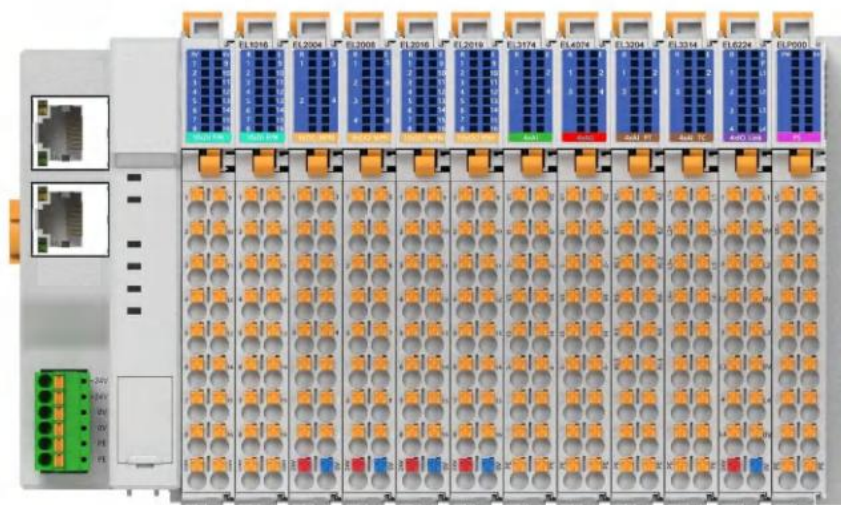


PRODUCT USE INSTRUCTIONS

Product Name: Card-Type I/O Comprehensive Manual

FFC Series Blade I/O Module User Manual



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4.1 Ordering Information 69

Intended Use

This manual describes decentralized input and output modules used for connection to an industrial network.

Installation and Start-up

Notice: Installation and start-up may only be performed by trained specialists. Qualified personnel are persons familiar with the installation and operation of the product and who have the qualifications required for this work. Damage caused by unauthorized operation, illegal use, or improper use is not covered by the manufacturer warranty. The equipment operator is responsible for ensuring compliance with the applicable safety and accident-prevention regulations.

Corrosion Resistance

Notice: FNI modules generally have good chemical and oil resistance. When used in corrosive media, such as media containing high concentrations of chemicals, oils, lubricants, coolants, or other substances with very low water content, the compatibility of the medium with the application materials must be checked and confirmed in advance. If module failure or damage is caused by such corrosive media, defect claims cannot be made.

Dangerous Voltage

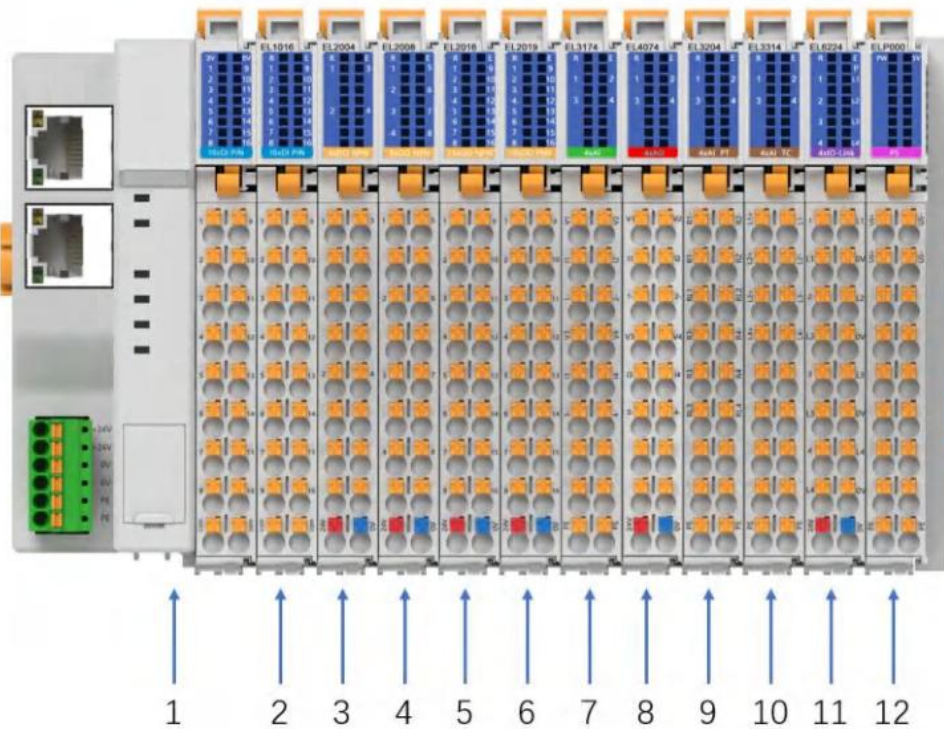
Notice: Disconnect all power supplies before using the device.

General Safety

Category	Safety Requirement
Commissioning and inspection	Read the user manual carefully before commissioning.
Faults	If defects or equipment faults cannot be corrected, operation of the device must be stopped to prevent possible damage caused by unauthorized use.
Obligations of the owner/operator	This device is an EMC Class A product and may generate RF noise. The owner/operator must take appropriate preventive measures when using this device.
Intended use	The system must not be used in environments where personnel safety depends on the function of the device. Intended use can only be ensured after the housing has been completely installed.
Power and cabling	The device may only be used with a matching power supply, and only applicable dedicated cables may be connected.
Warranty and limitation of liability	The manufacturer warranty and limited liability statement do not cover damage caused by unauthorized modification, improper use, or use, installation, and operation not in accordance with this user manual.

1 Getting Started

1.1 Module Overview



Note: The coupler is supplied as standard with one non-removable 16-point NPN/PNP digital input module to form the minimum usable system.

No.	Type	Model	Order Code
1	PROFINET bus coupler	FFC PNT-10F-916-P20	EF9300
1	EtherCAT bus coupler	FFC ECT-10F-916-P20	EF9100
1	Modbus-TCP bus coupler	FFC MBT-10F-916-P20	EF9700
2	16-point NPN/PNP digital input module	FFC BUS-10F-916-P20	EL1016
3	4-point NPN digital output module	FFC BUS-22N-904-P20	EL2224
4	8-point NPN digital output module	FFC BUS-22N-908-P20	EL2228
5	16-point NPN digital output module	FFC BUS-20N-916-P20	EL2016
6	16-point PNP digital output module	FFC BUS-20P-916-P20	EL2019
7	4-channel analog input module	FFC BUS-723-904-P20	EL3174
8	4-channel analog output module	FFC BUS-713-904-P20	EL4074
9	4-channel RTD temperature detection module	FFC BUS-762-904-P20	EL3204
10	4-channel thermocouple temperature detection module	FFC BUS-784-904-P20	EL3314
11	4-channel IO-Link master module	FFC BUS-510-904-P20	EL6224
12	Power relay module	FFC BUS-640-900-P20	ELP000

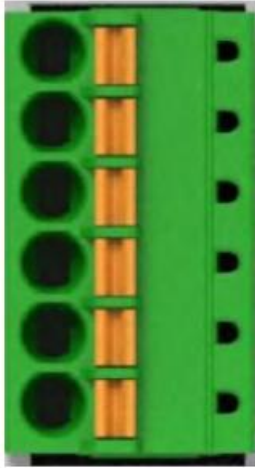
1.2 Mechanical Connection

During module installation, the DIN rail lock at the bottom of the module can be securely mounted on a 35 mm DIN rail. Align the module with the notch, push the module toward the DIN latch, and place the module onto the DIN rail.

1.3 Electrical Connection

For the FFC Series blade module, this module and one expansion module form a minimum slave control system. The module is shipped with one digital input module.

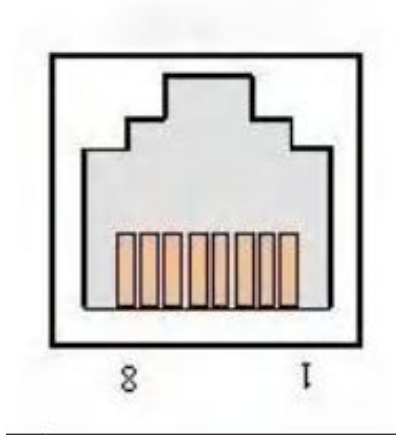
1.3.1 Power Interface



Pin	Function
1	24V
2	24V
3	0V
4	0V
PE	PE
PE	PE

One group of power supply terminals is provided and divided into four wiring terminals. Any terminal in the same network can be connected, making cascading power distribution convenient.

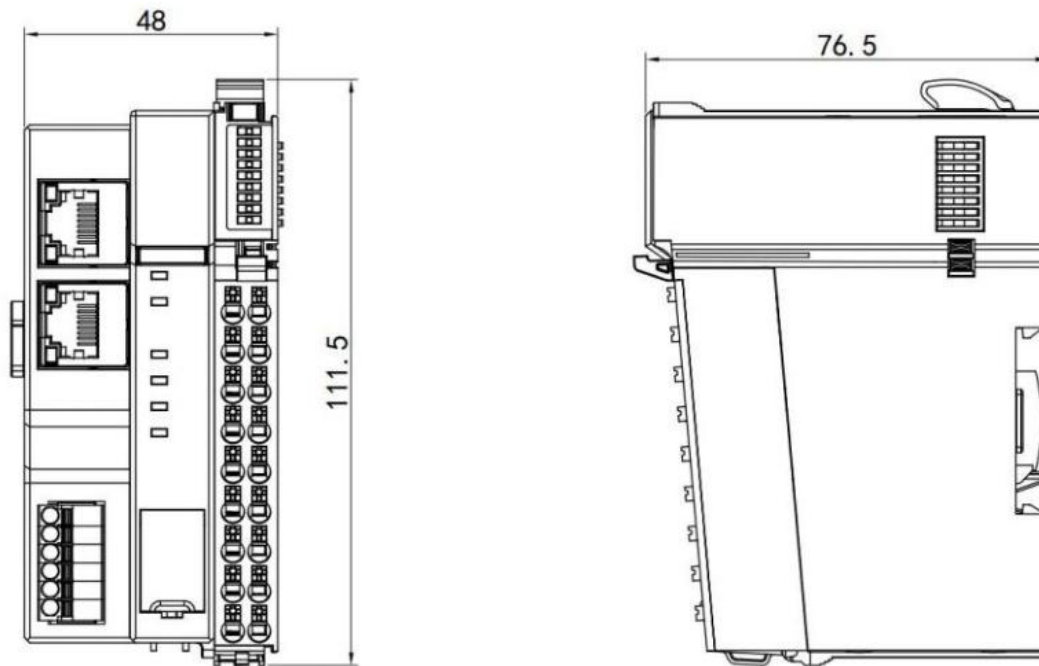
1.3.2 Network Interface (RJ45)



Item	Specification
Data link layer	Ethernet II, IEEE 802.3
Interface type	100BASE-TX
Transmission rate	100 Mbps
RJ45 pin 1	Tx+ transmit data
RJ45 pin 2	Tx- transmit data
RJ45 pin 3	Rx+ receive data
RJ45 pin 6	Rx- receive data

2 Technical Data

2.1 Coupler Parameters



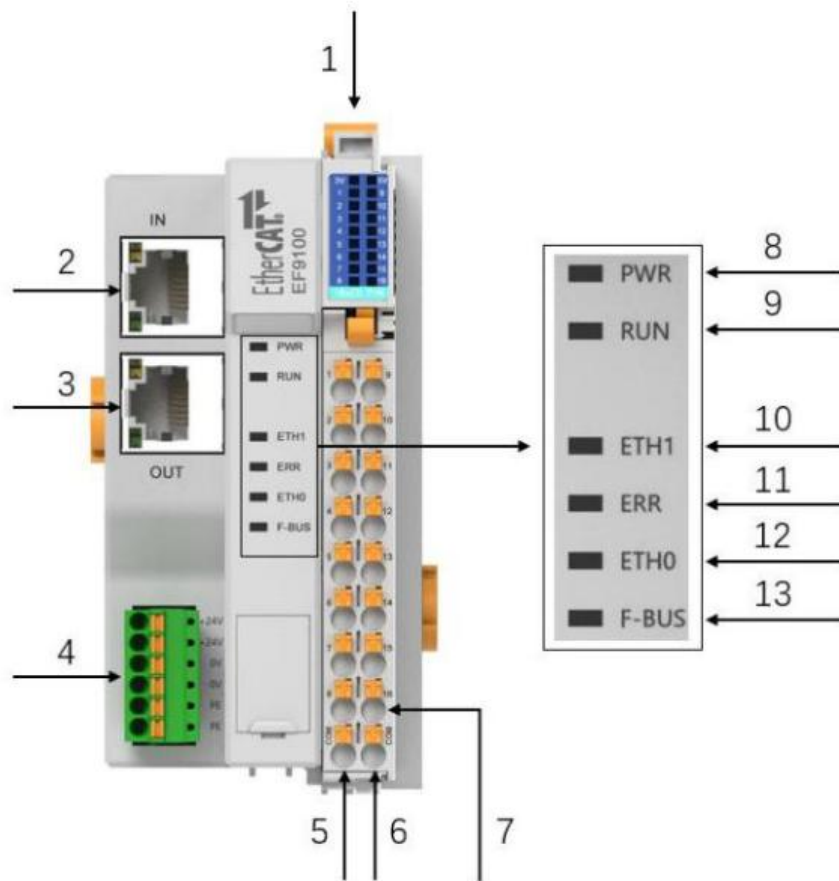
2.1.1 Mechanical Data

Item	Specification
Power interface	Terminal connection
Dimensions (W x H x D)	111.5 mm x 48 mm x 76.5 mm
Installation type	35 mm DIN rail
Power interface type	Push-in terminal

2.1.2 Operating Conditions

Item	Specification
Ambient temperature (operation)	-25°C ... +55°C
Ambient temperature (storage)	-40°C ... +85°C
Maximum temperature change	3 K/min
Relative humidity	5% ... 95%
Altitude range	0 ... 2000 m
Overvoltage category	II (EN 60664-1)
Protection type	IP20
Protection class	III (EN 61140)
Vibration resistance	Complies with EN 61131
Shock resistance	Complies with IEC 60068-2-27

2.1.3 EtherCAT Bus Coupler EF9100



No.	Component
1	DIN latch
2	RJ45 network interface
3	RJ45 network interface
4	Power input port
5	Input COM terminal
6	Input COM terminal
7	Module I/O points
8	Power indicator
9	Run indicator
10	ETH1 indicator
11	Error indicator
12	ETH0 indicator
13	F-BUS indicator

Indicator	Color/State	Description
PWR	Green / yellow / red	Green: input supply voltage normal and 5 V supply output normal; yellow: input supply voltage normal and 5 V output overcurrent; red: input supply overvoltage, undervoltage, or 5 V output short circuit.
RUN	Green	On: PLC or upper computer configuration data has been downloaded and the module operates normally; off: configuration data has not been downloaded.
EHT1	Green	On: EHT1 port connected; flashing: EHT1 connected with data transmission/reception; off: not connected.
ERR	Red	On: communication error on EHT1 or EHT0; off: no error.
EHT0	Green	On: EHT0 port connected; flashing: EHT0 connected with data transmission/reception; off: not connected.
F-BUS	Green	On: backplane expansion module connected; flashing: backplane expansion module connected with data transmission/reception; off: not connected.

Electrical Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Supported on system side; not supported on I/O side
Overvoltage protection	Supported
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm

Power Parameters

Item	Specification
Power supply voltage US	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	18.0 V (±0.5 V at 25°C)
Overvoltage alarm	30.0 V (±0.5 V at 25°C)
Overcurrent alarm	≥4 A (5 V power output supports overcurrent alarm)
Module current consumption	<100 mA (24 VDC)
Reverse voltage protection	Yes
Power supply type	24 VDC PELV or SELV power supply

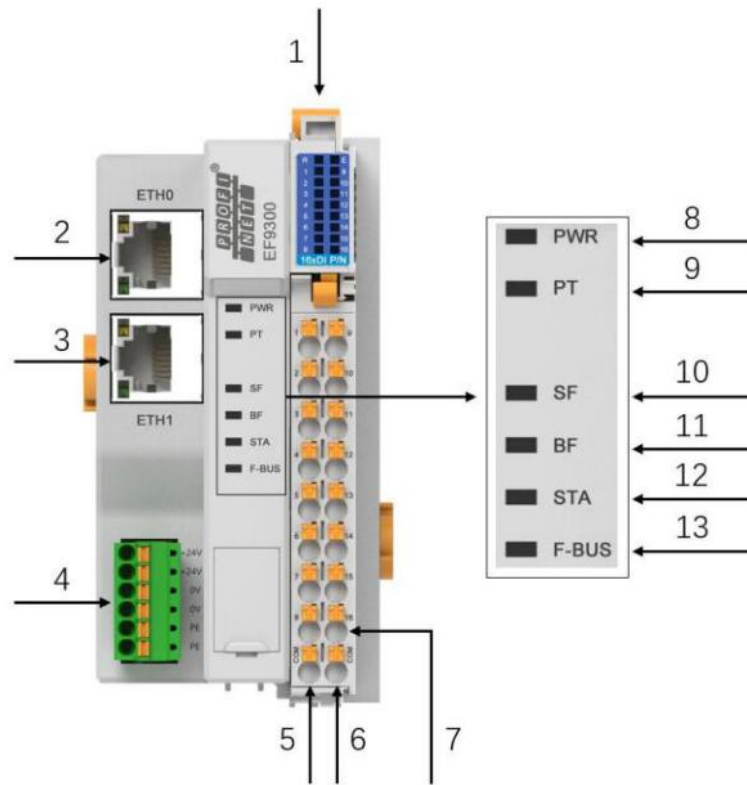
Digital Input

Item	Specification
Number of input channels	16
Rated input voltage	24 V / 0 V
Input signal change frequency	500 Hz, 2 ms
Isolation withstand voltage	DC 700 V
Isolation method	Optocoupler isolation
Input voltage range	PNP: 15-30 V (ON), 0-9 V (OFF); NPN: 0-9 V (ON), 15-30 V (OFF)

EtherCAT Parameters

Item	Specification
Bus protocol	EtherCAT
Address setting	According to master station
Expansion capacity	255
Maximum input/output bytes	Input: 2 Byte
Bus bandwidth	100 Mbps
Transmission distance	100 m (station-to-station distance)

2.1.4 PROFINET Bus Coupler EF9300



No.	Component
1	DIN latch
2	RJ45 network interface
3	RJ45 network interface
4	Power input port
5	Input COM terminal
6	Input COM terminal
7	Module I/O points
8	Power indicator
9	Protocol indicator
10	Status indicator (SF)
11	Status indicator (BF)
12	Status indicator (STA)
13	F-BUS indicator

Indicator	State	Description
Power LED (PWR)	Green on	Power supply normal
Power LED (PWR)	Green slow flashing	Overvoltage alarm
Power LED (PWR)	Green fast flashing	Undervoltage alarm
Power LED (PWR)	Orange on	5 V output overcurrent
Power LED (PWR)	Red on	5 V output short circuit
Power LED (PWR)	Off	Device not connected to power
Protocol LED (PT)	Green on	Module powered on and connected to PLC
Protocol LED (PT)	Orange flashing	Device is in PN protocol state
SF	Off	Normal operation
SF	Orange flashing	Device running
BF	Green on	Normal operation
BF	Red/green alternating, 1 s	No data exchange
BF	Red on	Invalid configuration or no physical link
STA	Green on	Normal operation
STA	Red/yellow fast alternating, 0.25 s	Product ID mismatch
STA	Red fast flashing, 0.25 s	Slave error
STA	Red on	Slave offline
STA	Red/yellow alternating, 0.50 s	Initializing
STA	Yellow/green fast alternating, 0.25 s	Pre-operational
STA	Green fast flashing, 0.25 s	Safe operation
STA	Yellow medium flashing, 0.33 s	Boot mode
F-BUS	Green on	Initializing
F-BUS	Red fast flashing	No other sub-device found
F-BUS	Yellow fast flashing	Waiting for physical connection
F-BUS	Yellow slow flashing	Establishing data exchange
F-BUS	Green fast flashing	Data exchange in progress
EHT0/EHT1	Green fast flashing	Network port connected and transmitting data
EHT0/EHT1	Off	Network port not connected

Electrical Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Supported on system side; not supported on I/O side
Overvoltage protection	Supported
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm

Power Parameters

Item	Specification
Power supply voltage US	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	18.0 V (± 0.5 V at 25°C)
Overvoltage alarm	30.0 V (± 0.5 V at 25°C)
Overcurrent alarm	≥ 4 A (5 V power output supports overcurrent alarm)
Module current consumption	< 100 mA (24 VDC)
Reverse voltage protection	Yes
Power supply type	24 VDC PELV or SELV power supply

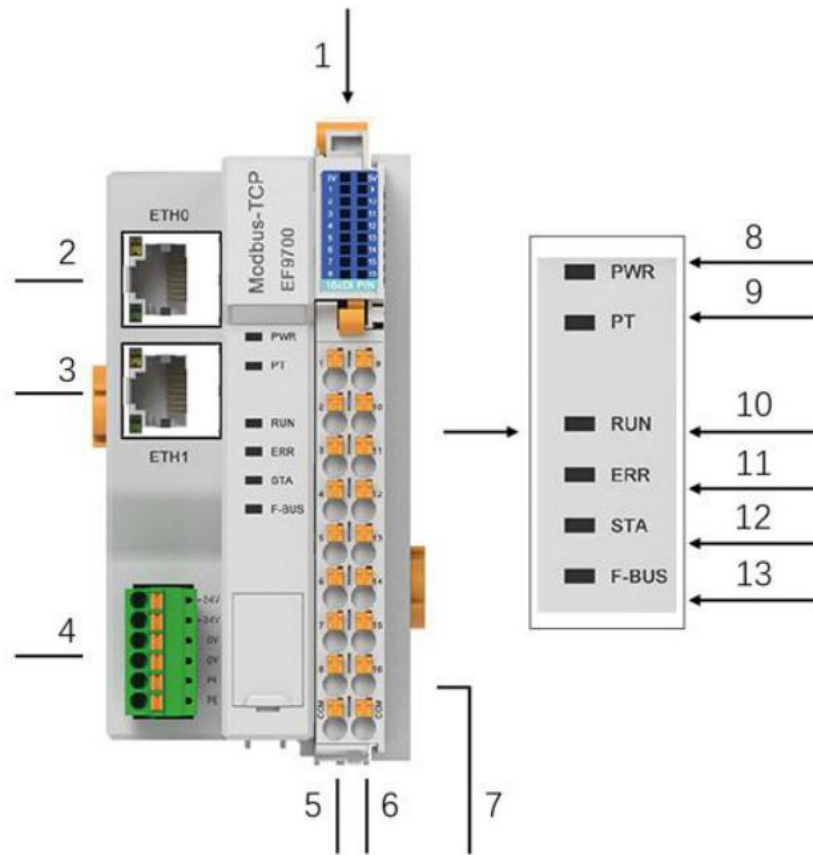
Digital Input

Item	Specification
Number of input channels	16
Rated input voltage	24 V / 0 V
Input signal change frequency	500 Hz, 2 ms
Isolation withstand voltage	DC 700 V
Isolation method	Optocoupler isolation
Input voltage range	PNP: 15-30 V (ON), 0-9 V (OFF); NPN: 0-9 V (ON), 15-30 V (OFF)

PROFINET Communication Parameters

Item	Specification
Alarm type	Diagnostic alarm, plug/unplug alarm
Topology identification	LLDP, SNMP
Minimum cycle time	RT_CLASS_1: 1 ms
Maximum input/output bytes	RT_CLASS_3: 1 ms
MRP redundancy	Not supported
PN IO specification	V2.3

2.1.5 MODBUS TCP Bus Coupler EF9700



No.	Component
1	DIN latch
2	RJ45 network interface
3	RJ45 network interface
4	Power input port
5	Input COM terminal
6	Input COM terminal
7	Module I/O points
8	Power indicator
9	Protocol indicator
10	Status indicator (RUN)
11	Status indicator (ERR)
12	Status indicator (STA)
13	F-BUS indicator

Indicator	State	Description
Power LED (PWR)	Green on	Power supply normal
Power LED (PWR)	Green slow flashing	Overvoltage alarm
Power LED (PWR)	Green fast flashing	Undervoltage alarm
Power LED (PWR)	Orange on	5 V output overcurrent
Power LED (PWR)	Red on	5 V output short circuit
Power LED (PWR)	Off	Device not connected to power
Protocol LED (PT)	Green on	Module powered on and connected to PLC
Protocol LED (PT)	Orange flashing	Device is in MODBUS TCP protocol state
RUN	Green on	Connected
RUN	Red flashing	Not connected
STA	Green on	Normal operation
STA	Red/yellow fast alternating, 0.25 s	Product ID mismatch
STA	Red fast flashing, 0.25 s	Slave error
STA	Red on	Slave offline
STA	Red/yellow alternating, 0.50 s	Initializing
STA	Yellow/green fast alternating, 0.25 s	Pre-operational
STA	Green fast flashing, 0.25 s	Safe operation
STA	Yellow medium flashing, 0.33 s	Boot mode
F-BUS	Green on	Initializing
F-BUS	Red fast flashing	No other sub-device found
F-BUS	Yellow fast flashing	Waiting for physical connection
F-BUS	Yellow slow flashing	Establishing data exchange
F-BUS	Green fast flashing	Data exchange in progress
EHT0/EHT1	Green fast flashing	Network port connected and transmitting data
EHT0/EHT1	Off	Network port not connected

Electrical Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Supported on system side; not supported on I/O side
Overvoltage protection	Supported
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm

Power Parameters

Item	Specification
Power supply voltage US	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	18.0 V (± 0.5 V at 25°C)
Overvoltage alarm	30.0 V (± 0.5 V at 25°C)
Overcurrent alarm	≥ 4 A (5 V power output supports overcurrent alarm)
Module current consumption	< 100 mA (24 VDC)
Reverse voltage protection	Yes
Power supply type	24 VDC PELV or SELV power supply

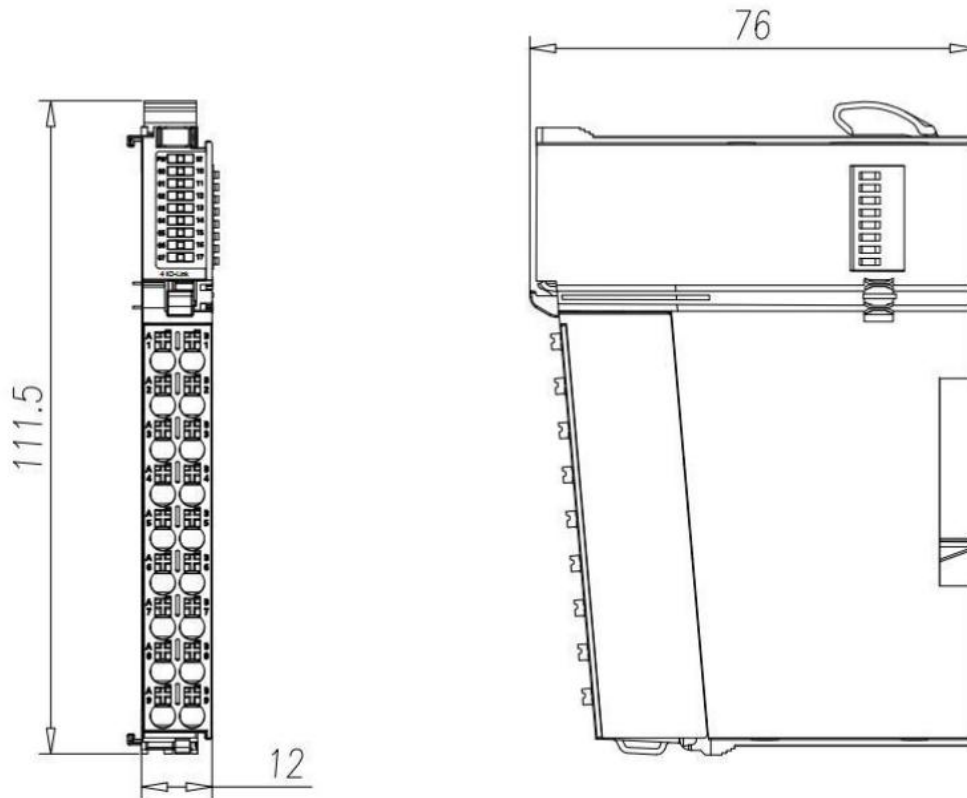
Digital Input

Item	Specification
Number of input channels	16
Rated input voltage	24 V / 0 V
Input signal change frequency	500 Hz, 2 ms
Isolation withstand voltage	DC 700 V
Isolation method	Optocoupler isolation
Input voltage range	PNP: 15-30 V (ON), 0-9 V (OFF); NPN: 0-9 V (ON), 15-30 V (OFF)

MODBUS TCP Communication Parameters

Item	Specification
Idle time before probe packet	10 s
Probe packet interval	1 s
Disconnect after probe failure count	3 times
Target port	502
Model	FFC MBT-10F-916-P20
Device type	EF9700
Hardware version	1.0.0
Firmware version	2.0.10

2.2 Blade Module Parameters



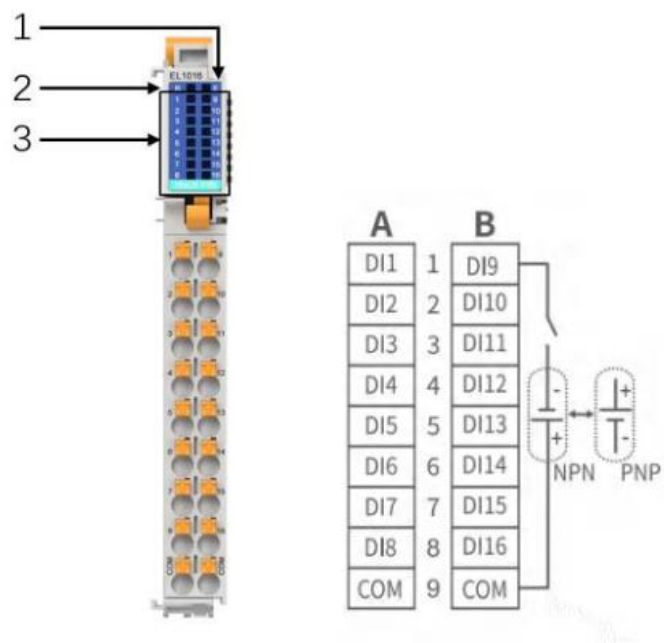
2.2.1 Mechanical Data

Item	Specification
Housing protection according to IEC 60529	IP20
Power interface	Terminal connection
Dimensions (W x H x D)	111.5 mm x 12 mm x 76 mm
Installation type	35 mm DIN rail
Power interface type	Push-in terminal

2.2.2 Operating Conditions

Item	Specification
Ambient temperature (operation)	-25°C ... +55°C
Ambient temperature (storage)	-40°C ... +85°C
Maximum temperature change	3 K/min
Relative humidity	5% ... 95%
Altitude range	0 ... 2000 m
Overvoltage category	II (EN 60664-1)
Protection type	IP20
Vibration resistance	Complies with EN 61131
Shock resistance	Complies with IEC 60068-2-27

2.2.3 EL1016 Digital Input Module



No.	Description
1	Error indicator
2	Run indicator
3	Port signal indicator

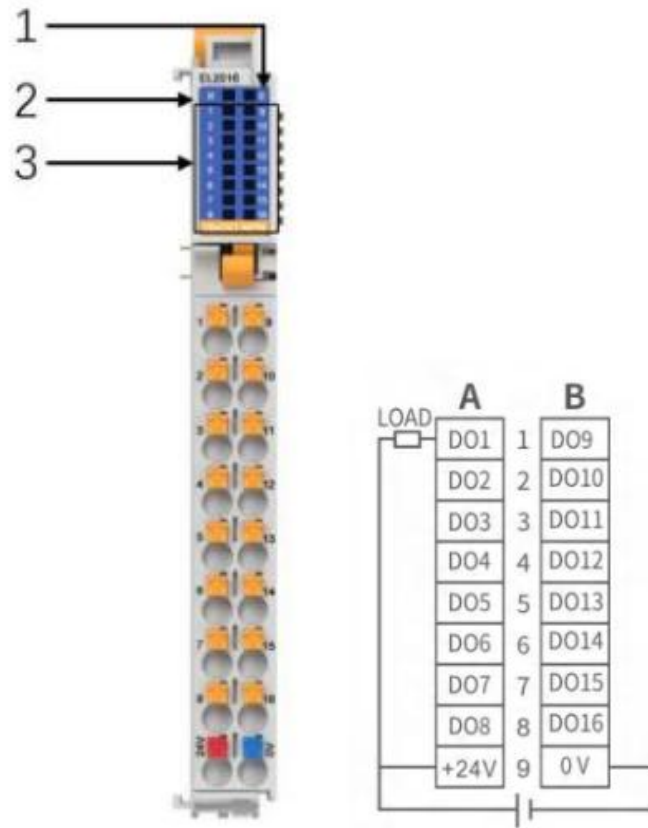
Indicator	Color	Description
R	Green	On: communicating; off: communication abnormal
E	Red	On: CRC error; off: no error
Port signal	Yellow	On: signal input present; off: no signal

EL1016 Power / Input Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm
Number of input channels	16
Rated input voltage	24 VDC
Isolation withstand voltage	DC 700 V

Isolation method	Optocoupler isolation
Module current consumption	100 mA (5 V)
Input voltage range	PNP: 15-30 V (ON), 0-9 V (OFF); NPN: 0-9 V (ON), 15-30 V (OFF)

2.2.4 EL2016 Digital Output Module



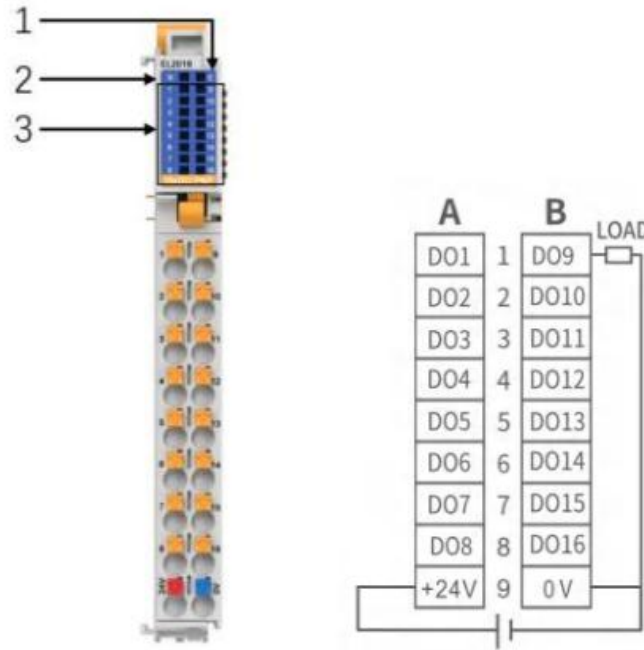
Indicator	Color	Description
R	Green	On: communicating; off: communication abnormal
E	Red	On: CRC error; off: no error
Port signal	Yellow	On: signal input present; off: no signal

EL2016 Output Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Single-channel load capacity 500 mA, total current <4 A; protection above 4 A.
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm
Number of output channels	16
Rated output voltage	0 V
Output signal type	Transistor
Drive capacity	500 mA per channel, maximum total output current 4 A
Load type	Resistive load, inductive load, lamp load

Overcurrent protection	Supported
Overtemperature protection	Supported
Isolation withstand voltage	DC 700 V
Isolation method	Optocoupler isolation
Module current consumption	150 mA (5 V)

2.2.5 EL2019 Digital Output Module



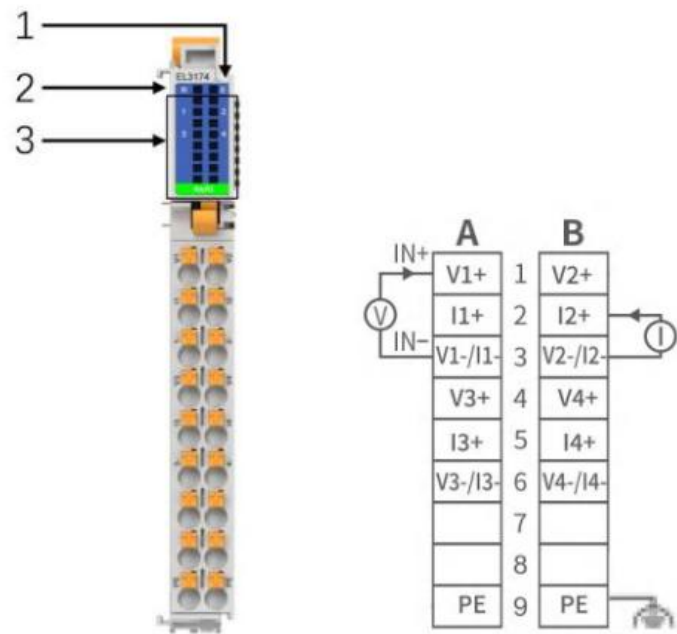
Indicator	Color	Description
R	Green	On: communicating; off: communication abnormal
E	Red	On: CRC error; off: no error
Port signal	Yellow	On: signal input present; off: no signal

EL2019 Output Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Single-channel load capacity 500 mA, total current <4 A; protection above 4 A.
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless
Stripping length	8-10 mm
Number of output channels	16
Rated output voltage	24 V
Output signal type	Transistor
Drive capacity	500 mA per channel, maximum total output current 4 A
Load type	Resistive load, inductive load, lamp load
Overcurrent protection	Supported
Overtemperature protection	Supported
Isolation withstand voltage	DC 700 V

Isolation method	Optocoupler isolation
Module current consumption	150 mA (5 V)

2.2.6 EL3174 Analog Input Module

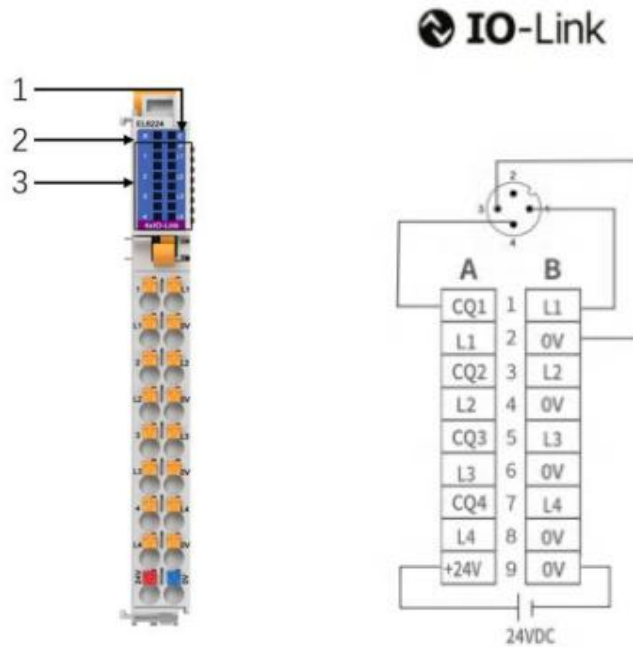


Indicator	Color	Description
R	Green	On: communicating; off: communication abnormal
E	Red	On: CRC error; off: no error
Port signal	Green	On: signal input present; off: no signal

EL3174 Analog Input Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Wiring specification	0.2-1.5 mm²
Wiring method	Screwless
Stripping length	8-10 mm
Number of input channels	4
Input filter	Average filtering
Input impedance	Voltage range: 30 kΩ; current range: 250 Ω
Resolution	16-bit
Accuracy	0.50%
Overvoltage protection	Supported
Isolation withstand voltage	DC 700 V between field side and digital side; no isolation between channels
Module current consumption	200 mA (5 V)

2.2.7 EL6224 IO-Link Master Module



Indicator	Color	Description
R	Green	On: module bus connected; flashing: module in bus startup state and waiting for connection (2 s flashing); off: module not powered
E	Red	On: module bus communication error; off: module working normally
IO-Link status (1-4)	Green / red	Green off: channel not enabled; green flashing: IO-Link not connected; green on: IO-Link connected; red on: IO-Link byte count mismatch
UA power (P)	Green / red	Green on: UA voltage input normal; red on: UA overvoltage >30 V; red slow flashing: UA undervoltage <18 V; red fast flashing: UA power loss <8 V
Power output (L1-L4)	Green / red	Off: channel not enabled; green on: channel enabled and output voltage normal; red on: output power short-circuit fault

EL6224 Power Parameters

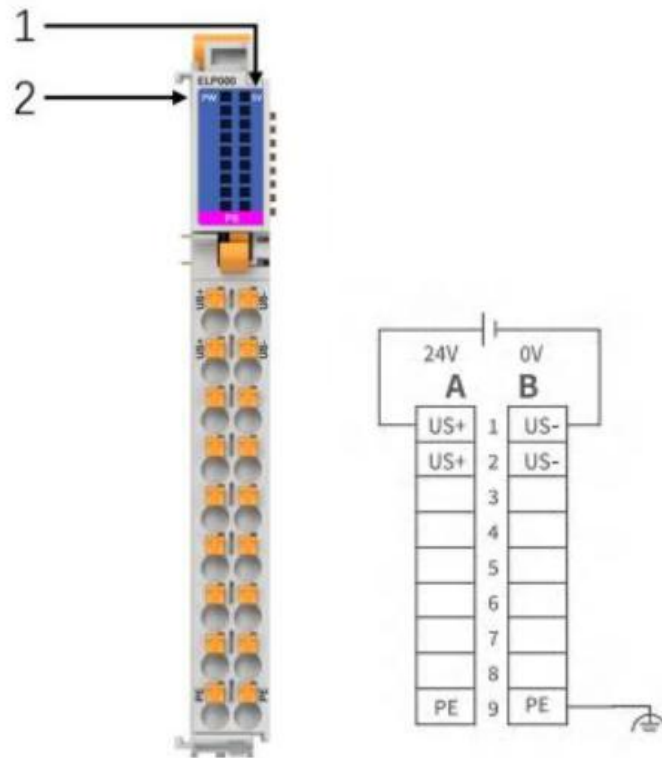
Item	Specification
Power supply voltage UA	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	18.0 V (±5% at 25°C)
Overvoltage alarm	30.0 V (±5% at 25°C)
Short-circuit alarm	Only supports short-circuit alarm on power output ports
Module current consumption	300 mA (5 V)
Reverse voltage protection	Yes
Power supply type	24 VDC PELV or SELV power supply

EL6224 IO-Link Port Parameters

Item	Specification
------	---------------

Number of IO-Link channels	4
IO-Link interface type	Class-A
IO-Link version	IO-Link V1.1.3
IO-Link transmission rate	COM1 (4.8 kbps), COM2 (38.4 kbps), COM3 (230.4 kbps)
Maximum load current	1 A/channel
Cable length (shielded twisted pair)	Max. 20 m
Wiring specification	0.2-1.5 mm ²
Stripping length	8-10 mm

2.2.8 ELP000 Power Relay Module



No.	Description
1	5 V indicator
2	PW indicator

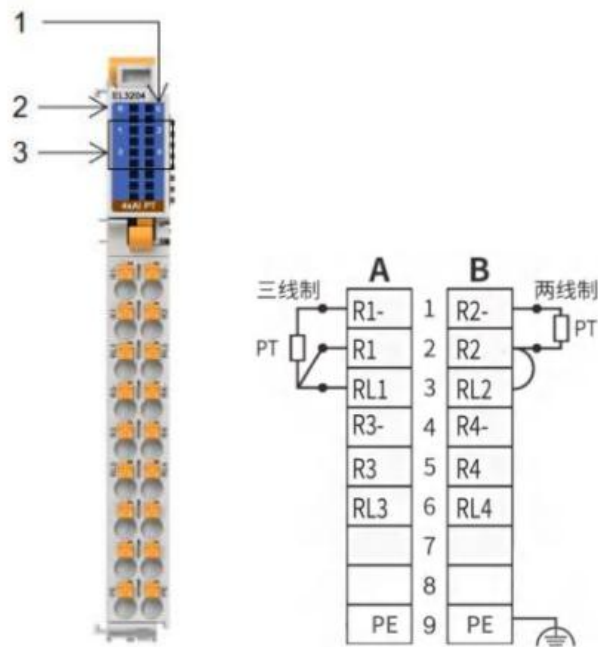
Indicator	Color	Description
PW	Green	Green on: input supply voltage normal
PW	Red	Red on: input supply overvoltage or undervoltage
5V	Green/yellow/red	Green on: 5 V supply output normal; yellow on: 5 V output overcurrent >5 A; red on: 5 V output short circuit, internal module temperature too high, input voltage below 10 V, etc.

ELP000 Power Parameters

Item	Specification
Power supply voltage US	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	18.0 V (± 0.5 V at 25°C)
Overvoltage alarm	30.0 V (± 0.5 V at 25°C)
Overcurrent alarm	≥ 5 A (only the 5 V power output supports overcurrent alarm)
Module current consumption	<100 mA (24 VDC)
Module output current	4 A
Reverse voltage protection	Yes

Power supply type	24 VDC PELV (protective extra-low voltage) or SELV (safety extra-low voltage) power supply
-------------------	--

2.2.9 EL3204 Four-Channel RTD Temperature Detection Module



Indicator	Color	Description
R	Green	Green on: module bus connected; green flashing: bus startup state, waiting for connection (2 s flashing); off: module not powered
E	Red	Red on: module bus communication error; off: module working normally
Channel indicator (1-4)	Green / red / orange	Off: port not enabled; green on: port enabled; orange on: sensor connected normally; red on: sensor over-range or short circuit

EL3204 Electrical Parameters

Item	Specification
System-side electrical isolation	AC 500 V
Reverse connection protection	Not supported
Overcurrent protection	Not supported
Overvoltage protection	Not supported
Wiring specification	0.2-1.5 mm²
Wiring method	Screwless

EL3204 RTD Connection Port

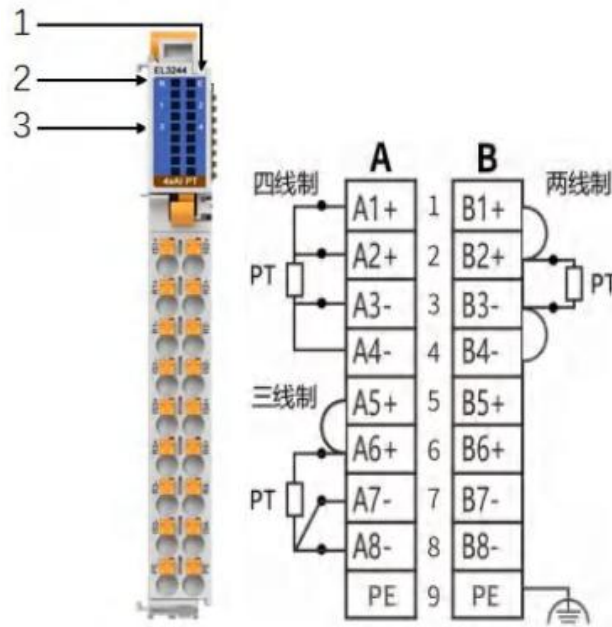
Item	Specification
Sensor type	RTD, PT100
2-/3-wire measurement method	Supported
Maximum resolution	15-bit
RTD temperature measurement range	-200°C to +850°C

Maximum sampling rate	15 ms
Maximum detection accuracy	$\pm 0.5^{\circ}\text{C}$
Diagnostic events	Sensor short circuit, sensor over measurement range

EL3204 Power and Communication

Item	Specification
Power supply voltage	5 VDC
Undervoltage alarm	Not supported
Overvoltage alarm	Not supported
Short-circuit alarm	Not supported
Module current consumption	<150 mA (5 VDC)
Reverse voltage protection	Yes
Interface type	F-BUS
Transmission rate	100 MBit/s

2.2.10 EL3244 Four-Channel RTD Temperature Detection Module



Indicator	Color	Description
R	Green	Green on: module bus connected; green flashing: bus startup state, waiting for connection; off: module not powered
E	Red	Red on: module bus communication error; off: module working normally
Channel indicator (1-4)	Green / red / orange	Off: channel not enabled; green on: channel enabled but no sensor connected; orange on: port and sensor connected; red on: sensor over-range or short circuit

EL3244 Power Parameters

Item	Specification
Power status indicator	None
Reverse voltage protection	None
Power interface type	Powered by backplane bus socket
Module current consumption	<150 mA (5 VDC)

EL3244 Operating Conditions

Item	Specification
Type	IP20 series 4-wire PT100 temperature measurement module
Product composition	Single board
Model	EL3244
Ambient temperature (operation)	-20°C ... +55°C
Ambient temperature (storage)	-20°C ... +60°C
Maximum temperature change	3 K/min
Relative humidity	<95% RH, non-condensing

Altitude range	0 ... 2000 m
Protection class according to IEC 60529	IP20
Fastener	Rail-mounting clip
Dimensions (L x W x H)	111.5 x 12 x 76.5 mm
Housing material	Plastic (PC+ABS)
Immunity	Power line 2 kV (IEC 61000-4-4)
Overvoltage category	II
EMC immunity level	Zone B, IEC 61131-2
Vibration resistance	Meets IEC 60068-2-6 requirements

EL3244 RTD Connection Port

Item	Specification
Status indicator	Available
Interface type	Crimping quick terminal
Wiring specification	0.2-1.5 mm ²
Number of ports	4 channels
Port pin function	Pin 1: positive excitation current source; Pin 2: positive RTD voltage detection; Pin 3: negative RTD voltage detection; Pin 4: negative excitation current source
Input filtering	Supported (software/hardware filtering)
Sampling rate	Four-channel polling sampling ≤15 ms (up to 2 kSPS supported)
ADC maximum bits	24-bit
Temperature measurement accuracy	±0.5°C
Temperature measurement resolution	0.01°C
Temperature measurement range	-200°C to 850°C
Sensor type	PT100, PT1000
Sensor open-circuit detection	Supported (condition: PT100 sensor resistance <10 Ω)
Sensor short-circuit detection	Supported (condition: PT100 sensor resistance >400 Ω)
Input port type	Type 3 (IEC 61131-2)

EL3244 Communication Port

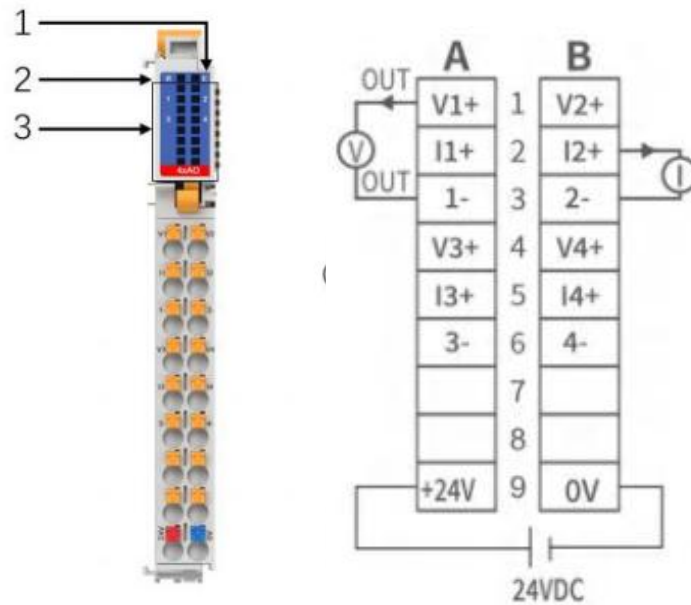
Item	Specification
Interface type	F-BUS
Interface bandwidth	100 Mbps

Index	Name	Flags	Value / Meaning	Default
80x0:0	CH Settings	RO	8	
80x0:01	enable	RW	Channel enable	0

80x0:02	Overlimit enable	RW	Above upper limit	1
80x0:03	Underlimit enable	RW	Below lower limit	1
80x0:04	Open alarm enable	RW	Open-circuit alarm	1
80x0:05	TemperatureUnit	RW	[°C, °F, Ω, adc]	0
80x0:06	Presentation	RW	Mode [PT100, PT1000]	0
80x0:07	DecimalPointPosition	RW	Display decimal [x1, x0.1, x0.01, x0.001, x0.0001]	0
80x0:0B	Calibration	RW	Calibration effective in Ω. Input -200 and 850°C respectively. Return 0 = success, <0 = failure. Temperature value is 0 until calibration is completed.	
80x0:0C	OffsetR	RW	Connected resistance error, unit Ω	0
80x0:0D	Offset	RW	Temperature offset	0

Module calibration procedure: Set TemperatureUnit to Ω, input -200°C on the sensor, write -200 to Calibration, and after return value 0, input 850°C on the sensor. Write 850 to Calibration, and after return value 0, set TemperatureUnit to the required unit to complete calibration.

2.2.11 EL4074 Four-Channel Analog Output Module



Indicator	Color	Description
R	Green	Green on: module bus connected; green flashing: bus startup state, waiting for connection (2 s flashing); off: module not powered
E	Red	Red on: module bus communication error; off: module working normally
Channel indicator (LD1-LD4)	Green / red / orange	Off: channel not enabled; green on: channel enabled in voltage output mode; orange on: channel enabled in current output mode; red on: output short circuit in voltage mode or output open circuit in current mode

EL4074 Electrical Parameters

Item	Specification
System-side electrical isolation	AC 500 V
Reverse connection protection	Supported
Overcurrent protection	Supported (analog output port supports overcurrent protection)
Overvoltage protection	Supported
Wiring specification	0.2-1.5 mm ²
Wiring method	Screwless

EL4074 Power Parameters

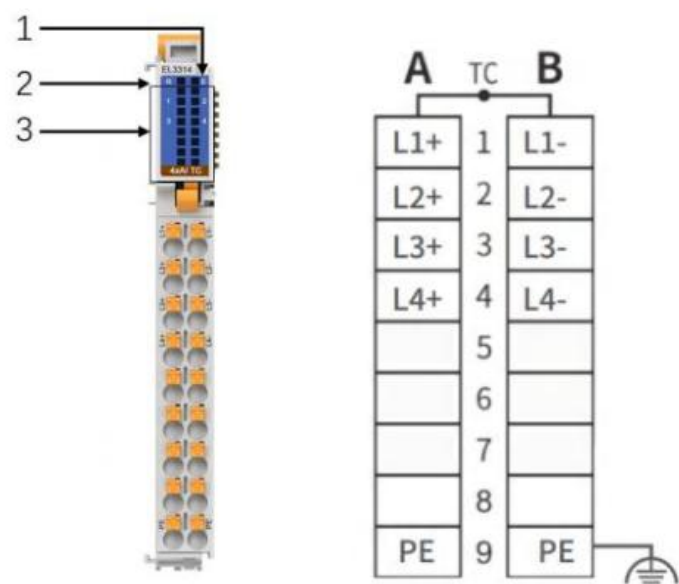
Item	Specification
Power supply voltage US	24 VDC, -25%/+25% (18 VDC ... 30 VDC)
Voltage above 34 V	Permanently damages the device
Undervoltage alarm	Not supported
Overvoltage alarm	Not supported
Module current consumption	<150 mA (24 VDC), <500 mA (5 V backplane power)

Reverse voltage protection	Yes
Power supply type	24 VDC PELV or SELV power supply

EL4074 Analog Output Connection Port

Item	Specification
Maximum accuracy	16-bit
Voltage output range	-10 V to +10 V, 0 V to +10 V, -5 V to +5 V, 0 V to +5 V, 1 V to 5 V
Current output range	0 mA to 20 mA, 4 mA to 20 mA
Output error	<0.5%
Voltage output short-circuit current	<16 mA
Current output open-circuit voltage	<24 V
Maximum capacitive load	<1.2 μ F
Maximum resistive load	>1000 Ω
Diagnostic events	Voltage output short circuit, current output open circuit, channel enable

2.2.12 EL3314 Four-Channel Thermocouple Temperature Detection Module



Indicator	Color	Description
R	Green	On: communicating; off: communication abnormal
E	Red	On: CRC error; off: no error
Port signal	Green/red	Green on: signal input present; off: channel closed; red: threshold exceeded

EL3314 Electrical Parameters

Item	Specification
System-side electrical isolation	DC 700 V
Reverse connection protection	Supported
Overcurrent protection	Not applicable
Overvoltage protection	Not applicable
Wiring specification	0.2-1.5 mm²
Wiring method	Screwless

EL3314 Analog TC Input

Item	Specification
Number of input channels	4
Sensor type	Thermocouple: B, E, J, K, N, R, S, T
Resolution	24-bit
Overvoltage protection	Supported
Isolation withstand voltage	DC 700 V between field side and digital side; no isolation between channels

Thermocouple Type	Detection Range	Accuracy
B	200°C to 1800°C	$\pm 5^{\circ}\text{C}$ @ $200 < T < 400^{\circ}\text{C}$; $\pm 5^{\circ}\text{C}$ @ $400 < T < 750^{\circ}\text{C}$; $\pm 3^{\circ}\text{C}$ @ $750 < T < 1200^{\circ}\text{C}$; $\pm 3.5^{\circ}\text{C}$ @ $1200 < T < 1800^{\circ}\text{C}$
E	-270°C to 1000°C	$\pm 1^{\circ}\text{C}$ @ $-270 < T < -200^{\circ}\text{C}$; $\pm 1^{\circ}\text{C}$ @ $-200 < T < 400^{\circ}\text{C}$; $\pm 1.5^{\circ}\text{C}$ @ $400 < T < 1000^{\circ}\text{C}$
N	-200°C to 1300°C	$\pm 2^{\circ}\text{C}$ @ $-200 < T < -150^{\circ}\text{C}$; $\pm 1.5^{\circ}\text{C}$ @ $-150 < T < 750^{\circ}\text{C}$; $\pm 0.2\%$ of displayed value @ $750 < T < 1300^{\circ}\text{C}$
J	-210°C to 1200°C	$\pm 1^{\circ}\text{C}$ @ $-210 < T < -100^{\circ}\text{C}$; $\pm 1^{\circ}\text{C}$ @ $-100 < T < 500^{\circ}\text{C}$; $\pm 0.2\%$ of displayed value @ $500 < T < 1200^{\circ}\text{C}$
K	-270°C to 1370°C	$\pm 1.5^{\circ}\text{C}$ @ $-270 < T < -200^{\circ}\text{C}$; $\pm 1.5^{\circ}\text{C}$ @ $-200 < T < -100^{\circ}\text{C}$; $\pm 1^{\circ}\text{C}$ @ $-100 < T < 500^{\circ}\text{C}$; $\pm 0.2\%$ of displayed value @ $500 < T < 1300^{\circ}\text{C}$; $\pm 2.6^{\circ}\text{C}$ @ $1300 < T < 1370^{\circ}\text{C}$
R	-50°C to 1768°C	$\pm 4^{\circ}\text{C}$ @ $-50 < T < 0^{\circ}\text{C}$; $\pm 4^{\circ}\text{C}$ @ $0 < T < 250^{\circ}\text{C}$; $\pm 2^{\circ}\text{C}$ @ $250 < T < 500^{\circ}\text{C}$; $\pm 3.5^{\circ}\text{C}$ @ $500 < T < 1700^{\circ}\text{C}$; $\pm 3.5^{\circ}\text{C}$ @ $1700 < T < 1768^{\circ}\text{C}$
S	-50°C to 1768°C	$\pm 4^{\circ}\text{C}$ @ $-50 < T < 0^{\circ}\text{C}$; $\pm 4^{\circ}\text{C}$ @ $0 < T < 250^{\circ}\text{C}$; $\pm 2^{\circ}\text{C}$ @ $250 < T < 500^{\circ}\text{C}$; $\pm 3.5^{\circ}\text{C}$ @ $500 < T < 1700^{\circ}\text{C}$; $\pm 3.5^{\circ}\text{C}$ @ $1700 < T < 1768^{\circ}\text{C}$
T	-270°C to 400°C	$\pm 1^{\circ}\text{C}$ @ $-270 < T < -200^{\circ}\text{C}$; $\pm 1^{\circ}\text{C}$ @ $-200 < T < 400^{\circ}\text{C}$

3 Integration

3.1 EF9100 Integration

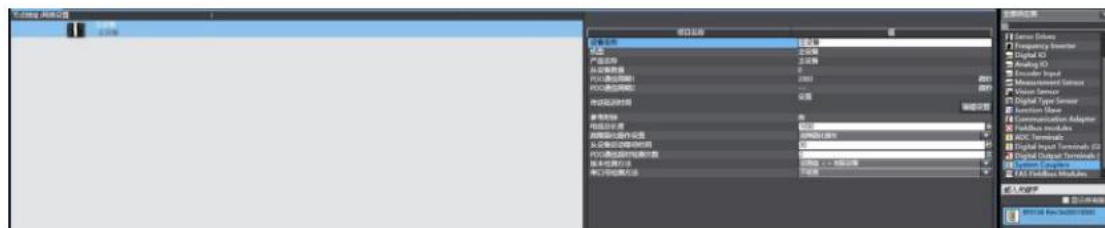
3.1.1 Integration in Omron NX1P2 Sysmac Studio

This example shows how to integrate the module into an Omron PLC system, using an Omron NX1P2 PLC as an example.

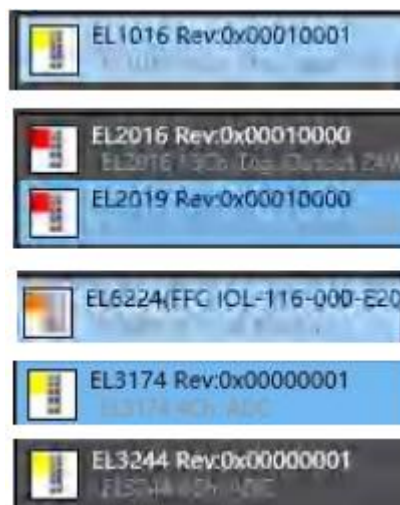
Install the ESI file: Configuration and Setup -> EtherCAT -> right-click the master device -> click Show ESI Library -> click Install File in the pop-up window -> select the corresponding product ESI file.

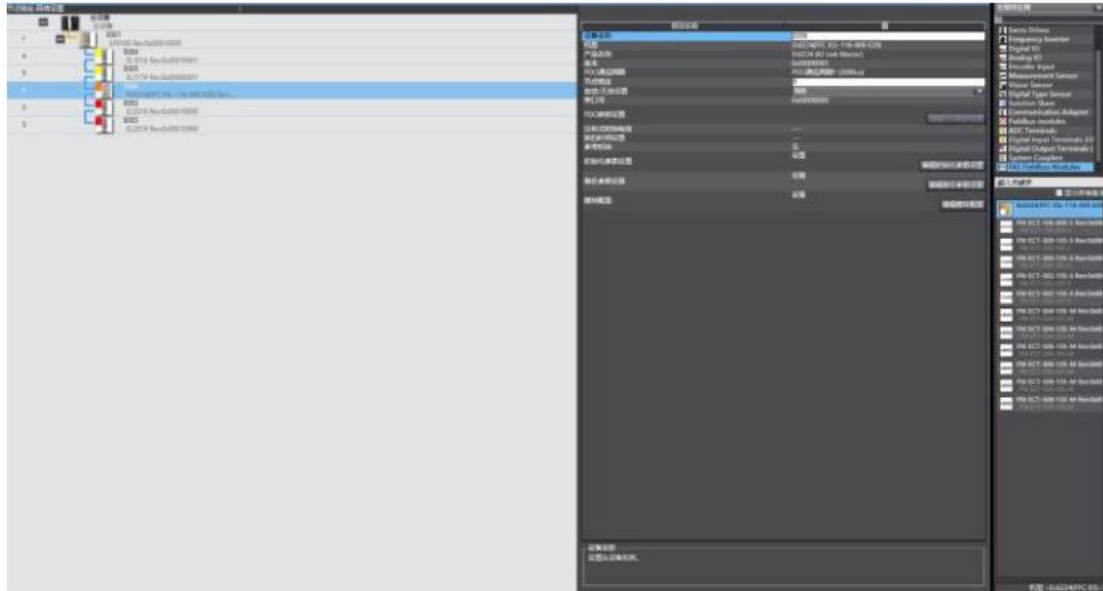


Create the module: click the Toolbox on the right -> find System Couplers -> select product model EF9100 -> double-click the product to add it to the master device.

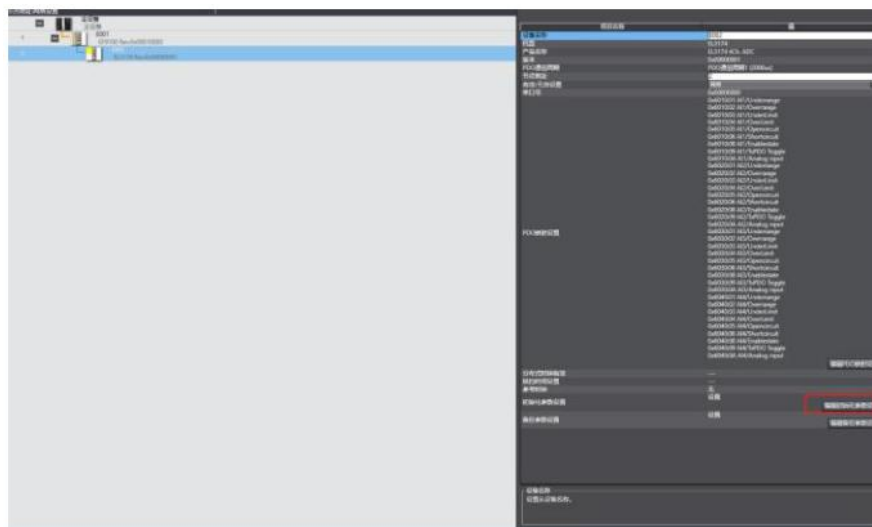


Add input and output modules: in the Toolbox, find Digital Input Terminals / Digital Output Terminals and select the required I/O module. Find the IO-Link master module under FAS Fieldbus Modules, and find analog modules under ADC Terminals. Double-click the corresponding product to add it to the master device.

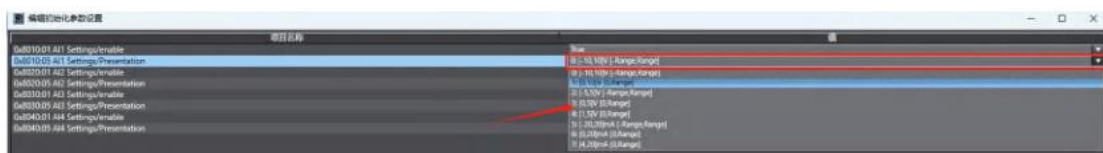




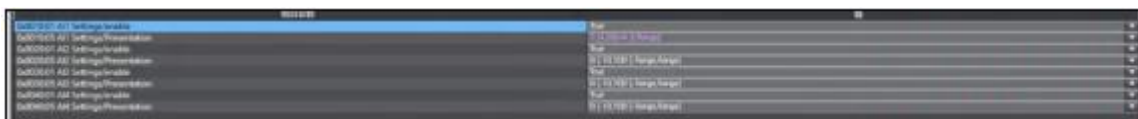
Analog card parameter configuration: After adding EL3174, select the module and click Edit Initial Parameter Settings to enter the initial parameter setting interface.



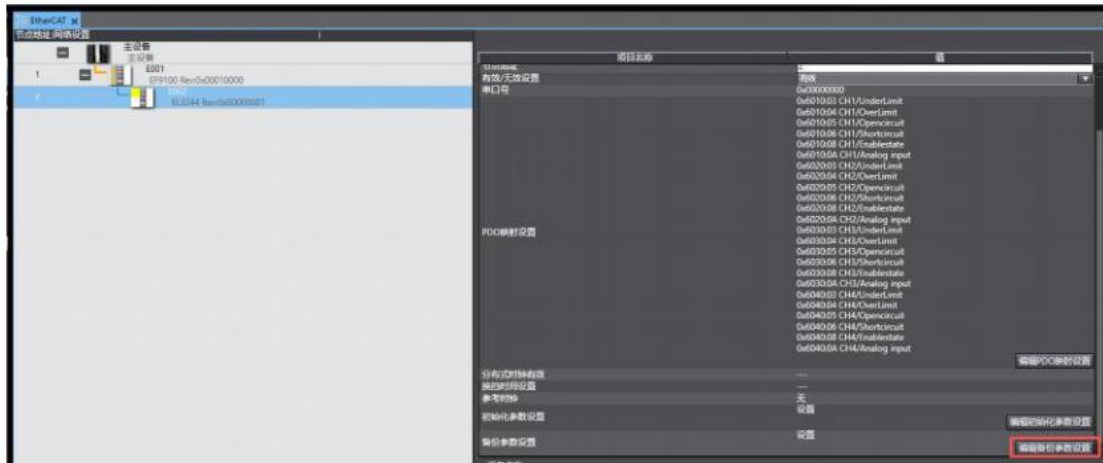
In this interface, configure the analog channel function.



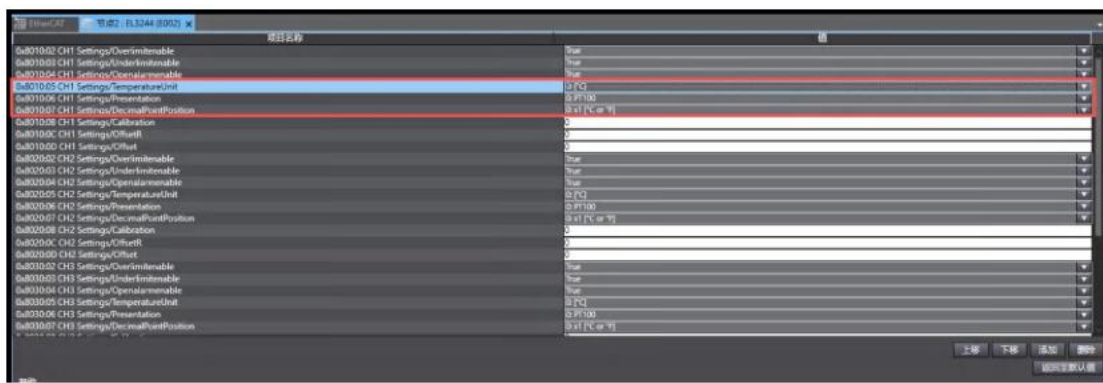
Select the required function and click OK to save.



After adding EL3244, select the module and click Edit Initial Parameter Settings to configure



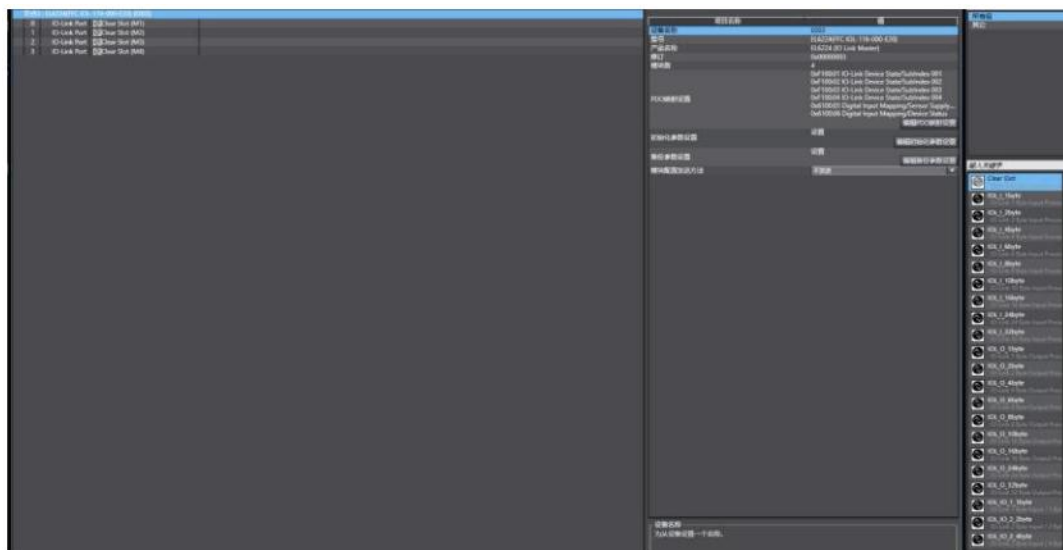
The sensor type, accuracy, and temperature unit,



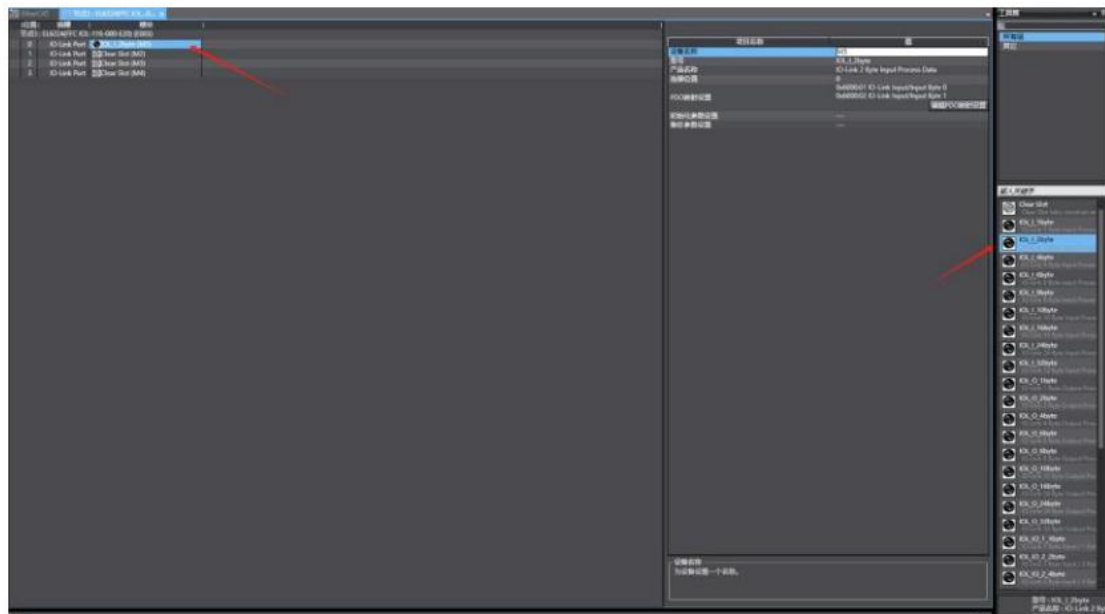
Then click OK to save.

IO-Link master card parameter configuration:

After adding the EL6224 master card, select the module and click Edit Module Configuration to enter the slot configuration interface. Select the slot to be configured, and drag the required byte length to the left side. The required byte length must be determined from the IO-Link slave manual.



Select the slot to be configured, and drag the required byte length to the left side. The required byte length must be determined from the IO-Link slave manual.



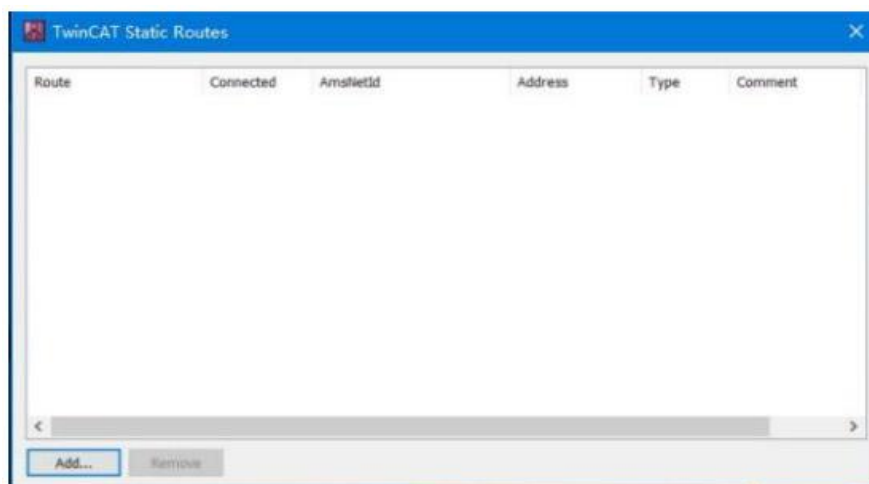
The slot configuration is then completed.

3.1.2 Integration in Beckhoff TwinCAT XAE

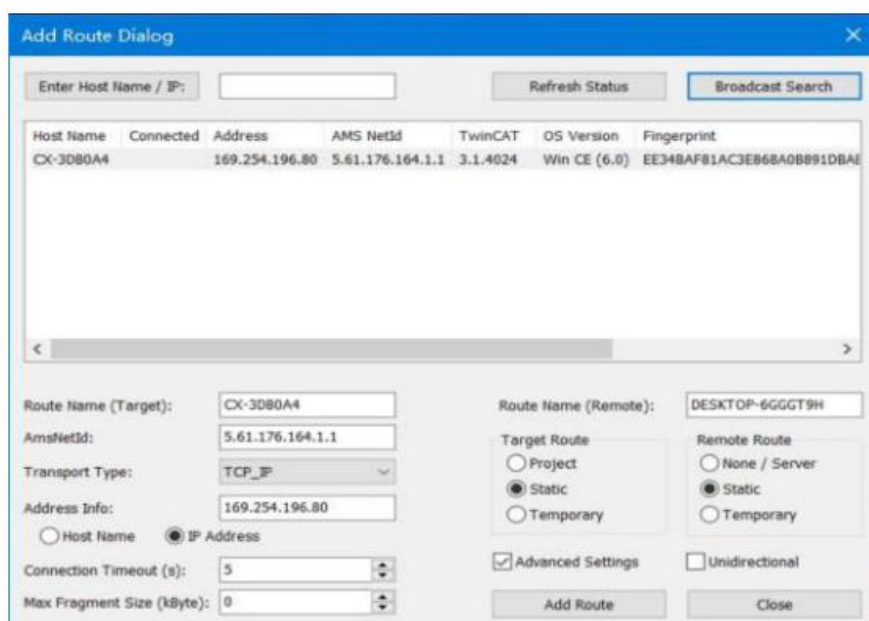
This example shows how to integrate the module into TwinCAT XAE using a CX5050 PLC as an example.



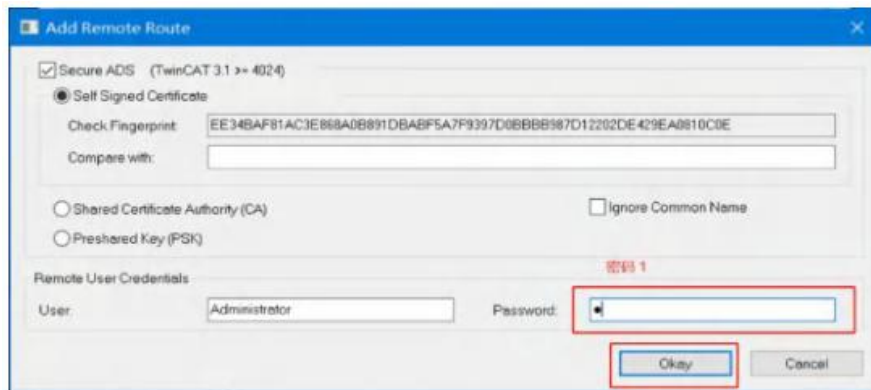
Add PLC route: right-click the TwinCAT icon in the lower-right corner and open Edit Routes.



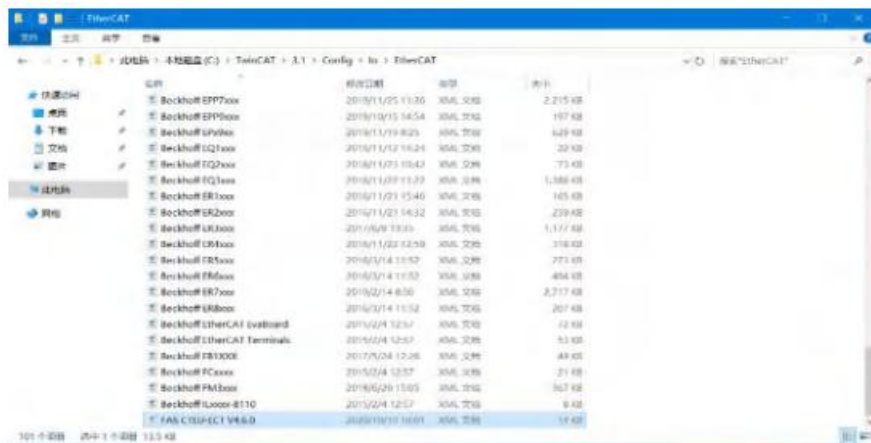
Click Add... to open Add Route Dialog. Use Broadcast Search, select the PLC (CX-3D0A4), and click Add Route.



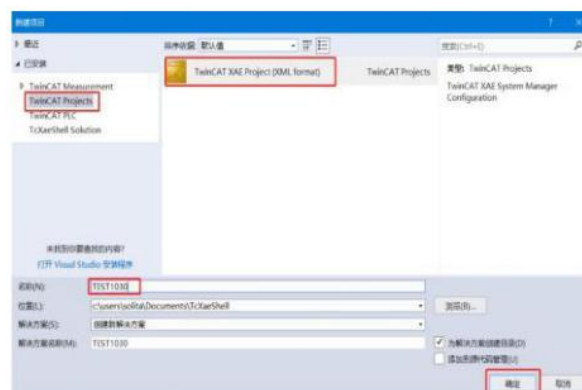
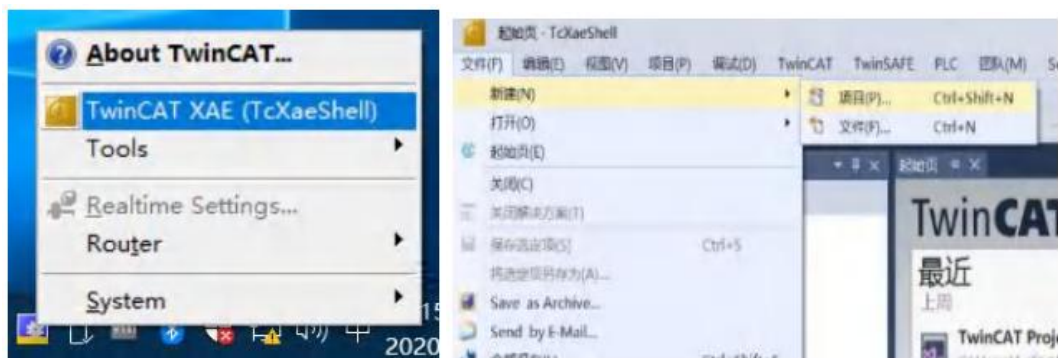
Enter the default password "1" and click OK to complete PLC route addition.



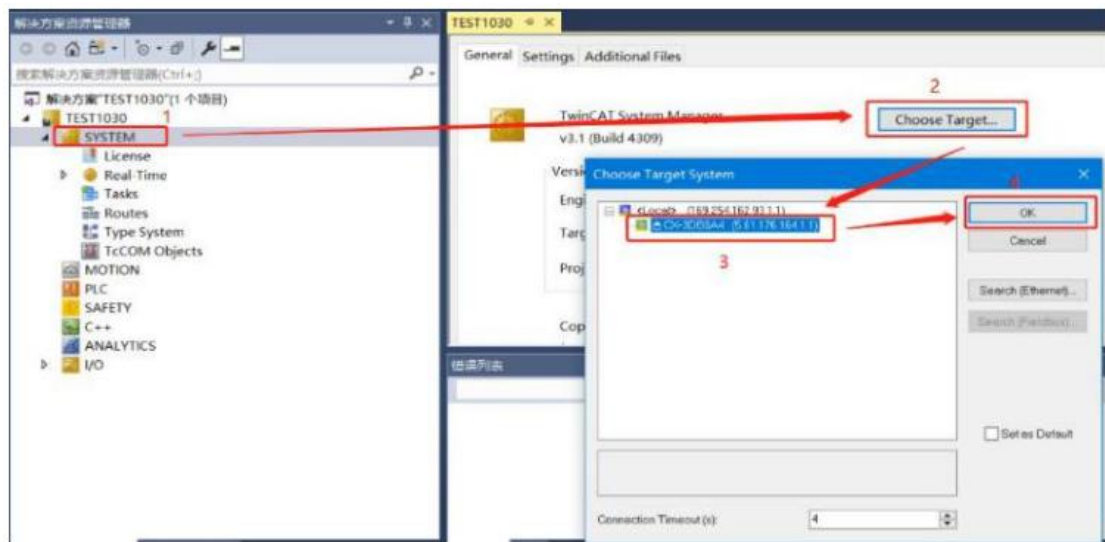
Add device configuration files: copy the FAS EF9100 and expansion module description files provided by FAS to C:\TwinCAT3.1\Config\IO\EtherCAT.



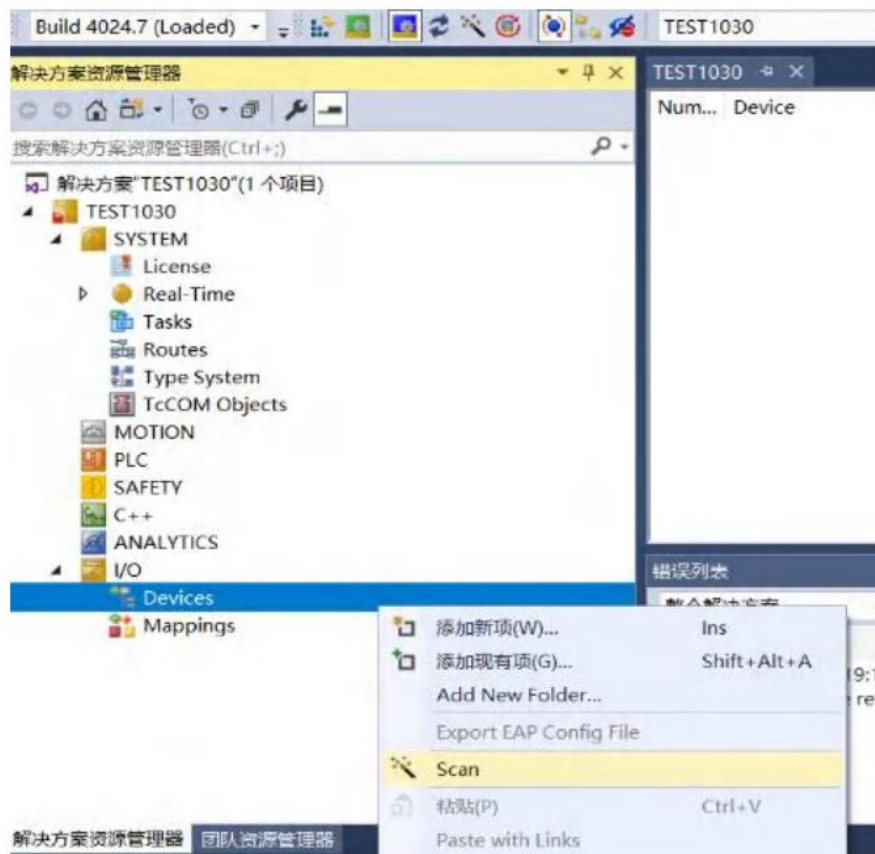
Create a new project: open TwinCAT XAE -> File -> New -> Project -> select TwinCAT XAE Project -> enter a name -> OK.



Select target system: SYSTEM -> Choose Target System -> select PLC (CX-3DB0A4) -> OK.



Add modules: expand IO -> DEVICES -> SCAN; search for the master station, select Device 2 (EtherCAT), and click OK.



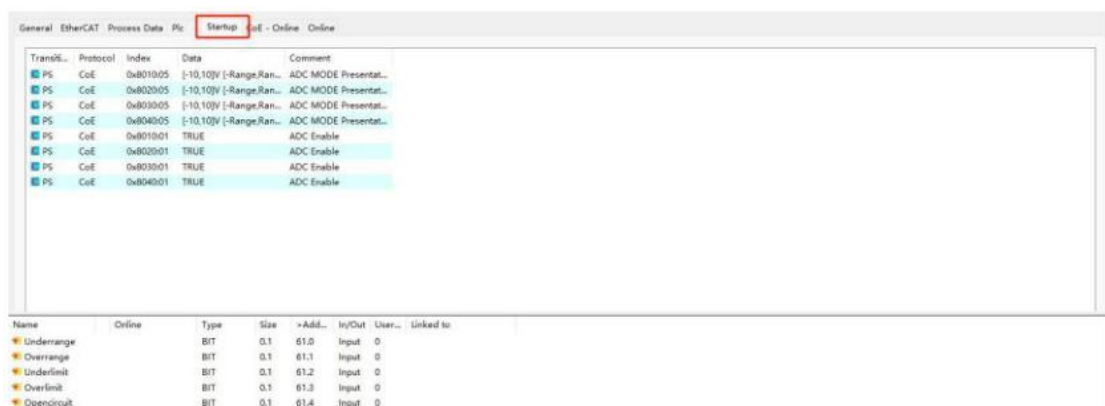
Module slot data (IO-Link mode): Locate module EF9100 in the lower part of the Explorer.



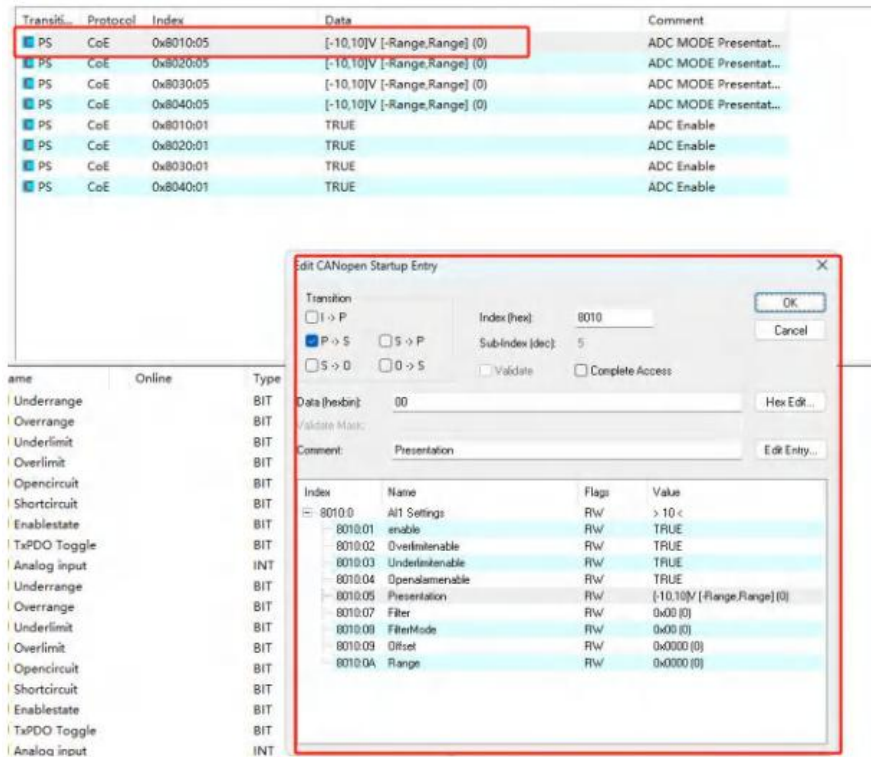
Right-click Term (EF9100), select Add New Item, open the FAS Electronics (Fujian) Co., Ltd. menu, and select the required input/output card type. Click OK.



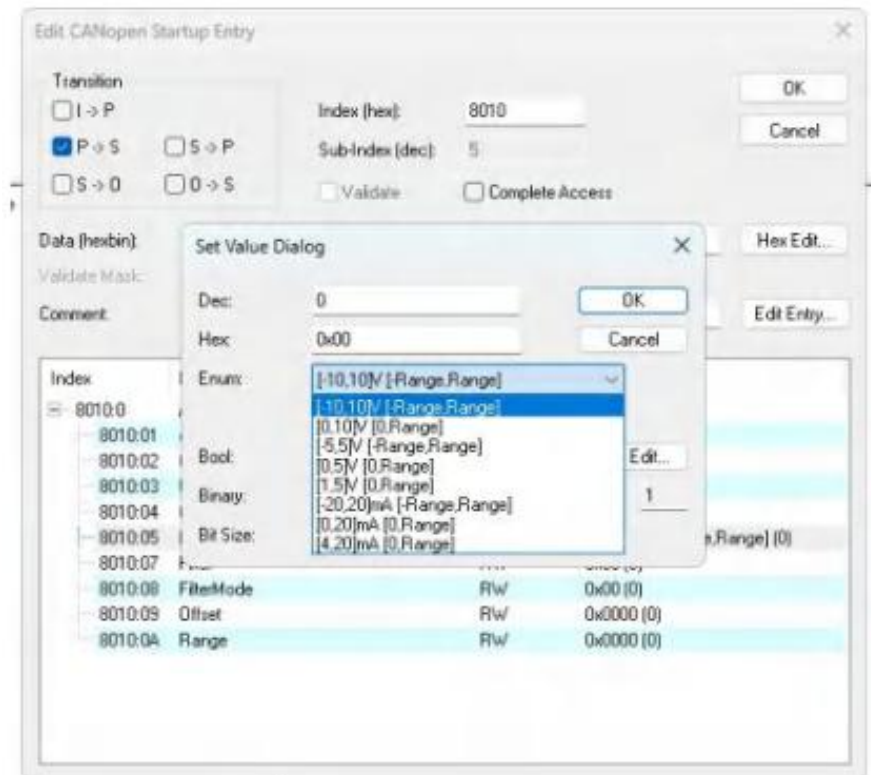
Analog card parameter configuration: After adding EL3174, double-click the module to open the configuration interface, and click Startup to open startup configuration.



Parameters 0x8010:05 to 0x8040:05 correspond to the four analog input channels. The module defaults to voltage input mode. To modify a channel function, double-click the required channel



Select Enum for 8010:05, configure the channel function,



And click OK to save

Transiti...	Protocol	Index	Data	Comment
PS	CoE	0x8010:05	[4,20]mA [0,Range] (7)	ADC MODE Presentat...
PS	CoE	0x8020:05	[-10,10]V [-Range,Range] (0)	ADC MODE Presentat...
PS	CoE	0x8030:05	[-10,10]V [-Range,Range] (0)	ADC MODE Presentat...
PS	CoE	0x8040:05	[-10,10]V [-Range,Range] (0)	ADC MODE Presentat...
PS	CoE	0x8010:01	TRUE	ADC Enable
PS	CoE	0x8020:01	TRUE	ADC Enable
PS	CoE	0x8030:01	TRUE	ADC Enable
PS	CoE	0x8040:01	TRUE	ADC Enable

IO-Link card parameter configuration: After adding EL6224, double-click the module to open the configuration interface, click Slots to enter IO-Link slot configuration

General EtherCAT Process Data I/O Slots Startup CoE - Online AutE - Online Diag History Online									
Slot	Module	ModuleIdenti							
IO-Link Port 0	Clear Slot	0x00004001							
IO-Link Port 1	Clear Slot	0x00004001							
IO-Link Port 2	Clear Slot	0x00004001							
IO-Link Port 3	Clear Slot	0x00004001							
Name	Online	Type	Size	→Add...	In/Out	User...	Linked to		
Status Of IO-Link...		USINT	1.0	49.0	Input	0			
Status Of IO-Link...		USINT	1.0	50.0	Input	0			
Status Of IO-Link...		USINT	1.0	51.0	Input	0			
Status Of IO-Link...		USINT	1.0	52.0	Input	0			
Sensor Supply ...		BITARRB	1.0	57.0	Input	0			

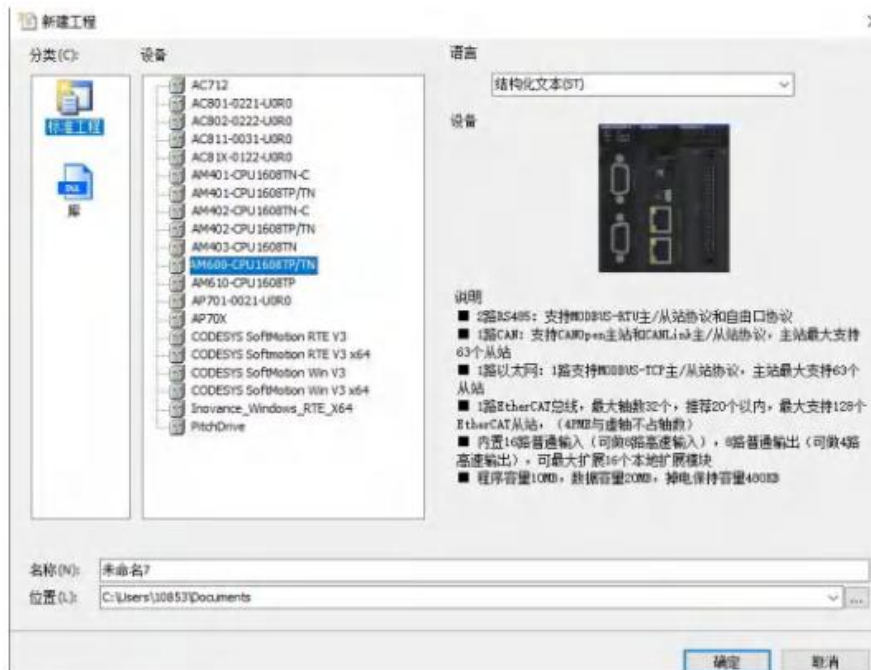
Select the required slot, and add the required byte length to the left side according to the IO-Link slave manual.

Slot	Module	ModuleIdenti							
IO-Link Port 0	IO-Link 4-Byte	0x00004305							
IO-Link Port 1	Clear Slot	0x00004001							
IO-Link Port 2	Clear Slot	0x00004001							
IO-Link Port 3	Clear Slot	0x00004001							
Name	Online	Type	Size	→Add...	In/Out	User...	Linked to		
Status Of IO-Link...		USINT	1.0	49.0	Input	0			
Status Of IO-Link...		USINT	1.0	50.0	Input	0			
Status Of IO-Link...		USINT	1.0	51.0	Input	0			
Status Of IO-Link...		USINT	1.0	52.0	Input	0			
Sensor Supply ...		BITARRB	1.0	57.0	Input	0			

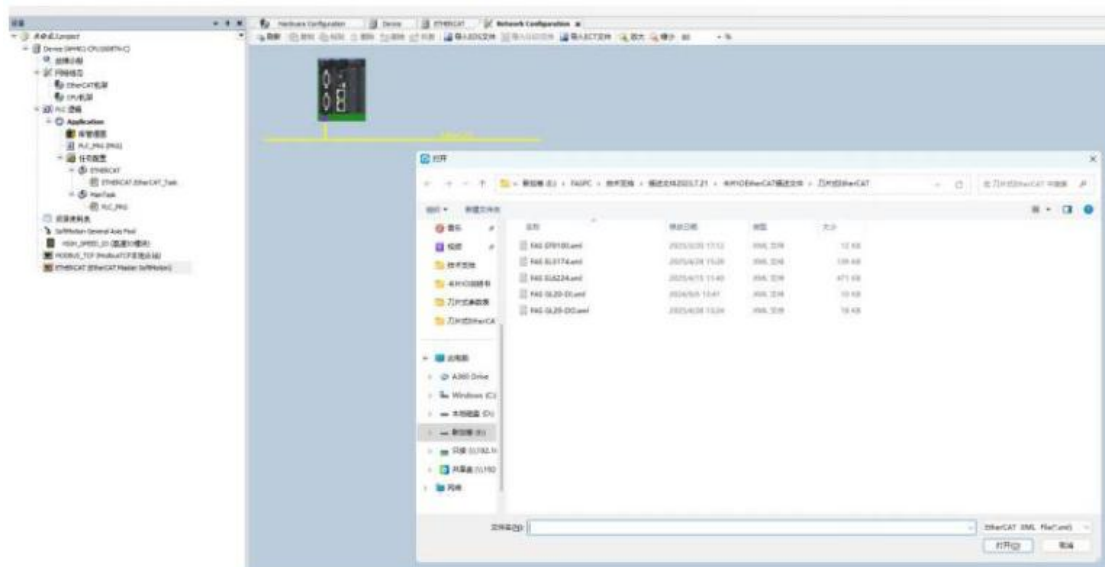
3.1.3 Integration in Inovance AM600-CPU1608TP/TN

This example shows how to integrate the module into Inproshop using an AM600-CPU1608TP/TN PLC as an example.

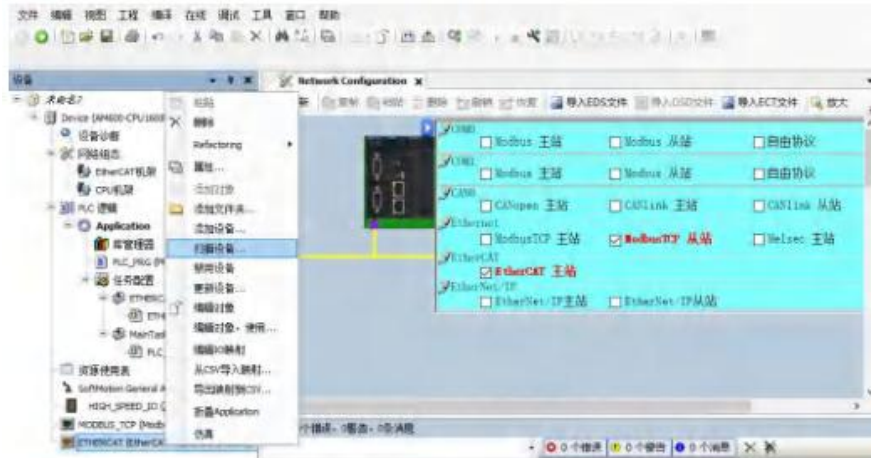
Create a new project and select the corresponding PLC model.



Add modules: double-click Network Configuration -> click Import ECT File -> select the EF9100 master description file and the actual I/O card description files.



Slot configuration: right-click module EF9100 in the device frame -> Add Device -> select the required device for configuration.
Click PLC -> enable EtherCAT master -> select the device on the left -> right-click ETHERCAT -> Scan Device.



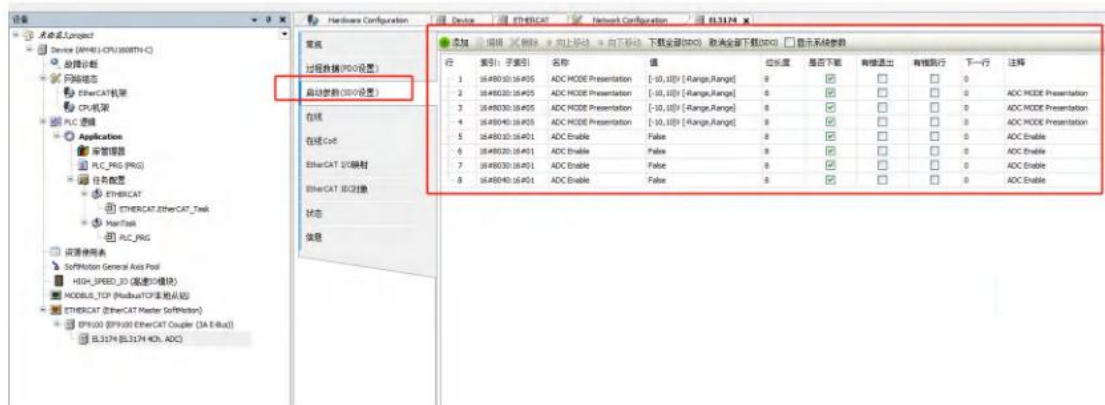
Slot configuration: right-click module EF9100 in the device frame -> Add Device -> select the required device for configuration.



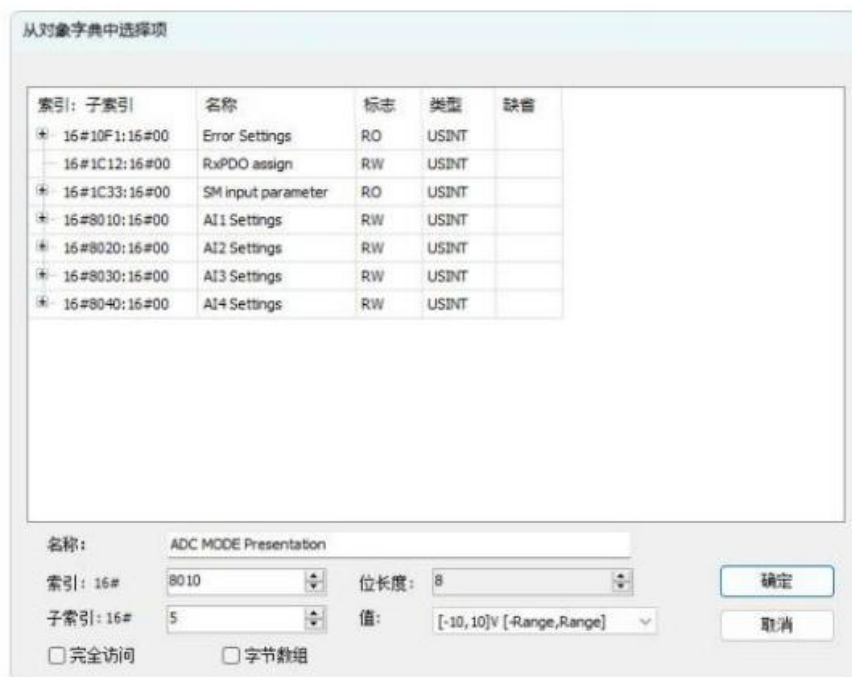
Expansion card configuration: select EF9100, right-click Add Device, and select the required device in the pop-up device window.



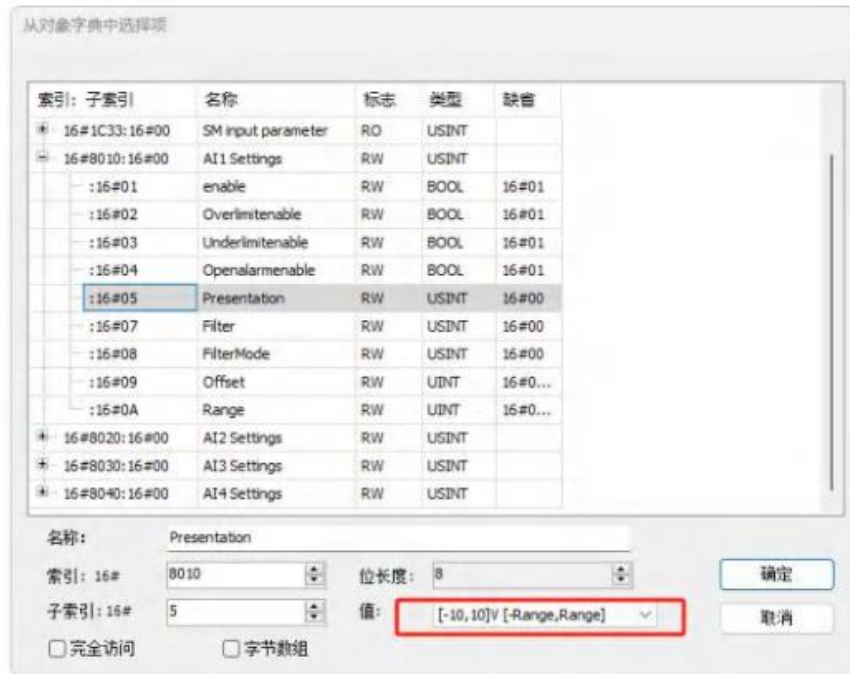
Analog card parameter configuration: After adding EL3174, double-click the module to enter module configuration, and click Startup Parameters (SDO Settings).



Parameters 16#8010:16#05 to 16#8040:16#05 correspond to the four analog input channels and default to voltage input mode. To modify a channel function, click Edit.



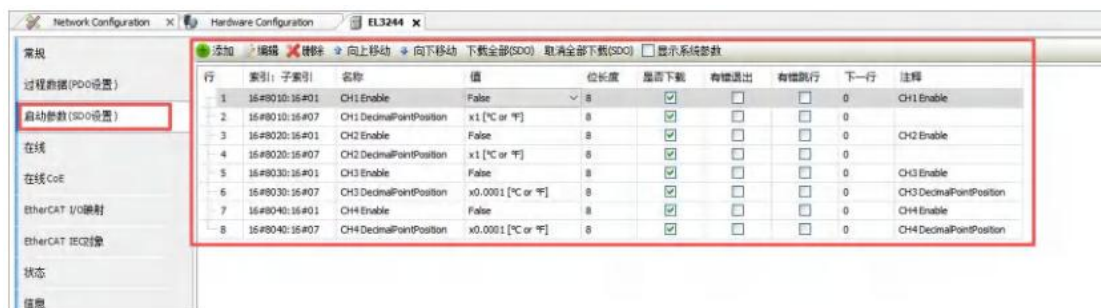
Expand 16#8010:16#00, select 16#05, and configure the channel function below.



Click OK to save.

行	索引: 子索引	名称	值	位长度	是否下载	有错误退出	有错误运行	下一行	注释
1	16#8010:16#05	Presentation	[4,20]mA [0,Range]	8	☒	☐	☐	0	
2	16#8020:16#05	ADC MODE Presentation	[-10,10]V [-Range,Range]	8	☒	☐	☐	0	
3	16#8030:16#05	ADC MODE Presentation	[-10,10]V [-Range,Range]	8	☒	☐	☐	0	
4	16#8040:16#05	ADC MODE Presentation	[-10,10]V [-Range,Range]	8	☒	☐	☐	0	
5	16#8010:16#01	ADC Enable	False	8	☒	☐	☐	0	ADC Enable
6	16#8020:16#01	ADC Enable	False	8	☒	☐	☐	0	ADC Enable
7	16#8030:16#01	ADC Enable	False	8	☒	☐	☐	0	ADC Enable
8	16#8040:16#01	ADC Enable	False	8	☒	☐	☐	0	ADC Enable

After adding EL3244, double-click the module to enter the configuration interface, then click Start Parameters (SDO Settings) to access the startup configuration interface.



For EL3244, select Online CoE; 16#8010:16#00 to 16#8040:16#00 correspond to the four analog input channels.

常规

过程数据(PDO设置)

启动参数(SDO设置)

在线

在线CoE

EtherCAT I/O映射

EtherCAT IEC对象

状态

信息

阅读这一页

☐ 自动上传

☒ 来自 ESI 的脱机文件

☐ 在线设置

索引: 子索引	名称	标志	类型	值
16#1000:16#00	Device type	RO	UDINT	
16#1001:16#00	Error register	RO	USINT	
16#1008:16#00	Device name	RO	STRING(6)	
16#1009:16#00	Hardware version	RO	STRING(4)	
16#100A:16#00	Software version	RO	STRING(4)	
* 16#1018:16#00	Identity	RO	USINT	
* 16#10F1:16#00	Error Settings	RO	USINT	
* 16#1802:16#00	TxPDO Parameter			
* 16#1A01:16#00	CH1 TxPDO-Map	RO	USINT	
* 16#1A02:16#00	CH2 TxPDO-Map	RO	USINT	
* 16#1A03:16#00	CH3 TxPDO-Map	RO	USINT	
* 16#1A04:16#00	CH4 TxPDO-Map	RO	USINT	
* 16#1C00:16#00	Sync manager type	RO	USINT	
16#1C12:16#00	RxPDO assign	RW	USINT	
* 16#1C13:16#00	TxPDO assign	RO	USINT	
* 16#1C33:16#00	SM input parameter	RO	USINT	
* 16#6010:16#00	AI1	RO	USINT	
* 16#6020:16#00	AI2	RO	USINT	
* 16#6030:16#00	AI3	RO	USINT	
* 16#6040:16#00	AI4	RO	USINT	
* 16#8010:16#00	CH1 Settings	RW	USINT	
* 16#8020:16#00	CH2 Settings	RW	USINT	
* 16#8030:16#00	CH3 Settings	RW	USINT	
* 16#8040:16#00	CH4 Settings	RW	USINT	
* 16#F000:16#00	Modular device profile	RO	USINT	
* 16#F010:16#00	Module profile list	RO	USINT	

Expand 16#8010:16#00 and configure the channel function below.

常规

阅读这一页

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☐ 在线设置

过程数据 (PDO 设置)

启动参数 (SDO 设置)

在线

在线 CoE

EtherCAT I/O 映射

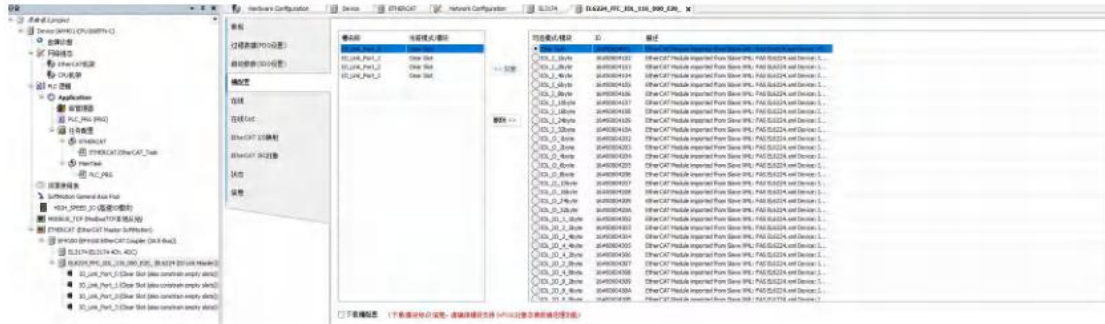
EtherCAT IEC 对象

状态

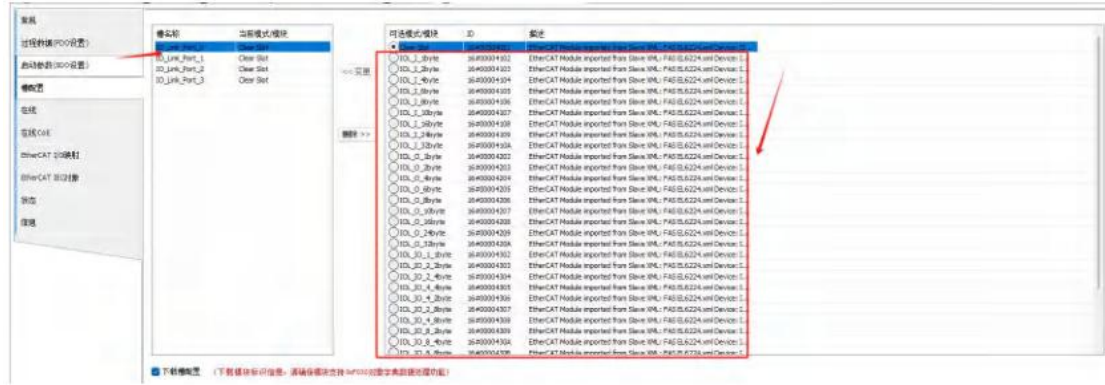
信息

索引: 子索引	名称	标志	类型	值
16#1000:16#00	Device type	RO	UDINT	
16#1001:16#00	Error register	RO	USINT	
16#1008:16#00	Device name	RO	STRING(6)	
16#1009:16#00	Hardware version	RO	STRING(4)	
16#100A:16#00	Software version	RO	STRING(4)	
* 16#1018:16#00	Identity	RO	USINT	
* 16#10F1:16#00	Error Settings	RO	USINT	
* 16#1802:16#00	TxPDO Parameter			
* 16#1A01:16#00	CH1 TxPDO-Map	RO	USINT	
* 16#1A02:16#00	CH2 TxPDO-Map	RO	USINT	
* 16#1A03:16#00	CH3 TxPDO-Map	RO	USINT	
* 16#1A04:16#00	CH4 TxPDO-Map	RO	USINT	
* 16#1C00:16#00	Sync manager type	RO	USINT	
16#1C12:16#00	RxPDO assign	RW	USINT	
* 16#1C13:16#00	TxPDO assign	RO	USINT	
* 16#1C33:16#00	SM input parameter	RO	USINT	
* 16#6010:16#00	AI1	RO	USINT	
* 16#6020:16#00	AI2	RO	USINT	
* 16#6030:16#00	AI3	RO	USINT	
* 16#6040:16#00	AI4	RO	USINT	
* 16#8010:16#00	CH1 Settings	RW	USINT	
:16#01	enable	RW	BOOL	
:16#02	Overlimitenable	RW	BOOL	
:16#03	Underlimitenable	RW	BOOL	
:16#04	Openalarmenable	RW	BOOL	
:16#05	TemperatureUnit	RW	USINT	
:16#06	Presentation	RW	USINT	
:16#07	DecimalPointPosition	RW	USINT	
:16#08	Calibration	RW	INT	
:16#0C	OffsetR	RW	REAL	
:16#0D	Offset	RW	REAL	

IO-Link card parameter configuration: After adding EL6224, double-click the module to enter module configuration. Click Slot Configuration to enter IO-Link slot configuration,



Select the required slot, add the required byte length according to the IO-Link slave manual, and check Download Slot Configuration.



Slot configuration is then completed.

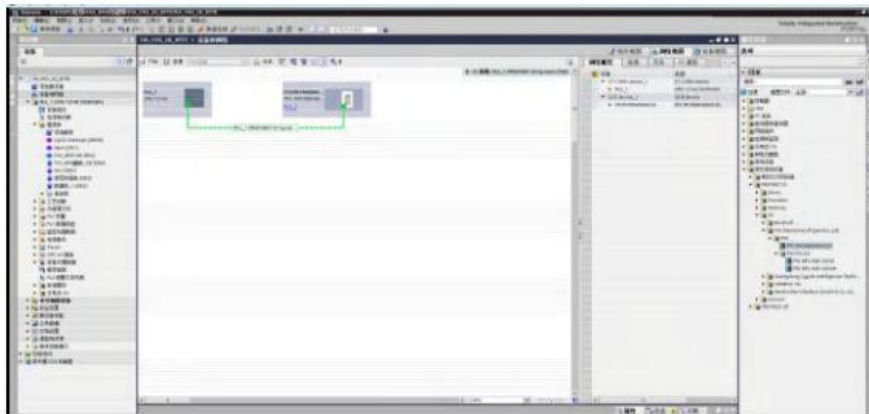
3.2 EF9300 Integration

3.2.1 Integration in Siemens S7-1200 TIA Portal (PROFINET)

Install the GSD file.



In PLC -> Device Configuration -> Network View -> Hardware Catalog, select the module and drag it into the project. Click Not assigned and select the PLC to connect.

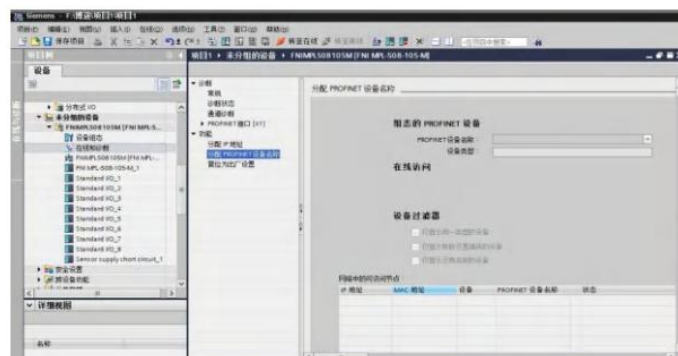


Double-click the module to enter configuration.

Slot function configuration: in the Hardware Catalog, drag modules into the slots in the Device Overview window according to the actual installation.



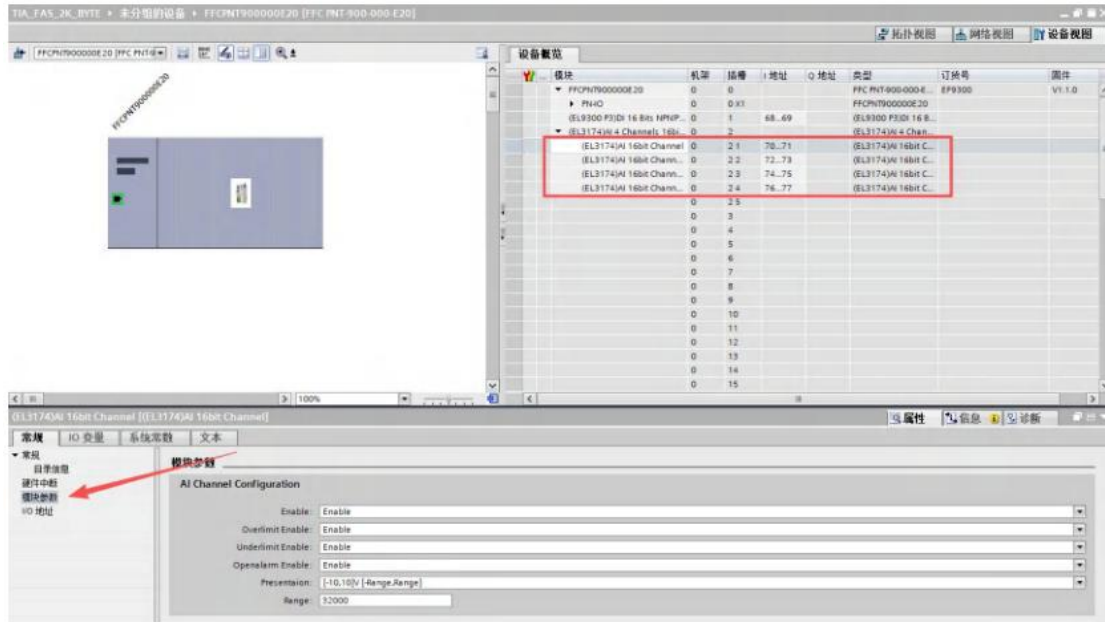
Assign the PN name: switch the PLC to online mode, select Ungrouped devices -> click the module name -> Online & Diagnostics -> Functions -> Assign PROFINET Device Name -> select the module in the list according to the physical MAC address -> click Assign Name to complete configuration.



Analog card parameter configuration: Add the analog module (for example, EL3174) to Device Overview.

▼ FFCPNT900000E20	0	0			FFC PNT-900-000-E...	EF9300	V1.1.0
▶ PN-IO	0	0 X1			FFC PNT900000E20		
(EL9300 P3)DI 16 Bits NPN/P...	0	1	68...69		(EL9300 P3)DI 16 B...		
▼ (EL3174)AI 4 Channels 16bi...	0	2			(EL3174)AI 4 Chan...		
(EL3174)AI 16bit Channel	0	2 1	70...71		(EL3174)AI 16bit C...		
(EL3174)AI 16bit Chann...	0	2 2	72...73		(EL3174)AI 16bit C...		
(EL3174)AI 16bit Chann...	0	2 3	74...75		(EL3174)AI 16bit C...		
(EL3174)AI 16bit Chann...	0	2 4	76...77		(EL3174)AI 16bit C...		

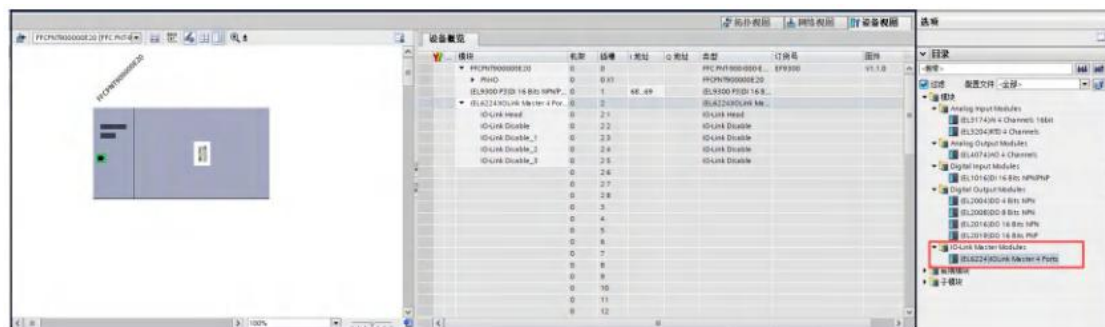
Click any module slot to enter the module parameter configuration interface



Where the analog module functions can be selected and configured.



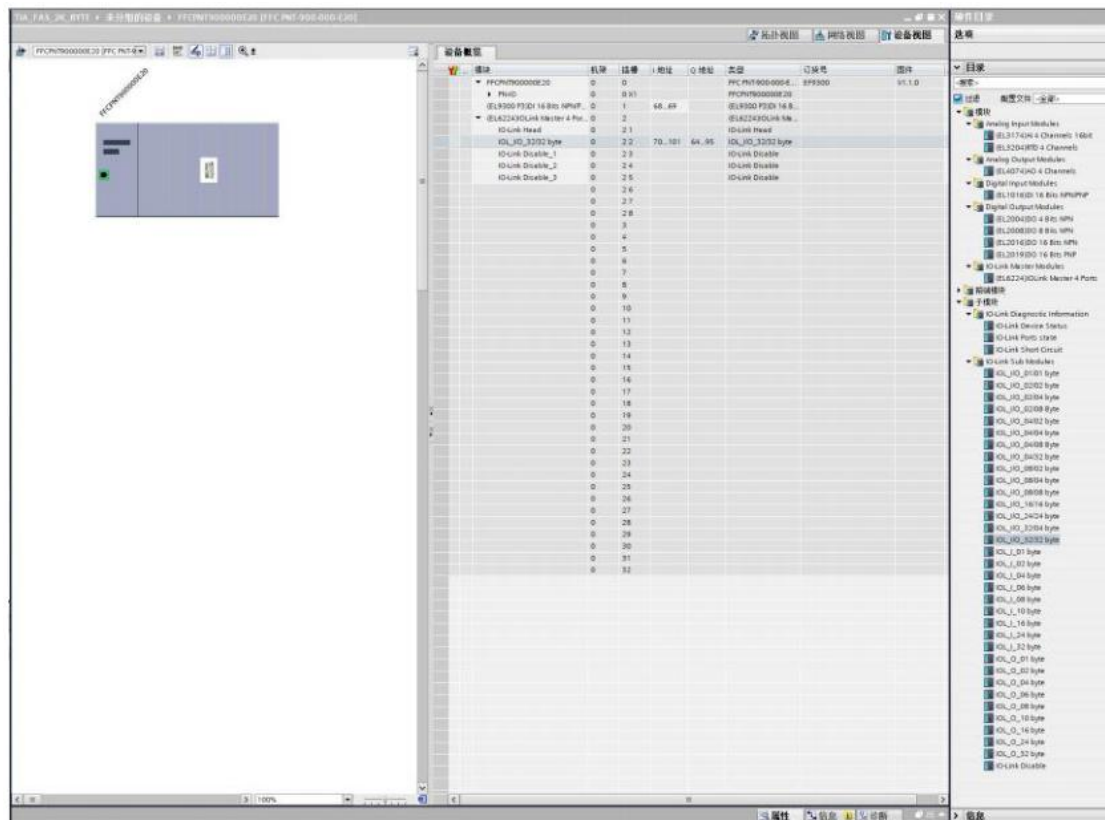
IO-Link card parameter configuration: Double-click the EL6224 card in the Hardware Catalog to add it to Device Overview.



Select the slot requiring IO-Link function configuration, delete the original IO-Link Disable item.

模块	机架	插槽	I 地址	Q 地址	类型	订货号	固件
FFCPNT90000E20	0	0			FFC PNT900-000-E...	EP9300	V1.1.0
▶ PNI-IO	0	0 X1			FFCPNT900000E20		
(EL9300 P3)DI 16 Bits NPN...	0	1	68...69		(EL9300 P3)DI 16 B...		
(EL6224)IO-Link Master 4 Por...	0	2			(EL6224)IO-Link Ma...		
IO-Link Head	0	2 1			IO-Link Head		
IO-Link Disable	0	2 2			IO-Link Disable		
IO-Link Disable_1	0	2 3			IO-Link Disable		
IO-Link Disable_2	0	2 4			IO-Link Disable		
IO-Link Disable_3	0	2 5			IO-Link Disable		
	0	2 6					
	0	2 7					
	0	2 8					
	0	3					
	0	4					
	0	5					
	0	6					
	0	7					
	0	8					
	0	9					
	0	10					
	0	11					
	0	12					

Then find Submodules -> IO-Link Sub Modules in the Hardware Catalog and double-click the required byte length to complete configuration.



3.3 EF9700 Integration

EL3174 Status Bit Description

Word Offset	Bit	Name	Description
Offset + 0	0	Underrange	Lower limit warning
Offset + 0	1	Overrange	Upper limit warning
Offset + 0	2	Underlimit	Lower limit alarm
Offset + 0	3	Overlimit	Upper limit alarm
Offset + 0	4	Opencircuit	Open-circuit detection
Offset + 0	14	Enable state	Channel enable status: 1 = channel enabled (VAL_Enable=1), 0 = channel disabled
Offset + 0	15	TxPDO Toggle	Data update flag; toggles every process data transfer and can be used to detect new data
Offset + 1	0-15	Same as Word0	Same bit definitions as Word0, representing channel 2 status
Offset + 2	0-15	Same as Word0	Same bit definitions as Word0, representing channel 3 status
Offset + 3	0-15	Same as Word0	Same bit definitions as Word0, representing channel 4 status

EL3204 Status Bit Description

Word Offset	Bit	Name	Description
Offset + 0	0	Underrange	Lower limit warning
Offset + 0	1	Overrange	Upper limit warning
Offset + 0	2	Underlimit	Lower limit alarm
Offset + 0	3	Overlimit	Upper limit alarm
Offset + 0	4	Opencircuit	Open-circuit detection
Offset + 0	5	Shortcircuit	Short-circuit detection
Offset + 0	14	Enable state	Channel enable status: 1 = channel enabled (VAL_Enable=1), 0 = channel disabled
Offset + 0	15	TxPDO Toggle	Data update flag; toggles every process data transfer and can be used to detect new data
Offset + 1	0-15	Same as Word0	Same bit definitions as Word0, representing channel 2 status
Offset + 2	0-15	Same as Word0	Same bit definitions as Word0, representing channel 3 status
Offset + 3	0-15	Same as Word0	Same bit definitions as Word0, representing channel 4 status

EL3314 Status Bit Description

Word Offset	Bit	Name	Description
Offset + 0	0	Underrange	Lower limit warning
Offset + 0	1	Overrange	Upper limit warning
Offset + 0	2	Underlimit	Lower limit alarm
Offset + 0	3	Overlimit	Upper limit alarm
Offset + 0	4	Opencircuit	Open-circuit detection

Offset + 0	5	Opencircuit	Short-circuit detection
Offset + 0	14	Enable state	Channel enable status: 1 = channel enabled (VAL_Enable=1), 0 = channel disabled
Offset + 0	15	TxPDO Toggle	Data update flag; toggles every process data transfer and can be used to detect new data
Offset + 1	0-15	Same as Word0	Same bit definitions as Word0, representing channel 2 status
Offset + 2	0-15	Same as Word0	Same bit definitions as Word0, representing channel 3 status
Offset + 3	0-15	Same as Word0	Same bit definitions as Word0, representing channel 4 status

EL4074 Status Bit Description

Word Offset	Bit	Name	Description
Offset + 0	0	enable_status	Channel 0 enable status
Offset + 0	1	VOUT_fault	Channel 0 voltage output error
Offset + 0	2	VOUT_fault	Channel 0 current output error
Offset + 0	8	enable_status	Channel 1 enable status
Offset + 0	9	VOUT_fault	Channel 1 voltage output error
Offset + 0	10	VOUT_fault	Channel 1 current output error
Offset + 1	0	enable_status	Channel 2 enable status
Offset + 1	1	VOUT_fault	Channel 2 voltage output error
Offset + 1	2	VOUT_fault	Channel 2 current output error
Offset + 1	8	enable_status	Channel 3 enable status
Offset + 1	9	VOUT_fault	Channel 3 voltage output error
Offset + 1	10	VOUT_fault	Channel 3 current output error

3.3.1 ISDU Modbus Register Manual

1. Overview

This manual defines the register mapping rules, data interaction format, and operation procedure for communication between ISDU (Intelligent Device Data Unit) and a Modbus TCP master. It is the core specification for implementing ISDU operation interaction between master and slave stations and applies to industrial device communication scenarios based on the Modbus TCP protocol.

2. Basic Register Specifications

Address definition: ISDU_REG_START = 3000. Address range: 3000 to 3123, totaling 124 registers and meeting the maximum 232-byte data interaction requirement.

Type	Purpose	Corresponding Modbus Function Code
Write registers (Holding Registers)	Master -> slave, used to issue ISDU request parameters	06 (single-register write) / 16 (multi-register write)
Read registers (Input Registers)	Slave -> master, returns ISDU execution results	04 (input-register read)

Data format: Big-endian byte order, where the high byte comes first and the low byte follows. Each 16-bit register stores two bytes: the high 8 bits store the high byte, and the low 8 bits store the low byte. The maximum data length of one interaction is 232 bytes, corresponding to 116 registers.

3. Write Register Mapping (Master -> Slave)

Register Address	Function Description	Data Type	Value Range
3000	Module serial number	16-bit unsigned integer	0-32
3001	Port number	16-bit unsigned integer	1-4 / 1-8
3002	Target index	16-bit unsigned integer	0-65535
3003	Target subindex	16-bit unsigned integer	0-255
3004	Request type	16-bit unsigned integer	0 = read, 1 = write
3005	Trigger flag	16-bit unsigned integer	Any value; value change triggers execution
3006	Data length	16-bit unsigned integer	0-232 bytes
3007-3122	Data area	16-bit unsigned integer array	-

- Trigger flag (3005): An ISDU operation is triggered only when the value changes. It is recommended to use incrementing values to ensure effective triggering.
- Changing the request type from read to write triggers the slave to execute an ISDU write operation.
- Changing the request type from write to read triggers the slave to execute an ISDU read operation.
- Data area: the data registers need to be manually byte-swapped as required.

4. Read Register Mapping (Slave -> Master)

Register Address	Function Description	Data Type	Value Range
3000	Module serial number	16-bit unsigned integer	0-65535
3001	Port number	16-bit unsigned integer	0-65535
3002	Target index	16-bit unsigned integer	0-65535
3003	Target subindex	16-bit unsigned integer	0-255
3004	Execution status	16-bit integer	0=idle, 1=executing, 2=completed, -1=failed
3005	Execution progress	16-bit integer	0-11 normal, -1 to -15 failed

3006	Error code	16-bit integer	0=no error, nonzero=specific error
3007	Data length	16-bit unsigned integer	0-232 bytes
3008-3123	Data area	16-bit unsigned integer array	-

- Data area (from 3008): stores data returned by read operations or echo data from write operations. The format is the same as the write-register data area.
- Execution status, progress, and error code reflect the ISDU operation in real time and are the core basis for judging operation results.

5. Core Status Code Definitions

Value	Meaning	Recommended Operation
0	Idle; no execution task	A new ISDU request can be issued
1	Executing; operation in progress	Wait; do not issue repeated requests
2	Execution successful; operation complete	Read result data if available
-1	Execution failed; operation incomplete	Read the error code and progress value to locate the problem

Execution Progress (Register 3005)

Normal Progress Value	Meaning
0	Idle
1	Writing target index
2	Writing target subindex
3	Writing read control command
4	Waiting for read operation response
5	Reading data length
6	Reading data
7	Writing data length
8	Writing data
9	Writing write control command
10	Waiting for write operation response
11	Reading error code

Failed Progress Value	Meaning
-1	Failed to write index
-2	Failed to write subindex
-3	Failed to write read control command
-4	Failed while waiting for read response
-5	Failed to read length
-6	Failed to read data
-7	Failed to write length
-8	Failed to write data
-9	Failed to write write control command
-10	Failed while waiting for write response
-11	Failed to read error code
-14	No device connected to the port

-15	Invalid data length
-----	---------------------

Error Code (Register 3006)

Value	Meaning	Description
0	No error	Operation executed successfully
Nonzero	Specific error code	Returned by SDO operation; the meaning is strongly related to the device SDO implementation

6. Standard Operation Procedure

Write operation (master issues an ISDU request):

write the module serial number to 3000 and port number to 3001;

write target index to 3002 and target subindex to 3003;

write request type (2 = write) to 3004 and data length to 3006;

write the data to be written into the data area starting from 3007 in big-endian order.

Modify the trigger flag value at 3005 (for example, increment by 1) to trigger the slave to execute the ISDU write operation. Poll register 3004 until the status becomes 2 (success) or -1 (failure).

Read operation (master obtains ISDU data):

write the module serial number to 3000 and port number to 3001;

write target index to 3002 and target subindex to 3003;

write request type (1 = read) to 3004.

Data length is not required. Modify the trigger flag value at 3005 to trigger the slave to execute the ISDU read operation. Poll register 3004 until the status becomes 2 (success);

read the data length from 3007, and then read the corresponding result data starting from 3008.

7. Notes

- Trigger mechanism: the slave executes an ISDU operation only when the trigger flag (3005) changes. The same trigger value will not trigger repeatedly. Incrementing values such as 1, 2, 3... are recommended.
- Data processing: the data length must be an even number; otherwise parsing errors may occur. Data registers need to be manually byte-swapped as required. The maximum data area is 232 bytes; extra data will be truncated.
- Register range: ensure that the Modbus server maps the 3000-3123 register space. Write operations correspond to Holding Registers, while read operations correspond to Input Registers. Do not confuse the two.
- Exception handling: the master must check the execution status and error code in real time. If an operation times out without response, reset the trigger flag or resend the request.

8. Troubleshooting

Fault Symptom	Possible Cause	Solution
ISDU operation not executed	Trigger flag did not change	Change the trigger flag to a different value; incrementing values are recommended
Data read/write error	Incorrect byte-order handling	Manually swap data registers as required
Execution status is failed (-1)	ISDU operation execution failed	Read progress value 3005 to locate the failed step and read error code 3006 to analyze the root cause
Data length is 0	No data for read operation or length not specified for write operation	Check request parameter configuration and verify actual device ISDU data
Register access failed	Modbus server configuration error	Confirm that the server maps registers 3000-3123 and that permissions are correct
Progress value is negative	The corresponding step failed	Troubleshoot the corresponding process according to the absolute value, for example -3 means failed to write the read control command

9. Performance Optimization Suggestions

- Batch communication: read and write multiple registers at one time to reduce Modbus communication frequency, for example writing parameters 3000-3006 at once.
- On-demand transmission: transmit only necessary data to avoid useless bandwidth occupation.
- Adaptive polling: set the polling interval to 10-50 ms at the early stage of operation to shorten response time. After operation exceeds 1 s, adjust the interval to 100-200 ms to reduce CPU usage.
- Timeout mechanism: set an operation timeout, for example 5 s, to avoid endless waiting.
- Error retry: implement automatic retry for non-fatal errors such as communication timeout.

10. Appendix

Type	Start Address	End Address	Quantity	Purpose
Write registers	3000	3122	123	Issue ISDU request parameters
Read registers	3000	3123	124	Return ISDU execution results

Term	Description
ISDU	Intelligent Device Data Unit
SDO	Service Data Object, used for reading and writing device parameters
Big-endian	A byte order in which the high byte is stored at the lower address and the low byte at the higher address
Holding Registers	Modbus write registers supporting read/write operations
Input Registers	Modbus read registers supporting read-only operations

Summary: The ISDU Modbus register area is divided into write registers (3000-3122, issuing requests) and read registers (3000-3123, returning results). Register type and address range must be strictly distinguished. The trigger flag (3005) is the key to executing ISDU operations, and it triggers only when the value changes. Execution status (3004), progress (3005), and error code (3006) are the core basis for judging and verifying operation results.

3.3.2 Inovance 521 MODBUS TCP Configuration Tutorial

1. Use the FAS coupler configuration tool to export the blade-module combination file.



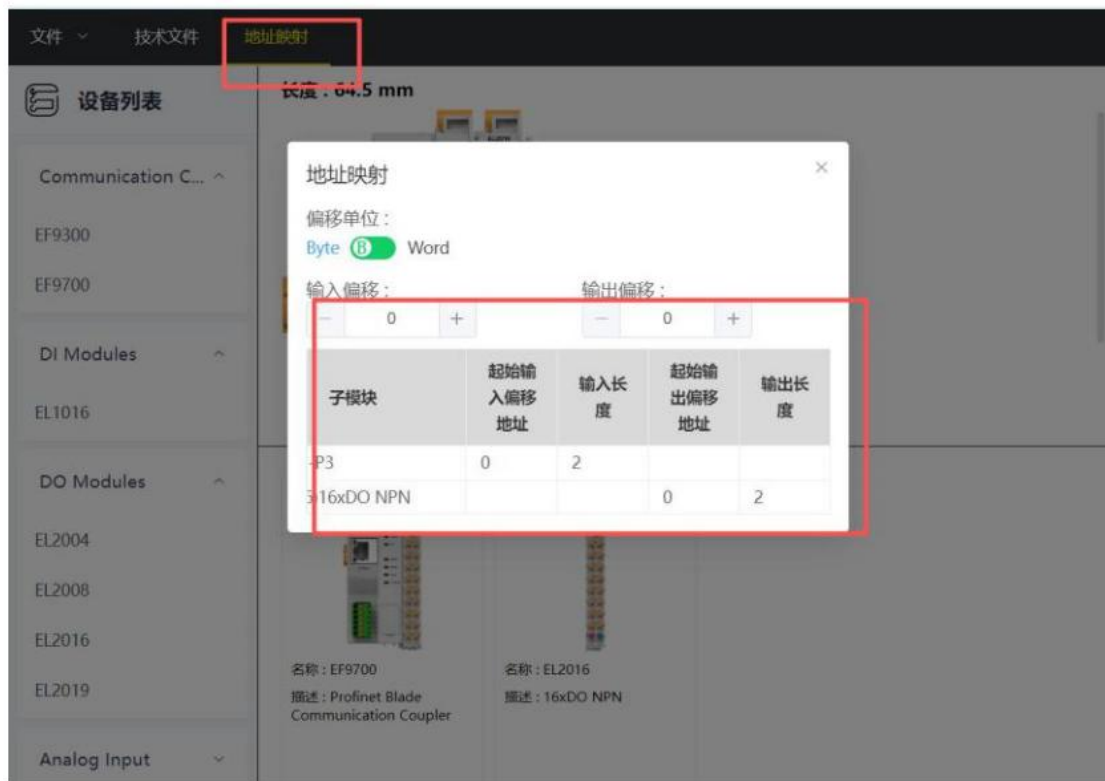
2. Click Series.



3. Select EF9700 and the combined blade modules. The corresponding picture appears. Double-click the module picture to configure parameters.



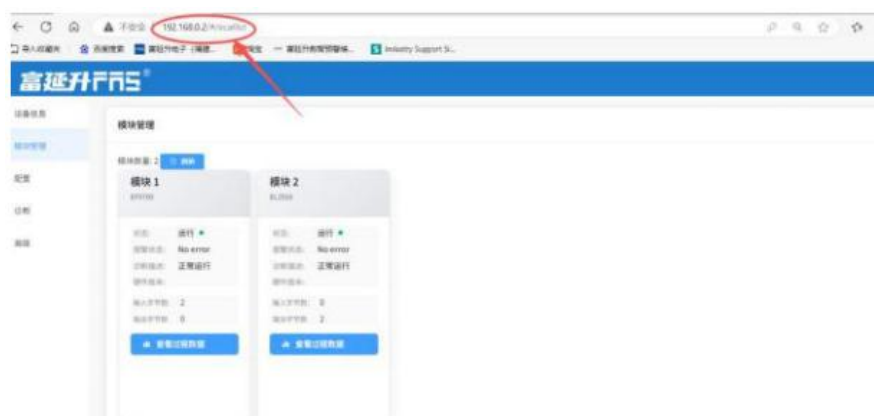
- Click Address Mapping to query the address mapping of the module combination.



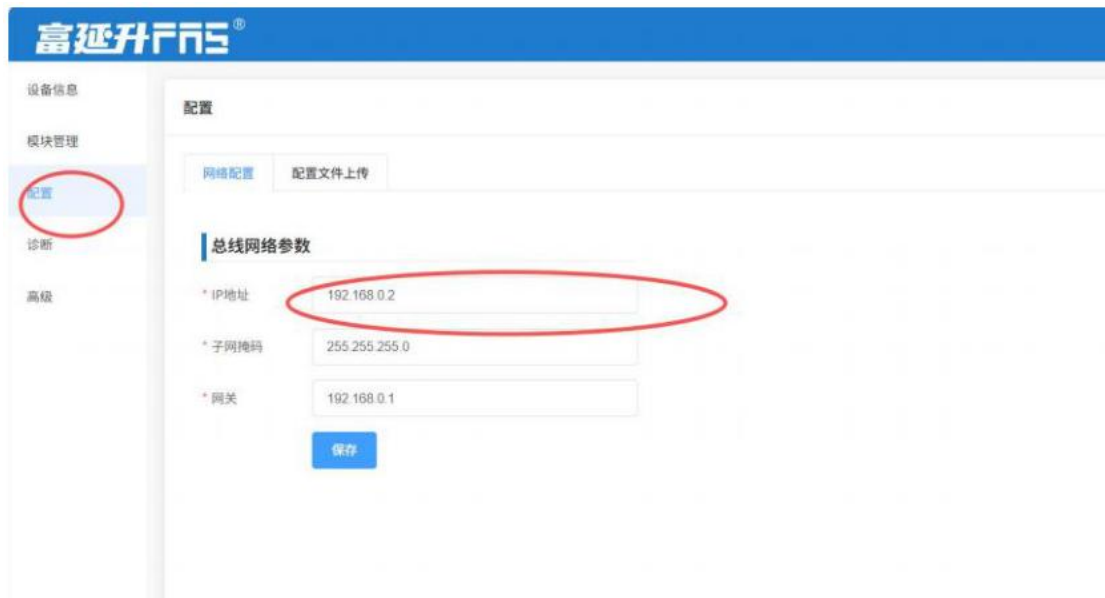
- Export the .JSON configuration file.



- The default IP address of EF9700 is 192.168.0.2. Access the web interface. Account: admin. Password: admin.



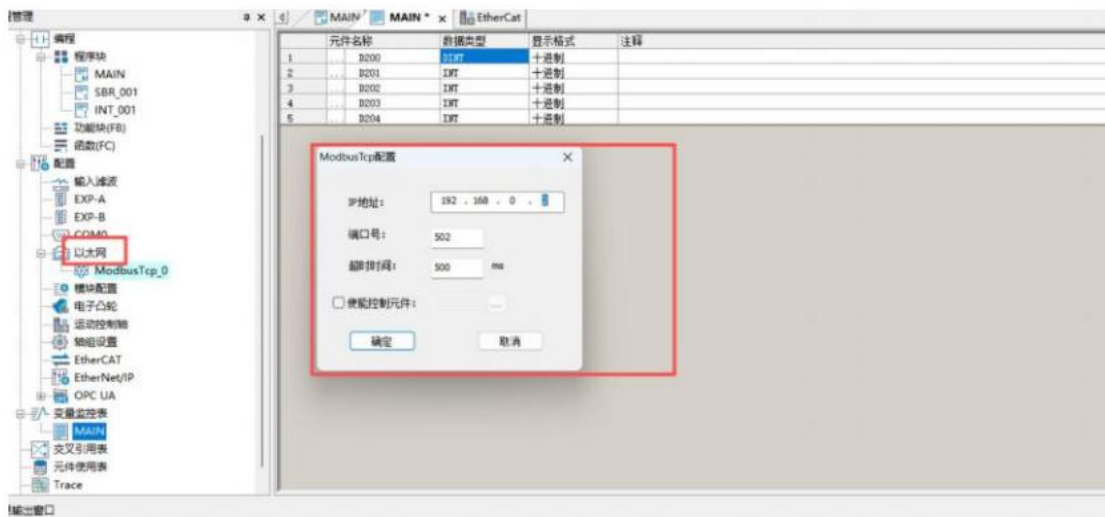
7. Click Configuration to set the coupler IP address.



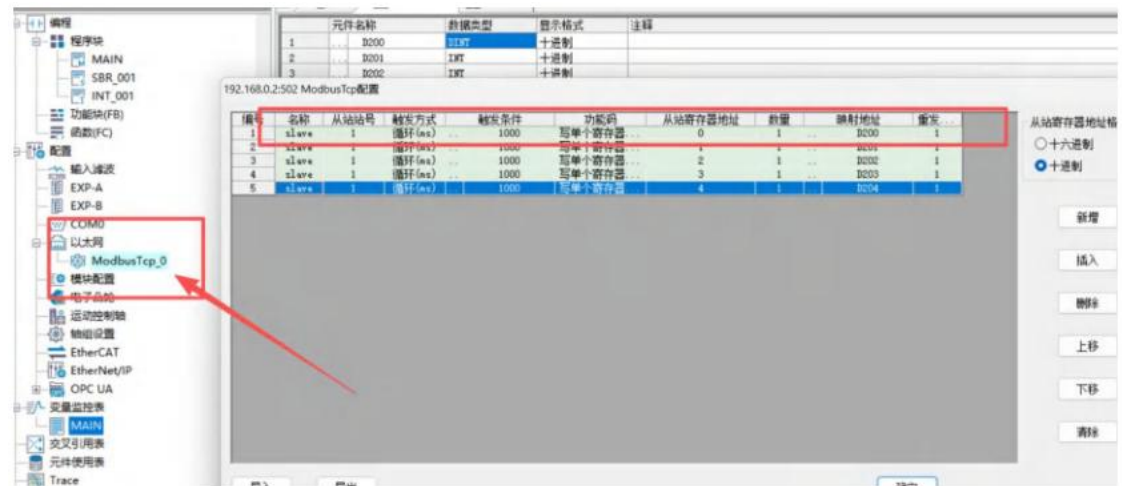
8. Click Configuration File Upload to upload the .JSON file. After upload succeeds, restart the power supply. The combination information is then imported into the coupler.



9. Open Inovance AutoShop programming software. After configuring the basic PLC information, right-click Ethernet, add Ethernet configuration, and enter the coupler IP address.



10. Configure address mapping; the system can then be used normally.



4 Appendix

4.1 Ordering Information

Product	Order Code
PROFINET bus coupler	EF9300
EtherCAT bus coupler	EF9100
Modbus-TCP bus coupler	EF9700
16-point NPN/PNP digital input module	EL1016
16-point NPN digital output module	EL2016
16-point PNP digital output module	EL2019
8-point NPN digital output module	EL2008
4-point NPN digital output module	EL2004
4-channel analog input module	EL3174
4-channel analog output module	EL4074
4-channel RTD temperature detection module	EL3204
4-channel RTD temperature detection module	EL3244
4-channel thermocouple temperature detection module	EL3314
4-channel IO-Link master module	EL6224
Power relay module	ELP000

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