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# AC700 Series Intelligent Mechanical Programmable Controller

## User Guide

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

Data code PS00004465A07

# Legal Information

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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.

# Preface

## Introduction

The AC700 series intelligent machine controller offers abundant network interfaces capable of meeting various project expansion requirements. It delivers robust motion control performance and can be used in various industries, such as packaging, printing, die cutting, mobile phone manufacturing, silicon wafer manufacturing, logistics, and pharmacy.

This guide describes the installation, wiring, operation instructions, maintenance, and troubleshooting of the controller.

## Standards compliance

The table below lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

| Certification | Directive | | Standard |
|---|---|---|---|
| CE certification | EMC directive | 2014/30/EU | **24 VDC products:**<br>EN 61131-2<br>**220 VAC products:**<br>EN 61131-2<br>EN 61000-3-2<br>EN 61000-3-3 |
| | LVD directive | 2014/35/EU | EN 61010-1<br>EN 61010-2-201 |
| | RoHS directive | 2011/65/EU amended by (EU)2015/863 | EN IEC 63000 |
| UL/cUL certification | - | | UL 61010-1<br>UL 61010-2-201<br>CAN/CSA-C22.2 No. 61010-1<br>CSA C22.2 No. 61010-2-201 |
| KCC certification | - | | - |
| EAC certification | - | | - |
| UKCA certification | Safety regulations | Electrical Equipment (Safety) Regulations 2016 | EN 61010-1<br>EN 61010-2-201 |
| | EMC regulations | Electromagnetic Compatibility Regulations 2016 | **24 VDC products:**<br>EN 61131-2<br>**220 VAC products:**<br>EN 61131-2<br>EN 61000-3-2<br>EN 61000-3-3 |
| | RoHS regulations | Directive (RoHS) Regulations 2012 | EN IEC 63000 |

## More documents

| Name | Data code | Description |
|---|---|---|
| Medium-Sized PLC Programming Guide (Software Use) | 19010334 | Introduces the basic functions, quick start, network configuration, and programming basics of the PLC software. |
| Medium-Sized PLC Programming Guide (Motion Control) | 19010539 | Introduces the composition of PLC motion control system, motion control program mechanism, detailed explanation of MC instructions, simulation and debugging related operations. |
| Medium-Sized PLC Instruction Guide | 19011700 | Introduces the basic instructions. |
| AC700 Series Intelligent Machanical Programmable Controller User Guide | PS00004465 | Introduces the installation, wiring, operation instructions, maintenance, and troubleshooting of the controller. |

## Revision history

| Date | Version | Description of change(s) |
|---|---|---|
| January 2026 | A07 | Updated effect diagrams and product codes. |
| February 2025 | A06 | Minor corrections. |
| July, 2024 | A05 | Minor corrections. |
| March 2024 | A04 | Updated the note in *"6.2 Power-Off" on page 38*. |
| Jan 2024 | A03 | • Added the note for network interface communication in *"5.4.1 Network Port Specifications" on page 29*.<br>• Updated the wiring diagram of the external circuit in *"5.3.3 Wiring of User Terminals" on page 26*.<br>• Updated CPU error codes in *"9.2 Controller Related Error Codes" on page 50*.<br>• Updated *"9.3 EtherCAT Related Error Codes" on page 52*. |
| August 2023 | A02 | Updated the following sections: Cable Selection, Nameplate and Model, Power-on, Power-off, Programming and Debugging, and Appendix.<br>Minor corrections. |
| December 2022 | A01 | Added solutions for error codes.<br>Updated product appearance, nameplate, and description.<br>Added network interface communication specifications. |
| January 2022 | A00 | First release. |

## Access to the guide

The guide is not delivered with the product. Download the PDF file in the following ways:

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



## Warranty

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 expires.

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

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, and unusual voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Secondary damage caused by force majeure (natural disasters, earthquakes and lightning strikes)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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# 1 Fundamental Safety Instructions

## 1.1 Fundamental Safety Instructions

### Safety Precautions

- This chapter provides essential safety instructions for proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety precautions may result in death, serious injury, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- 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 death or severe personal injuries.



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



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

### General Safety Instructions

- 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.

| Unpacking |
| --- |
| <br>• Do not install the equipment if you find damages, rust, or signs of use on the equipment or accessories upon unpacking.<br>• Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.<br>• Do not install the equipment if you find the packing list does not conform to the equipment you received. |




- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking 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 transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in 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.




- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in 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 equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- 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**




- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.

WARNING

- Thoroughly read the safety precautions and user guide before installation.
- Do not install this 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 red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

CAUTION

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

**Wiring**

DANGER

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

WARNING

- Do not connect the input power supply to the output end of the equipment. Failure to comply will 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.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in 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 an electric shock or equipment damage.

CAUTION

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

**Power-on**

DANGER

- 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.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

WARNING

- Perform a trial run after wiring and parameter setting to ensure the equipment operates 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 a fire.
- 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**

DANGER

- The equipment must be operated only by professionals. Failure to comply will 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 will result in an electric shock.

WARNING

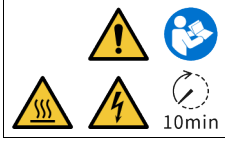
- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

**Maintenance**

| |
|---|
| DANGER<br><br>• Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.<br>• Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.<br>• Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.<br>• In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock. |
| WARNING<br><br>• Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record. |
| **Repair** |
| DANGER<br><br>• Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.<br>• Do not repair the equipment with power ON. Failure to comply will result in an electric shock.<br>• 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. |
| WARNING<br><br>• Require repair services according to the product warranty agreement.<br>• When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.<br>• When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.<br>• Replace quick-wear parts of the equipment according to the replacement instructions.<br>• Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.<br>• After the equipment is replaced, check the wiring and set parameters again. |
| **Disposal** |
| WARNING<br><br>• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.<br>• Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution. |

## Safety label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. 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.<br>• Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock. |

## 1.2 Industrial Information Security

This product provides an interface to connect to the network and transmit data through the network interface. To protect factories, systems, machines, and networks from cyber attacks, appropriate industrial information security protection mechanisms need to be implemented to ensure the safe operation of factories, systems, machines, and networks.

The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer's network or any other network, to prevent unauthorized access to their factory, systems, machines, and networks. The system or machine may only be connected to the corporate network or the Internet when a secure connection is established and proper security measures are in place (for example, using antivirus software and installing firewalls).

INOVANCE continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update your products promptly and always use the latest product versions.



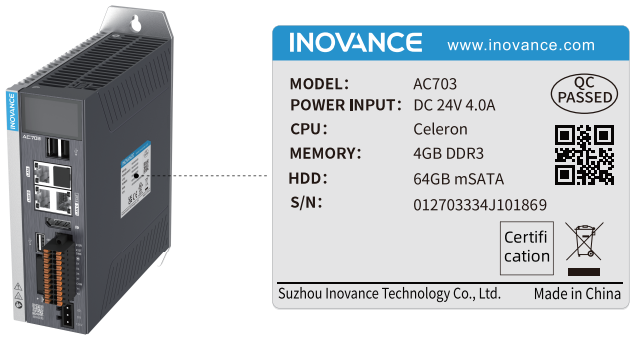

Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions strictly:

- Always use the latest software version. If the product version is no longer supported or the latest program version is not applied, customers are at increased risk of cyberattacks.
- Implement and maintain appropriate security measures (including but not limited to deploying anti-virus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the removable storage device from being damaged by malware and to protect products, networks, systems, and interfaces from unauthorized access, disruption, intrusion, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

# 2 Product Information

## 2.1 Nameplate and Model

### Nameplate




### Naming Rules

A ① C ② 7 ③ 03 ④ - W ⑤

| | | |
|---|---|---|
| ① **Product Name**<br>A: Controller | ③ **Series number (1st digit)**<br>7: Series 7 | ⑤ **Operating system**<br>• W: Windows system<br>• Blank: Linux system (such as AC703) |
| ② **Product structure**<br>C: Booksize | ④ **Hardware configuration**<br>03: Two-digit number, defined according to functions and performance | - |

## 2.2 Components

### 2.2.1 Appearance

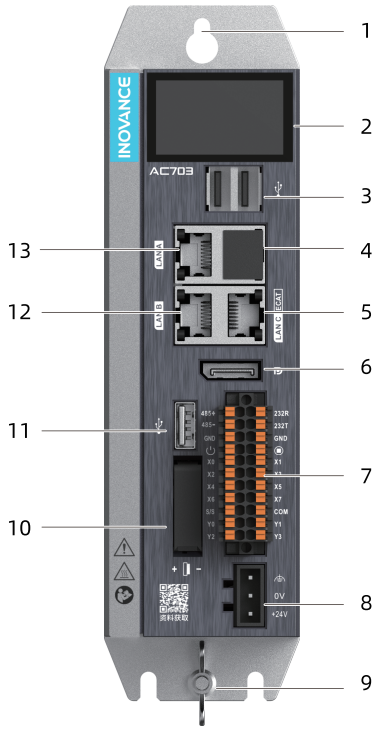



The AC700 series includes the following controllers and accessories:

| Product type | Product description | Module Model | Product Code |
|---|---|---|---|
| Booksize controller | Celeron processor; 4 GB memory; 64 GB hard disk; three USB 2.0 interfaces; three network interfaces; DP interface; Display; 16 axes | AC702-INT | 01441158 |
| Booksize controller | Celeron processor; 4 GB memory; 64 GB hard disk; three USB 2.0 interfaces; three network interfaces; DP interface; Display; 32 axes | AC703-INT | 01441225 |

### 2.2.2 Interfaces

The following figure shows the external interfaces of the AC700 series booksize controller:




| No. | Interface name | Description |
|---|---|---|
| 1 | Rear earhook | Standard component |
| 2 | Display | For specific functions and operations, see *"6.3 Display" on page 39* |
| 3/11 | USB interface | Three USB 2.0 interfaces |
| 4 | LAN interface | Not supported |
| 5 | LAN C interface | EtherCAT interface |
| 6 | DP interface | DisplayPort interface |
| 7 | I/O communica-tion interface | Eight DI terminals, four DO terminals, and RS485/RS232 communication terminals. For details, see *"5.3.4 RS485 Bus Wiring Instructions" on page 27*, *"5.3.5 RS232 Bus Wiring Instructions" on page 29*, and *"5.3.1 Interface Definition" on page 23* |
| 8 | Power supply interface | 24V power supply input |
| 9 | Grounding terminal | Controller grounding |
| 10 | Battery cover | Open the battery cover to replace the battery. |
| 12 | LAN B interface | Ethernet interface |
| 13 | LAN A interface | Ethernet interface |

# 3 Product Specifications

## 3.1 General Specifications

The AC700 series includes two controller models: AC702 and AC703. The following table provides basic specifications of the two models:

| Item | AC702 | AC703 |
|---|---|---|
| Power supply | 24 VDC (-15% to +20%) | |
| CPU model | Celeron, 2GHz | |
| Memory | 4 GB | |
| Memory type | DDR3 SO-DIMM | |
| Hard disk capacity | 64 GB | |
| Hard drive type | mSATA SSD | |
| SPI FLASH | 64 Mbit | |
| Programming mode | IEC 61131-3 programming language (LD, ST, SFC, CFC) | |
| Program execution mode | Compiling execution | |
| Number of EtherCAT axes | 16 | 32 |
| User program storage | 128 MB | |
| User data storage | 128 MB | |
| EtherCAT communication | 1 channel (that supports up to 128 slaves) | |
| Modbus TCP Communication | 2 channels (as master, that supports up to 63 slaves; as slave, that supports up to 16 masters) | |
| Modbus (serial port) communication | 2 channels (as master, that supports up to 31 slaves; as slave, that supports up to 1 master) | |
| Ethernet/IP | 1 channel<br>Maximum number of clients connected: 64<br>Maximum number of servers connected: 32 | |
| FINS TCP/UDP communication | 2 channels (that supports up to 32 connections per channel) | |
| MELSEC communication | 2 channels (that supports up to 32 connections per channel) | |
| Retentive space at power failure | 5 MB | |
| Dimensions (W x H x D) | 55 mm × 160 mm × 151 mm | |
| Weight (kg) | Approx. 1.3 kg | |
| Heat dissipation method | Naturally ventilated | |
| EMC specifications | EN61131-2 Zone B/EN61000-6-2/EN61000-6-4 | |

## 3.2 Environmental Specifications

| | Parameter Type | | Operating Specification | Transportation Specification | Storage Specification |
|---|---|---|---|---|---|
| Environmental parameters (IEC60721-3) | Class | | IE33 | IE22 | IE12 |
| | Temperature | | -5°C to +55°C | -40°C to +70°C | -25°C to +70°C |
| | Humidity | | 10% RH to 95% RH, without condensation | | |
| | Vibration | Frequency | 5 Hz to 150 Hz | 2M2 | 1M2 |
| | | Displacement | 3.5 mm (direct installation) (<8.4 Hz) | | |
| | | Acceleration rate | 1 g (direct installation) (>8.4 Hz) | | |
| | | Direction | 3-axial directions | | |
| | Shock (collision) | | 15 g, 11 ms, half sine wave, 3-axial directions | | |
| | Altitude/Air pressure | | 0 m to 2000 m | 0 m to 3000 m (> 70 kPa) | |

# 4 Installation

## 4.1 Installation Requirements

### 4.1.1 Installation Precautions

- Before installation, ensure that the controller is powered off.
- To avoid damage to the controller, do not drop or strike on the controller enclosure, terminal block, or connector.
- Do not disassemble the controller; otherwise the controller may be damaged.
- To avoid damage to the terminal and controller, do not overtighten the fasteners.
- The left panel of the controller is an aluminum plate for heat dissipation. Exercise caution to avoid burns.

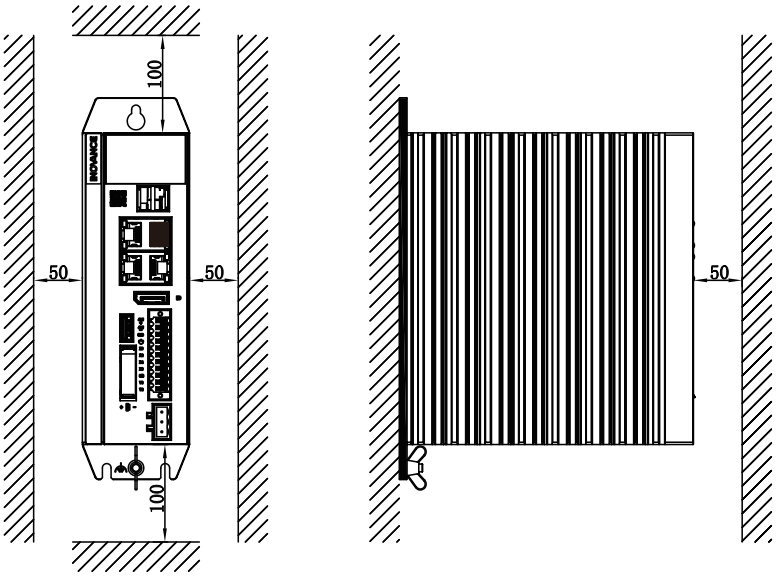
### 4.1.2 Installation Environment

When installing the controller, take the operability, maintainability, and environmental adaptation into account. Do not install the controller in a location with:

- An ambient temperature exceeding the range of -5°C to +55°C
- An ambient humidity exceeding the range of 10% to 95% RH
- Drastic temperature changes and condensation
- Corrosive or flammable gas
- Conductive powders (such as dust and iron powder), oil mist, salt, or organic solvents
- Direct sunlight
- Strong electric or magnetic fields
- Vibration or shocks

### 4.1.3 Installation Space

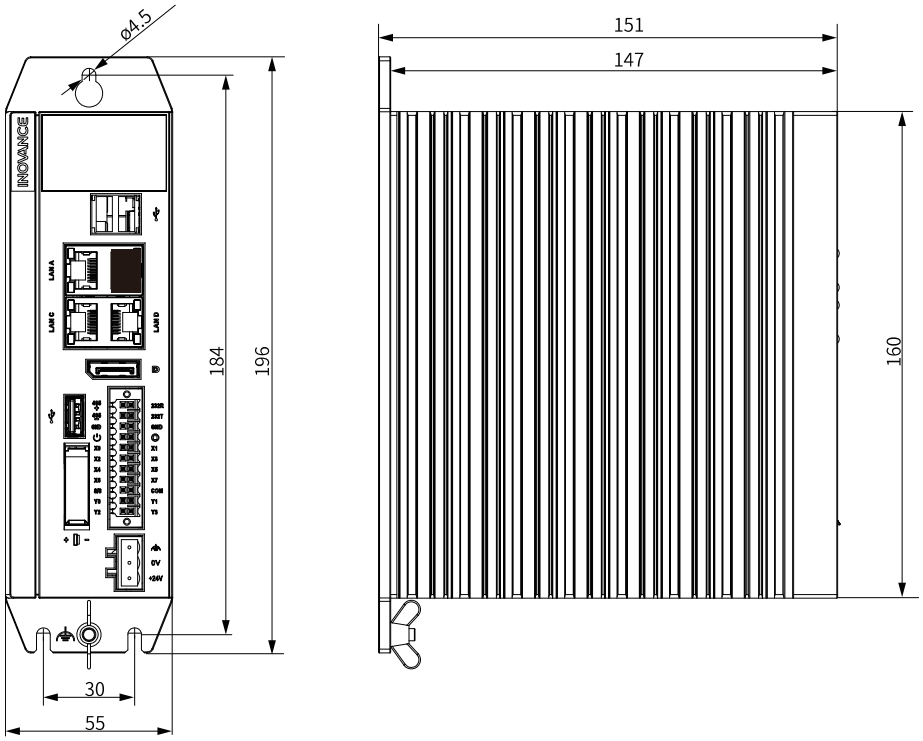
To facilitate ventilation and module replacement, reserve enough space around the product, as shown in the figure below (in mm).




## 4.2 Installation Instructions

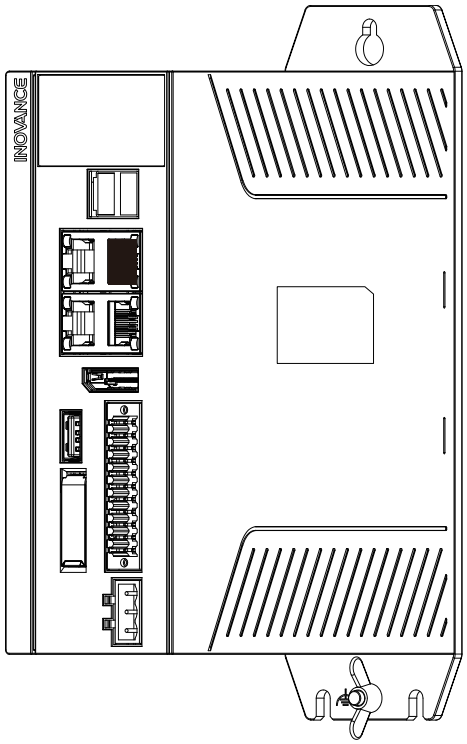
### 4.2.1 Installation Dimensions

The installation dimensions (in mm) are shown in the figure below.



### 4.2.2 Installation Method

Install the AC700 series booksize controller through the rear earhook, as shown below. Secure the controller with three screws at a torque of 1.2 N·m.



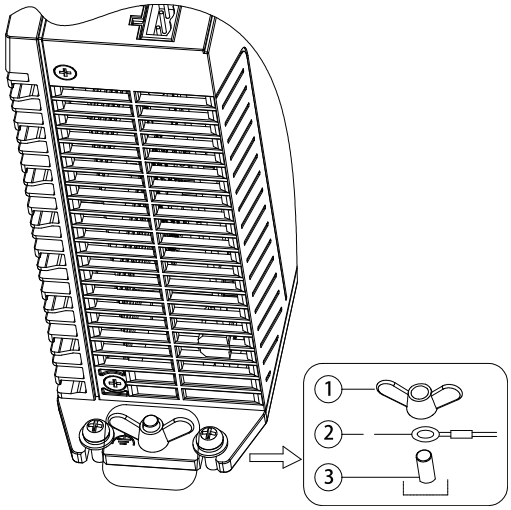
# 5 Wiring

## 5.1 Routing Recommendations

### 5.1.1 Grounding Requirements

A grounding point (⏚) is set on the power terminal of the controller and the rear earhook each. Choose one of the grounding points as needed. Use a grounding wire that is as thick and short (less than 30 cm) as possible to ground the controller. The grounding point on the rear earhook is recommended.

Use a wing nut for grounding, with a tightening torque of 0.55 N.m to 0.8 N.m, as shown below:

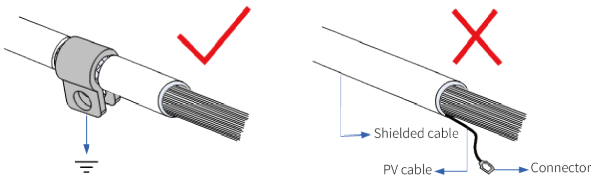



① - Wing nut; ② - Grounding cable; ③ - Grounding screw

**Grounding of shielded cables**

Use shielded cables for communication signals. Ground the shielded cable as close to the controller as possible so that the cable is not interfered by electromagnetic induction. The exposed shielded cable must be in large-area contact with the grounding point to ensure good contact.

Do not solder a PVC wire to the shielded cable for grounding because this will increase the high frequency impedance and attenuate the shielding effect. The shielded cable must be grounded at both ends, as shown below.

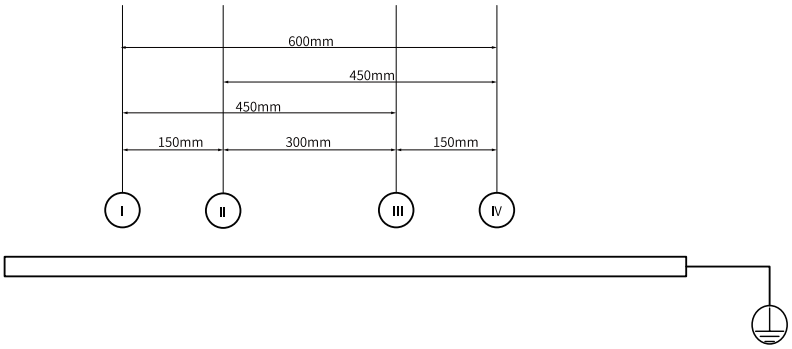


## 5.1.2 Cabling Requirements

Low-voltage cables (< 1 kV) are generally divided into four types. Only cables of the same type can be bundled together. Cables of different types must be separated without intersection or overlap. If intersection cannot be avoided, route cables in a right-angle crossover manner.

| No. | Type | Application |
|---|---|---|
| 1 | I | Ethernet interface and EtherCAT interface |
| 2 | II | Low-speed digital communication signals (such as RS232 and RS485) and DI/DO signals |
| 3 | III | Low-voltage AC power distribution cables or DC power cables (such as 24 VDC cable of a switch-mode power supply) |
| 4 | IV | Input and output cables, welding machine cables, and power converter cables |

Keep a proper distance between different types of cables. For cables shorter than 30 m, the minimum distance allowed is shown below.



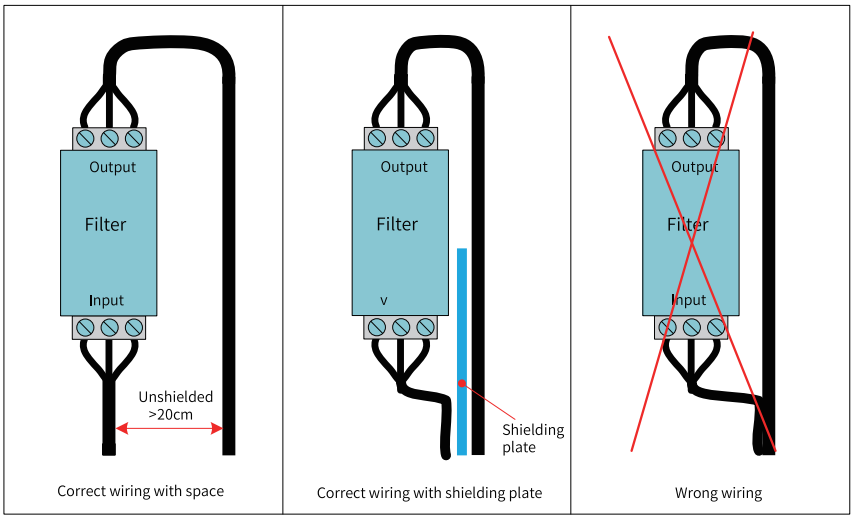

### *Note*

- If two cables run parallel for an extended length, increase the distance between the two cables accordingly.
- You can also install spliced shielding plates between different types of cables. To reduce cross interference, route all cables as closely as possible to the grounded structural components of the cabinet, such as the cabinet's mounting plate or rack components.

## 5.1.3 Installing the Filter

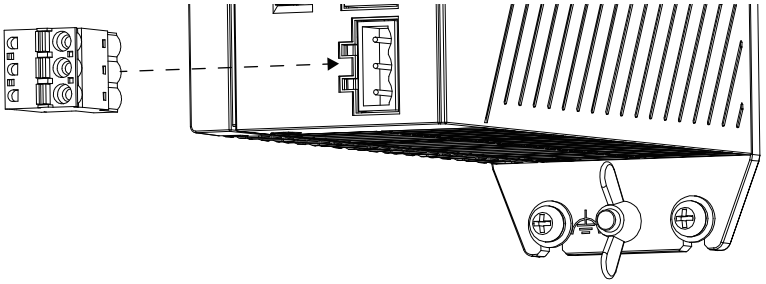
If the controller is subject to a strong interference source (such as an AC drive), it is recommended to add a noise filter to suppress the interference.

Install the filter as close as possible to the power supply of the controller. Fix the filter to the conductive backplane through screws. Protect the area around the screws with paint and ensure reliable grounding. The outgoing and incoming cables of the filter should be routed separately to avoid noise coupling on the cables.

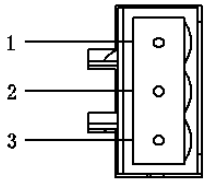



## 5.2 Wiring of Power Input Terminal

The power input terminal contains three pluggable pins spaced at 5.08 mm. To facilitate on-site wiring, replacement and maintenance, use springs to crimp wires onto the terminal. The following figure shows how to insert the power cable connector into the power input terminal:



### Definition of power input pins

| Terminal | No. | Name | Type | Function |
|---|---|---|---|---|
|   | 1 | ⏚ | Grounding | Enclosure protective earth |
| | 2 | 0V | Input | Negative DC input |
| | 3 | +24V | Input | Positive DC input |

### Specifications of input power supply

| No. | Item | Specification |
|---|---|---|
| 1 | Input voltage | 24 VDC (-15% to +20%) |
| 2 | Input current | 4 A |
| 3 | Power failure threshold | 18 V |
| 4 | Hold-up time upon power failure | 150 ms |
| 5 | Anti-reverse connection | Supported |
| 6 | Short circuit protection | Supported |

***Note***

The power input must be equipped with a fuse.

### Power supply cable preparation

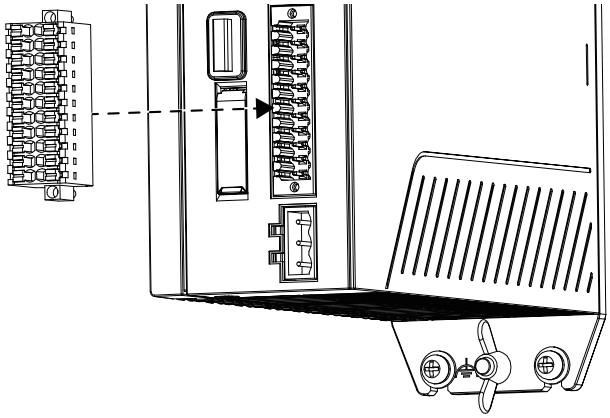
The power supply input cable uses a pin terminal. For preparation instructions, see *"5.7.2 Cable Preparation" on page 36*.

## 5.3 Wiring of I/O Communication Interface

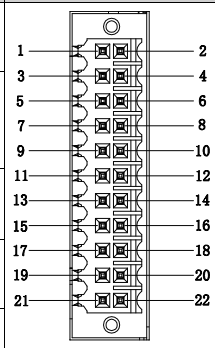
### 5.3.1 Interface Definition

### Introduction to I/O communication interface

The I/O communication interface adopts a 22-pin (dual-row 11-pin) terminal with a 3.5 mm pitch, which includes DI/DO signals, RS-232 signals, RS-485 signals, power-on signals, and PLC program run/stop control signals. The wiring terminal adopts screw-fixed pluggable terminals, utilizing spring-type and crimping connection methods for convenient on-site installation and wiring, replacement and maintenance. The following figure shows how to insert the I/O connector into the I/O communication interface:



### Definition of I/O communication interface

| Type | Function | Terminal | No. | I/O Communication Interface | No. | Type | Function | No. |
|---|---|---|---|---|---|---|---|---|
| RS485 | RS485+ | 485+ | 1 |  | 2 | 232R | RS232 reception | RS232 |
| | RS485- | 485- | 3 | | 4 | 232T | RS232 transmis-sion | |
| | Serial port ground | GND | 5 | | 6 | GND | Serial port ground | |
| DI | Power-on signal | ⏻ | 7 | | 8 | ▢ | RUN/STOP | DI |
| DI | High-speed input 0 | X0 | 9 | | 10 | X1 | High-speed input 1 | DI |
| DI | High-speed input 2 | X2 | 11 | | 12 | X3 | High-speed input 3 | DI |
| DI | High-speed input 4 | X4 | 13 | | 14 | X5 | High-speed input 5 | DI |
| DI | High-speed input 6 | X6 | 15 | | 16 | X7 | High-speed input 7 | DI |
| DI | Input common terminal | S/S | 17 | | 18 | COM | Output common terminal | DO |
| DO | High-speed output 0 | Y0 | 19 | | 20 | Y1 | High-speed output 1 | DO |
| DO | High-speed output 2 | Y2 | 21 | | 22 | Y3 | High-speed output 3 | DO |



### *Note*

- Power-on signal: When the controller is powered on, energize the input circuit for 5 s to shut it down. When it is powered off, energize the input circuit for 1 s to start it up.
- RUN/STOP signal: Continuously energizing the input circuit will repeatedly trigger the product to switch on and off.
- When the PLC crashes, you can forcibly stop and restart the PLC program through the RUN/STOP interface.
- When the startup icon on the display turns off, it indicates that the PLC is forcibly stopped.

## 5.3.2 Interface Specifications

### High-speed digital input specifications (pins 9/10/11/12/13/14/15/16)

| Item | Specification |
|---|---|
| Number of channels | 8 |
| Input type | DC digital input |
| Input mode | Sink/Source mode |

| Item | Specification |
|---|---|
| Maximum input frequency | 200 kHz |
| Frequency detection error | ±1 pulse |
| Input impedance | 4.3 kΩ |
| Input voltage/Current rating | Detection voltage: 24 V (max. 30 V. When all inputs are ON, the input voltage cannot exceed 26.4 V)<br>ON: Voltage ≥ 15 V; input current > 5 mA<br>OFF: Voltage ≤ 5 V; input current < 1.5 mA |

## High-speed digital output specifications (pins 19/20/21/22)

| Item | | Specification |
|---|---|---|
| Number of channels | | 4 |
| Output type | | Digital output/transistor output |
| Output mode | | Sink mode |
| Maximum output frequency | | 200 kHz (requiring an external equivalent load of more than 12 mA) |
| Control circuit voltage | | 5 VDC to 24 VDC |
| Minimum load | | 5 mA |
| Maximum output current | Resistive load | 0.1 A/channel; 0.5 A/module |
| | Inductive load | 7.2 W/24 VDC |
| | Lamp load | 0.9 W/24 VDC |
| Maximum voltage drop upon ON | | 0.2 V (typical value) |
| Leakage current upon OFF | | < 0.1 mA |
| ON response time | | 1 μs |
| OFF response time | | 1 μs |
| Isolation mode | | Isolated |
| Short circuit-proof output | | Supported |

## RS485 communication specifications

| Item | Specification |
|---|---|
| Number of channels | 1 |
| Communication rate (bps) | 4800, 9600, 19200, 38400, 57600, 115200 |
| Maximum number of stations | 31 |
| Supported protocol | Modbus and free protocols |
| Isolation mode | Isolated |

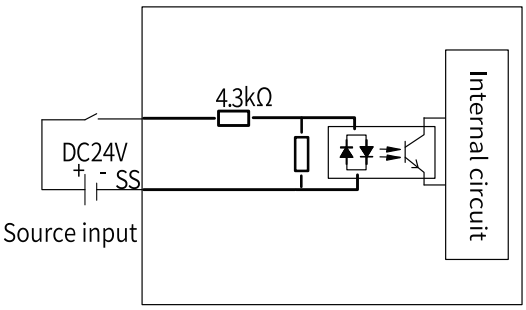
## RS232 communication specifications

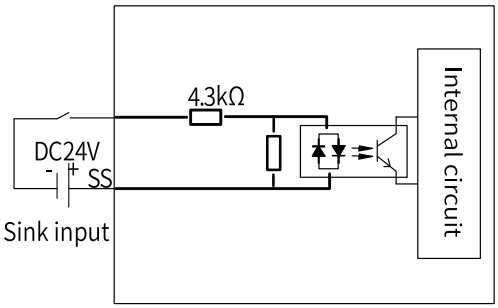
| Item | Specification |
|---|---|
| Number of channels | 1 |
| Communication rate (bps) | 4800, 9600, 19200, 38400, 57600, 115200 |
| Supported protocol | Modbus and free protocols |
| Isolation mode | Isolated |

## 5.3.3 Wiring of User Terminals

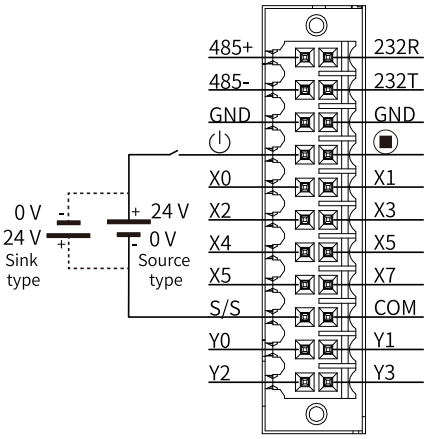
### Wiring of power-on signal terminal and run/stop signal terminal

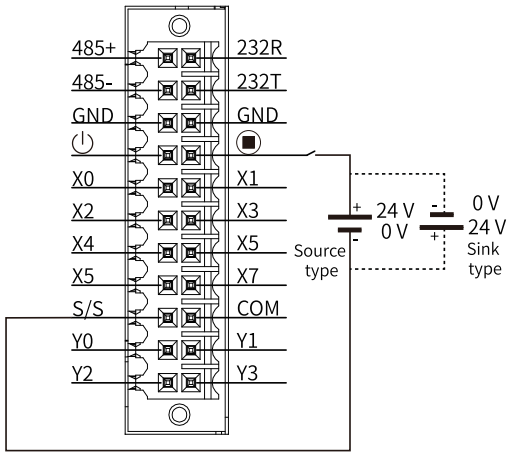
**Internal structure**



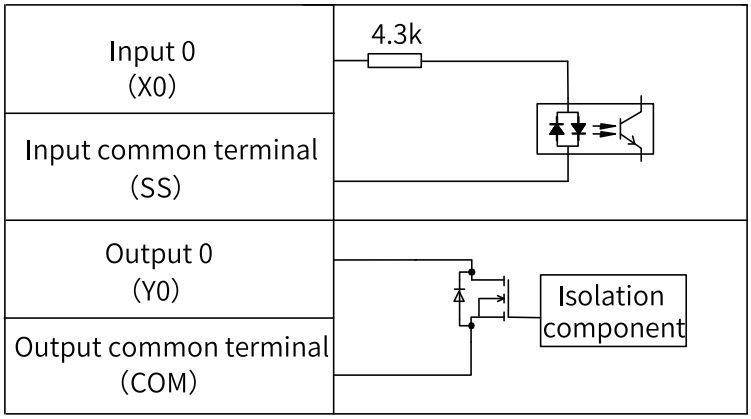

**Wiring of the external circuit**



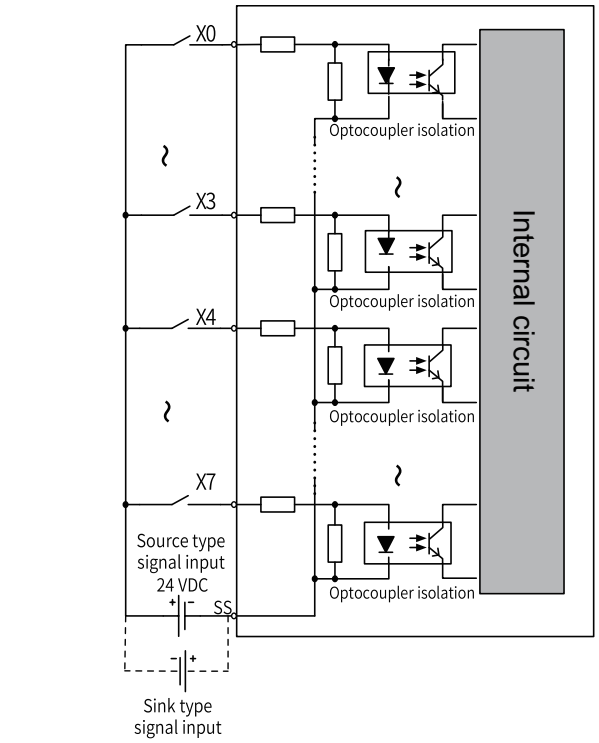



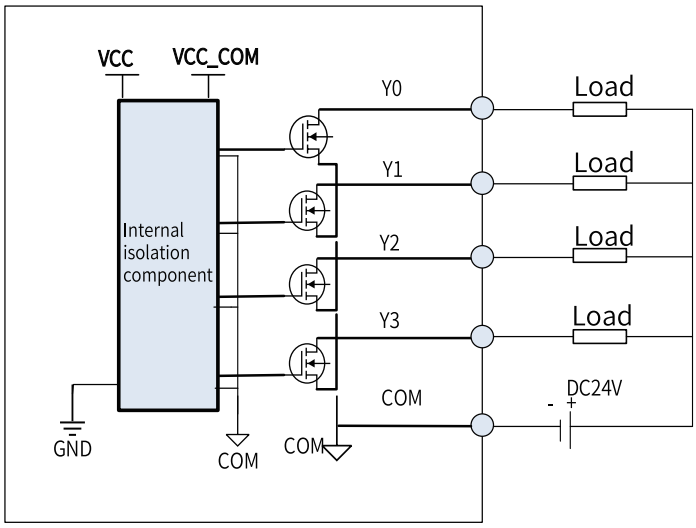

### Wiring of 8 high-speed DI and 4 high-speed DO terminals

**Internal structure**




**Wiring of the external circuit**




## 5.3.4 RS485 Bus Wiring Instructions

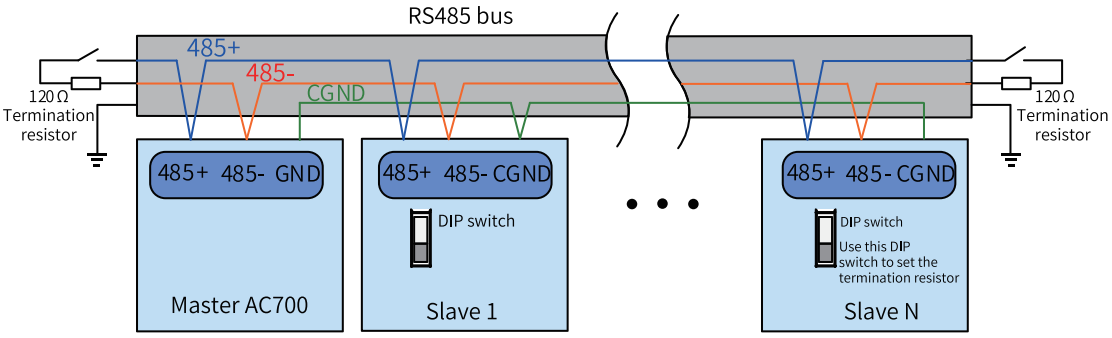
**Danger**

- Do not bundle the extension cable together with power cables (high voltage, large current) which produce strong interference signals. Separate it from other cables and avoid cabling in parallel.
- Select recommended cables and pinboards for connection. It is recommended that shielded cables be used as extension cables to enhance capacity of resisting interference.

- **RS485 topology**

  The figure below shows the RS485 bus topology. It is recommended to use a shielded twisted pair cable as the RS485 bus. The RS485+ and RS485– terminals are connected by a twisted pair cable.

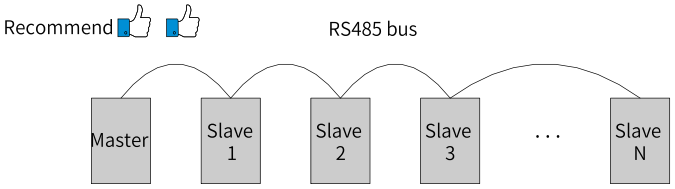
Connect a 120 Ω termination resistor to both ends of the bus to prevent signal reflection. Connect the signal reference grounds of all nodes together. Up to 128 nodes can be connected and the distance between branches must be less than 3 m.



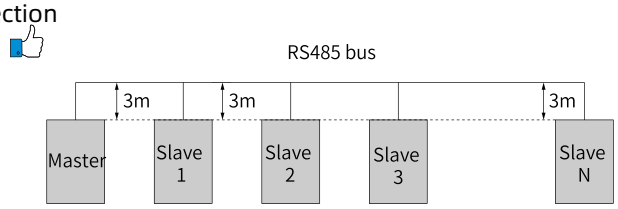

- **Multi-node topology**

  To connect a large number of nodes, use the daisy chain topology for the RS485 bus. If a branch cable is needed, keep its length shorter than 3 m and as short as possible. Star connection is strictly prohibited. The following figures show the common bus topology:

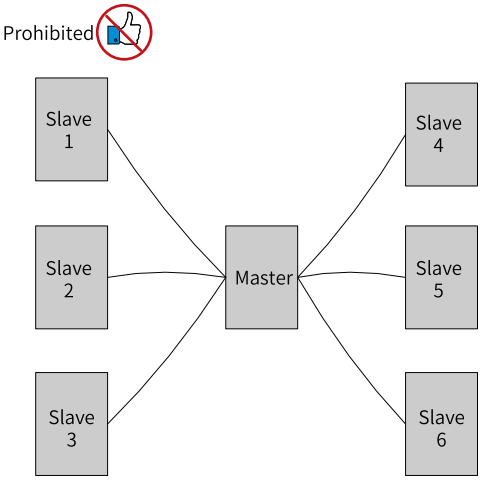
  - Daisy chain connection




  - Branch cable connection




  - Star connection (prohibited)

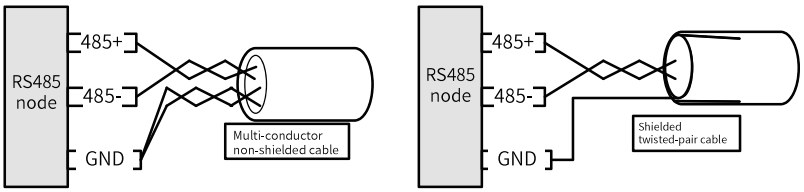



## *Note*

It is recommended that the distance between the bus and the node do not exceed 3 m.

- **Terminal wiring**
  The AC700 series controller provides three terminals (RS485+, RS485-, and GND) for RS485 communication. Ensure that the RS485 bus contains three cables and the terminals are connected correctly. For shielded cables, the shielding layer must be connected to the GND terminal, rather than controller enclosure, ground terminals, or any other location.

  Due to cable attenuation, use AWG26 or thicker cables for connection longer than 3 m. Twisted pair cables are always recommended for connecting RS485+ and RS485- terminals.




  - **Multi-conductor non-shielded cable**: A data transmission cable with weak anti-interference capability, mainly used in situations with low transmission quality requirements. Use one twisted pair to connect to RS485+ and RS485- terminals and twist other wires together to connect to the GND terminal.
  - **Shielded twisted-pair cable**: A cable with a shielding layer between the twisted pair and the outer insulation covering. It is mainly used in situations with strong interference, severe electromagnetic radiation, and high transmission quality requirements. Use the twisted pair to connect to RS485+ and RS485- terminals and use the shielding layer to connect to the GND terminal. The shielding layer can only be connected to GND, not to the ground.

### 5.3.5 RS232 Bus Wiring Instructions

When you use an RS232 to RS485 converter, it is recommended to use an external power supply for the converter. If the external power supply is unavailable, the baud rate should not exceed 9.6 kbps.

## 5.4 Network Port Wiring

### 5.4.1 Network Port Specifications

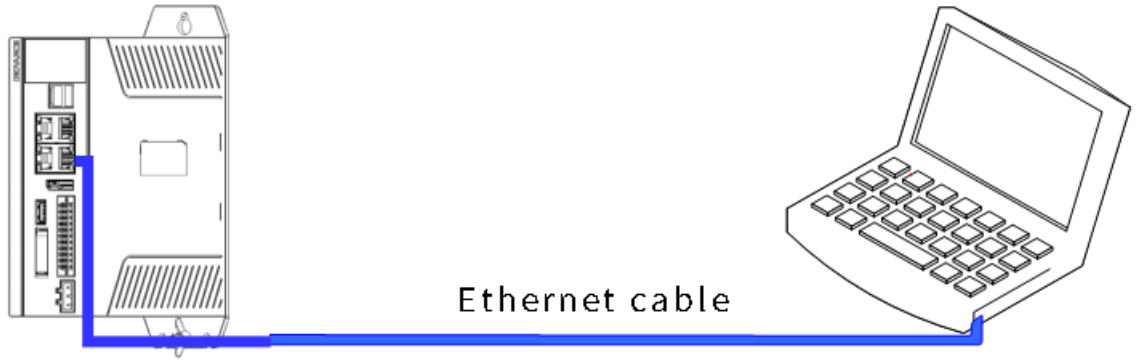
The AC700 series controller provides three network ports, which are described as follows:

| Module Model | No. | Network port | Functions |
|---|---|---|---|
| AC702 | 1 | LAN A | Programming port (used for downloading and monitoring) and communication port (for Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols) |
| | 2 | LAN B | Communication port for Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols |
| | 3 | LAN C | EtherCAT master port |
| AC703 | 1 | LAN A | Programming port (used for downloading and monitoring) and communication port (for Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols) |
| | 2 | LAN B | Communication port for Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols |
| | 3 | LAN C | EtherCAT master port |

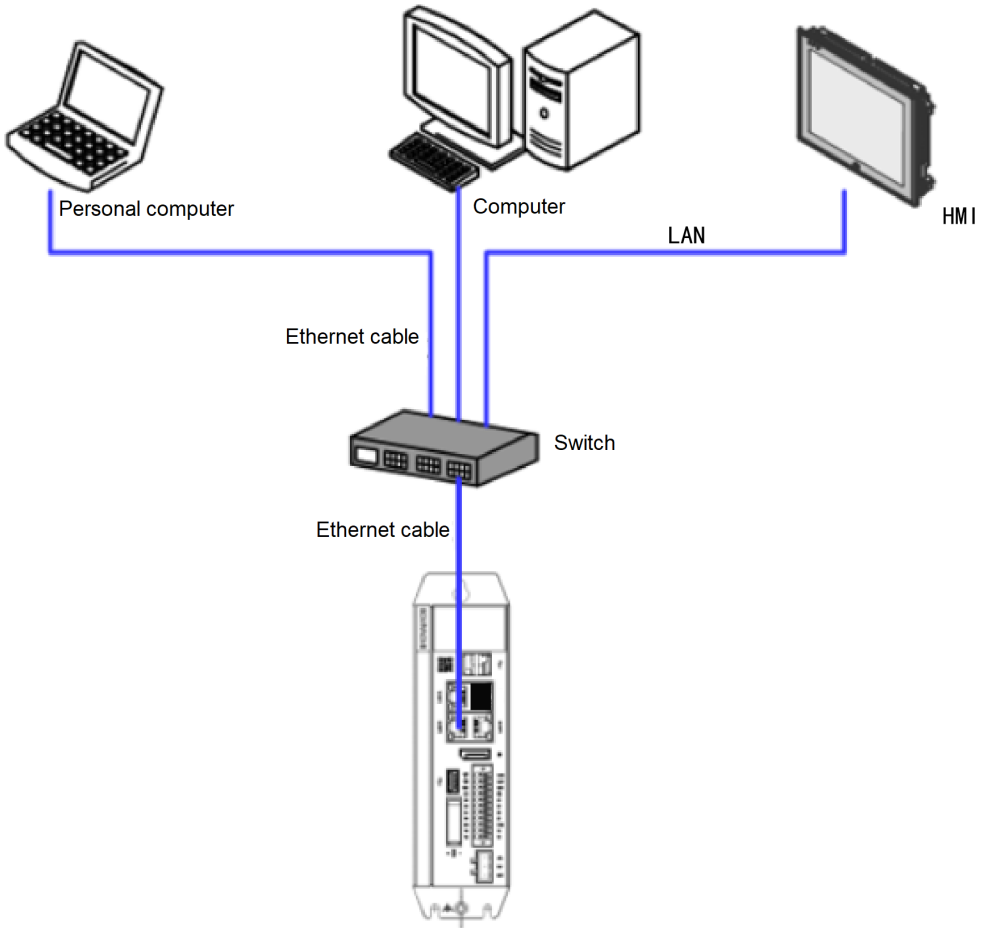
***Note*** The IP addresses of LAN A and LAN B ports must not be within the same subnet.

### 5.4.2 Ethernet Connection

The controller can be connected point-to-point with a computer, HMI, and other devices through the Ethernet port, as shown below.




The controller can also be connected to a hub or switch through the Ethernet cable, enabling multi-point connection with other network devices.




## 5.4.3 EtherNet Wiring Instructions

### EtherNet specifications

- Supports 2x standard Ethernet interfaces.
- Supported protocols: Modbus TCP, EtherNet/IP, and OPC UA.

The Modbus TCP communication specifications are as follows:

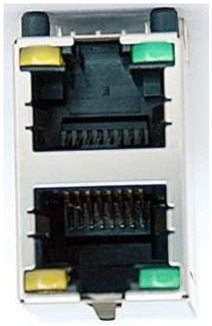
| Item | Specification |
|---|---|
| Station No. | 1 to 247 |
| Communication rate | 10M/100M/1000M adaptive |
| Data length | 8 bits |
| Parity bit | None/Odd parity/Even parity |
| Stop bit | 1 bit/2 bits |
| Maximum number of stations | 64 |
| Special functions | Diagnostic function |

The OPC UA communication specifications are as follows:

| Item | Specification |
|---|---|
| Security policy | - |
| User authentication | Anonymous |

| Item | Specification |
|---|---|
| Server interface | 4840 |
| Session timeout (s) | 5 to 600,000 |
| Sampling interval (ms) | 100, 300, 500, 1000, 2500, 5000 |
| Publish interval (ms) | 200 to 20,000,000 |
| Maximum number of sessions | 50 |
| Maximum number of subscriptions per server | 200 |
| Maximum number of monitored nodes per server | 20,000 |
| Maximum number of subscriptions per session | 50 |
| Maximum number of monitored nodes per subscription | 10,000 |
| Maximum number of nodes for single-frame read/write | 1000 |

### Definition of network interface indicators

| Indicator | Function | Color | Status | Description |
|---|---|---|---|---|
|  | A: Link/Act | Yellow |  | OFF: Disconnected |
| | | |  | Blinking: Connected with data sending/ receiving |
| | | |  | ON: Connected |
| | B: Speed | Green |  | OFF: Disconnected or connected at 10 Mbps |
| | | |  | ON: Connected at 100/1000 Mbps |

## 5.4.4 EtherCAT Wiring Instructions

### EtherCAT specifications

| Item | Specification |
|---|---|
| Number of channels | 1 |
| Communication protocol | EtherCAT protocol |
| Supported services | FoE, EOE, CoE (PDO, SDO) |
| Minimum synchronization period of the 8 axes with cam (32 axes without cam) | 1 ms (typical value) |
| Maximum number of axes | 32 |
| Synchronization mode | Distributed Clock (DC) synchronization for servo, input and output synchronization for I/O |
| Physical layer | 100BASE-TX |
| Baud rate | 100 Mbps (100Base-TX) |
| Duplex mode | Full duplex |
| Topology | Line topology |
| Transmission medium | Network cable, see cable specifications in the following section |
| Transmission distance | Less than 100 m between two nodes |

| Item | Specification |
|---|---|
| Number of slaves | 128 slaves per EtherCAT bus |
| EtherCAT frame length | 44 bytes to 1498 bytes |
| Process data | Maximum 1,486 bytes per Ethernet frame |
| Update time | The update time is specified only in the EtherCAT bus design. For specific update time, see the manual or specifications of the slave module. |
| Ring network | Not supported in the current version |
| Automatic scanning | Supported |

### Network interface indicators

See details in *" Definition of network interface indicators" on page 32*.

## 5.4.5 Communication Cable Wiring Instructions

### Connection of RJ45 network cable

Connection: Insert the cable into the RJ45 port of the communication module until you hear a click sound.

Removal: Press down the clip of the RJ45 cable and pull it out along the direction parallel with the module.

---

***Note***

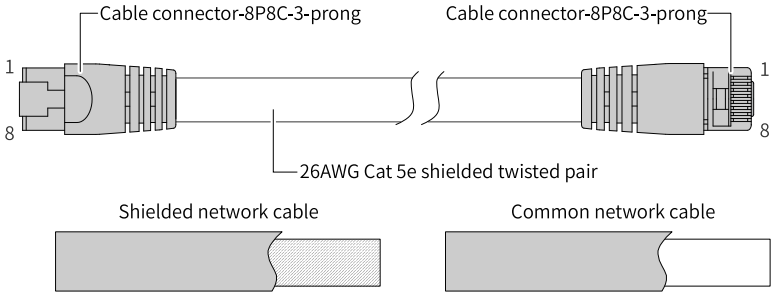
Fix the cable near the product before EtherCAT communication to prevent the cable from being affected by other tension and ensure communication stability.

---

### Cable specifications

Use shielded cables of Cat 5e and above for EtherCAT communication, as required below:

1. Cable requirements




2. Length requirements

   According to FastEthernet, when an EtherCAT bus is used, the length of the cable between devices cannot exceed 100 m. Otherwise, the signal will be attenuated, affecting communication.

3. Technical requirements

   100% continuity test without short circuit, open circuit, misalignment, or poor contact.

   Use a shielded cable as the EtherCAT bus for network data transmission, with the following recommended specifications:

| Item | Specification |
|---|---|
| Cable type | Flexible crossover cable, S-FTP, Cat 5e |
| Standard compliance | EIA/TIA568A, EN50173, ISO/IEC11801<br>EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36 |
| Cross sectional area | AWG26 |
| Conductor type | Twisted pair |
| Number of pairs | 4 |

4. Signal pin assignment

| Pin | Signal (Ethernet 1000 Mbps) | Signal Direction | Description |
|---|---|---|---|
| 1 | TD+ | Output | Data transmission + |
| 2 | TD- | Output | Data transmission - |
| 3 | RD+ | Input | Data reception + |
| 4 | -(DC+*) | -(bidirectional) | Unused (data C+) |
| 5 | -(DC-) | -(bidirectional) | Unused (data C+) |
| 6 | RD- | Input | Data reception - |
| 7 | -(DD+) | -(bidirectional) | Unused (data D+) |
| 8 | -(DD-) | -(bidirectional) | Unused (data D-) |

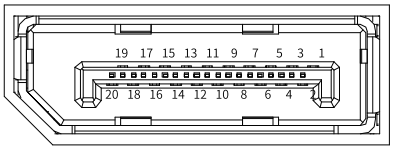
The definition of pins 4, 5, 7, and 8 under 1000 Mbps baud rate differs from that under 100 Mbps.

## 5.5 Display Port

The controller provides a standard display port (DP). The specifications of this port are as follows:

| Item | Specification |
|---|---|
| Signal type | Digital DP |
| Maximum resolution | 1920 x 1200 @60 Hz |
| Hot swap | Supported |

Pins of the DP port are defined as follows:

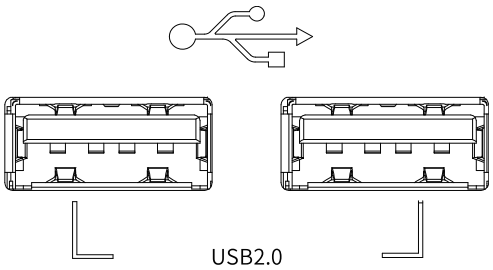



| No. | Description | Function |
|---|---|---|
| 1 | ML_Lane 0(p) | Lane 0 of the main link: Differential signal |
| 2 | GND | - |
| 3 | ML_Lane 0(n) | Lane 0 of the main link: Differential signal |
| 4 | ML_Lane 1(p) | Lane 1 of the main link: Differential signal |
| 5 | GND | - |
| 6 | ML_Lane 1(n) | Lane 1 of the main link: Differential signal |
| 7 | ML_Lane 2(p) | Lane 2 of the main link: Differential signal |
| 8 | GND | - |
| 9 | ML_Lane 2(n) | Lane 2 of the main link: Differential signal |
| 10 | ML_Lane 3(p) | Lane 3 of the main link: Differential signal |
| 11 | GND | - |
| 12 | ML_Lane 3(n) | Lane 3 of the main link: Differential signal |

| No. | Description | Function |
|---|---|---|
| 13 | GND | - |
| 14 | GND | - |
| 15 | AUX_CH(p) | Auxiliary channel: Differential signal |
| 16 | GND | - |
| 17 | AUX_CH(n) | Auxiliary channel: Differential signal |
| 18 | Hot Plug | Hot swap detection |
| 19 | DP_PWR Return | DP power return signal |
| 20 | DP_PWR | Power supply: +3.3 V |

## 5.6 USB Interface

The controller provides three USB 2.0 interfaces, as shown below:




USB interface specifications:

| Item | Specification |
|---|---|
| Maximum communication rate | 480 Mbps |
| Maximum output current at 5 V | 500 mA |
| Maximum communication distance | 5 m |
| Isolation | Not isolated |

## 5.7 Cable Selection and Preparation

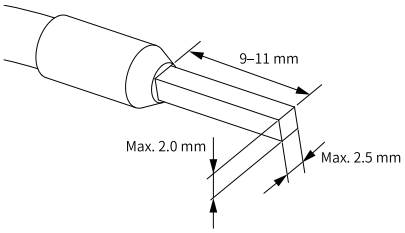
### 5.7.1 Cable Selection

- Power cable

  The cable lugs and diameters in the following table are only for reference.

| Material Name | Applicable Cable Diameter | | KST | | Suzhou Yuanli | |
|---|---|---|---|---|---|---|
| | $mm^2$ | AWG | Model | Crimping tool | Model | Crimping Tool |
| Tubular lug | 0.3 | 22 | E0308 | KST2000L | 0308 | YAC-5 |
| | 0.5 | 20 | E0508 | | 0508 | |
| | 0.75 | 18 | E7508 | | 7508 | |
| | 1.0 | 18 | E1008 | | 1008 | |
| | 1.5 | 16 | E1508 | | 1508 | |

  To use other types of tubular lugs, crimp the lug to the cables according to the shape and dimension requirements shown below.

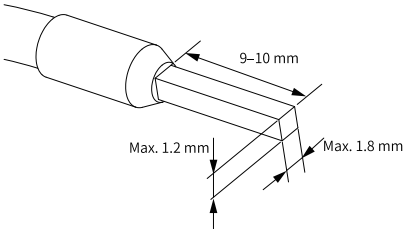



- Communication cable

  The cable lugs and diameters in the following table are only for reference.

| Material Name | Applicable Cable Diameter | | KST | | Suzhou Yuanli | |
|---|---|---|---|---|---|---|
| | $mm^2$ | AWG | Model | Crimping Tool | Model | Crimping Tool |
| Tubular lug | 0.3 | 22 | E0308 | KST2000L | 0308 | YAC-5 |
| | 0.5 | 20 | E0508 | | 0508 | |

To use other types of tubular lugs, crimp the lug to the cables according to the shape and dimension requirements shown below.

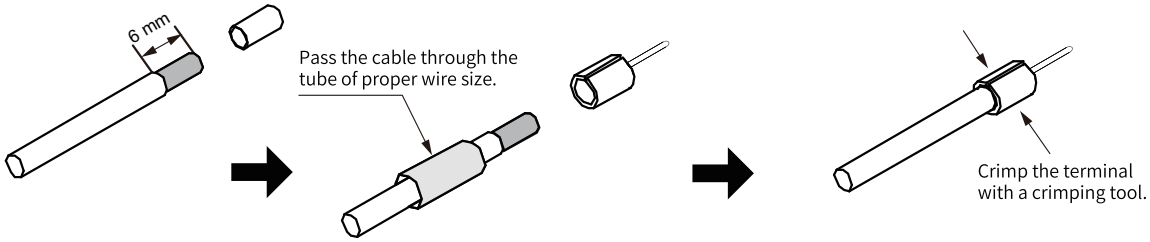



## 5.7.2 Cable Preparation

### Cable with pin type lug

Preparation procedure:

1. Strip the insulation layer to expose 6 mm of the conductor.
2. Pass the cable through the tube of proper wire size.
3. Insert the exposed conductor into the hole of the cable lug and then crimp it with a crimping tool recommended by the lug manufacturer.
4. Use a heat-shrinkable tube (Φ3) of 20 mm long to wrap the copper tube of the cable lug and then perform thermal shrinkage.
5. Insert the cable lug into the terminal block.

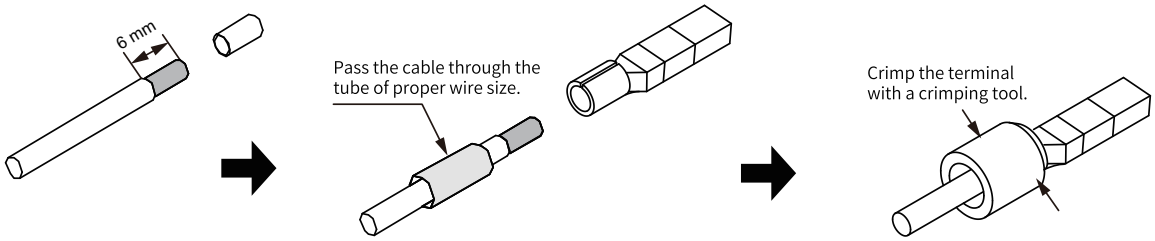



### Cable with tubular lug

Preparation procedure:

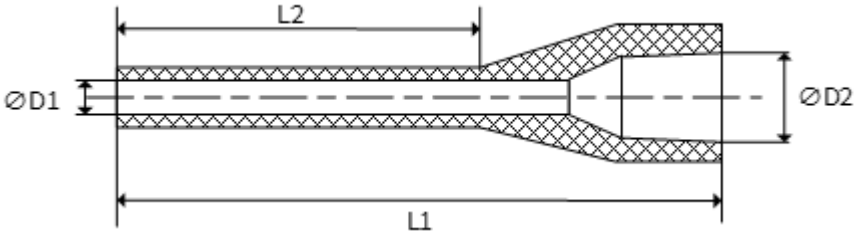
1. Strip the insulation layer to expose 6 mm of the conductor.

2. Pass the cable through the tube of proper wire size.
3. Insert the exposed conductor into the hole of the cable lug and then crimp it with a crimping tool recommended by the lug manufacturer.
4. Insert the cable lug into the terminal block and fix it with a screwdriver. The maximum tightening torque is 0.45 N.m.




For the 2*6-pin dual-row connector used for I/O and communication, the requirements are as follows:






| Category | Terminal Head Size | Length of Metal Part (L2) | Length of Stripped Part |
|---|---|---|---|
| Tubular head with sheath (max. conductor OD: 2.6 mm) | 1.00 mm² [H1.0/18D] | 12 mm | 15 mm |
| | 0.75 mm² [H0.75/18D] | 12 mm | 14 mm |
| | 0.50 mm² [H0.5/16D] | 10 mm | 12 mm |
| | 0.34 mm² [H0.34/12D] | 8 mm | 10 mm |
| | 0.25 mm² [H0.25/12D] | 8 mm | 10 mm |
| | 0.14 mm² [H0.14/12D] | 8 mm | 10 mm |
| Naked head | 1.50 mm² [H1.5/10D] | 10 mm | 10 mm |
| Tubular head with sheath (crimping two wires) | 2 x 0.20 mm² [H0.5/16D] | 10 mm | 12 mm |
| | 2 x 0.34 mm² [H0.5/16D] | 12 mm | 15 mm |

# 6 Operation Description

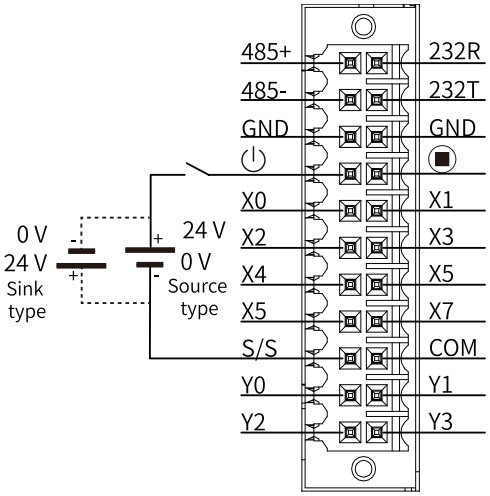
## 6.1 Power-On

**Prerequisite**: The controller has been powered off.

**Procedure**

The controller can be powered on in two ways:

- If the 24 V input power terminal is not connected, connect the 24 V power input.
- If the 24 V input power terminal is connected and the ON/OFF terminal is wired as shown below, power on the ON/OFF signal circuit for 1 second.




Warning

- Do not touch the terminals during power on. Failure to comply may result in electric shock.
- Do not disassemble this product, especially during power on or shortly after power off. Failure to comply may result in short circuits and other faults. In addition, sharp components and high temperatures inside the product may cause physical injury.
- Do not keep powering on the remote ON/OFF signal circuit. The input signal will repeatedly trigger the product to switch on and off.

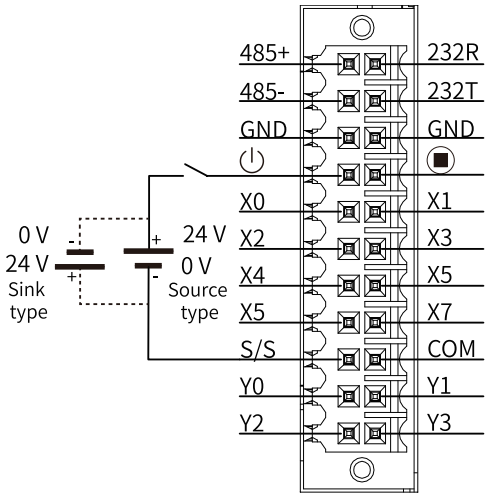
## 6.2 Power-Off

**Prerequisite**: The controller has been powered on.

**Procedure**

The controller can be powered off in three ways:

- Directly disconnect the 24 V input power.
- Enter the command "shutdown" on the Linux command line.
- If the ON/OFF terminal is wired as shown below, the controller can be powered off by powering on the ON/OFF signal circuit for 5 seconds.

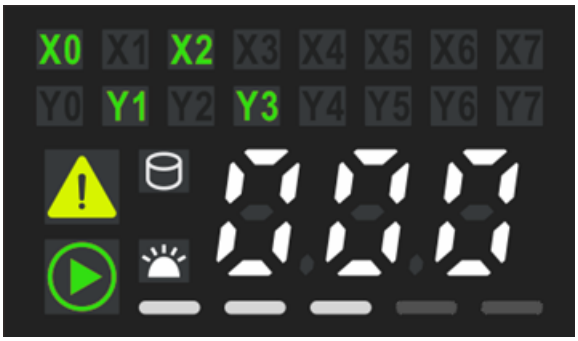



**Caution**

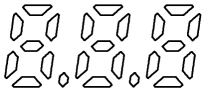
The product does not support rapid power-on and power-off. After power-off, ensure at least a 5-second interval before power-on. Failure to comply may result in unsuccessful power-on. In this case, power off and restart the product again.

## 6.3 Display

The display is shown below.




The following table describes the function of each display part.

| Part | Function | Remark |
|---|---|---|
|  | DI/DO status | ON: Green<br>OFF: Not displayed |
|  | Error code | White: The error code is displayed in white. |
|  | SSD indicator | The indicator blinks when data is being read or written. |
|  | Operation warning | Steady on (in yellow): Operation warning for user program or system. |

| Part | Function | Remark |
| --- | --- | --- |
|  | Error indicator<br>(ERR) | Steady on (in red): Error alarm for user program or system. |
|  | Running status indicator (RUN) | Blinking: The device is being identified.<br>Steady on (in green): The user program is running. |
|  | System identification indicator | Blinking: The PLC is identified. |
|  | CPU usage | 0 < CPU usage ≤ 10: One LED indicator is on.<br>10 < CPU usage ≤ 30: Two LED indicators are on.<br>30 < CPU usage ≤ 60: Three LED indicators are on.<br>60 < CPU usage ≤ 90: Four LED indicators are on.<br>CPU usage > 90: Five LED indicators are on. |

# 7 Programming and Debugging

For the programming and debugging process, see *Medium-Sized PLC Programming Software User Guide*, *Medium-Sized PLC Programming Guide (Motion Control)*, and *Medium-Sized PLC Programming Instructions*.

# 8 Maintenance and Troubleshooting

## 8.1 Periodical Maintenance and Inspection

Periodical inspection is required because the parts of the controller may deteriorate due to environmental conditions. The recommended interval is 6 to 12 months, which can be shortened according to the environmental conditions. If any item fails the inspection, take the corresponding solution.

| No. | Item | Description | Criteria | Solution |
|---|---|---|---|---|
| 1 | Power supply | Measure the voltage through the power terminal block to see if the voltage variation is within the allowable range. | 24 VDC (-15% to +20%) | Measure the voltage between terminals using a multimeter and keep the voltage variation within the allowable range. |
| 2 | Ambient environment | Ambient temperature (when the controller is located in a cabinet, the temperature in the cabinet is the ambient temperature). | -5°C to +55°C | Measure the ambient temperature using a thermometer and keep the ambient temperature within the range of -5°C to +55°C. |
| | | Ambient humidity (when the controller is located in a cabinet, the humidity in the cabinet is the ambient humidity). | 10% RH to 90% RH, without condensation | Measure the ambient humidity using a hygrometer and keep the ambient humidity within the range of 10% to 90% RH. If the temperature changes drastically, make sure there is no condensation. |
| | | Direct sunlight | Not allowed | Provide a shelter. |
| | | Dust, dirt, salt, and iron filings | Not allowed | Remove them and provide a shelter. |
| | | Droplets of water, oil, and chemicals | Not allowed | Remove them and provide a shelter. |
| | | Corrosive gas or flammable gas | Not allowed | Use an odor or gas sensor for detection. |
| | | Vibration or shock to the controller | The vibration or shock to the controller should be within the specified resistance range. | Use cushioning materials for vibration and shock resistance. |
| | | Interference sources | Not allowed | Keep the controller away from interference sources or take shielding measures. |

| No. | Item | Description | Criteria | Solution |
|---|---|---|---|---|
| 3 | Installation and wiring | Check whether the cable connectors are fully inserted and locked. | Avoid loose connection. | Fully insert the connector and lock it with screws. |
| | | Check whether the external wiring screws are securely fastened. | Avoid loose connection. | Use a Phillips screwdriver to tighten the screws. |
| | | Check whether the external wiring terminals are properly distanced. | Ensure a proper distance between terminals. | Check the distance visually and correct any improper distance. |
| | | Check for broken external cables. | Avoid broken external cables. | Check cables visually and replace broken cables (if any). |
| 4 | Real-time clock battery (button battery) | Check whether the battery has exceeded the validity period or service life. | No alarm for low battery voltage is displayed on the controller. | The validity period of the battery at 25°C is 5 years. The service life of the battery is generally 0.75 to 5 years, depending on the model and ambient temperature. If the service life expires, replace the battery whether it can run normally or not. For the replacement method, see section *"8.2 Battery Installation and Removal" on page 43*. |

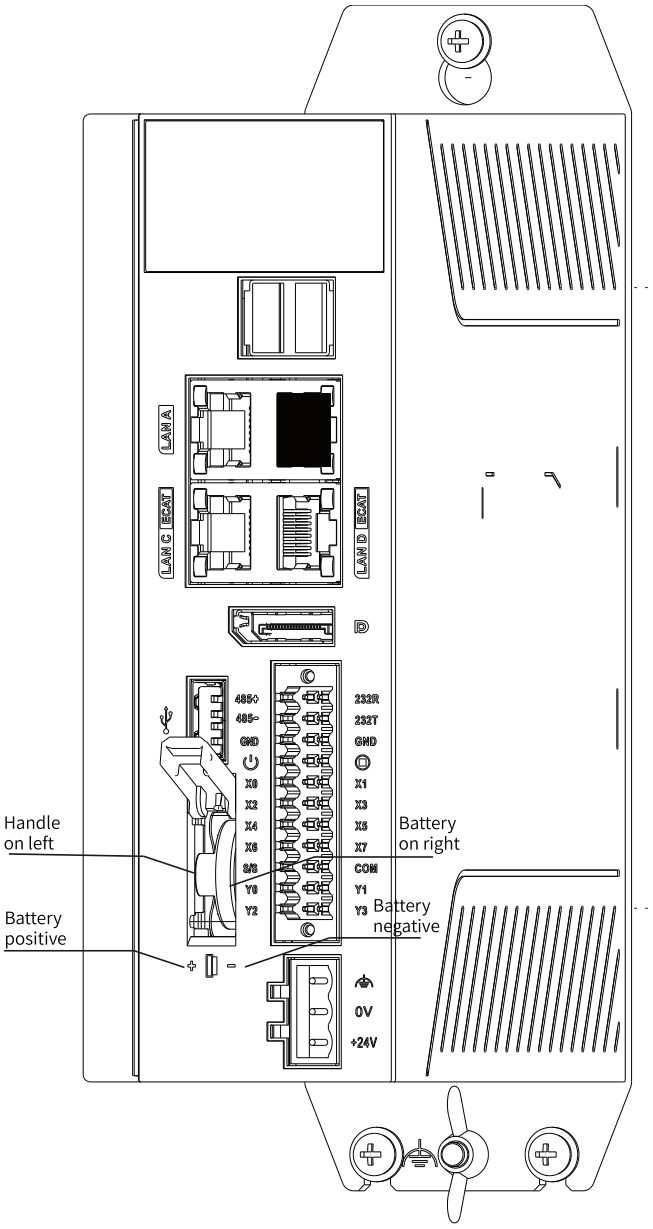
## 8.2 Battery Installation and Removal

### Precautions

- Before installing or removing the battery, power off the controller.
- When installing the battery, check the label at the bottom of the battery to identify the positive and negative poles. Make sure the battery is located on the right of the battery handle to facilitate the next removal.
- After replacing the battery, you need to manually start the controller.
- After replacing the battery, power on the controller and check if the controller reports a battery error. If such an error is reported, check whether the battery is installed correctly.
- If the controller is powered on without reporting any error, recalibrate the system clock.
- Do not replace the battery in environments with potential explosion hazards such as gas, vapor, dust, or fibers.
- Dispose of the removed battery properly to avoid environmental pollution and physical injury.

### Procedure

1. Open the battery cover clockwise.
2. Slowly pull out the battery handle in the direction perpendicular to the controller.




**Caution**

Do not pull the pull tab forcibly to prevent it from breakage.

3. Insert the new battery into the slot, flip the handle, and close the battery cover.

## 8.3 Maintenance of the Battery

### Purpose of the battery

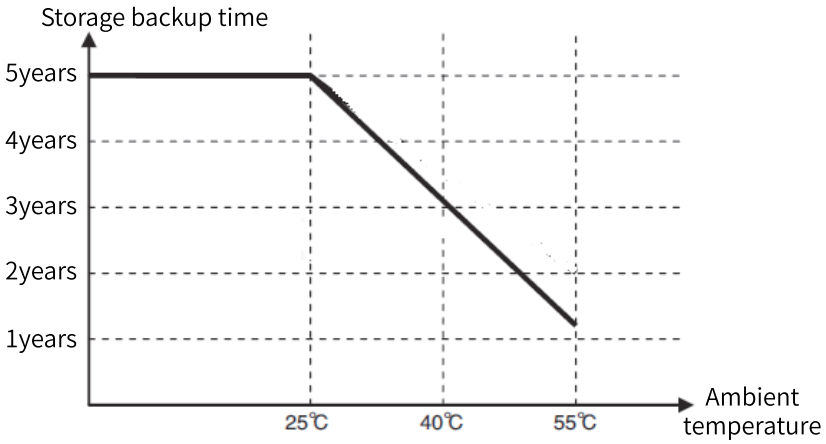
A battery is required for the RTC timing of the clock in the controller and for keeping the CMOS data when the power is off. If the battery is not installed or the battery is depleted, the clock will stop timing, and the BIOS CMOS data will be lost when the power is off.

### Battery life and replacement interval

The actual life of the battery is related to the application scenario of the controller. The curve below shows the longest life and is for reference only.

When the controller prompts that the battery is abnormal, replace the battery in time to ensure that the clock function of the controller is normal.

When a time deviation is found, check the battery voltage and replace the battery in time.




* The storage backup time in the figure is for reference.

## 8.4 Upgrade Using the USB Flash Disk

### PLC firmware upgrade

Procedure:

1. Obtain the PLC firmware upgrade package from Inovance.
2. Copy this package to the root directory of the USB flash disk, insert the USB flash disk to the USB interface of the PLC, and wait for the automatic upgrade.

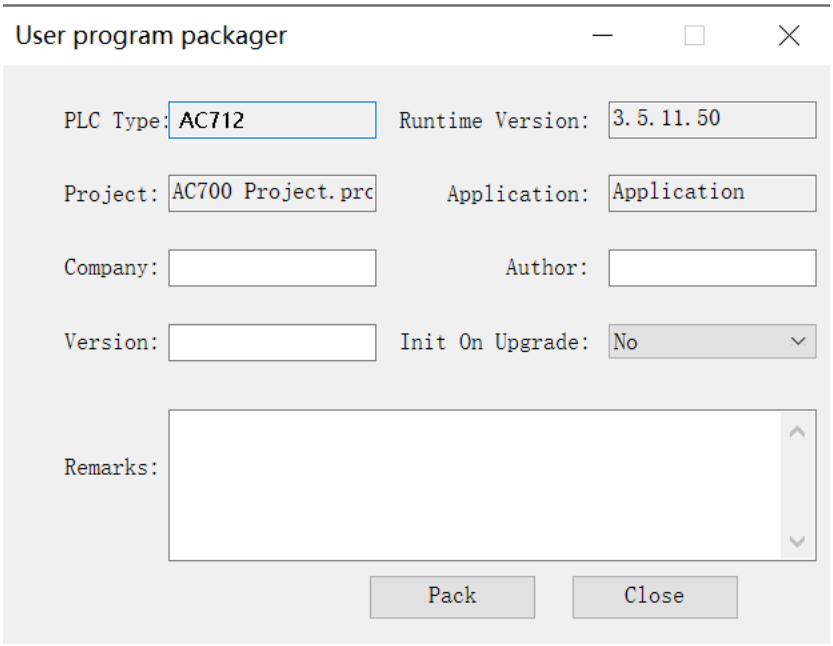
**Note**

- Do not modify the name of the PLC firmware upgrade package.
- Place the PLC firmware upgrade package only under the root directory of the USB flash disk.
- Before the upgrade is completed, do not remove the USB flash disk. Remove the disk only after the automatic restart following the upgrade.
- If you remove the USB flash disk before countdown, the upgrade will not start. The firmware upgrade starts after countdown. Removing the disk at this time will bring uncertainty to the upgrade result.
- Do not power off the controller during the firmware upgrade.

### User program upgrade

Procedure:

1. Choose Compile > Pack User Program to generate a user program package.




PLC Type: Retain the default value.

Runtime Version: Retain the default value.

Application: Retain the default value.

Init On Upgrade: "Yes" indicates the data saved upon power failure will be initialized after upgrade; "No" indicates an upgrade without initialization.

2. Place the user program package under the root directory of the USB flash disk, insert the USB flash disk to the USB interface of the PLC, and wait for the automatic upgrade.

**Note**

- Place the user program package only under the root directory of the USB flash disk.
- Before the upgrade is completed, do not remove the USB flash disk.
- Do not power off the controller during the user program upgrade.

## 8.5 USB Flash Disk Operation

***Note***

The PLC needs to be in normal operation to complete the following operations.

### Restoring the default IP address

If the IP address of the controller is unknown, restore the default IP address as follows:

1. Format the USB flash disk to FAT32 or NTFS.
2. Create an empty file "network.default" in the root directory of the USB flash disk.
3. Insert the USB flash disk into the controller and wait for the default IP address of the controller to be restored, which takes about 1 to 2 minutes. The default IP address of LAN A port is 192.168.1.88 and that of LAN B port is 192.168.2.88.

4. Use InoProShopTool to scan and modify the IP address by connecting the PC to the LAN A port of the controller.

## Obtaining the IP address

If the IP address of the controller is unknown, obtain the IP address as follows:

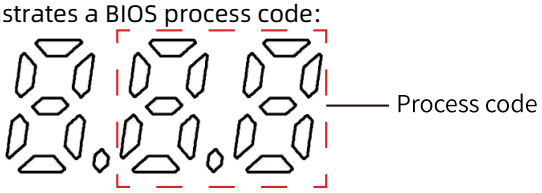
1. Format the USB flash disk to FAT32 or NTFS.
2. Create an empty file "network.info" in the root directory of the USB flash disk.
3. Insert the USB flash disk into the controller and wait for the IP address of the controller to be exported to the file "network.info", which takes about 1 to 2 minutes.

# 9 Appendix

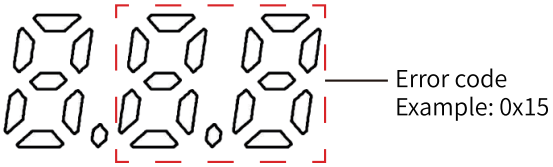
## 9.1 Process Codes and Error Codes During BIOS Startup

Note: BIOS process coding and error coding are independent of other error coding of the controller.

1. The following figure illustrates a BIOS process code:




2. The following figure illustrates a BIOS error code:




### *Note*

The last two digits on the display screen correspond to the last two digits of the error code. For example, if the last two digits on the display screen are 15, it means that the error code is 0x15.

| BIOS Code | Error Message |
|---|---|
| Process Code | |
| 0x15 | Pre-memory North Bridge initialization is started |
| 0x19 | Pre-memory South Bridge initialization is started |
| 0x32 | CPU post-memory initialization is started |
| 0x3B | Post-Memory South Bridge initialization is started |
| 0x4F | DXE IPL is started |
| 0x60 | DXE Core is started |
| 0x61 | NVRAM initialization |
| 0x62 | Installation of the South Bridge Runtime Services |
| 0x69 | North Bridge DXE initialization is started |
| 0x70 | South Bridge DXE initialization is started |
| 0x72 | South Bridge devices initialization |
| 0x78 | ACPI module initialization |
| 0x79 | CSM initialization |
| 0x90 | Boot Device Selection (BDS) phase is started |
| 0x91 | Driver connecting is started |
| 0x92 | PCI Bus initialization is started |
| 0x93 | PCI Bus Hot Plug Controller Initialization |
| 0x94 | PCI Bus Enumeration |
| 0x95 | PCI Bus Request Resources |
| 0x96 | PCI Bus Assign Resources |
| 0x97 | Console Output devices connect |
| 0x98 | Console input devices connect |
| 0x99 | Super IO Initialization |
| 0x9A | USB initialization is started |

| BIOS Code | Error Message |
|---|---|
| 0x9C | USB Detect |
| 0x9D | USB Enable |
| 0xA0 | IDE initialization is started |
| 0xA2 | IDE Detect |
| 0xAD | Ready To Boot event |
| 0xAE | Legacy Boot event |
| 0xB2 | Legacy Option ROM Initialization |
| 0xB4 | USB hot plug |
| Error code (When a BIOS error occurs, contact the manufacturer.) | |
| 0x0E | Microcode not found |
| 0x0F | Microcode not loaded |
| 0x50 | Memory initialization error. Invalid memory type or incompatible memory speed |
| 0x51 | Memory initialization error. SPD reading has failed |
| 0x52 | Memory initialization error. Invalid memory size or memory modules do not match |
| 0x2C | PEI_MEMORY_PRESENCE_DETECT |
| | Note: If the buzzer beeps consistently during startup, the memory is not installed properly or is not installed. Contact the manufacturer for a solution. |
| 0x54 | Unspecified memory initialization error |
| 0x55 | Memory not installed |
| 0x56 | Invalid CPU type or Speed |
| 0x57 | CPU mismatch |
| 0x58 | CPU self test failed or possible CPU cache error |
| 0x59 | CPU micro-code is not found or micro-code update is failed |
| 0x5A | Internal CPU error |
| 0x5B | reset PPI is not available |
| 0x5C | PEI phase BMC self-test failure |
| 0xAB | Setup Input Wait |
| 0xD0 | CPU initialization error |
| 0xD1 | North Bridge initialization error |
| 0xD2 | South Bridge initialization error |
| 0xD3 | Some of the Architectural Protocols are not available |
| 0xD4 | PCI resource allocation error. Out of Resources |
| 0xD5 | No Space for Legacy Option ROM |
| 0xD6 | No Console Output Devices are found |
| 0xD7 | No Console Input Devices are found |
| 0xD8 | Invalid password |
| 0xD9 | Error loading Boot Option (LoadImage returned error) |
| 0xDA | Boot Option is failed (StartImage returned error) |
| 0xDB | Flash update is failed |
| 0xDC | Reset protocol is not available |
| 0xDD | DXE phase BMC self-test failure |
| 0xE8 | S3 Resume Failed |
| 0xE9 | S3 Resume PPI not Found |
| 0xEA | S3 Resume Boot Script Error |
| 0xEB | S3 OS Wake Error |
| 0xF8 | Recovery PPI is not available |
| 0xF9 | Recovery capsule is not found |
| 0xFA | Invalid recovery capsule |

| BIOS Code | Error Message |
|---|---|
| 0xA1 | Failed to switch BIOS to OS |
| 0XA2 | No BIOS data was received |

## 9.2 Controller Related Error Codes

### FPGA error codes

| Error Code | Error Message | Solution |
|---|---|---|
| dE1 | FPGA watchdog timeout | • If you can connect to the PLC by using the "ping+space+controller IP address" command and the version is earlier than 1.10.27.0, it is recommended to upgrade the firmware.<br>• If you cannot, stop running the PLC program through external I/O and download the program again. |

### Runtime error codes

Runtime error codes for the AC700 series controller are the same as those for the AC800 series controller, indicated by the last two digits.

| Error Code | Error Message | Solution |
|---|---|---|
| 0x70 | Modbus RTU0:Slave address setting error | Set a legal slave address. |
| 0x71 | Modbus RTU0:Frame length error | Modify the data frame. |
| 0x72 | Modbus RTU0:Illegal data address | Set a legal data address. |
| 0x73 | Modbus RTU0:CRC check failed | 1 .Ensure the termination resistor is properly configured.<br>2 .Optimize wiring, such as eliminating potential interference sources. |
| 0x74 | Modbus RTU0:Illegal function | Check the slave parameters. |
| 0x75 | Modbus RTU0:Communication time out | 1 .Ensure the slave is working properly.<br>2 .Ensure the connection is normal.<br>3 .Ensure the termination resistor is properly configured.<br>4 .Optimize wiring, such as eliminating potential interference sources. |
| 0x76 | Modbus RTU0:Illegal data value | Check the range of data written by slave. |
| 0x77 | Modbus RTU0:Buffer overflow | Check the range of data written by slave. |
| 0x78 | Modbus RTU0:Server device failure | Check the slave communication device. |
| 0x79 | Modbus RTU0:Serial port setting error | Ensure the communication configuration is correct. |
| 0x80 | Modbus RTU1:Slave address setting error | Set a legal slave address. |
| 0x81 | Modbus RTU1:Frame length error | Modify the data frame. |
| 0x82 | Modbus RTU1:Illegal data address | Set a legal data address. |
| 0x83 | Modbus RTU1:CRC check failed | 1 .Ensure the termination resistor is properly configured.<br>2 .Optimize wiring, such as eliminating potential interference sources. |

| Error Code | Error Message | Solution |
|---|---|---|
| 0x84 | Modbus RTU1:Illegal function | Check the slave parameters. |
| 0x85 | Modbus RTU1:Communication time out | 1 .Ensure the slave is working properly.<br>2 .Ensure the connection is normal.<br>3 .Ensure the termination resistor is properly configured.<br>4 .Optimize wiring, such as eliminating potential interference sources. |
| 0x86 | Modbus RTU1:Illegal data value | Check the range of data written by slave. |
| 0x87 | Modbus RTU1:Buffer overflow | Reduce communication load. |
| 0x88 | Modbus RTU1:Server device failure | Check the slave communication device. |
| 0x89 | Modbus RTU1:Serial port setting error | Ensure the communication configuration is correct. |
| **Ethernet (Modbus TCP)** | | |
| 0x90 | Modbus TCP:Slave address setting error | Set a legal slave address. |
| 0x91 | Modbus TCP:Frame length error | Modify the data frame. |
| 0x92 | Modbus TCP:Illegal data address | Set a legal data address. |
| 0x93 | Modbus TCP:CRC check failed | 1 .Ensure the termination resistor is properly configured.<br>2 .Optimize wiring, such as eliminating potential interference sources. |
| 0x94 | Modbus TCP:Illegal function | Check the slave parameters. |
| 0x95 | Modbus TCP:Communication time out | 1 .Ensure the slave is working properly.<br>2 .Ensure the connection is normal.<br>3 .Ensure the termination resistor is properly configured.<br>4 .Optimize wiring, such as eliminating potential interference sources. |
| 0x96 | Modbus TCP:Illegal data value | Check the range of data written by slave. |
| 0x97 | Modbus TCP:Buffer overflow | Reduce communication load. |
| 0x98 | Modbus TCP:Server device failure | Check the slave communication device. |
| 0x9A | Modbus TCP:Destination XX is unreachable | 1 .Ensure the slave is working properly.<br>2 .Ensure the connection is normal.<br>3 .Ensure the master hardware is working properly.<br>4 .Optimize wiring, such as eliminating potential interference sources. |
| 0x9B | Modbus TCP:Protocol identifier error | Check the protocol identifier. |
| **CPU errors** | | |
| 0x21 | System:Runtime crashed | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| 0x22 | System:Comm.Timeout between PLC & LCD Panel | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| 0x24 | Battery voltage is too low or battery is in reverse | Replace the battery or reinstall it properly. |
| 0x25 | Fan is broken or not installed | Check for fan fault |

| Error Code | Error Message | Solution |
|---|---|---|
| 0x26 | The communication between daemon process and application program operation environment times out | 1 .Correct the application program and restart the PLC. Download and execute the program again.<br>2 .Obtain program run logs through the diagnostic window.<br>3 .Collect log information and analyze it through InoproShopTool. |
| 0x27 | Application exception! | Check and update the application program. |
| 0x28 | Load bootproject fail! | Check the startup project. |
| 0x2E | ProcessorLoad exception | Check the application task configuration |
| 0x2F | Network open failed | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| **Authentication errors** | | |
| 0x23 | Authentication failed, please contact the supplier! | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| **Memory errors** | | |
| 0x31 | Memory init fail | Return the device for repair. |
| **Register errors** | | |
| 0x29 | FPGA PCIE offline and online again | 1 .Record exceptions and provide feedback to Inovance developers.<br>2 .Analyze EMC issues on site. |

## 9.3 EtherCAT Related Error Codes

The EtherCAT error codes are independent and do not conflict with other error codes of the controller. All the EtherCAT error codes start with "E".

| Error Code | Error Message | Solution |
|---|---|---|
| E01 | Master communication error, data loss exceeding 100 consecutive frames. | 1 .Check if the network cable connection between the master and slave is down.<br>2 .Check that the connection to OUT port of the slave is correct.<br>3 .Check that the network cable is connected properly.<br>4 .Check that the network cable connector is wrapped in metal.<br>5 .Check that the network cable meets the specification requirements for Cat5e cables.<br>6 .Check that the device is properly grounded.<br>7 .On the master, set xRestart to TRUE to restart the bus.<br>8 .Power off and restart the PLC and slave. |
| E02 | Partial slaves are offline and the number of online slaves does not match the configured number. | Check if the slave is powered off and if the network cable is disconnected. |
| E03 | The DC clock is abnormal and the reference clock remains unchanged. | Check if the reference clock slave is disconnected. |

| Error Code | Error Message | Solution |
|---|---|---|
| E04 | Failed to open the network card. | 1 .Check the network interface configuration.<br>2 .Restart the PLC.<br>3 .Replace the PLC. |
| E05 | Failed to open the redundant network card. | 1 .Check the network interface configuration.<br>2 .Restart the PLC.<br>3 .Replace the PLC. |
| E06 | Failed to open the redundant network card: the redundancy function is incorrectly configured on the same network card. | 1 .Restart the PLC.<br>2 .Replace the PLC. |
| E07 | Slave initialization error: slave does not exist during startup, or communication cannot be established. | 1 .Check if the network cable connection between the master and slave is down.<br>2 .Check if the network cable connection between slave stations is disconnected, poorly connected, or experiencing hardware failure.<br>3 .Check if the slaves are interconnected at OUT ports.<br>4 .Use EtherCAT scanning function to locate the faulty slave.<br>5 .Power off and restart all slaves. |
| E08 | Vendor ID mismatch: the configured value does not match the actual one. | 1 .Use EtherCAT scanning function to compare configuration with scanning results.<br>2 .Power off and restart the slave that the master failed to access. |
| E09 | Product ID mismatch, the configured value does not match the actual one, or the master failed to read the slave's product ID. | 1 .Use EtherCAT scanning function to compare configuration with scanning results.<br>2 .Power off and restart the slave which the master failed to access. |
| E0A | Number of slaves mismatch, the configured number of slaves exceeds the actual ones. | Use EtherCAT scanning function to compare configuration with scanning results. |
| E0B | Failed to download EtherCAT SDO. | See the slave device user guide to find the error cause and the solution in "Return Error Code" section. |
| E0C | SDO downloading timeout | 1 .Check the network connection status of the slave.<br>2 .Check user programs, reduce the scheduling times of SDO, EOE, and SOE function blocks to reduce the communication load. |
| E0D | Slave emergency event error | See the slave device user guide to find the error cause in "Emergency Event Error Code", "Error Register", and "Manufacturer Custom Error Code" sections. |
| E0E | Failed to download EtherCAT SOE. | 1 .See the slave device user guide to find the error cause in "Return Error Code" section.<br>2 .Reconnect the slave to the network. |
| E0F | SOE downloading timeout | 1 .Check the network connection status of the slave.<br>2 .Check user programs, and reduce the number and frequency of SDO, EOE, and SOE function blocks. |

| Error Code | Error Message | Solution |
|---|---|---|
| E10 | Master request state machine timeout | 1 .In the overview interface of EtherCAT master, check the network cable connection status and the slaves with a non-zero receive error counter value.<br>2 .Check that the device is properly grounded.<br>3 .Restart EtherCAT master.<br>4 .Replace the slave device. |
| E20 | Slave alias address conflict: multiple slaves in the actual network are configured with the same alias address. | In the EtherCAT scanning interface, reconfigure the alias address of the conflicting slaves. After successful writing, power off and restart the slaves to take effect. |
| E21/E12D (E2D) | IN/OUT connection error between slaves | 1 .Check if the slaves are interconnected at OUT ports.<br>2 .Connect the OUT port of the slave to the master. |
| E22 | EEPROM access failed: master failed to access EEPROM of the slave during startup. | Power off and restart the slave. |
| E30 | Continuous frame drop error | 1 .Check that the network cable is connected.<br>2 .Replace the network cable.<br>3 .Replace the slave.<br>4 .Add a magnetic ring or replace with a higher-grade network cable. |
| E31 | Slave connection disconnected | 1 .Check that the network cable connector is connected properly.<br>2 .Check that the network cable is connected.<br>3 .Replace the network cable. |
| E32 | Occasional frame drop warning | 1 .Replace the network cable.<br>2 .Replace the current or the previous slave.<br>3 .Add a magnetic ring or replace with a higher-grade network cable. |
| E64 | Failed to switch the communication status | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E65 | Slave unspecified error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E66 | Slave mailbox memory allocation failed | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E6A | Firmware mismatch: the slave firmware version EEPROM storage information is inconsistent. | Replace the firmware program. |
| E6B | Failed to upgrade slave firmware. | Check the master state machine switchover request process; cross-level requests to change the slave state machine are prohibited. |
| E75 | State machine error | Check the master state machine switchover request process; cross-level requests to change the slave state machine are prohibited. |
| E76 | The slave received an unknown state change request. | Check the master state machine switchover request process; cross-level requests to change the slave state machine are prohibited. |
| E77 | State machine error: the slave does not support boot mode. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |

| Error Code | Error Message | Solution |
|---|---|---|
| E78 | Invalid firmware program | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E79 | Mailbox configuration error is detected in the slave boot state. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E7A | The mailbox configuration is incorrect. The slave pre-running state detects that the mailbox configuration is incorrect | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E7B | Sync manager error: invalid sync manager configuration is detected in the slave. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E7C | Input data invalid | Reconfigure slave input PDO data. |
| E7D | Output data invalid | Reconfigure slave output PDO data. |
| E7E | Sync error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E7F | Sync manager watchdog timeout | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E80 | Sync manager type invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E81 | Output PDO configuration invalid | The slave does not support the configuration quantity of output PDO object dictionary. Adjust the output PDO. |
| E82 | Input PDO configuration invalid | The slave does not support the configuration quantity of output PDO object dictionary. Adjust the input PDO. |
| E83 | Watchdog configuration invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E84 | Slave needs cold restart. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E85 | Slave needs initialization status. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E86 | Slave needs pre-operational status. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E87 | Slave needs safe-operational status. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E88 | Input mapping invalid: the slave does not support input PDO parameter configuration. | 1 .Check if input PDO object dictionary entries do not match the slave firmware program.<br>2 .Check if Vendor ID verification is disabled in slave configuration and check if Product ID is inconsistent between slave configuration and actual hardware. |
| E89 | Output mapping invalid: the slave does not support output PDO parameter configuration. | 1 .Check if output PDO object dictionary entries do not match the slave firmware program.<br>2 .Check if Vendor ID verification is disabled in slave configuration and check if Product ID is inconsistent between slave configuration and actual hardware. |

| Error Code | Error Message | Solution |
|---|---|---|
| E8A | Slave settings inconsistent | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E8B | Mode configuration error: the slave does not support free-run mode. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E8C | Mode configuration error: the slave does not support synchronization mode. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E8E | Parameter configuration error: the slave free-run mode requires configuration of three buffers. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E8F | Input and output invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E90 | DC synchronization error: the watchdog timed out for Sync0 in slave DC mode | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E91 | DC synchronization error: no Sync0 interrupt signal is detected during the switchover from slave safety mode to operation mode. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E92 | DC synchronization error: the slave synchronization cycle time is too short. | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E94 | DC synchronization configuration invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E95 | DC latch configuration invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E96 | PLL error: slave synchronization lost, master failure detected. | 1 .The slave reconnects after network disconnection, and the error is automatically reset.<br>2 .The bus cycle is unreasonable, recommended parameters: 125us to 8000us; the master synchronization offset is unreasonable, adjustment range: -50% to -50%. |
| E97 | DC Invalid | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E98 | DC timeout error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E99 | Synchronization cycle time error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| E9A | Sync0 configuration error: the Sync0 cycle of the slave is out of range. | Adjust the DC cycle setting of Sync0. |
| E9B | Sync1 configuration error: the Sync1 cycle of the slave is out of range. | Adjust the DC cycle setting of Sync1. |
| EA5 | Slave MBX_AOE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EA6 | Slave MBX_EOE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |

| Error Code | Error Message | Solution |
|---|---|---|
| EA7 | Slave MBX_COE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EA8 | Slave MBX_FOE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EA9 | Slave MBX_SOE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EB3 | Slave MBX_VOE error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EB4 | Slave EEPROM address not accessible | Change the EEPROM access address or data length. |
| EB5 | Slave EEPROM error | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EB6 | Slave external hardware not ready | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| EC4 | Slave restarted locally | 1 .Power on the controller again.<br>2 .Contact the agent or Inovance. |
| ED4 | Slave configuration error: the mounted module configuration of the slave coupler does not match the actual setup. | Use EtherCAT scanning function to compare the project configuration with scanning results. |

## 9.4 Other Display Codes

| Screen Display Code | Description |
|---|---|
| P.OF | The controller is saving data upon power failure. |
| U.UU | InoProshopTool is upgrading board firmware. |
| U.CC | InoProshopTool successfully upgraded board firmware. |
| P.UU | The application is being upgraded through the USB drive. |
| P.CC | The application was successfully upgraded through the USB drive. |
| P.Er | Failed to upgrade the application through the USB drive. |
| F.UU | The board firmware is being upgraded through the USB drive. |
| F.CC | The board firmware was successfully upgraded through the USB drive. |
| F.Er | Failed to upgrade the board firmware through the USB drive. |

# 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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