

RS Series Multifunction Integrated I/O

User Manual

DECOWELL Industrial Intelligence makes reliable partners



Website: www.decowellauto.com

Email: contact@decowellauto.com

Address: Building 13, Ruichuang Intelligent Manufacturing Park,
No. 19 Lanxin Road, Pukou District, Nanjing

Preface

■ Profile

Thank you for purchasing the DECOWELL RS Series Integrated Multifunctional I/O Module. The RS Series Integrated Multifunctional I/O Module is DECOWELL's new-generation integrated expansion module. It adopts a new modular split design and supports multiple signal types, including digital input modules, digital output modules, and digital input/output modules. The signal interfaces provide various connection options, such as single-row European terminals, 3-in-1 European terminals, and 3-in-1 E-CON terminals. In addition, this series supports multiple communication protocols, including PROFINET, EtherCAT, EtherNet/IP, and CC-Link IE Field Basic.

The RS Series Integrated EtherNet/IP Bus Module is a model within this series that supports the EtherNet/IP communication protocol.

This manual mainly describes the specifications, features, and usage of the module. Please read it carefully before use to ensure proper and safe operation of the product.

As products and technologies are continuously updated and improved, the contents of this document may not fully match the actual product. We appreciate your understanding. In case of any discrepancies, the actual product shall prevail. Changes due to product upgrades are subject to change without prior notice.

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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 a variety of industrial fieldbus protocols, such as EtherCAT, PROFINET, EtherNet/IP, DeviceNet, etc. The IO module supports a maximum of 32 channels of digital input/output. Users can select different IO panels based on actual needs, offering base units in both 16-bit and 32-bit specifications. The module supports the following functions:

- ① Module hot swap
- ② Support bus abnormality DO Output status configuration
- ③ Support USB Firmware Upgrade
- ④ Support slave station loss diagnosis and configuration inconsistency detection
- ⑤ Support one-click restoration to factory settings
- ⑥ DIP switch to set device name

1.2 Module Naming Rules

1.2.1 Digital Module Panel Naming Rules

EI2 - 16 DI (N-1)
 ① ② ③ ④ ⑤

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

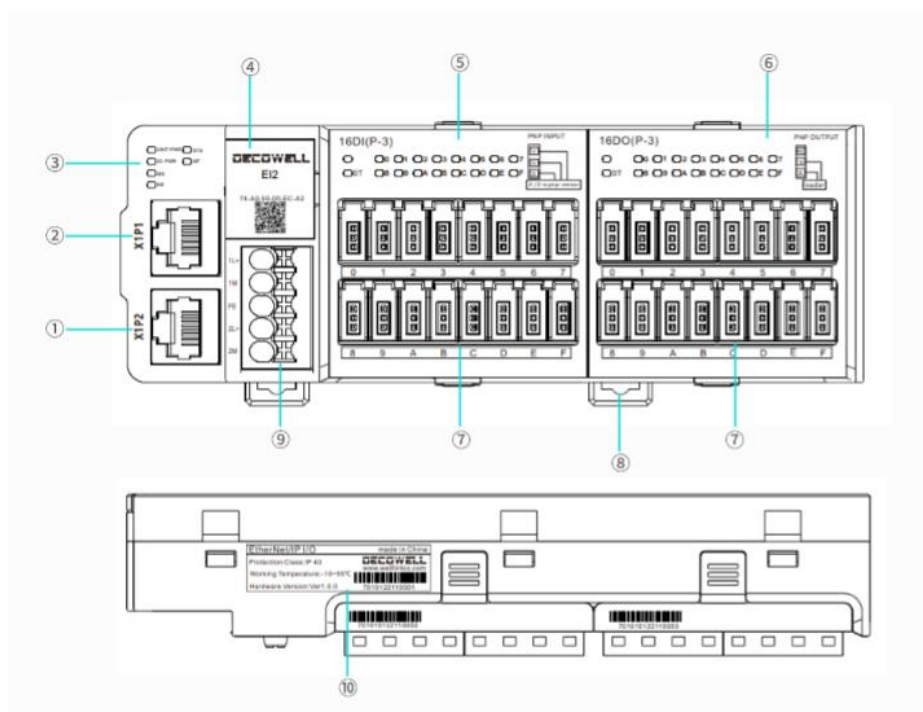
1.2.2 Analog Module Panel Naming Rules

EI2 - 8 AI (I5-1)
 ① ② ③ ④⑤ ⑥

NO.	Name	Meaning
①	Bus protocol	EI2:EtherNet/IP
②	Number of channels	4: 4 channels 8: 8 channels
③	Channel Type	AI: Analog Input AO: Analog Output TC/RTD: Temperature Measurement (TC/RTD) Module
④	Signal Type	I: Analog Current U: Analog Voltage C: Compatible with Current and Voltage N: Compatible with Thermocouple and RTD
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 0: 16-bit configurable channel type
⑥	Interface Type	1: Single-row European terminal 2: 3-in-1 terminal 3: E-CON connector

2.Product Overview

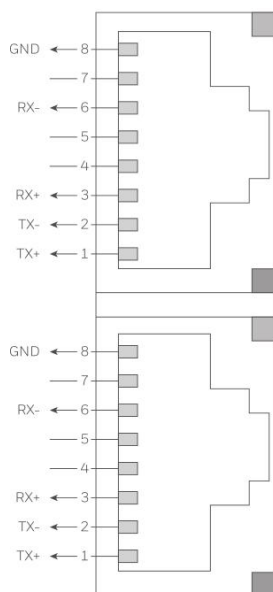
2.1 Hardware Interface Description



- ① EtherNet/IP port 1
- ② EtherNet/IP port 2
- ③ Module status/power indicator
- ④ USB Firmware upgrade/factory reset button/device name dial
- 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)

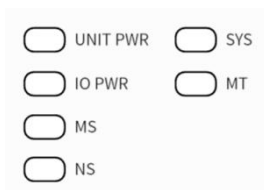
2.1.1 EtherNet/IP network port definition

EtherNet/IP uses a standard RJ45 interface with an 8-pin network port, defined as follows:



Pins	Definition
1	TX+
2	TX-
3	RX+
4	null
5	null
6	RX-
7	null
8	GND

2.1.2 Indicator lights and status description



- ① UNIT-PWR: System power indicator (green)
- ② IO-PWR: IO Power indicator light (green)
- ③MS: System fault indicator light (red/green)
- ④NS: Bus fault indicator light (red/green)
- ⑤ SYS: System operation indicator light (green)
- ⑥ MT: Maintenance indicator light (blue)

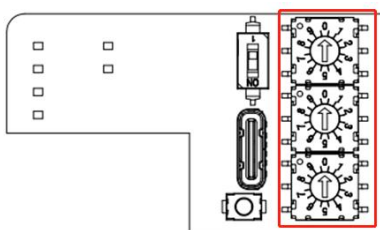
RS-EI	Definition	Color	Indication status	Flashing meaning
UNIT PWR	System Power Indicator	green	ON	The device power supply is normal
			OFF	Device power supply abnormality
IO PWR	I/O Power Indicator	green	ON	The device IO power supply is normal
			OFF	Device IO power supply is abnormal
MS	System Fault Indicator	green	ON	The system is working properly
		red	1Hz Flash	IP Out of range

NS	Bus Fault Indicator	green	ON	The system is working properly
			OFF	IP Out of range
		red	1Hz Flash	Disconnection, abnormal operation
SYS	System Run Indicator	green	1Hz Flash	Normal operation
			Flash	Slave lost flashing
			2 Flash and 1 OFF	Device diagnostics failed
MT	Maintenance Indicator	blue	OFF	Working fine
			Flash	Module Upgrade
			ON	Upgrade reset operation completed

2.1.3 Dial Instructions

The RS-EI2 operation compartment is located beneath the cover on the right side of the indicator panel. It is recommended to use a properly sized screwdriver to gently pry up the cover from the groove on the right side to open the compartment.

2.1.3.1 IP Address DIP Switch Description

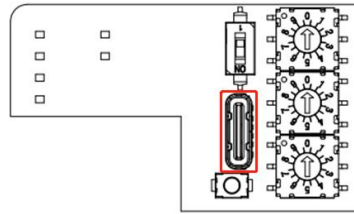


The device IP address can be configured via the DIP switch (two EtherNet/IP slaves with the same device name cannot exist in the same network). The manually set IP address range is 1–254. If the value is out of range, the software will fail to detect the module, and the module indicator will display an error. For details, refer to the figure above.

When the dial code is set to 0, the module can set its own IP in the software.

When the dial code is set to 1-254, the IP address set by the dial code can be scanned in the software.

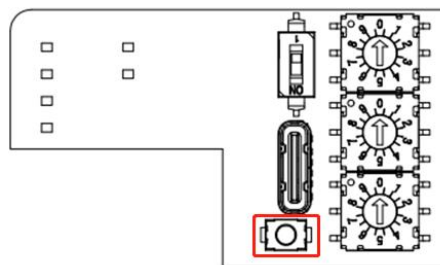
2.1.3.2 USB illustrate



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

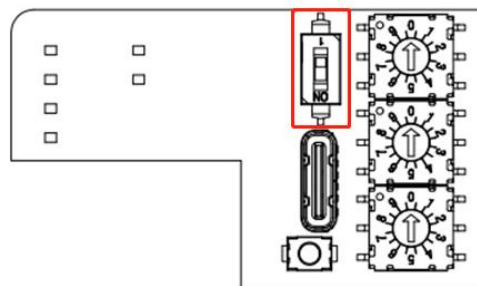
Note: Do not use USB port for other purposes to avoid USB damaged.

2.1.3.3 Reset Button Description



Press and hold the reset button for more than 5 seconds, and the module will automatically restore factory settings (I/O configuration will revert to default values). After pressing the reset button, the MT maintenance indicator will blink at 1Hz. Once the reset is complete, the MT indicator will remain steadily lit.

2.1.3.4 PLC mode selection button description



0 (Dip switch to ON): Normal mode (general EDS)

1 (Dip switch to 1): Special mode (general EDS + KEYENCE EDS)

a. Special mode parameter settings

Output when disconnected: (This parameter needs to be used with the option "Save module parameters")

Parameter setting product name: EI2 [1.1]

No.	Res...	Parameter	Set value	Type	Attri...
100	OK	☒ PLC Category Select	1 : Special PLC	INT	R
101	OK	☒ outputs Behaviour on bus e...	0 : All outputs off	INT	R/W
102	OK	☒ Save module parameters	0 : All outputs off		R/W
103	OK	☒ Restore module parameters	1 : Enable substitute value		R
104	OK	☒ Factory settings	2 : Hold last value		R/W

Parameter Value	illustrate
All output off	All DO Channel output is OFF(default)
Enable substitute value	Output using replacement values
Hold last value	Keep the last value of the program output

Save module parameters:

Parameter setting product name: EI2 [1.1]

No.	Res...	Parameter	Set value	Type	Attri...
100	OK	☒ PLC Category Select	1 : Special PLC	INT	R
101	OK	☒ outputs Behaviour on bus e...	0 : All outputs off	INT	R/W
102	OK	☒ Save module parameters	0 : NO	INT	R/W
103	OK	☒ Restore module parameters	0 : NO	INT	R
104	OK	☒ Factory settings	1 : YES 2 : STANDARD	INT	R/W

Parameter Value	illustrate
NO	Do not save
YES	Issued after power failure
STANDARD	Takes effect immediately (will become invalid after power failure)

Restore factory settings:

Parameter setting product name: EI2 [1.1]

No.	Res...	Parameter	Set value	Type	Attri...
100	OK	☒ PLC Category Select	1 : Special PLC	INT	R
101	OK	☒ outputs Behaviour on bus e...	0 : All outputs off	INT	R/W
102	OK	☒ Save module parameters	0 : NO	INT	R/W
103	OK	☒ Restore module parameters	0 : NO	INT	R
104	OK	☒ Factory settings	0 : NO 1 : YES	INT	R/W

Parameter Value	illustrate
NO	No recovery
YES	Restore and take effect after power failure

b.Normal mode parameter settings

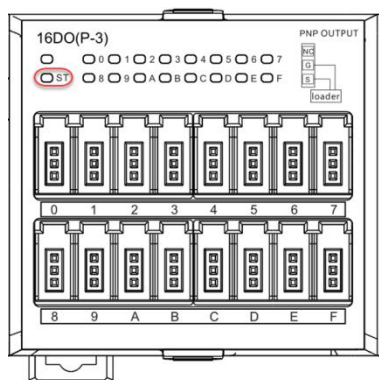
Setup parameter

✕

Parameter(P)		EI2	
No.	Parameter	Set value	Attribute
0004	Behaviour of outputs ...	0 : All outputs off	R/W
0005	Assembly Input Size	0 : All outputs off	R/W
0006	Assembly Output Size	2 : Hold last value	R/W
0007	Input_CP	100	R
0008	Output_CP	101	R

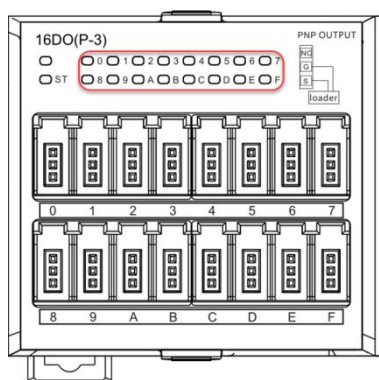
Parameter Value	illustrate
All outputs off	All DO Channel output is OFF(default)
Hold last value	Keep the last value of the program output

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 light	green	OFF	Channel input has no signal or is abnormal
		ON	Channel input signal is normal
DO Channel indicator light	green	OFF	The channel does not output or is abnormal
		ON	Channel output status is normal

2.2 Module combination

When configuring the slot module type for the RS series EtherNet/IP, the same model number can correspond to multiple different actual module models. For specific model numbers, please refer to the following table.

2.2.1 EtherNet/IP EI2-S1combination

Base Model	Configuration module model	Actual matching module models
EI2-S1/EI2-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 EI2-S1 can only be paired with one module type, while each EL2-S2 can be paired with up to two module types.

3. Technical parameters

3.1 EtherNet/IP Base Technical Parameters

Communication technical parameters	
Bus protocol	EtherNet/IP
Communication distance	100m (distance between stations)
Bus communication speed	100Mbps
Topology	depending on EtherNet/IP Master station specifications
Device Name	Software Distribution
Power supply technical parameters	
System power input	24VDC ($\pm 25\%$)
System power supply provides current	2A
IO power Input	24VDC ($\pm 25\%$)
IO power supply current	10A
Overcurrent protection	Supported
Overvoltage protection	None
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
Use ambient air	No corrosion
EMC level	CLASS A
General physical parameters	
Protection level	IP20

3.2 Digital Panel Technical Specifications

DI input technical parameters	
Input Rated Voltage	24V DC($\pm 25\%$)
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	$\leq 15\text{ms}$
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°C, 1s on, 9s off)
	5x10 ⁴ times (AgNi, 5A DC/250V AC, resistive load, room temperature, 1s on, 9s off)
Relay mechanical life	2x10 ⁷ times
*Note: The logic "0" (OFF) signal voltage for 16DIO is 15V–30V ($\pm 0.5\text{V}$).	

3.3 Analog Module Panel Technical Specifications

8AI Input Technical Specifications	
Number of channels	8
Input Impedance	$< 150\ \Omega$
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	<150 Ω
Output Load	<500 Ω
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	CLASS A

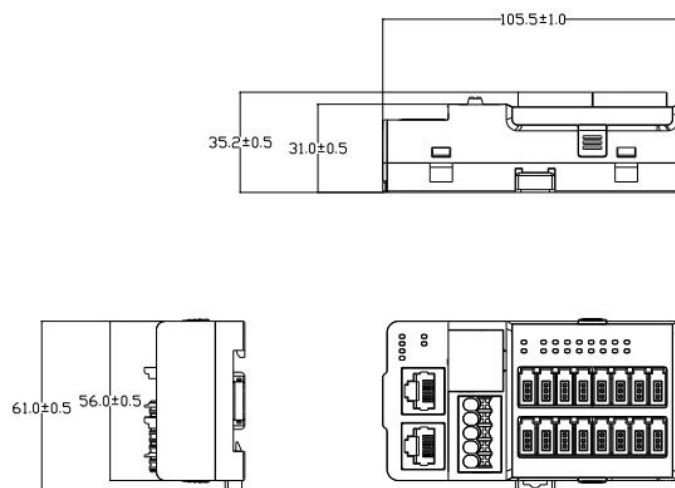
General Physical Specifications	
Protection Rating	IP20

4. Mechanical Installation

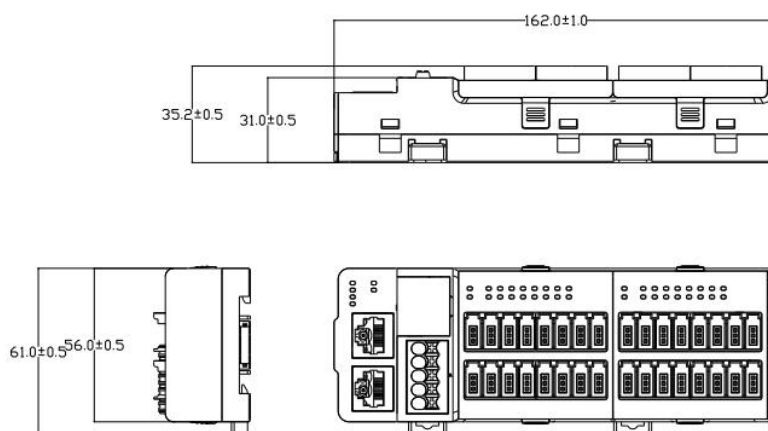
4.1 Module size

The dimensions in the following figures are all in mm

4.1.1 EI2-S1 Module Dimensions

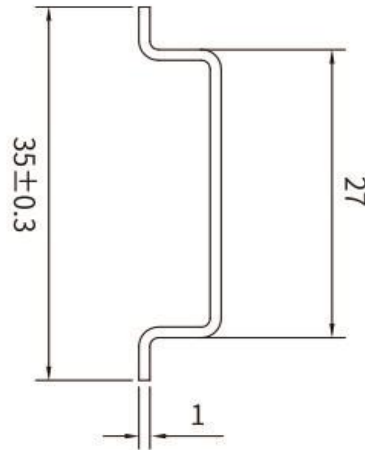


4.1.2 EI2-S2 Module Dimensions



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.

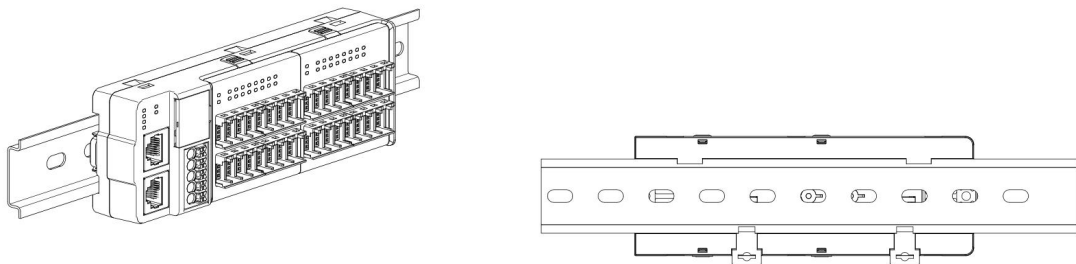


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- When this product is installed on a DIN rail other than the recommended type (especially when the DIN rail thickness is >1.0 mm), the rail locking clip may fail, preventing proper installation and resulting in malfunction. It is recommended to use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

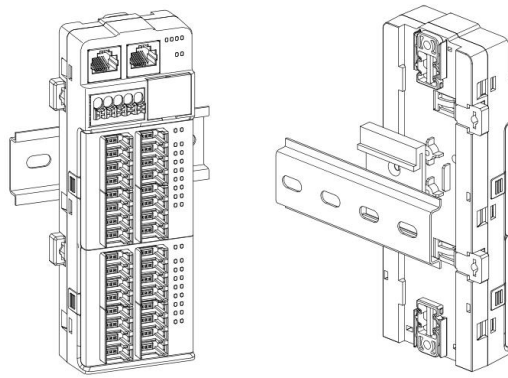
4.2.1 Horizontal rail installation

1. After fixing the module on the guide rail, push the two buckles inwards.



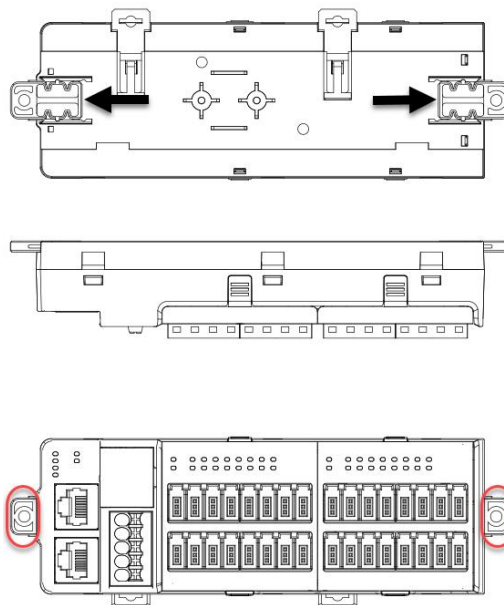
4.2.2 Vertical rail installation

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.

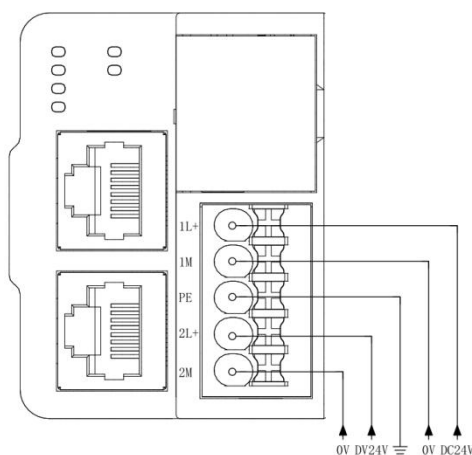


5. Electrical Installation

5.1 Base wiring diagram

5.1.1 Wiring diagram of Ethernet port base

The base needs to be connected to two sets of DC24V, 1L+/1MFor system power, 2L+/2MFor IO power supply, it is recommended to introduce two sets from the same power adapter **DC24V** Plug the wire into the base.

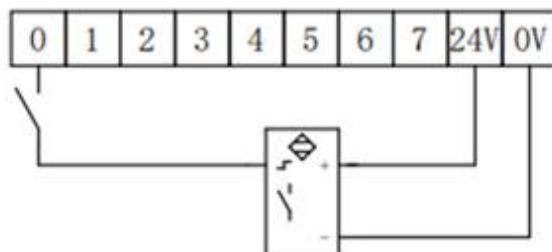
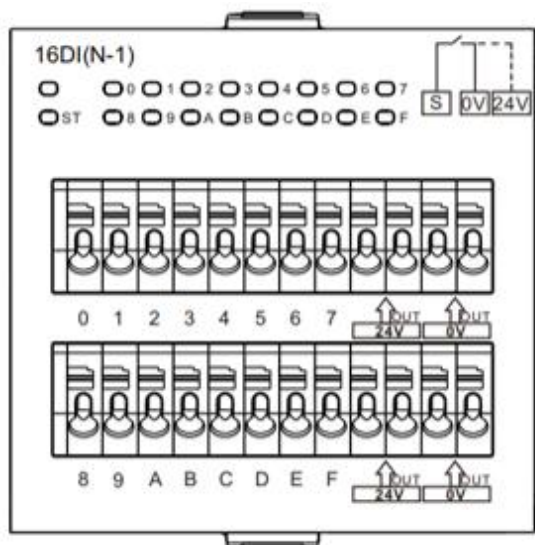


5.2 IO module wiring diagram

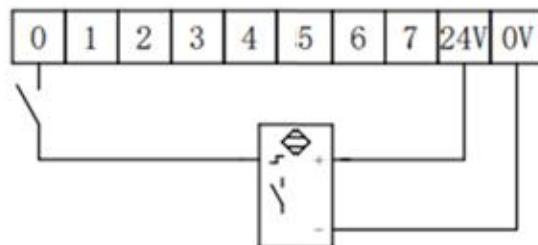
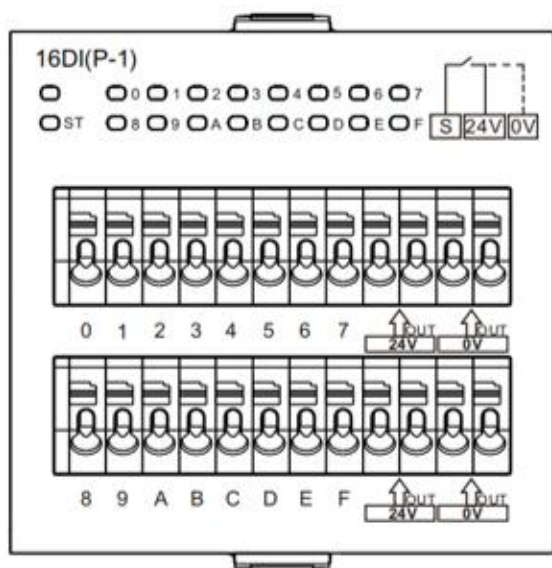
The IO module wiring diagram introduces the wiring methods of various IO modules. 4V or 0V It can power sensors or loads. IO modules can be divided into single-row European terminals, three-in-one terminals, E-CON connectors, relay modules.

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 Above
Trinity Terminal	0.2-0.75mm ²	
E-CON Connectors	0.13-0.50mm ²	

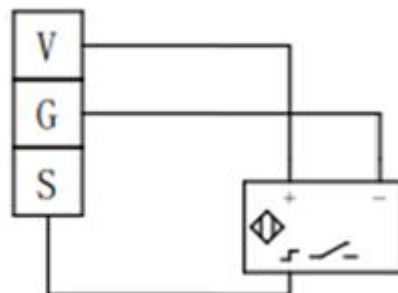
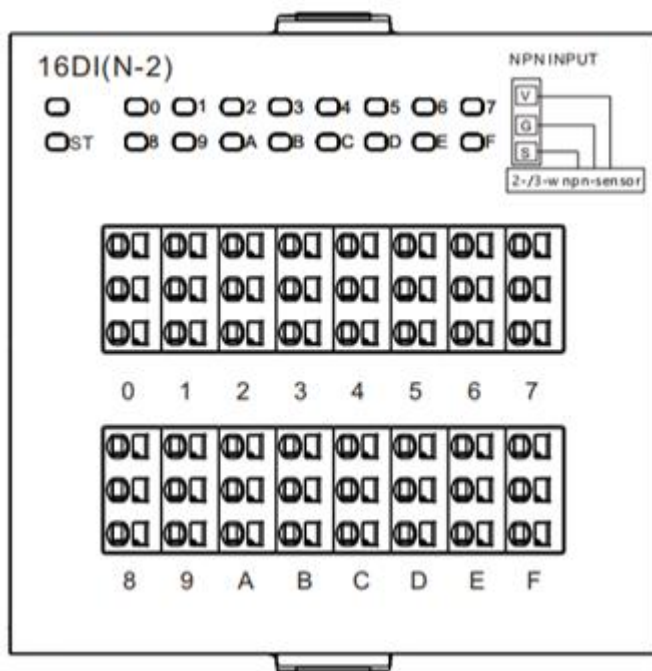
5.2.1 16DI Wiring Diagram



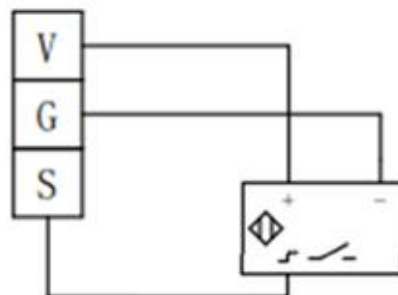
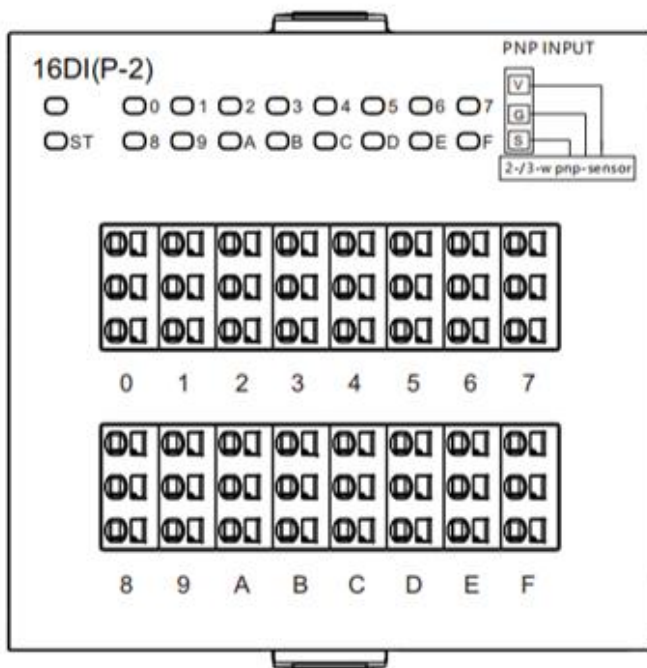
16DI(N-1)



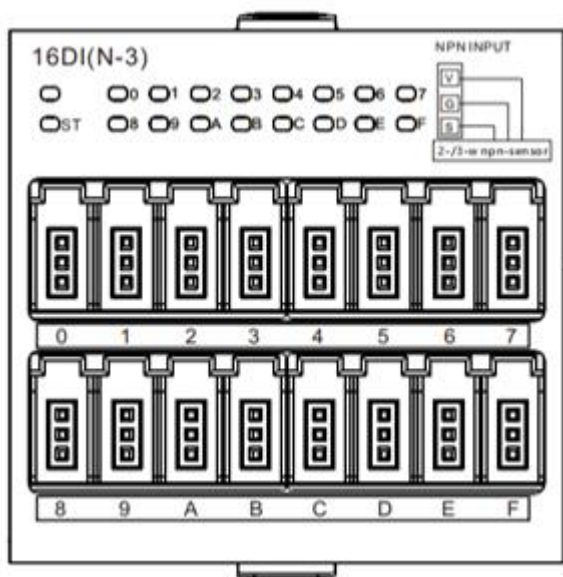
16DI(P-1)



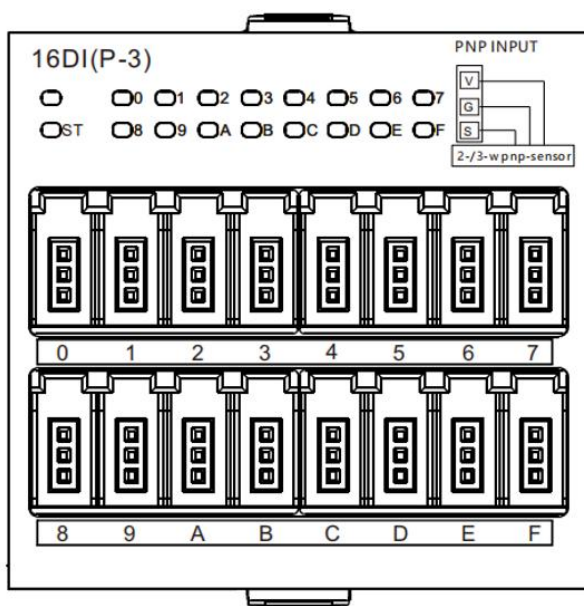
16DI(N-2)



16DI(P-2)

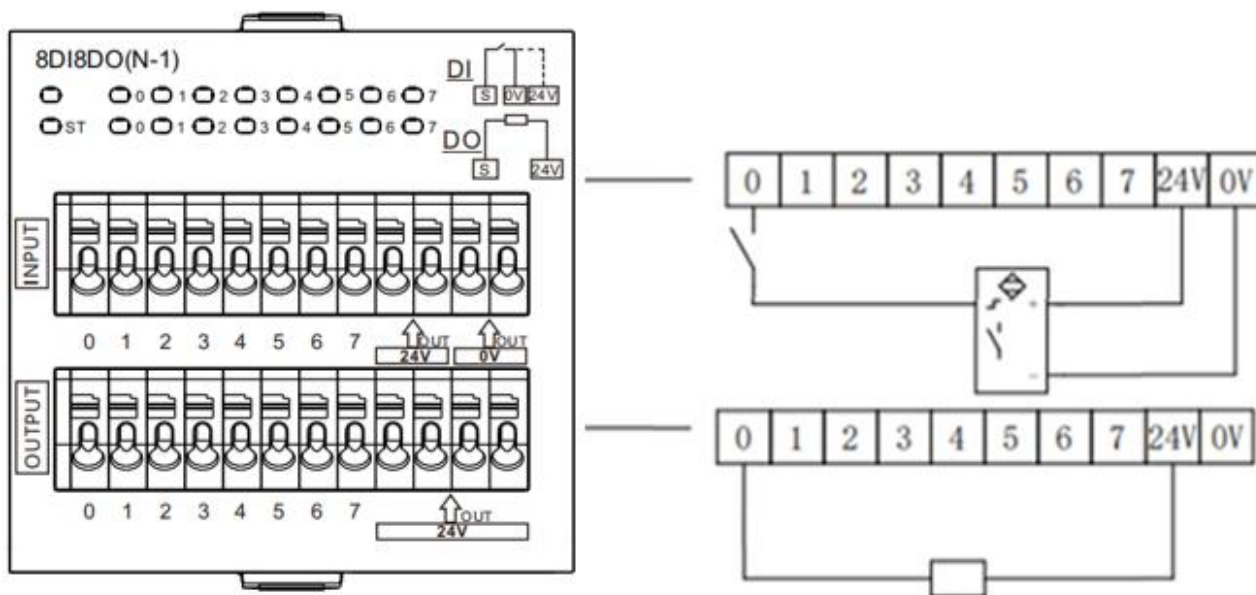


16DI(N-3)

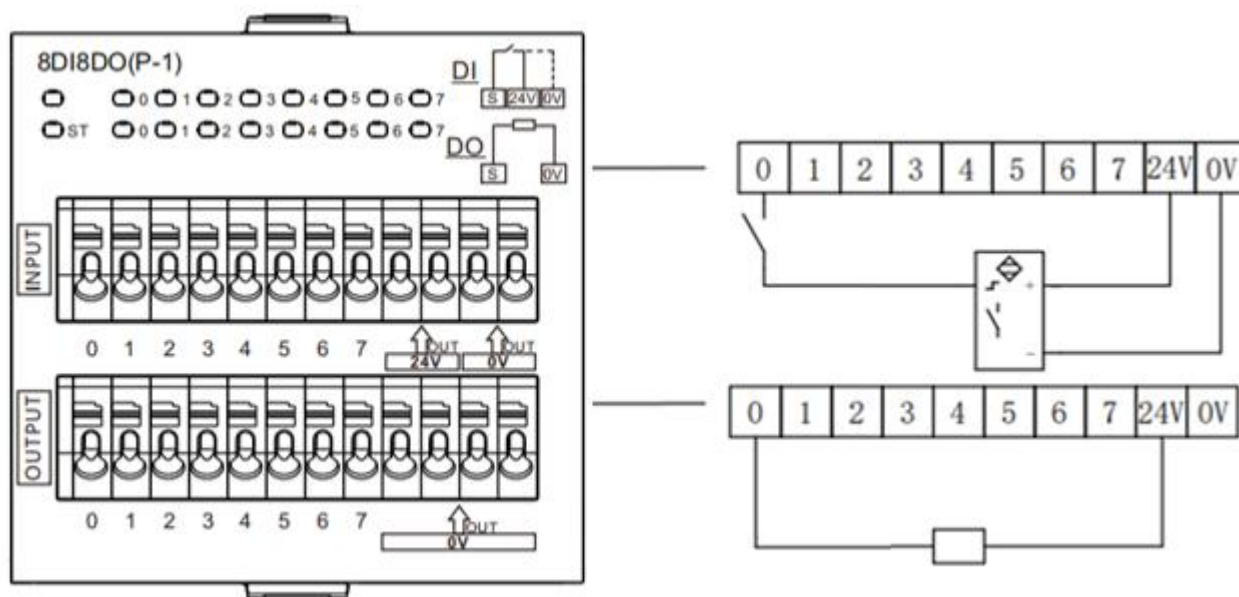


16DI(P-3)

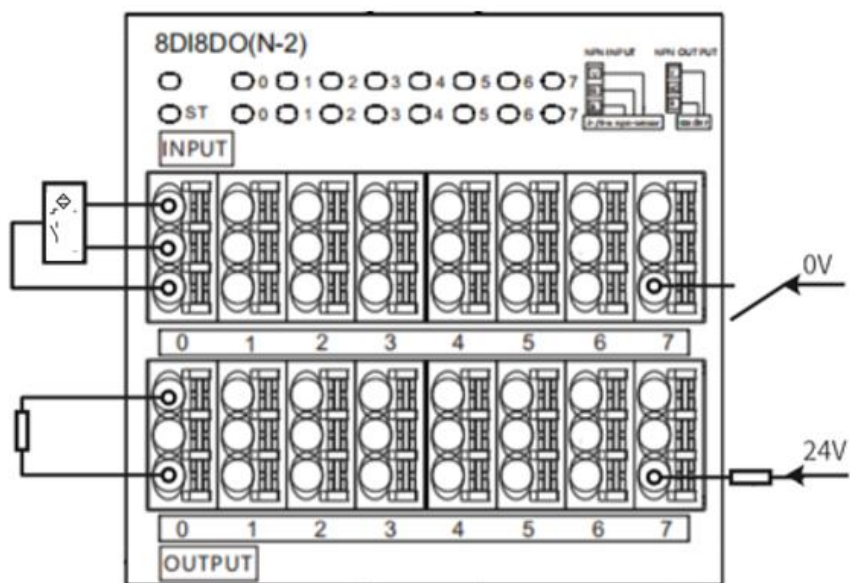
5.2.2 8DI8DO Wiring Diagram



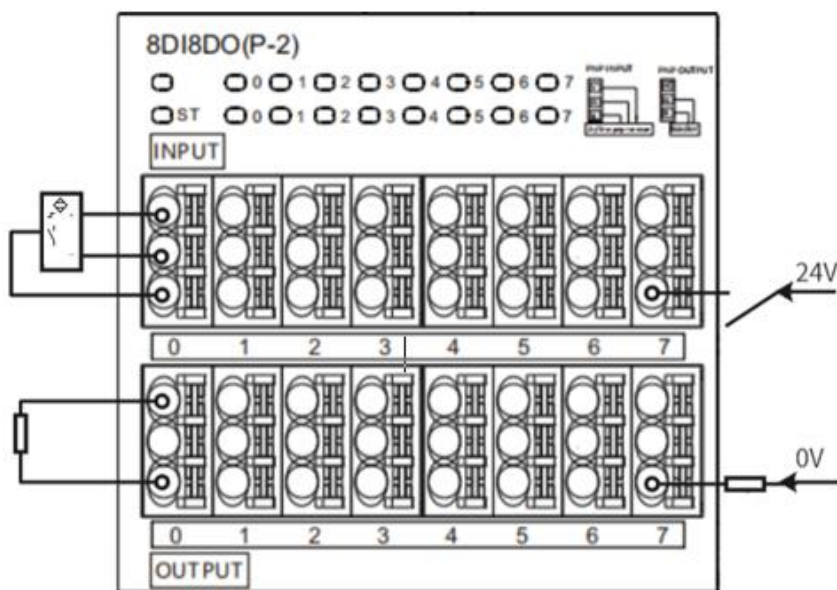
8DI8DO(N-1)



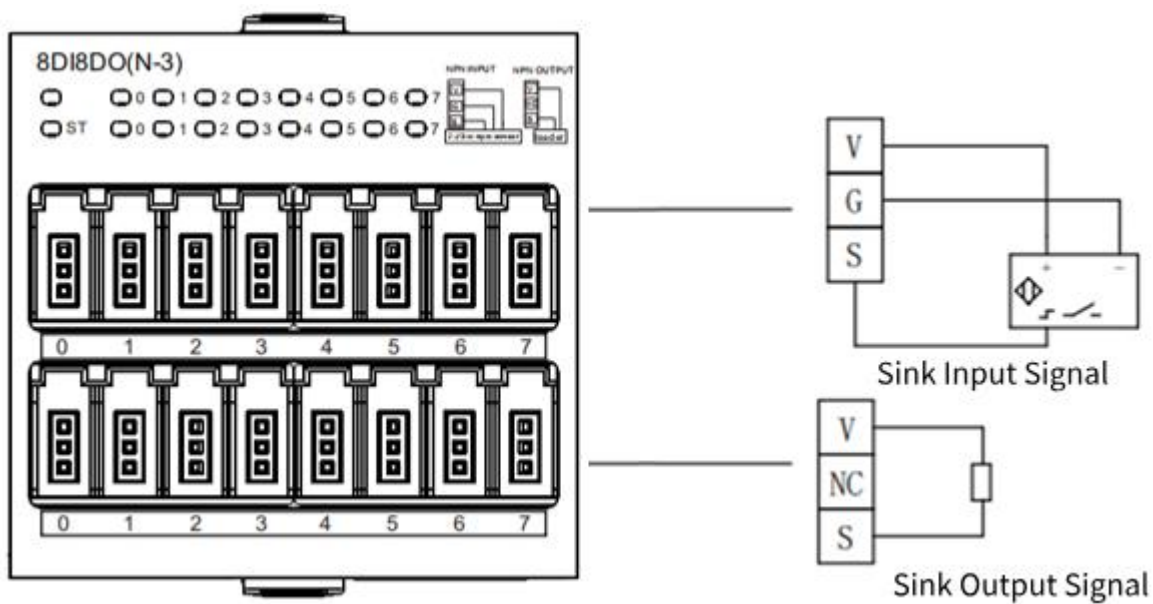
8DI8DO(P-1)



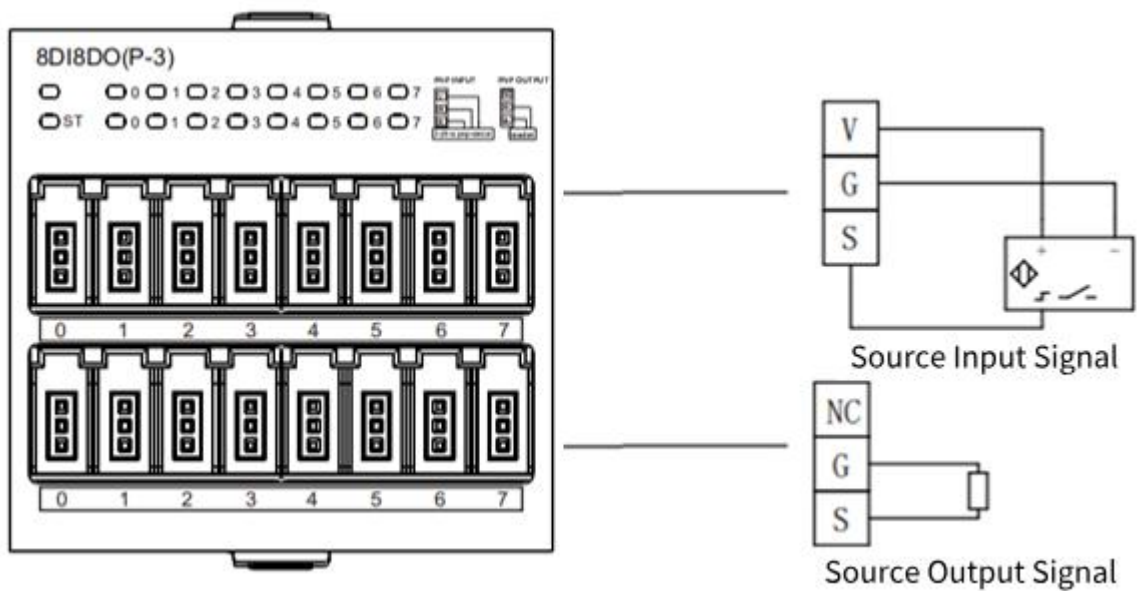
8DI8DO(N-2)



8DI8DO(P-2)

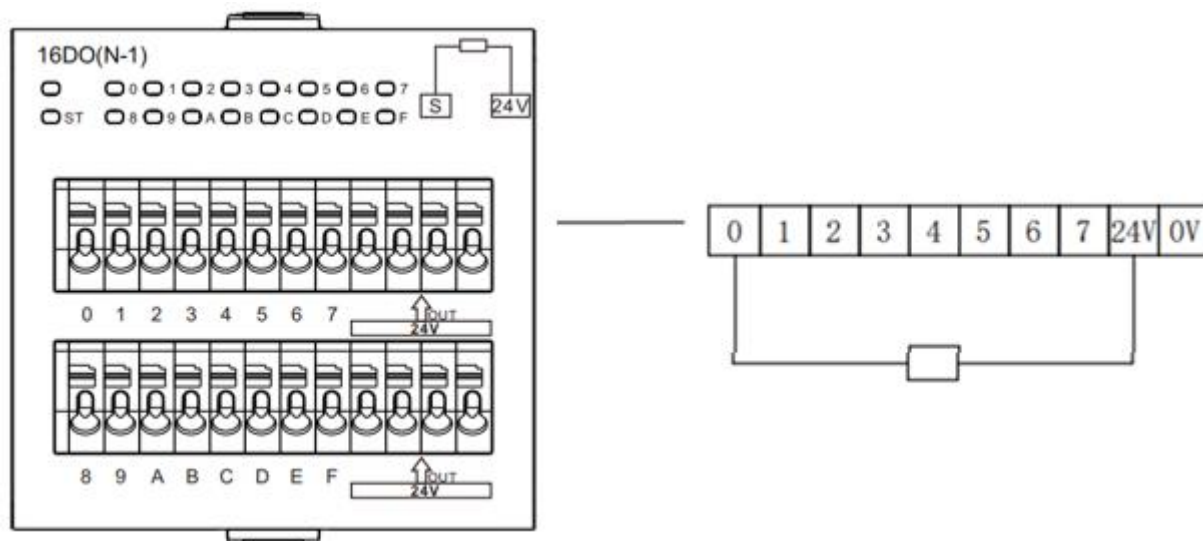


8DI8DO(N-3)

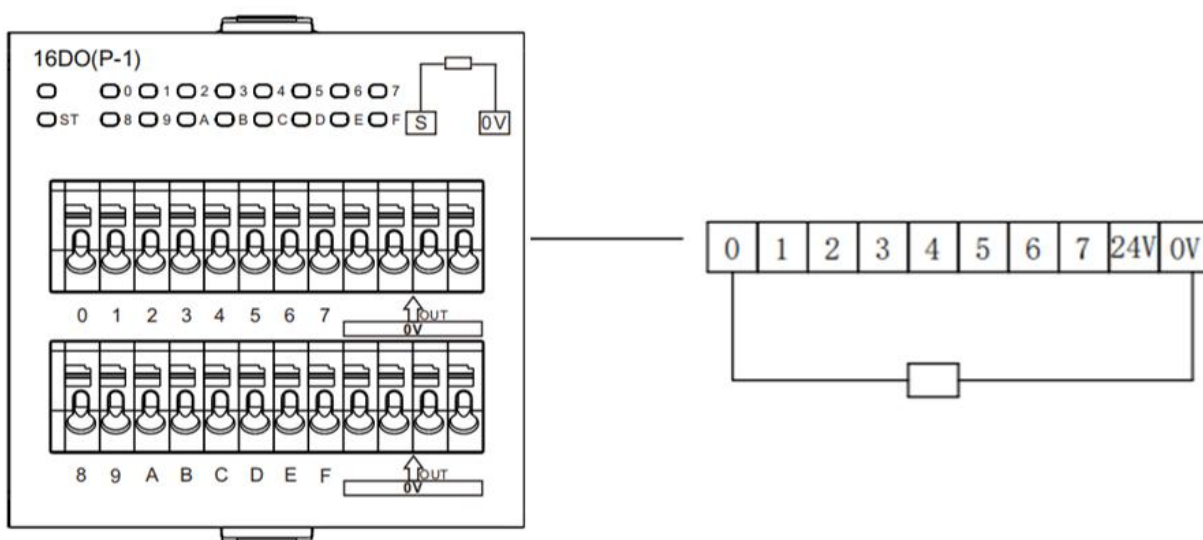


8DI8DO(P-3)

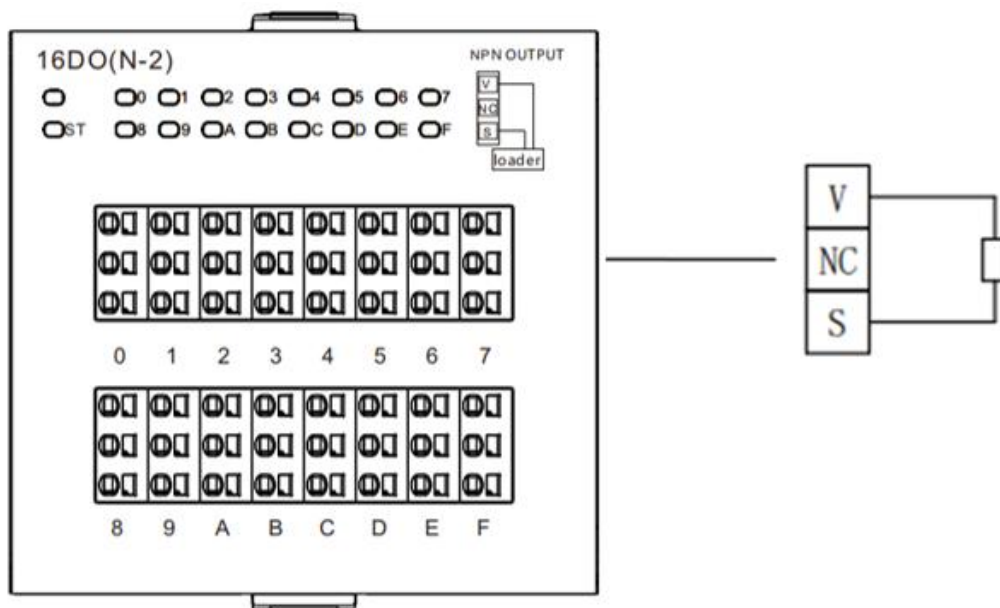
5.2.3 16DO Wiring Diagram



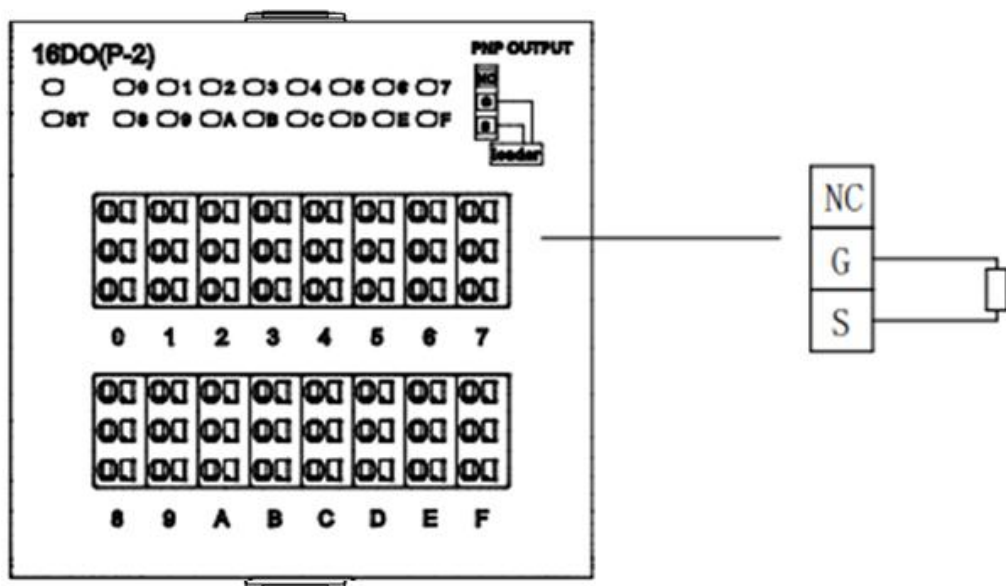
16DO(N-1)



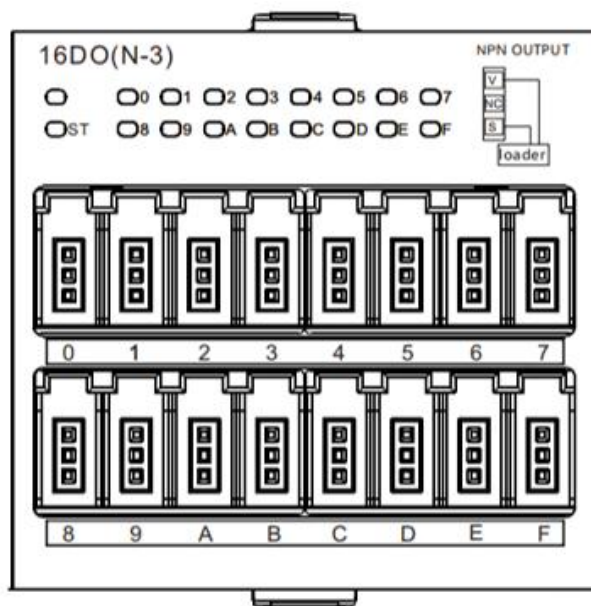
16DO(P-1)



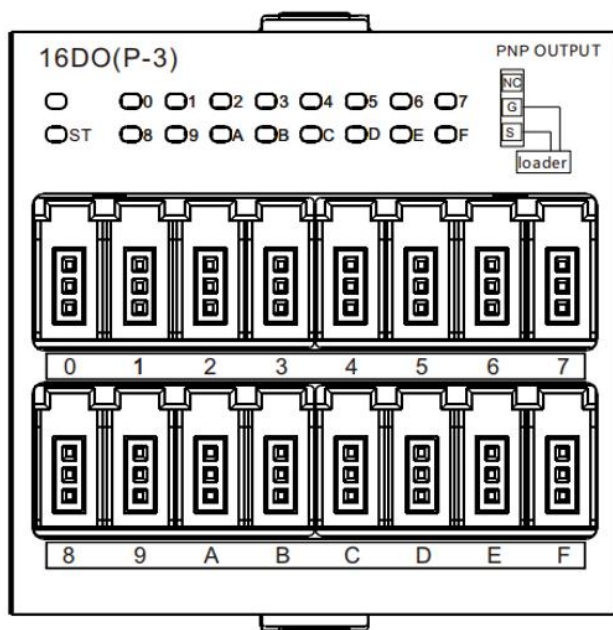
16DO(N-2)



16DO(P-2)

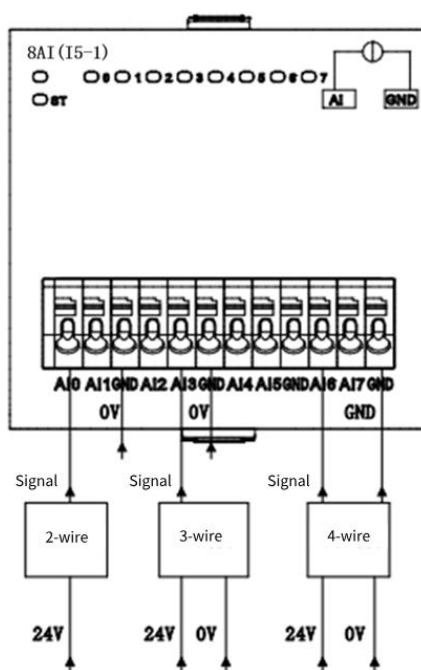


16DO(N-3)

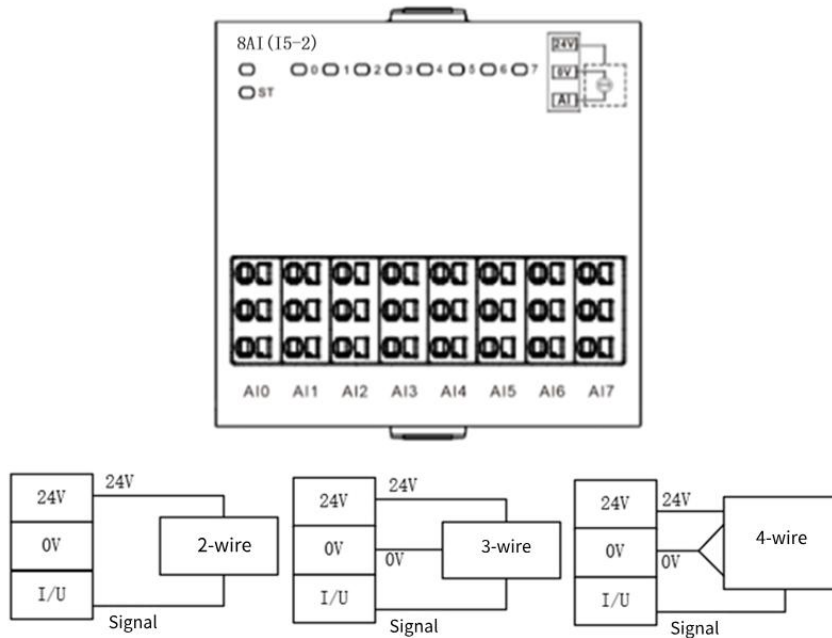


16DO(P-3)

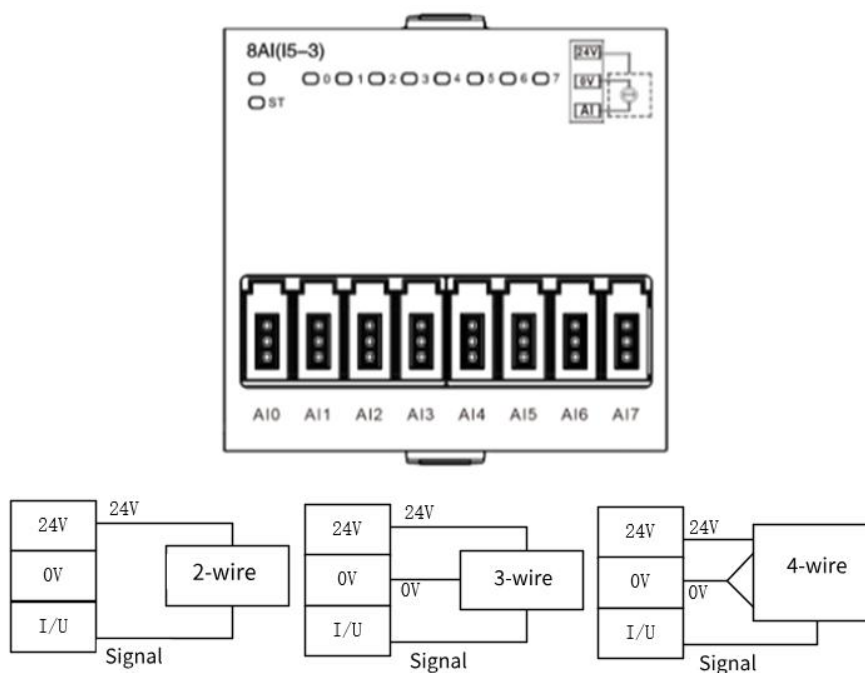
5.2.4 8AI Wiring Diagram



8AI(I5-1)

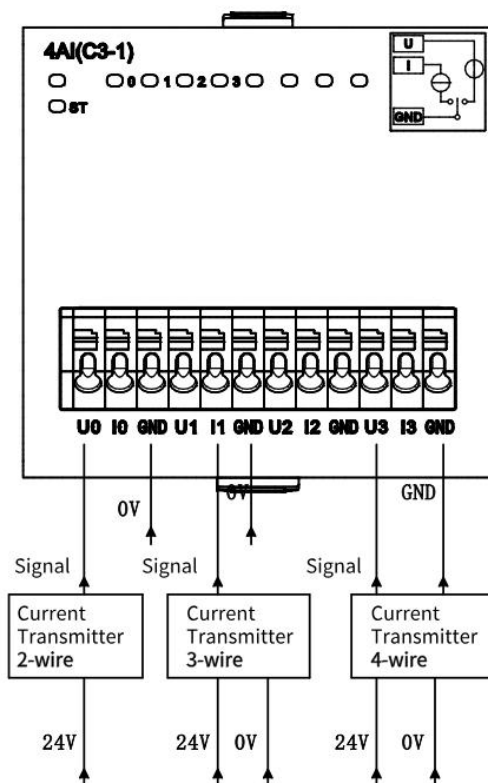


8AI(I5-2)

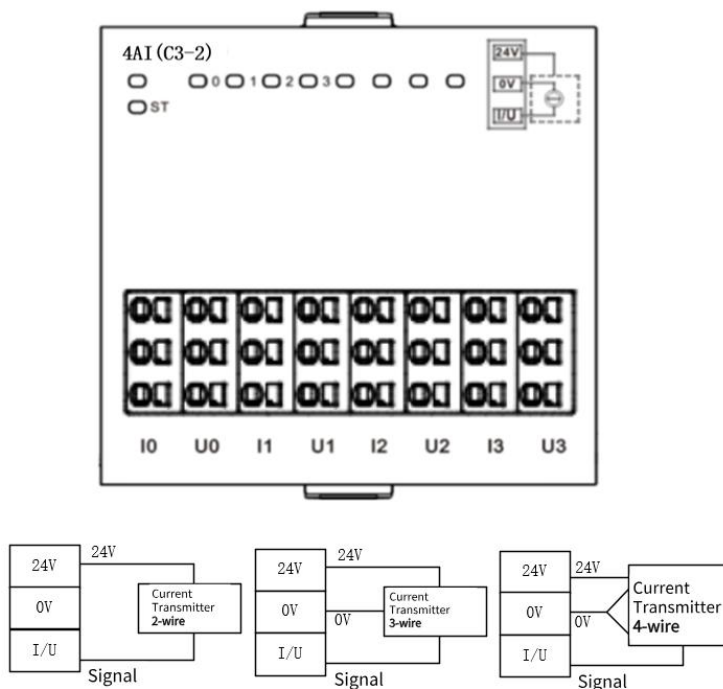


8AI(I5-3)

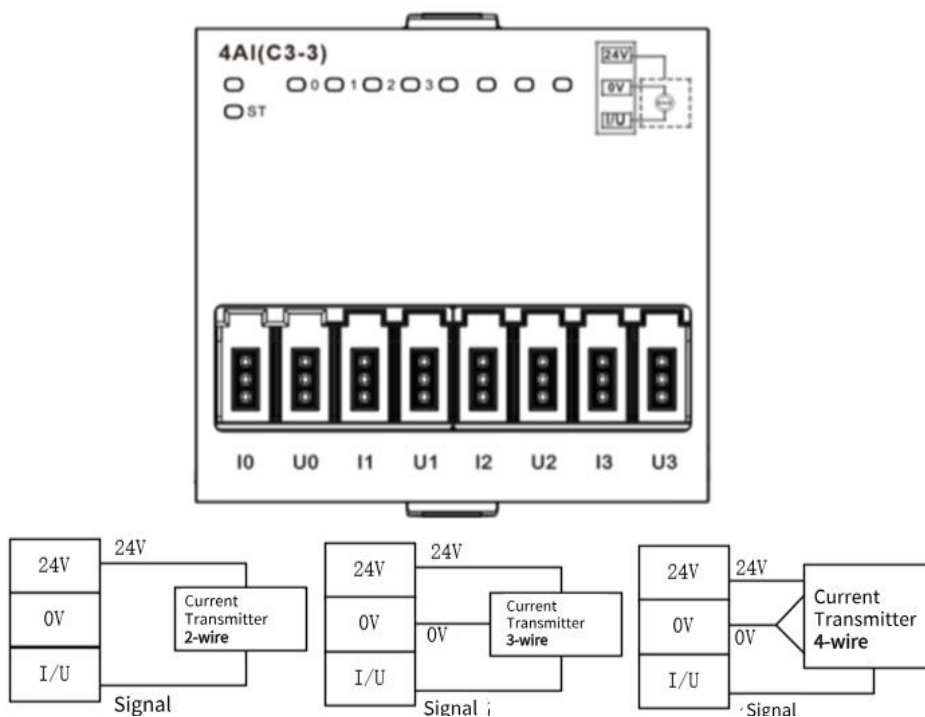
5.2.5 4AI Wiring Diagram



4AI(C3-1)

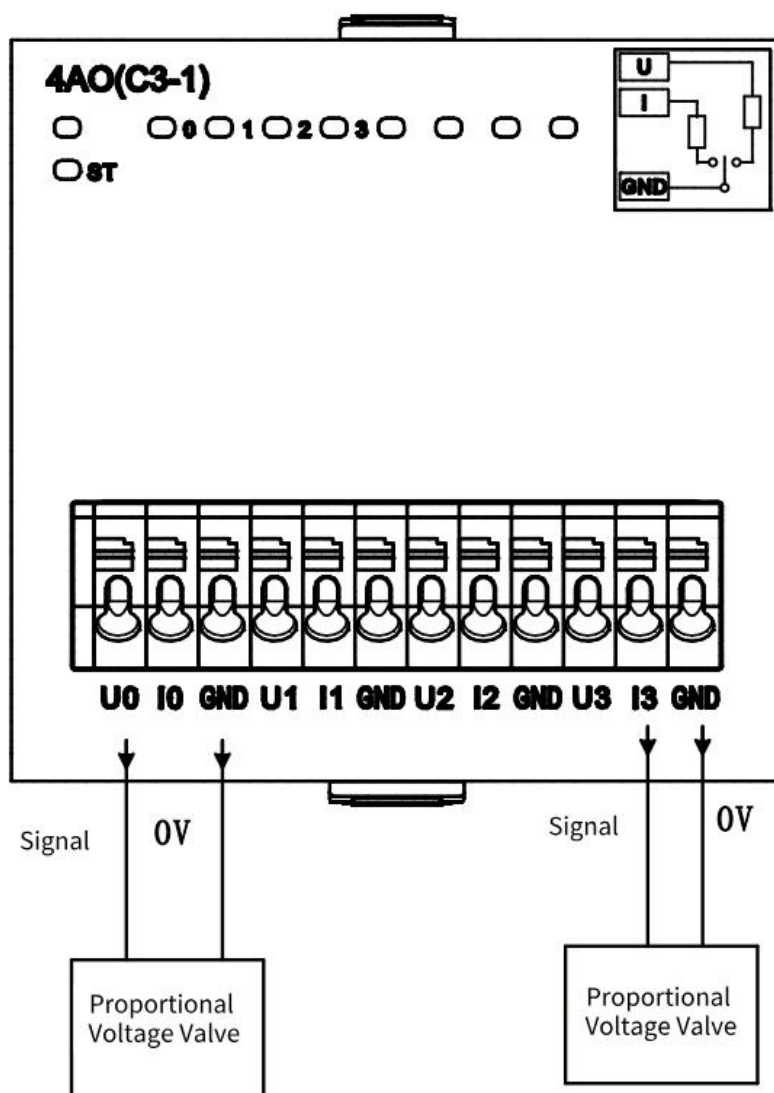


4AI(C3-2)

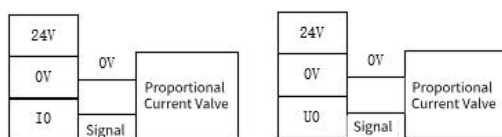
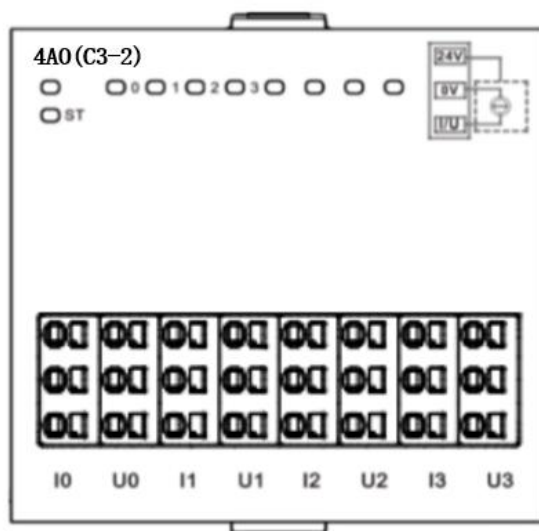


4AI(C3-3)

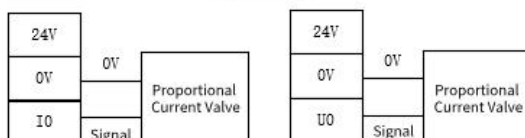
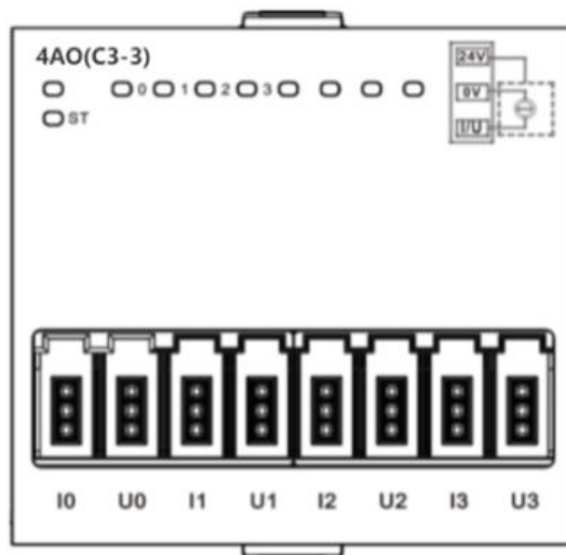
5.2.6 4AO Wiring Diagram



4AO(C3-1)

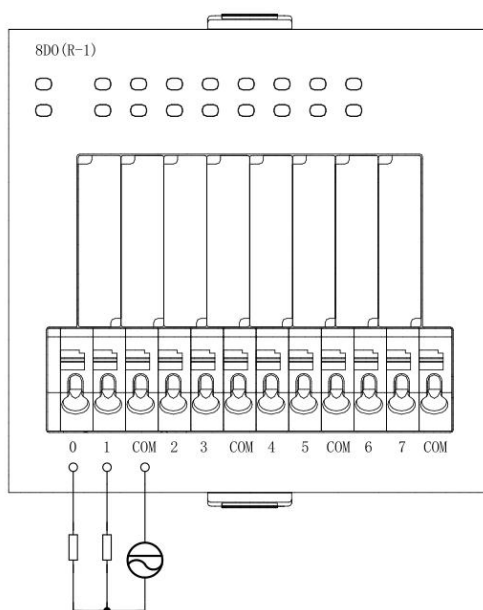


4AO(C3-2)



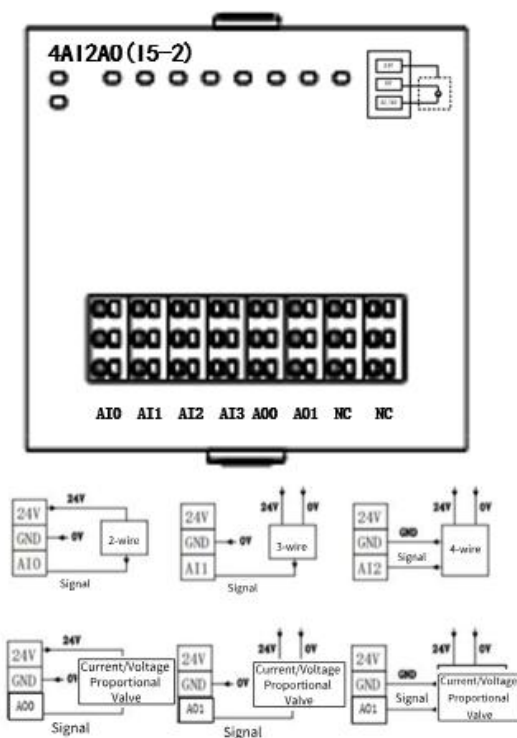
4AO(C3-3)

5.2.7 8DO Wiring Diagram



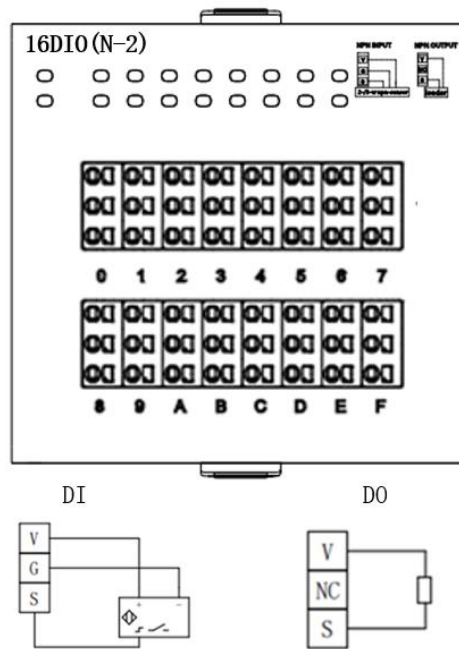
8DO(R-1)

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

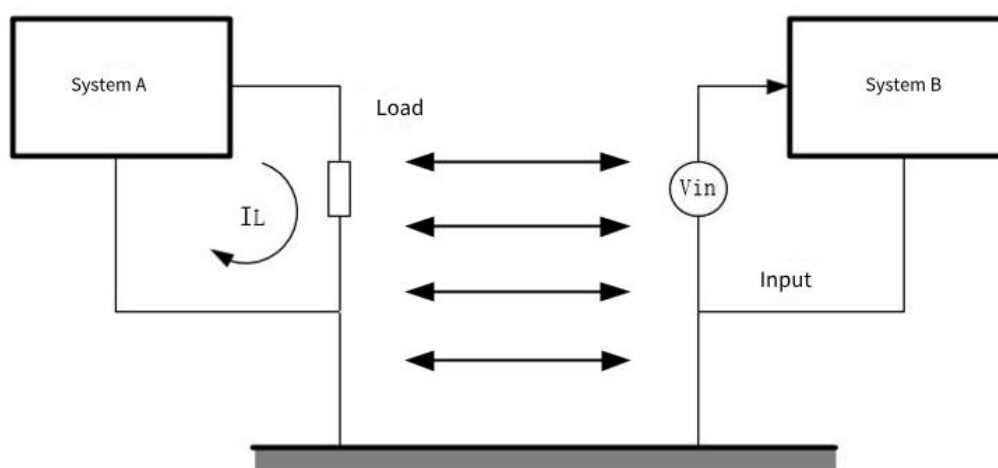
The primary purpose of standardized wiring and shielding in industrial environments is to ensure personnel safety, followed by maintaining system operational stability, and preserving electromagnetic compatibility (EMC) of equipment to ensure reliable system performance and data integrity in industrial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

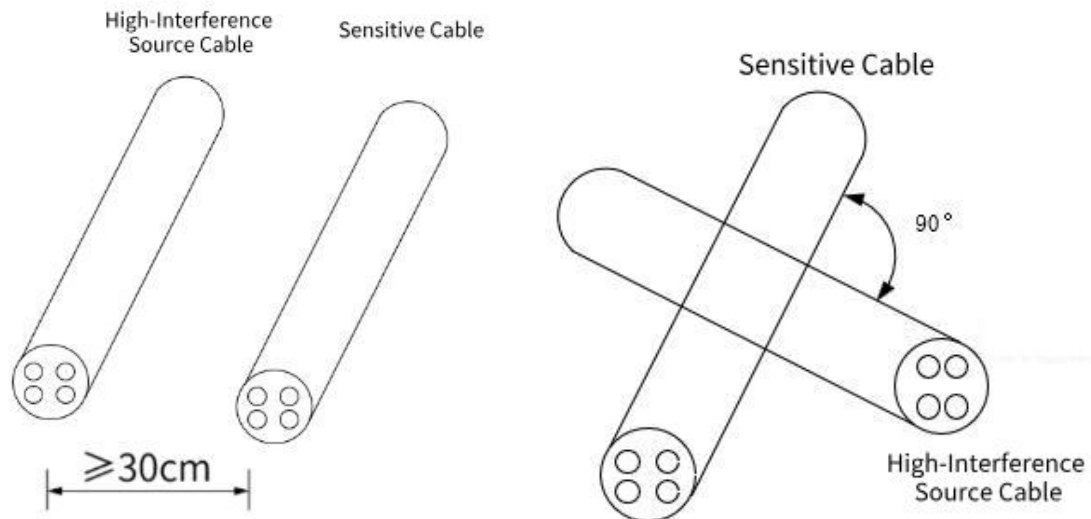
Cable routing requirements

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, EtherNet/IP bus
Digital I/O cable	Grouped and bundled in a non-shielded duct	DI sensor, DO control cable

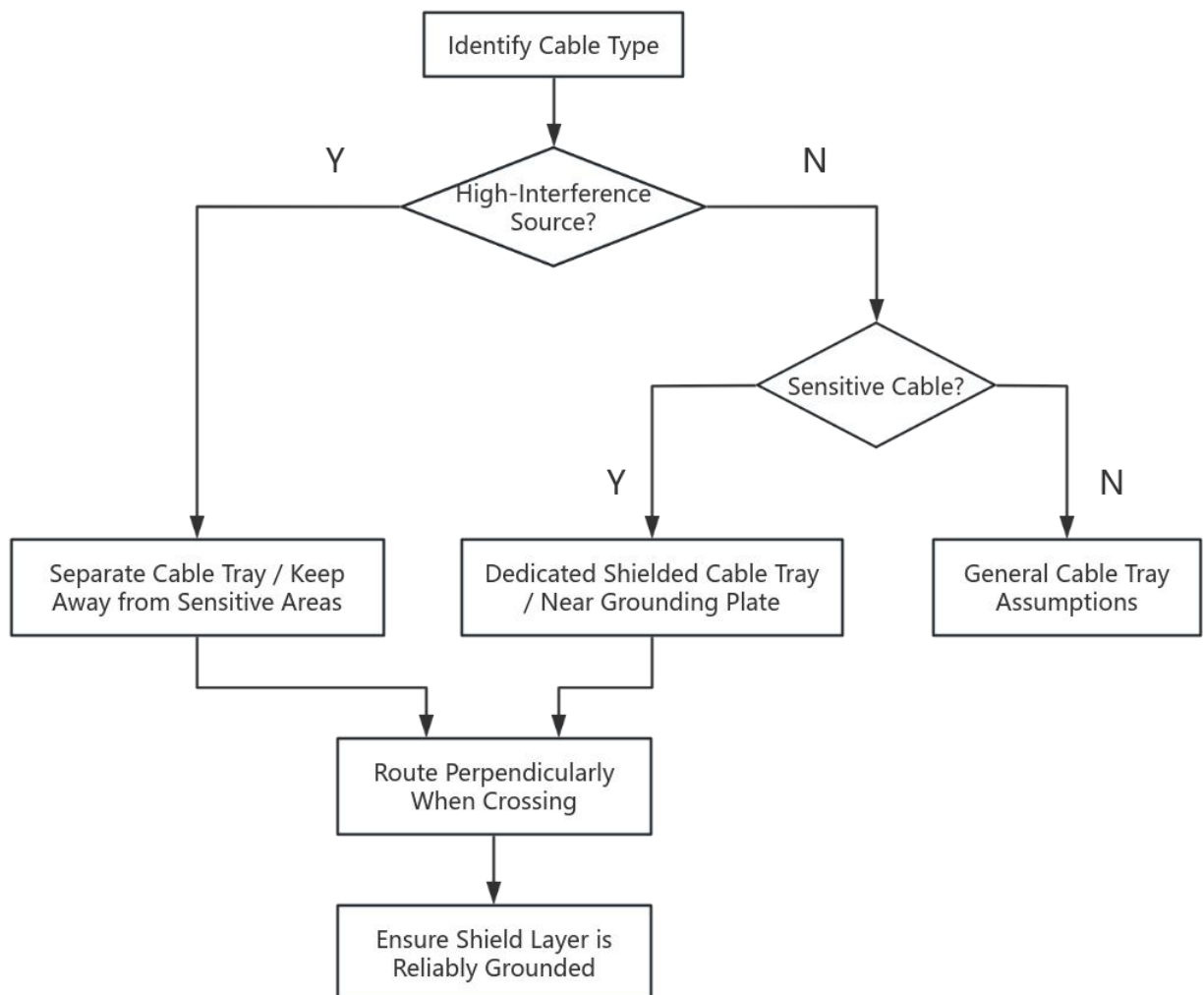
Wiring Recommendation:

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. Product Functions

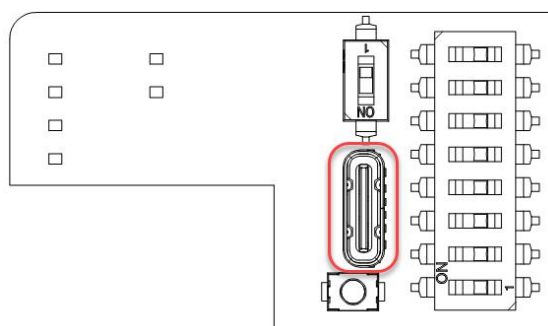
7.1 Reset and Upgrade Functions

7.1.1 Reset Function

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

7.1.2 Upgrade Function

Connect the computer to the Type-C port in the base operation compartment.



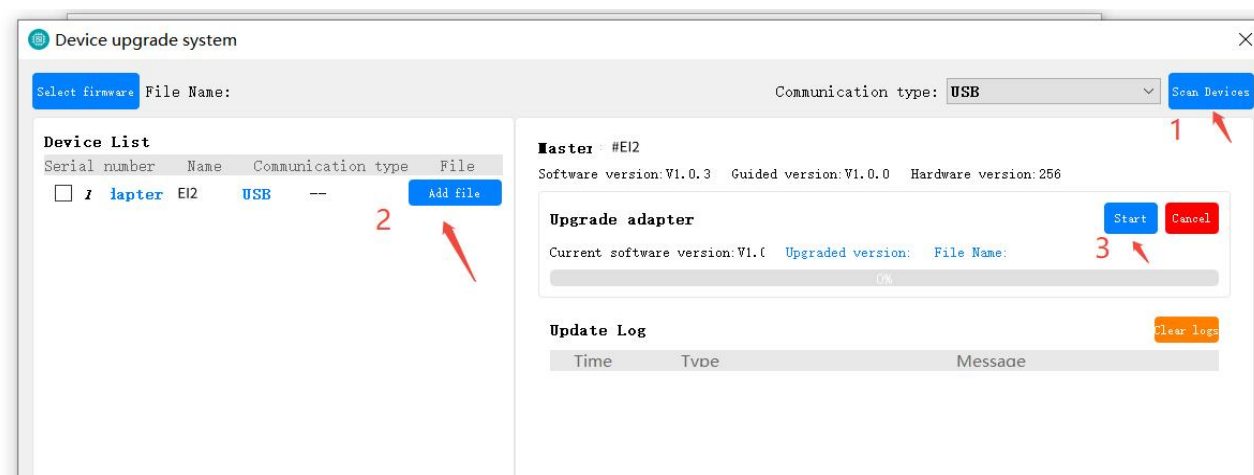
Open the Decowell IOTesterTool software.



Click **Online Upgrade** in IOTesterTool.



Click Scan Devices. After the module is detected, select the corresponding upgrade file, check the module, and then click Start Upgrade.



7.2 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.

7.2.1 Configuration (Engineering Setup)

For configuration operations, please refer to “RS-Ethernet/IP Module Configuration and Application.”

7.2.2 IOTesterTool Configuration

7.2.2.1 Overview

IOTesterTool is a configuration software tool for RS series I/O modules. By connecting a Type-C cable to the Type-C port of the RS-PN2 module, it can perform 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 verify via parameter upload

Monitor module diagnostic information in real time

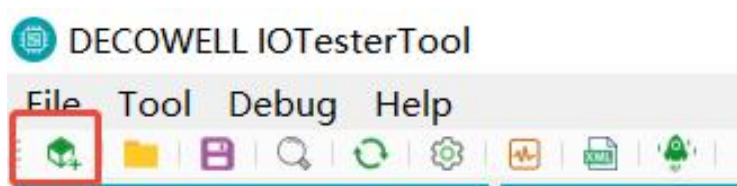
Force output and monitor input signals

7.2.2.2 Operation Procedure

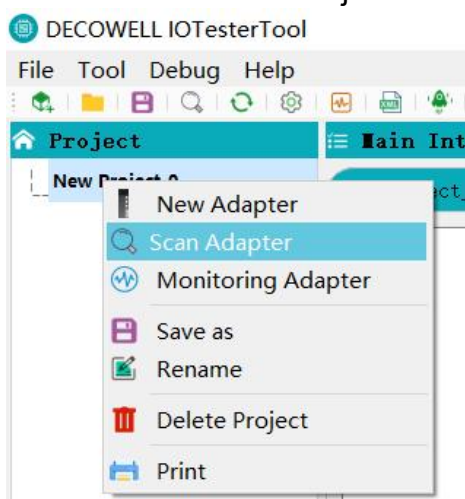
The IO panel of RS series integrated modules supports parameter configuration. This process can be carried out using Decowell's self-developed upper computer software, IO Tester Tool. The steps are as follows:

Open the Decowell IO Tester Tool software and click the highlighted area shown below to create a new project, as illustrated.

Right-click the created project and click "Scan Adapter."



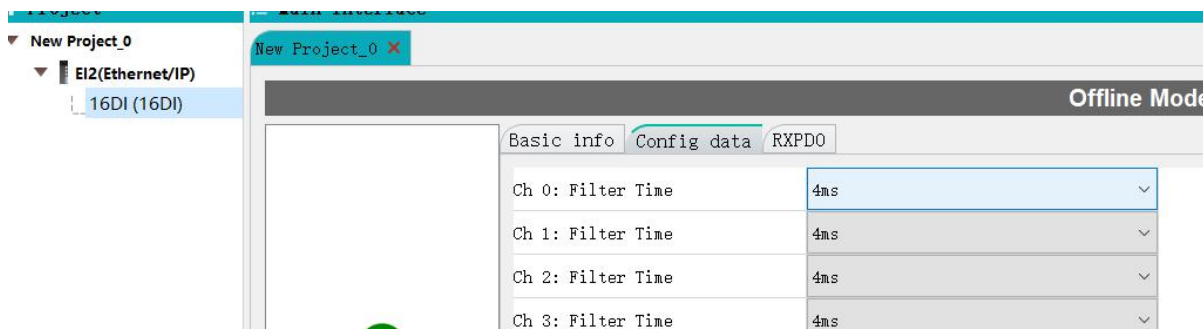
Create a New Project



Scan Adapter

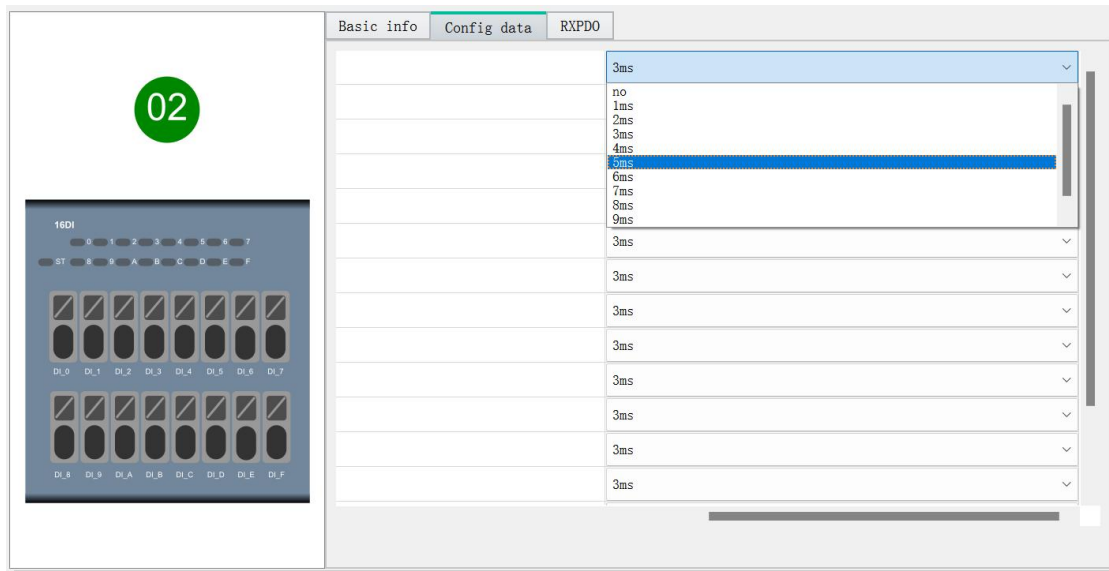
Select the communication mode, then scan for modules and add them to the project.

Click the module in the project tree on the left, locate the "Config Data" window, and modify the relevant parameters.



Modify Parameters

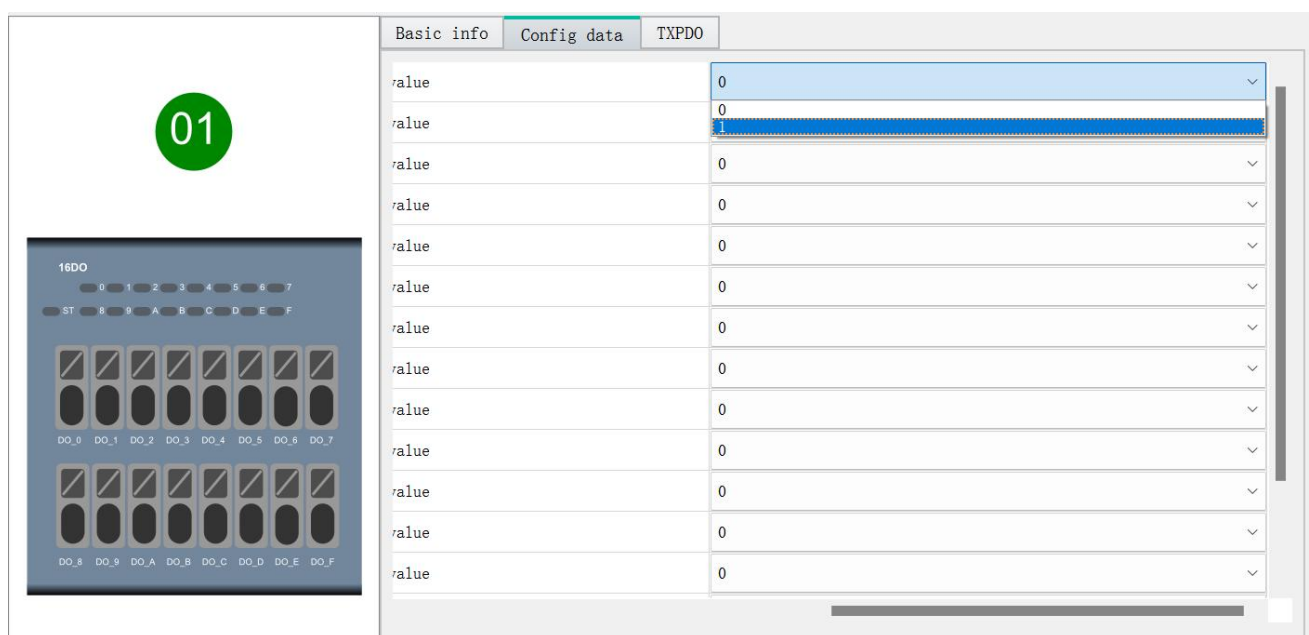
The DI channel parameters support configurable filter time from 0–10 ms, with a default value of 3 ms, as shown in the figure.



DI Parameter Configuration

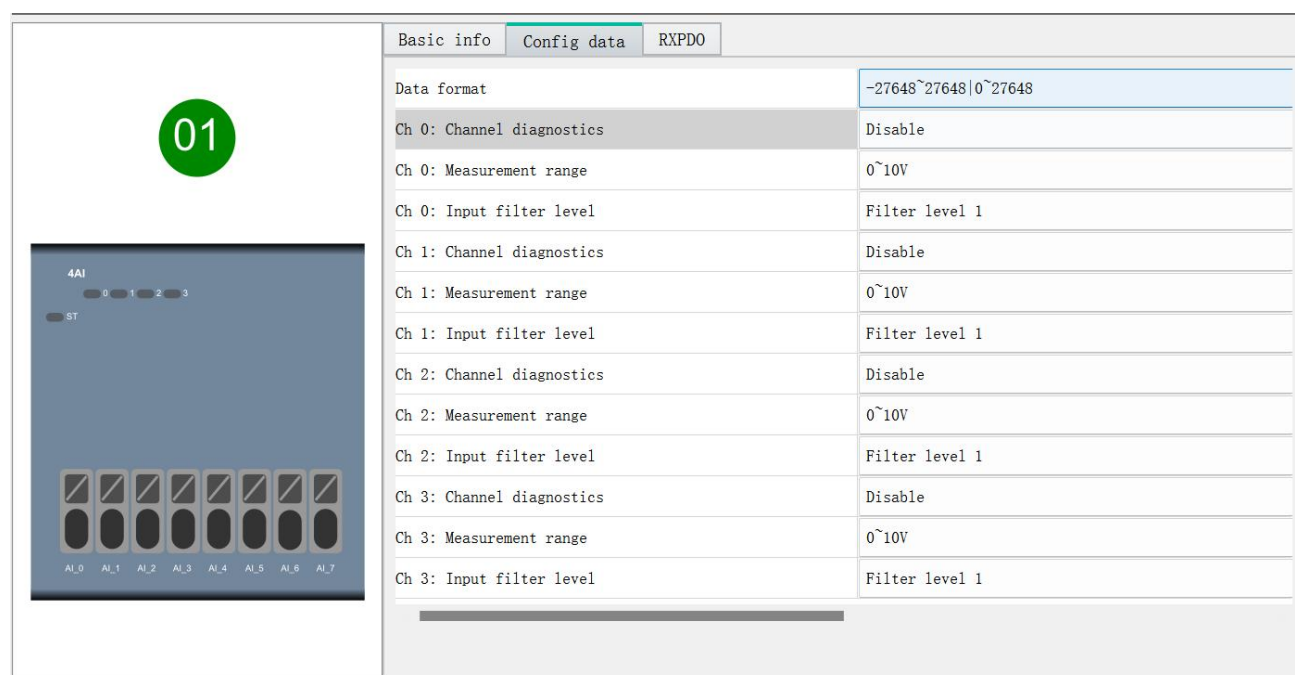
After modifying the parameters, they need to be downloaded to the module. Click **IO Panel - 16DI**, then click **Download Configuration**.

The DO channel parameters allow configuring a substitute value of **0** or **1**.



Bus Output Status Abnormal Value Configuration

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



Basic info		Config data	RXPDO
Data format	-27648~27648 0~27648		
Ch 0: Channel diagnostics	Disable		
Ch 0: Measurement range	0~10V		
Ch 0: Input filter level	Filter level 1		
Ch 1: Channel diagnostics	Disable		
Ch 1: Measurement range	0~10V		
Ch 1: Input filter level	Filter level 1		
Ch 2: Channel diagnostics	Disable		
Ch 2: Measurement range	0~10V		
Ch 2: Input filter level	Filter level 1		
Ch 3: Channel diagnostics	Disable		
Ch 3: Measurement range	0~10V		
Ch 3: Input filter level	Filter level 1		

Data format

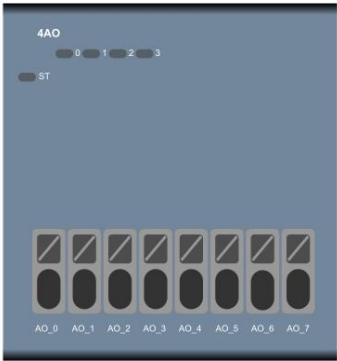
Type	Value Range
S7 Data format	0~27648 -27648~27648
OM Data format	0~30000 -15000~15000
BF Data format	0~32767 -32767~32767

Measurement range

Type	Value Range
Voltage Type	±10V/±5V/0-5V/0-10V
Current Type	0-20mA/4-20mA

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

02



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

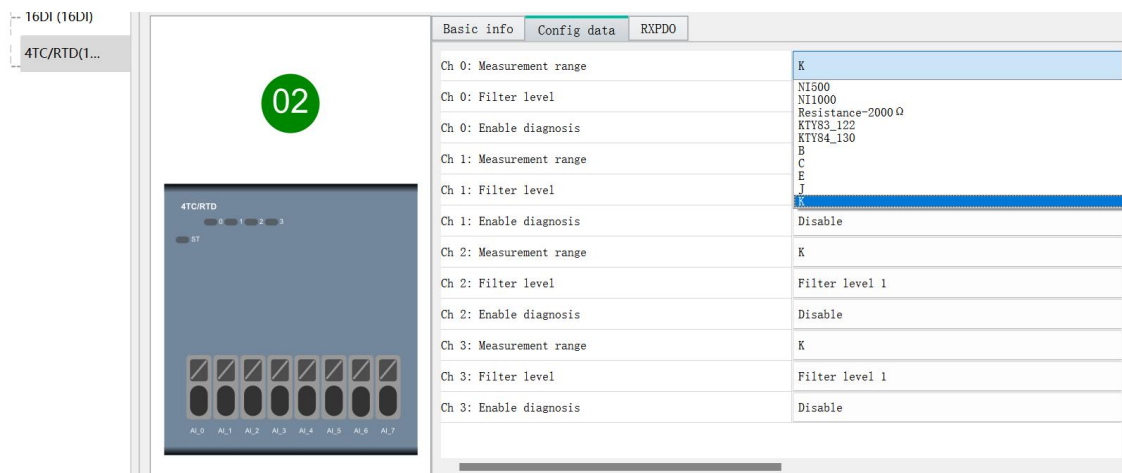
Data format

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

Measurement range

Type	Value Range
Voltage Type	±10V/±5V/0-5V/0-10V
Current Type	0-20mA/4-20mA

The thermocouple and RTD modules support configuration of **sensor type, filter level, and diagnostic functions**.



7.2.3 IP Address Configuration

IP Address Configuration Description

DIP Switch Value (Decimal)	IP Address
000	Set via BOOTP
001–254	The lower 1 byte of the IP address is set via the rotary switch
>254	Out of valid IP address range; the module status indicator (MS) flashes red

By default, the rotary switch is set to “000” at the factory, and no IP address is assigned.

Setting Method via Rotary Switch:

When configuring the IP address via the rotary switch from the factory default state, the IP address will be set as 192.168.0.□ (□ represents the rotary switch value from 1 to 254).

Example:

If the DIP switch is set to 1, the module IP address will be 192.168.0.1.

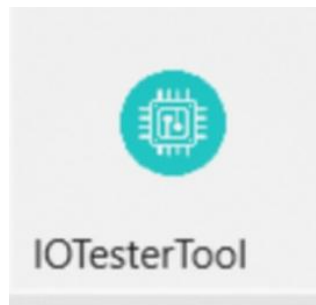
IP address can also be set via software.

Setting IP Address via Software

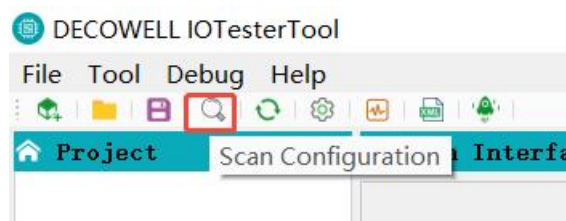
Set the DIP switch to 0, then connect the module to the computer using an Ethernet cable.

Open the DECOWELL IOTesterTool software. (If the DIP switch is not set to 0, the IP

address configured via software will be overridden by the address set by the DIP switch after power cycling.)



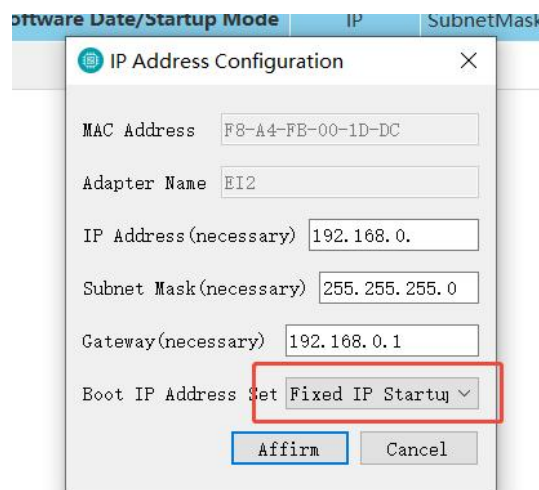
Click “Scan Configuration”.



In the pop-up Scan Device window, select the corresponding network adapter information and the module address range, then click “Search Configuration”.

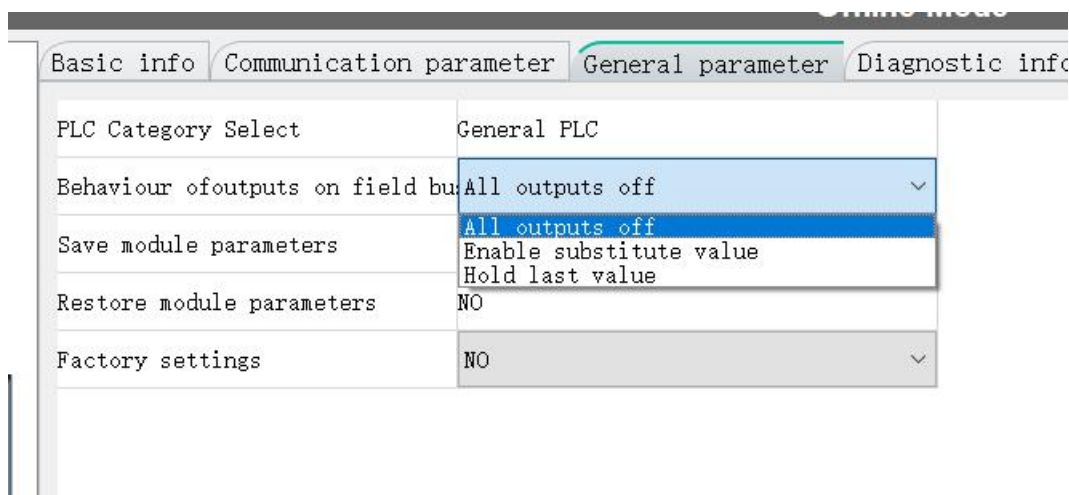


After a successful scan, modify the module IP address. Double-click the startup mode and set the boot IP address to a fixed IP. After startup, modify the IP address accordingly. (Note: Changes to the DIP switch will only take effect after powering off and restarting the module.)



7.2.4 Bus Fault Output Behavior

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



7.2.5 Hot-Swap Behavior

The RS series modules adopt a split structure of “**communication base + I/O panel**”, supporting hot-swapping under power without shutting down the system or interrupting bus communication.

During operation, only the I/O panel needs to be plugged or unplugged, while the communication base remains fixed. This does not affect the normal operation of other modules or the stability of the bus.

The module is equipped with built-in **overcurrent protection, reverse polarity protection, and ESD protection**, ensuring safe and reliable insertion and removal, effectively preventing circuit impact and device damage.

After inserting a new panel, the system automatically completes identification and configuration loading, enabling **plug-and-play** without restarting the device or

re-downloading the program. This greatly simplifies on-site maintenance and reduces fault recovery time.

When the RS-PN2 is operating, hot-swapping modules in either slot may result in the following conditions:

1. If a module is removed from any slot, the **SYS LED flashes at 5 Hz**, while the other module continues to operate normally.
2. If a module is removed and replaced with another module of the **same type/specification** (e.g., replacing 16DO (N-1) with 16DO (P-2)), the module operates normally after installation, and the **SYS LED returns to flashing at 1 Hz**.
3. If a module is removed and replaced with a **different type/specification** (e.g., replacing 16DO with 8DI8DO), the module will not operate, and its indicator LEDs remain off.
4. The RS-PN2 supports installing modules in both slots or only in the first slot. If only the second slot is populated, the module will not operate.
5. If the RS-PN2 is powered on with only the first slot populated, any module inserted into the second slot afterward will not operate.

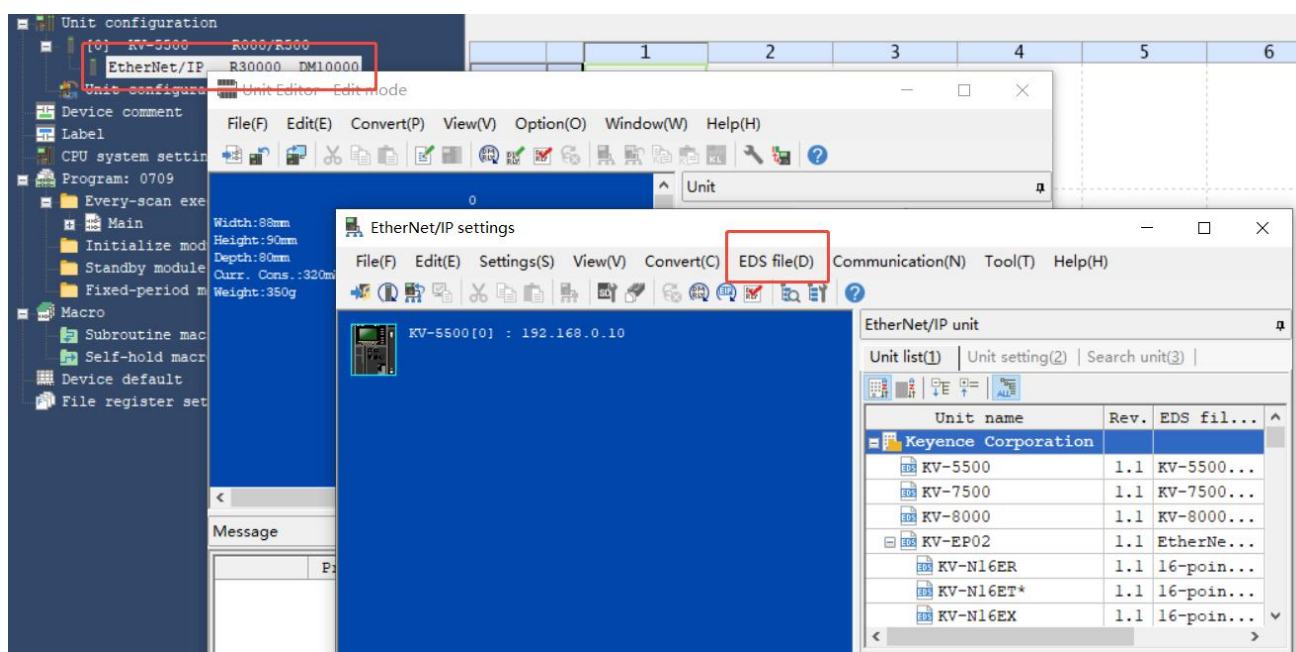
8.RS- EtherNet/IP module configuration and application

8.1 KV STUDIO

8.1.1 Installing and Uninstalling GSD Files

(1) Install GSD file

In the menu bar of the EtherNet/IP setting window, select "EDS File" > "Login" and open the "General Version" > "EI2_Series_V1.1" in the EDS folder.

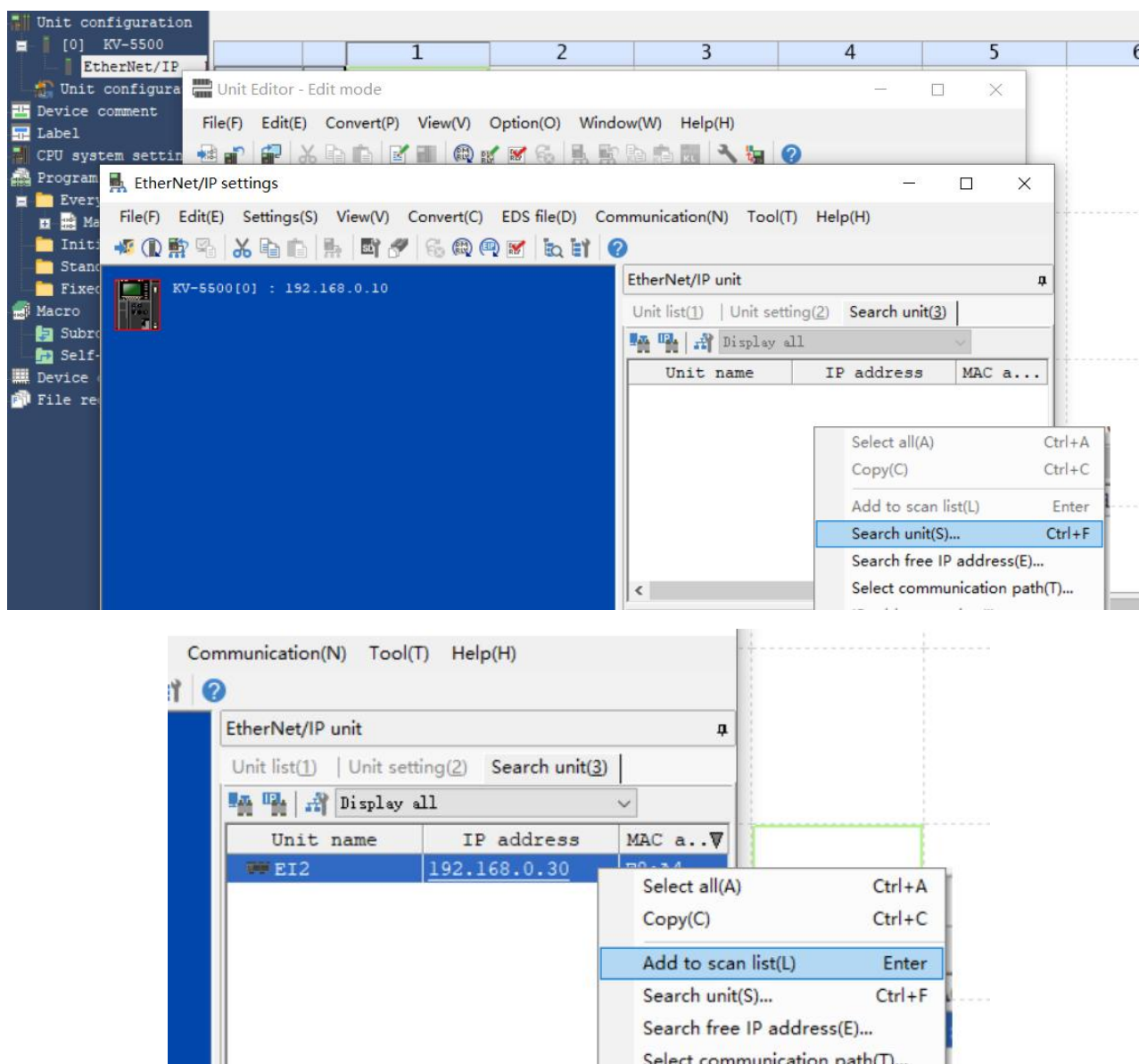


(2) Uninstall GSD file

In the EtherNet/IP Settings window, select "EDS File" > "Login" from the menu bar, open the "General Version" > "Select File" > "EI2_Series_V1.1" > delete.

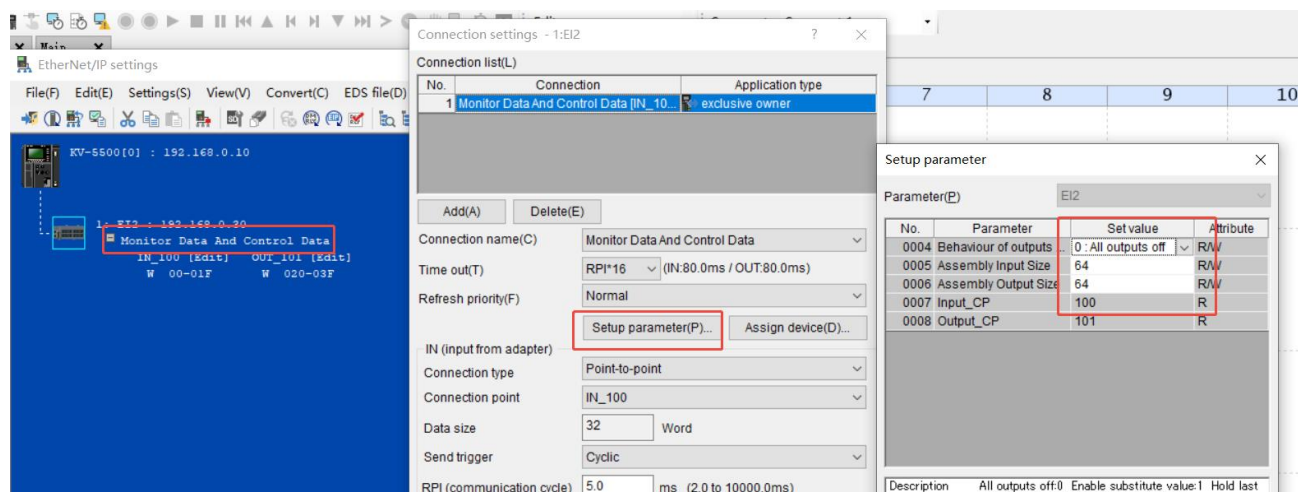
8.1.2 Configuration IOModules

Configure RS-EI2 mode to special PLC mode. In the device search option on the right, right-click the blank area and select "Device Search". Add the scanned device to the scan list, right-click the device to be added and select "Add to Scan List".



8.1.3 Configuration parameters

In the EtherNet/IP Settings window, select "Monitor Data And Control" > "Parameter settings". The parameter settings include output when power is off, saving module parameters, and restoring factory settings. For specific operations, refer to 2.1.6 *PLC Mode selection button description*.



Parameter Value	illustrate
Continue data exchange	Continue to exchange data, DI/DOValues are updated normally (default)
Behavior like field bus error	Same as bus communication error, data exchange stops DIThe value stops updating, DOValue stop output

9. FAQ

9.1 Common DI Issues

DI Failure – *Description*: Communication between the PLC or upper computer and the module is normal. DI channels are connected to signals, but the software does not detect any signal value, and the DI channel indicator LED is off.

Troubleshooting Steps:

1. Check the panel indicator LEDs.
2. Verify whether the DI input signal type matches the module specification.
3. Check whether the DI signal shares the 24V supply with the load (common source).

Troubleshooting Outcome:

- If the panel ST LED is abnormal, check whether the 24V load supply is connected.
- If a load power supply is present, verify the digital-to-analog mapping for different data formats.
- Check for any loose panels.
- If the LED is correct, verify that the DI signal type matches the module signal type (NPN/PNP).
- If all above are correct, confirm whether the DI signal and module load supply are from the same source and share a common 0V.
- If all steps are correct but the issue persists, it is likely a hardware problem.

DI Channel Abnormality – *Description*: Input channel 1 has a signal. Both channels 1 and 2 show signals, and their indicator LEDs light up simultaneously.

Troubleshooting Steps:

1. Slightly press the panel and observe the input indicator LEDs.
2. Disconnect the panel and measure the continuity of the two signal channels.
3. Inspect the panel and base for metal wires or foreign objects.

Troubleshooting Outcome:

- If pressing the panel makes the issue intermittent, the channel pins may be too long, causing a short to base components (this issue has been optimized).

- If step 1 passes, proceed to step 2 to determine whether the panel or base causes the issue.
- Finally, perform step 3.
- If all steps pass, the problem is likely hardware-related.

DI Channel Abnormality – *Description*: Communication between the PLC or upper computer and module is normal. After powering on, some DI channels show signals, but the corresponding indicator LEDs do not light up.

Troubleshooting Steps:

1. Check whether the DI channel corresponds to multiple variables.
2. Inspect the connector for damage or detached solder joints.

Troubleshooting Outcome:

- If no multiple-variable mapping exists, check the connector condition.
- If all checks pass, the issue is likely hardware-related.

9.2 Common DO Issues

DO Failure – *Description*: The DO channel indicator LED is off. The software has not set the corresponding DO channel to 1, but the DO channel actually outputs.

Troubleshooting Steps:

1. Check whether the corresponding DO has 24V voltage.
2. Verify the load wiring.

Troubleshooting Outcome:

- If the DO channel has no 24V, check the load wiring.
- When the load wiring is from a different source, potential differences may cause false load activation.

DO Failure – *Description*: DO directly drives a load, but the output DO signal cannot drive it; the channel LED is normal.

Troubleshooting Steps:

1. Check the 24V output and whether the load's inrush current exceeds 0.5A.

2. Confirm whether the DO remains in a TRUE state while the IO 24V supply is unstable.

Troubleshooting Outcome:

- If output voltage and load inrush current are correct, check step 2.
- After power cycling the IO supply, a new output control command must be manually sent for the DO to resume output (resolved in version V2.1.4 and later).

9.3 Common AI Issues

AI Value Abnormality – *Description:* A 16-bit current acquisition module shows a negative value.

Troubleshooting Steps:

1. Confirm whether the configured range matches the actual input current.
2. Check whether the channel's data type is double-word.

Troubleshooting Outcome:

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

AI Failure – *Description:* Communication between the PLC or upper computer and the module is normal. The AI channel is connected to a valid analog signal, but the software cannot monitor the value, and the AI channel indicator LED is abnormal.

Troubleshooting Steps:

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

Troubleshooting Outcome:

- If the range configuration is correct, verify the signal type.
- If both range and signal type are correct but the software still cannot read values, the issue is likely hardware-related.

AI Value Fluctuation – *Description:* Communication is normal. The AI channel receives a signal, but the monitored AI value fluctuates.

Troubleshooting Steps:

1. Check the module's current filter level configuration.
2. Verify whether the input signal has large fluctuations.
3. Inspect the site for strong electromagnetic interference sources (e.g., VFDs, motors, high-power equipment).

Troubleshooting Outcome:

- If the filter level is set to default, increase the filter level and observe whether the value stabilizes.
- If fluctuations persist, perform steps 2 and 3.
- Large fluctuations may be caused by on-site electromagnetic interference.

9.4 Common AO Issues

AO Failure – *Description:* Communication between the PLC or upper computer and the module is normal. The AO channel outputs a signal, and the channel LED is normal, but it cannot drive an external load.

Troubleshooting Steps:

1. Check whether the module's configured range matches the load's required range.
2. Verify whether the AO output signal has voltage or current.

Troubleshooting Outcome:

- If the range matches, check the output signal.
- If no voltage or current is detected, the issue is most likely hardware-related.

AO Output Abnormality – *Description:* Communication is normal. The AO outputs 5V or 10mA, but the load receives a signal higher than 5V or 10mA.

Troubleshooting Steps:

1. Verify whether the module's configured range matches the load's required range.
2. Confirm whether the load's 0V is connected to the AO module GND.

Troubleshooting Outcome:

- If the range matches, check for a common ground.
- If the load and module do not share a common ground, abnormalities may occur.

- If all above checks pass, the issue is likely hardware-related.

9.5 Common Panel Issues

Panel Signal Abnormality – *Description:* Communication between the PLC or upper computer and the module is normal. DI/DO/AI/AO signals are intermittent, occasionally failing.

Troubleshooting Steps:

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

Troubleshooting Outcome:

- This issue is most likely due to tolerance variations between the panel and base connectors.
- Pressing the panel and panel replacement can help diagnose the problem.

9.6 Common Module Issues

Module Abnormality – *Description:* After powering on, all module LEDs are unresponsive, and the 24V power cable becomes hot.

Troubleshooting Steps:

1. Verify whether the two 24V connections are correct.
2. Check whether cold-pressed terminals are properly seated.
3. Inspect the baseboard for burn marks.

Troubleshooting Outcome:

- If wiring and terminals are correct but the module is still unresponsive, the issue is most likely hardware-related.

Usage Abnormality – *Description:* RS module is correctly configured, but the PLC shows errors, and the panel ST LED is abnormal.

Troubleshooting Steps:

1. Check whether the IO PWR LED is steady and confirm that the 24V IO supply is normal.
2. Verify whether the panel is loose.
3. Confirm whether the PLC supports slot configuration and whether the panel order matches the configuration.

Troubleshooting Outcome:

- If the supply is correct and the LED is steady, swap panels.
- If swapping resolves the issue, it is likely due to connector tolerance between the panel and base.
- If unresolved, check step 3.
- If all steps pass and the issue persists, it is likely hardware-related.

9.7 Common Network Port Issues

Network Port Abnormality – *Description*: During operation, the network connection drops intermittently. The port LED is off when the fault occurs.

Troubleshooting Steps:

1. Check whether both ends of the network cable are loose.
2. Test a direct connection to confirm whether the device can be pinged.
3. Inspect the network cable connectors for cold soldering or detached pins.

Troubleshooting Outcome:

- If the cable is secure but ping fails, inspect the port soldering.

9.8 Common Configuration Issues

Configuration Abnormality – *Description*: During configuration, the IO base is automatically scanned, but the panel information is not detected.

Troubleshooting Steps:

1. Verify whether the IO supply 24V is normal and the panel ST LED is on.
2. Perform a panel cross-test.
3. Disconnect the panel and inspect the connector for damage.

Troubleshooting Outcome:

- If power and LED are normal, perform the panel cross-test.
- If the issue persists, inspect the connector.
- If still unresolved, create a new PLC or upper computer project and rescan, confirming that the PLC or upper computer supports slot configuration.
- If all checks pass but the issue persists, it is likely hardware-related.

10. Appendix

10.1 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.

10.1.1 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

10.1.2 Application Limitations

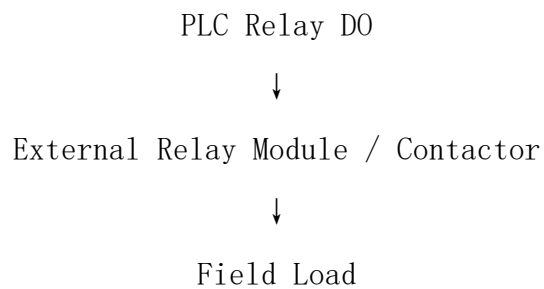
To ensure long-term stable operation, relay output modules are **not suitable** for the following situations:

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.

10.1.3 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

10.1.4 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



Nanjing Decowell Automation Co., Ltd.

Service Hotline

400-096-9016

Address: Building 13, Ruichuang Intelligent Manufacturing Park, No. 19 Lanxin Road, Pukou District, Nanjing, China

Email: contact@decowellauto.com

Website: www.decowellauto.com