

RS Series Multifunction Integrated I/O

User Manual

DECOWELL Industrial Intelligence makes reliable partners



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Preface

■ Profile

Thank you for purchasing the DECOWELL RS series integrated I/O module!

RS series integrated I/O modules are the new generation of integrated expansion modules of DECOWELL. This series of modules adopts a new split design, can carry a variety of signal types, and supports digital input modules, digital output modules, and digital input and output modules. The signal interface has a variety of connection methods, including single-row European terminals, 3-in-1 European terminals, and 3-in-1 E-CON terminals. At the same time, this series of modules can support a variety of communication buses, such as PROFINET, EtherCAT, EtherNet/IP, and CC-Link IE Field Basic.

RS series integrated EtherCAT bus module is the integrated module in the series that supports EtherCAT bus protocol.

This manual mainly describes the specifications, features and usage of the module. Please read it carefully before use so that you can use this product more clearly and safely.

Due to continuous updates and improvements to the product and technology, the contents of this document may not be fully consistent with the actual product. We appreciate your understanding. In case of any discrepancies, please refer to the actual product. Changes resulting from product upgrades are subject to change without prior notice.

CONTENTS

Preface	2
Safety Precautions	7
1.Product Introduction	10
1.1 Product Features	10
1.2 Module naming conventions	10
1.2.1 Digital Panel Naming Rules	10
1.2.2 Analog Panel Naming Rules	11
2.Product Overview	12
2.1 Hardware Interface Description	12
2.1.1 EtherCAT Network port definition	13
2.1.2 Indicator lights and status description	13
2.1.3 Operation Compartment Description	14
2.1.3.2 USB illustrate	15
2.1.3.3 Reset Button Description	15
2.1.3.4 DIP Switch Enable Description	16
2.1.4 IO Module Indicator Light Description	16
2.2 Module combination	17
3.RS-EtherCAT Technical Parameters	20
3.1 EtherCAT Base technical parameters	20
3.2 Digital Module Panel Technical Specifications	21
3.3 Analog Module Panel Technical Specifications	22
4. Mechanical Installation	24
4.1 Module size	24
4.1.1 EC2-S1 Module Dimensions	24
4.1.2 EC2-S2 Module Dimensions	24
4.2 Module Installation	24
4.2.1 Horizontal rail installation	25

4.2.2 Vertical rail installation	26
4.2.3 Screw-on installation	26
5. Electrical Installation	28
5.1 Base wiring diagram	28
5.1.1 Wiring diagram of Ethernet port base	28
5.2 IO module wiring diagram	28
5.2.1 16DI Wiring Diagram	29
5.2.2 8DI8DO Wiring Diagram	32
5.2.3 16DO Wiring Diagram	35
5.2.4 8AI Wiring Diagram	38
5.2.5 4AI Wiring Diagram	39
5.2.6 4AO Wiring Diagram	41
5.2.7 8DO Wiring Diagram	43
5.2.8 4AI2AO Wiring Diagram	43
5.2.9 16DIO Wiring Diagram	44
6. Grounding Cable and Field Wiring Instructions	45
6.1 Introduction	45
6.2 Core Suppression Mechanisms of Grounding Systems Against Electromagnetic Interference (EMI)	45
6.3 EMC Optimized Cabling Specifications	46
7. Object Dictionary	50
7.1 Object Dictionary Description	50
7.1.1 Adapter Object Dictionary	50
7.1.2 16DI	53
7.1.3 16DO	54
7.1.4 8DO(R)	56
7.1.5 16DIO	58
7.1.6 4AI (C3)	63
7.1.7 8AI(I1)	69
7.1.8 8AI(I5)	74

7.1.9 4AO(C3)	79
7.1.10 4AI2AO(I5)	83
8. Diagnostics	89
8.1 Module-Level Diagnostics	89
8.2 Channel-Level Diagnostics	89
9. Product Functions	91
9.1 Reset and Upgrade Functions	91
9.1.1 Reset Function	91
9.1.2 Upgrade Function	91
9.2 Parameter Configuration	93
9.2.1 Configuration via Engineering Tool	93
9.2.2 Configuration via IOTesterTool	93
9.2.3 Output Behavior on Bus Error	97
9.2.4 Hot-Swap Behavior	97
10.RS-EtherCAT module configuration and application	99
10.1 TwinCAT3	99
10.1.1Installing and uninstalling XMLdocument	99
10.1.2 Configuration IO modules	99
10.1.3Configuration parameters	100
10.2 CODESYS	103
10.2.1Installing and uninstalling XML document	103
10.2.2Configuration IO modules	104
10.2.3Configuration parameters	105
10.3 KV STUDIO	108
10.3.1Installing and uninstalling XML document	108
10.3.2Configuration IO modules	108
10.3.3Configuration parameters	109
10.4 Sysmac Studio	112
10.4.1Installing and uninstalling XMLdocument	112
10.4.2Configuration IO modules	113

10.4.3 Configuration parameters	114
10.5 InoProShop	116
10.5.1 Installing and uninstalling XML document	116
10.5.2 Configuration IO Modules	117
10.5.3 Configuration parameters	118
11. FAQ	121
11.1 Common Issues of DI	121
11.2 Common Issues of DO	122
11.3 Common Issues of AI	123
11.4 Common Issues of AO	124
11.5 Common Panel Issues	125
11.6 Common Module Issues	126
11.7 Common Ethernet Port Issues	127
11.8 Common Configuration Issues	127
12. Appendix	128
12.1 Relay Output Module Usage Requirements	128
12.1.1 Recommended Use Scenarios	128
12.1.2 Application Limitations	128
12.1.3 Recommended Usage Structures	129
12.1.4 Selection & Usage Suggestions	129

Safety Precautions

■ Security Statement

1. Before installing, operating, or maintaining the product, please read and comply with these safety precautions.
2. To ensure personal and equipment safety, follow all safety labels on the product and all safety instructions contained in this manual during installation, operation, and maintenance.
3. The “Note”, “Caution”, “Warning”, and “Danger” statements in this manual do not represent all safety precautions that should be observed; they are supplementary to the overall safety requirements.
4. This product must be used under conditions that meet the specified design requirements. Failure to meet these conditions may result in malfunction. Functional abnormalities or component damage caused by non-compliance are not covered by the product warranty.
5. DECOWELL assumes no legal liability for personal injury, property damage, or other losses caused by improper or unauthorized operation of the product.

■ Security level definition



Note

Indicates additional information or explanations that supplement the operating instructions.



Caution

Indicates a hazardous situation that may result in minor to moderate personal injury or equipment damage if not operated as instructed.



Warning

Indicates a hazardous situation that may result in serious personal injury or death if not operated as instructed.

 Warning — During Control System Design

01. When applying this system, please be sure to design a safety circuit to ensure that the control system can still operate safely when the external power supply fails or the expansion module malfunctions.
02. If the output circuit experiences prolonged overcurrent due to exceeding the rated load current or a load short circuit, the module may smoke or catch fire. External safety devices such as fuses or circuit breakers should be installed.

 Caution — During Control System Design

01. It is essential to install an emergency braking circuit, a protection circuit, an interlock circuit for forward and reverse operation, and upper and lower limit interlock switches to prevent machine damage in the external circuit of the expansion module;
02. To ensure the safe operation of the equipment, please design external protection circuits and safety mechanisms for output signals related to major accidents;
03. When the output units of the expansion module, such as relays and transistors, are damaged, their outputs cannot be controlled to be in the ON or OFF state;

 Caution — During Installation

01. During installation, prevent metal shavings and wire ends from falling into the module's ventilation holes, as this may cause fire, malfunction, or misoperation;
02. After installation, ensure that there are no foreign objects on its ventilation surface, otherwise it may cause poor heat dissipation, resulting in fire, malfunction, or misoperation;
03. During installation, ensure that the module is securely connected to its respective connector and that the module connection hooks are firmly locked. Improper module installation may lead to malfunctions, failures, or detachment.

 Warning — During Installation

01. Only professional maintenance personnel who have received relevant electrical equipment training and possess sufficient electrical knowledge can install this product;

02. When installing or removing modules, all external power supplies to the system must be completely disconnected before proceeding. Failure to disconnect the power supply may result in electric shock, module malfunction, or accidental operation.

03. Do not use the module in the following locations: places with dust, fumes, conductive dust, corrosive gases, or flammable gases; places exposed to high temperatures, condensation, or wind and rain; places subject to vibration or impact. Electric shock, fire, or misoperation may also cause product damage and deterioration.

1.Product Introduction

1.1 Product Features

The RS series integrated modules support multiple industrial fieldbus protocols, such as EtherCAT, PROFINET, EtherNet/IP, and DeviceNet. Each I/O module supports up to 32 digital input/output channels. Users can select different I/O panels based on actual requirements, with base options available in 16-bit and 32-bit configurations. The modules support the following features:

- ① Hot-swapping of modules
- ② Configurable DO output state on bus failure
- ③ USB firmware upgrade support
- ④ Slave loss diagnostics and configuration inconsistency detection
- ⑤ One-click restore to factory settings
- ⑥ DIP switch configuration of node address (effective only when configured with Omron PLC)

1.2 Module naming conventions

1.2.1 Digital Panel Naming Rules

EC2 - 16 DI (N-1)
 ① ② ③ ④ ⑤

NO.	Name	Meaning
①	Bus protocol	EtherCAT
②	Number of channels	8:8 channels 16:16 channels
③	Channel Type	DI: Digital input DO: Digital output
④	Signal Type	N:NPN P:PNP R:Relay
⑤	Interface Type	1: Single row European terminal 2: Trinity terminal 3. E-CON Connectors

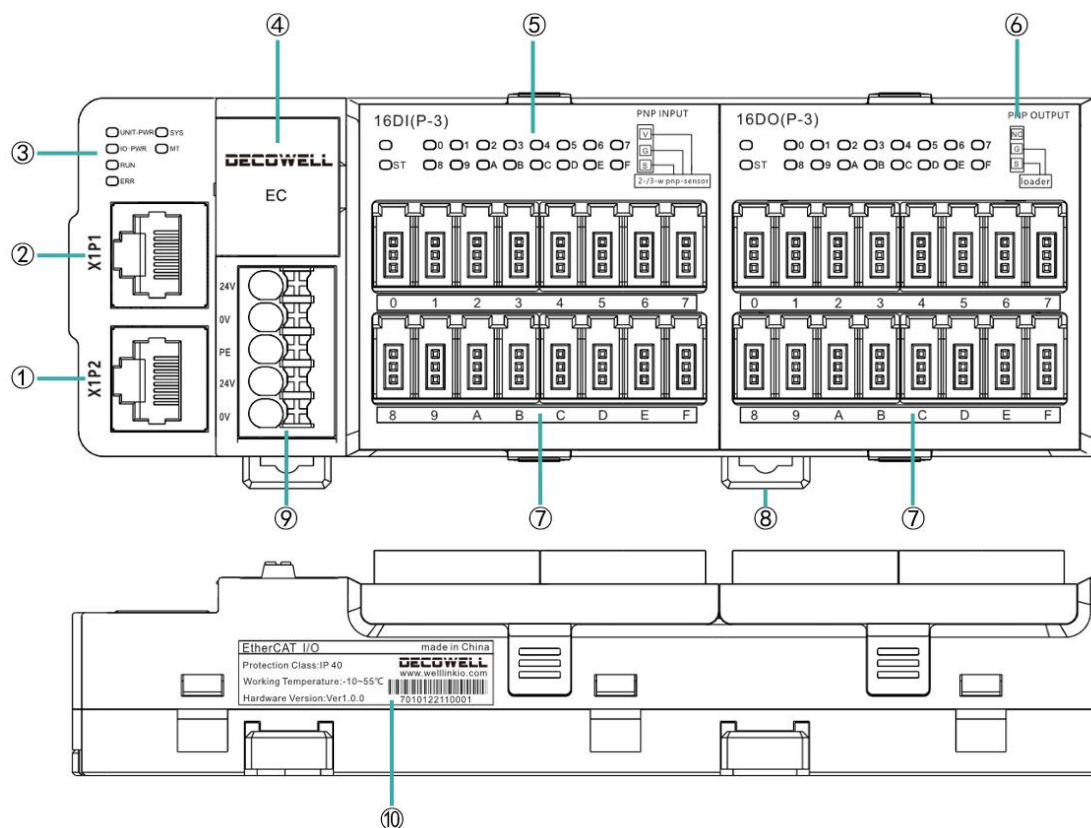
1.2.2 Analog Panel Naming Rules

EC2 - **8** **AI** **(I5-1)**
 ① ② ③ ④⑤ ⑥

NO.	Name	Meaning
①	Bus protocol	EtherCAT
②	Number of channels	4:4 channels 8:8 channels
③	Channel Type	AI: Analog Input AO: Analog Output TC/RTD: Temperature acquisition (TC/RTD) module
④	Signal Type	I: Analog current U: Analog voltage C: Analog current/voltage compatible
⑤	Measurement range	3: 16-bit U/I compatible, ±5V, 0–5V, 0–10V, ±10V, 0–20mA, 4–20mA; user-configurable range 5: 16-bit range compatible, 0–20mA, 4–20mA; user-configurable range 6: 16-bit range compatible, 0–10V, ±10V; user-configurable range
⑥	Interface Type	1: Single-row European terminal 2: Three-in-one terminal 3: E-CON connector

2.Product Overview

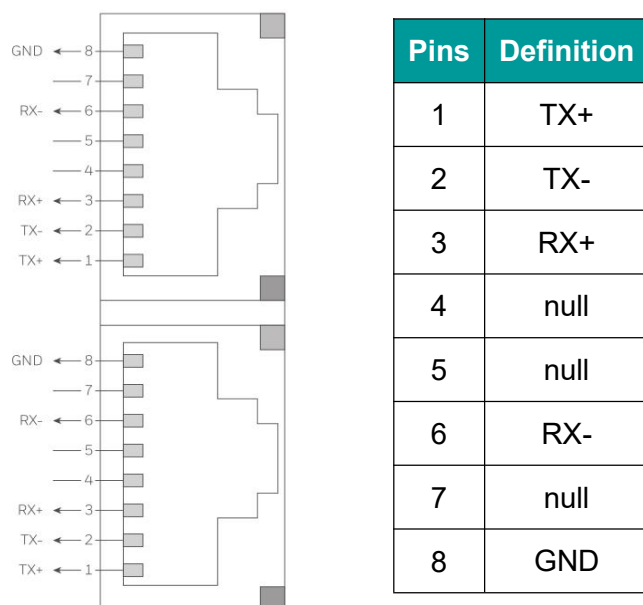
2.1 Hardware Interface Description



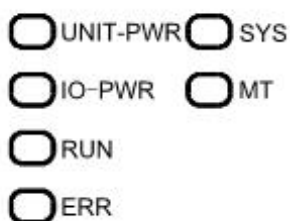
- ① EtherCAT OUT Ethernet port
- ② EtherCAT IN Ethernet port
- ③ Module status/power indicator
- ④ USB Firmware upgrade/factory reset button
- ⑤ IO Channel indicator light
- ⑥ IO Channel Wiring Diagram
- ⑦ IO Channel input/output interface
- ⑧ Module installation buckle
- ⑨ DC24V Power Connectors
- ⑩ Module information (protection level/operating temperature range/hardware version/module serial number)

2.1.1 EtherCAT Network port definition

EtherCAT uses a standard RJ45 interface (8-pin Ethernet port) with the following pinout definition:



2.1.2 Indicator lights and status description



① UNIT-PWR: System power indicator (green)

② IO-PWR: IO Power indicator light (green)

③ RUN: Bus operation indicator light (green)

④ ERR: Bus error indicator (red)

⑤ SYS: System operation indicator light (green)

⑥ MT: Maintenance indicator light (blue)

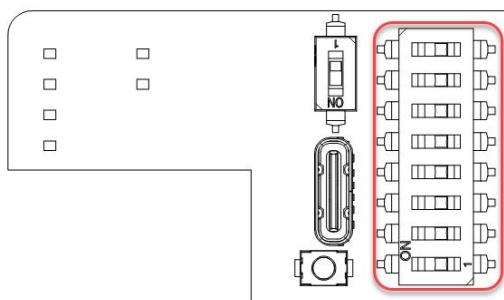
RS-EC	color	Indication status	Slave Status	Flashing meaning
UNIT PWR	green	ON	The power supply on the field side is normal	The device power supply is normal
		OFF	The power supply on the field side is abnormal	Device power supply abnormality
IO PWR	green	ON	The IO side power	The device IO power supply is normal

			supply is normal	
		OFF	The IO side power supply is abnormal	Device IO power supply is abnormal
RUN	green	OFF	INITIALISATION	The device is in initialization state
		Flash	PRE-OPERATIONAL	The device is in pre-operational state
		Single flash	SAFE-OPERATIONAL	The equipment is in safe operation
		ON	OPERATIONAL	The device is in operation
ERR	red	ON	Application controller failure	A serious communication or application controller error has occurred
		Flashes twice	Process data watchdog timeout/EtherCAT Watchdog timeout	Application watchdog timeout
		Flash once	Local Error	Due to a local error, the slave device application automatically changed the EtherCAT state.
		Flash	Configuration Error	General configuration errors
		OFF	No Error	The device's EtherCAT communication is in the operational state.
SYS	green	1Hz flashing	Normal operation	System reminder light, flashes once per second when the system is normal
		5Hz flashing	IO Lost	Slave lost flashing
		2 Flash and 1 OFF	Configuration failed	Device diagnostic configuration failed
MT	blue	OFF	Working fine	Non-maintenance status
		ON	Reset End	Reset operation completed
		1Hz flashing	Reset button trigger	Flashes when the reset button is pressed
		5Hz flashing	Module Upgrade	Flashing during the upgrade transmission process, always on during the factory reset test

2.1.3 Operation Compartment Description

The RS-EC2 operation compartment is located under the cover on the right side of the indicator LEDs. It is recommended to use a properly sized screwdriver to pry open the cover from the groove on the right side.

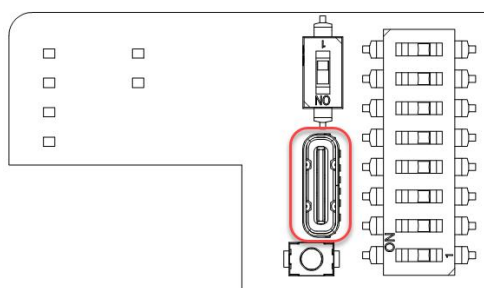
2.1.3.1 Node Address DIP Switch Description



The node address can be set via the DIP switches. Different combinations of switch positions correspond to different node addresses. The configurable range is 0–192 (no two EtherCAT slave devices in the same network may have the same node address).

DIP switch pin number (NO: 1/OFF:0)								DIP value	Node Address
1	2	3	4	5	6	7	8		
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1
0	1	0	0	0	0	0	0	2	2
.	.	.	.	.	.	.	.	.	.
0	1	0	1	0	0	0	0	10	10
0	0	0	0	0	0	1	1	192	192

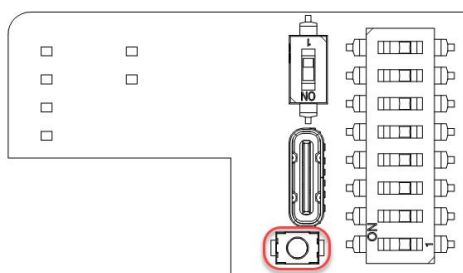
2.1.3.2 USB illustrate



TYPE-C port, mainly used to view device information and firmware upgrade.

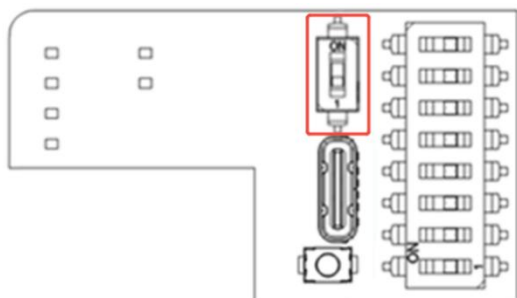
Note: Do not use USB port for other purposes to avoid USB port damaged.

2.1.3.3 Reset Button Description



Press and hold the reset button for more than 5 seconds to automatically restore the module to its factory settings. The IO configuration information will revert to the default values. After the reset button is pressed, the MT maintenance indicator will blink at a frequency of 1Hz. Once the reset is complete, the MT indicator will stay on.

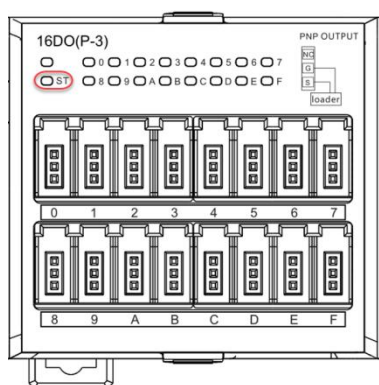
2.1.3.4 DIP Switch Enable Description



0 (DIP switch set to ON): Disable the 8-bit DIP switch

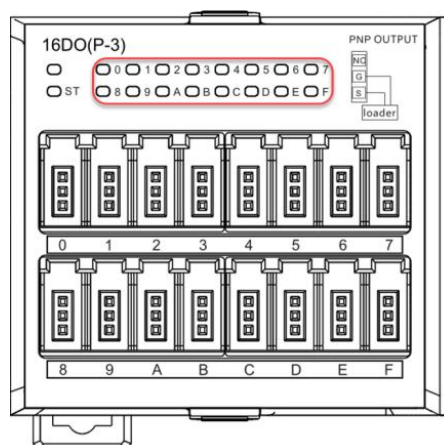
1 (DIP switch set to 1): Enable the 8-bit DIP switch

2.1.4 IO Module Indicator Light Description



IO module status indicator

Indicator Lights	color	state	illustrate
ST Indicator Lights	green	OFF	IO module is abnormal or not powered on.
		ON	The system recognizes IO modules
		Flash	The system does not recognize the IO module



IO Channel status indicator

Indicator Lights	Color	State	Illustrate
DI Channel indicator	green	OFF	Channel input has no signal or is abnormal
		ON	Channel input signal is normal
DO Channel indicator	green	OFF	The channel does not output or is abnormal
		ON	Channel output is normal
AI Channel Indicator	green	Flash	Within measurement range
		ON	Full range
		OFF	Below range
AO Channel Indicator	green	Flash	Within measurement range
		ON	Full range
		OFF	Below range

2.2 Module combination

For RS series EtherCAT configuration slot modules, a single module type in the configuration can correspond to multiple actual hardware module models. Refer to the following table for specific model mappings:

Base Model	Configuration module model	Actual matching module models
EC2-S1/EC2-S2	8DI8DO	8DI8DO(P-1)
		8DI8DO(N-1)
		8DI8DO(P-2)
		8DI8DO(N-2)
		8DI8DO(P-3)

		8DI8DO(N-3)
	16DI	16DI(P-1)
		16DI(N-1)
		16DI(P-2)
		16DI(N-2)
		16DI(P-3)
		16DI(N-3)
	16DIO	16DIO(N-2)
	8DO	8DO(R-1)
	8AI	8AI(I5-1)
		8AI(I5-2)
		8AI(I5-3)
	4AI	4AI(C3-1)
		4AI(C3-2)
		4AI(C3-3)
	4AI2AO	4AI2AO(I5-2)
	16DO	16DO(P-1)
		16DO(N-1)
		16DO(P-2)
		16DO(N-2)
		16DO(P-3)
		16DO(N-3)
	4AO	4AO(C3-1)
		4AO(C3-2)
		4AO(C3-3)

Note: (Each EC2-S1 can only be paired with one model type. Each EC2-S2 can be paired with up to two model types at most.)

2.3 Version Feature Differences Description

Software Version	Feature Changes
V1.1.5	Supports IO types: 8DI/8DO, 16DI, 16DO, 8DO, 4AO, 4AI, 8AI (I1) Added support for voltage ranges -5 to 5V and 0 to 5V for 4AI and 4AO
V1.1.7	Supports IO types: 8DI/8DO, 16DI, 16DO, 8DO, 4AO, 4AI, 8AI (I1) Optimized AI filtering algorithm
V1.1.8	Supports IO types: 8DI/8DO, 16DI, 16DO, 8DO, 4AO, 4AI, 8AI (I1), 8AI (I5)
V1.1.9	Supports IO types: 8DI/8DO, 16DI, 16DO, 8DO, 4AO, 4AI, 8AI (I1), 8AI (I5), 16DIO, 4AI2AO Added support for FoE firmware upgrade Modified the current value range under S7 format (-27648 to 27648 0 to 27648): • 4–20 mA range supports 1 to 22.81 mA • 0–20 mA range supports 0 to 23.52 mA

3.RS-EtherCAT Technical Parameters

3.1 EtherCAT Base technical parameters

Communication technical parameters	
Bus protocol	EtherCAT
Communication distance	<100m (distance between stations)
Bus communication speed	100Mbps
Communication cycle	Depends on EtherCAT Master station specifications
Refresh method	· SM (Sync Manager) synchronization · DC (Distributed Clock) synchronization · User-defined DC mode
Topology	· Line topology · Star topology · Ring topology
Node Address	Configurable 0-192
Number of input bytes	Maximum 128
Output Bytes	Maximum 128
Enter the mailbox size	256
Output mailbox size	256
Power supply technical parameters	
System power input	24V DC(±25%)
System-side power consumption	45mA
IO Power Input	24V DC(±25%)
IO Power supply current	10A
Overcurrent protection	supported
Overvoltage protection	/
Reverse polarity protection	supported
Electrical isolation on the system side	supported
Environmental technical parameters	

Operating temperature	-20℃～55℃
Working environment humidity	10%-95% no condensation
Working environment height	<2000m
Storage temperature	-40℃～85℃
Use ambient air	No corrosion
EMC grade	CLASS A
General physical parameters	
Protection level	IP20

3.2 Digital Module Panel Technical Specifications

DI input technical parameters	
Input Rated Voltage	24V DC(±25%)
Input Logic "1" Signal	NPN: 0～5V PNP: 15～30V
Input Logic "0" Signal *	NPN: 15～30V PNP: 0～5V
ON/OFF Response Time	11us
Input Filter Time	0～10ms, Default 3ms
Isolation Method	Optocoupler Isolation
Current Consumption per Channel	24V: 5mA
DO output technical parameters	
Rated output voltage	NPN: 0V
	PNP: 24V
Maximum load current	0.5A (continuous 8-channel maximum total load current 2A)
ON/OFF response time	20us (PNP) and 11us (NPN)
Load Type	Resistive Load, Inductive Load, Capacitive Load
Insulation method	Optocoupler Isolation
Relay output technical parameters	
Rated voltage	30V DC/250V AC
Rated current	30V DC/5A, 250V AC/5A
ON/OFF response time	≤15ms
Contact Type	Normally open contact
Load Type	Resistive Load, Inductive Load, Capacitive Load
Relay electrical life	1x10 ⁵ times (AgNi, 3A DC/250V AC, resistive load, 85℃, 1s on, 9s off)

	5x10 ⁴ times (AgNi, 5A DC/250V AC, resistive load, room temperature, 1s on, 9s off)
Relay mechanical life	2×10 ⁷ times
*Note: The logic "0" (OFF) signal voltage for 16DIO is 15V–30V (±0.5V).	

3.3 Analog Module Panel Technical Specifications

8AI Input Technical Specifications	
Number of channels	8
Input Impedance	<150Ω
Signal Type	0~20mA\4~20mA (default)
Resolution	16 bit
Accuracy	0.10%
Converted Digital Range	0–27648 0–30000 0–32767
Input filter time	Configurable: 0~3 levels (default 1)
4AI Input Technical Specifications	
Number of channels	4
Signal Type	0~5V/±5V/0~10V/±10V 0~20mA/4~20mA (default)
Input Impedance	Voltage Type: 1 MΩ / Current Type: <150 Ω
Resolution	16 bit
Accuracy	0.10%
Converted Digital Range	-27648~27648 0~27648 -15000~15000 0~30000 -32767~32767 0~32767
Input filter time	Configurable: 0~3 levels (default 1)
4AO Output Technical Specifications	
Number of channels	4
Signal Type	0~5V/±5V/0~10V/±10V 0~20mA/4~20mA (default)
Input Impedance	Voltage Type: >1 kΩ / Current Type: <500 Ω
Resolution	16 bit
Accuracy	0.10%
Converted Digital Range	-27648~27648 0~27648 -15000~15000 0~30000 -32767~32767 0~32767
Input filter time	Configurable: 0~3 levels (default 1)
4AI2AO (I5-2) Input/Output Technical Specifications	
Number of channels	6
Terminal Type	3-in-1 European Terminal
Signal Type	0~20mA\4~20mA (default)
Input Impedance	<150Ω

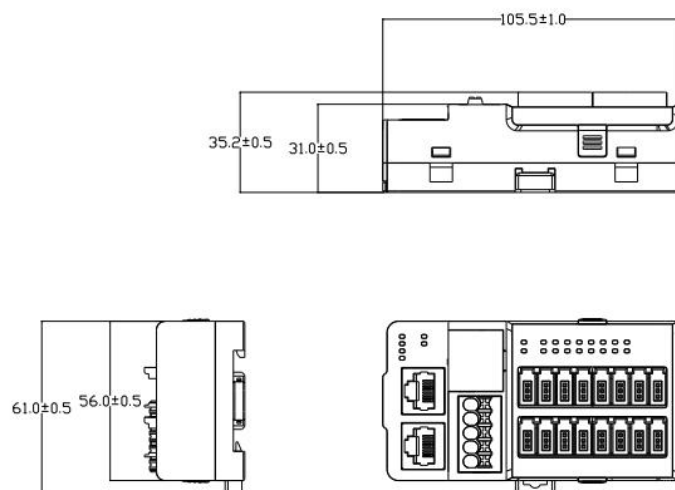
Output Load	<500Ω
Resolution	16 bit
Accuracy	0.10%
Converted Digital Range	0–27648 0–30000 0–32767
Input filter time	Configurable: 0~3 levels (default 1)
IO Module Electrical Technical Specifications	
Port Protection	/
Environmental technical parameters	
Operating temperature	-20℃~55℃
Operating Environment Relative Humidity	10%–95%, non-condensing
Working environment altitude	<2000m
Storage temperature	-40℃~85℃
EMC level	Area A
General Physical Specifications	
Protection Rating	IP20

4. Mechanical Installation

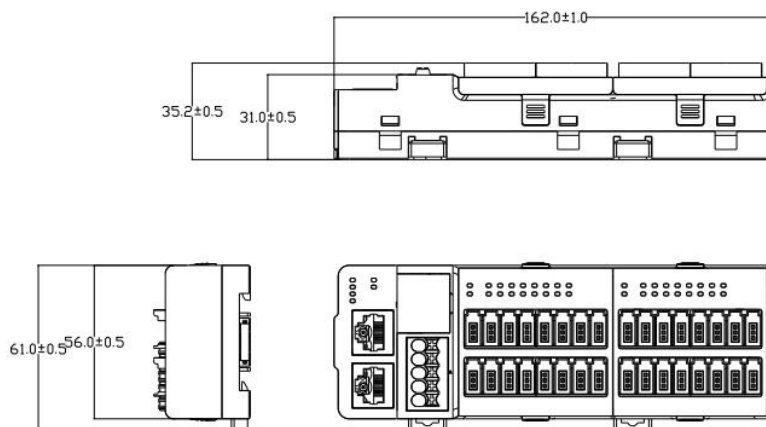
4.1 Module size

The dimensions in the following figures are all in mm

4.1.1 EC2-S1 Module Dimensions



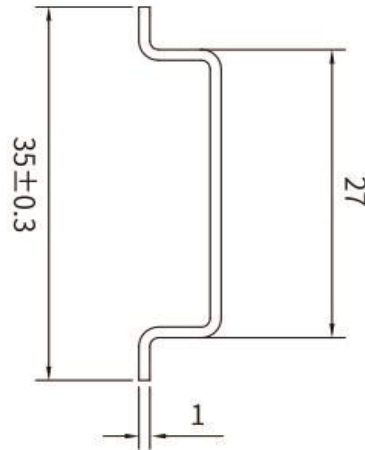
4.1.2 EC2-S2 Module Dimensions



4.2 Module Installation

RS series modules have three installation methods: horizontal rail installation, vertical rail installation, and screw installation (the diameter of the screw installation hole is $\phi 4.5$).

The module is mounted on a DIN rail, which must comply with the IEC 60715 standard (35 mm width, 1 mm thickness). The dimensional details are shown in the figure below.



Note: If the module is installed on a DIN rail other than the recommended DIN 35 type, the rail locking clip may not lock properly. Before installing the module, open the locking lever at the top of the module, then proceed with the installation.

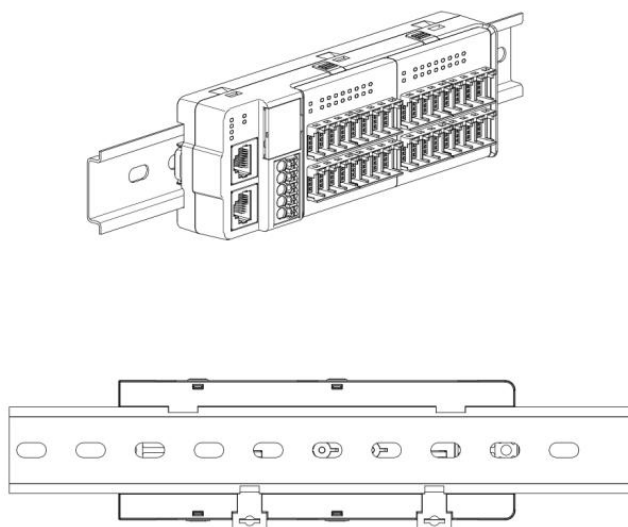


Cation

- When this product is installed on a DIN rail other than the recommended type (especially when the DIN rail thickness is >1.0 mm), the rail locking clip may fail, preventing proper installation and resulting in malfunction. It is recommended to use a DIN rail with a thickness of <1 mm.

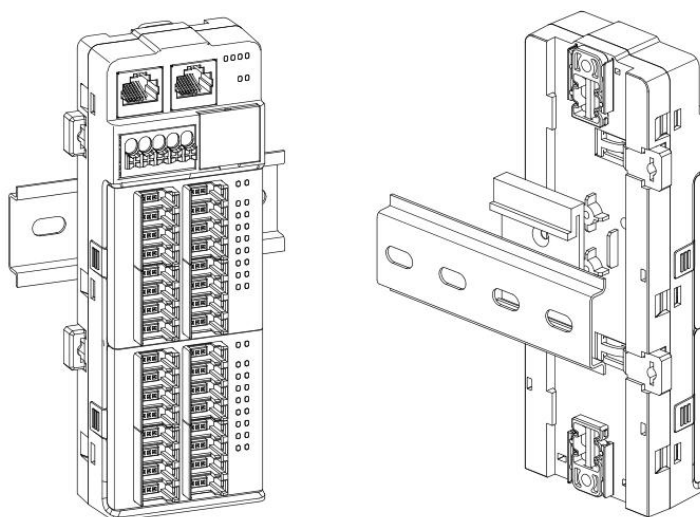
4.2.1 Horizontal rail installation

After fixing the module onto the DIN rail, push the two clips at the bottom of the module inward until you hear the DIN locking clip snap back onto the rail. Once installation is complete, the locking clip will automatically move upward to lock in place. If the clip does not move upward, press the bottom of the clip upward to ensure proper installation.



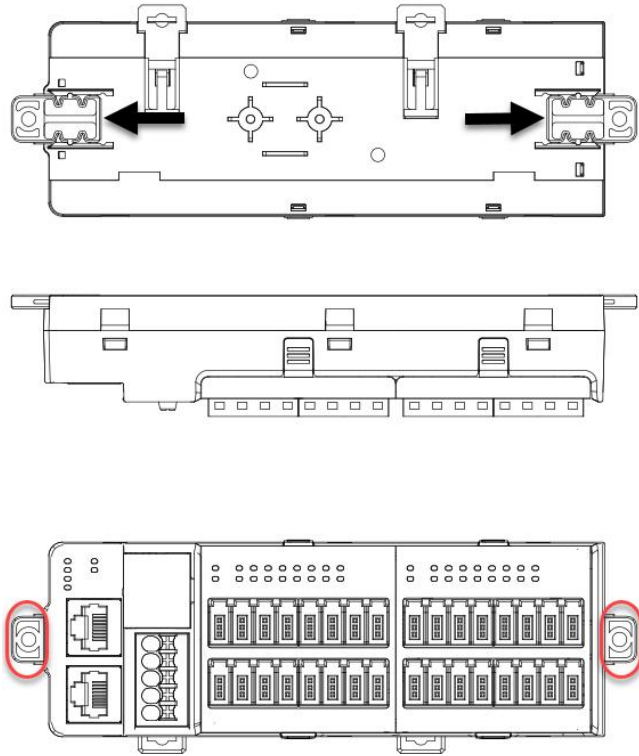
4.2.2 Vertical rail installation

1. The matching backplane must first be fixed to the module as shown in the diagram. Once it is firmly fixed, it can be installed on the guide rail as shown in the diagram.



4.2.3 Screw-on installation

1. You need to push out the two fixing buckles on the left and right sides of the bottom, and then fix them with screws.

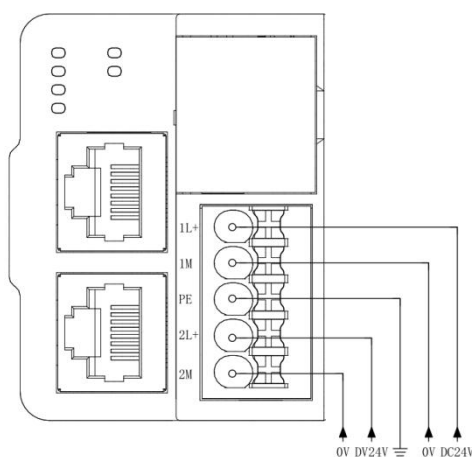


5. Electrical Installation

5.1 Base wiring diagram

5.1.1 Wiring diagram of Ethernet port base

The base requires two sets of 24 VDC connections: 1L+/1M for the system power supply and 2L+/2M for the IO power supply. It is recommended to derive both 24 VDC lines from the same power adapter and connect them to the base.



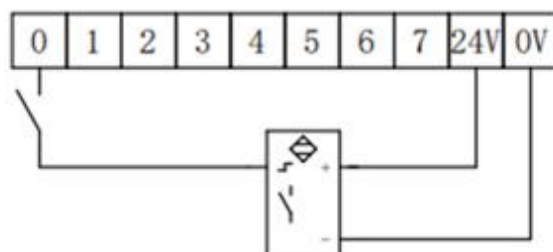
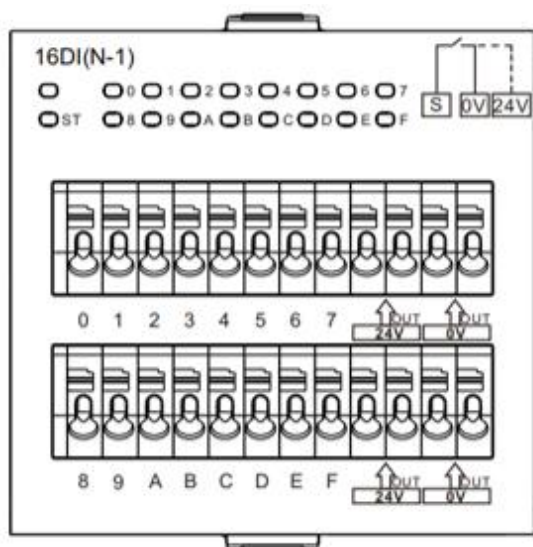
The grounding cable length should be less than 1 meter.

5.2 IO module wiring diagram

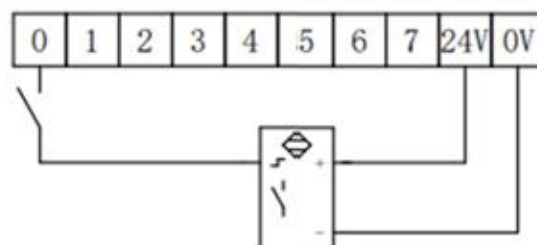
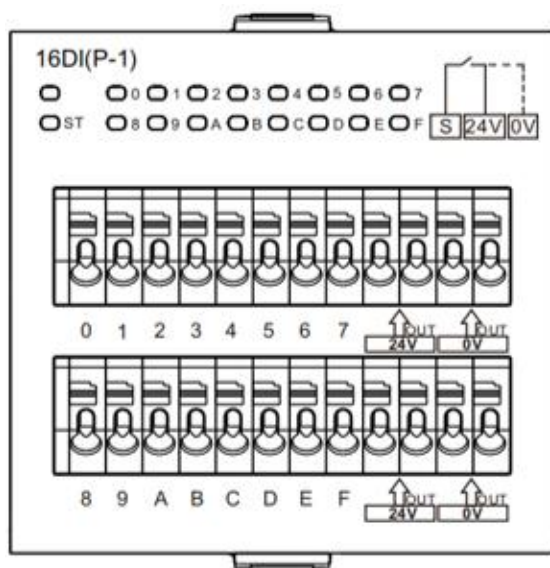
The IO module wiring diagram introduces the wiring methods of various IO modules. 4V or 0V It can power sensors or loads. IO modules can be divided into single-row European terminals, three-in-one terminals, E-CON connectors, relay modules.

IO module terminal type	Wire diameter	Remark
Single row European terminal	0.2-1.0mm ²	The length of the cold-pressed terminal should be >10mm
Trinity Terminal	0.2-0.75mm ²	
E-CON Connectors	0.13-0.50mm ²	

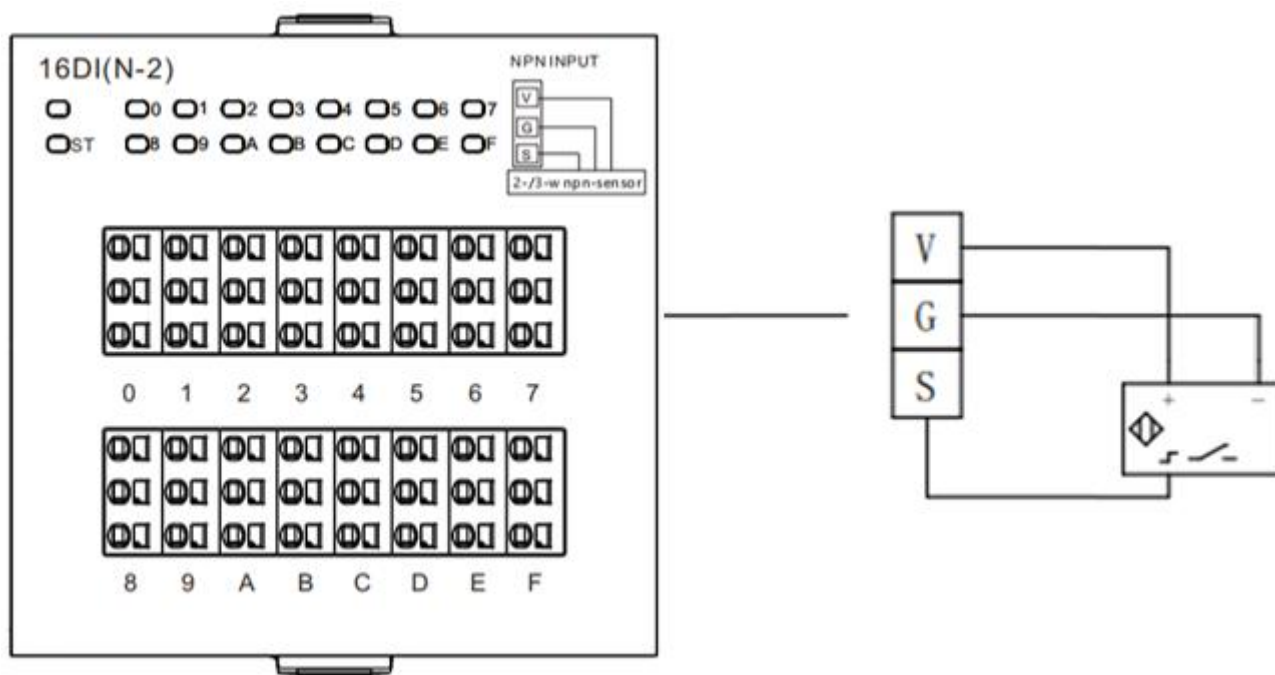
5.2.1 16DI Wiring Diagram



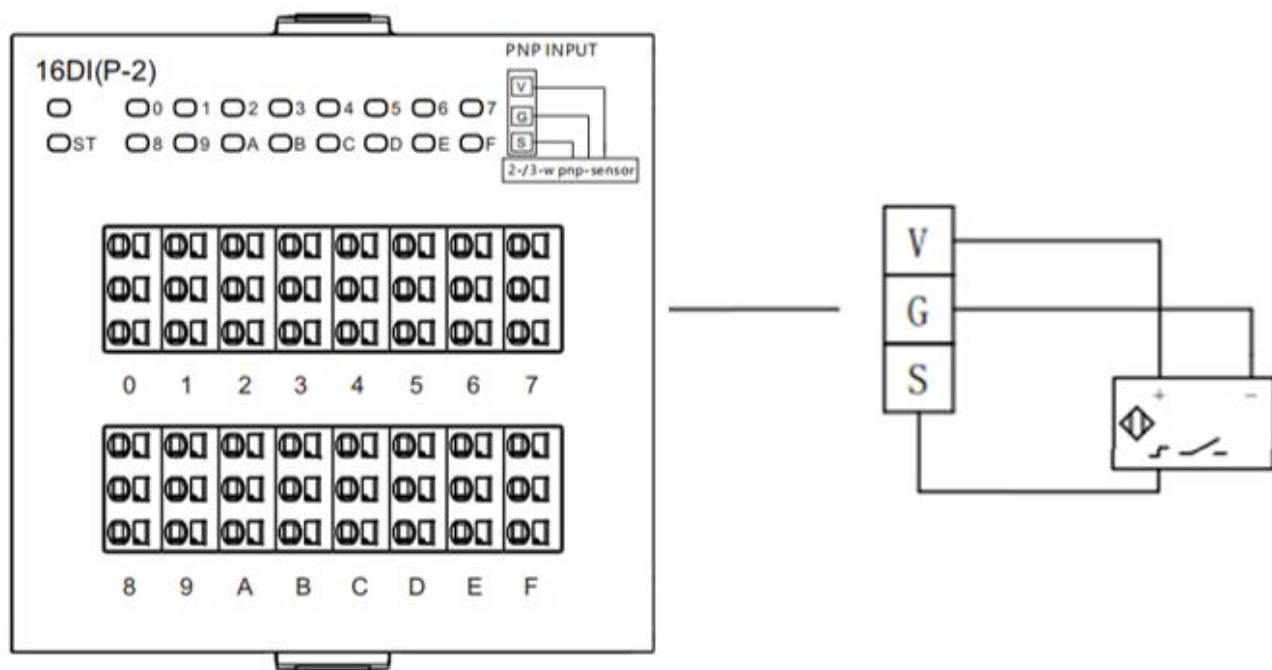
16DI(N-1)



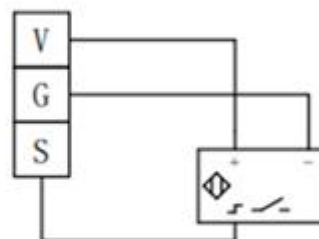
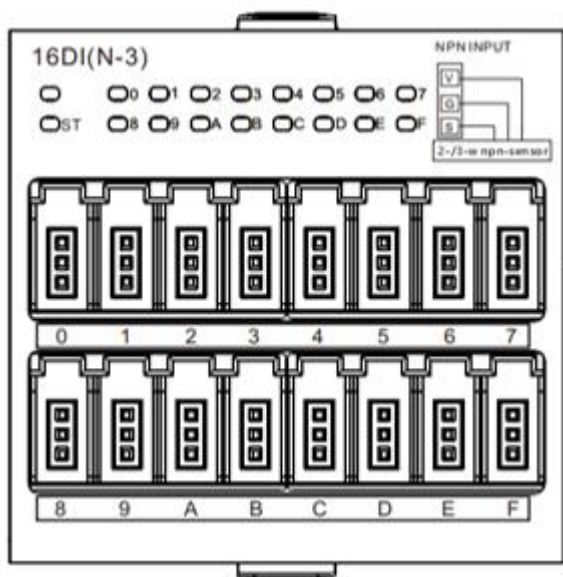
16DI(P-1)



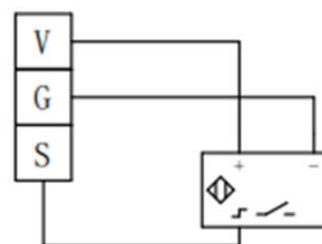
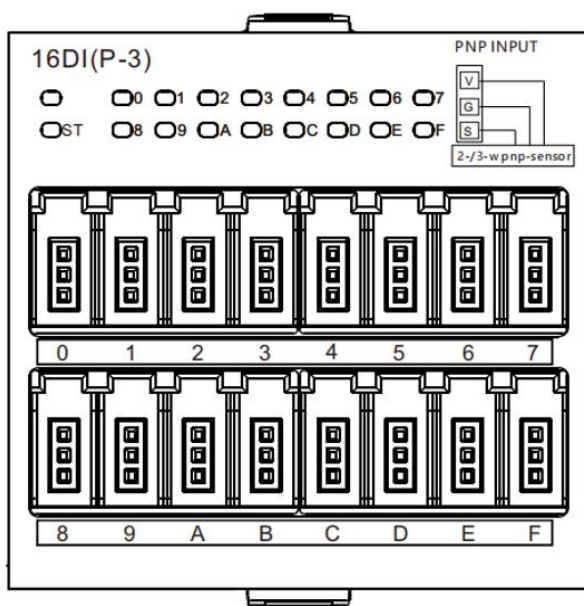
16DI(N-2)



16DI(P-2)

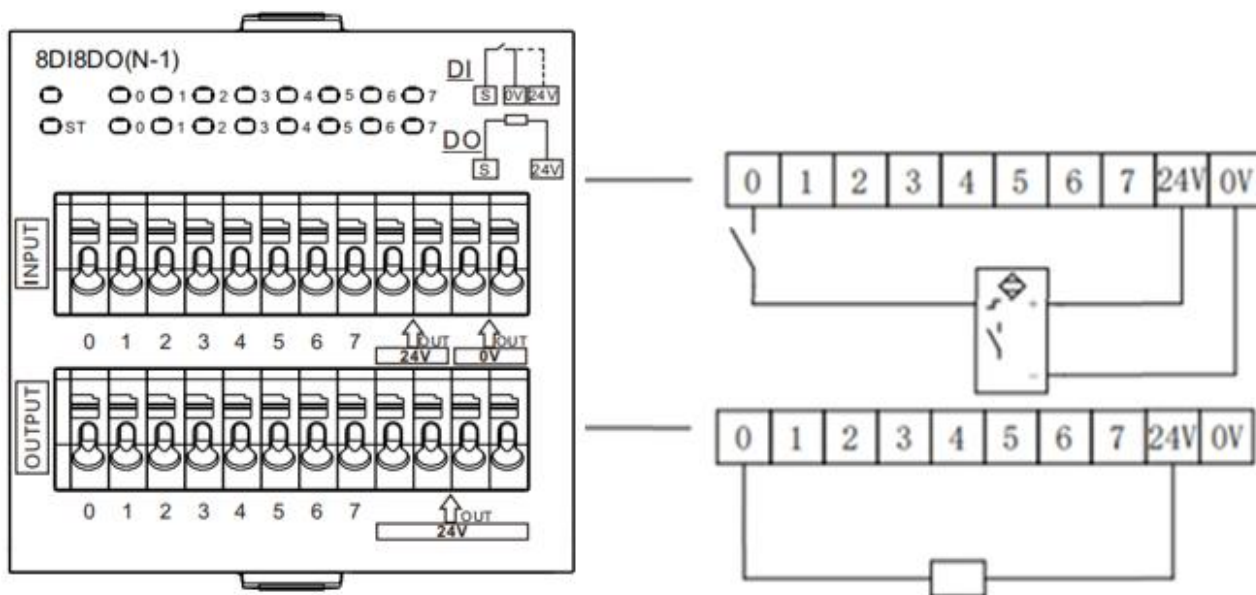


16DI(N-3)

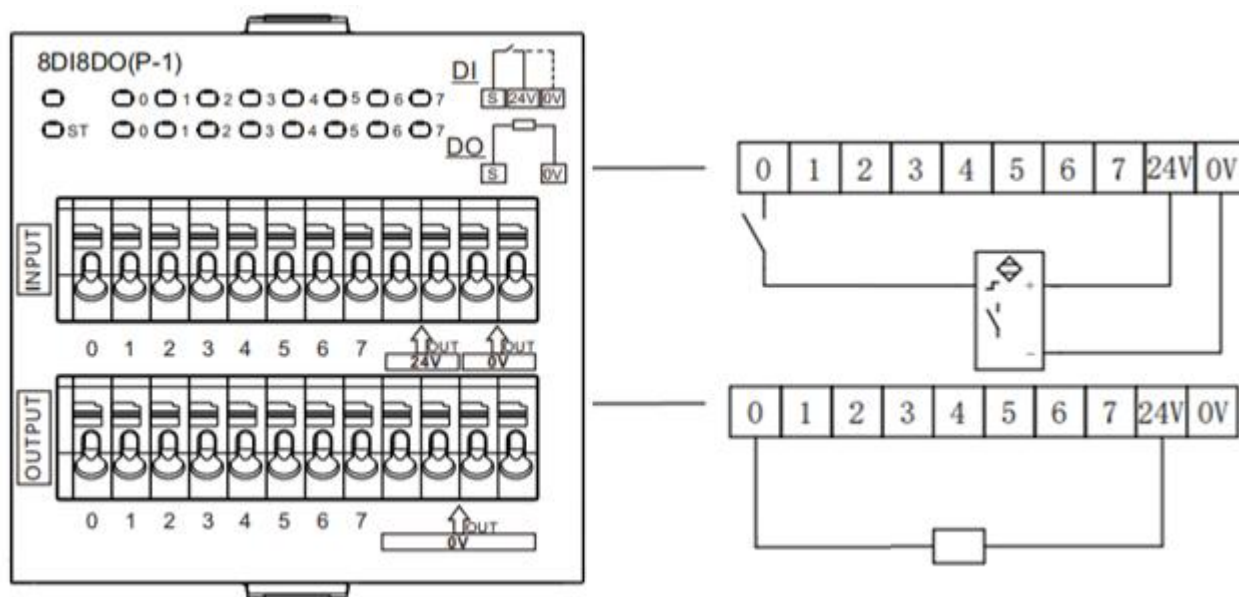


16DI(P-3)

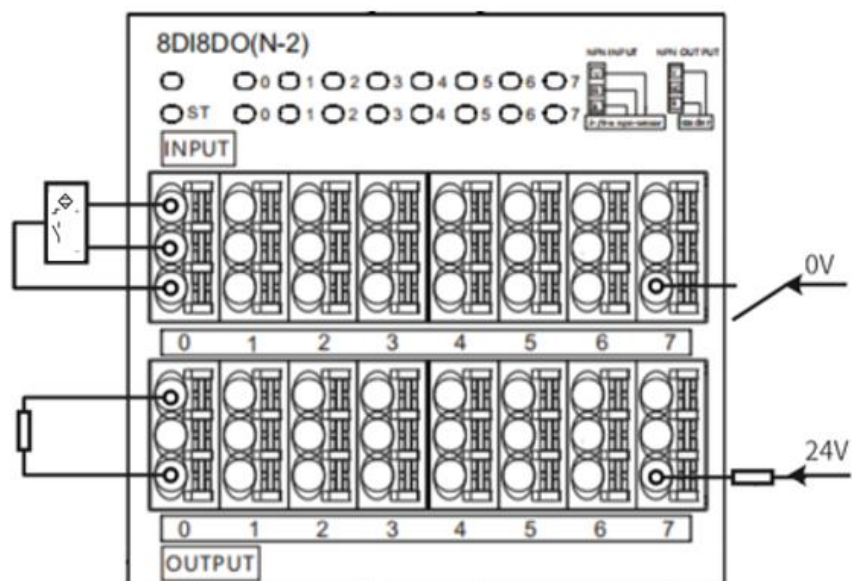
5.2.2 8DI8DO Wiring Diagram



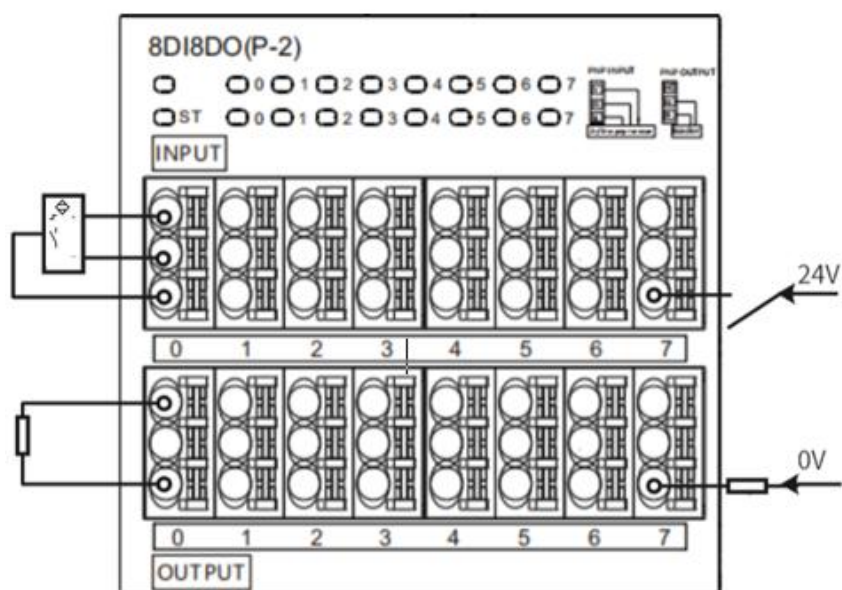
8DI8DO(N-1)



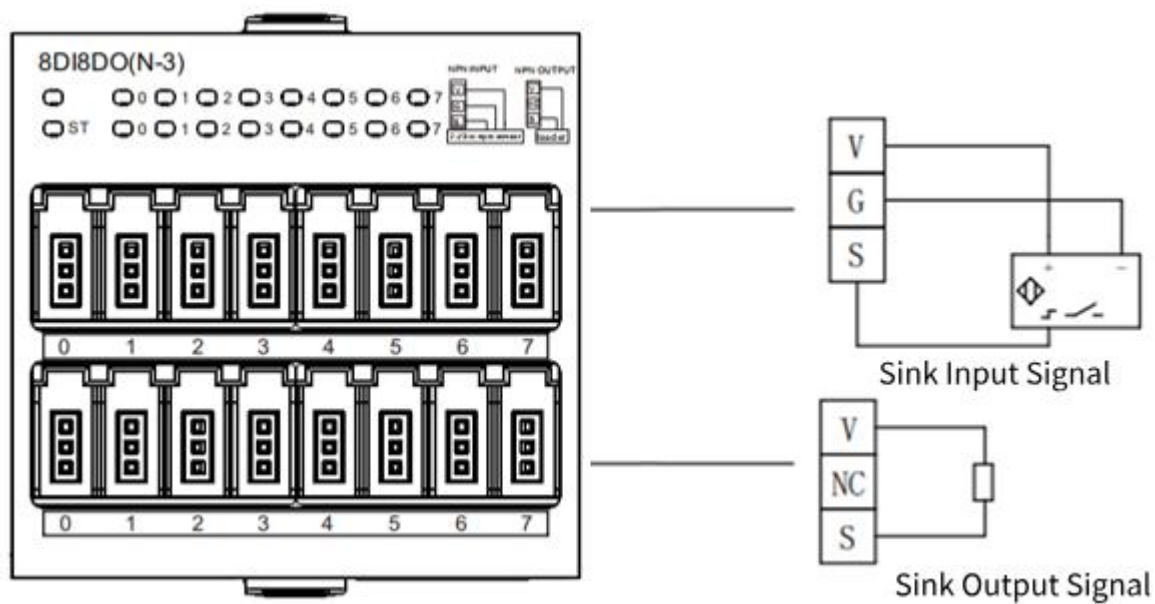
8DI8DO(P-1)



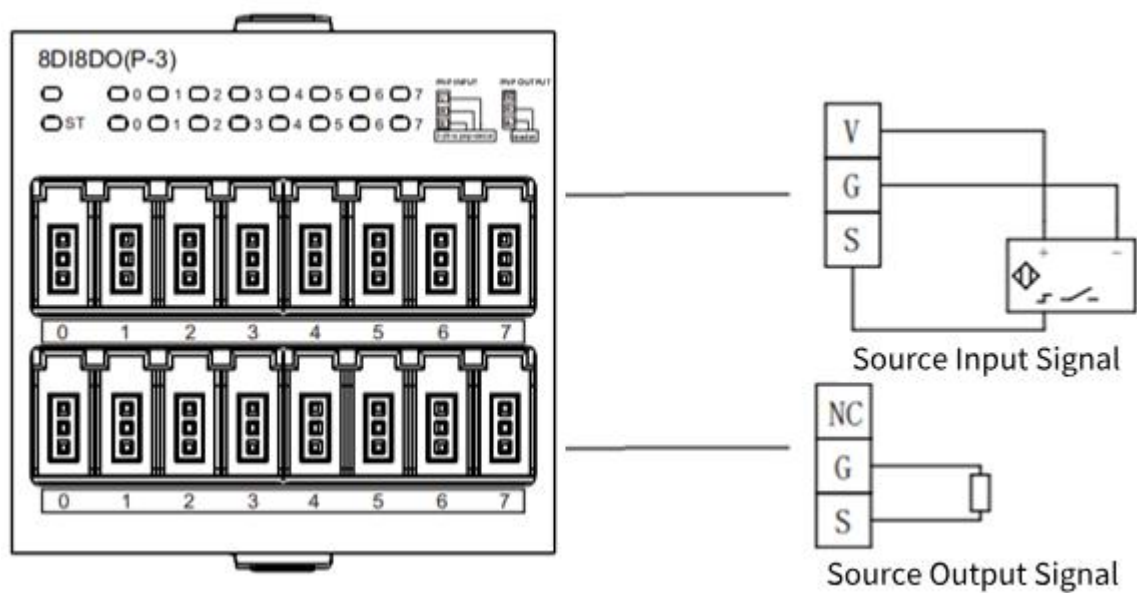
8DI8DO(N-2)



8DI8DO(P-2)

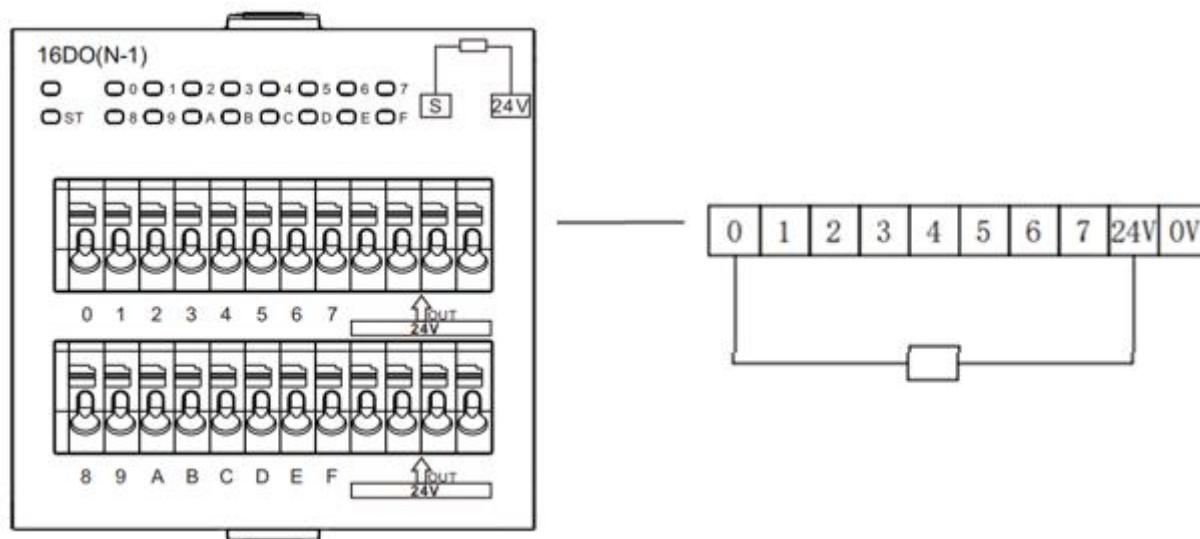


8DI8DO(N-3)

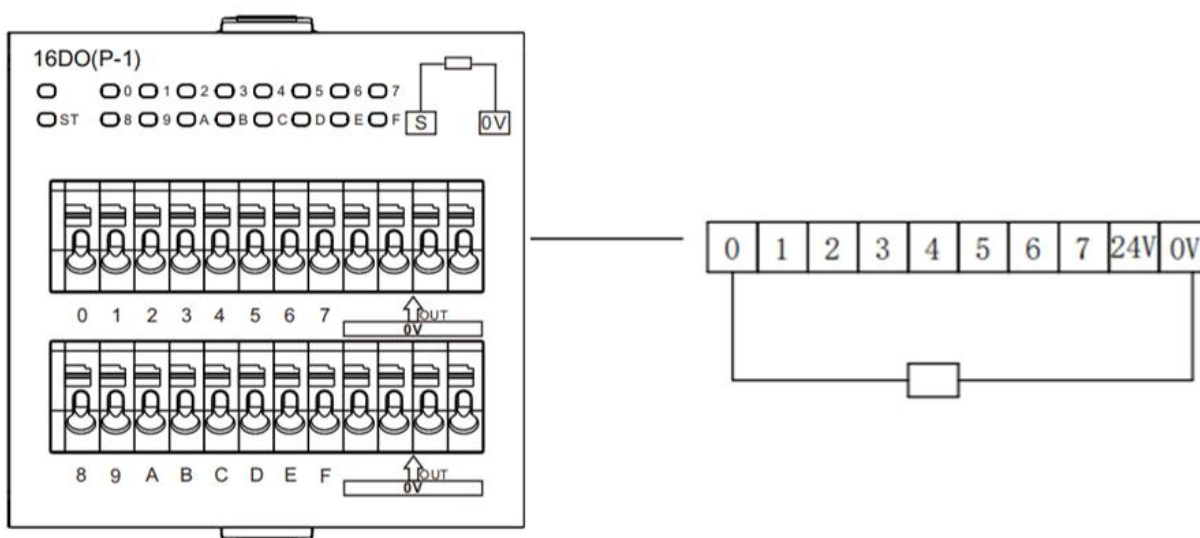


8DI8DO(P-3)

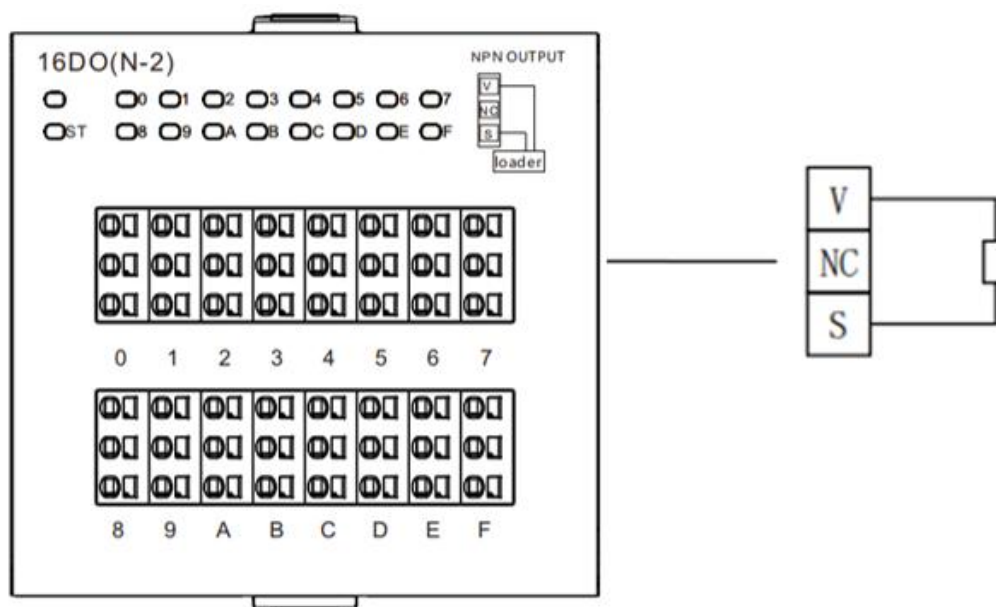
5.2.3 16DO Wiring Diagram



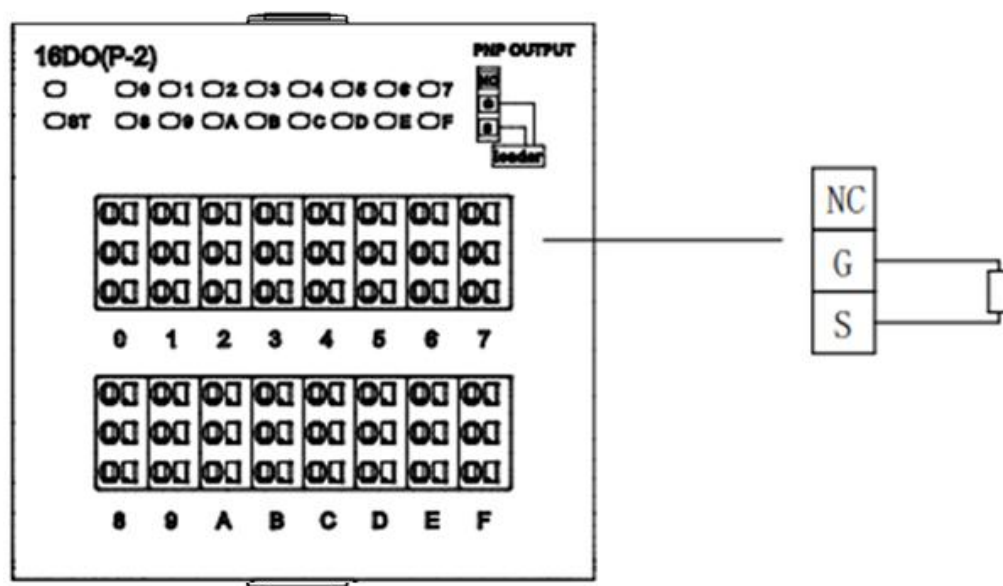
16DO(N-1)



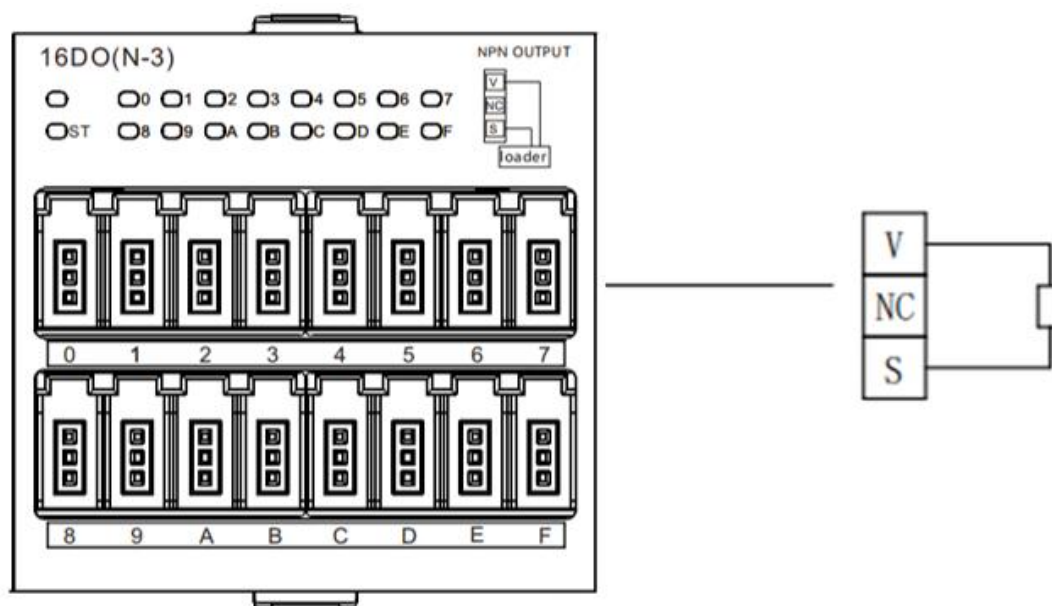
16DO(P-1)



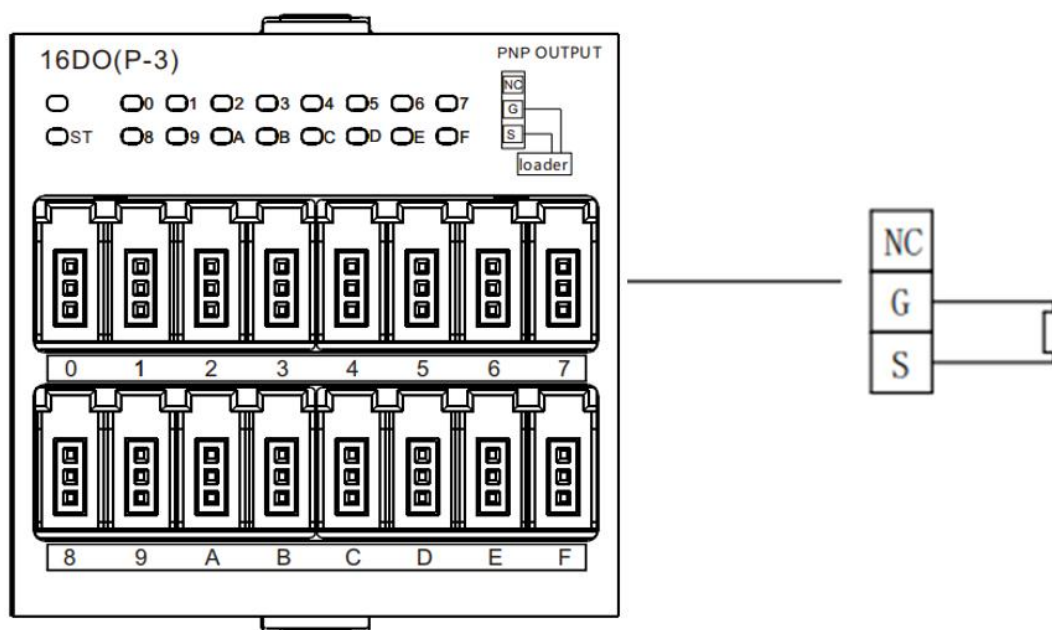
16DO(N-2)



16DO(P-2)

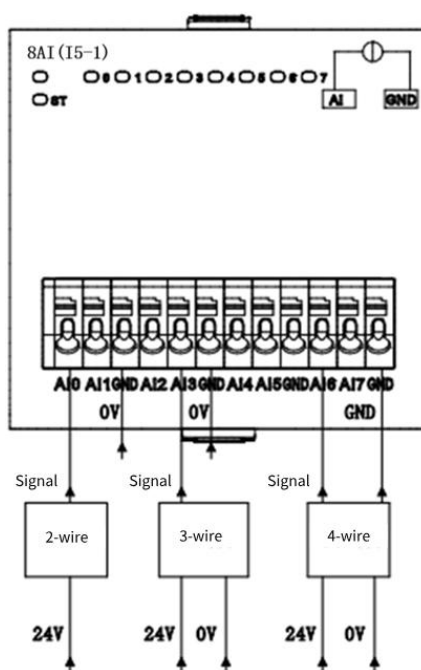


16DO(N-3)

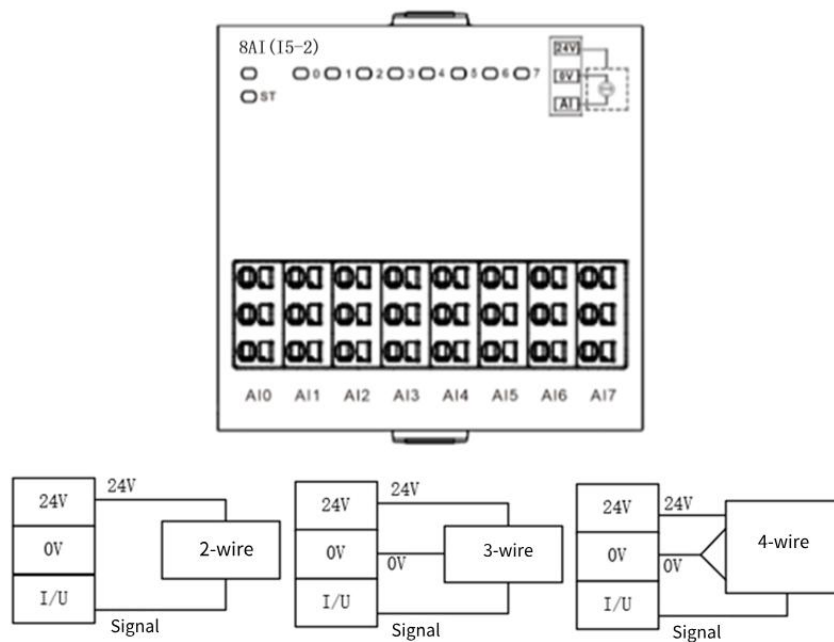


16DO(P-3)

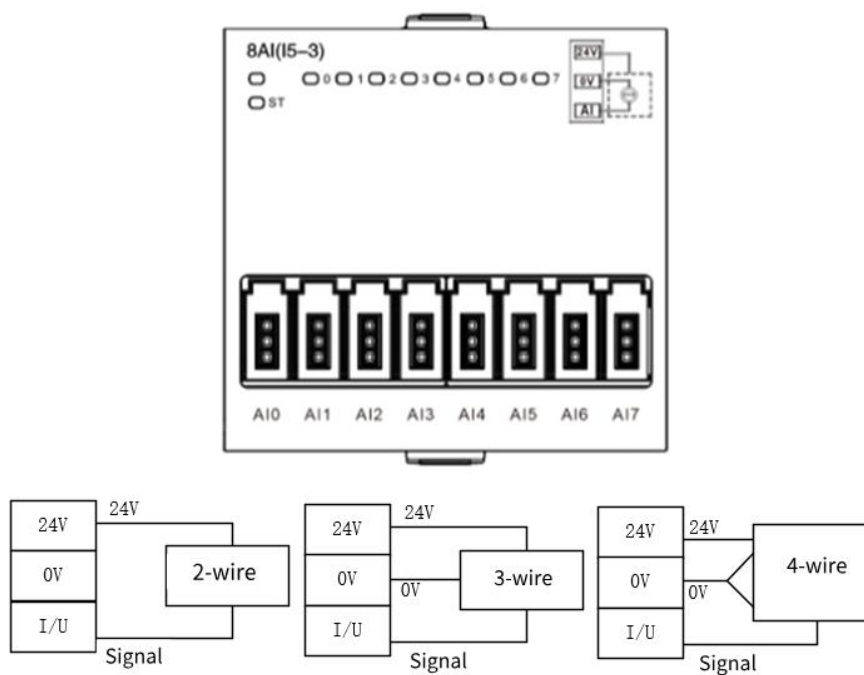
5.2.4 8AI Wiring Diagram



8AI(I5-1)

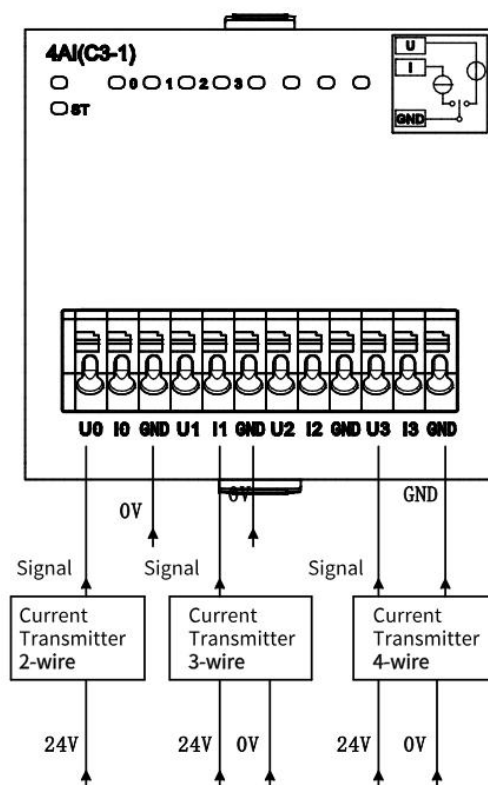


8AI(I5-2)

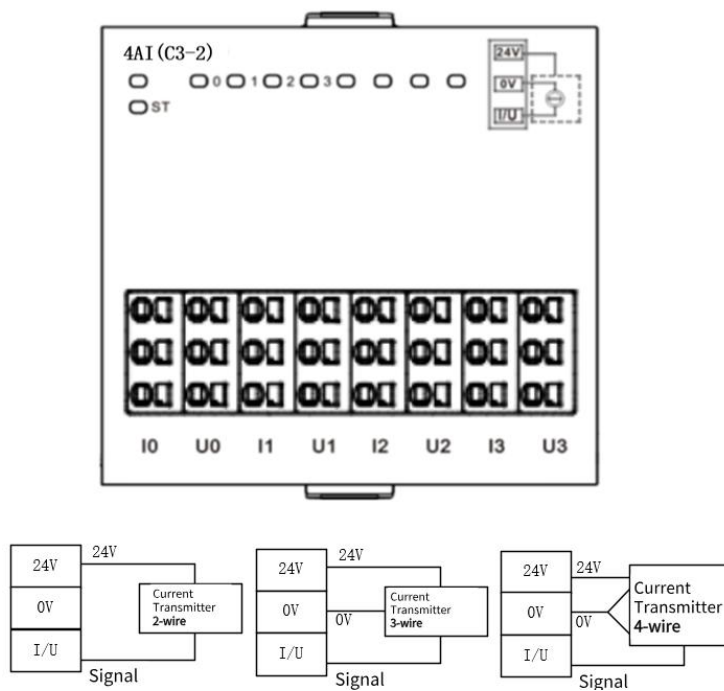


8AI(I5-3)

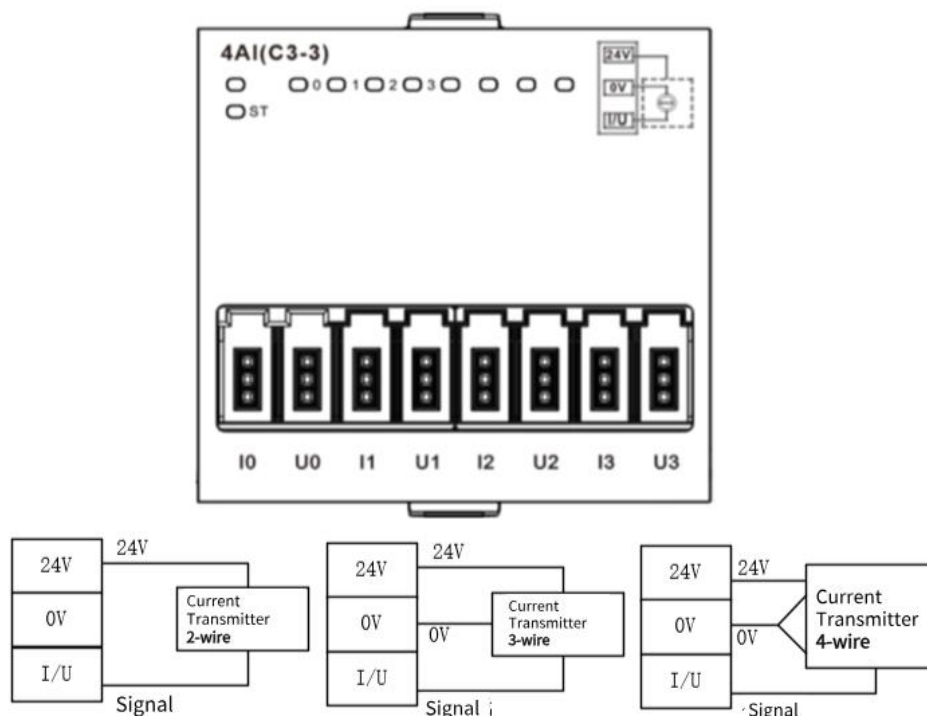
5.2.5 4AI Wiring Diagram



4AI(C3-1)

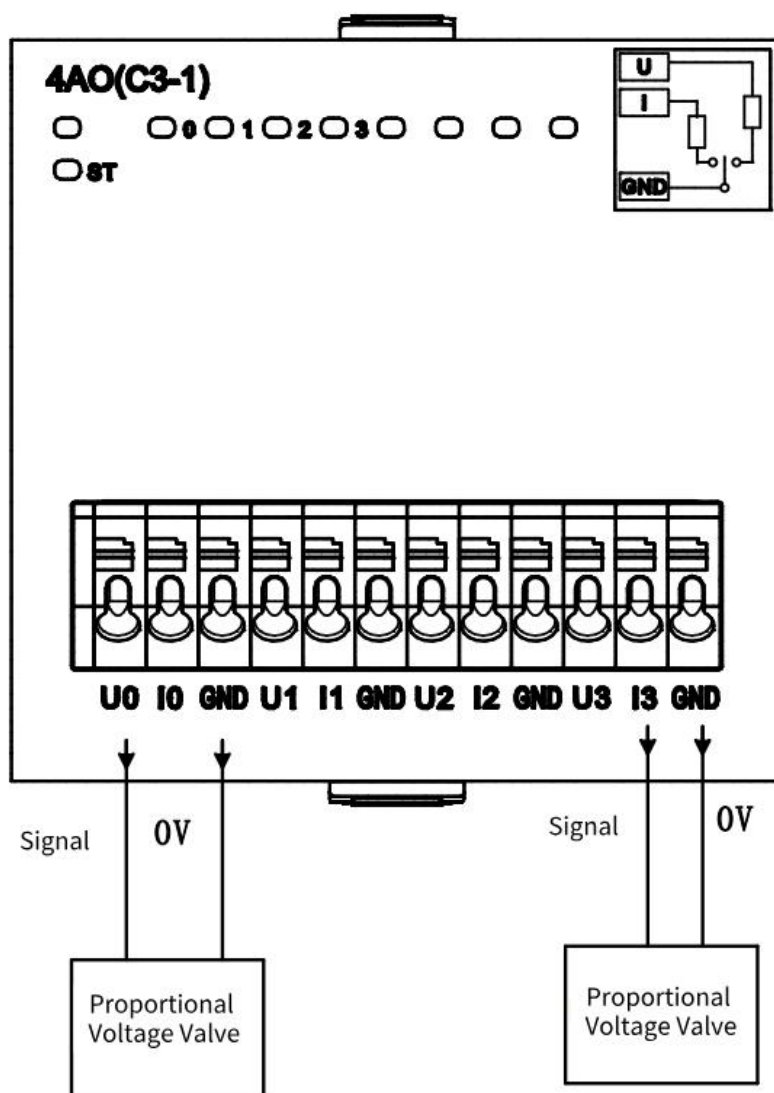


4AI(C3-2)

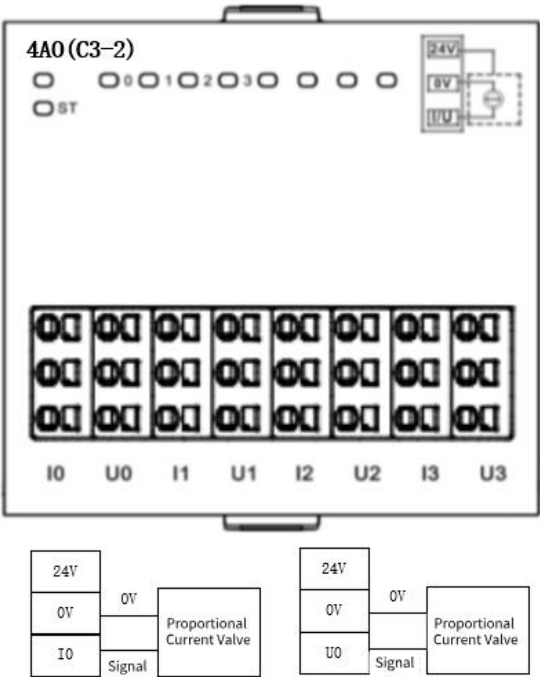


4AI(C3-3)

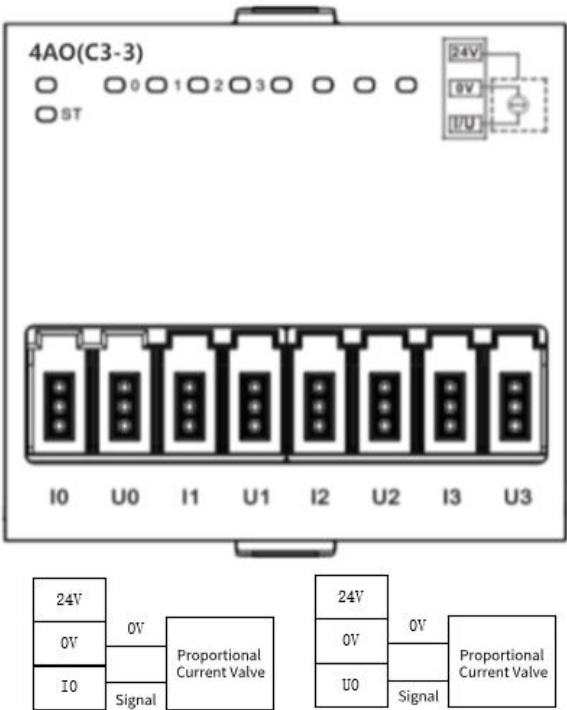
5.2.6 4AO Wiring Diagram



4AO(C3-1)

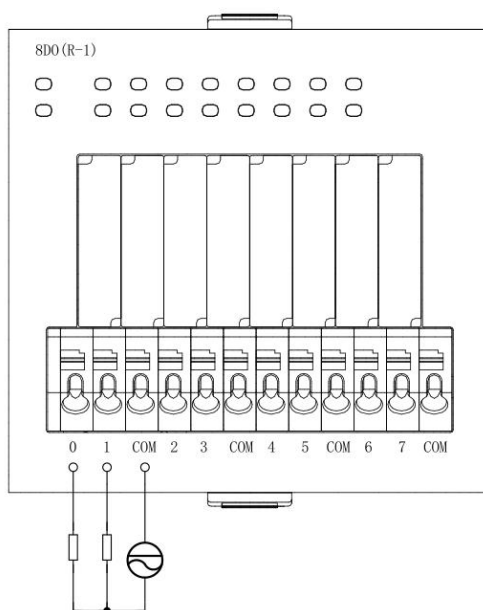


4AO(C3-2)



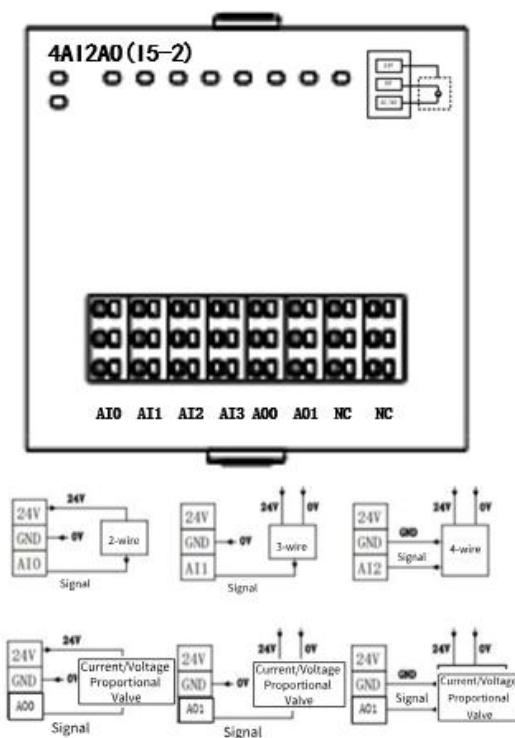
4AO(C3-3)

5.2.7 8DO Wiring Diagram



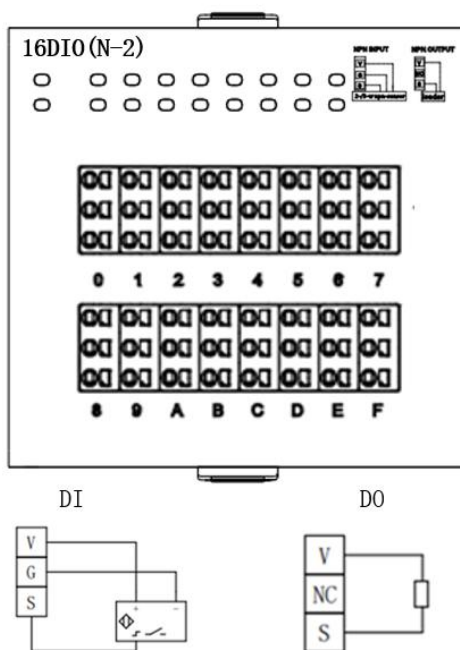
8DO(R-1)

5.2.8 4AI2AO Wiring Diagram



4AI2AO(I5-2)

5.2.9 16DIO Wiring Diagram



16DIO(N-2)

6. Grounding Cable and Field Wiring Instructions

6.1 Introduction

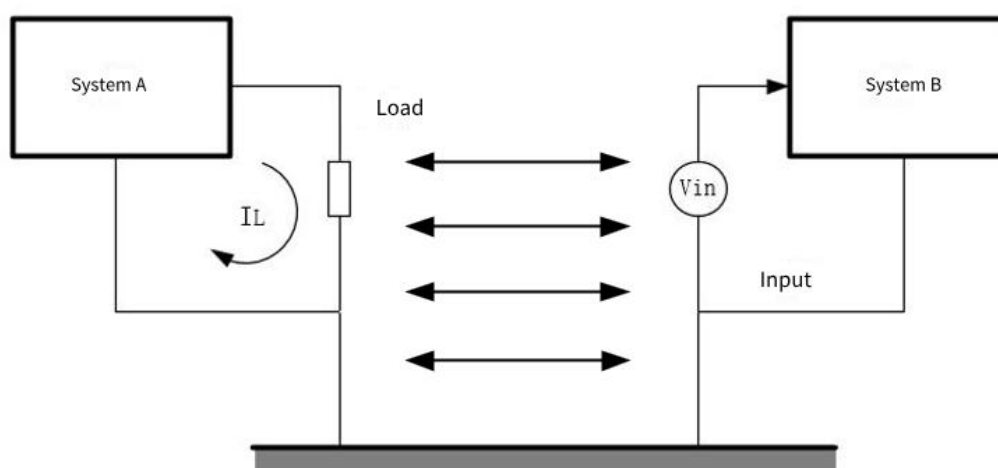
The primary purpose of standardized wiring and shielding in industrial environments is to ensure personnel safety, followed by maintaining system operational stability, and preserving electromagnetic compatibility (EMC) of equipment to ensure reliable system performance and data integrity in industrial control applications.

6.2 Core Suppression Mechanisms of Grounding Systems Against Electromagnetic Interference (EMI)

① Common Impedance Coupling:

When multiple devices share the same grounding path, the impedance of the ground line may cause variations in current, generating potential differences that interfere with sensitive circuits.

Mitigation: Adopt a star-point single grounding approach: all module PE terminals should be connected to a unified grounding copper bar in the control cabinet. The copper bar must establish a low-impedance connection with the cabinet's metal frame (paint must be removed at the contact surface).



② Capacitive Coupling:

Occurs due to electric field interference between parallel cables.

Mitigation: Use shielded twisted pair (STP) cables with single-ended grounding.

③ Inductive Coupling:

A changing current flowing through a cable generates surrounding magnetic and electric fields. Sensitive circuits within these fields may induce unwanted voltages or currents, affecting circuit performance.

Mitigation: Maintain a minimum spacing of ≥ 30 cm between power (high-voltage/current) and signal (low-level) cables. If crossing is required, maintain a 90° angle.

6.3 EMC Optimized Cabling Specifications

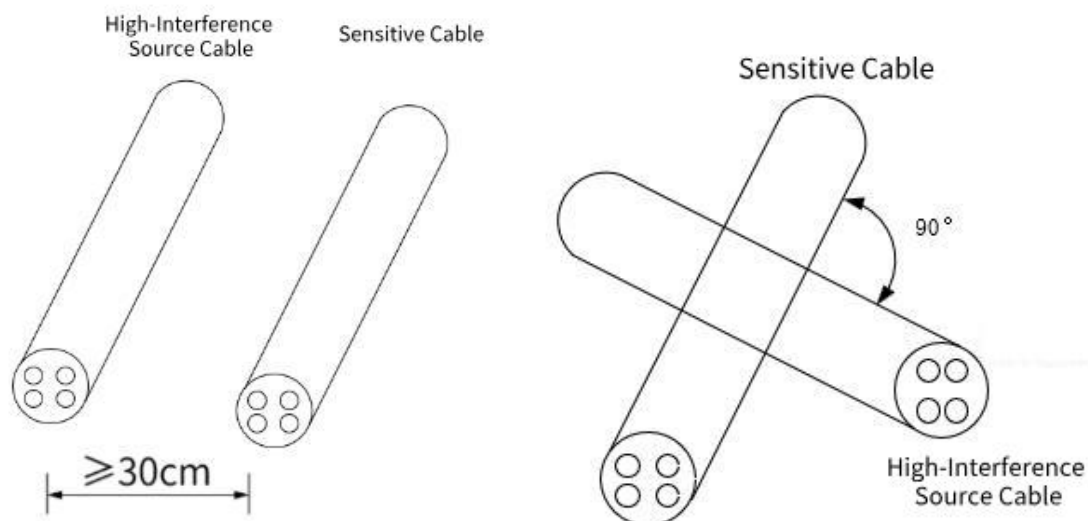
Cable routing requirements

Cable Type	Installation Requirements	Example Cables
Power cable	Routed in a separate metal duct (distance > 20 cm from signal ducts)	(distance > 20 cm from signal ducts) VFD output cables, brake resistor cables
Analog IO cable	Routed in a shielded duct with partitions; twisted pair pitch ≤ 5 cm	AI 4-20mA, EtherCAT bus
Digital I/O cable	Grouped and bundled in a non-shielded duct	DI sensor, DO control cable

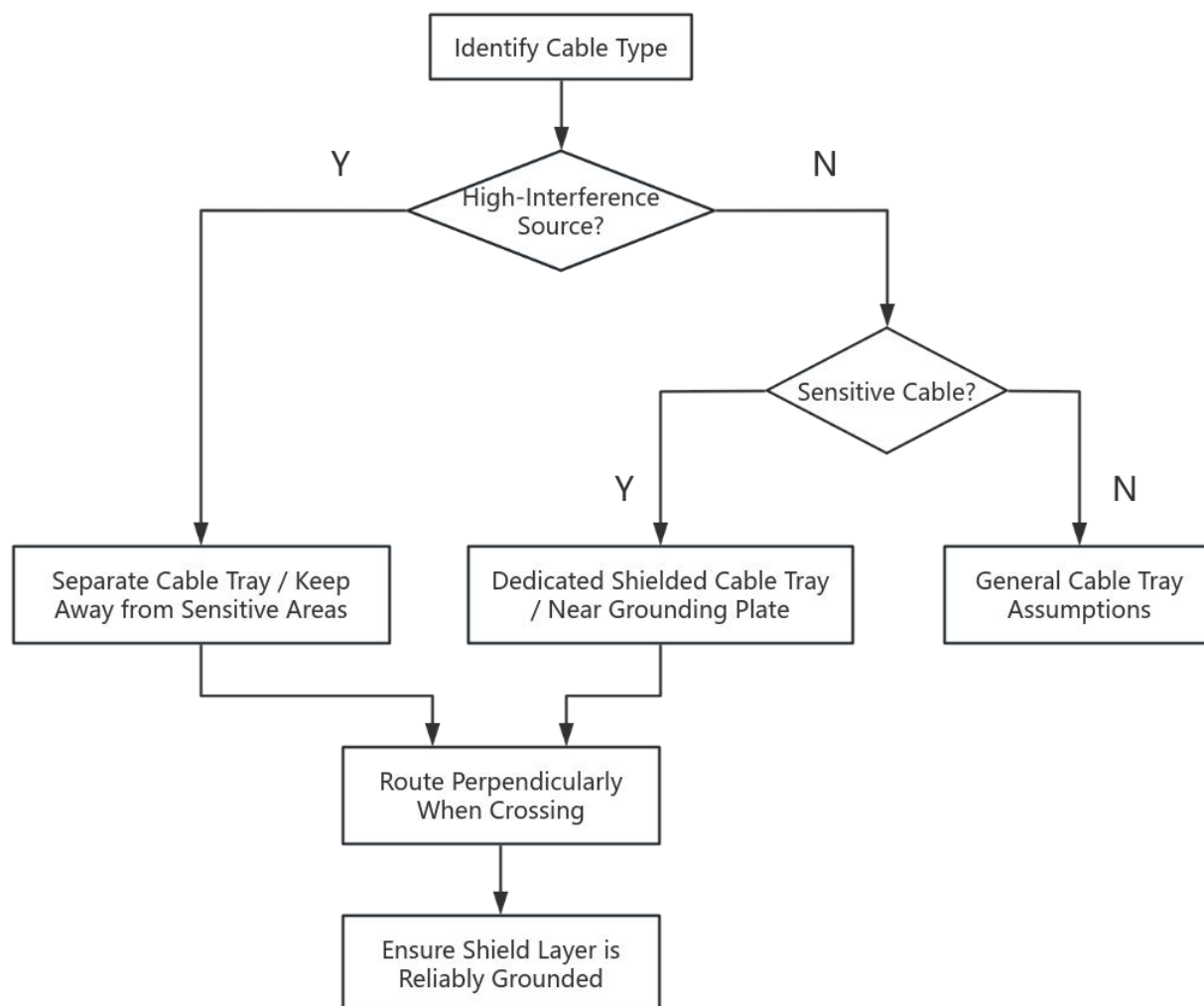
Wiring Recommendation:

To prevent communication interruptions or signal distortion caused by high-interference sources, maintain a minimum spacing of ≥ 30 cm or use shielded cables with both ends grounded. Sensitive cables (such as sensor or communication lines) must be strictly separated from high-interference cables (such as VFD or power lines) and must not be routed in parallel.

If the required spacing cannot be maintained, sensitive cables should be shielded with both ends grounded and installed to cross high-interference cables at a 90° angle.



For wiring, please refer to the following process:



Key Points

Cable Length: It is recommended to keep cable lengths as short as possible to minimize the risk of common-mode interference caused by coupling through the grounding path.

Spare Conductors: In multi-core cables, any spare conductors must be shorted to the PE bus. Leaving spare conductors floating is strictly prohibited.

Duct Connections: Conductive gaskets should be used at duct joints to ensure electromagnetic continuity. Shielded cables can effectively reduce interference from magnetic fields, electric fields, or electromagnetic fields by transferring interference currents from the shield to ground.

Shielded Cable Grounding: Shielded cables shorter than 1 meter should have their shield connected to the nearest PE terminal. Over-stripped cores can easily pick up interference. For modules without dedicated PE terminals, the shield may be connected to an external PE terminal.

Note on Safety Voltage Circuits (SELV / PELV)

According to international standards (IEC 61140), two types of safety extra-low voltage circuits are defined:

SELV (Safety Extra-Low Voltage Circuits): Safety is achieved through protective isolation, not relying on grounding.

PELV (Protective Extra-Low Voltage Circuits): Safety is achieved through grounding protection + voltage limitation, and relies on proper grounding.

Industrial control PLCs are categorized according to their power circuits: most PLC control circuits are SELV, while certain grounded power circuits may fall under PELV. Currently, all PLC and I/O products of our company belong to SELV.

Functional Grounding (FE) vs Protective Grounding (PE)

For SELV circuits, grounding is performed as functional grounding (FE) to meet equipment or system operational requirements. It establishes a stable reference potential to ensure proper device operation, accurate signal transmission, and suppression of electromagnetic interference. FE is not intended for personnel safety, but to maintain equipment performance (e.g., prevent signal drift, reduce noise, ensure correct logic operation).

PE grounding ensures personnel safety by connecting exposed conductive parts (such as metal enclosures or frames) to earth. In case of leakage (e.g., live wire contacting the enclosure), the leakage current is quickly diverted to ground, preventing electric shock. PE is mandatory under safety regulations, with strict impedance requirements (typically $\leq 4 \Omega$), and is directly related to shock protection.

7.Object Dictionary

7.1 Object Dictionary Description

7.1.1 Adapter Object Dictionary

7.1.1.1 Process Data (PDO)

Mapped data: Index 0x1AFF:

Index	0x1AFF: Device Status PDO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Mapping IO Power supply fault	UDINT	RO	NO	0xF1000101
2	Mapping Station pending	UDINT	RO	NO	0xF1000201
3	Mapping Errorbit 2	UDINT	RO	NO	0xF1000301
4	Mapping Errorbit 3	UDINT	RO	NO	0xF1000401
5	Mapping Systembus error	UDINT	RO	NO	0xF1000501
6	Mapping Errorbit 5	UDINT	RO	NO	0xF1000601
7	Mapping I/O-Configuration error	UDINT	RO	NO	0xF1000701
8	Mapping Errorbit 7	UDINT	RO	NO	0xF1000801
9	Mapping Errorbit 8	UDINT	RO	NO	0xF1000901
10	Mapping Errorbit 9	UDINT	RO	NO	0xF1000A01
11	Mapping Errorbit 10	UDINT	RO	NO	0xF1000B01
12	Mapping Errorbit 11	UDINT	RO	NO	0xF1000C01
13	Mapping Errorbit 12	UDINT	RO	NO	0xF1000D01
14	Mapping Errorbit 13	UDINT	RO	NO	0xF1000E01
15	Mapping Errorbit 14	UDINT	RO	NO	0xF1000F01
16	Mapping Errorbit 15	UDINT	RO	NO	0xF1001001

Process Data: Index 0xF100:

Index	0xF100: Coupler status				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	IO Power supply fault	BOOL	RO	YES	0

2	Station pending	BOOL	RO	YES	0
3	Errorbit 2	BOOL	RO	YES	0
4	Systembus error	BOOL	RO	YES	0
5	Errorbit 4	BOOL	RO	YES	0
6	Errorbit 5	BOOL	RO	YES	0
7	I/O-Configuration error	BOOL	RO	YES	0
8	Errorbit 7	BOOL	RO	YES	0
9	Errorbit 8	BOOL	RO	YES	0
10	Errorbit 9	BOOL	RO	YES	0
11	Errorbit 10	BOOL	RO	YES	0
12	Errorbit 11	BOOL	RO	YES	0
13	Errorbit 12	BOOL	RO	YES	0
14	Errorbit 13	BOOL	RO	YES	0
15	Slot 0 active status	BOOL	RO	YES	0
16	Slot 1 active status	BOOL	RO	YES	0

Mapped data: Index 0x16FF:

Index	0x16FF: Device Control PDO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Mapping Controlbit 0	UDINT	RO	NO	0xF2000101
2	Mapping Controlbit 1	UDINT	RO	NO	0xF2000201
...	...	...	...	...	...
16	Mapping Controlbit 15	UDINT	RO	NO	0xF2001001

Process data: Index 0xF200:

Index	0xF200: Coupler control				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16

1	Controlbit 0	BOOL	RO	YES	0
2	Controlbit 1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Controlbit 15	BOOL	RO	YES	0

7.1.1.2 Configuration Data (SDO)

Index	0xF800: Device configuration parameter				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Behaviour of outputs on field bus error	DT0800EN08	RW	NO	0
2	Save module parameters	USINT	RW	NO	0
3	Restore module parameters	USINT	RW	NO	0
4	Factory settings	USINT	WO	NO	0

Behaviour of outputs on field bus error	Meaning
0	All outputs off
1	Enable substitute value
2	Hold last value
Save module parameters	Meaning
0	Parameters are not saved (default)
1	Effective after power cycle
2	Parameters take effect immediately and are lost after power-off
Restore module parameters	Meaning
0	Default value
1	Module parameters have been saved
Factory settings	Meaning
0	Default value
1	Factory reset; user parameters cleared

7.1.2 16DI

Overview: The 16DI module is a 16-channel digital input module. The signal types include NPN and PNP (refer to the selection manual for details). Terminal types include single-row European terminals, 3-in-1 terminals, and 3-pin E-CON terminals. The module provides rich configuration options, including channel-level filtering.

- Name: 16DI
- Module type: DI
- Module ID: 0x00000301

7.1.2.1 Process Data (PDO)

Mapped data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
...	...	...	...	...	...
16	Input Mapping 16	UDINT	RO	NO	0x60n01001

Process data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 16DI				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Ch#0	BOOL	RO	YES	0
2	Ch#1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Ch#F	BOOL	RO	YES	0

7.1.2.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 16DI				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	47
2	Type string	STRING(30)	RW	NO	DI
3	Name string	STRING(30)	RW	NO	16DI
10	Module ident	UDINT	RW	NO	0x00000301
11	Slot	UINT	RW	NO	n
32	Ch 0: Filter Time	DT0801EN16	RW	NO	0x03
...	...	...	...	...	...
47	Ch F: Filter Time	DT0801EN16	RW	NO	0x03

Detected DI digital input filter time setting. Each channel can be configured independently.

The default value is 0x03, corresponding to a filter time of 3 ms.

The setting range is shown in the table below

Filter time value	Description
0	No filter
1	1msfilter
2	2msfilter
...	...
10	10msfilter

7.1.3 16DO

Overview: The 16DO module is a 16-channel digital output module. Signal types include NPN and PNP (refer to the selection manual for details). Terminal types include single-row

European terminals, 3-in-1 terminals, and 3-pin E-CON terminals. The module offers rich configuration options, including channel-level substitute value functionality.

- Name: 16DO
- Module type: DO
- Module ID: 0x00000302

7.1.3.1 Process Data (PDO)

Mapped data: For the module in slot n ($n = 0-1$), index $0x1600 + 0x01 \times n$:

Index	0x1600+0x01*n: RxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Output Mapping 1	UDINT	RO	NO	0x70n00101
2	Output Mapping 2	UDINT	RO	NO	0x70n00201
...	...	...	...	...	...
16	Output Mapping 16	UDINT	RO	NO	0x70n01001

Process data: For the module in slot n ($n = 0-1$), index $0x7000 + 0x10 \times n$:

Index	0x7000+0x10*n: Output 16DO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Ch#0	BOOL	RO	YES	0
2	Ch#1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Ch#F	BOOL	RO	YES	0

7.1.3.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 16DI
-------	-------------------------------

Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	47
2	Type string	STRING(30)	RW	NO	DO
3	Name string	STRING(30)	RW	NO	16DO
10	Module ident	UDINT	RW	NO	0x00000302
11	Slot	UINT	RW	NO	n
32	Ch 0: Substitute value	UINT	RW	NO	0
...	...	...	...	...	...
47	Ch F: Substitute value	UINT	RW	NO	0

DO digital output substitute value setting. Each channel can be configured independently.

The default value is 0x00, corresponding to output OFF. This setting takes effect when the bus error behavior F800:01 is set to "Enable substitute value."

The setting range is shown in the table below.

Value	Description
0	Output OFF
1	Output ON

7.1.4 8DO(R)

Overview: The 8DO(R) module is an 8-channel relay output module with normally open contacts. Terminal type is single-row European terminals. The module provides rich configuration options, including channel-level substitute value functionality.

- Name: 8DO(R)
- Module type: DO
- Module ID: 0x00000303

7.1.4.1 Process Data (PDO)

Mapped data: For the module in slot n ($n = 0-1$), index $0x1600 + 0x01 \times n$:

Index	0x1600+0x01*n: RxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Output Mapping 1	UDINT	RO	NO	0x70n00101
2	Output Mapping 2	UDINT	RO	NO	0x70n00201
...	...	...	...	...	...
8	Output Mapping 8	UDINT	RO	NO	0x70n00801

Process data: For the module in slot n ($n = 0-1$), index $0x7000 + 0x10 \times n$:

Index	0x7000+0x10*n: Output 8DO(R)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Ch#0	BOOL	RO	YES	0
2	Ch#1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Ch#7	BOOL	RO	YES	0

7.1.4.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 8DO(R)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	39
2	Type string	STRING(30)	RW	NO	DO
3	Name string	STRING(30)	RW	NO	8DO(R)
10	Module ident	UDINT	RW	NO	0x00000303
11	Slot	UINT	RW	NO	n
32	Ch 0: Substitute value	UINT	RW	NO	0
...	...	...	...	...	...
39	Ch 7: Substitute value	UINT	RW	NO	0

DO digital output substitute value setting. Each channel can be configured independently. The default value is 0x00, corresponding to output OFF. This setting takes effect when the bus error behavior F800:01 is set to "Enable substitute value."

The setting range is shown in the table below.

Value	Description
0	Output OFF
1	Output ON

7.1.5 16DIO

Overview: The 16DIO module is a 16-channel configurable digital input/output module.

Signal type includes NPN (refer to the selection manual for details). Terminal type is 3-in-1 terminals. The module offers rich configuration options, including channel-level filtering and output substitute value functionality.

- Name: 16DIO
- Module type: DIO
- Module ID: 0x0000030A

7.1.5.1 Process Data (PDO)

Mapped data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
...	...	...	...	...	...
16	Input Mapping 16	UDINT	RO	NO	0x60n01001

Process data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 16DI				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Ch#0	BOOL	RO	YES	0
2	Ch#1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Ch#F	BOOL	RO	YES	0

Mapped data: For the module in slot n ($n = 0-1$), index $0x1600 + 0x01 \times n$:

Index	0x1600+0x01*n: RxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Output Mapping 1	UDINT	RO	NO	0x70n00101
2	Output Mapping 2	UDINT	RO	NO	0x70n00201
...	...	...	...	...	...
16	Output Mapping 16	UDINT	RO	NO	0x70n01001

Process data: For the module in slot n ($n = 0-1$), index $0x7000 + 0x10 \times n$:

Index	0x7000+0x10*n: Output 16DO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	16
1	Ch#0	BOOL	RO	YES	0
2	Ch#1	BOOL	RO	YES	0
...	...	...	...	...	...
16	Ch#F	BOOL	RO	YES	0

7.1.5.2 Configuration Data (SDO)

For the module in slot n (n = 0–1), index 0x8000 + 0x10 × n:

Index	0x8000+0x10*n: Parameter 16DIO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	99
2	Type string	STRING(30)	RW	NO	DI
3	Name string	STRING(30)	RW	NO	16DIO
10	Module ident	UDINT	RW	NO	0x0000030A
11	Slot	UINT	RW	NO	n
32	Template: Mode	DT0811EN16	RW	NO	0x01
33	Template: Diag	DT0812EN16	RW	NO	0x01
34	Template: DI input delay	DT0814EN16	RW	NO	0x05
35	Template: DO sub.	DT0801EN16	RW	NO	0x01
36	Ch 0: Mode	DT080DEN16	RW	NO	0
37	Ch 0: Diag	DT080EEN16	RW	NO	0
38	Ch 0: DI input delay	DT0810EN16	RW	NO	0
39	Ch 0: DO sub.	DT080FEN16	RW	NO	0
...	...	...	...	...	...
99	Ch F: DO sub.	DT080FEN16	RW	NO	0

Module configuration parameters can be set either according to template parameters or individually per channel. The template module parameters include **Template: Mode**, **Template: Diag**, **Template: DO sub.**, and **Template: DI input delay**. The following sections describe each parameter in detail.

Template: Mode

DT0811EN16	
Value	Description
1	DI
2	DO

Template: Diag

DT0812EN16	
Value	Description
1	Disable
2	Enable

Template: DO sub.

DT0812EN16	
Value	Description
1	Off
2	On

Template: DI input delay

DT0814EN16	
Value	Description
1	no
2	0.5ms
3	1ms
4	2ms
5	3ms
6	4ms
7	5ms
8	6ms
9	7ms
10	8ms
11	9ms
12	10ms

The module also supports per-channel parameter configuration. If the user selects a non-Template Value in the Ch x parameters, the module parameters will take effect according to the user-defined settings. For example, if Ch 0: Mode is set to “DO” while

Template: Mode is set to “DI”, the Ch 0 Mode setting “DO” will take effect. The parameter setting range is as follows:

Ch x: Mode

DT080DEN16	
Value	Description
1	DI
2	DO

Ch x: Diag

DT080EEN16	
Value	Description
0	Template Value
1	Disable
2	Enable

Ch x: DO sub.

DT080FEN16	
Value	Description
0	Template Value
1	Off
2	On

Ch x: DI input delay

DT0810EN16	
Value	Description
0	Template Value
1	no
2	0.5ms
3	1ms
4	2ms
5	3ms
6	4ms

7	5ms
8	6ms
9	7ms
10	8ms
11	9ms
12	10ms

7.1.5.3 Diagnostic Data

Diagnostic Data: For the module in slot n (n = 0–1), index 0xA000 + 0x10 × n:

Index	0xA000+0x10*n: Input 16DIO				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	17
1	Module Diagnosis information	USINT	RO	NO	0
2	Ch 0: Diagnosis information	USINT	RO	NO	0
3	Ch 1: Diagnosis information	USINT	RO	NO	0
...	...	...	...	...	...
17	Ch F: Diagnosis information	USINT	RO	NO	0

For the specific meanings, refer to the “Diagnostics” section.

7.1.6 4AI (C3)

Introduction: The 4AI (C3) module is a 4-channel analog input module with switchable voltage/current input. The module has an accuracy of 0.1% and supports the following ranges: 0–20 mA, 4–20 mA, -5–5 V, 0–5 V, -10–10 V, and 0–10 V. Terminal types include single-row European terminals, three-in-one terminals, and three-position E-CON terminals.

The module provides rich configuration options, including data format, channel-level range selection, and channel-level filtering functions.

- **Name:** 4AI (C3)
- **Module Type:** AI
- **Module ID:** 0x00000304

7.1.6.1 Process Data (PDO)

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
3	Input Mapping 3	UDINT	RO	NO	0x60n00301
4	Input Mapping 4	UDINT	RO	NO	0x60n00401

Process Data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 4AI(C3)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	AI0	INT	RO	YES	0
2	AI1	INT	RO	YES	0
3	AI2	INT	RO	YES	0
4	AI3	INT	RO	YES	0

7.1.6.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 4AI(C3)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	47
2	Type string	STRING(30)	RW	NO	AI
3	Name string	STRING(30)	RW	NO	4AI(C3)
10	Module ident	UDINT	RW	NO	0x00000304
11	Slot	UINT	RW	NO	n
32	Data format	DT0802EN16	RW	NO	0
33	Ch 0: Channel diagnostics	DT080CEN16	RW	NO	0
34	Ch 0: Measurement range	DT080BEN16	RW	NO	0x03
35	Ch 0: Input filter level	DT0807EN16	RW	NO	0x01
...	...	...	...	...	...
42	Ch 3: Channel diagnostics	DT080CEN16	RW	NO	0
43	Ch 3: Measurement range	DT080BEN16	RW	NO	0x03
44	Ch 3: Input filter level	DT0807EN16	RW	NO	0x01

The module supports three data formats. For 0–20 mA, 4–20 mA, 0–5 V, and 0–10 V (positive ranges), selecting “-27648 – 27648 | 0–27648” corresponds to “0–27648.” Similarly, for -5–5 V and -10–10 V (bipolar ranges), selecting “-27648 – 27648 | 0–27648” corresponds to “-27648 – 27648.”

Data format

DT0802EN16	
Value	Description
0	Template Value
1	Disable
2	Enable

Digital-to-Analog Conversion Table for Different Data Formats

Range	I/U	Value			Status
		-27648~27648 0~27648	-15000~15000 0~30000	-32767~32767 0~32767	
0 ~ 20 mA	23.52mA	32511	/	/	Overloading
	21mA	29030	31500	-	
	20mA	27648	30000	32767	Nominal range
	10mA	13824	15000	16384	
	0mA	0	0	0	
4 ~ 20mA	22.81mA	32511	/	/	Overloading
	21mA	29376	31875	-	
	20mA	27648	30000	32767	Nominal range
	12mA	13824	15000	16384	
	4mA	0	0	0	
	3.6mA	-691	-615	-819	Underloading
	1.19mA	-4864	/	/	
	1mA	-5184	-5625	-6144	Break line
0 ~ 10V	10.2V	28201	30600	-	Overloading
	10 V	27648	30000	32767	Nominal range
	5V	13824	15000	16384	
	0V	0	0	0	
±10 V	10.2V	28201	15300	-	Overloading
	10V	27648	15000	32767	Nominal range
	5V	13824	7500	16384	
	0V	0	0	0	
	-5V	-13824	-7500	-16384	
	-10V	-27648	-15000	-32767	

	-10.2V	-28201	-15300	-	Underloading
0~5V	5.1V	28201	30600	-	Overloading
	5 V	27648	30000	32767	Nominal range
	2.5V	13824	15000	16384	
	0V	0	0	0	
±5 V	5.1V	28201	15300	-	Overloading
	5V	27648	15000	32767	Nominal range
	2.5V	13824	7500	16384	
	0V	0	0	0	
	-2.5V	-13824	-7500	-16384	
	-5V	-27648	-15000	-32767	
	-5.1V	-28201	-15300	-	Underloading

Values highlighted in red in the table indicate the module's over-limit and under-limit error conditions. The alarm is triggered only when the value exceeds the upper limit (greater than) or falls below the lower limit (less than). For the “-32767 – 32767 | 0–32767” data format, no over-limit error indication exists.

Note: The over-20 mA current detection function is supported only in firmware versions V1.1.9 or above.

Ch x: Channel diagnostics

DT080CEN16	
Value	Description
1	Disable
2	Enable

Ch x: Measurement range

DT080BEN16	
Value	Description
0	0~20mA

1	4~20mA
2	-10~10V
3	0~10V
4	-5~5V
5	0~5V

The higher the filter level, the stronger the filtering effect.

Ch x: Input Filter Level

DT0807EN16	
Value	Description
0	Filter level 0
1	Filter level 1
2	Filter level 2
3	Filter level 3

7.1.6.3 Diagnostic Data

Diagnostic Data: For the module in slot n (n = 0~1), index 0xA000 + 0x10 × n:

Index	0xA000+0x10*n: Input 4AI(C3)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Module Diagnosis information	USINT	RO	NO	0
2	Ch 0: Diagnosis information	USINT	RO	NO	0
3	Ch 1: Diagnosis information	USINT	RO	NO	0
4	Ch 2: Diagnosis information	USINT	RO	NO	0
5	Ch 3: Diagnosis information	USINT	RO	NO	0

For the specific meanings, refer to the “Diagnostics” section.

7.1.7 8AI(I1)

Introduction: The 8AI (I1) module is an 8-channel analog input current module with an accuracy of 0.2%. The supported ranges are 0–20 mA and 4–20 mA. The terminal type is a single-row European terminal. The module provides rich configuration options, including data format, channel-level range selection, and channel-level filtering functions.

- **Name:** 8AI (I1)
- **Module Type:** AI
- **Module ID:** 0x00000307

7.1.7.1 Process Data (PDO)

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
...	...	...	...	...	...
8	Input Mapping 8	UDINT	RO	NO	0x60n00801

Process Data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 8AI(I1)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	AI0	INT	RO	YES	0
2	AI1	INT	RO	YES	0
...	...	...	...	...	...
8	AI7	INT	RO	YES	0

7.1.7.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 8AI(I1)
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Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	56
2	Type string	STRING(30)	RW	NO	AI
3	Name string	STRING(30)	RW	NO	8AI(I1)
10	Module ident	UDINT	RW	NO	0x00000307
11	Slot	UINT	RW	NO	n
32	Data format	DT0802EN16	RW	NO	0
33	Ch 0: Channel diagnostics	DT080CEN16	RW	NO	0
34	Ch 0: Measurement range	DT0804EN16	RW	NO	0x01
35	Ch 0: Input filter level	DT0807EN16	RW	NO	0x01
...	...	...	...	...	...
54	Ch 7: Channel diagnostics	DT080CEN16	RW	NO	0
55	Ch 7: Measurement range	DT0804EN16	RW	NO	0x01
56	Ch 7: Input filter level	DT0807EN16	RW	NO	0x01

The module supports three data formats. For 0–20 mA and 4–20 mA (positive ranges), selecting “-27648 – 27648 | 0–27648” corresponds to “0–27648.”

DT0802EN16	
Value	Description
0	-27648~27648 0~27648
1	-15000~15000 0~30000

2	-32767~32767 0~32767
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Digital-to-Analog Conversion Table for Different Data Formats

Range	I/U	Value			Status
		-27648~27648 0~27648	-15000~15000 0~30000	-32767~32767 0~32767	
0 ~ 20 mA	23.52mA	32511	/	/	Overloading
	21mA	29030	31500	-	
	20mA	27648	30000	32767	Nominal range
	10mA	13824	15000	16384	
	0mA	0	0	0	
4~20mA	22.81mA	32511	/	/	Overloading
	21mA	29376	31875	-	
	20mA	27648	30000	32767	Nominal range
	12mA	13824	15000	16384	
	4mA	0	0	0	
	3.6mA	-691	-615	-819	Underloading
	1.19mA	-4864	/	/	
	1mA	-5184	-5625	-6144	Break line
0~10V	10.2V	28201	30600	-	Overloading
	10 V	27648	30000	32767	Nominal range
	5V	13824	15000	16384	
	0V	0	0	0	
±10 V	10.2V	28201	15300	-	Overloading
	10V	27648	15000	32767	Nominal range
	5V	13824	7500	16384	
	0V	0	0	0	

	-5V	-13824	-7500	-16384	
	-10V	-27648	-15000	-32767	
	-10.2V	-28201	-15300	-	Underloading
0~5V	5.1V	28201	30600	-	Overloading
	5 V	27648	30000	32767	Nominal range
	2.5V	13824	15000	16384	
	0V	0	0	0	
±5 V	5.1V	28201	15300	-	Overloading
	5V	27648	15000	32767	Nominal range
	2.5V	13824	7500	16384	
	0V	0	0	0	
	-2.5V	-13824	-7500	-16384	
	-5V	-27648	-15000	-32767	
	-5.1V	-28201	-15300	-	Underloading

Values highlighted in red in the table indicate the module's over-limit and under-limit error conditions. The alarm is triggered only when the value exceeds the upper limit (greater than) or falls below the lower limit (less than). For the “-32767 – 32767 | 0–32767” data format, no over-limit error indication exists.

Note: The over-20 mA current detection function is supported only in firmware versions V1.1.9 or above.

Ch x: Channel diagnostics

DT080CEN16	
Value	Description
1	Disable
2	Enable

Ch x: Measurement range

DT0804EN16	
Value	Description
0	0~20mA
1	4~20mA
2	-10~10V
3	0~10V
4	-5~5V
5	0~5V

The higher the filter level, the stronger the filtering effect.

Ch x: Input Filter Level

DT0807EN16	
Value	Description
0	Filter level 0
1	Filter level 1
2	Filter level 2
3	Filter level 3

7.1.7.3 Diagnostic Data

Diagnostic Data: For the module in slot n (n = 0–1), index 0xA000 + 0x10 × n:

Index	0xA000+0x10*n: Input 8AI(I1)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Module Diagnosis information	USINT	RO	NO	0
2	Ch 0: Diagnosis information	USINT	RO	NO	0
3	Ch 1: Diagnosis information	USINT	RO	NO	0
...	...	...	...	...	...
8	Ch 7: Diagnosis information	USINT	RO	NO	0

For the specific meanings, refer to the “Diagnostics” section.

7.1.8 8AI(I5)

Introduction:

The 8AI (I5) module is an 8-channel analog input current module with an accuracy of 0.1%. The supported ranges are 0–20 mA and 4–20 mA. The terminal type is a three-position E-CON terminal. The module provides rich configuration options, including data format, channel-level range selection, and channel-level filtering functions.

- **Name:** 8AI (I5)
- **Module Type:** AI
- **Module ID:** 0x0000030C

7.1.8.1 Process Data (PDO)

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
...	...	...	...	...	...
8	Input Mapping 8	UDINT	RO	NO	0x60n00801

Process Data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 8AI(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	AI0	INT	RO	YES	0
2	AI1	INT	RO	YES	0
...	...	...	...	...	...
8	AI7	INT	RO	YES	0

7.1.8.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 8AI(I5)
-------	----------------------------------

Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	56
2	Type string	STRING(30)	RW	NO	AI
3	Name string	STRING(30)	RW	NO	8AI(I5)
10	Module ident	UDINT	RW	NO	0x0000030C
11	Slot	UINT	RW	NO	n
32	Data format	DT0802EN16	RW	NO	0
33	Ch 0: Channel diagnostics	DT080CEN16	RW	NO	0
34	Ch 0: Measurement range	DT0804EN16	RW	NO	0x01
35	Ch 0: Input filter level	DT0807EN16	RW	NO	0x01
...	...	...	...	...	...
54	Ch 7: Channel diagnostics	DT080CEN16	RW	NO	0
55	Ch 7: Measurement range	DT0804EN16	RW	NO	0x01
56	Ch 7: Input filter level	DT0807EN16	RW	NO	0x01

The module supports three data formats. For 0–20 mA and 4–20 mA (positive ranges), selecting “-27648 – 27648 | 0–27648” corresponds to “0–27648.”

DT0802EN16	
Value	Description
0	-27648~27648 0~27648
1	-15000~15000 0~30000

2	-32767~32767 0~32767
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Digital-to-Analog Conversion Table for Different Data Formats

Range	I/U	Value			Status
		-27648~27648 0~27648	-15000~15000 0~30000	-32767~32767 0~32767	
0 ~ 20 mA	23.52mA	32511	/	/	Overloading
	21mA	29030	31500	-	
	20mA	27648	30000	32767	Nominal range
	10mA	13824	15000	16384	
	0mA	0	0	0	
4~20mA	22.81mA	32511	/	/	Overloading
	21mA	29376	31875	-	
	20mA	27648	30000	32767	Nominal range
	12mA	13824	15000	16384	
	4mA	0	0	0	
	3.6mA	-691	-615	-819	Underloading
	1.19mA	-4864	/	/	
	1mA	-5184	-5625	-6144	Break line
0~10V	10.2V	28201	30600	-	Overloading
	10 V	27648	30000	32767	Nominal range
	5V	13824	15000	16384	
	0V	0	0	0	
±10 V	10.2V	28201	15300	-	Overloading
	10V	27648	15000	32767	Nominal range
	5V	13824	7500	16384	
	0V	0	0	0	

	-5V	-13824	-7500	-16384	
	-10V	-27648	-15000	-32767	
	-10.2V	-28201	-15300	-	Underloading
0~5V	5.1V	28201	30600	-	Overloading
	5 V	27648	30000	32767	Nominal range
	2.5V	13824	15000	16384	
	0V	0	0	0	
±5 V	5.1V	28201	15300	-	Overloading
	5V	27648	15000	32767	Nominal range
	2.5V	13824	7500	16384	
	0V	0	0	0	
	-2.5V	-13824	-7500	-16384	
	-5V	-27648	-15000	-32767	
	-5.1V	-28201	-15300	-	Underloading

Values highlighted in red in the table indicate the module's over-limit and under-limit error conditions. The alarm is triggered only when the value exceeds the upper limit (greater than) or falls below the lower limit (less than). For the “-32767 – 32767 | 0–32767” data format, no over-limit error indication exists.

Note: The over-20 mA current detection function is supported only in firmware versions V1.1.9 or above.

Ch x: Channel diagnostics

DT080CEN16	
Value	Description
1	Disable
2	Enable

Ch x: Measurement range

DT0804EN16	
Value	Description
0	0~20mA
1	4~20mA
2	-10~10V
3	0~10V
4	-5~5V
5	0~5V

The higher the filter level, the stronger the filtering effect.

Ch x: Input Filter Level

DT0807EN16	
Value	Description
0	Filter level 0
1	Filter level 1
2	Filter level 2
3	Filter level 3

7.1.8.3 Diagnostic Data

Diagnostic Data: For the module in slot n (n = 0~1), index 0xA000 + 0x10 × n:

Index	0xA000+0x10*n: Input 8AI(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	8
1	Module Diagnosis information	USINT	RO	NO	0
2	Ch 0: Diagnosis information	USINT	RO	NO	0
3	Ch 1: Diagnosis information	USINT	RO	NO	0
...	...	...	...	...	...
8	Ch 7: Diagnosis information	USINT	RO	NO	0

For the specific meanings, refer to the “Diagnostics” section.

7.1.9 4AO(C3)

Introduction: The 4AO (C3) module is a 4-channel analog output module with switchable voltage/current output. The module has an accuracy of 0.1% and supports the following ranges: 0–20 mA, 4–20 mA, -5–5 V, 0–5 V, -10–10 V, and 0–10 V. Terminal types include three-in-one terminals and three-position E-CON terminals. The module provides rich configuration options, including data format, channel-level range selection, and channel-level filtering functions.

- **Name:** 4AO (C3)
- **Module Type:** AO
- **Module ID:** 0x00000305

7.1.9.1 Process Data (PDO)

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1600 + 0x01 \times n$:

Index	0x1600+0x01*n: RxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Output Mapping 1	UDINT	RO	NO	0x70n00101
2	Output Mapping 2	UDINT	RO	NO	0x70n00201
3	Output Mapping 3	UDINT	RO	NO	0x70n00301
4	Output Mapping 4	UDINT	RO	NO	0x70n00401

Process Data: For the module in slot n ($n = 0-1$), index $0x7000 + 0x10 \times n$:

Index	0x7000+0x10*n: Output 4AO(C3)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	AO0	INT	RO	YES	0
2	AO1	INT	RO	YES	0
3	AO2	INT	...	...	...
4	AO3	INT	RO	YES	0

7.1.9.2 Configuration Data (SDO)

For the module in slot n ($n = 0-1$), index $0x8000 + 0x10 \times n$:

Index	0x8000+0x10*n: Parameter 4AO(C3)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	40
2	Type string	STRING(30)	RW	NO	AI
3	Name string	STRING(30)	RW	NO	4AO(C3)
10	Module ident	UDINT	RW	NO	0x00000305
11	Slot	UINT	RW	NO	n
32	Data format	DT0802EN1 6	RW	NO	0
33	Ch 0: Measurement range	DT080BEN1 6	RW	NO	0
34	Ch 0: Substitute value	INT	RW	NO	0
...	...	...	...	...	...
40	Ch 3: Substitute value	INT	RW	NO	0

"The module supports three data formats. For 0–20 mA, 4–20 mA, 0–5 V, and 0–10 V (positive ranges), selecting "–27648 – 27648 | 0–27648" corresponds to "0–27648." Similarly, for –5–5 V and –10–10 V (bipolar ranges), selecting "–27648 – 27648 | 0–27648" corresponds to "–27648 – 27648."

DT0802EN16	
Value	Description
0	–27648 ~ 27648 0 ~ 27648
1	–15000 ~ 15000 0 ~ 30000

2	-32767~32767 0~32767
---	----------------------

Digital-to-Analog Conversion Table for Different Data Formats

Range	I/U	Value			Status
		-27648~27648 0~27648	-15000~15000 0~30000	-32767~32767 0~32767	
0 ~ 20 mA	23.52mA	32511	/	/	Overloading
	21mA	29030	31500	-	
	20mA	27648	30000	32767	Nominal range
	10mA	13824	15000	16384	
	0mA	0	0	0	
4~20mA	22.81mA	32511	/	/	Overloading
	21mA	29376	31875	-	
	20mA	27648	30000	32767	Nominal range
	12mA	13824	15000	16384	
	4mA	0	0	0	
	3.6mA	-691	-615	-819	Underloading
	1.19mA	-4864	/	/	
	1mA	-5184	-5625	-6144	Break line
0~10V	10.2V	28201	30600	-	Overloading
	10 V	27648	30000	32767	Nominal range
	5V	13824	15000	16384	
	0V	0	0	0	
±10 V	10.2V	28201	15300	-	Overloading
	10V	27648	15000	32767	Nominal range
	5V	13824	7500	16384	
	0V	0	0	0	

	-5V	-13824	-7500	-16384	
	-10V	-27648	-15000	-32767	
	-10.2V	-28201	-15300	-	Underloading
0~5V	5.1V	28201	30600	-	Overloading
	5 V	27648	30000	32767	Nominal range
	2.5V	13824	15000	16384	
	0V	0	0	0	
±5 V	5.1V	28201	15300	-	Overloading
	5V	27648	15000	32767	Nominal range
	2.5V	13824	7500	16384	
	0V	0	0	0	
	-2.5V	-13824	-7500	-16384	
	-5V	-27648	-15000	-32767	
	-5.1V	-28201	-15300	-	Underloading

Ch x: Measurement range

DT0804EN16	
Value	Description
0	0~20mA
1	4~20mA
2	-10~10V
3	0~10V
4	-5~5V
5	0~5V

Ch x: Substitute Value — The configurable range refers to the “Digital-to-Analog Mapping Table.”

7.1.10 4AI2AO(I5)

Introduction: The 4AI2AO (I5) module is a combined module with 4-channel analog input and 2-channel analog output (current). The module has an accuracy of 0.1% and supports the following ranges: 0–20 mA and 4–20 mA. The terminal type is a three-in-one terminal. The module provides rich configuration options, including data format, channel-level range selection, channel-level filtering functions, and substitute values.

- **Name:** 4AI2AO (I5)
- **Module Type:** AIAO
- **Module ID:** 0x0000030B

7.1.10.1 Process Data (PDO)

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1A00 + 0x01 \times n$:

Index	0x1A00+0x01*n: TxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
3	Input Mapping 3	UDINT	RO	NO	0x60n00301
4	Input Mapping 4	UDINT	RO	NO	0x60n00801

Process Data: For the module in slot n ($n = 0-1$), index $0x6000 + 0x10 \times n$:

Index	0x6000+0x10*n: Input 8AI(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	4
1	Input Mapping 1	UDINT	RO	NO	0x60n00101
2	Input Mapping 2	UDINT	RO	NO	0x60n00201
3	Input Mapping 3	UDINT	RO	NO	0x60n00301
4	Input Mapping 4	UDINT	RO	NO	0x60n00801

Mapped Data: For the module in slot n ($n = 0-1$), index $0x1600 + 0x01 \times n$:

Index	0x1600+0x01*n: RxPDO Mapping				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value

0	Number of entries	USINT	RO	NO	2
1	Output Mapping 1	UDINT	RO	NO	0x70n00101
2	Output Mapping 2	UDINT	RO	NO	0x70n00201

Process Data: For the module in slot n (n = 0–1), index 0x7000 + 0x10 × n:

Index	0x7000+0x10*n: Output 4AI2AO(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	2
1	AO0	INT	RO	YES	0
2	AO1	INT	RO	YES	0

7.1.10.2 Configuration Data (SDO)

For the module in slot n (n = 0–1), index 0x8000 + 0x10 × n:

Index	0x8000+0x10*n: Parameter 4AI2AO(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	48
2	Type string	STRING(30)	RW	NO	AIAO
3	Name string	STRING(30)	RW	NO	4AI2AO(I5)
10	Module ident	UDINT	RW	NO	0x0000030B
11	Slot	UINT	RW	NO	n
32	Data format	DT0802EN1 6	RW	NO	0
33	Ch 0: AI channel diagnostics	DT080CEN 16	RW	NO	0
34	Ch 0: AI measurement range	DT0804EN1 6	RW	NO	0x01
35	Ch 0: AI input filter level	DT0807EN1 6	RW	NO	0x01
36	Ch 1: AI channel diagnostics	DT080CEN 16	RW	NO	0

37	Ch 1: AI measurement range	DT0804EN16	RW	NO	0x01
38	Ch 1: AI input filter level	DT0807EN16	RW	NO	0x01
39	Ch 2: AI channel diagnostics	DT080CEN16	RW	NO	0
40	Ch 2: AI measurement range	DT0804EN16	RW	NO	0x01
41	Ch 2: AI input filter level	DT0807EN16	RW	NO	0x01
42	Ch 3: AI channel diagnostics	DT080CEN16	RW	NO	0
43	Ch 3: AI measurement range	DT0804EN16	RW	NO	0x01
44	Ch 3: AI input filter level	DT0807EN16	RW	NO	0x01
45	Ch 0: AO measurement range	DT080BEN16	RW	NO	0
46	Ch 0: AO substitute value	INT	RW	NO	0
47	Ch 1: AO measurement range	DT080BEN16	RW	NO	0
48	Ch 1: AO substitute value	INT	RW	NO	0

The module supports three data formats. For 0–20 mA and 4–20 mA (positive ranges), selecting “-27648 – 27648 | 0–27648” corresponds to “0–27648.”

Data format

DT0802EN16	
Value	Description

0	-27648~27648 0~27648
1	-15000~15000 0~30000
2	-32767~32767 0~32767

Digital-to-Analog Conversion Table for Different Data Formats

Range	I/U	Value			Status
		-27648~27648 0~27648	-15000~15000 0~30000	-32767~32767 0~32767	
0 ~ 20 mA	23.52mA	32511	/	/	Overloading
	21mA	29030	31500	-	
	20mA	27648	30000	32767	Nominal range
	10mA	13824	15000	16384	
	0mA	0	0	0	
4~20mA	22.81mA	32511	/	/	Overloading
	21mA	29376	31875	-	
	20mA	27648	30000	32767	Nominal range
	12mA	13824	15000	16384	
	4mA	0	0	0	
	3.6mA	-691	-615	-819	Underloading
	1.19mA	-4864	/	/	
	1mA	-5184	-5625	-6144	Break line
0~10V	10.2V	28201	30600	-	Overloading
	10 V	27648	30000	32767	Nominal range
	5V	13824	15000	16384	
	0V	0	0	0	
±10 V	10.2V	28201	15300	-	Overloading
	10V	27648	15000	32767	Nominal range
	5V	13824	7500	16384	

	0V	0	0	0	
	-5V	-13824	-7500	-16384	
	-10V	-27648	-15000	-32767	
	-10.2V	-28201	-15300	-	
0~5V	5.1V	28201	30600	-	Overloading
	5 V	27648	30000	32767	Nominal range
	2.5V	13824	15000	16384	
	0V	0	0	0	
±5 V	5.1V	28201	15300	-	Overloading
	5V	27648	15000	32767	Nominal range
	2.5V	13824	7500	16384	
	0V	0	0	0	
	-2.5V	-13824	-7500	-16384	
	-5V	-27648	-15000	-32767	
	-5.1V	-28201	-15300	-	Underloading

Values highlighted in red in the table indicate the module's over-limit and under-limit error conditions. The alarm is triggered only when the value exceeds the upper limit (greater than) or falls below the lower limit (less than). For the "-32767 – 32767 | 0–32767" data format, no over-limit error indication exists.

Note: The over-20 mA current detection function is supported only in firmware versions V1.1.9 or above.

Ch x: Channel diagnostics

DT080CEN16	
Value	Description
1	Disable
2	Enable

Ch x: Measurement range

DT0804EN16	
Value	Description
0	0~20mA
1	4~20mA

The higher the filter level, the stronger the filtering effect.

Ch x: Input Filter Level

DT0807EN16	
Value	Description
0	Filter level 0
1	Filter level 1
2	Filter level 2
3	Filter level 3

7.1.10.3 Diagnostic Data

Diagnostic Data: For the module in slot n (n = 0~1), index 0xA000 + 0x10 × n:

Index	0xA000+0x10*n: Input 8AI(I5)				
Sub-index	Name	Data Types	Access Type	Mappable	Default Value
0	Number of entries	USINT	RO	NO	5
1	Module Diagnosis information	USINT	RO	NO	0
2	Ch 0: Diagnosis information	USINT	RO	NO	0
3	Ch 1: Diagnosis information	USINT	RO	NO	0
4	Ch 2: Diagnosis information	USINT	RO	NO	0
5	Ch 3: Diagnosis information	USINT	RO	NO	0

For the specific meanings, refer to the “Diagnostics” section.

8. Diagnostics

Different module types provide different diagnostic information. The diagnostic information includes module-level diagnostics and channel-level diagnostics. Currently, modules that support diagnostic functions include 16DIO, 4AI, and 8AI.

Note: The 4–20 mA current input supports open-circuit (wire break) detection.

8.1 Module-Level Diagnostics

When an error occurs on any channel, the module diagnostic data becomes valid.

Module Diagnostics	Bit	Name	Description
	0	Reserved	
	1	Reserved	
	2	Reserved	
	3	Channel error	Channel Error Indication
	4	Reserved	
	5	Reserved	
	6	Reserved	
	7	Reserved	

8.2 Channel-Level Diagnostics

Single Channel	Bit	Name	Description
	0	Parameter error	0: No Error; 1: Error
	1	Overload	0: No Error; 1: Error
	2	Line break sensor supply	0: No Error; 1: Error
	3	External short-circuit	0: No Error; 1: Error
	4	Line break signal	0: No Error; 1: Error
	5	Process alarm lost	0: No Error; 1: Error
	6	Lower limit exceeded	0: No Error; 1: Error
	7	Upper limit exceeded	0: No Error; 1: Error

The channel diagnostics supported by 4AI and 8AI modules are as follows:

Single Channel	Bit	Name	Description
	0	Reserved	0: No Error; 1: Error
	1	Reserved	0: No Error; 1: Error
	2	Line break sensor supply	0: No Error; 1: Error
	3	Reserved	0: No Error; 1: Error
	4	Reserved	0: No Error; 1: Error
	5	Reserved	0: No Error; 1: Error
	6	Lower limit exceeded	0: No Error; 1: Error
	7	Upper limit exceeded	0: No Error; 1: Error

The channel diagnostics supported by 16DIO modules are as follows:

Single Channel	Bit	Name	Description
	0	Reserved	0: No Error; 1: Error
	1	Reserved	0: No Error; 1: Error
	2	Reserved	0: No Error; 1: Error
	3	External short-circuit	0: No Error; 1: Error
	4	Reserved	0: No Error; 1: Error
	5	Reserved	0: No Error; 1: Error
	6	Reserved	0: No Error; 1: Error
	7	Reserved	0: No Error; 1: Error

9. Product Functions

9.1 Reset and Upgrade Functions

9.1.1 Reset Function

The module can be restored to factory settings via the reset button. For details, refer to the “Reset Button Description.”

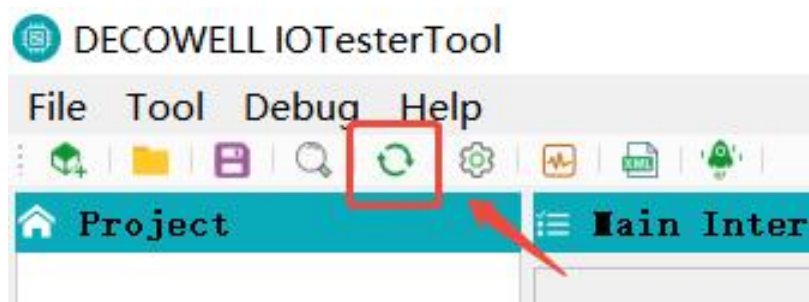
9.1.2 Upgrade Function

The module supports two upgrade methods: via Ethernet port (EtherCAT FoE function) and via the Type-C interface.

9.1.2.1 FoE Firmware Upgrade

The IOTesterTool software supports FoE upgrade functionality. The following takes FoE upgrade operation in IOTesterTool as an example.

(1) Open the upgrade interface

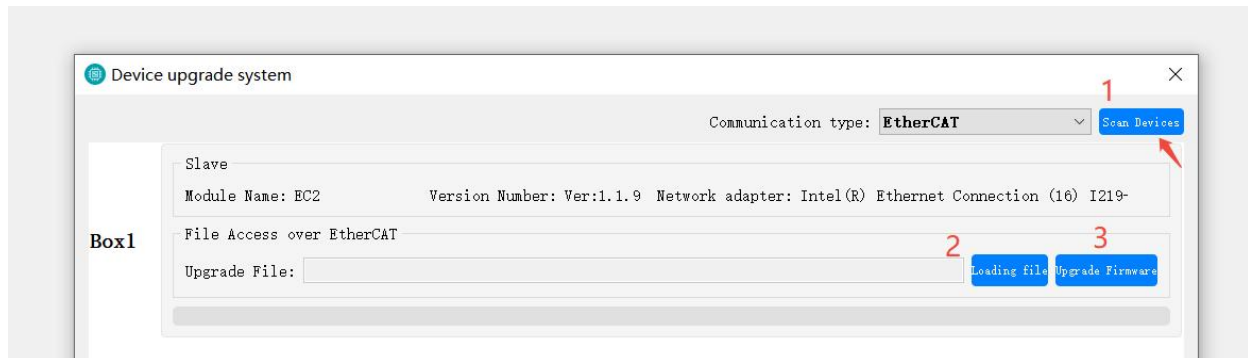


(2) Select the communication method as EtherCAT.



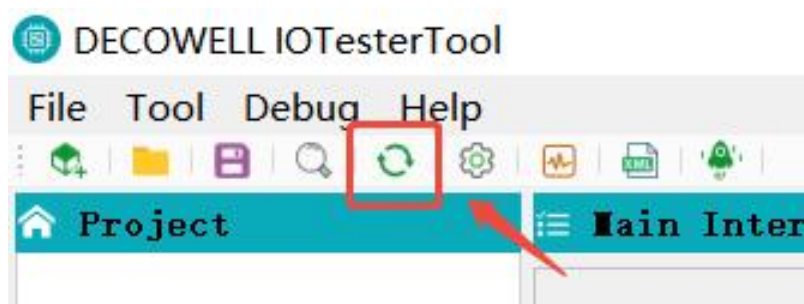
(3) Double-click to scan devices, and detect EC devices in the network that support the FoE function.

(4) Load the upgrade file, then double-click “Upgrade Firmware” to complete the firmware upgrade process.

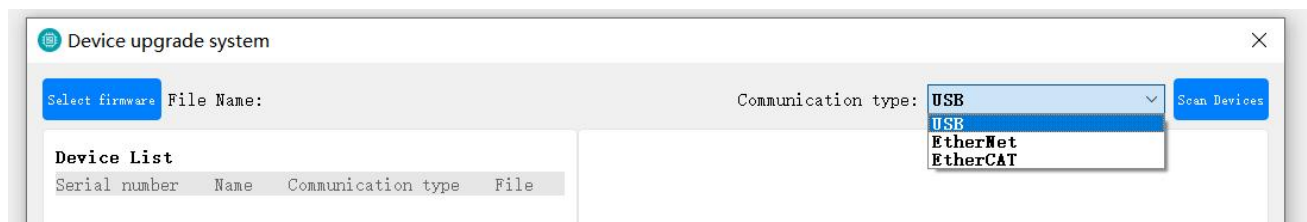


9.1.2.2 Type-C Interface Upgrade

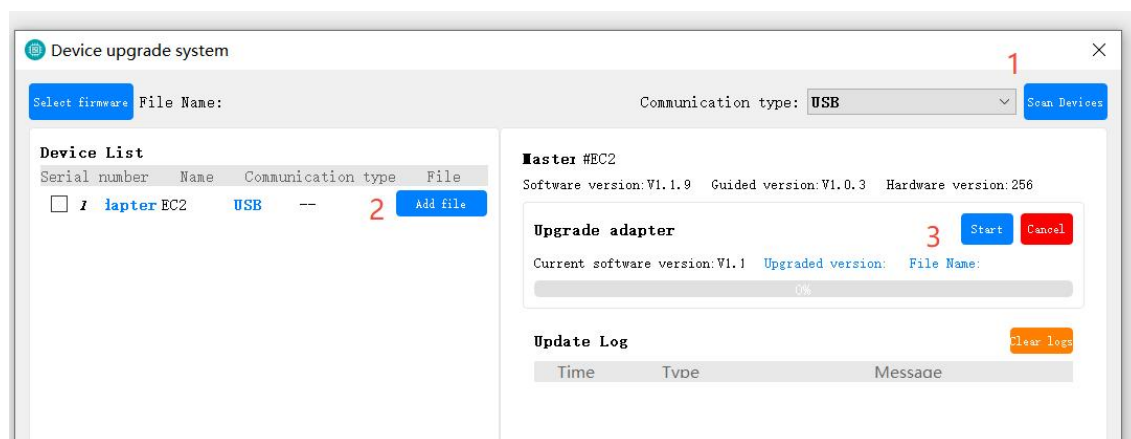
Prepare a Type-C data cable to connect to the RS-EC module. Open the upgrade interface.



Select the communication method as USB and scan for devices.



Add the upgrade file, then start the firmware upgrade.



9.2 Parameter Configuration

The module supports multiple parameter configuration methods. If the PLC startup parameter function is used, parameters set through other methods will become invalid.

9.2.1 Configuration via Engineering Tool

For the operation of configuration via the engineering tool, please refer to “RS-EtherCAT Module Configuration and Application.”

9.2.2 Configuration via IOTesterTool

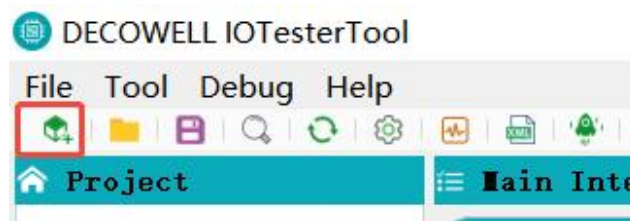
9.2.2.1 Introduction

IOTesterTool is a configuration software for RS series I/O modules. It can connect to the Type-C port of the RS-EC2 module via a Type-C cable and provides the following functions for all modules in the configuration:

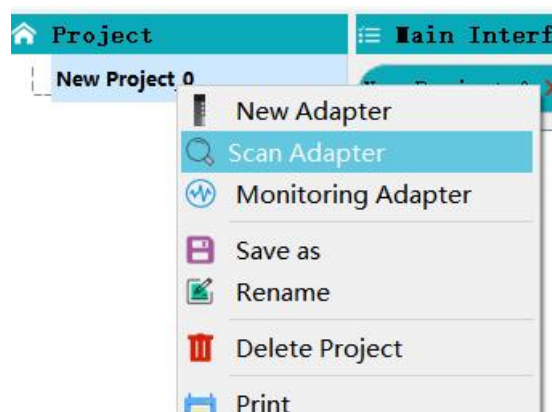
- Quickly obtain module configuration information
- Upgrade module firmware
- Configure module parameters and download them to the module, or upload parameters for verification
- Obtain real-time diagnostic information of the module
- Force output and monitor input functions

9.2.2.2 Operation Procedure

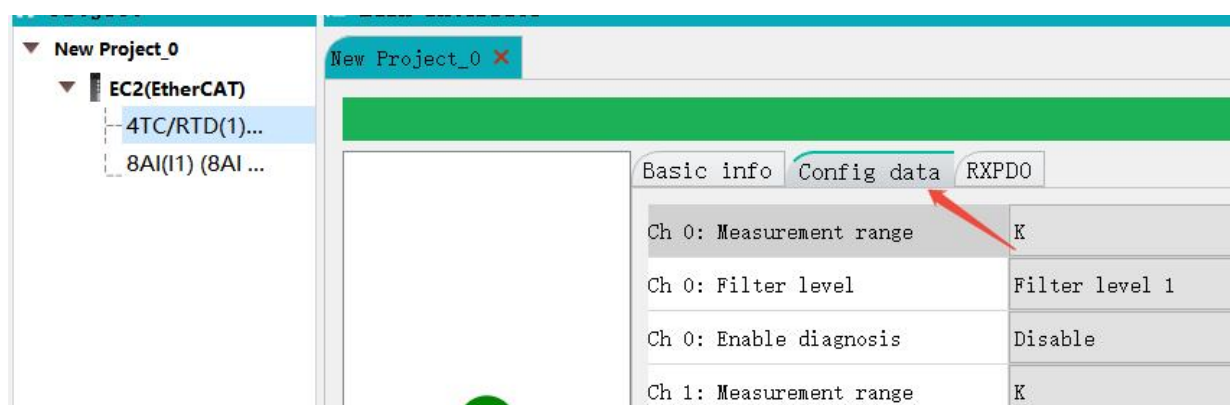
Open the Decowell IOTesterTool software and click the highlighted area in the figure below to create a new project, as shown in the figure below.



Right-click the created project and click “Scan Adapter,” as shown in the figure below.

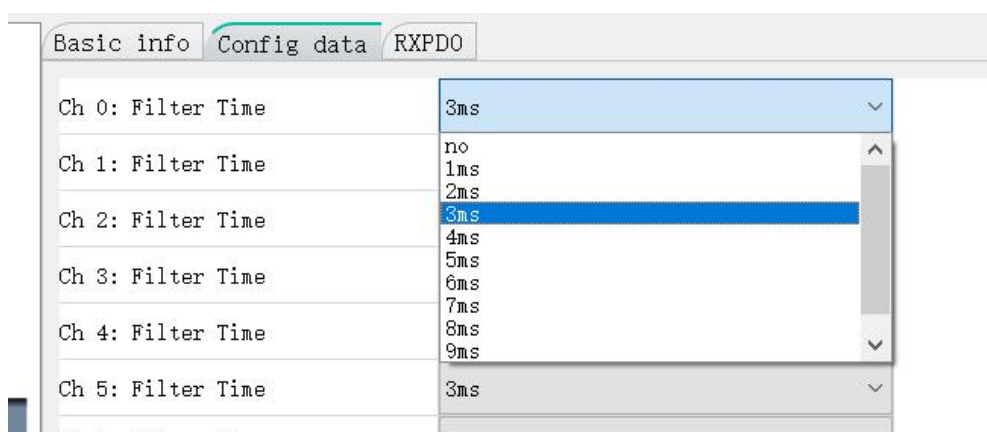


Select the communication mode, then scan the modules and add them to the project. Click the module in the left project panel, locate the “Config data” window, and modify the relevant parameters, as shown in the figure below.



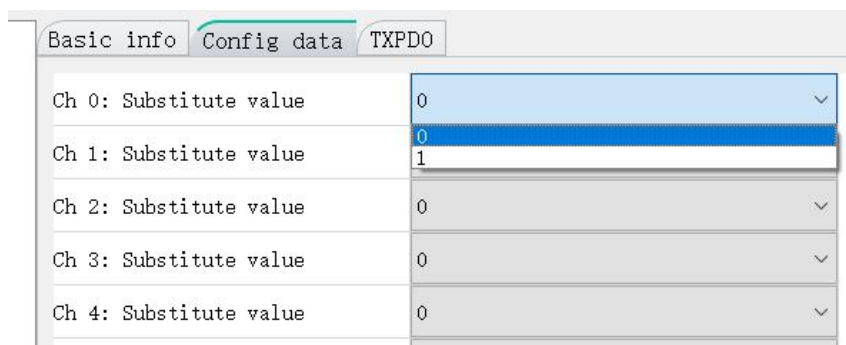
DI Channel Parameter Configuration

The DI channel parameters allow configuration of the filter time from 0–10 ms, with a default value of 3 ms, as shown in the figure below.



DO Channel Parameter Configuration

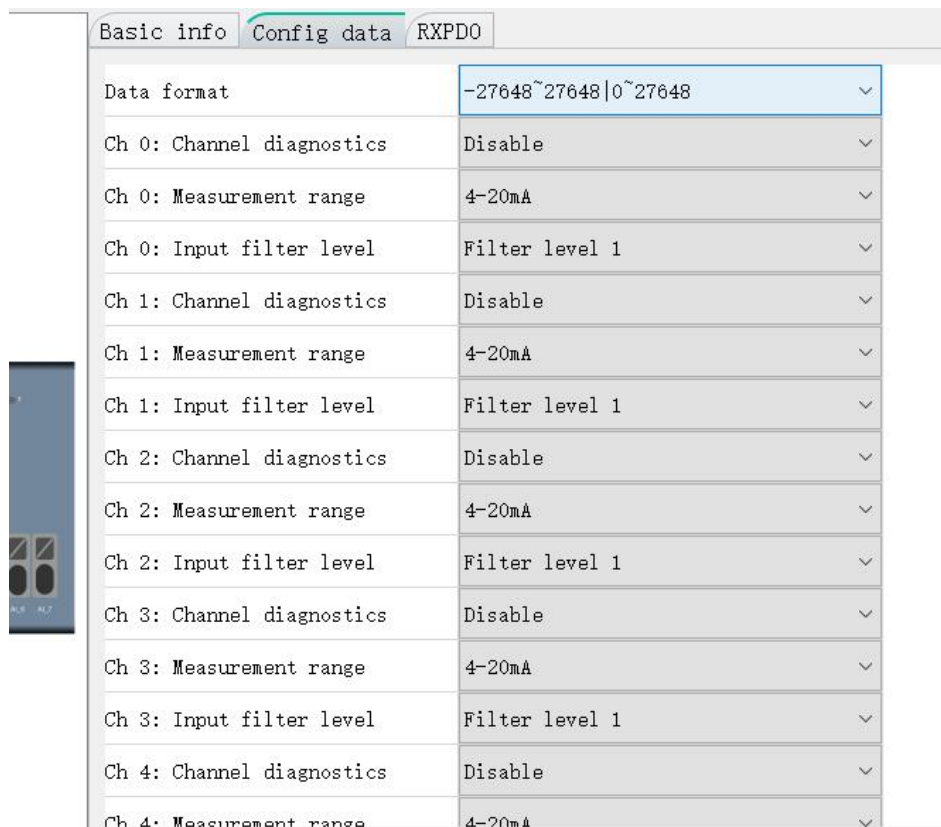
The DO channel parameters allow the substitute value to be configured as 0 or 1.



Channel	Substitute value
Ch 0: Substitute value	0
Ch 1: Substitute value	0
Ch 2: Substitute value	0
Ch 3: Substitute value	0
Ch 4: Substitute value	0

AI Channel Parameter Configuration

The AI channel parameters can be configured for data format, channel diagnostics, range selection, and filter level.



Channel	Parameter	Value
Ch 0	Data format	-27648~27648 0~27648
	Channel diagnostics	Disable
	Measurement range	4-20mA
Ch 1	Channel diagnostics	Disable
	Measurement range	4-20mA
	Input filter level	Filter level 1
Ch 2	Channel diagnostics	Disable
	Measurement range	4-20mA
	Input filter level	Filter level 1
Ch 3	Channel diagnostics	Disable
	Measurement range	4-20mA
	Input filter level	Filter level 1
Ch 4	Channel diagnostics	Disable
	Measurement range	4-20mA
	Input filter level	Filter level 1

Data Format	
Type	Code Range
S7 Data format	-27648~27648 0~27648
OM Data format	-15000~15000 0~30000
BF Data format	-32767~32767 0~32767

Measurement Range	
Signal Type	Range
Voltage	$\pm 10\text{V}/\pm 5\text{V}/0\text{-}5\text{V}/0\text{-}10\text{V}$
Current	0-20mA/4-20mA

AO Module Parameter Configuration

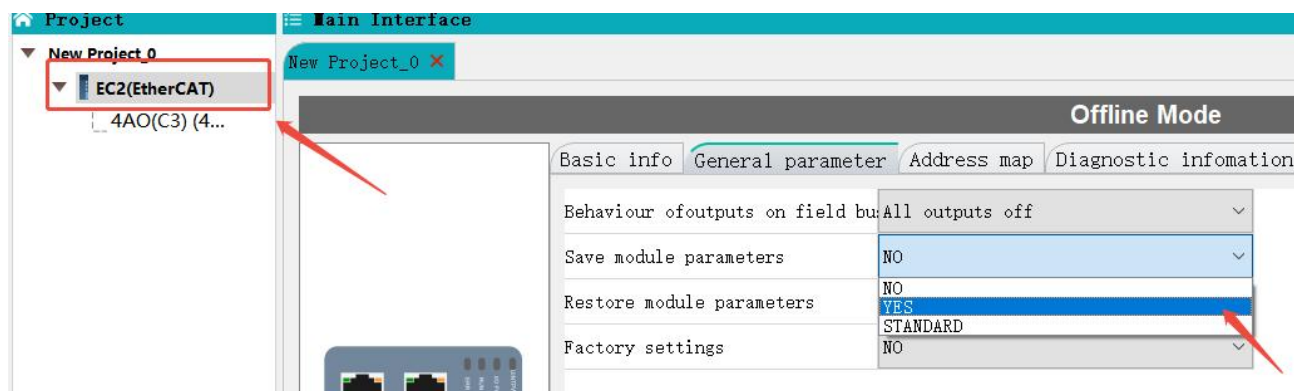
The AO module parameters can be configured for data format, range selection, and substitute value.

Basic info	Config data	TXPDO
Data format	-27648~27648 0~27648	
Ch 0: Measurement range	0~10V	
Ch 0: Substitute value	0	
Ch 1: Measurement range	0~10V	
Ch 1: Substitute value	0	
Ch 2: Measurement range	0~10V	
Ch 2: Substitute value	0	
Ch 3: Measurement range	0~10V	
Ch 3: Substitute value	0	

Data Format	
Type	Code Range
S7 Data format	-27648~27648 0~27648
OM Data format	-15000~15000 0~30000
BF Data format	-32767~32767 0~32767
Measurement Range	
Signal Type	Range
Voltage	$\pm 10\text{V}/\pm 5\text{V}/0\text{-}5\text{V}/0\text{-}10\text{V}$
Current	0-20mA/4-20mA

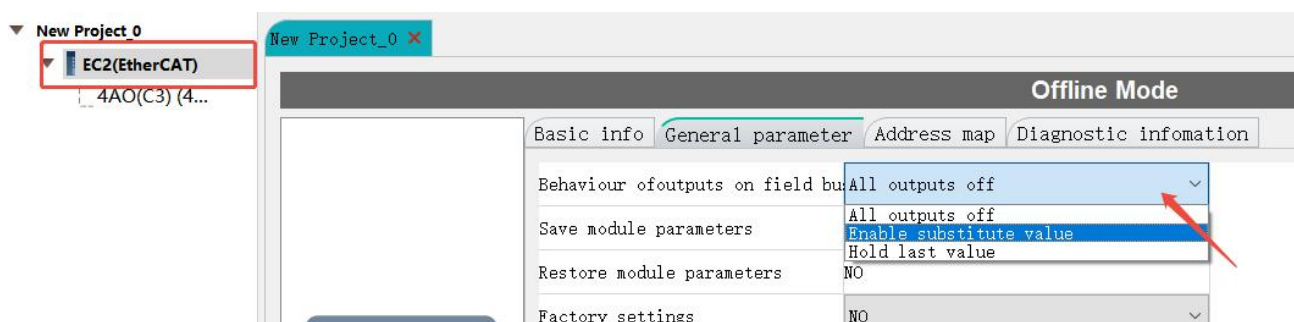
After modifying the parameters, they need to be downloaded to the module. Click the IO panel and then click “Download Configuration.”

If the module parameters need to be retained after power-off, set the adapter parameter “Save module parameters” to “Yes.”



9.2.3 Output Behavior on Bus Error

The module supports three types of output behavior in case of a bus error: reset to zero, substitute value, and hold the last output value. This function can be configured via the parameter “Behaviour of outputs on field bus error” in the IOTesterTool software.



9.2.4 Hot-Swap Behavior

RS series modules adopt a split structure of “communication base + I/O panel,” supporting online hot-swapping under power without shutting down the system power or interrupting bus communication. During operation, only the I/O panel needs to be plugged or unplugged, while the communication base remains fixed, without affecting the normal operation of other modules or the stability of the bus.

The module is equipped with overcurrent protection, reverse polarity protection, and ESD protection mechanisms. The plugging and unplugging process is safe and reliable, effectively preventing circuit impact and equipment damage. After a new panel is inserted,

the system automatically completes identification and configuration loading, enabling plug-and-play without restarting the device or re-downloading the program, greatly simplifying on-site maintenance and reducing recovery time.

When the RS-EC2 is operating, the following situations may occur when hot-swapping modules in the two slots:

1. If a module is removed from any slot, the SYS indicator flashes at 5 Hz, and the other module continues to operate normally.
2. If a module is removed from any slot and then replaced with a module of the same type (e.g., replacing 16DO(N-1) with 16DO(P-2)), the module operates normally after installation, and the SYS indicator returns to flashing at 1 Hz.
3. If a module is removed and replaced with a different type (e.g., replacing 16DO with 8DI8DO), the module will not operate, and its indicator will remain off.
4. The RS-EC2 can operate with modules installed in both slots or only in the first slot. If only the second slot has a module installed, the module will not operate.
5. If only the first slot has a module installed during power-on, any module installed later in the second slot will not operate.

10.RS-EtherCAT module configuration and application

10.1 TwinCAT3

10.1.1 Installing and uninstalling XML document

(1) Install XML document

Copy the XML file that needs to be installed to the TwinCAT3 installation directory, for example, to the path: C:\TwinCAT\3.1\Config\Io\EtherCAT;

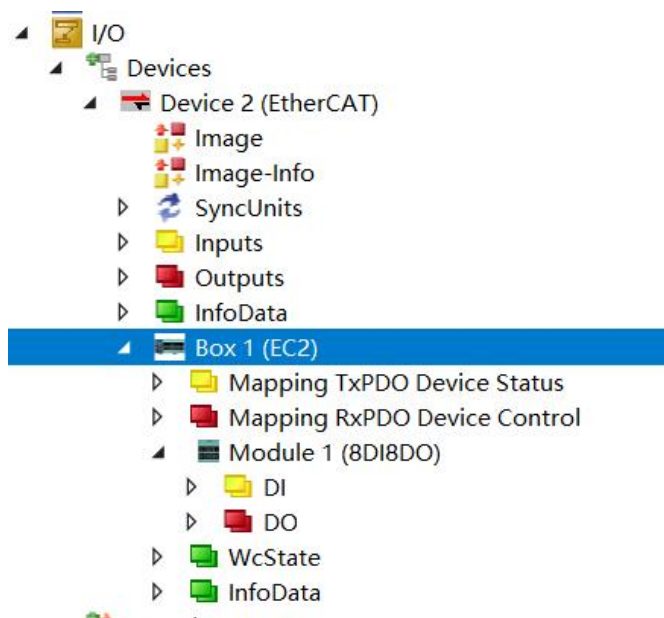
(2) Uninstall XML document

To uninstall the XML file in TwinCAT 3, simply delete the desired XML file from the designated installation directory, such as: C:\TwinCAT\3.1\Config\Io\EtherCAT.

10.1.2 Configuration IO modules

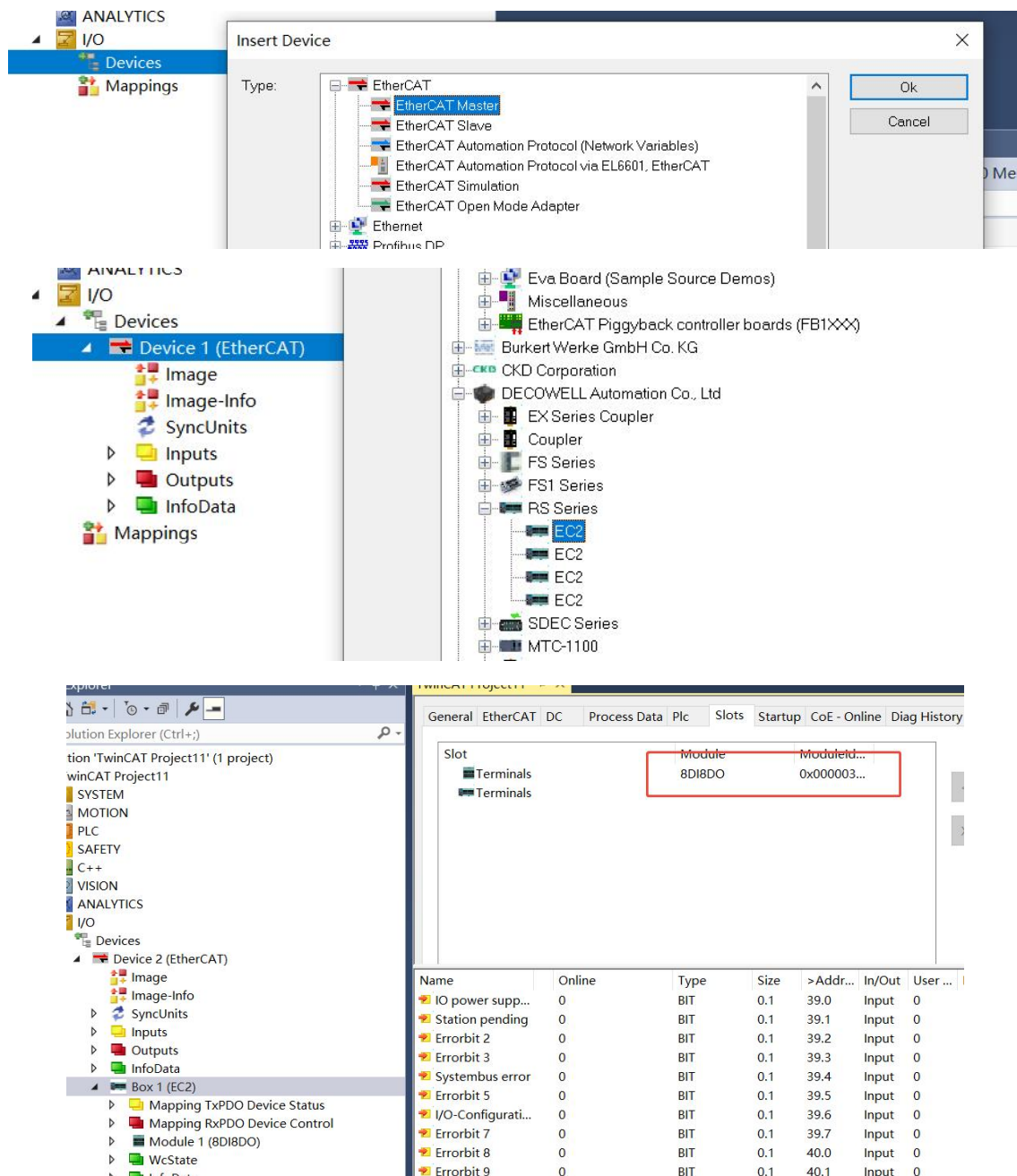
Online Scan IO Modules:

Open TwinCAT3 software to create a project, right-click "Device" and select "Scan" scan the connected IO Module, as shown in the figure below.



Manually add IO modules:

Right-click on "Device" and select "Add New Item". In the pop-up window, choose "EtherCAT Master". Then, right-click the added EtherCAT Master, select "Add New Item", choose the RS module under the "RS Series", and add the corresponding IO modules in the RS slots (e.g., 8DI/8DO in this case).



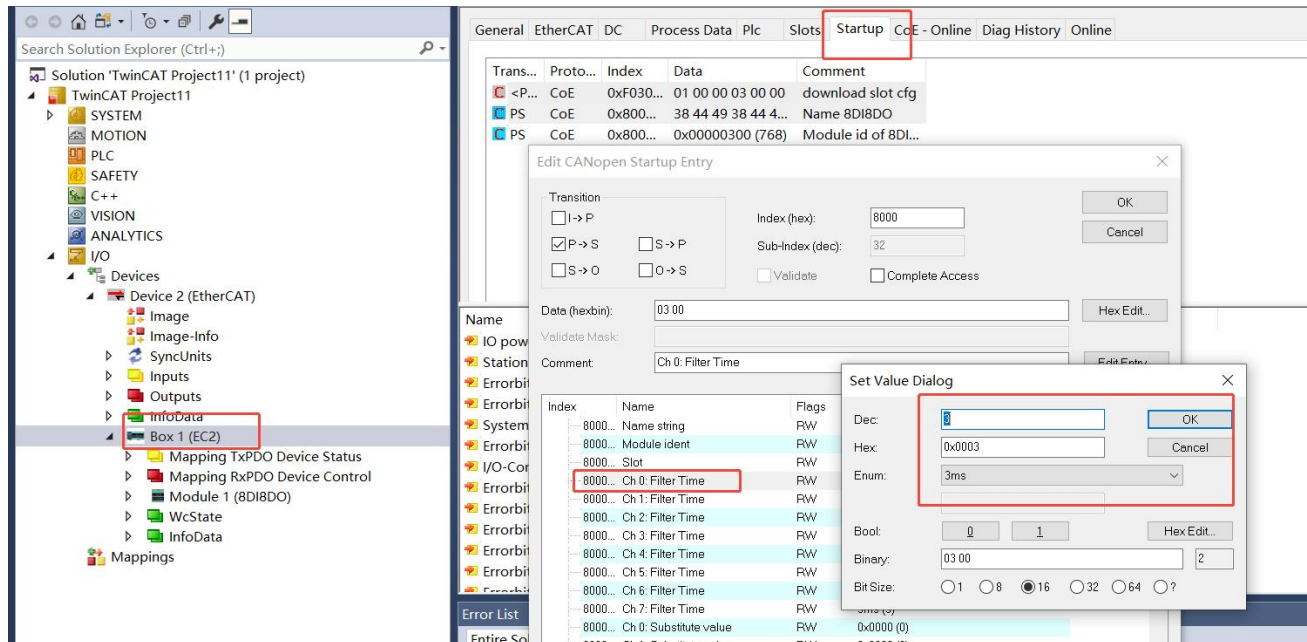
10.1.3 Configuration parameters

The configuration parameters are divided into three sections: DI parameter configuration, DO parameter configuration, and parameter saving. After modifying either DI or DO parameters, the parameters must be saved.

(1) DI Filter time configuration

In the EC2 module, the DI filter time can be configured by setting the startup parameters (the default DI

filter time is 3 ms). The configurable range is 0–10 ms. After completing the parameter configuration, the program must be re-downloaded to the PLC. (In this case, the DI filter time is configured via startup parameters, but it can also be configured online through CoE\Online.)

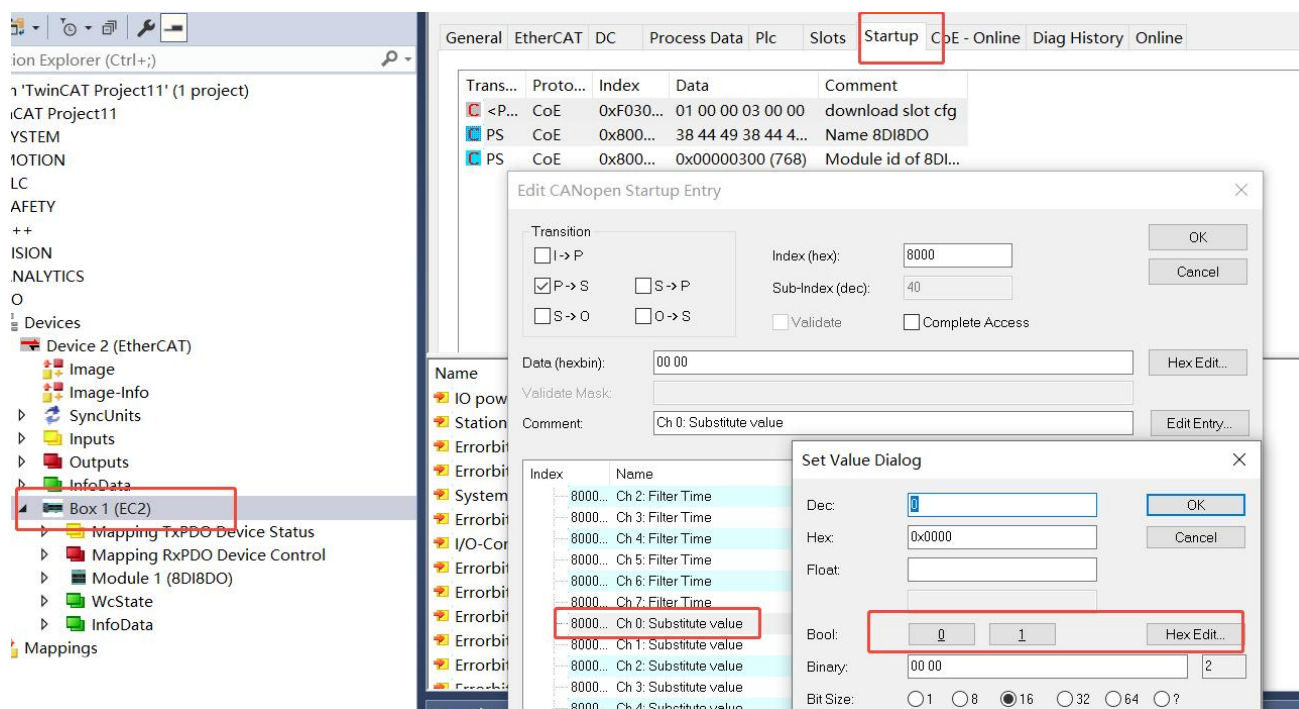


(2) Output configuration when bus communication is abnormal

When the bus communication is abnormal, DO Output values can be configured in three ways:

Parameter Value	illustrate
All output off	The output is OFF
Enable substitute value	Output using replacement values
Hold last value	Keep the last output status of the program

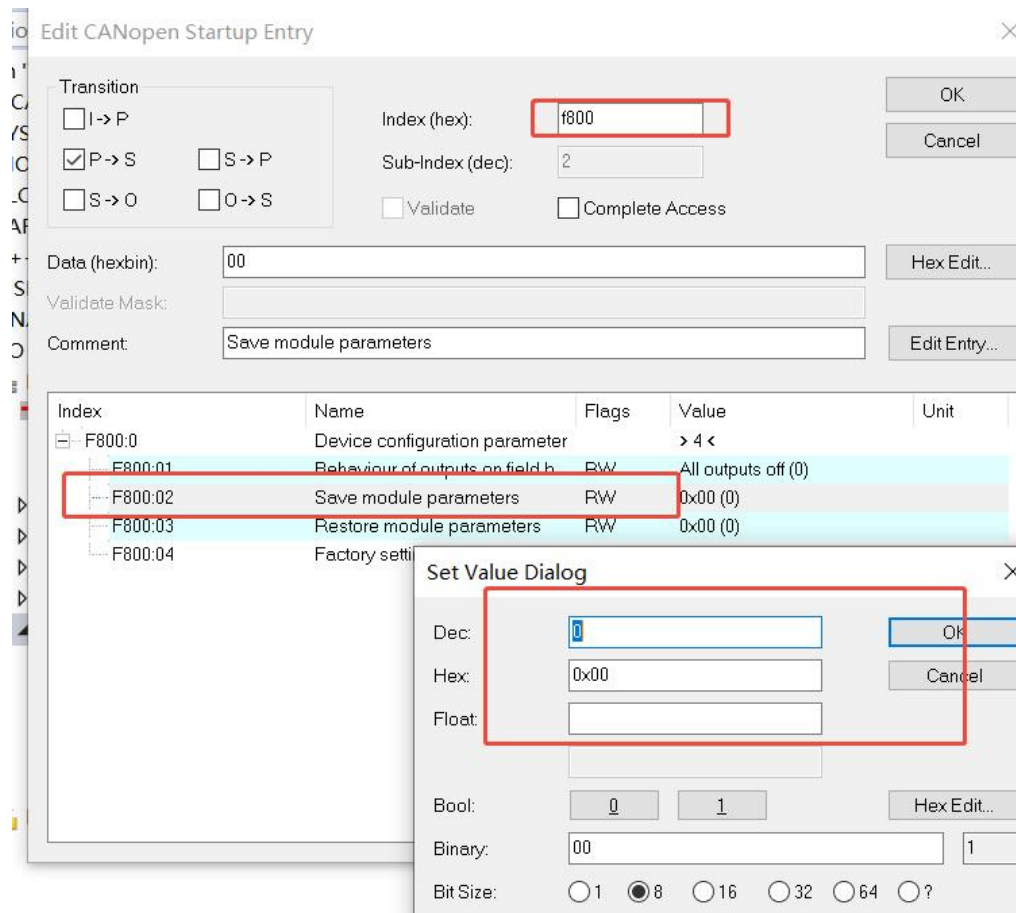
Substitute channel replacement value configuration, the configurable value range is 0 or 1, the default value is 0.



(3) Module parameter storage

After modifying the DI or DO parameters, the value of sub-index 02 under index F800h must be set to 1.

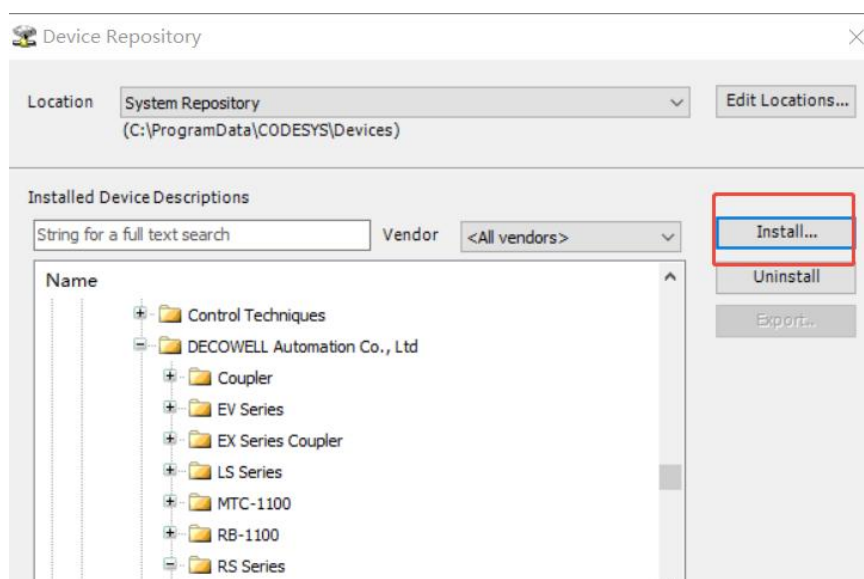
index	Sub-index	name	value	illustrate
F800h	02	Parameter preservation	0	Parameters are not saved, default values
			1	Take effect after power off and restart
			2	Parameters take effect immediately and are lost when power is off



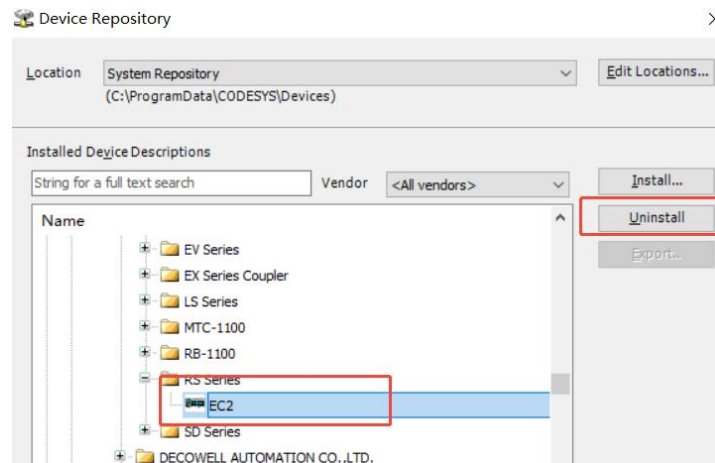
10.2 CODESYS

10.2.1 Installing and uninstalling XML document

(1) Open CODESYS programming software, select "Install" in the device library window, and select the file type to be installed as "EtherCAT XML Device Description Profile".

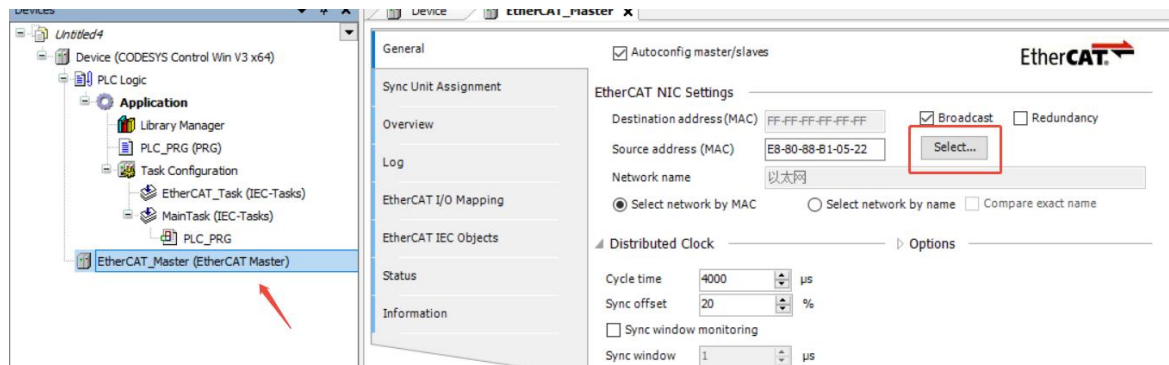


(2) In the device library, select the EtherCAT slave XML document



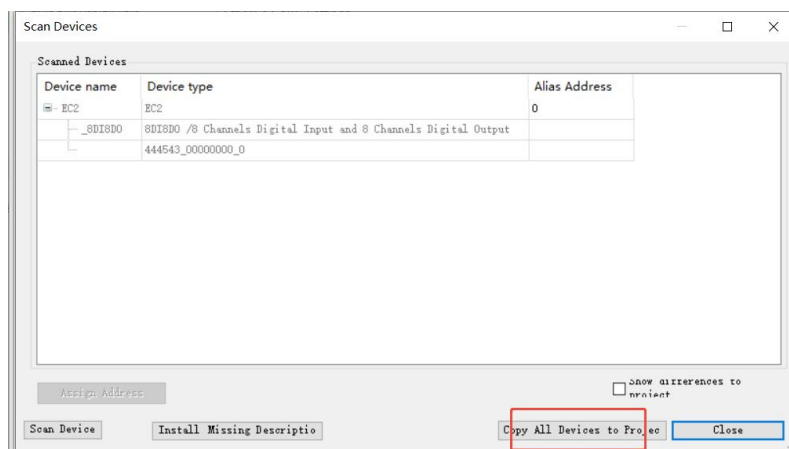
10.2.2 Configuration IO modules

Open the CODESYS programming software to create a project, right-click "Device" to add EtherCAT Master to the project tree, and configure its EtherCAT communication port parameters.



Online Scan IO Modules:

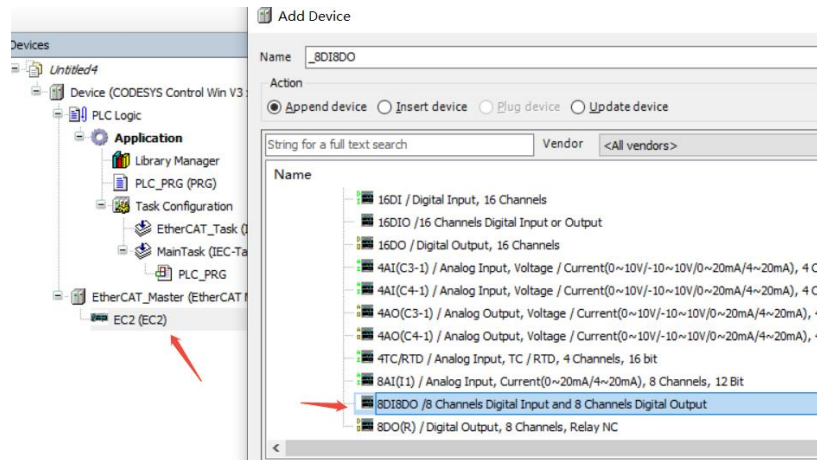
After the configuration is complete, log in to the device and right-click "EtherCAT_Master", select "Scan for devices" and add the IO module is scanned to the project.



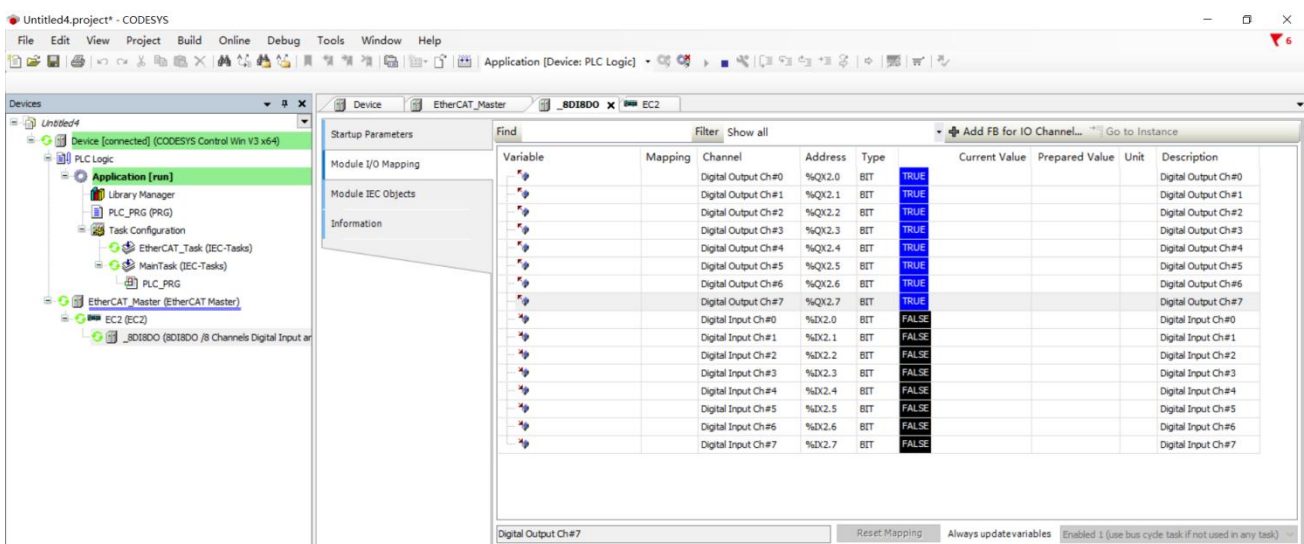
Manually add IO modules:

Right-click "EtherCAT_Master" in the project tree, select "Add Device", then choose "EC2" from the

device library. Next, right-click the EC2 module in the project tree, select "Add Device" again, and choose the IO module type that matches your actual hardware configuration.



Download the program to PLC, run and monitor whether the communication is normal. Double-click "_8DI8DO" to change the output channel value to TRUE and write.

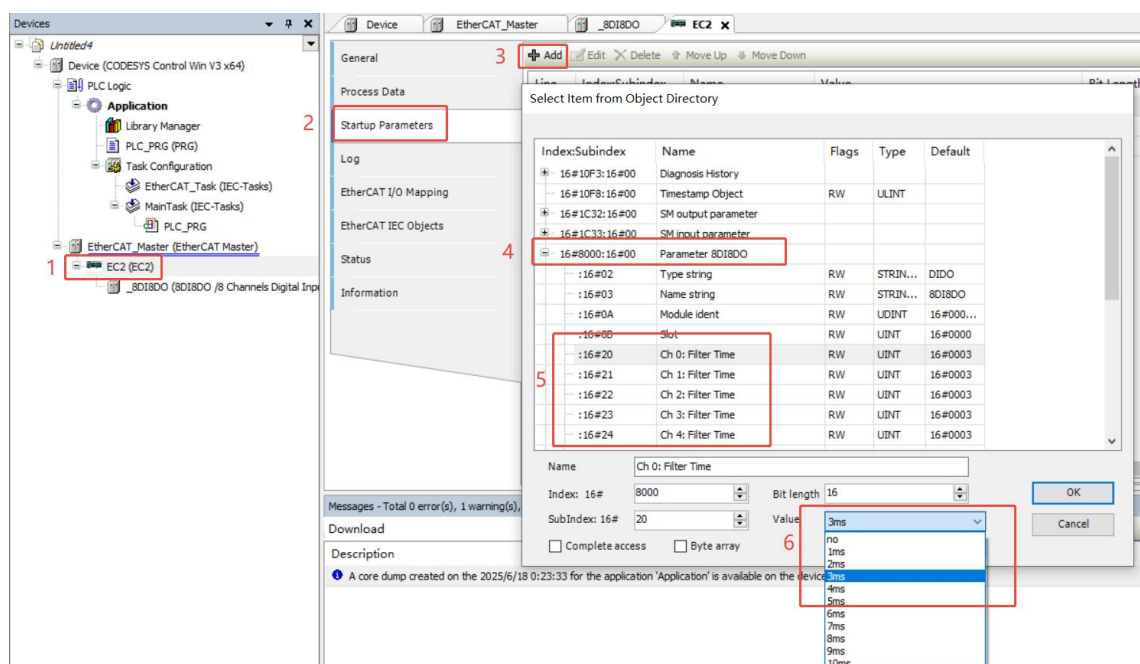


10.2.3 Configuration parameters

Parameter Configuration consists of three parts: DI parameter configuration, DO parameter configuration, and parameter saving. After modifying DI or DO parameters, the changes must be saved.

(1) DI Filter Time Configuration

In the EC2 module, the DI filter time (default: 3ms, configurable range: 0–10ms) is set via startup parameters. After configuration, the program must be re-downloaded to the PLC. (In this example, startup parameters are used for configuration. Alternatively, CoE online parameter configuration can be used.)

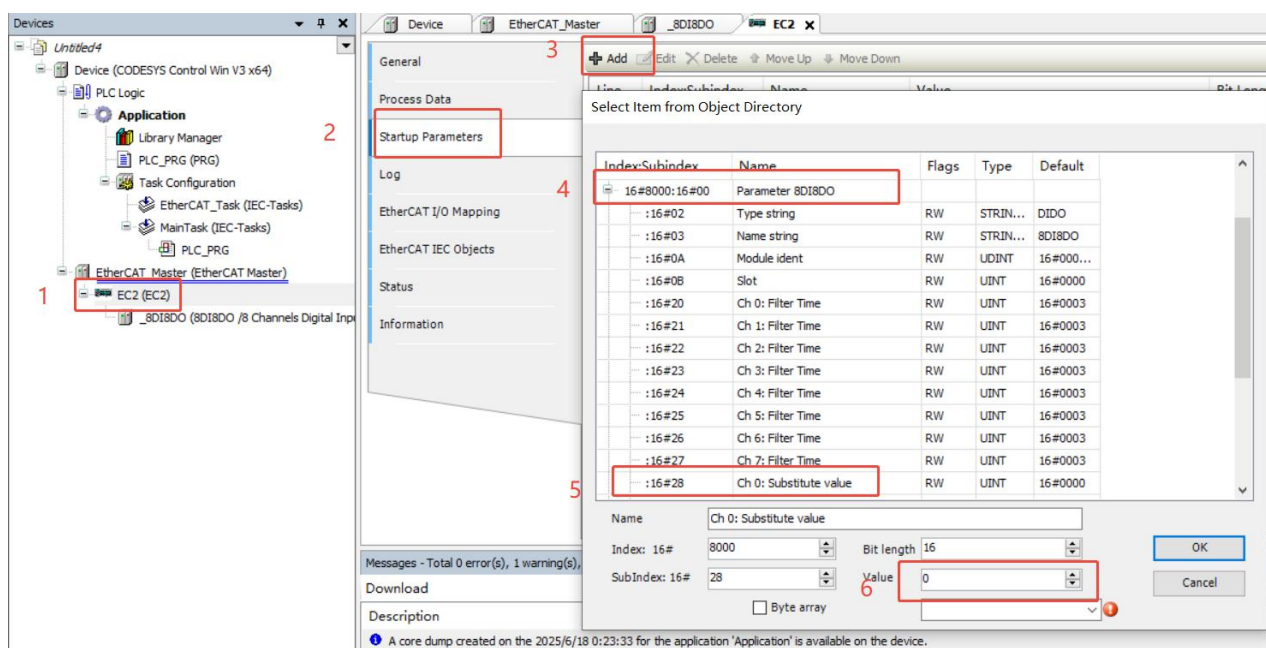


(2) Output configuration when bus communication is abnormal

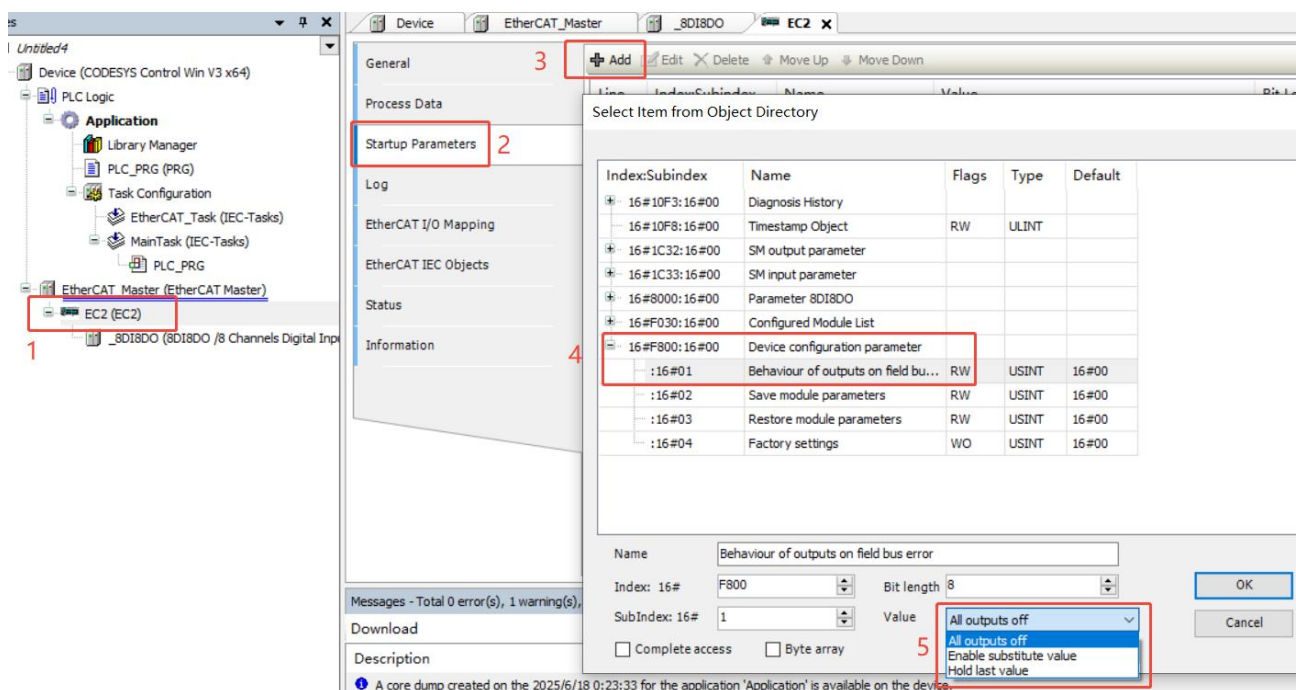
When the bus communication is abnormal, DO output values can be configured in three ways:

Parameter Value	illustrate
All output off	The output is OFF
Enable substitute value	Output using replacement values
Hold last value	Keep the last output status of the program

Substitute channel replacement value configuration, the configurable value range is 0 or 1, the default value is 0.



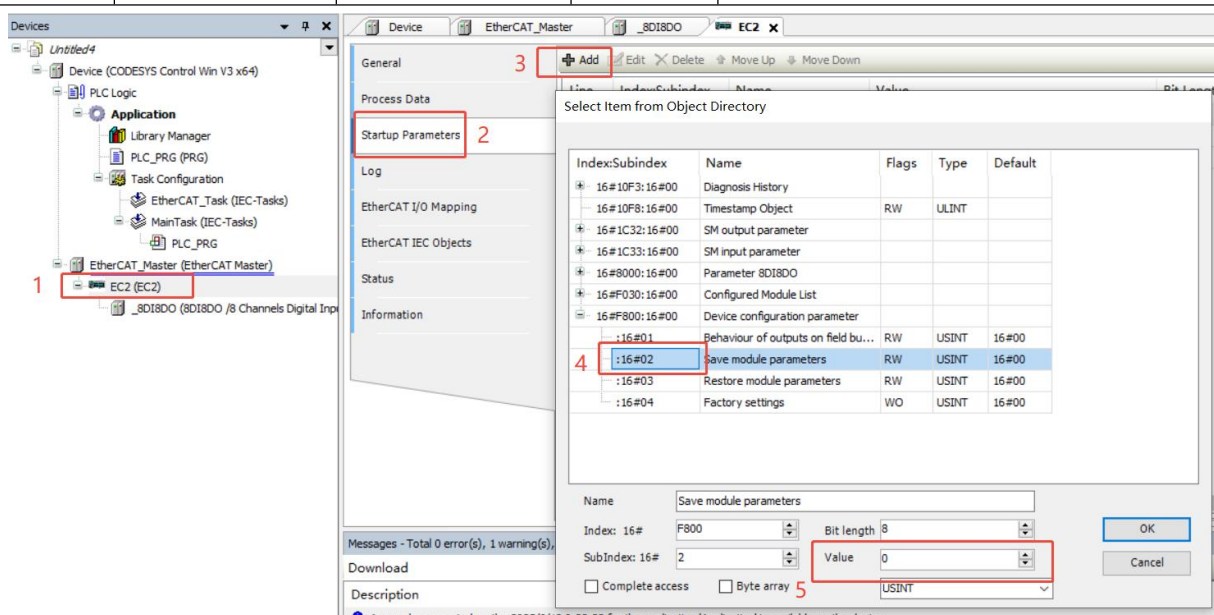
When the bus is abnormal, DO status Settings



(3) Module parameter storage

After modifying DI or DO parameters, the value of sub-index 02 in index F800h must be changed to 1.

index	Sub-index	name	value	illustrate
F800h	02	Parameter preservation	0	Parameters are not saved, default values
			1	Take effect after power off and restart
			2	Parameters take effect immediately and are lost when power is off



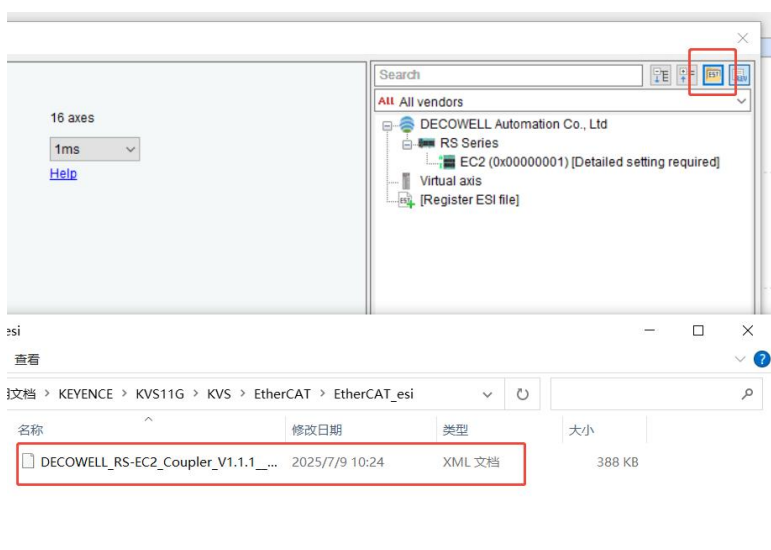
10.3 KV STUDIO

10.3.1 Installing and uninstalling XML document

(1) Double-click "Axis Configuration Settings" under KV-XH16EC, then install the EtherCAT slave XML file in the pop-up axis configuration window.

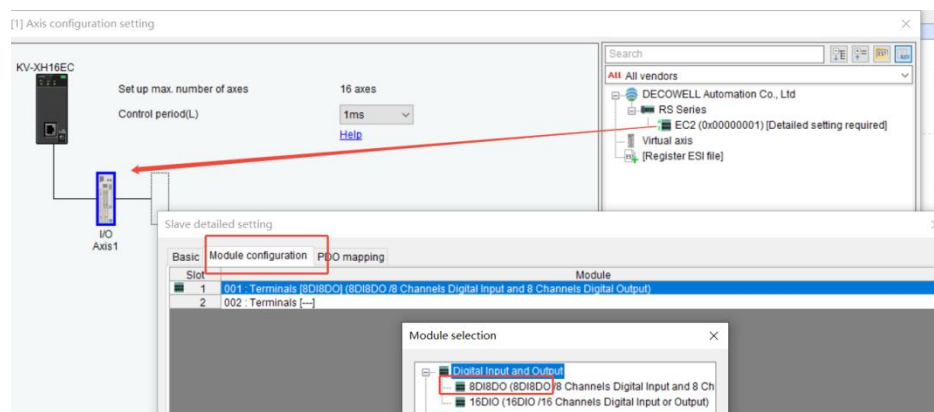


(2) To uninstall the XML file: In the Axis Configuration Settings window, select "Open ESI Folder". Locate and delete the corresponding EtherCAT slave XML file to be removed



10.3.2 Configuration IO modules

In the Axis Configuration Settings window, select the EtherCAT slave station to be configured, and set the module type in the IO slot.



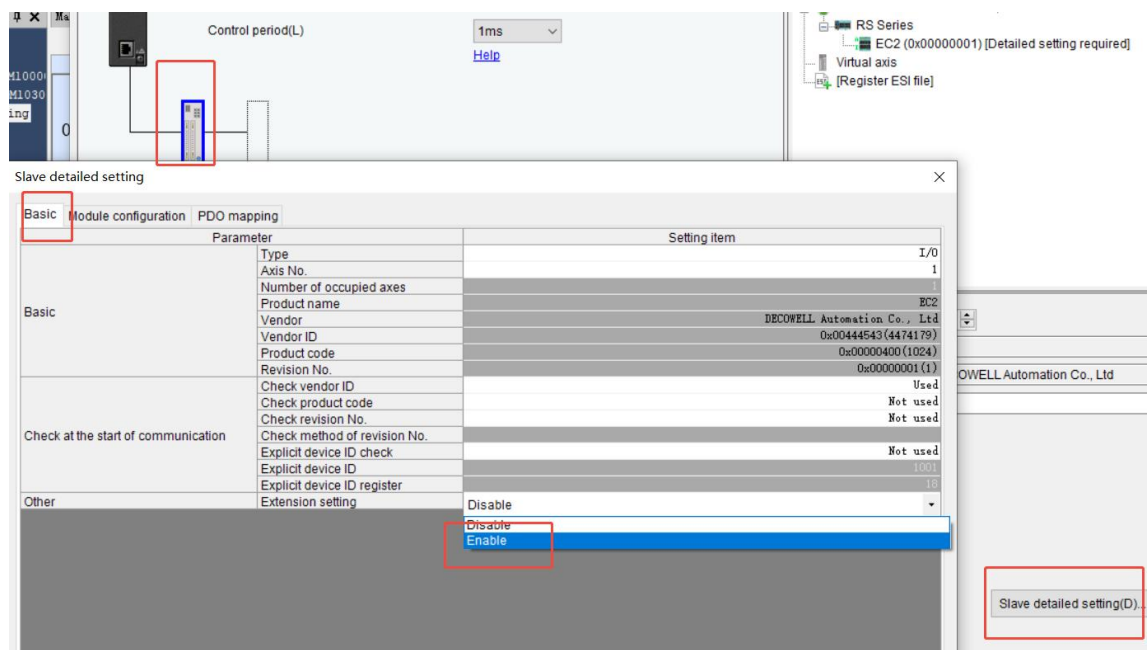
10.3.3 Configuration parameters

Parameter Configuration consists of three parts: DI parameter configuration, DO parameter configuration, and parameter saving. After modifying DI or DO parameters, the changes must be saved.

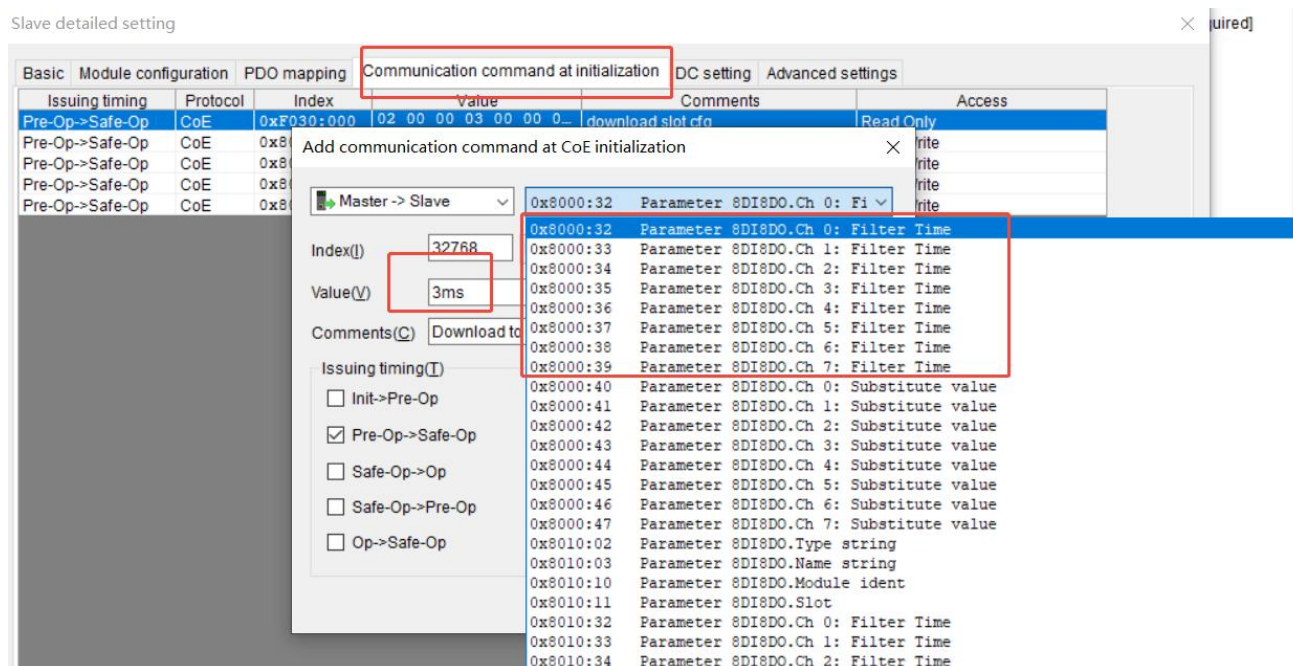
(1) DI Filter Time Configuration

In the EC2 module, the DI filter time is set via startup parameters.

Select the module to be configured, click "Slave Detailed Settings" and start the extended settings.

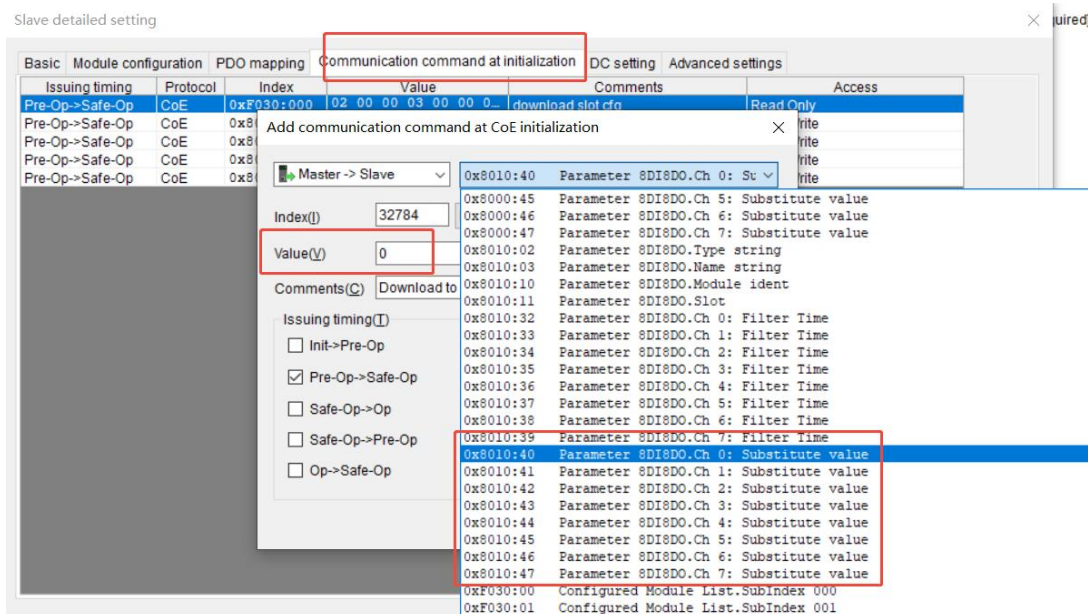


Configure the communication instructions during initialization and select the DI channel, and modify the filter time. (default: 3ms, configurable range: 0–10ms)

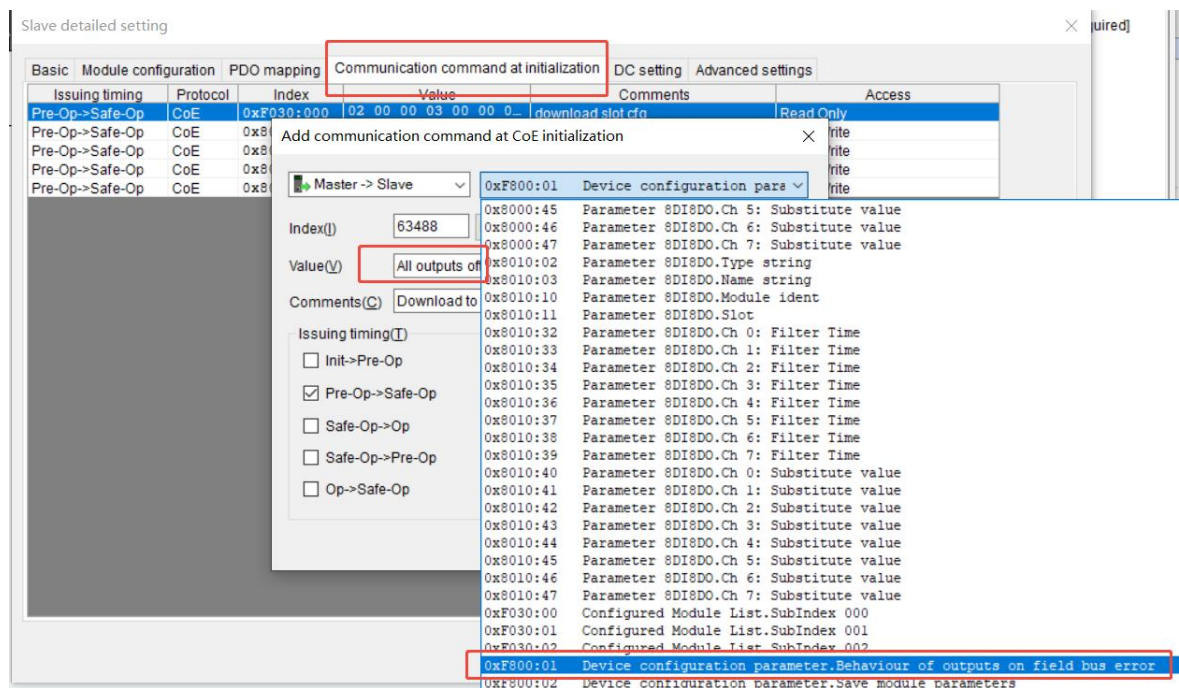


(2) Output configuration when bus communication is abnormal

Substitute Channel replacement value configuration, the configurable value range is 0 or 1, the default value is 0.



When the bus is abnormal, DO Status Settings



When the bus communication is abnormal, DO output values can be configured in three ways:

Parameter Value	illustrate
All output off	The output is OFF
Enable substitute value	Output using replacement values
Hold last value	Keep the last output status of the program

(3) Module parameter storage

After modifying DI or DO parameters, it is required to set the value of Sub-index 02 in Index F800h to 1.

index	Sub-index	name	value	illustrate
F800h	02	Parameter preservation	0	Parameters are not saved, default values
			1	Take effect after power off and restart
			2	Parameters take effect immediately and are lost when power is off

Slave detailed setting

The screenshot shows the 'Slave detailed setting' window with the 'Communication command at initialization' tab selected. A table lists various communication commands. The command '0xF800:02' is highlighted in blue, and its description 'Device configuration parameter.Save module parameters' is also highlighted. On the left side, the 'Value(V)' field is set to '0'.

Issuing timing	Protocol	Index	Value	Comments	Access
Pre-Op->Safe-Op	CoE	0xF030:000	02 00 00 03 00 00 0...	download slot cfg	Read Only
Pre-Op->Safe-Op	CoE	0x8010:00		Add communication command at CoE initialization	write
Pre-Op->Safe-Op	CoE	0x8010:01			write
Pre-Op->Safe-Op	CoE	0x8010:02			write
Pre-Op->Safe-Op	CoE	0x8010:03			write

Master -> Slave

Index(I): 63488

Value(V): 0

Comments(C): Download to

Issuing timing(I):

- ☐ Init->Pre-Op
- ☒ Pre-Op->Safe-Op
- ☐ Safe-Op->Op
- ☐ Safe-Op->Pre-Op
- ☐ Op->Safe-Op

0x8000:45 Parameter 8DI8DO.Ch 5: Substitute value

0x8000:46 Parameter 8DI8DO.Ch 6: Substitute value

0x8000:47 Parameter 8DI8DO.Ch 7: Substitute value

0x8010:02 Parameter 8DI8DO.Type string

0x8010:03 Parameter 8DI8DO.Name string

0x8010:10 Parameter 8DI8DO.Module ident

0x8010:11 Parameter 8DI8DO.Slot

0x8010:32 Parameter 8DI8DO.Ch 0: Filter Time

0x8010:33 Parameter 8DI8DO.Ch 1: Filter Time

0x8010:34 Parameter 8DI8DO.Ch 2: Filter Time

0x8010:35 Parameter 8DI8DO.Ch 3: Filter Time

0x8010:36 Parameter 8DI8DO.Ch 4: Filter Time

0x8010:37 Parameter 8DI8DO.Ch 5: Filter Time

0x8010:38 Parameter 8DI8DO.Ch 6: Filter Time

0x8010:39 Parameter 8DI8DO.Ch 7: Filter Time

0x8010:40 Parameter 8DI8DO.Ch 0: Substitute value

0x8010:41 Parameter 8DI8DO.Ch 1: Substitute value

0x8010:42 Parameter 8DI8DO.Ch 2: Substitute value

0x8010:43 Parameter 8DI8DO.Ch 3: Substitute value

0x8010:44 Parameter 8DI8DO.Ch 4: Substitute value

0x8010:45 Parameter 8DI8DO.Ch 5: Substitute value

0x8010:46 Parameter 8DI8DO.Ch 6: Substitute value

0x8010:47 Parameter 8DI8DO.Ch 7: Substitute value

0xF030:00 Configured Module List.SubIndex 000

0xF030:01 Configured Module List.SubIndex 001

0xF030:02 Configured Module List.SubIndex 002

0xF800:01 Device configuration parameter.Behaviour of outputs on field bus

0xF800:02 Device configuration parameter.Save module parameters

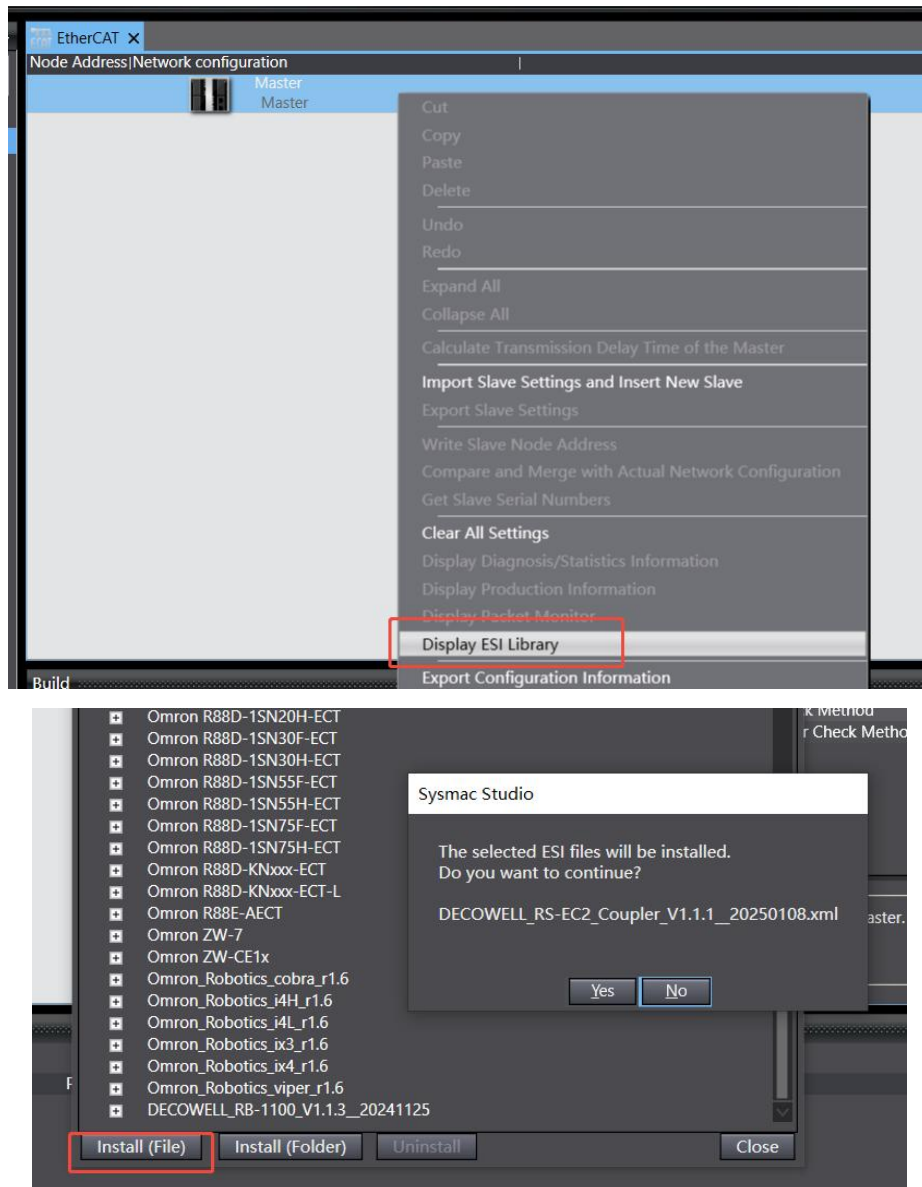
0xF800:03 Device configuration parameter.Restore module parameters

0xF800:04 Device configuration parameter.Factory settings

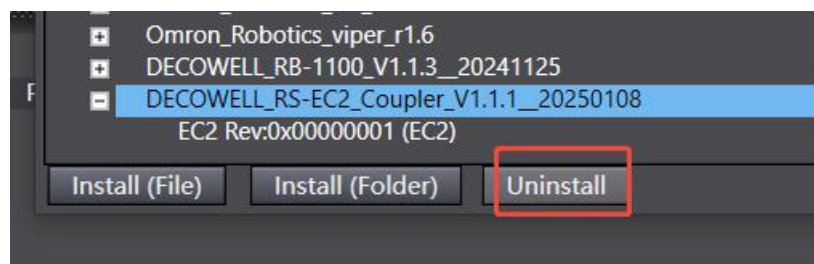
10.4 Sysmac Studio

10.4.1 Installing and uninstalling XML document

(1) To install the XML file, in the ESI library, select the EtherCAT XML file that needs to be installed.



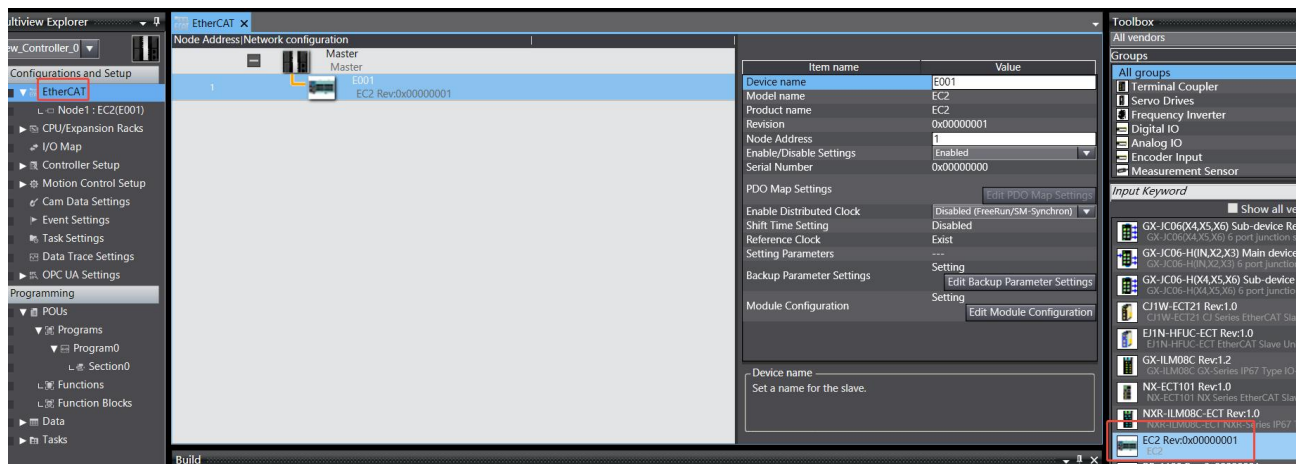
(2) Uninstall XMLFile, in ESIIn the library, select the EtherCAT XMLdocument.



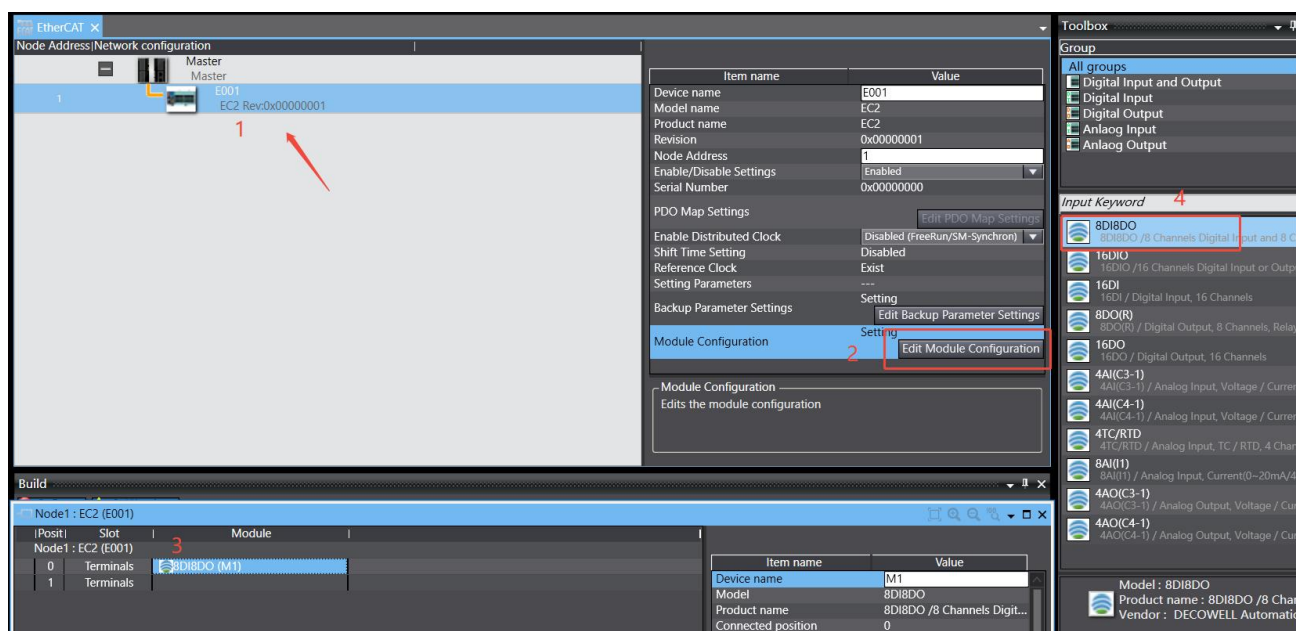
10.4.2 Configuration IO modules

Manually add IO modules:

Double-click "EtherCAT" and add the RS module in the EtherCAT window.

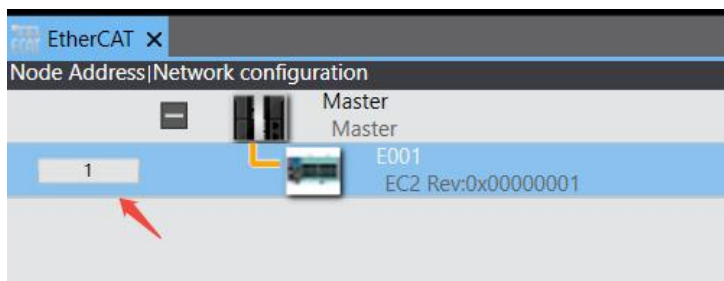


Configure IO slots: In the EtherCAT window, select the RS module in the node, click "Edit Module Configuration", and configure the module model in the slots (The configuration must match the actual modules; the example uses 8DI/8DO modules).



Node settings:

The RS series EtherCAT modules can set node addresses via DIP switches - refer to section 2.1.3 for DIP switch configuration instructions. If the DIP switch sets the node to 5, manually modify the configured RS module node to 5. Communication will fail if node addresses don't match.

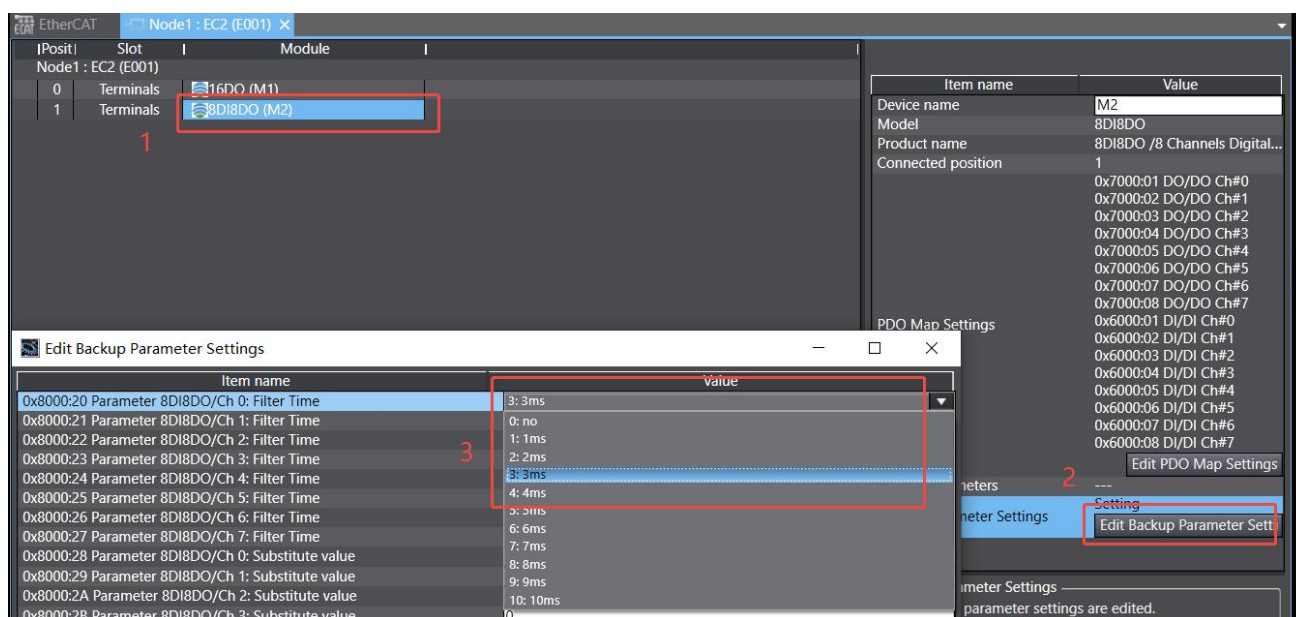


10.4.3 Configuration parameters

Parameter Configuration consists of three parts: DI parameter configuration, DO parameter configuration, and parameter saving. After modifying DI or DO parameters, the changes must be saved.

(1) DI Filter Time Configuration

In the EC2 module, the DI filter time is set via startup parameters. (default DI filter time is 3ms, and the configurable range is 0-10ms).

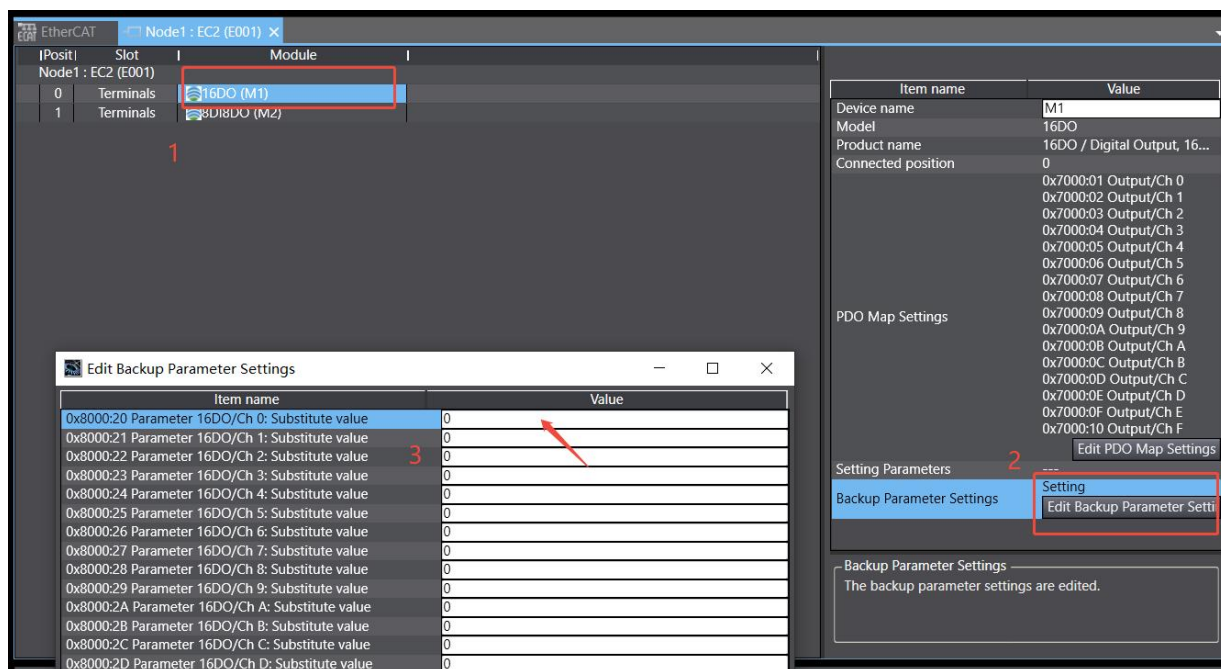


(2) Output configuration when bus communication is abnormal

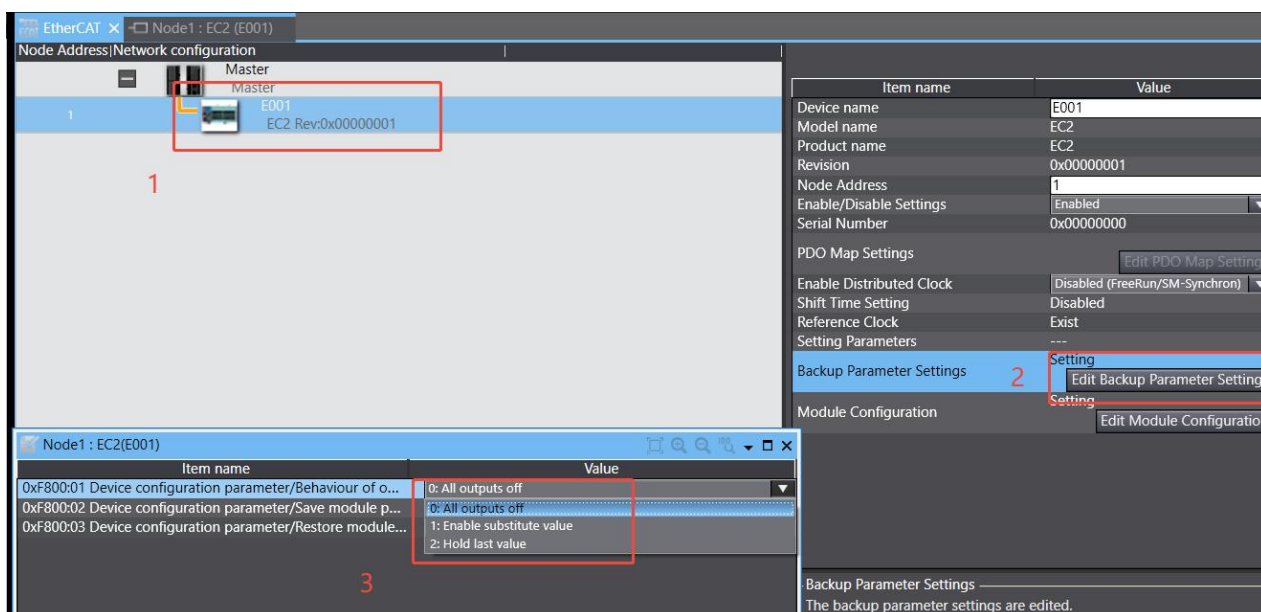
When the bus communication is abnormal, DO output values can be configured in three ways:

Parameter Value	illustrate
All output off	The output is OFF
Enable substitute value	Output using replacement values
Hold last value	Keep the last output status of the program

Substitute Channel replacement value configuration, the configurable value range is 0 or 1, the default value is 0.



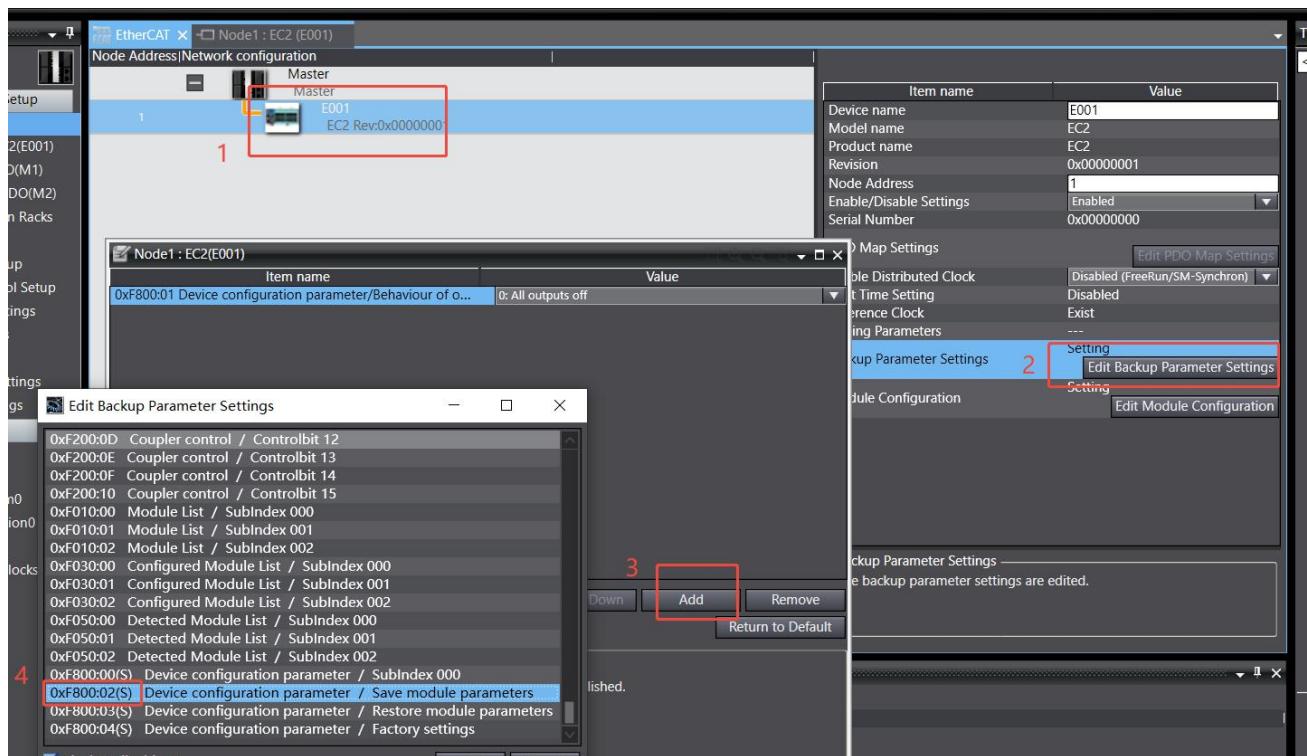
When the bus is abnormal, DO status Settings



(3) Module parameter storage

After modifying DI or DO parameters, it is required to set the value of Sub-index 02 in Index F800h to 1.

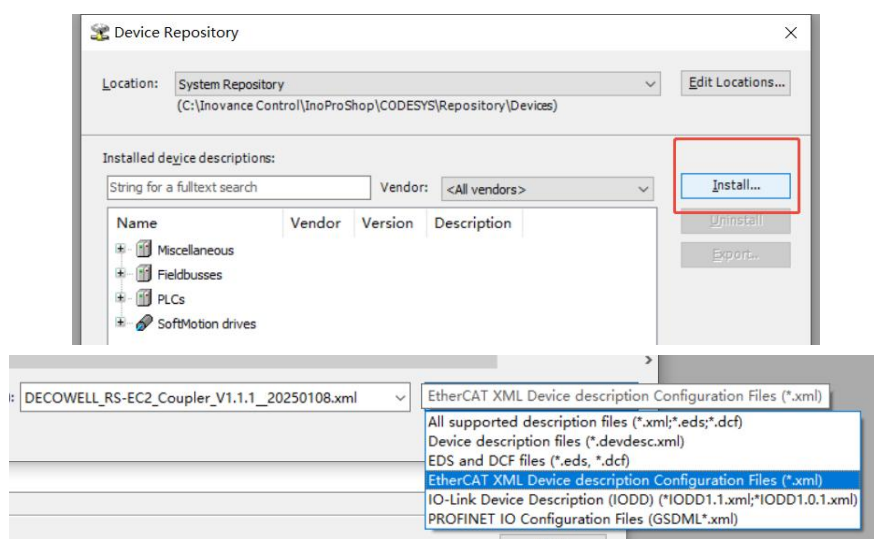
index	Sub-index	name	value	illustrate
F800h	02	Parameter preservation	0	Parameters are not saved, default values
			1	Take effect after power off and restart
			2	Parameters take effect immediately and are lost when power is off



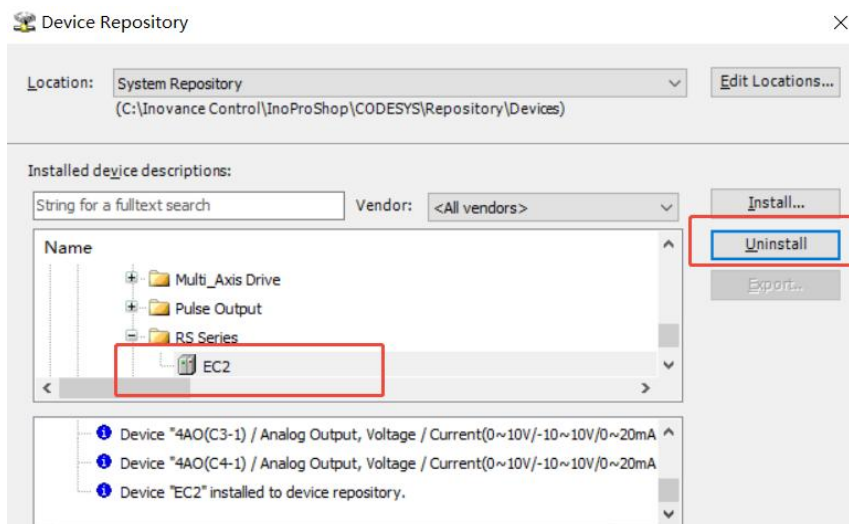
10.5 InoProShop

10.5.1 Installing and uninstalling XML document

(1) Open the InoProShop programming software, select "Install" in the device library window, and choose the file type to be installed as "EtherCAT XML device description configuration file" in the device description file window.

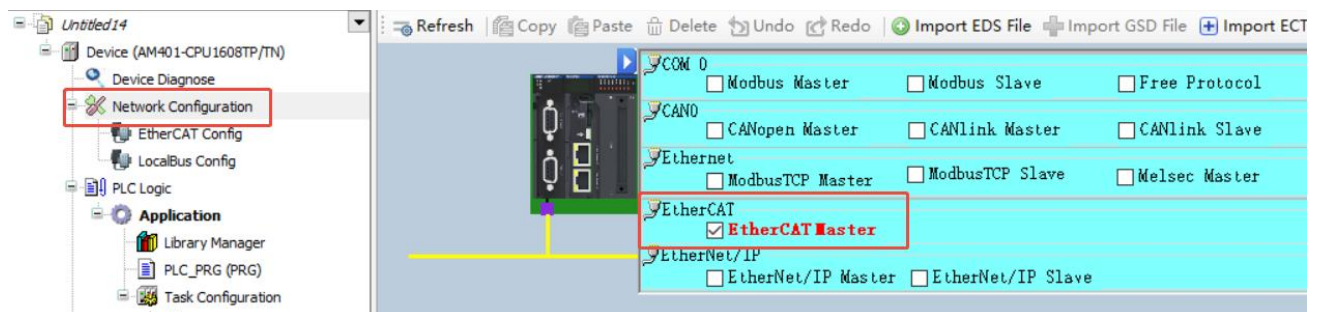


(2) In the device library, select the EtherCAT Slave XML document



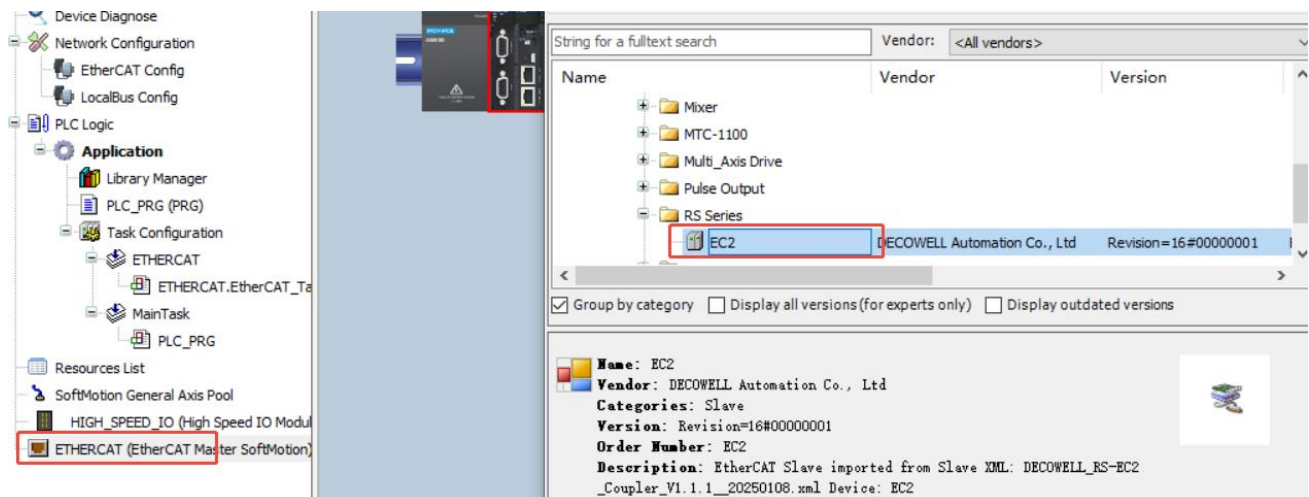
10.5.2 Configuration IO Modules

Click Network Configuration, and choose EtherCAT Master.

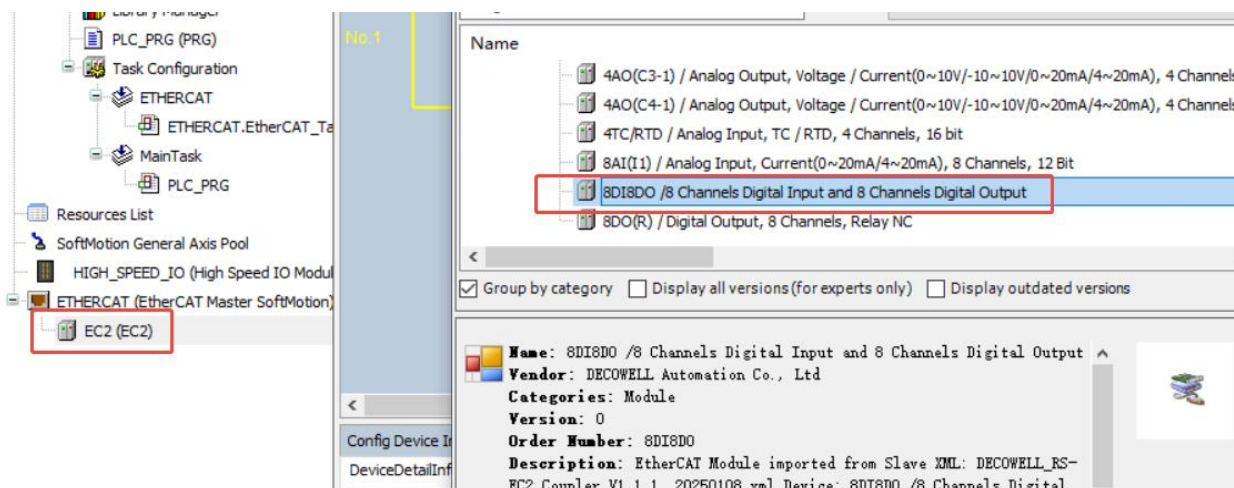


Manually add IO modules:

Right-click ETHERCAT, select Add Device, and select RS module in the Add Device window.

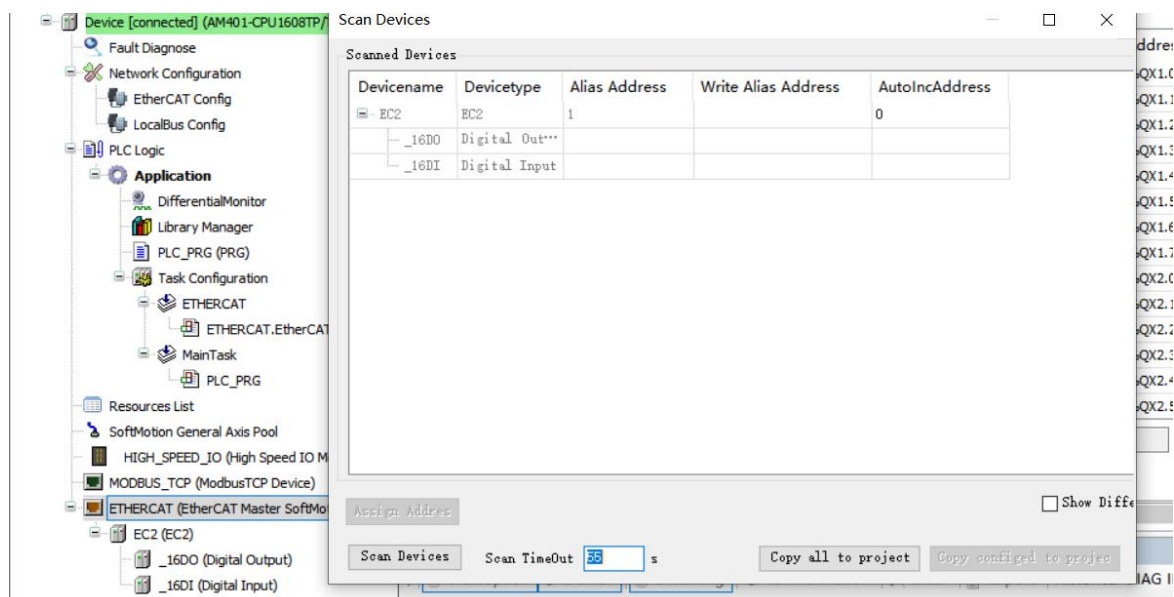


Add an IO module by right-clicking on "EC2" and selecting "Add Device." In the Add Device window, choose the IO module type that matches the actual hardware module.



Online Scan IO modules:

Select "EtherCAT" and choose "Scan Devices." In the Scan Devices window, click "Scan Devices" and add the scanned devices to the configuration.

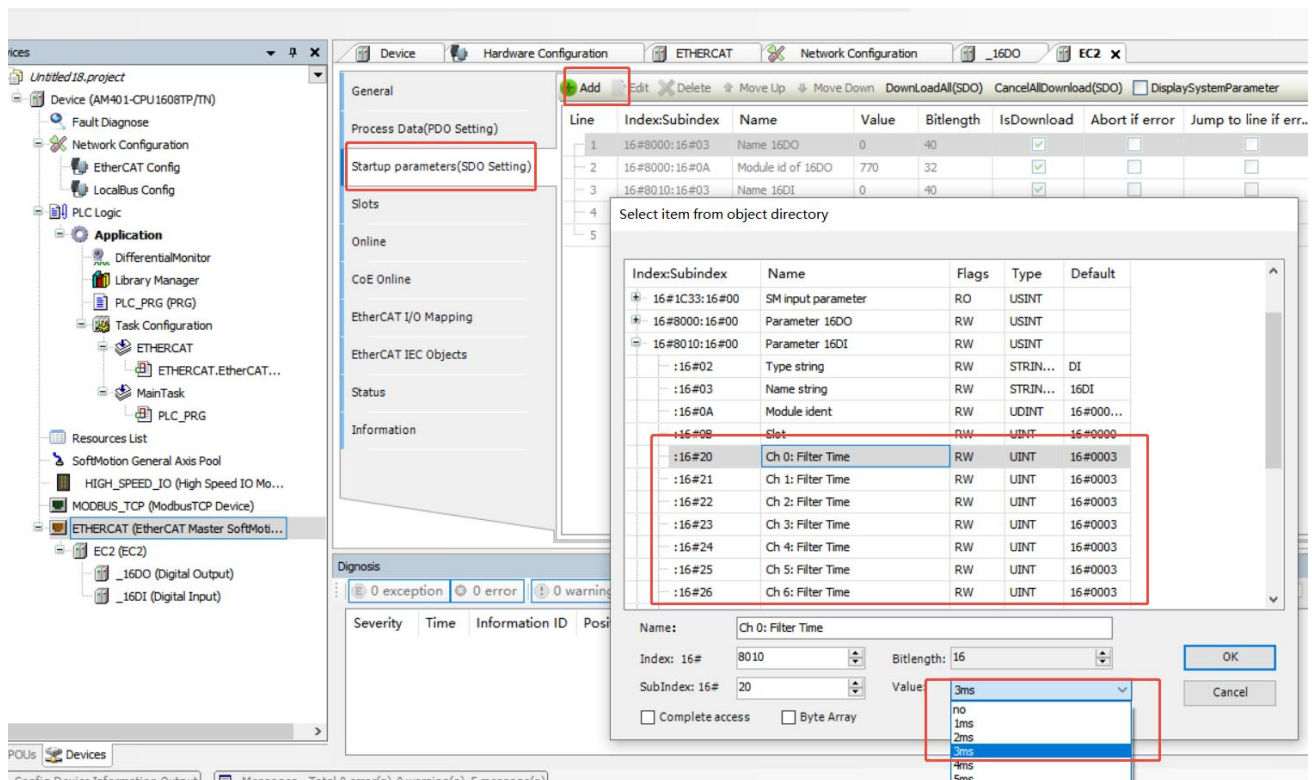


10.5.3 Configuration parameters

Parameter Configuration consists of three parts: DI parameter configuration, DO parameter configuration, and parameter saving. After modifying DI or DO parameters, the changes must be saved.

(1) DI Filter Time Configuration

In the EC2 module, the DI filter time (default: 3ms, configurable range: 0–10ms) is set via startup parameters.

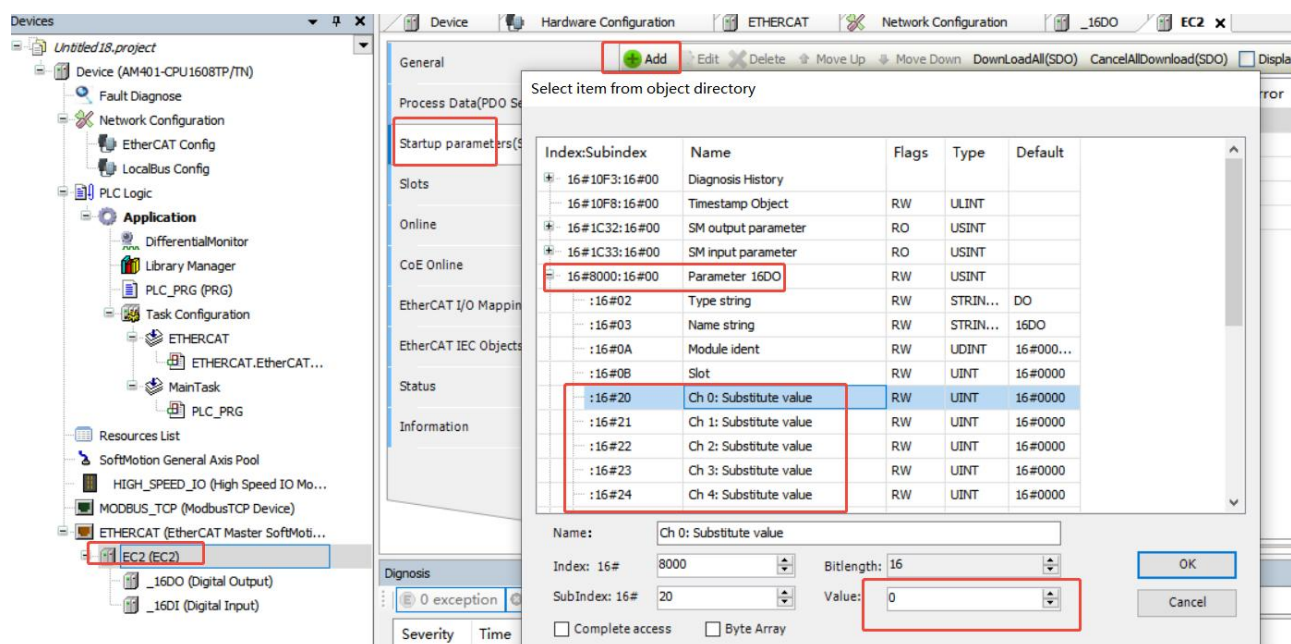


(2) Output configuration when bus communication is abnormal

When the bus communication is abnormal, DO output values can be configured in three ways:

Parameter Value	illustrate
All output off	The output is OFF
Enable substitute value	Output using replacement values
Hold last value	Keep the last output status of the program

Substitute channel replacement value configuration, the configurable value range is 0 or 1, the default value is 0.

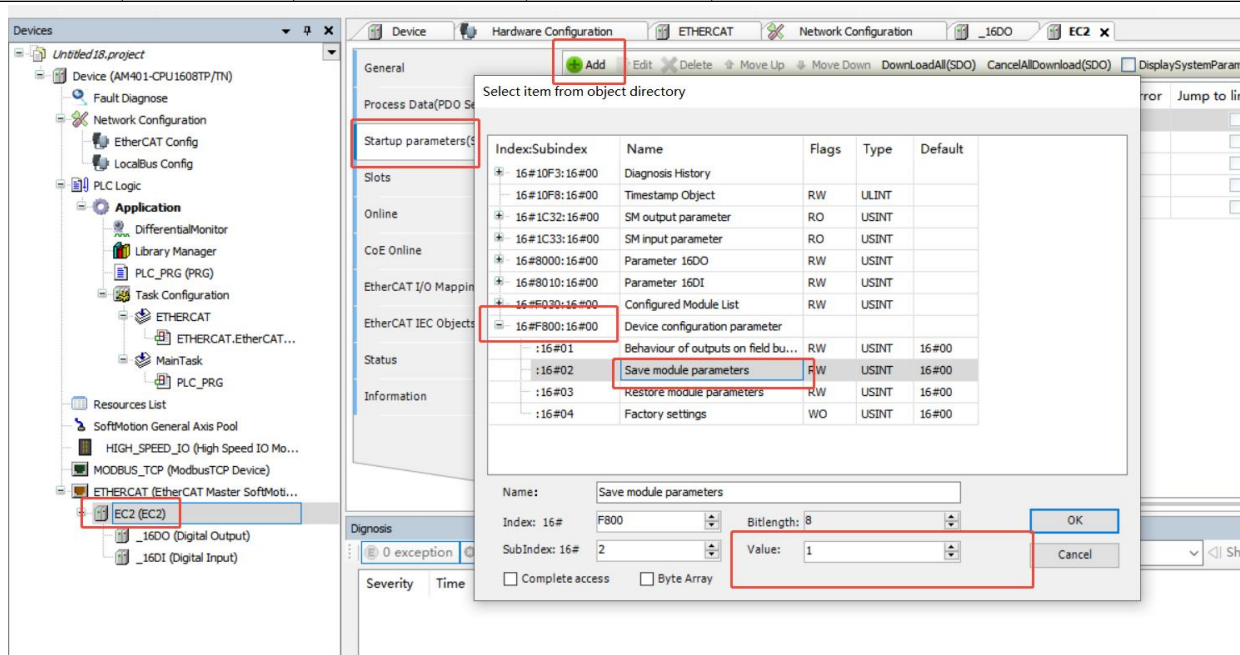


When the bus is abnormal, DO status Settings

(3) Module parameter storage

After modifying DI or DO parameters, the value of sub-index 02 in index F800h must be changed to 1.

Index	Sub-index	Name	Value	Illustrate
F800h	02	Parameter preservation	0	Parameters are not saved, default values
			1	Take effect after power off and restart
			2	Parameters take effect immediately and are lost when power is off



11.FAQ

11.1 Common Issues of DI

DI Failure

Description: Communication between the PLC or host computer and the module is normal. A signal is connected to the DI channel, but the signal value cannot be monitored in the software, and the DI channel indicator is off.

Troubleshooting Steps:

1. Check the panel indicator
2. Check whether the DI input signal type matches
3. Check whether the DI signal and the load 24V- share a common terminal (same power source)

Troubleshooting Result:

If the panel ST indicator is abnormal, check whether the load 24V power is properly connected. If the load power is connected, refer to the digital-to-analog mapping table under different data formats.

Check whether the panel is loose. If the indicator is confirmed normal, then check whether the DI signal type matches the module (NPN/PNP). If everything is correct, check whether the DI signal and module load power share the same source and have a common 0V. If all above checks are normal, the issue is most likely caused by hardware failure.

DI Channel Abnormality

Description: When inputting a signal to channel 1, both channel 1 and channel 2 have signals, and both indicators are on simultaneously.

Troubleshooting Steps:

1. Slightly press the panel and observe the input indicators
2. Remove the panel and measure the continuity of the two signal channels
3. Check whether there are wires or foreign objects in the panel or base

Troubleshooting Result:

If the issue appears intermittently when pressing the panel, it may be caused by overly long pins shorting components on the base (this issue has been optimized). If step 1 shows no issue, proceed to step 2 to determine whether the problem is caused by the base or the panel. Finally, perform step 3. If no issues are found, the problem is most likely due to hardware failure.

DI Channel Abnormality

Description: Communication between the PLC or host computer and the module is normal. After powering on the device, some DI channels have signals, but the corresponding indicators do not light up.

Troubleshooting Steps:

1. Check whether multiple variables are mapped to the same DI
2. Check whether the connector is damaged or if solder joints are loose

Troubleshooting Result:

If there is no multiple-variable mapping, check the condition of the connector. If everything is normal, the issue is most likely caused by hardware failure.

11.2 Common Issues of DO

DO Failure

Description: The DO channel indicator is off, and the corresponding DO channel is not set to “1” in the software, but the DO channel has actual output.

Troubleshooting Steps:

1. Check whether there is a 24V supply on the corresponding DO
2. Check whether the load wiring is correct

Troubleshooting Result:

If there is no 24V on the DO, check the load wiring. If the load wiring is not from the same power source, a potential difference may cause unintended load activation.

DO Failure

Description: The DO directly controls the load, but the output signal cannot drive the load, while the channel indicator is normal.

Troubleshooting Steps:

1. Check the output 24V and whether the load startup current exceeds 0.5A
2. Confirm whether the DO remains continuously in the TRUE state while the IO 24V power supply is unstable

Troubleshooting Result:

If the output voltage and load startup current are correct, proceed to step 2. After cycling the IO power supply, the output control command must be manually reissued for the DO to resume output (this issue is resolved in versions after V2.1.4).

11.3 Common Issues of AI

Abnormal AI Code Value

Description: For a 16-bit precision current input module, the acquired code value is displayed as a negative value.

Troubleshooting Steps:

1. Confirm whether the configured range matches the actual input current
2. Check whether the data type of the channel is set to double word (DWORD)

Troubleshooting Result:

If the range is correct, check the channel data type. Storing 16-bit precision data in a single word may cause overflow, resulting in negative values.

AI Failure

Description: Communication between the PLC or host computer and the module is normal. A valid analog signal is connected to the AI channel, but the acquired value cannot be monitored in the software, and the corresponding AI channel indicator is abnormal.

Troubleshooting Steps:

1. Check whether the configured range of the module matches the actual input signal range
2. Confirm that the input signal type matches the module channel type

Troubleshooting Result:

If the range configuration is correct, check whether the input signal type matches. If both the range and signal type are correct but the value still cannot be monitored, the issue is most likely caused by hardware failure.

Abnormal AI Code Value

Description: Communication between the PLC or host computer and the module is normal. The AI channel receives the signal, but the monitored value fluctuates.

Troubleshooting Steps:

1. Check the current filter level configuration of the module
2. Confirm whether the input signal itself fluctuates significantly
3. Check whether there are strong electromagnetic interference sources on site, such as inverters, motors, or high-power equipment

Troubleshooting Result:

If the filter level is at the default setting, increase the filter level and observe whether the value becomes stable. If fluctuations persist, proceed with steps 2 and 3. The issue may be caused by on-site interference affecting the input signal.

11.4 Common Issues of AO

AO Failure

Description: Communication between the PLC or host computer and the module is normal. The AO channel is outputting a signal and the channel indicator is normal, but it cannot drive the external load.

Troubleshooting Steps:

1. Check whether the module range matches the load requirements
2. Check whether there is voltage or current at the AO output

Troubleshooting Result:

If the range matches, check the output signal. If there is no voltage or current output, the issue is most likely caused by hardware failure.

Abnormal AO Output

Description: Communication between the PLC or host computer and the module is normal. The AO outputs 5V or 10 mA, but the load actually receives a value higher than 5V or 10 mA.

Troubleshooting Steps:

1. Check whether the module range matches the load requirements
2. Confirm whether the load 0V is connected to the AO module GND

Troubleshooting Result:

If the range is correct, check whether there is a common ground. If the load and module are not properly grounded together, abnormal behavior may occur. If all checks are normal, the issue is most likely caused by hardware failure.

11.5 Common Panel Issues

Abnormal Panel Signals

Description: Communication between the PLC or host computer and the module is normal, but DI/DO/AI/AO signals are intermittent or occasionally malfunction.

Troubleshooting Steps:

1. Gently press the module panel and observe whether the input indicators recover or change
2. Swap or replace the panel to confirm whether the issue disappears

Troubleshooting Result:

This issue is most likely caused by tolerance mismatches between the panel and the base connector. It can be identified through pressing tests and panel replacement.

11.6 Common Module Issues

Module Abnormality

Description: After powering on the module, none of the indicators respond, and the 24V power cable becomes hot.

Troubleshooting Steps:

1. Check whether the two sets of 24V wiring are correct
2. Check whether the crimp terminals are securely connected
3. Check whether there are any burn marks on the base

Troubleshooting Result:

If the wiring is confirmed correct, check the terminals and the base. If everything is normal but the module still has no response, the issue is most likely caused by hardware failure.

Abnormal Operation

Description: For RS modules, the configuration steps are correct, but the PLC reports an error, and the panel ST indicator is abnormal.

Troubleshooting Steps:

1. Check whether the IO PWR indicator is constantly on and confirm whether the 24V IO power supply is normal
2. Check whether the panel is loose
3. Confirm whether the PLC supports SlotS configuration and whether the panel order matches the configuration

Troubleshooting Result:

If the power supply is normal and the indicator is on, try swapping panels. If the issue is resolved after swapping, it is likely caused by tolerance issues between the panel and base connector. If the issue persists, proceed to step 3. If all checks are correct, the problem is most likely caused by hardware failure.

11.7 Common Ethernet Port Issues

Ethernet Port Abnormality

Description: During operation, disconnection occurs, and the Ethernet port indicator is off when the issue happens.

Troubleshooting Steps:

1. Check whether both ends of the Ethernet cable are loose
2. Use a direct connection to verify whether the device can be pinged
3. Check whether the Ethernet connector has cold solder joints or bent/missing pins

Troubleshooting Result:

If the cable is not loose and the device cannot be pinged, check the soldering of the Ethernet port.

11.8 Common Configuration Issues

Configuration Abnormality

Description: The base can be automatically detected during configuration, but the panel information cannot be scanned.

Troubleshooting Steps:

1. Check the 24V IO power supply and whether the panel ST indicator is normal
2. Perform a panel swap test
3. Remove the panel and check whether the connector is damaged

Troubleshooting Result:

If the power supply and indicators are normal, perform a panel swap test. If the issue persists, check the connector. If still unresolved, create a new PLC or host project and scan again, and confirm whether the PLC or host supports Slots configuration. If all checks are normal, the issue is most likely caused by hardware failure.

12. Appendix

12.1 Relay Output Module Usage Requirements

Relay output modules are suitable for low-frequency, status-type control applications. They use passive contacts to control the on/off state of external loads, offering good electrical isolation and strong voltage adaptability.

12.1.1 Recommended Use Scenarios

1. Equipment start/stop or mode switching
2. Alarm signal output
3. Indicator lamps and buzzer control
4. Driving intermediate relays or contactor coils
5. Signal isolation control between systems with different voltages

Typical Characteristics:

- Low operating frequency
- Control logic is primarily “status-based”
- High-speed or precise timing is not required

12.1.2 Application Limitations

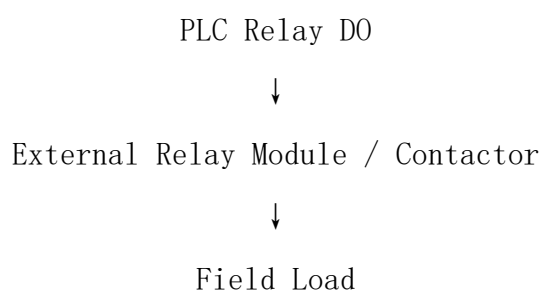
To ensure long-term stable operation, relay output modules are **not suitable** for the following situations:

1. **High-frequency or pulse control** (e.g., running lights, flashing outputs, PWM/pulse signals, high-frequency jog control)
 - Explanation: Relays have mechanical contacts that are not suitable for frequent switching.
2. **Precise synchronization or high-speed timing control** (e.g., multi-channel millisecond-level synchronous output, strict timing interlock control)
 - Explanation: Relay pull-in/release times vary physically and cannot guarantee precise synchronization.

3. **Direct driving of high-power or highly inductive loads** (e.g., motors, heaters, brake coils, high-power solenoid valves)
 - Recommendation: Such loads should be controlled via contactors or intermediate relays.

12.1.3 Recommended Usage Structures

To improve system reliability and maintainability, the following typical structure is recommended:



Advantages:

1. Effectively protects PLC output points
2. Relay wear or replacement does not affect the PLC module
3. Adapts to changes in field loads
4. Reduces on-site maintenance costs

12.1.4 Selection & Usage Suggestions

Usage Requirement	Recommended Solution
Low-frequency status control	Relay DO
Inductive load	Relay DO + External relay
High-frequency / pulse	Transistor DO
High reliability / easy maintenance	External relay module
Safety control	Dedicated safety module



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