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IRCB501-INT High-protection Series Robot Controller

User Guide

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code 19013033A00

Preface

Introduction

The IRCB501 high-protection series controller is a drive-control integrated controller designed for use with Inovance industrial robots. It features a compact and lightweight structure, abundant functions, easy installation, and easy expansion. Developed on the basis of the IRCB500 high-protection series drive-control integrated control system, the IRCB501 high-protection series mainly upgrades the robot core board and enhances the bus expansion capability of the system. It is widely used in automotive, die casting, machine tools, packaging and other industrial automation industries, as well as medical, laboratory automation and consumer product automation production industries. The main application processes of the IRCB501 high-protection series controller include handling, loading and unloading, pick and place of large parts, machine disassembly and assembly, deburring and polishing, etc.

This guide describes general specifications, installation and wiring, common fault diagnosis and solutions, and maintenance of the product.

More Data

Data name	Data code	Description
IRTP80 Series Robot Teach Pendant User Guide	19012261	Introduces the wiring, basic operation and more of the product.
IRTP81 Series Robot Teach Pendant User Guide	19011821	Introduces the wiring, basic operation and more of the product.
IR-TP200 Series Industrial Robot Teach Pendant User Guide	19012798	Introduces the software-related operations of the IR-TP200 series teach pendant.
IRCB501 Series 16-Channel Input Expansion Card User Guide	19012412	Introduces the terminal assignment, wiring and more of the product.
IRCB501 Series 16-Channel NPN Output Expansion Card User Guide	19012413	Introduces the terminal assignment, wiring and more of the product.
IRCB501 Series 2-Channel Incremental Encoder Expansion Card User Guide	19012411	Introduces the terminal assignment, wiring and more of the product.
IRCB501 Series IR-LINK Expansion Card User Guide	19012410	Introduces the terminal assignment, wiring and more of the product.
IRCB501 Series PROFINET Expansion Card User Guide	19012409	Introduces the terminal assignment, wiring and more of the product.
IRCB501 Series Functional Safety Expansion Card User Guide	19012408	Introduces the terminal assignment, wiring and more of the product.
IR-EC-CCLINK Expansion Card User Guide	19012955	Introduces the basic information, technical specifications, and network topology of the product.

Data name	Data code	Description
INT Version Small and Medium Payload Industrial Robots Functional Safety Guide	19013000	Introduces the safety functions, installation of the functional safety expansion card, commissioning of the safety parameters, and more of the product.
IRCB501-INT High-Protection Series Robot Controller User Guide (this guide)	19013033	Introduces the general specifications, installation and wiring, common fault diagnosis and solutions, and maintenance of the product.

Revision History

Revision date	Version	Revision
2026-08	19013033_A00	• Finished the guide migration and updated the data code to 19013033. • Updated Model and Nameplate. • Updated Technical Specifications. • Updated Connecting Power Supply. • Updated SAFETY Interface Wiring. • Updated RS485 Wiring Method. • Updated Expansion Method. • Updated Expansion Configuration. • Made minor corrections.
2025-11	PS00017685_A02	**Added the following content:** Added the Fuse Replacement and Specification Recommendations section. **Update** • Updated the appearance diagram and related dimension drawings for PI2.0. • Updated the controller nameplate in the Model and Nameplate section. • Updated the technical specifications in the Technical Specifications section. • Updated Connecting Power Supply. • Updated SAFETY Wiring. • Updated RS485 Wiring Method.

Revision date	Version	Revision
2025-03	PS00017685_A01	• Updated the controller nameplate in the Model and Nameplate section. • Updated the technical specifications in the Technical Specifications section. • Updated SAFETY Wiring. • Updated the instruction for expansion card insertion sequence in the Expansion Method section. • Updated the teach pendant figures. • Updated the SGS-TUV Saar certification mark in the Certification and Standard Compliance.
2024-11	PS00017685_A00	Initial release.

Access to the Guide

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

- Visit https://www.inovance.com/global, and choose Service&Support > Support > Documentation Download.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

Warranty Disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance will be charged after the warranty period expires.

Within the warranty period, maintenance will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or unusual 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 is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see Product Warranty Card.

Basic Safety Instructions

Safety Precautions

Safety Disclaimer

- This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to observe the safety instructions may result in death, severe personal injuries, or equipment damage.
- "DANGER", "WARNING", and "CAUTION" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this product according to designated environment requirements. Damage caused by improper use is not covered by warranty.
- This product is a standard industrial robot intended for general civil applications. It has not been certified under national safety standards for the specialized handling of high-energy explosives. The electrical system does not meet the nominal requirements stipulated by regulations applicable to high-energy explosives, and the robot is not designed with any functionality for explosive handling. Use in any operations involving explosives is strictly prohibited.
- This product is designed for conventional industrial environments and is not radiation-hardened. In environments where the ionizing radiation dose exceeding 5 x 10^4 Gy (Si), its performance may degrade significantly or fail completely. Operation under such conditions is strictly prohibited.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



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



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



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

Safety Precautions

- The drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as safety shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking



- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.



- Before unpacking, check whether the outer package is intact, damaged, wet, damped, or deformed.
- Unpack the package in the correct layered sequence. Do not strike the package violently.
- Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation



- Large-scale or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- 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 personal injuries or equipment damage.

CAUTION

- Handle the product with care and mind your steps to prevent personal injuries or product 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 personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

DANGER

- The equipment can only be operated by professionals with electrical knowledge. Non-professionals are not allowed to operate on the equipment.

WARNING

- Read through the guide and safety precautions before installation.
- Do not install the equipment 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 a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in yellow.
- When the equipment (such as controller) 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.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the product on an incombustible object such as metal and do not touch or attach the product to combustibles. Failure to comply can result in fire accident.

CAUTION

- Cover the top of the equipment (such as controller) 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 top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.

Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.
- Before wiring, disconnect the power supplies of all equipments. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply can result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply can result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply can result in an electric shock.

WARNING

- Do not connect the input power supply to the output side of the equipment. Failure to comply can result in equipment damage or even a 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.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Tighten the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may result in overheat, damage to the connecting parts, or a 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 electric shock or equipment damage.

CAUTION

- Follow the electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply can 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 a fire.
- Do not open the cabinet door or protective cover of the product, touch any wiring terminal of the product, or remove any part of the product with power on. Failure to comply can result in an electric shock.



- After the completion of wiring and parameter setting, perform a robot test run to confirm that the robot can operate safely. Failure to comply may result in personal 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 accident.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation



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



- Do not touch the equipment enclosure, fan, or resistor with bare hands. 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 a fire or equipment damage.
- The robot generates noise during operation. Be sure to wear hearing protection such as ear muffs or earplugs to prevent hearing damage.

Maintenance



- Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply can 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.
- When a permanent magnet motor is used, do not touch the motor terminals immediately after power-off because the motor terminals can generate induced voltage during rotation even after the equipment is powered off. Failure to comply can result in an electric shock.



- Perform routine and regular inspection and maintenance on the equipment in accordance with maintenance requirements and keep a record.

Repair



- Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply can 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 a request for repair services in accordance with the product warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage circuit 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 death, personal injuries or equipment damage.
- Troubleshooting and repair must be performed by professionals in accordance with the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment in accordance with the replacement instructions.
- Do not operate on damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

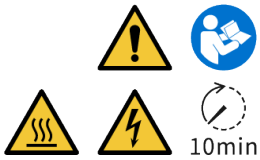
Disposal



- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in death, personal injuries, or property damage.
- Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.

Safety Label

For safe operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

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

Industrial Information Security

The product provides an interface to connect to the network and transmits data through the network interface. To protect factories, systems, machines, and networks from cyber attacks and ensure safe operation, a proper industrial information security protection mechanism must be implemented.
The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer network or any other network to prevent unauthorized access to its factories, systems, machines, and networks. The system or machine can be connected to the corporate network or the Internet only when secure connections are ensured and appropriate security measures are taken (for example, anti-virus software or firewall installed).
Inovance continuously develops and improves products and solutions to improve safety. It is strongly recommended that you update the product promptly and always use the latest version.



Malware (such as viruses, Trojans, and worms) can put the product in an unsafe running state, which may result in death, serious injuries, and property damage. Observe the following precautions:

- Always use the latest software version. If the product version is no longer supported or the latest version is not used, customers will be exposed to increased risk of cyber attacks.
- Take appropriate protection measures (including but not limited to installing anti-virus software, firewall, WAF, IPS/IDS, and situation awareness system, and applying authentication, data encryption) to prevent files in mobile storage devices from being damaged by malware, and to prevent products, networks, systems, and interfaces from unauthorized access, interference, intrusion, data leakage, or information breach.
- Check all safety-related interfaces and settings after commissioning.

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1 Legal Information

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Disclaimer of Liability

Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.

The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

2 Product Information

2.1 Model and Nameplate

Model Description

IR CB 501 - 6 N D - INT
① ② ③ ④ ⑤ ⑥ ⑦

① **Product family** INOVANCE Robot	⑤ **Power class** A: 400W+400W+400W+400W
② **Product type** Cabinet	B: 750W+400W+400W+400W C: 750W+750W+400W+400W M: 1200W+750W+750W+400W N: 2000W+2000W+1200W+400W+400W+200W R: 750W+750W+500W+150W+150W+90W L: 750W+750W+400W+400W+400W+400W G: 5000W+5000W+2000W+2000W+2000W+2000W
③ **Product series** 500: 1.0 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	⑧ **Functional safety** Blank: Not functional safety certificated INT: Functional safety certificated (international version)

NOTE

- Non-"-INT" models do not support safety functions through expansion cards.
- The "-INT" model supports EtherCAT slave and functional safety certified functions by default (requires an optional functional safety expansion card).

Nameplate

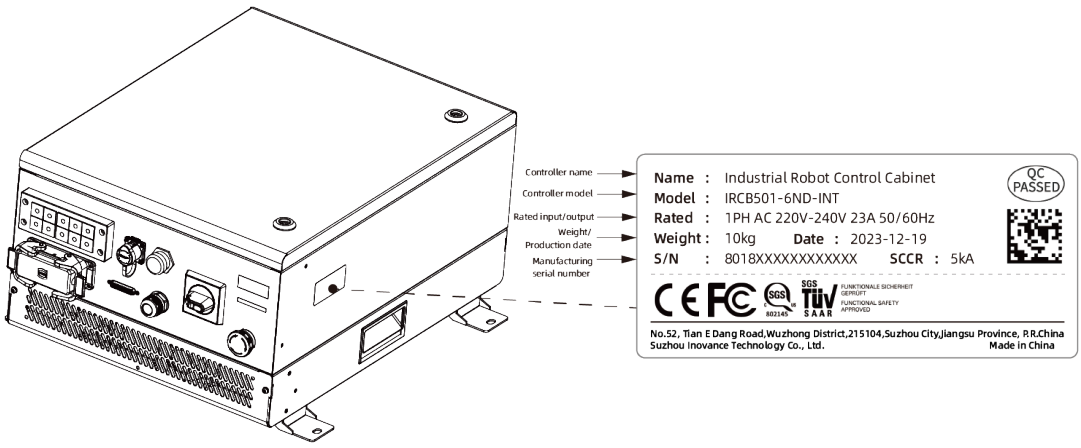


Figure 2-1-1 Nameplate information - "-INT" model

NOTE

The certification information in the above nameplate is for illustrative purposes only; Refer to the actual product certification for specific details.

NOTE

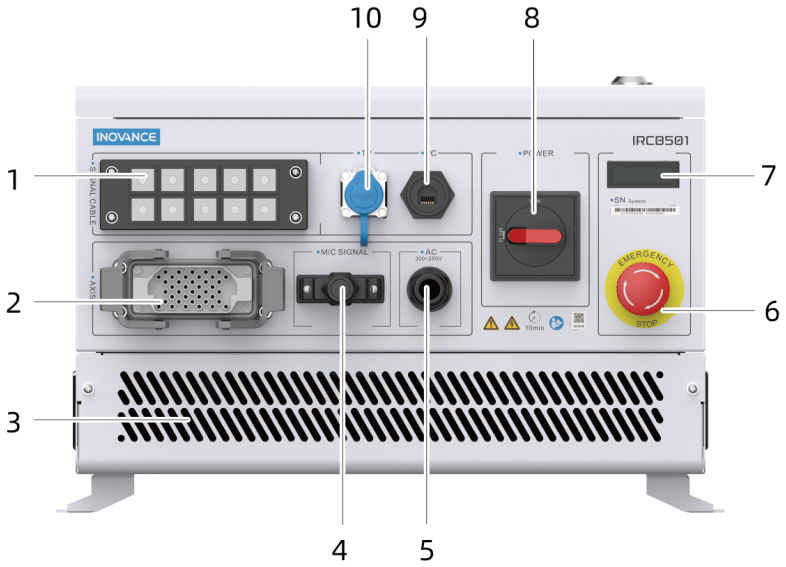
- Before the controller upgrade, the aviation connector features a black cover, by default compatible with the IRTP80 series teach pendant.
- After the controller upgrade, the aviation connector features a blue cover, by default compatible with the IR-TP200 series teach pendant.

For cross-use details, see the following table:

Before change	After change
	

Before change	After change
IRTP80, IRTP81 series: Direct connection 	IRTP80, IRTP81 series: Requires adapter cable 1504R442 
IR-TP200 series: Requires adapter cable 1504R443 	IR-TP200 Series: Direct connection 

2.2 Components

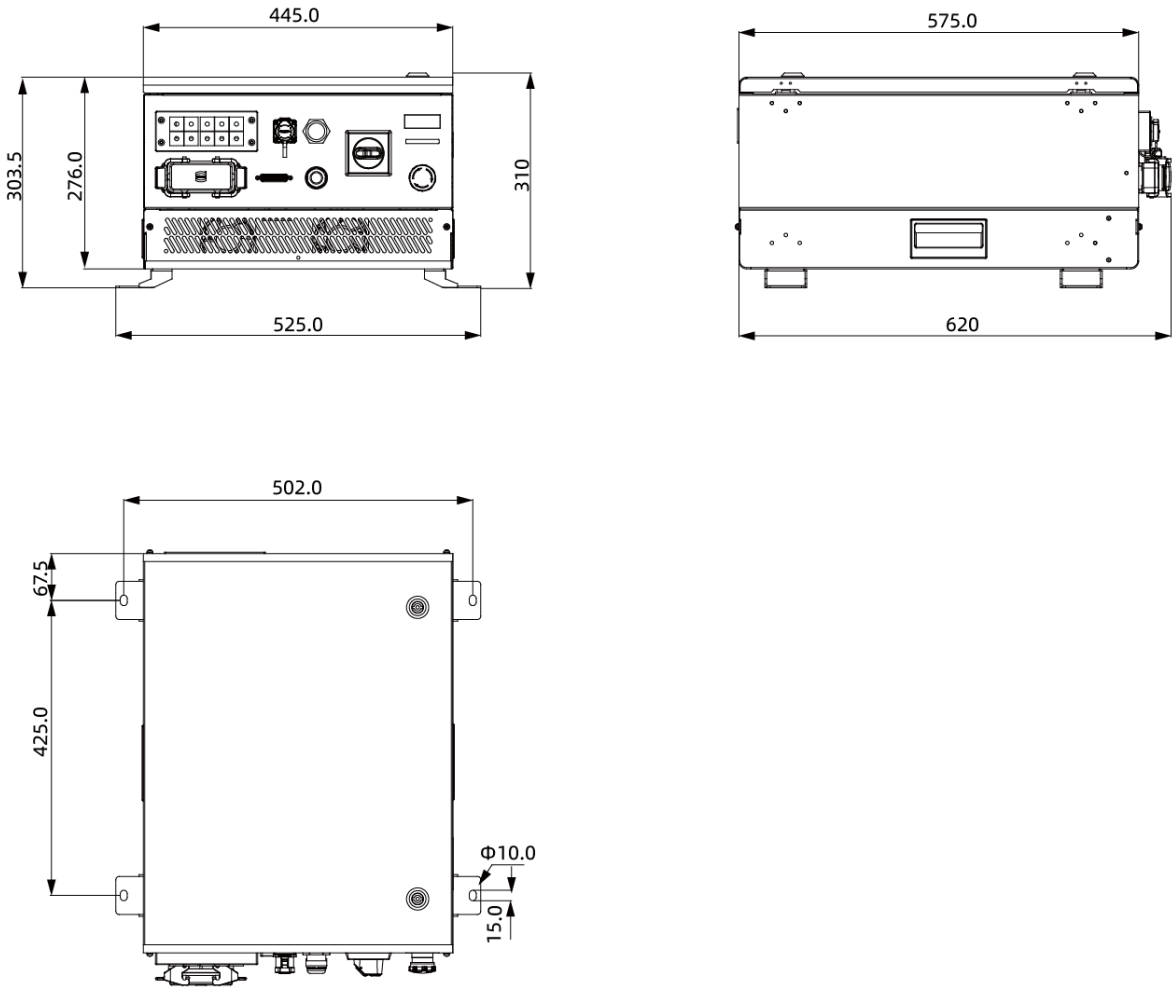


No.	Name	Description
1	Cable entry system	Introduces external cables into the controller, enhancing the controller's IP rating
2	Power connector	Connects to power supply cable and brake cable of the motor
3	Heat dissipation hole	Air inlet for heat dissipation
4	Encoder connector	Motor encoder feedback, etc
5	Power cable connector	Connects to external 220 VAC power input
6	Emergency stop button	Press for emergency stop
7	LED display	Displays controller status and alarms
8	Power switch	Power switch[1] of the controller
9	Virtual teach pendant connector	Network connector for the virtual teach pendant. This connector is provided with high protection and mainly used for temporary debugging. If long-term use is needed, please connect the wire to this connector through the ① cable entry system.
10	Hand-held teach pendant connector	Connects to the hand-held teach pendant

NOTE

[1]: After completing operations on the external power supply circuit breaker of the previous model, please close the protective cover.

2.3 Product Dimensions



Product dimensions (in mm)

2.4 Technical Specifications

Item	Specification
Model	IRCB501-6ND/4MD-INT
Maximum number of controlled axes	6 robot axes + 3 external axes
Mounting method	Vertical mounting, horizontal mounting, 19" rack mounting
Motion mode	Point-to-point, linear interpolation, circular interpolation, and free curve interpolation

Item	Specification
Program storage space	Maximum number of lines per program: 2000 Maximum storage space for a single program file: 500 kbit Maximum number of points: 9999 points Multi-tasking: Supports 1 main task, 2 PLC tasks, 1 xqt task (for versions earlier than V4R24C2, only supports 2 PLC tasks)
Retentive memory	Amount of saved data (Bytes): Supports 256 B, R, D, PR, or STR variables
Power-on/power-off interval	2s
Standard I/O	General digital I/Os: Standard 16 inputs and 16 NPN-type outputs (expandable) Safety I/Os: 6
Ethernet	2x, with a rate of 100 Mbps, one for hand-held teach pendant or PC-based teach pendant ① Both the PC and Ethernet ports support Modbus-TCP slave. ② Only Ethernet port supports EtherNet/IP master/slave: 8 slaves supported when used as a master; 1 master supported when used as a slave.
EtherCAT	3x, one for master and two for slave, speed 100 Mbps, full-duplex mode, linear topology and external axes supported EtherCAT slave sync jitter < 1 μs
USB2.0	1x
RS232	1x (reserved)
RS485	1x, standard Modbus-RTU protocol supported, baud rate 4800 bps to 115200 bps
CAN bus	1x, supports a maximum communication rate of 1Mbps; only supports operating as a CANopen master, with a maximum of 4 slave supported
Expansion slots (4x)	16-channel digital input (DI) expansion card
	16-channel digital output (DO) expansion card
	2-channel incremental encoder expansion card
	PROFINET slave expansion card
	CC-Link communication expansion card
	IR-Link adapter board expansion card
	Functional safety expansion card (supported only by "-INT" controller)
Control mode	InoRobotLab, teach pendant, remote I/O, and remote Ethernet (API)

Item	Specification
Input voltage range	Single-phase rated voltage 220 VAC (The rated voltage of the -INT model is 220 VAC to 240 VAC.)
Input current range	23 A (220V)
IP rating	IP54
Operating temperature	0°C to 45°C
Operating humidity	20% RH to 95% RH (30°C) (without condensation)
Altitude	≤ 1000 m
Certification compliance	CE certification, cSGSus certification, FCC certification, and functional safety certification (only supported by "-INT" controller and requires a functional safety expansion card), KC certification (refer to the certifications for the certified models).
Noise level	L_{Aeq} ≤ 70 dB(A)
Dimensions (W x H x D)	445 mm x 276 mm x 575 mm
Weight	30 kg
Supported models (standard)	IR-R10 series IR-R16&R25 series IR-S60&GS60 series

NOTE

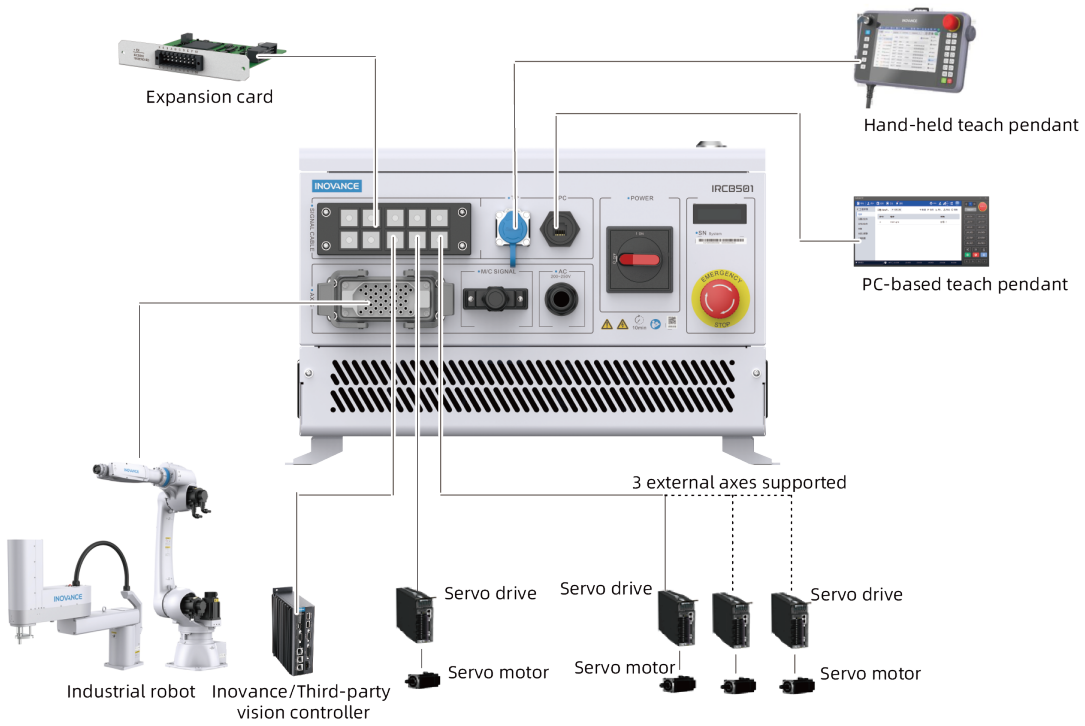
- The supported models (standard) mentioned above only lists the standard models from certain series. For other series and models compliant with functional safety certification, contact Inovance technical support.
- The USB drive must be in FAT32, EXT2, or EXT3 format to be successfully loaded.

CAUTION

The rated input voltage of the IRCB501-6ND-INT controller is 220 V. If the input voltage of the controller drops to 85% of the rated voltage, the average load rate of the robot needs to be reduced to below 75% for operation.

3 System Overview

3.1 System Connections



3.2 Optional Equipment

3.2.1 Hand-held Teach Pendant

The teach pendant is connected to the controller for robot programing, teaching and parameter setting. For the definition of teach pendant interfaces on the controller, see the Connector Pin Definition section. For details of the teach pendant, see the teach pendant user guide.

- The new controller with the new aviation connector for the IR-TP200 teach pendant is factory-configured with an aviation plug cap (1504W874) dedicated for the IR-TP200 teach pendant. When the controller is used with the teach pendant, this cap is not required.
- When a PC host software is used to connect to the controller with the new teach pendant aviation connector for commissioning, the teach pendant cannot be connected because the teach pendant and PC network port share the same PHY. If the aviation connector is not covered with the plug cap and no teach pendant is connected to the controller, the controller will continuously trigger an emergency stop alarm (alarm code: 0x0080).
- After the internal hardware of the controller is modified, the dedicated external plug cap must be used to cover the aviation connector and short the emergency stop signal from the teach pendant. Only then can the robot be enabled and commissioned normally.



Figure 3-2-1-1 Aviation plug cap



Figure 3-2-1-2 Connecting the aviation plug cap to the controller

3.2.2 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, CC-Link communication, PROFINET communication and more. For a detailed description of the expansion modules, see the 5.12.1 Expansion Method section.

4 Environment and Installation

4.1 Pre-installation Preparation

4.1.1 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.
- Product installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals.

4.1.2 Environmental and Space Requirements

Set up the robot system in an environment that complies with the following conditions in order to maximize and maintain the performance of the equipment and to use it safely.

- Install it indoors.
- Avoid installation and use in environments with conductive dust (e.g., metal dust, graphite dust), conductive fibers (e.g., carbon fiber filaments, metal filaments), explosive dust, flammable gases, water mist/greasy dirt, corrosive dust, salt particles, or corrosive gases (e.g., sulfur dioxide, hydrogen sulfide, chlorine, ammonia).
- Avoid use in an enclosed environment, as this might cause overheating of the controller and hence shorten its service life.
- Avoid direct sunlight.
- Avoid impacts and vibrations, etc.
- Keep it away from heating sources such as a heating stove.
- Keep away from sources of electrical interference such as large inverters, high-power high-frequency generators, large contactors, welding machines, etc.
- In installation and usage scenarios involving ordinary dust or lint, if dust or lint is continuously generated in the workshop and causes clogging of the controller air inlet filter, the controller will be at risk of overheating. Measures to reduce the risk include regularly cleaning or replacing the filter, or installing the controller in an environment with a low concentration of dust or lint.

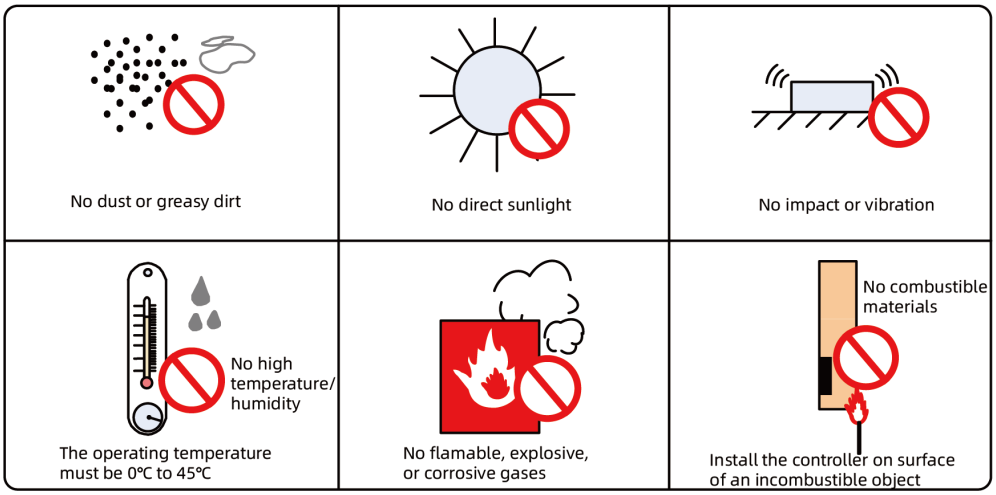
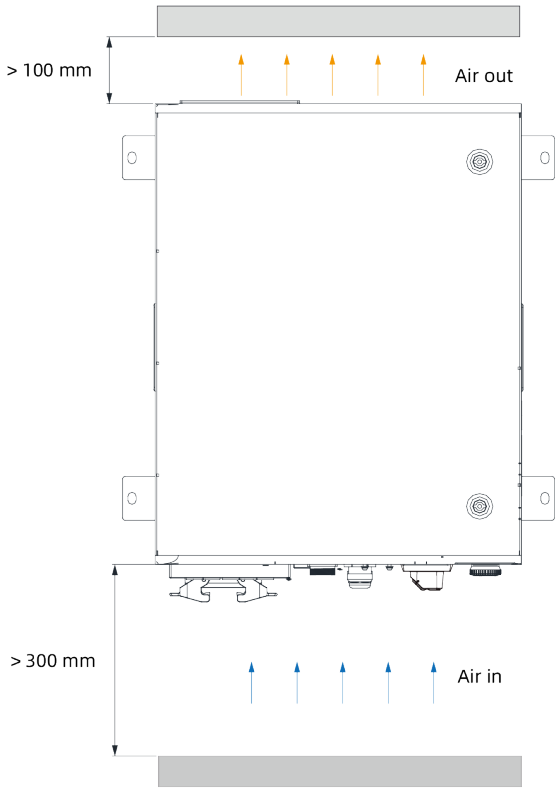


Table4-1-2-1 Environment requirements

Item	Requirement
Operating temperature/ humidity	• Temperature: 0℃ to 45℃ • Humidity: 20%RH to 95%RH (30℃), without condensation
Storage temperature/ humidity	• Temperature: -10℃ to +40℃ • Humidity: ≤ 95% RH (30℃), without condensation
Transportation temperature and humidity	• Temperature: -25℃ to +70℃ • Humidity: ≤ 95% RH (40℃), without condensation
Vibration	• Sinusoidal vibration: Conforms to "JB/T 8896-1999 Industrial Robot - Acceptance Rules", the vibration displacement at 5-25 Hz is 0.75 mm, and the vibration displacement at 25-55Hz is 0.15 mm, with each resonance point vibrating continuously for 3 minutes. • Random vibration: Conforms to ISTA 1H standard, the vibration acceleration at 4-100 Hz is 0.01 g^2/Hz, and the vibration acceleration at 200 Hz is 0.001 g^2/Hz, with Grms=1.14 g, and vibration for 30 minutes in each of X/Y/Z directions
Shock	The maximum shock shall not exceed the acceleration of 15 g and the duration shall not exceed 11 ms.
IP rating	IP54, resistant to metal dust (ensure the controller door is locked; do not open or leave it ajar) Special environment: Conductive dust and alkaline liquids may be present at the site of use.
Altitude	≤1000 m

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



4.1.3 Application Environment Protection Requirements

Set up the robot system in the application environment that meets the following conditions to ensure its performance and safe operation.

NOTE

- In the application environments involving carbon fiber and metal filaments, the controller door must not be opened and must remain locked at all times.
- In other application environments, the door may be opened briefly for necessary operations and must be tightly locked again immediately afterwards.

Interface	Protection instructions for commissioning phase	Protection instructions for operation phase
Signal cable and expansion card	• In the application environments involving carbon fiber and metal filaments, first transfer the connections to the outside of the controller through the cable entry system in a non-hazardous area outside the final application environment. Then, move the controller into the actual application environment. • In other application environments, the door may be opened briefly for wiring and commissioning. • Select appropriate cable diameter or seal the gap to ensure that no clearance exists between the cable and the cable entry system.	The controller door must not be opened and must remain locked at all times.

Air circuit breaker	After operating the air circuit breaker, immediately close its protective cover tightly and keep it securely fastened.	
Power cable	• In the application environments involving carbon fiber and metal filaments, connect the power cable to the controller in advance before entering the actual application environment, and ensure that the connection is tightly fastened. • In other application environments, keep the protective cover of the power cable interface tightly closed before wiring, and it may be opened briefly for connecting the power cable.	
Input power supply cable	• In the application environments involving carbon fiber and metal filaments, connect the power supply cable to the controller in advance before entering the actual application environment. Use the cable within the recommended wire diameter range, and ensure that the cable connector is tightened securely. • In other application environments, the wire cores must not be pulled out before wiring, and the protective cover may be opened briefly for wiring.	

4.1.4 Installation Tool Preparations

Table4-1-4-1 Installation Tool Preparations

Tool	Quantity (PCS)
Phillips screwdriver or electric screwdriver	1
Scissors	1
Safety shoes	1
Protective gloves	1

Installation Tools

The controller supports three mounting methods: horizontal mounting, vertical mounting, and standard 19-inch rack mounting. See the following table for the accessory list.

Mounting method	Accessory	Tool
Horizontal mounting	Standard M8 x 16 cross recessed hexagon head SEMS bolt with indentation	Phillips screwdriver or electric screwdriver
Vertical mounting	Standard M8 x 16 cross recessed hexagon head SEMS bolt with indentation	Phillips screwdriver or electric screwdriver
Rack mounting	M6 x 10 SEMS screw	Phillips screwdriver or electric screwdriver

4.2 Handling



- Wear safety shoes and protective gloves for handling.
- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.
- If condensation occurs on the equipment during transportation or storage, remove the condensation before turning on the power.

Two persons are required to carry the controller with bare hands.



Grasp the controller firmly at the bottom to prevent it from falling and being damaged.

4.3 Installation

4.3.1 Horizontal Mounting

This is the standard installation scenario. Place the controller stably on the table top, with a height between 0.6 m to 1.9 m above the ground. The table top must be flat and not inclined or deformed.



Auxiliary equipment such as forklifts are required for mounting heights over 1.5 m.



In environments where exposure to dripping water is possible, the equipment interface must not face upward.

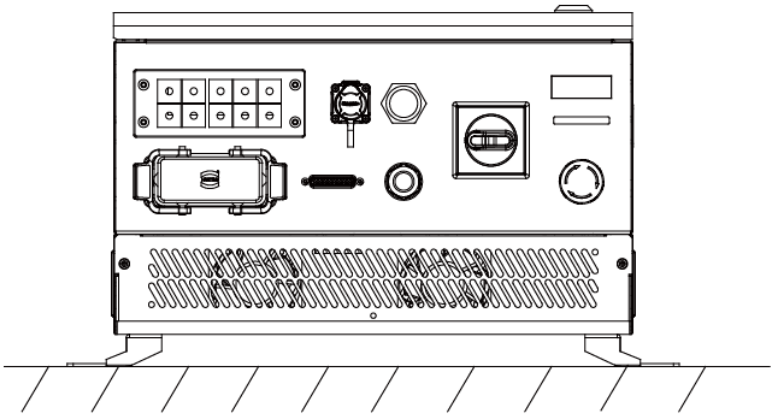
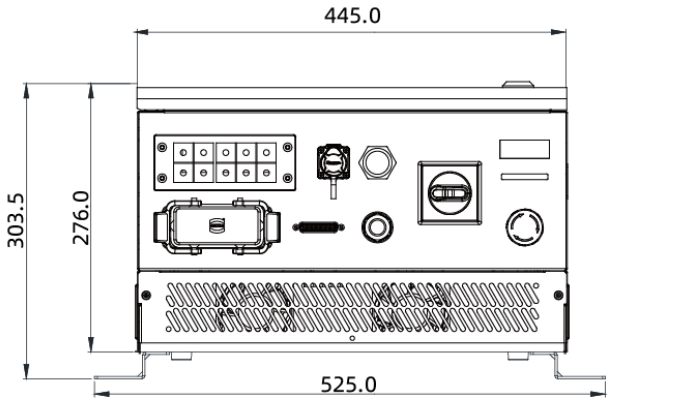
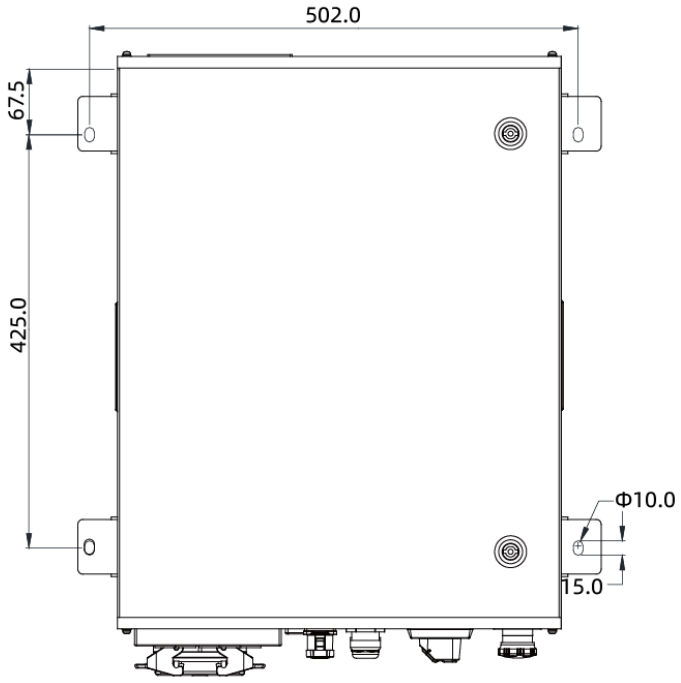


Figure 4-3-1-1 Table top requirements

The horizontal mounting dimensions are shown in the figure below:



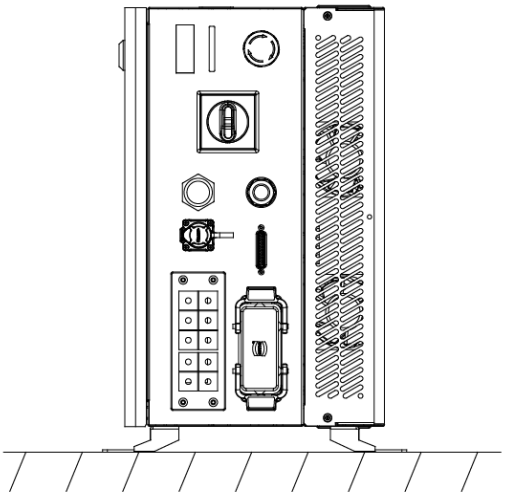


Horizontal mounting dimensions (in mm)

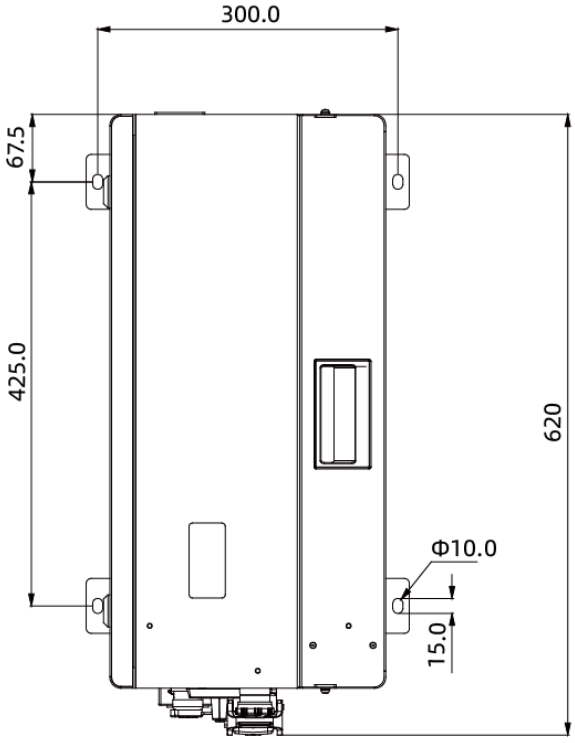
Place the controller on a flat installation surface and use the M8 x 16 SEMS bolts to lock the horizontal bracket onto the installation surface.

4.3.2 Vertical Mounting

This is the standard installation scenario. Place the controller stably on the table top, with a height between 0.6 m to 1.9 m above the ground. The table top must be flat and not inclined or deformed.

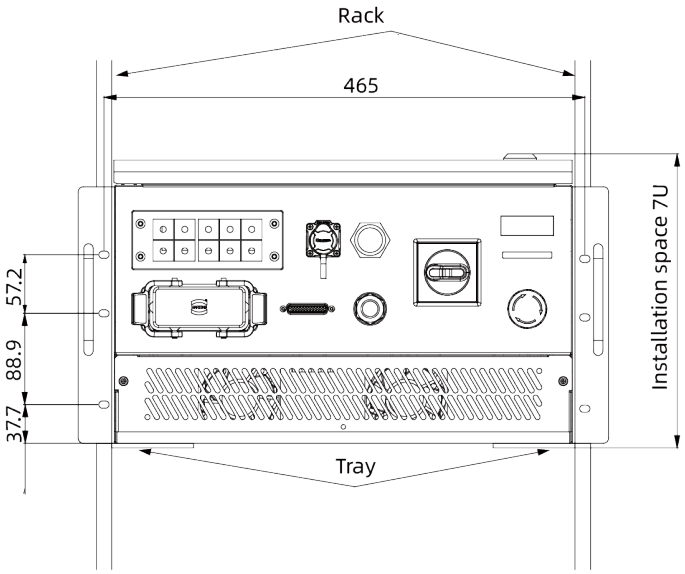


Secure the controller using the M8 x 16 SEMS screws. The mounting dimensions are shown in the figure below:



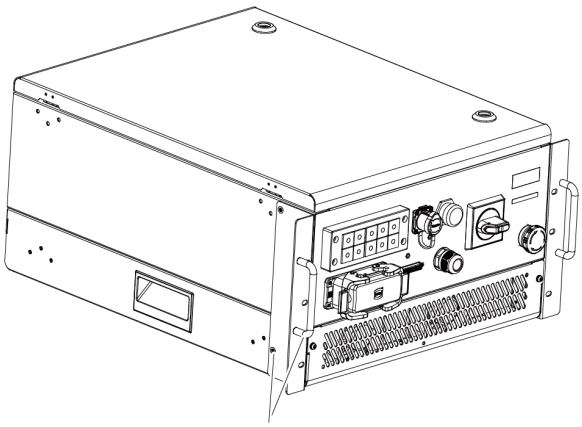
4.3.3 Rack Mounting

The mounting dimensions are shown in the figure below:



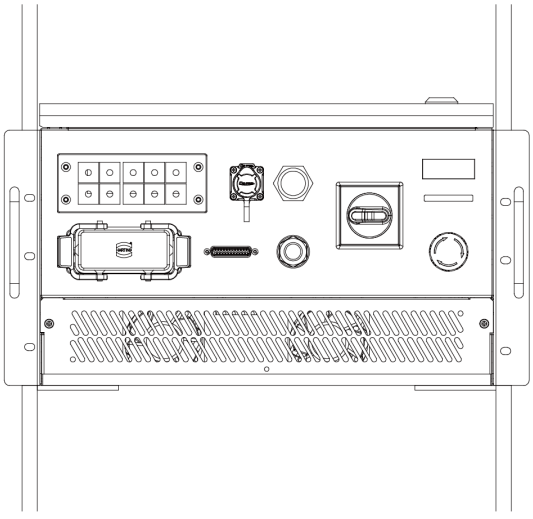
Mounting steps

1. Align the holes of the handle with the holes of the lugs, and then use M5 x 12 countersunk head screws (recommended torque 28 N·m) to fix the handle on the lugs.
2. Align the holes of the lug assembly with the holes of the controller, then use M5 x 12 countersunk head screws (recommended torque 28 N·m) to fix the lugs on both sides of the controller, as shown in the figure below.



Fixing the handle on the lugs with
M5x12 countersunk head screw (10 pcs)

3. Place the controller on the tray and push it into the rack. Align the holes of the lugs on both sides of the controller with the holes on both sides of the rack, and use M6 x 10 SEMS screws to fix them.



5 Wiring

5.1 Wiring Precautions

Installation, wiring, maintenance, or inspection must be carried out by personnel who have received necessary electrical training and experience. For details, see the Safety Precautions section.

5.2 Connecting Power Supply



- Only qualified personnel can perform the operation.
- Ground the controller properly to prevent electric shocks.
- Always use a plug or a disconnecting device that conforms to local safety standards for power supply cable. Do not connect the controller directly to the factory power supply.
- Cut off the power supply of the controller before performing the grounding work.

The IRCB501-6GT(*) series controller uses a 380 VAC power supply, while the IRCB501-6ND/4MD(*) series controller uses a 220 VAC power supply. Follow the steps below to prepare the power cables and ensure correct wiring.

For cables supplied by the customer, applicable safety regulations must be met. Use cables with a current-carrying capacity greater than the rated current of the external power supply circuit breaker.

- For the standard-power model IRCB501-6ND/4MD(*), use 3-core cables with a cross-sectional area of at least 4 mm^2.
- For the high-power model IRCB501-6GT(*), use 4-core sheathed cables with a core cross-sectional area of at least 4 mm^2.

Recommended residual current device (RCD) for external power supply: 100 mA (a time-delayed RCD is recommended).

Robot series	Controller model	Actual maximum current	Recommended external power supply circuit breaker selection
IR-S60&GS60 series	IRCB501-4MD(*)	20 A	25 A, D curve
IR-R10 series	IRCB501-6ND(*)	17 A	20 A, D curve
IR-R20 series	IRCB501-6ND(*)	29 A	32 A, D curve
IR-R16&R25 series	IRCB501-6ND(*)	29 A	
IR-R12&R35 series	IRCB501-6GT(*)	18 A	20 A, D curve

Wiring procedure

DANGER

- Always use a plug or a disconnecting device that conforms to local safety standards for power supply cable. Do not connect the controller directly to a factory power supply.
- Strictly follow the order of L/PE/N markings when making the power supply cable to avoid possible short circuit and electric shock.

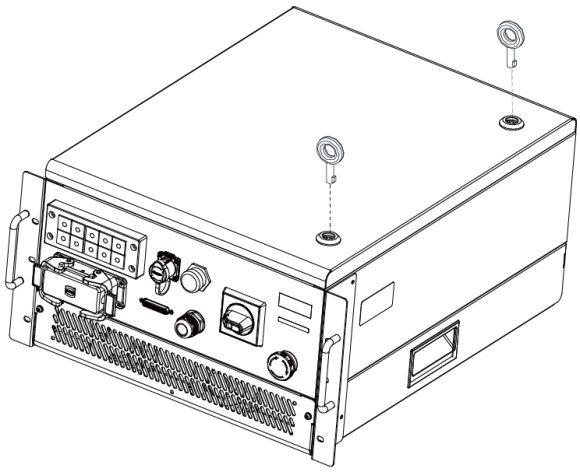
WARNING

There is a warning label attached below the PE marking of the power input terminal block. When wiring, make sure to follow the requirements of the warning label and connect the PE wire to the PE port.

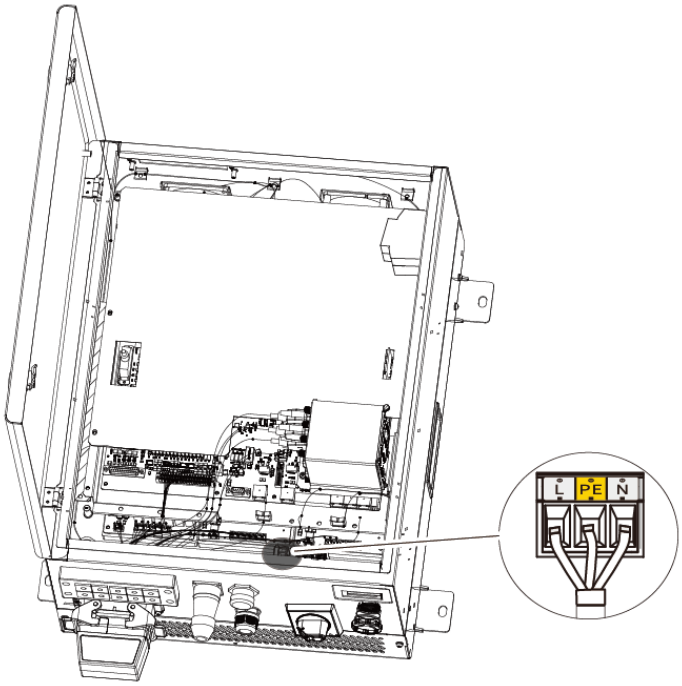
NOTE

- When the controller door is open or ajar, the equipment is not protected against metal dust.
- If the controller is to be used in an environment with conductive filaments, complete the cable connection first before moving the controller into the final application environment. Ensure the controller door is securely locked during commissioning and operation.

1. Open the top cover of the controller with the key.



2. Find the terminal block for the power supply cable and open the cover above the terminal block, as shown in the figure below.

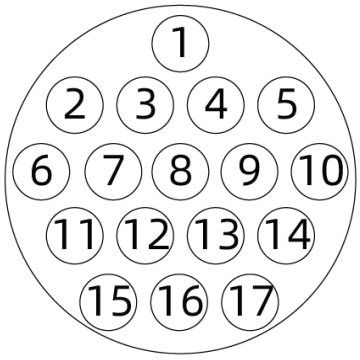


3. Loosen the screws under the cover, connect the power cable wires to the corresponding input terminals in the order of the terminal markings from left to right, and tighten the terminal screws securely.

5.3 Connecting Teach Pendant

5.3.1 Connector Pin Definition

IRTP80 teach pendant aviation connector



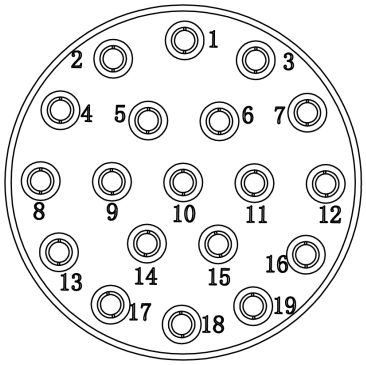
No.	Definition	Description	No.	Definition	Description
1	24 V	24 V power supply	10	24 V	24 V power supply
2	GND	Power supply GND	11	PE	Shielding ground
3	E-STOP1-A	Emergency stop 1-A terminal	12	TP_TX+	Ethernet data TX+
4	E-STOP1-B	Emergency stop 1-B terminal	13	TP_TX-	Ethernet data TX-

No.	Definition	Description	No.	Definition	Description
5	E-STOP2-A	Emergency stop 2-A terminal	14	TP_RX+	Ethernet data RX+
6	E-STOP2-B	Emergency stop 2-B terminal	15	TP_RX-	Ethernet data RX-
7	MODE_SW[1]	Key switch detection	16	PE	Shielding ground
8	24 V	24 V power supply	17	NET_SEL	Teach pendant network port selection input signal
9	DMS_NO	Three-position enable switch signal	-		

NOTE

[1]: The IRTP80 teach pendant without a key switch does not trigger this pin function.

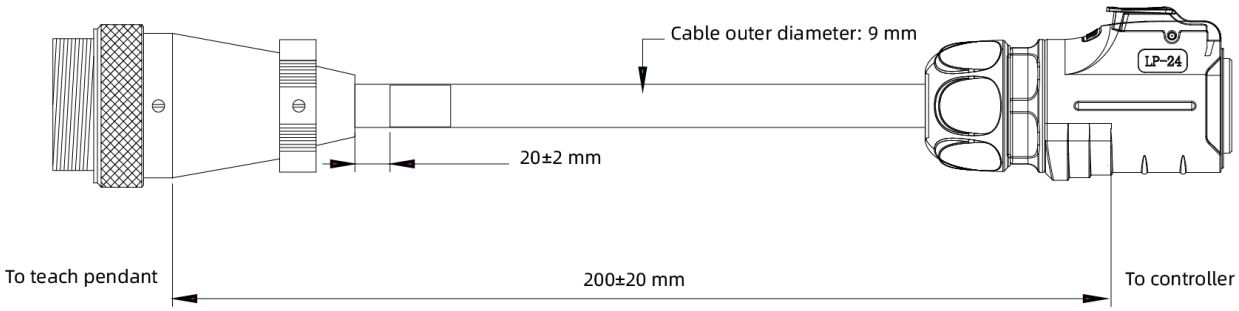
IR-TP200 teach pendant aviation connector



No.	Definition	Description	No.	Definition	Description
1	PE	Shielding ground	11	-	-
2	24 V	24 V power supply	12	PE	Shielding ground
3	E-STOP1-B	Emergency stop 1-B terminal	13	TP_TX+	Ethernet data TX+
4	GND	Power supply GND	14	TP_TX-	Ethernet data TX-
5	E-STOP2-B	Emergency stop 2-B terminal	15	TP_RX+	Ethernet data RX+
6	E-STOP2-A	Emergency stop 2-A terminal	16	TP_RX-	Ethernet data RX-
7	E-STOP1-A	Emergency stop 1-A terminal	17	-	-

No.	Definition	Description	No.	Definition	Description
8	DMS NO1	Normally open contact 1 of three-position enable switch	18	-	-
9	HANDMODE	Mode switch (reserved)	19	NET_SEL	Network port selection input signal
10	DMS NO2	Normally open contact 2 of three-position enable switch	-		

Teach pendant adapter cable



Material	Code
Adapter cable for IR-TP200 teach pendant	1504R443
Adapter cable for IRTP80 teach pendant	1504R442

PC-side pin definition

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

No.	Definition	Description
1	TX+	Data transmission +
2	TX-	Data transmission -
3	RX+	Data reception +
6	RX-	Data reception -
4, 5, 7, and 8	-	-
Enclosure	PE	Shielding enclosure

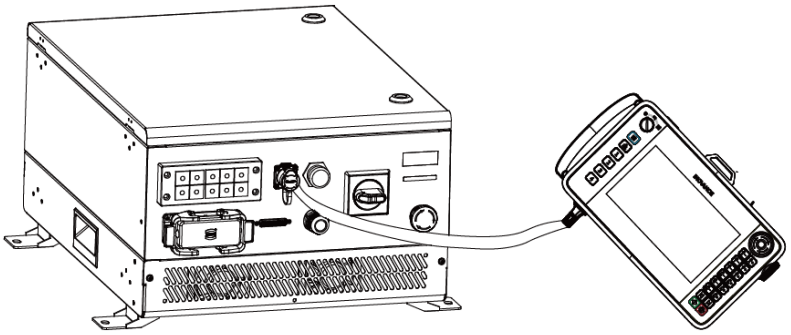
5.3.2 Wiring Method

This product can be used with an IRTP80 series or IR-TP200 series teach pendant for robot teaching and programming.

The wiring between the IR-TP200 series teach pendant and the controller is shown in the figure below. For detailed operations, see the "IR-TP200 Series Industrial Robot Teach Pendant User Guide".

NOTE

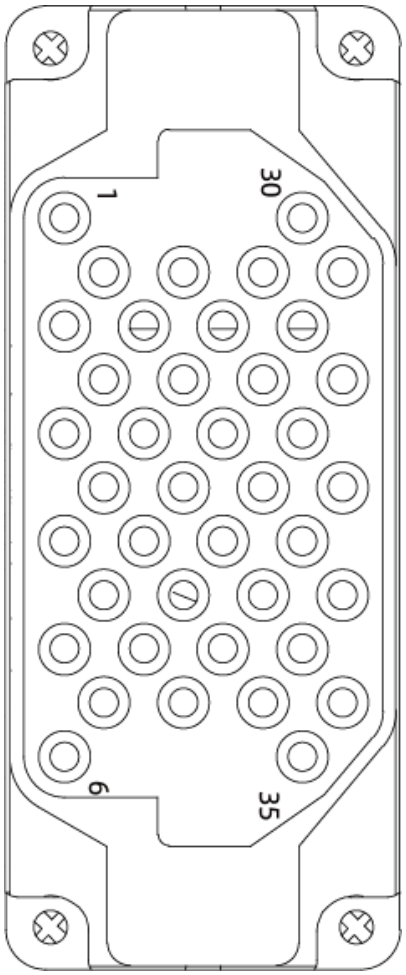
The PC interface can be connected to a PC or similar device, and is mutually exclusive with the hand-held teach pendant aviation connector. Only one interface is effective at a time. When both are connected simultaneously, the hand-held teach pendant aviation takes precedence.



5.4 Connecting Encoder and Power Cables

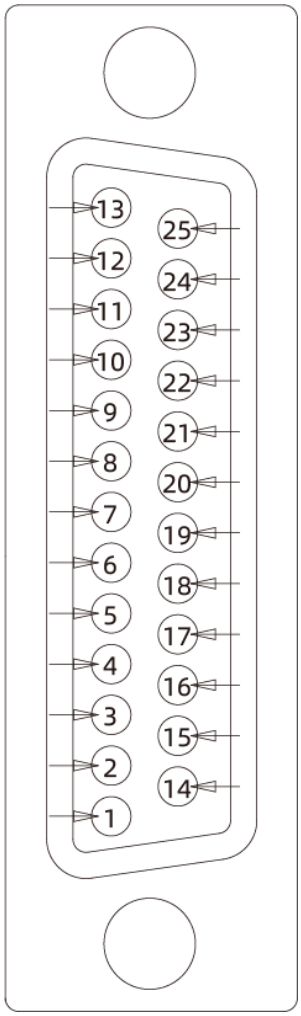
5.4.1 Connector Pin Definition

Power connector

Interface diagram	No.	Definition	Description	No.	Definition	Description
	1	U1	Motor output phase	25	U4	Motor output phase
	2	V1	Motor output phase	26	V4	Motor output phase
	3	W1	Motor output phase	27	W4	Motor output phase
	4	PE	Enclosure GND	21	PE	Enclosure GND
	7	U2	Motor output phase	30	U5	Motor output phase
	8	V2	Motor output phase	31	V5	Motor output phase
	9	W2	Motor output phase	32	W5	Motor output phase
	12	PE	Enclosure GND	22	PE	Enclosure GND
	16	U3	Motor output phase	36	U6	Motor output phase
	17	V3	Motor output phase	37	V6	Motor output phase
	18	W3	Motor output phase	38	W6	Motor output phase
	13	PE	Enclosure GND	33	PE	Enclosure GND
	6	BK1-	Brake 1	15	BK12+	Brake power supply
	11	BK2-	Brake 2	24	BK34+	Brake power supply
	20	BK3-	Brake 3	34	BK56+	Brake power supply
	29	BK4-	Brake 4	5	GND	Manual brake release
	35	BK5-	Brake 5	-	-	-
	40	BK6-	Brake 6	-	-	-

Encoder connector

Use shielded twisted pair to meet signal transmission requirements.

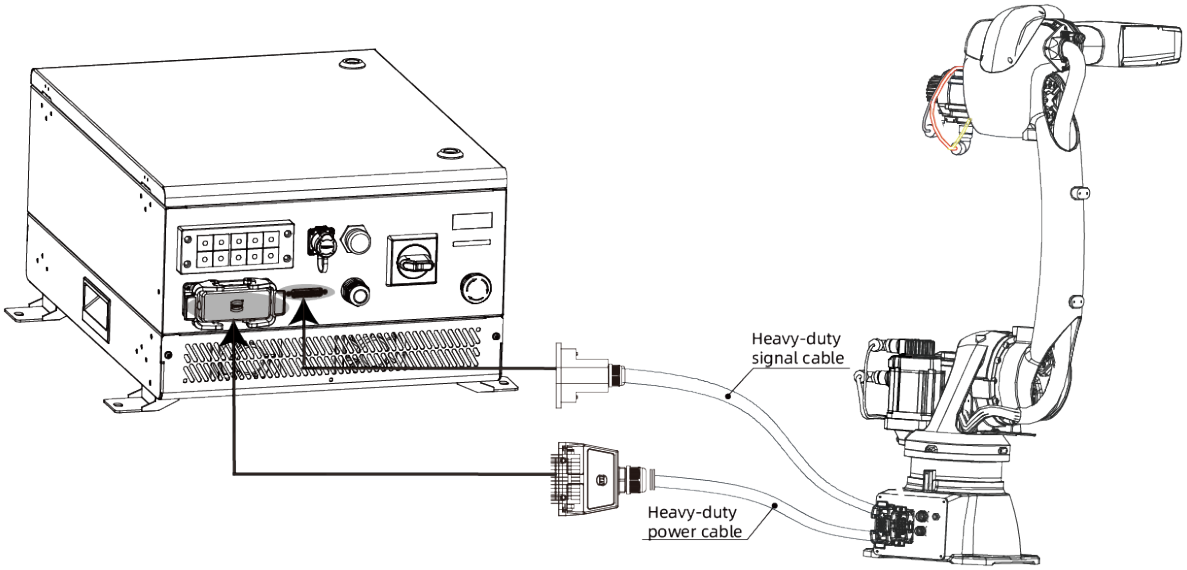
Interface diagram	No.	Definition	Description	No.	Definition	Description
	1	PS1+	Encoder differential signal +	7	PS5+	Encoder differential signal +
	14	PS1-	Encoder differential signal -	20	PS5-	Encoder differential signal -
	16	5 V	5 V	19	5 V	5 V
	3	GND	Signal ground	6	GND	Signal ground
	2	PS2+	Encoder differential signal +	8	PS6+	Encoder differential signal +
	15	PS2-	Encoder differential signal -	21	PS6-	Encoder differential signal -
	4	PS3+	Encoder differential signal +	10	24 V	24 V
	17	PS3-	Encoder differential signal -	23	GND	24 V power GND
	5	PS4+	Encoder differential signal +	25	TX+	IR-Link transmit differential input +
	18	PS4-	Encoder differential signal -	13	TX-	IR-Link transmit differential input -
	Enclosure	FG	Shield	24	RX+	IR-Link receive differential input +
	-	-	-	12	RX-	IR-Link receive differential input -
	-	-	-	11	DGND	IR-Link signal GND

5.4.2 Wiring Method

The controller comes with power cable, encoder cable and I/O cable for connecting it to the manipulator. Connect the manipulator and the controller according to the following figure.

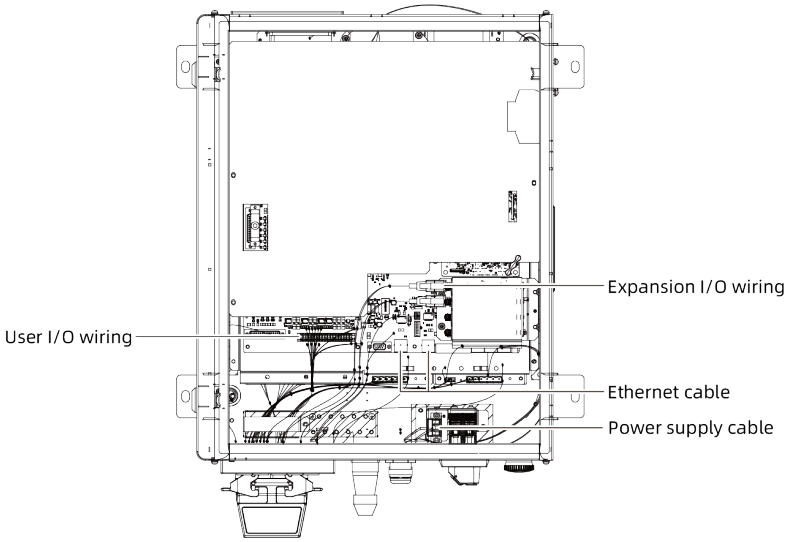
CAUTION

The power and encoder cables include connection markings. Connect the cable according to markings 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.

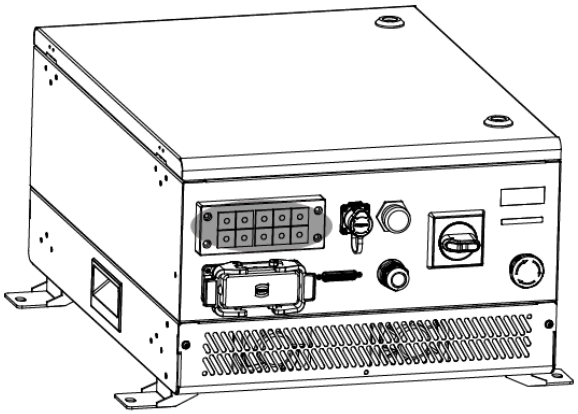


5.5 Internal Wiring of Controller

The wiring to the corresponding module has been set up inside the controller. The functional connection can be achieved by connecting the peripheral equipment to the external interfaces of the controller. The internal wiring of the controller is shown in the figure below.



5.6 Cable Entry System



All external cables come into or out of the controller through the 10 terminal blocks of the cable entry system as shown in the red block in the above figure. The outer diameter of the cables must match the inner diameter of the terminal blocks. The following table describes the specifications of the terminal blocks.

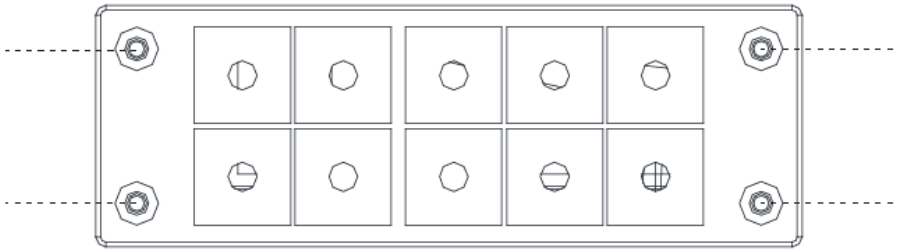
Terminal Block Model	Cable Diameter (mm)	Inovance Code	Qty
CES6	6 to 7	21020524	3
CES7	7 to 8	21020525	1
CES8	8 to 9	21020521	3
CES9	9 to 10	21020522	1
CES11	11 to 12	21020523	2

CAUTION

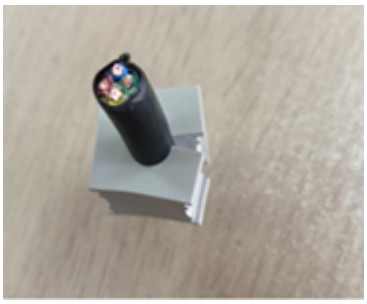
- If the outer diameter of the cable is not appropriate, the sealing of the controller will become insufficient, which may lead to the intrusion of electrical foreign matter into the controller, resulting in malfunction of the controller. When introducing a cable provided by the customer, adjust the cable to an appropriate outer diameter and ensure that the cable gland has no gaps.
- When the specifications of the actual cable used on site do not fully match the specifications of the standard terminal blocks, please contact the customer service.

Cable entry system wiring method

1. Remove the screws at the four corners of the cable entry system and remove it from the controller.



2. Install the cable into the terminal block corresponding to the cable diameter.

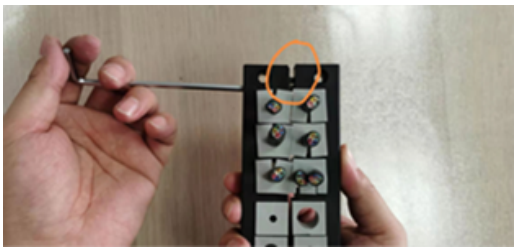


3. Place the terminal block with cable into the frame of the cable entry system. There are installation slots on both sides of the terminal block to guide it into the frame. The flat surface of the terminal block faces outwards.





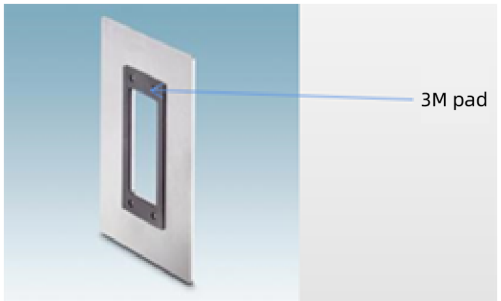
4. Assemble the two frames of the cable entry system and tighten the screws at the side of the frame.



5. After the cable entry system is assembled, seal the reserved terminal blocks with plugs.



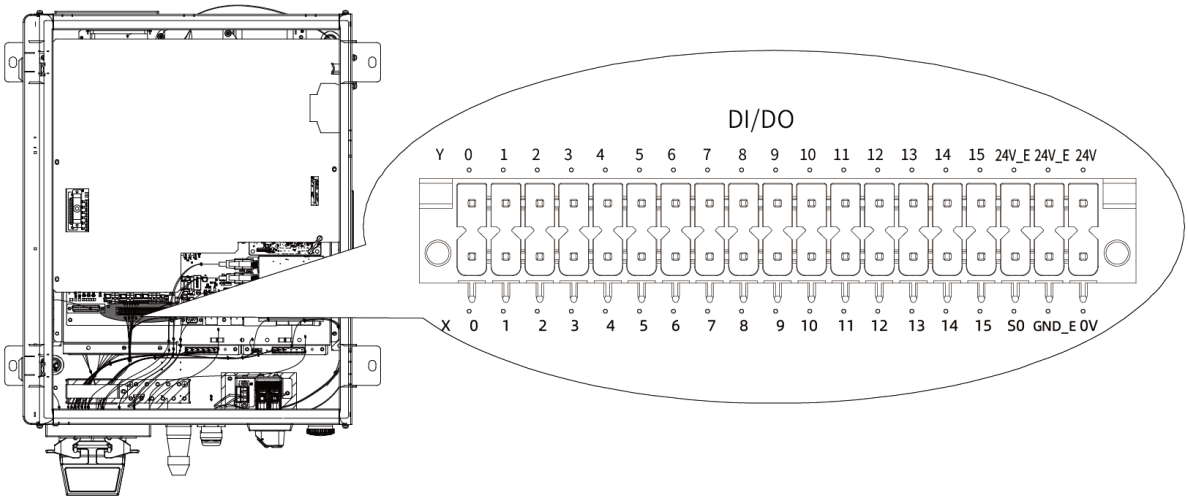
6. Attach a 3M pad to the corresponding opening on the controller for the cable entry system.



7. Secure the cable entry system to the controller.

5.7 Connecting DI

5.7.1 DI Definition



Definition	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
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 of DI0 to DI15

DI/DO power supply wiring instructions:

- DI and DO ports share one terminal.
- 24V and 0V are the 24 V power supply output from the controller to the outside, 24V_ E and GND_ E are the interfaces of external 24 V power supply to DO port in the controller.
- The two 24V_E on the actual terminal are internally connected together. Just connect one of them when in use.

DI/DO power supply specifications:

- 24V and 0V are the 24 V±20% power supply output from the controller to the outside, with a maximum allowable current of 0.8 A, which can supply power to DIs and DOs through external wiring.
- 24V_ E and GND_ E are the external power supply interface of DO circuit, with built-in overvoltage and overcurrent protection circuit.

5.7.2 DI Specifications

The controller includes 16 DIs. The specifications are described in the table below.

Item	Specification
Number of input channels	16 (X0 to X15)
Input connection method	Crimping wiring terminal
Input type	Digital, NPN or PNP input selected via the common terminal
Maximum input voltage	30 VDC
Input current (typical 24 V)	Approx. 5 mA
Input impedance	> 4 kΩ
ON voltage range	18 VDC to 30 VDC
OFF voltage range	0 VDC to 3 VDC
Maximum signal frequency of input	1 kHz
Isolation mode	Optoelectric isolation
Hardware response time	ON/OFF: 250 μs/250 μs

5.7.3 Wiring Method

Wiring rules

The terminal S0 is the common terminal for the 16-channel DI input.

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

Difference between NPN output and PNP output

- NPN type (sink type) output (negative common terminal)

When the load current flows into the output (Y) terminal, this type of output is called an NPN type output, which is a low-level output.

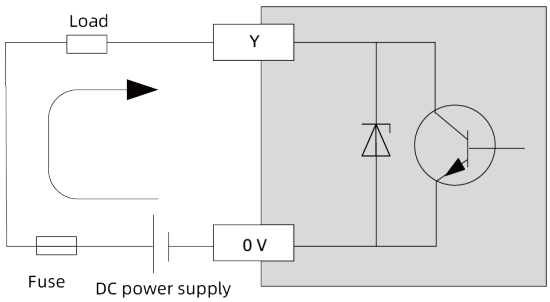


Figure 5-7-3-1 NPN output

- PNP type (source type) output (positive common terminal)

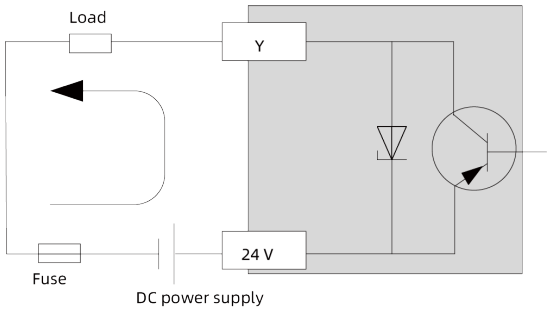


Figure 5-7-3-2 PNP output

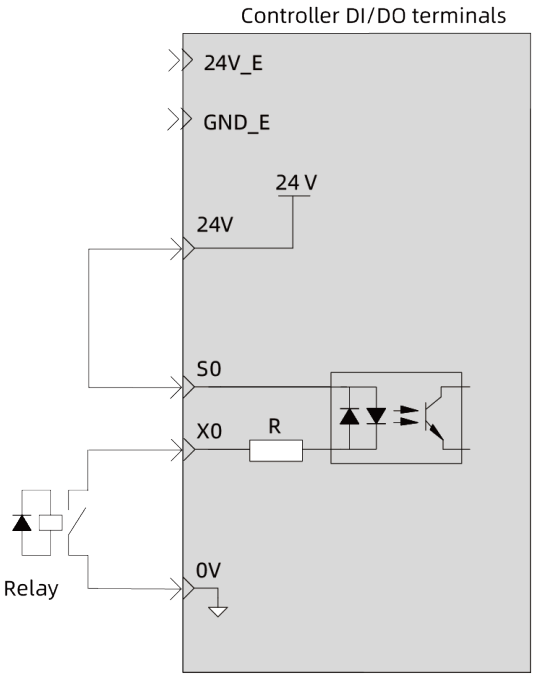
> NOTE
>
> NPN output is low level, while PNP output is high level.

Wiring diagram

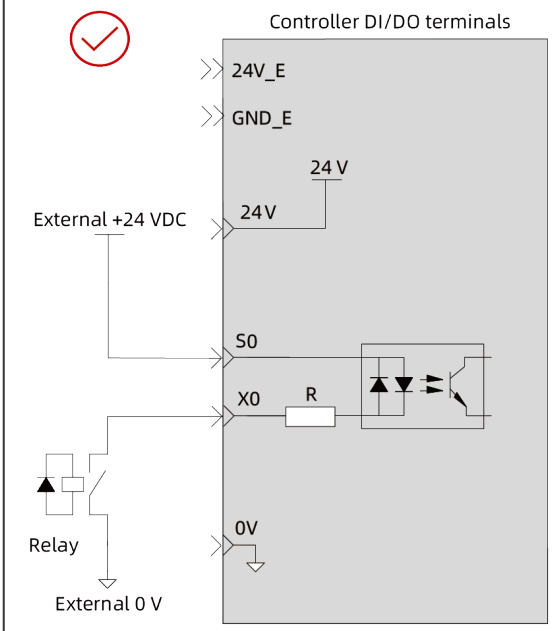
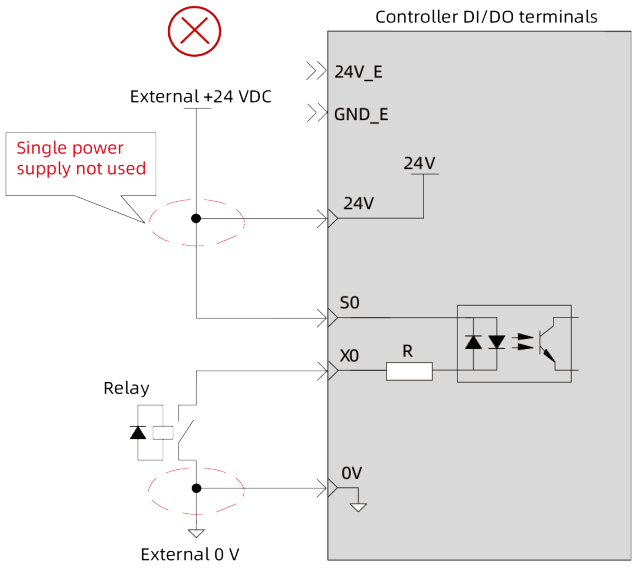
Here we take X0 as an example (X1 to X15 are the same as X0). It is recommended to use an external power supply.

- When the host controller provides relay output:

1. Using 24 V power supply provided by the controller



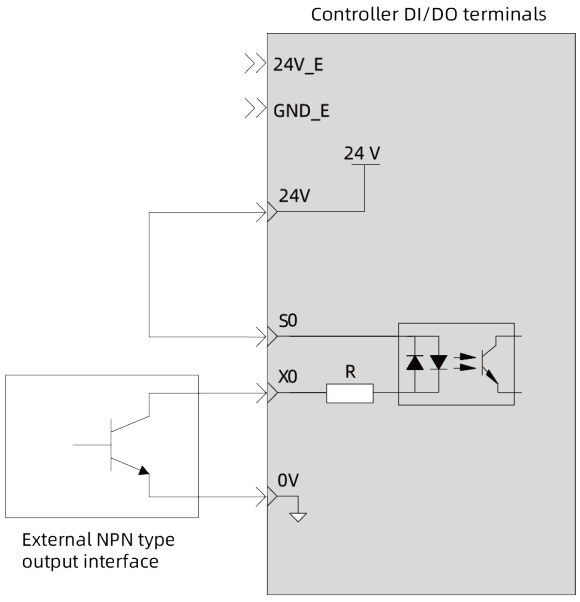
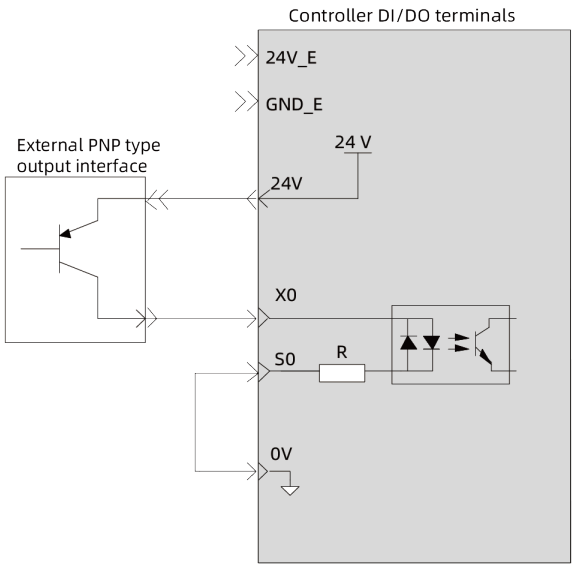
2. Using an external 24 V power supply

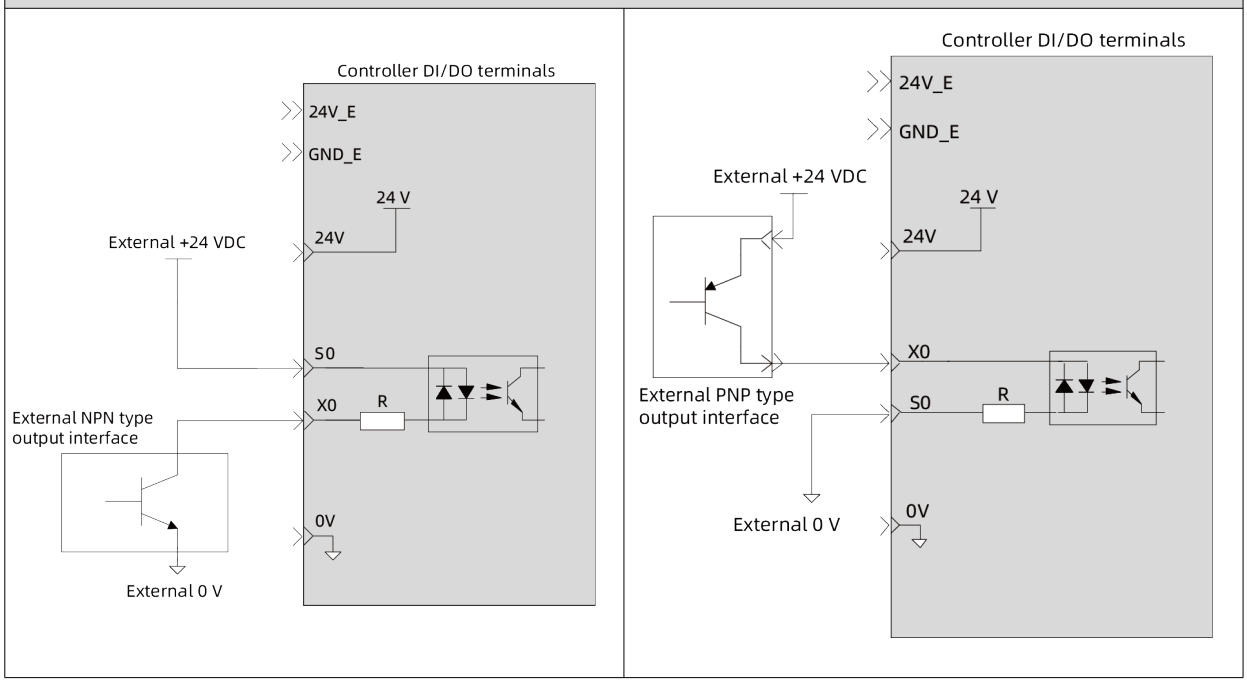
Correct wiring	Incorrect wiring
	

NOTE

- If an external 24 V power supply is used to power DI and the DO function is not needed, then 24V_ E and GND_ E connections are optional.
- If the DO function is needed, it is necessary to perform wiring according to the DO wiring instructions.

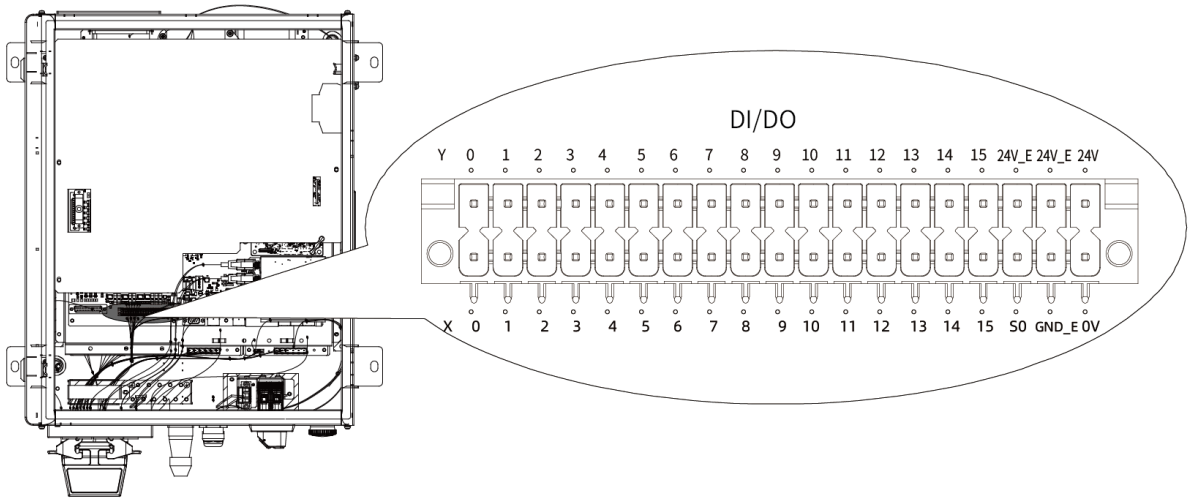
- When the host controller provides open-collector output:

Using 24 V power supply provided by the controller	
	

Using an external 24 V power supply


5.8 Connecting DO

5.8.1 DO Definition



Definition	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

Definition	I/O number	Name
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

DI/DO power supply wiring instructions:

- DI and DO ports share one terminal.
- 24V and 0V are the 24 V power supply output from the controller to the outside, 24V_ E and GND_ E are the interfaces of external 24 V power supply to DO port in the controller.
- The two 24V_E on the actual terminal are internally connected together. Just connect one of them when in use.

DI/DO power supply specifications:

- 24V and 0V are the 24 V±20% power supply output from the controller to the outside, with a maximum allowable current of 0.8 A, which can supply power to DIs and DOs through external wiring.
- 24V_ E and GND_ E are the external power supply interface of DO circuit, with built-in overvoltage and overcurrent protection circuit.

5.8.2 DO Specifications

Item	Specification
Number of output channels	16
Output connection method	Crimping wiring terminal
Output type	Sink type (NPN)
Operating voltage range of Y0-Y15	0 VDC to 29 VDC
24V_E and GND_E power supply	24 V±20%/0.2 A
Single-channel drive current	0.4 A
Y-COM_GND voltage at ON (Y-COM_GND)	< 1 V
Maximum leakage current at OFF	< 200 μA
Maximum output switching frequency	1 kHz
Isolation mode	Optocoupler isolation
Protective function	Overcurrent protection (0.8 A)
Hardware response time	< 500 μs (from OFF to ON), 500 μs (from ON to OFF)

5.8.3 Wiring Method

CAUTION

Failure to comply with the following requirements may damage the circuit.

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

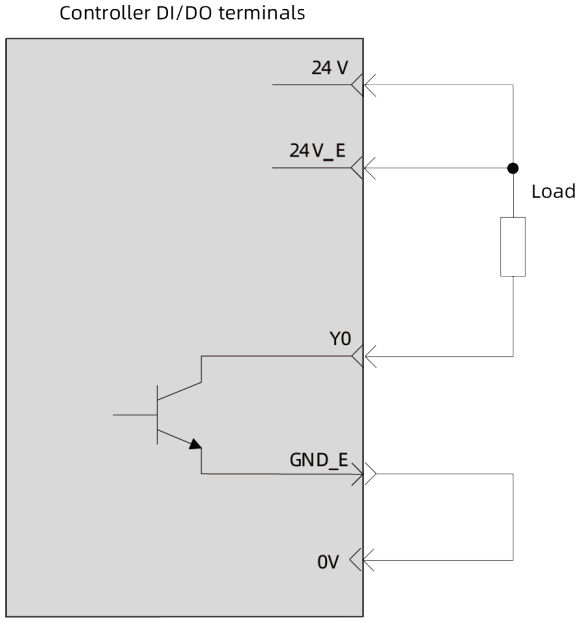
Wiring rules

24V_E/GND_E must be connected to 24 V power supply to ensure that the DOs work properly:

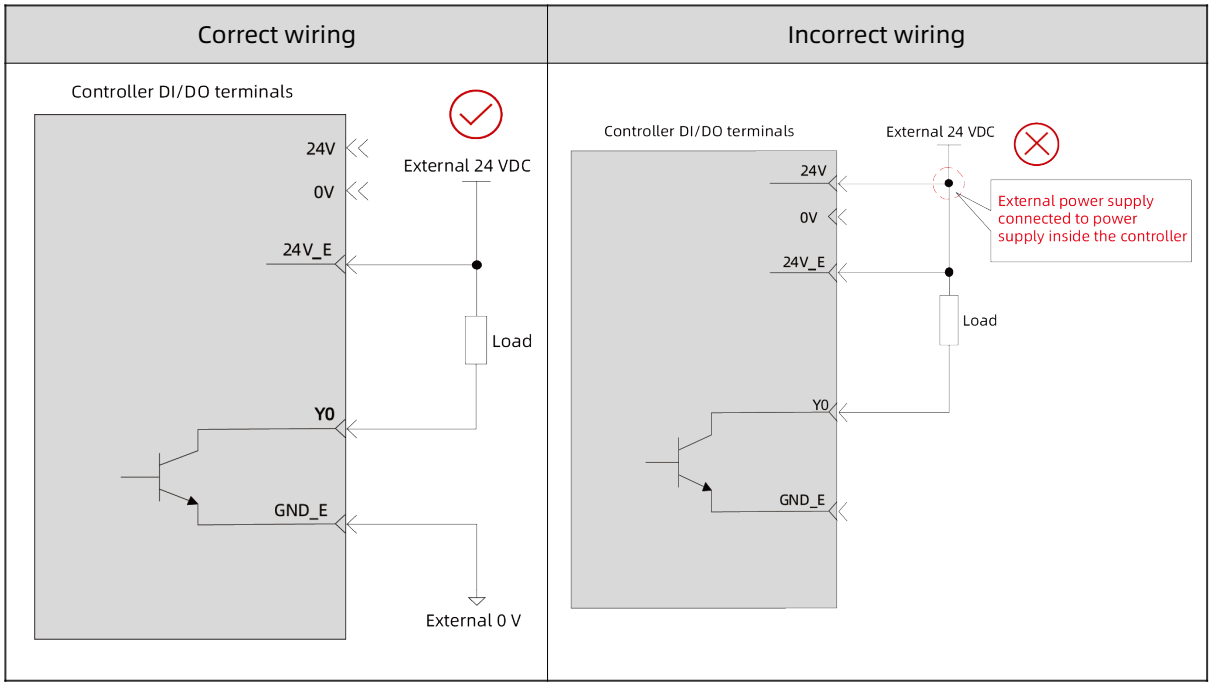
- If the load power supply of the DOs uses the 24V/0V controller power supply, it should be noted that the total continuous output current of 16 DOs must not exceed 0.8 A; otherwise, an external power supply is required.
- If an external 24 V power supply is used, connect the positive and negative terminals of the external power supply to 24V_E and GND_E terminals respectively. Note that the maximum driving current for each DO is 0.4 A. If the single output current exceeds 0.8 A, an over-current alarm occurs.

Wiring of the power supply

- Using 24 V power supply provided by the controller



- Using an external 24 V power supply



Wiring example

Here we take the external power supply as an example. When the power is supplied by controller, the same method applies.

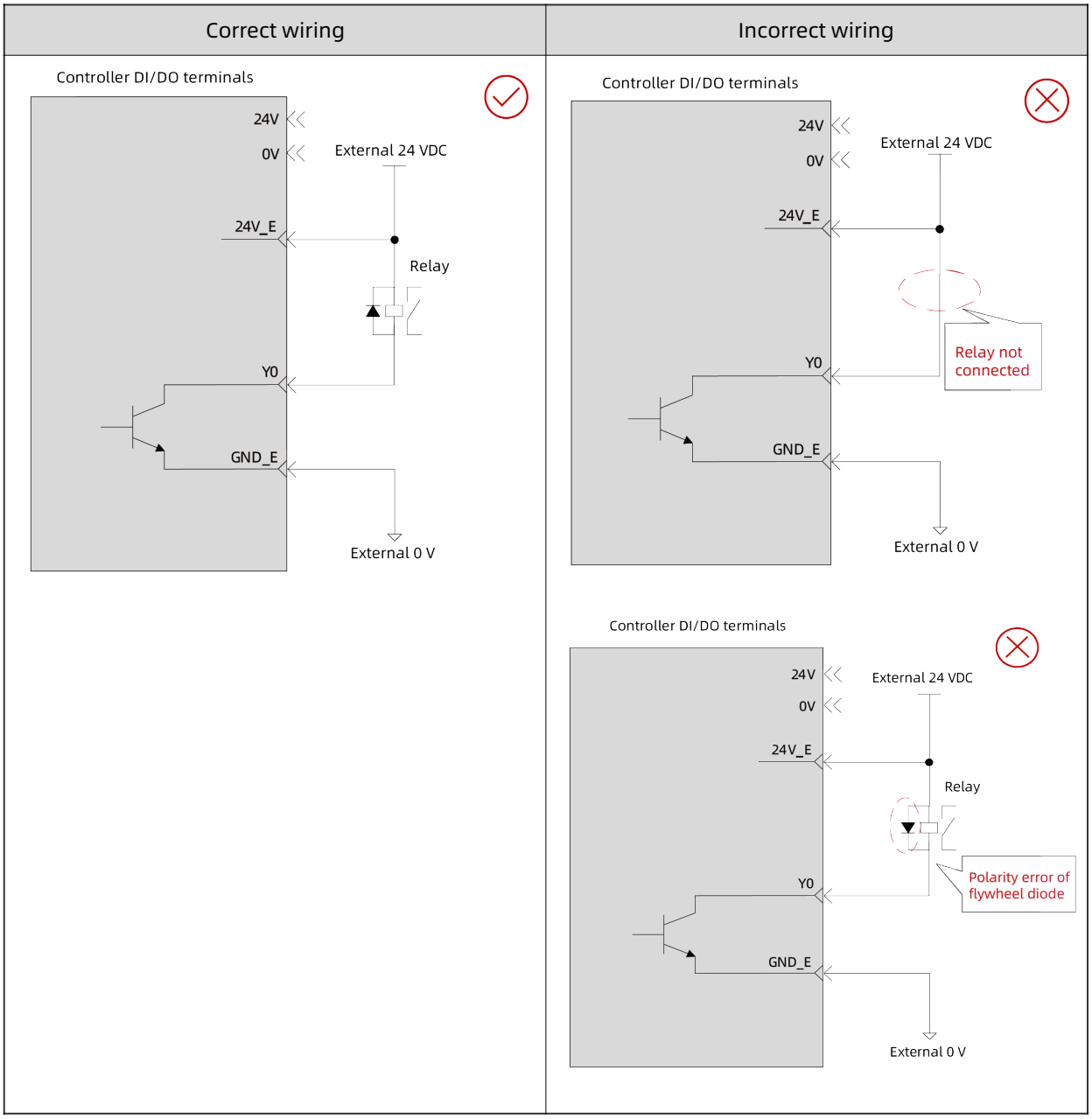
- Inductive load:

NOTE

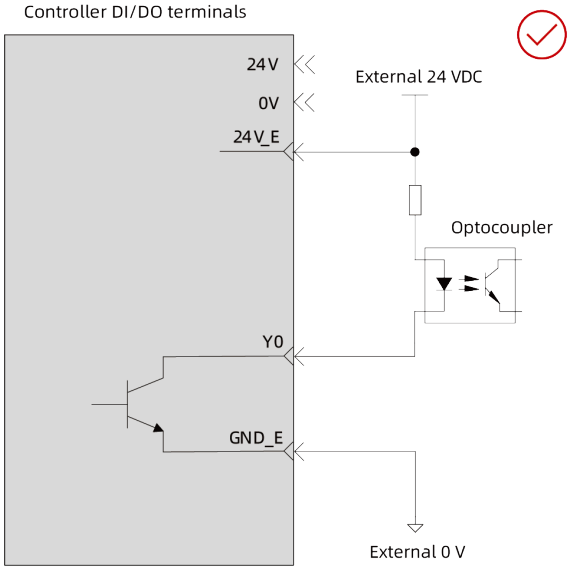
When the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, you can use a parallel flywheel diode with the load to extend the lifetime of the product.

The flywheel diode must meet the following requirements:

- Reverse voltage: 5 to 10 times of load voltage;
- Forward current: Larger than load current.



- Driving optocoupler load



5.9 SAFETY Interface Wiring

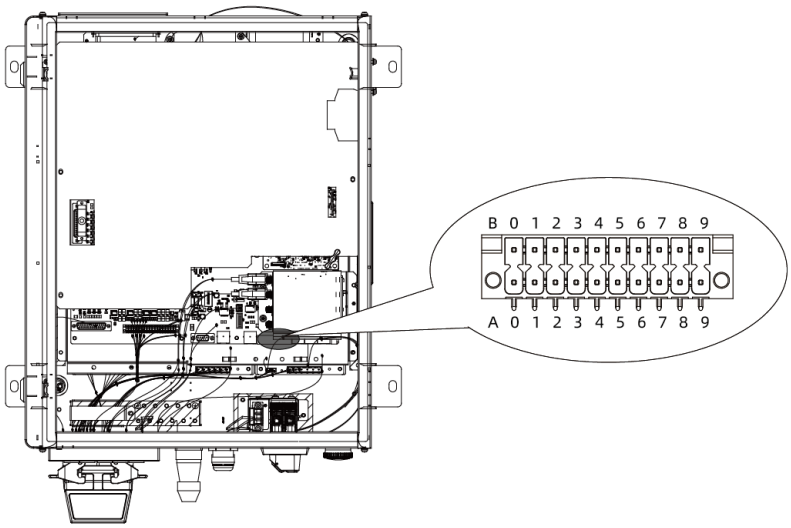
5.9.1 Connector Pin Definition

- The SAFETY interface includes input terminals for functions such as external emergency stop, external safety door, and start confirmation. 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 normally closed switches (such as mushroom shaped emergency stop switches). 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 fully 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 controller operate normally.

CAUTION

- Connect safety door switch, emergency stop switch, and start confirmation switch, etc., to the SAFETY interface to ensure safety. If the SAFETY interface is not required on site, maintain the factory default wiring. Companies and individuals that establish safety-related systems must conduct a risk assessment of the system according to relevant safety standards to ensure that it meets the required safety integrity level. In addition, companies and individuals that establish safety-related systems must take full responsibility for system installation and commissioning.
- If no safety connection is made or the safety connection is incorrect on the SAFETY interface, the robot system will not function properly.



The emergency stop, safety door, start confirmation, etc. of the controller meet the certification requirements. The specific terminal assignments are as follows.

No.	Definition	Remarks	No.	Definition	Remarks
A0	E-STOP_ 24V	Positive terminal of the 24 V power supply for emergency stop (maximum output current is 60 mA, must not be used for driving external load)	B0	E-STOP_ 24V	Positive terminal of the 24 V power supply for emergency stop (maximum output current is 60 mA, must not be used for driving external load)
A1	E-STOP11	SW1 contact for teach pendant emergency stop /external emergency stop	B1	E-STOP21	SW2 contact for teach pendant emergency stop /external emergency stop
A2	E-STOP12		B2	E-STOP22	
A3	E-STOP_ RDY1	Positive terminal of the emergency stop input 1	B3	E-STOP_ RDY2	Positive terminal of the emergency stop input 2
A4	E-STOP_ GND	Negative terminal of the 24 V power supply for emergency stop	B4	E-STOP_ GND	Negative terminal of the 24 V power supply for emergency stop
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 for emergency stop (maximum output current is 60 mA, must not be used for driving external load)	B6	E-STOP_ 24V	Positive terminal of the 24 V power supply for emergency stop (maximum output current is 60 mA, 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 for emergency stop (maximum output current is 60 mA, must not be used for driving external load)	B8	E-STOP_ 24V	Positive terminal of the 24 V power supply for emergency stop (maximum output current is 60 mA, 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 supply outputs from the controller, with a maximum output current of 60 mA and can only supply power to the safety I/Os.
- If this power supply is used, the SAFETY interface supports passive switch-type devices.
- When an external emergency stop device is connected in series, it must not cause the voltage of E-STOP_24V to drop below 18 V. Otherwise, the emergency stop function may fail after the button is pressed, causing the robot to trigger an alarm and shut down.
- 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 controller. The specific wiring method is described in the 5.9.3.1 Emergency Stop Wiring section.
- When connecting an external emergency stop device to the SAFETY I/O terminals:

  Connect the first contact of the external emergency stop device in series to A0/A1, and the second contact in series to B0/B1. For details, see the "Connection of external emergency stop switch (client) + teach pendant/controller emergency stop switch" diagram in the 5.9.3 Wiring and Topology Diagram section, and observe the corresponding notes in the connection diagram.

  Connect the first contact of the external emergency stop device in series to A0/A3, and the second contact in series to B0/B3. For details, see the "Connection of external emergency stop switch (customer)" diagram in the 5.9.3 Wiring and Topology Diagram section, and observe the corresponding notes in the connection diagram.

  When the external emergency stop signal is triggered by the safety DO (PNP type) of an external mechanism/device, it is recommended to connect the external emergency stop signal to the safety DI of the safety expansion card. For details on related wiring and configurations, see the "Safety DI of Safety Expansion Card" section and the "Safety I/O" section of the "IRCB501 Series Robot Controller Functional Safety Guide". If the robot is not equipped with a safety expansion card, the safety DO (PNP type) output signal from the external mechanism must be converted to a switch signal before being connected to the corresponding SAFETY interface.

The default wiring diagram for the SAFETY interface of the IRCB501 High-protection series controller is shown below:

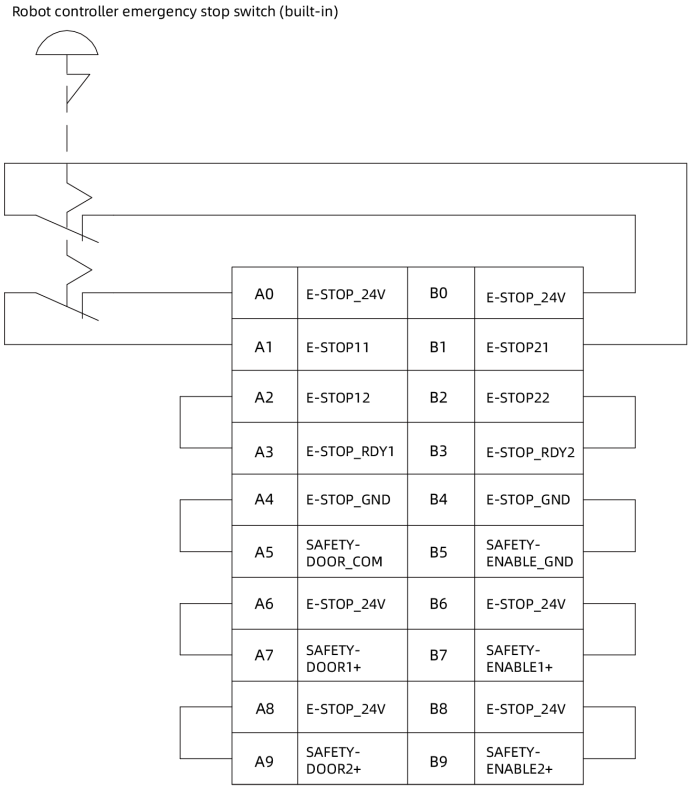


Figure 5-9-1-1 Default wiring for the SAFETY interface of the IRCB501 High-protection series controller

5.9.2 I/O Specifications

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

Item	Specification
Input connection method	Crimping wiring terminal
Input type	No common point design, supporting bidirectional input
Maximum input voltage	30 VDC
Input current (typical 24 V)	Approx. 5 mA
Input impedance	> 4 kΩ
ON voltage range	18 VDC to 30 VDC
OFF voltage range	0 VDC to 3 VDC
Maximum signal frequency of input	1 kHz
Isolation mode	Optoelectric isolation

5.9.3 Wiring and Topology Diagram

5.9.3.1 Emergency Stop Wiring

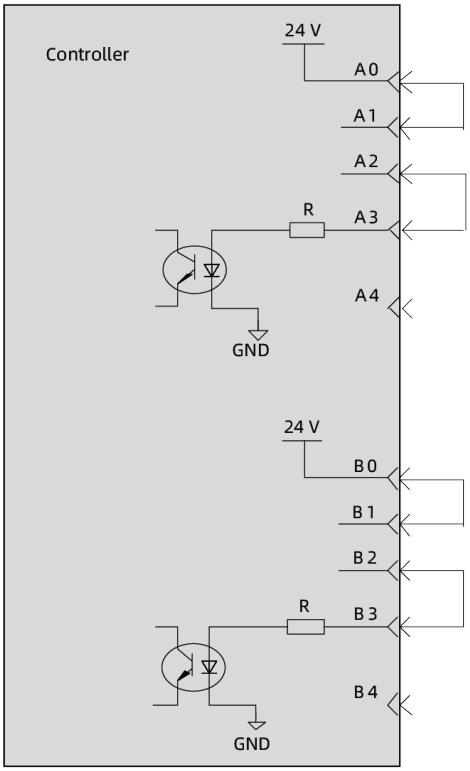
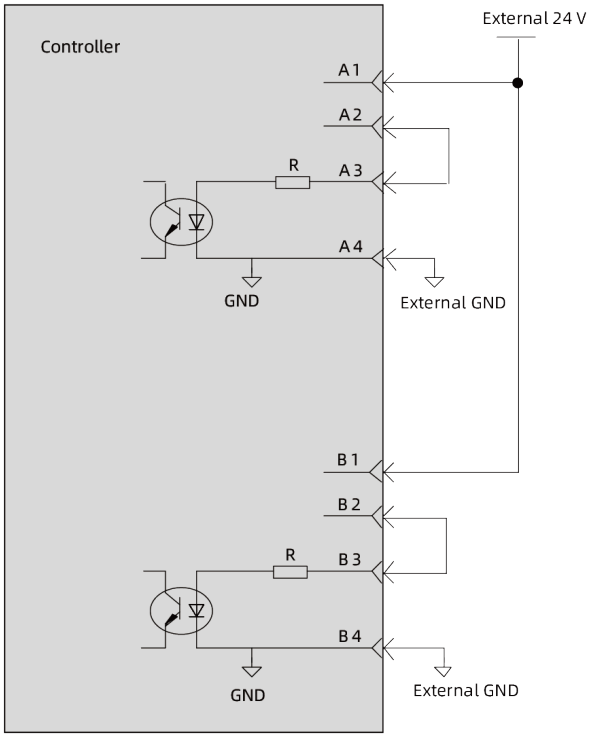
Emergency stop is a normally closed contact connection, with a dual circuit structure. The disconnection of any one circuit will trigger the emergency stop function. For different emergency stop wiring, note the corresponding precautions. The SAFETY interface only accepts passive emergency stop normally closed contact signal. When other signal is used on site, such as an active emergency stop safety DO signal, see the "Safety DI of Safety Expansion Card" section of "INT Version Small and Medium Payload Industrial Robots Functional Safety Guide" for wiring.



- 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.

The emergency stop function can be triggered by the emergency stop on the robot controller/teach pendant, or the emergency stop signal of a customer emergency stop device connected in series to the emergency stop circuit of the controller/teach pendant. When the emergency stop function of the SAFETY interface is triggered, the safety function **SF01 Emergency Stop** is activated, and the robot performs a Category 0 stop. The following are wiring diagrams for different emergency stop signal trigger sources on the SAFETY terminals:

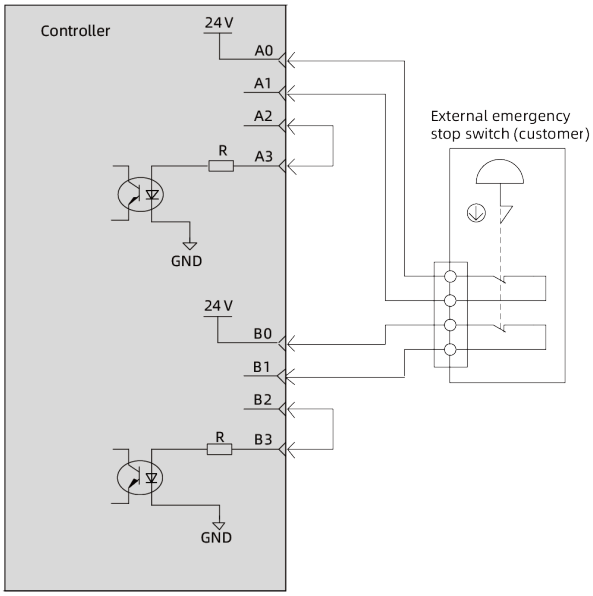
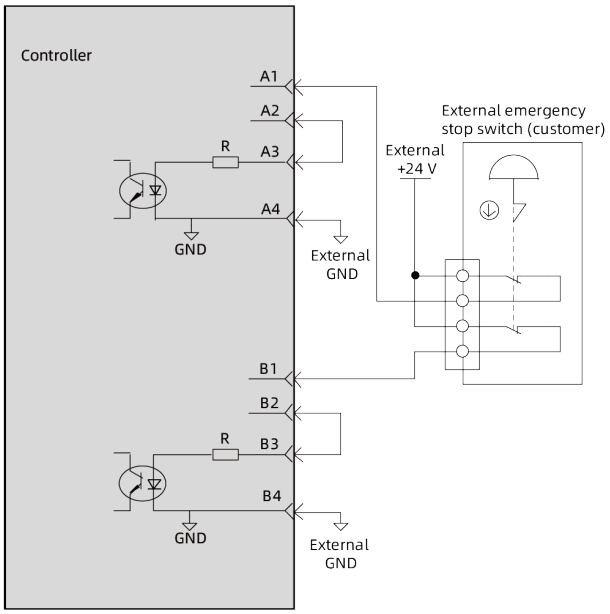
- For the connection using only robot side (teach pendant/controller) emergency stop (dual-circuit (A/B) interlocking mechanism), see the table below.

Using 24 V power supply provided by the controller (default wiring)	Using an external 24 V power supply
	

CAUTION

- The teach pendant emergency stop is not shown in the diagrams above, and "Emergency stop wiring on robot side only" should be consistent with the factory default wiring.
- When the "Connection using only robot side (teach pendant/controller) emergency stop" is adopted, and the safety expansion card is not configured for external emergency stop, the robot has no external emergency stop device (customer). Companies and individuals that establish safety-related systems must conduct a risk assessment of the system according to relevant safety standards to ensure that it meets the required safety integrity level. In addition, companies and individuals that establish safety-related systems must take full responsibility for system installation and commissioning.

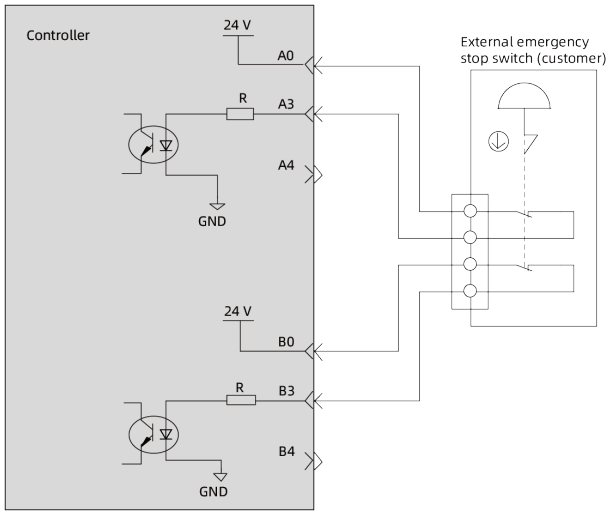
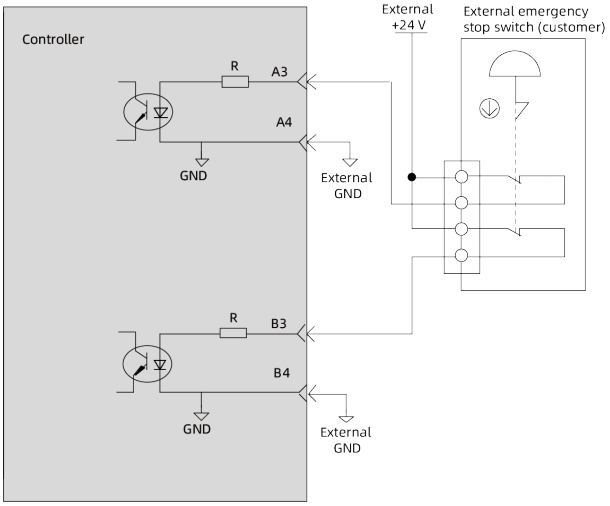
- For the connection using both external emergency stop switch (customer) and robot side (teach pendant /controller) emergency stop (dual-circuit (A/B) interlocking mechanism), see the table below.

Using 24 V power supply provided by the controller	Using an external 24 V power supply
	

CAUTION

When an external emergency stop device is connected to A0/A1/B0/B1 of the SAFETY interface in series, it must not cause the voltage of E-STOP_24V to drop below 18 V. Otherwise, the emergency stop function may fail after the button is pressed, causing the robot to trigger an alarm and shut down.

- For the connection using only external emergency stop (customer) switch (dual-circuit (A/B) interlocking mechanism), see the table below.

Using 24 V power supply provided by the controller	Using an external 24 V power supply
	

CAUTION

- When an external emergency stop device is connected to A0/A3/B0/B3 of the SAFETY interface in series, it must not cause the voltage of E-STOP_24V to drop below 18 V. Otherwise, the emergency stop function may fail after the button is pressed, causing the robot to trigger an alarm and shut down.
- When the "connection using only external emergency stop switch (customer)" is adopted, the default wiring between A0/A1/A2/A3/B0/B1/B2/B3 will be removed. At this point, the teach pendant/controller emergency stop switch will trigger the emergency stop function, causing the robot to alarm and stop. If the default wiring is not removed and the teach pendant aviation connector on the controller is covered with a teach pendant plug cap, only the external emergency stop switch (customer) will be active in the system. Companies and individuals that establish safety-related systems must conduct a risk assessment of the system according to relevant safety standards to ensure that it meets the required safety integrity level. In addition, companies and individuals that establish safety-related systems must take full responsibility for system installation and commissioning.

5.9.3.2 Safety Door and Start Confirmation Wiring

Safety door wiring

The wiring terminals for the protective stop function (safety door) can be used for controlling the safety door or safety grating on the surrounding protective fence during robot operation. When the safety door is opened, the safety door signal input is at a low level, the safety function **SF02 Emergency Stop** is activated, and the robot performs a Category 0 stop:

- The safety door utilizes a safety DI detection method with a dual circuit structure.
- The safety door is a normally closed dual-contact connection, with a dual circuit structure. The signal disconnection of any one circuit will trigger the Category 0 stop.

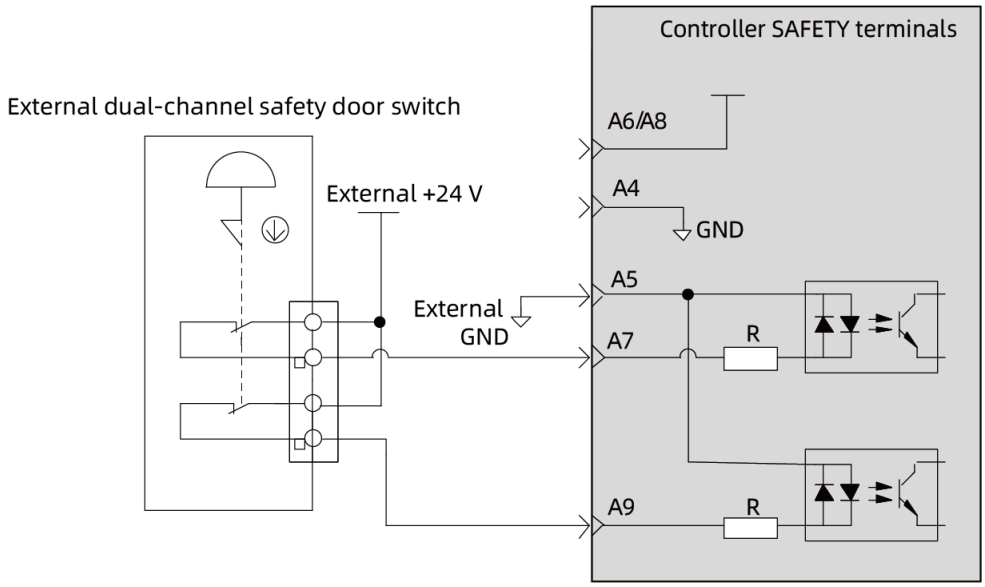
The controller system enables the safety door function by default (with factory default wiring). When using the safety door signal, connect the safety door trigger signal device to the corresponding interface.

CAUTION

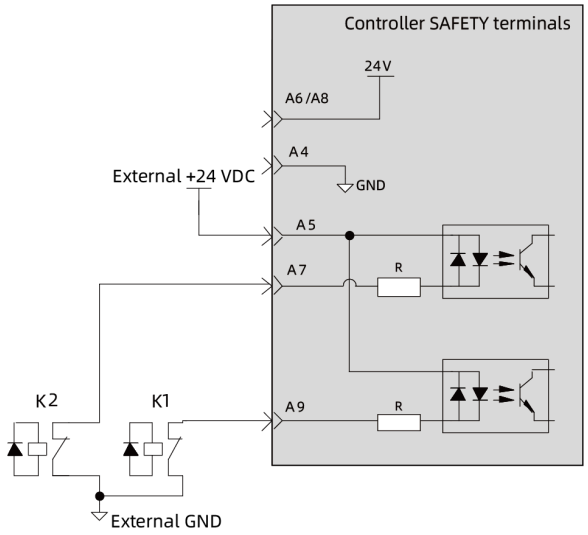
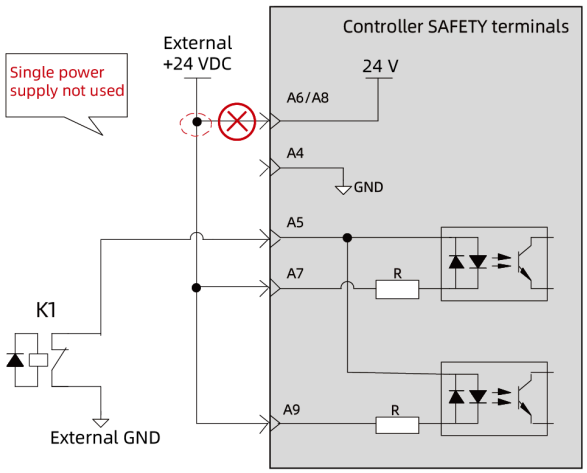
Connect the safety door circuit to the designated I/Os for SAFETY DOOR 1 and SAFETY DOOR 2. The safety door function is active only when both I/O inputs are valid. Otherwise, the system will alarm.

By default, the safety door terminal signal are powered by internal power supply. If you need to use the safety door to trigger the protective stop function, it is recommended to supply power to the safety door trigger device from an external +24 V power supply, and then connect the safety door signal to the corresponding interface terminal on the controller. The wiring for the safety door (protective stop function) is as follows:

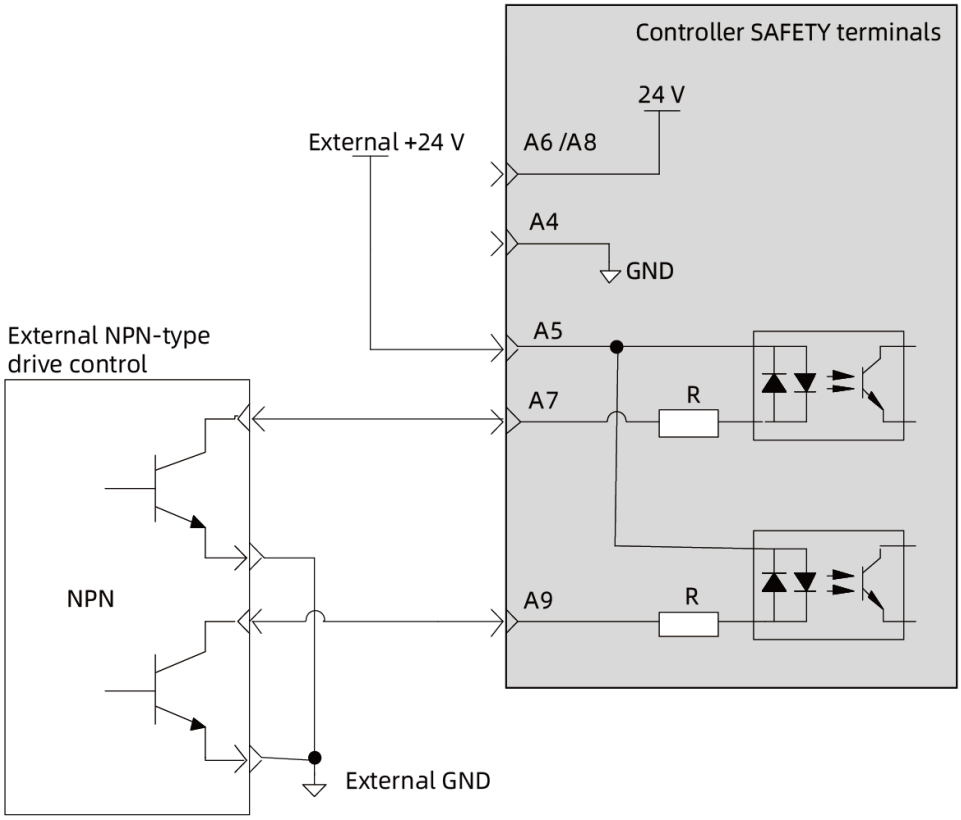
- When the external safety door control uses a dual-switch (recommended wiring with external 24 V power supply), the wiring is as shown below:



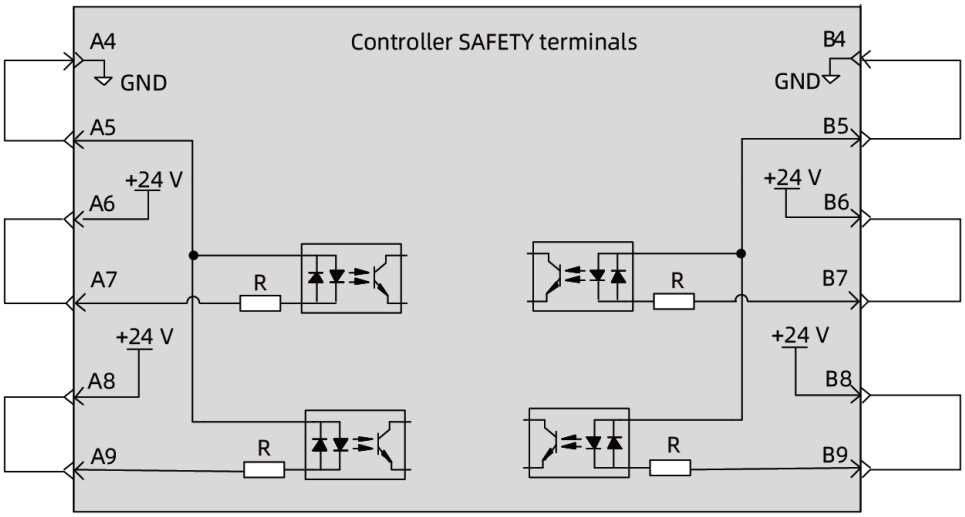
- When the external safety door control uses a relay output (recommended wiring with external 24 V power supply), the wiring is as shown below:

Correct wiring with relay	Incorrect wiring with relay
	

- When the external safety door control uses an NPN-type drive output (recommended wiring with external 24 V power supply), the wiring is as shown below:



- When the safety door function **is not enabled** (factory default wiring), the wiring is as shown below:



CAUTION

If the safety door function (protective stop) is left at factory default wiring, the function will not be enabled, and the robot has no safety door function (customer). Companies and individuals establishing safety-related systems must conduct a risk assessment according to relevant safety standards to ensure that the system meets the safety requirements. In addition, companies and individuals that establish safety-related systems must take full responsibility for system installation and commissioning.

Start confirmation wiring

The start confirmation function is used to verify the robot's readiness before startup operation. It utilizes a universal DI detection method with a dual circuit structure and operates in the following manner:

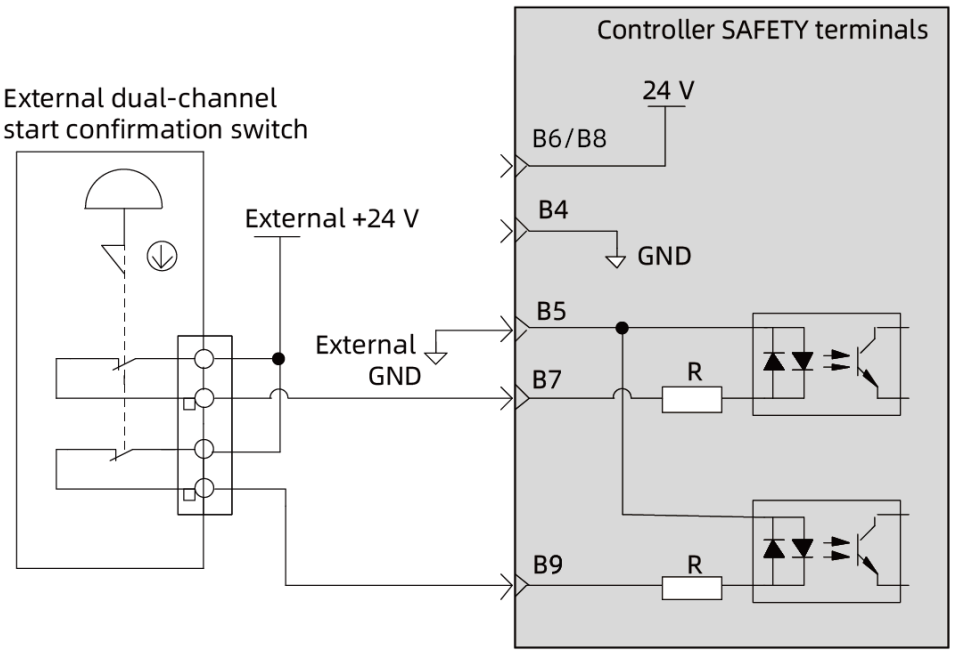
- Rising edge detection method. When the DI port detects a valid rising edge signal (with a pulse width greater than 500 μs) from 0 to 1, the start confirmation function is enabled and active. For example, the external control device uses a self-resetting type contact switch for control.
- If the DI port detects that there is always an ON input level, that is, this function is blocked. For example, the external control device uses a normally closed contact switch for control, and the input is always in a valid state.

The controller system turns on the start confirmation function by default. Therefore, note the wiring as follows:

- When the start confirmation function is active, the I/O detection circuit requires a rising edge input of 0 to 1 before each operation of the system. Otherwise, after the start button is pressed, the system will prompt "Please confirm the startup before automatic operation". Therefore, it is recommended to use a self-resetting switch in the start confirmation control circuit.

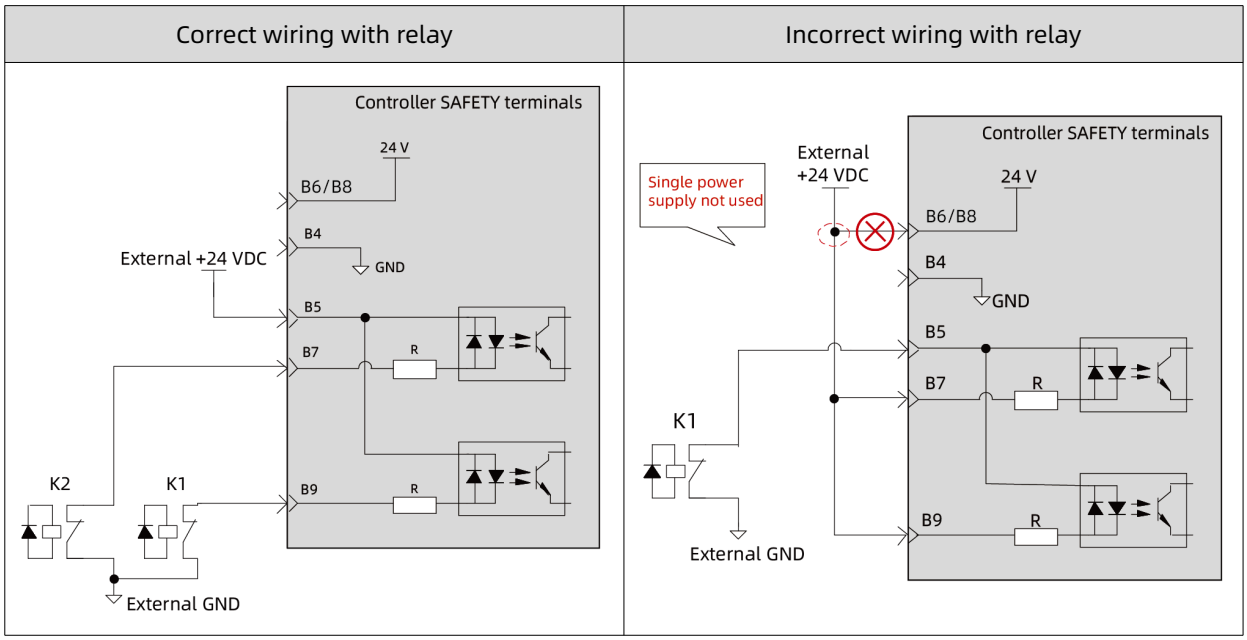
By default, the start confirmation function circuit are powered by internal power supply. If you need to connect an external control device to remotely operate the start confirmation function, it is recommended to use an external +24 V power supply. The wiring for the startup confirmation is as follows:

- When the external start confirmation control uses a dual-switch (recommended wiring with external 24 V power supply), the wiring is as shown below:

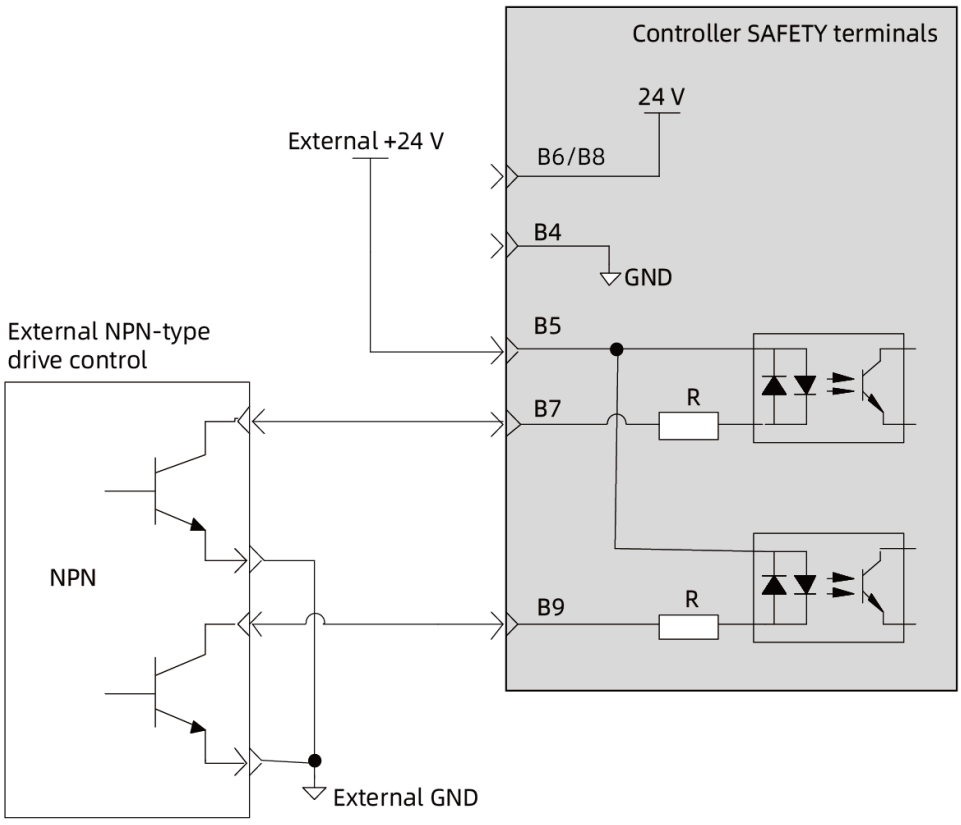


- When the external start confirmation control uses a relay output (recommended wiring with external 24 V power supply), the wiring is as shown below:

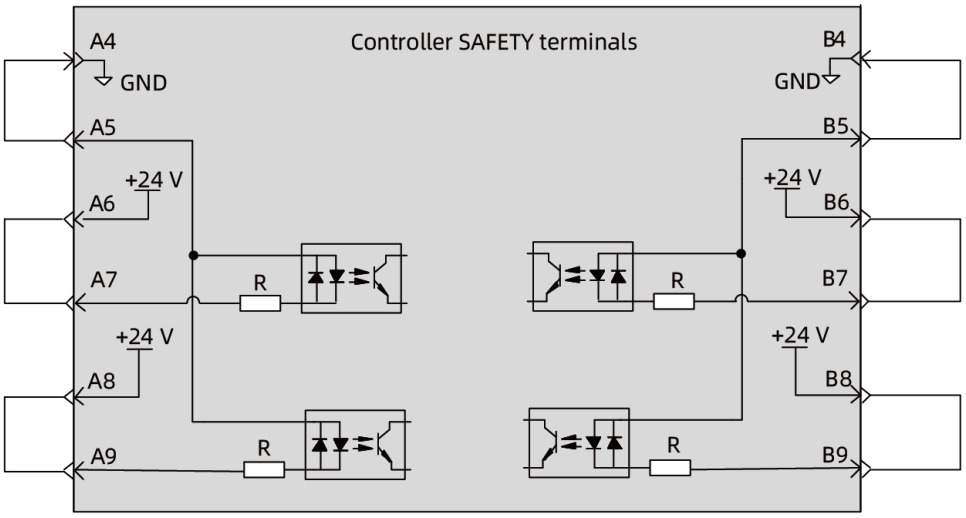
External safety door control (relay output)



- When the external safety door control uses an NPN-type drive output (recommended wiring with external 24 V power supply), the wiring is as shown below:



- The wiring for shielding the start confirmation function (factory default wiring) is as shown below:



CAUTION

If the start confirmation function is left at factory default wiring, the function will not be enabled, and the robot has no start confirmation function. Companies and individuals establishing safety-related systems must conduct a risk assessment according to relevant safety standards to ensure that the system meets the safety requirements. In addition, companies and individuals that establish safety-related systems must take full responsibility for system installation and commissioning.

5.9.3.3 Topology and Wiring for Emergency Stop, Safety Door and Start Confirmation Functions

Before wiring according to the following wiring topology for the SAFETY interface, read all the precautions in the 5.9 SAFETY Interface Wiring section.

- Topology and wiring for the SAFETY interface of IRCB501 high-protection series controller (without safety expansion card):

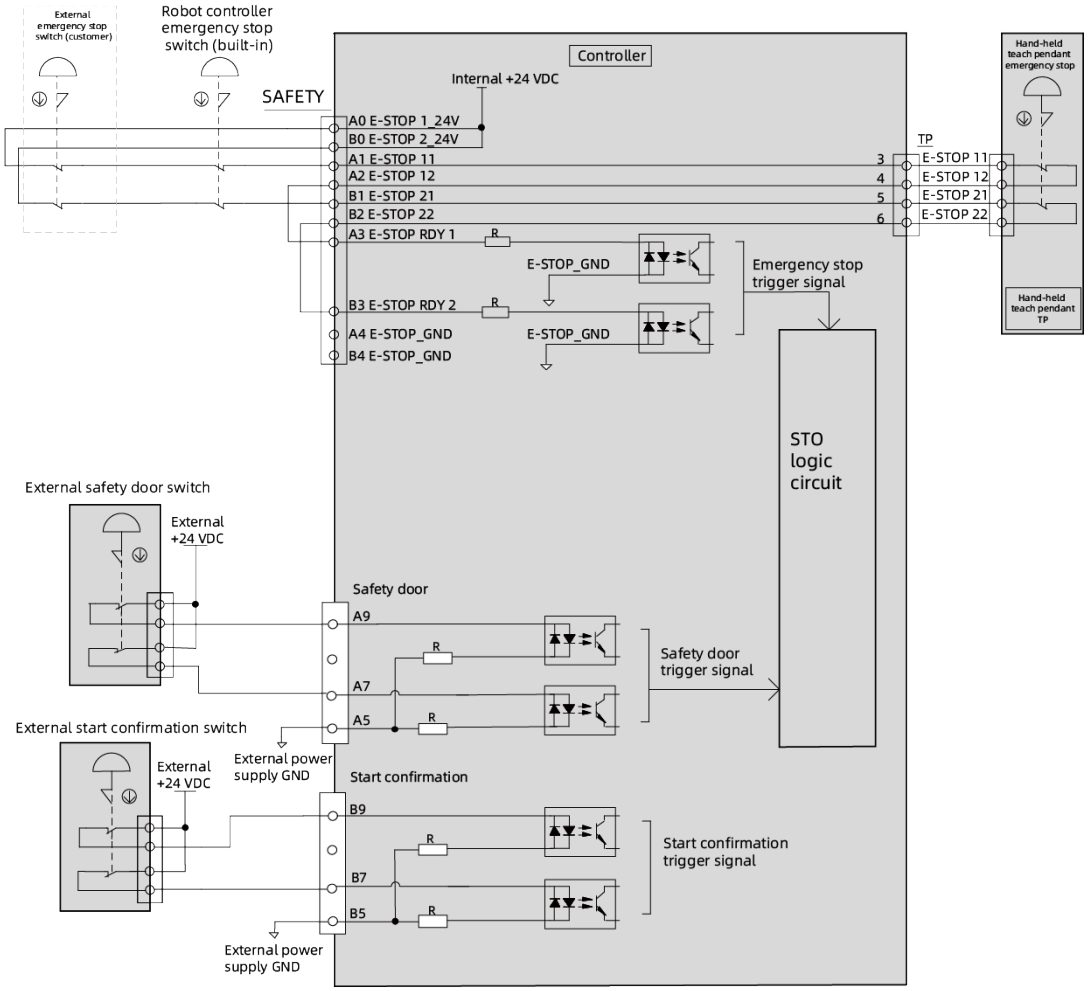


Figure 5-9-3-3-1 Topology and wiring for emergency stop, safety door and start confirmation functions

- Topology and wiring for the SAFETY interface of IRCB501 high-protection series controller (with safety expansion card):

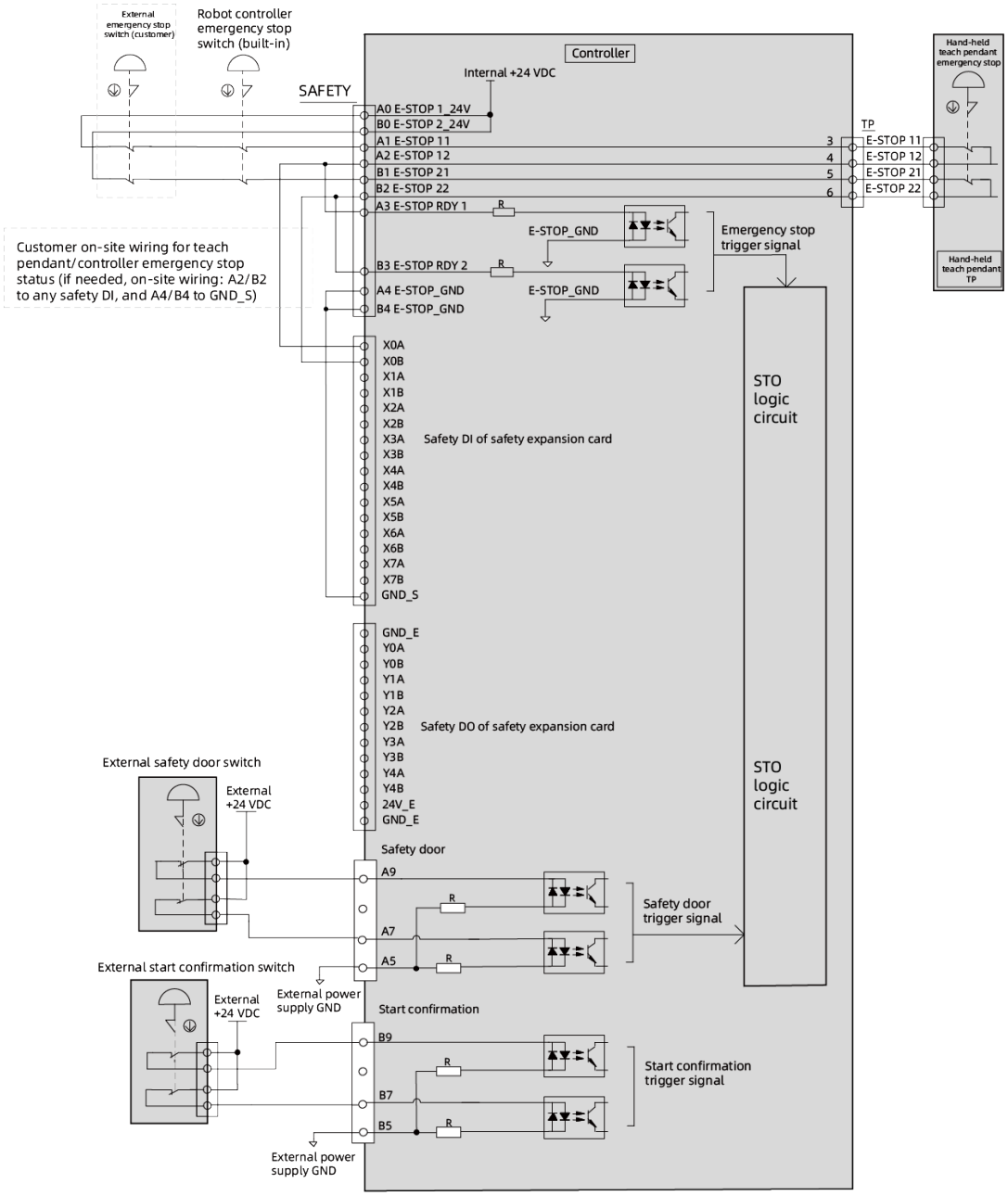
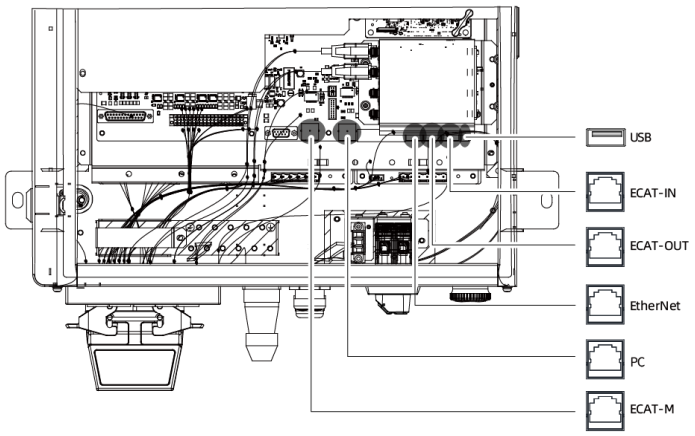


Figure 5-9-3-3-2 Topology and wiring for the emergency stop, external safety door, external start confirmation and teach pendant/controller emergency stop status output

5.10 Communication Interface Wiring Instructions

5.10.1 Communication Interface Description



Ethernet interface

This interface is used for vision system, with a rate of 100 Mbps. The specifications are described below.

No.	Definition	Description
1	TX+	Data transmission +
2	TX-	Data transmission -
3	RX+	Data reception +
4	-	-
5	-	-
6	RX-	Data reception -
7	-	-
8	-	-
Enclosure	PE	Shield

EtherCAT-M interface

ECAT(M) is the EtherCAT master communication interface for connecting external expansion axes.

Item	Specification
Communication protocol	EtherCAT protocol
Supported services	CoE (PDO, SDO)
Synchronization mode	DC - Distributed clock
Physical layer	100Base-TX
Baud rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex
Topology	Linear

Item	Specification
Transmission medium	Shielded cables of Cat 5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Max number of slaves connected	3
EtherCAT frame length	44 bytes to 1498 bytes
Process data	Max 1486 bytes per Ethernet frame

EtherCAT-IN and EtherCAT-OUT interfaces

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

When used as an intermediate node in a daisy-chain connection, EtherCAT-IN serves as the input and EtherCAT-OUT as the output. When used as the end node, only the EtherCAT-IN interface needs to be connected.

Item	Specification
Communication protocol	EtherCAT protocol
Supported services	CoE (PDO, SDO)
Synchronization mode	DC - Distributed clock
Physical layer	100Base-TX
Baud rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex
Topology	Linear
Transmission medium	Shielded cables of Cat 5e or higher
Transmission distance	Less than 100 m between two nodes (with proper environment and cables)
Synchronous jitter	< 1 μs

Network port

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

USB interface

The standard USB2.0 interface enables the connection and communication between the controller and external USB devices, for system upgrades, program loading, and more.

5.10.2 Communication Cable Description

- Cat 5e shielded twisted pair (STP) cables are recommended for the communication cables (EtherCAT-M, EtherNet, EtherCAT-IN, EtherCAT-OUT).

- In harsh EMC environments, highly flexible shielded Cat 6 cables are recommended.

> **NOTE**
>
> IR-Link uses a standard Ethernet cable for connection.

The supported S6 series cable models are described below.

S6 - L - T 04 - 3.0
① ② ③ ④ ⑤

① **Product series** S6 series	③ **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 **Product type** L: cable	④ **Connection type** 04: EtherCAT multi-device communication cable	

The cable ordering information is shown in the following table.

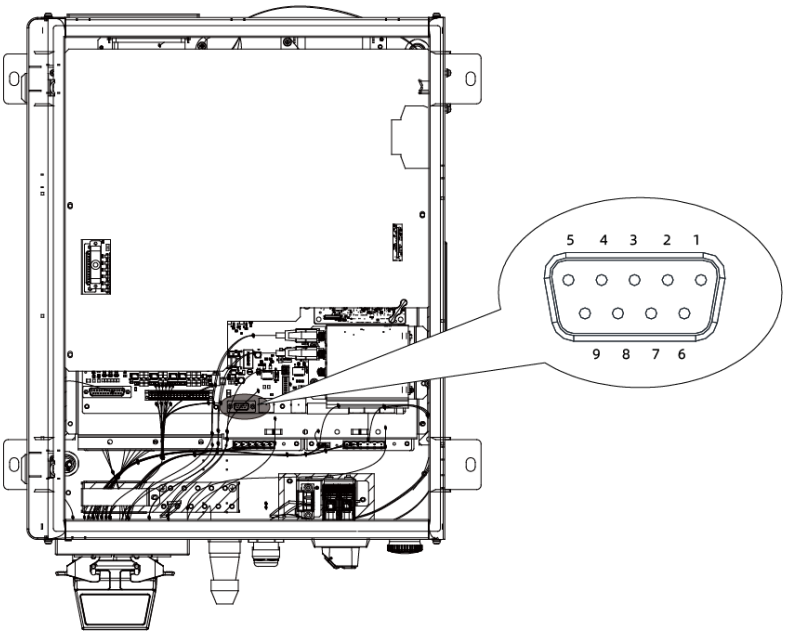
Material code	Cable model	Length (m)
15040261	S6-L-T04-0.3	0.3
15040262	S6-L-T04-3.0	3
15041960	S6-L-T04-0.2	0.2
15041961	S6-L-T04-0.5	0.5
15041962	S6-L-T04-1.0	1
15041963	S6-L-T04-2.0	2
15041964	S6-L-T04-5.0	5
15041965	S6-L-T04-10.0	10
15300377	Highly flexible Cat 6 shielded cable (recommended for harsh EMC environments)	5
15300378	Highly flexible Cat 6 shielded cable (recommended for harsh EMC environments)	3

See the following table for specifications of Cat 5e shielded twisted pair cables.

Item	Description
UL Certification	Compliance with UL
Cat 5e	Cat 5e cable
Double shield	• Braided shield (coverage: 85%) • Aluminum foil shield (coverage: 100%)
Environmental worthiness	• Operating ambient temperature: -30℃ to +60℃ • Resistant to industrial oil, corrosive acid and alkali

5.11 DB9 Interface

5.11.1 DB9 Interface Description



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

5.11.2 RS485 Wiring Method

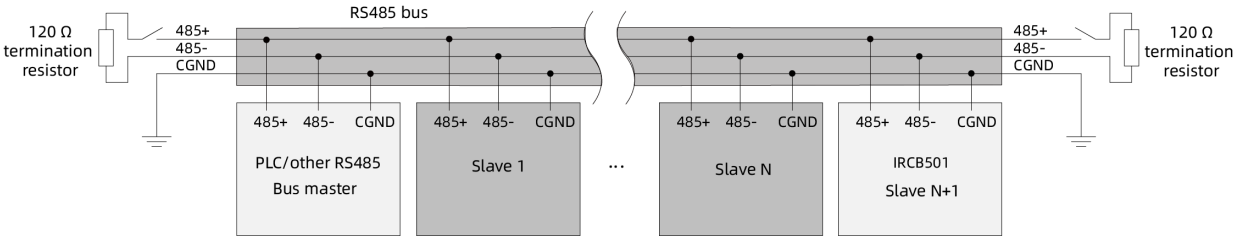
RS485 topology

The RS485 communication interface of the controller supports Modbus-RTU communication. Note that the controller can only be used as a slave.

The following figure shows the RS485 bus connection of the controller. Shielded twisted pair cables are recommended for connection).

- Use shielded twisted pair cables for the RS485 bus, and connect a 120 Ω termination resistor at both ends of the bus to prevent signal reflection.
- Connect the reference grounds of RS485 signals of all the nodes together.

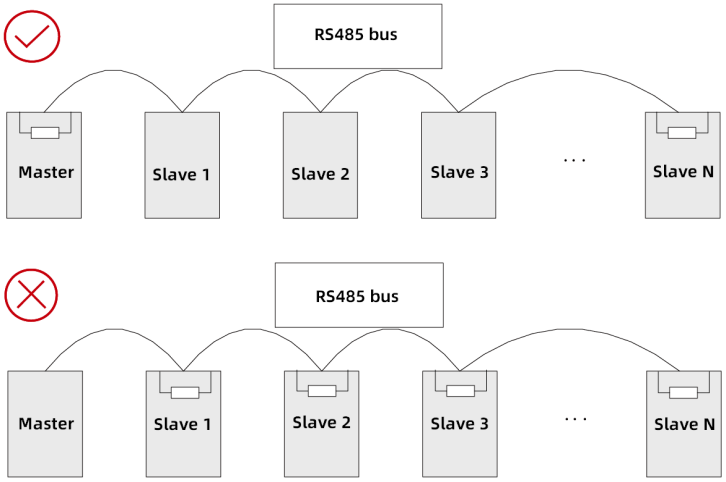
- A maximum of 128 nodes can be connected for a single bus, and the distance between two nodes must be less than 3 m.



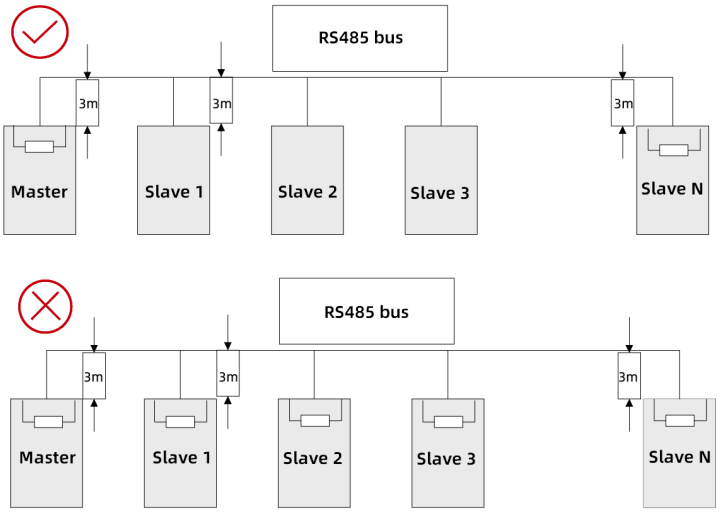
Multi-node topology

In case of a large number of nodes, connect the RS485 bus using the daisy chain mode.

- Daisy chain connection



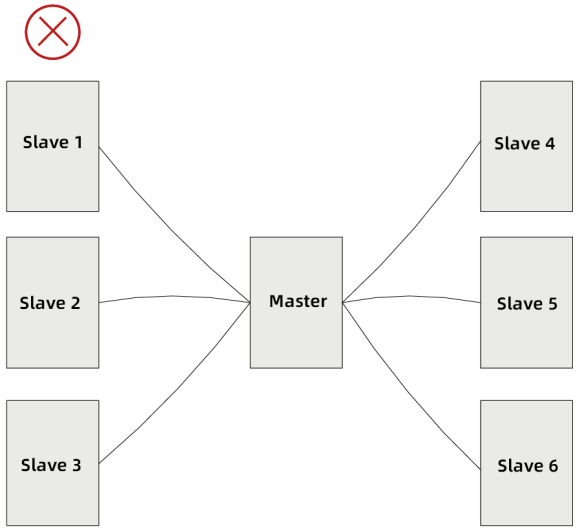
- Branch cable connection



NOTE

If branch cable connection is used, the cable length between the bus and the node must be as short as possible. The recommended branch cable length is not greater than 3 m.

- Star connection (prohibited)



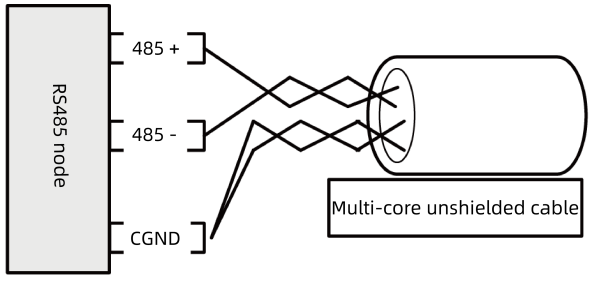
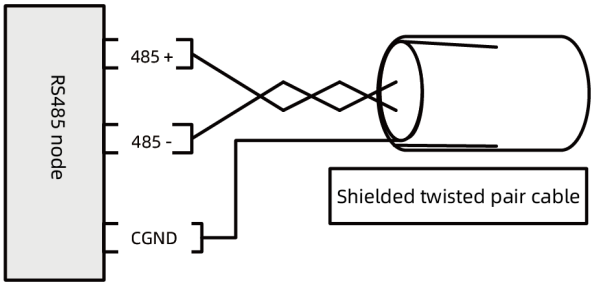
Multi-node wiring

- Terminal wiring for nodes with CGND

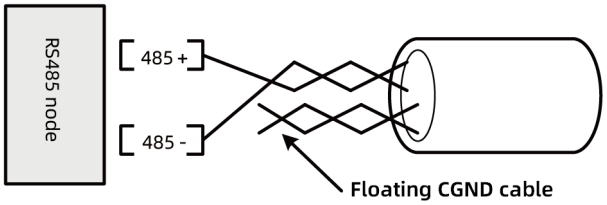
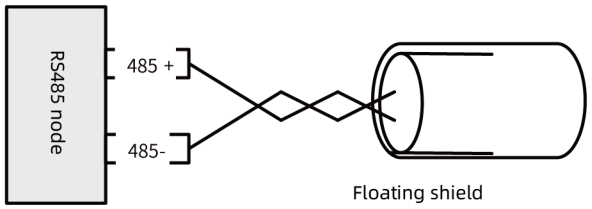
CAUTION

- Ensure that the RS485 bus contains three cables and the terminals are connected correctly.
- If shielded cables are used, the shield must be connected to the CGND terminal of one node only, at a single point. Along the entire transmission path, the shield must not be connected to any other grounding points (e.g., on-site enclosure, equipment grounding terminals, etc.).
- Considering signal attenuation, it is recommended to use AGW26 or thicker cables when the communication distance exceeds 3 m.
- It is always recommended to use twisted pair cables for the RS485+ and RS485- connections.

  - Recommended cable 1: Use multi-conductor twisted pair cables, with one twisted pair connected to RS485+ and RS485-, and others twisted together to connect CGND.
  - Recommended cable 2: Use shielded twisted pair cables, with the twisted pair connected to RS485+ and RS485-, and the shield connected to CGND.

Multi-core unshielded cable	Shielded twisted pair
	

- Terminal wiring for nodes without CGND
  For nodes without CGND, do not connect CGND cable or the shield to the PE terminal of nodes directly. Handle this issue by following the three methods.
  - Method 1: If the node has an internal reference ground shared with the RS485 circuit, directly connect the CGND cable or the shield of the bus to this pin.
  - Method 2: If the node has an independent RS485 circuit reference ground, lead it out and connect it to the CGND cable or the shield.
  - Method 3: If no suitable RS485 reference ground can be found, leave the CGND cable or the shield floating as shown in the figure below, and use an extra grounding cable to connect this node to the PE terminal of other nodes.

Multi-core unshielded cable	Shielded twisted pair
	

5.12 Expansion Card

5.12.1 Expansion Method

CAUTION

Disconnect the 220 VAC external power supply of the system before removing/installing the expansion card.

If the 220 VAC power supply is not disconnected, it may cause damage to the controller and failure of the expansion card.

Table5-12-1-1 Optional expansion cards

Ordering code	Model	Name	Software configuration
01650027	IRCB501-0016ETNDBD	IRCB501 series general I/O expansion card with 16 NPN outputs	0016
01650026	IRCB501-1600ENDBD	IRCB501 series general I/O expansion card with 16 inputs	1600
01650025	IRCB501-2ENID-BD	IRCB501 series 2-channel differential input incremental encoder expansion card	2ENC

01650028	IRCB501-2PN-BD	IRCB501 series PN expansion card	PN
01650029	IRCB501-6LDI3-BD	IRCB501 series IR-Link expansion card	Subject to the model of external expansion card
01650030	IRCB501-FS-01-BD	IRCB501 series functional safety expansion card	-
01650040	IR-EC-CCLINK	IR-EC-CCLINK expansion card	CC-Link expansion card

To install the expansion card, you need to open the top cover of the controller, as shown below.

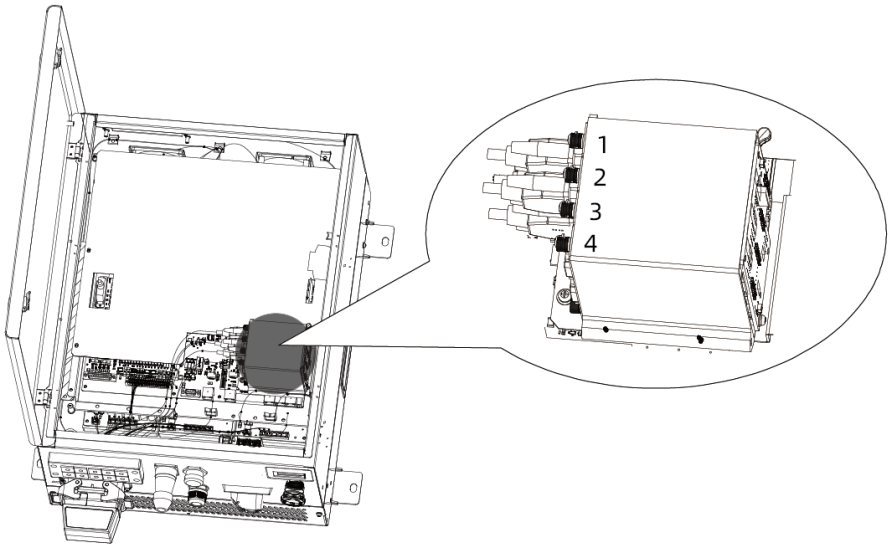
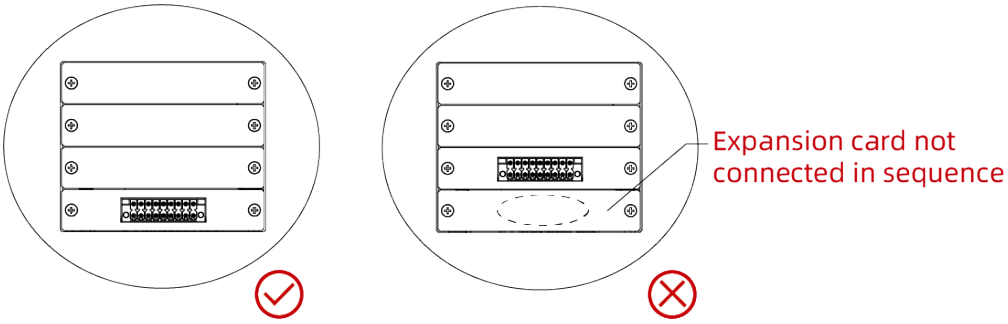


Figure 5-12-1-1 Installing Expansion Card

The controller provides four card slots each identified by a number. The expansion cards must be inserted in order, as shown below.



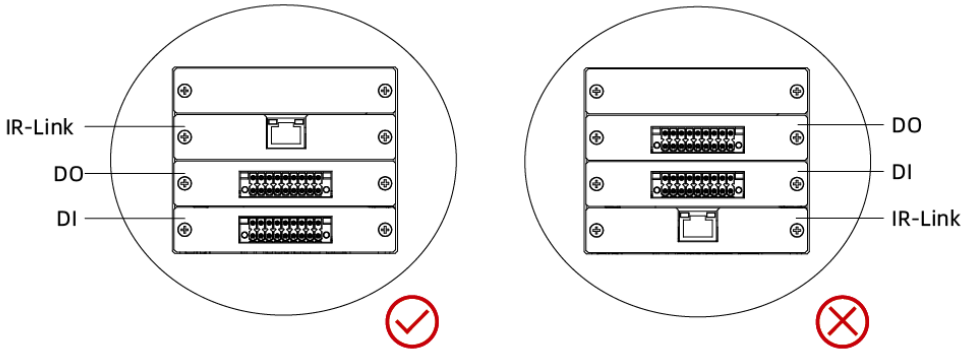
CAUTION

When installing the expansion cards, the expansion cards must be inserted sequentially according to the order of the control board, No. 1 - No. 4, otherwise it will cause the controller to alarm and fail to function properly. For the specific corresponding system alarm codes, contact Inovance technical support.

NOTE

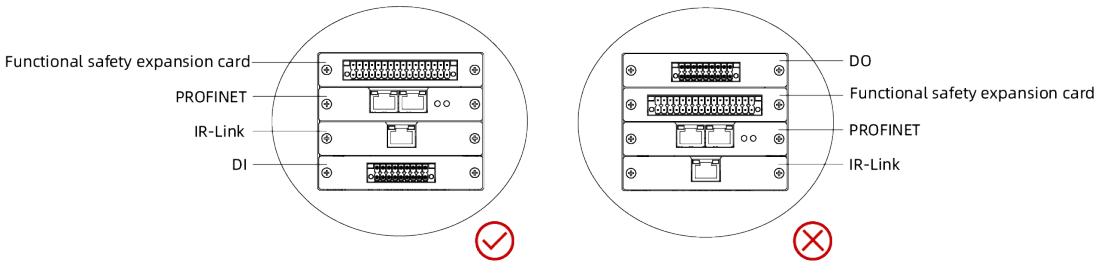
- If the slot #1 is vacant, insert the expansion card into slot #1 first.
- Card #2 can be inserted only if a card already exists in slot #1.
- Recommended card insertion priority for slots #1 to #4: DI > DO > Encoder > IR-Link > PROFINET > Functional Safety. Insert expansion cards in order according to this priority based on the currently available cards.

For example, if you need to insert a PROFINET card, a DO card, and an IR-Link card, the insertion order is: DO in slot #1, IR-Link in slot #2, and PROFINET in slot #3.



NOTE

- The IR-Link card must be inserted after the DI, DO, and encoder expansion cards. When using only the IR-Link card, it must be inserted in slot #1. Otherwise, it will not function properly.
- The CC-Link card can function properly when inserted into any expansion card slot.



CAUTION

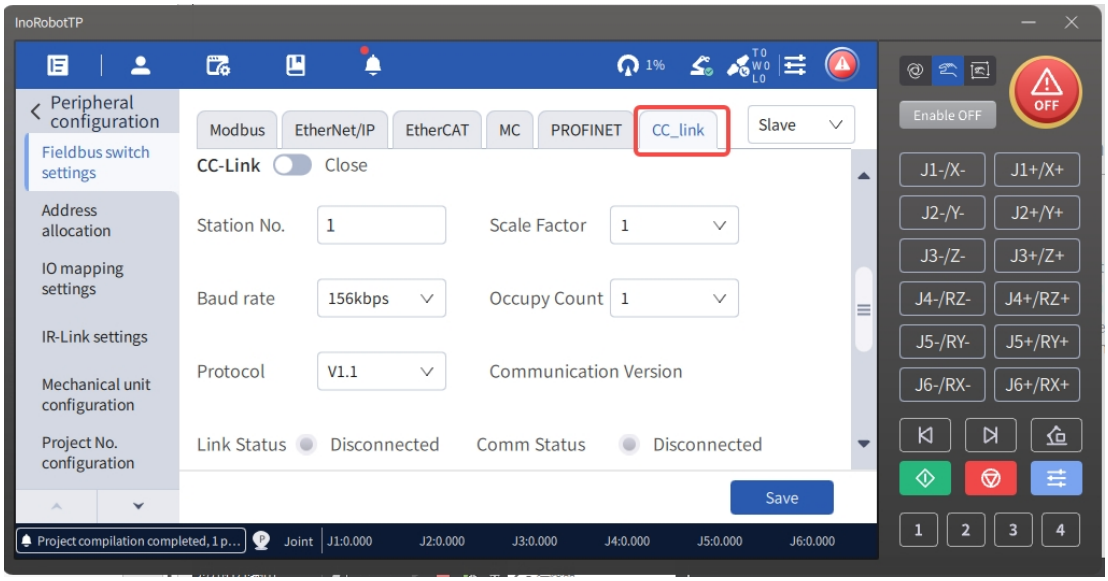
- The CC-Link card, PROFINET card and functional safety expansion card must be mounted after the DI card, DO card, encoder card, and IR-LINK card.
- When only CC-Link card, PROFINET card and functional safety expansion card are used, there is no limit on the order of slots in which they are mounted.
- Only one functional safety expansion card can be inserted per controller.

5.12.2 Expansion Configuration

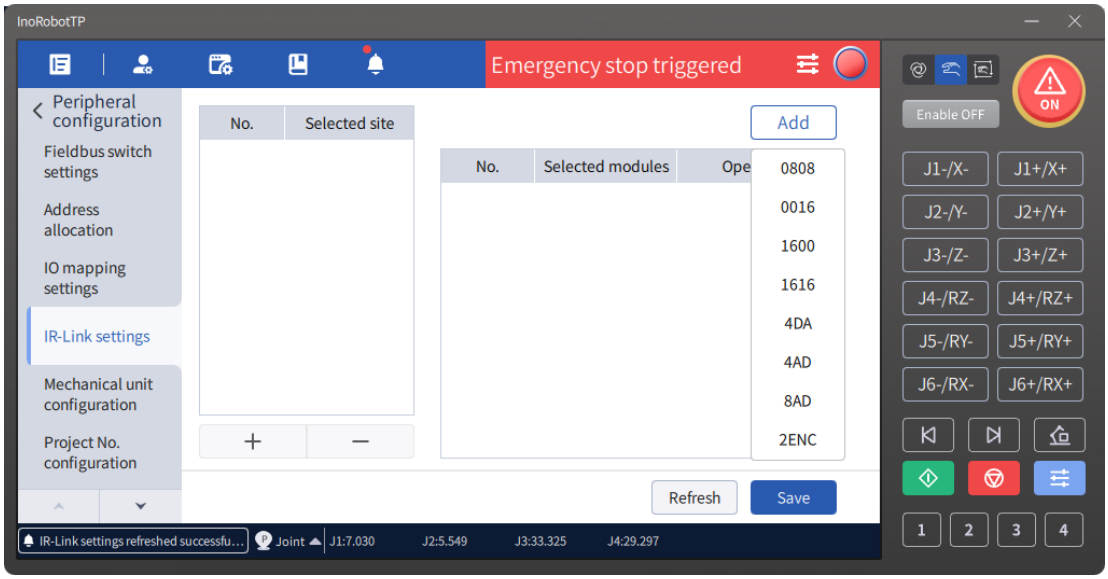
You can configure the corresponding modules in the software interface according to the actual physical configuration (which is strongly related to the corresponding configuration topology). Before configuring the expansion cards, you need to configure the adaption settings.

> **NOTE**
>
> The expansion modules are optional and will not be described in details in this guide.

1. After connecting the hardware device, you need to configure the IR-Link and CC-Link in the software.
2. Enter the InoRobotTP main interface, and click "Settings" > "More" > "Peripheral configuration" > "Fieldbus switch settings" > "CC_Link" to configure the CC_Link expansion card.

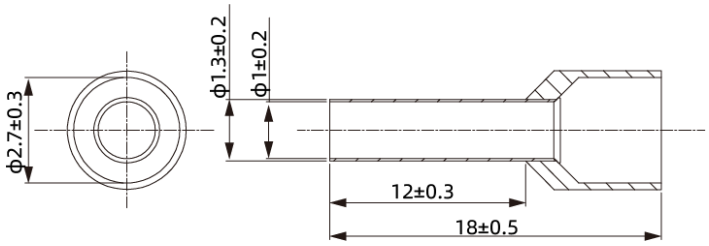


3. Enter the InoRobotTP main interface, and click "Settings" > "More" > "Peripheral configuration" > "IR-Link settings" to open the IR_Link configuration page. You can click the "Add" button in the upper right corner to pop up a selection box with options such as 0016, 1600, 2ENC, etc. Add the expansion module according to actual connections.



5.13 Instructions on Making Signal Cable

The wire-end ferrule is shown below.



Outline dimensions (unit: mm)

Item	Specifications
Applicable cable diameter	0.50 mm²
Color	Orange, white
Material	Copper tube/nylon
Surface treatment	Tin plating
Current carrying capacity	Max. 19 A

The recommended crimping tool is shown below:



Cable preparing procedures:

1. Strip the wire insulation by 12 mm.
2. Pass the cable through the cable marker.
3. Insert the exposed conductor into the terminal block, and then crimp it with recommended crimping tool.
4. Insert the wire-end ferrule into the corresponding position of the I/O terminal block, and pull back to ensure that the wire-end ferrule is locked with the internal spring of the terminal block.

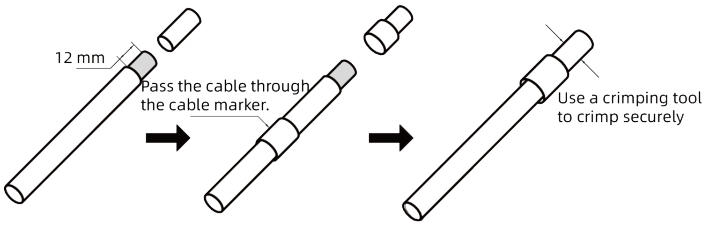
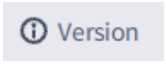
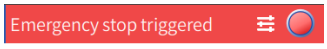
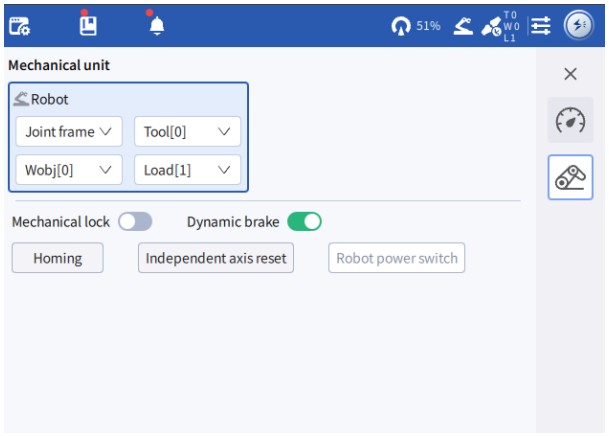
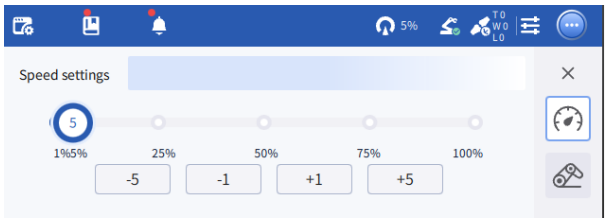


Figure 5-13-2 Making cable

5.14 Test Run

Table5-14-1 Test run procedure for IR-TP200 series teach pendant

No.	Step	Sub-step
1	Installation check	a. Check that both robot and controller are firmly installed. b. Check that the power cable and signal cable are properly connected between robot and controller. c. Check that the teach pendent is properly connected to the controller. d: Check that the SAFETY terminals are properly connected. e: Check that the power supply of the controller is properly connected and the connections are effectively protected.
2	Power-on	a. Check that the power supply voltage is within the required range. b. Turn on the power supply. c. The teach pendant is started, enters the connection interface, and then the main interface when the connection is successful. d. Check the status light and the message bar at the bottom of the interface of the teach pendant to confirm whether there is an alarm.
3	Robot model confirmation	a. Check that the robot model set on the controller is consistent with the actual connected robot model. b. On the teach pendant, press  and check whether the controller version is the same with the teach pendant version. If not, contact Inovance for technical support. c. Check that the emergency stop button works normally. Make sure the robot is at a standstill, and then press the emergency stop button. Confirm that the button stays depressed and that a red highlighted block  appears on the right side of the top toolbar on the teach pendant interface, indicating that the button works properly. Then, 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 adjusting the speed to be smaller than 25% in the control panel. Then, click the "Homing" button. Observe whether the robot zeros normally. If not, contact Inovance for technical support. 
4	Programming	a. Create a program file. b. Create coordinate data as needed. c. Create program as needed.

No.	Step	Sub-step
5	Test run	a. In the manual mode, verify that all coordinates can be reached. b. Enter the control panel and adjust the global speed to 5%.  C. Press the start button  to run the commands line by line and observe whether the robot acts correctly.
6	Formal run	a. On the teach pendant, press  to switch the robot from manual mode to auto mode. b. Adjust the speed to 5% in the control panel. Then press  to run the program. c. Gradually increase the global speed by 10%, such as 15%, 25%, 35% and so on, and check that the robot operates normally.



For PC-based virtual teach pendant, if it cannot connect to the controller, click the "Skip" button, go to the "Settings" > "System settings" > "Communication settings", enter the controller IP address (192.168.23.25), and then try again.

6 Faults Diagnosis and Troubleshooting

6.1 LED Display

There is a five-digit LED display on the operating panel. It displays the control status and fault codes. See the table below for details.

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 controller is started:

LED display	Controller status	Stage	Meaning
888	-	Controller system initialization	System hardware initialization status. If the display is not normal, please contact the manufacturer or consult the customer service.
8888	Last digit OFF	Controller system initialization	System boot. If the display is not normal, please contact the manufacturer or consult the customer service.

LED display	Controller status	Stage	Meaning
88888	Last digit ON	Controller system initialization	Loading the FPGA firmware. If the display is not normal, please contact the manufacturer or consult the customer service.
TEST	-	Controller system initialization	Board testing software of tooling (supports normal flashing function via 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	Network configuration, with status displayed
IMC	-	Operating system initialization	Loading the driver module and DSP firmware. Displays status and reports error if loading failed.
CPARA	-	Operating system initialization	System parameter initialization completed
CCOM	-	Operating system initialization	Communication with teach pendant is established
CFW	-	Operating system initialization	Robot firmware initialization completed
CECAT	-	Operating system initialization	EtherCAT initialization completed
CRLNK	-	Operating system initialization	IR-Link initialization completed
CTASK	-	Operating system initialization	Robot task established
CROB	-	Operating system initialization	Robot start completed

LED display after the controller is started, depending on controller status

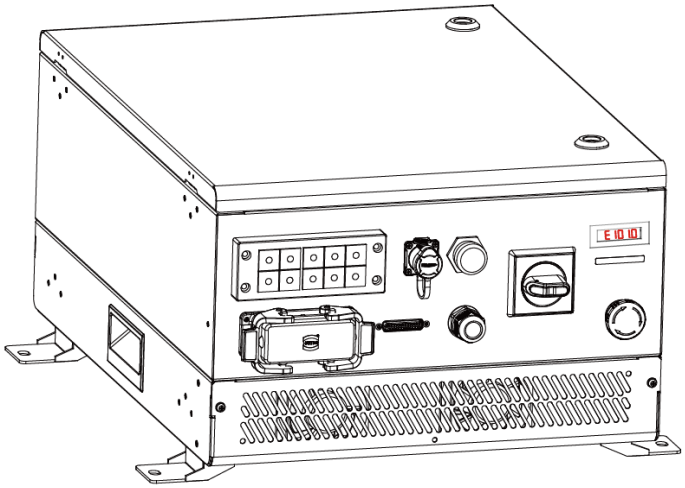
LED display	Controller status	Stage	Meaning
T-A-0	-	Control-Mode-Action	Teach pendant control - Auto mode - Stop status
T-A-1	-	Control-Mode-Action	Teach pendant control - Auto mode - Running status
T-A-2	-	Control-Mode-Action	Teach pendant control - Auto mode - Pause status
O-A-0	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Stop status

LED display	Controller status	Stage	Meaning
O-A-1	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Running status
O-A-2	-	Control-Mode-Action	Non-teach pendant control - Auto mode - Pause status
T-H-0	-	Control-Mode-Action	Teach pendant control - Manual mode - Stop status
T-H-1	-	Control-Mode-Action	Teach pendant control - Manual mode - Running status
T-H-2	-	Control-Mode-Action	Teach pendant control - Manual mode - Pause status
O-H-0	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Stop status
O-H-1	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Running status
O-H-2	-	Control-Mode-Action	Non-teach pendant control - Manual mode - Pause status
-USB-	Flashing	I/O read and write status	The controller is saving data to the USB drive.
USB-S	Display for at least 2 seconds	I/O read and write status	Data successfully saved to the USB drive.
-SD-	Flashing	I/O read and write status	The controller is saving data to the SD card.
-SD-S	-	I/O read and write status	Data successfully saved to the SD card.
-SPI-	Flashing	I/O read and write status	The controller is saving data to the SPI FLASH.
SPI-S	Display for at least 2 seconds	I/O read and write status	Data successfully saved to the SPI FLASH.
EXXXX	Flashing	System running	Controller fault
XEXXX	Flashing	System running	Servo fault
-E-P-	Flashing	System running	System emergency stop
-5-0-	Flashing	System running	Safety door open
READY	Flashing	System running	System ready
BURN	-	-	System firmware upgrade

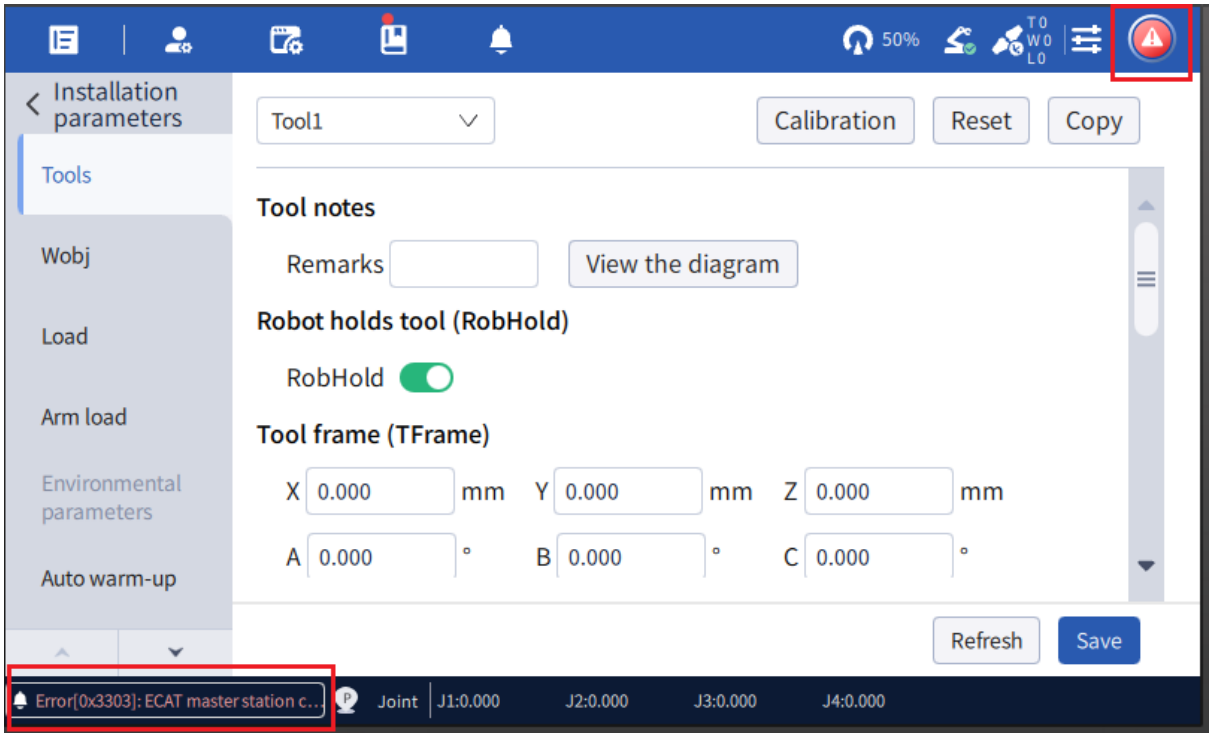
6.2 Robot Alarms

If an alarm occurs during the playback mode, the robot immediately stops.

- The alarm info are displayed on the LED display of the operating panel, as shown below.



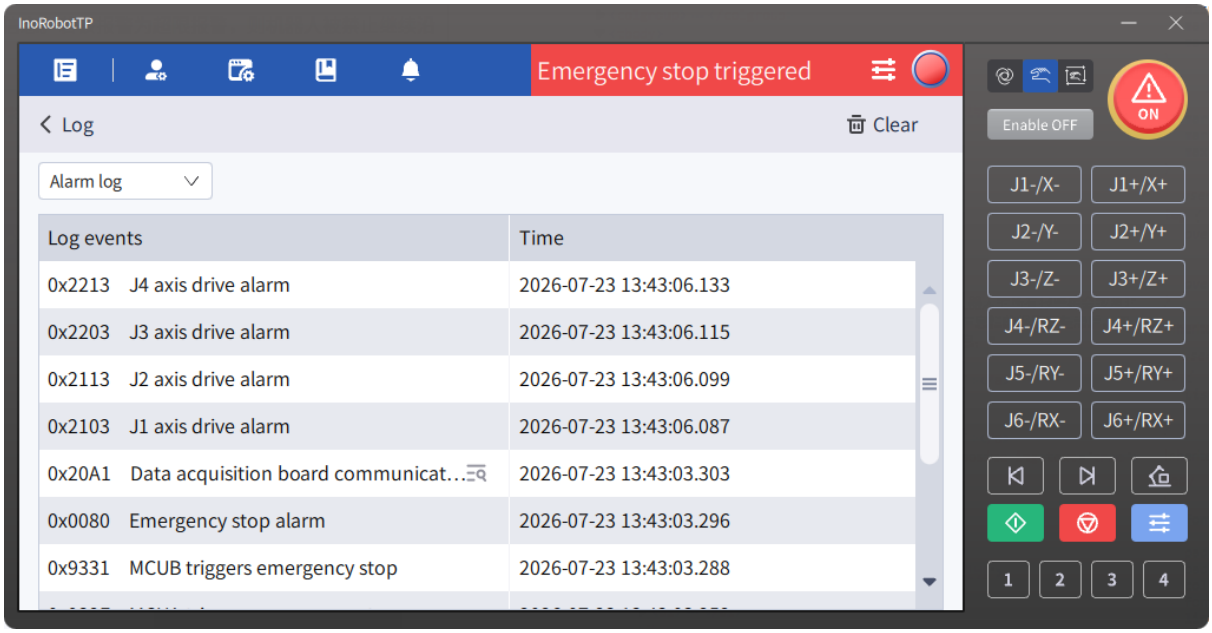
- An alarm icon appears in the upper right corner of the screen of the teach pendant. At the same time, the message bar at the bottom of the screen will display the alarm ID and alarm info, as shown in the figure below.



NOTE

- If there are multiple alarm messages, the message bar displays the last message.
- If an alarm occurs during the teach mode, the robot immediately stops. The message bar will display the alarm information similar to that during the playback mode. If an over limit alarm occurs in a certain direction in the teach mode, the robot cannot be taught further in that direction, but is allowed to move in the opposite direction. When the robot leaves the limit position, the alarm automatically disappears.

- On the monitoring interface, you can view the logs, as shown in the figure below. All robot alarms are arranged in chronological order. Sometimes the alarm information displayed on the log page lags behind the alarm in the message bar. You can also refresh the current alarm information by re-entering the log page or switching the tabs.



NOTE

- When the robot has an alarm that can be cleared, you can clear the current alarm by clicking the alarm icon.
- If the robot encounters a hardware or software error, such as a servo error, EtherCAT configuration error, underlying driver error, etc., the alarm in the message bar cannot be cleared. In this case, check the hardware connections, and power cycle the robot. If the alarm persists, contact Inovance for technical support.

6.3 Common Faults and Solutions

No.	Fault	Solution
1	At power-on, the LED display on the front panel does not light up.	1. Check that the power supply is connected correctly. Connect the L/N/PE cables according to the marks. 2. Check that the molded case circuit breaker switch is toggled ON.
2	Communication with PC through Ethernet port on the front panel failed.	1. Observe the two indicators on the Ethernet port. The hardware communication is normal only when the indicators are on or flashing. 2. The Ethernet signal line in the teach pendant aviation connector is mutually exclusive with the PC Ethernet port. To use the PC Ethernet port, unplug the aviation plug of the teach pendant. 3. Check that the IP addresses are set correctly.
3	The front panel output I/O is not functioning.	1. Check that 24_E/GND_E is connected to a 24 V power supply and is powered by a single power supply. 2. Check that the total continuous output current of a single I/O does not exceed 1.2 A; check that the total continuous output current of the 16 I/Os does not exceed 1.2 A when using the power supply inside the controller. 3. Check that the wiring is correct when driving relay or optocoupler load.
4	The front panel input I/O is not functioning.	1. Check that it is powered by a single power supply. 2. Check that the input voltage value at the X* is valid. When S0/S1 is connected to 24V and X* is connected to 0V, the input signal is active; when S0/S1 is connected to 0V and X* is connected to 24V, the input signal is active.
5	Emergency stop alarm	1. Check that the wiring of the safety terminals is correct. For details, see 5.9.2 I/O Specifications. 2. Check whether the series emergency stop switch is open or faulty, and ensure it is set to the closed position.
6	IR-Link configuration error (The inserted expansion card cannot be recognized.)	1. Check that the protective tape on the gold finger of the expansion card has been removed. 2. Check that the expansion card is fixed in the slot. 3. Check that the expansion card is inserted correctly according to the sequence. For details, see 5.12.1 Expansion Method. 4. Check that the software has been configured correctly for the module. For details, see Expansion Configuration. 5. Replace the expansion card.

6.4 Servo Troubleshooting

This section describes alarms except for the general servo alarms. For the general servo alarms, see the "Troubleshooting" section of the "SV660N Series Servo User Guide" (data code: PS00005512).

E124.7: Cooling fan stall

Cause: The system has detected a fan stall feedback signal.

Cause	Troubleshooting method	Solution
The fan detection terminal is loose.	Check whether the DI terminal of servo is loose.	If loose, tighten the terminal.
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.
Poor contact of fan	Observe whether the fan connection terminals are fastened.	Unplug and plug the fan connection terminals.
The fan is damaged.	Observe whether the fan and its circuit are burnt.	Replace the fan.

E203.0: Controller protection

Cause: The fault was actively triggered by the controller.

Cause	Troubleshooting method	Solution
The fault was actively triggered by the controller.	Check whether the fault was actively triggered by the controller.	The controller triggers a fault shutdown to protect the controller and robot. Simply clear the alarm.

E420.3: Main circuit de-energized

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

Cause	Troubleshooting method	Solution
The power detection signal terminal is loose.	Check whether the DI terminal of servo is loose.	If loose, tighten the terminal.
The power supply of the main circuit is unstable or power failure occurs.	Check the input power supply specifications and measure whether the input voltage on the controller side (L/N) is within the following range: Value range: 340 V to 440 V	Replace or adjust the power supply according to the specifications.
The controller is faulty.	Check if the external input power supply is normal and meets the specifications.	Unplug and plug the core board. If the problem persists, replace the controller.

EB00.0: Excessive position deviation

Cause: 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 method	Solution
The motor is stalled due to mechanical factors.	Read the servo's black box data including the position instruction, position feedback, speed instruction, and torque instruction. The position instruction is not zero but the position feedback is always zero, and the torque instruction increases continuously to the maximum value.	Eliminate possible mechanical blocking factors.
Excessive friction force	1. Check whether the robot is immediately put into operation in a cold state and whether it undergoes warmup. 2. Check whether the reducer or grease is abnormal. 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.
Low servo gain	Check the position loop gain and speed loop gain of the servo: H0800-H0802.	Refer to the robot's factory servo settings.
The value of H1440 and H1441 is too small under current operating conditions.	Check whether the value of H1440 and H1441 is too small.	Set H1440 and H1441 according to factory settings.
Position reference increment excessively high	Check whether the electronic gear ratio is 8:1.	Set the electronic gear ratio correctly.
Encoder initial phase error	In the enabled state, the average load rate H0B12 is too high.	Replace the motor.
The controller is faulty.	Read the servo's black box data including the position instruction, position feedback, speed instruction, and torque instruction. The position instruction is not zero but the position feedback is always zero, and the torque instruction is 0.	Contact Inovance for technical support.

EB01.6: Position reference beyond the limit

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

Cause	Troubleshooting method	Solution
The acceleration in position reference exceeds the set value of H14-60.	Read the servo's black box data including the position instruction and real time absolute target position.	Contact Inovance for technical support.

EC00.1 Excessive speed deviation

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

Cause	Troubleshooting method	Solution
The motor is stalled due to mechanical factors.	Read the servo's black box data including the speed instruction, speed feedback, torque instruction, and torque feedback. The speed instruction is not zero but the speed feedback is always zero, and the torque instruction increases continuously to the maximum value.	Eliminate possible mechanical blocking factors.
Collision or mechanical jamming occurs during movement	1. Check whether interference exists in the robot's motion trajectory. 2. Check whether the robot model is correct.	Handle according to the troubleshooting results
Excessive friction force	1. Check whether the robot is immediately put into operation in a cold state and whether it undergoes warmup. 2. Check whether the reducer or grease is abnormal. 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.
Low servo gain	Check the servo speed loop gain: H0800 to H0801	Refer to the robot's factory servo settings.
The value of H1438 is too low for current operating conditions.	Check whether the value of speed deviation H1438 is too small.	Set H1438 according to factory settings.
Encoder initial phase error	In the enabled state, the average load rate H0B12 is too high.	Replace the motor.
The controller is faulty.	Read the servo's black box data including the speed instruction, speed feedback, torque instruction, and torque feedback. The speed instruction is not zero but the position feedback is always zero, and the torque instruction is 0.	Contact Inovance for technical support.

EC01.0: Too large motor current deviation

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

Cause	Troubleshooting method	Solution
Servo parameter mismatch	Observe whether the motor has obvious vibration or howling.	1. Check whether the setting of the load moment of inertia ratio (H0815) is reasonable through the inertia auto-tuning function. 2. Increase the filtering time constant (H0705) in torque instruction to filter out high-frequency signals. Ensure the cut-off frequency of the torque reference low-pass filter is 4 times higher than the maximum follow-up frequency of the speed loop, that is, 1000/2/π/H0705 ≥ (H0800 x 4). 3. Notch filter: Capture the torque instruction and current feedback waveform during howling using a trigger oscilloscope, and calculate the resonance frequency by FFT function of waveform analyzer, and then set H0912 to the calculated frequency, H0913=5, H0914=2. 4. Reduce the servo gain parameter according to the principle of H0802=H0800 x 1.5 and H0801=1500/H0800. First, 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 speaking, the gain parameter is not less than 60% of the factory value.
Power output disconnection	1. Check whether the alarm is triggered on every running 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 servo's black box data and the current feedback is obviously smaller than the current reference.	1. Reconnect the power cable. 2. Replace or repair the cable. 3. If the black box data does not match the troubleshooting method, please provide data feedback to Inovance.
Poor contact of inverter board	Check whether inverter board is in poor contact.	Reinstall and fix the inverter board

Cause	Troubleshooting method	Solution
Voltage saturation	Check whether the robot runs normally at low speed, but alarms when running at high speed.	1. Check whether the value of H07-26 is 1. If not, import the servo parameters. 2. If the alarm persists when H07-26 is 1, contact Inovance for technical support.
Inverter board damaged	If the inverter boards in the controller have the same power rating, cross-verify them. If an identical model is available on site, perform a cross-verification between the controller and the robot body to locate the source of the problem. Otherwise, replace the inverter board for verification.	Replace the inverter board or the controller.

NOTE

This section summarizes only some typical servo fault alarm codes. For abnormal situations not covered, contact Inovance for technical support.

6.5 Safety Function Troubleshooting

For the types of safety function faults that may occur during product use and the corresponding troubleshooting methods, see the "Safety Function Troubleshooting" section in the "INT Version Small and Medium Payload Industrial Robots Functional Safety Guide".

7 Inspection and Maintenance

7.1 Maintenance Precautions

Before maintenance, be sure to read this guide and other related guides carefully to fully understand the safety maintenance procedures.

Maintenance work on the robot system must be performed by personnel who have been properly trained and qualified in safety.

Safety-trained and qualified personnel refer to those who have completed and passed safety training that complies with the applicable national laws and regulations, and is intended for workers engaged in industrial robot-related tasks. This training typically covers knowledge of industrial robots, operation and teaching methods, inspection and maintenance procedures, and relevant safety regulations.



- Maintenance work must be performed by personnel who have been properly trained and qualified in safety. Before maintenance, be sure to read and understand the "Safety Precautions" in the guide. Operating without understanding the safety precautions may result in severe personal injury.
- Do not remove or work on any parts not covered in this guide. Follow the maintenance procedure strictly as described in this guide. Improper operation may not only cause improper function of the robot system but also serious safety problems.
- It is strictly prohibited to enter the robot's motion area while the power is ON. Even if the robot appears stationary, it may suddenly move and cause severe injury.
- Check the motion of the robot after components replacement outside the safety fence. Failure to comply may cause severe injury due to unexpected movement of the robot.
- Before operating the robot system, make sure that both the emergency stop switch and safeguard switch function properly. If the safety switches fail, protective functions will not activate in emergencies, which may result in severe injury.
- Only local control modes that have passed safety assessment are allowed. All other control modes and remote control access channels are prohibited.

WARNING

- Open the cover of the controller only when maintenance is needed. High-voltage live parts are present inside the controller, and there is a risk of electric shock even when the power is off.
- Before performing maintenance, turn off the power to the controller and related equipments, and unplug the power plug. Failure to comply may result in electric shock or equipment malfunction.
- Do not install or remove the motor connector while the power is on. Failure to comply may cause abnormal action of the robot and serious danger.
- Ensure the power is locked by unplugging the power plug. Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.
- For tasks such as inspection and maintenance that must be performed with the power on, two persons are required to work together. One person must be positioned where the emergency stop button can be pressed at any time. The other person must work within the robot's motion range, remain highly alert, and complete the work quickly. The safe evacuation path must be confirmed in advance before starting the work.
- Maintenance personnel must keep the robot key properly. Unauthorized personnel are strictly prohibited from accessing the robot software system in manual mode, and from viewing or modifying programs and parameters.

CAUTION

If the robot has been stored for more than six months without use, a gradual power-up is required before re-energizing to reactivate the electrolytic capacitors. Otherwise, there is a risk of equipment damage.

7.2 Routine Inspection

The ambient temperature, humidity, dust, and vibration will age the equipment and thereby reduces its service life. Therefore, it is necessary to carry out routine and regular maintenance. More frequent inspections are required if the drive is used in environments subject to the following conditions:

■ High ambient temperature
■ Frequent start/stop
■ AC power supply or load fluctuation
■ Strong vibration or impact
■ Dust and hydrochloric acid

Check the following items daily to ensure a proper operation of the device. It is recommended to make a copy of this checklist and sign the "Checked" column after each inspection.

Inspection item	Description	Solution	Checked
Installation environment	Check that the controller and cables are normal.	Check the mounting bracket for vibration. Check whether terminals become loose or get corroded.	☐

Inspection item	Description	Solution	Checked
Input voltage	Input power supply voltage	Check whether the input voltage is within the allowed range. Check whether a heavy load is being started around the equipment.	☐
Terminal	Controller connection terminals	Check that the screws on both sides of the input, output, and SAFETY terminals are tight.	☐

7.3 Regular Inspection

Regularly inspect the areas that are difficult to check during operation. Always keep the controller clean. Effectively remove dust, especially metal dust, from the product surface to prevent it from entering the product.

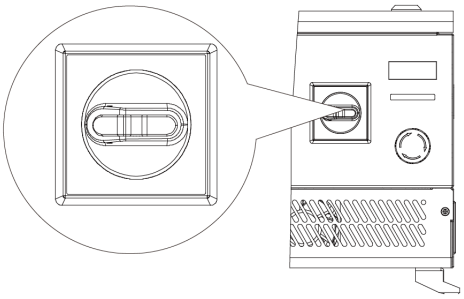
Inspection item	Description	Solution	Monthly inspection
Cable	Check power cables and connections for discoloration. Check whether the insulation layer is aged or cracked.	Replace the cracked cable. Replace the damaged terminals.	☐
Air duct	Check whether the air filter and heatsink are clogged. Check whether the fan is damaged.	Clean the air filter. Replace the fan.	☐

7.4 Power Switch Lockout



- During de-energized maintenance, ensure the controller power switch is in the OFF position and will not be mistakenly turned on. Failure to do so may cause danger.
- Turn the controller power switch to the OFF position. The locking mechanism on the rotary handle will then pop up, allowing a padlock to be attached to lock the switch in the OFF position.

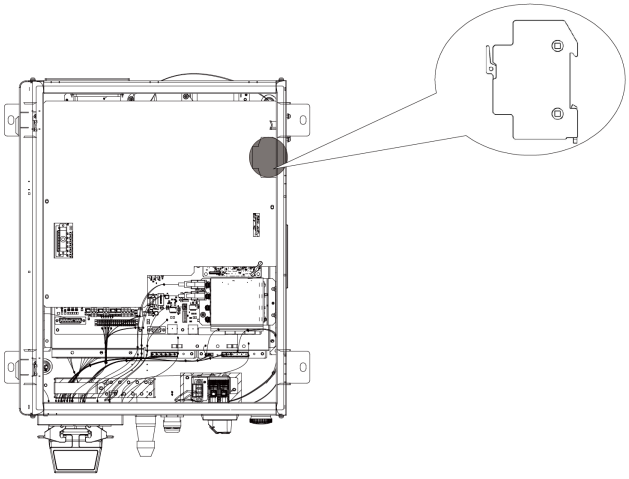
When the equipment inside the safety fence is operating normally or during de-energized maintenance, be sure to turn the controller power switch knob to the OFF position, and lock the switch by attaching the padlock to the popped up padlock locking mechanism. It ensures that the power will not be turned on mistakenly during work, as shown in the figure below.



7.5 Fuse Replacement and Specification Recommendations

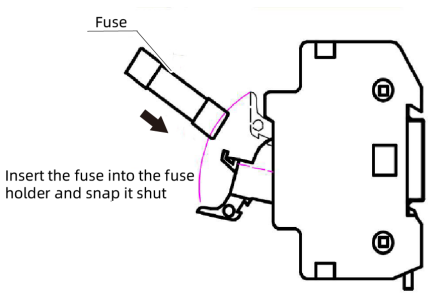
Replacing the fuse

The internal input power supply circuitry of the controller compatible with the IR-TP200 teach pendant differs from that of the controller compatible with the IRTP80 teach pendant.
The switch on the controller has been changed to a rotary isolating switch, which does not have breaking capacity. Therefore, a fuse is connected in series in the power supply input circuit to ensure the power supply can be cut off in time under extreme conditions such as a downstream short circuit. The fuse is installed in a fuse base on the inner side wall of the controller.



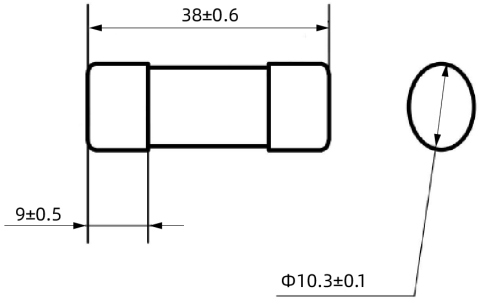
Steps:

1. To replace the fuse, make sure that the power switch of the controller is in the "OFF" position and is locked.
2. Unsnap the fuse base inside the controller, remove the fuse to be replaced, and then insert a qualified fuse that meets the recommended specifications into the fuse base and snap it tightly.
3. Remove the padlock, power on the controller, and check whether the power circuit has returned to normal. If the controller does not recover, contact Inovance technical support promptly.



Recommended fuse specifications

- Rated voltage: 690 VAC
- Rated current: 32 A
- Dimensions: Φ10 mm x 38 mm cylindrical cap fuse

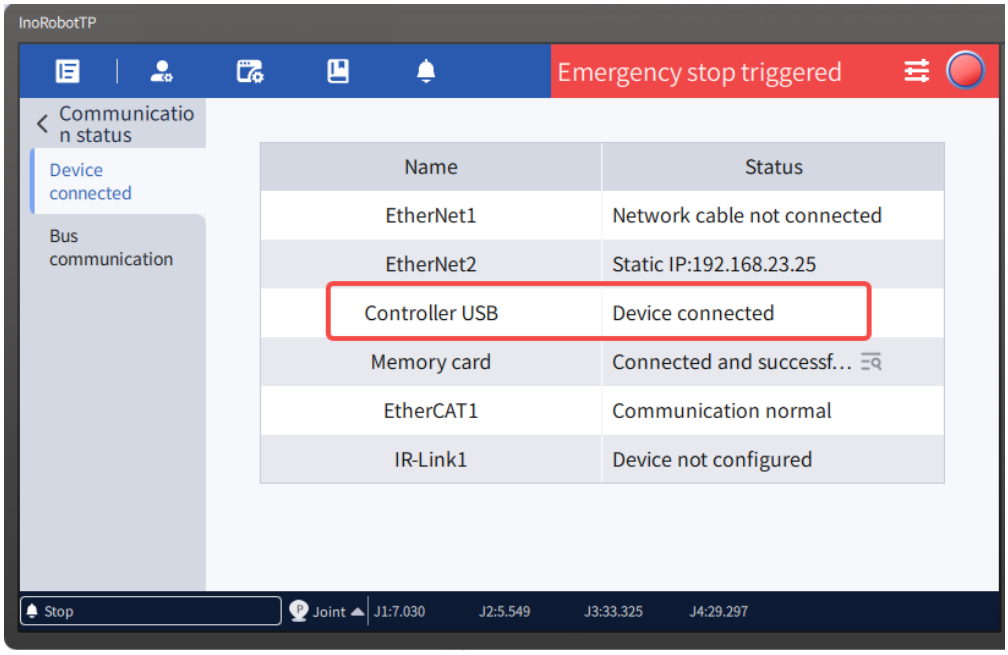


7.6 File Backup and Recovery

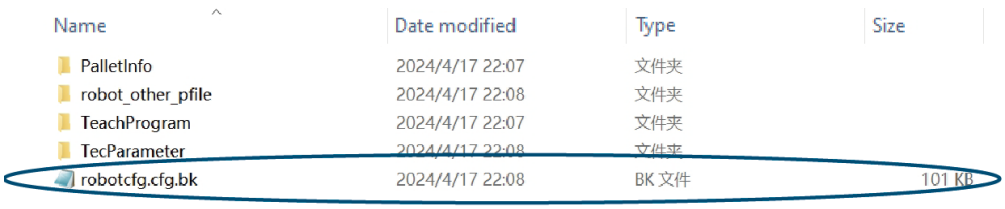
The robot system provides file backup and loading functions. The file includes configuration files and program files, both of which are backed up and loaded through a USB drive (recommended to use branded USB drives).

Configuration file backup and loading

- Configuration file backup
  This process allows you to back up the robot configuration files (including various parameter files for robot settings, zero point settings, frames, motion range, and motion characteristics) in the memory card of the controller into a USB drive. The steps are as follows:
  1. Insert a USB drive into the controller and check the connection status. If the monitored communication status in the teaching software displays "The USB controller has been inserted into the device and successfully mounted", it indicates that communication is normal. Otherwise, check the connection. Keep the USB drive in good communication during operation.



  2. Click the backup button and confirm. The system backs up the program automatically and exits when the loading is complete.
     After the backup is complete, a new file named "robotcfg.cfg.bk" will appear in the root directory of the USB drive, which is the backup configuration file.



NOTE

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

1. PLC program [plcfiles]
2. Network configuration, operation logs [systemConf]
3. Robot model and controller model information [initConf]
4. Robot settings, peripheral configuration, motion parameters, zero point settings, etc. in controller parameter configuration [RobotParams, RobotParamsDefault]
5. Process data files (vision calibration and conveyor tracking process)
6. Mechanical unit configuration parameters
7. Tool, work object, and load parameters
8. B/R/D Variable

- Configuration file loading
  You can load the configuration from the USB drive into the memory card of the robot controller. Do as follows:
  1. Insert the USB drive into the controller and check the USB connection status in the monitoring interface. Keep the USB drive in good communication during operation.
  2. Click the load button and confirm. The system loads the file automatically and exits when the loading is complete. After this, restart the controller.

CAUTION

Do not load configuration files of different robot models to avoid calibration parameter errors, which may affect robot positioning accuracy.

Program backup and loading

The program backup function allows you to back up the control program in the memory card of the controller into a USB drive, while the program loading functions allows you to load the control program from the USB drive into the controller. The backup and loading directories for version S01.14 and earlier are different from those for version S01.15 and later, as shown in the table below:

Type	Version S01.14 and earlier	Version S01.15 and later
Program backup	1. TeachProgram 2. PalletInfo	1. TeachProgram 2. PalletInfo 3. TecParameter

Type	Version S01.14 and earlier	Version S01.15 and later
Program loading	1. TeachProgram 2. PalletInfo	1. TeachProgram 2. PalletInfo 3. TecParameter

The functions of each folder are as follows:

TeachProgram: Program file folder containing all .pro program files

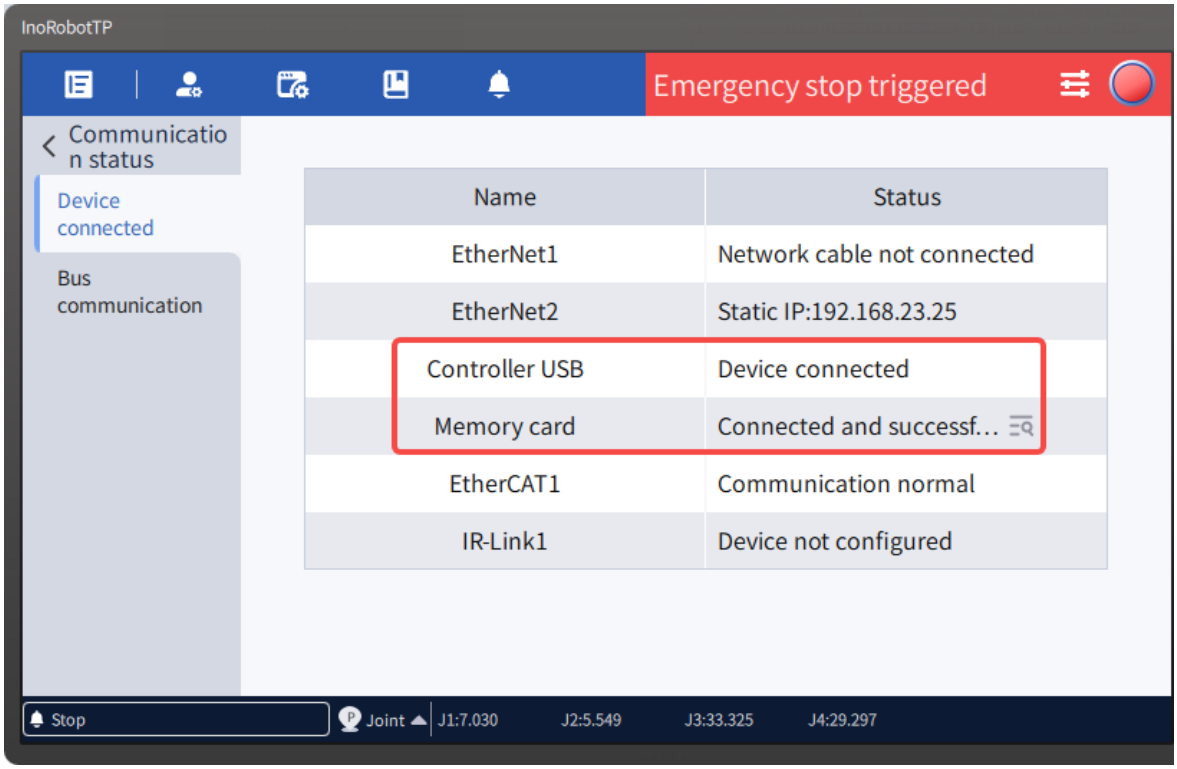
PalletInfo: Pallet file folder containing information about the stacking and pallet. This folder is used when pallet variables are used.

TecParameter: Process folder containing information about the screw driving and dispensing processes. This folder is used when the screw driving, dispensing processes are used.

- Program backup

  The program backup procedure is as follows:

  1. Insert the USB drive into the controller and check the connection status between the USB drive and the memory card. If the monitored communication status in the software displays "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 memory card and the USB drive in good communication during operation.



  2. Click the backup button and confirm. The system backs up the program automatically and exits when the loading is complete.

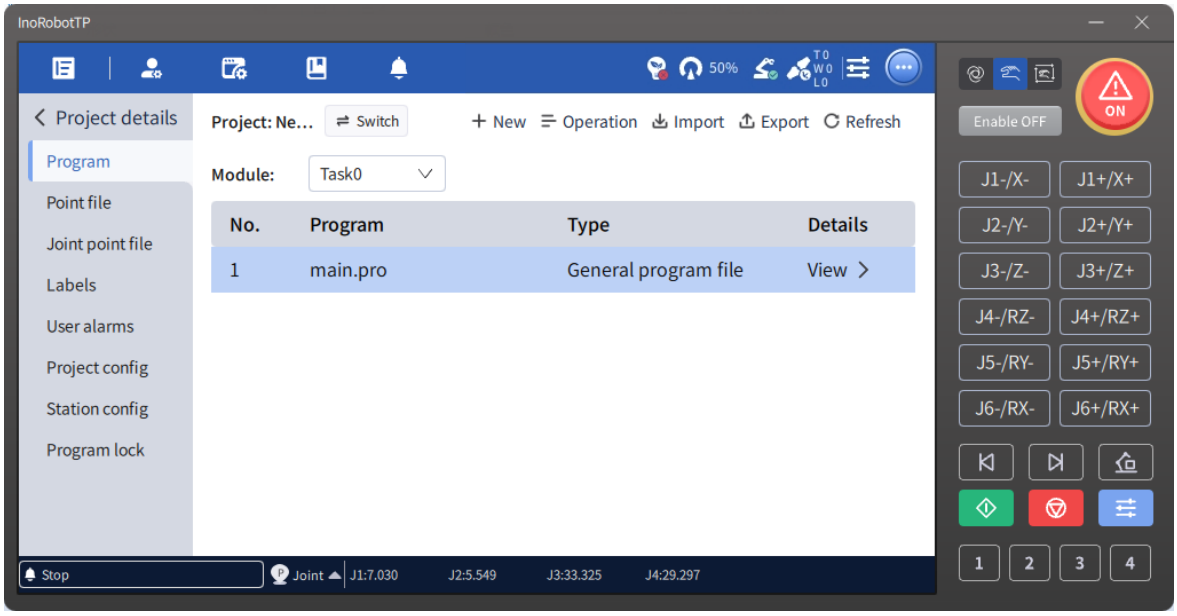
  3. After the backup is complete, several new folders will appear in the root directory of the USB drive.

- Program loading

  The program loading procedure is as follows:

  1. Insert the USB drive into the controller and check the connection status between the USB drive and the memory card. If the monitored communication status in the software displays "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 memory card and the USB drive in good communication during operation.

2. Click the load button and confirm. The system loads the program automatically.
3. Go to the programming interface and click the refresh button in the upper-right corner to display the loaded program in the program list.



8 Certification and Standard Compliance

Third-party certification

Certification mark	Certification	Description	Standard
CE	CE	The product complies with the LVD, MD, EMC, and RoHS directives and is labeled with 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 TÜV SAAR FUNKTIONALE SICHERHEIT GEPRÜFT FUNCTIONAL SAFETY APPROVED	SGS-TUV Saar	This product is certified by SGS-TUV Saar for functional safety.	• ISO 13849-1:2023 • EN ISO 13849-1:2015
SGS C US	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
FC	FCC	This product has passed the Federal Communications Commission (FCC) EMC testing and carries the FCC mark.	-
KC	KC	This product has passed the Korea Certification (KC) EMC testing and carries the KC mark.	-

NOTE

The above certification standards only apply to standard model products. For customized products, consult Inovance technical personnel for specific certification information.

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 (EMC)	2014/30/EU
ROHS Directive	2011/65/EU Amended by (EU)2015/863

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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