

RB Series Adapter

User Manual

DECOWELL Industrial Intelligence makes reliable partners



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Preface

■ Document Overview

Thank you for purchasing the DECOWELL RB series card-type I/O modules!

The RB Series Card-type I/O Modules are distributed expansion modules developed by DECOWELL. The series consists of an adapter, I/O modules, power modules, and terminal modules. The adapter supports a variety of communication buses, such as PROFINET, EtherCAT, CC-Link, and Modbus TCP. The I/O modules include digital input modules, digital output modules, analog input modules, analog output modules, and functional modules, which can be flexibly combined according to actual application requirements.

The RB-1110 is a PROFINET bus adapter, and each adapter can be expanded with up to 32 I/O modules.

This manual describes the specifications, features, and operation of this module. Please read this manual carefully before use to ensure correct and safe operation of the product.

Due to continuous product and technical updates and improvements, the content in this document may not fully correspond to the actual product. Please understand. In case of any discrepancies, the actual product shall prevail. Content changes resulting from 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 Information

1.1 Product Overview

The RB-1110 (hereinafter referred to as “the product”) is a new generation PROFINET bus adapter module developed by DECOWELL. It functions as a PROFINET slave device and connects to a PROFINET network. Through the local bus, it can be flexibly expanded with digital I/O, analog I/O, temperature measurement modules, and others, enabling control and acquisition of various actuator and sensor signals. The product is compatible with PROFINET master devices and is widely used in industries such as environmental protection, photovoltaics, lithium battery production, and logistics.

Key Advantages:

- Space-saving: Ultra-thin 12 mm design significantly reduces cabinet space.
- Fast Wiring: Large-aperture terminals allow tool-free installation and wiring.
- Stable & Reliable: Enhanced diagnostics, three-part modular design, and support for hot-swapping to enable maintenance without system shutdown.

1.2 Product Naming and Nameplate

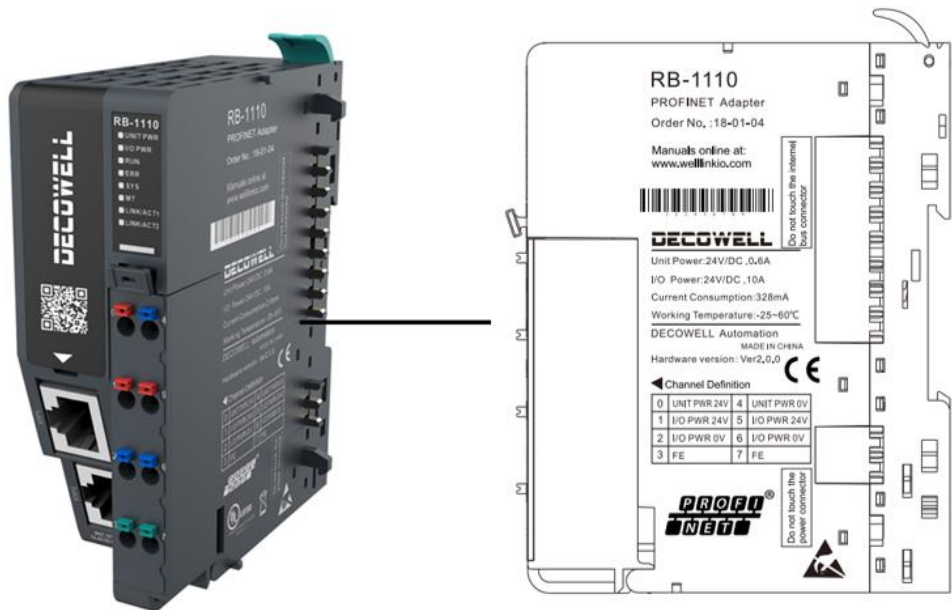
RB-1110

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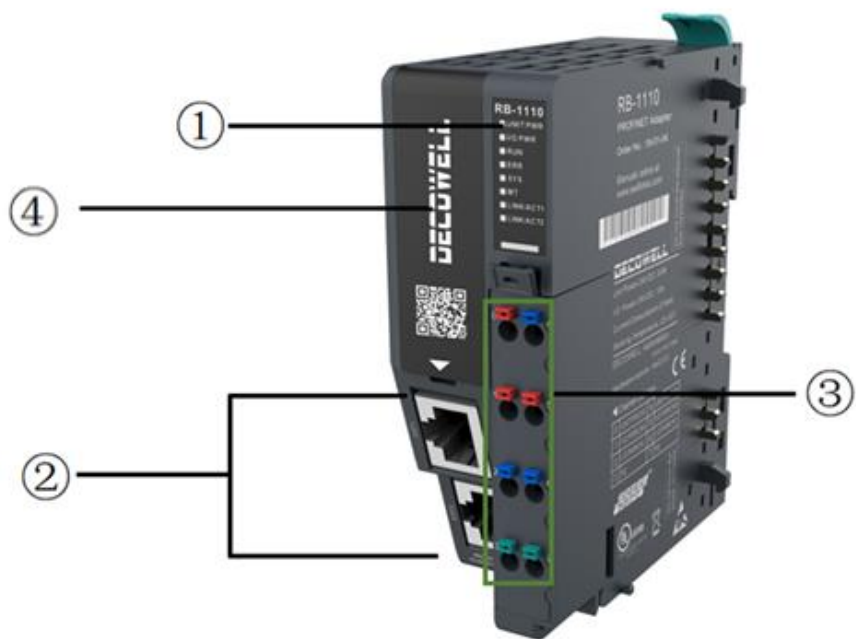
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No.	Name	Definition
①	RB Series	Card-type I/O
②	Bus Adapter	PROFINET bus adapter

Supported Models: The RB-1110 can be expanded with RB Series digital, analog, and functional modules.



1.3 Component Description



1	Status Indicators
2	Communication Interface
3	Power Supply Channel
4	Operator Compartment

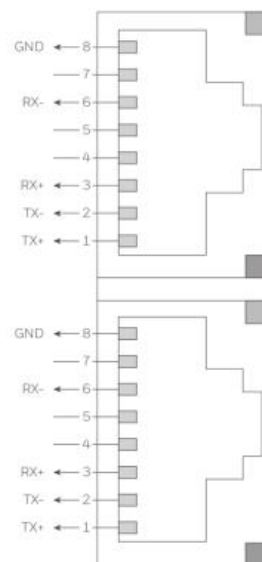
1.3.1 Status Indicator Definition

Name	Describe	State	Function Definition
UNIT PWR	System power indicator	ON (green)	System power supply normal
		OFF	Power off
		ON (red)	System power failure or overload
IO PWR	IO power indicator	ON (green)	IO power supply normal
		ON (red)	IO power supply not connected or faulty
RUN	Operation indicator	ON (green)	Communication normal, data transmission normal
		OFF	Communication stopped, data transmission stopped
ERR	System fault indicator	ON (red)	Network disconnected or fault detected
		Flashing (red)	Network connected / PN communication abnormal
		OFF	Network connected / PN communication normal
SYS	System indicator	1Hz Flashing(green)	Communication normal
		5Hz Flashing(green)	IO slave lost
		2 blink + 1 off	IO module configuration failed
MT	Maintenance indicator	OFF	Operating normally
		ON (blue)	Restoring factory settings
		Fast Flash (blue)	Module upgrade
LINK/ACT1	Network port X1P1 indicator	Flashing (orange)	Receiving data
		OFF	Network disconnected or abnormal
		ON (yellow-green)	Network connection normal
LINK/ACT2	Network port X1P2 indicator	Flashing (orange)	Receiving data
		OFF	Network disconnected or abnormal
		ON (yellow-green)	Network connection normal

1.3.2 Communication Interface Definition

The communication I/O port uses a standard RJ45 8-pin Ethernet connector. The pin assignments are as follows:

Pin	Definition
1	TX+
2	TX-
3	RX+
4	NC
5	NC
6	RX-
7	NC
8	GND



1.3.3 Power Channel Definition

0	24V	Adapter power+	4	0V	Adapter power -
1	24V	IO power 1+	5	24V	IO power 2+
2	0V	IO power 1-	6	0V	IO power 2-
3	FE	Functional Earth	7	FE	Functional Earth
Notice		Only one pin pair (1/2 or 5/6) is required to supply the 24 V power input.			

1.3.4 DIP switch definitions and USB and reset button descriptions

1.3.4.1 DIP switch definition



Node addresses can be configured via DIP switches. Different DIP switch combinations correspond to different node addresses (no two PROFINET slave devices on the same network may share the same node address). The default factory DIP switch value is 0.

DIP switch pin numbers (NO: 1 / OFF: 0)								DIP switch value	Equipment Name
1	2	3	4	5	6	7	8		
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0	User-defined (software settings)
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1	rb1110-001
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2	rb1110-002
.	.	.	.	.	.	.	.	.	.
OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	10	rb1110-010
OFF	ON	ON	ON	ON	ON	ON	ON	254	rb1110-254
ON	ON	ON	ON	ON	ON	ON	ON	255	rb1110-255

1.3.4.2 USB Description



The Type-C port is used for firmware upgrade. For details, refer to the “IO Tester Tool Configuration” section.

Note: Do not use the USB port for any other purpose to avoid potential damage.

1.3.4.3 Reset Button Description



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

1.4 Technical Specifications

Basic parameters	
Dimensions	100×77×34mm
Protection Rating	IP20
Wiring specifications	0.2~1.5mm ²
Wiring method	Straight-through spring connector
Weight	Approx. 140g
Power parameters	
System-side power input	24VDC (±25%)
System terminal rated current	Max: 0.6A
I/O port-side power input	24VDC (±25%)
I/O port-side output current	Max: 8A
Current consumption	Max: 328mA
System-side electrical isolation	500VAC
Power protection	Overcurrent protection, overvoltage protection, reverse polarity protection
Software parameters	
Communication protocol	PROFINET
Address assignment	Assigned by master
Expanding I/O count	32
Maximum input/output data size	Input:1015 Byte/Output: 1015 Byte
Communication rate	100Mbps
Transmission distance	100m (distance between stations)

Note: The system-side power supply (US) powers the control adapter, communication, and the overall rack system, while the I/O port-side power supply (UA) provides power to external field devices such as sensors.

1.5 Environmental Specifications

Environmental parameters	
Operating temperature	-25~60℃
Operating humidity	95% non-condensing
Atmosphere	≥ 795 hPa (altitude ≤ 2000 m) as per IEC 61131-2
Storage temperature	-40~85℃
Overvoltage category	I

1.6 Usage Process

Step	Refer to
Preparation	1.3 Component Description 1.4 Technical Specifications 1.5 Environmental Specifications 2.1 Understanding before installation 4. Grounding and Cable Wiring Instructions
Wiring installation	2.2 Installation Method 3.1 Cable Selection 3.2 Terminal wiring
Configuration debugging	6. Adapter Configuration Case



Caution

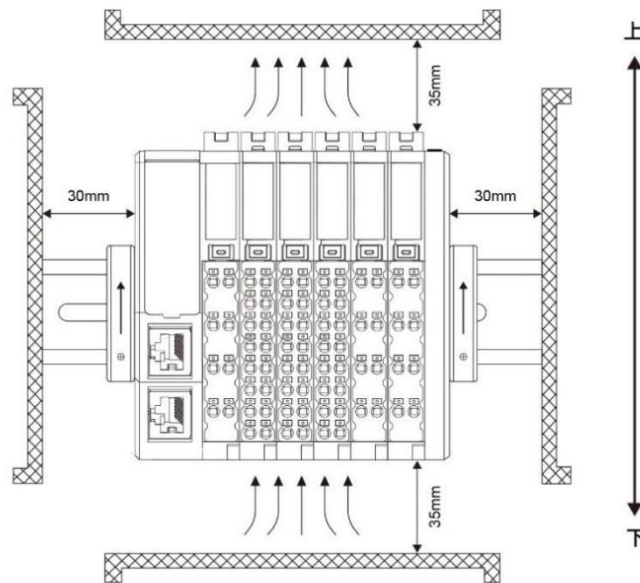
- When the controller is connected to the RB-1110 through a switch, it is recommended to use a standard industrial Ethernet switch to avoid device abnormalities caused by network issues related to non-industrial switches.
- Some switches provide BSP and QoS functions, which can mitigate certain network interference in specific environments. If multiple switches are cascaded on site, the BSP function must be enabled.

2. Mechanical installation

2.1 Understanding before installation

2.1.1 Installation Method

This product supports horizontal DIN rail mounting. To ensure proper ventilation and heat dissipation, as well as sufficient wiring space, the minimum installation clearance around the product must be maintained as shown in the figure below.



Note: Do not install this product directly above high-temperature heat sources (such as heaters, transformers, or high-power resistors). In other installation positions, a minimum clearance of 100 mm must be maintained from any high-temperature heat source.

2.1.2 Installation Precautions

To ensure the reliability and functional integrity of this product, please comply with the following installation requirements:

Do not install this product in environments with:

- Ambient temperatures outside the range of -25°C to $+60^{\circ}\text{C}$
- Relative humidity exceeding 95%RH
- Altitudes exceeding 2000 m (795 hPa)
- Rapid temperature fluctuations that may cause condensation
- Corrosive or flammable gases

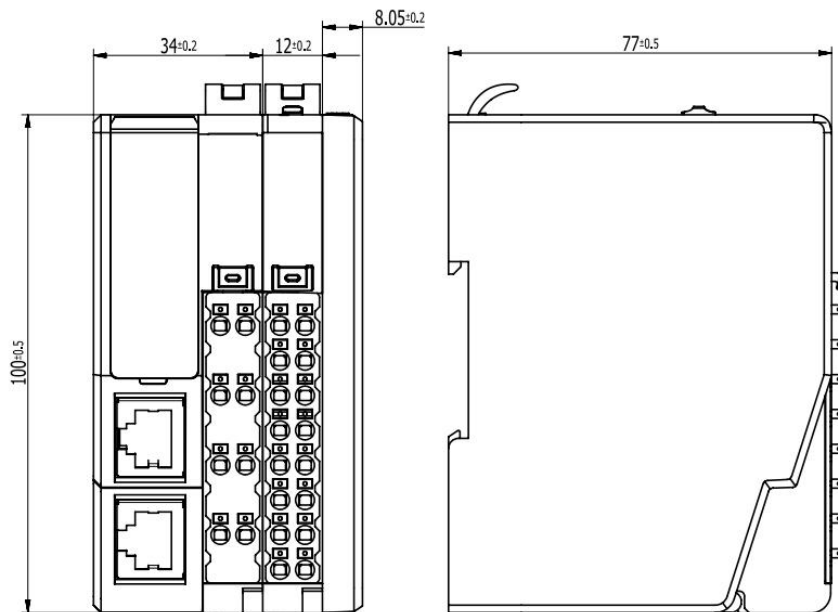
- Excessive dust, conductive particles (e.g., iron powder), moisture, oil mist, salt, or organic solvents
- Direct exposure to sunlight
- Strong vibration or repetitive mechanical shock

If installation is required in the following environments, appropriate and sufficient isolation measures must be implemented:

- Areas affected by static electricity or other types of electrical noise
- Areas exposed to strong electromagnetic fields
- Environments where radioactive exposure may occur
- Locations in close proximity to power lines

2.1.3 Installation space

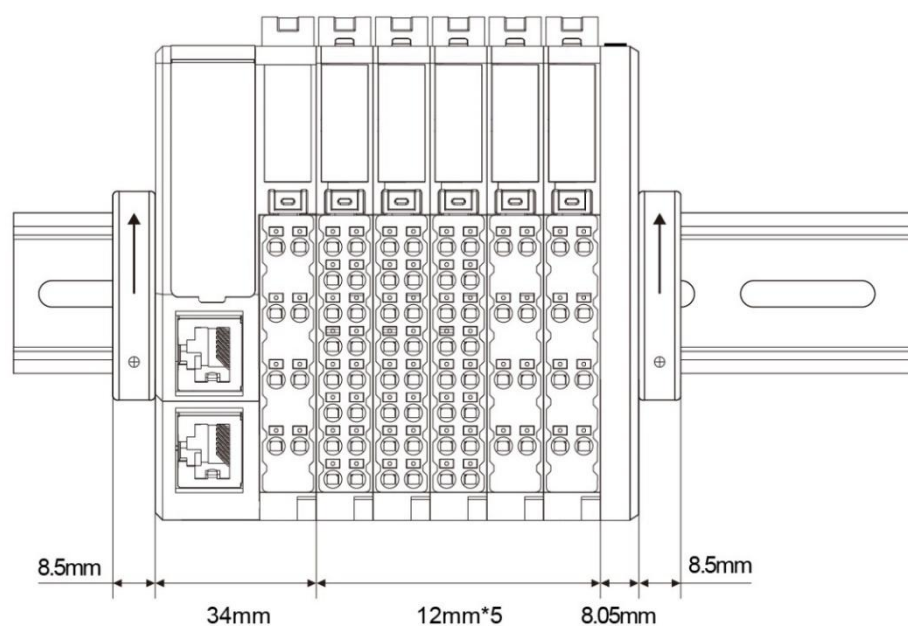
The installation dimensions of this product are in millimeters (mm), as shown in the figure below.



Installation Width Calculation Example

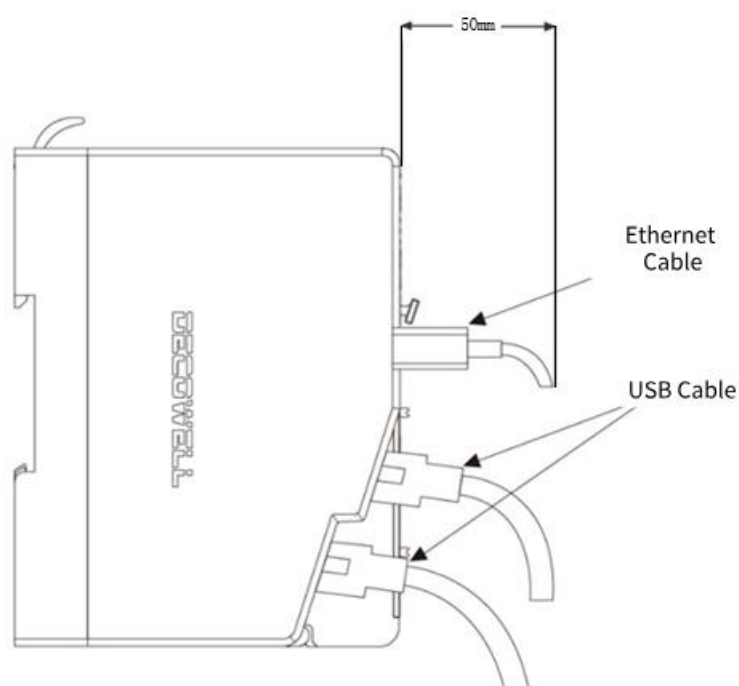
As an example, when using 1 RB-1110 module + 5 expansion modules + 1 terminal module, the installation width is calculated as shown in the figure below (unit: mm).

The total installation width is: $34 + 12 \times 5 + 8.05 + 8.5 \times 2 = 119.05$ mm



Cable space reserved:

Please allow at least 50mm of space for USB, RJ45 and other connecting cables.



2.2 Installation Method

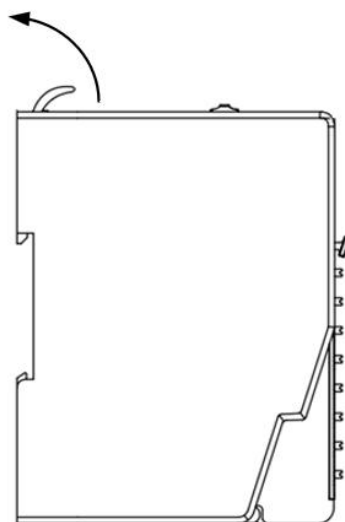
2.2.1 Module-to-Module Installation

The RB series modules adopt a three-section design, consisting of the terminal block, module body, and module base, and support hot swapping. This allows pre-wiring before

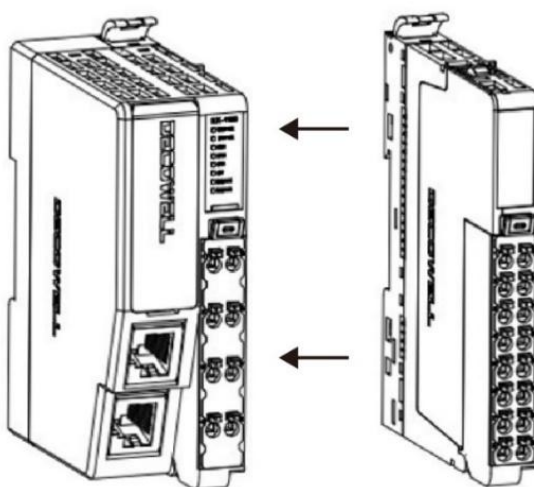
installation to improve installation efficiency, and enables one-step replacement during maintenance to reduce downtime.

Module Assembly:

Module installation is performed through the locking lever located on the top of the module. Before installation, lift the locking lever upward to the unlocked position, as shown in the figure below.

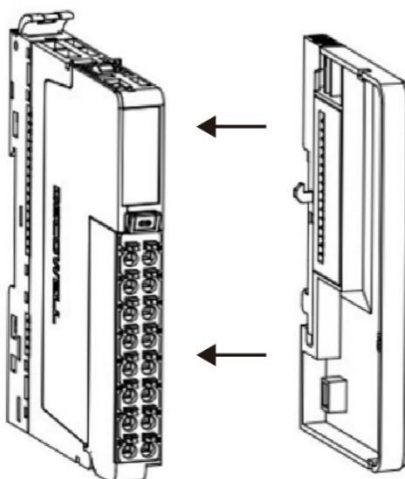


After unlocking the locking levers on both modules to be assembled, align the modules in the direction shown below and press them together. Once the modules are fully seated, an audible click will confirm proper engagement. Then press all locking levers downward to lock the modules in place. Installation is now complete.

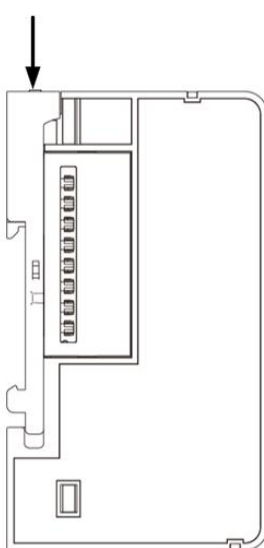


Module-to-Module Removal: Before removal, lift the locking levers on the top of the modules to the unlocked position, same as during installation. After unlocking the levers, pull the modules apart to detach them.

Terminal module installation: Align the end module with the last expansion module, then press in the direction of the arrow until fully engaged. An audible click will confirm that the module is properly installed, as shown in the figure below.



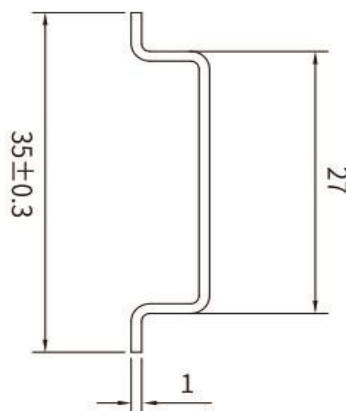
Terminal Module Removal: Press the PUSH button on the end module downward as shown in the figure. After fully pressing it to the bottom, separate the end module from the other modules.



The module adopts DIN rail mounting.

The DIN rail must comply with the IEC 60715 standard (35 mm width, 1 mm thickness).

The dimensional information is shown in the figure below.



Note: When installing the module on DIN rails other than the recommended DIN-35 type, the rail locking latch may fail to lock properly. Before installation, make sure to unlock the top locking lever of the module, and then proceed with the installation steps.

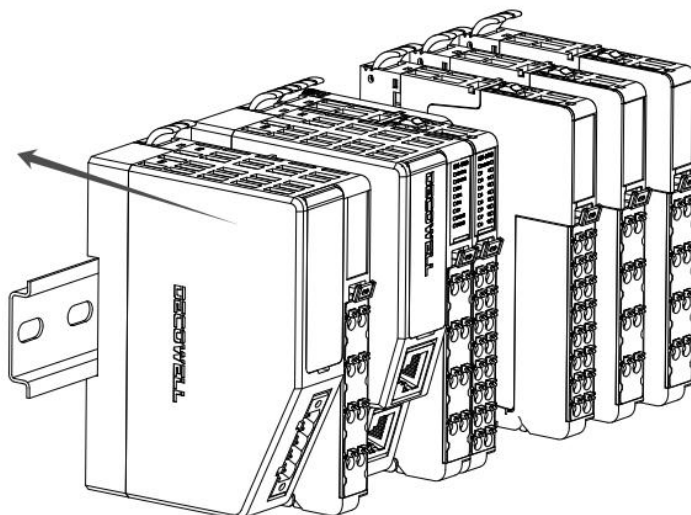


- When this product is installed on DIN rails other than the recommended types (especially DIN rails with a thickness ≤ 1.0 mm), the DIN rail locking latch may fail. This may result in improper mounting and prevent the product from functioning correctly.
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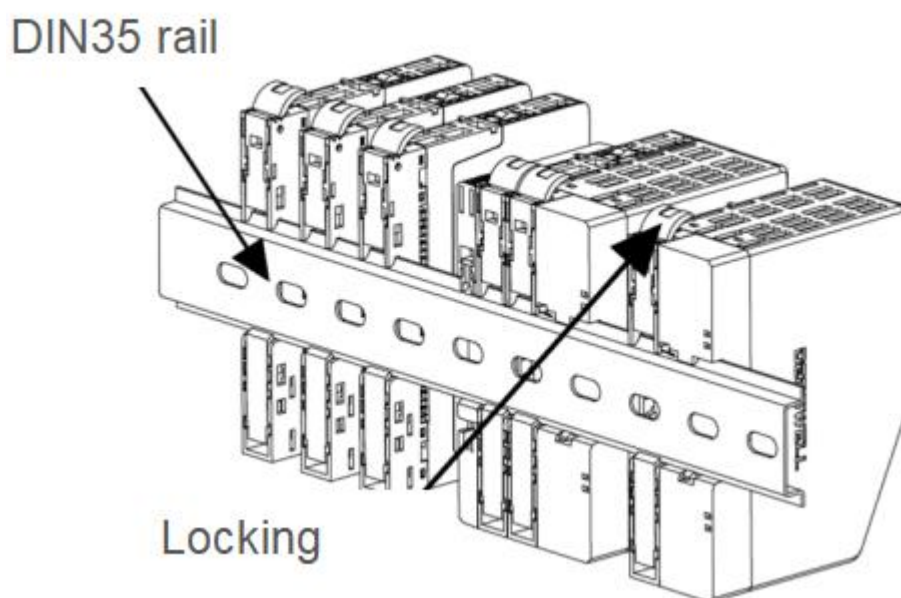
2.2.2 DIN Rail Mounting

Installation

Align the module with the DIN35 rail and press it in the direction indicated by the arrow to hook the module onto the rail, as shown below.



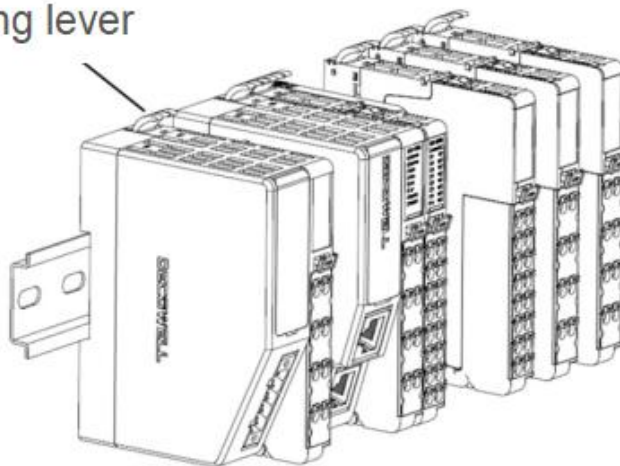
After the module is placed on the rail, press the locking lever downward to secure the module onto the rail and ensure proper installation, as shown below.



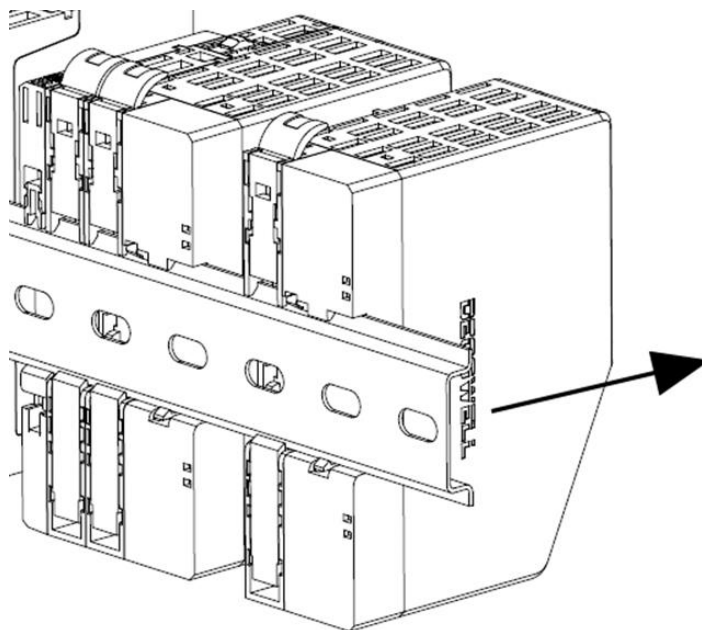
Removal:

To remove the module, push the locking lever upward to unlock the module, as shown below.

Lift the locking lever



After unlocking the lever, pull the module away from the DIN35 rail in the direction indicated, as shown below, and the removal is completed.



3. Electrical installation

3.1 Cable Selection

PROFINET bus communication uses shielded Ethernet cables for network data transmission. Short circuits, incorrect wiring, and poor contact must be avoided. Category 5e or higher shielded twisted-pair cables with molded iron-shell connectors are required. The shielded cable specifications are listed below.

Name	Function Definition
Cable type	Flexible crossover cable, double-shielded (S/FTP), Category 5e or above
Double Shielding	Braided shielding (coverage $\geq 85\%$), aluminum foil shielding (coverage 100%)
Applicable Standards	EIA/TIA 568A, EN50173, ISO/IEC 11801 EIA/TIA bulletin TSB, EIA/TIA SB40-A & TSB36
Conductor Cross-section	AWG26 or larger
Conductor Type	Twisted pair
Number of Pairs	4
Environment	Resistant to industrial oil, acid and alkali corrosion; Operating temperature: $-30^{\circ}\text{C} \sim 60^{\circ}\text{C}$
Notes: 1. The cable length between devices shall not exceed 100 m. Exceeding this length will cause signal attenuation and affect normal communication. 2. If the operating temperature exceeds the normal operating temperature (60°C), please use high-temperature resistant network cables.	

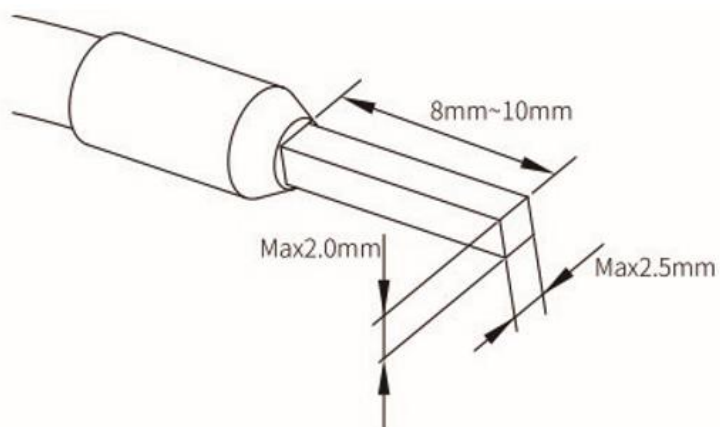
Power-related cables: the wire lug diameters listed in the table below are for reference only. Please perform appropriate calculations based on actual application conditions and adjust accordingly.

Name	Compatible wire diameter		KST	
Ring Lug	GB/mm ²	American Standard/AWG	Model	Wire crimping pliers
	0.25	24	E0208	KST2000L
	0.5	20	E0510	
	0.75	18	E7510	

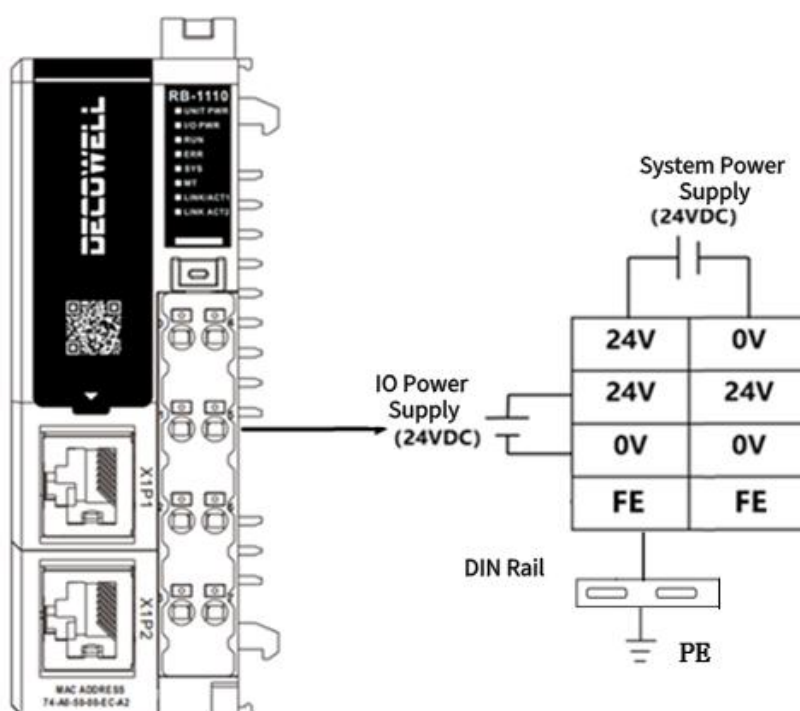
	1.0	18	E1010	
	1.5	16	E1510	

Stripping length: 8-10mm

The shape and size requirements for the crimped terminals are shown in the following figure:



3.2 Terminal wiring





- The grounding terminal of the adapter module must be directly grounded to prevent interference to the I/O module signals.
- The power supply for the RB series adapter is divided into system power and I/O power. To avoid interference to the system, it is recommended to route two independent 24 VDC power lines from the same power supply module to the adapter's system power and I/O power, respectively.

4. Grounding Cables and Field Wiring Instructions

4.1 Introduction

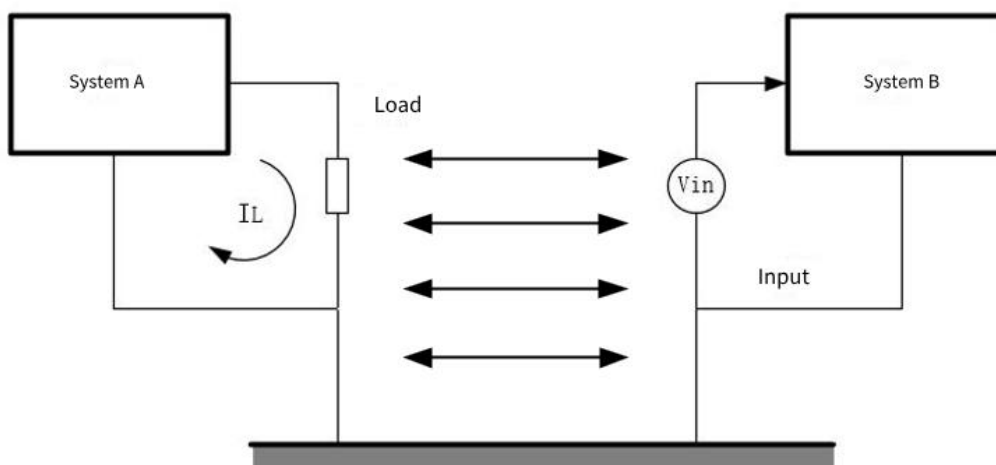
The primary purpose of standardized wiring and shielding in industrial environments is to ensure personnel safety, followed by maintaining system operational stability, and preserving electromagnetic compatibility (EMC) of equipment to ensure reliable system performance and data integrity in industrial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

4.2 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.

4.3 EMC Optimized Cabling Specifications

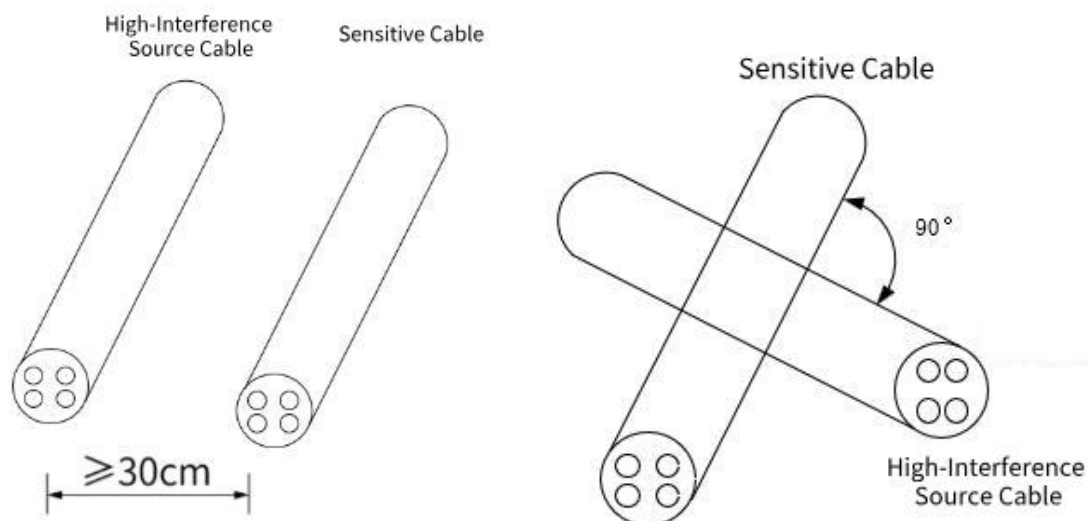
Cable routing requirements

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/Communication cable	Routed in a shielded duct with partitions; twisted pair pitch ≤ 5 cm	AI 4-20mA, PROFINET bus
Digital I/O cable	Grouped and bundled in a non-shielded duct	DI sensor, DO control cable

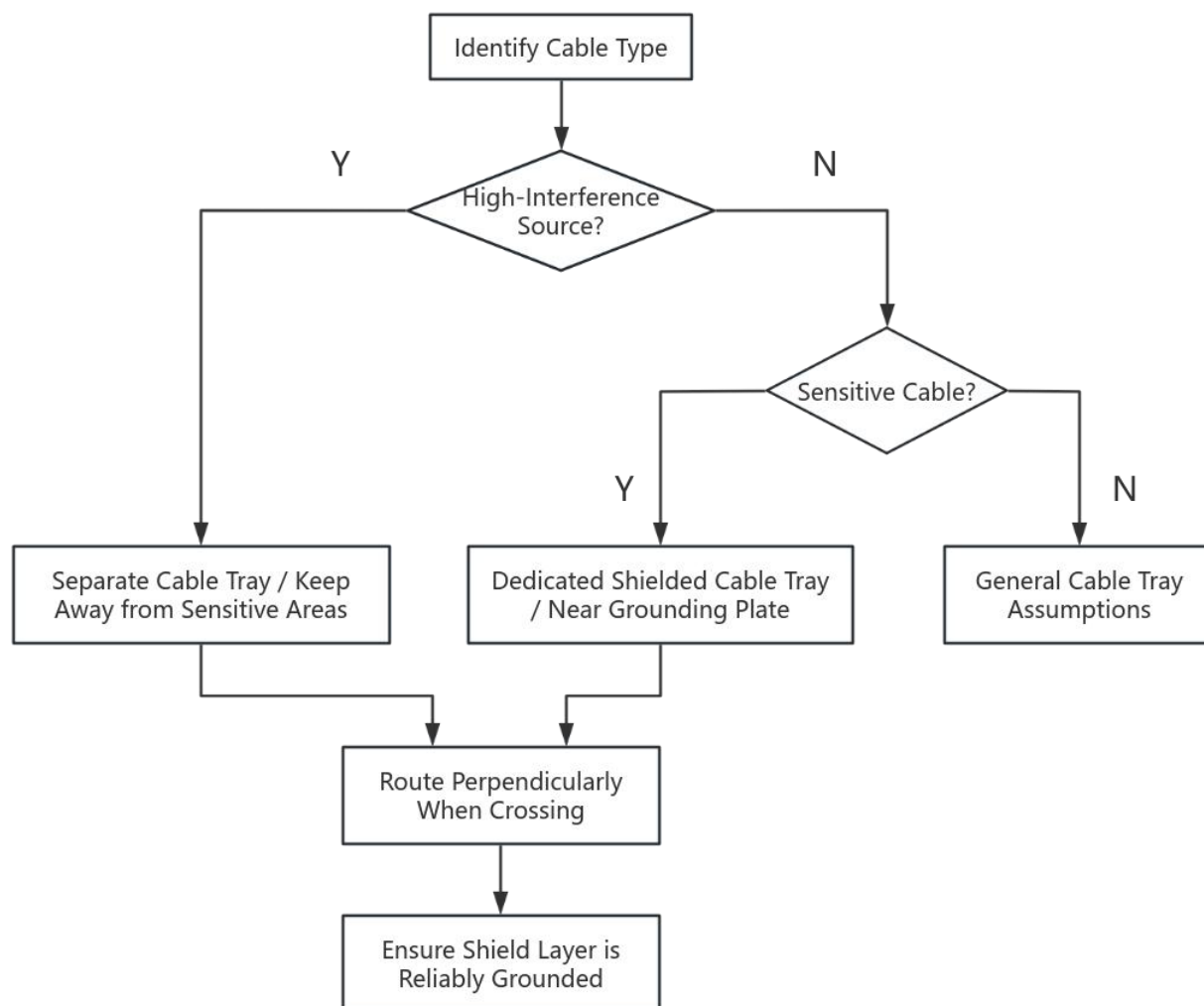
Wiring Recommendation:

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.

5. Module Functions

5.1 Reset and Upgrade Functions

5.1.1 Reset Function



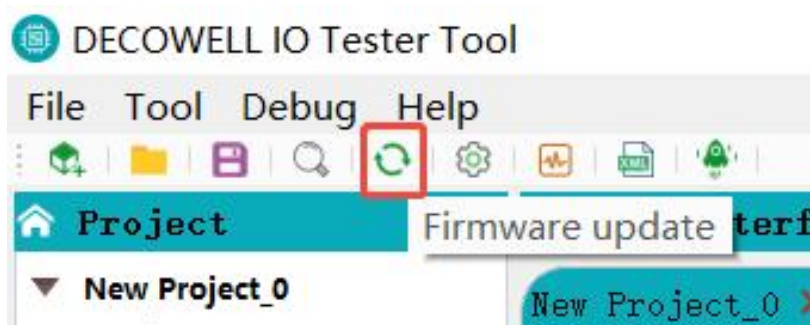
Press and hold the Reset button for 5 seconds, then release it. The device will restore factory settings and automatically restart.

5.1.2 Upgrade Function

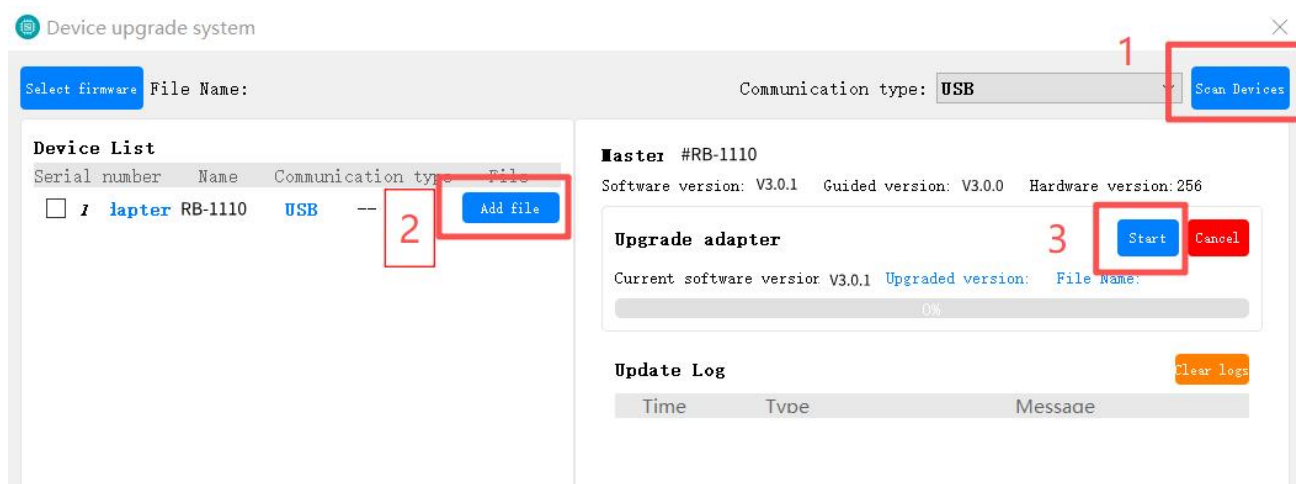
Connect the computer to the adapter via the Type-C port.



Click "Firmware Upgrade" in the IO Tester Tools.



Click Search, select the corresponding upgrade file after the module is found, check the module and click Start Upgrade.



5.2 DIP switch instructions



The device name can be defined via the DIP switch. The relationship between device name and DIP switch value is shown in the table below.(No two PROFINET slave devices on the same network may have the same device name.)

DIP switch pin numbers (NO: 1 / OFF: 0)								DIP switch value	Equipment Name
1	2	3	4	5	6	7	8		
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0	User-defined (software settings)
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1	rb1110-001
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2	rb1110-002
.	.	.	.	.	.	.	.	.	.
OFF	ON	OFF	ON	OFF	OFF	OFF	OFF	10	rb1110-010

OFF	ON	ON	ON	ON	ON	ON	ON	254	rb1110-254
ON	ON	ON	ON	ON	ON	ON	ON	255	rb1110-255

Note:

DIP switch settings for the device name take effect after a power cycle.

When the device name is first configured via software, and then later configured via DIP switch after a power cycle, the DIP switch setting takes precedence and will overwrite the software-configured device name.

5.3 Configuration

5.3.1 Configuration

For details on configuring the settings, please refer to "Adapter Configuration Case".

5.3.2 IO Tester Tools Configuration

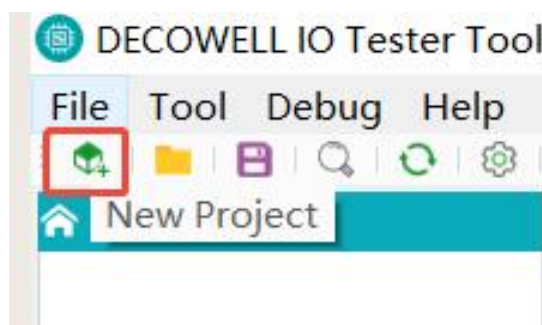
(1) Introduction

The IO Tester Tool is a configuration software for the RB series I/O modules. It can connect to the corresponding module interface via Type-C cable or Ethernet cable and provides the following functions for the RB-1110 module:

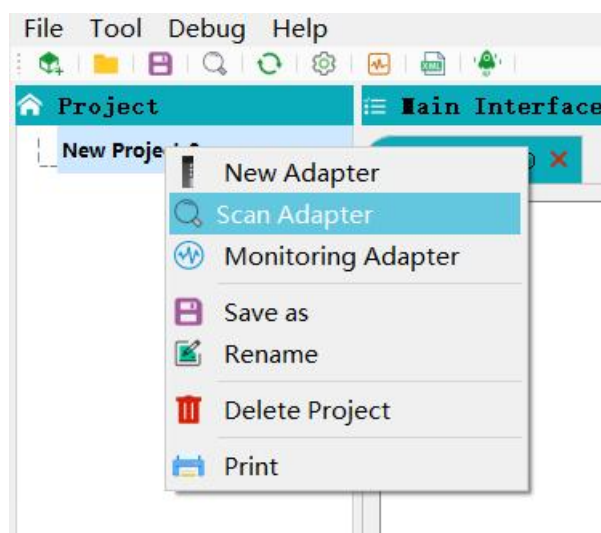
- Upgrade the module firmware
- Retrieve module version information
- Configure module parameters

(2) Operation Procedure

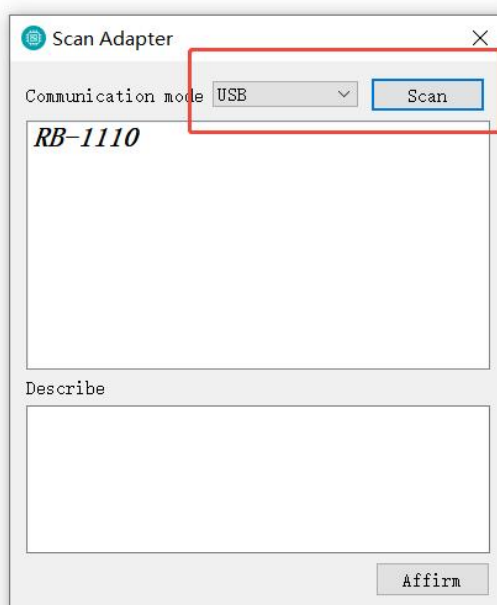
Connect the RB-1110 module via a USB cable. Launch the Decowell IO Tester Tool on the PC and click New Project.



Right-click the new project and select Scan Adapter.



In the adapter scanning interface, select USB communication mode and click scan. After the scan is successful, click Affirm.



After a successful scan, double-click the adapter icon to enter the adapter configuration interface. In the Basic Info tab, you can view the adapter's basic information.



Online Mode	
Basic info Address map Diagnostic information	
Module Name	RB-1110
SN	0123456789abcdef
Order Number	18-01-04
HW Version	256
HW Name	RB04A.0100
Boot Version	V3.0.0
APP Version	V3.0.1
Current Consumption	360mA
DIM Info (LxWxH)	100x77x34mm
Description	PROFINET

You can configure a module by clicking on the included module in the project panel on the left.



Online Mode	
Basic info Config data TXPDO	
Module Name	RB-5454
SN	---
Order Number	18-07-02
HW Version	256
HW Name	---
Boot Version	---
APP Version	V3.1.0
Current Consumption	11mA
DIM Info (LxWxH)	100x77x12mm
Description	Analog Output, Current(4-20mA/0-20mA), 4 Channels,

5.4 Hot-swap function

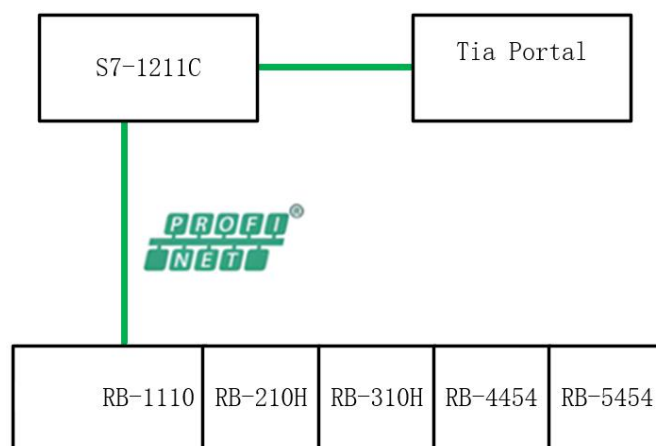
The RB series modules support hot swapping. The adapter provides two types of hot swap exception behaviors: continue data exchange and bus-wide exception behavior. This feature enables efficient maintenance without system downtime.

The behavior can be configured via Module Behaviour on Hot Swap.

6. Adapter configuration case

6.1 TIA Portal and RB-1110 Connection and Configuration

6.1.1 Communication Connection Diagram



Communication connection diagram

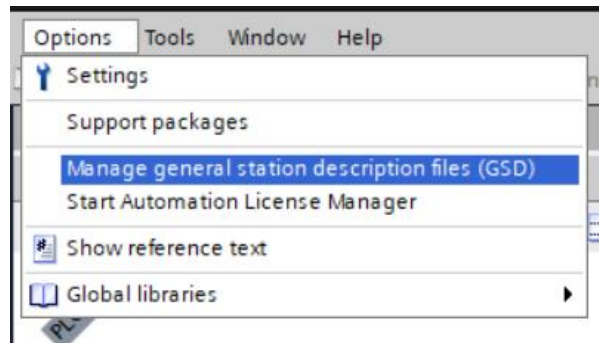
6.1.2 Hardware Configuration

Hardware Configuration Table

Hardware	Quantity	Remark
PC	1	Install TIA Portal V18
Controller	1	S7-1211C
RB-1110	1	PROFINET adapter
RB-210H	1	Digital input module
RB-310H	1	Digital output module
RB-4454	1	Analog input module
RB-5454	1	Analog output module
Cables	several	

6.1.3 Installing GSD files

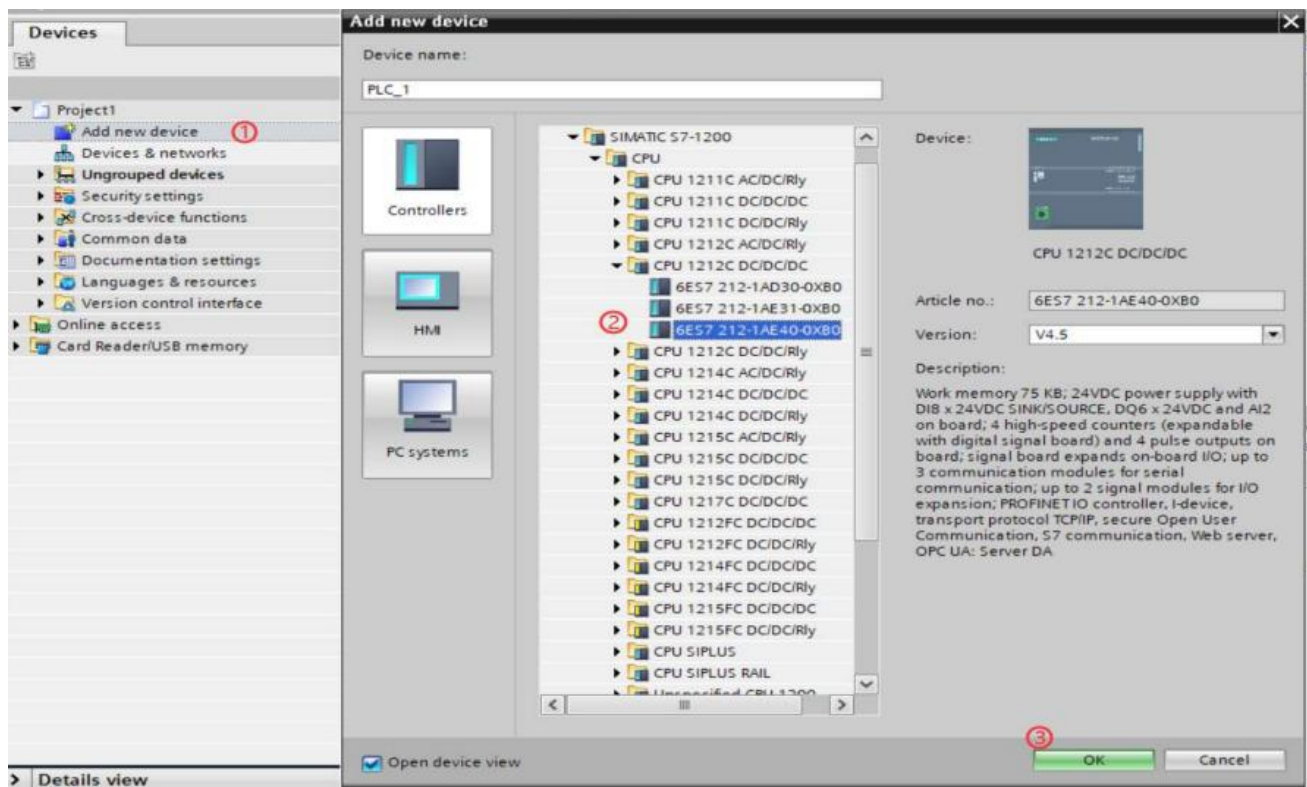
Open TIA Portal V18. In the menu bar, select "Options" > "Manage general station description files (GSD)", as shown in the figure below.



Install GSD files

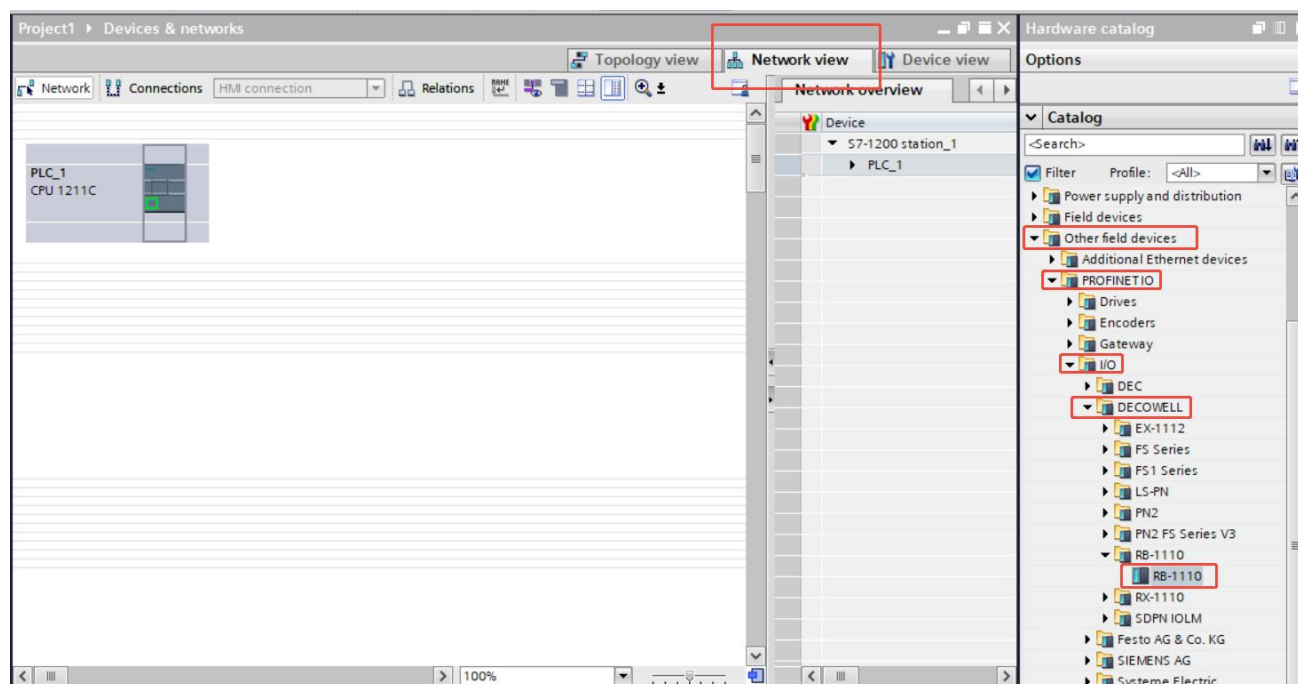
6.1.4 Configuration of New Construction Projects and Equipment

Open TIA Portal V18, select New Project and configure it, as shown in the figure.

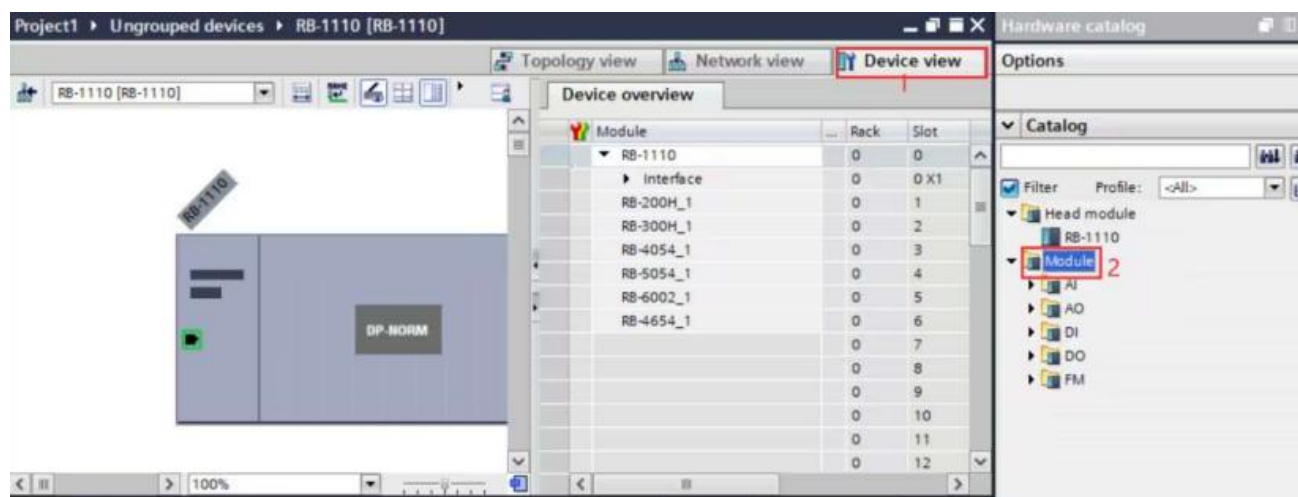


New construction projects

To configure a device, expand the hardware catalog in the network view, select the adapter, and double-click the adapter to enter the Device View to configure the I/O module.

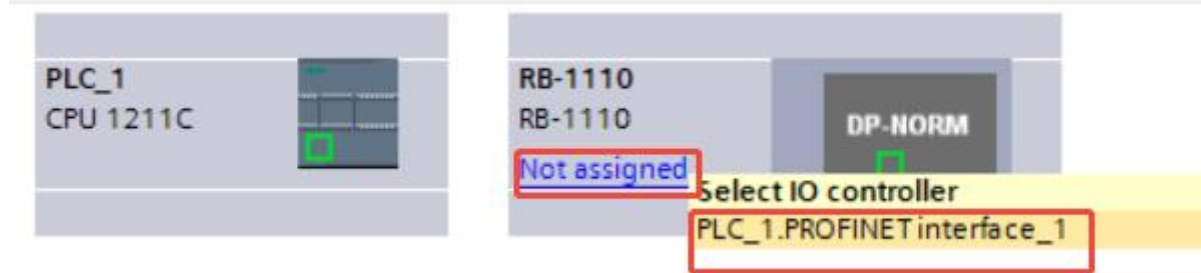


Configuring Device



Configure I/O modules

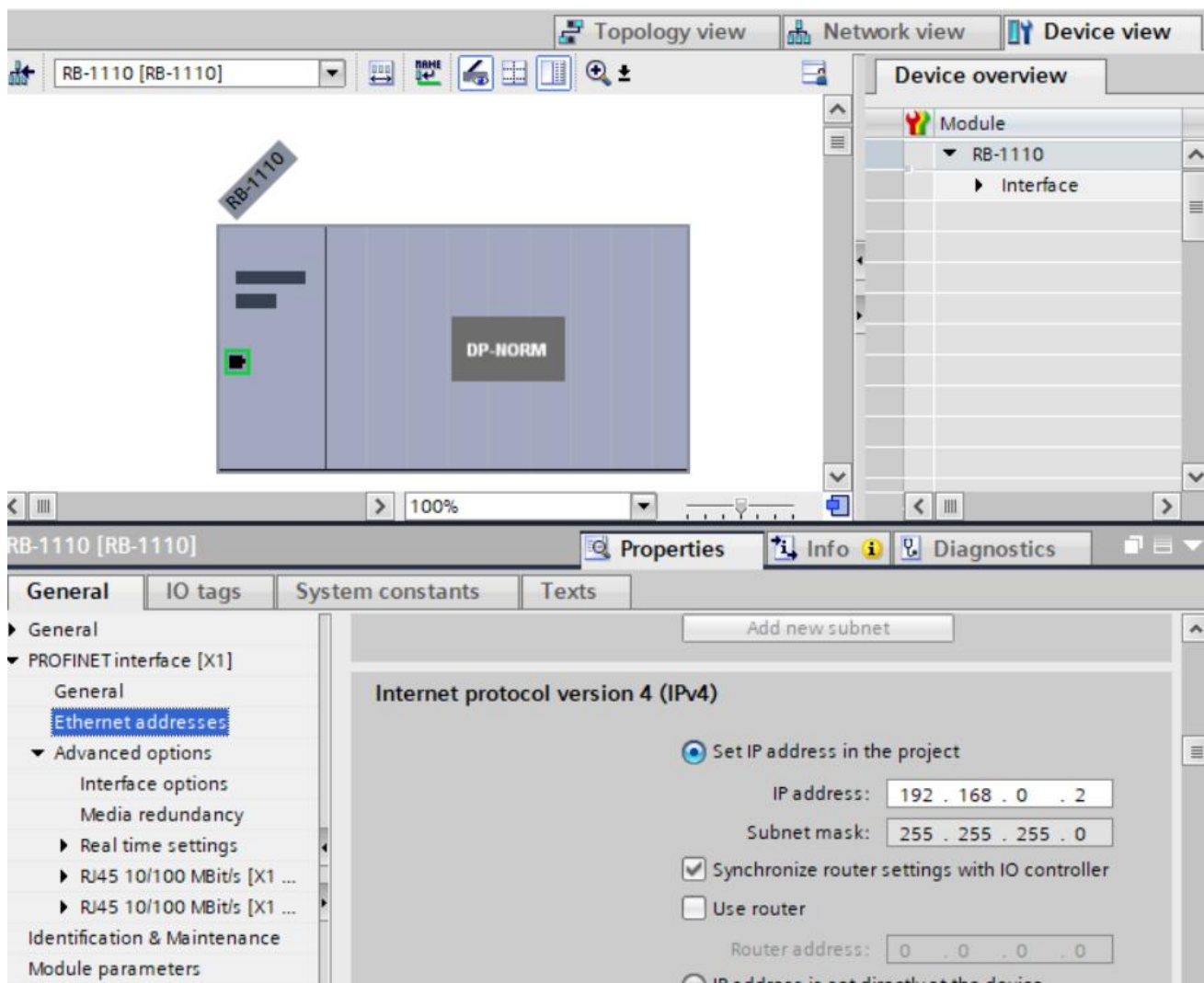
In the network view, assign a controller to the IO module. Click "Not assigned" and select PLC_1.PROFINET interface_1.



Assign

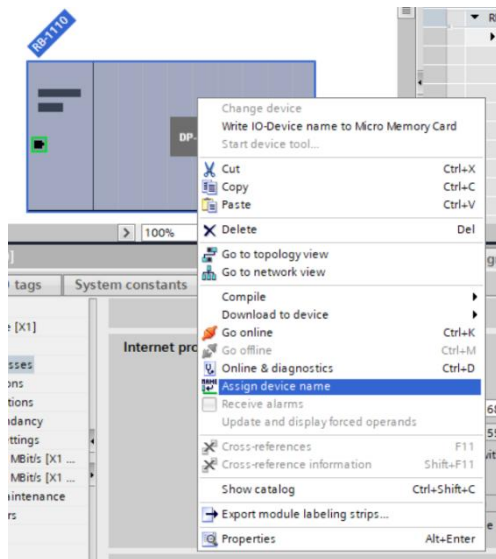
I/O controller

To set the IP address of the I/O module, double-click the module in the device view to enter the Properties view, as shown in the figure.

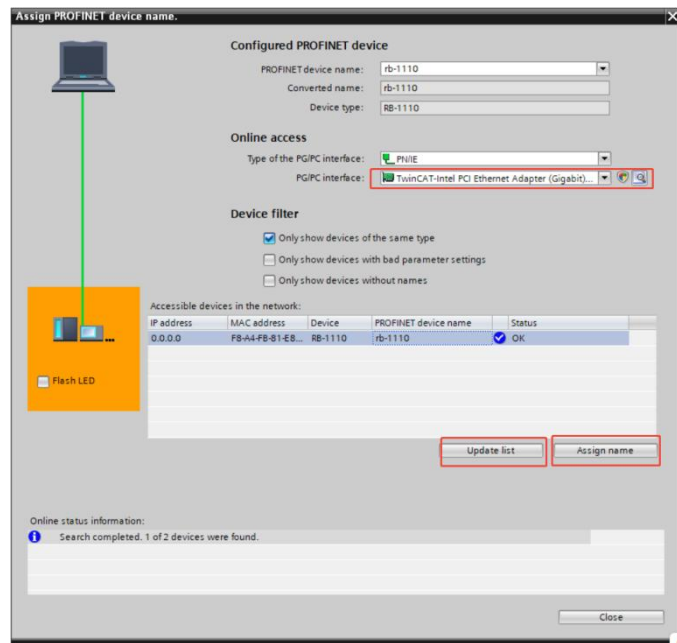


Assign IP address

To assign a device name to a remote I/O module, right-click the module, select "Assign Device Name," choose the interface type, update the list, and assign a name.



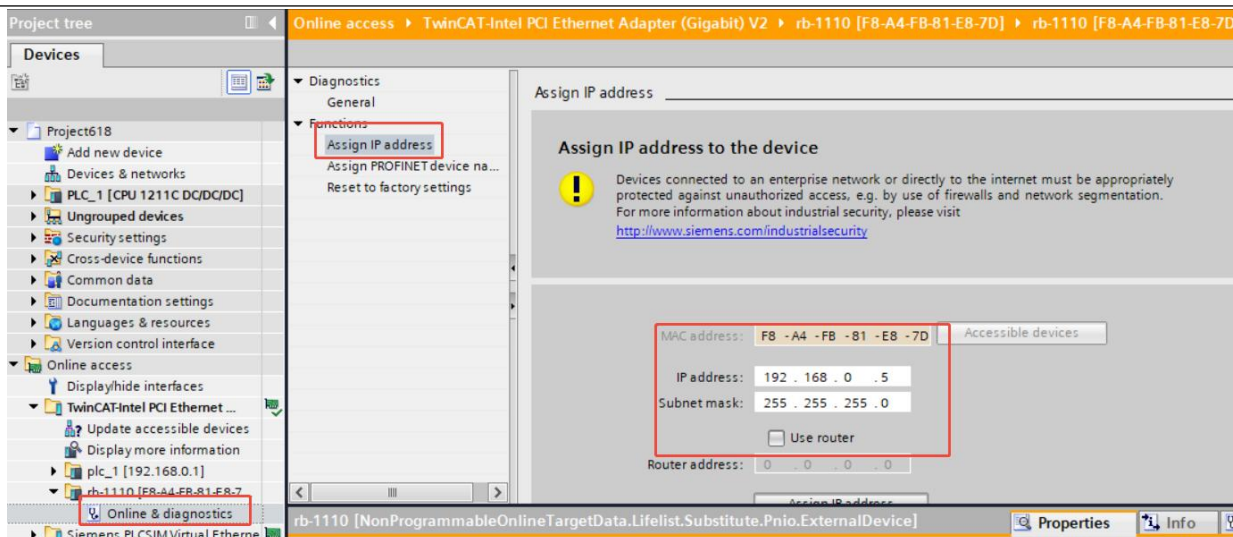
Select "Assign Device Name"



Update the list and assign names



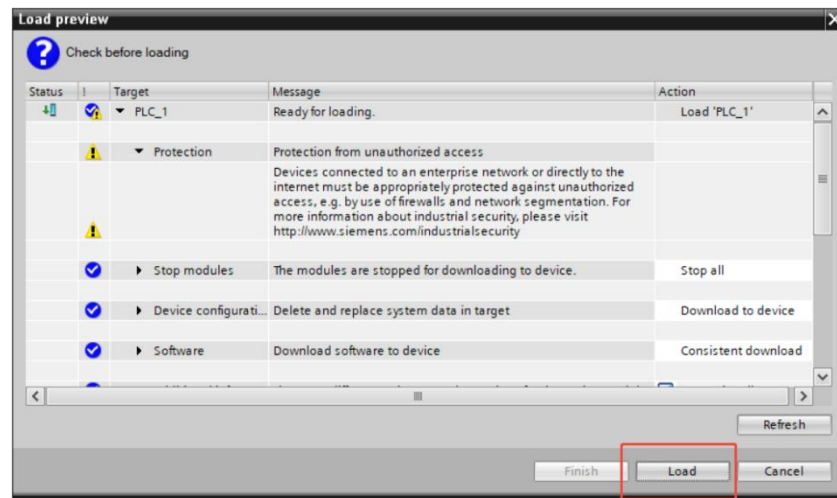
- We recommend changing your IP address in “Online access”, as shown in the image.



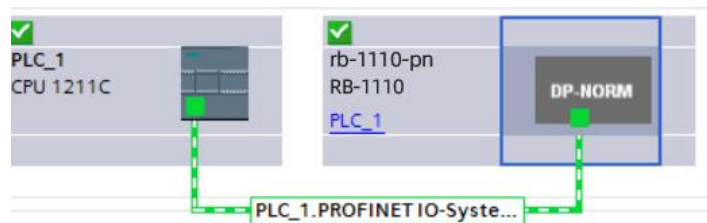
Online access to change IP

6.1.5 Program Download and Equipment Monitoring

Select all devices in the network view and download them. After the program is downloaded, start the CPU to run it and switch to online monitoring to check if the communication is normal.



Program Download

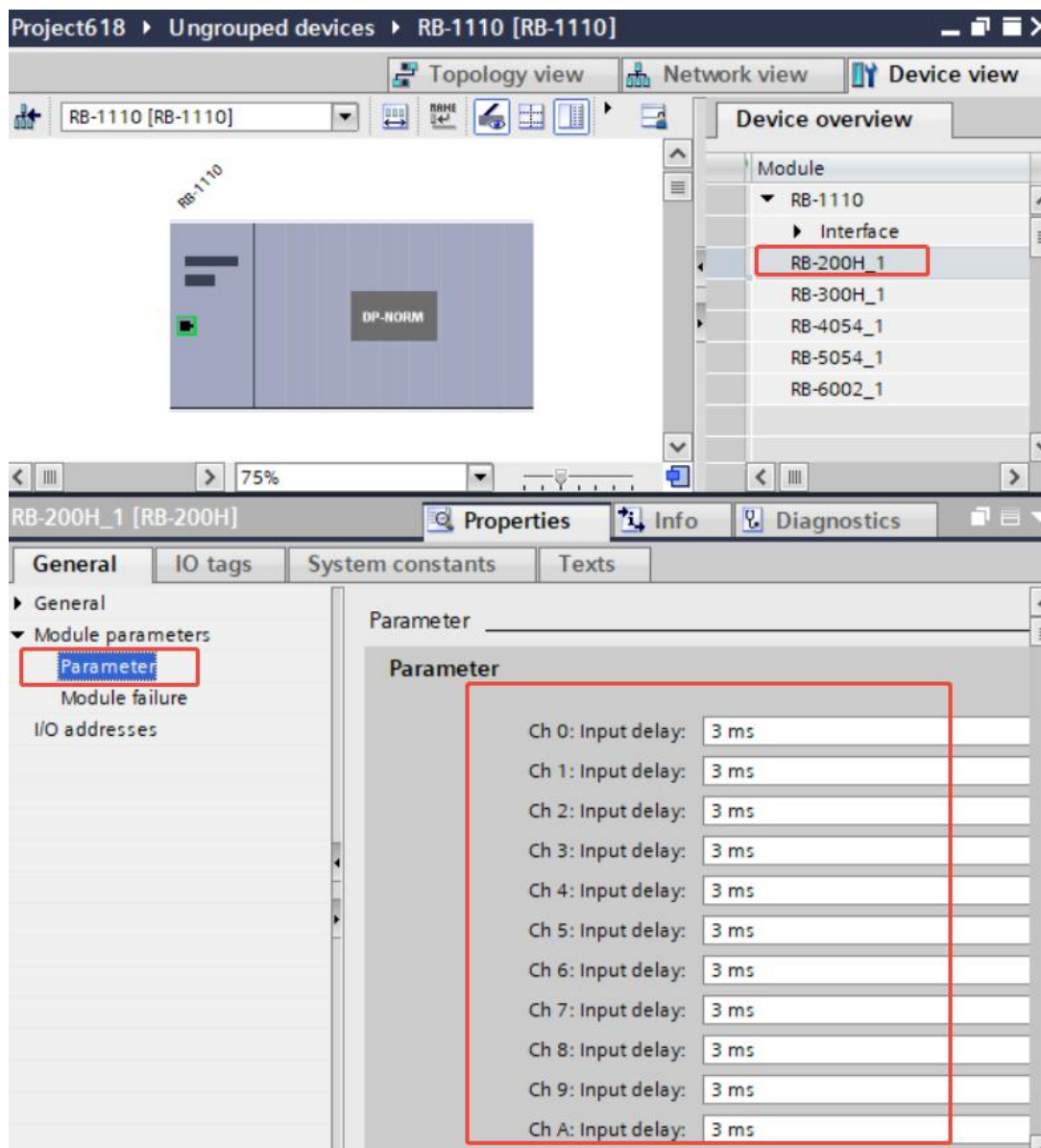


Equipment monitoring

6.1.6 Configuration Parameters

(1) DI filter parameter configuration

In the device view, double-click the IO module in the slot, select "Parameters" in the module parameters, and configure the filtering time of the corresponding DI channel (default 3ms), which can be configured from 0 to 10ms.



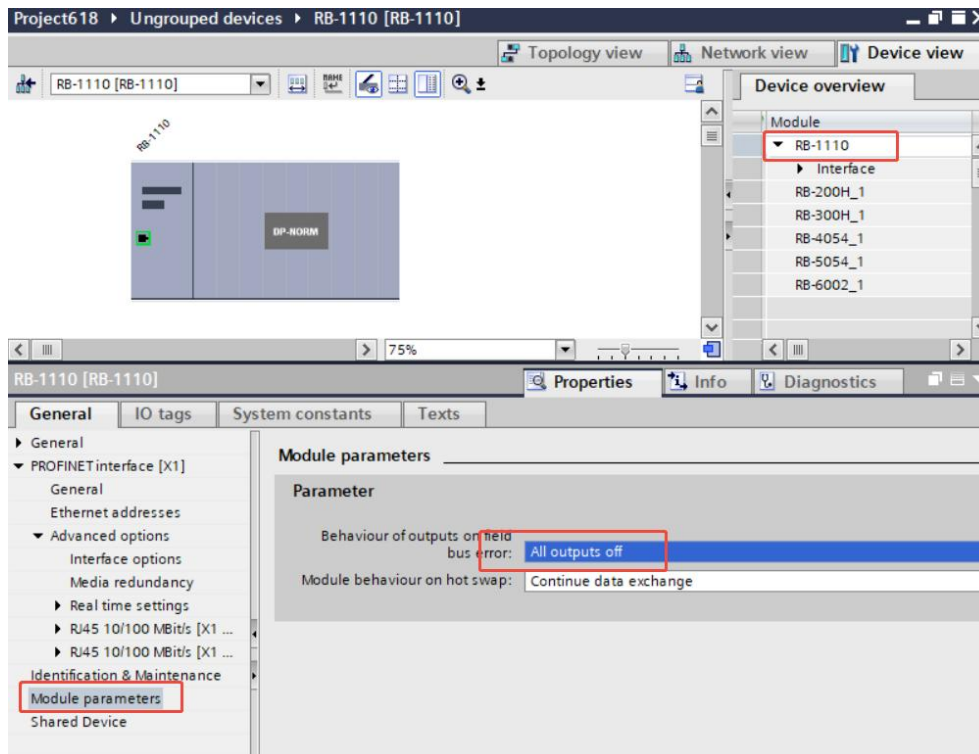
DI parameter configuration

(2) Bus communication exception output configuration

When bus communication fails, the DO/AO output value can be configured in three ways.

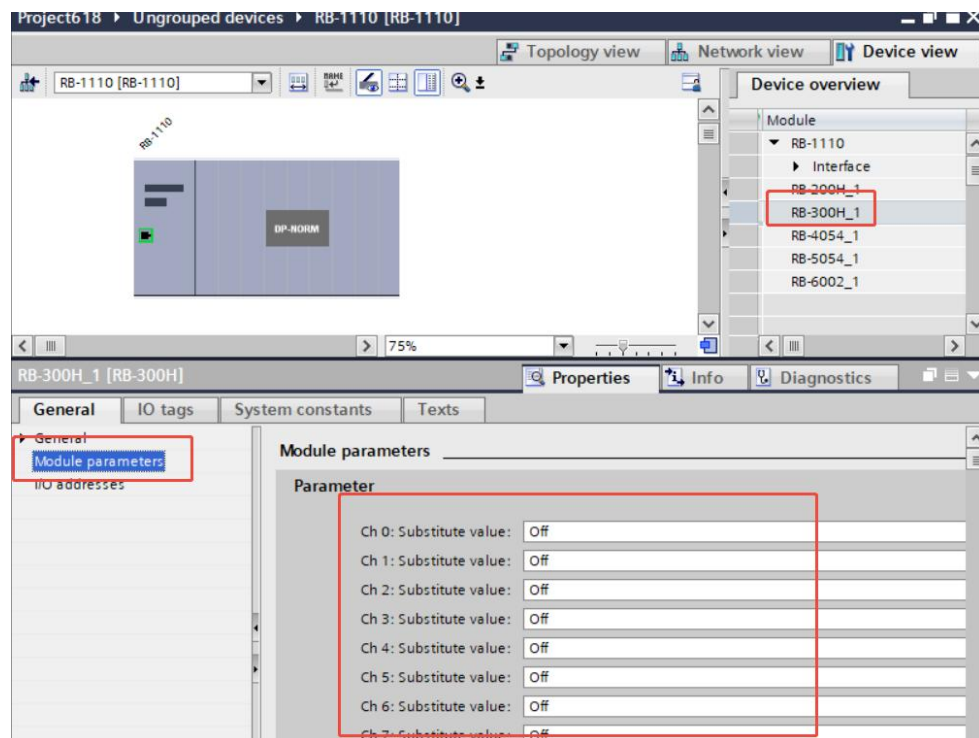
Value	Describe
All outputs off (default)	Clear output module status data
Hold last value	Keep the previous value
Enable substitute value	Startup Alternative Value

In the device view, double-click the adapter, and in the module parameters, click "Behaviour of outputs on field bus error"



Bus communication error output configuration

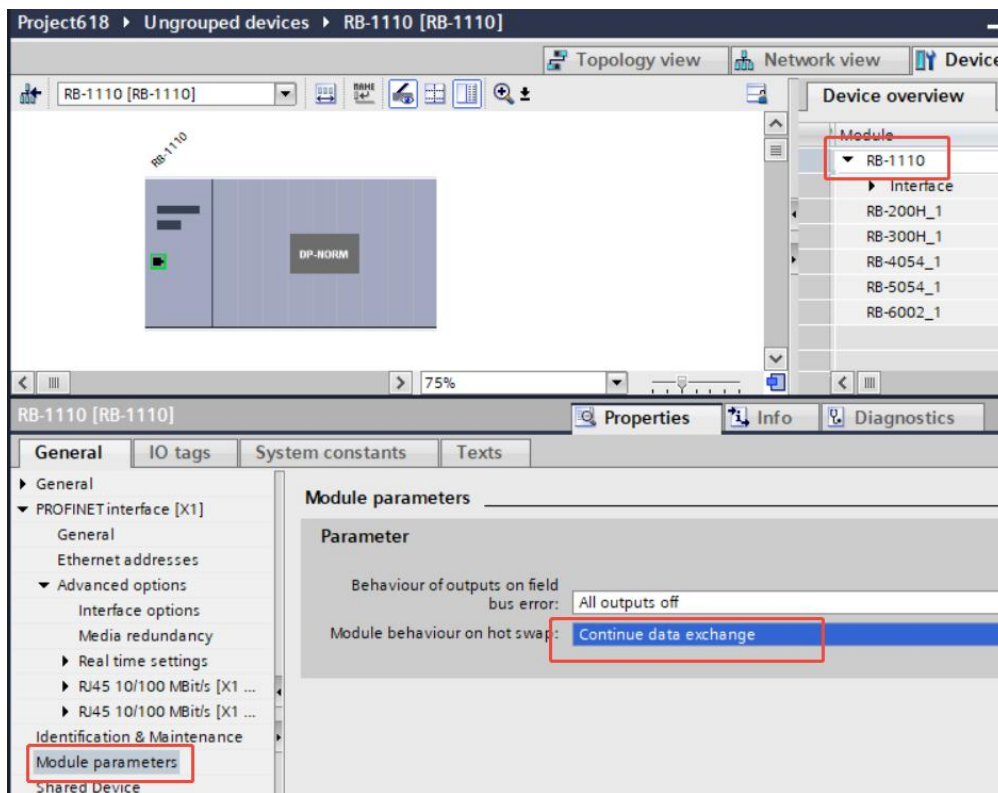
In the device view, double-click the IO module in the slot, and configure the corresponding channel replacement settings in the module parameters. The configurable value range is on or off, with the default value being off.



Channel substitution configuration

(3) Module hot-swap function

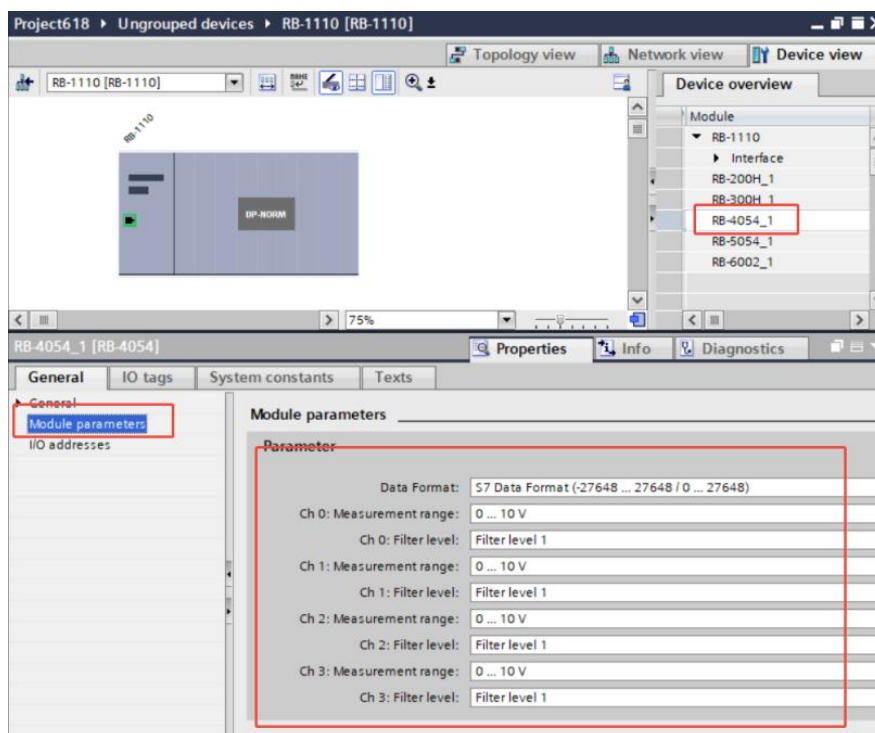
In the device view, double-click the adapter, and in the module parameters, click "Module behavior on hot swap"



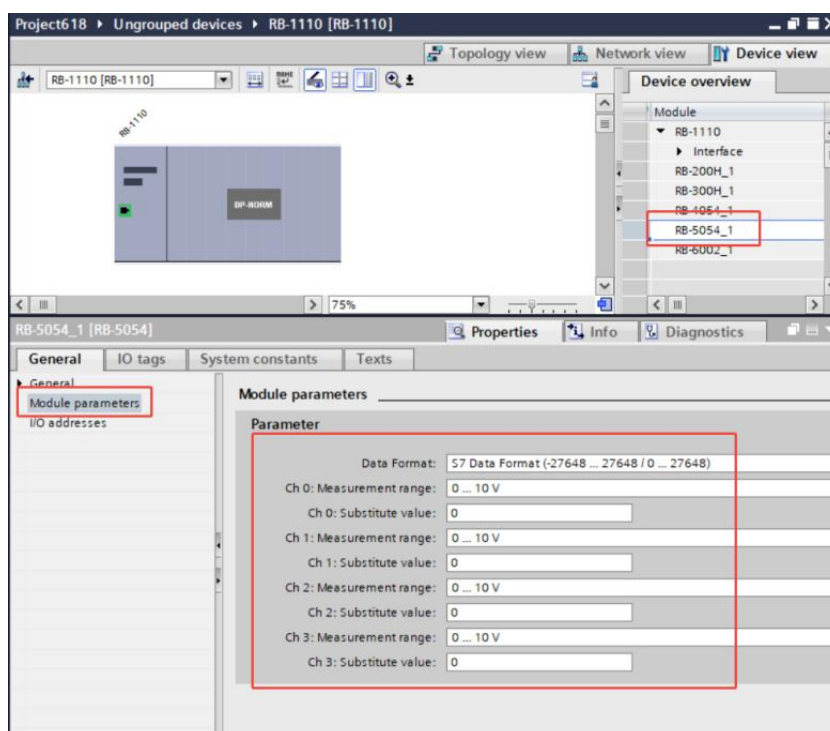
Value	Describe
Continue data exchange (default)	Continuous interaction, DI/DO normal value updates (default)
Behavior as with field bus error	Inherited bus exception handling method: data exchange stops, DI value updates stop, DO value output stops

(4) Modification of module analog parameters

In the device view, click on the module whose parameters need to be modified, and then change the analog parameters in the module parameters.

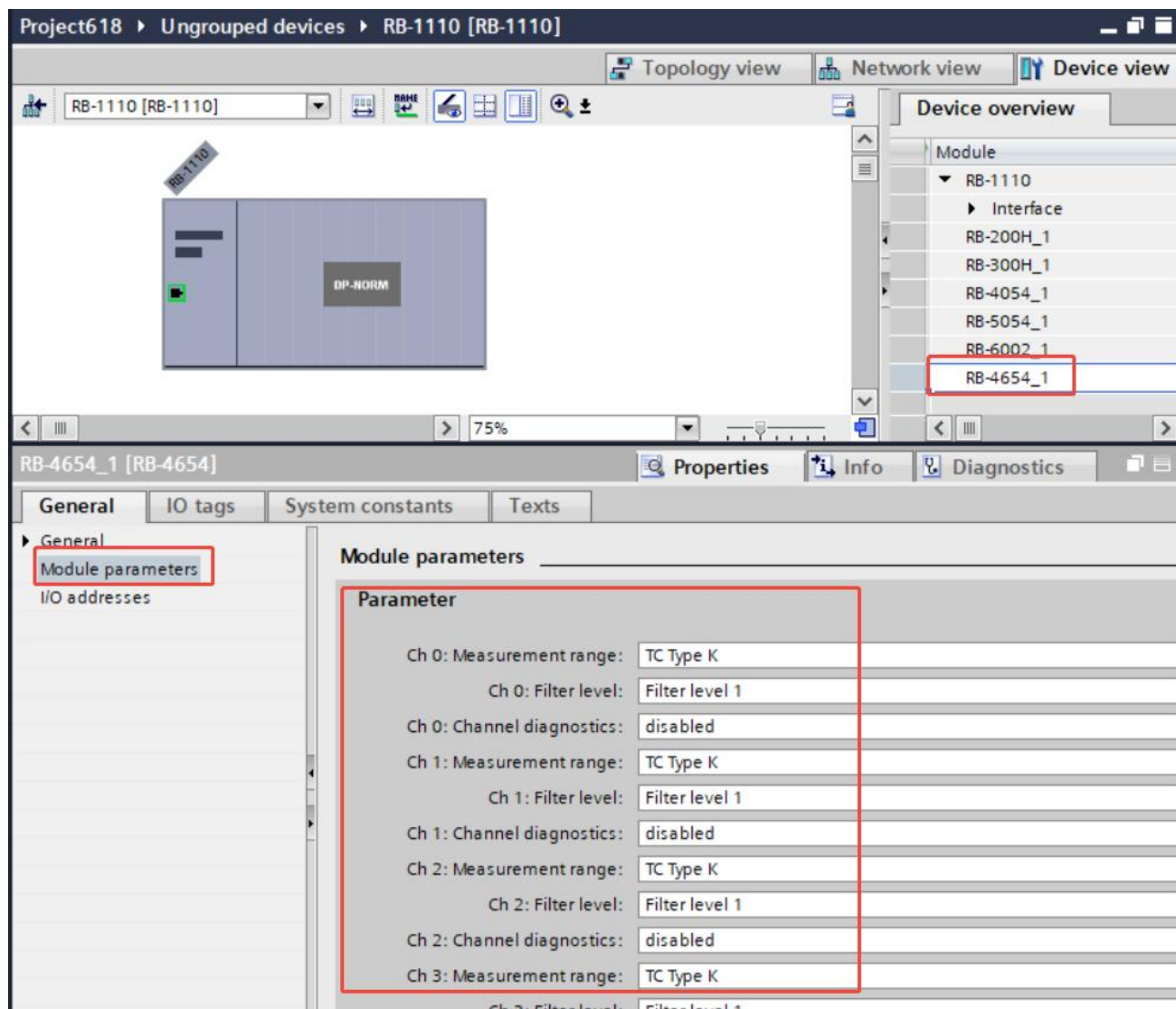


Analog input parameter configuration



Analog output parameter configuration

Note: Analog output substitution values need to be set in the adapter parameters.



Temperature module parameter configuration

7. FAQ

7.1 DO Failure

1. DO Failure -- Description of DO Failure: The DO channel indicator is normal, but there is no output from the DO channel.

Troubleshooting Steps:

- 1) Check the Load: Ensure that the load current is within the module's rated range, and confirm there is no short circuit or overload.
- 2) Wiring Test: Measure the DO terminal output to verify normal operation and rule out wiring disconnection or poor contact.
- 3) Configuration Check: Verify the channel parameters (e.g., forced status, output mode) are not misconfigured or locked.
- 4) Hardware Replacement: Replace the DO module or channel to determine if the issue is caused by hardware failure.

2. DO Failure -- Description of DO Failure: The DO channel indicator is off, the corresponding DO channel is not set to 1 in the software, but the DO channel actually has output.

Troubleshooting Steps:

- 1) Backfeed Check: Verify whether external power backfeed or a short circuit is causing forced output on the DO channel.
- 2) Forced Mode Inspection: Confirm that the module or software has not been mistakenly set to forced output or configured with a latching function.
- 3) Hardware Fault Detection: Measure the channel voltage; if abnormal, replace the module to check for internal relay or circuit damage.

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

Troubleshooting Steps:

- 1) Load Matching Check: Verify whether the load current/voltage exceeds the rated capacity of the module's DO channel.
- 2) Line Impedance Test: Measure the continuity and impedance of the line from the output to the load to rule out disconnection or poor contact.
- 3) Output Type Verification: Check whether the module's output type (relay/transistor) matches the load characteristics (e.g., inductive load).
- 4) Short-Circuit Protection Check: Inspect whether a short circuit triggers module protection; reset or replace the module to verify.

4. Relay Module Abnormality -- Description: The upper-level system or PLC communicates normally with the module, but the module cannot drive the load properly.

Troubleshooting Steps:

- 1) Load Status Check: Confirm whether the load is open-circuited, short-circuited, or the current exceeds the module's rated value.
- 2) Relay Power Check: Measure the supply voltage of the relay coil (e.g., 24V) to ensure it is normal.
- 3) Contact Function Test: Use a multimeter to check the relay contact continuity and rule out sticking or damage.
- 4) Software Diagnosis: Use PLC diagnostic tools to check the output channel status (e.g., forced output to verify hardware action).
- 5) Module Replacement Verification: Replace the module with the same model to determine whether it is a hardware failure.

7.2 DI Failure

1. DI Failure -- Description: The PLC or upper-level system communicates normally with the module. A signal is applied to the DI channel, but the software cannot detect the signal, and the DI channel indicator is off.

Troubleshooting Steps:

- 1) Check Signal Source and Wiring: Ensure the DI signal source outputs correctly (e.g., 24V). Use a multimeter to verify the signal reaches the module terminal, ruling out wiring disconnection or poor contact.
- 2) Verify Module Power Supply: Ensure the module's independent 24VDC supply (not backplane power) is normal. An unlit indicator may be caused by a missing power supply.
- 3) Check Channel Status: Verify that the DI channel address in the software matches the hardware to avoid address conflicts or interference from forced assignments.
- 4) Interference Check: Inspect grounding and shielding measures to eliminate electromagnetic interference causing abnormal signals.
- 5) Hardware Diagnosis: If the signal and power supply are normal but the indicator still does not light, the optocoupler in the channel or the module may be damaged; replace the module or test the channel.

2. DI Failure -- Description: The PLC or upper-level system communicates normally with the module. After a signal is applied and then removed from the DI channel, the software monitoring value remains triggered, while the DI channel indicator is normal.

Troubleshooting Steps:

- 1) Measure Residual Voltage: After removing the signal, measure the DI channel voltage. If it does not return to zero, there may be line leakage or interference.
- 2) Check Channel Parameters: Verify whether the filter time configured in the module is too long, causing software response delay.
- 3) Verify Hardware Status: Replace the DI channel or module to rule out contact sticking or internal circuit faults.
- 4) Firmware Version Check: Verify the module firmware version to fix any logic errors that may cause signal latching.

Note: When the indicator is normal but the software value is latched, common causes include hardware contact sticking, incorrect filter parameter settings, or firmware defects.

3. DI Failure -- Description: The PLC or upper-level system communicates normally with the module. A signal is applied to the DI channel, the software can detect the signal, but the DI channel indicator is off.

Troubleshooting Steps:

- 1) Indicator Fault: Check whether the LED is damaged or has poor contact; replace and test if necessary.
- 2) Driver Circuit Abnormality: Measure the power supply and driver components of the indicator (e.g., resistors, transistors).
- 3) Configuration/Firmware Issue: Ensure the module parameters have not disabled the indicator function; upgrade firmware if necessary.
- 4) Input Signal at Threshold: Verify whether the input voltage/current meets the specifications (e.g., 24VDC, $\geq 3\text{mA}$).

4. DI Failure -- Description: The PLC or upper-level system communicates normally with the module. A sensor is connected to the DI channel, but the sensor is not triggered, while the software still detects a signal.

Troubleshooting Steps:

- 1) Sensor Issue: The sensor may be directly conducting, causing the module to detect an input signal.
- 2) Leakage Current Issue: The sensor may be affected by interference, generating leakage current that drives the module input.

7.3 AI Failure

1. AI Value Abnormality -- Description: In a 16-bit current acquisition module, the collected value displays as a negative number.

Troubleshooting Steps:

- 1) Data Format Mismatch: Check the value range of the current module. Each channel is monitored in the software as a 16-bit word, with data types such as INT: -32767 to

32767, UINT: 0 to 65535, etc. If a channel value exceeds 32767, check the data type of the corresponding channel address. If it is INT, change it to UINT.

- 2) Module Sampling Range Check: Ensure that the module's sampling range parameters (unipolar/bipolar) match the sensor output.
- 3) Measure Actual Input Current: Use a multimeter to verify that the input current is within the configured range (e.g., 4–20mA).
- 4) Calibration Value Check: If the calibration value is not saved successfully, recalibrate the channel by connecting a standard current source and writing the correct calibration value.
- 5) Signal Line Polarity Check: Ensure that the input current polarity is correct and consistent with the module definition.

2. AI Failure -- Description: The PLC or upper-level system communicates normally with the module. An AI signal is applied to the AI channel, but the software cannot monitor the value, and the AI channel indicator is off.

Troubleshooting Steps:

- 1) Power Supply Check: Verify that the module's backplane power and external 24V supply are normal. The indicator is powered by the backplane, but the module itself requires independent power.
- 2) Signal Input Verification: Use a multimeter or oscilloscope to measure the AI channel voltage/current to ensure it is normal, ruling out sensor or wiring faults.
- 3) Configuration Matching: Check that the AI range setting in the software (e.g., 0–5V or 4–20mA) matches the actual signal. Incorrect range configuration can result in no measurable value.
- 4) Channel Hardware Check: If a single channel is abnormal, inspect the terminal connections for looseness, or try replacing the channel to confirm whether the hardware is faulty.
- 5) Module Replacement Test: If all the above are normal but there is still no output, replace the module with the same model to verify whether it is a hardware failure.

3. AI Value Abnormality -- Description: The PLC or upper-level system communicates normally with the module. The AI channel receives the AI signal, but the signal fluctuates.

Troubleshooting Steps:

- 1) Power Stability Check: Ensure the module supply voltage is stable to eliminate power ripple interference.
- 2) Signal Line Shielding and Grounding: Confirm that the AI signal uses twisted-pair shielded cable, with the shield grounded at one end, and routed away from high-voltage lines.
- 3) Sensor/Transmitter Test: Disconnect the field signal and connect a standard signal source (e.g., 4–20mA generator). If the fluctuation disappears, inspect the sensor or external interference.
- 4) Module Filter Settings: Enable digital filtering for the AI channel (e.g., adjust filter time constants in the PLC program or configuration software).
- 5) Common Ground Check: Ensure proper grounding between the module and sensor to avoid noise from ground potential differences.
- 6) Channel Hardware Inspection: Replace the channel or module to verify whether the issue is caused by hardware (e.g., ADC malfunction).

Quick Handling: Prioritize checking grounding and shielding, and temporarily short the signal input to rule out external interference.

4. AI Failure -- Description: The AI module collects a signal, but the value remains fixed and does not change, while the channel indicator is normal.

Troubleshooting Steps:

- 1) Signal Source Check: Disconnect the field signal and connect a standard signal source (e.g., 4–20mA generator) to determine whether the sensor/transmitter is faulty or the output is stuck.
- 2) Line Continuity Check: Measure the signal line for open circuits or poor contact (e.g., loose terminals or broken wires).
- 3) Module Configuration Verification: Check whether the AI channel range and filter parameters match the signal type (e.g., current/voltage mode).

- 4) **Forced Input Test:** Force a fixed value via configuration software to verify whether the module responds correctly, ruling out software logic issues.
- 5) **Channel Hardware Replacement:** Replace the channel or module to determine whether the AD converter or signal conditioning circuit is faulty.

Quick Handling: Short the signal input (e.g., short a 4–20mA loop to 0 Ω). If the display shows the lower limit value, the wiring is normal; otherwise, inspect the wiring or module hardware.

5. AI Failure -- Description: The module value does not match the sensor signal strength in the field.

Troubleshooting Steps:

- 1) **Sensor Signal Verification:** Check whether the sensor signal matches the required parameters (e.g., the customer expects 5 V, but the sensor outputs 6 V).
- 2) **Range Selection Check:** Ensure the module range matches the sensor output (e.g., field sensor 0–5 V, module range 0–10 V).
- 3) **Data Format Consistency:** Verify that the module data format matches the monitoring system format (e.g., module value in S7 format vs. customer using Omron format).

6. AI Failure -- Description: Module configuration is normal, but the PLC reports an error and the module STA indicator is red.

Troubleshooting Steps:

- 1) **Sensor Range Check:** Determine whether the sensor output exceeds the module measurement range. Signals outside the configured range will trigger an over-range alarm.

7.4 AO Failure

1. AO Failure -- Description: The PLC or upper-level system communicates normally with the module. The AO channel indicator is normal, but the channel cannot drive the load.

Troubleshooting Steps:

- 1) Load and Power Check: Ensure the load impedance matches the module's driving capability, and the power supply voltage/current meets the load requirements.
- 2) Output Line Inspection: Measure the AO channel output terminal voltage/current to verify that there is no open circuit, short circuit, or poor contact.
- 3) Forced Output Test: Force a fixed output value via configuration software to confirm whether the module can output correctly.
- 4) Load Replacement Test: Disconnect the original load and connect a simulated load (e.g., resistor box) to rule out load failure or overload.
- 5) Module Hardware Check: Replace the AO channel or module to determine whether the output circuitry (e.g., operational amplifier, driver chip) is faulty.

Quick Handling: Short the AO output terminal and measure the current/voltage. If there is no output, inspect module hardware or power supply; if there is output, check the load or wiring.

2. AO Output Abnormality -- Description: The PLC or upper-level system communicates normally with the module. When commanding the AO channel to output 5 V (voltage mode) or 10 mA (current mode), the actual signal at the load exceeds 5 V or 10 mA.

Troubleshooting Steps:

- 1) Load Impedance Check: Verify that the load impedance is not too low (voltage mode) or open-circuited (current mode), ensuring it is within the module's output capability.
- 2) Module Output Measurement: Measure the AO channel output voltage/current directly to rule out line interference or superimposed external power.
- 3) Output Mode and Range Verification: Confirm that the module is configured for the correct output mode (voltage/current) and that the range (e.g., 0–10 V / 4–20 mA) matches the set value.
- 4) External Interference Check: Inspect the signal line for interference from external power sources (e.g., strong coupling). Ensure shielded cables are grounded at one end.
- 5) Module Hardware Check: Replace the channel or module to determine whether the output circuitry (e.g., DAC, operational amplifier) is drifting or damaged.

- 6) Output Range Selection: Verify the module output range matches the actual requirement (e.g., field requires 0–5 V but the module is set to 0–10 V).
- 7) Module Value Type Check: Ensure the module code value type matches the control system. For example, using an S7 data range to output while the module uses Beckhoff's range may cause mismatches.

Quick Handling: Disconnect the load and measure the module output. If it still exceeds the limit, the issue is likely hardware; if normal, check the load impedance or external interference.

3. AO Failure -- Description: The PLC or upper-level system communicates normally with the module. The AO channel indicator is abnormal, but the channel can still drive the load.

Troubleshooting Steps:

- 1) Indicator Status Check: Inspect other channel indicators on the module to rule out overall module failure.
- 2) Module Configuration Check: Verify that the AO channel range and output mode (voltage/current) match the actual requirements.
- 3) Forced Output Test: Force a specific value via software and observe the load response and indicator behavior.
- 4) Power and Grounding Check: Measure the module supply voltage stability and ensure reliable grounding to avoid interference from voltage fluctuations.
- 5) Hardware Replacement Verification: Replace the module or channel to determine whether the issue is caused by the indicator circuit (e.g., LED driver) or internal module communication fault.

Quick Handling: If the load operates normally during forced output but the indicator is abnormal, focus on inspecting module hardware or firmware version compatibility.

4. AO Failure -- Description: The PLC or upper-level system communicates normally with the module. The AO channel indicator is abnormal, and the channel cannot drive the load.

Troubleshooting Steps:

- 1) **Indicator and Configuration Check:** Verify that the AO channel configuration (range/mode) is correct. Compare the indicator status with other channels when the AO indicator is abnormal.
- 2) **Forced Output Verification:** Force a fixed value via software and measure the module terminal to check for signal output, ruling out logic or communication issues.
- 3) **Load and Line Inspection:** Disconnect the load and measure the AO output voltage/current. Check for short circuits, open circuits, and ensure load impedance matches the module's capability.
- 4) **Power and Grounding Check:** Ensure stable module power supply and reliable grounding to prevent common-ground interference.
- 5) **Hardware Replacement Test:** Replace the AO channel or module to determine whether the driver circuit (e.g., operational amplifier, isolation chip) is faulty.

Key Point: If the terminal has no output and the indicator is abnormal, prioritize checking module hardware or firmware compatibility.

7.5 Communication Module Failure

1. **RS232 Module Abnormality -- Description:** The PLC or upper-level system communicates normally with the module. The RS232 module cannot read or write, and the indicator is abnormal.

Troubleshooting Steps:

- 1) **Physical Connection Check:** Ensure the RS232 cable is intact with no breaks or looseness. Verify that TX/RX lines are correctly crossed or matched.
- 2) **Parameter Configuration Verification:** Confirm that the baud rate, data bits, parity, and other settings match the connected device. Disable flow control.
- 3) **Direct Serial Tool Test:** Use a serial debugging tool to send and receive data directly to rule out interference from PLC or upper-level software.
- 4) **Power and Interference Check:** Measure the module supply voltage, ensure proper grounding, and keep it away from strong electromagnetic sources.

- 5) Hardware Replacement Verification: Replace the RS232 module or adapter to determine whether the chip (e.g., MAX232) or port is faulty.

Key Point: If the indicator does not flash or there is no response, prioritize checking the cable and configuration. If data transmission fails but the indicator is normal, check the protocol or possible interference.

2. RS485 Module Abnormality (Indicator Normal) -- Description: The PLC or upper-level system communicates normally with the module. The RS485 module cannot read or write, but the indicator is normal.

Troubleshooting Steps:

- 1) A/B Line Polarity Check: Ensure A+/B- wiring is correct and the termination resistor (120 Ω) is installed.
- 2) Parameter Configuration Verification: Confirm that the baud rate, data bits, parity, and slave address match the master station and there are no address conflicts.
- 3) Interference Check: Ground the shield at one end, keep the bus away from high-voltage lines, and measure the differential bus voltage (± 5 V is normal).
- 4) Hardware Replacement Test: Replace the module or RS485 converter to rule out chip or port faults.

Key Point: If wiring and parameters are correct but there is still no response, check for bus interference or module damage.

3. RS485 Module Abnormality (Indicator Abnormal)

Description: The PLC or upper-level system communicates normally with the module. The RS485 module cannot read or write, and the indicator is abnormal.

Troubleshooting Steps:

- 1) Power and Wiring Check: Ensure stable module power, correct A/B wiring without reverse connection or short circuit, and proper 120 Ω termination resistor installation.
- 2) Indicator Logic Analysis: A red LED constantly on or flashing may indicate communication failure; if the green LED is off, check power supply or chip status.

- 3) **Bus Voltage Measurement:** Measure the differential voltage between A and B (± 5 V is normal) to rule out signal attenuation or interference.
- 4) **Hardware Replacement Verification:** Replace the module or RS485 converter to determine whether the chip or port is faulty.

Key Point: If power and wiring are correct but the indicator is abnormal, prioritize checking module hardware or firmware compatibility.

7.6 Encoder Module Failure

1. **Encoder Module Function Abnormality -- Description:** The Z-phase output signal of the encoder cannot perform Z-phase reset.

Troubleshooting Steps:

- 1) **Hardware Check:** Ensure correct Z-phase wiring, intact cables, and stable power supply ($24\text{ VDC} \pm 25\%$). Add resistors if necessary.
- 2) **Signal Detection:** Use an oscilloscope to check Z-phase pulse signals. Ensure pulse width > 1 ms and adjust the IO module's trigger conditions and filter time.
- 3) **Software Inspection:** Verify Z-phase address mapping and reset logic in the PLC program. Ensure no program conflicts and monitor input status online.
- 4) **Encoder Test:** Replace the encoder or test another input channel. Check mechanical installation synchronization.
- 5) **Interference Mitigation:** Use shielded cables, separate signal lines from power lines, and add ferrite rings or filters if necessary.
- 6) **Other Checks:** Verify firmware version and compatibility. For long-distance signal transmission, ensure signal strength is sufficient.

Summary: If all above checks are normal, investigate the module's hardware or software faults.

2. **Encoder Module Failure -- Description:** The PLC or upper-level system communicates normally with the module. The module cannot acquire pulse signals. Wiring is correct, but the indicator is abnormal.

Troubleshooting Steps:

- 1) **Signal Source Check:** Use an oscilloscope to verify pulse amplitude and frequency meet requirements. Check the signal source's load capacity.
- 2) **Module Configuration:** Confirm the channel is set to pulse input mode. Adjust the filter time and ensure the signal frequency is within the module's supported range.
- 3) **Wiring Review:** Verify signal and power lines are secure, polarity is correct, use shielded cables, and ground the shield at one end.
- 4) **Power and Indicator Check:** Measure supply voltage stability (24 VDC $\pm 25\%$) and use the indicator status to diagnose power or channel faults.
- 5) **Replacement Test:** Connect the signal to another channel or replace the module to rule out hardware faults.
- 6) **Software and Interference:** Check PLC program address mapping, update firmware, and use ferrite rings or filters for interference mitigation.

Summary: If all above checks are normal, investigate the module's hardware or software faults.

7.7 Bus Module Failure

1. PROFINET (PN) Module Configuration Error -- Description: After configuring the PN module in TIA Portal (Step 7), communication is abnormal.

Troubleshooting Steps:

- 1) **Configuration Verification:** Ensure the device name and IP address match the hardware and there are no conflicts.
- 2) **Physical Connection Check:** Inspect network cables and switch ports for looseness or damage. Monitor for packet loss or CRC errors.
- 3) **GSD File and Firmware:** Verify that the adapter's GSD file is correctly installed and the firmware version matches.
- 4) **Diagnostic Tools:** Use TIA Portal online diagnostics to check module status. Review PLC error logs and adapter alarm codes.

- 5) Network Topology: Verify the network topology (e.g., IRT synchronization settings) and disable unnecessary services (e.g., LLDP).
- 6) Replacement Test: Replace the adapter or network cable to rule out hardware faults.
- 7) Environmental Interference: Check for electromagnetic interference and ensure proper grounding.
- 8) Technical Support: If the issue persists, provide diagnostic screenshots to technical support.

Summary: If all checks above are normal, investigate the module's hardware or firmware faults.

7.8 Temperature Module Failure

1. RTD Temperature Module Abnormality -- Description: The PLC or upper-level system communicates normally with the module, but the module cannot correctly detect temperature. The temperature value is not displayed in software.

Troubleshooting Steps:

- 1) Sensor Check:
 - Verify RTD wiring (e.g., PT100) is correct, ensure 3-wire line lengths are equal, and there are no open circuits or poor contacts.
 - Measure the sensor resistance with a multimeter to rule out component damage or out-of-range values.
- 2) Module Configuration Verification:
 - Confirm that the sensor type (RTD), range, and filter parameters in software match the hardware.
 - Check the module data address mapping to ensure it aligns with the PLC/upper-level program.
- 3) Signal Line Diagnostics:
 - Test that the shield of signal lines is grounded at one end to avoid EMI-induced signal errors.

- Inspect module terminal blocks for oxidation or poor contact. Use a signal isolator if necessary.

4) Hardware Status Check:

- Measure module 24 V power supply stability to ensure it is within rated range.
- Replace the module or RTD sensor with a spare to verify whether it is a hardware fault.

Tip: Use PLC diagnostic tools (e.g., TIA Portal) to read the module channel status word for errors such as broken wires or out-of-range values.

Summary: If all checks above are normal, investigate the module's hardware or software faults.

2. TC Temperature Module Abnormality -- Description: The PLC or upper-level system communicates normally with the module, but the module cannot correctly detect temperature. The temperature value is not displayed in software.

Troubleshooting Steps:

1) Sensor and Wiring Check:

- Verify thermocouple polarity is correct. Ensure compensation wires have no breaks or shorts, and check that cold junction compensation resistors are correctly connected.
- Measure thermocouple output (mV) with a multimeter. If the signal is abnormal or unchanging, the sensor may be damaged or the wiring faulty.

2) Module Configuration Verification:

- Check that the thermocouple type (e.g., K-type, J-type) and range match the sensor. Ensure cold junction compensation is enabled.
- Verify the channel is activated and PDO mapping matches the PLC parameters.

3) Interference and Grounding Check:

- Use shielded cables with single-end grounding. Check line-to-ground insulation resistance ($\geq 100 \text{ M}\Omega$) to avoid common-mode voltage interference.

- If the module and sensor power grounds are separate, connect a common ground wire to eliminate potential differences.
- 4) Module Diagnostics and Replacement Test:
- Observe module indicators (e.g., SF LED flashing may indicate input over-range or broken wire). Test unused channels by shorting them.
 - Replace the module or channel with a spare to determine whether it is a hardware fault.

Summary: If all checks above are normal, investigate the module's hardware or software faults.

7.9 Power Supply Module Failure

1. Power Supply Module Abnormality -- Description: The PLC or upper-level system communicates normally with the module, but the IO modules powered by the supply exhibit abnormal input/output behavior.

Troubleshooting Steps:

- 1) Power Output Check: Measure the module's output voltage to ensure stability and that it is within the rated range (e.g., 24 VDC $\pm 25\%$).
- 2) Load Capacity Verification: Confirm that the power supply can meet the demand of all connected IO modules to prevent overload.
- 3) Wiring and Terminal Inspection: Check for loose or oxidized power terminals and ensure reliable grounding.
- 4) Module Replacement Test: Test the faulty IO modules individually to determine if abnormal power caused hardware damage.
- 5) Configuration Parameter Verification: Check that power module parameters (e.g., voltage thresholds) match the system configuration.

Summary: If all checks above are normal, investigate the module's hardware or software faults.

7.10 Ethernet Port Failure

1. Ethernet Port Abnormality -- Description: During operation, the device experiences disconnections. The Ethernet port indicator is off when the fault occurs.

Troubleshooting Steps:

- 1) Check Cable Connections: Inspect both ends of the network cable for looseness, especially in environments with vibration, which may cause the port to become loose.
- 2) Direct Connection Test: Connect directly and attempt to PING the device.
- 3) Cable Termination Check: Examine the network cable connectors for cold solder joints or partially detached pins.

Troubleshooting Procedure: If step 1 identifies no issues, proceed with steps 2 and 3. If direct PING fails, inspect the solder joints of the Ethernet port.

8. Appendix

Model	RB-1110
Adapter power consumption	Max: 328mA
Order number	18-01-04
Maximum number of I/O	32 pieceS
Maximum number of input bytes	1015
Maximum number of output bytes	1015
Does it support digital modules?	Yes
Does it support analog input modules?	Yes
Does it support functional modules?	Yes (≤6 pieces)
Does it support a communication module?	Yes (≤6 pieces)



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