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AC800 Series

Intelligent Programmable Logic Controller

User Guide

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

Data code PS00002145B10

Legal Information

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

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

Waste Disposal

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 AC800 intelligent controller is a high-performance multi-axis motion controller based on an Intel x86 processor platform and compliant with PLCopen standards. With EtherCAT as the fieldbus, it supports multi-axis servo control and is ideal for high-speed production equipment and large-scale machinery in advanced manufacturing.

This guide describes the installation and wiring of the product, including mechanical installation, electrical installation, and operating instructions.

Standards compliance

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

More documents

Document	Code	Description
Medium-Sized PLC Programming Software User Guide	PS00003145	Describes the basic functions, quick start guidance, network configuration, and programming basics of the medium-sized PLC programming software.
Medium-Sized PLC Programming Guide (Motion Control)	19012378	Describes the composition of the medium-sized PLC motion control system, the mechanisms of motion control programs, detailed explanation of MC instructions, simulation and commissining operations.
Medium-Sized PLC Instructions User Guide	19012377	Describes the basic instructions for the medium-sized PLC.
AM800 Series Intelligent Programmable Logic Controller User Guide (this guide)	PS00002145	Describes the installation and wiring of the product, including mechanical installation, electrical installation, and operating instructions.

Revision history

Date	Version	Description of changes
2026-08	B10	Corrected some minor errors.
2026-04	B09	**New content:** • Added *"5.3.2 Power-Off Data Retention Wiring" on page 31*. • Added *"5.3.3 Remote RUN/STOP Control Wiring" on page 32*. • Added the description for AC802-0222-U0R0-A02 in *"2.2 Nameplate and Model" on page 13*. • Added the product information for AC802-0222-U0R0-A02 in *"2.3.1 Controller Appearance" on page 14*. • Added the specifications for AC802-0222-U0R0-A02 in *"3.1 General Specifications" on page 20*. **Removed content:** Deleted the "UPS and Status I/O Wiring" section.
2025-12	B08	• Added the fault code 0x3F (Er.3F) in *"9.2 Appendix 2 Fault Codes for Controller-Related Functions" on page 64*. • Added descriptions of FINS TCP/UDP and MELSEC protocols in *"3.1 General Specifications" on page 20*. • Corrected some minor errors.
2025-02	B07	Corrected some minor errors.
2024-04	B06	Modified the voltage specifications in *"5.3.1 I/O Communication Interface Specifications" on page 29*.

Date	Version	Description of changes
2024-01	B05	• Modified CPU fault codes in *"9.2 Appendix 2 Fault Codes for Controller-Related Functions" on page 64*. • Modified the EtherCAT fault codes in *"9.3 Appendix 3 Fault Codes for EtherCAT-Related Functions" on page 66*.
2023-07	B04	Corrected some minor errors.
2023-06	B03	Deleted the information related to the multi-function expansion card slot. Corrected some minor errors.
2022-12	B02	Optimized interface descriptions.
2022-11	B01	Corrected some minor errors.
2020-10	B00	• Added the optional accessory of CAN expansion card. • Added information on AC801 and AC812 models. • Updated the display screen operations and added "expansion card version", "restore backup program", "UPS settings", and "factory reset" sections.
2018-11	A00	Initial release.

Access to the guide

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

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

Even within the warranty period, maintenance will be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal 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 disaster, earthquake, lightning strike)

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.

First Use

Read through this user guide carefully before use for the first time. If you have any question concerning product functions or performance, contact Inovance for technical support.

Standard

Certification marks on the product nameplate indicate compliance with the corresponding certifications.

Certification	Certification Mark	Directive		Standard
CE Certification	CE	EMC Directive	2014/30/EU	EN 61800-3
		LVD Directive	2014/35/EU	EN 61800-5-1
		RoHS Directive	2011/65/EU	EN 50581
TUV Certification	TÜV SÜD	-		EN 61800-5-1
UL Certification	c UL us LISTED	-		UL61800-5-1 C22.2 No.14-13
EAC Certification	EAC	-		CU-TR
KCC Certification	KC	-		-
3C Certification	CCC	-		-

- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE standards and the European Norm.
- For more information on product certifications, contact Inovance agent.

System Startup Process

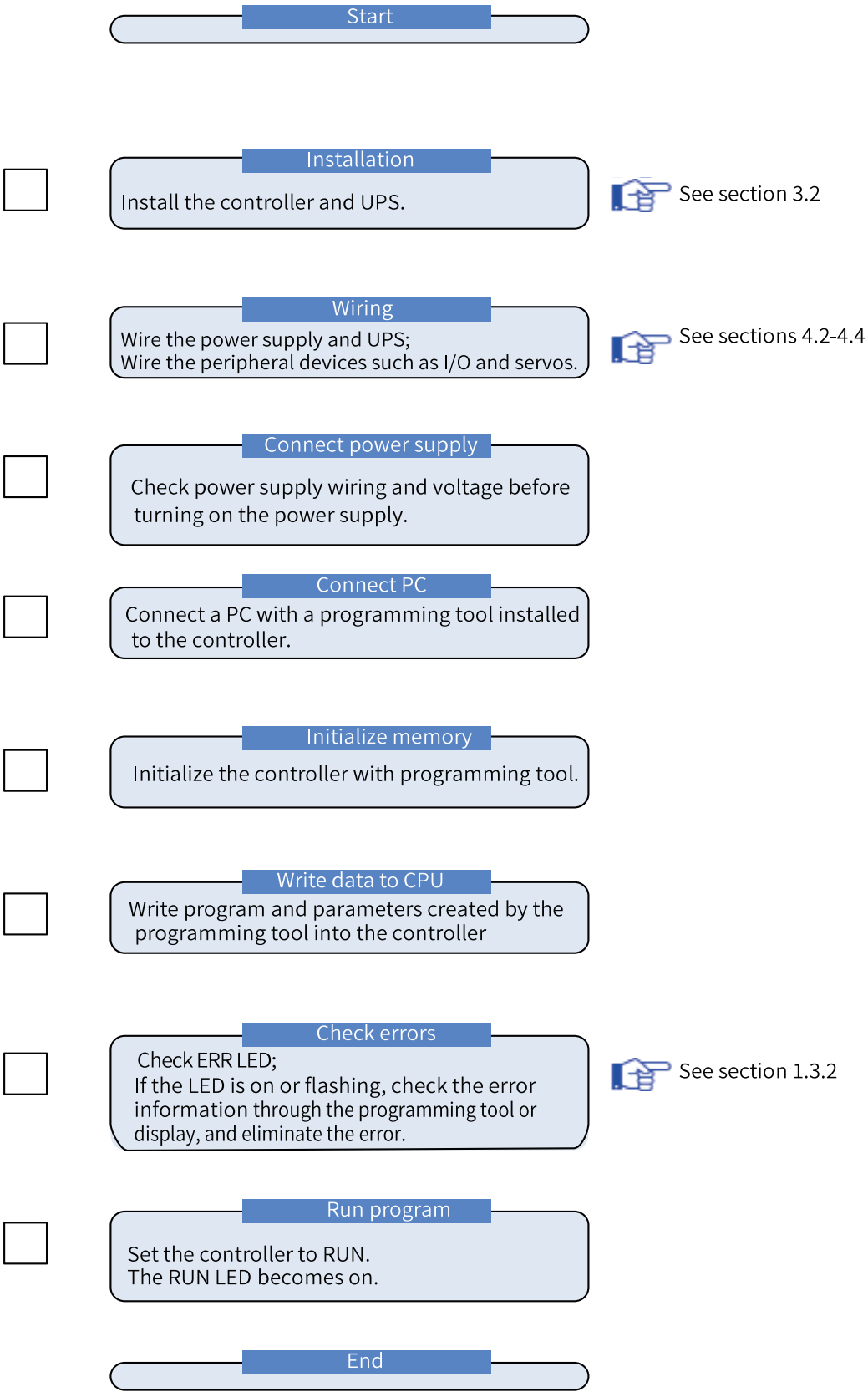


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1 Fundamental Safety Instructions

1.1 General Safety Instructions

Safety Disclaimer

1. Read and comply with the safety instructions during installation, operation, and maintenance of the product.
2. To ensure personal and equipment safety, observe all safety precautions marked on the product and described in this guide during installation, operation, and maintenance.
3. The "CAUTION", "WARNING", and "DANGER" are only supplements to the safety instructions.
4. Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
5. Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety Levels and Definitions



The "DANGER" sign indicates that failure to comply with the notice will result in death or serious injury.



The "WARNING" sign indicates that failure to comply with the notice could result in death or serious injury.



The "CAUTION" sign indicates that failure to comply with the notice could result in minor or moderate injury, or equipment damage.

Unpacking
 • Do not install the product in case of any damage, rust, or signs of prior use on the product or its accessories upon unpacking. • Do not install the product in case of water seepage into the product or missing or damaged components upon unpacking. • Do not install the product in case of any discrepancy between the product you received and the product name on the packing list.
 • 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 for damage, rust, or dents on the surfaces of the product and accessories upon unpacking. • After unpacking, check the contents against the packing list to ensure that the equipment and accessories are in the correct quantities, and that all documentation is complete.

Storage and transportation

WARNING

- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely connected components may fall off and result in personal injury or equipment damage.
- Do not stand or stay below the product which is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply could result in personal injury or equipment damage.

Caution

- Handle the equipment with care and mind your step during transportation to prevent personal injury 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 could result in personal injury.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- Do not store or transport the equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Never transport the equipment with other devices or items that could impact or cause harm to the equipment.

Design

DANGER

- Design a safety circuit and add an error handling program in the software to ensure the product remains in a safe state upon external power failure or product faults.
- If a sustained overcurrent occurs due to overload or load short circuit, the product may smoke or catch fire. An external safety device (such as a fuse or circuit breaker) must be installed.

WARNING

- If an output component (such as a relay or transistor) in this product is damaged, the corresponding output may become uncontrolled and remain permanently ON or OFF.
- The product design must comply with the overvoltage category requirements specified in the environmental specifications. A system-level lightning protection device must be installed on the power supply to ensure that lightning-induced overvoltages do not reach the product's power input, signal input, or control output terminals, thereby preventing damage to the product.
- Ensure that appropriate actions have been taken to prevent product malfunction caused by a communication fault between the product and related devices. Failure to comply could cause personal injury or equipment damage.

Caution

Switches that could cause personal injury or equipment damage must not be configured on the touch screen. Use independent switches for performing critical operations. Failure to comply could result in accidents caused by wrong outputs or faults.

Installation

DANGER

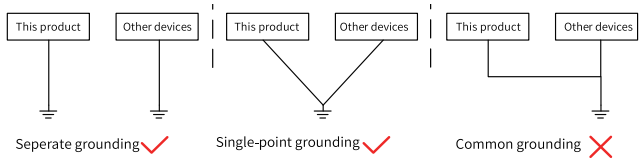
This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.

Installation
WARNING • Read through the guide and safety instructions before installation. • Do not install this equipment in places with strong electric or magnetic field. • 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. • Before installation, ensure that the installation site meets the required environmental conditions. Failure to comply could result in equipment damage. • Do not wear loose clothes or accessories during installation. Failure to comply could result in electric shock. • When installing the equipment in an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so could result in equipment overheating or fire. • Do not retrofit the equipment. • Never loosen or turn the fixing bolts on product components, or any bolts marked in red. • This equipment must be installed inside an indoor cabinet or terminal equipment. The cabinet or terminal equipment itself must be provided with the necessary protective enclosures, such as a fireproof enclosure, an electrical protective enclosure, and a mechanical protective enclosure. The IP rating of these enclosures must comply with the relevant IEC standards, and applicable 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 a non-combustible object such as metal. Keep the equipment away from combustible objects. Failure to comply could result in fire. • For products not supporting hot swapping, disconnect all external power supplies of the system before installing/removing the product. Failure to comply could result in electric shock, product failure, or malfunction.
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 product and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent the ventilation holes from being blocked, which could cause overheating due to poor heat dissipation. • During installation, ensure the equipment is connected to the respective connector securely and hook the equipment firmly. Improper installation may result in malfunction, failure, or detachment.

Wiring

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.
- Before wiring, disconnect all the power supplies of the equipment. Wait for at least the time designated on the 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 could result in electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply could result in electric shock.
- Ensure that the equipment is grounded properly. Failure to comply could result in electric shock. Separate grounding or single-point grounding, other than common grounding, is recommended.



- Insulate the cable terminals properly to ensure the insulation distance between cables will not be shortened after cables are connected to the terminal block. Failure to comply could result in electric shock or equipment damage.
- Install the terminal cover attached to the equipment before power-on or operation after wiring is completed. Failure to comply could result in electric shock.

WARNING

- Never connect the power cable to output terminals of the equipment. Failure to comply could cause equipment damage or even fire.
- Cables used for wiring must comply with the requirements for the cross-sectional area and shielding. The shielding layer of the shielded cable must be reliably grounded at one end.
- Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage to the joint, which could result in fire.
- After wiring is done, ensure that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply could result in electric shock or equipment damage.

Caution

- Follow the proper electrostatic discharge (ESD) procedure, and wear an anti-static wrist strap to perform wiring. Failure to comply could damage the equipment or its internal circuits.
- Use shielded twisted pair cables for the control circuit. Connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on

DANGER

- This equipment must be operated only by trained and qualified electrical personnel. Non-professionals must not operate this equipment.
- Before power-on, ensure that the equipment is installed and wired properly.
- Ensure that the power supply meets equipment requirements before power-on to prevent equipment damage or fire accident.
- Do not open the cabinet door or protective cover of the product, touch any wiring terminal of the product, or remove any components or parts while the product is powered on. Failure to comply could result in personal injury or even death.

WARNING

Perform a trial run after wiring to ensure the equipment operates safely. Failure to comply could result in personal injury or equipment damage.

Operation
DANGER • The equipment must be operated only by professionals. Failure to comply can result in injury or death. • Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply could result in electric shock.
WARNING • Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply could result in burns. • Prevent metal or other objects from falling into the equipment during operation. Failure to comply could result in fire or equipment damage. • During operation, do not bring live parts into contact with the metal enclosure of the product. Failure to comply could result in fire or product damage.
Caution • Operate the equipment within the specified environmental conditions. Failure to comply could result in equipment failure or damage. • Touch the HMI panel with hands only. Failure to comply could cause panel damage, which is out of the warranty range.
Safety recommendations • In positions where the operator directly touches the mechanical parts, for example, where a mechanical device is loaded/unloaded, or where a machine runs automatically, manually-operated devices or other alternative means must be carefully designed so that they are independent of the equipment to start or stop the automatic operation of the system. • If you need to modify the program while the system is running, use the lock function or other protective measures. Ensure that only authorized personnel can make the necessary modifications.

Battery usage
WARNING • Do not use batteries that do not meet the product requirements. Failure to comply could result in death, personal injury, explosion, or fire. • Do not throw batteries into fire or hot ovens. Do not crush or cut the battery. Failure to comply could result in death, personal injury, explosion, or fire. • Do not expose the battery to extremely high temperatures. Failure to comply could result in death, personal injury, explosion, or fire. • Do not swallow batteries. Failure to comply could result in chemical burns. • Seek for medical treatment immediately if a button battery is swallowed by accident, because this may cause severe internal burns within two hours and even death.
Caution • Keep batteries out of reach of children. • If the battery compartment is not securely closed, stop using the product immediately and keep it out of reach of children.

Maintenance
DANGER • Maintenance must be performed only by trained and qualified electrical personnel. • Do not maintain the equipment with power ON. Failure to comply could result in electric shock. • Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label. • Disconnect all external power supplies of the system before cleaning the equipment or re-tightening screws on the terminal block or screws for connector installation. Failure to comply could result in electric shock. • Disconnect all external power supplies of the system before removing or installing the product, or connecting or disconnecting cables. Failure to comply could result in electric shock or malfunction.

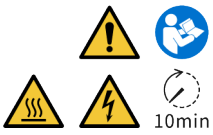
Maintenance
WARNING Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair
DANGER • Repair must be performed only by trained and qualified electrical personnel. • Do not repair the equipment with power ON. Failure to comply could result in electric shock. • Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
WARNING • Submit a request for repair based on the warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply could result in equipment damage, personal injury, or death. • Troubleshooting and repair of faulty or damaged equipment must be performed by professionals in accordance with the repair instructions, and proper repair records must be kept. • Replace quick-wear parts of the equipment according to the replacement instructions. • Do not use damaged equipment. Failure to comply could result in death, personal injury, or severe equipment damage. • Recheck the wiring and reset the parameters after equipment replacement.

Disposal
WARNING • Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply could result in property damage, personal injury, or death. • Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution. • Treat the scrapped equipment as industrial waste. Dispose of the batteries according to local laws and regulations.

Safety Label

To ensure safe operation, comply with safety labels on the equipment and do not damage or remove the labels. The following table describes the meanings of the safety labels.

Safety label	Description
	• Before using the equipment, read the guide and safety precautions carefully. Failure to comply could result in personal injury, death, or equipment damage. • Do not touch the terminals or remove the cover with power-on or within 10 min after power-off. Failure to comply could result in electric shock. • The surface of the product may become very hot during operation. Do not touch these hot areas, as this may cause burns!

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.



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

- Always use the latest software version. If the product version is no longer supported or the latest version is not used, you will be exposed to increased risk of cyber attacks.
- Develop and maintain appropriate protective measures (including but not limited to antivirus software, firewalls, WAF, IPS/IDS, situational awareness system, identity authentication, and data encryption) to prevent the files in mobile storage devices from being damaged by malware, and to protect the products, networks, systems, and interfaces from unauthorized access, tampering, hacking, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

2.1 Overview

The AC800 series intelligent programmable logic controller (PLC) features a booksize design with an all-metal enclosure and a wide range of network interfaces to meet the expansion requirements of various projects. It delivers outstanding motion control performance. The interfaces include up to two Gigabit Ethernet ports, two EtherCAT ports, two USB 2.0 ports, two USB 3.0 ports, one RS485 port, and one RS232 port.

This product series supports a wide operating temperature range of -5°C to +55°C and offers excellent EMC performance.

2.2 Nameplate and Model

Model

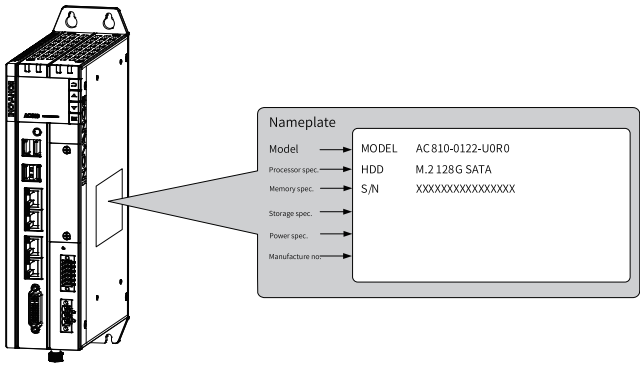
AC810-0122-U0R0

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① **Product name** A: Controller	④ **Sub-series number (2nd digit)**	⑦ **Software configuration** • W: Windows system • L: Linux system • U: Ubuntu system • V: Vxworks system
② **Product structure** C: Booksize	⑤ **Specific model** 0: AC810	⑧ **Software configuration** 0: system version
③ **Series number (1st digit)** 8: 800 series	⑥ **Hardware configuration**	⑨ **Software configuration** R0: Software configuration + version

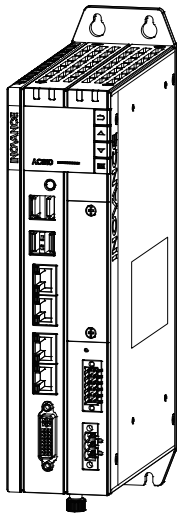
Note: AC802-0222-U0R0-A02 is a specific model that is not subject to the above naming rules.

Nameplate



2.3 Product Components and Functions

2.3.1 Controller Appearance

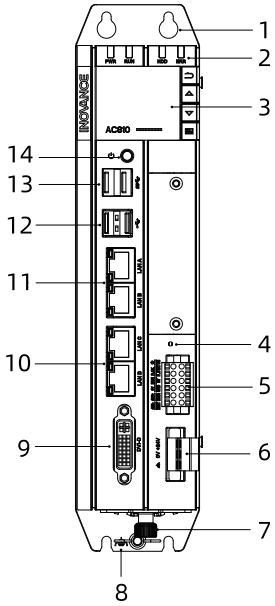


The AC800 series PLCs include the following controllers and accessories:

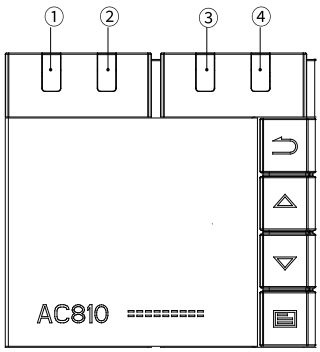
Type	Product description	Model	Product code
Booksize controller	2 x USB 2.0 ports; 2 x USB 3.0 ports; 4 x network ports; DVI-D; display; internal mini-PCIE expansion slot	AC812-0322-U0R0	01440143
Booksize controller	2 x USB 2.0 ports; 2 x USB 3.0 ports; 4 x network ports; DVI-D; display; internal mini-PCIE expansion slot	AC810-0122-U0R0	01440038
Booksize controller	2 x USB 2.0 ports; 2 x USB 3.0 ports; 4 x network ports; DVI-D; display; internal mini-PCIE expansion slot	AC802-0222-U0R0	01440101
Booksize controller	2 x USB 2.0 ports; 2 x USB 3.0 ports; 4 x network ports; DVI-D; display; internal mini-PCIE expansion slot	AC802-0222-U0R0-A02	01441775
Booksize controller	2 x USB 2 ports; 2 x USB 3.0 ports; 3 x network ports; DVI-D; display; internal mini-PCIE expansion slot	AC801-0221-U0R0	01440103

The AC800 series PLC interface diagram and descriptions are shown in the table below.

Table 2–1 AC800 series PLC interfaces

–	No.	Interface	Description
	1	Rear mounting lug	Standard component
	2	Status indicator	For detailed description of the LED indicators, see *"2.3.2 LED Status Indicators" on page 15*.
	3	Display and buttons	For detailed functions and operating instructions, see Section 6 "Operating Instructions".
	4	Reset button	Pinhole reset button
	5	I/O communication interface	3 DI/2 DO, for RS485/ RS232 communication. For detailed pin assignment and specifications, see *"5.3.4 RS485 Bus Wiring Instructions" on page 33*.
	6	Power interface	24V power input
	7	Fan compartment latch (only available in AC810 and AC812 series)	Openable fan compartment for fan and RTC battery replacement.
	8	Grounding terminal	Controller grounding point
	9	DVI-D port	Standard DVI-D display port
	10/11	LAN port	4 x LAN ports: 2 x Ethernet ports and 2 x EtherCAT ports (3 LAN ports for AC801 series, including 2 Ethernet ports and 1 EtherCAT port)
	12/13	USB Port	2 x USB 2.0 ports and 2 x USB 3.0 ports
	14	Power button	Controller power-on control

2.3.2 LED Status Indicators



The indicators are described as follows:

No.	LED	Name	Function	Status	Description
1	PWR	Power indicator	Controller power status	Green	OFF: Abnormal ON: Normal
2	RUN	RUN indicator	Running status	Green	OFF: User program is not running. Blinking: The device is being identified. ON: User program is running.
3	HDD	Hard drive indicator	Hard drive status	Green	OFF: HDD not detected. Blinking: HDD is working normally.
4	ERR	Error indicator	Operation error	Red	OFF: Normal Blinking: Low battery ON: 1. Overtemperature 2. User program error 3. System failure

2.3.3 Power Button

The power button is located under the front panel of the controller. See the following for the details:

No.	Operation	Result
1	Power-on	The controller is turned on.
2	Pressing the button after power-on	No operation
3	Long pressing the button after power-on	The controller is shut down.
4	Pressing the button upon power on after the controller is shut down.	The controller is turned on.

2.3.4 Display and Buttons

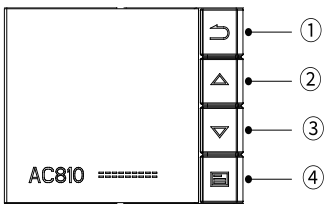


Figure 2-1 Display

The controller display is used to display basic information and perform simple commissioning. The display parameter specifications are as follows:

Item	Description
Outline dimensions	31.46 x 36.68
Visible area	16.3 x 28.78
Display type	FSTN negative display
Resolution	128 x 64

Functions of the buttons are described in the following table:

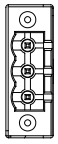
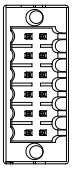
Item	Description
Button 1	Back
Button 2	Page up
Button 3	Page down
Button 4	Enter

The display shows the information on the following. For detailed operation instructions, see *“Programming and Debugging” on page 57*.

1. system operation
2. controller status
3. fault and commissioning
4. basic controller information: basic hardware information, software version, and IP address
5. upgrade and download progress

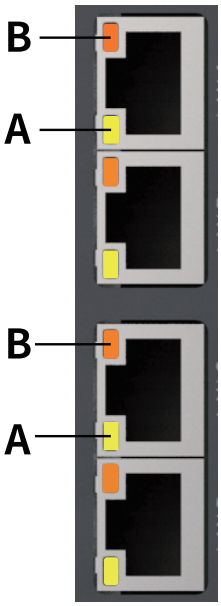
2.3.5 Interfaces

The table below summarizes the interfaces of the AC800 booksize controller:

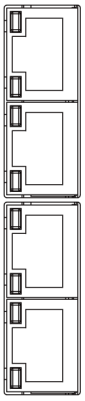
No.	Interface	Description	Interface type	Terminal type
1	Power input	24 VDC (-20% to +20%)	3-pin pluggable 5.08 mm European style terminal block, spring-clamp connection, with fixing screws, black	
2	I/O communication terminal	3DI, 2DO RS485 port RS232 port	2x6-pin pluggable 3.5 mm European style terminal block, spring-clamp connection, with fixing screws, black	

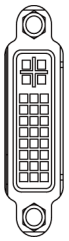
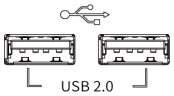
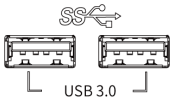
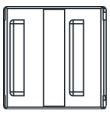
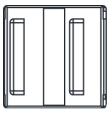
<table>
<tr><th>No.</th><th>Interface</th><th>Description</th><th>Interface type</th><th>Terminal type</th></tr>
<tr><td>3</td><td>EtherNet port</td><td colspan="2">Four LAN ports, labeled LAN A, LAN B, LAN C, and LAN D from top to bottom (AC801 has three LAN ports).

The Ethernet ports use Intel Gigabit Ethernet controllers and fully comply with the requirements of 802.1Qav, IEEE1588/802.1AS, and IEEE 802.3az. They also support Intel® active management technology (AMT). Intel® AMT is supported only on specific Intel® Core™ i processor models. The Ethernet ports provide four standard RJ45 jacks. The states of the front-panel LED indicators are described below:

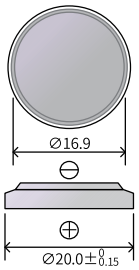
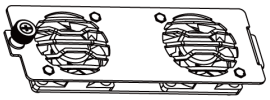
<table>
<tr><th>Indicator</th><th>Function</th><th>Color</th><th>State</th><th>Description</th></tr>
<tr><td rowspan="4">
</td><td rowspan="3">A: Link/Act</td><td rowspan="3">Yellow</td><td></td><td>OFF:
Not connected</td></tr>
<tr><td></td><td>Flashing:
Flashing: Connected and transmitting/ receiving data.</td></tr>
<tr><td></td><td>ON:
Connected</td></tr>
<tr><td rowspan="3">B: Speed</td><td rowspan="3">Green/ Orange</td><td></td><td>OFF:
1. 10 Mbps connection
2. Not connected</td></tr>
<tr><td></td><td>ON:
100 Mbps connection</td></tr>
<tr><td></td><td>ON:
1000 Mbps connection</td></tr>
</table>

Port assignment:

<table>
<tr><th>Port</th><th>Function</th><th>Description</th></tr>
<tr><td>LAN A</td><td>Ethernet 1</td><td>• For system program debugging
• For user program download and debugging
• Supports Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols.
• Socket (TCP, UDP)</td></tr>
<tr><td>LAN B</td><td>Ethernet 2</td><td>• Supports Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC protocols.
• Socket (TCP, UDP)</td></tr>
<tr><td>LAN C</td><td>EtherCAT1</td><td>• Supports the EtherCAT protocol.
• Supports automatic scanning.
• Independently supports axes and I/O.</td></tr>
<tr><td>LAN D</td><td>EtherCAT2</td><td>• Supports the EtherCAT protocol.
• Supports automatic scanning.
• Independently supports axes and I/O.</td></tr>
</table>
</td><td rowspan="2"></td></tr>
<tr><td>4</td><td>EtherCAT port</td></tr>
</table>

<table>
<tr><th>No.</th><th>Interface</th><th>Description</th><th>Interface type</th><th>Terminal type</th></tr>
<tr><td>5</td><td>DVI socket</td><td>Standard DVI-D communication</td><td>Standard DVI-I socket, white insulator, with shielded housing</td><td></td></tr>
<tr><td>6</td><td>USB2.0</td><td colspan="2" rowspan="2">The product provides four USB ports, all of which support plug-and-play and hot-swapping, and can connect up to 127 external devices. Two of the ports comply with the USB 2.0 standard, and the other two comply with the USB 3.0 standard. The USB ports are USB EHCI Rev. 2.0 compliant.
The pin assignments are as follows:
<table>
<tr><th colspan="4">USB 2.0 port pin assigment</th></tr>
<tr><td rowspan="5">
USB 2.0</td><td>Pin</td><td>Signal name</td><td>Function</td></tr>
<tr><td>1</td><td>VCC</td><td>Power supply</td></tr>
<tr><td>2</td><td>DATA-</td><td rowspan="2">USB 2.0 differential data signal</td></tr>
<tr><td>3</td><td>DATA+</td></tr>
<tr><td>4</td><td>GND</td><td>Power supply ground</td></tr>
<tr><td colspan="4">USB 3.0 port pin assigment</td></tr>
<tr><td rowspan="10">
USB 3.0</td><td>Pin</td><td>Signal name</td><td>Function</td></tr>
<tr><td>1</td><td>VCC</td><td>Power supply</td></tr>
<tr><td>2</td><td>DATA-</td><td rowspan="2">USB 2.0 differential data signal</td></tr>
<tr><td>3</td><td>DATA+</td></tr>
<tr><td>4</td><td>GND</td><td>Power supply ground</td></tr>
<tr><td>5</td><td>SSRX-</td><td rowspan="2">High-speed differential data receive signal</td></tr>
<tr><td>6</td><td>SSRX+</td></tr>
<tr><td>7</td><td>GND</td><td>Signal ground</td></tr>
<tr><td>8</td><td>SSTX-</td><td rowspan="2">High-speed differential data transmit signal</td></tr>
<tr><td>9</td><td>SSTX+</td></tr>
</table>
</td><td></td></tr>
<tr><td>7</td><td>USB3.0</td><td></td></tr>
</table>

2.3.6 Spare Parts and Options

No.	Name	Diagram	Description	Ordering code
1	RTC button battery CR2032		3 V, 230 mAh	09050002
2	fan components		70,000 Hours at 40℃, 65% RH	98050167
3	UPS	-	An external UPS power supply is required for retentive at power failure.	72030025

3 Product Specifications

3.1 General Specifications

The AC800 series includes the following controllers. Their general specifications are shown in the table below.

Item	AC801-0221-U0R0	AC802-0222-U0R0-A02	AC802-0222-U0R0	AC810-0122-U0R0	AC812-0322-U0R0
Power supply	24 VDC (–20% to +20%)				
Program-ming	IEC 61131-3 programming languages (LD, ST, SFC, CFC)				
Program execution mode	Compiled execution				
User program memory	128 MB				
User data memory	128 MB				
EtherNet/IP communi-cation	Two channels (The PLC supports up to 128 slaves as a master and supports connections from up to 128 masters as a slave.)			Two channels (The PLC supports up to 256 slaves as a master and supports connections from up to 256 masters as a slave.)	
EtherCAT communi-cation	One channel (The channel supports up to 128 slaves, with a total of 48 servo axes. It also supports robot control, CNC, electronic camming, and electronic gearing.)	Two channels (Each channel supports up to 128 slaves, with a total of 128 servo axes. It also supports robot control, CNC, electronic camming, and electronic gearing.)		Two channels (Each channel supports up to 128 slaves, with a total of 256 servo axes. It also supports robot control, CNC, electronic camming, and electronic gearing.)	
Modbus TCP communi-cation	Two channels (The PLC supports up to 63 slaves as a master and supports connections from up to 31 masters as a slave.)				
Modbus (serial) communi-cation	Two channels (Each channel supports up to 32 slaves)				
FINS TCP/ UDP communi-cation	Two channels (Each channel supports up to 32 connections)				
MELSEC communi-cation	Two channels (Each channel supports up to 32 connections)				
Retentive memory	5 MB; requires an external UPS for power supply.				
Dimensions (W x H x D)	60mm x 225mm x 164mm				

Item	AC801-0221-U0R0	AC802-0222-U0R0-A02	AC802-0222-U0R0	AC810-0122-U0R0	AC812-0322-U0R0
Weight	Approx. 2.5 kg				
Cooling method	Natural convection			Fan cooling	
Battery life	5 years (at 25°C) Note: Battery life may be affected by operating temperatures above 40°C.				
EMC	EN61131-2 Zone B/EN61000-6-2/EN61000-6-4				

3.2 Environmental Specifications

The environmental specifications of the controller are shown in the following table:

Item	Type		Operating specification	Transportation	Storage
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 200 Hz	2M2	1M2
		Displace-ment	3.5 mm (direct installation) (< 8.4 Hz)		
		Acceleration	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 2,000 m	0 m to 3,000 m (≤ 70 kPa)	

4 Installation and Mounting

4.1 Requirements

4.1.1 Installation Environment

When installing the controller on the guide rail, take the operability, maintainability, and robustness into account. Do not install the module in a location which is subject to

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

4.1.2 Installation Space

To facilitate ventilation and module replacement, keep enough space between the module and its surroundings.

Installation diagram:

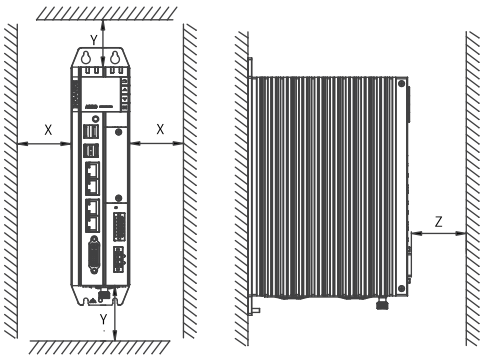


Figure 4-1 Installation space for booksize controller

The clearances are shown in the following table:

Direction	Minimum requirement on cabinet dimensions (mm)
X	50
Y	100
Z	50

4.1.3 Installation Precautions

- Before installation, ensure that the controller is powered off.
- To avoid damage to the controller, do not drop or shock the controller's housing, 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.

4.2 Guide

4.2.1 Installation Dimensions

The installation dimensions of the controller are shown in the following figure:

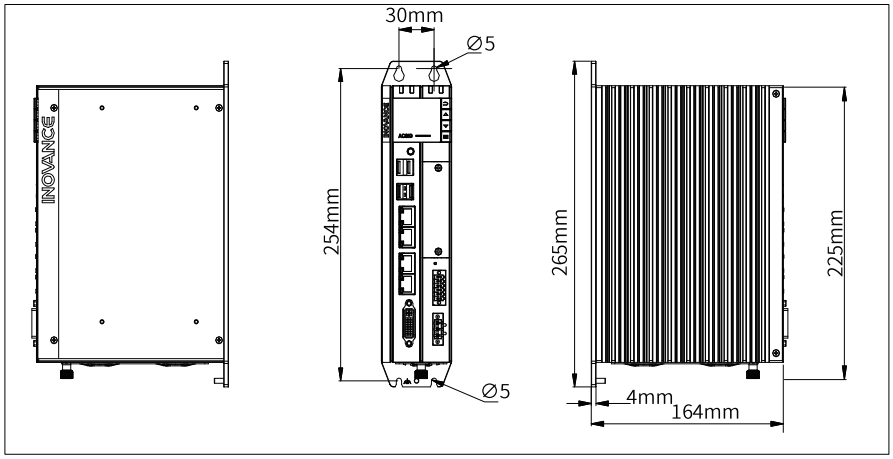
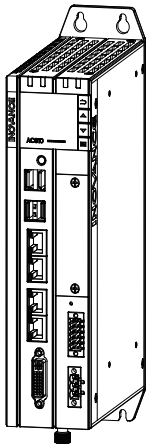


Figure 4-2 Installation dimensions (rear earhook)

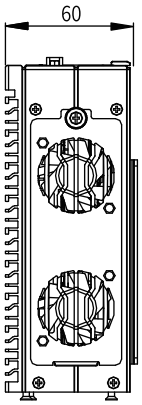
4.2.2 Installation Method

1) Rear earhook



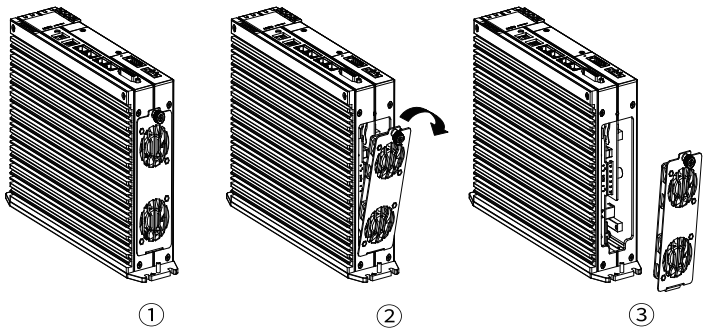
4.3 Installation and Removal of the Fan

Fan (mm)



Removal

The bottom fan is removed as follows:



1. Unscrew the screws on the fan with your hand.
2. Pull out the fan assembly in the direction shown in the figure. Be careful not to damage the bottom wedge.
3. Remove the fan assembly.

Installation

Install the fall in reverse order.

4.4 Installation and Removal of the Battery

Prerequisite

The battery can only be installed or removed after the fan is removed. Remove the fan as instructed in section *"4.3 Installation and Removal of the Fan" on page 24* first.

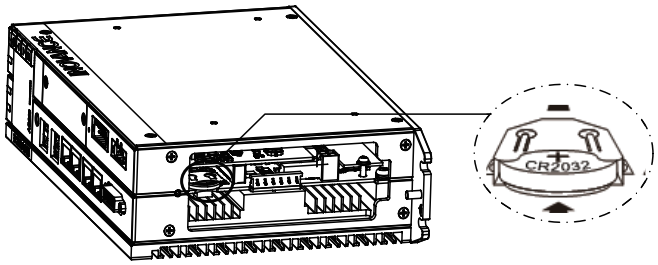
Note

- When removing the battery,be careful not to touch the surrounding parts to avoid damage. Live working is not allowed.

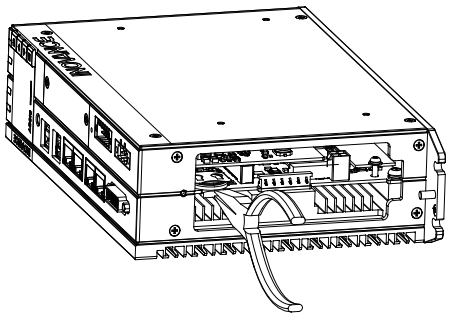
- When installing the battery, see the label at the bottom of the battery to identify the battery's positive and negative poles.
- After replacing the battery, you need to manually start the controller.
- After replacing the battery, power on the controller and check if the controller reports a battery 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.

Operating procedure

1. Loosen the screws on the bottom of the controller and open the fan cover. You can see the battery as shown below.



2. Clamp the battery with flat-nose pliers and remove it along the parallel direction of the battery slot.



3. Use your fingers to push the new battery into the battery slot.

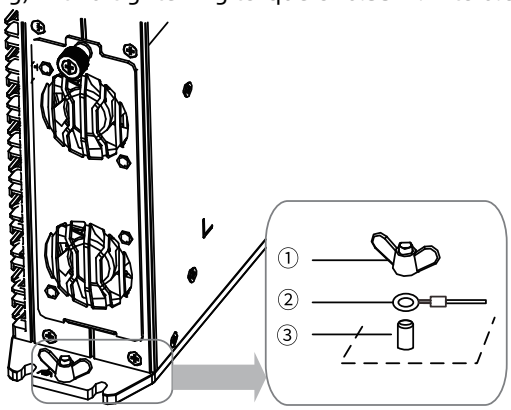
5 Wiring

5.1 Instructions

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 back 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

Figure 5-1 Grounding the controller

Grounding of shielded cables

Communication cables must be shielded cables. Ground the shielded cable as close to the controller as possible so that the cable is not interfered with by electromagnetic induction. The exposed shielded cable must touch the grounding point as much as possible 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. Attention should be paid to avoid this whenever possible. The shielded cables of the communication signal cable must be grounded at both ends.

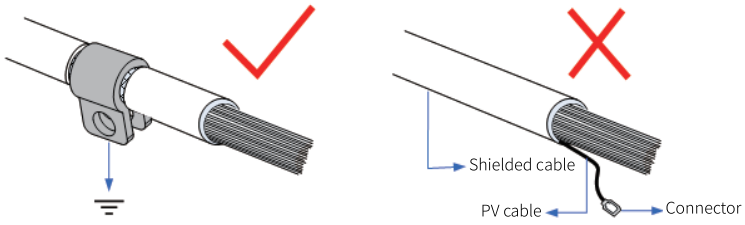


Figure 5-2 Grounding the shielded cable

5.1.2 Routing 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 cross-connection or overlap. If cross-connection cannot be avoided, make them cross-connected at 90 degrees.

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

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

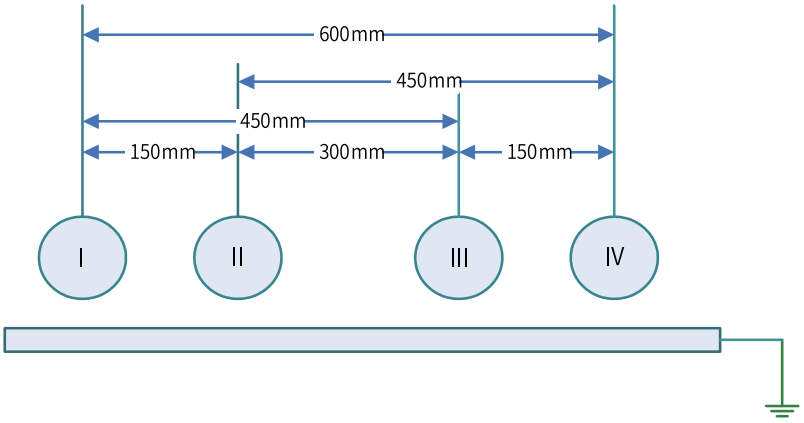


Figure 5-3 Required distances between different types of cables

Note

- If two cables run parallel for an extended length, increase the distances 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 that you 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.

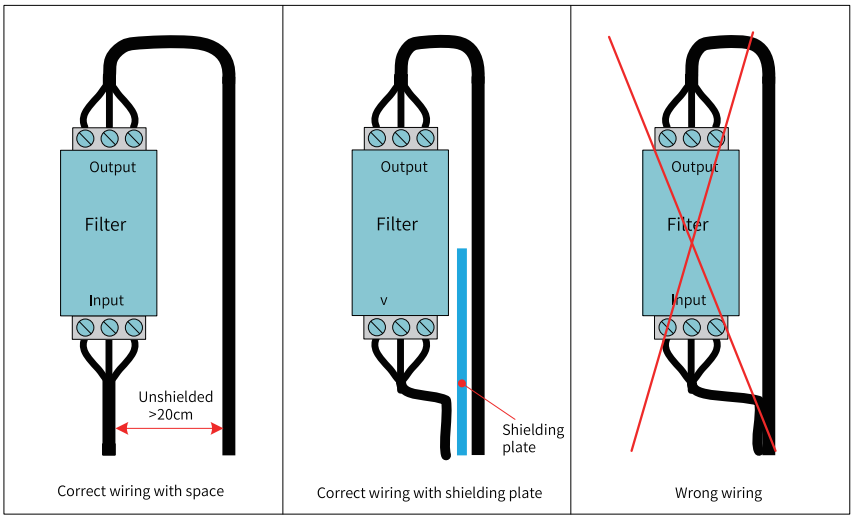


Figure 5-4 Installing the filter

5.2 Wiring of Power Input Terminals

The power input terminal is a 3-pin screw-fixed pluggable terminal with a pitch of 5.08 mm. To facilitate wiring, replacement and maintenance, use a spring clamp crimping terminal. The following illustration shows how the power supply cable connector is inserted into the power input terminal:

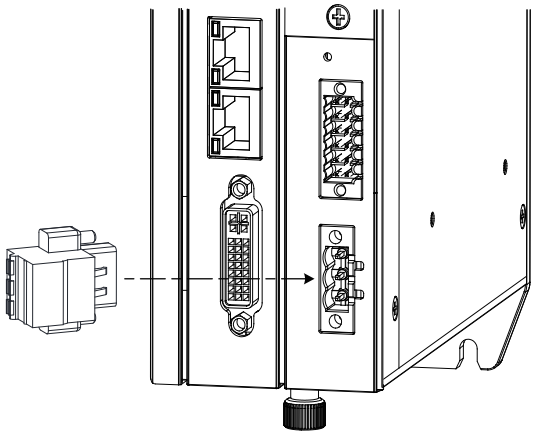
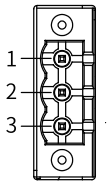


Figure 5-5 Wiring of power input terminals

1. **Definition of the power terminals**

Terminal	No.	Name	Type	Function
	1	+24 V	Input	DC input positive
	2	0 V	Input	DC input negative
	3	⏚	Grounding	Enclosure protective GND

2. **Specifications of input power supply**

No.	Item	Specification
1	Input voltage	24 VDC (-20% to +20%)
2	Input current	3 A
3	Fool-proof design for connection	Supported
4	Short-circuit protection	Supported

The power input must be equipped with a fuse.

3. **Power supply cable preparation**

The power supply input cable uses a pin terminal. For preparation instructions, see section *"5.7.2 Cable Preparation Requirements" on page 41*.

5.3 Wiring of I/O Communication Interfaces

5.3.1 I/O Communication Interface Specifications

1 Introduction

The I/O communication interface adopts a 12-pin (dual-row 6-pin) terminal with a 3.5mm pitch, which includes UPS auxiliary signals, RS-232 signals, RS-485 signals, power-on signals, PLC program run/stop control signals, and power status 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 configure shows the connection of the IO/communication terminal plug to the IO/communication interface.

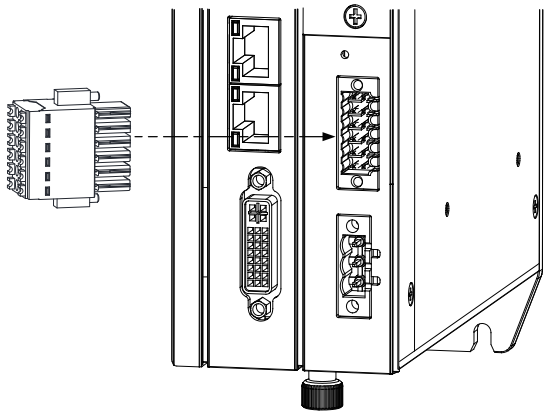
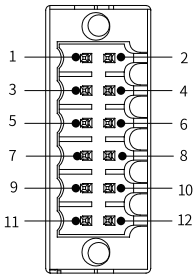


Figure 5-6 User terminal wiring diagram

2 Definition of I/O communication interface

Description	Function	Signal	No.	I/O communication interface	No.	Signal	Function	Description
Starts the PLC through a 500 ms high level width pulse	On signal (works with UPS or remote start)	⏻	1		2	P_STATUS	Power-on indicator signal	Active after the controller is powered on
Enables power failure retention during ON-OFF switchover	Power failure detection signal	P_OK	3		4	P_STATUS	Operation status signal	Active after the controller is powered on
OFF during RUN; ON during STOP	RUN/STOP	RUN	5		6	0 V	DO reference GND	-
-	Input common terminal	0 V	7		8	GND	Communication reference ground	-
COM1	RS485+	485+	9		10	232R	RS232 reception	COM0
	RS485-	485-	11		12	232T	RS232 transmission	

Note

The status control signals in the above table are dedicated I/Os and cannot be used otherwise.

3 Specifications of status control signals

The specifications of the status control signals are described in the following table:

Item	Input Signal (pin 1/3/5)		Output Signal (pin 2/4)
I/O type	DC digital input		Transistor, high-level output
I/O mode	Source		Source
Input/Output voltage class	24 VDC (-20% to +20%)	OFF voltage: ≤ 5 V	24 VDC (-20% to +20%)
		ON voltage: ≥ 15 V	
ON response time	Less than 10 ms (hardware response time)		Less than 0.5 ms (hardware response time)
OFF response time	Less than 10 ms (hardware response time)		Less than 0.5 ms (hardware response time)
Isolation mode	Optocoupler isolation		Optocoupler isolation
Short circuit-proof output	N/A		Supported

4 RS-485 communication specifications

RS485 communication supports the Modbus RTU protocol and free protocol, with relevant specifications as described in the following table.

No.	Item	Specification
1	Station number	1 to 247
2	Communication rate (bps)	4.8K, 9.6K, 19.2K, 38.4K, 57.6K, 115.2K
3	Data length	8 bits
4	Parity check bit	None/Odd/Even
5	Stop bit	1.2
6	Max. number of stations	32

5 RS-232 communication specifications

The RS232 bus supports the following communication specifications as described in the following table.

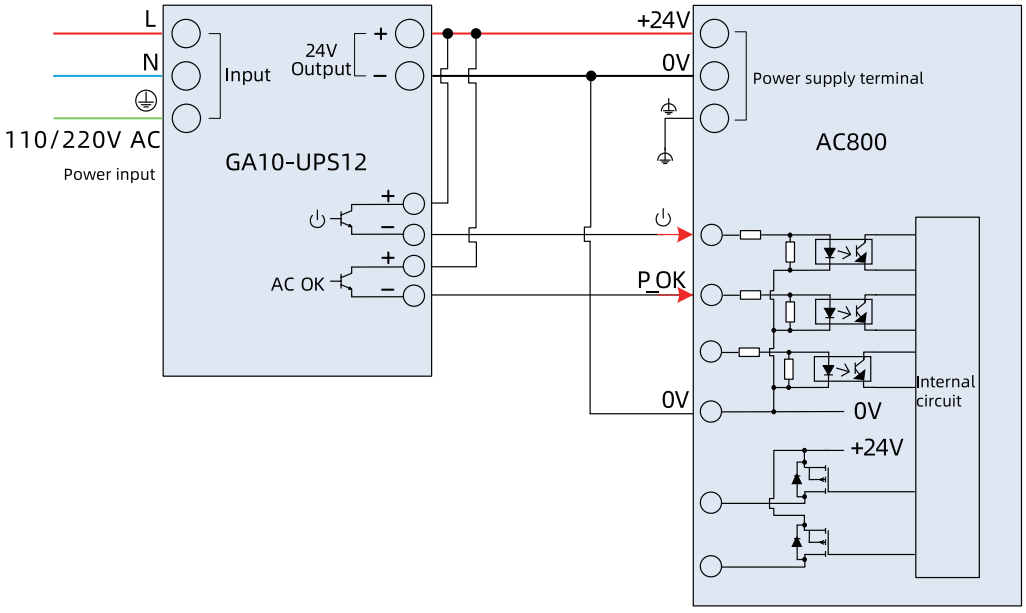
No.	Item	Specification
1	Number of slaves	1
2	Communication rate (bps)*	300, 600, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 57.6K, 115.2K

Note

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

5.3.2 Power-Off Data Retention Wiring

To enable data retention during power failure of the AC800 controller, purchase and install the compatible GA10-UPS12 UPS. The wiring for the control signals between the UPS and the AC800 controller is shown in the figure below.



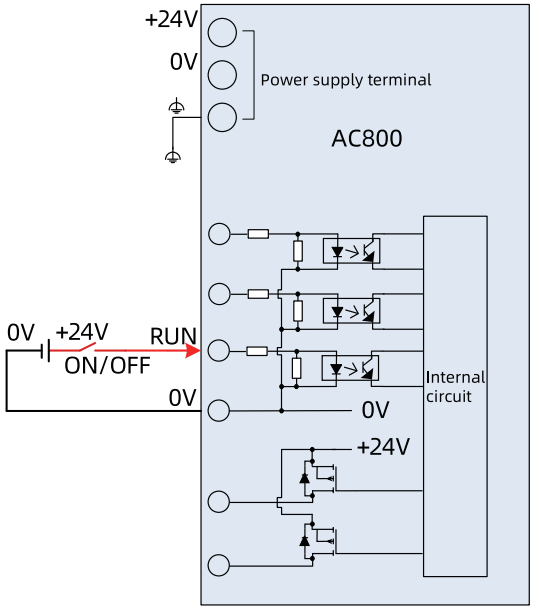
- Power-off detection signal (P_OK): When the P_OK terminal of the AC800 controller detects an external power failure, the signal changes from ON to OFF, and the controller saves the data and shuts down automatically.
- Power-on signal (⏻): When the ⏻ terminal of the AC800 controller detects that an external 24 V power supply is switched on, the signal changes from OFF to ON, and the controller powers on automatically.

Caution

- To ensure reliable data retention during a power failure, the following two requirements must be strictly observed:
  - The GA10-UPS12 UPS must be dedicated to the AC800 controller. Do not connect any other loads to it.
  - The AC800 controller power-off detection signal (P_OK), power-on signal (⏻), and 0 V must be wired properly.
- Wait at least 10s before powering on the AC800 controller again. An interval shorter than 10s may prevent the system from powering on automatically. In this case, press the power-on button manually.

5.3.3 Remote RUN/STOP Control Wiring

To control the RUN/STOP state of the AC800 controller using an external signal, purchase and install the compatible GA10-UPS12 UPS. The wiring for the control signals between the UPS and the AC800 controller is shown in the figure below.



The remote control logic is shown in the table below.

Switch/Relay state	AC800 controller state
ON	STOP
OFF	RUN

5.3.4 RS485 Bus Wiring Instructions

The RS485 bus connection topology is shown in the figure below. It is recommended to use shielded twisted-pair cables for RS485 bus connection and twisted pairs for RS485+ and RS485- connection. Install a termination resistor with the resistance of 120 Ω at both ends of the bus to prevent signal reflection. Connect the reference grounds of RS485 signals for all nodes together. A maximum of 32 nodes is supported and the distance between the node and the RS485 bus must be less than 3 m.

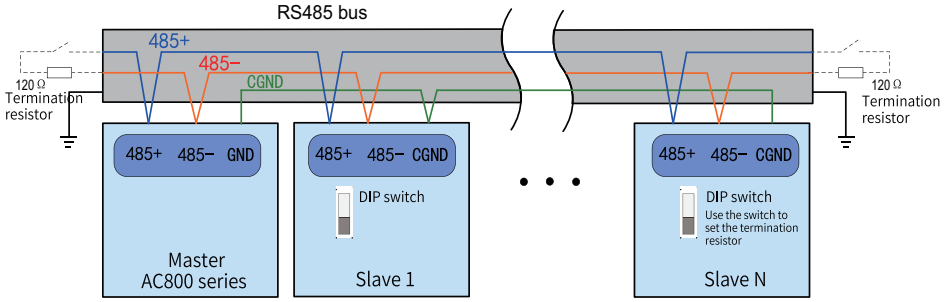


Figure 5-7 RS485 communication connection

Multi-node connection

In case of a large number of nodes, connect the RS485 bus using the daisy chain mode. If branches need to be connected, keep the cable length between the bus and the node as short as possible, preferably not exceeding 3 m. Star connections are prohibited. Common bus structures are shown in the following figures.

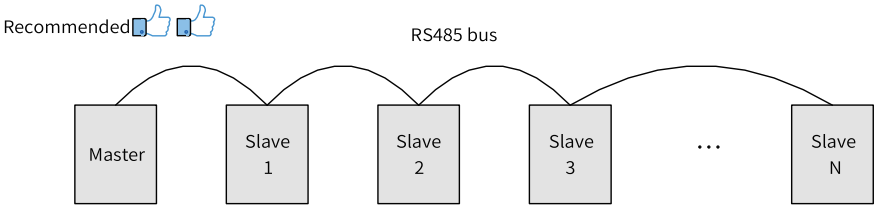


Figure 5-8 Daisy chain connection mode

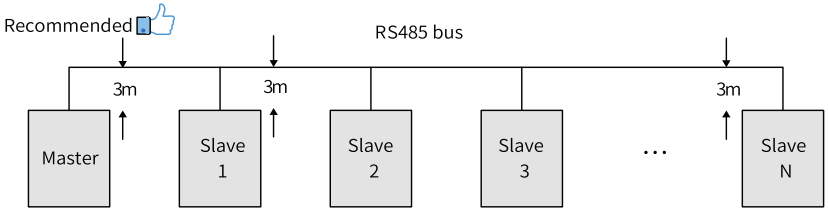


Figure 5-9 Branch connection structure

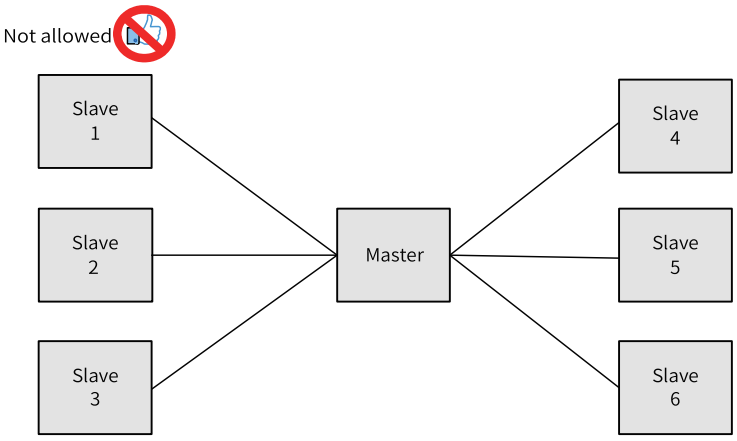
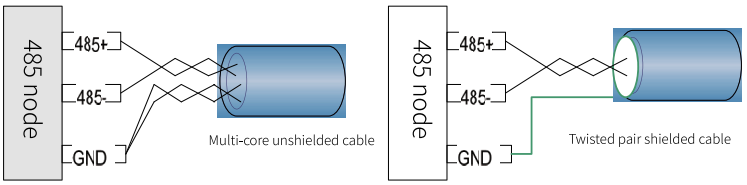


Figure 5-10 Star connection structure (wrong)

Terminal wiring

The controller provides three terminals (485+, 485- and GND) for RS485 communication. Ensure that the RS485 bus contains three cables, and the terminals are connected correctly. If you are using shielded cables, the shielding layer must be connected to the GND terminal, rather than any other location (including housings and equipment ground terminals).

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.



a. Multicore unshielded cable b. Shielded twisted pair

Figure 5-11 Terminal wiring diagram

- Recommended cable 1: Use multi-conductor twisted pair cables, with one twisted pair connected to 485+ and 485-, and others twisted together to connect GND.
- Recommended cable 2: Use shielded twisted pair cables, with the twisted pair connected to 485+ and 485-, and the shield layer connected to GND.

Note

Particular attention must be paid to scenarios where shielded cables are used as connection wiring–the shielding layer should only be connected to GND and must not be connected to the site ground.

5.3.5 RS232 Bus Wiring Instructions

When you use an RS232 to RS485 converter, it is recommended that you use an external power supply to power 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 Communication Specifications

The AC800 series PLCs have four Gigabit network ports (except for AC801, which has three Gigabit network ports). The port definitions are shown in the table below.

No.	Port	Function
1	LAN A	Programming port (for downloading and monitoring), and Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC communication
2	LAN B	Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC communication
3	LAN C	EtherCAT master port, supporting a communication rate of up to 100 Mbps
4	LAN D	

Note

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

Gigabit Ethernet specifications

- Two standard Ethernet interfaces.
- Supported protocols: Modbus TCP, EtherNet/IP, OPC UA, FINS TCP/UDP, and MELSEC.

The Modbus TCP communication specifications are as follows:

Item	Specification
Station number	1 to 247
Communication rate	10/100/1000 Mbps auto-negotiation
Data length	8 bits
Parity	None/Odd/Even
Stop bit	1, 2
Maximum number of stations	64
Special function	Diagnostics

The OPC UA communication specifications are as follows:

Item	Specification
Security policy	-
User authentication	Anonymous
Server port	4840
Session timeout (s)	5 to 600,000
Sampling interval (ms)	100, 300, 500, 1000, 2500, 5000
Publishing 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

Item	Specification
Maximum number of monitored nodes per subscription	10,000
Maximum number of read/write nodes per frame	1000

EtherCAT communication specifications

The LAN C and LAN D ports support EtherCAT communication. The detailed specifications are as follows:

Item	Specification
Communication protocol	EtherCAT protocol
Supported services	FoE, CoE (PDO, SDO)
Minimum synchronization cycle for 12-axis camming	500 μs (typical)
Maximum synchronization jitter	± 40 μs
Maximum number of axes	256
Synchronization mode	DC (distributed clocks) for servo drives; I/O synchronization for I/O modules
Physical layer	100BASE-TX
Baud rate	100 Mbps (100Base-TX)
Duplex mode	Full duplex
Topology	Ring
Transmission medium	Network cable. For details, see cable specifications in the next subsection.
Transmission distance	Less than 100 m between two nodes
Maximum number of slaves	256
EtherCAT frame length	44 to 1498 bytes
Process data	Up to 1486 bytes per Ethernet frame
Synchronization jitter betwen two slaves	< 1 μs
Refresh cycle	Approx. 30 μs for 1,000 digital inputs and outputs Approx. 100 μs for 32 servo axes
Ring Networking	Not supported on AC801; supported on AC802/AC810/AC812
Automatic scanning	Supported

5.4.2 Ethernet Wiring Instructions

Networking

With the Ethernet port, the controller can be connected point-to-point with devices such as a computer and HMI through an Ethernet cable.

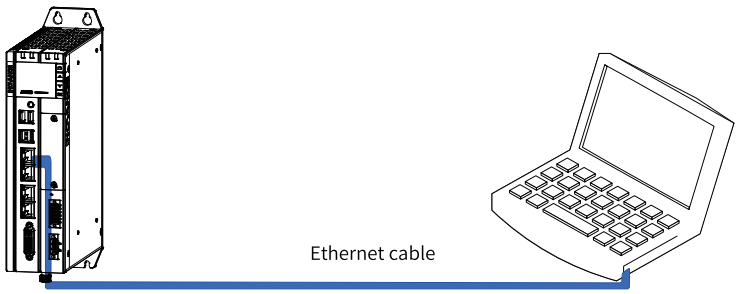


Figure 5-12 Connecting controller to PC

The controller can also be connected to a hub or switch, which is further connected with other network devices, through an Ethernet cable to achieve multi-point connection.

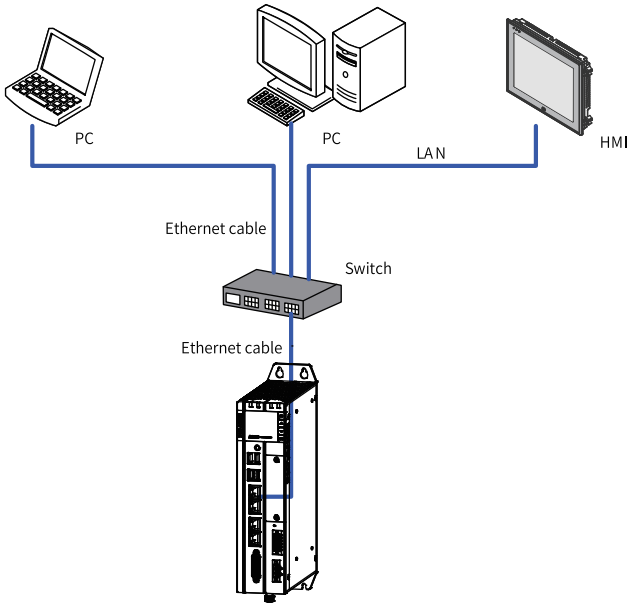


Figure 5-13 Connecting controller to other devices through switch

5.4.3 EtherCAT Wiring Instructions

With the EtherCAT port, the controller can be connected to various servo drives, slave modules or expansion modules that support EtherCAT communication.

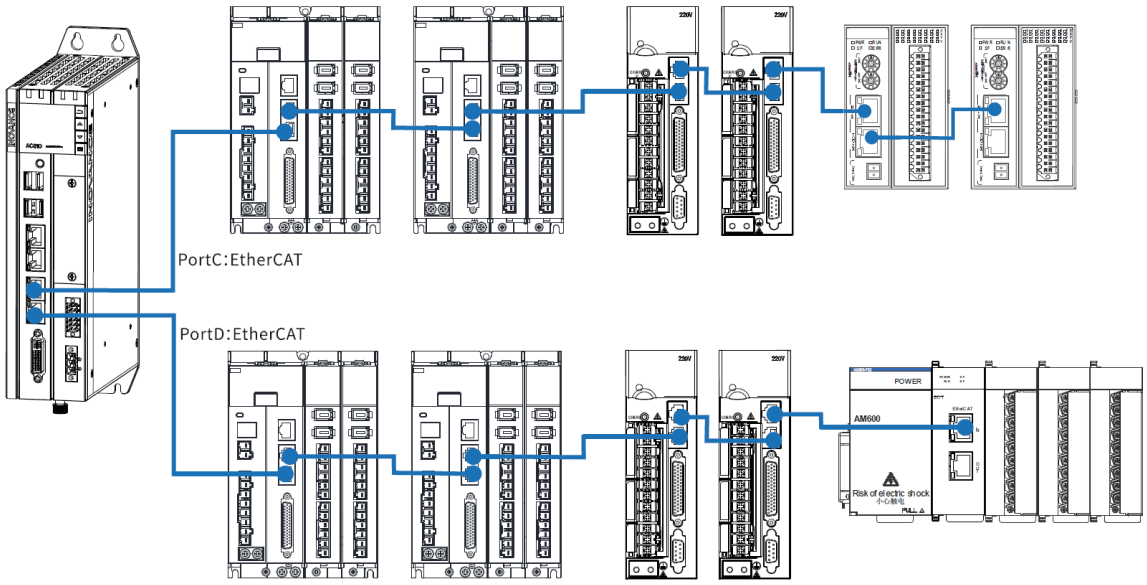


Figure 5-14 Connecting controller to other devices through EtherCAT port

5.4.4 Wiring Requirements of Communication Cables

Connection of RJ45 cable

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

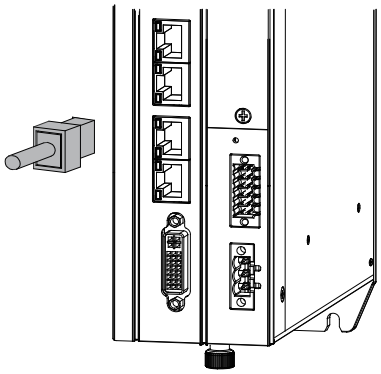


Figure 5-15 Connection of RJ45 cable

Removal: Press the tail of the registered jacket to pull out the connector.

Requirements on Ethernet cable

Use Cat 5e STP and injection cable with iron housing.

Figure 5-16 Requirements on Ethernet cable

Unshielded cable	Shielded cable
	

Cable Preparation

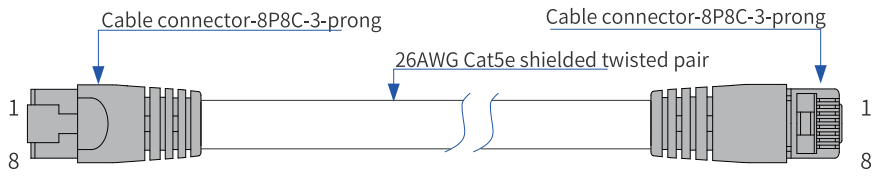


Figure 5-17 Requirement on the EtherCAT cable

Signal pin assignment

Pin	Signal (Ethernet 1,000 Mbps)	Signal Direction	Signal 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+)

*Note: The definition of pins 4, 5, 7, and 8 under 1,000 Mbps differs from that under 100 Mbps. Pay attention to the information in parentheses.

- **Length requirements:**
  When an EtherCAT bus is used, the length of the cable between the devices must not exceed 100 meters. Exceeding this length will attenuate the signal and affect communication.
- **Technical requirements:**

  1. 100% continuity test without short circuit, open circuit, misalignment, or poor contact.
  2. The cable length is within the allowable tolerance range.

STP is used as EtherCAT bus for network data transmission. Cables with the following specifications are recommended:

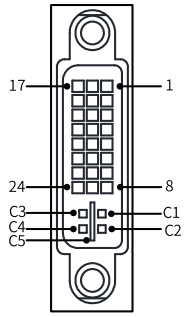
Item	Specification
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Standards compliance:	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Cross sectional area	AWG26
Conductor type	Twisted pair
Number of pairs	4

5.5 Display Interface

The controller provides a standard DVI-D display interface with the following specifications (no cable is provided):

Item	Specification
Signal type	DVI-D (digital signal)
Interface type	24+1
Number of channels	Single-channel
Max. resolution	1920 x 1200 @60 Hz

The DVI-D interface is detailed in the following table:

Illustration	Pin	Signal	Pin	Signal
	1	TMDS data 2-	13	TMDS data 3+
	2	TMDS data 2+	14	+5 V DC power supply
	3	TMDS data 2/4 mask	15	GND (+5 V circuit)
	4	TMDS data 4-	16	Hot swapping detection
	5	TMDS data 4+	17	TMDS data 0-
	6	DDC clock	18	TMDS data 0+
	7	DDC data	19	TMDS data 0/5 mask
	8	Analog vertical synchronization	20	TMDS data 5-
	9	TMDS data 1-	21	TMDS data 5+
	10	TMDS data 1+	22	TMDS clock mask
	11	TMDS data 1/3 mask	23	TMDS clock+
	12	TMDS data 3-	24	TMDS clock-
	C1	Analog vertical synchronization	C4	Analog horizontal synchronization
	C2	Analog green	C5	AGND (RGB circuit)
	C3	Analog blue	-	-

Note

It is recommended to use a standard DVI-D cable. If your display does not provide a DVI-D interface, you can use a DVI to VGA converter.

5.6 USB Interface

The controller provides four USB ports: two USB2.0 ports (③ and ④ in the figure below), and two USB3.0 ports (① and ② in the figure below).

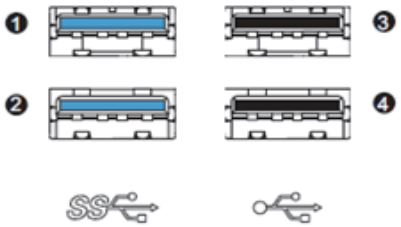


Figure 5-18 USB interface

The specifications of the USB ports are as follows:

Item	USB2.0	USB3.0
Max. communication rate	480Mbps	5.0Gbps
Max. output current at 5 V	500 mA	900 mA
Max. communication distance	5 m	3 m
Isolation	Not supported	Not supported

Note

- For industrial applications, select industry-level USB devices to ensure reliability.
- To prevent interference, avoid long distance connection and run the cable according to the routing specifications.
- If interference cannot be removed, install a magnetic ring at both ends of the communication cable to filter the interference.

5.7 Cable Selection and Assembly

5.7.1 Cable Selection

Applicable Signal	Material Name	Applicable Cable Diameter	
		MM^2	AWG
Power signal cable	Pin type lug	0.8-2.5	20-10
User signal cable	Pin type lug	0.2-1.5	24-16
Grounding cable	Tubular lug	≥ 2	≤ 14
Ethernet cable	-	-	-

5.7.2 Cable Preparation Requirements

1 Cable with pin type lug

Prepare a cable with a pin tye lug:

1. Strip back the wire outer coating by 6 mm.
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 recommended crimping tool.
4. Use a heat-shrinkable tube (Φ3) of 20 mm long to wrap the copper tube of a cable lug and then perform thermal shrinkage.
5. Insert the cable lug into the terminal block.

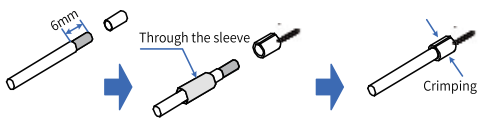


Figure 5-19 Preparing cable with pin type lug

2 Cable with tubular lug

Preparing a cable with a tubular lug:

1. Remove the insulation of the cable so that a length of 6 mm of the conductor is exposed. Then pass the cable through a cable marking tube.
2. Insert the exposed conductor into the hole of the cable lug, and then crimp it with recommended crimping tool.
3. Pass the cable lug through the terminal block and tighten it with a screwdriver. The maximum tightening torque is 0.45 N•m.

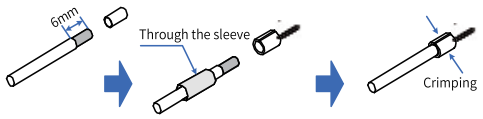
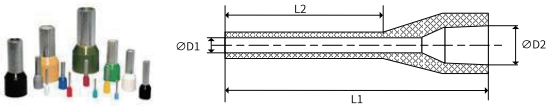


Figure 5-20 Preparing cable with tubular lug

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



Category	Terminal Size	Length of Metal Part L2	Strip Length
Tubular end 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
Naked end	1.50 mm² [H1.5/10D]	10 mm	10 mm
Tubular end with sheath (crimped with two conductors)	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 Procedure

6.1 Power-On

6.1.1 Safety Precautions

Safety Precautions
Warning • Do not touch the terminal when the power is on. Failure to comply may result in electric shock. • Do not disassemble this product. Especially when the power is on or shortly after the power is turned off. Because high voltage can be generated by the voltage boost inside the power supply, which may cause electric shock. In addition, internal sharp parts and high temperatures may cause injuries.
Caution It takes about 15 to 25 or 70 to 80 seconds from power-on to entering the operating mode. During this period, the output remains OFF or a value corresponding to module/slave settings, and external communication is unavailable. To avoid malfunction of external devices, you should construct a fail-safe circuit with "Output during Operation" of the power supply unit.

6.1.2 PLC Startup

The PLC becomes operable after the following time since power-on. Before the PLC enters the operating status, the RUN LED indicator is off.

PLC startup time after power-on:

- If the programming port (enp1s0) is set to a static IP address, it takes about 15 to 25 seconds for the PLC to enter operating mode.
- If the programming port (enp1s0) is set to a DHCP-assigned address, but no DHCP server or network connection is available, it takes about 70 to 80 seconds for the PLC to enter operating mode.

Note

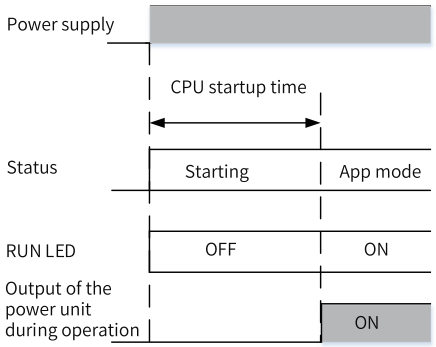
1. Some EtherCAT slaves allow you to set the maximum waiting time (1s to 200s), but the PLC only becomes operable when the EtherCAT master starts operation, regardless of the waiting time.
2. The EtherCAT master function module treats a slave that has not been activated within the maximum waiting time as an error.

6.1.3 Operations when PLC becomes Operable

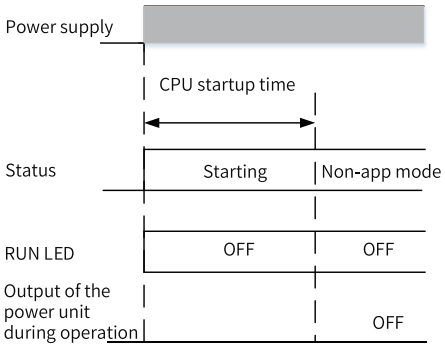
If there is an app when the PLC becomes operable, the PLC enters operating status immediately. You can also change the default setting to make the PLC to enter stop status instead. If the operation

mode of the user program (App) is "NO-APP" when the power is on, the PLC immediately enters No-APP state.

· App mode



· Non-app mode



6.2 Power-Off

6.2.1 Safety Precautions

Safety Precautions
Warning • The AC800 series controller will continue to operate normally for a certain period of time when an instantaneous power failure occurs, so it may receive error signals from external devices affected by the instantaneous power failure. • Take fail-safe measures externally and monitor the power supply voltage on the external device side as necessary, and also take safety measures in the user program.

As shown in the following table, the power-off detection time may vary depending on the power supply type.

Power-off voltage

UPS code	Power supply input	Power-off voltage
72030025	24 VDC	Below 22.5 V

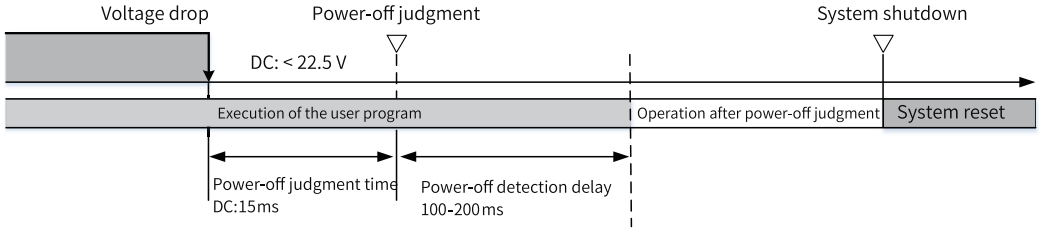
Power supply type

Power supply type	Power-off detection time
Non-UPS	Power off immediately
UPS	15 ms

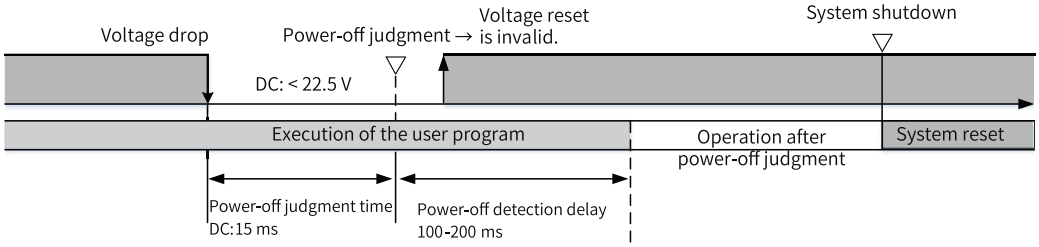
6.2.2 Operations at Power-Off

When the power is off due to exceeding the following power-off detection time, the user program will be terminated. The PLC will be stopped when the process after power-off detection are performed (described below).

Power supply type	Instantaneous power-off time at power-off
Non-UPS	Power off immediately
UPS	Above 15 ms



After the power-off detection time, even if the voltage is reset, the PLC still stops running, as shown in the following figure:



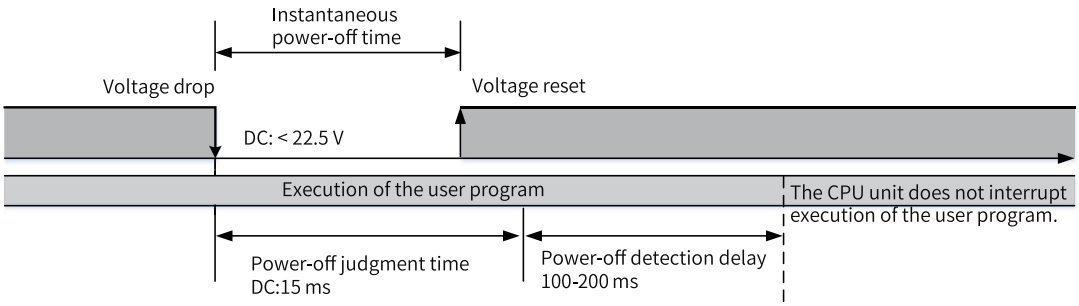
The times in the above figure are described as follows:

Item	Description
Power-off detection time	The period from the time when the power supply voltage drops to the time when the UPS power supply detects that the power supply is off. Before it is determined that the power supply is off, the PLC continues to operate.
Power-off detection delay	The period from the time when the UPS detects that the power supply is off to the time when the PLC starts to process after power-off detection.

6.2.3 Operations at Instantaneous Power-off

When an instantaneous power-off occurs within the following time, the user program will continue to execute.

Power supply type	Time before Power-off
Non-UPS	Power off immediately
UPS	Below 15 ms



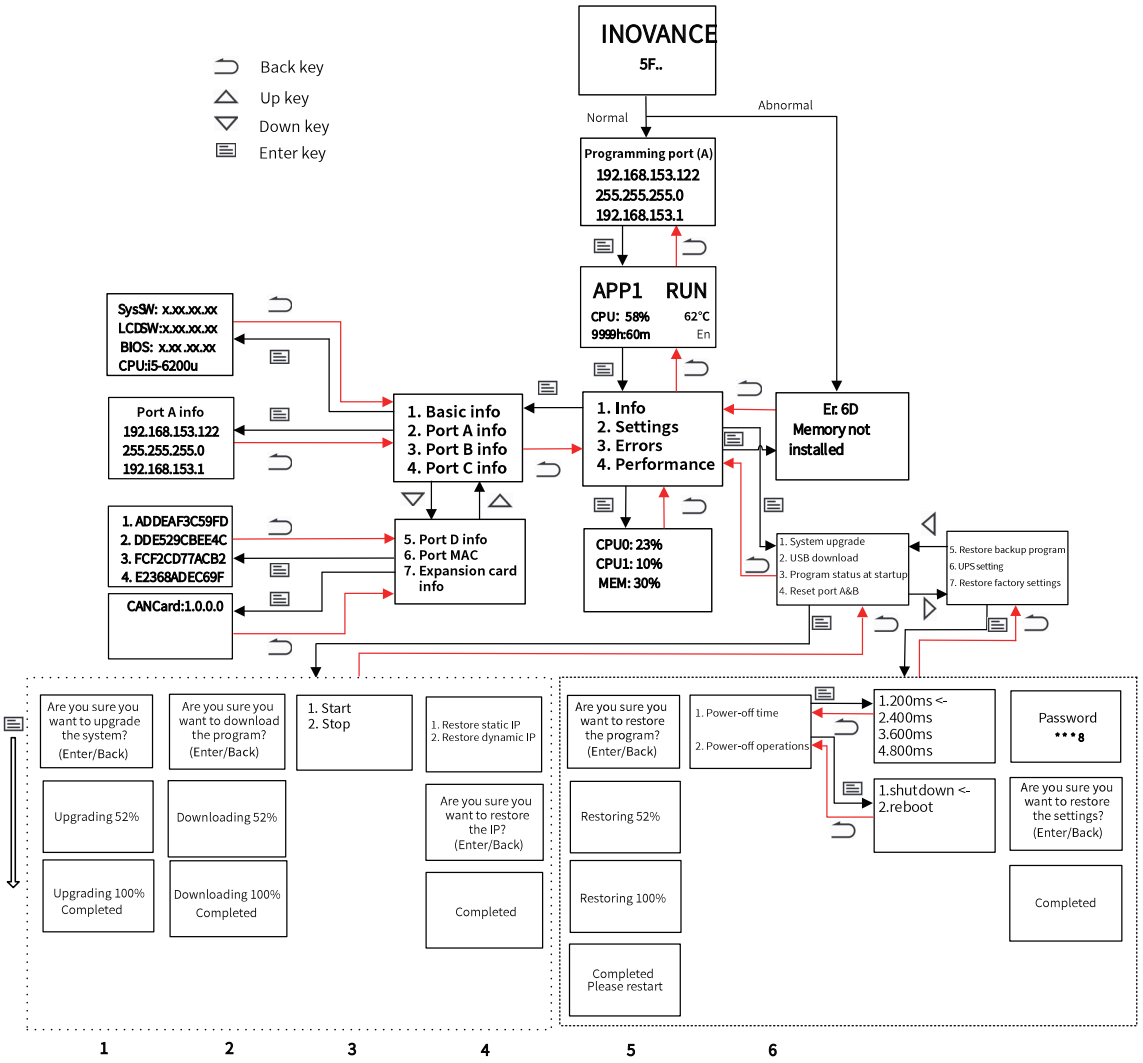
6.2.4 Processing after Power-off Detection

If the UPS determines that the power supply is off, it notifies the PLC through I/O to perform the following processes before the PLC stops.

Item		Contents
Processing	Transferring user program (Including online editing)	The transfer is terminated. The controller will be in a no-app state at the next power-on, waiting for the user application program to be downloaded.
	Executing user program	The instruction execution is terminated, and the data is saved in the hard drive via power failure retention.

6.3 Display Operation

6.3.1 Menus



After the PLC is turned on, the BIOS starts and the main page, which includes the Inovance logo and self-test codes, displays.

- If no error occurs, you will see the programming interface page.
- If any error occurs, the error code and detailed error information will display (see section *"9.1 Appendix 1 Process Codes and Error Codes During BIOS Startup" on page 62* for details).

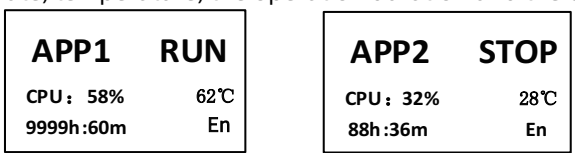
Programming interface page: Displays network information for the programming port (Port A, Ethernet). Use this information to establish a connection to Port A for PLC configuration, program downloads, and other operations. Press "Enter" or wait 30 seconds, to return to the main page.

Note

To prevent endless loop caused by improper programming, you can force the application program not to run at next PLC startup by pressing the combination key "Back" + "Enter", +, in the programming interface page. (see section *"9.2 Appendix 2 Fault Codes for Controller-Related Functions" on page 64* for details).

6.3.2 Main Page

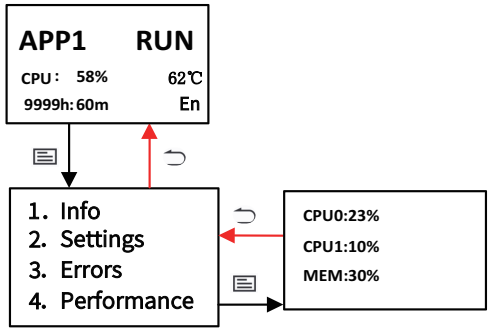
The main page is the most frequently used page when the PLC is running. It is used to display the current status parameters of the PLC, including the application running status (such as "APP1 RUN"), the total CPU occupancy rate, temperature, the operation duration and the current system language.



You can check the running status of multiple applications by pressing the "Up" and "Down" keys.

- Long press the Enter key for 3 seconds to switch the system language
- Press Enter to enter the "Main Menu" interface

Note: Through "Main Menu"-"Performance", you can also view the individual occupancy rate of each CPU core and memory occupancy (see section "4 Performance" in *"6.3.3 Main Menu" on page 48* for details).



6.3.3 Main Menu

1 Information

The Information menu provides basic PLC information, such as version number and CPU model, as well as information about each network port.

1. Basic information

Category	Description	Display style
SysSW	Board software version	SysSW: 1.10.40.0 LCDSW: 1.0.20.0 BIOS: 5.12.0.3
LCDSW	Display software version	
BIOS	BIOS version	
CPU	CPU model	

2. Port information

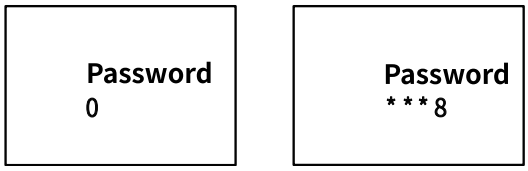
Marking	Function	Port information	Physical address[Note]	Description
LAN A	Ethernet	Port A Info 192.168.153.122 255.255.255.0 192.168.153.1	1. ADDEAF3C59FD 2. DDE529CBEE4C 3. FCF2CD77ACB2 4. E2368ADEC69F	Factory reset is supported. For details, see "2 Settings (5)" in *"6.3.3 Main Menu" on page 48*.
LAN B				-
LAN C	EtherCAT			-
LAN D				

Note: The physical address of each port can be viewed under Network Port MAC.

2 Settings

1. Password

The Settings menu provides access to high-level PLC operations. If no password is configured using InoProShop or the password is set to 0000, which is treated as no password, you can access the Settings menu directly and perform the corresponding operations. If a four-digit password other than 0000 is configured using InoProShop, you will be prompted to enter the password when accessing a "Settings" submenu.



Password entry screen

- When the password entry screen is opened, the first digit flashes and displays "0". Press the "△" or "▽" key to cycle through the digits "0-9".
- When the desired digit is displayed, press the "OK" key to confirm the digit.
- After each digit is entered, the cursor automatically moves to the next digit. Enter the digits in sequence and press "OK" to complete the password entry.
- There is no backspace function when entering the password. If you enter a digit incorrectly, press the "Back" key to return to the previous menu, and then press the "OK" key to reopen the password entry screen.

Password entry process

- During password entry, the current digit is displayed in plain text. After you press the "OK" key, the entered digit is masked.
- After entering the last digit, press the "OK" key. If the password is incorrect, the entered password is cleared and "Enter password" is displayed. In this case, you must enter the password again.
- If the password is correct, press the "OK" key to access the next-level menu.

Note

Within 5 minutes after entering the correct password, you will enter the menu that requires permission without prompting for the password again. After 5 minutes or when the password is changed, you will be prompted to enter the password again when you re-enter the menu that requires permission.

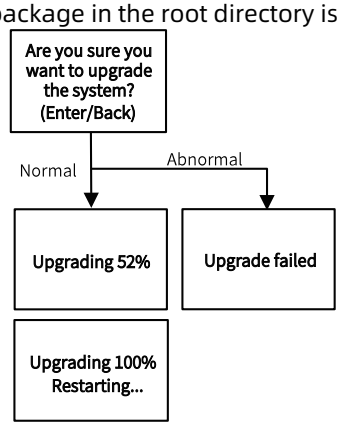
2. System Upgrade

"System upgrade" allows you to upgrade the PLC system. After the upgrade is successful, you can view the updated version information under "Information -> Basic Information" menu.

Insert a USB flash drive containing the system upgrade package into any USB port on the PLC. Then, access the "System upgrade" menu to upgrade the system as instructed (as shown in the figure below). If the upgrade proceeds normally, the upgrade progress is displayed. When the progress reaches 100%, the PLC automatically restarts. If an error occurs during the upgrade, the "Upgrade failed" message is displayed.

Basic requirements for upgrade

- a. The USB flash drive contains the system upgrade package provided by the manufacturer.
- b. Store the upgrade package in the root directory of the USB flash drive. If multiple upgrade packages are present, only the package in the root directory is valid.



Note

1. The system will be upgrade in an exclusive mode, that is, all key operations are temporarily disabled until the upgrade is successful or fails.
2. USB upgrade and InoProShop tool upgrade cannot be performed at the same time. If you start the system upgrade through the USB drive first, and then perform the upgrade again with the InoProShop tool, the tool will prompt "Firmware is being updated". If you start the system upgrade through the InoProShop tool first, and then perform the upgrade again through the USB drive, the display will prompt "Software tool is upgrading the system, please try again later."

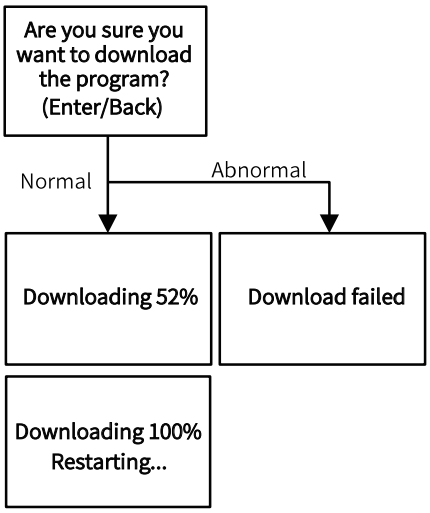
3. Download program via USB flash drive

"Download program from USB flash drive" allows you to download an application package stored on the USB flash drive and replace the application program on the PLC.

Insert a USB flash drive containing the application package into any USB port on the PLC. Then, access the "Download program from USB flash drive" menu to download the program as instructed. If the download proceeds normally, the download progress is displayed. When the progress reaches 100%, the "Download successful" message is displayed. If an error occurs during the download, the "Download failed" message is displayed.

Basic requirements for downloading

- a. The USB flash drive contains the application package named Application.userprg, which is generated by InoProShop.
- b. Store the package in the root directory of the USB flash drive. If multiple packages are present, only the package in the root directory is valid.



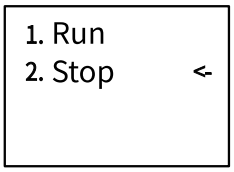
Note

1. The program download is performed in an exclusive mode, that is, all key operations are temporarily disabled until the download is successful or fails.
2. USB download and InoProShop tool download cannot be performed at the same time. If you download the program through a USB drive first, and then perform the download again with the InoProShop tool, the tool will prompt "USB drive is updating firmware or downloading application program". If you download the program through InoProShop first, and then perform the download again through the USB drive, the display will prompt "Software tool is downloading program, please try again later".

4. Program status at power-on

"Program Status at power-on" is used to set the operating state of the application program when the PLC is powered on next time. The factory default is "1. Run program at power-on".

Choose "Settings -> 3. Program status at power-on", use the "△"/"▽" key to select the desired status, and press the *"OK" key to confirm. After the setting is saved successfully, "<-" moves to the selected menu item. "<-" indicates the default startup state of the application program currently configured on the PLC. If multiple application programs are configured on the PLC, this setting applies to all application programs, as shown in the figure below.



Troubleshooting

When a fault occurs, the display usually shows an fault code. For details, see "3 Faults" in "6.3.3 Main Menu" section. If no fault code is displayed and the screen does not respond to key presses as expected, the application program may be stuck in an infinite loop or otherwise consuming excessive PC resources, causing the system to freeze. In this case, stop the application program and then delete it.

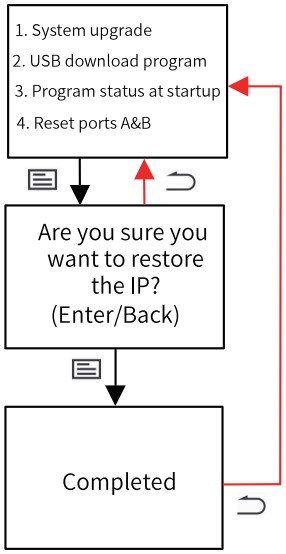
Procedure:

a. On the startup screen, press and hold the "Back" and "OK" keys simultaneously for more than 5s to force "Program status at power-on" to switch to "2. Stop program at power-on", stopping the program from running.

b. Log in to "InoProShop", reset the AC800 controller to its initial values (see the Medium-Sized PLC Programming Software User Guide), and then download the correct application program again.

5. Reset network ports A and B

"Reset network ports A and B" resets the network settings of network ports A and B to their factory-default or dynamic IP addresses, as shown in the figure below. After the reset is successful, configure the PC to use the same subnet as the PLC. You can then connect to and operate the PLC directly through an network cable. For example, set the PC to the 192.168.1.X subnet to connect directly to network port A, or to the 192.168.2.X subnet to connect directly to network port B.

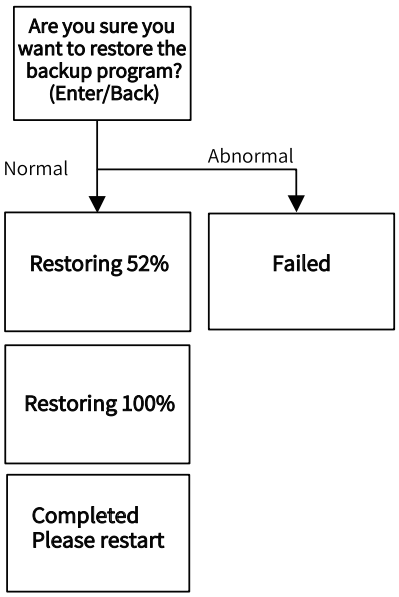


The network port information is shown in the table below:

Marking	LAN A	LAN B
Factory settings	**Port A Info** 192.168.1.88 255.255.255.0 192.168.11	**Port B Info** 192.168.2.88 255.255.255.0 0. 0. 0. 0

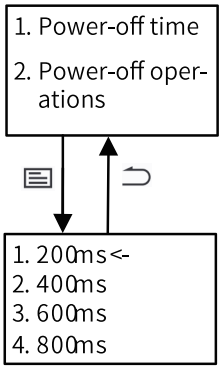
6. Restore backup program

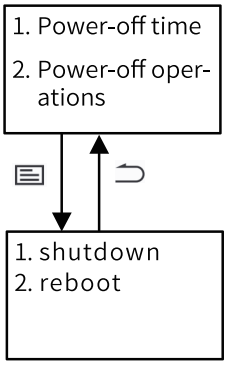
"Restore backup program" allows you to restore the APP to the latest backup program. It does not distinguish between backup programs created through online modifications and those created through downloads; the latest backup program is determined solely by its timestamp. Follow the procedure shown in the figure below to restore the backup program. After the restore is completed successfully, restart the PLC for the changes to take effect. The APP is then restored to the latest backup program.



7. UPS settings

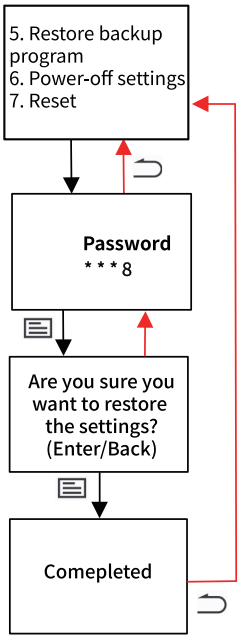
"UPS Settings" allows you to configure the UPS outage duration and the action to taken when a power outage occurs. The power outage duration can be set to 200 ms, 400 ms, 600 ms, or 800 ms, and the power outage action can be set to Restart or Shut Down.





8. Factory reset

"Factory reset" allows you to restore the PLC to its factory settings and clears the user passwords, application programs, and other data.

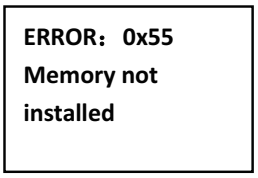


3 Faults

Startup fault

After the PLC starts up, it enters the BIOS self-test phase, during which the Inovance logo and self-test code are displayed. If a fault is detected during the self-test, the display switches to the fault screen and shows the fault code and message. For detailed fault information, see Appendix 1.





If a fault occurs during startup, see Appendix I or contact the manufacturer for technical support.

BIOS fault

If the display remains on the startup screen showing the Inovance logo, one of two BIOS startup faults may have occurred.

- The BIOS self-test code has been sent, but the system fails to start. If the display remains on the startup screen showing the Inovance logo and self-test code, and the message "Er.A1 Failed to switch BIOS to OS" appears after two minutes,it indicates that the BIOS failed to switch to the operating system (OS). Press the "Back" key to return to the startup screen.
- No self-test code is sent during BIOS startup. If the display remains on the startup screen showing the Inovance logo without a self-test code, and the message "Er.A2 No BIOS data was received" appears after one minute, it indicates that the BIOS did not send the self-test code. Press the "Back" key to return to the startup screen.

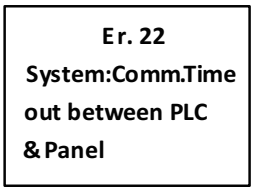
Program and system faults

- Fault pop-up window

If a program or system fault occurs while the display is on the programming port screen or main screen, the display will switch to the fault screen and shows the fault code and message. Press the "Back" key to return to the previous screen. If multiple faults occur, press the "△"/"▽" key to view the complete information for the current fault. Press the "OK" key to switch to the next fault.

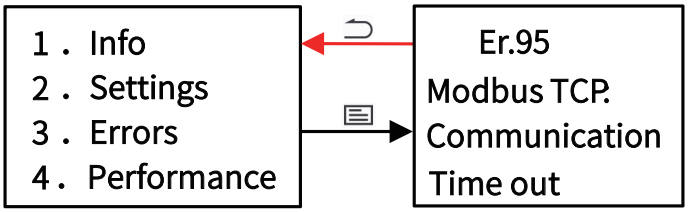
Note

Special error Er.22 indicates that the communication between the display and the PLC is disconnected. It is due to system crash or communication timeout between the screen and board daemon process caused by an endless loop in an application program. In this case, the display cannot obtain and display PLC information, and cannot be operated by keys. The user can restart the computer and use the key combination Back+Enter on the programming interface page to forcibly modify the APP's next startup status to "stop". When the error is removed, the error information will be cleared.



Fault menu

The "Fault" menu allows you to view the faults currently present on the PLC. If multiple faults occur, press the "△"/"▽" key to view the complete information for the current fault. Press the "OK" key to switch to the next fault. For details about the faults, see *"9.1 Appendix 1 Process Codes and Error Codes During BIOS Startup" on page 62*.

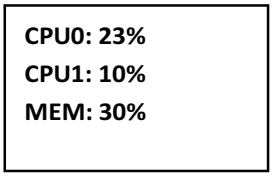


If no faults are currently present on the PLC, the message "NO ERROR!!" is displayed.



4 Performance

The "Performance" menu allows you to view PLC performance parameters, including the CPU utilization of each core and memory utilization.



6.3.4 Page Switchover

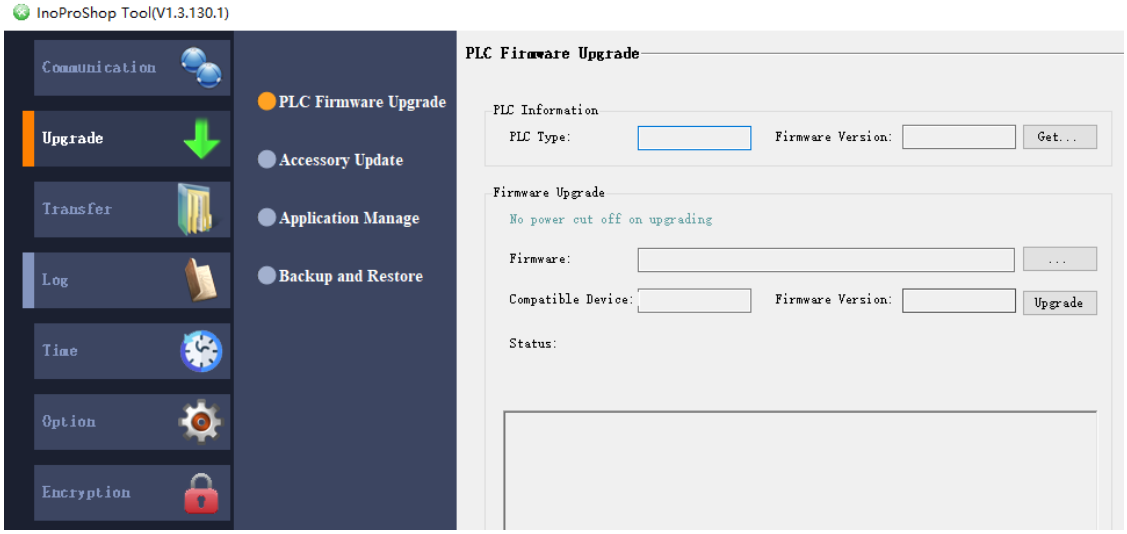
When you switch pages on the display panel:

1. The screen will automatically turn off if there is no key operation for 15 minutes (the screen will not turn off when there is an error window). When the screen is off, press any key to wake up the screen.
2. The programming interface page displays for 30 seconds before switching to the active page.
3. Apart from the programming interface page and error page, if you stay on a page for 2 minutes without pressing any key, the screen will switch to the active page.
4. When you insert a USB drive and it is correctly recognized by the system, the display will directly switch to the Settings menu, which is convenient for further operations. However, this does not apply to an interactive page (a page related to upgrade, download, password input, and network port recovery).

6.4 System Upgrade

The PLC system can be upgraded in the following two ways.

1. InoProShop
   You can connect to the PLC with the InoProShop tool and select the PLC firmware upgrade package and accessory firmware upgrade package provided by the manufacturer to upgrade the PLC (see InoProShop User Guide for details).



2. USB drive
   You can upgrade the PLC by inserting a USB flash drive on the PLC and carry out the upgrade procedure on the display (see (3) Download USB program in 2 Settings in section 5.3.2).

7 Programming and Commissioning

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

8.1 Periodical Maintenance and Inspection

Regular Checklist

No.	Item	Description	Criteria	Process
1	Power supply	Measure the power terminal block and check that the voltage change is within the allowed range.	24 VDC (-20% to +20%)	Use a multimeter to measure the terminals, and control the supply voltage within the allowable range.
2	Ambient environment	Check that the ambient temperature is suitable (when the controller is in a cabinet, the temperature in the cabinet is the ambient temperature).	-5°C to 55°C	Use a thermometer to measure the ambient temperature and control the ambient temperature within the range of 0°C to +55°C.
		Check that the ambient humidity is suitable (when used inside the cabinet, the cabinet humidity is considered the ambient humidity).	10% RH to 90% RH, without condensation	Use a hygrometer to measure the ambient humidity control the ambient humidity within 10% to 90% RH. If the temperature changes drastically, check for 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 and shock resistance should meet relevant requirements.	Install cushioning materials for vibration and shock resistance.
		Interference sources	Not allowed	Keep the controller away from any interference sources or take shielding measures.
3	Installation and wiring	Check that cable connectors are fully inserted and locked.	Looseness is not allowed.	Fully insert the connector and lock it with screws.
		Check that external wiring screws are securely fastened.	Looseness is not allowed.	Use a Phillips screwdriver to tighten the screws.
		Check that 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.	Broken external cables are not allowed.	Check cables visually and replace broken cables (if any).

No.	Item	Description	Criteria	Process
4	Real-time clock battery (button battery)	Check that the shelf life or service life does not expire.	No "battery voltage low" alarm is displayed on the controller.	The shelf life of the battery at 25°C is 5 years, and its service life is generally 0.75 to 5 years, depending on the model and ambient temperature. If this predefined period is exceeded, replace the battery no matter if it can still work normally or not. For the replacement method, see section *"4.4 Installation and Removal of the Battery" on page 24*.
5	Cooling fan	Check that the shelf life or service life does not expire.	No "Fan is abnormal" alarm on the controller.	The design life of the fan at 40°C is 70,000 hours, and its service life varies with the ambient temperature. If the predefined period is exceeded, replace the fan no matter if it can still work normally or not. For the replacement method, see section *"4.3 Installation and Removal of the Fan" on page 24*.

Tools needed

- Phillips screwdriver
- Multimeter or digital meter
- Industrial alcohol and cotton cloth
- Pliers

Measuring instruments required for different occasions

- Oscilloscope
- Thermometer, humidity meter

8.2 Maintenance of the Battery

Purpose of the battery

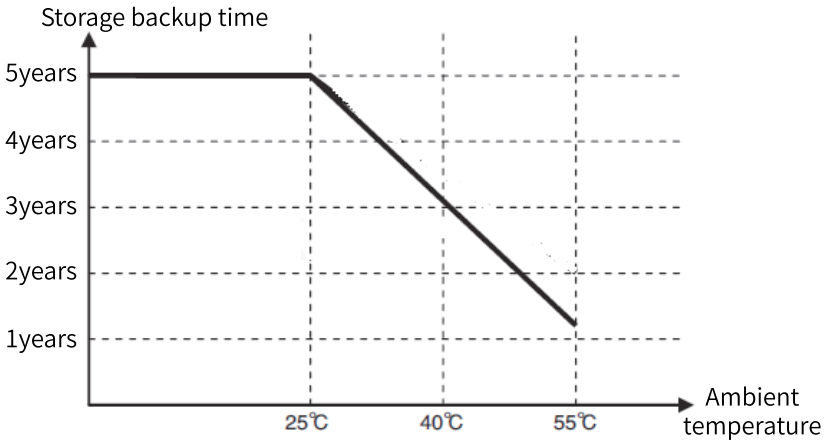
A battery is required for the RTC timing of the clock in the controller and for keeping the CMOS data when the power is off. If the battery is not installed or the battery is depleted, the clock will stop timing, and the BIOS CMOS data will be lost when the power is off.

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.



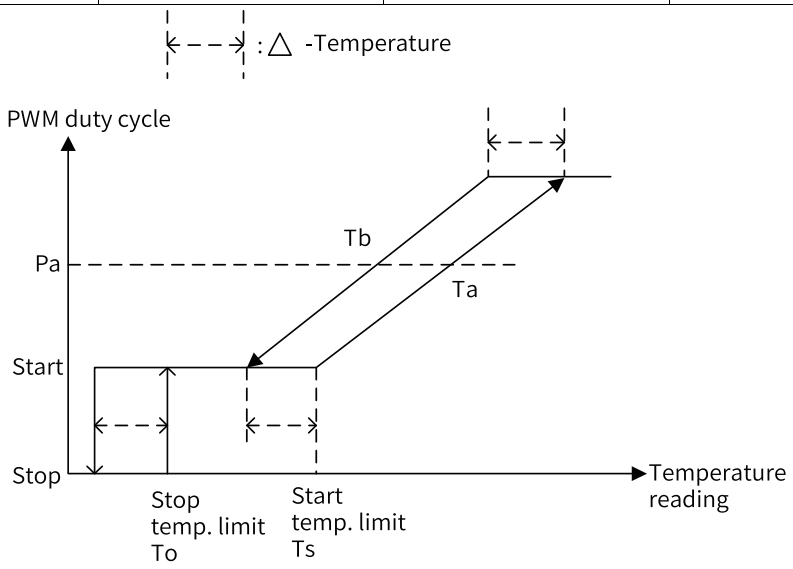
* The storage backup time in the figure is for reference.

8.3 Maintenance of the Fan

Purpose of the fan

If the temperature in the controller reaches or exceeds the set temperature, the fan will automatically start to cool down the controller. When the temperature of the controller drops below the fan stop threshold, the fan will stop.

Name	Stop temperature To	Start temperature limit Ts	Upper temperature limit Tf
Temperature threshold	40℃	45℃	75℃



Fan life and replacement interval

Code	Model	Fan service life
98050167	AC810-FAN1	70,000 hours

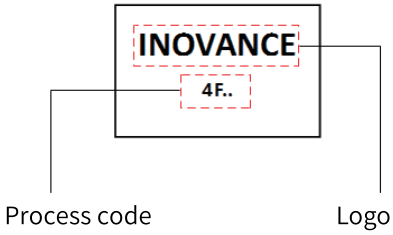
When the controller prompts that the fan is abnormal, replace the fan in time to ensure heat dissipation of the controller.

9 Appendix

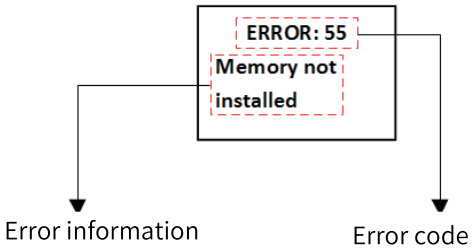
9.1 Appendix 1 Process Codes and Error Codes During BIOS Startup

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

1. The following figure illustrates display of a BIOS process code:



2. The following figure illustrates display of a BIOS error code:



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

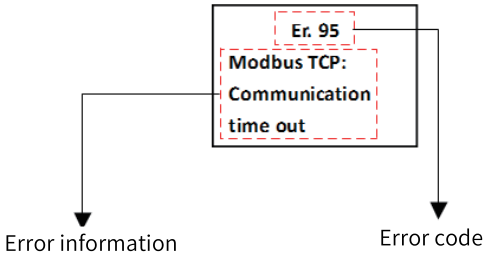
BIOS Code	Error Message
0x9A	USB initialization is started
0x9C	USB Detect
0x9D	USB Enable
0xA0	IDE initialization is started
0xA2	IDE Detect
0xAD	Ready To Boot event
0xAE	Legacy Boot event
0xB2	Legacy Option ROM Initialization
0xB4	USB hot plug
Error code (When a BIOS error occurs, restart the device; If the error persists, 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
0x53	Memory initialization error. No usable memory detected Note: If the buzzer sounds 6 times during startup, it means that the memory is installed improperly 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 Appendix 2 Fault Codes for Controller-Related Functions

Note: Each fault code is unique and does not conflict with any other fault code.

An example of the fault code display is shown in the figure below.



Fault code	Fault message	Solution
Serial communication port 0 (Modbus/RTU)		
0x70	Modbus RTU0:Slave address setting error	Set a valid slave address.
0x71	Modbus RTU0: Frame length error	Modify the data frame.
0x72	Modbus RTU0: Illegal data address	Set a valid data address.
0x73	Modbus RTU0: CRC check failed	1 .Check if the termination resistor is properly configured. 2 .Improve the wiring, for example, by checking for potential sources of interference.
0x74	Modbus RTU0: Illegal function	Check the slave parameters.
0x75	Modbus RTU0: Communication timeout	1 .Check if the slave is operating properly. 2 .Check if the wiring is disconnected. 3 .Check if the termination resistor is properly configured. 4 .Improve the wiring, for example, by checking for potential sources of interference.
0x76	Modbus RTU0: Illegal data value	Check the range of data written by the slave.
0x77	Modbus RTU0: Buffer overflow	Reduce the communication load.
0x78	Modbus RTU0: Server device failure	Check the slave communication device.
0x79	Modbus RTU0: Serial port setting error	Check if the communication settings are correct.
Serial communication port 1 (Modbus/RTU)		
0x80	Modbus RTU1: Slave address setting error	Set a valid slave address.
0x81	Modbus RTU1: Frame length error	Modify the data frame.
0x82	Modbus RTU1: Illegal data address	Set a valid data address.
0x83	Modbus RTU1: CRC check failed	1 .Check if the termination resistor is properly configured. 2 .Improve the wiring, for example, by checking for potential sources of interference.
0x84	Modbus RTU1: Illegal function	Check the slave parameters.

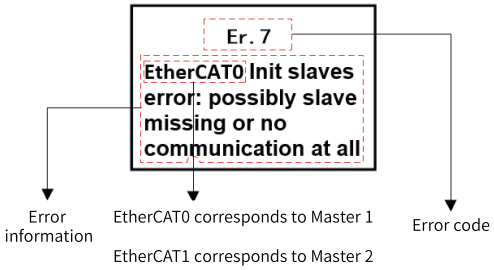
Fault code	Fault message	Solution
0x85	Modbus RTU1: Communication timeout	1 .Check if the slave is operating properly. 2 .Check if the wiring is disconnected. 3 .Check if the termination resistor is properly configured. 4 .Improve the wiring, for example, by checking for potential sources of interference.
0x86	Modbus RTU1: Illegal data value	Check the range of data written by the slave.
0x87	Modbus RTU1: Buffer overflow	Reduce the communication load.
0x88	Modbus RTU1: Server device failure	Check the slave communication device.
0x89	Modbus RTU1: Serial port setting error	Check if the communication settings are correct.
Ethernet (Modbus TCP)		
0x90	Modbus TCP: Slave address setting error	Set a valid slave address.
0x91	Modbus TCP: Frame length error	Modify the data frame.
0x92	Modbus TCP: Illegal data address	Set a valid data address.
0x93	Modbus TCP: CRC check failed	1 .Check if the termination resistor is properly configured. 2 .Improve the wiring, for example, by checking for potential sources of interference.
0x94	Modbus TCP: Illegal function	Check the slave parameters.
0x95	Modbus TCP: Communication timeout	1 .Check if the slave is operating properly. 2 .Check if the wiring is disconnected. 3 .Check if the termination resistor is properly configured. 4 .Improve the wiring, for example, by checking for potential sources of interference.
0x96	Modbus RTU0: Illegal data value	Check the range of data written by the slave.
0x97	Modbus TCP: Buffer overflow	Reduce the communication load.
0x98	Modbus RTU0: Server device failure	Check the slave communication device.
0x9A	Modbus TCP: Destination XX is unreachable	1 .Check if the slave is operating properly. 2 .Check if the wiring is disconnected. 3 .Check if the master hardware is operating properly. 4 .Improve the wiring, for example, by checking for potential sources of interference.
0x9B	Modbus TCP: Protocol identifier error	Check the protocol identifier.
CPU fault		
0x21	Runtime crashed	1 .Power cycle the device. 2 .Contact the manufacturer.
0x22	LCD: Communication timeout between CPU	
0x24	Battery voltage is too low or battery is in reverse	Replace the battery or check the battery installation.
0x25	Fan is broken or not installed	Check the fan for faults.
0x26	Daemon: Communication timeout between runtime	1 .Correct the application program, restart the PLC, and download and run the program again. 2 .Obtain the application runtime log from the Diagnostics window. 3 .Collect the log information using InoProShopTools and send it back for analysis.
0x27	Application exception	Check and update the application program.
0x28	Bootproject load fail	Check the startup project.

Fault code	Fault message	Solution
0x2E	ProcessorLoad exception	Check the application task settings.
0x2F	Network open failed	1 .Power cycle the device. 2 .Contact the manufacturer.
0x3F	PLC systime calibration required	Synchronize the RTC time using InoProShop or InoProShopTool ***Note*** This fault code is reported by AC800 series PLCs with a SysSW (board software version) of 1.50.0.9, 1.50.0.11, 1.50.0.12, 2.1.0.0, or 2.1.0.4 when the fault occurs.
Permission error		
0x23	Authentication failed, please contact the supplier!	1 .Power cycle the device. 2 .Contact the manufacturer.
Memory error		
0x31	Memory init fail	Return the device for repair.
Register fault		
0x29	FPGA PCIE offline and online again	1 .Record the exceptions and report them to our development team. 2 .Analyze the EMC issues on site.

9.3 Appendix 3 Fault Codes for EtherCAT-Related Functions

Note: Each fault code is unique and does not conflict with any other fault code. The corresponding fault message is displayed on the screen.

An example of the fault code display is shown in the figure below.



Fault code	Fault message	Solution
EtherCAT		
0x01	Error:communication lost! check the cables!	1 .Check the network cable connection between the master and slave. 2 .Check if the OUT port of the slave is connected to the correct device. 3 .Check if the network cable is connected securely. 4 .Check if the network cable connector is metal-shielded. 5 .Check if the network cable complies with the Cat5e or higher standards. 6 .Check if the device is properly grounded. 7 .Set xRestart to TRUE on the master to restart the bus. 8 .Power cycle the PLC and slave.
0x02	Warning: number of slaves has changed or is different to the configuration!	Check if the slave is powered off and if the network cable is disconnected.
0x03	Distributed clock is always the same value! Change in and out connector of slave	Check if the reference clock slave is offline.
0x04	Network adapter could not be found	1 .Check the network port configuration. 2 .Restart the PLC. 3 .Replace the PLC.
0x05	Second network adapter could not be found	1 .Check the network port configuration. 2 .Restart the PLC. 3 .Replace the PLC.
0x06	Second network adapter uses the MAC-ID as the first network adapter	1 .Restart the PLC. 2 .Replace the PLC.
0x07	Init slaves error: possibly slave missing or no communication at all	1 .Check the network cable connection between the master and slave. 2 .Check if the network cable connection between slaves is disconnected or loosely connected, and check for hardware faults. 3 .Check if the OUT port of one slave is connected to the OUT port of another slave. 4 .Use the EtherCAT device scan function to locate the faulty slave. 5 .Power cycle all slaves.
0x08	Vendor ID does not match -> All stopped	1 .Use the EtherCAT device scan function to compare the configured devices with the scan results. 2 .Power cycle the slaves that cannot be accessed by the master.
0x09	Product ID does not match -> All stopped	1 .Use the EtherCAT device scan function to compare the configured devices with the scan results. 2 .Power cycle the slaves that cannot be accessed by the master.
0x0A	Read of product or vendor ID not successful, more slaves in config as real?	Use the EtherCAT device scan function to compare the configured devices with the scan results.

Fault code	Fault message	Solution
0x0B	SDO write error in startup procedure	See the slave device user guide for causes and solutions based on the "return fault code".
0x0C	SDO timeout in startup procedure	1 .Check the network connection status of the slave. 2 .Check the user program and reduce the scheduling frequency of the SDO, EOE, and SOE function blocks to reduce the communication load.
0x0D	Emergency from device received	See the slave device user guide for causes based on the "emergency error code", "fault register", and "manufacturer-defined fault code".
0x0E	IDN write error in startup procedure	1 .See the slave device user guide for causes based on the "return error code". 2 .Reconnect the slave to the network.
0x0F	IDN timeout in startup procedure	1 .Check the network connection status of the slave. 2 .Check the user program and reduce the scheduling frequency of the SDO, EOE, and SOE function blocks.
0x10	Watchdog expired for opmode	1 .On the EtherCAT master overview interface, check for slaves with non-zero receive error counters and verify the network cable connection. 2 .Check if the device is properly grounded. 3 .Restart the EtherCAT master. 4 .Replace the slave.
0x20	Slave alias address duplicate error!	On the EtherCAT device scan interface, reconfigure the alias address of the conflicting slave. After the new alias address is written successfully, power cycle the slave for the change to take effect.
0x21/0x12D	In/out connection error between slaves	1 .Check if the the OUT port of a slave is connected to the OUT port of another slave. 2 .Check of the OUT port of a slave is connected to the master.
0x22	Access slave eeprom timeout	Power cycle the slave.
0x30	Continuous frame drop error!	1 .Check if the network cable is connected properly. 2 .Replace the network cable. 3 .Replace the slave. 4 .Add a ferrite core or replace the network cable with a higher-category cable.
0x31	Link lost error!	1 .Check if the network cable connector is connected securely. 2 .Check if the network cable is connected properly. 3 .Replace the network cable.

Fault code	Fault message	Solution
0x32	Occasion frame drop error!	1 .Replace the network cable. 2 .Replace the current slave or the preceding slave. 3 .Add a ferrite core or replace the network cable with a higher-category cable.
0x65	Unspecified error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x66	No memory	1 .Power cycle the device. 2 .Contact the manufacturer.
0x6A	Firmware and EEPROM do not match	1 .Power cycle the device. 2 .Contact the manufacturer.
0x6B	Firmware update not successful	Check the master state machine transition request sequence. Do not request a slave state transition that skips intermediate states.
0x75	Invalid requested state change	Check the master state machine transition request sequence. Do not request a slave state transition that skips intermediate states.
0x76	Unknown requested state	Check the master state machine transition request sequence. Do not request a slave state transition that skips intermediate states.
0x77	Bootstrap not supported	1 .Power cycle the device. 2 .Contact the manufacturer.
0x78	No valid firmware	1 .Power cycle the device. 2 .Contact the manufacturer.
0x79	Invalid mailbox configuration	1 .Power cycle the device. 2 .Contact the manufacturer.
0x7A	Invalid mailbox configuration	1 .Power cycle the device. 2 .Contact the manufacturer.
0x7B	Invalid sync manager configuration	1 .Power cycle the device. 2 .Contact the manufacturer.
0x7C	No valid inputs available	Reconfigure the slave input PDOs.
0x7D	No valid outputs	Reconfigure the slave output PDOs.
0x7E	Synchronization error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x7F	Sync manager watchdog	1 .Power cycle the device. 2 .Contact the manufacturer.
0x80	Invalid Sync Manager Types	1 .Power cycle the device. 2 .Contact the manufacturer.
0x81	Invalid Output Configuration	The slave does not support the configured number of output PDO entries. Reconfigure the output PDOs.
0x82	Invalid Input Configuration	The slave does not support the configured number of output PDO entries. Reconfigure the input PDOs.
0x83	Invalid Watchdog Configuration	1 .Power cycle the device. 2 .Contact the manufacturer.

Fault code	Fault message	Solution
0x84	Slave needs cold start	1 .Power cycle the device. 2 .Contact the manufacturer.
0x85	Slave needs INIT	1 .Power cycle the device. 2 .Contact the manufacturer.
0x86	Slave needs PREOP	1 .Power cycle the device. 2 .Contact the manufacturer.
0x87	Slave needs SAFEOP	1 .Power cycle the device. 2 .Contact the manufacturer.
0x88	Invalid input mapping	1 .Check if the input PDO entries are incompatible with the slave firmware. 2 .Check if the Vendor ID check is disabled for the slave. 3 .Check if the Product ID is inconsistent between the slave configuration and actual hardware.
0x89	Invalid output mapping	1 .Check if the output PDO entries are incompatible with the slave firmware. 2 .Check if the Vendor ID check is disabled for the slave. 3 .Check if the Product ID is inconsistent between the slave configuration and actual hardware.
0x8A	Inconsistent settings	1 .Power cycle the device. 2 .Contact the manufacturer.
0x8B	Free-Run not supported	1 .Power cycle the device. 2 .Contact the manufacturer.
0x8C	Synchronization not supported	1 .Power cycle the device. 2 .Contact the manufacturer.
0x8D	Free-Run needs 3 buffer mode	1 .Power cycle the device. 2 .Contact the manufacturer.
0x8E	Backgroundwatchdog	1 .Power cycle the device. 2 .Contact the manufacturer.
0x8F	No valid inputs and outputs	1 .Power cycle the device. 2 .Contact the manufacturer.
0x90	Fatal Sync error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x91	No Sync error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x92	Cycle Time too small	1 .Power cycle the device. 2 .Contact the manufacturer.
0x94	Invalid DC SYNCH Configuration	1 .Power cycle the device. 2 .Contact the manufacturer.
0x95	Invalid DC Latch Configuration	1 .Power cycle the device. 2 .Contact the manufacturer.

Fault code	Fault message	Solution
0x96	PLL Error	1 .Disconnect the slave from the network and reconnect it. The error is automatically cleared. 2 .Set the bus cycle time to a value between 125 µs and 8000 µs. Set the master synchronization offset to a value between –50% and 50%.
0x97	Invalid DC IO Error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x98	Invalid DC Timeout Error	1 .Power cycle the device. 2 .Contact the manufacturer.
0x99	DC invalid Sync Cycle Time	1 .Power cycle the device. 2 .Contact the manufacturer.
0x9A	DC Sync0 Cycle Time	1 .Power cycle the device. 2 .Contact the manufacturer.
0x9B	DC Sync1 Cycle Time	1 .Power cycle the device. 2 .Contact the manufacturer.
0xA5	MBX AOE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xA6	MBX EOE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xA7	MBX_COE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xA8	MBX_FOE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xA9	MBX SOE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xB3	MBX_VOE	1 .Power cycle the device. 2 .Contact the manufacturer.
0xB4	EEPROM no access	Change the EEPROM access address or data length.
0xB5	EEPROM error	1 .Power cycle the device. 2 .Contact the manufacturer.
0xB6	External hardware not ready	1 .Power cycle the device. 2 .Contact the manufacturer.
0xC4	Slave restarted locally	1 .Power cycle the device. 2 .Contact the manufacturer.
0xC5	The device's identifier value has been altered	1 .Power cycle the device. 2 .Contact the manufacturer.
0xD4	Detected Module and Configured does not match	Use the EtherCAT device scan function to compare the configured devices with the scan results.

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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