Kinco 步科

AK840M Motion Controller
User Manual

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Support

If you have questions during product selection or usage, customers in China can call our technical support hotline at **400-700-5281** (Chinese service only).

For inquiries about the products described in this manual, please contact your local Kinco office or distributor. For information on user training, visit our company website or consult your local distributor for training plans.

Manual Acquisition

This manual is a paperless document. To obtain a PDF version, visit the Kinco official website (https://en.kinco.cn/), navigate to **"Service → Download"**, and search by keywords to download.

Device Description File Acquisition

The AK8X0 series motion controller package file (.PACKAGE) integrates device descriptions for all CPU modules in the AK8X0 series. Please visit the Kinco official website https://www.kinco.cn/ (CN), https://en.kinco.cn/ (EN) or contact Kinco's official customer service department to obtain the latest device description files.

Reversion History

Reversion Date	Release Version	Description
2024/05/28	AK840_usermanual_V000	Initial Revision
2024/11/27	AK840_usermanual_V001	Content Update

Catalogue

1 Safety Instructions

This chapter outlines safety precautions for proper use of the product. Before use, read this manual and any related documentation to understand the safety instructions. Failure to follow these precautions may result in death, serious injury, or equipment damage.

The "Danger," "Warning," and "Caution" notes in this manual are not exhaustive but supplement general safety measures.

Use this product within its design specifications to avoid malfunctions. Damage or issues caused by non-compliance are not covered under warranty.

Kinco assumes no legal responsibility for personal injury, property damage, or other accidents resulting from non-compliance with this manual or improper operation of the product.

To ensure safe use, this manual employs specific symbols and graphical markings to highlight important safety-related information. Please adhere strictly to these precautions.

	**Danger/Prohibited** Indicates prohibited actions. If proper precautions are not taken, it may result in serious personal injury or even death.
	**Warning** Indicates cautionary actions. If proper precautions are not taken, it may result in serious personal injury or even death.
	**Caution** Indicates general information or directives. If the corresponding precautions are not followed, it may lead to unintended results.

	During power supply
	❖ During power supply, do not touch terminals or attempt disassembly. Wait for capacitors to discharge after turning off the power to avoid electric shock or hazards.
	During electrical assembly
	❖ Installation, wiring, maintenance, and inspection must be performed by qualified personnel trained in electrical equipment. ❖ Avoid dusty, corrosive, or high-temperature environments.
	❖ When processing screw holes or wiring, take care to prevent metal shavings, dust, and wire fragments from entering the controller's ventilation channels, as this may cause fire, malfunctions, or other unintended operations.
	During wiring
	❖ The installation, wiring, maintenance, and inspection of this product must be carried out by professional electrical maintenance personnel who have received relevant training in electrical equipment and possess sufficient electrical knowledge. ❖ Wiring work must only be performed after ensuring that the external power supply to the system is completely disconnected. Otherwise, there is a risk of electric shock, equipment failure, or unintended operation.
	❖ After completing installation and wiring, ensure the product is fully assembled (including end caps and cover plates) before powering on and operating; otherwise, there is a risk of electric shock. ❖ Cable terminals must be properly insulated, and the insulation distance between cables should not decrease after installation on the terminal block. Failure to do so may result in electric shock, short circuit, or equipment damage.
	❖ When processing screw holes or wiring, take care to prevent metal shavings, dust, and wire fragments from entering the controller's ventilation channels, as this may cause fire, malfunctions, or unintended operations. ❖ Before connecting cables, confirm the type of interface being connected. Incorrect interface connections or wiring errors may result in controller or external equipment malfunctions or damage. ❖ Tighten the bolts on the terminal block within the specified torque range. Failure to tighten them properly may result in circuit short circuits, loose connections, or fire hazards. Over-

tightening could damage the bolts or the controller, causing component detachment, circuit short circuits, or fire hazards.

- ❖ When connecting external devices via connectors, use tools specified by the manufacturer for proper crimping, pressing, or soldering. Poor connections may lead to short circuits, fire, or unintended operations.
- ❖ Do not bundle control lines or communication cables with main circuit or power supply lines, nor place them too close to each other. Ensure control and communication cables are arranged at least 100 mm apart from main circuit power lines in separate cable ducts or spaces to prevent noise-induced malfunctions.
- ❖ For applications with severe interference, use specialized shielded cables for high-frequency signal input or output to enhance the system's anti-interference capability.

During system design and debugging

- ❖ Always design a safety circuit to ensure that the control system remains secure in the event of an external power failure or controller malfunction.
- ❖ If the output circuit experiences prolonged overcurrent due to exceeding the rated load current or a short circuit in the load, the controller may emit smoke or catch fire. Install external fuses or circuit breakers as safety protection devices.

- ❖ Ensure that the external circuit of the controller includes an emergency brake circuit, protection circuit, interlock circuits for forward/reverse operations, and upper/lower limit interlock switches to prevent machine damage.
- ❖ To ensure safe equipment operation, design external protection circuits and safety mechanisms for output signals related to critical accidents.
- ❖ The controller's CPU may automatically disable all output signals when detecting a system abnormality. If part of the controller's circuitry malfunctions, outputs may become uncontrollable. To ensure proper operation of the equipment, design appropriate external control circuits.
- ❖ If the controller's transistor output unit is damaged, its output state may become uncontrollable.
- ❖ Programmable Logic controllers (PLCs) are designed for indoor use in electrical environments with overvoltage category II. The power supply system should include lightning protection devices to prevent overvoltage caused by lightning from affecting the power input, signal input, or control output ports of the controller, thus avoiding equipment damage.

During operation and maintenance

- The installation, wiring, maintenance, and inspection of this product must be carried out by professional electrical maintenance personnel who have received relevant training in electrical equipment and possess sufficient electrical knowledge.
- Before cleaning or re-tightening the bolts on the terminal block or the connector installation bolts, please ensure that the system's power supply is completely disconnected.

- During equipment debugging, thoroughly read the user manual before performing operations such as online program modifications, forced outputs, start (RUN), and stop (STOP). Ensure that the safety of these operations is fully confirmed before proceeding.

2 General Instructions

This product is Kinco's self-developed next-generation medium-sized PLC, integrating 8 digital inputs (DI), 8 digital outputs (DO), 1 RS485, 2 Ethernet ports, 2 EXP expansion ports, 1 EtherCAT port, and 1 Type-C interface. It supports up to 32-axis EtherCAT synchronized motion control (typical synchronization cycle 1ms @8, E-Cam). The dual Ethernet port design enables multi-layer network communication, and the backplane bus supports up to 16 expansion modules.

2.1 Series Introduction

The AK8X0 series is Kinco's new generation of high-performance, cost-effective CoDeSys-based medium-sized EtherCAT bus motion controllers. It has made significant improvements in overall performance, functionality, integration, and ease of use. Paired with the RP20 series remote IO system, it is another new solution offered by Kinco to help break industry barriers for customers in various sectors. The AK8X0 series is widely applicable in the general industrial automation field and more specifically in areas like building automation, agricultural intelligence, energy detection, and energy management, aiming to provide customers with flexible and adaptable solution possibilities.

2.2 Naming Rules

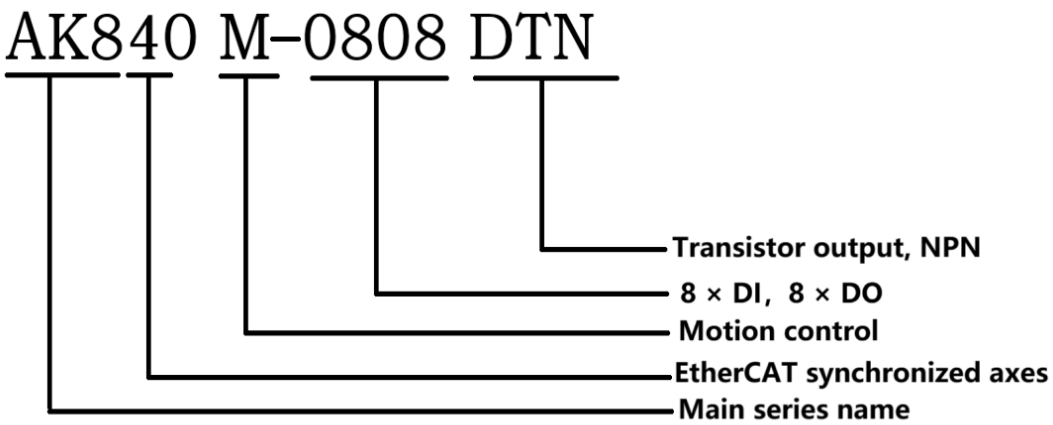

Fig. 2.2-1 ‘AK840M-0808DTN’ naming description

2.3 Fuselage Label

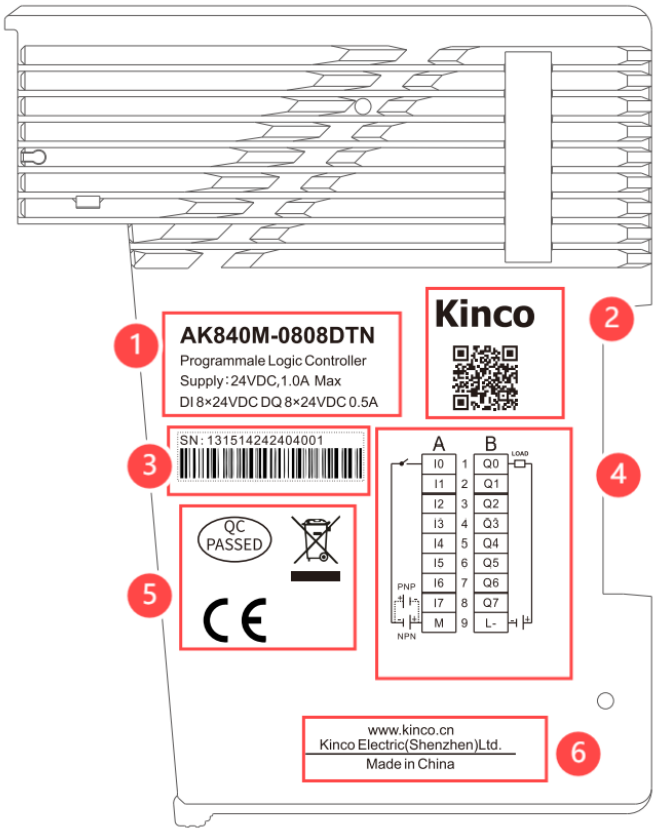

Fig2.3-1 Fuselage Label Diagram

No.	Item	Description
①	Model and Brief Description	Includes basic information such as product model, power supply, and function description.
②	Kinco official QR Code	Scan the code to directly access Kinco's official website for more information.
③	Product Serial Number	Unique and traceable.
④	I/O Wiring Diagram	Provides a clear view of wiring information.
⑤	Certification	Includes the product's certification standards.
⑥	Kinco official website	Enter the website address to visit Kinco's official website for more information.

3. Product Specification

3.1 General Specification

Transportation and Storage Conditions		
Climatic Conditions	Ambient Temperature	-40℃～+70℃
	Relative Humidity	10%～95%,no condensation.
	Atmospheric Pressure	Equivalent to 0-3000 meters above sea level.
Mechanical Conditions	Free Fall	With transport packaging, allows 5 drops from 1m height to the cement floor.
Operating Conditions		
Climatic Conditions	Ambient Temperature	Open device with natural ventilation, ambient temperature range: -20℃～+55℃.
	Relative Humidity	10%～95%,no condensation.
	Atmospheric Pressure	Altitude≤2000 meters
	Pollution Level	Suitable for pollution level 2
Mechanical Conditions	Sine Vibration	5 < f < 8.4 Hz, Random: 3.5mm displacement, Continuous: 1.75mm displacement.
		8.4 < f < 150 Hz, Random: 1.0g acceleration, Continuous: 0.5g acceleration
	Shock	Half sine wave, 15g, 11ms, 6 times per axis
Electromagnetic Compatibility (EMC)	EMC Immunity Level	Zone B，IEC61131-2
	Electrostatic Discharge	Air discharge 8kV, contact discharge 4kV.
		Performance Leve A
	Surge	DC power supply 0.5kV CM, 0.5kV DM.
		I/O and communication ports: 1kV CM.
		Performance Leve A
	Fast Transient Burst	Power coupling: 2kV, 5kHz. I/O and communication coupling: 1kV, 5kHz.
		Performance Leve A
Protection Level		IP20

Cooling Type	Natural air cooling
Assembly Method	DIN35 rail mounting
Certification	CE

3.2 Power Supply

Item	Specification
Rated Power Supply	24V DC +/-20% （19.2V DC～28.8V DC）
Rated Power	6W (CPU unit only)/20W (Full-load)
Power Protection	Overcurrent Protection Reverse Polarity Protection Surge Absorption

3.3 Overall Specification

Technical Specification	
Program Memory	32MB
Data Memory	32MB
Non-volatile Storage	1MB
EtherCAT	1 × EtherCAT
	Typical motion control synchronization cycle:8-axis electronic cam synchronization, @1ms
	Axis Capability: 8 to 32 axes,1 to 4ms, Electronic cam/interpolation: Support
Local Expansion	Kinco dedicated K-bus backplane, supports up to 16 local expansion modules of the RP20 series. * Without the power module, up to 8 RP20 series local expansion modules are supported.
Ethernet (RJ45)	2 × Ethernet, both support Modbus TCP master/slave, with a maximum of 31 TCP slaves per channel.
	Both support program upload and download.
COM	1 × RS485, supporting Modbus RTU master/slave protocol, supporting up to 31 Modbus RTU slaves.
USB (Type-C)	1 × USB OTG, supports firmware updates via USB drive (limited to FAT32 format).
Local I/O	8 × Digital inputs, sourcing/sinking, supports 2-channel of high-speed counters. supports 2-channel high-speed inputs, A/B phase and pulse/direction signals, with a maximum of 200KHz.
	8 × Digital outputs, with selectable output types of PNP or NPN.
Indicators	PWR: Power status
	RUN: Device operation status
	ERR: Device error
	BUS: Expansion bus error
	BATT: Low voltage of backup battery
Dimensions (W × H × D) mm	57 × 80 × 108
Weight	≈180g

3.4 Local I/O Specification

Item	AK840M-0808DTN
Digital Input	
Type and Polarity	Sourcing/Sinking
Number of channels	8
Rated Input Voltage	24V DC, maximum allowable 30V DC.
Input Impedance	5.4K
Logic "0" Max. Input Voltage	5V,0.8mA
Logic "1" Min. Input Voltage	15V,2mA
Turn-on Delay	<2.5μs
Turn-off Delay	<2.5μs
Isolation	Optoelectronic isolation, 500VAC/minute
Digital Output	
Type and Polarity	Transistor output, NPN
Number of channels	8
Rated Output Voltage	24V DC, maximum allowable 30V DC.
Output Current/Channel	Maximum 500mA (24V DC ±10%)
Output Leakage Current	Maximum 10μA
Output Impedance	Typical: 0.26Ω， Maximum: 0.56Ω
Output Delay	<5uS
Protection	Inductive load output protection Short circuit protection
Output Load	Resistive load: 12W/channel，48W/module
	Inductive load: 6W/channel，24W/module
	Lamp load: 5W/channel，20W/module
Isolation	Digital isolation, 500VAC/minute.

4. Component Description

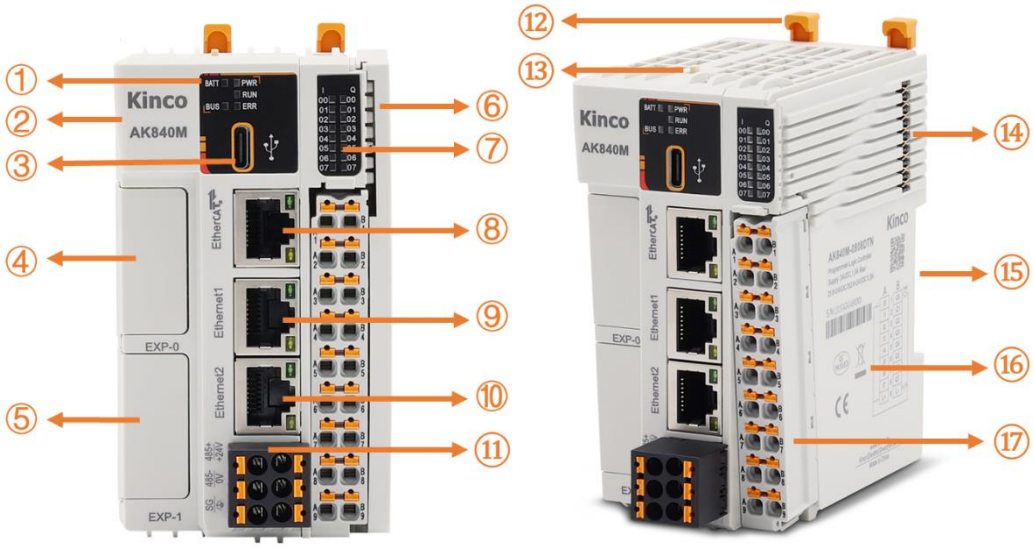

Fig4.1-1 Photograph of AK840M

No.	Item	Comment	
①	Indicator Panel	PWR: Power Status	**Steady On:** Power supply normal **Off**: Power abnormal or not connected
		RUN: Device Operating Status	**Steady On:** Device is running **Off:** Device is stopped
		ERR: EtherCAT bus Status	**Steady On:** EtherCAT bus error detected **Off:** EtherCAT bus is running normally
		BATT: Battery Status	**Steady On:** Battery group low or not installed **Off:** Operating normally
		BUS: Expansion Bus Status	**Steady On:** Expansion modules detected **Flashing:** Expansion module failure detected **Off:** No expansion modules detected
②	Model Symbol	Indicates the controller model.	
③	USB-C	Can be used for controller firmware updates.	
④	EXP0	Expansion BD slot 0, supports only serial ports and digital I/O expansion.	
⑤	EXP1	Expansion BD slot 1, supports CANopen, COM, TF-card, and digital I/O expansion.	
⑥	Cover	Used to protect exposed connectors on the side of the PLC.	

⑦	Local I/O Indicators	**Steady On:** Indicates output/input received **Off:** No output/input received
⑧	EtherCAT	Connects to EtherCAT bus devices.
⑨	EtherNet1	Supports Modbus TCP Slave/Master protocols, allows debugging and program downloading. Default IP: 192.168.1.100.
⑩	EtherNet2	Supports Modbus TCP Master/Slave, allows debugging and program downloading. Default IP: 192.168.2.100.
⑪	Power Supply and RS485 Connector	Two groups, the L group is for RS485 connection, the other group (right side) is for power supply.
⑫	Locking Latch	Standard DIN35 rail installation
⑬	RUN/STOP Toggle	Controls device status: **STOP** for halting the program, **RUN** for starting the program.
⑭	Side Connectors	Used for backplane (expansion) communication and power supply.
⑮	DIN Rail Slot	Compatible with standard DIN35 rails for assembly
⑯	Fuselage Label	Includes basic product information such as model number, serial number, certifications, and wiring diagrams. Refer to **2.3 Fuselage Label** for details
⑰	Local I/O Connector	Plug-In Spring Terminals: Tool-free installation and efficient connections. For details, refer to specific model connection diagrams.

5. Wiring

5.1 Power Supply & RS485

The power supply and RS485 share the same 6-pin dual-row detachable connector, which is equipped with a mechanical lock.

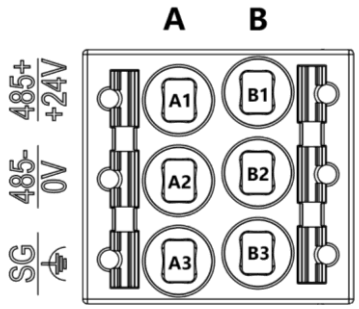

Fig5.1-1 Power supply and RS485 wiring diagram

The definition of the connector is as follows.

Pin	Symbol	Description	Pin	Symbol	Description
A1	485+	RS485+	B1	24V+	Power Supply+
A2	485-	RS485-	B2	0V	Power Supply-
A3	SG	RS485 Ground	B3	⏚	Power Supply Ground

5.2 Local I/O

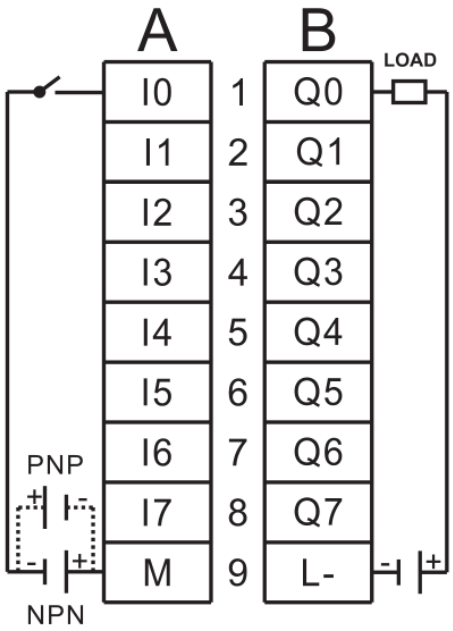

Fig.5.2-1 Local I/O wiring diagram

6. Dimensions

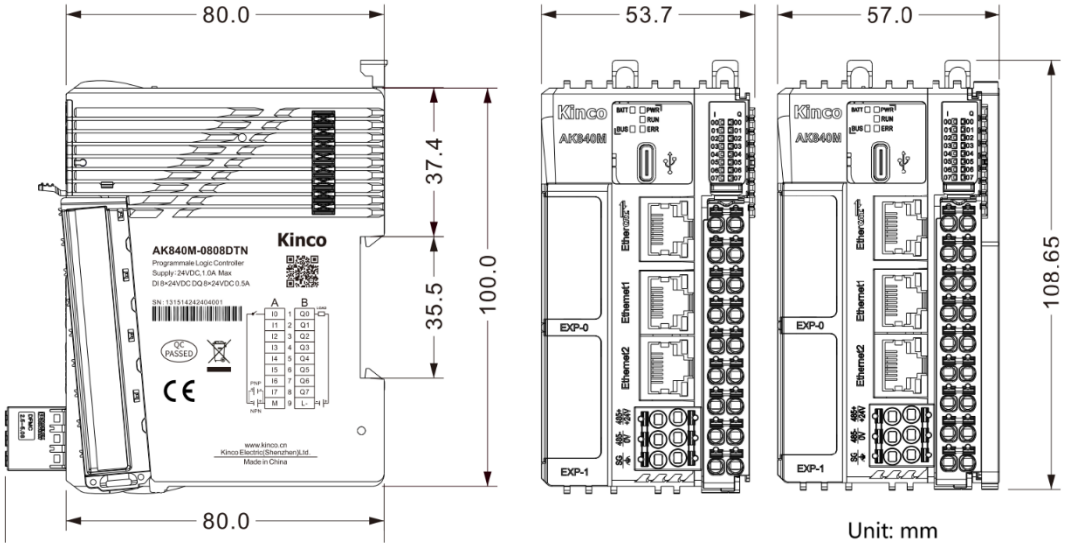

Fig.6.1-1 Dimension diagram of AK840M

7. Assembly Instructions

7.1 Assembly Dimensions

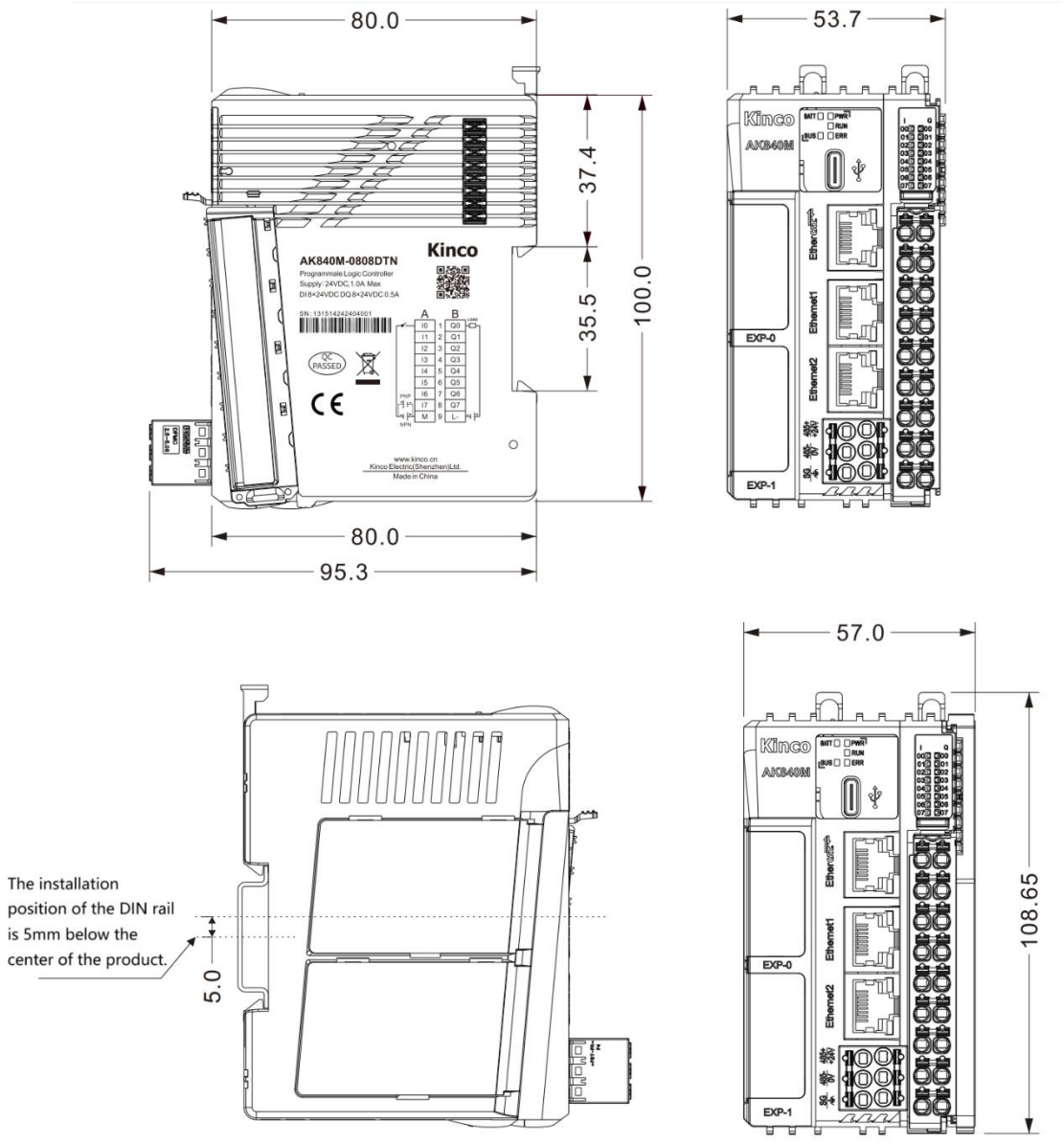

Fig.7.1-1 Assembly dimension diagram of AK840M

7.2 Assembly Method

7.2.1 DIN Rail Dimensions

AK8X0 series controller supports assembly by standard DIN rails (35mm wide and 1mm thick). The following two heights are commonly used.

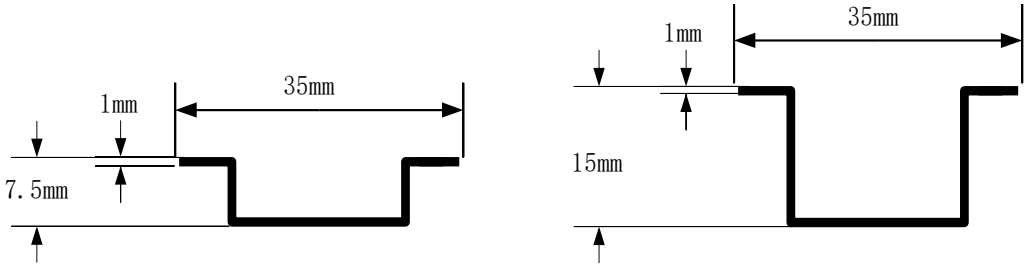

Fig.7.2-1 Standard DIN Rail

Notes: If the rail thickness is less than 1mm, the latch may not lock securely, causing looseness. If thicker than 1mm, the latch may not close properly, and forcing it to lock could damage the module.

7.2.2 Module Assembly

During assembly, pull the spring-loaded self-locking latch on the top of the module upward, position the module vertically onto the DIN rail, ensure the lower latch aligns with the bottom edge of the rail, and then release the latch. Once it resets automatically, the module will be securely fixed to the rail.

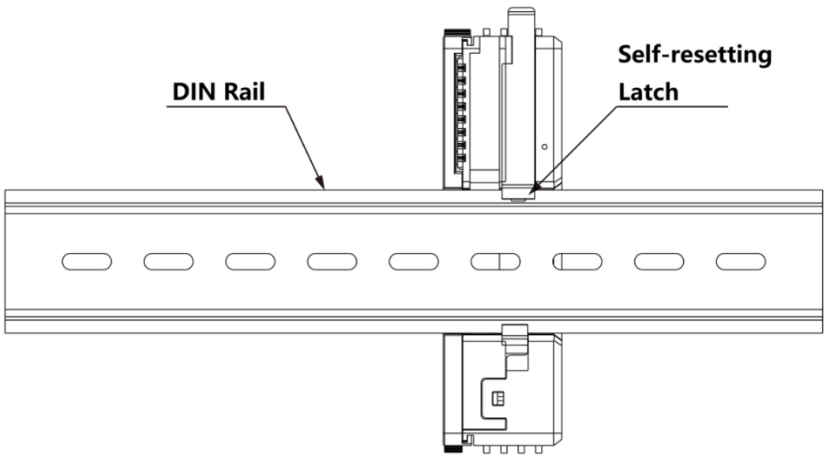

Fig.7.2-2 Assembly onto the Din Rail

After all modules are assembled, use rail fixing blocks that are compatible with the rail size to secure the PLC and expansion I/O modules in their intended positions on the rail. This prevents improper displacement during mechanical vibrations or

transportation, ensuring system safety.

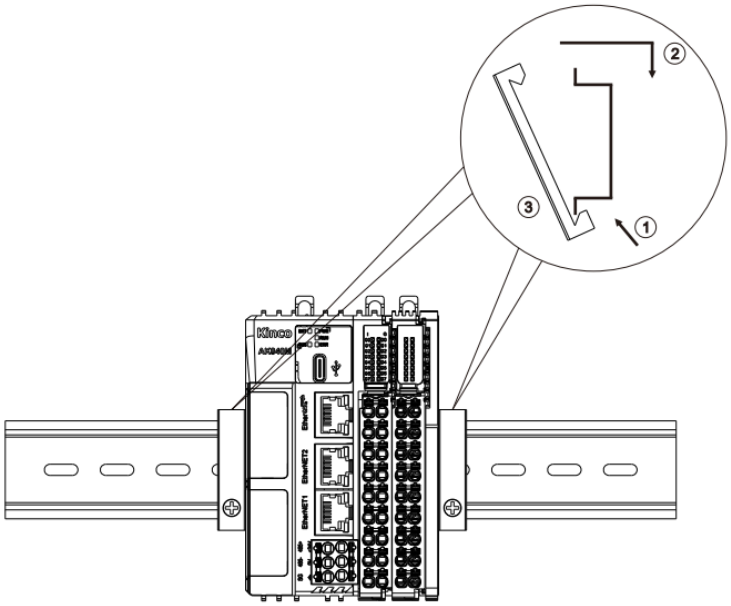

Fig.7.2-3 Fix and ensure security

During disassembly, first loosen the rail fixing block, then use a flathead screwdriver or other tools to lift the spring-loaded self-locking latch on top of the module. Afterward, remove the module from the rail.

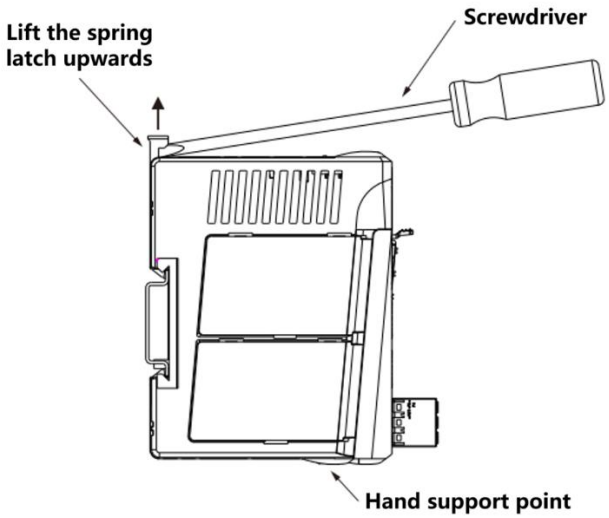

Fig.7.2-4 Disassembly

Notes: Rail fixing blocks must match the size of the DIN rail. Customers should purchase the blocks separately based on their specific requirements.

7.2.3 Connector Assembly

- Disassembly

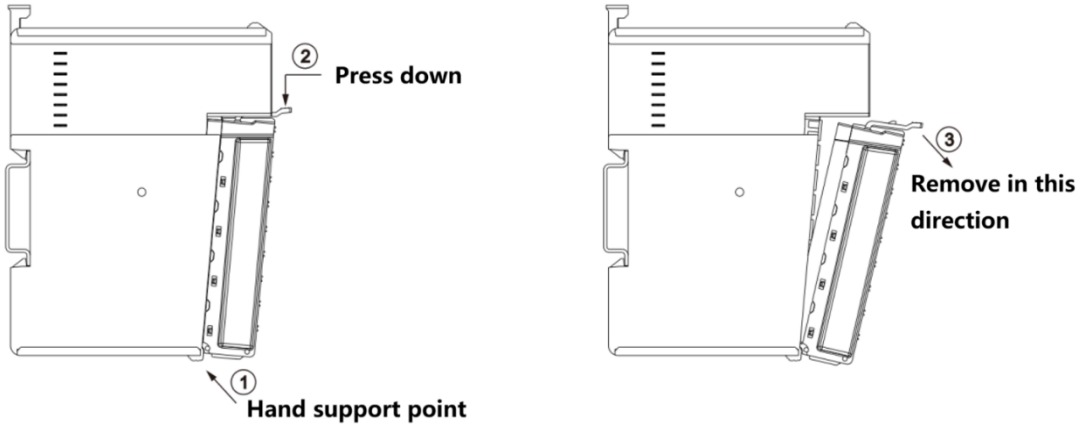

Fig.7.2-5 Connector disassembly

- Assembly

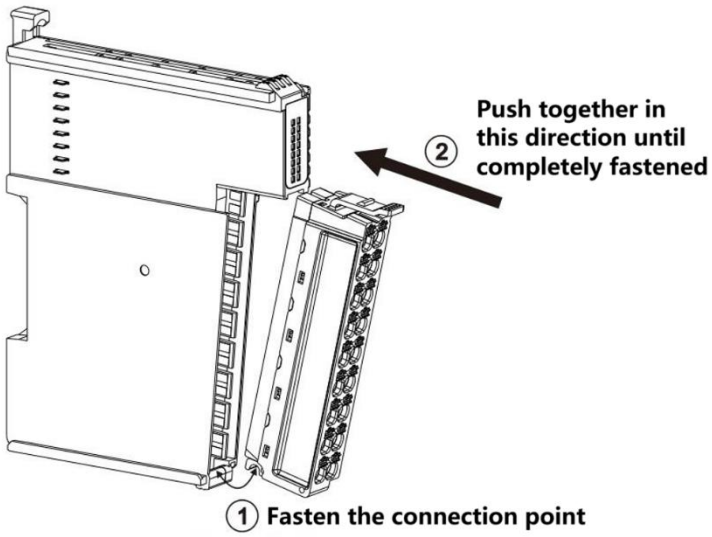

Fig.7.2-6 Connector assembly

8. Getting Started

8.1 Device Description File Acquisition

The AK8X0 series motion controller package file (.PACKAGE) integrates device descriptions for all CPU modules in the AK8X0 series. Please visit the Kinco official website https://www.kinco.cn/(CN), https://en.kinco.cn/ (EN) or contact Kinco's official customer service department to obtain the latest device description files.

8.2 Install Device Description File

This chapter demonstrates the device installation process using the standard CoDeSys-style interface (CoDeSys V3.5.19).

Step 1: Open CoDeSys V3.5.19, locate and open the "CODESYS Installer" under the "Tools" menu.

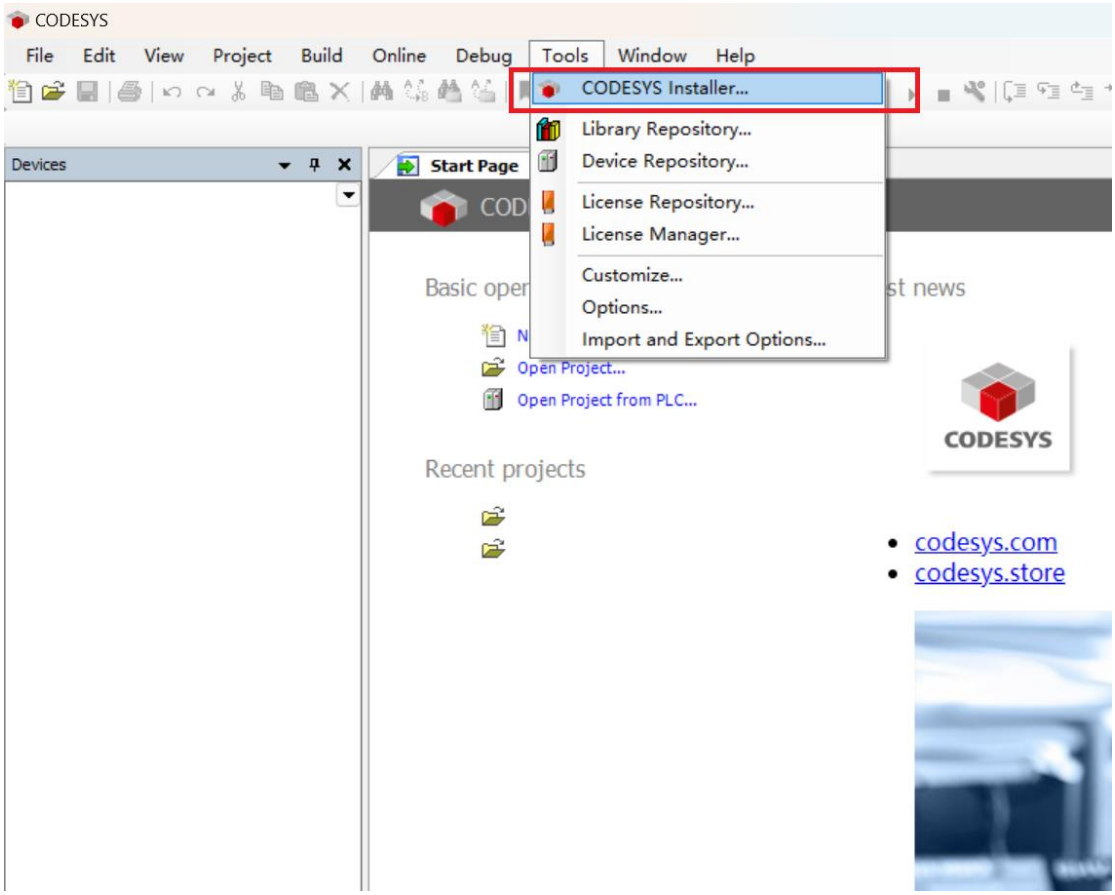

Fig. 8.2-1 Open 'CODESYS installer'

Step 2: In the CODESYS Installer, click **Install File** to select the device you want to install. Before installation, please close the CODESYS software as instructed, otherwise the installation cannot proceed.

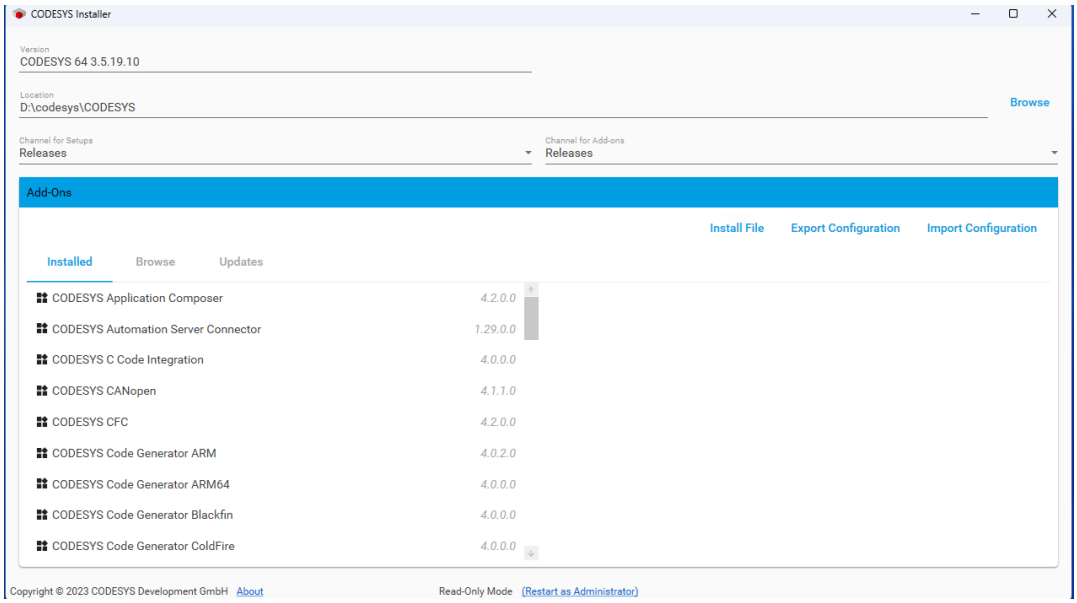

Fig. 8.2-2 Select file and install

Step 3: After the prompt box appears, check the box 'I want to continue despite the missing signature', and click 'Continue' to proceed with the next step of the installation.

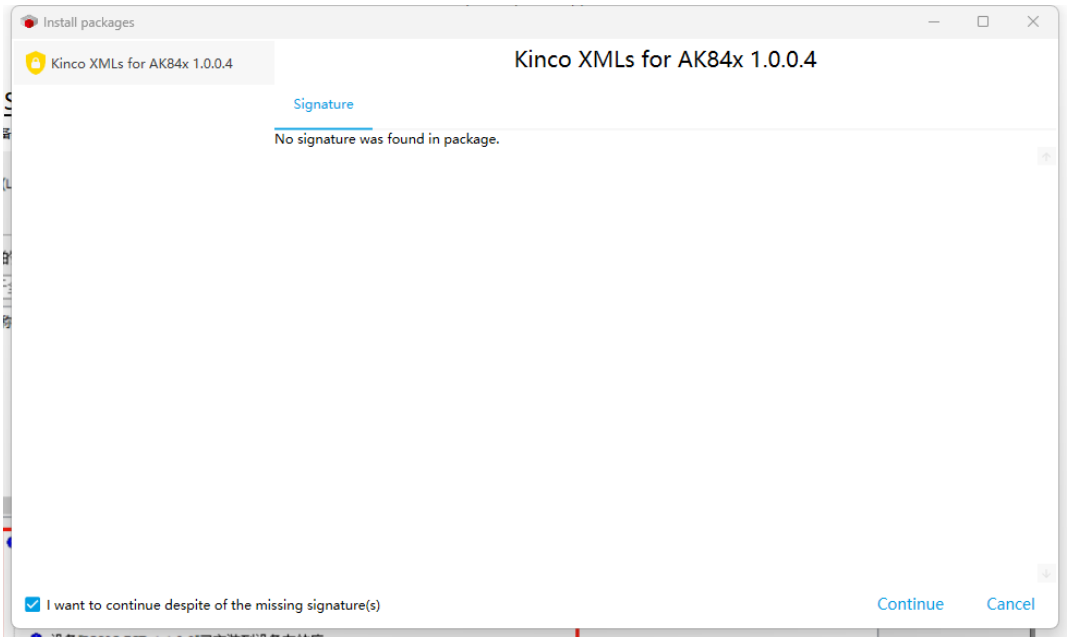

Fig. 8.2-3 Click 'Continue' to proceed

Step 4: Please wait patiently for the installation to complete.

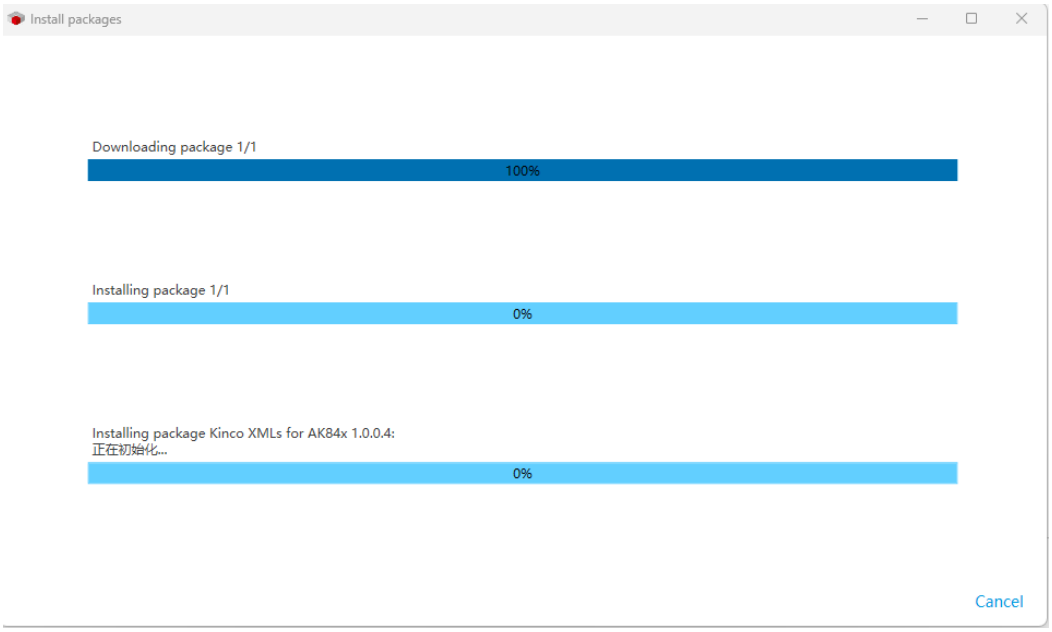

Fig. 8.2-4 Wait for the installation to complete

Step 5: Wait for the installation to finish. After that, you can close the installer and restart CODESYS software.

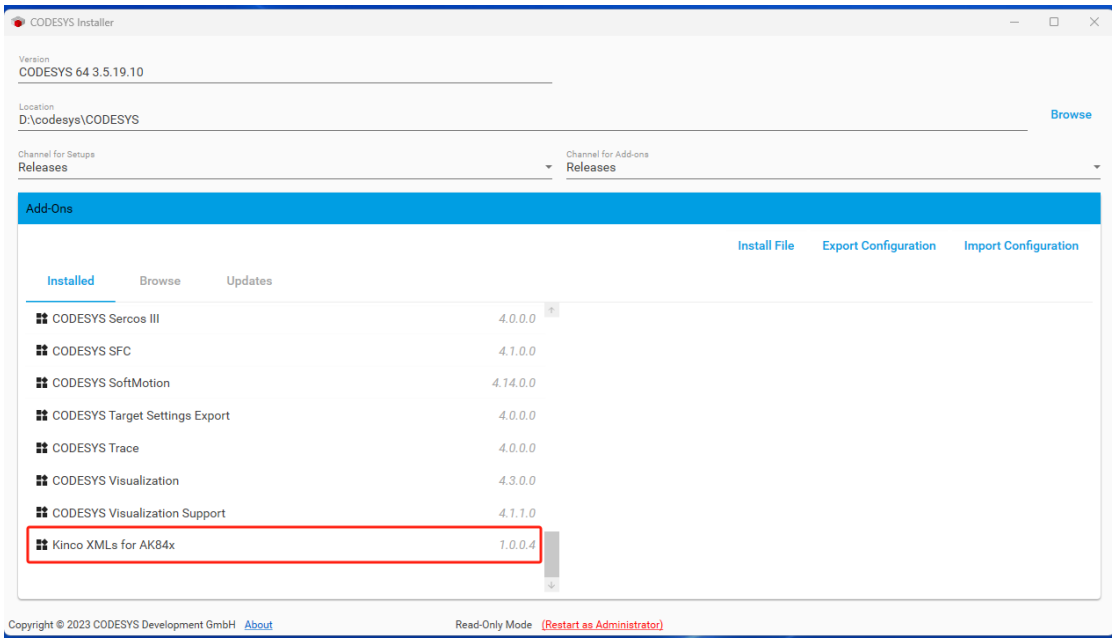

Fig. 8.2-5 Installation complete

8.3 Upgrade Instructions

8.3.1 Upgrade via USB

Step 1: Place the firmware program to be updated in the root directory of the USB drive. The firmware with the **delapp** suffix will erase the existing user program in the PLC (note that the USB drive must be formatted as FAT32).

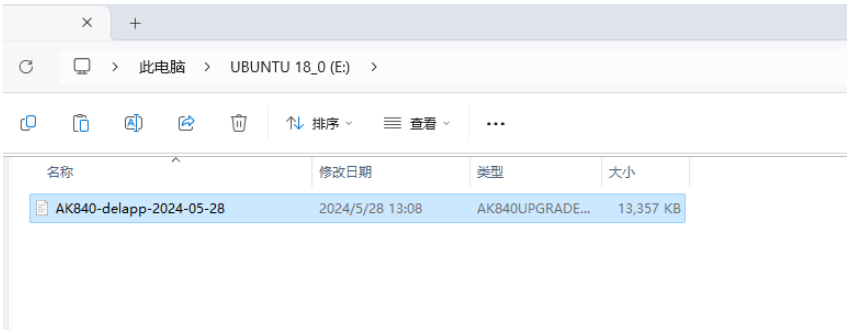

Fig.8.3-1 Place the firmware program

Step 2: Insert the USB drive into the Type-C port on the AK840, and then power off and restart. Please use a USB drive with a Type-C connector or use a USB-A to USB-C adapter.

Fig.8.3-2 USB-A to USB-C adapter

Step 3: During the reboot, observe the RUN light. A green flashing light indicates that the firmware update is in progress (do not power off or perform any other interrupting actions). When the RUN light is solid green, it means the update is complete.

8.3.2 Upgrade via CoDeSys

Step 1: After connecting to the AK840, go to the **Device** interface, and in the **Files** tab, place the firmware program in the **runtime** root directory.

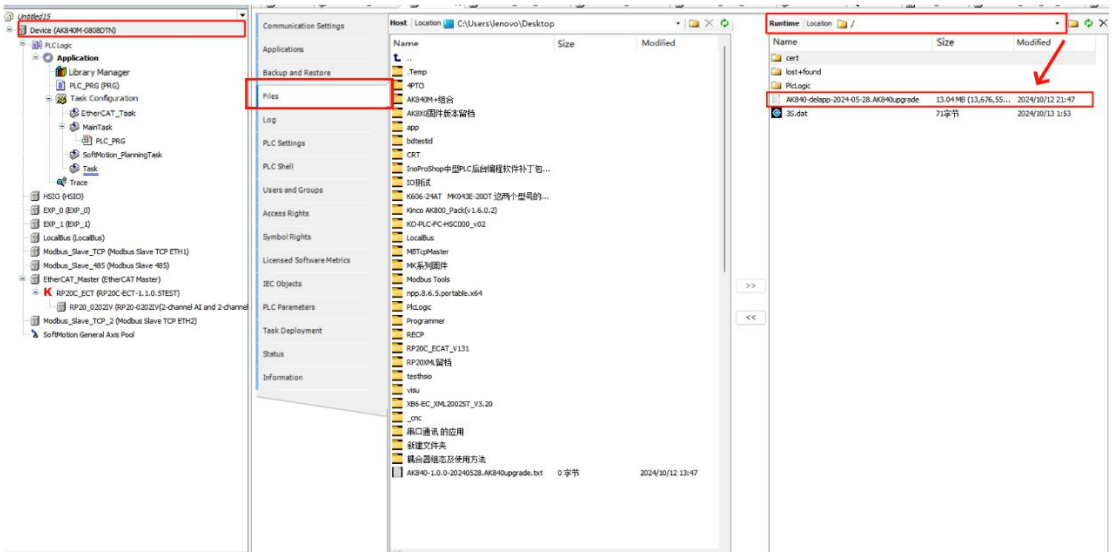

Fig.8.3-1 place the firmware program in the runtime root directory

Step 2: Power off and restart the PLC.

Step 3: During the reboot, observe the RUN light. A green flashing light indicates that the firmware update is in progress (do not power off or perform any other interrupting actions). When the RUN light remains green, it means the update is complete.

8.4 IP Modification

Step 1: After logging into the device, go to the PLC Parameters option under the Device tab. Modify the IP by entering the desired IP address in the preset value field of the corresponding channel, then click **Write Parameters** button in the upper right corner to apply the changes.

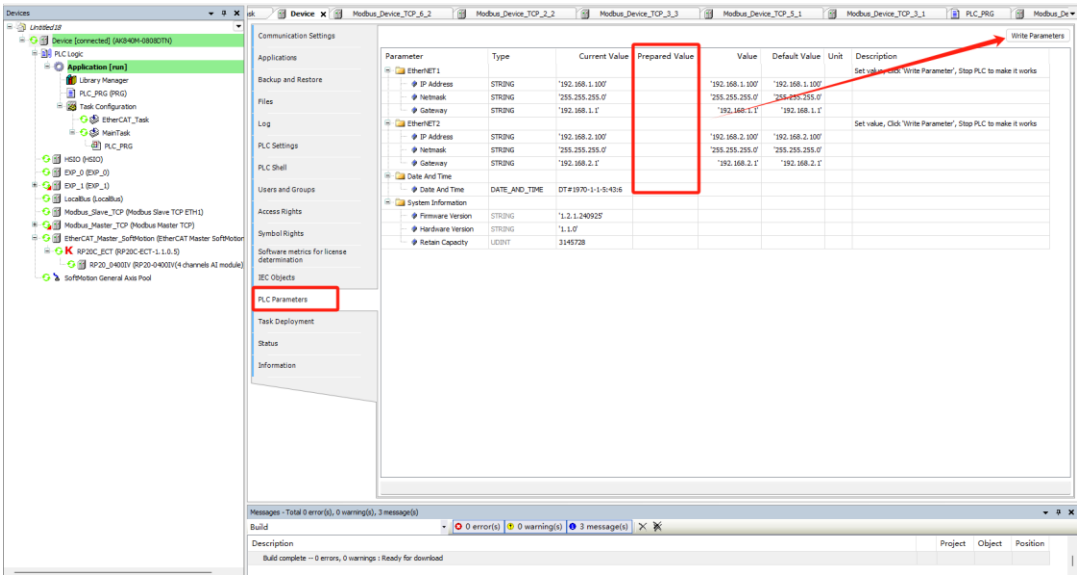

Fig.8.4-1 Modify device IP and gateway

Step 2: At this point, the IP of the corresponding channel has not been fully updated. The new IP will take effect only after reboot.

8.5 Modbus TCP

8.5.1 Modbus TCP Slave

Step 1: The **Modbus_slave_TCP** (Modbus TCP Slave ETH1) is one of the default items created when generating a new program. Double-click **Modbus_slave_TCP** to open the settings interface and adjust the configuration. For instance, the default parameters for the **ETH1** port are **Port: 502** and **Slave ID: 1**, as shown. (To configure parameters for the **ETH2** port, you'll need to add a corresponding TCP slave for **ETH2**).

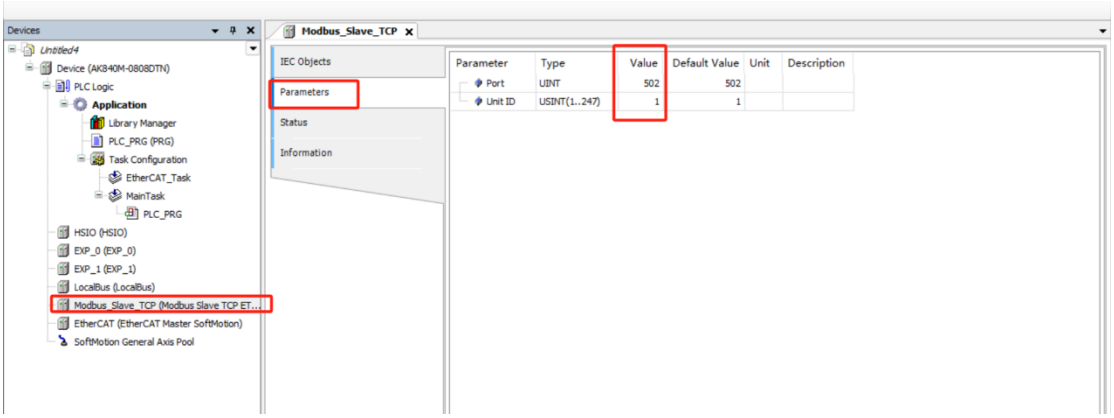

Fig.8.5.1-1 Modify device configuration

Step 2: After downloading the program, use **Modbus_Poll** to simulate communication. In the **Modbus_Poll** simulation software, set the function code to **16** and write the value **100** to the PLC register address **%MW100**. If the program shows that **%MW100** has received the value **100**, it indicates that Modbus TCP communication has been successfully established.

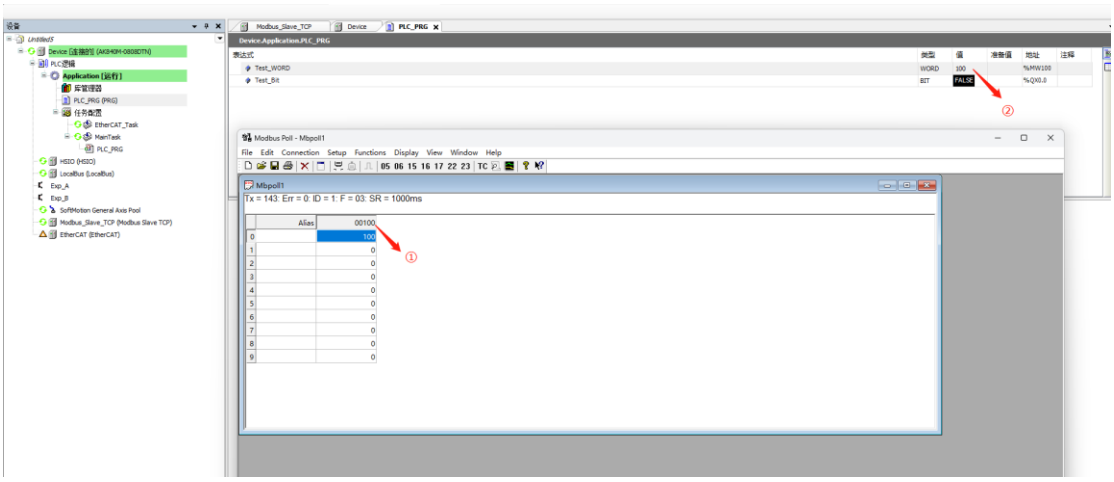

Fig.8.5.1-2 use **Modbus Poll** to simulate communication

8.5.2 Modbus TCP Master

Step 1: Right-click on **Device**, select **Add Device**, and add **Modbus Master TCP** in the shown directory.

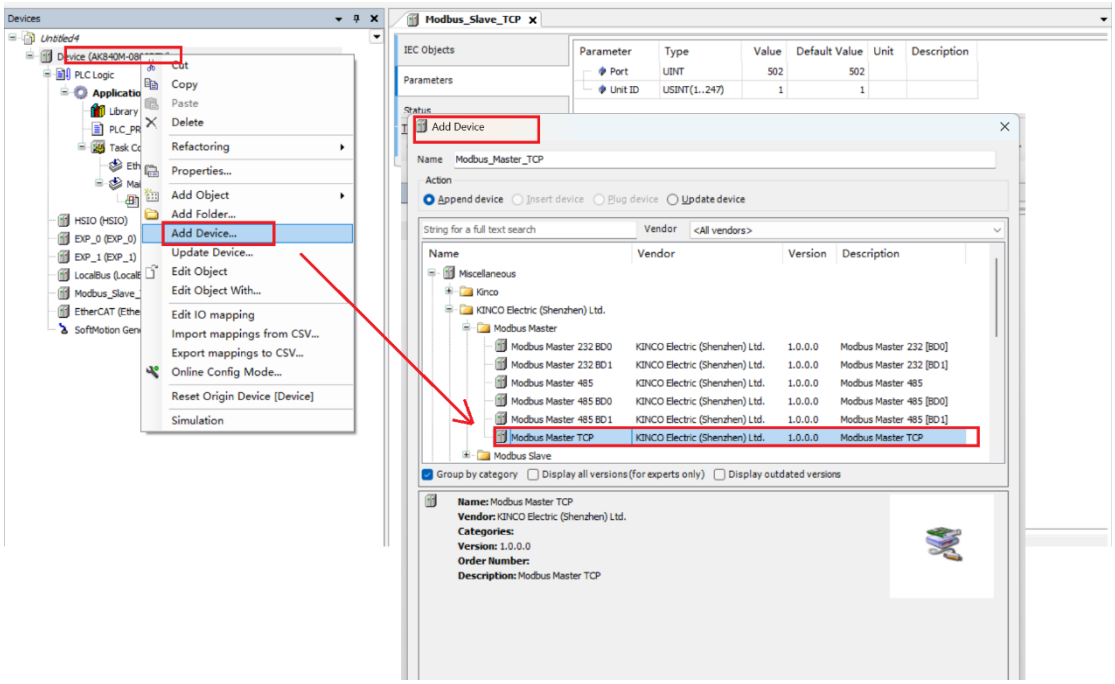

Fig.8.5.2-1 Add Modbus TCP Master Device

Step 2: Right-click on **Modbus Master TCP**, select **Add Device**, and then add **Modbus Device TCP**.

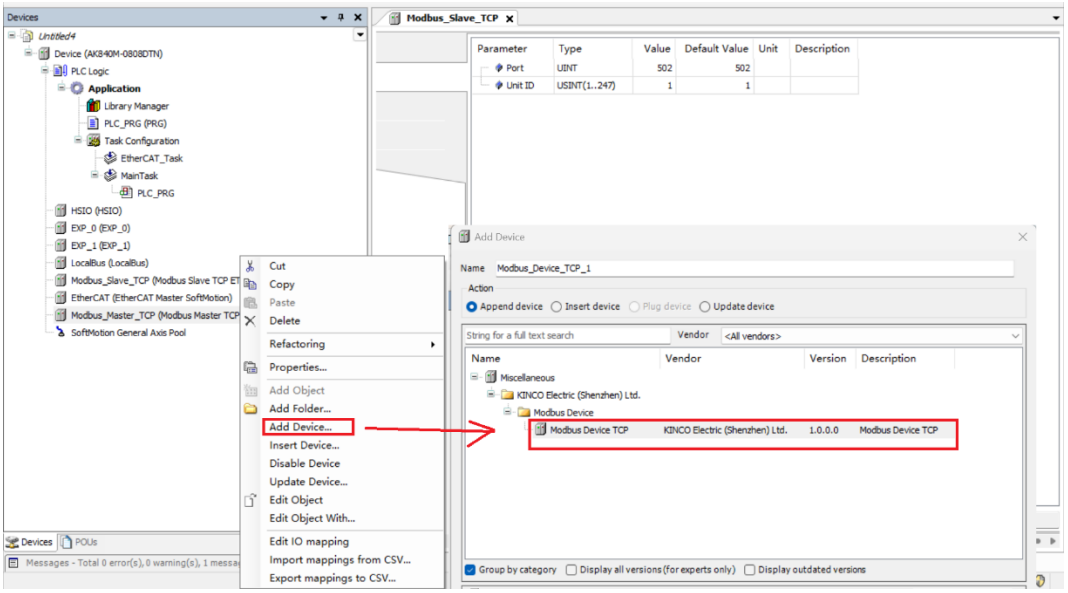

Fig.8.5.2-2 Add Modbus Device TCP

Step 3: Configure the slave information in the **Modbus Device TCP** tab.

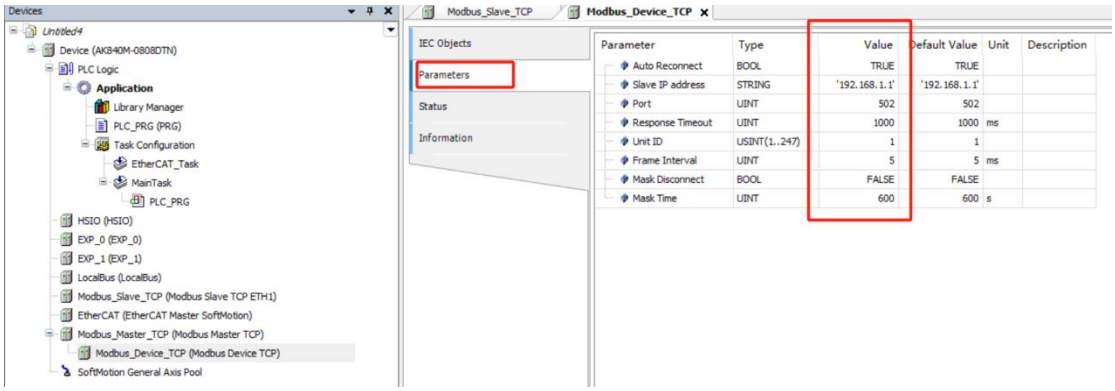

Fig.8.5.2-3 Modify the configuration information

Step 4: Right-click on **Modbus Device TCP**, select **Add Device**, and under the slave device, you can add a functional channel. In this example, add **Function Code 16: Write Multiple Registers**.

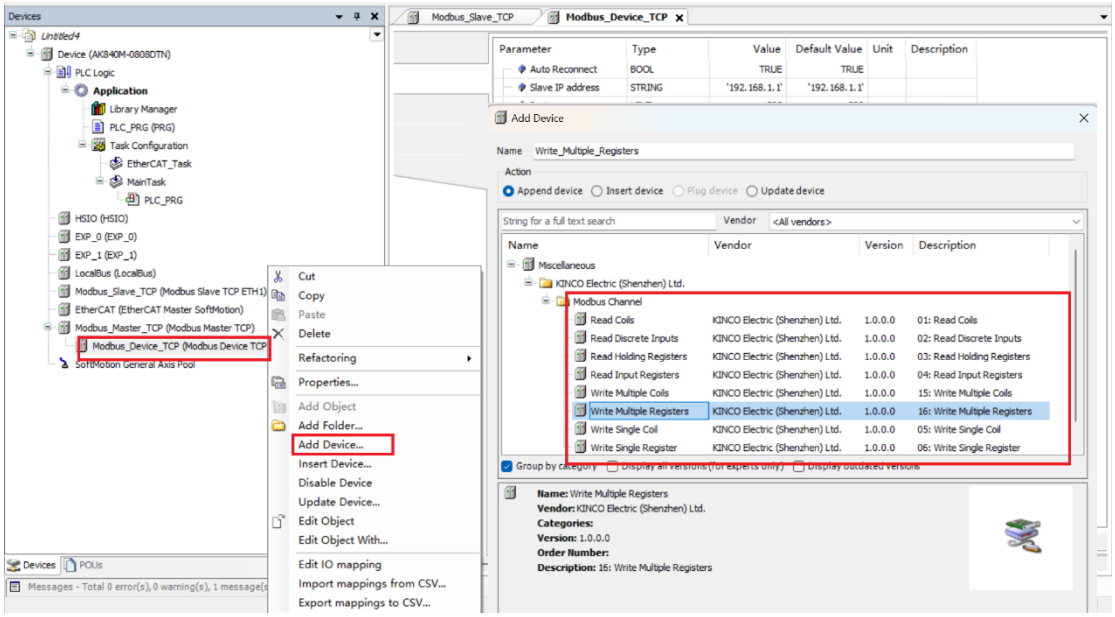

Fig.8.5.2-4 Add functional channels

Step 5: In the **Write_Multiple_Registers** tab, configure the parameters as shown in the diagram, setting the length to 10.

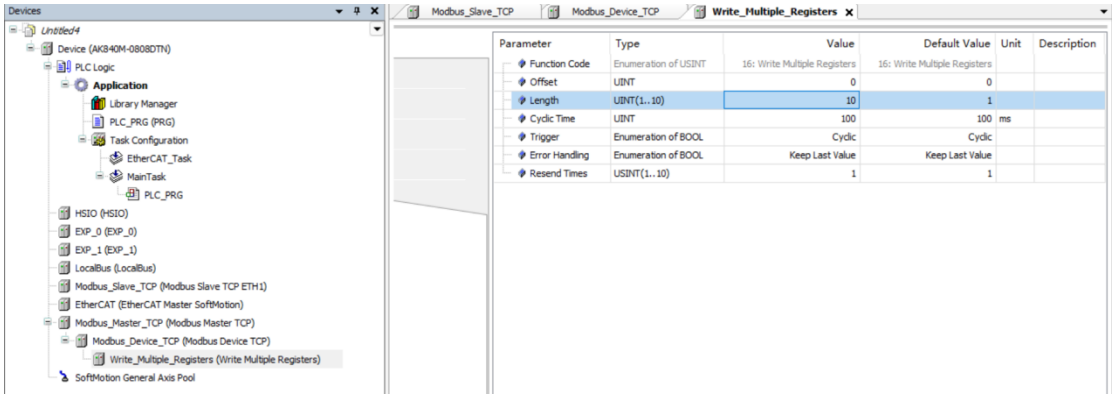

Fig.8.5.2-5 Modify the configuration information

Step 6: After downloading the program, use **Modbus_slave** to simulate

communication. In the **Write_Multiple_Registers** channel, write **100** in the I/O mapping. If the **Modbus_slave** simulation software receives the value **100**, it indicates that Modbus TCP communication has been successfully established.

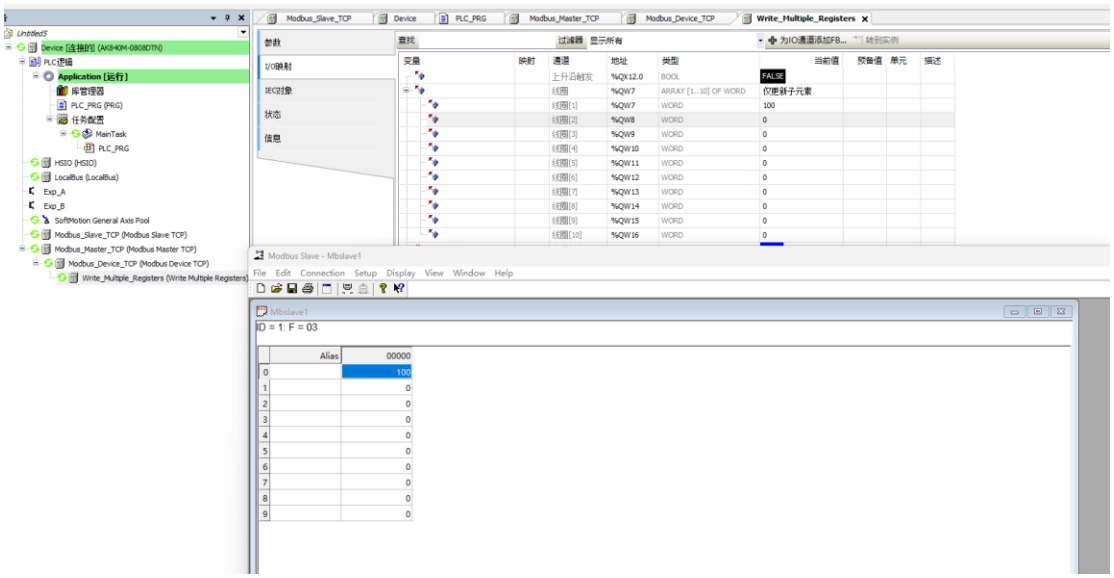

Fig.8.5.2-6 Use **Modbus Slave** to simulate communication

8.6 Modbus RTU

8.6.1 Modbus RTU Slave

Step 1: Right-click on **Device**, select **Add Device**, and add **Modbus Slave 485** in the shown directory.

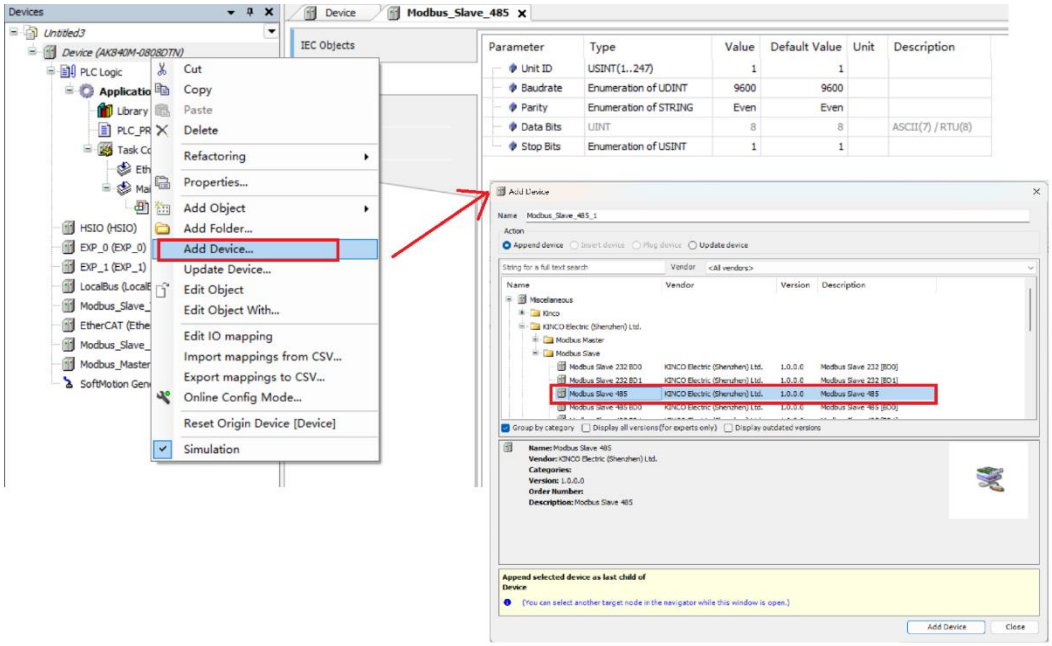

Fig.8.6.1-1 Add Modbus RTU slave

Step 2: Double-click to open the **Modbus Slave 485** tab, and modify the configuration information in the **Parameter** interface.

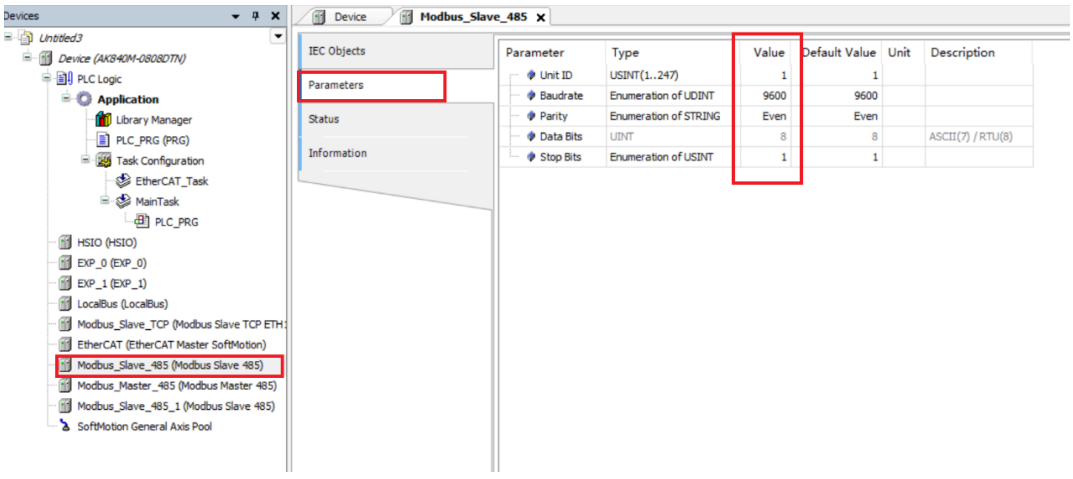

Fig.8.6.1-2 Modify the configuration information

Step 3: After downloading the program, use **Modbus Poll** to simulate communication. Set the function code to 16, and write the value 100 to the PLC register address %MW100 as shown in the diagram. If the data transfer is successful, it indicates that the Modbus RTU communication has been successfully established.

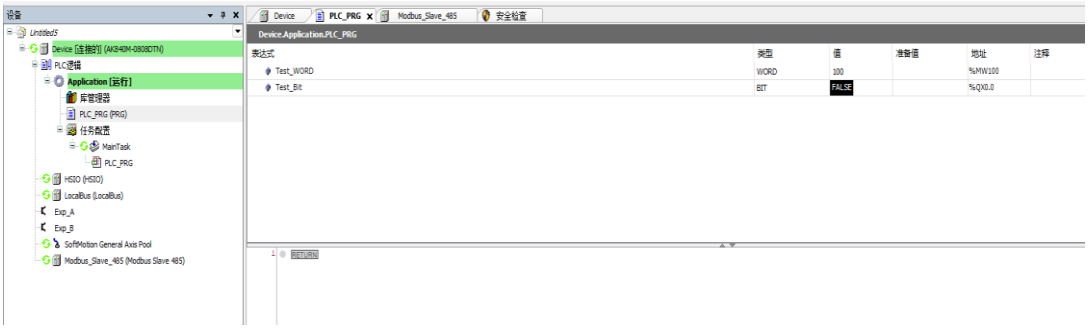

Fig.8.6.1-3 use **Modbus Poll** to simulate communication

8.6.2 Modbus RTU Master

Step 1: Right-click on **Device**, select **Add Device**, and add **Modbus Master 485** in the shown directory.

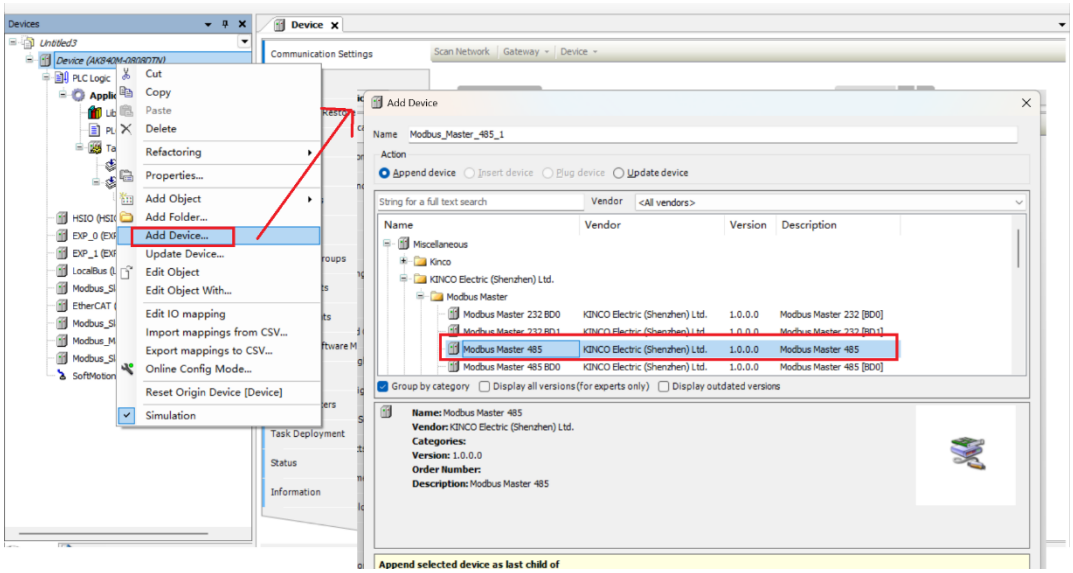

Fig.8.6.2-1 Add **Modbus Master 485**

Step 2: Right-click on **Modbus Master 485**, select **Add Device**, and then add **Modbus Device RTU**.

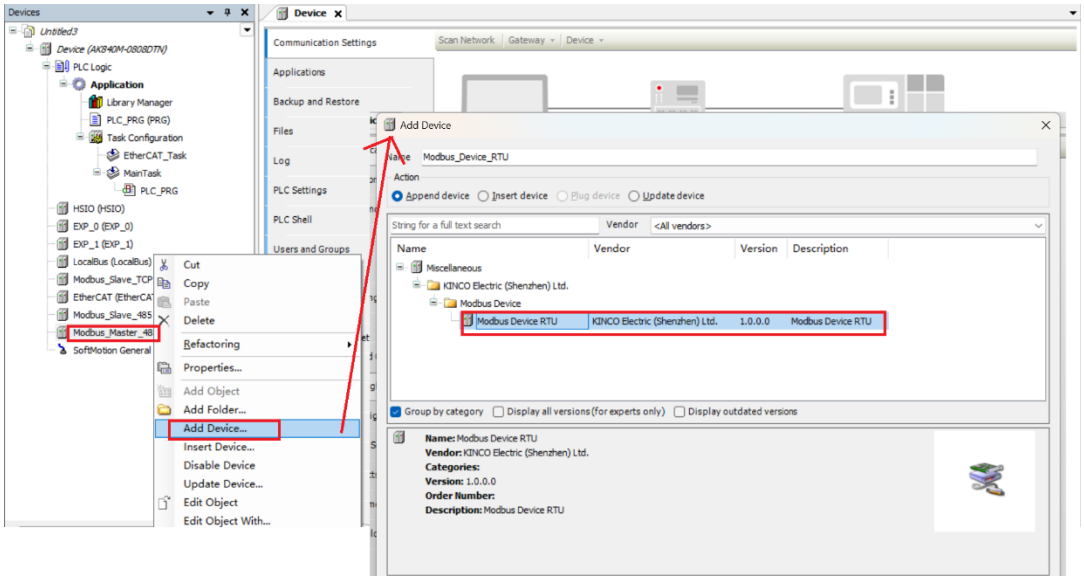

Fig.8.6.2-2 Add **Modbus Device RTU**

Step 3: Double-click to open the **Modbus Master 485** tab, and modify the configuration information in the **Parameter** interface.

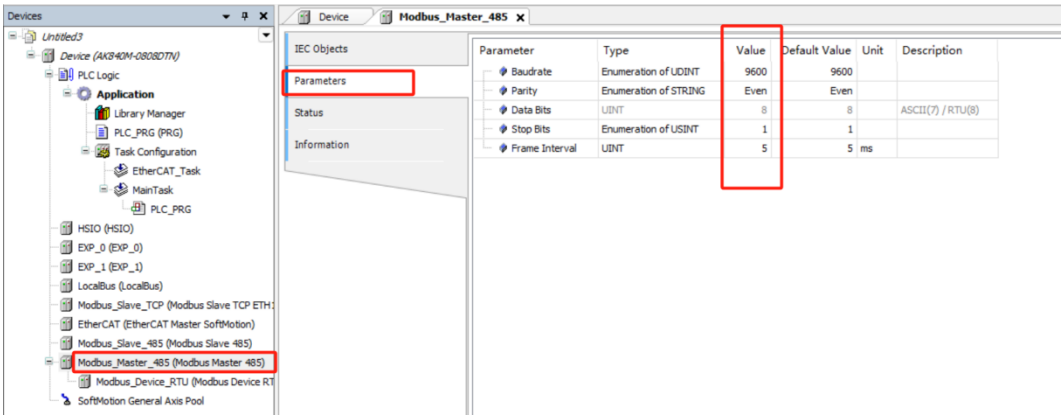

Fig.8.6.2-3 Modify the configuration information

Step 4: Double-click to open the **Modbus Device RTU** tab, and modify the configuration information in the **Parameter** interface.

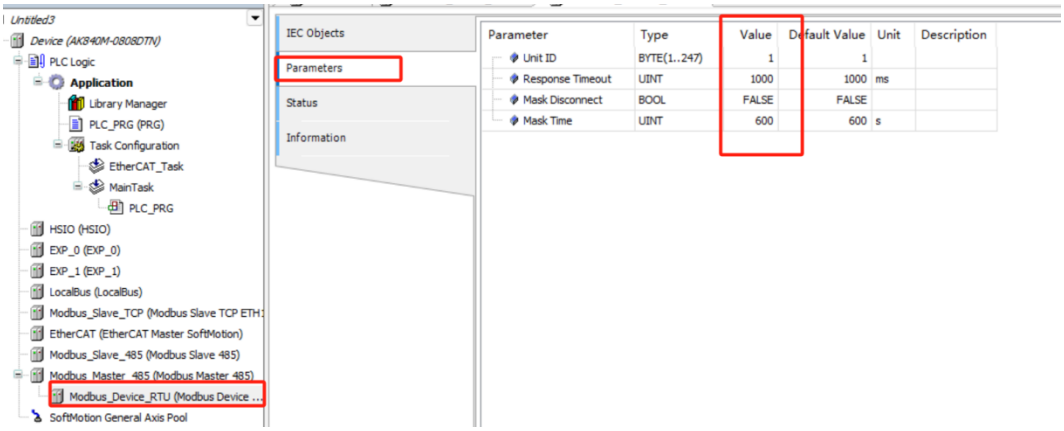

Fig.8.6.2-4 Modify the configuration information

Step 5: Right-click on **Modbus Device RTU**, select **Add Device**, and under the slave device, you can add a functional channel. In this example, add **Function Code 16:**

Write Multiple Holding Registers.

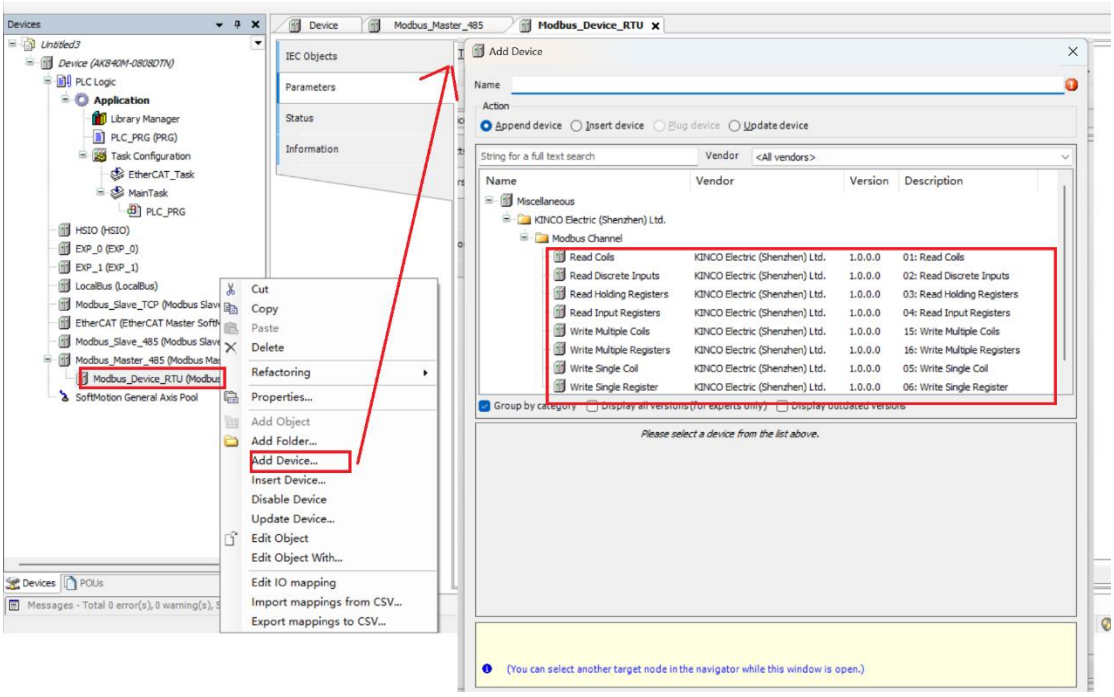

Fig.8.6.2-5 Add Modbus RTU functional channel

Step 6: In the **Write_Multiple_Registers** tab, configure the parameters as shown in the diagram, setting the length to 10.

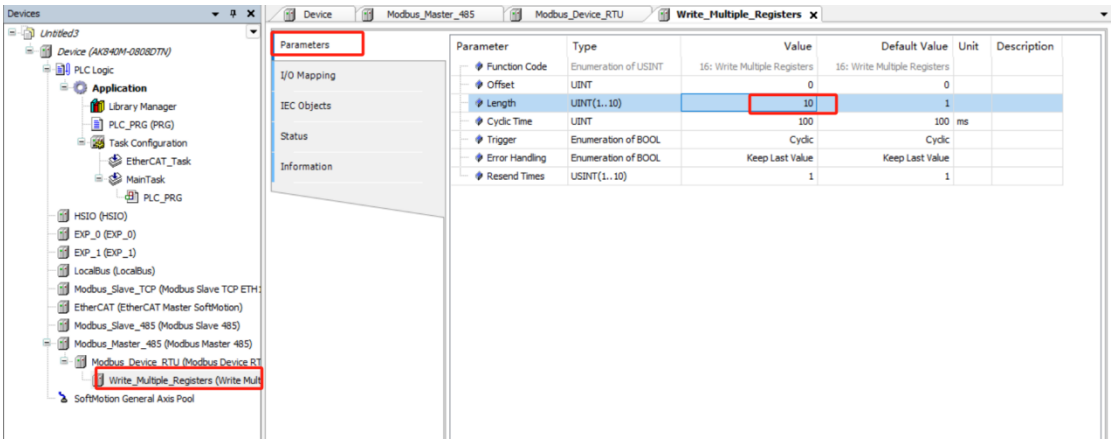

Fig.8.6.2-6 Configure functional channel parameters.

Step 7: After downloading the program, use **Modbus_slave** to simulate communication. In the **Write_Multiple_Registers** channel, write **100** in the I/O mapping. If the **Modbus_slave** simulation software receives the value **100**, it indicates that Modbus RTU communication has been successfully established.

8.7 High-speed Input

All AK840 series PLCs support two high-speed inputs.

- **In Pulse/Direction mode**:
  - For **CH0 (Channel 0)**, the pulse signal connects to terminal **I0**, and the direction signal connects to terminal **I1**.
  - For **CH1 (Channel 1)**, the pulse signal connects to terminal **I2**, and the direction signal connects to terminal **I3**.

- **In AB Phase mode**:
  - For **CH0 (Channel 0)**, the A-phase signal connects to terminal **I0**, and the B-phase signal connects to terminal **I1**.
  - For **CH1 (Channel 1)**, the A-phase signal connects to terminal **I2**, and the B-phase signal connects to terminal **I3**.

PIN	A/B Phase Mode	Pulse/Direction mode
I0	CH0 A-phase	CH0 Pulse
I1	CH0 B-phase	CH0 Dir
I2	CH1 A-phase	CH1 Pulse
I3	CH1 B-phase	CH1 Dir
I4	CH0 Latch Signal	CH0 Latch Signal
I6	CH1 Latch Signal	CH1 Latch Signal

In the HSIO tab's parameter interface, you can configure the high-speed counter parameters: counting mode, count upper limit, count lower limit, and latching mode.

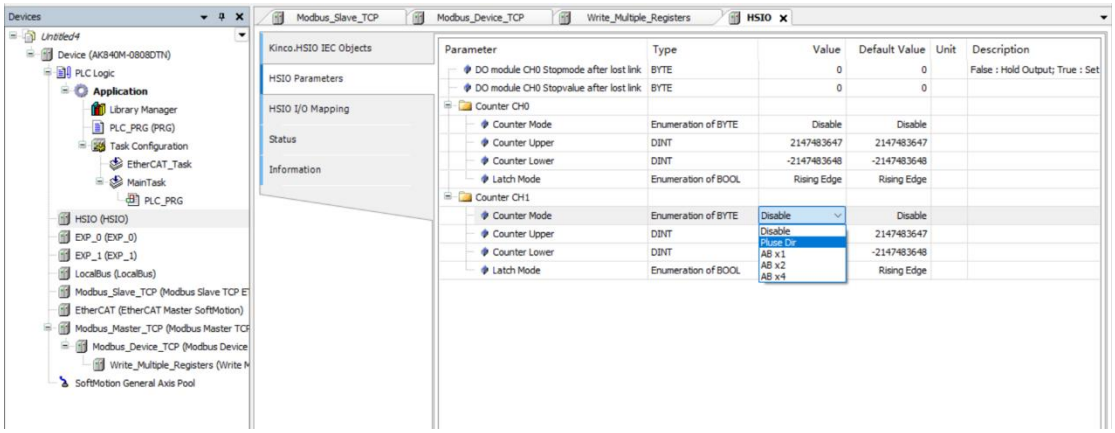

Fig.8.7-1 High-speed counter configuration interface

In the HSIO I/O mapping parameters under the HSIO tab, there are default register addresses available for users to control the high-speed counter, such as enabling channel pins, clearing the count value, enabling latching, etc.

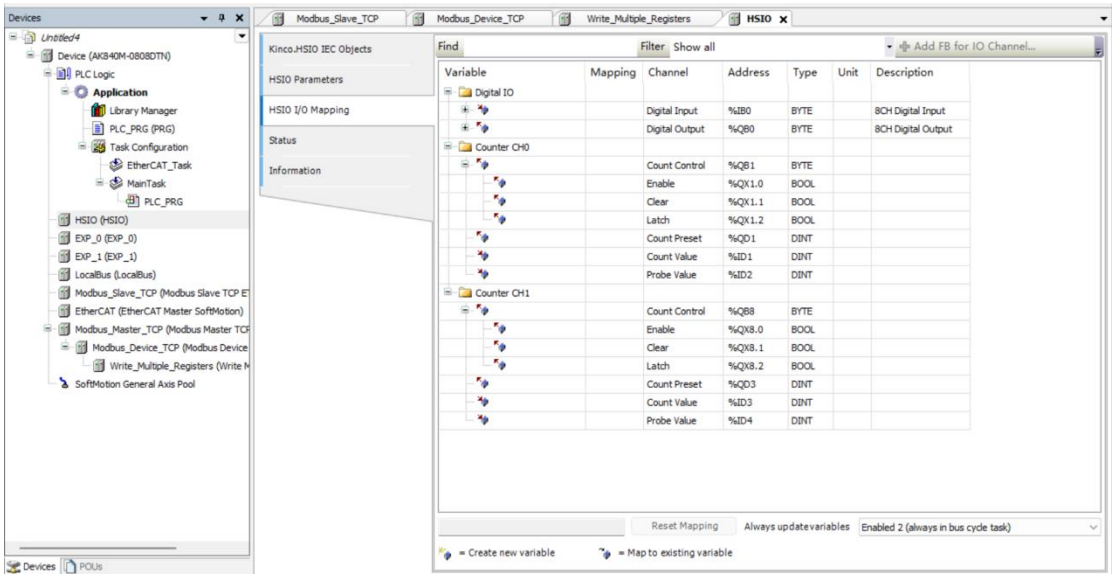

Fig.8.7-2 High-speed counter apply interface

9. Error Diagnosis

9.1 Error Query Method

Error queries require logging into the device. After logged in, go to the Device interface, select the Logs tab, and click the Refresh button to display the latest device log information.

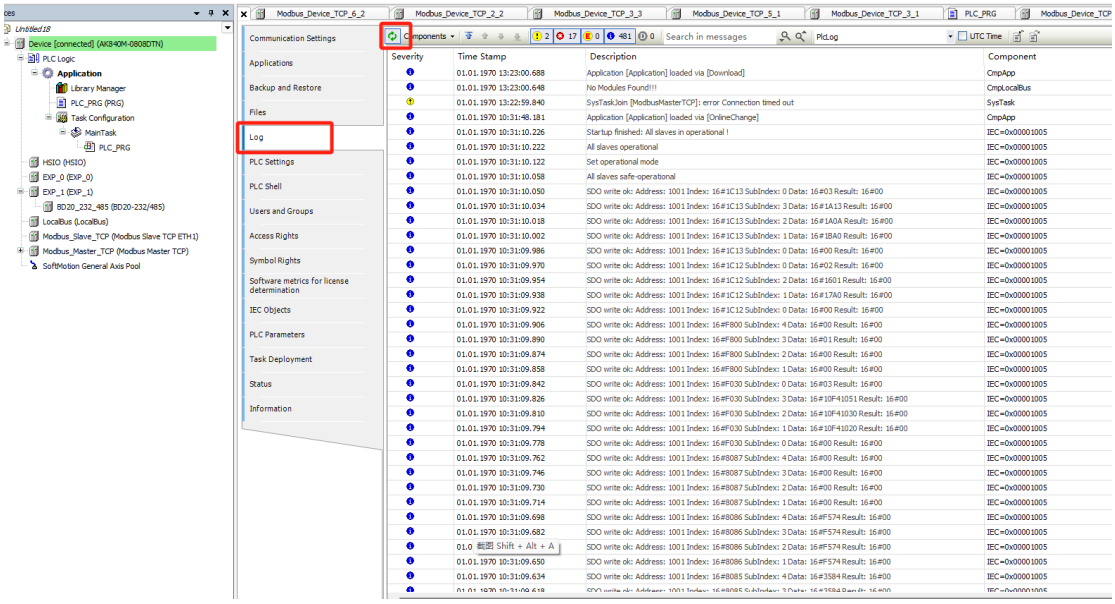

Fig.9.1-1 Error queries

9.2 Common Error Codes and Description

Name	Codes	Comment
ERR_FAILED	0x0001	Common error
ERR_PARAMETER	0x0002	Error parameters
ERR_NOTINITIALIZED	0x0003	Function cannot be executed, since component has not been initialized yet. It may work later
ERR_VERSION	0x0004	Version conflict
ERR_TIMEOUT	0x0005	Operation timed out
ERR_NOBUFFER	0x0006	Insufficient memory to carry out the request
ERR_PENDING	0x000A	For async-calls: call not complete, yet
ERR_NUMPENDING	0x000B	To many pending calls. Try later
ERR_INVALIDID	0x000D	No object with the provided id found
ERR_OVERFLOW	0x000E	Integer overflow
ERR_BUFFERSIZE	0x000F	The size of a buffer is to small or invalid
ERR_NO_OBJECT	0x0010	No object with this specified name available
ERR_NOMEMORY	0x0011	No heap memory available
ERR_DUPLICATE	0x0012	An object with the same name is still available
ERR_MEMORY_OVERWRITE	0x0013	Heap memory was written out of bounds!
ERR_INVALID_HANDLE	0x0014	Invalid handle to an object
ERR_END_OF_OBJECT	0x0015	End of object reached
ERR_NO_CHANGE	0x0016	No changes done
ERR_INVALID_INTERFACE	0x0017	Invalid or unknown interface
ERR_NOT_SUPPORTED	0x0018	Functionality not supported
ERR_NO_ACCESS_RIGHTS	0x0019	No access rights FOR THIS operation
ERR_OUT_OF_LIMITS	0x001A	Specified limits OF a resource exceeded
ERR_ENTRIES_REMAINING	0x001B	Remaining entries that could NOT be transmitted because OF buffer limitation
ERR_INVALID_SESSION_ID	0x001C	Invalid online session ID
ERR_EXCEPTION	0x001D	Exception occurred
ERR_SIGNATURE_MISMATCH	0x001E	Signature mismatch OF an api FUNCTION
ERR_VERSION_MISMATCH	0x001F	Version mismatch
ERR_TYPE_MISMATCH	0x0020	TYPE mismatch
ERR_ID_MISMATCH	0x0021	ID mismatch
ERR_NO_CONSISTENCY	0x0022	Consistency error
ERR_NO_COMM_CYCLE	0x0023	No COMM_CYCLE needed
ERR_DONT_SUSPEND_TASK	0x0024	DO NOT suspend task after an exception

ERR_MEMORY_LOCK_FAILED	0x0025	Memory cannot be locked in THIS operation
ERR_LICENSE_MISSING	0x0026	License missing FOR the runtime
ERR_OPERATION_DENIED	0x0027	Operation denied
ERR_DEVICE	0x0028	Device error
ERR_DISK_FULL	0x0029	Disk full
ERR_CRC_FAILED	0x0030	Internal use in runtime
ERR_FILE_ERROR	0x0032	File error. e.g. cannot open a file FOR writing because it could be write PROTECTED
ERR_NO_RETAIN_MEMORY	0x0033	No RETAIN memory available
ERR_OUT_OF_LIMITS_MIN	0x0034	Specified minimum-limit of a resource exceeded
ERR_OUT_OF_LIMITS_MAX	0x0035	Specified maximum-limit of a resource exceeded
ERR_CALL_AGAIN	0x0037	Specified maximum-limit of a resource exceeded
ERR_NOTHING_TO_DO	0x0038	Operation has nothing TO DO. No execution.
ERR_SECURITY_CHECKS_FAILED	0x0039	Some security checks have failed. THIS is a generic error code TO report THIS error over PUBLIC channels. In THIS CASE the error code doesn’t provide a detailed cause for the error.
ERR_INVALID_REFERENCE	0x003B	Dereferencing an IEC reference in IecVarAccess failed due to invalid destination address, e. G. NULL.
ERR_CONVERSION_INCOMPLETE	0x003C	Conversion of string encodings was not lossless.
ERR_SOCK_NOTINITIALIZED	0x0201	Socket not initialized
ERR_SOCK_NOTSOCKET	0x0202	The provided socket handle is invalid
ERR_SOCK_AFUNSUPPORTED	0x0203	The address family is NOT supported
ERR_SOCK_PROTOUNSUPPORTED	0x0204	Protocol is NOT supported
ERR_SOCK_NOBUFFER	0x0205	NOT enough buffer TO handle the request
ERR_SOCK_WOULDBLOCK	0x0206	Socket is in nonblocking mode but THIS call would block
ERR_SOCK_ADDRINUSE	0x0207	The provided address is already in use
ERR_SOCK_ADDRNOTAVAILABLE	0x0208	The provided address is NOT available on THIS computer
ERR_SOCK_CONNREFUSED	0x0209	Connection has been refused BY the remote host
ERR_SOCK_TIMEDOUT	0x020A	Operation timed out

ERR_SOCK_HOSTNOTFOUND	0x020B	The host has NOT been found
ERR_SOCK_HOSTUNREACHABLE	0x020C	Host is unreachable
ERR_SOCK_ISCONNECTED	0x020D	Socket is already connected
ERR_SOCK_NOTCONNECTED	0x020E	The socket is NOT connected
ERR_SOCK_SHUTDOWN	0x020F	Shutdown has been called on the socket
ERR_SOCK_MSGSIZE	0x0210	FOR sockets OF TYPE DGRAM. The package TO send exceeds the maximum package size
ERR_SOCK_CLOSED	0x0211	Socket has been gracefully closed. No more send/receives allowed
ERR_L7_TAG_MISSING	0x0300	Tag missing in online communication buffer
ERR_L7_UNKNOWNCMDGROUP	0x0301	Unknown command group
ERR_L7_UNKNOWNCMD	0x0302	Unknown command (within a valid command group)
ERR_L7_INCOMPLETE	0x0303	Level 7 service incomplete
ERR_CERT_UNABLE_TO_GET_ISSUER_CERT	0x701	illegal error (FOR uninitialized values, TO avoid ERR_CERT_OK)

10. Appendix

10.1 EXP-BD Model List

Model	Description	Available Slot ID
BD20-CAN	1×CANopen	EXP1
BD20-COM	1×RS485,1×RS232 RS485 support Modbus RTU master/slave and free protocol, supporting up to 31 Modbus RTU slaves. RS232 support Modbus RTU master/slave protocol, supporting up to 31 Modbus RTU slaves.	EXP0/EXP1
BD20-TF	Supports firmware updates, user program updates, memory expansion, and data backup functions.	EXP1
BD20-04DI	DI 4×24V DC, Sourcing/Sinking	EXP0/EXP1
BD20-04DO	DO 4×24V DC, PNP/NPN	EXP0/EXP1

10.2 RP20 Model List

Model	Description
RP20-1600DT	DI 16×24V DC, sourcing/sinking
RP20-0016DTP	DO 16×24V DC, PNP
RP20-0016DTN	DO 16×24V DC, NPN
RP20-0008DR	DO 8×Relay output, normally open contacts (NO)
RP20-0808DTP	DI 8×24V DC, sourcing, DO 8×24V DC, PNP
RP20-0202IV	AI 2×IV, 4-20mA/0-20mA/0-10V/1-5V AO 2×IV, 4-20mA/0-20mA/0-10V/1-5V
RP20-0400IV	AI 4×IV, 4-20mA/0-20mA/±10V/1-5V/*±20mA
RP20-0004IV	AO 4×IV, 4-20mA/0-20mA/±10V/1-5V
RP20-0400RD	AI 4×RTD, sensor type: Pt100/Pt1000/Cu50
RP20-0400TC	AI 4×TC, thermocouple type: J/K/E/S/T/0-99mV
RP20-PW	Power Module, powered by 24V DC, rated output: 5V DC, 2A