



Product Manual
Instructions for IRC-D6A Controller



Product Manual Instructions for Controller

V1.1

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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 composing the body, controller, wired handle, cables, software and other accessories of the collaborative robot. When designing the robot system, the integrator must fully consider safety precautions for the user and the system and observe the safety requirements of the standards and regulations of relevant countries. Nobody is allowed to modify the collaborative 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 for medical and life-related applications

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




For safety issues uncovered in this Manual, please refer to the Safety Manual.

Definition of safety signs

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 additional descriptions 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 additional descriptions outside the scope of danger or warning.

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

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 its working range.
- Maintenance Engineer
 - Operate the robot.
 - Perform teaching of the robot within its working range.
 - Carry out maintenance (repair, adjustment, replacement) operations on the robot.

The "Operator" is not allowed to enter the working range of the robot.

The "Robot Engineer" and "Maintenance Engineer" can carry out operations within the working range of the robot

The operations within the working range of the robot include handling, setting, teaching, adjustment, maintenance, etc.

To carry out the operations within the working range of the robot, 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
- Goggles



Warning

1. Ensure that robot arms and tools (or end-effector) are correctly and firmly bolted.
2. Ensure that the robot arms have sufficient spaces of free movement.
3. Ensure that safety measures and parameters have been established to protect the users based on risk assessment.
4. Never wear loose clothes or jewelry when operating the robots. Tie long hair (if any) behind your head when operating the robot.
5. Always keep your head and face outside the reach of the robot during operation.
6. Never enter the safe range of the robot or touch the operating robot if a safe range has been

determined by risk assessment.

7. The user must be aware of the position of the E-stop button.

Warnings and precautions related to operation of the controller

Warning

Warnings and precautions related to operation of the controller

1. IRC-D6A 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. Provide more than one emergency stop button within reach of the operator according to the system configuration.
5. 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
	Warning - electric shock
	Warning - hands pinching
	Beware of burns due to high temperature.
	Grounding

I. MAINTENANCE

1 SUMMARY

This Instructions is applicable to the IRC-D6A controller.

It describes the maintenance and connection of IRC-D6A for the robot.

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

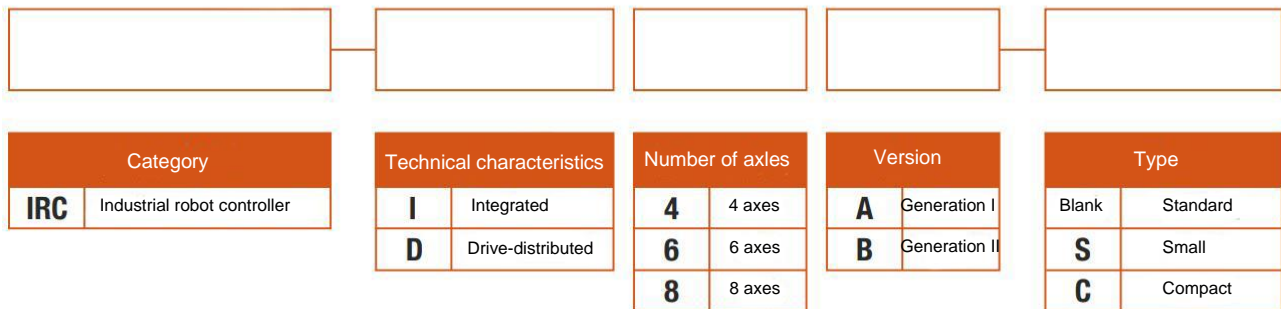
Connection: Methods for connecting IRC-D6A and the robot mechanism and peripheral devices and mounting the controller.



Warning

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

Naming rules for robot controllers



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.

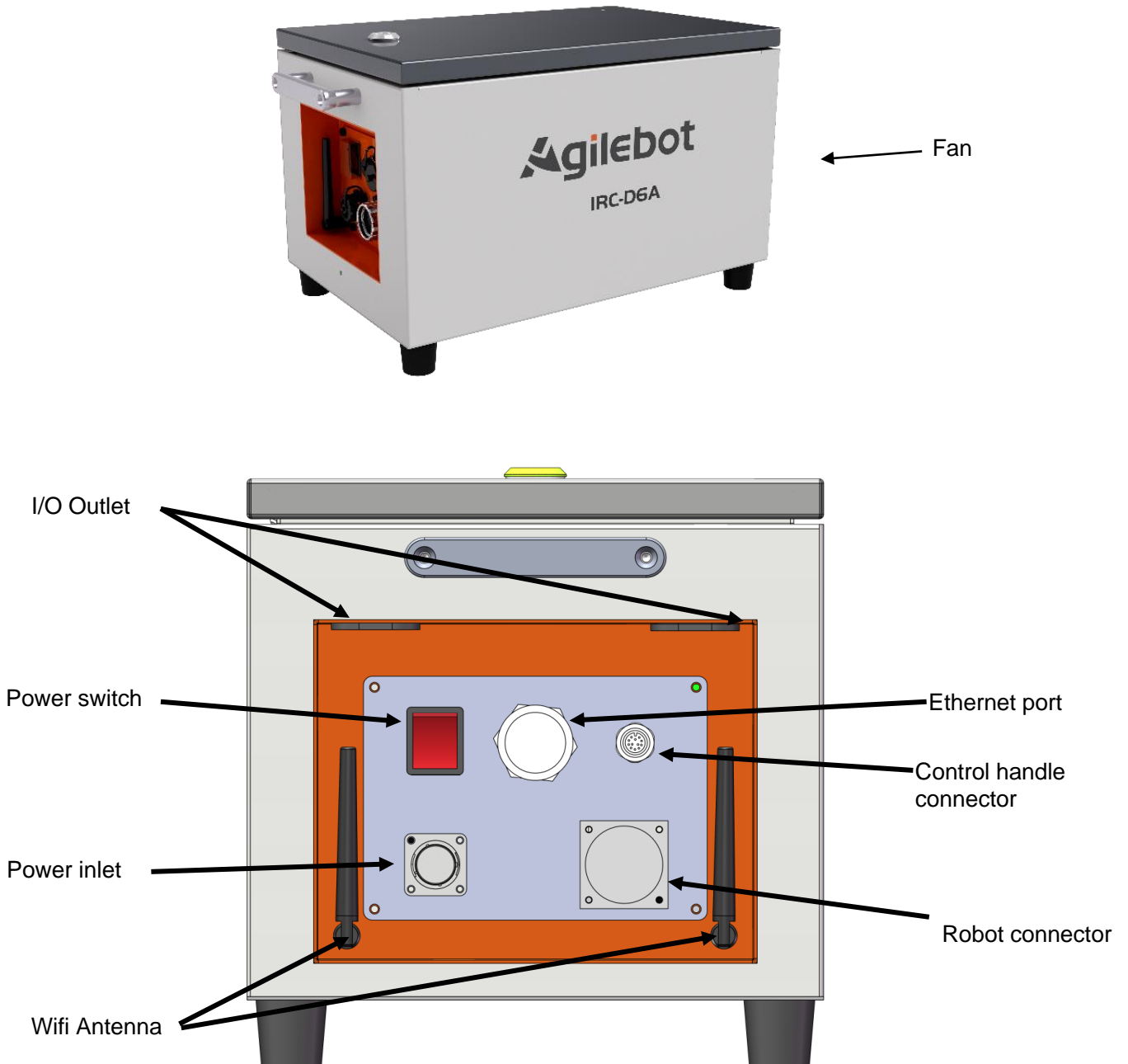
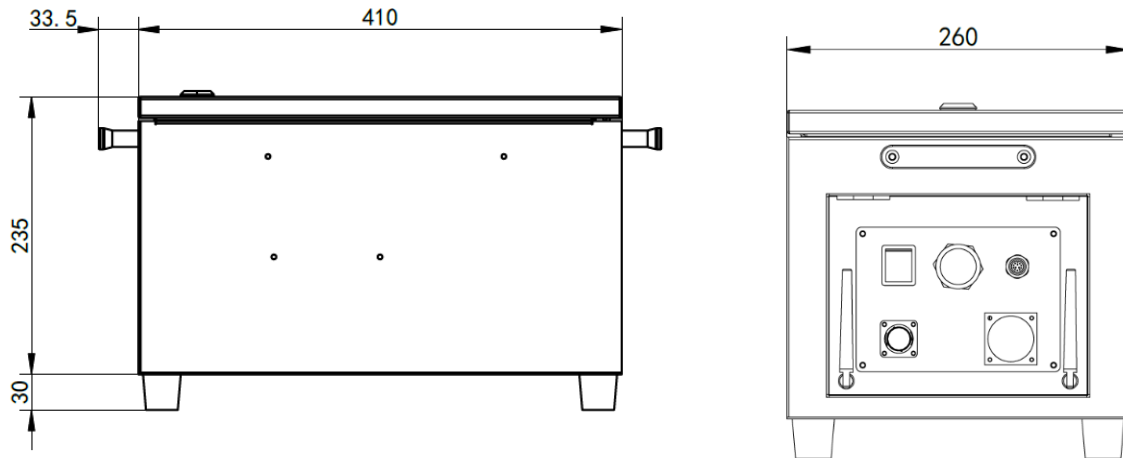


Fig. 2.1 Appearance of Controller



Caution

The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

Fig. 2.2 Dimensions of Controller (unit: mm)

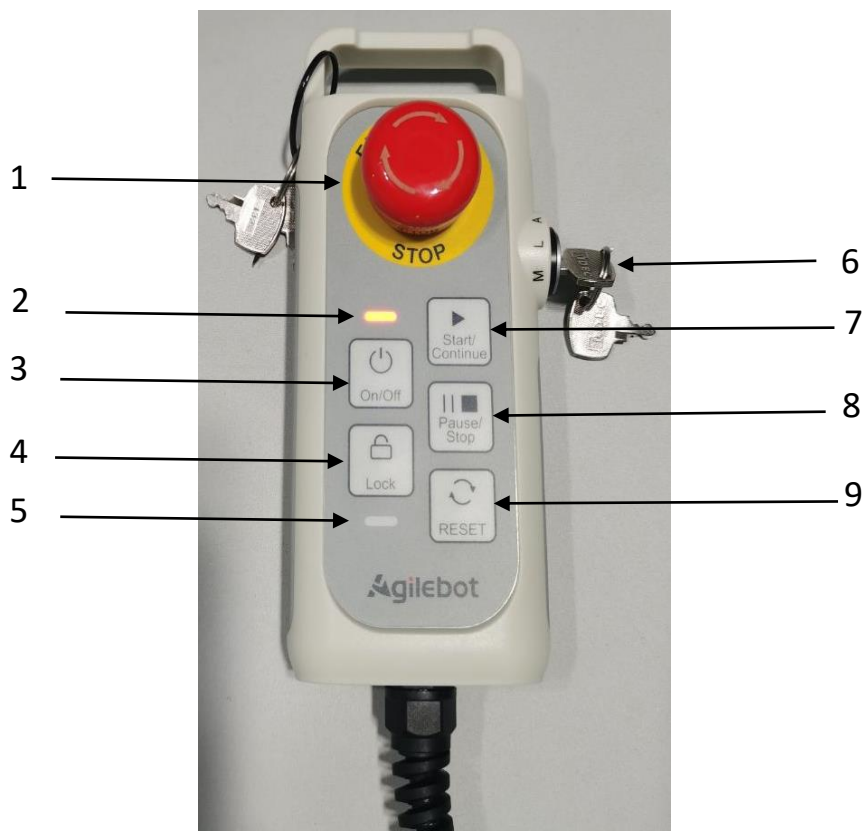


Fig. 2.3 Appearance of Handle

S/N	Name	Function
1	E-stop	The robot immediately stops (Cat. 1 stop) when it is pressed.
2	Power light	Off: Shutdown status. Red flash status: The robot is in excitation mode Green lighting status: The robot is in normal mode Green flash status: The program pauses in normal mode Yellow lighting status: The robot is in the drag teaching mode
3	On/Off	Press and hold for 3s to power on. Press and hold for 10s to shut down. Note: When shutting down, press and hold this button for 3s, a pop-up will appear on the operating terminal. Then, press Confirm to immediately shut down without waiting for 10s.
4	Lock key	Press and hold it for 3s to lock or unlock all buttons on the handle (except for e-stop and mode selector).
5	Lock light	It is on when the button is locked.
6	Mode switch	It is used to switch among Auto, Manual and LimitManual modes.
7	Start/Continue	Continuously run a program after its start or pause. The default program may be started when the mode selector is in AUTO. It can be designated in system configuration. Enter the editing interface of a program when the mode selector is in MANUAL. Press this button to run the program currently being edited. This button is irresponsive on other pages.
8	Pause/Abort	Press it to pause a running program, and press it again to abort the program.
9	Reset	Clear the error while enabling. However, RESET is invalid when the "forced drive" function is in effect.

2.2 COMPONENT UNITS

The following figure shows main components inside the IRC-D6A controller.

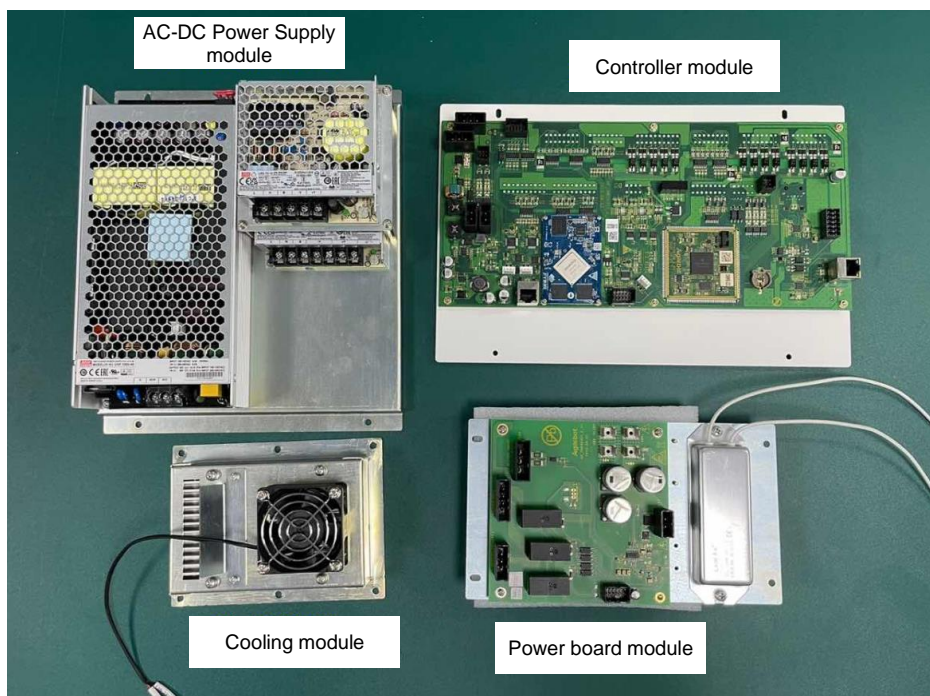


Fig. 2.4 Internal Modules of Controller

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 wired handle 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.

- **Monthly maintenance**

- 1) Confirm if the fan rotates normally. Clean excessive dust and other impurities (if any) adhering to the fan.
- 2) Clean the dust from the interior of the controller. Wipe off any dust adhering to the fan and the transformer.
- 3) 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.
- 4) Check for any abnormal stains inside the controller. If any, please identify the cause and take necessary measures to clean them. Please check for any gaps around the sealing gasket in the locked state. Check for any gaps around the cable port.

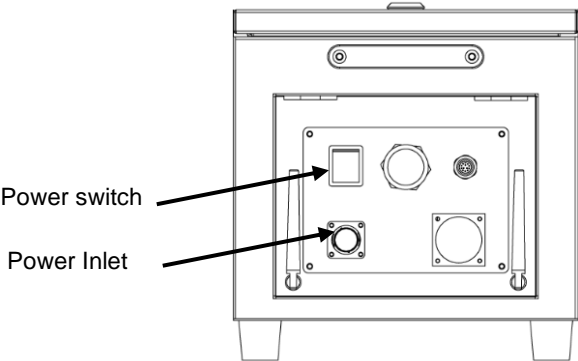
- **Maintenance tools**

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

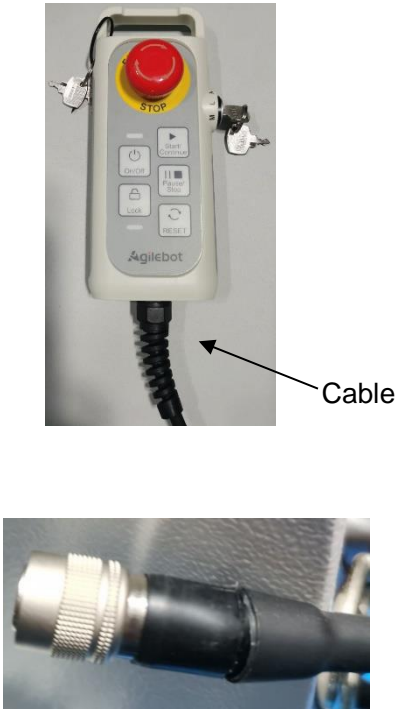
- 1) Measuring instrument: AC/DC voltmeter (sometimes, a digital voltmeter is required)
- 2) Oscilloscope: (frequency bandwidth above 5MHz, dual channel)
- 3) Tools: Phillips screwdriver, slotted screwdriver, socket screwdriver, wire pliers, scissors and tweezers.

3 RESOLUTION OF COMMON FAULTS

3.1 DON'T POWER ON

Inspection and treatment	Diagram
<p>Inspection 1: Confirm that the circuit breaker has been switched on.</p> <p>Treatment 1: Switch on the circuit breaker when it is not connected.</p> <p>Treatment 2: Check if the AC220V power cable is properly connected.</p>	 <p>The diagram shows the front panel of the IRC-D6A Controller. Two arrows point to specific components: one to a rectangular switch labeled 'Power switch' and another to a circular port labeled 'Power Inlet'.</p>

3.2 WHEN THE HANDLE CANNOT BE POWERED ON (THE HANDLE LED DOES NOT LIGHT UP)

Inspection and treatment	Diagram
<p>Inspection 1: Confirm if the handle cable is damaged.</p> <p>Inspection 2: Confirm if the pin of the handle port is damaged.</p> <p>Treatment 1: Check if the cable is damaged and replace it if damaged.</p> <p>Treatment 2: Check if the pin is damaged and replace it if damaged.</p>	 <p>The top photograph shows the Agilebot handle with a red emergency stop button and several control buttons. An arrow points to the black cable connected to the bottom of the handle, labeled 'Cable'. The bottom photograph is a close-up of the handle's connector, showing a metal pin and a black plastic housing.</p>

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 operating terminal, click on the character in the red box in Fig. 3.1 to pop up the screen as shown in Fig. 3.2.

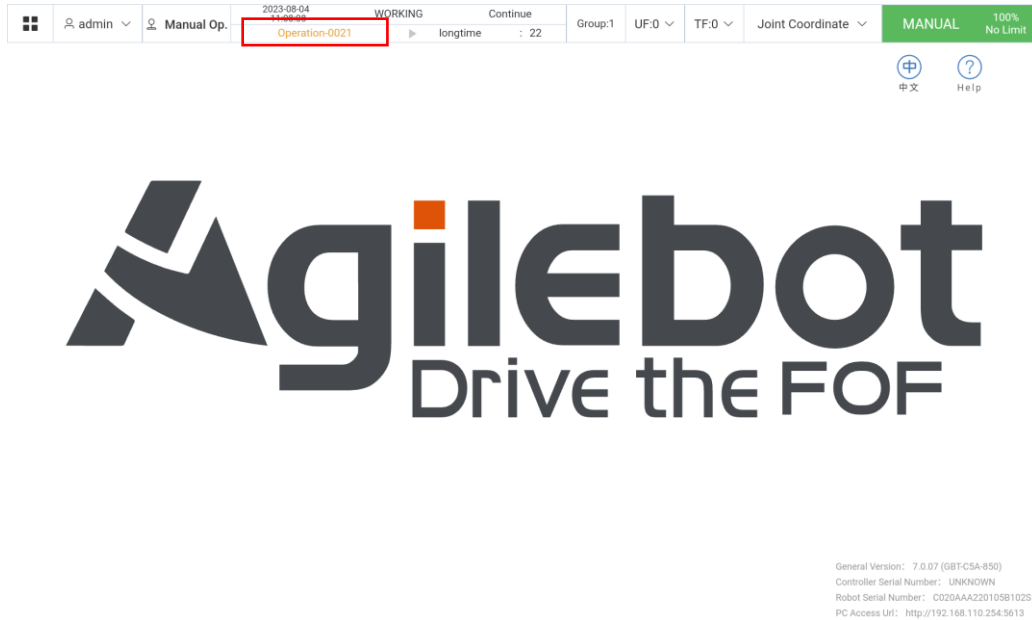


Fig. 3.1 Main Screen of Operating Terminal

2. Click on the historical event to see the current alarm log and view the alarm history, as shown in Fig. 3.3.

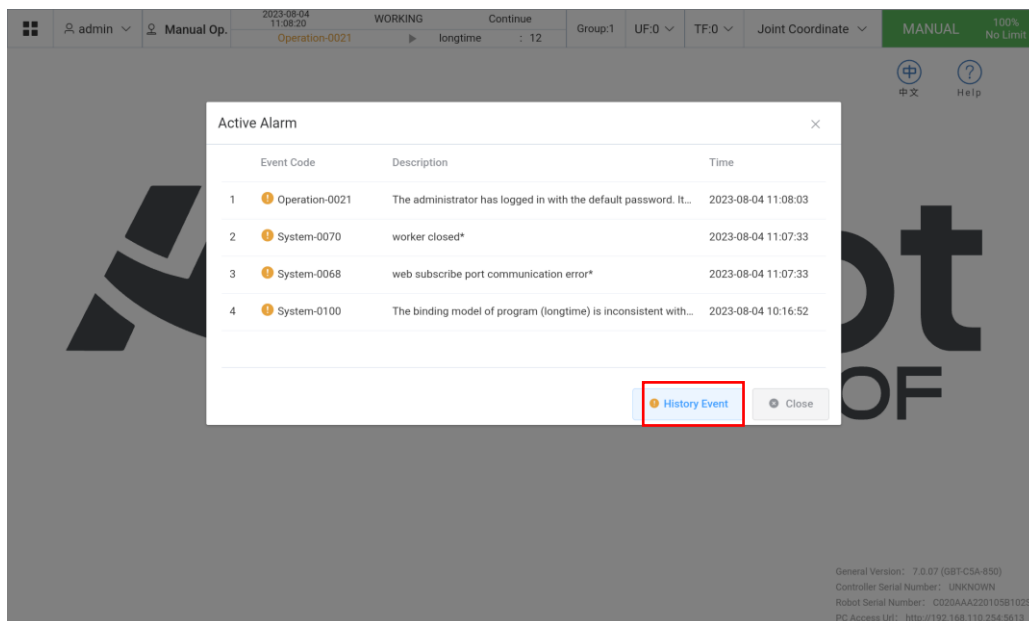


Fig. 3.2 Current Alarm Popup

3. After viewing historical events, you can see various alarm codes and other messages. Click on the red box in Fig. 3.3 to filter the alarm types.

Event Code	Description	Time
1	Operation-0021 The administrator has logged in with the default password. It is recommended to update the password*	2023-08-04 11:08:03
2	Operation-0017 admin login success*	2023-08-04 11:08:03
3	Operation-0065 user mode switching to UnlimitedManual*	2023-08-04 11:07:50
4	System-2196 TpComm logrun /rpc/tp_comm/getPublishTable success*	2023-08-04 11:07:50
5	System-2196 TpComm logrun /rpc/tp_comm/getRpcTable success*	2023-08-04 11:07:49
6	System-0069 Establish communication with control cabinet	2023-08-04 11:07:49
7	System-0070 worker closed*	2023-08-04 11:07:33
8	System-0068 web subscribe port communication error*	2023-08-04 11:07:33
9	System-0070 worker closed*	2023-08-04 10:37:37
10	System-2196 TpComm logrun /rpc/tp_comm/getPublishTable success*	2023-08-04 10:25:27

Fig. 3.3 Alarm History Screen

- After filtering the alarm types, you can see corresponding alarm messages as shown in Fig. 3.4.

Event Details

Operation-0021 (WARNING) 2023-08-04 11:08:03

ADMIN_LOGIN_WITH_DEFAULT_PASSWORD

Event Description
The administrator has logged in with the default password. It is recommended to update the password*

Consequence

Cause

Solution

[Previous](#) [Next](#)

Fig. 3.4 Alarm Information

3.4 RESOLUTION OF COMMON FAULTS BASED ON ALARM CODES

Motion-A32097 - UI servo enable is off*

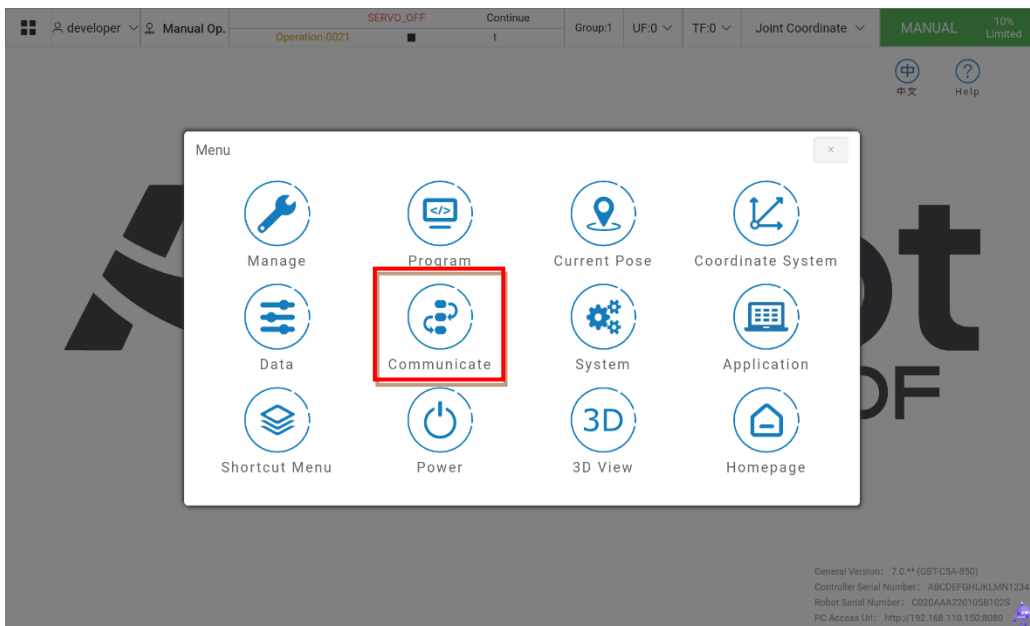
Phenomenon: UI servo enable is off

Result: Stop

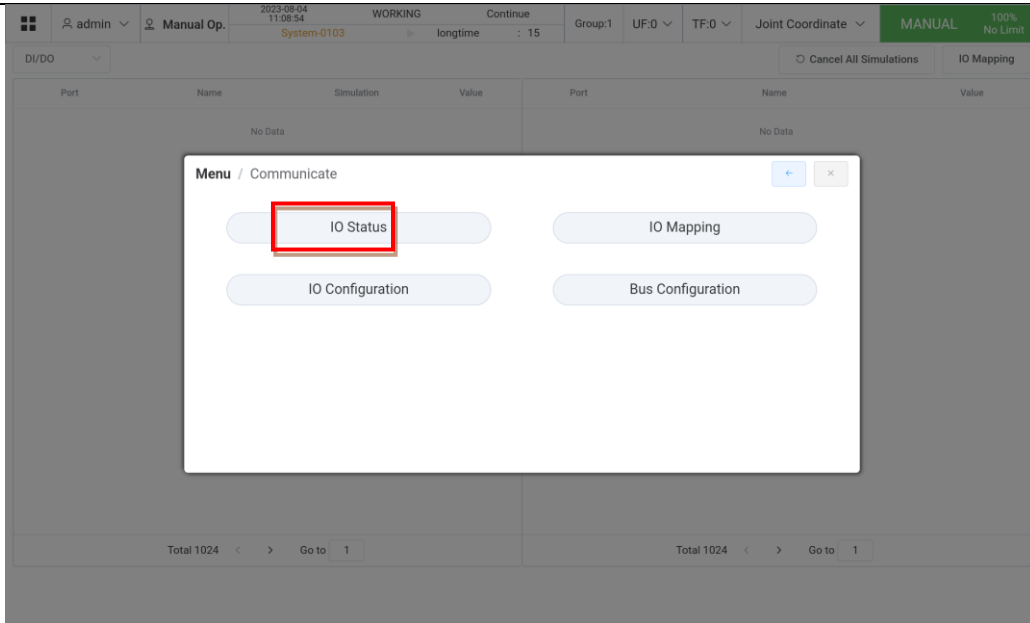
Cause: triggered by UI signal

Countermeasure: Keep the UI signal at a high level. Otherwise, the low level may trigger a Cat. 0 stop.

(1) To view the UI signal, click the menu at the upper left corner of the screen, as shown in the following figure, and then click the communication screen.



(2) After opening the communication screen, click on the I/O status to view the I/O signal as shown in the following figure.



(3) After opening the I/O status screen, click on the part in the circle to view different types of signals as shown in the following figure.

The screenshot shows the Agilebot control interface with the 'RI/RO' dropdown menu highlighted by a red rectangle. Below the dropdown is a table of I/O signals. The table has columns for 'Port', 'Name', 'Simulation', and 'Value'. The 'Value' column shows 'OFF' for all signals. The table is divided into two sections: RI (Robot In) and RO (Robot Out).

Port	Name	Simulation	Value	Port	Name	Value
RI[1]	robot_arm1	UnSim Sim	OFF	RO[1]	robot_arm7	OFF
RI[2]	robot_arm2	UnSim Sim	OFF	RO[2]	robot_arm8	OFF
RI[3]	robot_arm3	UnSim Sim	OFF	RO[3]	robot_arm9	OFF
RI[4]	robot_arm4	UnSim Sim	OFF	RO[4]	robot_arm10	OFF
RI[5]	robot_arm5	UnSim Sim	OFF	RO[5]	robot_arm11	OFF
RI[6]	robot_arm6	UnSim Sim	OFF	RO[6]	robot_arm12	OFF

At the bottom of the interface, there are two 'Total 6' and 'Go to 1' indicators.

(4) UI1, UI2 and UI5 signals should be normally off as shown in the following figure.

Port	Name	Bypass	Value	Port	Name	Value
UI[1]	Servo_Enable	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> ON	UI[1]	CMD_Enable	<input type="checkbox"/> OFF
UI[2]	Pause_Request	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> ON	UI[2]	Paused	<input type="checkbox"/> OFF
UI[3]	Reset	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[3]	Fault	<input type="checkbox"/> OFF
UI[4]	Start&Restart	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[4]	Program_Running	<input checked="" type="checkbox"/> ON
UI[5]	Abort_Program	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> ON	UI[5]	Servo_Status	<input checked="" type="checkbox"/> ON
UI[6]	Selection_Strobe	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[6]	Selection_Check_Request	<input type="checkbox"/> OFF
UI[7]	MPLCS_Start	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[7]	MPLCS_Start_Done	<input type="checkbox"/> OFF
UI[8]	Program_Selection_1	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[8]	Selection_Confirm_1	<input type="checkbox"/> OFF
UI[9]	Program_Selection_2	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[9]	Selection_Confirm_2	<input type="checkbox"/> OFF
UI[10]	Program_Selection_3	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> OFF	UI[10]	Selection_Confirm_3	<input type="checkbox"/> OFF

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

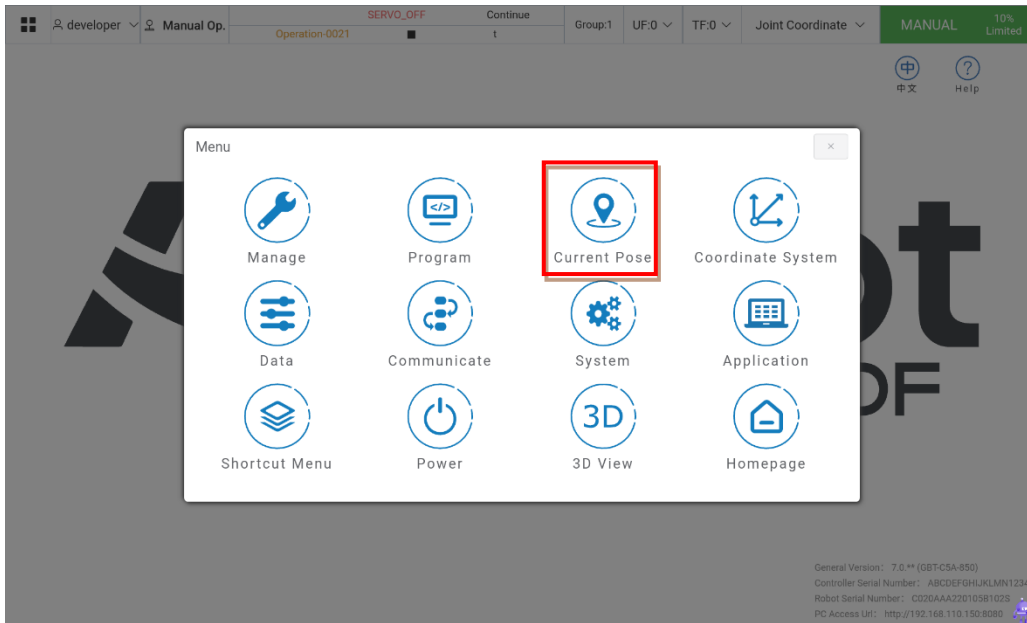
System-2193 - Controller detects the safety board is not ready when reset operation*
Phenomenon: The robot cannot be powered on after RESET is pressed.
Result: The operation fails.
Cause: The safety board signal is not ready.
Countermeasure: Check the alarm codes reported simultaneously and the safety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

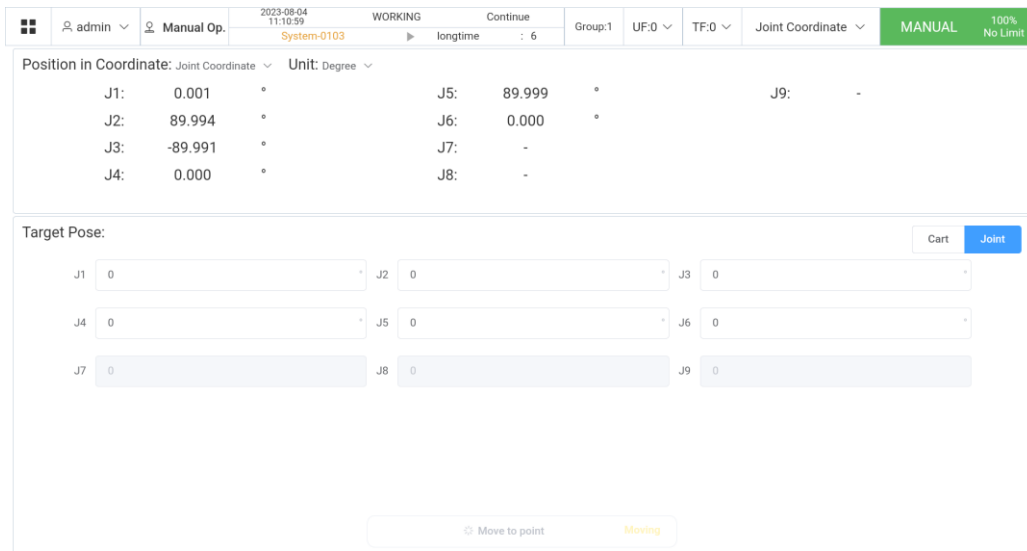
- 1) View current position message and soft limit position message of each axis.
- 2) Implement zero calibration due to the soft limit caused by the loss of zero calibration.

The operation steps are as follows for Case 1:

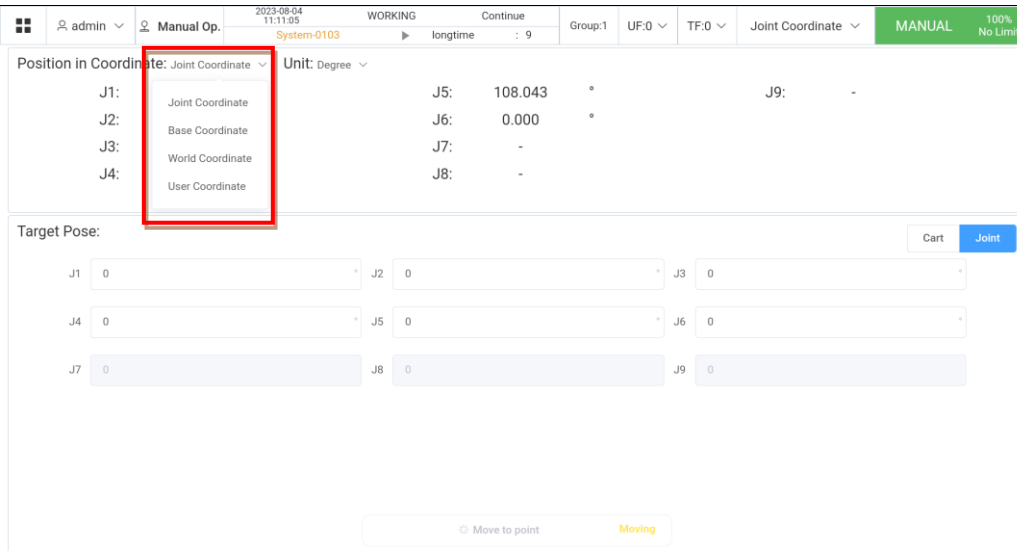
1. Click the menu and then current pose icon.



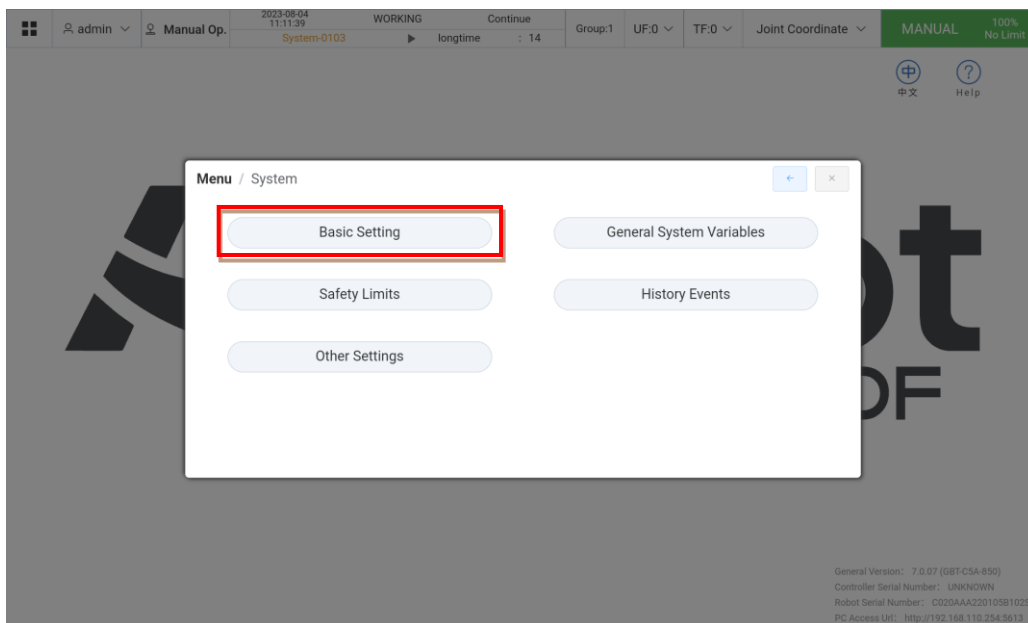
2. After selecting the current position icon, you can view the position information of each axis as shown in the following figure.



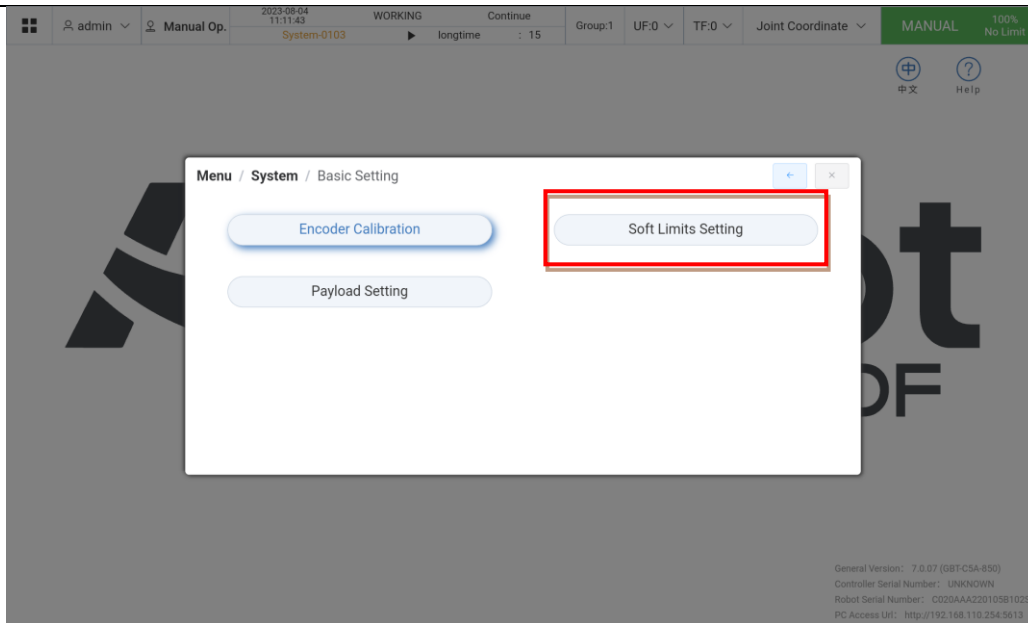
3. Switch relative coordinate systems to view the position information of each axis under different coordinate systems, as shown in the following figure.



- Click on the system icon as shown in the figure below and then the Basic Setting to open the Soft Limit Setting screen.



- Click on the Soft Limit Setting to view the soft limit value of each axis.



6. The following figure shows upper and lower limits of the soft limit of each axis.

The screenshot shows the 'Soft Limits Setting' interface. At the top, there is a status bar with 'admin', 'Manual Op.', '2023-08-04 11:11:53', 'System-0103', 'WORKING', 'Continue', 'longtime : 5', 'Group:1', 'UF:0', 'TF:0', 'Joint Coordinate', 'MANUAL', and '100% No Limit'. Below this, there is a dropdown menu for 'Group: GBT-C5A-850'. The main content is a table with the following data:

Axis	Default lower	Lower Soft	Upper Soft	Default upper
Axis1	-360 °	-360 °	360 °	360 °
Axis2	-85 °	-85 °	265 °	265 °
Axis3	-161 °	-161 °	161 °	161 °
Axis4	-85 °	-85 °	265 °	265 °
Axis5	-360 °	-360 °	360 °	360 °
Axis6	-360 °	-360 °	360 °	360 °

At the bottom right of the table, there is an 'Edit' button.

The operation steps are as follows for Case 2:

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

The screenshot shows the Agilebot control interface. At the top, there are navigation and status elements including 'developer', 'Manual Op.', 'Operation-0021', 'SERVO_OFF', 'Continue', 'Group:1', 'UF:0', 'TF:0', 'Joint Coordinate', 'MANUAL', and '10% Limited'. Below this is a 'Method' dropdown set to 'General Calibration Method' and a 'Group' dropdown set to '1: GBT-C5A-850'. The main area contains a table with columns 'Axis No.', 'Offset (°)', and 'Status'. The table lists axes 1 through 6, all with an offset of 0 and a status of 'Zero Lost'. At the bottom, there are buttons for 'Temporary Masking Error', 'Reset Encoder', and 'Calibrate'.

2. A prompt message may appear in the upper right corner after calibration. Then, click "Save" below it to save the calibration information and then complete the calibration.

The second screenshot shows the same interface after calibration. A 'SUCCESS' message box is displayed in the upper right corner, stating 'Calibrated successfully'. The table now shows the status for all axes as 'Not Saved'. The 'Calibrate' button has been replaced by 'Cancel' and 'Save' buttons.

4 REPLACEMENT OF UNITS

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) Turn off the switch.
- (2) Remove the power cable.

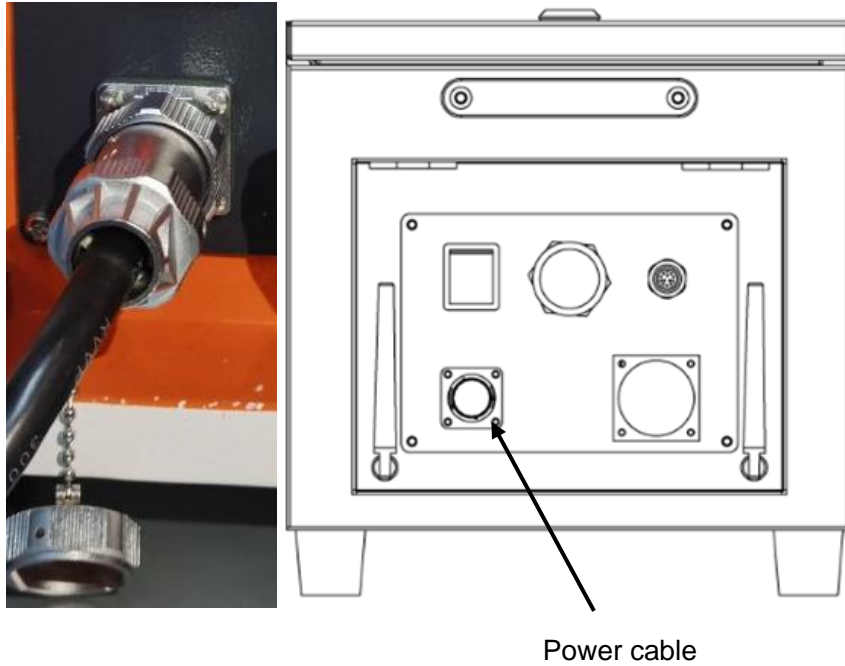


Fig. 4.1 Power inlet

- (3) Open the top cover of the controller with the triangular key.

II. CONNECTION

1 SUMMARY

1.1 OVERVIEW OF ROBOT COMPONENTS

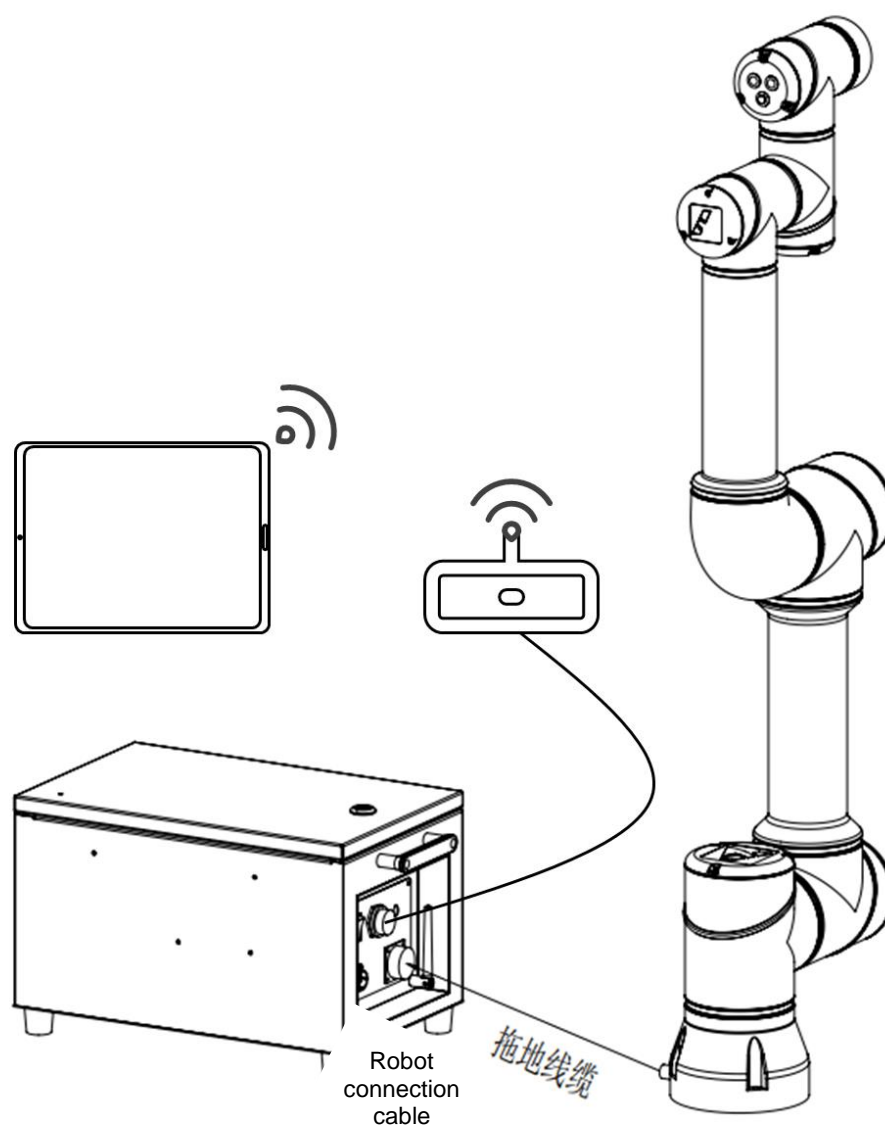


Fig. 1.1 Diagram of Robot System

External ports

The following diagram describes the connection ports on the front panel of the IRC-D6A 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.

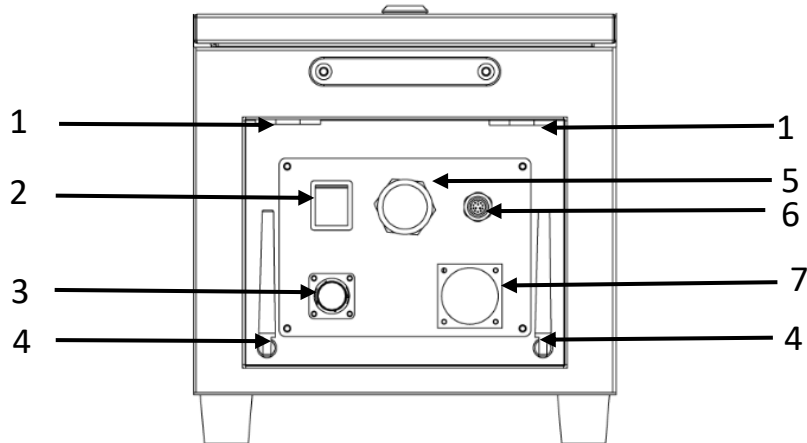


Fig. 1.1 Front View of Controller

S/N	Part name	Function
1	I/O Outlet	I/O Outlet
2	On/Off	On/Off of controller
3	Power Inlet	220 V AC Power Inlet
4	Antenna	2.4G wifi antenna
5	Ethernet port	An Ethernet port of the controller, used to connect a router or operating terminal for debugging.
6	Control Handle connector	Connect the wire handle.
7	Robot connector	Used to connect the robot body

2 CONNECTION WITH DEVICES

2.1 CONNECTING CABLES OF THE ROBOT

The connecting cables between the robot and the controller include robot connection cables.

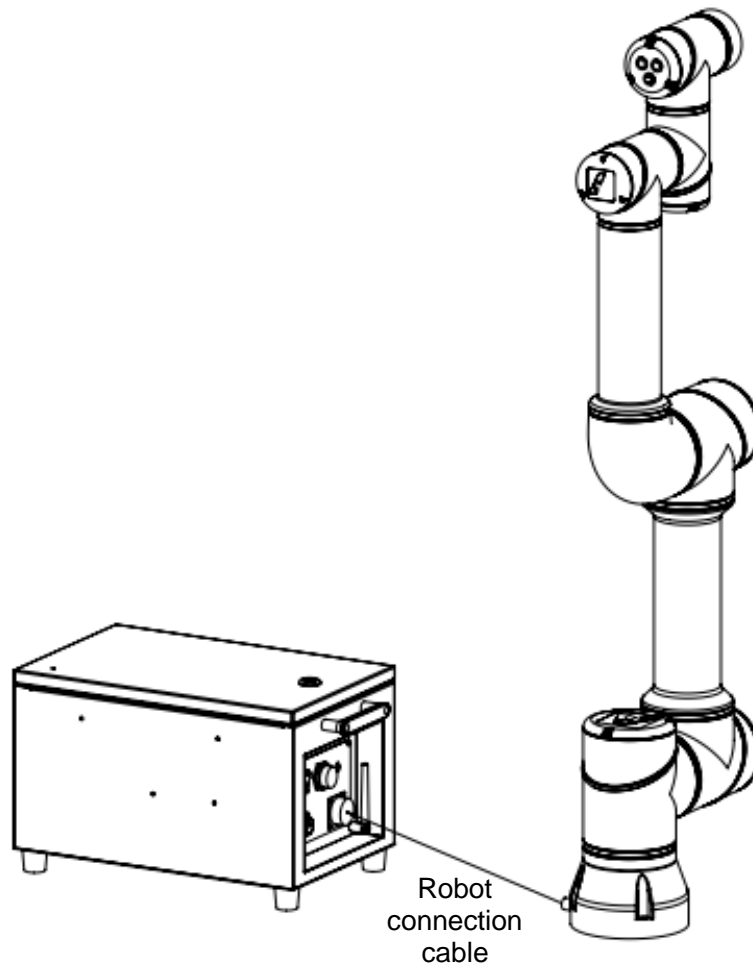


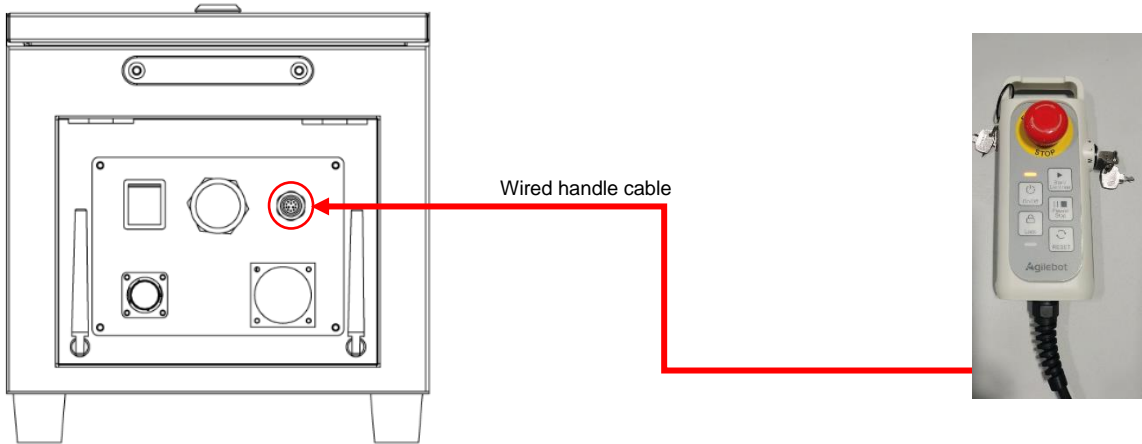
Fig. 2.1 Connection between Robot and Controller



Caution

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

2.2 WIRED HANDLE CABLE



The wired handle connector on IRC-D6A is located on the controller. Make sure to check for dirt or damage before connecting the connector to the controller. Please clean the components or replace damaged ones.

2.3 PREPARATION OF INPUT POWER CABLE

Connect the power cable of IRC-D6A, use accessories provided by us, or prepare them independently. Prepare the power cable yourself according to the following requirements. Connect the power side according to the field situation.

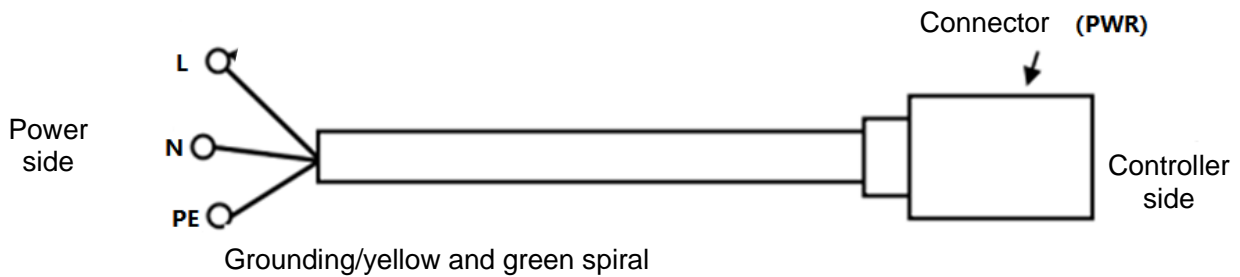


Fig. 2.3 Connection of Power Cable

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

Material number	Name	Specification	Standard	Length	Cable diameter	Minimum bend radius
4010300001	Cables outside single-phase power cabinet	RVVP, 3*2.5mm ² , red/blue/yellow green	JB/T 8734.5-2016	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.

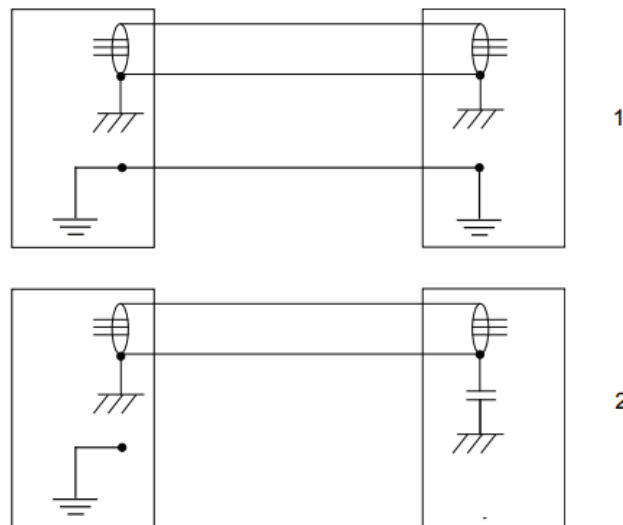


Fig. 2.4 Grounding Connection

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 clamped 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.

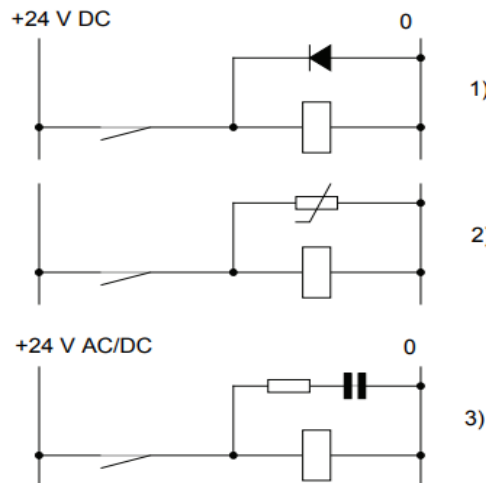


Fig. 2.5 Elimination of Interference

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 100Ω and the capacitance should be $1W$ $0.1-1 \mu F$ (usually $0.47 \mu F$).

2.6 ABOUT LEAKAGE CIRCUIT BREAKER

The power supply of the robot controller may have a high-frequency leakage current, which sometimes leads to (incorrect) action of the leakage circuit breaker or leakage protector arranged on the robot controller. Therefore, the leakage circuit breaker corresponding to the inverter and able to avoid the incorrect operation should be used.

2.7 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.

3 PERIPHERAL DEVICES

3.1 CONTROLLER WIRING PANEL

The controller wiring panel of IRC-D6A has signal inputs, signal outputs, safety outputs, safety inputs, emergency inputs, user inputs, encoder inputs and analog inputs.

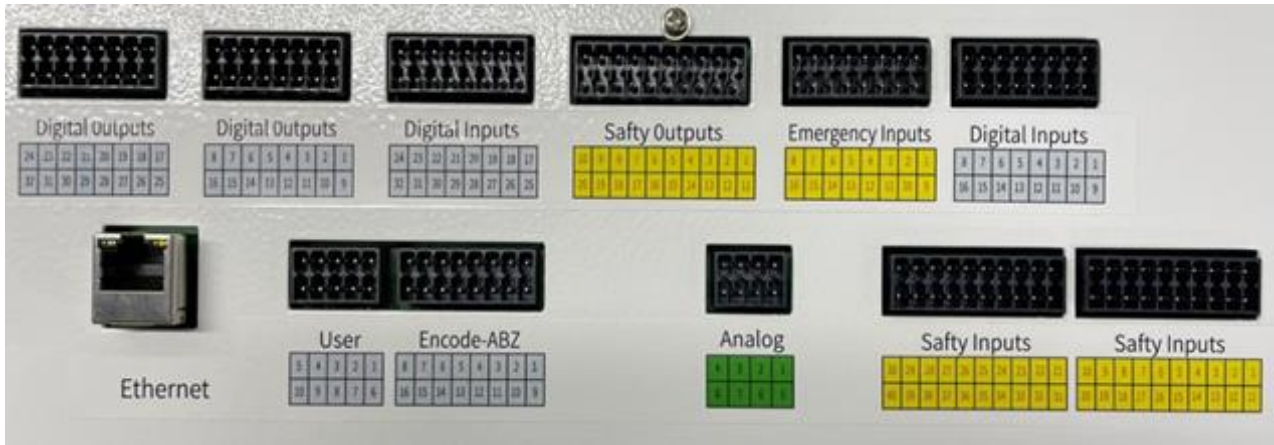


Fig. 3.1 Wiring Panel of IRC-D6A Controller

1. Signal inputs

Digital Inputs

24	23	22	21	20	19	18	17
32	31	30	29	28	27	26	25

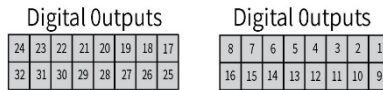
Digital Inputs

8	7	6	5	4	3	2	1
16	15	14	13	12	11	10	9

DIGITAL INPUTS			
PIN NO.	SIGNAL DEFINITION	PIN NO.	SIGNAL DEFINITION
1	DI 1	9	24V+
3	DI 2	10	24V+
5	DI 3	11	DI_COM_1-8
7	DI 4	12	DI_COM_1-8
9	DI 5	13	DI_COM_1-8
11	DI 6	14	DI_COM_1-8
13	DI 7	15	GND
15	DI 8	16	GND
17	DI 9	25	24V+
19	DI 10	26	24V+
21	DI 11	27	DI_COM_9-16
23	DI 12	28	DI_COM_9-16
25	DI 13	29	DI_COM_9-16
27	DI 14	30	DI_COM_9-16
29	DI 15	31	GND
31	DI 16	32	GND

TABLE 3.1 SIGNAL INPUT LIST

2. Signal outputs



DIGITAL OUTPUTS			
PIN NO.	SIGNAL DEFINITION	PIN NO.	SIGNAL DEFINITION
1	DO 1	9	24V+
2	DO 2	10	24V+
3	DO 3	11	DO_PS_IN_1-8
4	DO 4	12	DO_PS_IN_1-8
5	DO 5	13	DO_PS_IN_1-8
6	DO 6	14	DO_PS_IN_1-8
7	DO 7	15	GND
8	DO 8	16	GND
17	DO 9	25	24V+
18	DO 10	26	24V+
19	DO 11	27	DO_PS_IN_9-16
20	DO 12	28	DO_PS_IN_9-16
21	DO 13	29	DO_PS_IN_9-16
22	DO 14	30	DO_PS_IN_9-16
23	DO 15	31	GND
24	DO 16	32	GND

TABLE 3.2 SIGNAL OUTPUT LIST

3. Safety outputs

Safety Outputs

10	9	8	7	6	5	4	3	2	1
20	19	18	17	16	15	14	13	12	11

SAFETY OUTPUTS			
PIN NO.	SIGNAL DEFINITION	PIN NO.	SIGNAL DEFINITION
1	SO1A	11	24V+
2	SO1B	12	24V+
3	SO2A	13	SO_PS_IN_1-5
4	SO2B	14	SO_PS_IN_1-5
5	SO3A	15	SO_PS_IN_1-5
6	SO3B	16	SO_PS_IN_1-5
7	SO4A	17	SO_PS_IN_1-5
8	SO4B	18	SO_PS_IN_1-5
9	SO5A	19	GND
10	SO5B	20	GND

TABLE 3.3 SAFETY OUTPUT LIST

4. Safety input

Safety Inputs

Safety Inputs

30	29	28	27	26	25	24	23	22	21	10	9	8	7	6	5	4	3	2	1
40	39	38	37	36	35	34	33	32	31	20	19	18	17	16	15	14	13	12	11

SAFETY INPUTS			
PIN NO.	SIGNAL DEFINITION	PIN NO.	SIGNAL DEFINITION
1	SI1A GND	11	SI1A
2	0V	12	24V
3	SI1B GND	13	SI1B
4	0V	14	24V

5	SI2A GND	15	SI2A
6	0V	16	24V
7	SI2B GND	17	SI2B
8	0V	18	24V
9	SI3A GND	19	SI3A
10	0V	20	24V
21	SI3B GND	31	SI3B
22	0V	32	24V
23	SI4A GND	33	SI4A
24	0V	34	24V
25	SI4B GND	35	SI4B
26	0V	36	24V
27	SI5A GND	37	SI5A
28	0V	38	24V
29	SI5B GND	39	SI5B
30	0V	40	24V

TABLE 3.4 SAFETY INPUT LIST

5. Emergency inputs

Emergency Inputs

8	7	6	5	4	3	2	1
16	15	14	13	12	11	10	9

If e-stop signals are not used in practical applications, the emergency inputs should be shorted out. If only some e-stop signals are used, those unused should be shorted out.

Emergency Inputs			
Pin No.	Signal definition	Pin No.	Signal definition
1	EstopA GND	9	EstopA Input
2	0V	10	24V
3	EstopB GND	11	EstopB Input
4	0V	12	24V
5	SafedoorA GND	13	SafedoorA Input
6	0V	14	24V
7	SafedoorB GND	15	SafedoorB Input
8	0V	16	24V

TABLE 3.5 EMERGENCY INPUT LIST

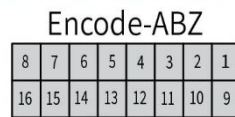
6. User inputs



User			
Pin No.	Signal definition	Pin No.	Signal definition
1	5V	6	Power ON
2	5V	7	Power OFF
3	0V	8	0V
4	0V	9	0V
5	485_A	10	485_B

TABLE 3.6 USER INPUTS LIST

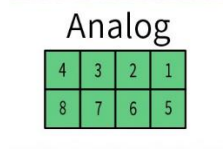
7. Encoder inputs



Encode-ABZ			
Pin No.	Signal definition	Pin No.	Signal definition
1	5V	9	0V
2	PA+	10	PA-
3	PA+	11	PA-
4	PB+	12	PB-
5	PB+	13	PB-
6	PZ+	14	PZ-
7	PZ+	15	PZ-
8	5V	16	0V

Table 3.7 Encoder Input List

8. Analog inputs



Analog			
Pin No.	Signal definition	Pin No.	Signal definition
1	5V	5	0V
2	AI1	6	0V
3	AI2	7	0V
4	5V	8	0V

Table 3.8 Analog Input List

3.2 CONNECTION OF COMMUNICATION DEVICE (ETHERNET PORT)

The IRC-D6A controller is provided with standard Ethernet RJ45 ports and supports multiple protocols, and one Ethernet port is 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

Fixing and handling of controller

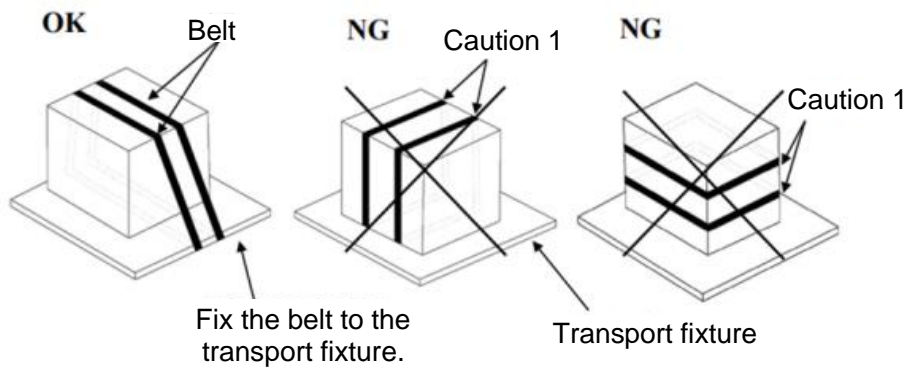


Fig. 4.1 Fixing of Controller



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

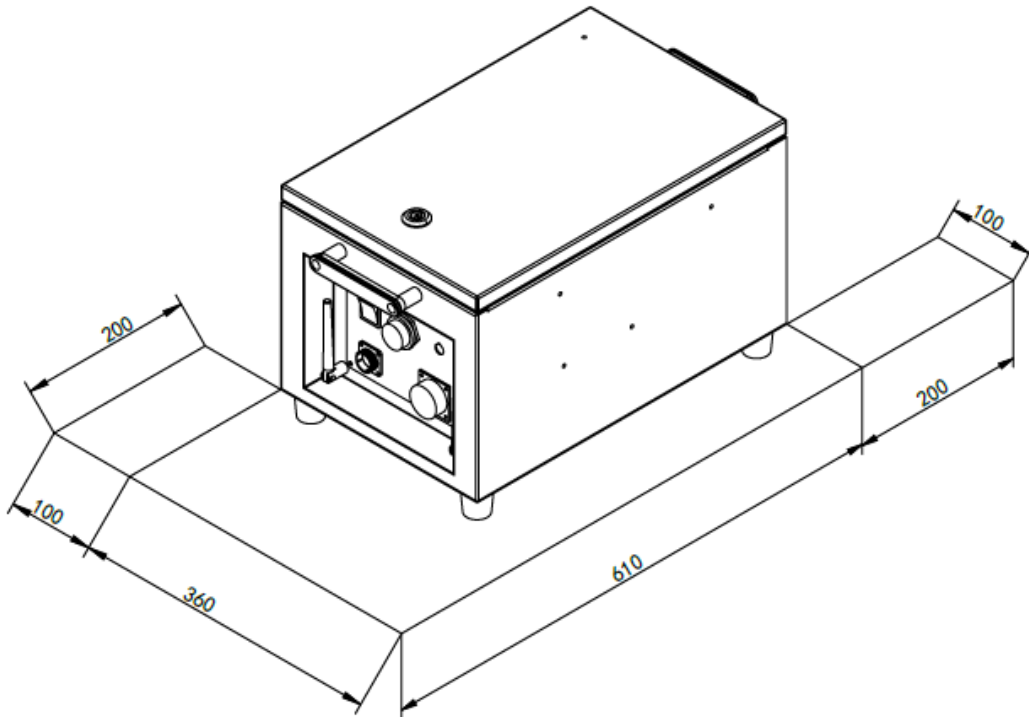


Fig. 4.3 Mounting of Controller



Caution

The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

- If mounted on a desktop (without a rack), the controller requires 100mm free space on both sides.
- 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

The IRC-D6A controller may not intentionally generate/use high-frequency energy of wireless bandwidth in the combined electromagnetic, inductive or capacitive form. Except for ordinary household devices directly connected to low-voltage networks, this controller can be used for induction and radiation barriers in material handling/investigation/analysis facilities. In non-industrial environments, its electromagnetic compatibility may sometimes be problematic. Never use this device in residential areas.

Otherwise, it may cause malfunctions. In order to prevent interference with users' reception of radio and television signals, it cannot be used unless special measures are taken to reduce electromagnetic radiation. This device may not malfunction due to harmonics generated in general factory environments, but it may malfunction when connected to a distorted power source containing higher harmonics. In this case, please take harmonic countermeasures for the power device.

Item	Requirements
Operating temperature	0-50℃
Protection level	IP54

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	Confirm the port signal between the controller and the robot mechanism.
8	Confirm and set all parameters.
9	Confirm the motion of each axis under manual feed.
10	Confirm the conditions of control port signals of peripheral devices.

APPENDICE

A. 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-D6A.

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 (Cat. 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.	Output high level when the following conditions are met (this signal at high level indicates that it is allowed to use the <i>Program Start Method in Auto Mode</i> to start the sequence or pause recovery. based on whether it is currently Paused): 1. The running status of the robot is "On-Standby". 2. It is in "Auto" mode. 3. The "Single Step" or "Reverse" is not selected as the program execution mode.
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 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 launch/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 Control handle. Take the effective falling edge to start or restart the program.	UO[4]	Program Running Program running signal	ON indicates that the program is running; OFF indicates that no program is running.

<p>UI[5]</p>	<p>Abort Program Program abort signal</p>	<p>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.</p>	<p>UO[5]</p>	<p>Servo Status</p>	<p>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".</p>
<p>UI[6]</p>	<p>Selection Strobe Trigger signal</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "MPLCS Simple Trigger". 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).</p>	<p>UO[6]</p>	<p>Selection Check Request</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "SMPLCS Simple Mode".</p>
<p>UI[7]</p>	<p>MPLCS Start</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "MPLCS Simple Trigger". It is a start signal of program number selection.</p>	<p>UO[7]</p>	<p>MPLCS Start Done</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "MPLCS Simple Trigger".</p>
<p>UI[8]- UI[13]</p>	<p>Program Selection 1-6</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "MPLCS Simple Trigger". 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.</p>	<p>UO[8] - UO[13]</p>	<p>Selection Confirm 1-6</p>	<p>It is only valid when the "Program Launch Mode" is set to "MPLCS" or "MPLCS Simple Trigger". 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.</p>

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