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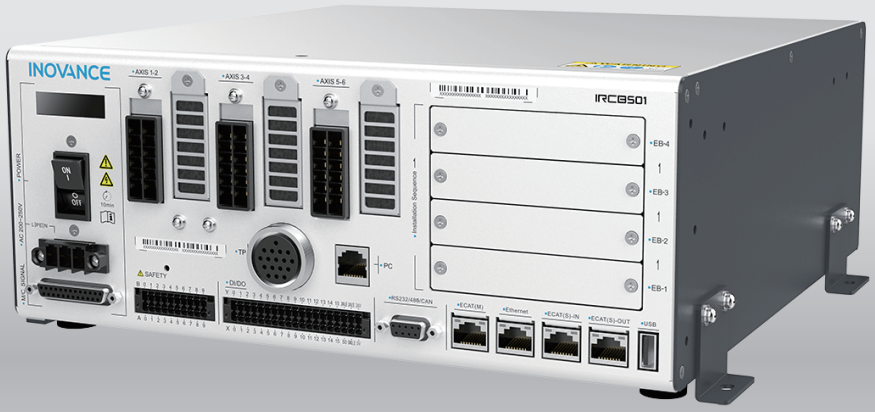


IRCB501-INT Series Robot Control Cabinet

User Guide

Industrial Automation

Intelligent Elevator

New Energy Vehicle

Industrial Robot

Rail Transit

Data code PS00017628A01

Preface

Introduction

Integrating drive and control functions, the IRCB501 control cabinet features delicate structure, abundant functions, easy installation, and easy expansion. They are designed to work with SCARA robots and 6-axis robots. The IRCB501 series evolved from the IRCB500 series, with upgraded core board of the robot and enhanced bus expansion capability of the system. The IRCB501 series control cabinets are widely used in industries such as mobile phones, TP, lithium batteries, photovoltaics, plastic machines (including toys), and boutique packaging (hat boxes).

This guide describes the basic specifications, installation and wiring, common fault diagnosis and troubleshooting, and maintenance of the IRCB501 series control cabinets.

More Documents

Name	Data Code	Introduction
IRTP80 Series Robot Teach Pendant User Guide	19012261	Describes the wiring and basic operation of the product.
IRCB501 Series 16-Channel Input I/O Expansion Card User Guide	19012412	Describes the port assignment and wiring of the product.
IRCB501 Series 16-Channel NPN Output I/O Expansion Card User Guide	19012413	Describes the port assignment and wiring of the product.
IRCB501 Series 2-Channel Incremental Encoder Expansion Card User Guide	19012411	Describes the port assignment and wiring of the product.
IRCB501 Series 1-Channel IR-LINK Expansion Card User Guide	19012410	Describes the port assignment and wiring of the product.
IRCB501 Series PROFINET Expansion Card User Guide	19012409	Describes the port assignment and wiring of the product.
IRCB501 Series Robot Functional Safety Expansion Card User Guide	19012414	Describes the port assignment and wiring of the product.
IRCB501 International Series Robot Control Cabinet User Guide (this guide)	PS00017628	Describes the basic specifications, installation and wiring, common fault diagnosis and troubleshooting, and maintenance of the IRCB501 series control cabinets.

Revision History

Date	Version	Description
November 2024	A01	Corrected minor errors
July 2024	A00	First release

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following ways:

- **Inovance website:** Visit *www.inovance.com*, go to "Support" > "Download", search by keyword, and then download the PDF file.
- **QR code**: Scan the QR code on the product with your smart phone.
- **My Inovance app:** Scan the QR code below to install the My Inovance app, and search for the file in the app.

Warranty

For faults and damage incurred during normal use in the warranty period, Inovance provides free repair service. (For details of the warranty period, see the purchase order.) A maintenance fee will be charged out of the warranty period.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (such as natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

Table of Contents

Safety Precautions

Safety Disclaimer

- This chapter presents essential safety instructions for proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety precautions may result in equipment damage, severe physical injuries, or even death.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the instructions that need to be followed; they just supplement the safety instructions.
- Use this product in an environment that complies with the design specifications. Malfunctions or component damage caused by improper use is not covered by warranty.
- Inovance shall not be held liable for any physical injuries or property damage caused by improper use.

Safety Categories and Definitions

indicates that failure to comply with the notice will result in severe physical injuries or even death.

indicates that failure to comply with the notice may result in severe physical injuries or even death.

indicates that failure to comply with the notice may result in minor or moderate physical injuries or equipment damage.

Safety Precautions

- Some drawings in this guide show the equipment without covers or protective guards to display more details. Be sure to install the covers and protective guards before using the equipment and operate the equipment in accordance with this guide.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical protective measures to protect personal safety. For example, wear and use necessary protective equipment, such as crush-resistant shoes, safety clothing, safety glasses, protective gloves, and sleeves.

Unpacking

- Do not install the product if you find damage, rust, or signs of use on it or its accessories upon unpacking.
- Do not install the product if you find water seepage or any components being missing or damaged upon unpacking.
- Do not install the product if the packing list does not match the product you received.

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surfaces of the equipment and accessories for any damage, rust, and scratches.
- Check the equipment, accessories, and materials in the package against the packing list.

Storage and Transportation

- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in physical injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in physical injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in physical injuries or equipment damage.

- Handle the equipment with care and mind your steps. Failure to comply may result in physical injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in physical injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storage for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the product properly before transportation by vehicle. Use an enclosed box for long-distance transportation.
- Never transport the product with devices or materials that may damage or negatively impact the product.

Installation

- Installation must be carried out by technicians who have received relevant training on electrical equipment and have sufficient electrical expertise. Non-professionals are not allowed to operate the equipment.

- Read through the guide and safety instructions before installation.
- Do not install the product in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire.
- Do not modify the product.
- Do not fiddle with the bolts used to fix parts and components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- If any equipment with strong electromagnetic interference, such as a transformer, is needed, install a shielding device to prevent malfunction of this product.
- Install the equipment on metal or other incombustible objects. Keep the equipment away from combustible objects. Failure to comply will result in fire.

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when a machine supposed to run at a constant speed is running at variable speeds. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

- Do not allow non-professionals to perform equipment installation, wiring, maintenance, inspection, or parts replacement.
- Before wiring, cut off all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply may result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board while power is on. Failure to comply may result in an electric shock.
- Ensure that the equipment is well grounded. Failure to comply may result in an electric shock.

- Do not connect the input power supply to the output end of the equipment. Failure to comply may result in equipment damage or even fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Use cables with required diameter and shield. Properly ground one end of the shield if a shielded cable is used.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in fire.
- After wiring is done, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

- During wiring, follow the proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply will result in damage to the equipment or internal circuits of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply may result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in physical injuries or even death.

Operation

- The equipment must be operated only by professionals. Failure to comply will result in physical injuries or even death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply may result in an electric shock.

- Do not touch the equipment casing, fan, or resistor to check the temperature. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in fire or equipment damage.

Maintenance

- Do not allow non-professionals to perform equipment installation, wiring, maintenance, inspection, or parts replacement.
- Do not maintain the equipment while power is on. Failure to comply may result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply may result in an electric shock.

- Carry out daily and periodic inspection and maintenance on the equipment according to maintenance requirements and retain a maintenance record.

Repair

- Do not allow non-professionals to perform equipment installation, wiring, maintenance, inspection, or parts replacement.
- Do not repair the equipment while power is on. Failure to comply may result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in equipment damage, physical injuries, or even death.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the product according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in further equipment damage, physical injuries, or even death.
- After equipment replacement, check the wiring and set parameters again.

Disposal
WARNING • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, physical injuries, or even death. • Recycle retired equipment in accordance with waste disposal standards of the industry to avoid environmental pollution.

Safety Label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the safety labels.

Safety Label	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, physical injuries, or even death. • Do not touch the terminals or remove the cover while power is on or within 10 min after power-off. Failure to comply may result in an electric shock.

1 Product Information

1.1 Model and Nameplate

Model

IR CB 501 - 6 F D - INT

① ② ③ ④ ⑤ ⑥ ⑦

① **Product family** INOVANCE Robot	⑤ **Power class** A: 400 W + 400 W + 400 W + 400 W B: 750 W + 400 W + 400 W + 400 W C: 750 W + 750 W + 400 W + 400 W D: 1,000 W + 1,000 W + 750 W + 400 W E: 2,000 W + 2,000 W + 750 W + 750 W F: 750 W + 750 W + 750 W + 750 W + 400 W + 400 W H: 400 W + 400 W + 400 W + 400 W + 400 W + 400 W L: 750 W + 750 W + 400 W + 400 W + 400 W + 400 W M: 1,200 W + 750 W + 750 W + 400 W
② **Product type** Cabinet	
③ **Product Series** 501: 2.0 series	⑥ **Input voltage** D: Single-phase 220 VAC S: Three-phase 220 VAC T: Three-phase 380 VAC
④ **Number of servo axes** 4: 4 axes 6: 6 axes	⑦ **Version** INT: International (With functional safety)

Note

The EtherCAT slave is standard for international models, with functional safety certification.

Nameplate

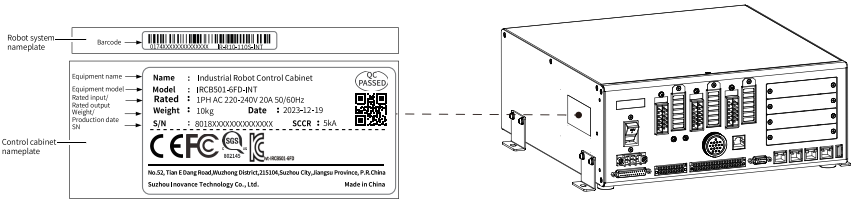


Figure 1-1 Nameplate information - Functional safety certified model

1.2 Components

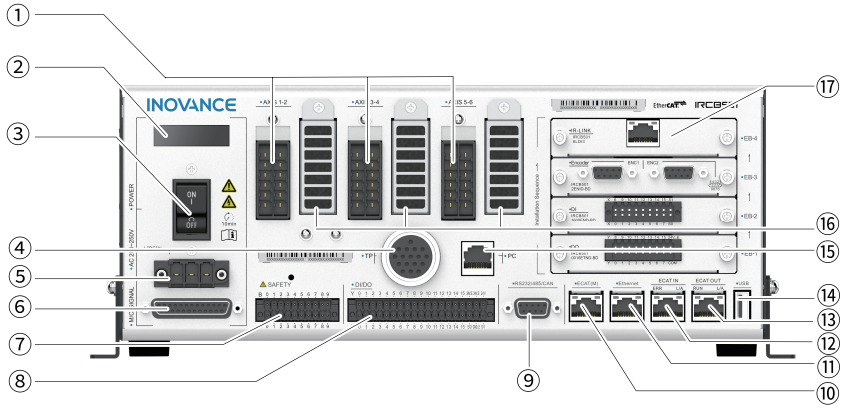


Figure 1-2 Components

No.	Name	Function Description
①	Robot power cable connector	Connects to the power cable of the robot
②	LED display	Displays status and alarms of the control cabinet
③	Power switch	Power switch of the control cabinet
④	Teach pendant aviation plug connector	Connects to the teach pendant
⑤	220 VAC input port	Connects to the external 220 VAC power supply
⑥	Encoder port	Receives motor encoder feedback
⑦	SAFETY port	I/O port for emergency stop, safety door, and start confirmation
⑧	User I/O	16 DIs and 16 DOs
⑨	DB9 connector	RS232, RS485, and CAN communication port
⑩	EtherCAT port	Connects to the EtherCAT master (external axis)
⑪	Ethernet interface	Ethernet communication port
⑫	EtherCAT-IN port	EtherCAT slave input port for bus communication
⑬	EtherCAT-OUT port	EtherCAT slave output port for bus communication
⑭	USB port	USB2.0 communication port for standard PC and external devices
⑮	PC-based teach pendant port	Connects to the PC-based teach pendant

No.	Name	Function Description
⑯	Heat dissipation hole	Heat dissipation
⑰	Expansion card slot	Connects to optional parts such as DI and DO expansion cards

1.3 Product Dimensions

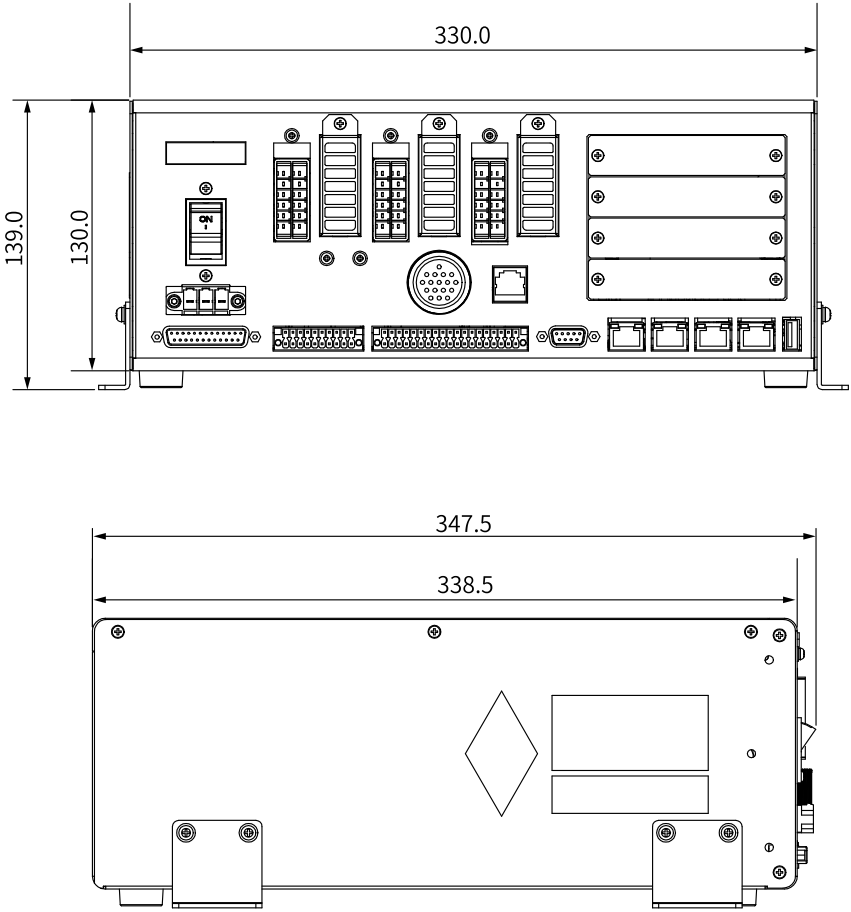


Figure 1-3 Dimensions of the standard power model (unit: mm)

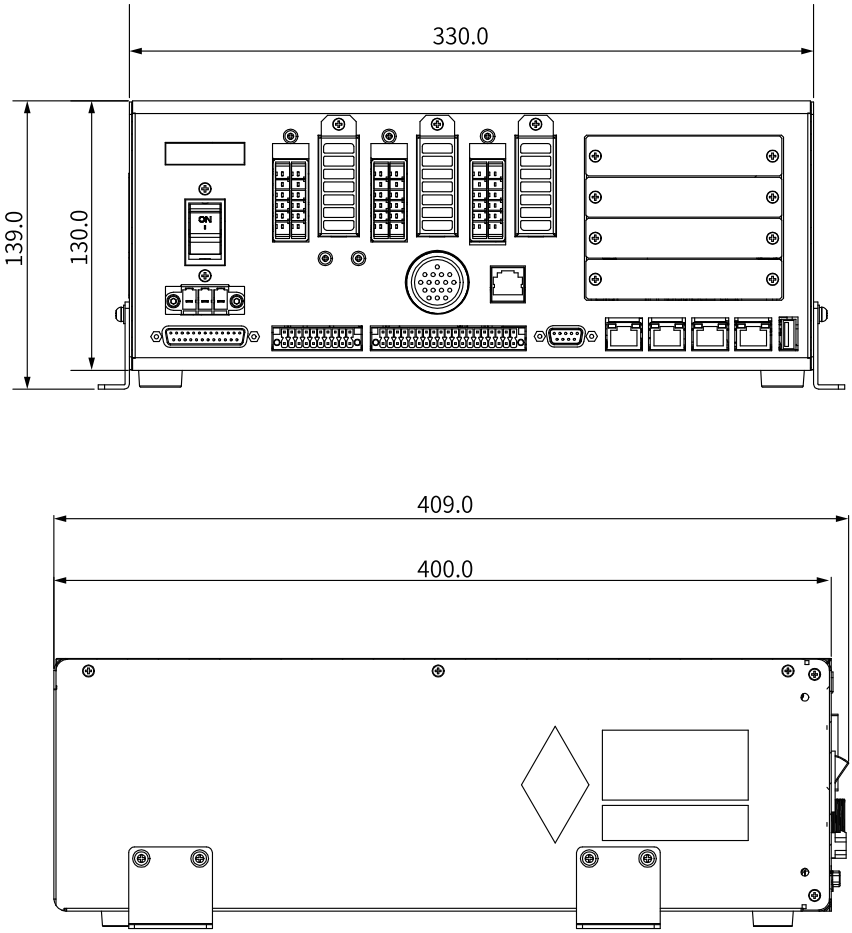


Figure 1-4 Dimensions of the high-power model (unit: mm)

1.4 Technical Specifications

Item	Specifications
Model	IRCB501-6LD/4AD/4CD-INT: Standard-power model IRCB501-6FD/4ED-INT: High-power model
Maximum number of controlled axes	6 (robot axes)+3 (external axes)
Installation method	Vertical mounting, horizontal mounting, and standard 19-inch rack mounting
Motion mode	Point-to-point, linear interpolation, circular interpolation, and free curve interpolation

Item	Specifications
Program storage space	Maximum number of lines per program: 2000 Maximum storage space per program file: 500 kbit Maximum number of points: 9999 Multi-tasking: One main task, two PLC tasks, and one XQT task
Retentive memory	Saved data volume (bytes): 256 for each of the B, R, D, PR, and STR variables
Interval between power off and on	2s
Standard I/Os	General digital I/Os: standard 16 inputs and 16 NPN outputs (expandable) Safety I/Os: 6
Ethernet	2, one for the TP/PC teach pendant interface, with a rate of 100 Mbps ① Both the PC and EtherNet network ports support Modbus TCP slaves. ② Only the EtherNet network port supports the EtherNet/IP slaves/masters. As a master, it supports eight slaves. As a slave, it supports only one master.
EtherCAT	3, one for master and two for slave, with a rate of 100 Mbps; full-duplex work mode; supporting the linear topology; supporting driving external axes for functional expansion EtherCAT slave synchronization jitter: < 1 μs
USB 2.0	1
RS232	1 (reserved)
RS485	1; supporting standard Modbus-RTU protocol; baud rate: 4,800 bps to 115,200 bps
CAN bus	1, with a maximum rate of 1 Mbps, only as the CANopen master, supporting a maximum of four slaves
Number of expansion slots (4)	Expansion card of 16 DIs
	Expansion card of 16 DOs
	2-channel incremental encoder expansion card
	PROFINET slave expansion card
	Functional safety expansion card (supported by the "-INT" electronic control cabinet only)
Control mode	PC programming platform control, teach pendant control, remote I/O control, and remote Ethernet (API) control
Input voltage range	Rated single-phase voltage: 220 VAC to 240 VAC, 50 Hz/60 Hz (input voltage being –15% to +10% of rated voltage)
Input current range	Standard power model: Max. 10 A High-power model: Max. 20 A
IP rating	IP20

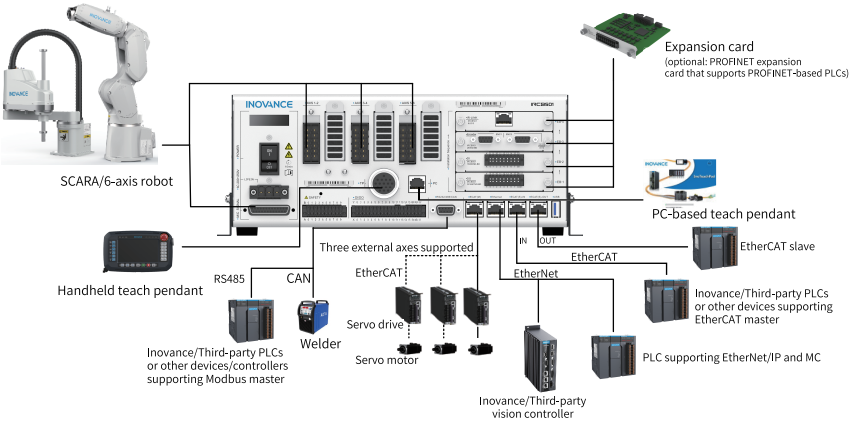
Item	Specifications
Ambient temperature	High-power model: 0°C to 45°C High-power model: 0°C to 40°C
Ambient humidity	20% RH to 95% RH (30°C), non-condensing
Altitude	1,000 m
Certification	CE, cSGSus, FCC, KCs, and functional safety certification (supported by the "-INT" control cabinet only, requiring a functional safety expansion card)
Noise	⩽ 65 dB
Size (WDH)	Standard power model: 330 mm x 338.5 mm x 130 mm High-power model: 330 mm x 400 mm x 130 mm
Weight	Standard model: 8 kg High-power model: 10 kg
Supported models (standard)	IR-S4 series IR-S7 series IR-S10 series IR-S20 series IR-GS20 series IR-S50 series IRS311 series IR-R4 series IR-R11 series

Note

The USB drive must be in FAT32, EXT2, or EXT3 format to be successfully loaded.

2 System Overview

2.1 System Connection



2.2 Main Options

2.2.1 Handheld Teach Pendant

The teach pendant is connected to the control cabinet for robot programing, teaching, and parameter setting. For the definition of teach pendant interfaces on the control cabinet, see *"4.4.1 Connector Pin Assignment" on page 35*. For details of the teach pendant, see the teach pendant manual.

2.2.2 Expansion Card

The expansion card slot of the controller, combined with optional expansion modules, can achieve functions such as general DIs/DOs, encoder inputs, IR-LINK communication, and PROFINET communication. For details of the expansion modules, see *"4.11.1 Expansion Card Slot" on page 70*.

3 Environment and Installation

3.1 Preparation for Installation

3.1.1 Installation Personnel Requirements

Ensure that the installation personnel have obtained mechanics knowledge or received mechanics training in advance to understand various dangers and risks in the installation process.

The installation personnel must be familiar with the installation requirements and relevant technical information.

Never allow non-skilled personnel to carry out installation, wiring, maintenance, inspection, or part replacement.

3.1.2 Environment and Space Requirements

Set up the robot system in accordance with the following environment requirements to maximize and maintain the performance of the robot and to use it safely.

- Install the robot indoors.
- Install and use the robot in a place free from conductive dust (such as metal dust and graphite powder), conductive fibers (such as carbon fiber and metal wire), explosive dust, flammable gases, water mist/oil pollution, corrosive dust, salt particles, and corrosive gases (such as sulfur dioxide, hydrogen sulfide, chlorine, and ammonia).
- Do not use the robot in an enclosed environment, as this may cause too high temperature of the control cabinet that shortens its service life.
- Avoid direct sunlight.
- Avoid impact and vibration.
- Install the robot in a place away from heat sources such as a heating stove.
- Keep away from electrical interference sources such as large inverters, high-power high-frequency generators, large contactors, and welding machines.
- In scenarios with ordinary dust/fluff, such as in workshops that continuously produce dust/fluff, the control cabinet's air inlet filter may be blocked, posing a risk of over-temperature. To reduce this risk, regularly clean and replace the filter or install the control cabinet in an environment with a low concentration of dust/fluff.

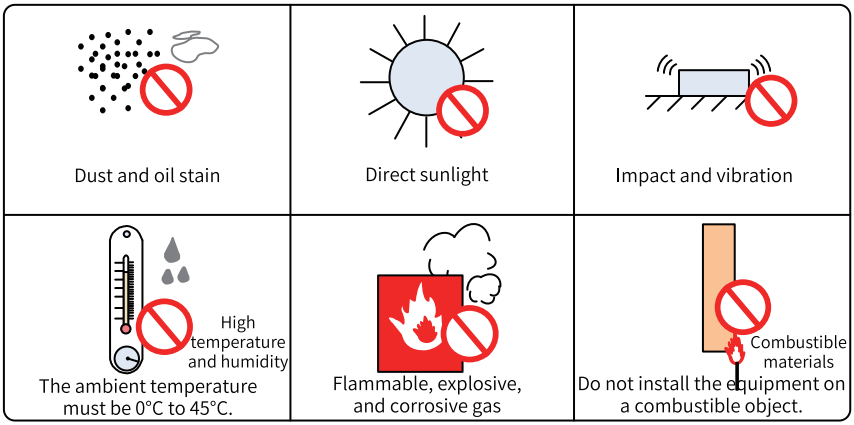
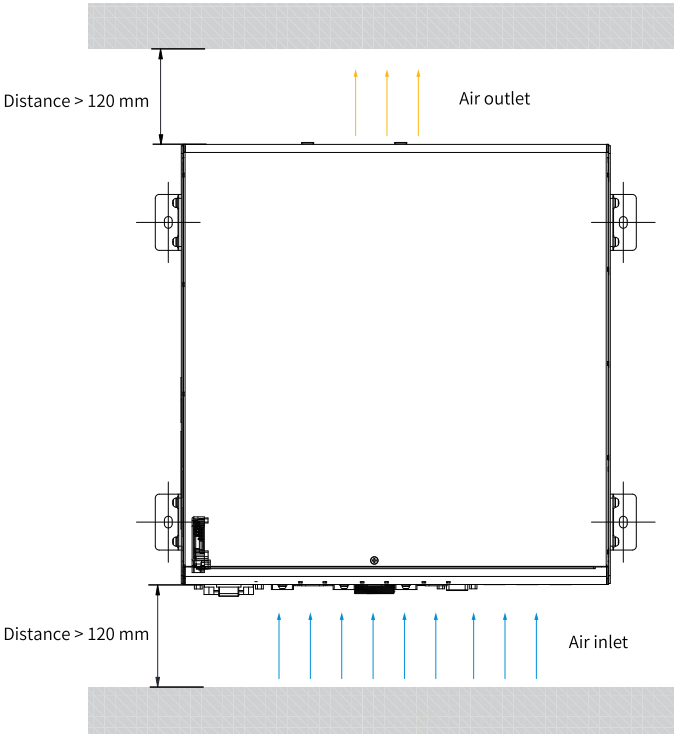


Figure 3-1 Installation Environment Requirements

Table 3–1 Ambient conditions

Item	Requirements
Ambient temperature and humidity	• Temperature: 0°C to 45°C for standard power models; 0°C to 40°C for high power models • Humidity: 20% RH to 95% RH (30°C), non-condensing
Storage temperature and humidity	• Temperature: 0°C to 45°C • Humidity: ⩽ 95% RH (30°C)
Transportation temperature and humidity	• Temperature: –25°C to +70°C • Humidity: ⩽ 95% RH (40°C)
Vibration	• Sinusoidal vibration: Conforms to "JB/T 8896-1999 Industrial Robot - Acceptance Rules". The displacement is 0.75 mm under vibration at 5 Hz to 25 Hz, and 0.15 mm under vibration at 25 Hz to 55 Hz, with continuous vibration for 3 minutes at each resonance point. • Random vibration: Conforms to the ISTA 1H standard. The acceleration rate is 0.01 g^2/Hz under vibration at 4 Hz to 100 Hz, and 0.001 g^2/Hz under vibration at 200 Hz. Grms = 1.14 · g, vibration for 30 minutes in each of X/Y/Z directions
Shock	The maximum shock shall not exceed the acceleration rate of 15 · g and the duration shall not exceed 11 ms.
IP rating	IP20
Altitude	⩽ 1,000 m

Reserve the installation spaces as shown in the following figure to ensure sufficient space for heat dissipation.



3.1.3 Preparation of Installation Tools

The following table lists the installation tools.

Tool	Quantity (pcs)
Phillips screwdriver or electric screwdriver	1
Scissors	1
Anti-smash shoes	1
Protective gloves	1

The control cabinet supports horizontal mounting, vertical mounting, and mounting at a standard 19-inch rack.

The following table lists the installation methods.

Installation Method	Tools Required	Installation Tools	Recommended Tightening Torque
Horizontal mounting	M5x16 standard cross recessed hexagon socket head bolt assembly	Phillips screwdriver or electric screwdriver	2.8 N·m
Vertical mounting	M5x16 standard cross recessed hexagon socket head bolt assembly	Phillips screwdriver or electric screwdriver	2.8 N·m
Standard 19-inch rack mounting	M6x10 SEMS screw	Phillips screwdriver or electric screwdriver	4.8 N·m

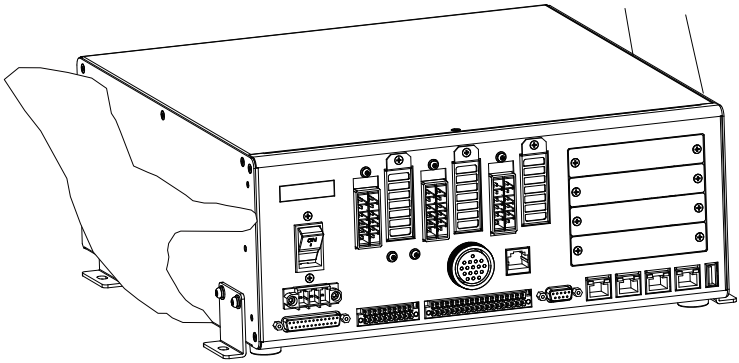
3.2 Handling

Prepare gloves and anti-smash shoes before handling the product.

Caution

Handle the product with gloves and anti-smash shoes.

You can handle the product with both hands.



Caution

During handling, hold the equipment firmly to avoid dropping which may damage the equipment.

3.3 Installation

3.3.1 Horizontal Mounting

This is a standard installation scenario that requires a stable mounting surface at a height of 0.6 m to 1.9 m above the ground. The mounting surface must be flat and not inclined or deformed.

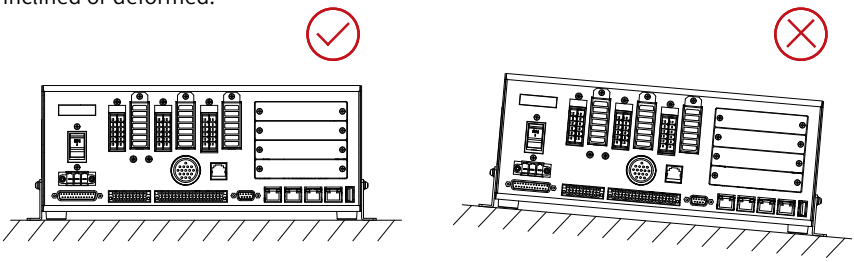


Figure 3-2 Mounting surface requirements

The mounting dimensions are shown below:

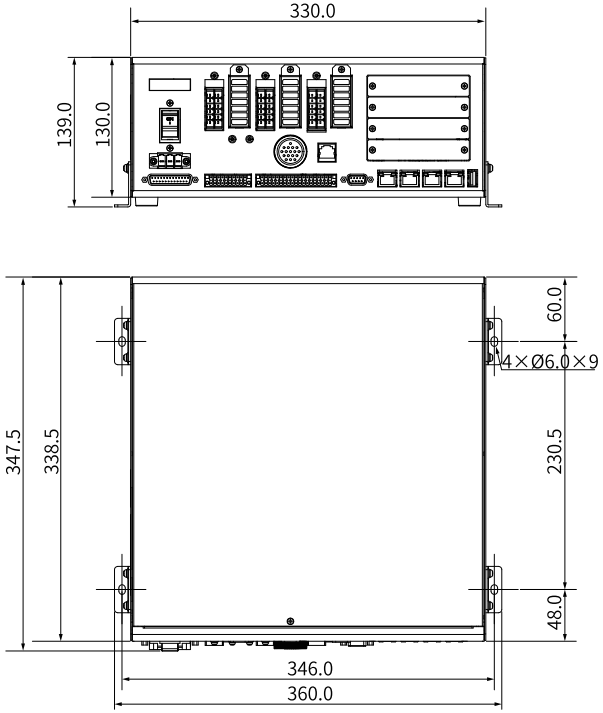


Figure 3-3 Horizontal mounting dimensions (standard power model) (unit: mm)

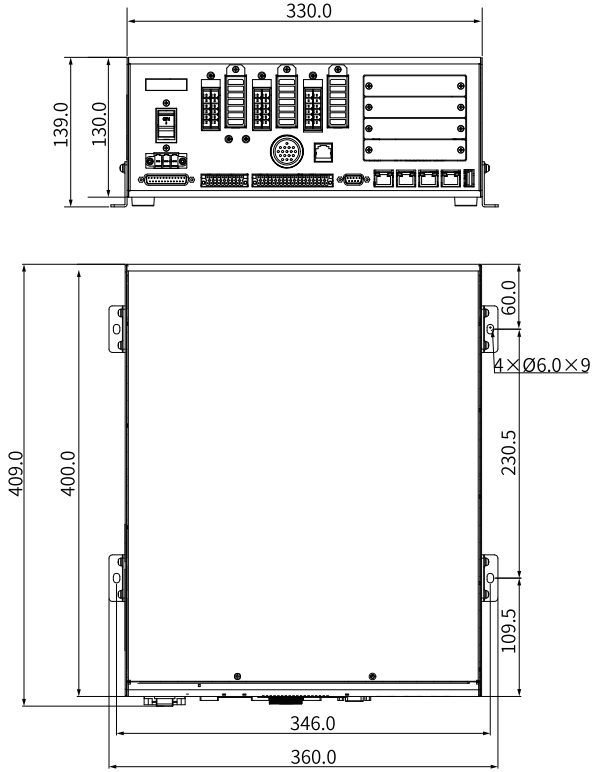
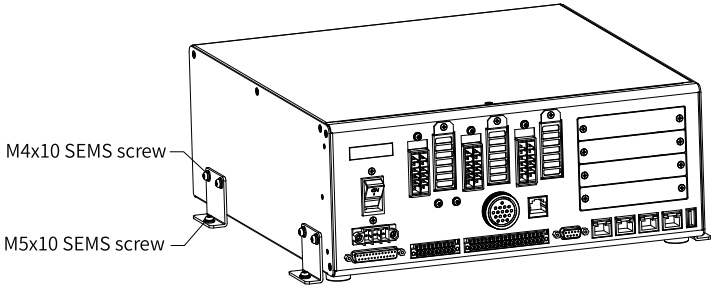


Figure 3-4 Horizontal mounting dimensions (high-power model) (unit: mm)

Place the control cabinet on the flat mounting surface. Secure the horizontal mounting bracket onto the mounting surface with the M5x10 SEMS screws (recommended torque: 2.5 N·m).



3.3.2 Vertical Mounting

This is a standard installation scenario that requires a stable mounting surface at a height of 0.6 m to 1.9 m above the ground. The mounting surface must be flat and not inclined or deformed.

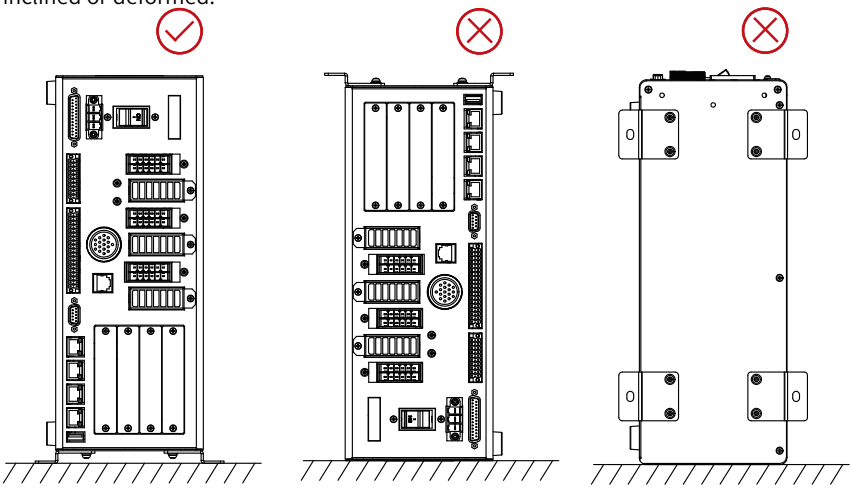


Figure 3-5 Vertical mounting requirements

The installation dimensions are shown below:

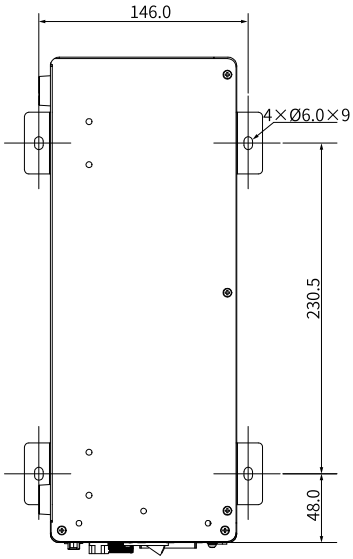


Figure 3-6 Vertical mounting dimensions (standard-power model) (unit: mm)

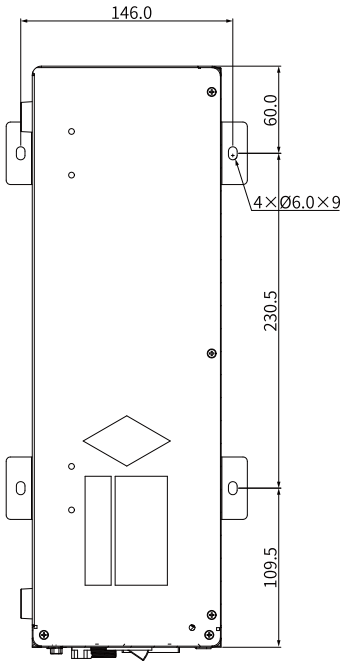
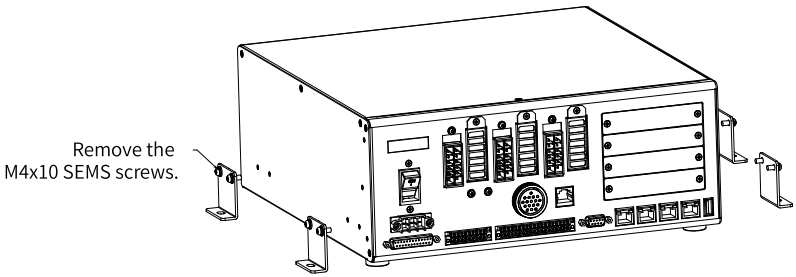


Figure 3-7 Vertical mounting dimensions (high-power model) (unit: mm)

Vertical mounting procedure:

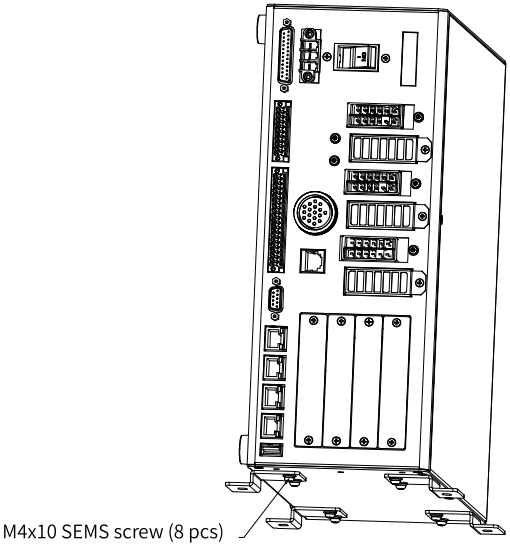
Step 1: Secure the chassis to the table top with the brackets and screws.

When the control cabinet leaves the factory, it is provided with horizontal mounting brackets for horizontal mounting. Before starting vertical installation, remove the horizontal mounting brackets, as shown in the following figure.



Step 2: Fix the vertical mounting brackets to a side of the control cabinet.

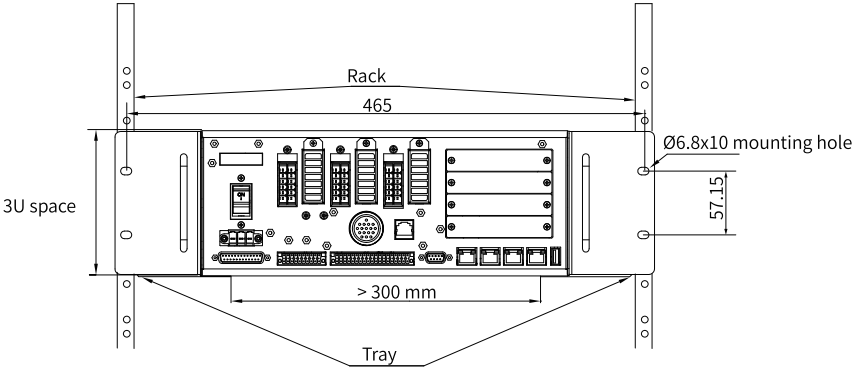
Install eight vertical mounting brackets at each of the Ø4 holes on the side of the control cabinet, and secure the brackets with M4x10 (recommended torque: 1.2 N•m) SEMS screws.



Step 3: Secure the vertical mounting brackets to the mounting surface by using M5x10 SEMS screws (recommended torque: 2.5 N•m).

3.3.3 Rack Mounting

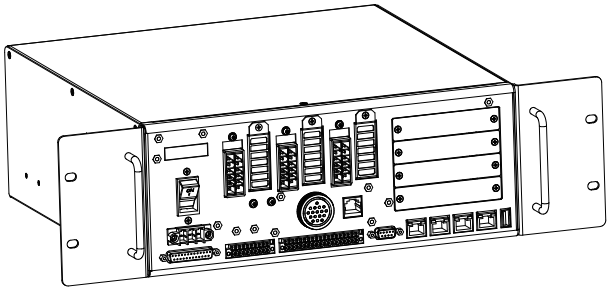
The panel dimensions are 465 mm x 57.15 mm and the space on left and right sides of the tray is smaller than 300 mm, as shown in the following figure.



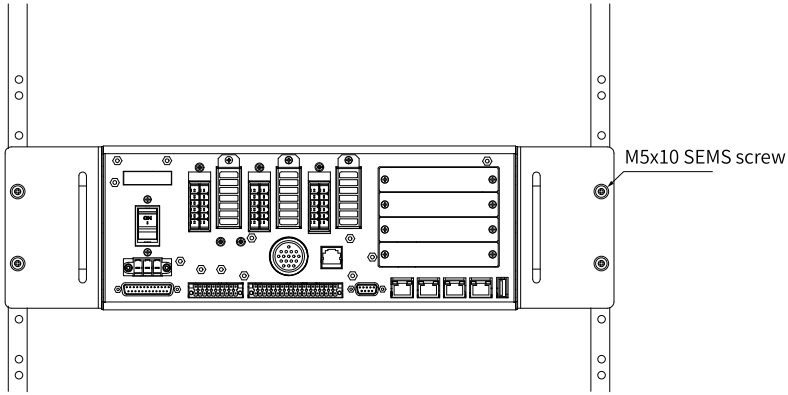
Mounting procedure:

1. Align the holes on the handle with the holes on the lug. Secure the handle onto the lug with the M4x10 SEMS screw (recommended torque: 1.2 N · m).

2. Align the holes on the lug assembly with the holes on the control cabinet. Secure each lug assembly onto one side of the control cabinet with the M4x10 SEMS screw (recommended torque: 1.2 N·m), as shown in the following figure.



3. Place the control cabinet on the tray and push it into the rack.
   Align the holes on the lugs with the holes on the racks, and secure the lugs with the M5x10 SEMS screws (recommended torque: 2.5 N·m).



4 Wiring

4.1 Wiring Precautions

Installation, wiring, maintenance, and inspection of the product must be carried out only by trained technicians with electrical expertise. See *" Safety Precautions" on page 5* for relevant precautions.

4.2 LED Display

There is a 5-digit LED display on the operating panel to show control status and fault codes, as described in the following table.

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
	0		9		I		R
	1		A		J		S
	2		B		K		T
	3		C		L		U
	4		D		M		V
	5		E		N		W
	6		F		O		X
	7		G		P		Y
	8		H		Q		Z

LED display after the power is turned on and before the control cabinet is started:

LED Display	Status	Stage	Meaning
888	-	Controller system initialization	Initializing system hardware. If the display is abnormal, contact Inovance or get technical support.
8888	Last digit OFF	Controller system initialization	System booting. If the display is abnormal, contact Inovance or get technical support.
88888	Last digit ON	Controller system initialization	Loading the FPGA firmware. If the display is abnormal, contact Inovance or get technical support.
TEST	-	Controller system initialization	Tooling board test software (supports normal flashing through network port)
LKRNL	-	Controller system initialization	Loading the system kernel
ISTRT	-	Operating system initialization	Successfully entered the system and started to establish the robot environment, with status displayed
INET	-	Operating system initialization	Configuring the network, with status displayed
IMC	-	Operating system initialization	Loading the driver module and DSP firmware, with status displayed. An error is reported if the loading fails.
CPARA	-	Operating system initialization	System parameter initialization is completed.
CCOM	-	Operating system initialization	Communication with the teach pendant is established.
CFW	-	Operating system initialization	Robot firmware initialization is completed.
CECAT	-	Operating system initialization	EtherCAT initialization is completed.
CRLNK	-	Operating system initialization	IR-LINK initialization is completed.
CTASK	-	Operating system initialization	Robot task is established.
CROB	-	Operating system initialization	Robot start is completed.

LED display after the control cabinet is started, depending on control cabinet status:

LED Display	Status	Stage	Meaning
T-A-0	-	Control-Mode-Action	Teach pendant control - Auto mode - Stop
T-A-1	-	Control-Mode-Action	Teach pendant control - Auto mode - Running
T-A-2	-	Control-Mode-Action	Teach pendant control - Auto mode - Pause
O-A-0	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Stop
O-A-1	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Running
O-A-2	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Pause
T-H-0	-	Control-Mode-Action	Teach pendant control - Manual mode - Stop
T-H-1	-	Control-Mode-Action	Teach pendant control - Manual mode - Running
T-H-2	-	Control-Mode-Action	Teach pendant control - Manual mode - Pause
O-H-0	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Stop
O-H-1	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Running
O-H-2	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Pause
-USB-	Blinking	Read and write I/O	The controller is saving data to the USB flash disk.
USB-S	Display for at least 2 seconds	Read and write I/O	Data is successfully saved to the USB flash disk.
-SD–	Blinking	Read and write I/O	The controller is saving data to the SD card.
-SD-S	-	Read and write I/O	Data is successfully saved to the SD card.
-SPI-	Blinking	Read and write I/O	The controller is saving data to the SPI flash memory.
SPI-S	Display for at least 2 seconds	Read and write I/O	Data is successfully saved to the SPI flash memory.
EXXXX	Blinking	System running	Controller fault
XEXXX	Blinking	System running	Servo axis fault
-E-P-	Blinking	System running	System emergency stop
-5-0-	Blinking	System running	Safety door open

LED Display	Status	Stage	Meaning
READY	Blinking	System running	System ready
BURN	-	-	System firmware upgrade

4.3 Connecting Power Supply

Warning

- This work must be conducted by qualified personnel only.
- To prevent electric shock, it is essential to ground the controller properly.
- Always use a plug or a disconnecting device that conforms to local safety standards for power connecting cable. Do not connect the controller directly to a factory power source.
- Disconnect the power supply before grounding the controller.

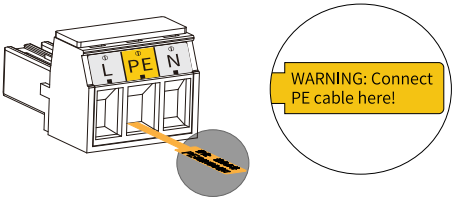
This product needs a 220 VAC power supply. Follow the procedure below to prepare the power cords and ensure correct wiring.

Customers should select cables that comply with applicable safety regulations.

For the standard power model, the cable should have three conductors with a cross-sectional area of at least 1.5 mm^2. It is recommended to use an external C curve circuit breaker with a rated current of at least 16 A.

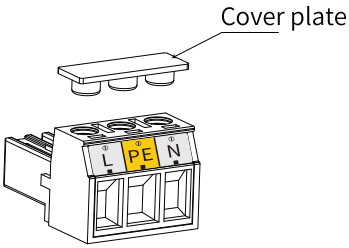
For the high-power model, the cable should have a cross-sectional area of at least 4 mm^2, and it is recommended to use a D curve circuit breaker with a rated current of at least 25 A.

There is a warning label installed below the PE identification of the input terminal. During wiring, make sure to follow the instructions of the warning label and connect the PE cable to the PE port.

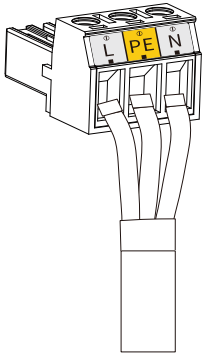


Wiring procedure:

1. Open the cover on the input terminal, as shown in the following figure.



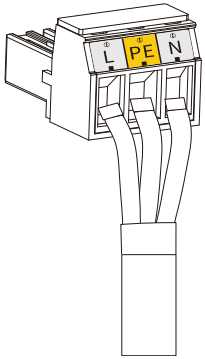
2. Loosen the screws under the cover, connect the three wires of the power cord to the three pins of the input terminal in the order of L, PE, and N from left to right, and tighten the screws. It is recommended to use a PH1 (1 #) Phillips screwdriver.



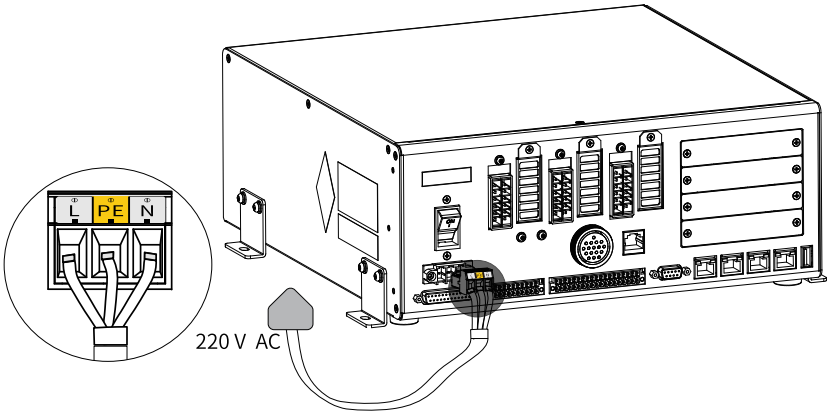
Note

- Use a power supply crimping terminal. The recommended model is E1512.
- Strip the wire for 12 mm, insert the stripped wire into the input terminal, and fix it with screws.

3. After connecting the power cord, close the cover above the input terminal.



4. Plug the input terminal into the power input connector of the control cabinet.



As shown in the preceding figure, connect the three wires of the power cord to the three pins of the input terminal in the order of L, PE, and N from left to right.

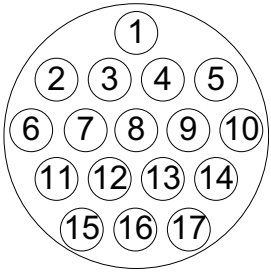
Danger

Connect power cable in the order of L/PE/N to avoid short circuit which may cause electric shock.

4.4 Connecting Teach Pendant

4.4.1 Connector Pin Assignment

Pin assignment of aviation plugs of IRTP80 teach pendant



No.	Assignment	Description	No.	Assign ment	Description
1	24V	24 V power supply	10	24V	24 V power supply
2	GND	Power ground	11	PE	Shielding ground
3	E-STOP1-A	Emergency stop terminal 1-A	12	TP_TX+	Teach pendant Ethernet data TX+
4	E-STOP1-B	Emergency stop terminal 1-B	13	TP_TX–	Teach pendant Ethernet data TX–
5	E-STOP2-A	Emergency stop terminal 2-A	14	TP_RX+	Teach pendant Ethernet data RX+
6	E-STOP2-B	Emergency stop terminal 2-B	15	TP_RX–	Teach pendant Ethernet data RX–
7	MODE_SW[1]	Key switch detection	16	PE	Shielding ground
8	24V	24 V power supply	17	NET_SEL	Network port selection input signal
9	DMS_NO	3-position enable switch signal	-	-	-

Note

[1]: Such pin functions are not triggered for the teach pendant IRTP80 without a key switch.

PC connector pin assignment

The PC-based teach pendant adopts Ethernet communication. It supports the TCP/IP protocol with a rate of 10/100 Mbps.

No.	Assignment	Description
1	TX+	Data transmit+
2	TX–	Data transmit–
3	RX+	Data receive+
6	RX–	Data receive–
4, 5, 7, and 8	-	-
Enclosure	PE	Shielding enclosure

4.4.2 Wiring Method

This product can be equipped with the IRTP80 series teach pendant for robot teaching and programming. Connect the teach pendant to the control cabinet, as shown in the following figure. For operation details of the teach pendant, see its user guide.

Note

The PC interface can be connected to a PC. It cannot be used with the teach pendant interface at the same time. If both are connected, only the teach pendant interface is effective.

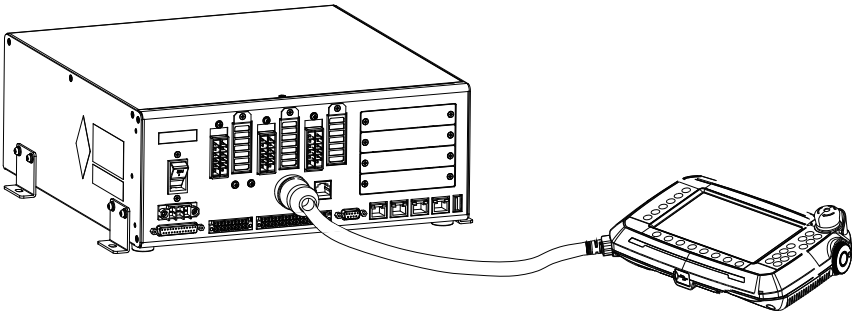


Figure 4-1 Connecting the control cabinet to the teach pendant

4.5 Connecting Encoder Cable and Power Line

4.5.1 Power Cable Connector

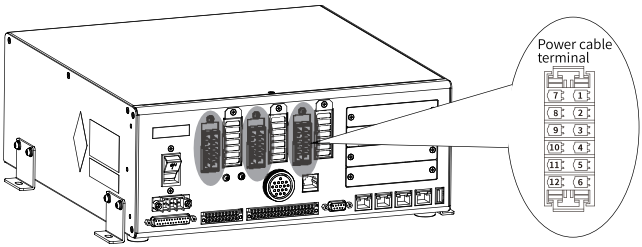
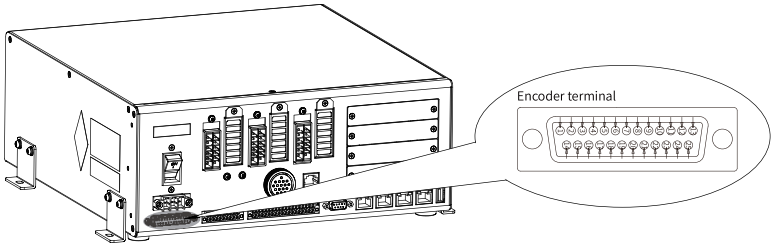


Table 4–1 Pin assignment of power cable on controller side

No.	Meaning	Description	No.	Meaning	Description	No.	Meaning	Description
AXIS 1-2 power terminal			AXIS 3-4 power terminal			AXIS 5-6 power terminal		
1	U2	Motor output phase	1	U4	Motor output phase	1	U6	Motor output phase
2	V2	Motor output phase	2	V4	Motor output phase	2	V6	Motor output phase
3	W2	Motor output phase	3	W4	Motor output phase	3	W6	Motor output phase

No.	Meaning	Description	No.	Meaning	Description	No.	Meaning	Description
AXIS 1-2 power terminal			AXIS 3-4 power terminal			AXIS 5-6 power terminal		
4	PE	Enclosure ground	4	PE	Enclosure ground	4	PE	Enclosure ground
5	BK2-OUT	Control signal of brake 2	5	BK4-OUT	Control signal of brake 4	5	BK6-OUT	Control signal of brake 6
6	0V	Negative power electrode of brake	6	0V	Negative power electrode of brake	6	0V	Negative power electrode of brake
7	U1	Motor output phase	7	U3	Motor output phase	7	U5	Motor output phase
8	V1	Motor output phase	8	V3	Motor output phase	8	V5	Motor output phase
9	W1	Motor output phase	9	W3	Motor output phase	9	W5	Motor output phase
10	PE	Enclosure ground	10	PE	Enclosure ground	10	PE	Enclosure ground
11	BK1-OUT	Control signal of brake 1	11	BKX-OUT	Control signal of brake X	11	BK5-OUT	Control signal of brake 5
12	24V	Brake power supply	12	24V	Brake power supply	12	24V	Brake power supply

4.5.2 Encoder Cable Connector



Connector pin assignment on control cabinet side (4-axis)

No.	Meaning	Description	No.	Meaning	Description
1	PS1+	Encoder differential signal+	14	PS1—	Encoder differential signal—
2	PS2+	Encoder differential signal+	15	PS2—	Encoder differential signal—
3	GND12	Signal ground	16	5V12	5V
4	PS3+	Encoder differential signal+	17	PS3—	Encoder differential signal—
5	PS4+	Encoder differential signal+	18	PS4—	Encoder differential signal—
6	GND34	Signal ground	19	5V34	5V
9	DGND	IR-LINK signal ground	22	LED	Robot indicator (SCARA)
10	24V	Data acquisition board input power supply/ indicator power supply	23	24_GND	Data acquisition board input power ground
11	DGND	IR-LINK signal ground	24	RX+	IR-LINK receive differential input+
12	RX–	IR-LINK receive differential input–	25	TX+	IR-LINK transmit differential input+
13	TX–	IR-LINK transmit differential input–	-	-	-

Connector pin assignment on control cabinet side (6-axis)

No.	Meaning	Description	No.	Meaning	Description
1	PS1+	Encoder differential signal+	13	TX–	IR-LINK transmit differential input–
2	PS2+	Encoder differential signal+	14	PS1—	Encoder differential signal—
3	GND12	Signal ground	15	PS2—	Encoder differential signal—
4	PS3+	Encoder differential signal+	16	5V12	5V
5	PS4+	Encoder differential signal+	17	PS3—	Encoder differential signal—
6	GND34	Signal ground	18	PS4—	Encoder differential signal—
7	PS5+	Encoder differential signal+	19	5V34	5V

No.	Meaning	Description	No.	Meaning	Description
8	PS6+	Encoder differential signal+	20	PS5—	Encoder differential signal—
9	DGND	IR-LINK signal ground	21	PS6—	Encoder differential signal—
10	24V	Data acquisition board input power supply	23	24_GND	Data acquisition board input power ground
11	DGND	IR-LINK signal ground	24	RX+	IR-LINK receive differential input+
12	RX–	IR-LINK receive differential input–	25	TX+	IR-LINK transmit differential input+

4.5.3 Connection Diagram

The control cabinet comes with encoder cable, power line, and I/O cable for connecting it to the robot. Connect the robot and the control cabinet according to the following figure.

Caution

The encoder cable and power line connecting the robot body to the control cabinet have connection identifications. Connect the cables according to the identifications of AXIS 1-2, AXIS 3-4, and AXIS 5-6. Wrong cable connection will make the robot system inoperable, and may cause equipment damage and serious safety problems.

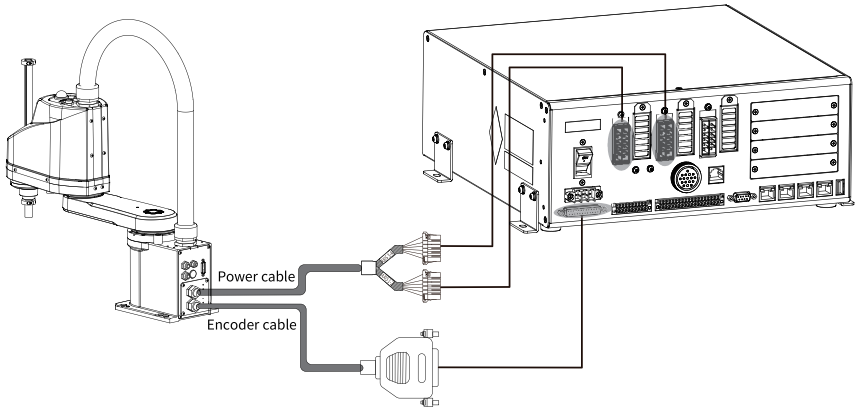


Figure 4-2 Connecting the SCARA robot to control cabinet

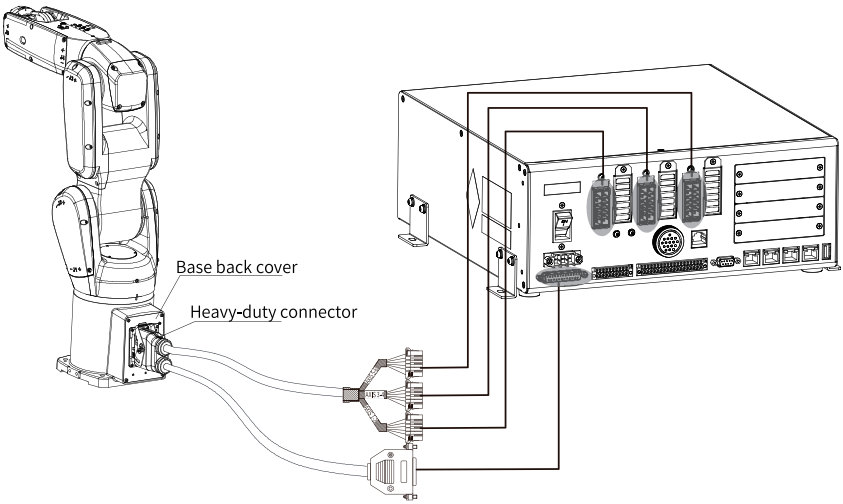
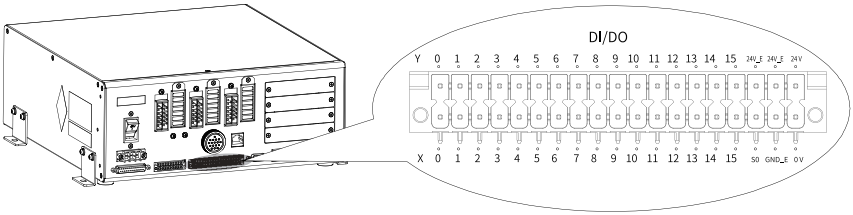


Figure 4-3 Connecting the 6-axis robot to control cabinet

4.6 Connecting DI

4.6.1 DI Terminal Assignment



Item	I/O Number	Name
X0	DI0	Common input 0
X1	DI1	Common input 1
X2	DI2	Common input 2
X3	DI3	Common input 3
X4	DI4	Common input 4
X5	DI5	Common input 5
X6	DI6	Common input 6
X7	DI7	Common input 7
X8	DI8	Common input 8
X9	DI9	Common input 9

Item	I/O Number	Name
X10	DI10	Common input 10
X11	DI11	Common input 11
X12	DI12	Common input 12
X13	DI13	Common input 13
X14	DI14	Common input 14
X15	DI15	Common input 15
S0	-	Common terminal for DI0 to DI15

Note

DI and DO wiring instructions:

- DI and DO ports share one terminal.
- The 24V and 0V terminals are used to output 24 V power from the control cabinet to the outside. The 24V_E and GND_E terminals are used to input 24 V power from the outside to the DO ports in the control cabinet.
- The two 24V_E terminals are internally connected to each other. You may just connect one of them for use.

DI and DO power specifications:

- The 24V and 0V terminals are used by the control cabinet to output 24 V±20% power to the outside, with a maximum allowable current of 0.8 A, which can power the DIs and DOs through external wiring.
- The 24V_E and GND_E terminals are used to input external power supply to the DO circuit. There is a built-in overvoltage and overcurrent protection circuit.

4.6.2 Input Port Specifications

The control cabinet comes with 16 DIs, as described in the following table.

Item	Specifications
Number of input channels	16 (X0 to X15)
Input connection mode	Crimping terminal
Input type	Digital NPN or PNP input, selectable through the common terminal
Maximum input voltage	30 VDC
Input current (typical 24 V)	Approx. 5 mA
Input impedance	> 4 kΩ
Voltage at ON	18 VDC to 30 VDC
Voltage at OFF	0 VDC to 3 VDC
Maximum input signal frequency	1 kHz

Item	Specifications
Isolation mode	Optoelectronic isolation
Hardware response time	ON/OFF: 250 μs/250 μs

4.6.3 Wiring Procedure

Wiring rules

S0 is the common terminal for the 16 DIs.

- When S0 is connected to the 24V terminal and X* is connected to the 0V terminal, the input signal is active (photocoupler ON).
- When S0 is connected to the 0V terminal and X* is connected to the 24V terminal, the input signal is active (photocoupler ON). The NPN or PNP I/O device can be connected.

Difference between NPN output and PNP output

- NPN (sink) output (negative common terminal)
  When the load current flows into the output (Y) terminal, the output is called NPN output, which is low-level output.

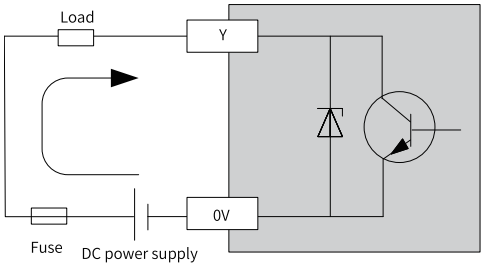


Figure 4-4 NPN output

- PNP (source) output (positive common terminal)

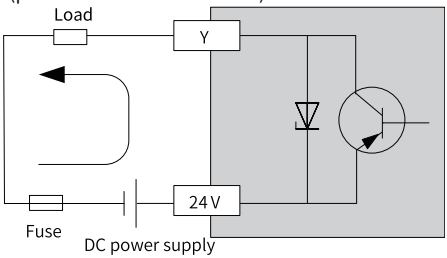


Figure 4-5 PNP output

Note

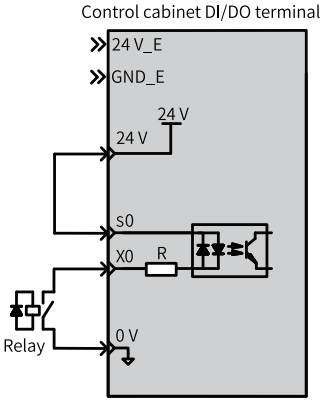
An NPN output provides a low level, while a PNP output provides a high level.

Wiring diagram

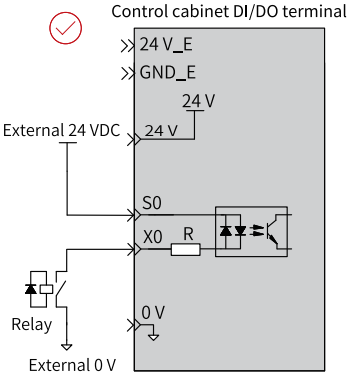
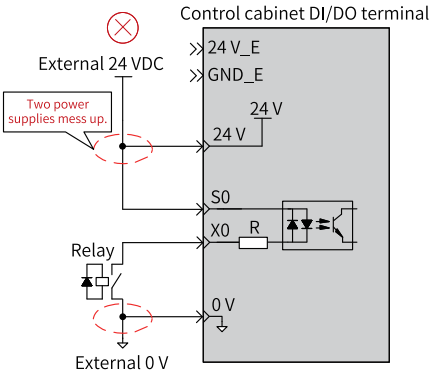
The following diagrams take X0 as an example (X1 to X15 are the same as X0). It is recommended to use an external power supply.

When the host controller provides relay output:

1. Using the 24 V power supply provided by the control cabinet



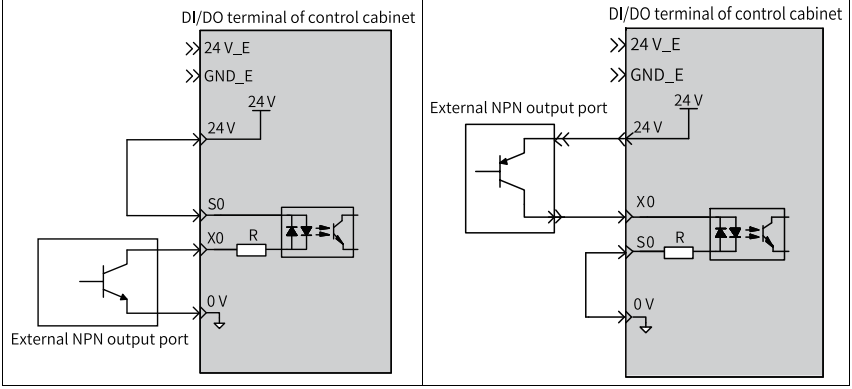
2. Using an external 24 V power supply

Correct Wiring	Incorrect Wiring
	

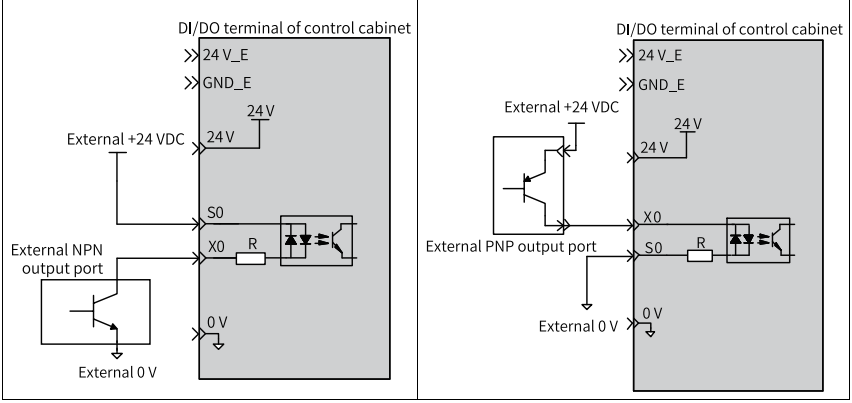
If an external 24 V power supply is used to power DIs and the DO function is not needed, you may either connect 24V_E and GND_E or leave them unconnected. If the DO function is needed, it is necessary to wire the DO terminals according to the instructions.

When the host controller provides open collector output:

Using the 24 V power supply provided by the control cabinet

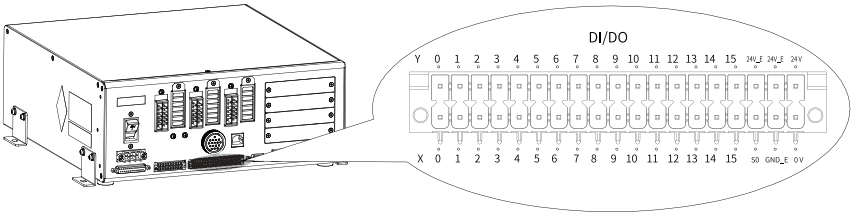


Using an external 24 V power supply



4.7 Connecting DO

4.7.1 DO Terminal Assignment



Meaning	I/O Number	Name
Y0	DO0	Common output 0
Y1	DO1	Common output 1
Y2	DO2	Common output 2
Y3	DO3	Common output 3
Y4	DO4	Common output 4
Y5	DO5	Common output 5
Y6	DO6	Common output 6
Y7	DO7	Common output 7
Y8	DO8	Common output 8
Y9	DO9	Common output 9
Y10	DO10	Common output 10
Y11	DO11	Common output 11
Y12	DO12	Common output 12
Y13	DO13	Common output 13
Y14	DO14	Common output 14
Y15	DO15	Common output 15

Note

DI and DO wiring instructions:

- DI and DO ports share one terminal.
- The 24V and 0V terminals are used to output 24 V power from the control cabinet to the outside. The 24V_E and GND_E terminals are used to input 24 V power from the outside to the DO ports in the control cabinet.
- The two 24V_E terminals are internally connected to each other. You may just connect one of them for use.

DI and DO power specifications:

- The 24V and 0V terminals are used by the control cabinet to output 24 V±20% power to the outside, with a maximum allowable current of 0.8 A, which can power the DIs and DOs through external wiring.
- The 24V_E and GND_E terminals are used to input external power supply to the DO circuit. There is a built-in overvoltage and overcurrent protection circuit.

4.7.2 Output Port Specifications

Item	Specifications
Number of output channels	16
Output connection mode	Crimping terminal
Output type	Sink (NPN)
Operating voltage of Y0 to Y15	0 VDC to 29 VDC
24V_E and GND_E power supply	24 V±20%, 0.2 A
Maximum drive current per channel	0.4 A
Y-COM_GND voltage at ON ($V_{Y\text{-}COM\_GND}$)	< 1 V
Maximum leakage current at OFF	< 200 μA
Maximum output switching frequency	1 kHz
Isolation mode	Photocoupler isolation
Protection	Current limiting protection (0.8 A)
Hardware response time	< 500 μs (OFF to ON)/500 μs (ON to OFF)

4.7.3 Wiring Procedure

Caution

- Do not short-circuit the Y0 to Y15 outputs directly to the +24V terminal.
- Do not connect the Y0 to Y15 outputs to the 0V terminal of the power supply, or connect GND_E to the +24V terminal of the power supply.
- The load voltage connected to the Y0 to Y15 outputs must be less than 29 V.

Failure to follow these three requirements of wiring will damage the circuit.

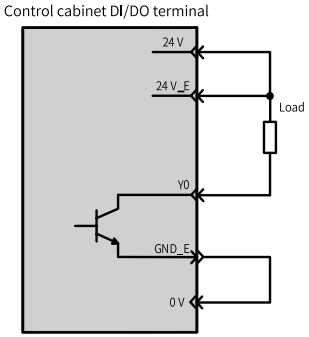
Wiring rules

To ensure proper operation of the DO ports, the 24V_E and GND_E terminals must be connected to a 24 V power supply.

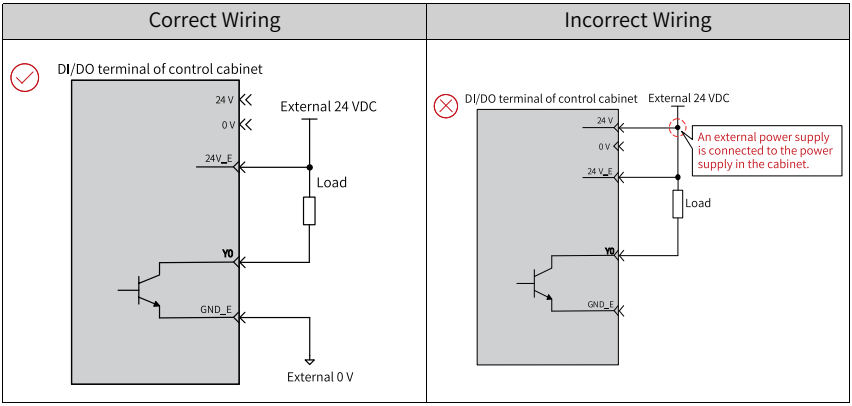
- If the load power supply of the DOs uses the 24 V/0 V power supply inside the cabinet, the total continuous output current of 16 DOs must not exceed 0.8 A; otherwise, an external power supply is required.
- When using an external 24 V power supply, connect the positive and negative poles of the external power supply to 24V_E and GND_E, respectively, through I/O terminals. Note that the maximum driving current of each channel is 0.4 A. When the output current of any single channel exceeds 0.8 A, an "overcurrent" alarm occurs.

Wiring of the power supply

- Using the 24 V power supply provided by the control cabinet



- Using an external 24 V power supply



Wiring example

This example illustrates the wiring of an external power supply. When the power is supplied by the control cabinet, the same method applies.

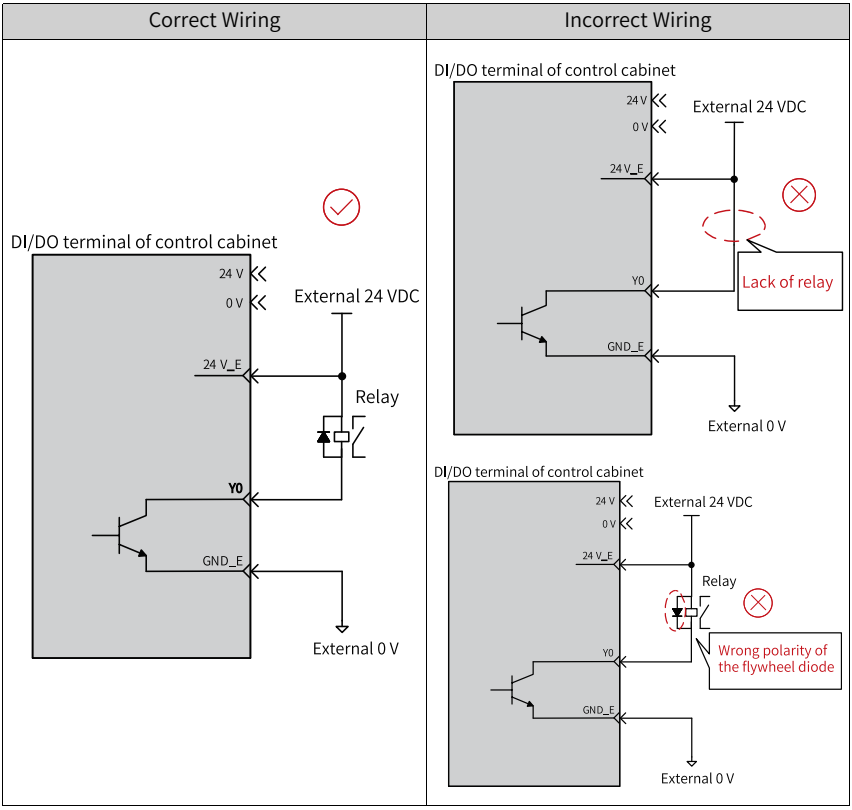
- Driving an inductive load

Note

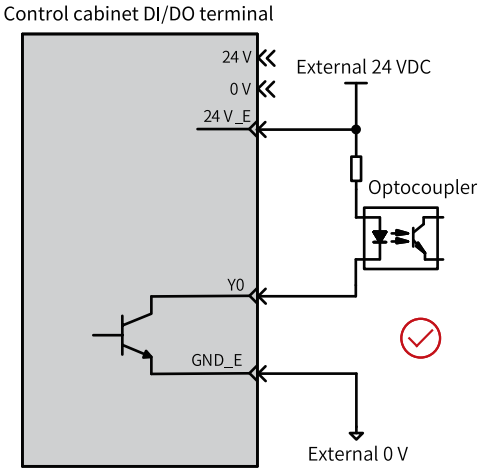
When inductive load is applied, large back EMF is generated between contacts and arc discharge also occurs when the inductive load stops. This may result in contact failure or contact sag, shortening the contact service life. Therefore, you can connect a flywheel diode in parallel with the load to extend the service life of the product.

The flywheel diode must meet the following requirements:

- The reverse voltage is 5 to 10 times of the load voltage.
- The forward current is larger than the load current.



- Driving a photocoupler load



4.8 SAFETY Wiring

4.8.1 Safety I/O Specifications

The specifications of I/Os for emergency stop input, safety door, and start confirmation are described below.

Item	Specifications
Input connection mode	Crimping terminal
Input type	No common point; supporting bidirectional input
Maximum input voltage	30 VDC
Input current (typical 24 V)	Approx. 5 mA
Input impedance	> 4 kΩ
Voltage at ON	18 VDC to 30 VDC
Voltage at OFF	0 VDC to 3 VDC
Maximum input signal frequency	1,000 Hz
Isolation mode	Optoelectronic isolation

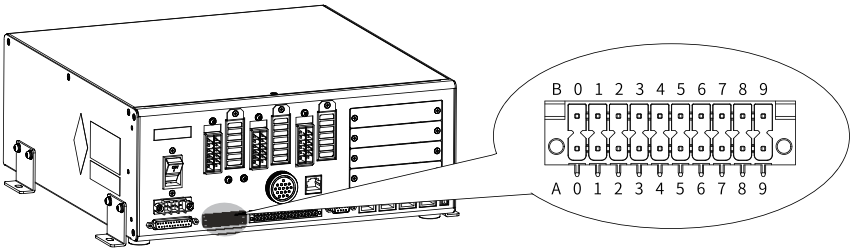
4.8.2 Connector Pin Assignment

- The SAFETY port includes input terminals for the external emergency stop, external safety door, and start confirmation functions. To ensure the safe operation of the robot system, make sure to use these input terminals.
- The emergency stop function is used in emergency situations, usually connected in series with a normally closed switch (such as a mushroom-shaped emergency stop switch). In case of emergency, you can stop the robot system urgently by pressing the emergency stop switch.
- The safety door function ensures the safe operation around the robot system by connecting peripheral gratings and switches. If you want to enter the safe range, you need to disconnect the gratings and switches installed on the periphery.
- The start confirmation function ensures that the robot system safely enters the automatic mode operation.

The emergency stop, safety door, and start confirmation functions all adopt dual confirmation signals. Only when both signals are normal can the control cabinet operate normally.

Caution

- Connect the safety door switch, emergency stop switch, and start confirmation switch on the SAFETY terminal to ensure safety.
- If no safety device is connected to the SAFETY terminal or the connection is incorrect, the robot system will not operate normally.



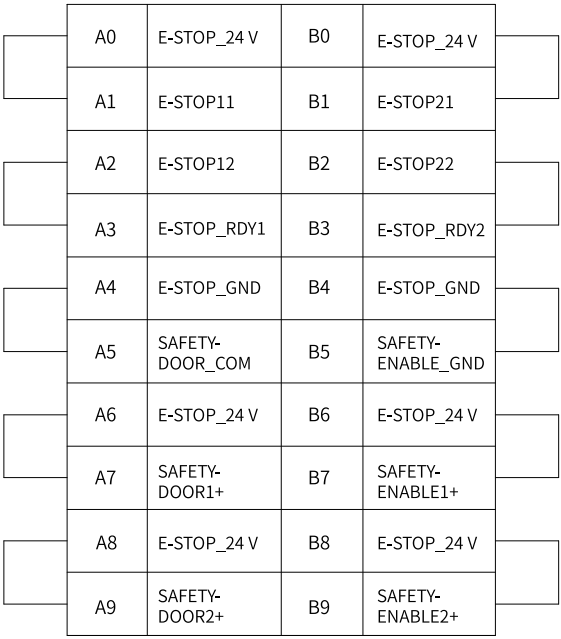
The emergency stop, safety door, and start confirmation functions meet the certification requirements. The specific terminal assignment is described below.

No.	Assignment	Remarks	No.	Assignment	Remarks
A0	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)	B0	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)
A1	E-STOP11	Access point 1 for teach pendant to exert emergency stop	B1	E-STOP21	Access point 2 for teach pendant to exert emergency stop
A2	E-STOP12		B2	E-STOP22	
A3	E-STOP_RDY1	Positive terminal of external emergency stop 1 input	B3	E-STOP_RDY2	Positive terminal of external emergency stop 2 input
A4	E-STOP_GND	Negative terminal of the 24 V power supply provided by the control cabinet for emergency stop	B4	E-STOP_GND	Negative terminal of the 24 V power supply provided by the control cabinet for emergency stop

No.	Assignment	Remarks	No.	Assignment	Remarks
A5	SAFETY-DOOR_COM	Common terminal for the two-channel safety door	B5	SAFETY-ENABLE_GND	Common terminal for the two-channel start confirmation
A6	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)	B6	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)
A7	SAFETY-DOOR1+	Safety door 1	B7	SAFETY-ENABLE1+	Start confirmation 1
A8	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)	B8	E-STOP_24V	Positive terminal of the 24 V power supply provided by the control cabinet for emergency stop (Maximum 60 mA output; must not be used for driving external load)
A9	SAFETY-DOOR2+	Safety door 2	B9	SAFETY-ENABLE2+	Start confirmation 2

Caution

E-STOP_24V and E-STOP_GND are 24 V power supplies in the control cabinet that can only supply power to the I/Os of the SAFETY terminal at a maximum output current of 60 mA. When external wiring causes a short circuit or the output current exceeds 60 mA for a long time, it can cause damage to the power supply inside the control cabinet. The specific wiring method is described in the "Emergency Stop Wiring Method" below.



A0	E-STOP_24 V	B0	E-STOP_24 V
A1	E-STOP11	B1	E-STOP21
A2	E-STOP12	B2	E-STOP22
A3	E-STOP_RDY1	B3	E-STOP_RDY2
A4	E-STOP_GND	B4	E-STOP_GND
A5	SAFETY-DOOR_COM	B5	SAFETY-ENABLE_GND
A6	E-STOP_24 V	B6	E-STOP_24 V
A7	SAFETY-DOOR1+	B7	SAFETY-ENABLE1+
A8	E-STOP_24 V	B8	E-STOP_24 V
A9	SAFETY-DOOR2+	B9	SAFETY-ENABLE2+

Figure 4-6 Default SAFETY terminal wiring

4.8.3 Wiring of Emergency Stop

Caution

- During normal robot operation, minimize the use of the emergency stop function for non-emergency situations. Emergency stop may cause the robot stop trajectory to deviate from the normal operation trajectory, and the emergency stop shock can reduce the service life of the robot reducer and increase the wear and tear of the motor brake pads.
- If you want to enter the emergency stop state, first set the robot speed to 0, and then press the emergency stop button.
- In case of an emergency, press the emergency stop button directly to enter the emergency stop state.

Emergency stop utilizes a normally closed contact connection, with a dual circuit structure. The disconnection of either circuit will trigger the emergency stop function. If the emergency stop is configured to be triggered by the PC-based teach pendant only, the

series emergency stop circuit of the handheld teach pendant will be disconnected. In this case, the emergency stop can only be triggered through the PC-based teach pendant.

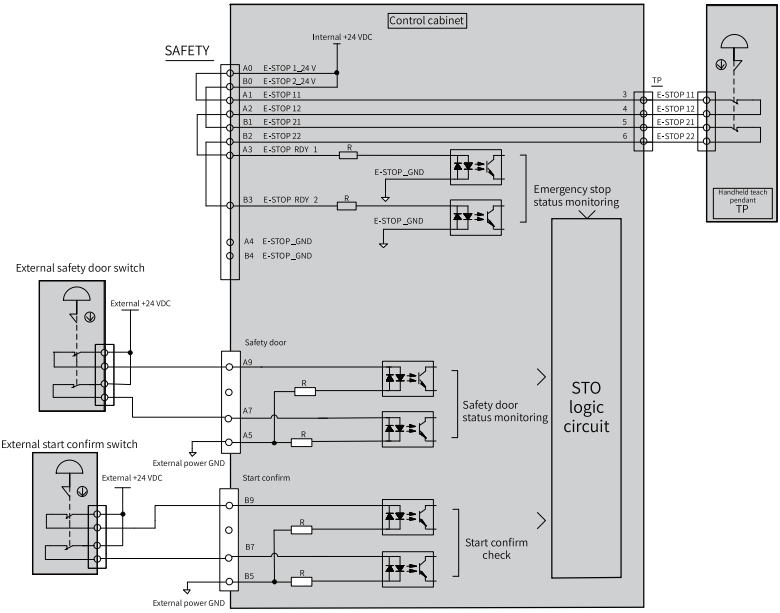
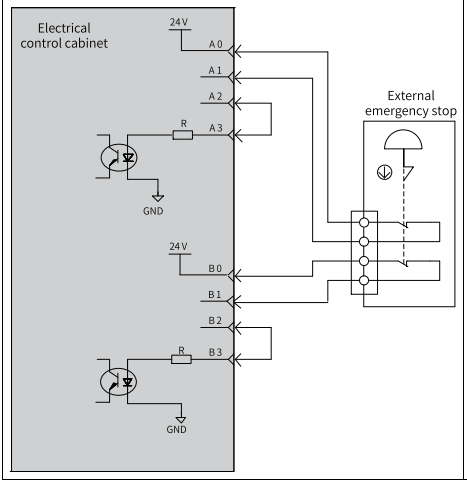
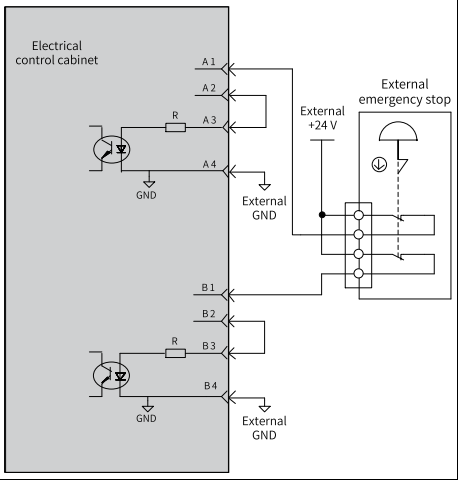
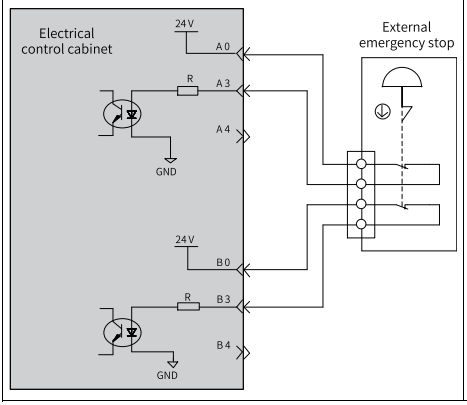
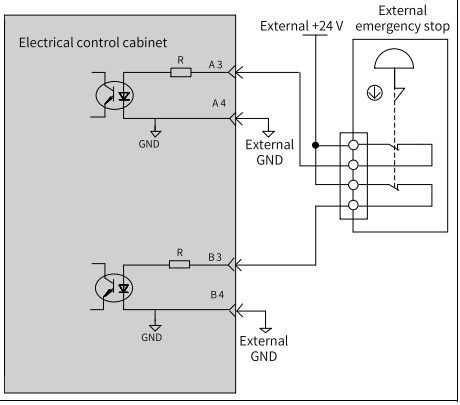


Figure 4-7 Wiring topology for the emergency stop, safety door, and start confirmation functions

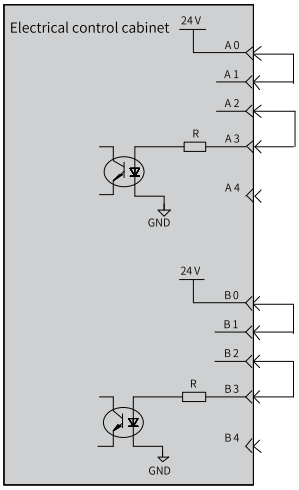
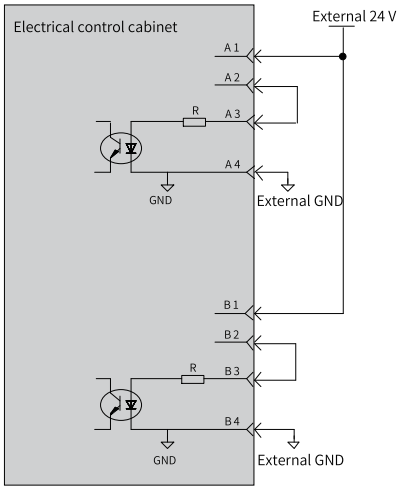
- Connection using an external switch and the teach pendant (dual-circuit (A/B) interlocking mechanism)

Using the 24 V Power Supply Provided by the Control Cabinet	Using an External 24 V Power Supply
	

- Connection using an external switch only (dual-circuit (A/B) interlocking mechanism)

Using the 24 V Power Supply Provided by the Control Cabinet	Using an External 24 V Power Supply
	

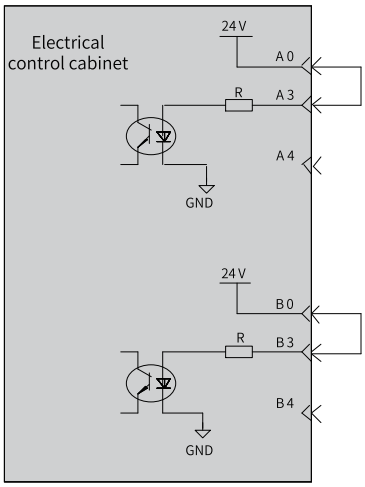
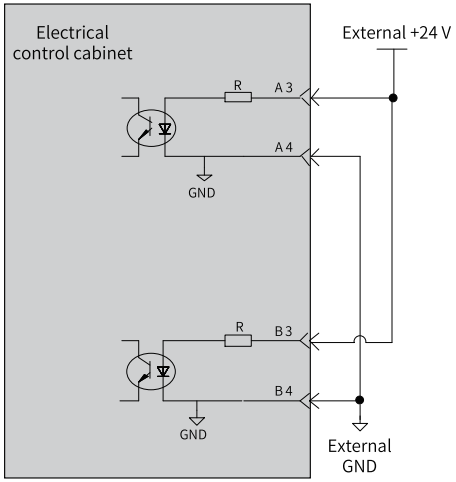
- Connection using the teach pendant only (dual-circuit (A/B) interlocking mechanism)

Using the 24 V Power Supply Provided by the Control Cabinet (Default)	Using an External 24 V Power Supply
	

- Connection without any physical emergency stop

Note

This usage is strongly deprecated as emergency braking of the robot is not possible in case of an emergency.

Using the 24 V Power Supply Provided by the Control Cabinet	Using an External 24 V Power Supply
	

4.8.4 Wiring of Safety Door and Start Confirmation

The safety door function is used to control the safeguard or door during robot operation.

The start confirmation function is used to check and confirm the operation of the robot before starting and running.

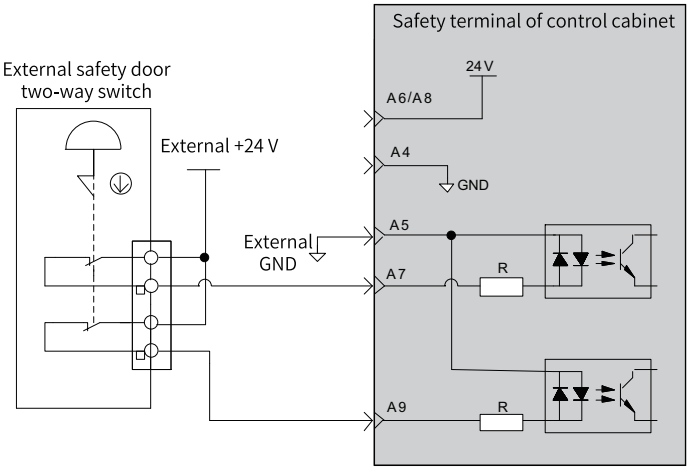
- Both the safety door and start confirmation functions utilize a common DI detection method with a dual circuit structure.
- The safety door utilizes a normally closed contact connection, with a dual circuit structure. The disconnection of either circuit will trigger the emergency stop function.
- The start confirmation function adopts the following working method:
  - Rising edge detection method. When the DI port detects an active 0-to-1 rising edge signal (with a pulse width greater than 500 μs), the start confirmation function is activated. For example, an external control device adopts a self-resetting contact switch for control.
  - If the DI port detects that there is always an ON input level, this function is blocked. For example, an external control device adopts a normally closed contact switch for control, and the input is always ON.

For the control cabinet system, the safety door and start confirmation functions are enabled by default. Therefore, observe the following wiring requirements:

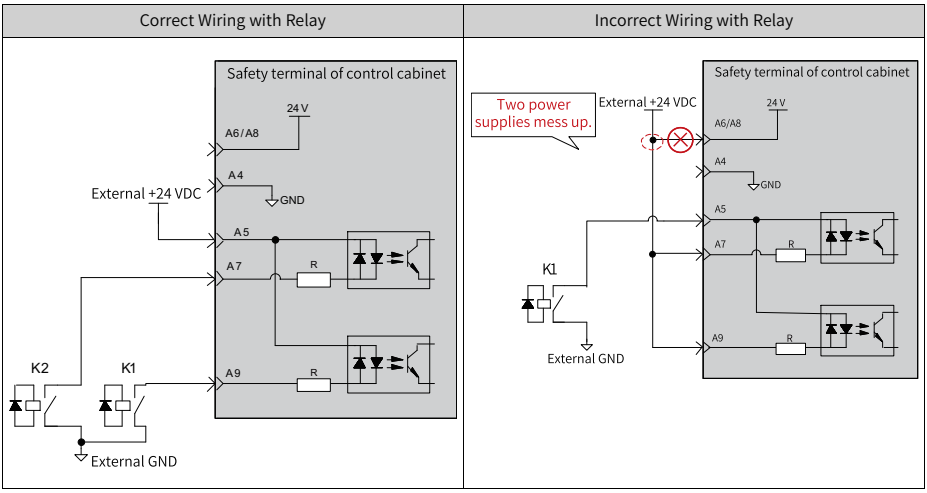
- Connect the safety door circuit to the designated I/Os: safety door 1 and safety door 2. Both I/O inputs must be valid to activate the safety door function. Otherwise, the system will alarm.
- When the start confirmation function is activated, the I/O detection circuit requires a 0-to-1 rising edge input before each operation of the system. Otherwise, after the start button is pressed, the system will prompt the user to confirm the start before automatic operation. Therefore, it is recommended to use a self-resetting switch in the start confirmation control circuit.

By default, the safety door and start confirmation circuits are powered by internal power supply. If you need to connect an external control device to remotely operate the safety door and start confirmation functions, it is recommended to use an external +24 V power supply. The external wiring for the start confirmation function is similar to that for the safety door function. The following figure illustrates the wiring method for the safety door function.

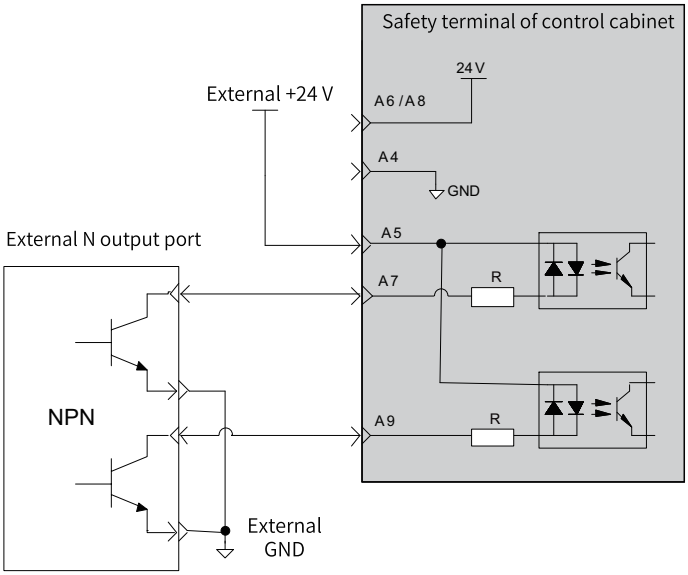
- When the external safety door control uses a dual hard switch (external 24 V power supply is recommended):



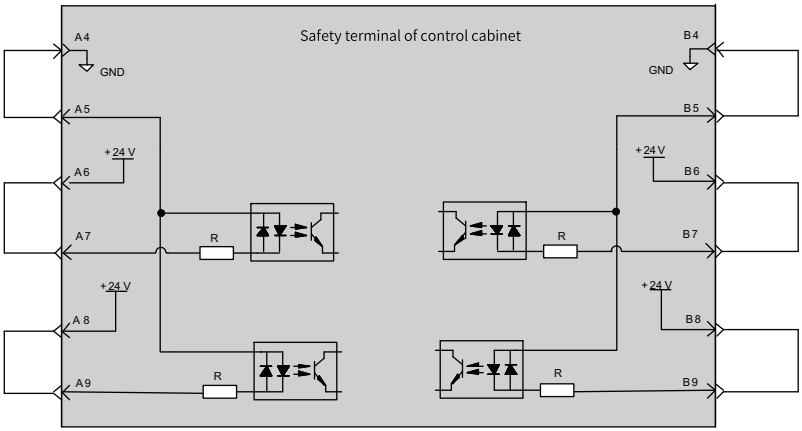
- When the external safety door control uses a relay output (external 24 V power supply is recommended):



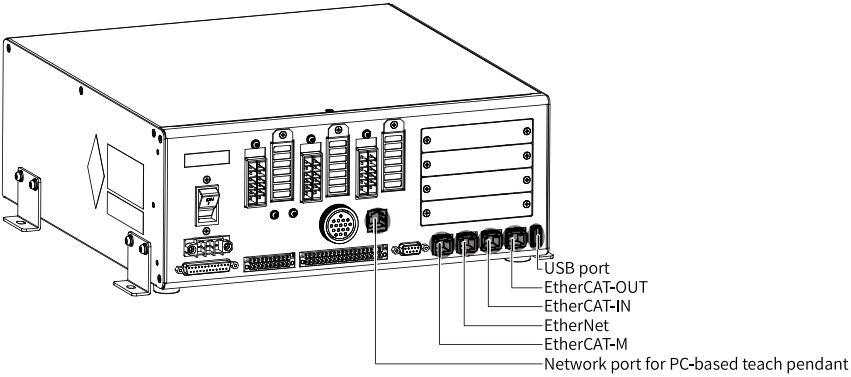
- When the external safety door control uses an N-type drive output (external 24 V power supply is recommended):



- Wiring for shielding safety door and start confirmation functions (factory default):



4.9 Wiring of Communication Interfaces



4.9.1 Ethernet Interface

A standard 100-MB Ethernet interface is provided for connecting vision equipment. This interface supports a rate of 100 Mbps. Its terminal assignment is as follows.

No.	Item	Description
1	TX+	Data transmit+
2	TX–	Data transmit–
3	RX+	Data receive+
4	-	-
5	-	-
6	RX–	Data receive–
7	-	-
8	-	-
Enclosure	PE	Shield

4.9.2 EtherCAT-M Interface

ECAT(M) is a communication interface of the EtherCAT slave to connect to external extension axes.

Item	Specifications
Communication protocol	EtherCAT protocol
Service supported	CoE (PDO and SDO)
Synchronization mode	Distributed clock (DC)
Physical layer	100Base-TX
Baud Rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex

Item	Specifications
Topology structure	Linear
Transmission media	Shielded cables of Cat5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Maximum number of slaves connected	3
EtherCAT frame length	44 bytes to 1,498 bytes
Process data	Maximum 1,486 bytes per Ethernet frame

4.9.3 EtherCAT-IN and EtherCAT-OUT Interfaces

ECAT(S)-IN is the interface of the EtherCAT-IN slave, while ECAT(S)-OUT is the communication interface of the EtherCAT-OUT slave.

When used as an intermediate node in a cascade, EtherCAT-IN inputs information and EtherCAT-OUT outputs information. When used as an end node, only the EtherCAT-IN interface needs to be connected.

Item	Specifications
Communication protocol	EtherCAT protocol
Service supported	CoE (PDO and SDO)
Synchronization mode	Distributed clock (DC)
Physical layer	100Base-TX
Baud Rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex
Topology structure	Linear
Transmission media	Shielded cables of Cat5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Synchronization jitter	< 1 μs

4.9.4 Network Port for PC-based Teach Pendant

There is a network port is for connecting the PC-based teach pendant, with a rate of 100 Mbps.

4.9.5 USB Interface

The standard USB 2.0 interface enables the connection and communication between the control cabinet and external USB devices for system upgrade and program loading.

4.9.6 Recommended Communication Cables

For EtherCAT-M, EtherNet, EtherCAT-IN, and EtherCAT-OUT communication cables, it is recommended to use Cat5e shielded twisted pair cables. In harsh EMC environments, it is recommended to use Cat6 highly flexible shielded cables.

Note

IR-LINK uses a standard network cable.

Supported S6 series cable models are described in the following figure.

S6 - L T 04 - 3.0
① ②③ ④ ⑤

① **S6 series**	④ **Cable type** T: Communication cable	⑤ **Cable length** 0.2: 0.2 m 0.3: 0.3 m ... 5.0: 5 m 10.0: 10 m
② **Cable**	⑤ **Communication cable connection type** 04: EtherCAT multi-device communication cable	

The cable ordering information is shown in the following table.

Part No.	Cable Model	Length (m)
15040261	S6-L-T04-0.3	0.3
15040262	S6-L-T04-3.0	3
15041960	S6-L-T04-0.2	0.2
15041961	S6-L-T04-0.5	0.5
15041962	S6-L-T04-1.0	1
15041963	S6-L-T04-2.0	2
15041964	S6-L-T04-5.0	5
15041965	S6-L-T04-10.0	10
15300377	Highly flexible Cat6 shielded cable (recommended for harsh EMC environments)	5
15300378	Highly flexible Cat6 shielded cable (recommended for harsh EMC environments)	3

The specifications of Cat5 shielded twisted pair cables are listed in the following table.

Item	Description
UL certified	UL Certified
Cat5e cable	Cat5e cable
Double shield	Braided shield (coverage: 85%) Aluminum foil shield (coverage: 100%)
Environmental robustness	Ambient temperature: –30°C to +60°C Resistant to industrial oil and acid and alkali corrosion

4.10 DB9 Connector

4.10.1 Overview of DB9 Connector

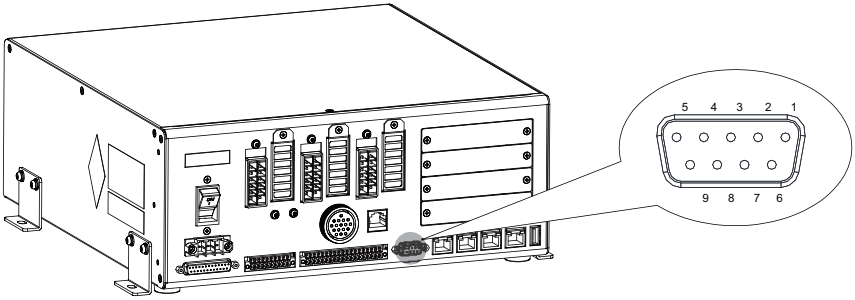


Table 4–2 DB9 connector pin assignment

Pin No.	Name	Description
2	RS232-TX	RS232 signal (reserved)
3	RS232-RX	
5	RS232-GND	
4	RS485–	RS485 bus signal
9	RS485+	
8	CGND	
1	CAN-L	CAN bus signal
6	CAN-H	
7	CGND	

4.10.2RS485 Wiring Method

RS485 topology

The RS485 interface of the control cabinet supports Modbus RTU communication. Note that the control cabinet only functions as a slave. The figure below shows the RS485 bus topology of the control cabinet. It is recommended that you use the shielded twisted pair for connection.

The control cabinet has a built-in 120 Ω terminal resistor to prevent signal reflection. The signal reference ground of all RS485 nodes should be connected together. The RS485 bus supports a maximum of 128 communication nodes and the distance between each node and the bus must be less than 3 m.

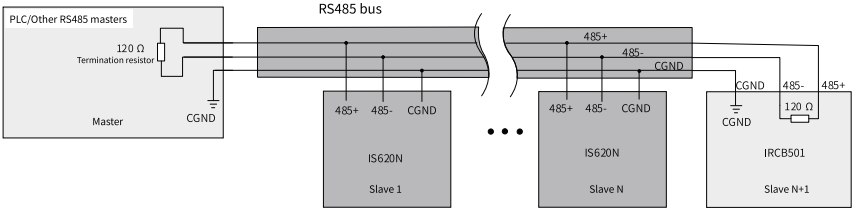


Figure 4-8 RS485 topology

Multi-node topology

To connect a large number of nodes, the daisy chain topology is recommended for the RS485 bus. If the branch topology is used, the cable length between the bus and any node must be as short as possible, and shall not exceed 3 m. (Note: The control cabinet should be on the last node of the bus.)

Dur to the built-in 120 Ω termination resistor of the control cabinet, neither the daisy chain connection nor the branch line connection allows to mount multiple control cabinet slave nodes on the RS485 bus. To mount multiple control cabinet slave nodes, an RS485 repeater is required.

- Daisy chain connection

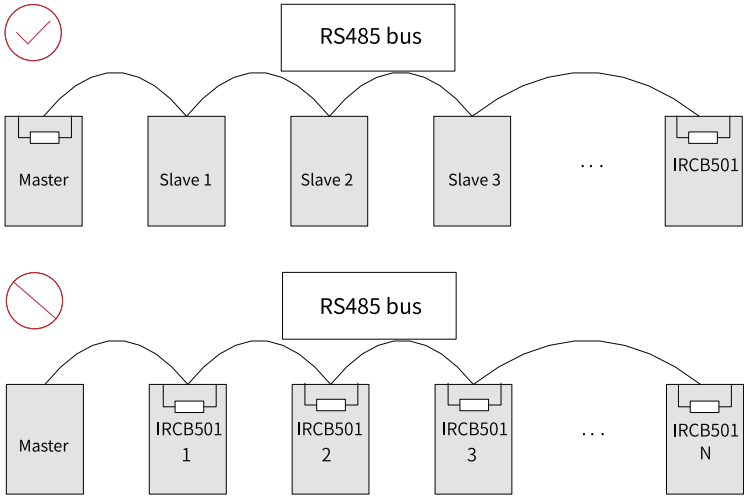


Figure 4-9 Daisy chain connection

- Branch line connection

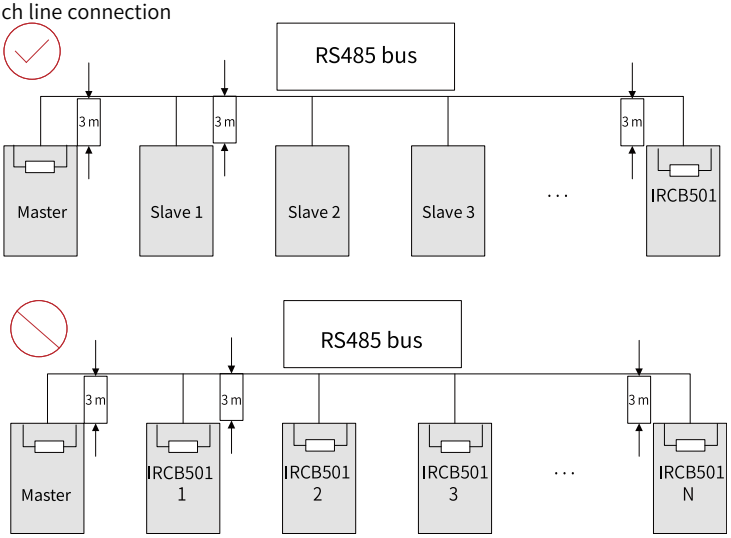


Figure 4-10 Branch line connection

Note

Branch lines should not exceed 3 m.

- Connecting multiple control cabinets by using an RS485 repeater

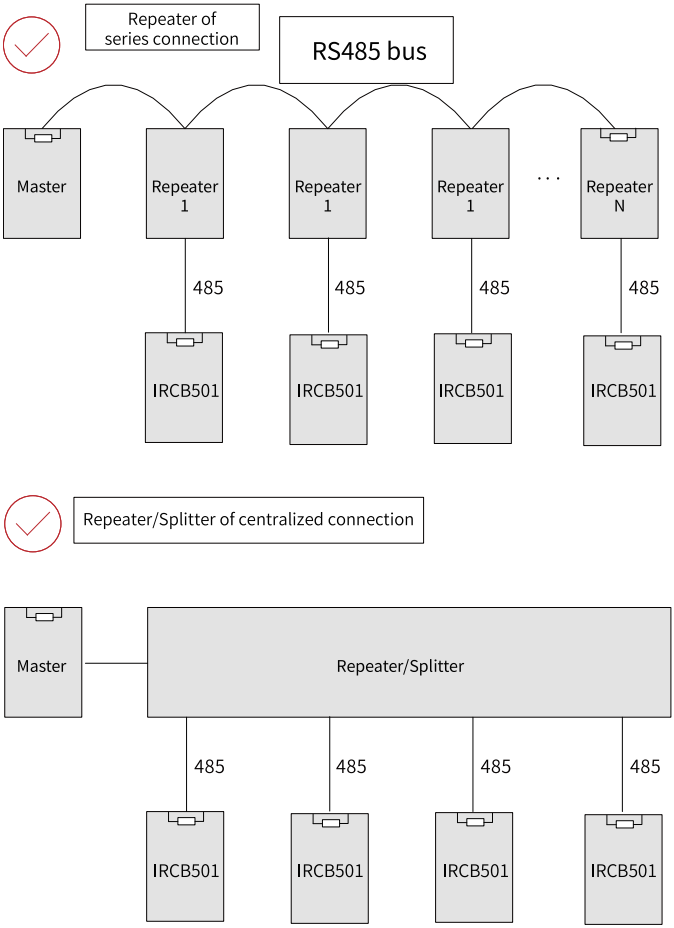


Figure 4-11 RS485 repeater connection

- Star connection (prohibited)

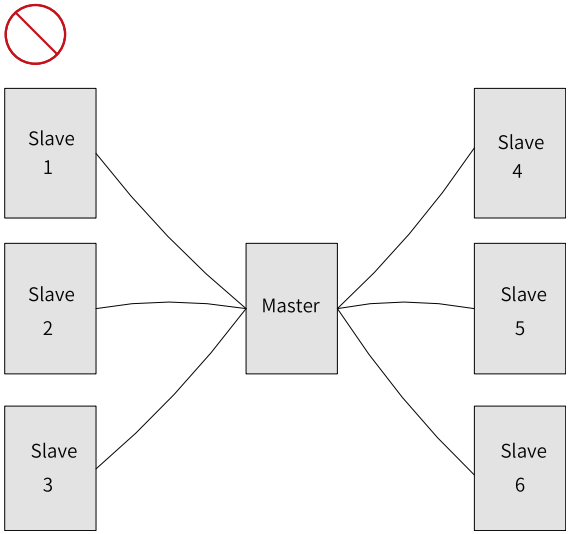


Figure 4-12 Star connection

Multi-node wiring method

- Terminal wiring for nodes with CGND
  Ensure that the RS485 bus cable includes three wires and the wires are connected to the terminal correctly. If a shielded cable is used, connect the shield to CGND. Never connect the shield to any terminal except CGND, including the device enclosure and equipment grounding terminals. Given the attenuation effect of cables, it is recommended to use AGW26 or thicker cables for connections longer than 3 m. Always use twisted pair cables to connect the RS485+ and RS485– terminals.

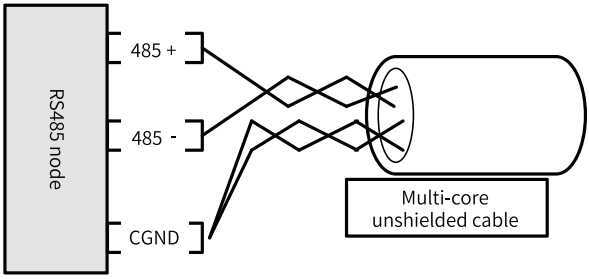


Figure 4-13 Multi-conductor unshielded cable

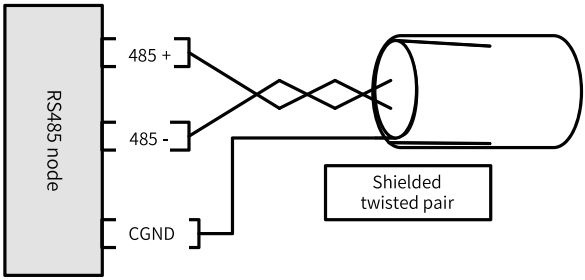


Figure 4-14 Shielded twisted pair cable

Recommended cable 1: Use multi-conductor unshielded twisted pair cables, with one twisted pair connected to the RS485+ and RS485– terminals, and others twisted together to connect the CGND terminal.

Recommended cable 2: Use shielded twisted pair cables, with the twisted pair connected to the RS485+ and RS485– terminals, and the shield connected to the CGND terminal.

When shielded cables are used, the shield can be connected to CGND only. Never connect the shield to the ground.

- Terminal wiring for nodes without CGND
  For any node without a CGND terminal, do not connect the CGND cable or the shield to the PE terminal of the node directly. Handle this issue using the following methods.

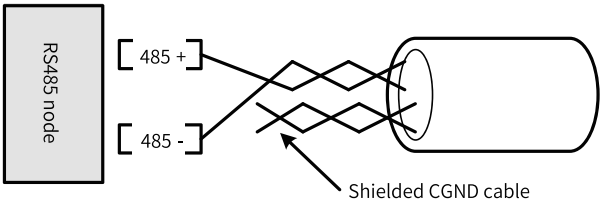


Figure 4-15 Multi-conductor unshielded cable

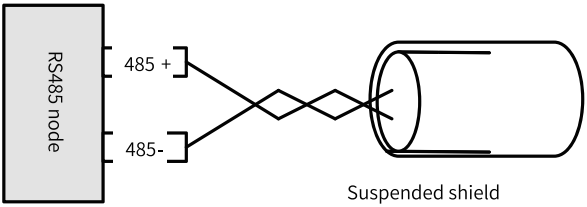


Figure 4-16 Shielded twisted pair cable

- Method 1: Check whether another port on the node shares a common reference ground with the RS485 circuit. If yes, connect the CGND cable (the shield) of the bus directly to the pin.
- Method 2: Find the reference ground of the RS485 circuit on the PCB of the node and connect the drain wire to the CGND cable or the shield.
- Method 3: If no reference ground of the RS485 circuit is found, keep the CGND cable or the shield unconnected and use an extra grounding cable to connect the node to the PE terminal of another node.

4.11 Bus Expansion

4.11.1Expansion Card Slot

Expansion card is an optional accessory developed for customer applications. It is based on the custom IR-LINK bus protocol of Inovance, featuring flexible expansion, powerful function, and ease of use. Optional expansion cards include DI, DO, encoder, and PROFINET expansion cards. The expansion card slot does not limit the type of expansion cards.

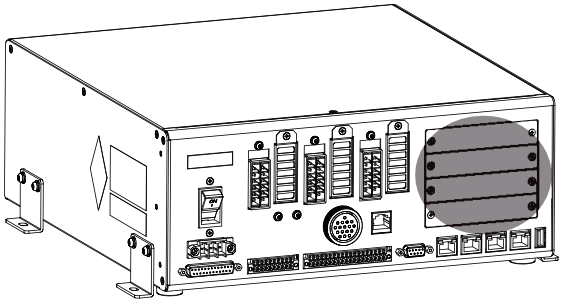


Table 4–3 Optional expansion cards

Order No.	Model	Name	Software Configuration
01650027	IRCB501-0016ETND-BD	General-purpose 16-output NPN I/O extension card of IRCB501 series	0016
01650026	IRCB501-1600END-BD	General-purpose 16-input I/O extension card of IRCB501 series	1,600
01650025	IRCB501-2ENID-BD	2-channel differential input incremental encoder expansion card of IRCB501 series	2ENC

Order No.	Model	Name	Software Configuration
01650028	IRCB501-2PN-BD	IRCB501 series PROFINET extension card	PN
01650030	IRCB501-FS-01-BD	IRCB501 series functional safety expansion card	-

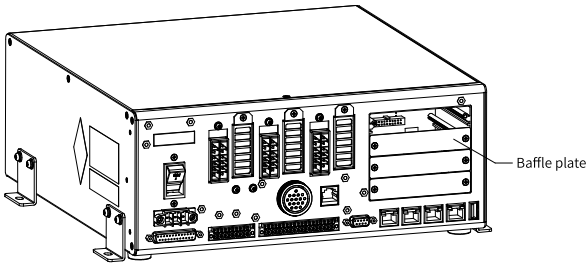
4.11.2Expansion Mode

Caution

Disconnect the 220 VAC external power supply of the system before removing or installing an expansion card. Failure to comply may cause damage to the control cabinet and failure of the expansion card.

Procedure

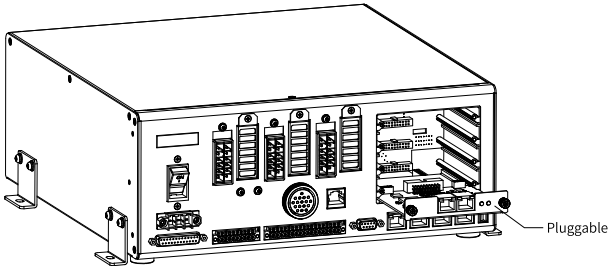
1. Remove the screws fixing the baffle plate for expansion card using a Phillips screwdriver and then remove the baffle plate.



2. Align the expansion card with and insert it into the card slot and then tighten the expansion card with the Phillips screwdriver.

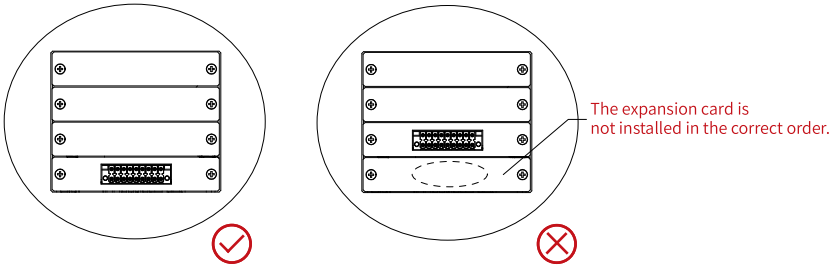
Caution

The expansion cards must be inserted to the slots in the specified order; otherwise, the control cabinet reports an alarm and fails to work.



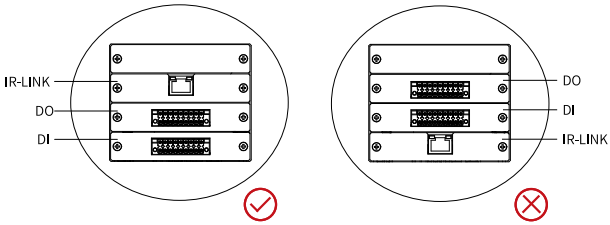
Note

The control cabinet provides four card slots each identified by a number. The DO, DI, encoder, and IR-LINK expansion cards[1] must be inserted in order. For example, if the slot 1 is vacant, you need to insert the card to this slot firstly. Only when the slot 1 is occupied can the card be installed to slot 2, and so on, as shown in the following figure.



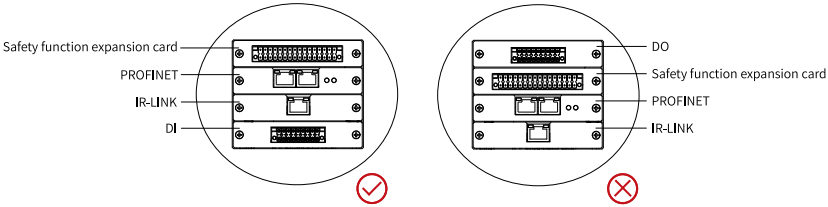
Note

The IR-LINK expansion card[1] can only be used as the last card in the sequence, that is, be connected after all other expansion cards. Failure to do so will prevent the card from functioning properly.



Note

- The PROFINET expansion card and the functional safety expansion card can only be installed after the DI, DO, encoder card, and IR-LINK expansion card[1].
- When only the PROFINET expansion card and the functional safety expansion card are used, you may insert them into any available slots.



Note

[1]: Contact the sales representative of Inovance for IR-LINK expansion cards.

4.11.3Expansion Configuration

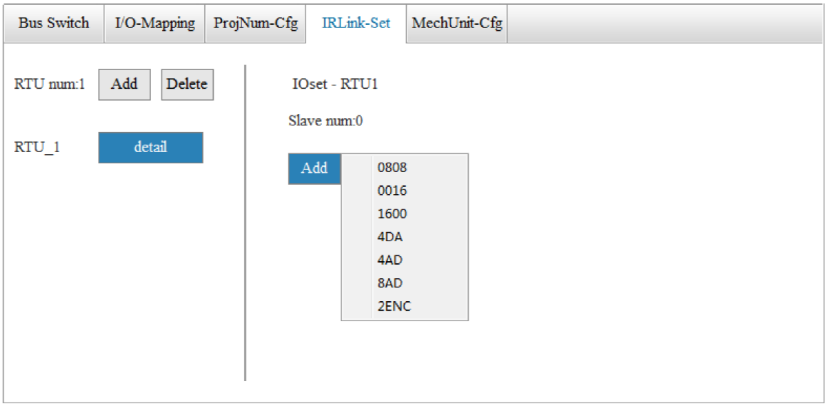
You can configure the corresponding modules on the software page according to the actual physical configuration (which is strongly related to the corresponding configuration topology). Before configuring the expansion cards, you need to configure the adaption settings.

1. After connecting the hardware device, you need to configure the IR-LINK in the software.
2. Click the Add button on the left side of the page to generate an RTU. The details of the added RTU are displayed on the right side. You can add up to five RTUs.
3. Click the Add button on the right, and an option box will pop up, with options including 0016, 1600, and 2ENC.

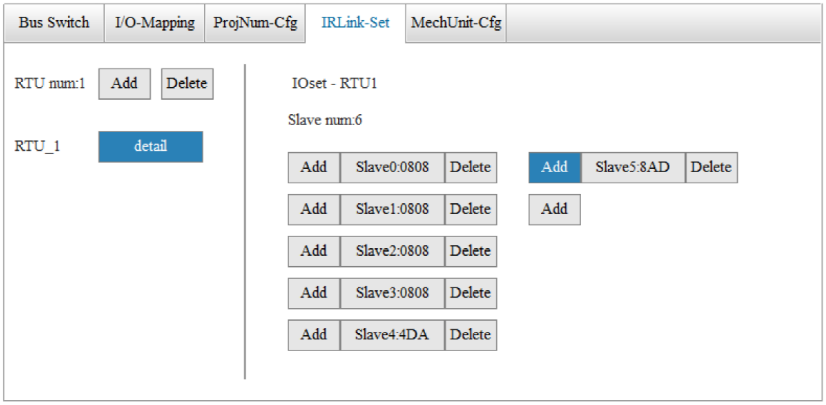
Note

The expansion modules are not described in details in this guide. Purchase expansion modules if needed.

4. Add the expansion module according to actual connections.



5. For example, you can add two 0016 modules and two 1600 modules. The result is as follows.



4.12 Crimping Signal Cable

The cable pin is shown in *"Figure 4–17 " on page 74* :

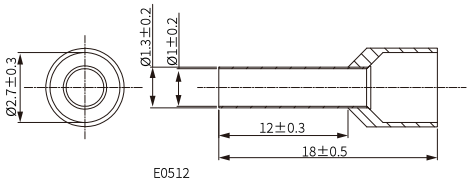


Figure 4-17 Dimensions of the cable pin (unit: mm)

Item	Specifications
Applicable Cable Size	0.50 mm^2
Color	Orange, white
Materials	Copper tube/nylon
Surface treatment	Tin-plated
Current carrying capacity	Maximum 19 A

Recommended crimping tool:

Cable preparation procedure:

1. Strip off 12 mm of the wire insulation.
2. Pass the cable through the cable marking sleeve.
3. Thread the cable conductor through the round hole of the wire pin. Crimp the wire pin with the crimping pliers recommended by the wire pin manufacturer.
4. Insert the wire pin into the corresponding hole on the I/O port terminal block. Pull back the wire pin to ensure that it is securely locked by the spring in the terminal block.

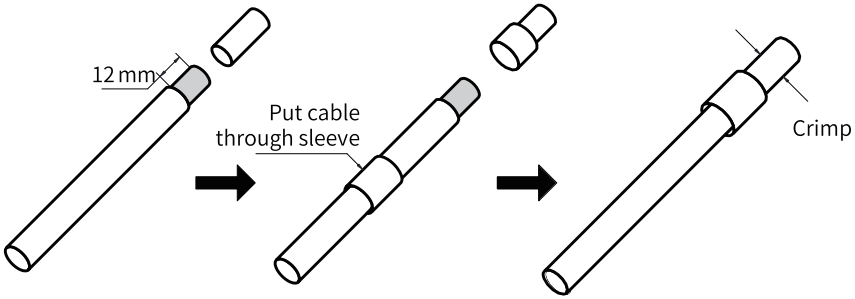


Figure 4-18 Cable preparation

4.13 Test Run

Step	Sub-step
1. Robot installation check	a. Check whether both the robot and the control cabinet are firmly installed. b. Check whether the power lines and signal cables are properly connected between the robot and the control cabinet. c. Check whether the teach pendent is properly connected to the control cabinet. d: Check whether the SAFETY terminal is properly connected. e: Check that the power supply of the control cabinet is properly connected and the connections are effectively protected.
2. Power-on	a. Check whether the power supply voltage is within the required range. b. Turn on the power supply. c. The teach pendant is started enters the connection page, and then enters the main screen when the connection is successful. d. Check the status light and the message bar at the bottom of the teach pendant screen to confirm whether there is an alarm. When an alarm occurs, the ERROR indicator turns on and the alarm message scrolls at the bottom of the screen.
3. Robot confirmation	a. Check whether the robot model set on the controller is consistent with the model of the connected robot. b. On the teach pendant, press the "Mon  /Version" button to check whether the controller version is the same with the teach pendant version. If not, contact Inovance. c. Check whether the emergency stop button works normally. Make sure the robot is in static state and press the emergency stop button. If the button can be pressed down and the alarm message indicating emergency stop error scrolls at the bottom of the teach pendant screen, it means that the button works normally. Pull up the emergency stop button to restore to the non-emergency stop state. d. Make sure the robot operates at a low speed by pressing the  button and adjusting the speed to be smaller than 25%. Then press the  button and check whether the robot zeros normally. If not, contact Inovance.
4. Programming	a. Create a program file. b. Create coordinate point data as needed. c. Create a program as needed.

Step	Sub-step
5. Trial run	a. In manual mode, verify that all coordinate points can be reached. b. On the teach pendant, press the button and adjust the global speed to 5%. Then, press the button to run the program line by line to check whether the robot acts correctly.
6. Formal run	a. On the teach pendant, press the button to switch the robot from the manual mode to the automatic mode. b. On the teach pendant, press the button and adjust the global speed to 5%. Then, press the button to run the program. c. Gradually increase the global speed by 10%, such as 15%, 25%, 35% and so on, and check whether the robot operates normally.

Caution

- For handheld teach pendant, it is directly connected to the EtherNet2 port of the controller using a network cable. The controller IP address is 192.168.23.25 and you need to fill this IP address on the teach pendant. By default, the teach pendant connects to the controller automatically after the system is powered on.
- For PC-based teach pendant, if it cannot connect to the controller, click the Skip button, and choose Settings > System Settings > Communication Settings. On the page displayed, enter the controller IP address (fixed to 192.168.23.25), and then connect them again.

5 Fault Diagnosis and Troubleshooting

5.1 LED Display

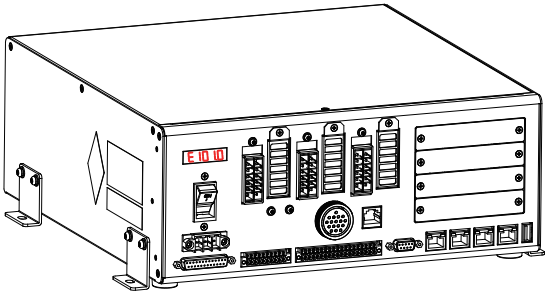
There is a 5-digit LED display on the operating panel to show control status and fault codes, as described in the following table.

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
	0		9		I		R
	1		A		J		S
	2		B		K		T
	3		C		L		U
	4		D		M		V
	5		E		N		W
	6		F		O		X
	7		G		P		Y
	8		H		Q		Z

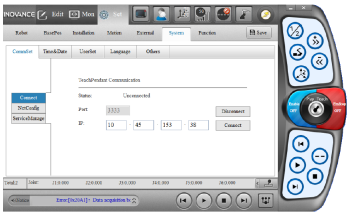
5.2 Robot Alarms

If an alarm occurs in play mode, the robot immediately stops.

1. The alarm message is displayed on the LED display of the control cabinet panel, as shown in the following figure.



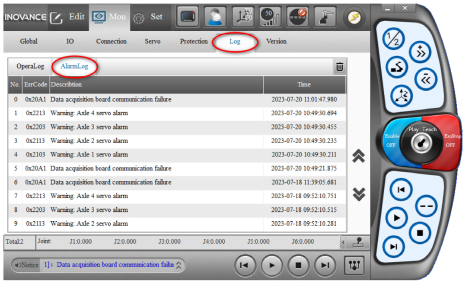
2. An alarm icon appears in the upper-right corner of the screen of the teach pendant. Besides, the message bar at the bottom of the screen will display the alarm ID and alarm message, as shown in the following figure.



If there are multiple alarm messages, the message bar will display the last message.

If an alarm occurs in teach mode, the robot immediately stops. The alarm screen in teach mode is similar to that in play mode. If an overlimit alarm occurs in a certain direction in teach mode, the robot cannot be taught in that direction any more. In this case, you can teach the robot in the opposite direction. When the robot leaves the limit position, the alarm automatically disappears.

On the Mon page, click Log. The log tab page is displayed, as shown in the following figure. On this page, all robot alarms are displayed in chronological order. Sometimes the alarm message displayed on the log page lags behind the alarm in the message bar. You can also refresh the current alarm message by exiting the application or switching the tabs.



When the robot is in an alarm state, you can press the emergency stop button to clear the alarm from the message bar. However, if the robot encounters a hardware or software error, such as a servo error, EtherCAT configuration error, underlying driver error, or other errors, the alarm in the message bar cannot be cleared. In this case, check the hardware connection, power off the robot and power it on again. If the alarm persists, contact the manufacturer.

5.3 Common Fault Troubleshooting

No.	Fault	Solution
1	The power indicator on the cabinet door does not light up during power-on.	(1) Check whether the power supply is connected correctly, with L1/L2/L3/PE cables connected according to the marks. (2) Check whether the micro-disconnection switch is toggled to ON.
2	The PC network port cannot be connected.	(1) Check the two indicators on the Ethernet port. The hardware communication is normal only when the indicators are steady on or blinking. (2) The network signal cable in the aviation plug is mutually exclusive with the PC network port. To use the PC network port, you need to remove the aviation plug of the teach pendant. (3) Check whether the IP addresses are set correctly.
3	Invalid DO	(1) Check whether the 24_E and GND_E terminals are connected to a 24 V power supply and are powered by only one power supply. (2) Check whether the total output current of a single DO does not exceed 0.4 A when the I/O terminals are powered by an external 24 V power supply. Check whether the total continuous output current of the 16 DOs does not exceed 0.8 A when the I/O terminals are powered by the power supply inside the control cabinet. (3) Check whether the wiring is normal when the device drives relay or photocoupler loads.
4	Invalid DI	(1) Check whether the terminal is powered by only one power supply. (2) Check whether the connected common terminal matches the input terminal, with S0 and X0-X15 as a group. (3) Check whether the input voltage on terminal X* is valid. When S0 is connected to the 24V terminal, 0 V input to terminal X* is considered valid. Conversely, when S0 is connected to the 0V terminal, 24 V input to terminal X* is considered valid.

No.	Fault	Solution
5	Servo fault	For details, see the Robot Fault Troubleshooting Guide.
6	Emergency stop alarm	Check whether the SAFETY terminal is correctly wired. For details, see *"4.8.1 Safety I/O Specifications" on page 51*. Check whether the emergency stop switch in series is open or malfunctions. If open, close the switch.

5.4 Servo Fault Troubleshooting

This section describes alarms except for the general-purpose servo alarms. For the general-purpose servo alarms, see the troubleshooting section of the SV660N series servo drive user guide.

E124.7: Cooling fan stall

Fault mechanism:

The system has detected a fan stall feedback signal.

Cause	Troubleshooting	Solution
The fan detection terminal is loose.	Check whether the servo DI terminal is loose.	If yes, tighten the terminal and its screw.
The fan is stuck by a foreign matter.	Check whether the fan is stuck by a foreign matter.	If there is a foreign matter, turn off the power and remove the foreign matter.
The fan is in poor contact.	Check whether the fan terminals are fastened.	Unplug and plug the fan terminals.
The fan is damaged.	Check whether the fan and its circuit are burned.	Replacing the Fan

E203.0: Controller protection

Fault mechanism:

The fault is actively triggered by the controller.

Cause	Troubleshooting	Solution
The fault is actively triggered by the controller.	The fault is actively triggered by the controller.	The controller triggers the fault to stop to protect the control cabinet and the robot. Just clear this alarm.

E420.3: Main circuit de-energized

Fault mechanism:

The system has detected that the 380 V power input is disconnected.

Cause	Troubleshooting	Solution
The power detection signal terminal is loose.	Check whether the servo DI terminal is loose.	If yes, tighten the terminal and its screw.
The power supply of the main circuit is unstable or power failure occurs.	Check whether the input voltage of the main circuit on the control cabinet side (L/N) complies with the following specifications: Effective value: 340 V to 440 V	Replace or adjust the power supply according to the specifications.
The control cabinet is faulty.	Check whether the external input power supply is normal and meets the specifications.	Unplug and plug the core board. If the problem persists, replace the control cabinet.

EB00.0: Excessive position deviation

Fault mechanism:

In position control mode, the position deviation is greater than the position deviation threshold. The position deviation threshold is calculated based on H1440 and H1441 and automatically adjusted with gain.

Cause	Troubleshooting	Solution
Motor stall occurs due to mechanical factors.	Read the black box data of the servo, including the position reference, position feedback, speed reference, and torque reference. The position reference is not zero but the position feedback is always zero, and the torque reference increases continuously to the maximum value.	Eliminate possible mechanical factors causing motor stall.
The robot friction force is too large.	1. Check whether the robot is immediately put into operation in a cold state and whether it is warmed up. 2. Check whether the reducer or grease is normal. 3. Check whether the brake is ineffective and cannot be released. 4. Check whether the robot is mechanically stuck.	1. Warm up the robot before operation. 2. Repair the robot. 3. Replace the motor. 4. Repair the robot.
The servo gain is low.	Check the position loop gain and speed loop gain of the servo: H0800 to H0802.	See the robot's factory servo settings.

Cause	Troubleshooting	Solution
The values of H1440 and H1441 are too small under current operating conditions.	Check whether the values of H1440 and H1441 are too small.	Set H1440 and H1441 according to factory settings.
The position reference increment is too large.	Check whether the electronic gear ratio is 8:1.	Set the electronic gear ratio correctly.
The encoder initial phase is incorrect.	In the enabled state, the average load factor H0B12 is too high.	Replace the motor.
The control cabinet is faulty.	Read the black box data of the servo, including the position reference, position feedback, speed reference, and torque reference. The position reference is not zero but the position feedback is always zero, and the torque reference is zero.	Contact Inovance.

EB01.6: Acceleration rate in position reference beyond the limit

Fault mechanism:

The acceleration rate in position reference exceeds the set value of H14-60.

Cause	Troubleshooting	Solution
The acceleration rate in position reference exceeds the set value of H14-60.	Read the black box data of the servo, including the position reference and real-time absolute target position.	Contact Inovance.

EC00.1: Excessive speed deviation

Fault mechanism:

The speed deviation is larger than the set value of H1438.

Cause	Troubleshooting	Solution
Motor stall occurs due to mechanical factors.	Read the black box data of the servo, including the speed reference, speed feedback, torque reference, and torque feedback. The speed reference is not zero but the speed feedback is always zero, and the torque reference increases continuously to the maximum value.	Eliminate possible mechanical factors causing motor stall.
Collision or mechanical jamming occurs during movement.	1. Check whether interference exists in the robot movement trajectory. 2. Check whether the robot model is correct.	Handle according to the troubleshooting results.
The robot friction force is too large.	1. Check whether the robot is immediately put into operation in a cold state and whether it is warmed up. 2. Check whether the reducer or grease is normal. 3. Check whether the brake is ineffective and cannot be released. 4. Check whether the robot is mechanically stuck.	1. Warm up the robot before operation. 2. Repair the robot. 3. Replace the motor. 4. Repair the robot.
The servo gain is low.	Check the servo speed loop gain: H0800 to H0801.	See the robot's factory servo settings.
The value of H1438 is too small under current operating conditions.	Check whether the value of the speed deviation (H1438) is too small.	Set H1438 according to factory settings.
The encoder initial phase is incorrect.	In the enabled state, the average load factor H0B12 is too high.	Replace the motor.
The control cabinet is faulty.	Read the black box data of the servo, including the speed reference, speed feedback, torque reference, and torque feedback. The speed reference is not zero but the position feedback is always zero, and the torque reference is zero.	Contact Inovance.

EC01.0: Excessive current deviation

Fault mechanism:

The current deviation is larger than the set value of H1442.

Cause	Troubleshooting	Solution
Servo parameters do not match.	Check whether the motor has obvious vibration or howling.	1. Check whether the set value of the load moment of inertia ratio (H0815) is reasonable through the inertia tuning function. 2. Increase the filter time constant (H0705) in the torque reference to filter out high-frequency signals. Ensure that the cutoff frequency of the torque reference low-pass filter is higher than 4 times the maximum follow-up frequency of the speed loop, that is, 1,000/2/π/H0705 ⩾ (H0800 x 4). 3. Notch: Capture the torque reference and current feedback waveform during howling using a trigger oscilloscope, and calculate the resonance frequency by the FFT function of the waveform analyzer, and then set H0912 to the calculated frequency, and set H0913 to 5 and H0914 to 2. 4. Reduce the servo gain according to the principle of H0802 = H0800 x 1.5 and H0801 = 1,500/H0800. Firstly, reduce H0800 by 30% and observe the current fluctuation. If there is still high-frequency current fluctuation, reduce the gain appropriately until the current fluctuation is normal. Generally, the gain is not less than 60% of the factory value.

Cause	Troubleshooting	Solution
Power output disconnection occurs.	1. Alarm is triggered multiple times during operation. 2. Check whether there are loose cables or open circuit, and whether there are loose pins, pin retraction, or wire breakage at the terminals. If there are no such problems, measure the phase-to-phase resistance of the motor to confirm whether there is an open circuit. 3. Check the black box data of the servo and whether the current feedback is obviously smaller than the current reference.	1. Reconnect the power line. 2. Replace or repair the cable. 3. If the black box data does not match the troubleshooting method, please provide data feedback to Inovance.
The inverter board is in poor contact.	The inverter board is in poor contact.	Reinstall and fix the inverter board.
The voltage is saturated.	The robot runs normally at low speed, but alarms when running at high speed.	1. Check whether the value of H07-26 (flux weakening enabling) is 1. If not, import the servo parameters. 2. If the alarm persists when H07-26 is 1, contact Inovance.
The inverter board is damaged.	If there is another control cabinet having the same inverter board power as the current control cabinet, cross verify the inverter boards of the two control cabinets. If there is a robot of the same model in the field, verify whether the problem is caused by the control cabinet or the robot. Otherwise, replace the inverter board.	Replace the inverter board or control cabinet.

5.5 Functional Safety Fault Troubleshooting

Caution

In the order of decreasing severity, faults and warnings of the safety function are divided into the following classes:

- Class-1 (No. 1) non-resettable faults
- Class-2 (No. 2) resettable faults
- Class-3 (No. 3) resettable warnings

The following faults may occur during the use of the product. Troubleshoot the faults related to the safety functions according to the solutions described in the following table.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9016	Axis 1 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-1 speed limit.	Clear the alarm.
0x9017	Axis 2 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-1 speed limit.	Clear the alarm.
0x9018	Axis 3 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-1 speed limit.	Clear the alarm.
0x9019	Axis 4 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-1 speed limit.	Clear the alarm.
0x901A	Axis 5 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-1 speed limit.	Clear the alarm.
0x901B	Axis 6 exceeds Group-1 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-1 speed limit.	Clear the alarm.
0x901C	Axis 1 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-2 speed limit.	Clear the alarm.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x901D	Axis 2 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-2 speed limit.	Clear the alarm.
0x901E	Axis 3 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-2 speed limit.	Clear the alarm.
0x901F	Axis 4 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-2 speed limit.	Clear the alarm.
0x9020	Axis 5 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-2 speed limit.	Clear the alarm.
0x9021	Axis 6 exceeds Group-2 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-2 speed limit.	Clear the alarm.
0x9022	Axis 1 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-3 speed limit.	Clear the alarm.
0x9023	Axis 2 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-3 speed limit.	Clear the alarm.
0x9024	Axis 3 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-3 speed limit.	Clear the alarm.
0x9025	Axis 4 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-3 speed limit.	Clear the alarm.
0x9026	Axis 5 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-3 speed limit.	Clear the alarm.
0x9027	Axis 6 exceeds Group-3 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-3 speed limit.	Clear the alarm.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9028	Axis 1 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-4 speed limit.	Clear the alarm.
0x9029	Axis 2 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-4 speed limit.	Clear the alarm.
0x902A	Axis 3 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-4 speed limit.	Clear the alarm.
0x902B	Axis 4 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-4 speed limit.	Clear the alarm.
0x902C	Axis 5 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-4 speed limit.	Clear the alarm.
0x902D	Axis 6 exceeds Group-4 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-4 speed limit.	Clear the alarm.
0x902E	Axis 1 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-5 speed limit.	Clear the alarm.
0x902F	Axis 2 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-5 speed limit.	Clear the alarm.
0x9030	Axis 3 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-5 speed limit.	Clear the alarm.
0x9031	Axis 4 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-5 speed limit.	Clear the alarm.
0x9032	Axis 5 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-5 speed limit.	Clear the alarm.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9033	Axis 6 exceeds Group-5 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-5 speed limit.	Clear the alarm.
0x9034	Axis 1 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-6 speed limit.	Clear the alarm.
0x9035	Axis 2 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-6 speed limit.	Clear the alarm.
0x9036	Axis 3 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-6 speed limit.	Clear the alarm.
0x9037	Axis 4 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-6 speed limit.	Clear the alarm.
0x9038	Axis 5 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-6 speed limit.	Clear the alarm.
0x9039	Axis 6 exceeds Group-6 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-6 speed limit.	Clear the alarm.
0x903A	Axis 1 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-7 speed limit.	Clear the alarm.
0x903B	Axis 2 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-7 speed limit.	Clear the alarm.
0x903C	Axis 3 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-7 speed limit.	Clear the alarm.
0x903D	Axis 4 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-7 speed limit.	Clear the alarm.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x903E	Axis 5 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-7 speed limit.	Clear the alarm.
0x903F	Axis 6 exceeds Group-7 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-7 speed limit.	Clear the alarm.
0x9040	Axis 1 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-8 speed limit.	Clear the alarm.
0x9041	Axis 2 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-8 speed limit.	Clear the alarm.
0x9042	Axis 3 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-8 speed limit.	Clear the alarm.
0x9043	Axis 4 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-8 speed limit.	Clear the alarm.
0x9044	Axis 5 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-8 speed limit.	Clear the alarm.
0x9045	Axis 6 exceeds Group-8 speed limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-8 speed limit.	Clear the alarm.
0x9046	Axis 1 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.
0x9047	Axis 2 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9048	Axis 3 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.
0x9049	Axis 4 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.
0x904A	Axis 5 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.
0x904B	Axis 6 exceeds Group-1 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-1 position limit.	Disable the axis position monitoring or disable Group-1 axis position limit, and move the robot to a safe position.
0x904C	Axis 1 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.
0x904D	Axis 2 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.
0x904E	Axis 3 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.
0x904F	Axis 4 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.
0x9050	Axis 5 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9051	Axis 6 exceeds Group-2 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-2 position limit.	Disable the axis position monitoring or disable Group-2 axis position limit, and move the robot to a safe position.
0x9052	Axis 1 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9053	Axis 2 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9054	Axis 3 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9055	Axis 4 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9056	Axis 5 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9057	Axis 6 exceeds Group-3 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-3 position limit.	Disable the axis position monitoring or disable Group-3 axis position limit, and move the robot to a safe position.
0x9058	Axis 1 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.
0x9059	Axis 2 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x905A	Axis 3 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.
0x905B	Axis 4 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.
0x905C	Axis 5 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.
0x905D	Axis 6 exceeds Group-4 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-4 position limit.	Disable the axis position monitoring or disable Group-4 axis position limit, and move the robot to a safe position.
0x905E	Axis 1 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.
0x905F	Axis 2 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.
0x9060	Axis 3 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.
0x9061	Axis 4 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.
0x9062	Axis 5 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9063	Axis 6 exceeds Group-5 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-5 position limit.	Disable the axis position monitoring or disable Group-5 axis position limit, and move the robot to a safe position.
0x9064	Axis 1 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x9065	Axis 2 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x9066	Axis 3 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x9067	Axis 4 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x9068	Axis 5 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x9069	Axis 6 exceeds Group-6 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-6 position limit.	Disable the axis position monitoring or disable Group-6 axis position limit, and move the robot to a safe position.
0x906A	Axis 1 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x906B	Axis 2 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x906C	Axis 3 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x906D	Axis 4 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x906E	Axis 5 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x906F	Axis 6 exceeds Group-7 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-7 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x9070	Axis 1 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 1 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-8 axis position limit, and move the robot to a safe position.
0x9071	Axis 2 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 2 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-8 axis position limit, and move the robot to a safe position.
0x9072	Axis 3 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 3 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-7 axis position limit, and move the robot to a safe position.
0x9073	Axis 4 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 4 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-8 axis position limit, and move the robot to a safe position.
0x9074	Axis 5 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 5 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-8 axis position limit, and move the robot to a safe position.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9075	Axis 6 exceeds Group-8 position limit.	No. 2 resettable fault	Manual reset	Axis 6 exceeds Group-8 position limit.	Disable the axis position monitoring or disable Group-8 axis position limit, and move the robot to a safe position.
0x9077	Overspeed in manual mode	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds 250 mm/s in manual mode.	Clear the alarm.
0x9078	Group-1 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-1 Cartesian speed setpoint.	Clear the alarm.
0x9079	Group-2 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-2 Cartesian speed setpoint.	Clear the alarm.
0x907A	Group-3 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-3 Cartesian speed setpoint.	Clear the alarm.
0x907B	Group-4 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-4 Cartesian speed setpoint.	Clear the alarm.
0x907C	Group-5 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-5 Cartesian speed setpoint.	Clear the alarm.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x907D	Group-6 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-6 Cartesian speed setpoint.	Clear the alarm.
0x907E	Group-7 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-7 Cartesian speed setpoint.	Clear the alarm.
0x907F	Group-8 Cartesian speed limit is exceeded.	No. 2 resettable fault	Manual reset	The Cartesian speed of the robot exceeds Group-8 Cartesian speed setpoint.	Clear the alarm.
0x9080	Robot enters interference zone 1.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 1.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 1.
0x9081	Robot enters interference zone 2.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 2.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 2.
0x9082	Robot enters interference zone 3.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 3.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 3.
0x9083	Robot enters interference zone 4.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 4.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 4.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9084	Robot enters interference zone 5.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 5.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 5.
0x9085	Robot enters interference zone 6.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 6.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 6.
0x9086	Robot enters interference zone 7.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 7.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 7.
0x9087	Robot enters interference zone 8.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 8.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 8.
0x9088	Robot enters interference zone 9.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 9.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 9.
0x9089	Robot enters interference zone 10.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 10.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 10.
0x908A	Robot enters interference zone 11.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 11.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 11.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x908B	Robot enters interference zone 12.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 12.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 12.
0x908C	Robot enters interference zone 13.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 13.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 13.
0x908D	Robot enters interference zone 14.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 14.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 14.
0x908E	Robot enters interference zone 15.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 15.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 15.
0x908F	Robot enters interference zone 16.	No. 2 resettable fault	Manual reset	The robot enters Cartesian position restriction area 16.	Disable the Cartesian position monitoring or disable Cartesian position restriction area 16.
0x909C	Category 1 emergency stop takes too long.	No. 2 resettable fault	Manual reset	The category 1 emergency stop time of the robot exceeds the setpoint.	1. Extend the delay time appropriately for category 1 emergency stop. 2. Contact Inovance for support.
0x909D	STO stop takes too long.	No. 2 resettable fault	Manual reset	The STO stop time of the robot exceeds the setpoint.	1. Extend the delay time appropriately for category 0 emergency stop. 2. Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x909E	CRC failed for axis-1 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-1 position in the actual data frame of the master chip.	Contact Inovance for support.
0x909F	CRC failed for axis-2 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-2 position in the actual data frame of the master chip.	Contact Inovance for support.
0x90A0	CRC failed for axis-3 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-3 position in the actual data frame of the master chip.	Contact Inovance for support.
0x90A1	CRC failed for axis-4 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-4 position in the actual data frame of the master chip.	Contact Inovance for support.
0x90A2	CRC failed for axis-5 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-5 position in the actual data frame of the master chip.	Contact Inovance for support.
0x90A3	CRC failed for axis-6 position in the actual data frame of the master chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-6 position in the actual data frame of the master chip.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90AA	CRC failed for axis-1 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-1 position in the actual data frame of the slave chip.	Contact Inovance for support.
0x90AB	CRC failed for axis-2 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-2 position in the actual data frame of the slave chip.	Contact Inovance for support.
0x90AC	CRC failed for axis-3 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-3 position in the actual data frame of the slave chip.	Contact Inovance for support.
0x90AD	CRC failed for axis-4 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-4 position in the actual data frame of the slave chip.	Contact Inovance for support.
0x90AE	CRC failed for axis-5 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-5 position in the actual data frame of the slave chip.	Contact Inovance for support.
0x90AF	CRC failed for axis-6 position in the actual data frame of the slave chip.	No. 1 non-resettable fault	Non-resettable	CRC failed for axis-6 position in the actual data frame of the slave chip.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90B6	Axis-1 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90B7	Axis-2 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90B8	Axis-3 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90B9	Axis-4 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90BA	Axis-5 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90BB	Axis-6 SN code in the actual data frame of the master chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the master chip fluctuates.	Contact Inovance for support.
0x90C2	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90C3	Axis-2 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.
0x90C4	Axis-3 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.
0x90C5	Axis-4 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.
0x90C6	Axis-5 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.
0x90C7	Axis-6 SN code in the actual data frame of the slave chip fluctuates.	No. 1 non-resettable fault	Non-resettable	Axis-1 SN code in the actual data frame of the slave chip fluctuates.	Contact Inovance for support.
0x90CE	Master chip's axis-1 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-1 actual multiturn value overflows.	Contact Inovance for support.
0x90CF	Master chip's axis-2 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-2 actual multiturn value overflows.	Contact Inovance for support.
0x90D0	Master chip's axis-3 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-3 actual multiturn value overflows.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90D1	Master chip's axis-4 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-4 actual multiturn value overflows.	Contact Inovance for support.
0x90D2	Master chip's axis-5 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-5 actual multiturn value overflows.	Contact Inovance for support.
0x90D3	Master chip's axis-6 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Master chip's axis-6 actual multiturn value overflows.	Contact Inovance for support.
0x90DA	Slave chip's axis-1 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-1 actual multiturn value overflows.	Contact Inovance for support.
0x90DB	Slave chip's axis-2 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-2 actual multiturn value overflows.	Contact Inovance for support.
0x90DC	Slave chip's axis-3 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-3 actual multiturn value overflows.	Contact Inovance for support.
0x90DD	Slave chip's axis-4 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-4 actual multiturn value overflows.	Contact Inovance for support.
0x90DE	Slave chip's axis-5 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-5 actual multiturn value overflows.	Contact Inovance for support.
0x90DF	Slave chip's axis-6 actual multiturn value overflows.	No. 1 non-resettable fault	Non-resettable	Slave chip's axis-6 actual multiturn value overflows.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90E6	Axis position status abnormal	No. 1 non-resettable fault	Non-resettable	The axis position status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90E7	Axis speed status abnormal	No. 1 non-resettable fault	Non-resettable	The axis speed status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90E8	Cartesian speed status abnormal	No. 1 non-resettable fault	Non-resettable	The Cartesian speed status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90E9	Safety low speed function status abnormal	No. 1 non-resettable fault	Non-resettable	The safety low speed status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90EA	Cartesian position monitoring function status abnormal	No. 1 non-resettable fault	Non-resettable	The Cartesian position status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90EB	Category 1 emergency stop status abnormal	No. 1 non-resettable fault	Non-resettable	The emergency stop status check is inconsistent between the master and slave chips.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90EC	Operation status abnormal	No. 1 non-resettable fault	Non-resettable	The operation status check is inconsistent between the master and slave chips.	Contact Inovance for support.
0x90ED	System initialization failed.	No. 1 non-resettable fault	Non-resettable	System initialization failed.	Contact Inovance for support.
0x90EE	Axis No. 1 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 1 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.
0x90EF	Axis No. 2 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 2 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.
0x90F0	Axis No. 3 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 3 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.
0x90F1	Axis No. 4 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 4 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.
0x90F2	Axis No. 5 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 5 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.
0x90F3	Axis No. 6 in the actual data frame of the master chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 6 in the actual data frame of the master chip is abnormal.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x90F4	Axis No. 1 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 1 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x90F5	Axis No. 2 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 2 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x90F6	Axis No. 3 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 3 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x90F7	Axis No. 4 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 4 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x90F8	Axis No. 5 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 5 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x90F9	Axis No. 6 in the actual data frame of the slave chip is abnormal.	No. 1 non-resettable fault	Non-resettable	Axis No. 6 in the actual data frame of the slave chip is abnormal.	Contact Inovance for support.
0x9106	Category 0 stop is triggered by the master chip.	No. 2 resettable fault	Manual reset	Category 0 stop is triggered by the master chip.	Clear the alarm.
0x9107	Category 0 stop is triggered by the slave chip.	No. 2 resettable fault	Manual reset	Category 0 stop is triggered by the slave chip.	Clear the alarm.
0x20FD	MCU configuration information check error	No. 1 non-resettable fault	Non-resettable	MCU configuration information check error	Contact Inovance for support.
0x9301	MCUA failed to read EEPROM.	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9302	MCUB failed to read EEPROM.	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.
0x9303	MCUA failed to write to EEPROM.	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.
0x9304	MCUB failed to write to EEPROM.	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.
0x9305	DMA transfer error on MCUA	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.
0x9306	DMA transfer error on MCUB	No. 1 non-resettable fault	Non-resettable	Chip-EEPROM communication error	Contact Inovance for support.
0x9307	MCUB failed to collect the discharge voltage.	No. 1 non-resettable fault	Non-resettable	Discharge voltage error	Contact Inovance for support.
0x9308	3.3 V voltage error on MCUA	No. 2 resettable fault	Manual reset	The power supply voltage of the safety controller is abnormal.	Check the power supply voltage.
0x9309	3.3 V voltage error on MCUB	No. 2 resettable fault	Manual reset	The power supply voltage of the safety controller is abnormal.	Check the power supply voltage.
0x930A	MCUA board voltage error	No. 2 resettable fault	Manual reset	The board voltage of the safety controller is abnormal.	Check the power supply voltage.
0x930B	MCUA/MCUB board voltage error	No. 2 resettable fault	Manual reset	The board voltage of the safety controller is abnormal.	Check the power supply voltage.
0x930C	CRC failed during MCUA initialization.	No. 1 non-resettable fault	Non-resettable	The EEPROM storage parameter of MCUA is abnormal.	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x930D	CRC failed during MCUB initialization.	No. 1 non-resettable fault	Non-resettable	The EEPROM storage parameter of MCUB is abnormal.	Contact Inovance for support.
0x930E	CRC failed during MCUA mutual check.	No. 1 non-resettable fault	Non-resettable	The EEPROM storage parameter of MCUA is abnormal.	Contact Inovance for support.
0x930F	CRC failed during MCUB mutual check.	No. 1 non-resettable fault	Non-resettable	The EEPROM storage parameter of MCUB is abnormal.	Contact Inovance for support.
0x9310	MCUA chip self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip damage	Contact Inovance for support.
0x9311	MCUB chip self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip damage	Contact Inovance for support.
0x9312	MCUA failed to parse host controller mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9313	MCUA failed to process host controller mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9314	MCUA failed to parse MCUB mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9315	MCUA failed to process MCUB mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9316	MCUB failed to parse MCUA mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9317	MCUB failed to process MCUA mailbox data.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x9318	MCUA detected disconnection from MCUB.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9319	MCUA detected disconnection from FPGA.	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x931A	DI comparison failed on MCUA.	No. 2 resettable fault	Manual reset	DI error	Check DI.
0x931B	DI comparison failed on MCUB.	No. 2 resettable fault	Manual reset	DI error	Check DI.
0x931C	MCUA waiting for MCUB message timeout	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x931D	MCUA interrupt execution timeout	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x931E	MCUB interrupt execution timeout	No. 1 non-resettable fault	Non-resettable	Communication error	Contact Inovance for support.
0x931F	MCUA timing error	No. 1 non-resettable fault	Non-resettable	Hardware error	Contact Inovance for support.
0x9320	MCUB timing error	No. 1 non-resettable fault	Non-resettable	Hardware error	Contact Inovance for support.
0x9321	DO comparison failed on MCUA.	No. 2 resettable fault	Manual reset	DO error	Check the power supply.
0x9322	DO comparison failed on MCUB.	No. 2 resettable fault	Manual reset	DO error	Check the power supply.
0x9323	Parameter initialization on MCUA failed.	No. 1 non-resettable fault	Non-resettable	Error in parameter saving	Contact Inovance for support.
0x9324	Parameter initialization on MCUB failed.	No. 1 non-resettable fault	Non-resettable	Error in parameter saving	Contact Inovance for support.
0x9325	Parameter saving on MCUA failed.	No. 1 non-resettable fault	Non-resettable	Error in parameter saving	Contact Inovance for support.
0x9326	Parameter saving on MCUB failed.	No. 1 non-resettable fault	Non-resettable	Error in parameter saving	Contact Inovance for support.

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9327	MCUA output pin readback failed.	No. 1 non-resettable fault	Non-resettable	Pin readback error	Contact Inovance for support.
0x9328	MCUB output pin readback failed.	No. 1 non-resettable fault	Non-resettable	Pin readback error	Contact Inovance for support.
0x9329	Three-position enable DI comparison failed.	No. 1 non-resettable fault	Non-resettable	Teach pendant enable signal error	Contact Inovance for support.
0x932A	Clock self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip error	Contact Inovance for support.
0x932B	CPU self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip error	Contact Inovance for support.
0x932C	RAM self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip error	Contact Inovance for support.
0x932D	Flash self-check failed.	No. 1 non-resettable fault	Non-resettable	Chip error	Contact Inovance for support.
0x932E	Safety gate triggered by MCUA	No. 2 resettable fault	Manual reset	Gate attributes are configured and the correspond ing DI is activated.	Change the DI attribute or stop DI input
0x932F	Emergency stop triggered by MCUA	No. 2 resettable fault	Manual reset	Emergency stop attributes are configured and the correspond ing DI is activated.	Change the DI attribute or stop DI input
0x9330	Safety gate triggered by MCUB	No. 2 resettable fault	Manual reset	Gate attributes are configured and the correspond ing DI is activated.	Change the DI attribute or stop DI input

Fault Code	Fault Description	Fault Level	Reset Method	Cause	Solution
0x9331	Emergency stop triggered by MCUB	No. 2 resettable fault	Manual reset	Emergency stop attributes are configured and the correspond ing DI is activated.	Change the DI attribute or stop DI input
0x9332	MCUA write parameter readback failed.	No. 1 non-resettable fault	Non-resettable	Error in safety parameter saving	Contact Inovance for support.
0x9333	MCUB write parameter readback failed.	No. 1 non-resettable fault	Non-resettable	Error in safety parameter saving	Contact Inovance for support.
0x9334	The system requires restart after the safety controller parameters are reset to factory defaults.	No. 3 resettable warning	Manual reset	Initialization of safety controller parameters takes effect after restart.	Manually restart the control cabinet.

6 Maintenance & Care

6.1 Maintenance Precautions

Before maintenance, read the precautions for maintenance, this guide, and other related guides carefully to fully understand the methods of safe maintenance.

The robot system must only be maintained by qualified personnel.

Qualified personnel refer to those who have received safety training (training on industrial robot knowledge, operation, teaching, and inspection and relevant laws and regulations) stipulated by laws and regulations of a country intended for workers engaged in industrial robot-related work.

DANGER

- The robot system must only be maintained by qualified personnel. Before maintenance, read the maintenance precautions in the user guide. If you operate the robot system without fully understanding the precautions, serious injury or significant damage may occur.
- Do not remove the parts not mentioned in this guide. Do not maintain any part with a method different from that described in this guide. Improper disassembly or maintenance will cause malfunction of the robot system, and even serious safety issues. Never enter the action area of the robot when the power is on. Even if the robot seems to have stopped moving, it may still move again, which may cause serious safety issues.
- Untrained personnel must not approach an energized robot. Never enter the action area of the robot. Even if the robot seems to have stopped moving, it may still move again if energized, which may cause serious safety issues.
- When checking the action of a robot whose component has been replaced, you must stay behind a guard fence. Otherwise, serious safety issues may be caused as the robot may perform unexpected actions.
- Before operation, ensure that the emergency stop switch and safety door switch are normal. If the equipment is run while the switches do not operate properly, the safety functions will fail in case of emergency, resulting in serious injury or major damage.

CAUTION

- Open the control cabinet cover only for maintenance. There are high-voltage parts inside the control cabinet, which may cause electric shock even when the power supply is off.
- Before part replacement, turn off the power supply of the control cabinet and related devices and unplug the power connector. Live working may cause electric shock or failure.
- Do not install or remove the motor connector with the power on. Otherwise, it may lead to abnormal movements of the manipulator. In addition, live working may cause electric shock or failure.
- Make sure the power supply is blocked by unplugging the power supply connector. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply.
- Overhaul and maintenance must be carried out with the power on. In this case, two persons are required. One of them must be prepared to press the emergency stop button immediately, while the other must keep alert and work quickly within the robot's action range. In addition, an evacuation path must be provided before operation.

WARNING

- Disassembly and operation of components not covered in the maintenance guide are prohibited.
- Maintenance personnel must keep the robot keys well. It is strictly forbidden for unauthorized personnel to access the robot software system in manual mode, and read or modify programs and parameters.

6.2 Daily Inspection

Influence of ambient temperature, humidity, dust, and vibration will cause aging of components in the product, shortening the service life of the product. Therefore, it is essential to carry out daily and periodic maintenance on the product. More frequent inspection is required if the product is used in harsh environments, including those with high ambient temperature, frequent start and stop, fluctuations in the AC power supply or load, excessive vibrations or shock, dust, and hydrochloric acid corrosion. Check the following items daily to avoid deterioration in performance or product damage. Copy this checklist and sign the "Checked" column after each inspection.

Item	Check Item	Solution	Ack
Installation environment	Check whether the control cabinet and surrounding cables are normal.	Check the mounting bracket for vibration. Check whether cable terminals become loose or get corroded.	☐
Input voltage	Input voltage	Check whether the input voltage is within the permissible range. Check whether heavy load starts around.	☐
Terminal	Control cabinet terminal	Ensure that the bolts on both sides of input, output, and SAFETY terminals are tightened.	☐

6.3 Periodic Inspection

Perform periodic inspection on items that are difficult to check during operation. Clear the dust especially metal powders on the surface of the control cabinet to prevent the dust from entering the control cabinet.

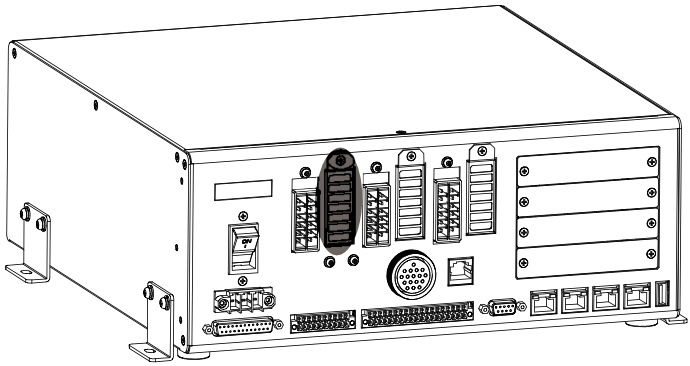
Item	Check Item	Solution	Monthly inspection
Cable	Check power lines and connections for discoloration. Check the cable insulation layer for aging or wear.	Replace cracked cables. Replace damaged terminals.	☐
Air vent	Check whether the air duct and heatsink are clogged. Check whether the fan is damaged.	Clean the air duct. Replace the fan.	☐

6.4 Replacing the Fan Dust Screen Filter

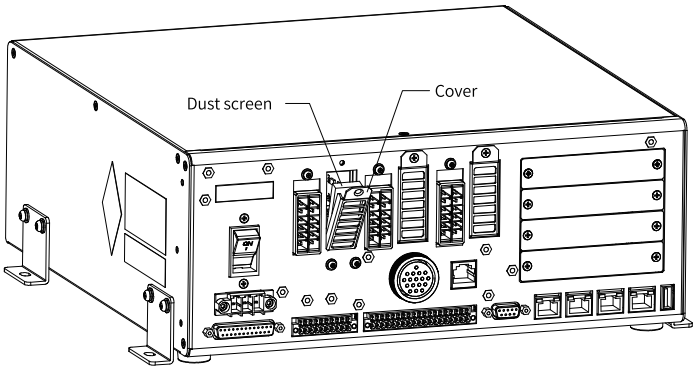
If dust accumulates on the fan dust screen during use, clean the dust in time or replace the dust screen regularly. The replacement cycle should be determined based on the environmental conditions. Replace the dust screen every three months in good environment, or one month in bad environment.

To replace the fan dust screen filter, do as follows:

Step 1: Open the vent cover using a Phillips screwdriver.



Step 2: Remove the dust screen filter.



Step 3: Install a new dust screen filter and then lock the vent cover.

Caution

To ensure heat dissipation and dust prevention of the fan, you can order dust-proof screen from Inovance.

6.5 File Backup and Recovery

The robot system provides file backup and loading functions. The files include configuration files and program files, both of which are backed up and loaded through a USB drive (it is recommended to use branded USB drives).

Configuration file backup and loading

- Configuration file backup
  Function:

  Saves all robot-related parameters into a file and stores the file in local disk.

  Operation method:

  1. Click the "Config. File Backup" button, select the save path, enter the file name, and click "Confirm".
  2. After a dialog box indicating backup completion is displayed, you can find the backup file in the specified path.

Note

The backup file is named "robotcfg.cfg.bk" by default and covers the following:

1. PLC program [plcfiles].
2. Network configuration and operation logs [systemConf].
3. Robot model and control cabinet model information [initConf].
4. Robot settings, peripheral configuration, motion parameters, zero point settings, and other information in controller parameter configuration [RobotParams and RobotParamsDefault].
5. Process data files (vision calibration and tracking process).
6. Mechanical unit configuration parameters.
7. Tool, workpiece, and load parameters.
8. BRD variables.

- Configuration file loading
  You can load the configuration files from the USB drive to the memory card of the robot controller. Do as follows:

  1. Insert the USB drive into the control cabinet and check the USB connection status in the monitoring interface. Keep the USB drive in good communication during operation.
  2. Click the "Config Load" button and confirm the operation. The system loads the file automatically and exits when the loading is completed. After this, restart the cabinet.

Caution

Do not load configuration files of different robots for each other. Failure to comply will lead to calibration parameter errors, affecting the positioning accuracy of robots.

Program file backup and loading

The program backup function allows you to back up the control program in the memory card of the control cabinet to a USB drive, while the program loading function allows you to load the control program from the USB drive to the control cabinet. The backup and loading directories for Version 14 and earlier are different from those for Version 15 and later, as shown in the following table.

Table 6–1 Difference in backup and loading directories

Type	Version 14 and Earlier	Version 15 and Later
Program backup	1. TeachProgram 2. PalletInfo	1. TeachProgram 2. PalletInfo 3. TecParameter
Program loading	1. TeachProgram 2. PalletInfo	1. TeachProgram 2. PalletInfo 3. TecParameter

The respective folders are explained below:

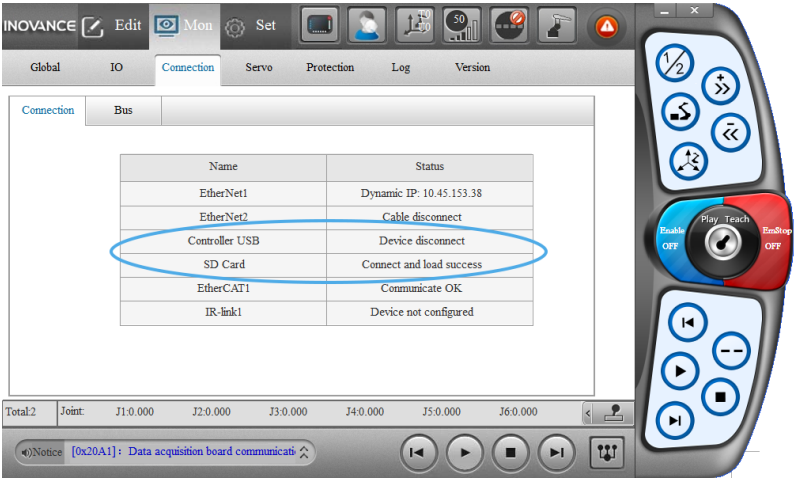
TeachProgram: Program file folder containing all .pro program files.

PalletInfo: Pallet file folder containing information about the stacking and pallet. It needs to be used when pallet variables are used.

TecParameter: Process folder containing information about the screw driving and dispensing processes. It needs to be used when the screw driving and dispensing processes are used.

- Program backup
  The program backup procedure is as follows:

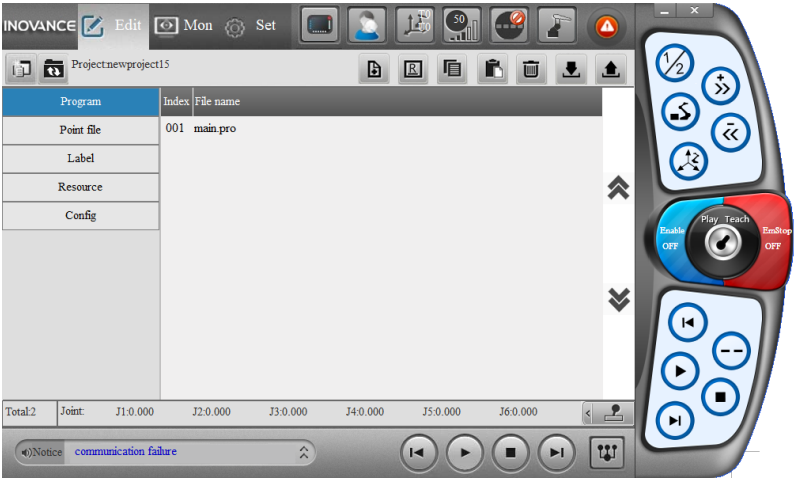
  1. Insert the USB drive into the control cabinet and check connection status of the USB drive and the memory card. If the monitored communication status in the software is "The USB controller has been inserted into the device and successfully mounted" and "The memory card has been inserted and successfully mounted", it indicates that the communication is normal. Otherwise, check the connection. Keep the USB drive and memory card in good communication during operation.



2. Click the "Program Backup" button and confirm the operation. The system backs up the program automatically and exits when the backup is completed.
3. In this case, several new folders appear in the root directory of the USB drive.

- Program loading
  The program loading procedure is as follows:

  1. Insert the USB drive into the control cabinet and check connection status of the USB drive and the memory card. Similarly, if the monitored communication status in the software is "The USB controller has been inserted into the device and successfully mounted" and "The memory card has been inserted and successfully mounted", it indicates that the communication is normal. Otherwise, check the connection. Keep the USB drive and memory card in good communication during operation.
  2. Click the "Program Load" button and confirm the operation. The system loads the program automatically.
  3. Go to the programming page and click the "Refresh" button in the upper-left corner. The loaded program appears in the program list.


INOVANCE
Edit
Mon
Set
Project:newproject15
Program
Point file
Label
Resource
Config
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File name
001 main.pro
Total:2
Joint:
J1:0.000
J2:0.000
J3:0.000
J4:0.000
J5:0.000
J6:0.000
Notice
communication failure
Enable
OFF
Play
Teach
EmStop
OFF

7 Certification and Standard Compliance

Third-party certification

Certification Mark	Certification	Description	Instruction
	CE	This product complies with Low Voltage Directive (LVD), Machinery Directive (MD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives and carries the CE mark.	• EN 60204-1:2018 • EN ISO 10218-1:2011 • EN ISO 12100:2010 • EN 61000-6-2:2019 • EN 61000-6-4:2019 • ISO 13849-1:2023, • EN ISO 13849-1:2015
	SGS	This product is certified by Societe Generale de Surveillance (SGS) for functional safety.	
	cSGSus	This product is certified by SGS North America of Nationally Recognized Test Laboratory (NRTL).	• UL 1740, 4th Ed., Jan. 26, 2018 • NFPA 79 2021 Edition, Dated Oct. 25, 2020 • CAN/CSA Z434-14 (R2019), Reaffirmed 2019
	FCC	This product has passed the Federal Communications Commission (FCC) EMC testing and carries the FCC mark.	-
	KC	This product has passed the Korea Ex Certification (KCs) EMC testing and carries the KC mark.	-

Note

The preceding certification standards only apply to standard models of products. For specific certification information about customized products, consult Inovance technical personnel.

Declaration of conformity with EU directives

Inovance robots have been certified by the following directives and meet basic requirements of the CE-MD, CE-LVD, CE-EMC, and RoHS directives.

Machinery Directive (MD)	2006/42/EC
Low Voltage Directive (LVD)	2014/35/EU
Electromagnetic Compatibility Directive (EMC)	2014/30/EU
RoHS Directive (ROHS)	2011/65/EU Amended by (EU)2015/863
Applied Harmonized Standards	• EN 60204-1:2018 • EN ISO 10218-1:2011 • EN ISO 12100:2010 • EN 61000-6-2:2019 • EN 61000-6-4:2019 • ISO 13849-1:2023 • EN ISO 13849-1:2015

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