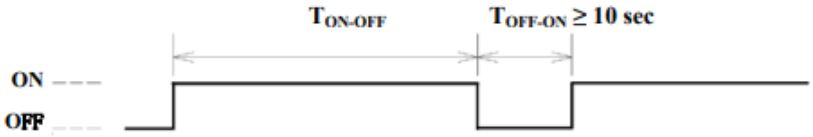


Fig. 2.6 Timing Diagram of Circuit Breaker

2.8 Connection of external emergency stop signals

During system building, confirm that the robot is stopped through all safety signals and take care to avoid incorrect connections if safety signals, such as safety plug and safety door signals, are connected.

Without an I/O board terminal block, a safety plug should be connected if the external emergency input or safety barrier signals are invalid.

3 Peripheral devices

3.1 Ports of peripheral devices

The peripheral device ports of IRC-I8A-S are divided into IO board, safety board and arm I/O signal ports.

Fig. 3.1 External IO Board

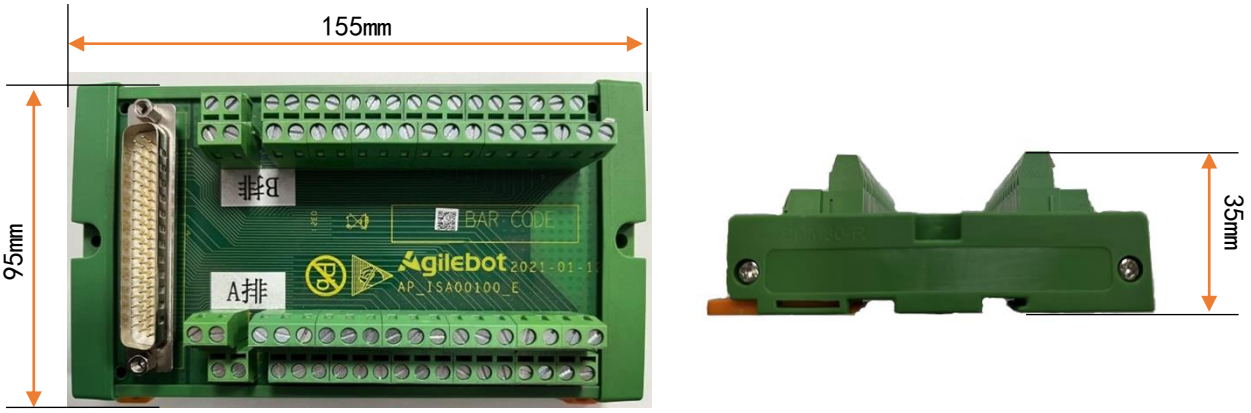


Fig. 3.2 Dimensions of External IO Board

The controller IRC-I8A-S provides 25 DI/DO ports and the I/O adapter totally has 4 sets of terminal blocks, of which the terminal block A is for DI ports and the terminal block B is for DO ports. In addition, there is also a set of 24V and 0V terminal blocks with 4 PINs each.

The I/O board IMB totally provides 25 DI ports and 25 DO ports. However, in the default settings of the teach pendant, 13 DI ports and 13 DO ports are defined by the system as dedicated functions (i.e. UI, UO). Therefore, the customer can freely use 12 DI and DO ports, respectively. Table 3.1 and Table 3.2 list all ports and default settings. They can be set independently in the teach pendant if necessary.

Port No. of terminal block A	Function	Default setting	Signal description
1	Input Port 1	UI_1	Servo excitation locked
2	Input Port 2	UI_2	Pause signal
3	Input Port 3	UI_3	Reset signal
4	Input Port 4	UI_4	Program start/resume signal

5	Input Port 5	UI_5	Program abort signal
6	**IO_0V**	**IO_0V**	**0V**
7	Input Port 6	UI_6	Trigger signal
8	Input Port 7	UI_7	MPLCS start signal
9	Input Port 8	UI_8	MPLCS main program status signal, 6 bits in total
10	Input Port 9	UI_9	
11	Input Port 10	UI_10	
12	**IO_0V**	**IO_0V**	**0V**
13	Input Port 11	UI_11	MPLCS main program status signal, 6 bits in total
14	Input Port 12	UI_12	
15	Input Port 13	UI_13	
16	Input Port 14	DI_1	User's input signal
17	Input Port 15	DI_2	User's input signal
18	**IO_0V**	**IO_0V**	**0V**
19	Input Port 16	DI_3	User's input signal
20	Input Port 17	DI_4	User's input signal
21	Input Port 18	DI_5	User's input signal
22	Input Port 19	DI_6	User's input signal
23	Input Port 20	DI_7	User's input signal
24	**IO_0V**	**IO_0V**	**0V**
25	Input Port 21	DI_8	User's input signal
26	Input Port 22	DI_9	User's input signal
27	Input Port 23	DI_10	User's input signal
28	Input Port 24	DI_11	User's input signal
29	Input Port 25	DI_12	User's input signal
30	**IO_0V**	**IO_0V**	**0V**
31	**IO_0V**	**IO_0V**	**0V**
32	**IO_0V**	**IO_0V**	**0V**

Table 3.1 Definition of Pins on Terminal Block A of IO Board

Port No. of terminal block B	Function	Default setting	Signal description
1	**DO_PS_IN6**	**DO_PS_IN6**	**DO power selector port**
2	Output Port 25	DO_12	User's output signal
3	Output Port 24	DO_11	User's output signal
4	Output Port 23	DO_10	User's output signal
5	Output Port 22	DO_9	User's output signal
6	Output Port 21	DO_8	User's output signal
7	**DO_PS_IN5**	**DO_PS_IN5**	**DO power selector port**
8	Output Port 20	DO_7	User's output signal
9	Output Port 19	DO_6	User's output signal
10	Output Port 18	DO_5	User's output signal

11	Output Port 17	DO_4	User's output signal
12	**DO_PS_IN4**	**DO_PS_IN4**	**DO power selector port**
13	Output Port 16	DO_3	User's output signal
14	Output Port 15	DO_2	User's output signal
15	Output Port 14	DO_1	User's output signal
16	Output Port 13	UO_13	MPLCS main program status feedback, 6 bits in total
17	**DO_PS_IN3**	**DO_PS_IN3**	**DO power selector port**
18	Output Port 12	UO_12	MPLCS main program status feedback, 6 bits in total
19	Output Port 11	UO_11	
20	Output Port 10	UO_10	
21	Output Port 9	UO_9	
22	**DO_PS_IN2**	**DO_PS_IN2**	**DO power selector port**
23	Output Port 8	UO_8	MPLCS main program status feedback, 6 bits in total
24	Output Port 7	UO_7	MPLCS start signal
25	Output Port 6	UO_6	MPLCS selection request
26	Output Port 5	UO_5	Servo status signal
27	**DO_PS_IN1**	**DO_PS_IN1**	**DO power selector port**
28	Output Port 4	UO_4	Program in progress
29	Output Port 3	UO_3	Alarm signal
30	Output Port 2	UO_2	"Paused" status signal
31	Output Port 1	UO_1	Robot's operation status/mode
32	/	/	/

Table 3.2 Definition of Pins on Terminal Block A of IO Board

Fig. 3.3 External Safety Board

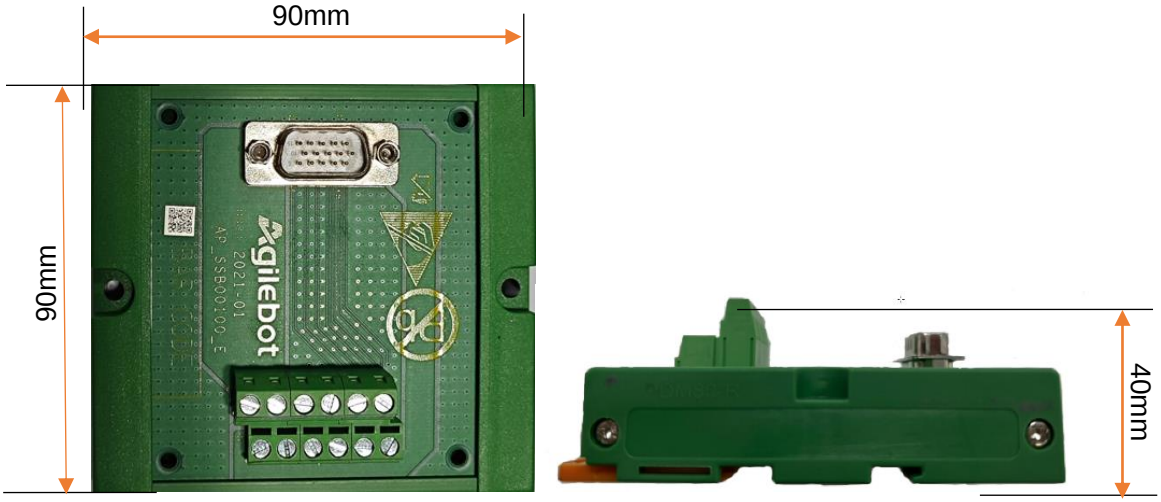


Fig. 3.4 Dimensions of External Safety Board

Fig. 3.5 Safety Plug

If safety signals are not used in practical applications, it is required to insert the safety plug into the safety port. If some safety signals are used, the safety signals unused should be short-circuited.

Pin No.	Function	Signal description

1	Limit_stop_1	Limit signal 1
2	Limit_stop_2	Limit signal 2
3	Ext_E_stop_1	External emergency stop 1
4	Ext_E_stop_2	External emergency stop 2
5	Safety_Door_1	Safety door signal 1
6	Safety_Door_2	Safety door signal 2
7	User_reset_1	User's reset, reserved
8	Blank	Blank
9	24V	24V power supply
10	0V	0V
11	24V	24V power supply
12	0V	0V

Table 3.3 Definition of Safety Board Wire Sequence

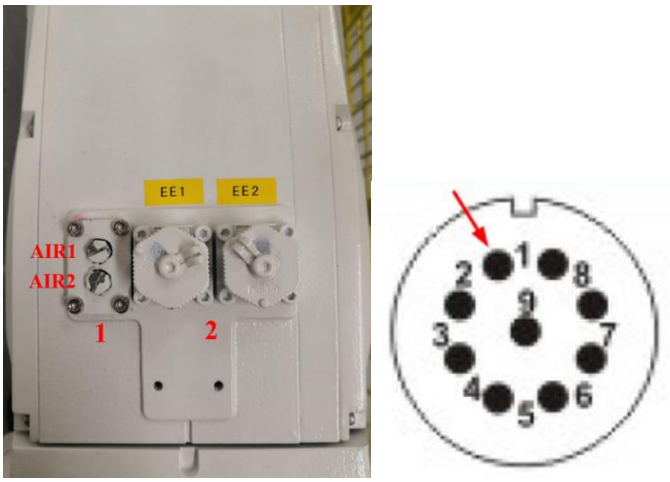


Fig. 3.6 I/O Signal Port on Arm

Note: RI/RO ports are only available on the arm of P-series six-axis robot.

Pin No.	Function
1	RO1
2	RO2
3	RO3
4	RO4
5	RI1
6	RI2
7	IO_24V
8	IO_0V
9	/

Table 3.4 Definition of EE1 Aviation Plug

Pin No.	Function
1	RO5
2	RO6
3	RI3
4	RI4
5	RI5
6	RI6
7	IO_24V
8	IO_0V

Table 3.5 Definition of EE2 Aviation Plug

3.2 Ports and connection of peripheral devices

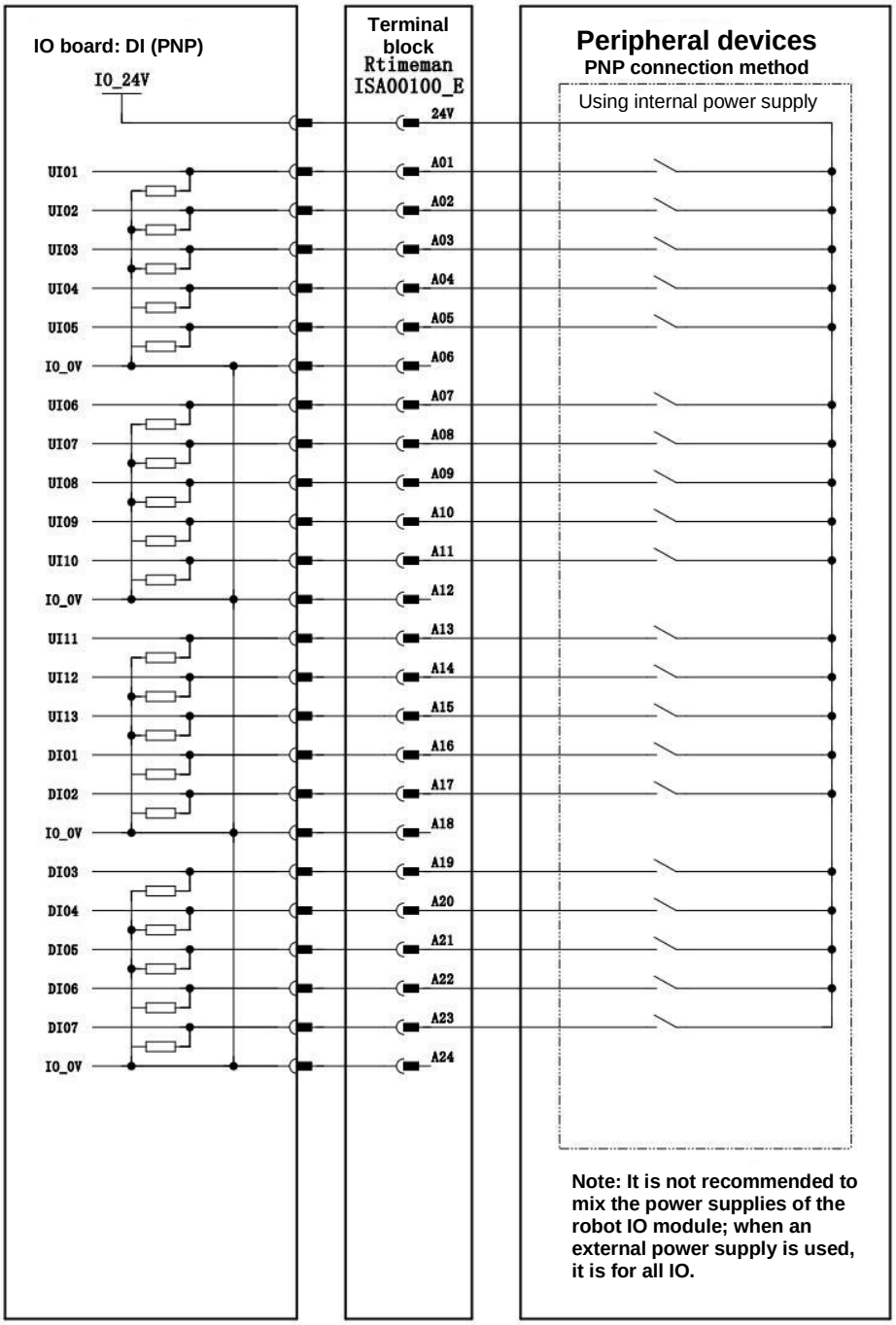


Fig. 3.6 Connection of DI Signals

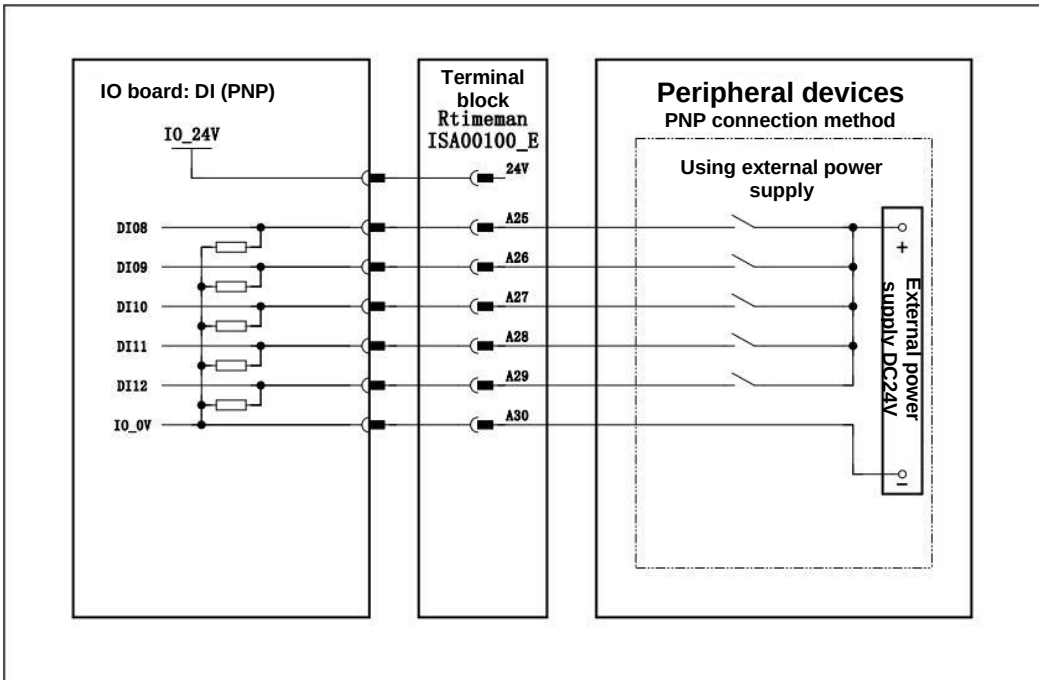


Fig. 3.7 Connection of DI Signals

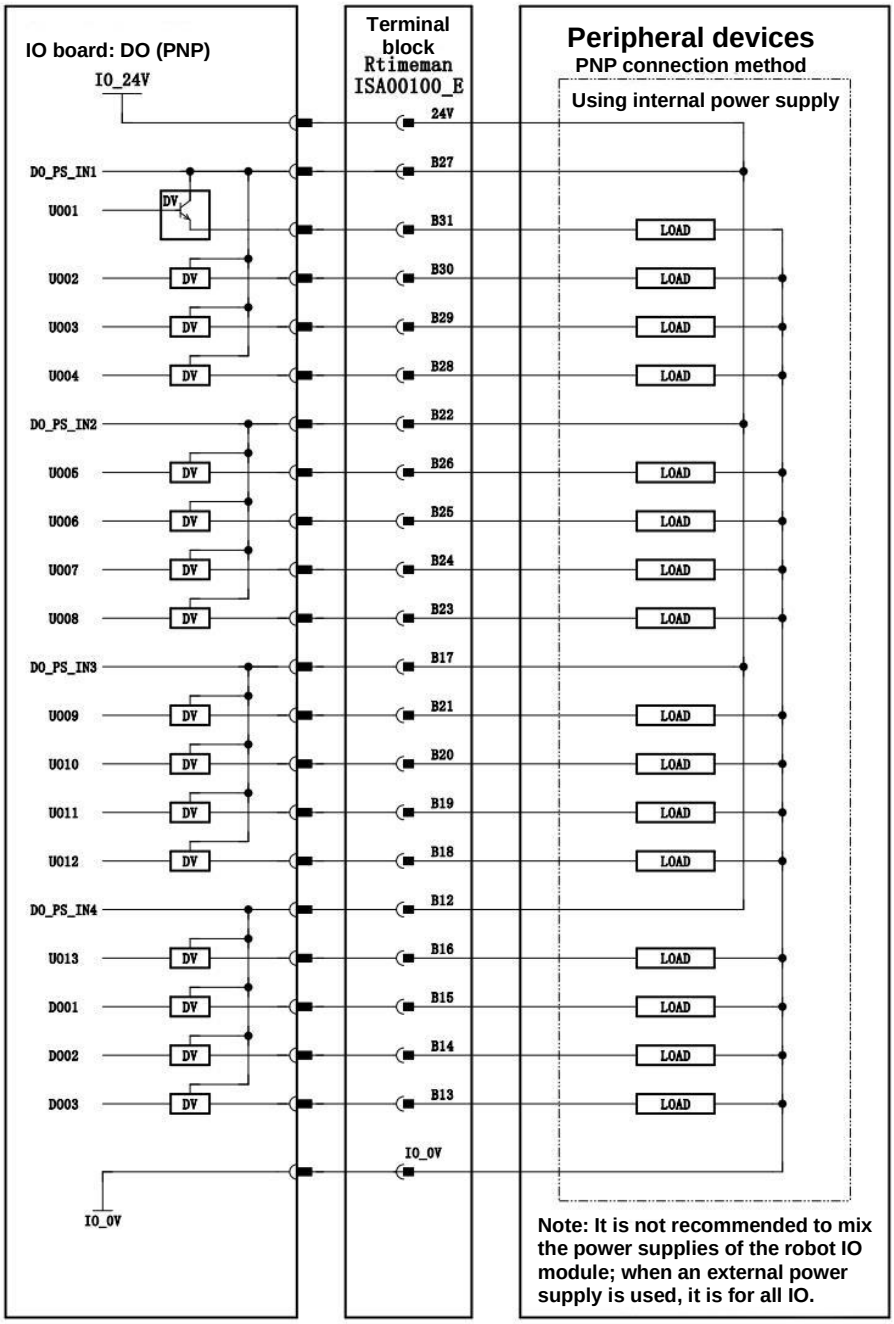


Fig. 3.8 Connection of DO Signals

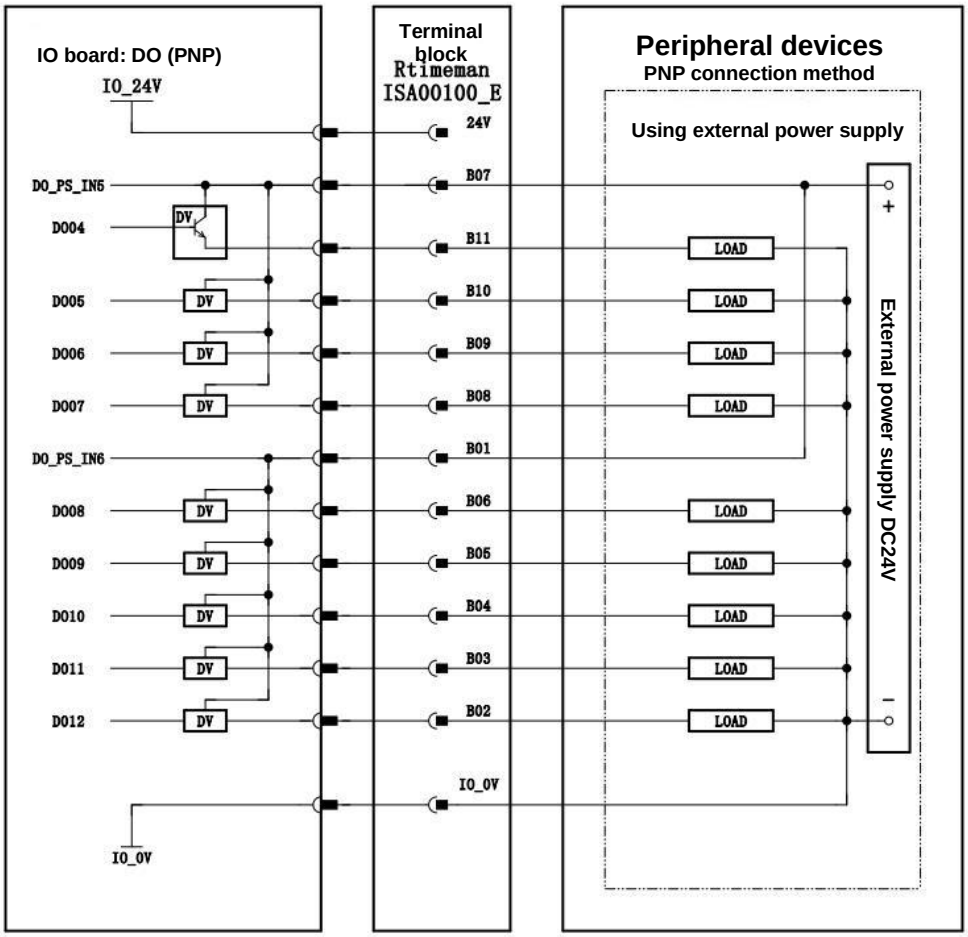


Fig. 3.9 Connection of DO Signals

3.3 Connection between safety board and peripheral devices

The safety circuit ports for the users can only support the 24V power supply inside the controller rather than external 24V power supply. Therefore, the user can only use safety devices with passive and normally-closed contacts. It doesn't support active contacts. In addition, safety circuit signals not used by the user, e.g. safety door signals, should be connected to 24V to ensure normal operation of the robot.

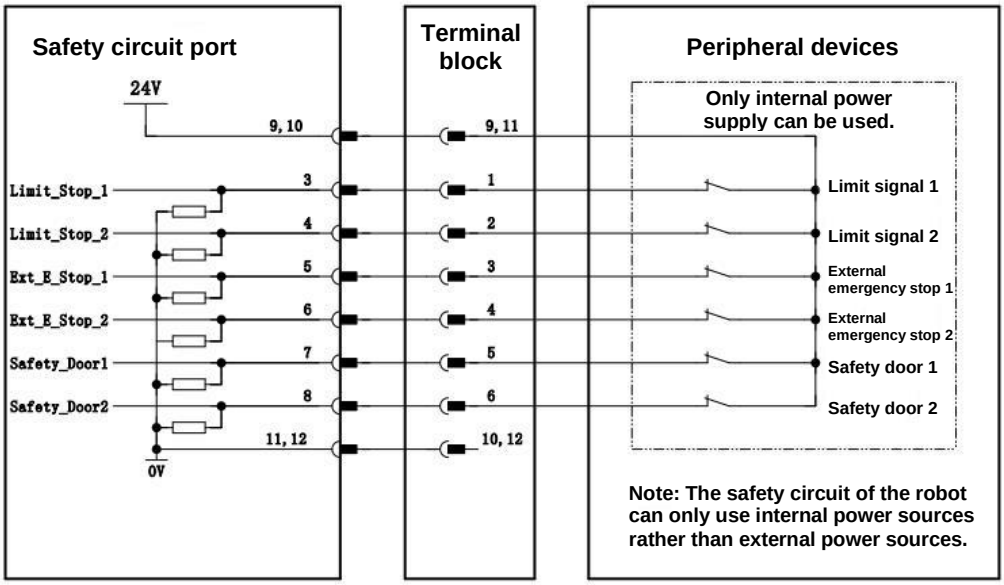


Fig. 3.10 Connection of External Safety Signal

3.4 Connection between arm I/O port and peripheral devices

There are two I/O signal ports on the wrist of the robot, with EE1 near the air pipe and EE2 on the other end. A total of 6 RI and 6 RO ports are provided and directly connected to the dedicated IO ports on the controller's I/O board.

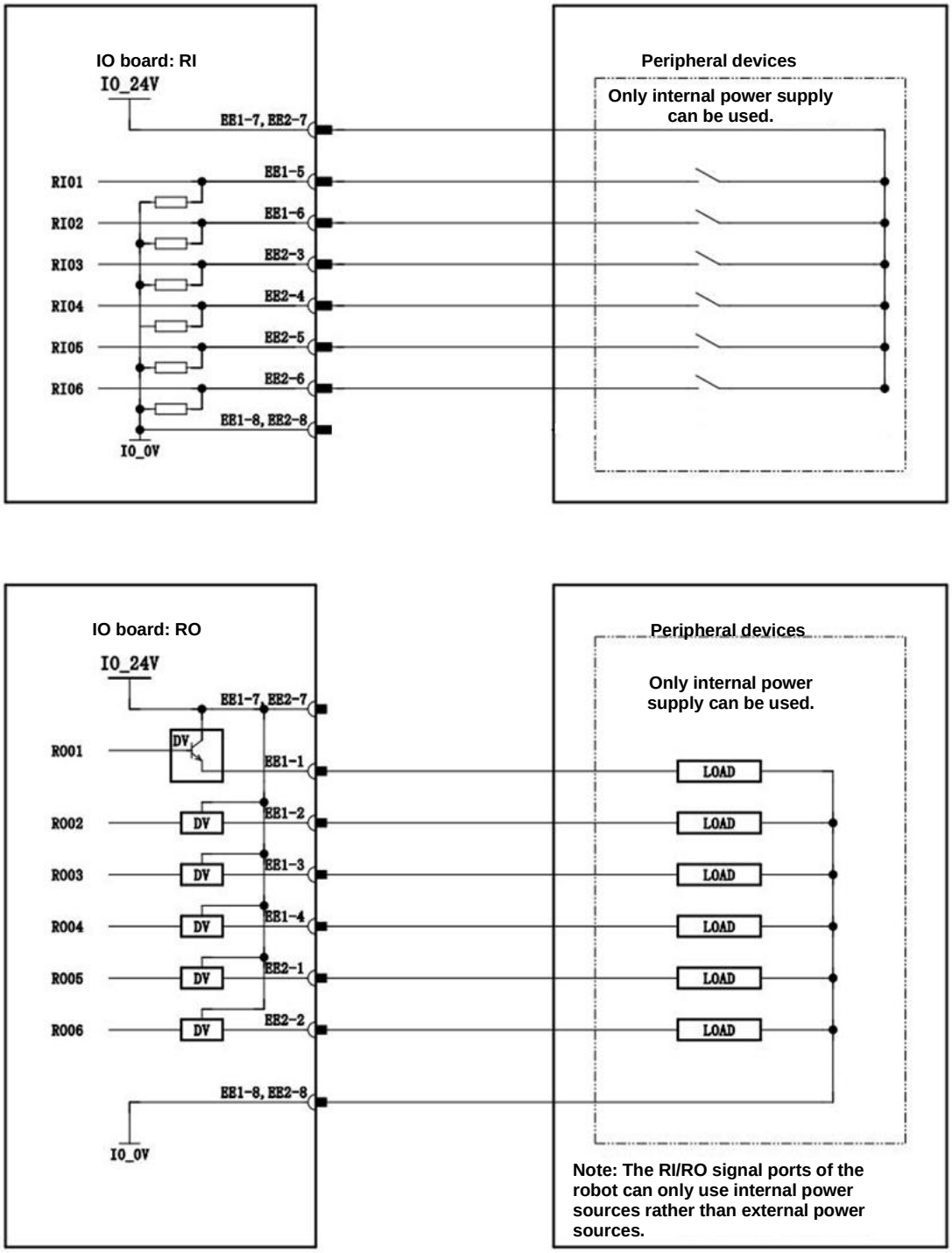


Fig. 3.11 Connection of Arm I/O Signal Ports

3.5 Connection of communication device (Ethernet port)

The IRC-I8A-S controller is provided with standard Ethernet RJ45 ports and supports multiple protocols, and two Ethernet ports are interconnected internally.

Caution

Please consult various device manufacturers for the construction of the network or the operating conditions of the devices other than robot controller (HUBs, transceivers, cables, etc.). It is required to fully consider that the network constructed is not affected by other noise sources. The noise sources of power lines and motors should be electrically separated from network cables sufficiently and it is necessary to connect the ground wires of each device. In addition, it is necessary to note that high and insufficient grounding impedance may sometimes lead to communication barriers. The communication tests should be carried out for confirmation after equipment setting and before formal operation.

We cannot guarantee normal operation of devices (other than robot controller) due to network failures.

4 Handling and mounting

4.1 Handling method

Handle the robot in a stationary mode.

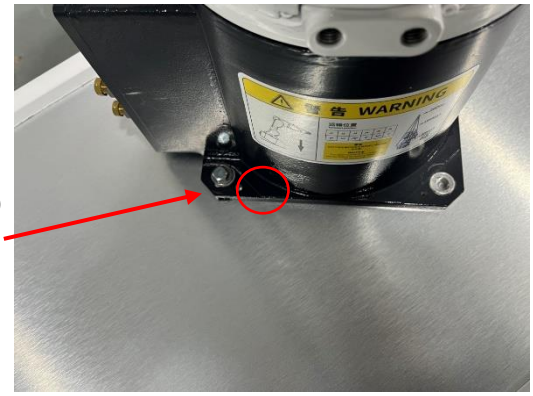
(1) Move the robot to the handling position.

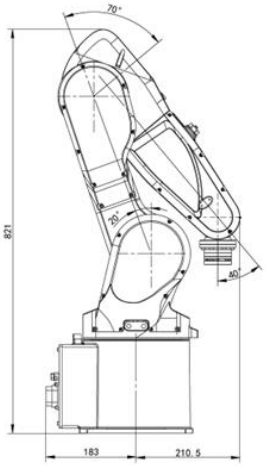
(2) Fix the robot on a wooden bracket with M10 screws.

(3) Put the controller into the box.

(4) Move the box to the handling area with care.

Fix the base to the wooden bracket with four wood screws.





Handling posture

Fig. 4.1 Fixing of Body

Fixing and handling of controller

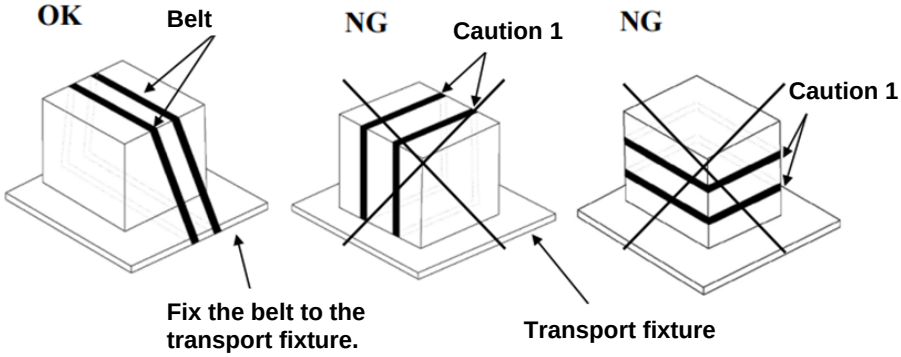


Fig. 4.2 Fixing of Controller

> ⚠ Caution
>
> If being tied too tightly to the controller, the belt may damage the sealing gasket of the door, and the damaged state of the sealing gasket may not be restored after removal of the belt. When used, it may be impossible to ensure the airtightness of the controller.
>
> Please use cushioning materials to avoid exerting pressure on the cable and the cover of the cable port.

4.2 Mounting method

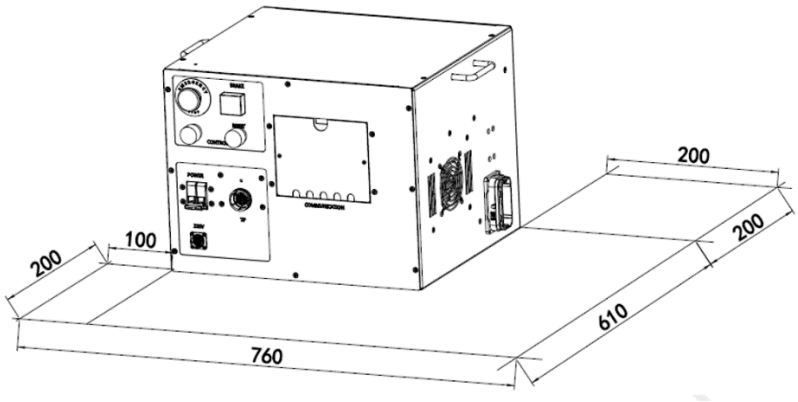


Fig. 4.3 Mounting of Controller

- If mounted on a desktop (without a rack), the controller requires 100mm free space on the left and 200mm free space on the right.
- The controller requires 200mm free space on the back to ensure proper cooling. Never place the customer's cable on the fan cover on the back of the controller. Otherwise, it may inspection difficult and result in insufficient cooling.

Caution

Please ensure the above areas for the purpose of maintenance and heat dissipation.

Please mount the controller in a well-ventilated and open space. Mounting in a closed space may cause such issues as ineffective cooling, high temperature, lower reliability or malfunction of the controller.

4.3 Mounting conditions

During operation, the IRC-I8A-S controller may generate electromagnetic interference to the outside, which mainly affects peripheral devices by conduction and radiation. In non-industrial environments, the electromagnetic interference generated by the controller may affect peripheral devices occasionally. So, do not use this controller in residential areas.

If it is required to use this controller in residential areas, special measures should be taken to reduce electromagnetic interference to prevent the generated electromagnetic interference from affecting normal operation of peripheral devices.

This controller will not malfunction due to harmonics generated in general industrial environments, but it may be problematic when the connected power supply contains large harmonics. In this case, a stable power supply device should be provided.

Item	Requirements
Operating ambient temperature	Temperature: 5~40 ℃ Humidity: 20%~95% (30 ℃) (without condensation)
Storage temperature and humidity	Temperature: -5~40 ℃ Humidity: ≤ 95% RH (30 ℃)
Transport temperature and humidity	Temperature: -25~70 ℃ Humidity: ≤ 95% RH (40℃)
Vibration	Sinusoidal vibration: In accordance with the *Industrial Robots - Acceptance Rules* (JB/T 8896-1999), the vibration displacement is 0.75mm at 5-25Hz and 0.15mm at 25-55Hz and the vibration continues for 3min at each point; Random vibration: It meets the ISTA 1H standard and the vibration acceleration is $0.01g^2$/Hz at 4-100Hz and 0.001 g^2/Hz at 200Hz; Grms=1.14g, and the bare machine vibrates for 30min per X/Y/Z axial direction.
Impact	The maximum impact must not exceed the acceleration of 15g and its duration must be longer than 11ms.
Protection level	IP20
Altitude	1000m and below

4.4 Adjustment and confirmation items during mounting

Item	Contents
1	Check internal and external appearance of the controller.
2	Check if the fixing screw terminals have been properly connected.
3	Confirm the insertion status at mounting positions of connectors and printed circuit board.
4	Connect the cables of the controller and the mechanism.
5	Switch off the Circuit Breaker and connect the input power cable.
6	Confirm the input power voltage.
7	Press the E-stop button on the operation panel and turn on the power.
8	Confirm the port signal between the controller and the robot mechanism.
9	Confirm and set all parameters.
10	Release the emergency stop on the operation panel.
11	Confirm the motion of each axis under manual feed.
12	Confirm the conditions of control port signals of peripheral devices.

Appendice

A. List of Specifications

Overall unit			
Description of material	**Material No.**	**Description of model and specification**	**Note**
IRC-I8A-S brake board	404AP_SSA00101_E0100	AP_SSA00101_E/2.441x2.283in./R010A-03	
IRC-I8A-S controller core board	404AP_CCB00402_E0110	AP_CCB00402_E/4.102x3.730in./R010A-03	
IRC-I8A-S Controller Main Board	404AP_CMB00401_E0110	AP_CMB00401_E/10.00x6.220in./R010A-03	
P7A drive board, 400W custom	404AP_DMB00406_E0110	AP_DMB00406_E/380x280mm/R010A-03	
IRC-I8A-S safety board	404AP_SMB00404_E0100	AP_SMB00404_E/5.475x6.953in./R010A-03	
IRC-I8A-S IO board	404AP_IMB00402_E0100	AP_IMB00402_E/5.475x6.960in./R010A-03	
IRC-I8A-S EMI filter board	404AP_FMB00100_E0100	AP_FMB00100_E/73x243mm/R010A-03	
IRC-I8A-S Power Soft Start Circuit Board	404170000101 01	AP_SSC00101_E/1.9685x2.7589in.	
Circuit Breaker	2020100001	IC65N-C25; A9F18225; Circuit Breaker; 2P; 25A	
Contactor	2020300001	LC1D18BDC; AC contactor; 3P; 18A	
Contactor accessories	2020300002	LADN20C; normally open contact of contactor; 2NO	
Battery	2020400003	CR1220; button lithium battery; 3V	Battery of Controller Main Board
Fan	2020600001	PE80252B1-000C-A99; fan; 80*80*25; 24VDC	Inner
Fan	2020600002	MF92252V1-1000C-A99; fan; 92*92*25; 24VDC	Outer
Fan accessories	2020600003	ZHJ42-92; fan filter screen; 92*92	Big
AC-DC Power Supply	2020400006	NDR-240-24; AC-DC Power Supply; rail-mounting; 220VAC; 240W; 24VDC/10A	Small
AC-DC Power Supply	2020400007	NDR-120-24; AC-DC Power Supply; rail-mounting; 220VAC; 120W; 24VDC/5A	
Panel-mounted interface	2030100002	RJ45F71; Ethernet port RJ45	
Switch	2020600004	EKI-2525; Ethernet switch; 4 output ports	
Panel-mounted interface	2030100003	TPB-AWB-RTM; teach pendant junction box; threaded joint	

Teach pendant			
Description of material	**Material No.**	**Description of model and specification**	**Note**
Teach pendant	2110000003	T008A-02; 8-inch TP; cable length 5m	
TP plug	2030400001	DT-TP-RTM; TP plug	

RCC cable			
Description of material	**Material No.**	**Description of model and specification**	**Note**
P7A robot connection cable	4010100001	SN-2019-GBT-023; robot connection cable; 5m; specific for P7A	

Power line of the controller			
Description of material	**Material No.**	**Description of model and specification**	**Note**
Cables outside single-phase power cabinet	4010300001	SN-2019-GBT-031; external wiring of 220V power cabinet; single phase; 3×2.5mm^2; 5m	

General accessories and additional devices			
Description of material	**Material No.**	**Description of model and specification**	**Note**
EMC module	40600001	EMC magnetic ring kit; 74271251; black snap-on magnetic ring × 2; specific for P7A and S6A	

Others			
Description of material	**Material No.**	**Description of model and specification**	**Note**
IO signal cables outside IRC-I8A-S controller	4010300012	SN-2019-GBT-021; IO board adapter cable; 5m; specific for IRC-I8A-S controller	
Safety board signal cables outside IRC-I8A-S controller	4010300011	SN-2019-GBT-020; pre-wires for safety board; 5m; specific for IRC-I8A-S controller	
IRC-I8A-S IO board	404AP_ISA00100_E0110	AP_ISA00100_E/3.155x5.315in.	
IRC-I8A-S safety board	404AP_SSB00100_E0110	AP_SSB00100_E/2.756x3.150in.	
Integrated plug	2030400004	WY16J9TE; plug; 9-pin; straight c light fastening; welding method	
Safety plug	2030400002	DT-SMB-RTM; safety port plug; Weipu port class	
Straight pipe quick connector	2070100006	KQ2H04-M5A; straight pipe quick connector; applicable pipe outer diameter 4; external thread M5; brass	
Straight pipe quick connector	2070100007	KQ2H04-01AS; straight pipe quick connector; applicable pipe outer diameter 4; external thread R1/8; brass	

B. Meaning of control system I/O signals of peripheral devices

The following table lists the system I/O signals for the ports of the peripheral devices on IRC-I8A-S.

List of UI/UO signals						
UI[1]	Servo_Enable Servo enable signal (it can be used as an alarm signal of instantaneous stop peripheral software; or after pausing, it turns off the servo-holding brake to make a complete stop)	Servo_Enable is usually ON. When the peripheral upper computer does not want the robot to move or when power is switched on, it is switched to OFF. It is used for safety locking. In the OFF state, the system performs the following processing: 1. Issue an alarm and then disconnect the servo power supply. 2. Instantly stop the robot (Class 0 stop) and suspend the execution of the program. 3. The servo cannot always be enabled. The bypass is ON.		UO[1]	CMDENBLE Allow peripheral devices to control the status signals of the robot.	ON indicates that peripheral device control is enabled, while OFF means that peripheral device control is disabled. Output high level when the following conditions are met: 1. UI[5] is ON. 2. The mode selector is in "Auto" mode. 3. UO[3] is OFF.
UI[2]	Pause_Request	Pause signal. It is usually ON. In the OFF state, the system performs the following processing: It is planned to slow down and stop the executing action and to suspend the execution of the program. The bypass is ON.		UO[2]	Paused	"Paused" status signal. When the program execution status is "Paused", this signal is ON (i.e. the robot is paused).
UI[3]	Reset Alarm reset signal	Release the alarm, power on the servo and effectively generate a Reset request at a high level.		UO[3]	FAULT	When an alarm occurs in the system, this alarm signal is output and can be reset by RESET. Note: This signal is not output when the system issues a warning type alarm.
UI[4]	Start & Restart Program start/resume signal	Start or restart the program (depending on whether the program status is “Aborted” or “Pause”) and its function is the same as the Start button on TP. Take the effective falling edge to start or restart the		UO[4]	Program Running Program running signal	ON indicates that the program is running; OFF indicates that no program is running.

		program.				
UI[5]	Abort Program Program abort signal	Request to terminate a program in execution or paused state. It is usually ON. In the OFF state, the system performs the following processing: The alarm bar indicates a program abort request and the program enters the abort mode. If the program is still running, immediately stop the robot's action and then abort the program. It is similar to an "aborted" alarm. Allow to enable and teach the servo, but not to manually or automatically execute programs. The bypass is ON.		UO[5]	Servo Status	This signal is set to high level when the robot operation status is "Working", "On Standby" or "Servo ON". It is at lower level under “Servo-OFF”.
UI[6]	Selection Strobe Trigger signal	It is only valid when the "Program Start Mode" is set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number". Read the trigger signal for selecting the program to be executed. When it is ON, read the input of Program Selection 1-6 and select the program to be executed. Note: This signal is ignored when a program is executing (running or paused).		UO[6]	Selection Check Request	It is only valid when the "Program Start Mode" is set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number".
UI[7]	MPLCS Start	It is only valid when the "Program Start Mode" is set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number". It is a start signal of program number selection.		UO[7]	MPLCS Start Done	It is only valid when the "Program Start Mode" is set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number".
UI[8]-UI[13]	Program Selection 1-	It is only valid when the "Program Start Mode" is		UO[8]-UO[13]	Selection Confirm	It is only valid when the "Program Start Mode"

	6	set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number". The 6-digit binary number of the program number is converted to a decimal number, which is the start number of the main program to be executed.			1-6	is set to "Start by Main Program Number" or "Simple Start Mode by Main Program Number". After receiving the Selection Strobe signal, the robot controller may read the status of UI[8]-UI[13] and feed it back to the upper level for confirmation.

Contact us

Agilebot Robotics Co., Ltd. (Shanghai Headquarters):

Floor 8, Tower 6, Zhongjian Jinxiu Plaza, No. 50, Lane 308, Xumin Road, Qingpu District, Shanghai

Agilebot Operation and Technical Service Center:

Building 1, No. 338 Jiuye Road, Qingpu District, Shanghai

Service hotline: +86-21-5986 0805

Website: www.sh-agilebot.com